BURGESS & NIPLE

Waseem Khalifa, Ph.D., P.E.
Project Manager
Ohio Department of Transportation
District 11
2201 Reiser Avenue
New Philadelphia, OH 44663

Re: BEL-7-19.75
PID 106237
Final Project Memorandum

May 3, 2022

Dear Waseem,

Burgess & Niple, Inc. (B&N) has completed the authorized preliminary design work for the above referenced project. The purpose of this memorandum is to summarize the work completed to date to assist the Department in deciding on next steps for the project.

PROJECT OVERVIEW

This project pertains to the BEL-7-1975 bridge located in Bridgeport, OH. The project site is shown in Figure 1. Photos of the existing bridge are shown in Figure 2. The scope of the initial work performed by Burgess & Niple was as follows:

- Perform a study to explore bridge rehabilitation and replacement options.
- Prepare engineering plans to retrofit deficient pier caps.

The main driver of this project is deficient pier caps. Several of the T-type pier caps exhibit significant cracking that are consistent with structural deficiencies. Since work to replace the bridge or perform significant rehabilitation would take several years, B&N was asked to expedite the production of engineering plans for pier cap retrofits to allow time for planning a larger project for the bridge.

Subsequent to the initially scoped items, B&N was asked to investigate ideas to improve traffic operations at the Interstate 70 & Route 7 interchange at this location and prepared a traffic study to explore a possible interchange improvement.

The following is a summary of the above-described work.

Figure 1

Looking North

Looking South

Figure 2

STRUCTURE TYPE STUDY

B&N commenced with exploring bridge rehabilitation and replacement options in September 2017. The existing bridges are "twin" separate northbound and southbound structures crossing over several highways, a creek and various other land use features. The twin bridges have separate T-type piers but share common abutments. The bridges are both 1628 feet long but have differing span lengths. Other than the differences between the first four span lengths on the north bound structure and the first three span lengths on the south bound structure, the structures are

similar. Forward of Pier 3 on each of the structures all detailing is identical with the north bound and south bound structures mirrored about the centerline. The structures are made up of five units (426', 182', 323', 374' and 323') with cantilevered hinges at the end of each unit.

B&N studied bridge rehabilitation and replacement options.

For the rehabilitation option, only the pier stems and foundations would be retained – all other bridge components would be replaced, more or less retaining the overall bridge spans and length. To facilitate construction in general, part-width construction, and because of significant tilting of the abutments, new abutments would be placed in front of the existing abutments. Additionally, Piers 9 and10, the piers adjacent to Wheeling Creek, would be entirely replaced due to structural pier stem and cap deficiencies found by analysis that would not be practical to retrofit.

For the replacement option, two alternatives were studied. In Option A the existing twin bridges would be replaced by three shorter twin bridges. This option is feasible because much of the current land use under the bridge does not need to be retained (does not need to be "bridged"). More information about the specific land uses under the existing bridge is contained in the Structure Type Study. In general terms, the total length of the three shorter bridges is about half the length of the existing bridges. The space between the three bridges would consist of MSE wall "islands". Based on supplemental geotechnical information obtained during the study (via D11 geotechnical task order contract), it was determined that supplemental support (e.g. stone columns) would be needed to support the MSE islands. The determination of the exact type of geotechnical strengthening was beyond the scope of B&N's study, but an allocation for this supplemental support was included in construction cost estimates.

Replacement Option B would consist of full length "twin" bridges similar to the existing.

The structures study work comparing these rehabilitation and replacement option was put in the form of a Structure Type Study, which was submitted for ODOT review in March 2019. The Structure Type study was revised in accordance with ODOT review comments and the revised Structure Type Study is shown in **Attachment A**. A copy of the review comments and their disposition is included separate from this memorandum.

Comparative estimates of probable construction costs (bridge only) for the two options as presented in the 2019 Structure Type Study are:

Rehabilitation Option:	$ 21.7 million*
Replacement Option A (3 bridges w/ MSE islands):	$ 20.7 million*
Replacement Option B (full length bridge):	$ 25.2 million*

Note that these costs are for structure only and do not include any roadway costs. Estimates used Estimator 2017 cost information inflated to 2019 and include 20% contingency and no engineering costs.

The Bridge Replacement Option A (3 Bridges w/MSE Islands) is recommended for this project.

PIER CAP REPAIRS

Concurrent with the structure type study work, B&N prepared a study of pier cap strengthening and retrofit options. An external post-tensioning option was selected as the preferred option. B&N prepared engineering plans for that option and the construction project was awarded on September 27, 2018 and completed on May 31, 2019. The engineering plans for that work are included as **Attachment B**. A photo of one of the completed pier cap retrofits is show as Figure 3.

Figure 3

INTERCHANGE EVALUATION TECHNICAL MEMORANDUM

In August 2019, District 11 requested that B&N explore ideas to improve traffic operations in this Route 7 interchange with the thought that the reconstruction of the bridge would be a good time to make these improvements if they were warranted. The goal of the work was to determine if there was a feasible interchange modification that would significantly improve traffic operations while being consistent with the proposed bridge reconfiguration. On September 23, 2019, B&N was authorized to proceed with the study. Meetings with D11 and Central Office personnel were held in November 2019 and February 2020, and on April 22, 2020, B&N submitted the study to D11 as an Interchange Evaluation Technical Memorandum. A copy of that memorandum is shown in **Attachment C**.

Layouts for several interchange concepts were developed. A single roundabout at the Main Street (US40)/Lincoln Avenue intersection was identified as the best feasible alternative to improve traffic operations while best fitting within the constraints of the project area. (See Figure 4). This roundabout would necessitate changing the span arrangement and length of the middle bridge of the bridge replacement option. Additionally, it would require that two of the piers be straddle bents with pier columns located in the roundabout islands, and additionally, two other pier columns located close to the edge of the proposed roadway.

The additional construction cost to incorporate the roundabout into the project is estimated to be $ 4.8 million (2019 costs).

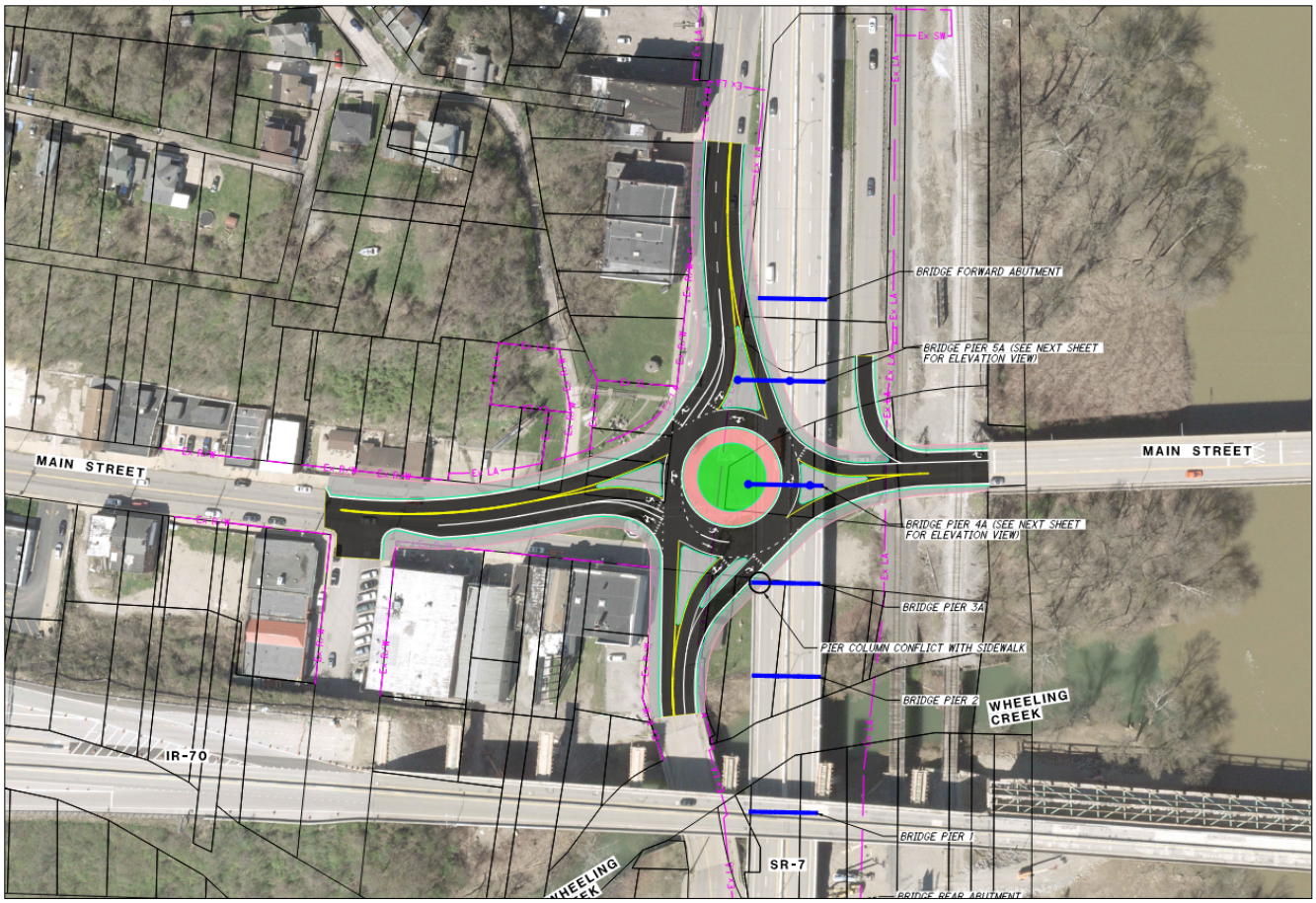

Figure 4

ROUNDABOUT TRAFFIC STUDY

The interchange evaluation described above was prepared based on existing and available traffic data. Subsequent to the preparation of the interchange evaluation, ODOT requested that B&N prepare Certified Traffic for the interchange and confirm that the roundabout alternative met the traffic operational performance metrics using the Certified Traffic data. B&N prepared a traffic study report and submitted to ODOT on November 11, 2021. The primary conclusion from the study was that the proposed roundabout improved the traffic operations at the Main Street (US 40) & Lincoln Avenue intersection from LOS E in the existing condition to LOS B. The study also described potential improvements to other intersections to improve traffic operations.

This traffic study is shown in **Attachment D**.

ROUNDABOUT IMPACTS MEETING

On January 27, 2022, a virtual meeting was held with B&N and D11 to discuss in more detail the advantages, disadvantages, and impacts to the project if the roundabout improvement was done as part of the project. Items discussed were clear zone and sight distance for substructures adjacent to the roundabout, experience by other states in constructing similar facilities (roundabouts under bridges), pier column/cap risk assessment issues, maintenance of traffic, and property impacts.

A copy of the information presented at that meeting is shown in **Attachment E**.

REVISED ESTIMATES OF PROJECT COSTS

As stated earlier, construction cost estimates were based on 2017 Estimator data inflated to 2019. Assuming that the construction midpoint is now in 2025, the following are new total project construction cost estimates (Note: Costs include a 20% contingency but do not include right-of-way or engineering).

Item	**Cost**	
Comparative Bridge Costs (Bridge Only)	**2017**	**2025**
Bridge Rehabilitation	$ 21.7 M	$ 27.6 M
Bridge Replacement Option A (3 bridges w/ MSE Islands)	$ 20.7 M	$ 26.3 M
Bridge Replacement Option B (Single Full Length Bridge)	$ 25.2 M	$ 32.0 M
Bridge Replacement Option A Full Project (no roundabout)	$ 24.9 M	$ 31.6 M
Bridge Replacement Option A Full Project (with roundabout)	$ 29.7 M	$ 37.7 M

Information showing how these construction costs were calculated is shown in **Attachment F**.

The Bridge Replacement Option A (3 Bridges w/MSE Islands) is recommended for this project. Although the traffic analysis indicated a roundabout would improve traffic flow, the required bridge pier columns would obstruct stopping sight distance entering the roundabout. Additionally, the bridge pier cap over the roundabout would be non-redundant, which BDM section 1001.2 states should be avoided. These concerns, along with the additional project cost, lead to this recommendation.

CONCLUSION

We appreciate the opportunity to serve ODOT and supply this information in support of making decisions about how to proceed with improvements. If you have any questions or need any additional information, please do not hesitate to contact me.

Respectfully,

Thomas A. Bolte, PE
Project Manager

Attachment A

BURGESS & NIPLE
Engineers ■ Architects ■ Planners

STRUCTURE TYPE STUDY -

BEL-7-1975 OVER RAMP B, WHEELING CREEK, US40/US250 AND ACCESS TO RAMP D

Bridgeport, Ohio

PID No: 106237

Prepared for:
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ODOT District 11
2201 Reiser Avenue
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March 13, 2019
Revised April 2022

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GENERAL VIEW OF STRUCTURE LOOKING NORTHWEST

INTRODUCTION

PROJECT DESCRIPTION

This Structure Type Study has been prepared by Burgess & Niple (B&N) for the Ohio Department of Transportation (ODOT), District 11, to compare alternatives between rehabilitating or replacing the BEL-7-1975 structure carrying SR7 over Ramp B (ramp from SR7 North Bound to South Lincoln Avenue), Wheeling Creek, US Route 40/US Route 250 and access to Ramp D (ramp to SR7 North Bound) in Bridgeport, Ohio. Two options were investigated. The **Rehabilitation Option** includes removing most of the existing structure except for pier stems and footings, replacing the two piers adjacent to Wheeling Creek, replacing the remaining pier caps, replacing the abutments and replacing the superstructures. The **Replacement Option** includes removing the existing structures and replacing with three twin bridges combined with two areas of MSE fill. It is anticipated that traffic will be maintained during construction by utilizing crossovers, for either the replacement or rehabilitation option.

> Terminology: For inventory purposes, ODOT classifies this structure as a single bridge, with one Structure File Number. The superstructures and piers for the northbound structure and the southbound structure are separate. The abutments are shared. For the purpose of this Structure Type Study, the terminology "bridges", "bridge", "structures", and "structure" may be used interchangeably to more clearly define the physical element being described.

DESIGN REFERENCES

For the **Rehabilitation Option**, all preliminary design calculations for the new superstructure conform to the 2007 ODOT LRFD Bridge Design Manual (BDM) and AASHTO LRFD Bridge Design Specifications. All preliminary design calculations for the existing substructures conform to the 2004 ODOT LFD BDM and the AASHTO Bridge Design Standard Specification (LFD). For the **Replacement Option**, all preliminary design calculations for the new structure conform to the 2007 ODOT LRFD BDM and AASHTO LRFD Bridge Design Specifications.

DESIGN CONSIDERATIONS

EXISTING STRUCTURE

The existing bridge crosses over several highways, a creek and various existing features. See **Exhibit 1** for an aerial view of the project site, and **Exhibit 2** for representative bridge photographs. The north bound bridge has twenty-two spans. The south bound bridge has twenty-one spans. Both superstructures are approximately 1628 feet long. Other than the differences between the first four span lengths on the north bound structure and the first three span lengths on the south bound structure, the structures are similar. Forward of Pier 3 on each of the structures all detailing is identical with the north bound and south bound structures mirrored about the centerline. The structures are made up of five units (426', 182', 323', 374' and 323') with cantilevered hinges at the end of each unit. Elastomeric strip seal type expansion joints are located in the deck above each of the hinges and at the abutments. The superstructure for Units 1, 2, 4 and 5 is non-composite ASTM A36 Steel beams and Unit 3 is non-composite ASTM A36 haunched girders. The existing bearings are ODOT standard rocker and bolster type.

All piers are reinforced concrete T-type. All piers, except Piers 9E, 9W, 10E and 10W (piers adjacent to Wheeling Creek), are supported on piles. Piers 9E, 9W, 10E and 10W are supported on spread footings. The deck width of each structure is 35 foot-1 inch with a 2 inch gap between the north bound and south bound structures. The existing abutments are reinforced concrete wall type supported on piles. The original design loading was CF 2000 (57). The bridge was originally constructed in 1968 and underwent a rehabilitation in 1998. See **Appendix E** for the original and rehabilitation plans. Behind the abutments, cast in place reinforced concrete retaining walls supported on piles make up the approach ramps to allow the roadway to rise up to the viaduct type structures at 4.0% grades. The approach ramp behind the Rear Abutment is approximately 300-foot-long and the approach ramp forward of the Forward Abutment is approximately 400-foot long. In addition to several highways and Wheeling Creek, various existing features are located under the structures, including a towing company's office and yard, a basketball court, access to community recycling dumpsters, an access road to a sewage pump station, a public park, and public parking with meters. Interstate Route 70 passes over the bridge. Norfolk Southern Railroad and Wheeling and Lake Erie Railway are located east and parallel of the bridge by approximately 100 feet and 200 feet, respectively.

EXHIBIT 1: PROJECT LOCATION AND PRIMARY FEATURES

Looking North

Looking South

EXHIBIT 2: EXISTING BRIDGE PHOTOS

DESIGN CRITERIA FOR SR7

Road Classification: Other, Freeway or Expressway

Roadway and Bridge width: 2 – 12-foot lanes, 5-foot outside shoulders, 2-foot 2 inch inside shoulders

Design and posted speed: 50 MPH

Rehabilitation Option Loading: Superstructure – HL-93

Substructure – HS20-44 or Alternate Military Loading

Replacement Option Loading: HL-93

Future Wearing Surface: 60 PSF

PROPOSED BRIDGE ALTERNATIVES

Rehabilitation Option

The Rehabilitation Option work includes removing portions of the existing structures and replacing the two piers adjacent to Wheeling Creek, replacing the remaining pier caps, replacing the abutments in front of the existing abutments and replacing the superstructures utilizing part width construction. The rehabilitated structure will consist of five units, similar to the existing structure. Existing pier points of fixity and expansion will be retained. Cantilevered beams with hinges and deck expansion joints offset from the centerlines of the piers will not be replicated. New two gland modular type deck expansion joints will be located over the centerline of piers 5, 8, 11 and 16. Strip seal type deck expansion joints will be located at the abutments. Elastomeric type bearings are proposed. The deck will require scuppers. The existing ramps at both ends of the project will remain in place. See **Appendix B** for the Rehabilitation Option Site Plan and miscellaneous details.

Replacement Option

The Replacement Option work includes removing the existing structures and replacing with three twin bridges combined with two areas of MSE fill. Work will be performed utilizing part width construction. **Existing soils under the MSE fill areas are not suitable to support MSE walls without ground improvement (see Geotechnical Considerations).** Removal and replacement of 10 feet of soil in these areas has been assumed for the purposes of this study. Starting at the Rear Abutment of the existing bridge, new MSE walls and stub type abutments behind MSE walls will be constructed in front of the existing abutments. Progressing up station, Bridge Number 1 will consist of two-span concrete I-beam type structures on cap and column type piers and semi-integral type abutments behind MSE walls. The north bound and south bound structures will be offset to allow Ramp B to pass diagonally below the structures. Concrete I-beams are proposed for economy and durability since sufficient depth is available and required under clearance can be provided. Up station of Bridge Number 1 will be MSE Island Number 1. The north bound island will be approximately 394 feet in length and the south bound will be approximately 361 feet in length. Next will be Bridge Number 2, a four-span steel plate girder structure supported on cap and column type piers on drilled shafts with stub type semi-integral type abutments behind MSE walls. The length of the bridge exceeds the ODOT BDM maximum limit for semi-integral type structures, however, ODOT OSE was contacted and indicated that the maximum could be exceeded if one of the substructures were fixed and earth pressures were limited on the back walls. Pier 2 will be fixed and the backwall wall pressures will need to be investigated at the next stages of design. Up station of Bridge Number 2 is MSE Island Number 2 with a length of approximately 373 feet. Next will be Bridge Number 3, a three-span cast-in-place concrete slab bridge utilizing ODOT standard drawing details. A cast-in-place slab bridge is proposed to provide a shallow superstructure to allow the required under clearance for the Access Road to Ramp D. At the north end of the project, up station of Bridge Number 3, new MSE walls and stub type abutments behind MSE walls will be constructed in front of the existing abutments. Scuppers will be required in the bridge decks and inlets will be necessary in the MSE islands. The existing ramps at both ends of the project will remain in place. See **Appendix C** for the Replacement Option Site Plan and miscellaneous details.

BRIDGE AND ROADWAY ALIGNMENT AND PROFILE

The existing SR7 centerline alignment has a 1273.24-foot radius as the roadway approaches the structure from the south. A spiral connecting the curve to a tangent section extends 59.63’ onto the bridge north of the Rear Abutment. As the roadway extends across the structures to the north the alignment is tangent. The point of curvature for a 4583.66’ radius curve is located 78.99’ north of the Forward Abutment. The proposed alignment will match the existing alignment.

The existing SR7 profile consists of the following in the vicinity of the bridges:

Station	Grade	Length	Vertical Curve Type
157+14.5	+4.00%		
		140.5’	
158+55	+4.00%		
		650’ VC	Crest
165+05	-3.80%		
		30’	
165+35	-3.80%		
		450’ VC	Sag
169+85	+2.50%		
		16’	
170+01	+2.50%		
		550’ VC	Crest
175+51	-4.00%		
		99’	
176+50	-4.00%		

Centerline Bearings: Rear Abutment = Station 159+15, Forward Abutment = 175+43

The proposed SR7 profile consists of the following in the vicinity of the **Rehabilitation Option**:

Station	Grade	Length	Vertical Curve Type
159+10	+2.70%		
		500’ VC	Crest
164+10	-3.15%		
		70’	
164+80	-3.15%		
		280’ VC	Sag
167+60	+2.00%		
		270’	
170+30	+2.00%		
		510’ VC	Crest
175+54	-4.38%		

Centerline Bearings: Rear Abutment = Station 159+26, Forward Abutment = 175+32

The proposed SR7 profile consists of the following in the vicinity of the **Replacement Option**:

Station	Grade	Length	Vertical Curve Type
159+10	+2.70%		
		500’ VC	Crest
164+10	-3.25%		
		50’	
164+60	-3.25%		
		310’ VC	Sag
167+70	+2.50%		
		160’	
169+30	+2.50%		
		550’ VC	Crest
175+80	-3.70%		

Centerline Bearings: Rear Abutment (NB) = Station 159+54, Rear Abutment (SB) = Station 159+66, Forward Abutment = 175+17

The Rehabilitation Option and Replacement Option have different profiles due to different superstructure depths over US Route 40/250 and the need to provide the required 16-foot 6 inch under clearance.

MAINTENANCE OF TRAFFIC

To maintain one lane of traffic in each direction along SR7, the proposed structures will need to be built using part width construction. Traffic will need to be routed from two lanes to one lane in each direction via the use of crossovers. Portable concrete barrier will be used along the centerline of each structure to separate the opposing directions of traffic. Portions of removed approach median barrier will be reconstructed after crossovers are no longer necessary.

For the **Rehabilitation Option**, temporary closures will be required at Ramp B, US40/US250 and Access Road to Ramp D during existing beam removal and erection of new beams. For the **Replacement Option**, similar temporary closures will be required at Ramp B and US40/US250, but a longer duration temporary closure will be necessary at the Access Road to Ramp D due to the falsework necessary to construct the cast-in-place slab bridge.

EXISTING FEATURES UNDER BRIDGE

Various existing features are located under the bridge. From the Rear Abutment to the Forward Abutment (south to north), the following are encountered:

Ramp B – Ramp B is the SR7 north bound exit ramp to South Lincoln Avenue in Bridgeport, Ohio. The ramp exits the east side of SR7 and passes under Span 2 of the north bound and south bound BEL-7-1975 structure. A stop sign is located at South Lincoln Avenue.

A-1 Towing – A-1 Towing has a trailer type office and a fenced in storage yard under the structure that occupies what appears to be an old B&O Railroad right of way under Spans 3 and 4 of the south bound structure and under Spans 3 through 5 of the north bound structure. Several vehicles that appear to be associated with the towing company are parked outside the fenced area. For the **Replacement Option**, since MSE Island Number 2 will be constructed at the same location currently occupied by A-1 Towing offices and vehicle storage areas, the facility will need to be relocated.

Sewage Pump Station Access Drive – A gravel access drive which continues to a sewage pump station access drive occupies the area under Span 5 of the south bound structure and Span 6 of the north bound structure. For the **Replacement Option**, since MSE Island Number 2 will cut off access from Lincoln Avenue to the Sewage Pump Station, a new relocated access drive will need to be constructed. The new access drive will be located under Span 2 of Bridge Number 1 and will tie into the existing access drive west of the existing at grade crossing with the Norfolk Southern Railroad.

Paved Parking – An asphalt parking lot occupies the area under Span 6 of the south bound structure and Span 7 of the north bound structure. The lot does not have parking meters. The paved parking was not previously permitted by ODOT and the use will need to be terminated prior to a bridge project.

Basketball Court – A fenced asphalt basketball court occupies the area under Span 7 of the south bound structure and Span 8 of the north bound structure. For the **Replacement Option**, since MSE Island Number 2 will be constructed at the same location currently occupied by a fenced asphalt basketball court, the court will need to be removed. For either option, the basketball court was not previously permitted by ODOT and will need to be removed prior to a bridge project. As it was not previously permitted by ODOT, the basketball courts are not a 4(f) resource.

Paved Access to Recycling Dumpsters – An asphalt access road to six recycling dumpsters and a parking area with signs indicating permit parking occupies the area under Span 8 of the south bound structure and Span 9 of the north bound structure. For either option, this use was not previously permitted by ODOT and will need to be removed prior to a bridge project.

Grass and Gravel Creek Bank – A sloping grass and gravel creek bank occupies the area under Span 9 of the south bound structure and Span 10 of the north bound structure.

Wheeling Creek – Wheeling Creek is located under Span 10 of the south bound structure and Span 11 of the north bound structure.

Lincoln Avenue Park – A park with a perimeter fence, picnic pavilion, picnic tables and park benches is located under Span 11 of the south bound structure and Span 12 of the south bound structure. This use was not previously permitted by ODOT and will need to be removed prior to a bridge project. The park is not a 4(f) resource since it was not permitted.

Paved/Gravel Metered Parking – An asphalt and gravel parking lot with parking meters occupies the area under Span 12 of the south bound structure and Span 13 of the north bound structure. The parking was not previously permitted by ODOT and the use will need to be terminated prior to a bridge project.

US Route 40 and US Route 250 – US Route 40 and US Route 250 combine to form three lanes that pass under Span 13 of the south bound structure and Span 14 of the north bound structure. Under deck lighting is attached to the US Route 40/250 side of the pier caps. A traffic signal for west bound traffic is attached to north side of Pier 12W.

Paved/Gravel Metered/Non-Metered Parking – Asphalt and gravel parking lots, some with meters and some are non-metered occupy the areas under Spans 14 through 19 of the south bound structure and Spans 15 through 20 of the north bound structure. Under deck lighting is attached to the north side of Pier 17 E/W and the south side

of Pier 18 E/W. The parking was not previously permitted by ODOT and the use will need to be terminated prior to a bridge project.

Access to Ramp D – An access road from the intersection of South Lincoln Avenue and US 250 to the ramp to north bound SR7 (Ramp D) is located under Span 20 of the south bound structure and Span 21 of the north bound structure.

REMOVAL CONSIDERATIONS

The existing bridge will need to be removed part width, coordinated with the maintenance of traffic phasing. As noted above, various existing features are located under the bridges and will need to be temporarily closed, relocated or permanently removed as necessary. For the **Replacement Option**, at locations where MSE fill is proposed, foundations from buildings at the site prior to the original bridge construction may be present along with the possibility of old tanks and other underground structures. These structures will need to be removed prior to soil stabilization and MSE construction. In addition, the existing pier concrete footings at locations where MSE fill is proposed will need to be completely removed to eliminate rigid areas under the MSE fill. The existing pier footing piles can remain.

TRANSVERSE SECTION

The proposed bridge decks will be slightly narrower than the existing bridge decks. Single slope barrier 1'-6" wide by 3'-6" tall on the outside faces (ODOT Standard Drawing SBR-1-13) and 1'-10" wide by 4'-9" tall at the medians (ODOT Standard Drawing SBR-2-13) are proposed. Two 12-foot lanes with 5 foot outside shoulders and 2'-2" inside shoulders are proposed. The bridge lane and shoulder widths will match the existing approach lane and shoulder widths. The existing shoulder widths are substandard per ODOT L&D Volume 1 figure 301-3 which requires 10 foot outside shoulders and 4 foot inside shoulders. A design exception for shoulder widths will be required per ODOT L&D Volume 1 Section 105.2. If wider structures were to be constructed, the wider shoulders would require the bridge deck widths to increase by 6'-10" for an out-to-out widths of 41'-6". Wider structures would require the approach ramps (including retaining walls) to be reconstructed. Temporary and permanent vandal protection fencing will not be necessary due to the current requirements of Section 305.2 of the 2007 ODOT BDM (effective 07-20-18).

VERTICAL CLEARANCE

Existing and proposed vertical clearances are indicated below:

Under Clearance

Location	Existing	Preferred	Proposed (Rehabilitation)	Proposed (Replacement)
Ramp B	22.82'	16.50'	22.60'	21.72'
SR7 (IR70 above)	15.59'	16.50' (see **Note 1**)	16.87'	16.84'
US 40/US 250	14.49'	16.50'	16.86'	16.66'
Access to Ramp D	15.04'	16.50' (see **Note 2**)	15.78'	16.99'

Note 1 = Past ODOT projects have allowed 16' instead of 16.5' since the underlying roadway surface is a bridge deck and the probability of a 6" thick overlay is unlikely.

Note 2 = ODOT L&D Volume 1 Table 302-1E indicates that a 15.5' minimum clearance may be used in highly developed urban areas if attainment of 16.5' clearance would be unreasonably costly and if there is an alternate route or bypass which provides a minimum 16.5' vertical clearance. Obtaining 16.5' of clearance would require the grade to be raised on the forward approach, increasing the height of the existing retaining walls and adding considerable cost to the project. Since east bound US 250 vehicles over 15.5' in height could access SR7 north bound by turning south on South Lincoln Avenue, then east of US 40/US250 which provides 16.5' of vertical clearance, then north on Ramp D. This alternate route satisfies the bypass requirement and would allow for a 15.5' vertical clearance under the structures for access to Ramp D. Special signs would be required directing vehicles over 15.5' along the bypass route.

HORIZONTAL CLEARANCE

Horizontal clearance is not a concern for the proposed structure. The nearest railroad is Norfolk Southern, located approximately 100 feet east and parallel to the SR7 centerline.

ABUTMENTS

The existing abutments are reinforced concrete wall type supported on 12-inch diameter cast in place reinforced concrete piles at the Rear Abutment and 10BP42 steel H-piles at the Forward Abutment.

Both abutments exhibit the following deficiencies:

Abutment breastwalls and backwalls have tilted towards the adjacent piers (Rear Abutment tilt varies from approximately 3/16 inch to 7/8 inch in 3 feet, Forward Abutment tilt varies from approximately 1/4 inch to 5/8 inch in 3 feet).

Joints between the turn back wing wall portions of abutments and approach retaining walls are tight at the bottom of the walls (approximately 1 1/2-inch gap) and the gaps increase with elevation as the joint progressives up the walls (approximately 5-inch gap). Backfill material has spilled out of the joint openings and has accumulated in piles at the base of the walls. See **Appendix G** for photographs.

Horizontal cracks are present in the abutment wingwalls. The cracks start at the joint between the turn back wingwalls and the approach retaining walls, are located approximately 2 to 3 feet above ground and progress towards the front face of the breastwalls. See **Appendix G** for photographs.

The existing abutments were analyzed to determine their current structural capacity. A summary of the findings for design equivalent fluid pressures of 30 pounds per cubic foot (1959 design criteria) and 40 pounds per cubic foot (current design requirement) are shown below.

Structural Capacity using 30 pounds per cubic foot equivalent fluid pressure

	Description	RA (South)		FA (North)	
		Value	Status	Value	Status
Stability	Overturning F.S.	3.16	OK	3.64	OK
	Sliding F.S.	2.69	OK	4.32	OK
Pile Load	Design Pile Capacity (kips)	80		70	
	Max. Actual Pile Load (kips)	88.59		71.3	
	% of overload	11%		2%	
	Uplift Force?	No		No	
Breast Wall Reinf. (Vertical, Far Face @ Base of Wall)	Req'd #6 spa. @ bot. wall (in)	3.81		6.43	
	Act. #6 spa. @ bot. wall (in)	6		12	
	Perf. (Act/Req'd) Ratio *	64%		54%	

* = if < 100%, existing reinforcing steel is inadequate.

Structural Capacity using 40 pounds per cubic foot equivalent fluid pressure

	Description	RA (South)		FA (North)	
		Value	Status	Value	Status
Stability	Overturning F.S.	2.37	OK	2.80	OK
	Sliding F.S.	1.62	OK	2.29	OK
Pile Load	Design Pile Capacity (kips)	80		70	
	Max. Actual Pile Load (kips)	90.83		79.77	
	% of overload	14%		14%	
	Uplift Force?	No		No	
Breast Wall Reinf. (Vertical, Far Face @ Base of Wall)	Req'd #6 spa. @ bot. wall (in)	2.93		4.97	
	Act. #6 spa. @ bot. wall (in)	6		12	
	Perf. (Act/Req'd) Ratio *	49%		41%	

* = if < 100%, existing reinforcing steel is inadequate.

The findings indicate that the pile loads exceed the allowable design capacity and that the far face reinforcing steel at the base of the wall is inadequate.

ODOT District 11 engineers were consulted and indicated that due to the noted structural deficiencies, the existing abutments should be removed and new abutments should be constructed in front of the existing abutments. The new abutment design and detailing for the **Rehabilitation Option** will be similar to the existing abutments. Superstructure movements will be handled with strip seal type expansion joints. New cast-in-place concrete wing walls will be constructed between the existing approach ramp retaining walls and the new abutments. New abutments for the **Replacement Option** will be semi-integral stub type supported on two rows of piles behind MSE walls. New MSE walls will be constructed between the existing approach ramp retaining walls and the new MSE walls in front of the new abutments.

PIERS

Due to numerous variables (beam reactions due to various span lengths, various stem heights, various footing sizes, various number and arrangement of piles, etc.), representative piers were selected to verify their structural capacity. Existing Piers 6, 9, 10 and 16 were investigated. See **Appendix A** for a summary of the results.

The summary of analysis results is shown in **Appendix A.** After discussion of the results with District 11, it was concluded that the overstressed piles and minor overstressed stems (<16%) at Piers 6 and 16 were acceptable but that the supplementing the reinforcing in the river pier stems (Piers 9 and 10) would be cost prohibitive and should not be carried forward.

The **Rehabilitation Option** assumes Piers 9 and 10 are replaced with new cap and column type piers supported on drilled shafts on the bank side of the existing piers. At all the remaining piers, the pier caps are removed and replaced. B&N performed a separate study of the pier caps and confirmed that shear reinforcement in the caps was insufficient. Pier caps at Piers 8E, 8W, 11E, 11W, 16E and 16W were strengthened with external post tensioning in a separate project.

For the three new structures proposed for the **Replacement Option**, all new piers will be constructed. Cap and column type piers on piles are proposed at Bridge Number 1 and 3. At Bridge Number 2, cap and column type piers on drilled shafts with rock sockets are proposed at the river piers and cap and column type on piles for the pier adjacent to US Route 40/250.

SUPERSTRUCTURE DETAILS

For the **Rehabilitation Option,** new steel beams and girders supported on new pier caps at locations of the existing piers for all locations except for the new river piers are proposed in a similar five-unit configuration. Five lines of beams or girders spaced at 7 feet 11 inches on centers for each superstructure are proposed. Points of fixity will be similar as the existing. Locations of deck joints will also be similar to the existing, however, the cantilevered hinges adjacent to Piers 5, 8, 11 and 16 will not be replicated. New deck expansion joints at these locations will be positioned at the centerline of the piers. Composite, 50 ksi, weathering steel beams and girders are proposed. 30-inch deep wide flange beams are proposed at Units 1, 2, 4 and 5. Plate girders with 50-inch deep webs are proposed for Unit 3. Composite 8 ½ inch thick reinforced concrete decks with ODOT Standard Drawing SBR-1-13 type barrier on the exterior and ODOT Standard Drawing SBR-2-13 type barrier on the interior are proposed. Bearings will be laminated elastomeric type bearing pads.

For the **Replacement Option,** the proposed three bridges will consist of three different superstructure types:

Bridge Number 1 will be two span structures composed of five lines of AASHTO Type 3 prestressed concrete I beams spaced at 7 feet 10 inches on centers. Composite 8 ½ inch thick reinforced concrete decks with ODOT Standard Drawing SBR-1-13 type barrier on the exterior and ODOT Standard Drawing SBR-2-13 type barrier on the interior are proposed. Bearings will be laminated elastomeric type bearing pads.

Bridge Number 2 will be four span structures composed of five lines of composite, continuous, 50 ksi, weathering steel girders spaced at 7 feet 11 inches on centers with 50-inch deep webs. Composite 8 ½ inch thick reinforced concrete decks with ODOT Standard Drawing SBR-1-13 type barrier on the exterior and ODOT Standard Drawing SBR-2-13 type barrier on the interior are proposed. Bearings will be laminated elastomeric type bearing pads.

Bridge Number 3 will be three span cast-in-place structures similar to ODOT Standard Drawing CS-1-08. A 27-inch thick reinforced concrete superstructure with ODOT Standard Drawing SBR-1-13 type barrier on the exterior and ODOT Standard Drawing SBR-2-13 type barrier on the interior are proposed.

Fill sections contained by MSE walls are proposed between the existing Rear Abutment and Bridge Number 1, Bridge Number 1 and Bridge Number 2, Bridge Number 2 and Bridge Number 3 and Bridge Number 3 and the existing Forward Abutment.

Reducing the number of beam lines from five to four was investigated, however, four beam lines would increase the superstructure depth which would reduce the under clearance to below the minimum requirements. The profiles would have to be revised to allow overhead clearance below Interstate 70 and under clearance over US 40. In addition, for the **Rehabilitation Option** the grade would have to be raised at the forward approach, possibly creating alterations or replacement of the retaining walls at the forward approach ramp.

DECK DRAINAGE

The existing north bound and south bound structures currently have a total of approximately 34 scuppers.

Rehabilitation Option

Scuppers will be required on the new bridge decks to ensure deck drainage remains on the outside shoulders and does not encroach into the lanes. Scupper type will be as shown on ODOT Standard Bridge drawing GSD-1-96. Scupper locations have been adjusted to keep the downspouts close to the piers to eliminate long horizontal runs of drain pipe. Additional scuppers have been added at the sag points as required by ODOT L&D Section 1103.5. Approximately 25 scuppers will be necessary on each bridge for a total of 50.

Replacement Option

Scuppers will be required on the three new bridge decks and inlets on the MSE fill sections to ensure deck drainage remains on the outside shoulders and does not encroach into the lanes. Inlets and associated drainage pipes will need to be detailed and constructed properly to reduce the possibility of leakage and wash out of MSE granular fill. Scupper type will be as shown on ODOT Standard Bridge drawing GSD-1-96 and inlets will be as shown on ODOT Standard Drawing I-2.3 (Inlet No. 3 for Single Slope Barrier Type D). Scupper locations have been adjusted to keep the downspouts close to the piers to eliminate long horizontal runs of drain pipe. Additional scuppers have been added at the sag points as required by ODOT L&D Section 1103.5. Approximately 16 scuppers on the bridges and 6 inlets in the MSE fill areas will be necessary on each structure for a total of 32 scuppers and 12 inlets.

AESTHETIC CONSIDERATIONS

There are currently no aesthetic requirements for this structure beyond standard ODOT policy, so aesthetic considerations were not included in the assessment of alternatives.

UTILITIES

Utilities located during the field survey include storm sewers, sanitary sewers, water, high pressure natural gas, overhead telecommunications, underground telecommunications, overhead electric, underground electric and underground fiber optic. For the **Rehabilitation Option**, since for the majority of the piers the existing pier footings and stems will be re-used, no excavation will be required and no underground utilities should be disturbed. Some overhead utilities may need to be temporarily relocated during removal of existing beams/girders and erection of new beams/girders. No utilities should be disturbed at the new abutments if they are positioned in front of the existing abutments. For the **Replacement Option**, the following will need to be relocated due to the requirements of ODOT BDM Section 301.7 which states "Placing utilities through or underneath MSE walls should be avoided when possible":

30-inch diameter sewer crossing the SR7 centerline at approximately Station 161+50.

Water line crossing the SR7 centerline at approximately Station 162+00.

Overhead telecommunications connected to the A-1 Towing office.

12-inch diameter high pressure natural gas line crossing the SR7 centerline at approximately Station 165+13.

Unknown diameter storm sewers at approximately Stations 168+75 and 170+00.

Others may be necessary.

See **Appendix C**, Rehabilitation Site Plan – Utility Disposition, Sheet 3 of 5 for highlighted utilities requiring relocation.

TRAFFIC SIGNAL

A traffic signal is attached to the north side of the cap at Pier 12W. For the **Rehabilitation Option**, the traffic signal will need to be removed, temporarily relocated and re-installed on the new pier cap. For the **Replacement Option**, the traffic signal will need to be removed and re-installed on a new ground mounted pole, since the new pier will be located 30 feet south of existing Pier 12W.

RIGHT OF WAY

The majority of the foot print of the existing bridge is located within Limited Access Easement (EX LA indicated on the Site Plan) type right of way. However, in the vicinity of Piers 2E(A), 3E and 3W, Aerial Easement (EX A indicated on the Site Plan) type right of way is present at the location of the removed B&O Railroad tracks. The Site Plan indicates a general easement was acquired for right of way at the location of the existing footings for Piers 2E(A), 3E and 3W. For the **Rehabilitation Option**, no additional right of way should be necessary. For the **Replacement Option**, since the area currently identified as Aerial Easements will be occupied with new substructures, retaining walls or fill, right of way will need to be acquired.

A-1 Towing has a trailer type office and a fenced in storage yard under the structure that occupies what appears to be an old B&O Railroad right of way under Spans 3 and 4 of the south bound structure and under Spans 3 through 5 of the north bound structure. A-1 Towing will need to be relocated prior to a bridge project.

TEMPORARY SHEETING

For the **Rehabilitation Option**, temporary sheeting and temporary wire faced MSE walls will be required along the centerline of SR7 to maintain traffic with part width construction during the removal of the existing abutments and construction of the new cast-in-place abutments. See "Plan View at Rear Abutment" in **Appendix B** for details. For the **Replacement Option**, the new abutments at the existing abutments will be stub type behind MSE walls with similar sheeting details. In additions, temporary wire faced MSE walls will be necessary along the centerline of SR7 to construct the MSE fill sections. See "Typical MSE Wall Section" in **Appendix C** for details. Temporary sheeting due to the undercut is not anticipated along the west side (Lincoln Avenue) and the east side (Norfolk Southern Railroad) of the proposed MSE fill sections. Sufficient clearance is available in these areas to allow 1:1 open cut slopes. The cost of temporary sheeting has been included in the construction cost estimates.

RAILROADS

Norfolk Southern Railroad and Wheeling and Lake Erie Railway are located east and parallel of the existing north bound SR7 structure by approximately 100 feet and 200 feet, respectively. Both railroads have bridges that cross Wheeling Creek and at grade crossings at US40/US250. A gravel access road to a sewage pump station crosses the Norfolk Southern Railroad tracks at grade southeast of the Rear Abutment. Previously two B&O Railroad tracks passed under Unit 1 of the SR7 structure. The rails and ties have been removed, but the right of way is occupied by A-1 Towing.

HYDRAULIC CONSIDERATIONS

The Federal Emergency Management Agency Flood Insurance Study for Belmont County, Ohio dated April 5, 2006 indicates the 100-year flood water elevation due to backwater from the Ohio River at SR7 crossing over the Wheeling Creek to be approximately elevation 658.5 (page 13P and 18P). The original bridge plans for the State Route 7 Viaduct dated 1959 agree with that study and indicate a high-water elevation of 659.0 (backwater from assumed maximum Ohio River Flood). The bottom of the lowest girder from the existing structure is approximately elevation 665.0 +/-. The **Rehabilitation Option** and **Replacement Option** will have low girder elevations above elevation 659.0. In addition, both options will provide water way openings larger than the existing upstream structure (Lincoln Avenue over Wheeler Creek Bridge) and the existing downstream structures (Norfolk Southern Railroad over Wheeling Creek Bridge and the Wheeling & Lake Erie Railway over the Wheeling Creek Bridge).

LIGHTING

Existing two arm light poles are located on top of the median barrier on the structure at approximately 200 feet on centers. Re-using the existing lights or new lighting is proposed on the new structures.

Under bridge lighting is currently located between Piers 12/13 and 18/19. New under bridge lighting should be added at the span over US Route 40/250 for both options. Under bridge lighting between Piers 18/19 can be removed and should not be replaced. Under bridge lighting may need to be considered at the spans over Ramp B and the Access Road to Ramp D for both options.

GEOTECHNICAL CONSIDERATIONS

A preliminary geotechnical assessment was made based on the review of historical information including records of subsurface investigations that were obtained as part of the original bridge construction initiated in the late 1950's. Fifteen existing boring logs were obtained from the ODOT TIMS system and reviewed. See **Appendix F** for 1958 boring logs. These fifteen borings provided a general indication of what could be expected when a final subsurface exploration is performed. The existing borings showed that the site is underlain by generally cohesive type soils with some interbedded granular layers overlying relatively shallow bedrock. The bedrock depth is generally about 60 feet below surface grades near the Rear Abutment and the first few bridge piers. The bedrock depth is then generally 30-40 feet below surface grades for the remainder of the bridge project generally sloping upwards from south to north. The soil strength conditions are generally relatively weak near the ground surface and become more competent with depth. The bedrock encountered was comprised of shales and sandstones.

During the review of the subsurface conditions it was noted that there were significant depths of unsuitable fill materials that were initially encountered in many of the borings that were obtained in the late 1950's. This site had many existing structures (including three gas stations) within the footprint of the bridge that were demolished as part of the existing bridge construction. Because of this there was a concern expressed that it was likely that even more unsuitable fills could be expected within the footprint of this project. As a result of this concern ODOT obtained eight additional shallow borings in the vicinity of the proposed MSE walls to explore for the existence of unsuitable fill. See **Appendix F** for boring logs obtained in 2018. These borings confirmed there are significant amounts of unsuitable fill (some including hydrocarbon contamination) present at this site.

The **Replacement Option** will reduce the total bridge length by eliminating some of the existing bridge spans. This would be accomplished by using back-to-back MSE walls at two locations with embankment fill placed between the walls. Because of the existence of the near surface unsuitable fills this option would require ground improvement. The ground improvement could consist of undercut and replacement, stone columns, rammed aggregate piers, or other ground improvement methods. The feasibility of these options will require additional subsurface investigation to determine their viability from a strength and settlement standpoint. Deeper borings with additional laboratory testing will be required to explore the soil materials beneath the surface fills. Based on review of the existing borings taken in 1958 that are in the general vicinity of the two proposed MSE walls, the soils generally appear to become more competent with depth below the surface fill soils. Therefore, we believe the assumed 10 feet of soil undercut and replacement to be feasible. However, we recommend that the subsurface conditions within the footprints of the proposed MSE wall locations be further explored prior to making a final determination.

Regardless of whether it is possible or not to eliminate some of the bridge spans, all new bridge foundations will require deep foundation support. Based on our review of the existing subsurface conditions the use of H-piles driven to refusal on the underlying bedrock appear to be the most economical foundation choice for the majority of the piers and the two abutments. At the piers which are adjacent to Wheeling Creek the use of drilled shafts to avoid the construction of cofferdams is a viable alternate.

H-piles driven to refusal on the underlying bedrock can be designed for their full structural capacity. Boulders were noted in the existing boring logs overlying the bedrock surface and the use of pile points are anticipated. Based on the significant amounts of fill encountered and the reported composition of the fill soils we recommend the soils be tested for corrosion potential relative to steel and concrete foundations. Drilled shafts adjacent to Wheeling Creek would appear to derive their support from the underlying sandstone or shale bedrock. Any new borings in this area should be extended deep enough to ascertain the bedrock conditions for design and construction of the drilled shaft bedrock sockets.

ENVIRONMENTAL CONSIDERATIONS

Reviewing the SR7 Bridge Replacement/Rehabilitation project limits from Howard Street on the south to US250 ramps on the north and between Lincoln Street on the west and the Norfolk Southern railroad tracks on the east, the following were identified from a search of secondary literature sources:

Ecological Resources

Within the project limits there are no habitats present for Threatened and Endangered Species. The area around the bridge includes gravel areas, maintained grass lawns and roadways. The area along Wheeling Creek that passes under SR7 where Interstate 70 passes over SR7 has some scrubs and small trees growing along the bank. The stream bank is mostly exposed soil with some vegetation. The US Fish and Wildlife Service Wetland Mapping Website has identified Wheeling Creek as Riverine. No other mapped wetlands were identified within the project limits.

Floodplains

Wheeling Creek and the Ohio River have mapped floodplains within the project area. Two sets of piers for the SR7 Bridge are located within the Floodway of Wheeling Creek. The section of the SR7 Bridge between Howard Street on the south to 1075 feet north of Main Street is in the 100-year floodplain with an elevation of 658 feet above mean sea level (AMSL). Most of the piers for the SR7 Bridge are located within the floodplain.

Lincoln Street Park

The Lincoln Street Park is located under the SR7 Bridge at the Main Street and Lincoln Street intersection and the north side of Wheeling Creek. The park is identified by a sign and includes a shelter house and picnic tables surrounded by a maintained grass lawn. On the south side of Wheeling Creek is a basketball court under SR7. This court is surrounded by a chain link fence. Conversations between ODOT and Bridgeport indicate that these facilities were constructed without ODOT permission. As such, the park is not considered a 4(f) resource.

Cultural Resources

A review of the Ohio Historic Preservation Office online Web service indicated a total of 7 historic properties located adjacent to or within a half mile radius of the project. The closest historic site is the US Post Office Building located at the southwest corner of Lincoln and Howard Streets. No archaeological sites were identified within the project area.

Section 4(f) Resources

A park and a basketball court currently exist under the bridge as described earlier. These land uses were placed without prior permission from ODOT and are not considered 4(f) resources.

Regulated Materials Review

A review of the ODOT-Office of Environmental Services (OES) Regulated Materials Review (RMR) website identified two sites adjacent to the project limits. At Howard Street and South Lincoln Street (206 S. Lincoln Street) a reported Leaking Underground Storage Tank (LUST) site was identified at Working Mans Used Cars. The Bureau of Underground Storage Tanks Regulations (BUSTR) issued a No Further Action (NFA) letter that the site was cleaned up to State requirements. No additional investigation was required. A second RMR site was identified at the SR7 and US250 ramps at the north end of the project. In 2017 a diesel fuel spill of 75 gallons occurred at this location. The site was cleaned and no further investigation was required by the Ohio EPA. No other sites were identified within or adjacent to the project limits.

Eight supplemental soil borings were taken in 2018 at various locations along the length of the bridge for the purpose of identifying soil strength parameters. The borings were taken to a depth of approximately 15 feet. During the drilling, a relatively strong hydrocarbon-type odor was encountered in Boring B-007-0-18. This boring was sealed with bentonite, and no laboratory testing was performed on any of the samples recovered from this boring. A slight hydrocarbon odor was also noted at roughly 8-foot depth in Boring B-004-0-18.

SPECIAL SIGNING FOR US 250 TO RAMP TO SR7 NB

For the **Rehabilitation Option**, vehicles over 15.5 feet in height traveling east bound on US250 wishing to continue north bound on SR7 will have to be re-routed since the proposed under clearance for the access road to north bound SR7 under BEL-7-1975 (north end of the structure between Piers 18 and 19) will be 15.78 feet. Signs for the detour will need to direct east bound vehicles from the intersection of US250 and Lincoln Avenue south bound on Lincoln Avenue, then east bound on US40/US250 (clearance under BEL-7-1795 will be 16.86 feet) and north bound on Ramp D. Vehicles will then continue past the access road under BEL-7-1975 and onto the on ramp to north bound SR7. The bypass route will be approximately 1/8 mile in length.

ESTIMATE OF PROBABLE COSTS

Two primary options for this bridge have been investigated, a **Rehabilitation Option** and a **Replacement Option**. The assumptions and characteristics of these options are described earlier in the report.

The **Replacement Option** identified in the Scope of Services consisted of replacing the existing bridge with three shorter length bridges and two MSE islands. After it became apparent that soil conditions would require soil improvement (deep undercuts, stone columns or rammed aggregate piers) for the MSE islands, an additional study was undertaken to determine if constructing all new bridge (full length bridge without MSE islands, **Replacement Option B**) would be cost competitive to constructing MSE islands with soil improvement. The results of that study indicated that the construction cost of a full-length bridge option would be more expensive than the replacement option with MSE islands with assumed 10’ undercuts and that consideration of life cycle costs would further favor the MSE islands option.

The comparative construction costs of the options are as follows:

Option	Initial Construction Cost (Millions)	Future Maintenance Cost (Millions)	Life Cycle Cost (Millions)
Rehabilitation	**$21.7**	**$9.4**	**$31.1**
Replacement A: Three Bridges with MSE Islands	**$20.7**	**$4.8**	**$25.5**
Replacement B: Full Length Bridge	**$25.2**	**$9.4**	**$34.6**

See **Appendix D** for additional cost estimate information.

APPENDIX A – SUMMARY OF EXISTING PIER ANALYSIS (1 OF 2)

Bridge Number: **BEL-7-1975**

Calc'd: JHL Date: 5/3/2018
Chl'd: RMK Date: 5/4/2018

Rehab Pier Design Check Summary

	Pier 6	Pier 9	Pier 10	Pier 16
Soil fill depth on top of footing (ft.):	2	24	28	2
Footing W (ft.):	20.5	24	24	20.5
Footing L (ft.):	11.0	12	14	9.0
No. of Piles:	15			15

		Pier 6				Pier 9				Pier 10				Pier 16			
Pier Type	Brg. Type	Fixed				Expansion				Fixed				Expansion			
	Foundation	Pile Support (HP12x53) (41 ft. pile Length)				Spread Footing (24' x 12')				Spread Footing (24' x 14')				Pile Support (HP10x42) (38 ft. pile Length)			
Pier Stem Strength		Column Strength Design (P-M Diagram)				Column Strength Design (P-M Diagram)				Column Strength Design (P-M Diagram)				Column Strength Design (P-M Diagram)			
		Bottom (k ft)		Top (k ft)		Bottom (k ft)		2.25' from Bot. (k ft)		Bottom (k ft)		26' from Bot. (k ft)		Bottom (k ft)		Top (k ft)	
		Mu	ϕMn	Mu	ϕMn	Mu	ϕMn	Mu	ϕMn	Mu	ϕMn	Mu	ϕMn	Mu	ϕMn	Mu	ϕMn
		1230.04	1521.20	2051.68	8063.9	3979.37	4343.5	3799.24	2930.3	5150.42	9894.5	2636.62	2918.6	1237.23	1393.4	1943.29	7780.1
		Mu/ϕMn	**81%**	Mu/ϕMn	**25%**	Mu/ϕMn	**92%**	Mu/ϕMn	**130%**	Mu/ϕMn	**52%**	Mu/ϕMn	**90%**	Mu/ϕMn	**89%**	Mu/ϕMn	**25%**
		Stem dimensions as built				Stem dimensions as built				Stem dimensions as built				Stem dimensions as built			
		Column Strength Design (P-M Diagram) *				Column Strength Design (P-M Diagram) *				Column Strength Design (P-M Diagram) *				Column Strength Design (P-M Diagram) *			
		Bottom (k ft)		Top (k ft)		Bottom (k ft)		2.25' from Bot. (k ft)		Bottom (k ft)		26' from Bot. (k ft)		Bottom (k ft)		Top (k ft)	
		Mu	ϕMn	Mu	ϕMn	Mu	ϕMn	Mu	ϕMn	Mu	ϕMn	Mu	ϕMn	Mu	ϕMn	Mu	ϕMn
		1838.47	1628.70	2011.82	1838.1	3979.24	3189	3933.92	1577.7	5150.42	8298.6	2949.87	1977.5	1805.41	1552	1945.69	1779.7
		Mu/ϕMn	**113%**	Mu/ϕMn	**109%**	Mu/ϕMn	**125%**	Mu/ϕMn	**249%**	Mu/ϕMn	**62%**	Mu/ϕMn	**149%**	Mu/ϕMn	**116%**	Mu/ϕMn	**109%**
		Adjusted stem dimensions to effective with 1% reinforcing steel ratio				Adjusted stem dimensions to effective with 1% reinforcing steel ratio				Adjusted stem dimensions to effective with 1% reinforcing steel ratio				Adjusted stem dimensions to effective with 1% reinforcing steel ratio			
Pier Footing & Pile	Footing Reinf. Steel	Flexure		Shear		Flexure (k ft) **		Shear (k) **		Flexure (k ft) **		Shear (k) **		Flexure		Shear	
		As req'd (in^2)	As prov. (in^2)	Vu	ϕVn	As req'd (in^2)	As prov. (in^2)	Vu	ϕVn	As req'd (in^2)	As prov. (in^2)	Vu	ϕVn	As req'd (in^2)	As prov. (in^2)	Vu	ϕVn
		25.00	24.00	1569.7	2624.8	26.92	27.31	1637.3	4598	38.69	53.34	2757.9	4597.7	15.57	18.96	1541.7	2634
		104%		**60%**		**99%**		**36%**		**73%**		**60%**		**82%**		**59%**	
	Pile overstress	Service (kips)		Factored (kips) ***		NA		NA		NA		NA		Service (kips)		factored (kips) ***	
		Design	Max.	Design	Max.									Design	Max.	Design	Max.
		80	86	112	135									70	76	98	132
		108%		**121%**										**109%**		**135%**	
	Bearing Pressure	NA		NA		Service (ksf) **		NA		Service (ksf) **		NA		NA		NA	
						Design	Max.			Design	Max.						
						20	13.33			20	15.91						
						67%				**80%**							

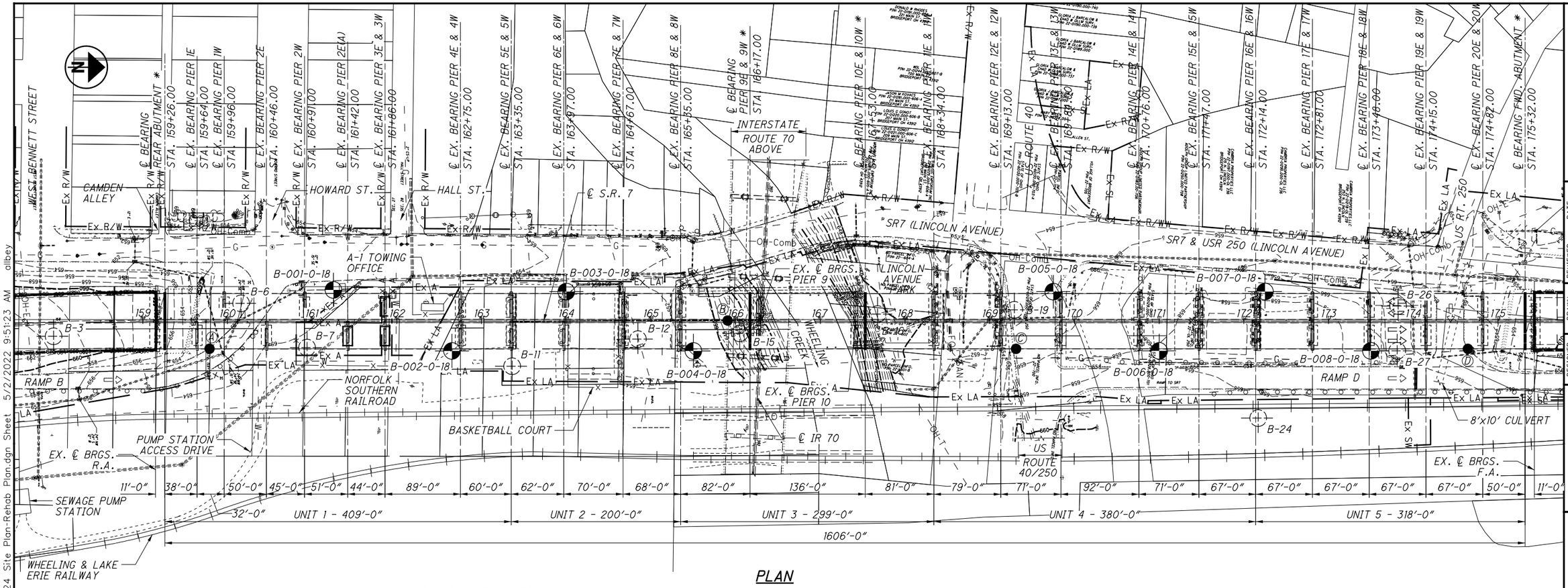
APPENDIX A – SUMMARY OF EXISTING PIER ANALYSIS (2 OF 2)

* = Modified (reduced) pier stem width to satisfy min. steel ratio (1% rebar area of gross stem concrete area). P-M Diagram = Interaction diagram for combined bending and axial load.
** = Reduced Footing Size to 21.5'x12'(Pier 9) & 21'x14'(Pier 10) for analysis purpose.
Analyze the footing using a reduced length such that the reinforcing in the long direction is adequate. If the bearing pressure and reinforcing in the reduced effective footing area are adequate, then say OK.
***= Assumed Factored pile capacity has been calculated 0.7xUltimate capacity, which is 2 times of unfactored pile capacity
Assume the installed ultimate bearing value of each pile is 2 x design load given in the plans (35 or 40 tons). Then, the factored bearing resistance is approximately 0.7 x 2 x (35 or 40 tons).
The 0.7 ϕ factor is what is currently used for piles that were dynamically load tested.

Design Check Assumptions and Remarks

	Description	Proposed Piers	Comments
Deck	Deck width	34'-8"	2' and 5' shoulder
DL	Deck thickness	8 1/2"	
	FWS	60 psf	
LL	Design Loading	HS20	
Material	Pier Cap & Stem Concrete Strength (f'c)	4.0 ksi	Per original plans (1962), used Class "C" concrete (4.0 ksi)
	Pier Footing Concrete Strength (f'c)	3.4 ksi	Per original plans (1962), used Class "E" concrete (3.4 ksi)
	Cap steel Strength (fy)	60 ksi	
	Column & Footing Steel Strength (fy)	40 ksi	Per original plans (1962), used basic unit stress 20,000psi (40 ksi)

APPENDIX B – REHABILITATION OPTION SITE PLAN AND DETAILS



PLAN

BENCHMARK DATA

DATUM: NAVD88

BM #1 - POINT NUMBER SVT320, ELEVATION 656.86, ARROW ON FIRE HYDRANT, STATION 157+42.51, OFFSET 109.39' LEFT.

BM #2 - POINT NUMBER SVT860, ELEVATION 657.76, ARROW ON FIRE HYDRANT, STATION 162+64.83, OFFSET 112.90' LEFT.

BM #3 - POINT NUMBER SVT763, ELEVATION 654.10, ARROW ON FIRE HYDRANT, STATION 165+45.86, OFFSET 42.11' LEFT.

BM #4 - POINT NUMBER SVT762, ELEVATION 654.37, ARROW ON FIRE HYDRANT, STATION 168+42.99, OFFSET 139.68' LEFT.

BM #5 - POINT NUMBER SVT924, ELEVATION 656.35, ARROW ON FIRE HYDRANT, STATION 173+72.76, OFFSET 99.69' LEFT.

HISTORIC BORING LOCATIONS

BORING	STATION	OFFSET	TOP OF ROCK
B-3	157+94.69±	17.81'± RIGHT	NOT ENCOUNTERED
B-6	160+16.08±	21.12'± LEFT	583.6±
B-7	160+93.94±	31.11'± RIGHT	589.8±
B-11	163+36.09±	53.11'± RIGHT	612.3±
B-12	164+84.59±	21.18'± RIGHT	607.7±
B-15	166+04.70±	14.31'± RIGHT	613.0±
B-16	167+67.45±	8.46'± LEFT	610.2±
B-19	169+29.04±	13.48'± LEFT	620.2±
B-24	172+16.91±	114.29'± RIGHT	**
B-26	173+82.10±	17.91'± LEFT	621.8±
B-27	173+81.07±	34.96'± RIGHT	623.0±

DESIGN TRAFFIC:

2019 ADT = 35,000 2019 ADTT = 2,450
2031 ADT = 37,000 2031 ADTT = 2,590

℄ SR-7 CURVE DATA

T.S. = STA. 149+83.67
S.C. = STA. 153+33.67
C.S. = STA. 156+24.63
S.T. = STA. 159+74.63
△ = 28°50'36" (RT.)
D = 4°30'00"
R = 1273.24'
Lc = 290.96'
Ls = 350.00'
Ts = 503.35'
Es = 45.57'

℄ SR-7 CURVE DATA

P.I. = STA. 180+79.33
P.C. = STA. 176+21.99
△ = 11°23'45" (RT.)
D = 1°15'00"
R = 4583.66'
T = 457.34
E = 22.76

NOTES:

1. SEE SHEET 2 / 5 FOR ELEVATION VIEW.
2. SEE SHEET 3 / 5 FOR UTILITY DISPOSITION.

BORING LOCATIONS

BORING	STATION	OFFSET	TOP OF ROCK
B-001-0-18	161+25.00	35.00' LEFT	NOT ENCOUNTERED
B-002-0-18	162+65.00	35.00' RIGHT	NOT ENCOUNTERED
B-003-0-18	164+00.00	35.00' LEFT	NOT ENCOUNTERED
B-004-0-18	165+50.00	35.00' RIGHT	NOT ENCOUNTERED
B-005-0-18	169+75.00	35.00' LEFT	NOT ENCOUNTERED
B-006-0-18	171+00.00	35.00' RIGHT	NOT ENCOUNTERED
B-007-0-18	172+25.00	35.00' LEFT	NOT ENCOUNTERED
B-008-0-18	173+50.00	35.00' RIGHT	NOT ENCOUNTERED

LEGEND:

℄ = BORING LOCATION
⊕ = HISTORIC BORING OBTAINED IN 1958
* = PROPOSED SUBSTRUCTURE LOCATION
** = BORING LOG NOT LEGIBLE
ǂ = INFORMATION FROM 1959 PLANS
● = VERTICAL CLEARANCE:
Ⓐ = 16.50' REQUIRED MINIMUM, 22.60' ACTUAL
Ⓑ = 16.50' REQUIRED MINIMUM, 16.87' ACTUAL
Ⓒ = 16.50' REQUIRED MINIMUM, 16.86' ACTUAL
Ⓓ = 16.50' REQUIRED MINIMUM, 15.50' IF ALTERNATE ROUTE, 15.78' ACTUAL
① = PROPOSED DECK EXPANSION JOINT (3 INCHES STRIP SEAL)
② = PROPOSED DECK EXPANSION JOINT (2 GLAND MODULAR)

EXISTING STRUCTURES

TYPE: CONTINUOUS ROLLED BEAMS AND WELDED GIRDERS WITH REINFORCED CONCRETE DECKS AND SUBSTRUCTURES
SPANS: 21-SPANS (SB), 22-SPANS (NB)
ROADWAY: 31'-4" F/F CURB (SB AND NB)
LOADING: CF 200 (57)
SKEW: NONE
WEARING SURFACE: 1¾"± MICRO-SILICA MODIFIED CONCRETE ON 1"± MONOLITHIC CONCRETE
APPROACH SLABS: AS-1-54, 25'-0"± LONG
ALIGNMENT: TANGENT
SUPERELEVATION: VARIES
DATE BUILT: 1968 REHABILITATED: 1998
DISPOSITION: SALVAGE SOME SUBSTRUCTURES AND CONSTRUCT NEW SUBSTRUCTURES AND SUPERSTRUCTURES.
COORDINATES: 40°04'08.55" N 80°44'25.99" W
STRUCTURE FILE NUMBER: 0700541

LEGEND:

BRGS. = BEARINGS
E = EXPANSION
EX. = EXISTING
F/F = FACE TO FACE
F.A. = FORWARD ABUTMENT
F = FIX
NB = NORTHBOUND
O/O = OUT TO OUT
R.A. = REAR ABUTMENT
RT. = RIGHT
SB = SOUTHBOUND
S.R. = STATE ROUTE
T/T = TOE TO TOE
MSE = MECHANICALLY STABILIZED EARTH
_E = PIER NUMBER EAST
_W = PIER NUMBER WEST

PROPOSED STRUCTURES

PROPOSED REHABILITATION WORK: USING PART WIDTH CONSTRUCTION, REMOVE EXISTING SUPERSTRUCTURES AND PIER CAPS. REMOVE EXISITNG ABUTMENTS AND TWO RIVER PIERS. SALVAGE REMAINING PIER STEMS AND FOOTINGS. CONSTRUCT NEW PIER CAPS, NEW DRILLED SHAFT RIVER PIERS AND ABUTMENTS. CONSTRUCT NEW SUPERSTRUCTURE GIRDERS, BEAMS AND DECKS.

TYPE: CONTINUOUS ROLLED WEATHERING STEEL BEAMS AND WELDED WEATHERING STEEL GIRDERS WITH REINFORCED CONCRETE DECKS AND SUBSTRUCTURES
SPANS: 21-SPANS (SB), 22-SPANS (NB)
ROADWAY: 31'-2" T/T PARAPET (SB & NB)
LOADING:
SUPERSTRUCTURE: HL-93 AND 60 PSF FUTURE WEARING SURFACE
SUBSTRUCTURE: HS20 AND ALTERNATE MILITARY LOAD AND 60 PSF FUTURE WEARING SURFACE
SKEW: NONE
PARAPET: SBR-1-13 AND SBR-2-13
APPROACH SLABS: 30'-0" LONG (AS-1-15) (AS-2-15)
ALIGNMENT: TANGENT
CROWN: 0.016 FT/FT
WEARING SURFACE: 1" MONOLITHIC CONCRETE
COORDINATES: 40°04'10.22" N 80°44'25.29" W
STRUCTURE FILE NUMBER: 0700541

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DESIGNED	DRAWN	REVIEWED	DATE
CAS	AAA	TAB	2/21/19
CHECKED	REVISED		STRUCTURE FILE NUMBER
JHL			0700541

BELMONT COUNTY
STA. 159+26.00
STA. 175+32.00

SITE PLAN - REHABILITATION OPTION-PLAN

BRIDGE NO. BEL-7-1975
OVER RAMP B, WHEELING CREEK, US40/US 250 AND RAMP D

BEL-7-19.75
PID No. 105324

1 / 5

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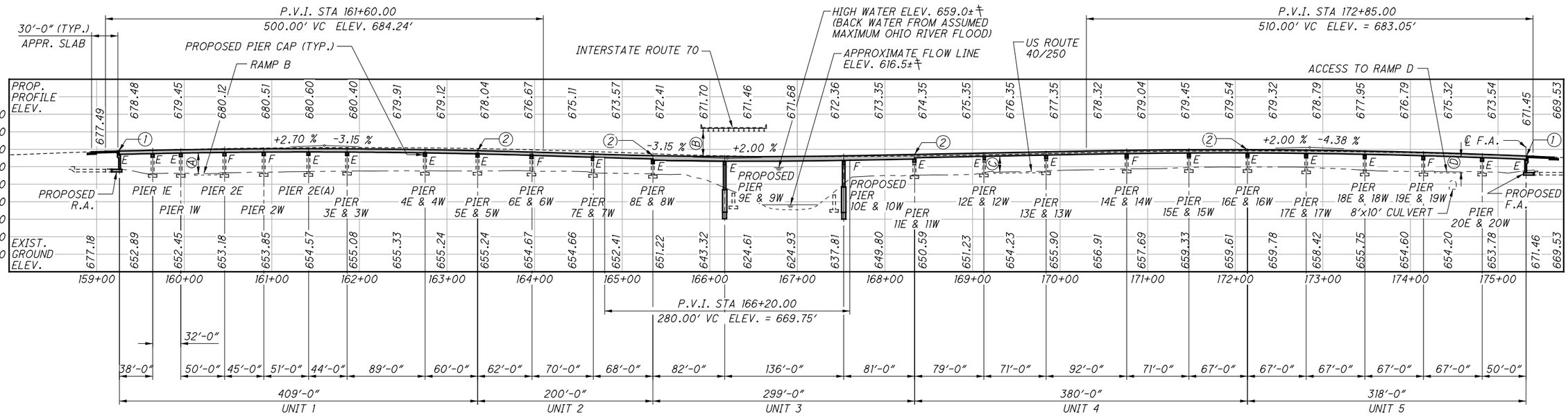

ELEVATION

(PARAPET & PILES NOT SHOWN)

NOTE:

1. SEE SHEET 1 / 5 FOR NOTES, LEGEND AND ADDITIONAL INFORMATION.

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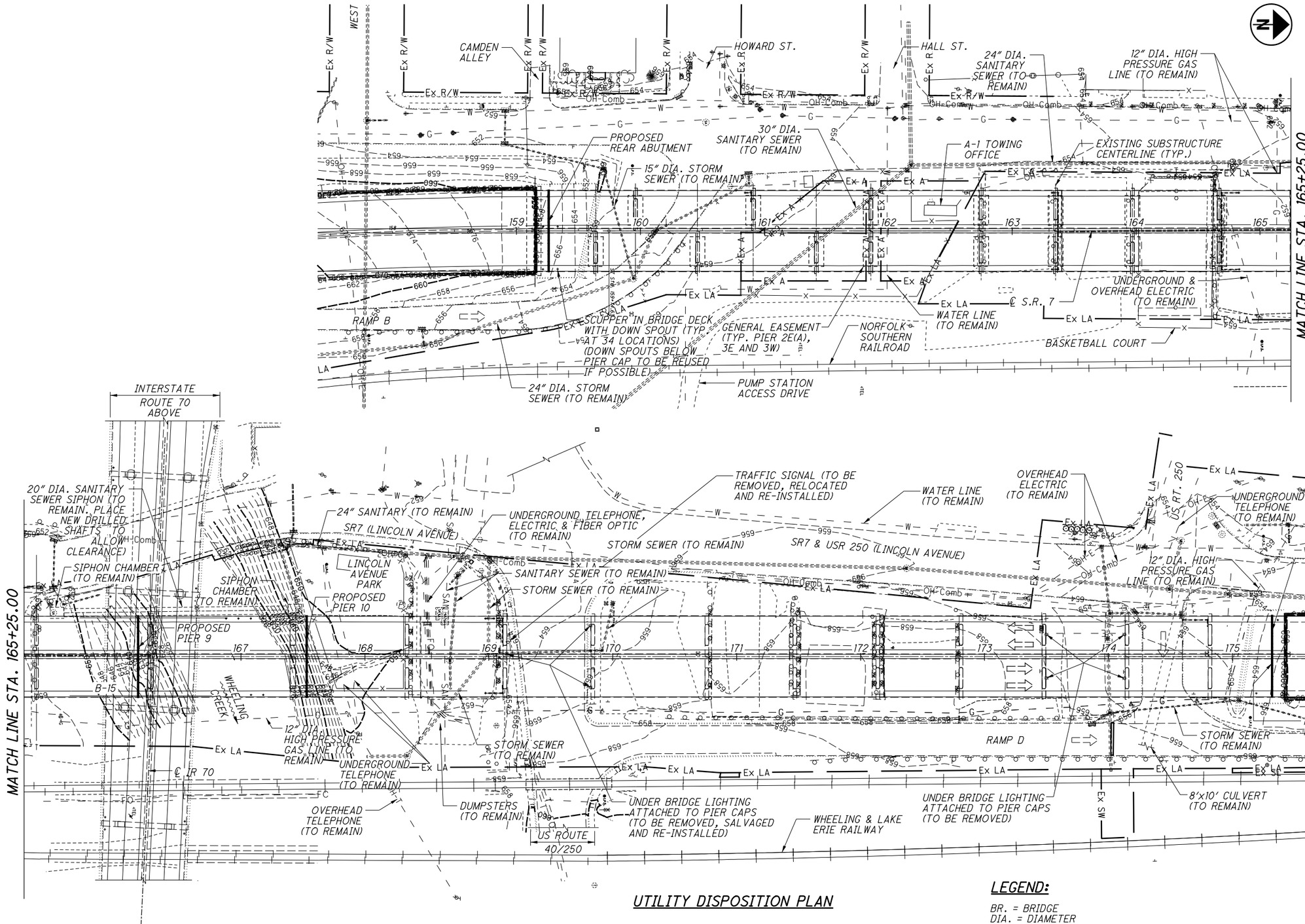
DESIGNED	DRAWN	REVIEWED	DATE
CAS	AAA	TAB	2/21/19
CHECKED	REVISED	STRUCTURE FILE NUMBER	
JHL		0700541	

BELMONT COUNTY
STA. 159+26.00
STA. 175+32.00

SITE PLAN - REHABILITATION OPTION-ELEVATION
BRIDGE NO. BEL-7-1975
OVER RAMP B, WHEELING CREEK, US40/US 250 AND RAMP D

BEL-7-19.75
PID No. 105324

2 / 5



UTILITY DISPOSITION PLAN

LEGEND:

BR. = BRIDGE
DIA. = DIAMETER
FWD. = FORWARD
SR = STATE ROUTE

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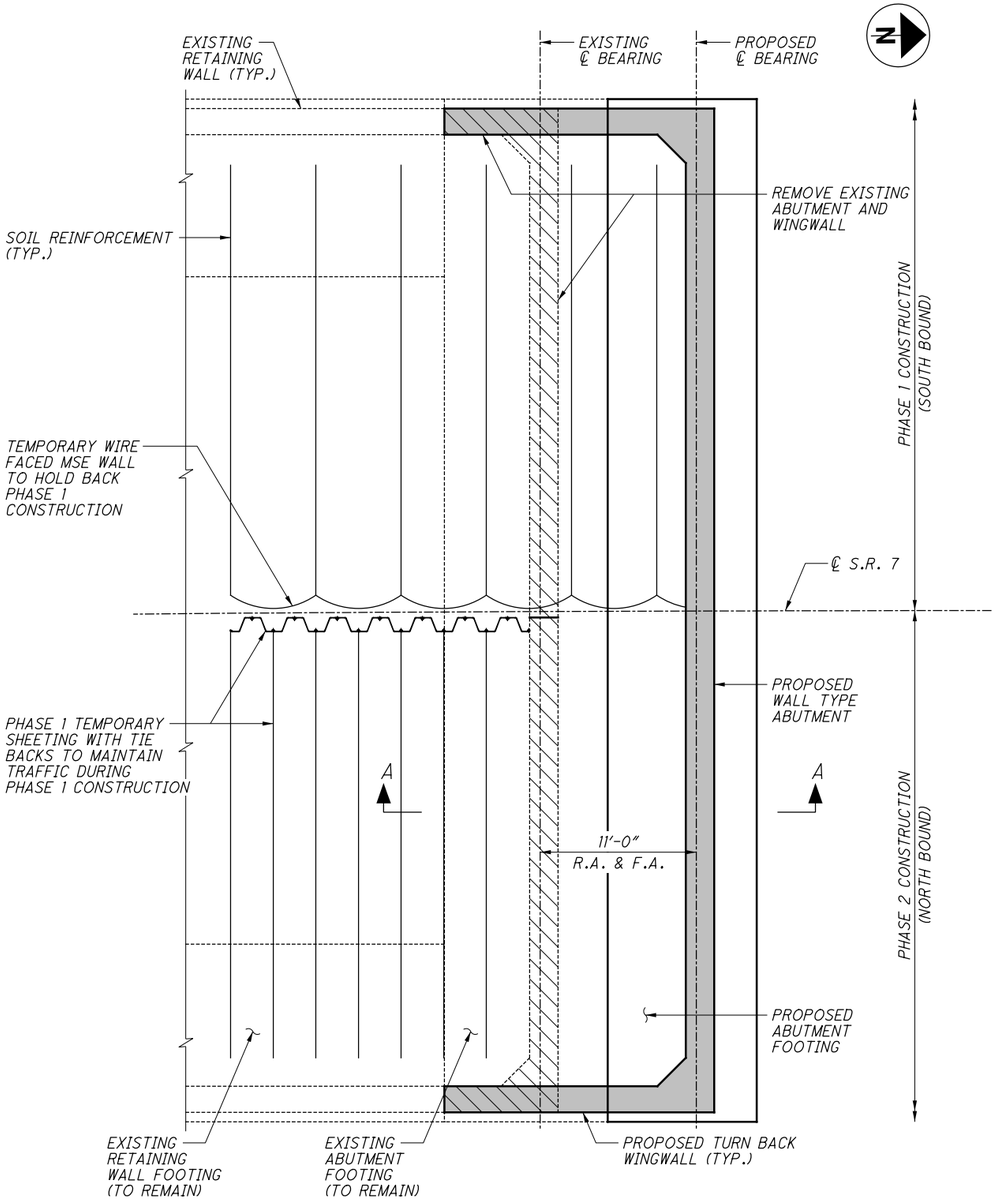
DESIGNED	DRAWN	REVIEWED	DATE
CAS	AAA	TAB	2/21/19
CHECKED	REVISED	STRUCTURE FILE NUMBER	
JHL		0700541	

BELMONT COUNTY
STA. 159+26.00
STA. 175+32.00

REHABILITATION SITE PLAN – UTILITY DISPOSITION
BRIDGE NO. BEL-7-1975
OVER RAMP B, WHEELING CREEK US40/US250 AND RAMP D

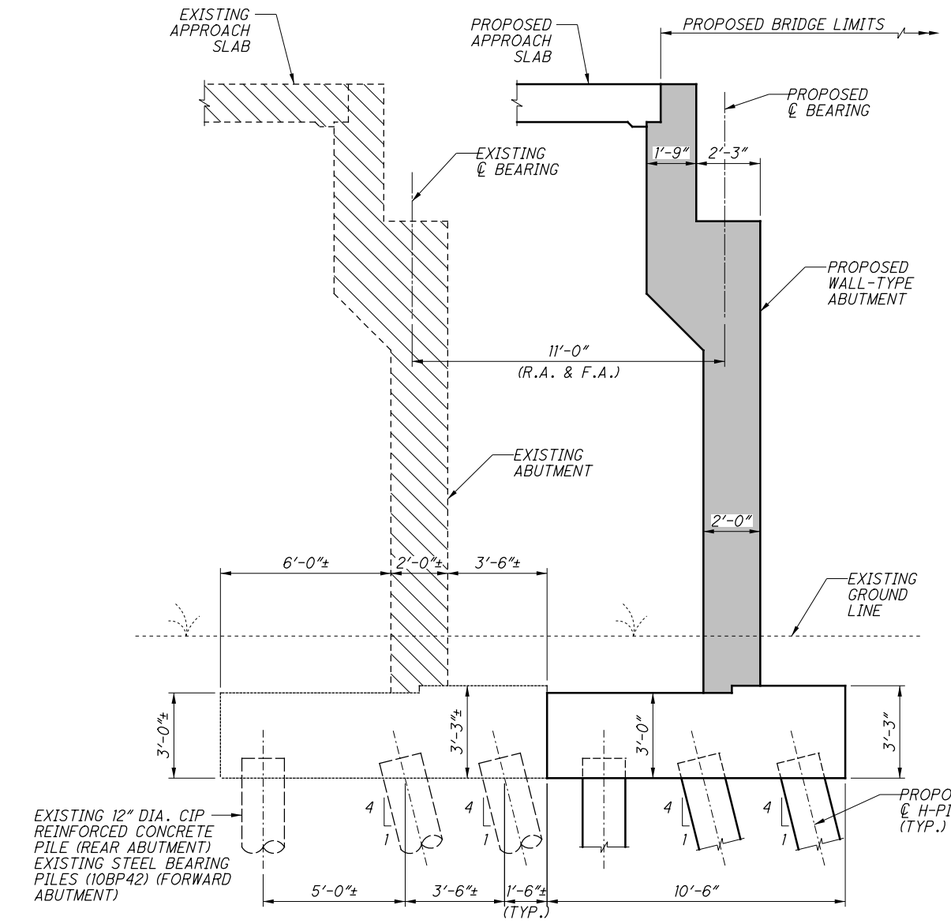
BEL-7-19.75
PID No. 105324

3 / 5



PLAN VIEW AT REAR ABUTMENT

(FINAL CONDITION SHOWN)
(EXISTING AND PROPOSED PILES NOT SHOWN)
(FORWARD ABUTMENT MIRRORED)



SECTION A-A

LEGEND:

= LIMITS OF ABUTMENT REMOVAL

= LIMITS OF PROPOSED ABUTMENT

CIP = CAST-IN-PLACE
F.A. = FORWARD ABUTMENT
R.A. = REAR ABUTMENT

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DESIGNED	DRAWN	REVIEWED	DATE
JHL	AAA	TAB	2/21/19
CHECKED	REVISED	STRUCTURE FILE NUMBER	
CAS		0700541	

TYPICAL ABUTMENT - REHABILITATION OPTION
BRIDGE NO. BEL-7-1975
OVER RAMP B, WHEELING CREEK, US40/US250 AND RAMP D

BEL-7-19.75
PID No. 105324

4 / 5

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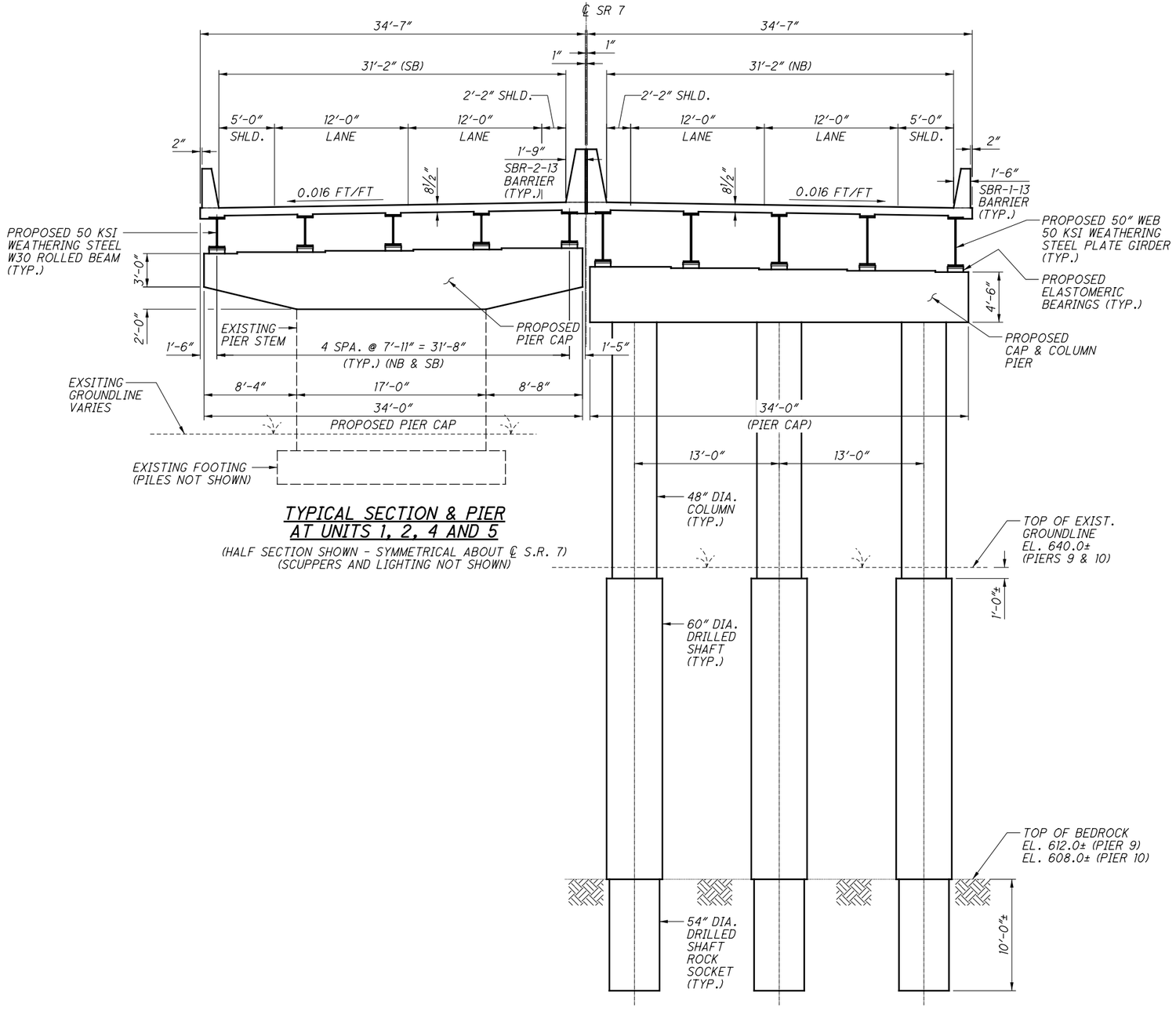

TYPICAL SECTION & PIER AT UNITS 1, 2, 4 AND 5

(HALF SECTION SHOWN - SYMMETRICAL ABOUT ℄ S.R. 7)
(SCUPPERS AND LIGHTING NOT SHOWN)

TYPICAL SECTION & PIER AT UNIT 3

(HALF SECTION SHOWN - SYMMETRICAL ABOUT ℄ S.R. 7)
(SCUPPERS AND LIGHTING NOT SHOWN)

LEGEND:

NB = NORTH BOUND
SB = SOUTH BOUND
SHLD. = SHOULDER
S.R. = STATE ROUTE

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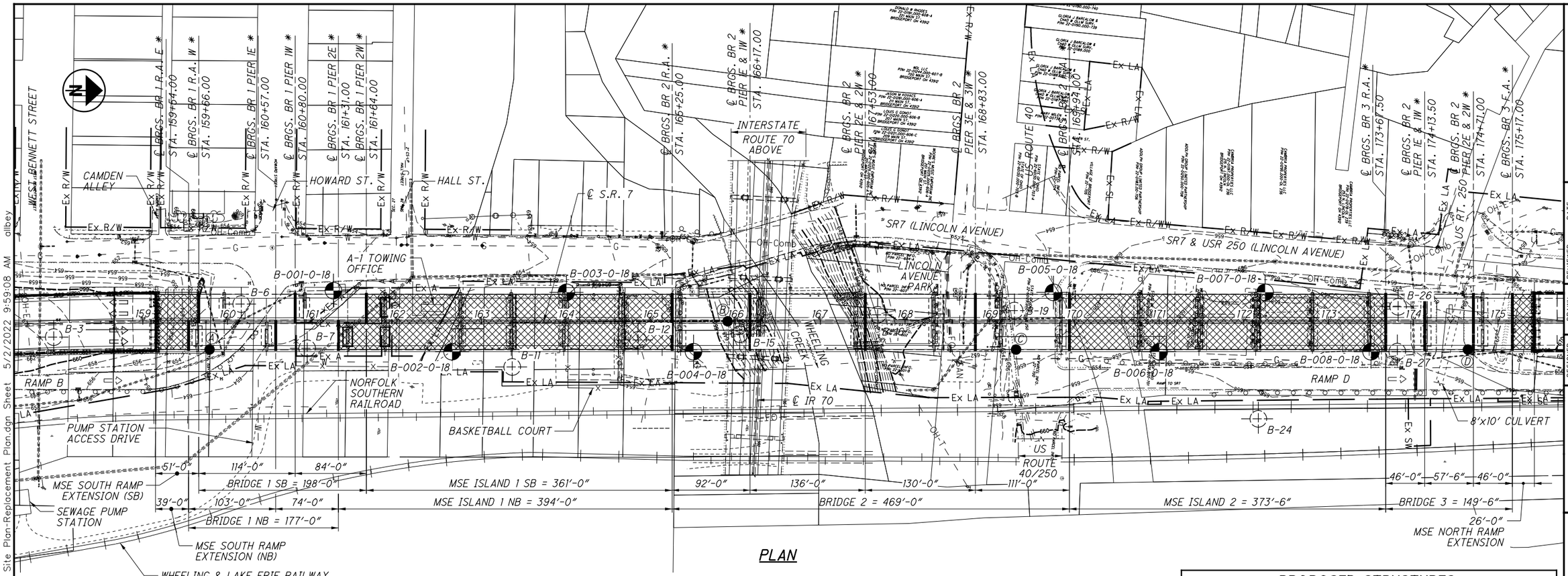
DESIGNED	DRAWN	REVIEWED	DATE
JHL	AAA	TAB	2/21/19
CHECKED	REVISED	STRUCTURE FILE NUMBER	
CAS		0700541	

TRANSVERSE SECTIONS - REHABILITATION OPTION
BRIDGE NO. BEL-7-1975
OVER RAMP B, WHEELING CREEK, US40/US250 AND RAMP D

BEL-7-19.75
PID No. 105324

5 / 5

APPENDIX C – REPLACEMENT OPTION SITE PLAN AND DETAILS



PLAN

BENCHMARK DATA

DATUM: NAVD88

BM #1 - POINT NUMBER SVT320, ELEVATION 656.86, ARROW ON FIRE HYDRANT, STATION 157+42.51, OFFSET 109.39' LEFT.

BM #2 - POINT NUMBER SVT860, ELEVATION 657.76, ARROW ON FIRE HYDRANT, STATION 162+64.83, OFFSET 112.90' LEFT.

BM #3 - POINT NUMBER SVT763, ELEVATION 654.10, ARROW ON FIRE HYDRANT, STATION 165+45.86, OFFSET 42.11' LEFT.

BM #4 - POINT NUMBER SVT762, ELEVATION 654.37, ARROW ON FIRE HYDRANT, STATION 168+42.99, OFFSET 139.68' LEFT.

BM #5 - POINT NUMBER SVT924, ELEVATION 656.35, ARROW ON FIRE HYDRANT, STATION 173+72.76, OFFSET 99.69' LEFT.

HISTORIC BORING LOCATIONS

BORING	STATION	OFFSET	TOP OF ROCK
B-3	157+94.69±	17.81'± RIGHT	NOT ENCOUNTERED
B-6	160+16.08±	21.12'± LEFT	583.6±
B-7	160+93.94±	31.11'± RIGHT	589.8±
B-11	163+36.09±	53.11'± RIGHT	612.3±
B-12	164+84.59±	21.18'± RIGHT	607.7±
B-15	166+04.70±	14.31'± RIGHT	613.0±
B-16	167+67.45±	8.46'± LEFT	610.2±
B-19	169+29.04±	13.48'± LEFT	620.2±
B-24	172+16.91±	114.29'± RIGHT	**
B-26	173+82.10±	17.91'± LEFT	621.8±
B-27	173+81.07±	34.96'± RIGHT	623.0±

DESIGN TRAFFIC:

2019 ADT = 35,000 2019 ADTT = 2,450
2031 ADT = 37,000 2031 ADTT = 2,590

℄ SR-7 CURVE DATA

T.S. = STA. 149+83.67
S.C. = STA. 153+33.67
C.S. = STA. 156+24.63
S.T. = STA. 159+74.63
△ = 28°50'36" (RT.)
D = 4°30'00"
R = 1273.24'
Lc = 290.96'
Ls = 350.00'
Ts = 503.35'
Es = 45.57'

℄ SR-7 CURVE DATA

P.I. = STA. 180+79.33
P.C. = STA. 176+21.99
△ = 11°23'45" (RT.)
D = 1°15'00"
R = 4583.66'
T = 457.34
E = 22.76

NOTES:

1. SEE SHEET 2 / 5 FOR ELEVATION VIEW.
2. SEE SHEET 3 / 5 FOR UTILITY DISPOSITION.

BORING LOCATIONS

BORING	STATION	OFFSET	TOP OF ROCK
B-001-0-18	161+25.00	35.00' LEFT	NOT ENCOUNTERED
B-002-0-18	162+65.00	35.00' RIGHT	NOT ENCOUNTERED
B-003-0-18	164+00.00	35.00' LEFT	NOT ENCOUNTERED
B-004-0-18	165+50.00	35.00' RIGHT	NOT ENCOUNTERED
B-005-0-18	169+75.00	35.00' LEFT	NOT ENCOUNTERED
B-006-0-18	171+00.00	35.00' RIGHT	NOT ENCOUNTERED
B-007-0-18	172+25.00	35.00' LEFT	NOT ENCOUNTERED
B-008-0-18	173+50.00	35.00' RIGHT	NOT ENCOUNTERED

LEGEND:

= BORING LOCATION
= HISTORIC BORING OBTAINED IN 1958
= LIMITS OF MSE RAMP EXTENSION OR MSE ISLAND

* = PROPOSED SUBSTRUCTURE LOCATION
** = BORING LOG NOT LEGIBLE
ǂ = INFORMATION FROM 1959 PLANS
● = VERTICAL CLEARANCE:
Ⓐ = 16.50' REQUIRED MINIMUM, 21.72' ACTUAL
Ⓑ = 16.50' REQUIRED MINIMUM, 16.84' ACTUAL
Ⓒ = 16.50' REQUIRED MINIMUM, 16.66' ACTUAL
Ⓓ = 16.50' REQUIRED MINIMUM, 16.99' ACTUAL

BRGS. = BEARINGS
E = EXPANSION
EX. = EXISTING
F/F = FACE TO FACE
F.A. = FORWARD ABUTMENT
F = FIX
NB = NORTHBOUND
O/O = OUT TO OUT
R.A. = REAR ABUTMENT
RT. = RIGHT
SB = SOUTHBOUND
S.R. = STATE ROUTE
T/T = TOE TO TOE
MSE = MECHANICALLY STABILIZED EARTH
_E = PIER NUMBER EAST
_W = PIER NUMBER WEST

EXISTING STRUCTURES

TYPE: CONTINUOUS ROLLED BEAMS AND WELDED GIRDERS WITH REINFORCED CONCRETE DECKS AND SUBSTRUCTURES
SPANS: 21-SPANS (SB), 22-SPANS (NB)
ROADWAY: 31'-4" F/F CURB (SB AND NB)
LOADING: CF 200 (57)
SKEW: NONE
WEARING SURFACE: 1¾"± MICRO-SILICA MODIFIED CONCRETE ON 1"± MONOLITHIC CONCRETE
APPROACH SLABS: AS-1-54, 25'-0"± LONG
ALIGNMENT: TANGENT
SUPERELEVATION: VARIES
DATE BUILT: 1968 REHABILITATED: 1998
DISPOSITION: TO BE REMOVED
COORDINATES: 40°04'08.55" N 80°44'25.99" W
STRUCTURE FILE NUMBER: 0700541

PROPOSED STRUCTURES

PROPOSED REPLACEMENT WORK: USING PART WIDTH CONSTRUCTION, REMOVE EXISTING SUPERSTRUCTURES AND SUBSTRUCTURES AS NECESSASY. UNDERCUT EXISTING SOILS TO APPROXIMATELY 10 FEET DEEP AND CONSTRUCT TWO MSE RAMP EXTENSIONS AND TWO MSE ISLANDS. CONSTRUCT NEW ABUTMENTS BEHIND MSE WALLS, PIERS AND SUPERSTRUCTURES AT THREE BRIDGES.

MSE SOUTH RAMP EXTENSIONS:
WEST STRUCTURE (SOUTH BOUND) LENGTH: 51'-0"
EAST STRUCTURE (NORTH BOUND) LENGTH: 39'-0"
BRIDGE 1:
TYPE: 2-SPAN CONTINUOUS CONCRETE I-BEAM ON SEMI-INTEGRAL ABUTMENT WITH MSE WALL
SPAN: 114'-0", 84'-0" (SB) 103'-0", 74'-0" (NB) C/C BEARINGS
STRUCTURE FILE NUMBER: TO BE DETERMINED
COORDINATES: 40°04'10.62" N 80°44'25.27" W (SB)
40°04'10.50" N 80°44'25.28" W (NB)
MSE ISLAND 1:
WEST STRUCTURE (SOUTH BOUND) LENGTH: 361'-0"
EAST STRUCTURE (NORTH BOUND) LENGTH: 394'-0"
BRIDGE 2:
TYPE: 4-SPAN CONTINUOUS WEATHERING STEEL PLATE GIRDER ON SEMI-INTEGRAL ABUTMENT WITH MSE WALL
SPAN: 92'-0", 136'-0", 130'-0", 111'-0" C/C BEARINGS
STRUCTURE FILE NUMBER: TO BE DETERMINED
COORDINATES: 40°04'16.14" N 80°44'25.02" W
MSE ISLAND 2:
STRUCTURE LENGTH: 373'-6"
BRIDGE 3:
TYPE: 3-SPAN CONTINUOUS CONCRETE SLAB ON SEMI-INTEGRAL ABUTMENT WITH MSE WALL
SPAN: 46'-0", 57'-6", 46'-0" C/C BEARINGS
STRUCTURE FILE NUMBER: TO BE DETERMINED
COORDINATES: 40°04'24.46" N 80°44'24.58" W
MSE NORTH RAMP EXTENSIONS:
STRUCTURE LENGTH: 26'-0"

ROADWAY: 31'-2" T/T PARAPET
LOADING: HL93 AND FUTURE WEARING SURFACE (FWS) OF 0.06 KSF
SKEW: NONE
PARAPET: SBR-1-13 AND SBR-2-13
APPROACH SLABS: 30'-0" LONG (AS-1-15) (AS-2-15)
ALIGNMENT: TANGENT
CROWN: 0.016 FT/FT
WEARING SURFACE: 1" MONOLITHIC CONCRETE

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DESIGNED CAS | DRAWN AAA | CHECKED JHL | REVIEWED TAB | DATE 2/21/19 | REVISED | STRUCTURE FILE NUMBER 0700541

BELMONT COUNTY
STA. VARIES
STA. VARIES

SITE PLAN - REPLACEMENT OPTION-PLAN
BRIDGE NO. BEL-7-1975
OVER RAMP B, WHEELING CREEK, US40/US250 AND RAMP D

BEL-7-19.75
PID No. 105324

1 / 5

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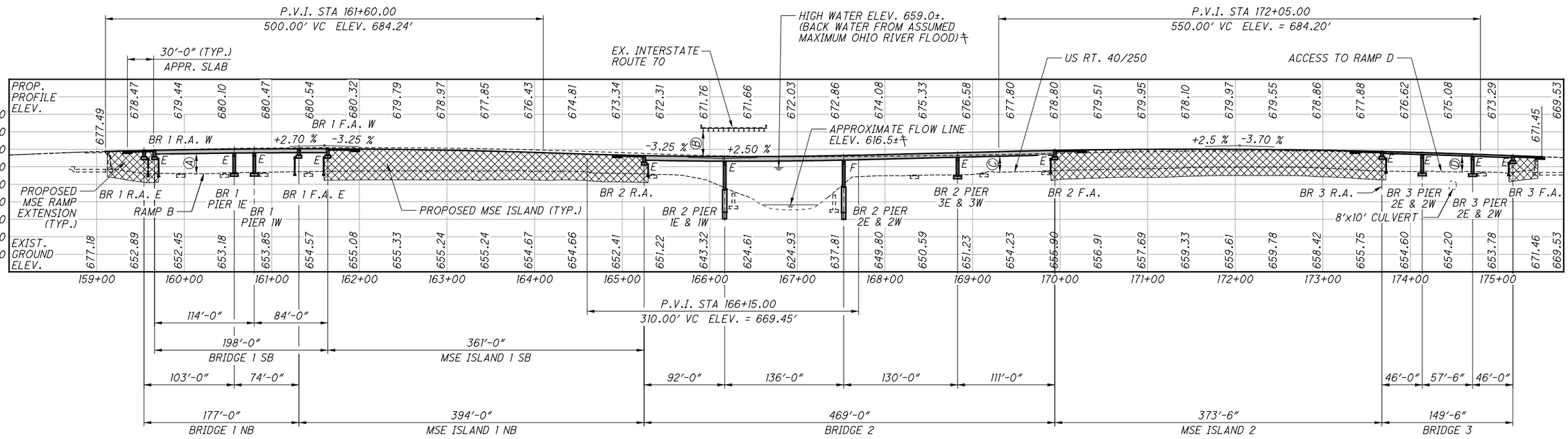

ELEVATION

(SB MSE WALL STRUCTURE SHOWN, NB STRUCTURE SIMILAR)
(PARAPET & PILES NOT SHOWN)

NOTE:

1. SEE SHEET 1 / 5 FOR NOTES, LEGEND AND ADDITIONAL INFORMATION.

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DESIGNED	DRAWN	REVIEWED	DATE
CAS	AAA	TAB	2/21/19
CHECKED	REVISED	STRUCTURE FILE NUMBER	
JHL		0700541	

BELMONT COUNTY
STA. VARIES
STA. VARIES

SITE PLAN - REPLACEMENT OPTION-ELEVATION
BRIDGE NO. BEL-7-1975
OVER RAMP B, WHEELING CREEK, US40/US250 AND RAMP D

BEL-7-19.75
PID No. 105324

2 / 5

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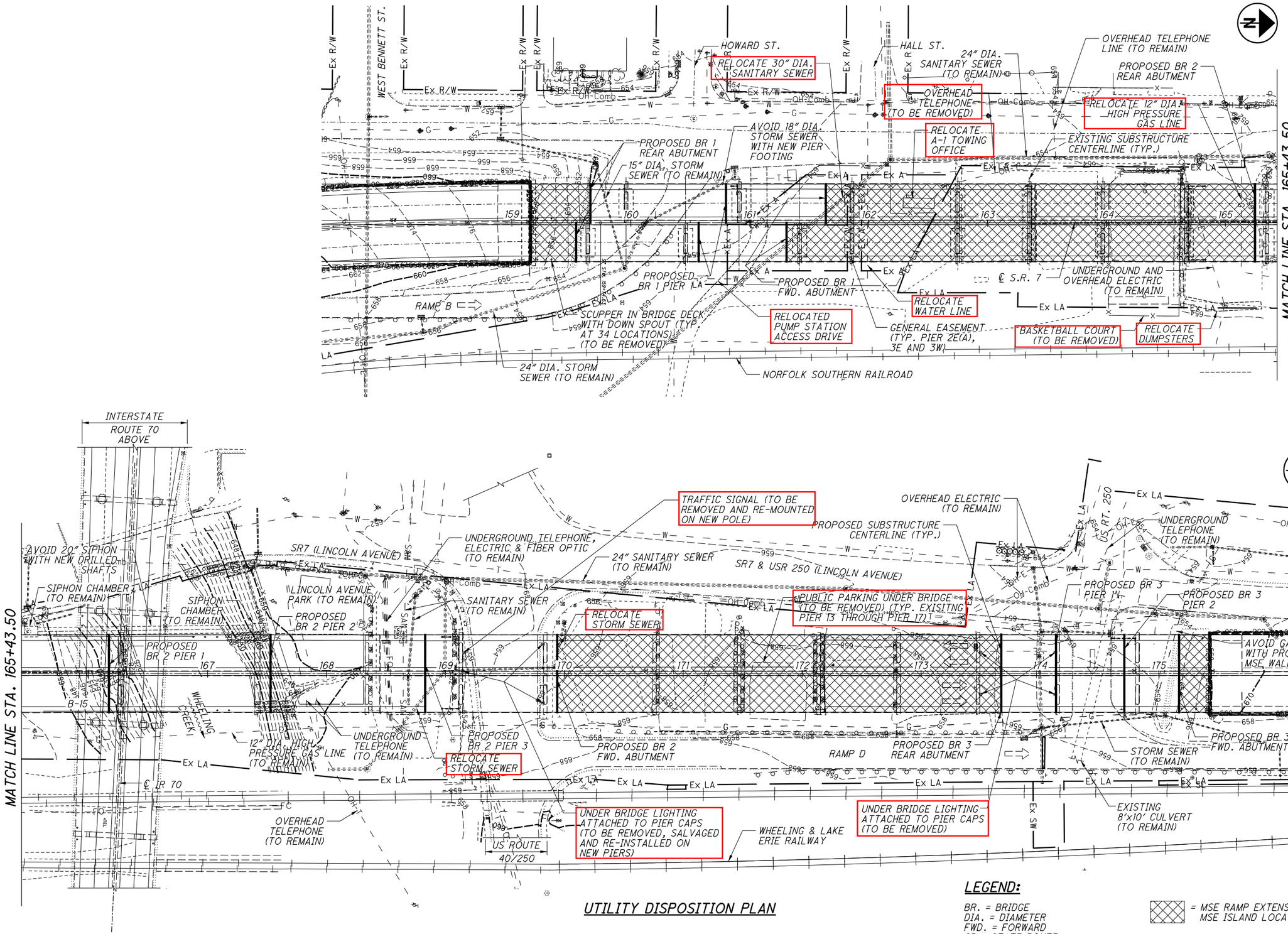

UTILITY DISPOSITION PLAN

LEGEND:

BR. = BRIDGE
DIA. = DIAMETER
FWD. = FORWARD
SR = STATE ROUTE

= MSE RAMP EXTENSION OR MSE ISLAND LOCATION

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DESIGNED	DRAWN	REVIEWED	DATE
CAS	AAA	TAB	2/21/19
CHECKED	REVISED	STRUCTURE FILE NUMBER	
JHL		0700541	

BELMONT COUNTY
STA. VARIES
STA. VARIES

REPLACEMENT SITE PLAN – UTILITY DISPOSITION
BRIDGE NO. BEL-7-1975
OVER RAMP B, WHEELING CREEK US40/US250 AND RAMP D

BEL-7-19.75
PID No. 105324

3 / 5

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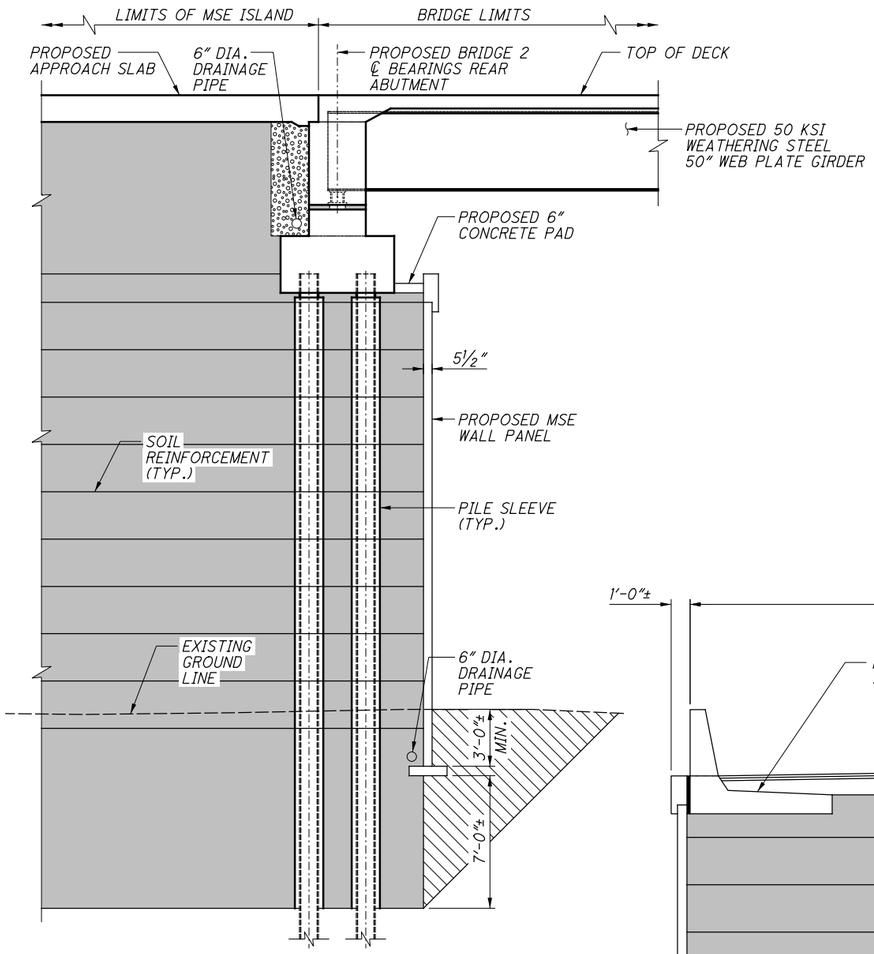


TYPICAL SEMI-INTEGRAL ABUTMENT WITH MSE WALL

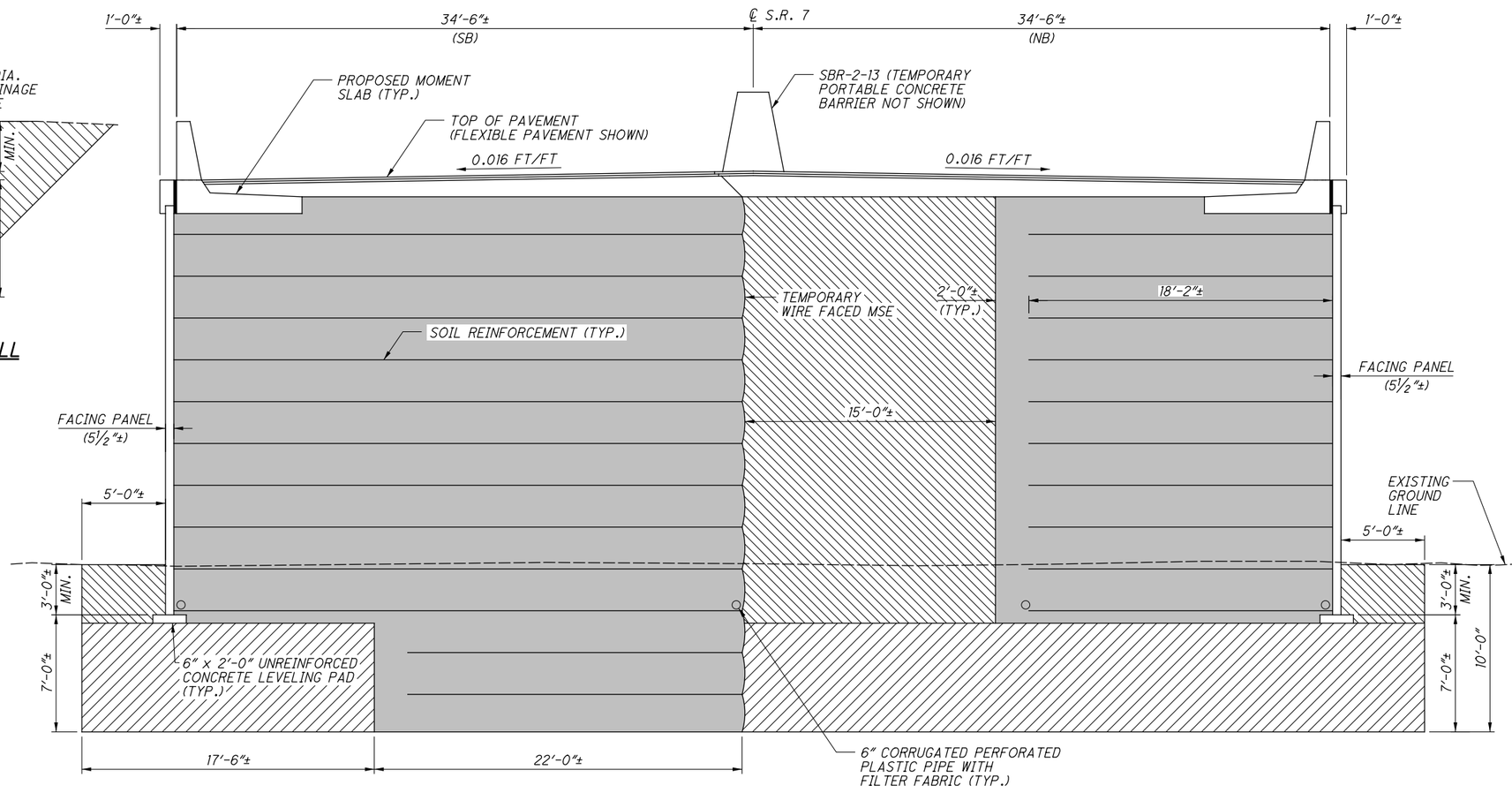
(BRIDGE 2 REAR ABUTMENT SHOWN, OTHER ABUTMENTS SIMILAR)
(SEE LEGEND FOR MATERIAL DESIGNATIONS)

LEGEND:

= SELECT GRANULAR BACKFILL

= ITEM 203 EMBANKMENT

= FOUNDATION PREPARATION (ITEM 203 GRANULAR MATERIAL, TYPE B)



TYPICAL MSE WALL SECTION

(INLETS AND LIGHTING NOT SHOWN)
(SEE LEGEND FOR MATERIAL DESIGNATIONS)

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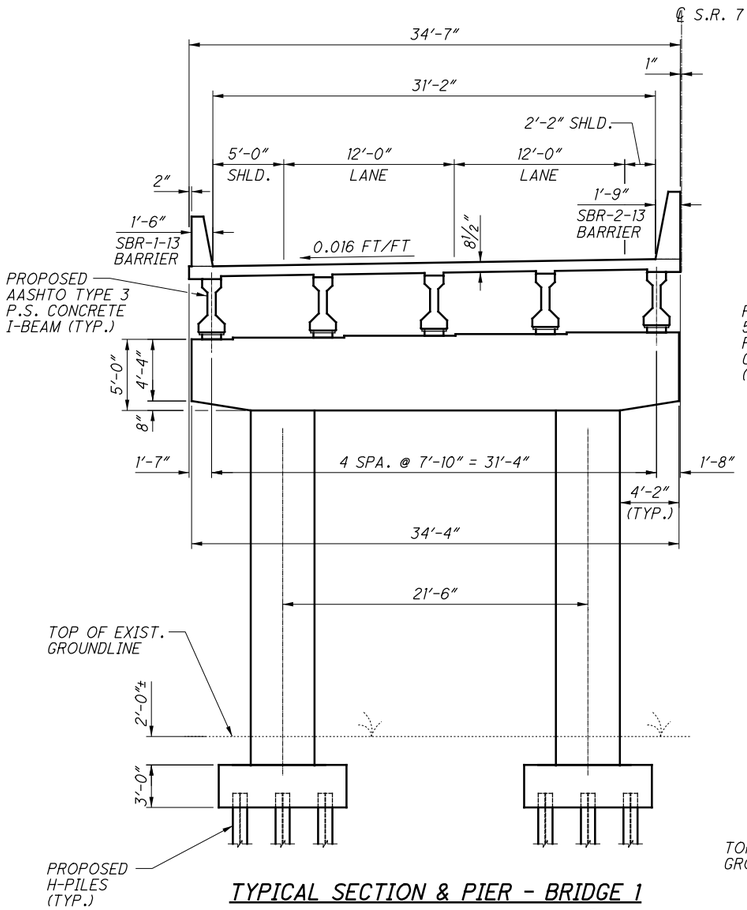
JHL	AAA	TAB	2/21/19
CHECKED	REVISED	STRUCTURE FILE NUMBER	
CAS		0700541	

TYPICAL ABUTMENT - REPLACEMENT OPTION
BRIDGE NO. BEL-7-1975
OVER RAMP B, WHEELING CREEK, US40/US250 AND RAMP D

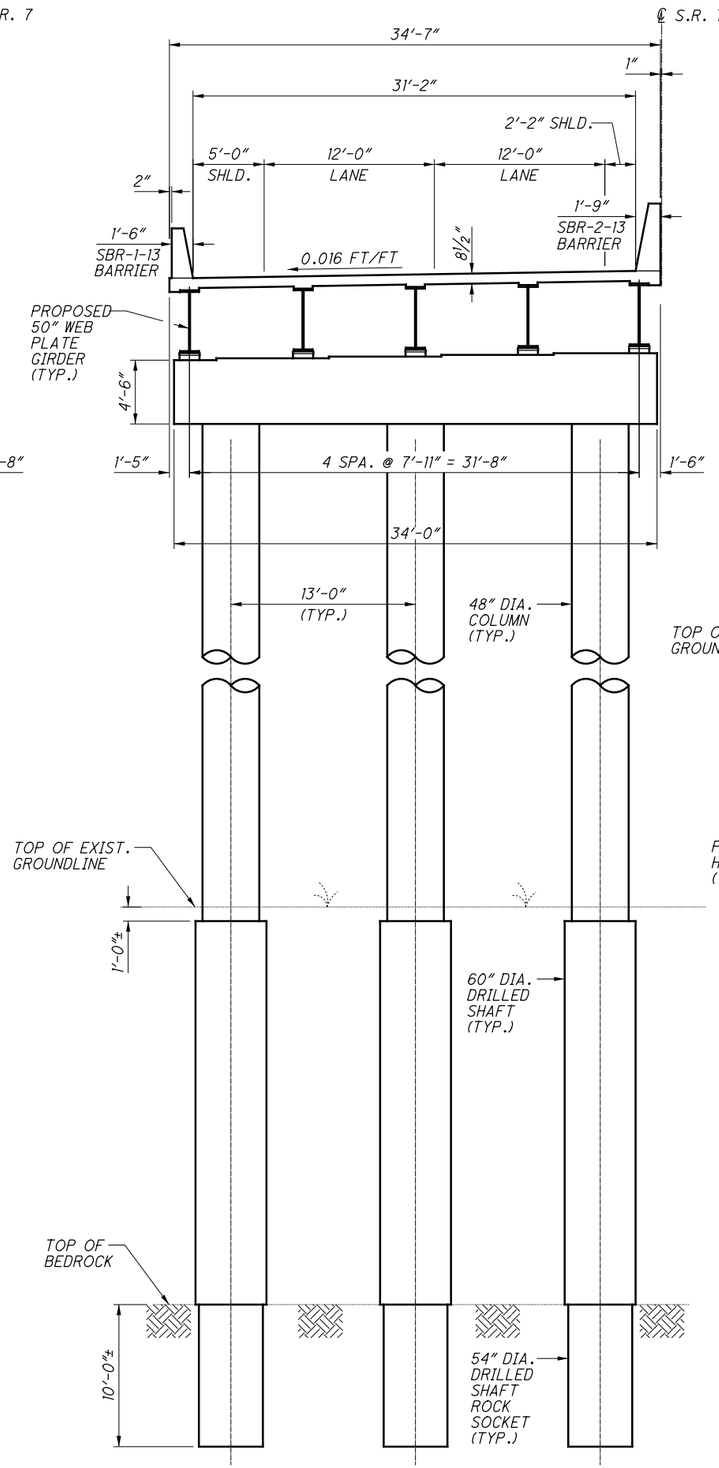
BEL-7-19.75
PID No. 105324

4 / 5



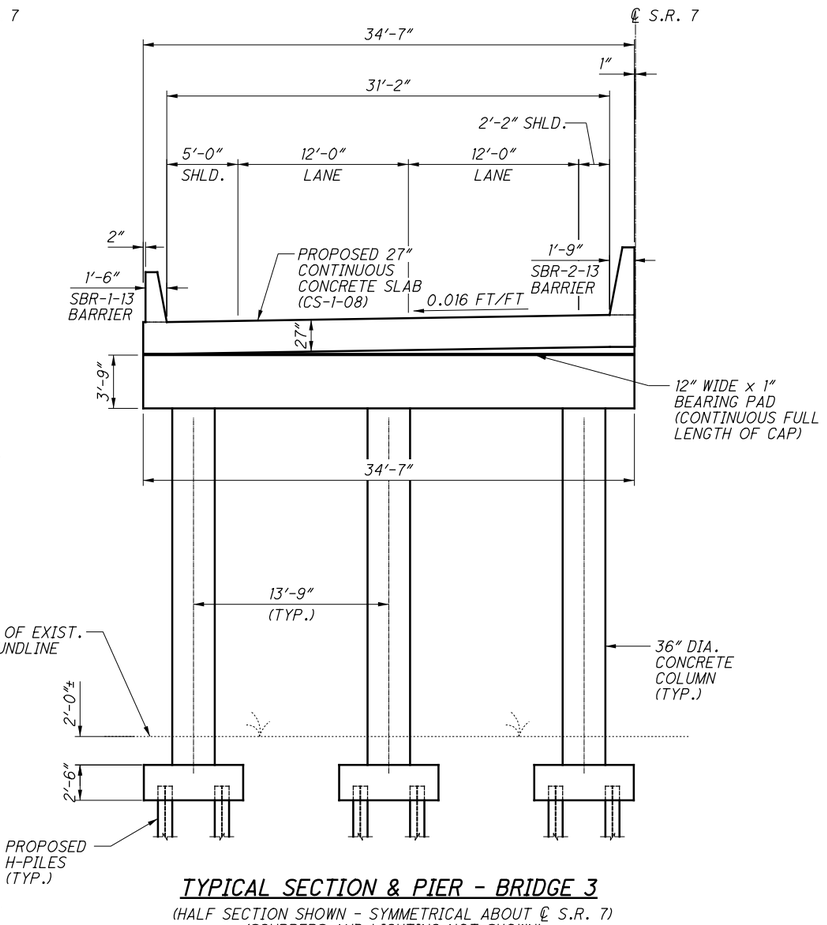
TYPICAL SECTION & PIER - BRIDGE 1

(HALF SECTION SHOWN - SYMMETRICAL ABOUT ℄ S.R. 7)
(SCUPPERS AND LIGHTING NOT SHOWN)



TYPICAL SECTION & PIER - BRIDGE 2

(PIER 1 AND 2 SHOWN)
(HALF SECTION SHOWN - SYMMETRICAL ABOUT ℄ S.R. 7)
(SCUPPERS AND LIGHTING NOT SHOWN)



TYPICAL SECTION & PIER - BRIDGE 3

(HALF SECTION SHOWN - SYMMETRICAL ABOUT ℄ S.R. 7)
(SCUPPERS AND LIGHTING NOT SHOWN)

LEGEND:

P.S. = PRE-STRESSED
SHLD. = SHOULDER
S.R. = STATE ROUTE

BURGESS & NIPLE
Engineers ■ Architects ■ Planners
5085 REED ROAD, COLUMBUS, OHIO 43220

DESIGNED	DRAWN	REVIEWED	DATE
JHL	AAA	TAB	2/21/19
CHECKED	REVISED	STRUCTURE FILE NUMBER	
CAS		07000541	

TRANSVERSE SECTIONS - REPLACEMENT OPTION

BRIDGE NO. BEL-7-1975
OVER RAMP B, WHEELING CREEK, US40/US250 AND RAMP D

BEL-7-19.75
PID No. 105324

5 / 5

APPENDIX D – COST ESTIMATES

BEL-7-1975

BEL-7-1975 over Ramp B, Wheeling Creek, US40/US250 and Ramp D

PRELIMINARY STRUCTURE CONSTRUCTION COST ESTIMATE

Rehabilitation Option

ITEM DESCRIPTION	TOTAL QUANTITY	UNIT	2019 UNIT PRICE	TOTAL 2019 CONSTRUCTION COST
PORTIONS OF STRUCTURE REMOVED, AS PER PLAN	1	LUMP	$3,160,000.00	$3,160,000
APPROACH SLAB REMOVED	378	SQ YD	$34.08	$12,882
COFFERDAMS, CRIBS AND SHEETING	1	LUMP	$5,000.00	$5,000
UNCLASSIFIED EXCAVATION	357	CU YD	$39.11	$13,962
PILE DRIVING EQUIPMENT MOBILIZATION	1	LUMP	$21,486.80	$21,487
STEEL PILES HP10X42, FURNISHED	3,489	FT	$19.63	$68,489
STEEL PILES HP10X42, DRIVEN	3,184	FT	$16.06	$51,135
STEEL POINTS OR SHOES	61	EACH	$93.14	$5,682
EPOXY COATED REINFORCING STEEL	1,179,080	POUND	$1.02	$1,202,662
CLASS QC2 CONCRETE WITH QC/QA, BRIDGE DECK	3,406	CU YD	$633.41	$2,157,394
CLASS QC2 CONCRETE WITH QC/QA, BRIDGE DECK (PARAPET), AS PER PLAN	1,219	CU YD	$728.43	$887,956
CLASS QC1 CONCRETE WITH QC/QA, PIER ABOVE FOOTINGS	998	CU YD	$853.78	$852,072
CLASS QC1 CONCRETE WITH QC/QA, ABUTMENT NOT INCLUDING FOOTING	279	CU YD	$573.10	$159,895
CLASS QC1 CONCRETE WITH QC/QA, FOOTING	171	CU YD	$341.02	$58,314
SEALING OF CONCRETE SURFACES (NON-EPOXY)	10,380	SQ YD	$9.60	$99,648
STRUCTURAL STEEL MEMBERS, LEVEL 2, STEEL ROLLED BEAM	4,438,400	POUND	$1.44	$6,391,296
STRUCTURAL STEEL MEMBERS, LEVEL 4, STEEL PLATE GIRDER	1,014,100	POUND	$1.58	$1,602,278
STRUCTURAL STEEL MEMBERS, MODULAR EXPANSION JOINT, LEVEL UF, AS PER PLAN	277	FT	$1,200.00	$332,400
WELDED STUD SHEAR CONNECTORS	32,200	EACH	$3.18	$102,396
FIELD PAINTING STRUCTURAL STEEL, INTERMEDIATE COAT	20,261	SQ FT	$2.87	$58,149
FIELD PAINTING STRUCTURAL STEEL, FINISH COAT	20,261	SQ FT	$2.57	$52,071
STRUCTURAL EXPANSION JOINT INCLUDING ELASTOMERIC STRIP SEAL	139	FT	$423.41	$58,854
ELASTOMERIC BEARING WITH INTERNAL LAMINATES AND LOAD PLATE (NEOPRENE)	225	EACH	$1,232.71	$277,360
SCUPPERS, INCLUDING SUPPORTS	50	EACH	$1,129.32	$56,466
DRILLED SHAFTS, 54" DIAMETER, INTO BEDROCK	120	FT	$839.10	$100,692
DRILLED SHAFTS, 60" DIAMETER, ABOVE BEDROCK	348	FT	$425.83	$148,189
REINFORCED CONCRETE APPROACH SLABS WITH QC/QA (T=17")	454	SQ YD	$263.84	$119,783
SPECIAL - RETAINING WALL MISC.: WIRE FACED MSE WALL	859	SQ FT	$17.90	$15,376
REMOVE AND REERECT EXISTING LIGHT POLE	26	EACH	$668.74	$17,387
			Subtotal:	$18,089,276
		Contingency %:	20%	$3,617,855
			TOTAL COST:	**$21,707,131**
			TOTAL COST PER SF:	**$195**

STRUCTURE DESCRIPTION:

1. 21-span (NB) & 22-span (SB), 5-unit structures, Total bridge length = 1606 ft (c/c Bearings).
2. 2 lanes traffic with 2'-2" & 5' shoulders, (34'-7" deck width), 2-Ext. parapet (SBR-1-13) & 2-Int. parapet (SBR-2-13).
3. 5-steel rolled beams (unit 1, 2, 4 & 5) and 5-steel plate girders (unit 3) @ each structure.
4. Salvage ex. pier stems and footings and rebuild the new pier caps (typical piers), 2 new river piers supported on drilled shafts.
5. Existing abutments (RA & FA) were removed and construct new proposed abutments (RA & FA).
6. MOT costs are not included.

Assumed Annual Inflation (%)	1.5%
Unit Price Basis Year:	2017
Assumed Construction Year:	2019

BEL-7-1975

BEL-7-1975 over Ramp B, Wheeling Creek, US40/US250 and Ramp D

PRELIMINARY STRUCTURE CONSTRUCTION COST ESTIMATE

Replacement with Bridges/MSE Islands Option (Sheet 1 of 2)

ITEM DESCRIPTION (All Bridge items except information noted MSE from sheet 2 of 2)	TOTAL QUANTITY	UNIT	2019 UNIT PRICE	TOTAL 2019 CONSTRUCTION COST
PORTIONS OF STRUCTURE REMOVED, AS PER PLAN	1	LUMP	$3,460,000.00	$3,460,000
APPROACH SLAB REMOVED	378	SQ YD	$34.08	$12,882
COFFERDAMS, CRIBS AND SHEETING	1	LUMP	$5,000.00	$5,000
UNCLASSIFIED EXCAVATION	447	CU YD	$39.11	$17,482
PILE DRIVING EQUIPMENT MOBILIZATION	1	LUMP	$21,486.80	$21,487
STEEL PILES HP10X42, FURNISHED	12,276	FT	$19.63	$240,978
STEEL PILES HP10X42, DRIVEN	11,106	FT	$16.06	$178,362
STEEL POINTS OR SHOES	234	EACH	$93.14	$21,795
EPOXY COATED REINFORCING STEEL	670,160	POUND	$1.02	$683,563
CLASS QC2 CONCRETE WITH QC/QA, SUPERSTRUCTURE	159	CU YD	$749.81	$119,220
CLASS QC2 CONCRETE WITH QC/QA, BRIDGE DECK	2,334	CU YD	$633.41	$1,478,379
CLASS QC2 CONCRETE WITH QC/QA, BRIDGE DECK (PARAPET), AS PER PLAN	612	CU YD	$728.43	$445,799
CLASS QC1 CONCRETE WITH QC/QA, PIER ABOVE FOOTINGS	557	CU YD	$853.78	$475,555
CLASS QC1 CONCRETE WITH QC/QA, ABUTMENT NOT INCLUDING FOOTING	162	CU YD	$573.10	$92,842
CLASS QC1 CONCRETE WITH QC/QA, FOOTING	450	CU YD	$341.02	$153,459
SEALING OF CONCRETE SURFACES (NON-EPOXY)	6,742	SQ YD	$9.60	$64,723
STRUCTURAL STEEL MEMBERS, LEVEL 4, STEEL PLATE GIRDER	1,650,500	POUND	$1.58	$2,607,790
WELDED STUD SHEAR CONNECTORS	9,400	EACH	$3.18	$29,892
FIELD PAINTING STRUCTURAL STEEL, INTERMEDIATE COAT	5,067	SQ FT	$2.87	$14,542
FIELD PAINTING STRUCTURAL STEEL, FINISH COAT	5,067	SQ FT	$2.57	$13,022
DRAPED STRAND PRESTRESSED CONCRETE BRIDGE I-BEAM MEMBERS, LEVEL 3, TYPE 3	20	EACH	$18,562.50	$371,250
1" ELASTOMERIC BEARING PAD	133	SQ FT	$250.00	$33,250
ELASTOMERIC BEARING WITH INTERNAL LAMINATES AND LOAD PLATE (NEOPRENE)	100	EACH	$1,232.71	$123,271
SCUPPERS, INCLUDING SUPPORTS	32	EACH	$1,129.32	$36,138
DRILLED SHAFTS, 54" DIAMETER, INTO BEDROCK	120	FT	$839.10	$100,692
DRILLED SHAFTS, 60" DIAMETER, ABOVE BEDROCK	271	FT	$425.83	$115,400
REINFORCED CONCRETE APPROACH SLABS WITH QC/QA (T=17")	1,360	SQ YD	$263.84	$358,822
REMOVE AND REERECT EXISTING LIGHT POLE	26	EACH	$668.74	$17,387
MSE ISLANDS AND MSE RAMP EXTENSION COST (SEE SHEET 2 OF 2))			$5,979,197	$5,979,197
			Subtotal:	$17,272,182
		Contingency %:	20%	$3,454,436
			TOTAL COST:	**$20,726,618**
			COST PER SQ. FT. (BRIDGE):	**$243**
			COST PER SQ. FT. (MSE):	**$126**

STRUCTURE DESCRIPTION:

1. 2 - MSE Wall Ramp Extensions, 3 - Bridges and 2 - MSE Wall Islands, Total bridge length = 799.5 ft(East), 816.5 ft(West)
2. 2 lanes traffic with 2'-2" & 5' shoulders, (34'-7" deck width), 2-Ext. parapet (SBR-1-13) & 2-Int. parapet (SBR-2-13).
3. 5-PS concrete I-beams(bridge 1), 5-steel plate girders(bridge 2) and concrete slab bridge(bridge 3)
4. MSE Island 1 Length = 394 ft(East), 361 ft(West) and MSE Island 2 length = 373.5 ft (East & West)
5. Remove all ex. substructures and construct new piers and abutments on MSE walls, 2 new river piers supported on drilled shafts.
6. MOT costs are not included.

Assumed Annual Inflation (%)	1.5%
Unit Price Basis Year:	2017
Assumed Construction Year:	2019

BEL-7-1975

BEL-7-1975 over Ramp B, Wheeling Creek, US40/US250 and Ramp D

Preliminary Structure Construction Cost Estimate

Replacement with Bridges/MSE Islands Option (Sheet 2 of 2)

ITEM DESCRIPTION (MSE)	TOTAL QUANTITY	UNIT	2019 UNIT PRICE	TOTAL 2019 CONSTRUCTION COST
REMOVAL MISC.: RELOCATE PUMP STATION ACCESS ROAD	1	LUMP	$16,440.00	$16,440
REMOVAL MISC.: REMOVE AND RELOCATE 30" DIAMETER SANITARY SEWER	1	LUMP	$82,200.00	$82,200
REMOVAL MISC.: REMOVE AND RELOCATE 12" DIAMETER HIGH PRESSURE NATURAL GAS LINE	1	LUMP	$55,074.00	$55,074
REMOVAL MISC.: REMOVE AND RELOCATE WATER LINE	1	LUMP	$41,100.00	$41,100
EMBANKMENT	12,558	CU YD	$7.74	$97,199
ASPHALT CONCRETE BASE, PG64-22	1,360	CU YD	$90.52	$123,107
AGGREGATE BASE	1,614	CU YD	$43.94	$70,919
ASPHALT CONCRETE SURFACE COURSE, 12.5MM, TYPE A (446)	85	CU YD	$144.05	$12,244
ASPHALT CONCRETE INTERMEDIATE COURSE, 19MM, TYPE A (446)	127	CU YD	$115.02	$14,608
EPOXY COATED REINFORCING STEEL	43,566	POUND	$1.02	$44,437
CLASS QC2 CONCRETE WITH QC/QA, SUPERSTRUCTURE (PARAPET)	259	CU YD	$650.71	$168,534
CLASS QC1 CONCRETE WITH QC/QA, SUBSTRUCTURE (MOMENT SLAB)	609	CU YD	$520.00	$316,680
SPECIAL - RETAINING WALL MISC.: WIRE FACED MSE WALL	27,126	SQ FT	$18.14	$492,066
12" CONDUIT, TYPE B	140	FT	$66.51	$9,311
18" CONDUIT, TYPE B	822	FT	$84.96	$69,837
CATCH BASIN, NO. 3	12	EACH	$2,854.30	$34,252
CATCH BASIN FRAME AND GRATE	12	EACH	$790.16	$9,482
MANHOLE, NO. 3	6	EACH	$3,250.49	$19,503
MANHOLE FRAME AND COVER	6	EACH	$289.11	$1,735
CONCRETE BARRIER, SINGLE SLOPE, TYPE B1	822	FT	$88.41	$72,673
MECHANICALLY STABILIZED EARTH WALL	49,966	SQ FT	$24.18	$1,208,178
WALL EXCAVATION (UNDERCUT)	26,028	CU YD	$14.46	$376,365
FOUNDATION PREPARATION (GRANULAR MATERIAL, TYPE B)	13,561	CU YD	$44.67	$605,770
SELECT GRANULAR BACKFILL (WITHIN MSE REGIONS)	45,024	CU YD	$38.67	$1,741,078
6" DRAINAGE PIPE, PERFORATED	3,288	FT	$14.63	$48,103
CONCRETE COPING	1,644	FT	$96.27	$158,268
AESTHETIC SURFACE TREATMENT	33,702	SQ FT	$1.39	$46,846
SGB INSPECTION AND COMPACTION TESTING	1	LUMP	$43,189.10	$43,189
			Subtotal:	$5,979,197
		Contingency %:	0%	$0
			COST MSE ISLANDS/RAMP EXT.:	**$5,979,197**

STRUCTURE DESCRIPTION:

Assumptions:
1. All items on this sheet are for the MSE portion of the new structures
2. 2 lanes traffic with 2' & 5' shoulders
3. Roadway consisting of asphalt pavement, moment slabs with exterior barrier, median barrier
4. Based on MSE islands with 23 foot average height
5. Assumed 10.55 feet of undercut and backfill under MSE walls

Assumed Annual Inflation (%)	1.5%
Unit Price Basis Year:	2017
Assumed Construction Year:	2019

LIFE CYCLE COST ANALYSIS (Rehabilitation Option)

BEL-7-1975 SFN: 0700541

REHABILITATION OPTION: Replaces superstructures and pier caps, salvage some substructures

75-YEAR LIFE ESTIMATE: **$31,094,000**

1968 : Year of Original Construction

Date	Year	Repair Work	Est. Cost	PWF	PWF x Cost
2019	0	***Rehabilitate Bridge***	$21,707,131	1.0000	$21,707,131
2024	5			0.9657	$0
2029	10	***Patching & maintenance of decks***	$133,297	0.9326	$124,315
2034	15			0.9007	$0
2039	20	***Deck overlay and patching of concrete substructures***	$732,650	0.8698	$637,246
2044	25			0.8400	$0
2049	30	***Superstructure painting and patching & maintenance of deck***	$3,460,460	0.8112	$2,807,048
2054	35			0.7834	$0
2059	40	***Rehabilitate Bridge - New deck, parapets & joints and patching of concrete substructures***	$3,697,274	0.7565	$2,797,067
2064	45			0.7306	$0
2069	50	***Patching & maintenance of decks***	$133,297	0.7055	$94,047
2074	55			0.6814	$0
2079	60	***Superstructure painting, deck overlay and patching of concrete substructures***	$4,323,814	0.6580	$2,845,108
2084	65			0.6355	$0
2089	70	***Patching & maintenance of decks***	$133,297	0.6137	$81,801
2094	75			0.5926	$0
		SALVAGE VALUE (based on 0-year remaining life of bridge)	$0	0.5926	$0
				TOTAL COST:	**$31,094,000**

Real Discount Rate*: 0.7%

Legend:

* = Based on Office of Management and Budget, *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs, Appendix C,* OMB Circular A-94, Washington, D.C., Revised December, 2016.

PWF = Present Worth Factor

LIFE CYCLE COST ANALYSIS (Replacement Option A - Three Bridges with MSE Islands)

BEL-7-1975 SFN: 0700541

REPLACEMENT OPTION A: Replace existing bridges with three bridges and MSE islands

75-YEAR LIFE ESTIMATE: **$25,520,000**

1968 : Year of Original Construction

Date	Year	Repair Work	Est. Cost	PWF	PWF x Cost
2019	0	***Replace Bridge***	$20,726,618	1.0000	$20,726,618
2024	5			0.9657	$0
2029	10	***Patching & maintenance of bridge decks/patching and maintanance of pavement at MSE islands***	$71,515	0.9326	$66,696
2034	15			0.9007	$0
2039	20	***Deck overlay, patching of concrete substructures, mill and resurface pavement at MSE islands***	$615,851	0.8698	$535,656
2044	25			0.8400	$0
2049	30	***Superstructure painting, patching & maintenance of bridge deck/patching and maintanance of pavement at MSE islands***	$1,290,985	0.8112	$1,047,218
2054	35			0.7834	$0
2059	40	***Rehabilitate Bridge - New decks, parapets, patching of concrete substructures and new pavement at MSE islands***	$2,308,793	0.7565	$1,746,651
2064	45			0.7306	$0
2069	50	***Patching & maintenance of bridge decks/patching and maintanance of pavement at MSE islands***	$71,515	0.7055	$50,457
2074	55			0.6814	$0
2079	60	***Superstructure painting, deck overlay, patching of concrete substructures, mill and resurface pavement at MSE islands***	$1,979,321	0.6580	$1,302,411
2084	65			0.6355	$0
2089	70	***Patching & maintenance of bridge deck/patching and maintanance of pavement at MSE islands***	$71,515	0.6137	$43,887
2094	75			0.5926	$0
		SALVAGE VALUE (based on 0-year remaining life of bridge)	$0	0.5926	$0
				TOTAL COST:	**$25,520,000**

Real Discount Rate*: 0.7%

Legend:

* = Based on Office of Management and Budget, *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs, Appendix C,* OMB Circular A-94, Washington, D.C., Revised December, 2016.

PWF = Present Worth Factor

LIFE CYCLE COST ANALYSIS (Replacement Option B - Full Length Bridges)

BEL-7-1975 SFN: 0700541

REPLACEMENT OPTION B: Replace existing bridges with new full length bridges

75-YEAR LIFE ESTIMATE: **$34,646,000**

1968 : Year of Original Construction

Date	Year	Repair Work	Est. Cost	PWF	PWF x Cost
2019	0	***Replace Bridge***	$25,259,206	1.0000	$25,259,206
2024	5			0.9657	$0
2029	10	***Patching & maintenance of decks***	$133,297	0.9326	$124,315
2034	15			0.9007	$0
2039	20	***Deck overlay and patching of concrete substructures***	$732,650	0.8698	$637,246
2044	25			0.8400	$0
2049	30	***Superstructure painting and patching & maintenance of deck***	$3,460,460	0.8112	$2,807,048
2054	35			0.7834	$0
2059	40	***Rehabilitate Bridge - New deck, parapets & joints and patching of concrete substructures***	$3,697,274	0.7565	$2,797,067
2064	45			0.7306	$0
2069	50	***Patching & maintenance of decks***	$133,297	0.7055	$94,047
2074	55			0.6814	$0
2079	60	***Superstructure painting, deck overlay and patching of concrete substructures***	$4,323,814	0.6580	$2,845,108
2084	65			0.6355	$0
2089	70	***Patching & maintenance of decks***	$133,297	0.6137	$81,801
2094	75			0.5926	$0
		SALVAGE VALUE (based on 0-year remaining life of bridge)	$0	0.5926	$0
				TOTAL COST:	**$34,646,000**

Real Discount Rate*: 0.7%

Legend:

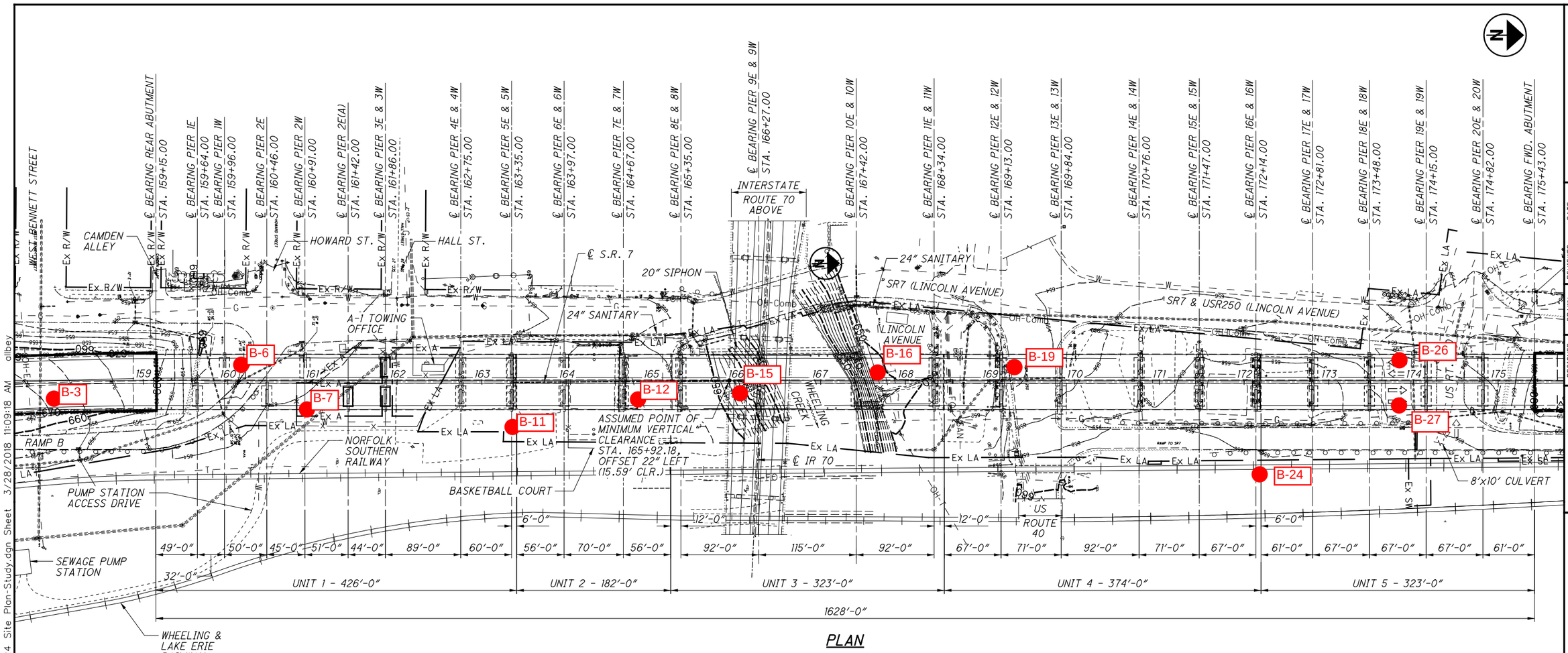
* = Based on Office of Management and Budget, *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs, Appendix C,* OMB Circular A-94, Washington, D.C., Revised December, 2016.

PWF = Present Worth Factor

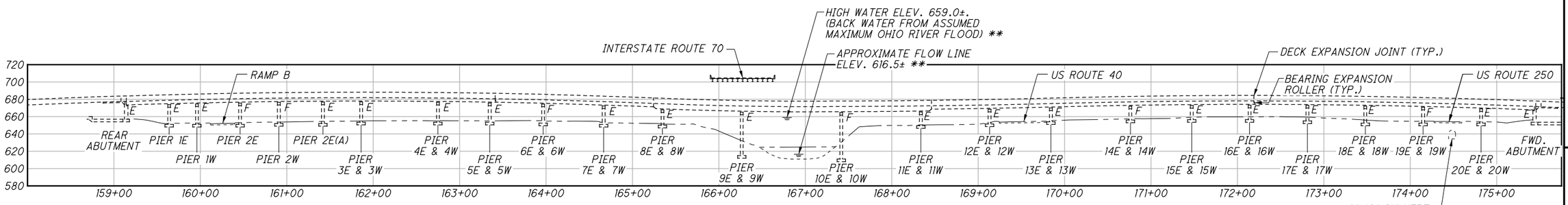
APPENDIX E – EXISTING BRIDGE PLANS (ORIGINAL AND REHABILITATION)

Existing Plans on File With ODOT and Not Included

APPENDIX F – 1958 AND 2018 SOIL BORINGS



PLAN



ELEVATION

(PILES NOT SHOWN)

BURGESS & NIPLE
Engineers ■ Architects ■ Planners
5085 REED ROAD, COLUMBUS, OHIO 43220

DESIGNED	DRAWN	REVIEWED	DATE
CAS	AAA	TAB	3/15/18
CHECKED	REVISED	STRUCTURE FILE NUMBER	
XXX		0700541	

BELMONT COUNTY
STA. XXX+XX.XX
STA. XXX+XX.XX

SITE PLAN

BRIDGE NO. BEL-7-1975
OVER US40, SR767 AND WHEELING CREEK

BEL-7-19.75
PID No. 105324

P:\PR56046\BEL\105324\Design\Bridge\Rehab vs Replacement Study\CADD\105324 Site Plan Study.dgn Sheet 3/28/2018 11:09:18 AM allbey

STATE OF OHIO
DEPARTMENT OF HIGHWAYS
TESTING LABORATORY

B-1

LOG OF BORING

CO., RT. NO., SEC. BEL-7-19.80 BRIDGE NO. BEL-7-SR 7 VIA
ING FALL SOUTH
LOCATION: T.H. B1 STA. 89+92 OFFSET 53' LT(B,L,) FED. NO.

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
	0			
	2			Cinder Fill
	4			
643.2	6	5	81530	Brown Silty Sandy Gravel
	8			
	10			
545.2	12	12	81531	Brown Gravelly Sandy Clay
	14			
640.2	16	12	81532	Gray Gravelly Silt
	18			
635.2	20	12	81533	Gray & Brown Silty Clay
	22			
	24			
630.2	26	19	81534	Brown Sandy Gravelly Clay
	28			
625.2	30	22	81535	Brown Gravelly Silt
	32			
	34			
-620.2	36	26	81536	Gray Silty Gravel

8-14-58

LOG OF BORING (CONTINUED)
BRIDGE NO. BEL-7-SR 7 VIADUCT T.H. B1

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
	38			
	40			
	42	23	81537	Gray Silt
	44			
610.2	46	31	81538	Gray Silt & Clay
	48			
605.2	50			
	52	22	81539	Gray Silty Clay
	54			
600.2	56	43	81540	Gray Gravelly Clay
	58			
	60			
595.2	62	20	[illegible]	Gray Clay & Shale Fragments
	64		81541	Sandstone Fragments & Clay
	66			BOTTOM OF BORING
	68			
	70			
	72			
	74			
	76			
	78			
	80			
	82			

8-14-58

STATE OF OHIO
DEPARTMENT OF HIGHWAYS
TESTING LABORATORY

LOG OF BORING

B-2

CO., RT. NO., SEC. BEL-7-19.80 BRIDGE NO. BEL-7-3R 7 Viad SOUTH WALL

LOCATION: T.H. B2 STA. 91+05 OFFSET 179'LT(B.L) FED. NO.

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
[illegible]	0			
	2			
	4			
[illegible]	6	3	82460	Brown Silty Sandy Gravel
	8			
644.1	10	5	82461	Gray Silty Sandy Gravel
	12			
	14			
639.1	16	22	82462	Brown Clayey Gravel
	18			
634.1	20	23	82463	Brown Silty Gravel
	22			
	24			
629.1	26	20	-----	Brown Silt & Boulders
	28			
	30			
624.1	32	10	82464	Brown Silt
	34			
619.1	36	11	82465	Brown Silt

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LOG OF BORING (CONTINUED)

BRIDGE NO. BEL-7-3R 7 Viaduct T.H. B2

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
	38			
[illegible]	40	14	82466	Gray Silt
	42			
	44			
[illegible]	46	30	82467	Gray Sandy Silt
	48			
[illegible]	50	14	82468	Gray Silt
	52			
	54			
599.1	56	18	82469	Gray & Green Silt
	58			
594.1	60	45	82470	Red Silty Sandy Gravel
	62			
	64			
589.1	66	----	-----	Red Calcareous Clay Bouldery
	68			
584.1	70	120	82471	Red Silt & Clay Bouldery
	72			
579.1	74			TOP OF ROCK
577.3	76			Sandstone, Gray, Fine to Medium-grained, Micaceous, Firm, Thin-bedded, With 0.4' Shale at Top. Core Loss: 0%
	78			
	80			Shale, Gray, Siliceous, Firm. Core Loss: 4%
	82			

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LOG OF BORING (CONTINUED)

BRIDGE NO. BEL-7-SR 7 Viaduct T.H. 32

ELEV.	DEPTH ft.	NO. BLOWS	SAMPLE NO.	DESCRIPTION
	84			Shale, Gray, Siliceous, Firm. Core Loss: 4
	86			BOTTOM OF BORING

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LOG OF BORING

B-3

CO., RT. NO., SEC. BEL-7-19.80 BRIDGE NO. BEL-7-SR 7 VI. SOUTH WALLS

LOCATION: T.H. B3 STA. 91+67 OFFSET 82' LT (B.L.) FED. NO.

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
652.4	0			
	2			Cinder Fill
	4			
647.4	6	9	82005	Brown Gravelly Clay
	8			
642.4	10	25	82006	Brown Silt & Clay
	12			
	14			
637.4	16	9	82007	Br. Sandy Gravelly Clay — Boulders & Fragments of Limestone & Sandstone (Both Coarse-grained, friable S.S. and Medium to Fine-grained Calcareous S.S.) With Red Ferruginous Clay
	18			
632.4	20	8	82008	Br. Sandy Gravelly Clay
	22			
	24			
627.4	26	6	82009	Brown Sandy Silt
	28			
622.4	30	19	82010	Brown Silt
	32			
	34			
617.4	36			Brown Silt

LOG OF BORING (CONTINUED)

BRIDGE NO. BEL-7-SR 7 VIADUCT T.H. B3

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
	38			
	40	22	82012	Brown Sandy Silt
	42			
	44			
607.	46	30	82013	Gray & Brown Sandy Silt
	48			Boulders & Fragments of Limestone & Sandstone (Both Coarse-grained, Friable S.S. and Medium to Fine-grained Calcareous S.S.) With Red Ferruginous Clay.
592.	50			
	52	35	82014	Br. Silt
	54			
577.4	56	22	82015	Brown Silt
	58			
592.4	60			
	62	200	82016	Brown Sandy Gravel
	64			
	66			Red Clay With Boulders
558.				BOTTOM OF BORING
	68			
	70			
	72			
	74			
	76			
	78			
	80			
	82			

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LOG OF BORING

B-6

CO., RT. NO., SEC. BEL-7-19.80 BRIDGE NO. BEL-7-SR 7 VIAD
PIER OVER B&O RR (EB & WB) UNIT

LOCATION: T.H. B6 STA. 93+94 OFFSET 140' LT (B.L.) FED. NO.

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
653.6	0			
	2			(FILL)
	4			
648.6	6	3	82832	Silty Gravelly Sand (Brown)
	8			
643.6	10	11	82833	Brown Silt & Clay
	12			
	14			
638.6	16	19	82834	Brown Silty Clay
	18			
633.6	20	41	82835	Brown Silt & Clay
	22			
	24			
628.6	26	10	82836	Brown Sandy Silt
	28			
623.6	30	12	82837	Brown Sandy Silt
	32			
	34			
618.6	36	11	82838	Brown Sandy Silt

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LOG OF BORING (CONTINUED)

BRIDGE NO. [illegible] T.H. B7

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
	38			
	40			[illegible]
	42			
	44			
	46	[illegible]	[illegible]	[illegible] Sandy Gravel
	48			
	50	[illegible]	[illegible]	[illegible]
	52			
	54			
	56	[illegible]	[illegible]	[illegible] Gravelly Silt
	58			
	60	[illegible]	[illegible]	[illegible]
	62			
	64			
	66	62	[illegible]	[illegible]
	68			
	70			TOP OF ROCK
	72			Sandstone, greenish-gray, fine-grained, argillaceous in part, firm. No core loss.
	74			
	76			[illegible], very, siliceous, firm. Core loss.
	78			
	80			
	82			BOTTOM OF BORING

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LOG OF BORING

B7

CO., RT. NO., SEC. BEL-7-19.80 BRIDGE NO. BEL-7-SR 7 V[illegible]
[illegible] IER (V[illegible] B&O RR (EB & WB)) UNIT [illegible]

LOCATION: T.H. B7 STA 94+70 (B.L.) OFFSET 32' LT. (B.L.) FED. NO.

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
[illegible]	0			
	2			
	4			
649.8	6	16	81510	CINDER FILL
	8			
[illegible]	10			
	12	12	81511	CINDERS WITH SANDY SILT
	14			
639.8	16			
	18	17	81512	BROWN CLAY
634.8	20			
	22	19	81513	BROWN CLAY
	24			
629.8	26	11	81514	BROWN SILT & CLAY
	28			
[illegible]	30			
	32	11	81515	BROWN SANDY SILT
	34			
619.8	36	14	81516	BROWN SILT

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LOG OF BORING (CONTINUED)

BRIDGE NO. BEL-7-SR 7 VIADUCT (UNIT) T.H. B7

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
	38			
	40			
		23	81517	BROWN GRAVELLY SANDY SILT
	42			
	44			
	46	50	81518	BROWN SILTY SANDY GRAVEL
	48			
	50			
		62	81519	BROWN SANDY SILT WITH COAL FRAGMENTS
	52			
	54			
	56	32	81520	BROWN SILTY SANDY GRAVEL
	58			
	60			
		180	81521	BROWN SILTY SANDY GRAVEL
	62			
	64			
				SANDSTONE BOULDERS
				BOTTOM OF BORING
	66			
	68			
	70			
	72			
	74			
	76			
	78			
	80			
	82			

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LOG OF BORING

B-11

CO., RT. NO., SEC. BEL-7-19.80 BRIDGE NO. BEL-7-SR 7 VIADUCT OVER B&O RR (EB & WB) UNIT 1
PIER

LOCATION: T.H. B11 STA. 97+07 OFFSET 66' LT (B.) FED. NO.

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
	0			
	2			
650.3	4	44	81522	BROWN SILTY SANDY GRAVEL
	6			
	8			
645.3	10	24	81523	BROWN GRAVELLY SILT
	12			
	14			
640.3	16	22	81524	BROWN SILT & CLAY
	18			
635.3	20	24	81525	BROWN SILT & CLAY
	22			
	24			
630.3	26	19	81526	BROWN SILT & CLAY
	28			
625.3	30	11	81527	BROWN SANDY SILT
	32			
	34			
620.3	36	13	81528	BROWN SANDY SILT

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LOG OF BORING (CONTINUED)

BRIDGE NO. BEL-7-SR 7 VIADUCT JOINT 1 T.H. B11

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
	38			
	40			
		110	81529	BROWN SILTY SANDY GRAVEL
	42			BROKEN, WEATHERED SANDSTONE (TOP OF ROCK)
	44			SANDSTONE, GRAY & BROWN, MEDIUM TO FINE GRAINED, CALCAREOUS IN PART, FIRM, IRREGULARLY BEDDED, WITH THIN SHALE SEAMS. NO CORE LOSS.
	46			
	48			
	50			SHALE, GRAY, SILICEOUS, FIRM, JOINTED IN TOP HALF, WITH CLAY SEAMS. CORE LOSS: 22%
	52			
	54			SHALE, GRAY, SLIGHTLY SILICEOUS, FIRM. NO CORE LOSS.
	56			
	58			BOTTOM OF BORING
	60			
	62			
	64			
	66			
	68			
	70			
	72			
	74			
	76			
	78			
	80			
	82			

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LOG OF BORING

B-12

CO., RT. NO., SEC. BEL-7-19.20 BRIDGE NO. BEL-7-SR 7 VI... UNITS 2 & 3

LOCATION: T.H. B12 STA. 68+43 OFFSET 38'LT.(B.L) FED. NO.

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
	0			
	2			(FILL)
647.7	4			
	6	-----	-----	Fill Stone & Concrete With Gravel
	8			
647.7	10	19	82447	Brown Silt & Clay
	12			
	14			
637.7	16	23	82448	Brown Silty Clay
	18			
632.7	20	22	82449	Brown Silt
	22			
	24			
627.7	26	23	82450	Brown Silt & Clay
	28			
	30			
622.7	32	13	82451	Brown Sandy Silt
	34			
617.7	36			Brown Silty Sand

RC

LOG OF BORING (CONTINUED)

BRIDGE NO. BEL-7-SR 7 VIADUCT T.H. B12

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
	38			
	40			Brown Bouldery Gravelly Silty Sand
	42			
	44			
	46			TOP OF ROCK
	48			Sandstone, Gray & Brown, Medium Grained, Firm, Medium Bedded. No Core Loss
	50			
	52			Shale, Gray, Siliceous, Firm. Core Loss
	54			
	56			BOTTOM OF BORING
	58			
	60			
	62			
	64			
	66			
	68			
	70			
	72			
	74			
	76			
	78			
	80			
	82			

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LOG OF BORING B-15

CO., RT. NO., SEC. BEL-7-19.80 BRIDGE NO. BEL-7-SR 7 VIADUCT UNITS 2 & 3

LOCATION: T.H. B15 STA. 29+73 OFFSET 102'LT(B,L) FED. NO.

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
	0			
	2			(Fill)
	4			
645.0	6	5	82453	Brown Silty Gravelly Sand
	8			
641.0	10	18	82454	Brown Silty Sandy Gravel
	12			
	14			
636.0	16	33	82455	Brown Gravelly Clay
	18			
631.0	20	60	82456	Brown Silty Sandy Gravel
	22			
	24			
626.0	26	11	82457	Brown Sandy Clay
	28			
621.0	30	33	82458	Brown Silty Clay
	32			
	34			
616.0	36			Brown Gravelly Sand

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LOG OF BORING (CONTINUED)

BRIDGE NO. BEL-7-SR 7 VIADUCT T.H. B15

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
	38			TOP OF ROCK
	40			Sandstone, Gray, Medium to Coarse-grained in Bottom Quarter, Medium-grained in Remainder, Calcarecus 45.0' 46.5', Firm. Core Loss: 13%
	42			
	44			
	46			
	48			
	50			Clay Shale, Gray, Firm, No Core Loss
				BOTTOM OF BORING
	52			
	54			
	56			
	58			
	60			
	62			
	64			
	66			
	68			
	70			
	72			
	74			
	76			
	78			
	80			
	82			

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B-16

LOG OF BORING

CO. RT. NO. SEC. BEL-7-19.80 BRIDGE NO. BEL-7-SR 7 VIADUCT
LENTH UNITS 2 AND 3
LOCATION: T.H. B16 STA 01+11 OFFSET 122' LT (B.L.) FED. NO.

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
650.2	0			
	2			
	4			
646.2	6	3	82017	Cinder Fill
	8			
640.2	10	7	82018	Brown Sandy Gravelly Clay
	12			
	14			
635.2	16	21	82019	Brown Gravelly Clay
	18			
630.2	20	14	82020	Brown Gravelly Clay
	22			
	24			
625.2	26	27	82021	Brown Silt & Clay
	28			
620.2	30	16	82022	Brown Gravelly Clay & Silt
	32			
	34			
615.2	36	37	82023	Brown & Gray Silt & Clay

RC

LOG OF BORING (CONTINUED)

BRIDGE NO. [illegible] T.H. B16

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
	38			
	40	96	[illegible]	SANDSTONE BOULDERS [illegible], Sandy Gravel, TOP OF ROCK
	42			Shale, Gray & Brown, Siliceous in top half-gradi[illegible] Gray Shale is Remainder, Medium Firm to Soft, Brown in Top Half, With 0.5' Sandstone at 41.0'. No Core L[illegible]
	44			Sandstone, Br.& Gr., Medium Graine[illegible] Siliceous in lower Third, Firm, [illegible] Bedded (With Irregular, Sloping Bedding Surfaces), With Thin Seams of Clay & Shale. Core Loss: 3%
	46			
	48			
	50			Shale, Gray, Siliceous, Firm. Core Loss [illegible]
	52			BOTTOM OF BORING
	54			
	56			
	58			
	60			
	62			
	64			
	66			
	68			
	70			
	72			
	74			
	76			
	78			
	80			
	82			

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LOG OF BORING

B-19

CO., RT. NO., SEC. BUT-7-19.80 BRIDGE NO. BUT-7-8.7 [illegible]
[illegible] PIER UNIT 4

LOCATION: T.H. 19 STA. 102+82 OFFSET 13' LT (R.) FED. NO.

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
	0			
	2			
	4			
[illegible]	6	18	83867	Brown Silt
	8			
641.6	10			
	12	19	83868	Brown Silt
	14			
636.6	16	18	83869	Brown Silt
	18			
	20			
631.6	22	19	83870	Brown Silt
	24			
626.6	26	22	83871	Brown Sandy Silt
	28			
	30			
621.6	32	12	83872	Brown & Gray Silty Sandy Gravel TOP OF ROCK
619.3				Sandstone, Br.& Gr., Med.to Fine-Grained, Firm, Thin-Bedde[illegible]
617.7	34			Shale, Brown & Browmish-Gray, Siliceous, Firm, With Sandstone Stringers. No Core Loss.
616.6				Sandstone, Br.& Gr., Fine-Grained, Firm, Thin Bedded. No [illegible]oss
	36			Shale, Gray, Siliceous, Firm, With Clay Seams. Core Loss: 27%

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LOG OF BORING (CONTINUED)

BRIDGE NO. [illegible] T.H. B19

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
	38			
	40			Shale, Gray, Siliceous, Firm, with Clay Seams. Core Loss: 27%
	42			
	44			Sandstone, Brown & Gray, Medium-Hard, Firm, Wavy Seams
	46			BOTTOM OF BORING
	48			
	50			
	52			
	54			
	56			
	58			
	60			
	62			
	64			
	66			
	68			
	70			
	72			
	74			
	76			
	78			
	80			
	82			

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LOG OF BORING

B-24

CO., RT. [illegible] SEC. [illegible] BRIDGE NO. [illegible]

LOCATION: T.H. [illegible] STA. [illegible] OFFSET [illegible] FED. NO. [illegible]

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
	0			[illegible]
	2			
	4			
	6			[illegible] Silty Gravelly Sand
	8			
	10			[illegible] Silty Gravel
	12			
	14			
	16	7	[illegible]	Brown Sandy Silt
	18			
	20			
	22			[illegible] Brown [illegible] Silty
	24			
	26			[illegible]
	28			
	30			
	32	10	[illegible]	Brown Sandy Silt
	34			
	36	12	82830	Brown Sandy Silt

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LOG OF BORING (CONTINUED) 3/

BRIDGE NO. [illegible] T.H. [illegible]

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
	38			
	40			
		12	3 23[illegible]	[illegible] Fragments
	42			
	44			
	46			Recovered material consists of sand-stone(boulders) with 0.6' gray fi[illegible] ceous shale at base-the shale is flat lying and may be bedrock.
	48			
	50			[illegible] OF BORING
	52			
	54			
	56			
	58			
	60			
	62			
	64			
	66			
	68			
	70			
	72			
	74			
	76			
	78			
	80			
	82			

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SHEET 32

LOG OF BORING

B-26

CO., RT. NO., SEC. BEL-7-19.9P BRIDGE NO. BEL-7-SR 7 VI[illegible] (UNI[illegible])

LOCATION: T.H. [illegible] STA. 107+90 OFFSET 131'LT(B.L.) FED. NO.

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
651.8	0			
	2			
	4			
646.8	6	4	83223	Black Gravelly Sandy Silt
	8			
641.8	10			
	12	8	83224	Black Clay & Stone Fragments
	14			
636.8	16	14	83225	Brown Silty Gravel
	18			
631.8	20			
	22	6	83226	Clayey Sandy Gravel
	24			
626.8	26	171	-----	Sand & Boulders
	28			
621.8	30			TOP OF ROCK
	32			Shale, Gray, Siliceous, Generally Firm, Poorly Fissile, Jointed in Top 3.5', Broken at Top With Clay Seams, Core Loss: 37%
	34			
	36			

LOG OF BORING (CONTINUED)

BRIDGE NO. BEL-7-23.7 VIADUCT T.H. B26

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
	38			Shale, gray, Siliceous, Firm, Grading in Part to Argillaceous Sandstone. No Core Loss.
	40			BOTTOM OF BORING
	42			
	44			
	46			
	48			
	50			
	52			
	54			
	56			
	58			
	60			
	62			
	64			
	66			
	68			
	70			
	72			
	74			
	76			
	78			
	80			
	82			

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B-27

LOG OF BORING

CO., RT. NO., SEC. BEL-7-19.80 BRIDGE NO. BEL-7-SR 7 VIADUCT
NINTH PIER (UNIT 2)

LOCATION: T.H. B27 STA. 107+85 OFFSET 21'LT. B.L. LPED NO.

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
648.0	0			
	2			
	4			Cinders & Boulder Fill
643.0	6	28	-----	Boulder
	8			
638.0	10	6	82845	Gray Clayey Sandy Gravel
	12			
	14			
633.0	16	25	82846	Stone Fragments
	18			
628.0	20	48	82847	Stone Fragments
	22			
	24			
623.0	26	240	82848	Brown Silt & Clay TOP OF BROKEN ROCK
	28			Shale, brown & gray, siliceous, medium firm to firm, broken in top half. Core loss: 30%
	30			
616.9	32			Shale, gray, siliceous, firm, grading to argillaceous sandstone near much of the intervals [illegible] loss.
613.0	34			

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B-30

LOG OF BORING

CO., RT. NO., SEC. BEL-7-17.98 BRIDGE NO. BEL-7-SR 7 VIADUCT NORTH WALLS

LOCATION: T.H. B10 STA. 111+12 OFFSET 138'LT&E/L FED. NO.

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
[illegible]	0			
	2			
	4			
653.3	6	33	83873	Brown Silty Sand & Stone Fragts.
	8			
[illegible]	10			
	12	12	83874	Brown & Gray Clay
	14			
643.3	16	49,	83875	Brown & Gray Sandy Clay & Silt
	18			
	20			
638.3	22	64	83876	Reddish-Brown Silt
	24			
633.3	26	100	83877	Reddish-Brown Silt & Clay
	28			
	30	1200	83878	Gr.Gray.Clay & Silt TOP OF ROCK
	32			Shale,Gray,Siliceous;Firm in Lower Half,Medium Firm but with Extensive Soft Zones & Clay Seams in Top Half, Jointed in Top Quarter.No Core Loss.
	34			
	36			

LOG OF BORING (CONTINUED)

BRIDGE NO. BEL-7-SR 7 VIADUCT T.H. B10

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
	38			Shale,Gray,Siliceous,Firm in Lower Half,Medium Firm but with Extensive Soft Zones & Clay Seams in Top Half, Jointed in Top Quarter.No Core Loss.
	40			
	42			BOTTOM OF BORING
	44			
	46			
	48			
	50			
	52			
	54			
	56			
	58			
	60			
	62			
	64			
	66			
	68			
	70			
	72			
	74			
	76			
	78			
	80			
	82			

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LOG OF BORING

B-33

CO., RT. NO., SEC. BEL-7-12.80 BRIDGE NO. BEL-7-3R 7 VIA NORTH WALL

LOCATION T.H. 33 STA. 312+64 OFFSET 65' LT (R.L.) FED. NO.

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
	0			
	2			
651.4	4			
	6	25	83217	Brown Gravelly Clay
	8			
	10			
	12	13	83218	Brownish-Red Gravelly Clay
	14			
	16	11	83219	Brownish-Red Gravelly Clay
	18			
636.4	20			
	22	23	83220	Brownish-Red Silt & Clay
	24			
631.4	26	21	83221	Brownish-Red Gravelly Clay
	28			
626.4	30			
	32	31	83222	Gray Gravelly Silt
622.4				TOP OF BROKEN ROCK
	34			Shale, Gray, Siliceous, Firm, Broken in Top 1.5', with Thin Stringers of Calcareous Sandstone; Core Loss: 20%
	36			

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LOG OF BORING (CONTINUED)

BRIDGE NO. BEL-7-3R 7 VIADUCT T.H. B-33

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
	38			
	40			
	42			Shale, Gray, Siliceous, Firm, Broken in Top 1.5', With Thin Stringers of Calcareous Sandstone. Core Loss: 20%
	44			
	46			BOTTOM OF BORING
	48			
	50			
	52			
	54			
	56			
	58			
	60			
	62			
	64			
	66			
	68			
	70			
	72			
	74			
	76			
	78			
	80			
	82			

8-14-58

December 4, 2018

ODOT District 11
2201 Reiser Ave.
New Philadelphia, OH 44663

Attention: Mr. Cody Notz, P.E.

Reference: **District 11 Geotechnical Engineering Services Agreement**
PID 97216
Agreement No. 31109
Task Order Number 11-S

BEL-7-19.75 - Soil Boring Logs
PID 105324
S&ME Project No. 1179-18-026L

Mr. Notz:

S&ME has completed the drilling and laboratory testing for the soil borings requested for an MSE wall replacement study at the SR 7 viaduct bridge in Bridgeport, Ohio. The eight (8) requested borings were performed at the locations marked in the field by District 11 (see Plate 1). The surveyed latitude, longitude, and ground surface elevation at each boring were also provided by District 11 and are provided on each boring log.

During the field drilling program, a relatively strong hydrocarbon-type odor was encountered in Boring B-007-0-18. This boring was sealed with bentonite, and no laboratory testing was performed on any of the samples recovered from this boring. A slight hydrocarbon odor was also noted at roughly 8 feet in Boring B-004-0-18.

We appreciate the opportunity to be of continued service. Please don't hesitate to contact us if you have any questions.

Respectfully,

S&ME, Inc.

Nathan D. Abele, P.E.
Project Engineer

Richard S. Weigand, P.E.
Senior Engineer/Senior Reviewer

Attachments: Boring Logs (9 sheets)

Submitted: Email Copy (cody.notz@dot.ohio.gov)

PLATE 1

S&ME JOB: 1179-18-026L

PROJECT: BEL-7-19.75	DRILLING FIRM / OPERATOR: OTB / ALEX	DRILL RIG: OTB SKID D25	STATION / OFFSET: 161+25, 35' LT	EXPLORATION ID B-001-0-18
TYPE: BRIDGE REHABILITATION	SAMPLING FIRM / LOGGER: S&ME / C. WEST	HAMMER: CME AUTOMATIC	ALIGNMENT: SR 7	
PID: 105324 BR ID:	DRILLING METHOD: 2.25" HSA	CALIBRATION DATE: 11/5/18	ELEVATION: 653.4 (MSL) EOB: 15.0 ft.	PAGE 1 OF 1
START: 11/12/18 END: 11/12/18	SAMPLING METHOD: SPT	ENERGY RATIO (%): 87.4	LAT / LONG: 40.070004 N, 80.740611 W	

MATERIAL DESCRIPTION AND NOTES	ELEV. 653.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
Fill: Loose to medium-dense brown and black **GRAVEL WITH SAND**, little silt, trace clay, few coal and concrete fragments, dry.	651.8	1	4 50-3"	-	78	SS-1	-	-	-	-	-	-	-	-	-	10	A-1-b (V)	
Fill: Very-loose to loose coal fragments, few brick fragments below 7.5', dry to damp.		2	5 5 4	13	89	SS-2	-	-	-	-	-	-	-	-	-	12	Visual (V)	
		3	2 2 2	6	83	SS-3	-	-	-	-	-	-	-	-	-	14	Visual (V)	
		4	1 1 1	3	89	SS-4	-	-	-	-	-	-	-	-	-	11	Visual (V)	
	645.3	5	2 1 1	3	89	SS-5	-	-	-	-	-	-	-	-	-	13	Visual (V)	
Fill: Very-loose brown and black **GRAVEL WITH SAND, SILT AND CLAY**, moist.	644.4	6	1 1 1	3	67	SS-6A	-	-	-	-	-	-	-	-	-	14	Visual (V)	
						SS-6B	-	-	-	-	-	-	-	-	-	60	A-2-6 (V)	
Fill: Medium-stiff to stiff dark-gray **SILT AND CLAY**, some fine to coarse sand, trace fine gravel, few coal and brick fragments, damp to moist.	642.9	7	1 1 1	3	89	SS-7	0.75-1.25	7	6	21	43	23	39	24	15	23	A-6a (8)	
Stiff to very-stiff gray **SILT CLAY**, trace to little fine to coarse sand.		8	1 2 3	7	89	SS-8	1.0-1.25	-	-	-	-	-	50	29	21	32	A-6b (V)	
		9	1 3 3	9	67	SS-9	1.25-2.25	0	0	5	53	42	39	22	17	25	A-6b (11)	
- Becoming brown mottled with gray at 13.5'.	638.4	10 EOB	2 3 5	12	72	SS-10	2.0-2.25	-	-	-	-	-	-	-	-	26	A-6b (V)	

- No groundwater noted.
- Boring caved at 10.9' after augers pulled.

NOTES: SEE ABOVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: SOIL CUTTINGS MIXED WITH BENTONITE

S&ME ODOT LOG (8.5X11) - SGE 07/2018 - OH DOT.GDT - 12/4/18 11:22 - T:\RESOURCES\CS\GINTWPROJECTS\117918026L.GPJ

PLATE 2

S&ME JOB: 1179-18-026L

PROJECT: BEL-7-19.75	DRILLING FIRM / OPERATOR: OTB / ALEX	DRILL RIG: OTB SKID D25	STATION / OFFSET: 162+65, 35' RT	EXPLORATION ID B-002-0-18
TYPE: BRIDGE REHABILITATION	SAMPLING FIRM / LOGGER: S&ME / C. WEST	HAMMER: CME AUTOMATIC	ALIGNMENT: SR 7	
PID: 105324 BR ID:	DRILLING METHOD: 2.25" HSA	CALIBRATION DATE: 11/5/18	ELEVATION: 655.1 (MSL) EOB: 15.0 ft.	PAGE 1 OF 1
START: 11/12/18 END: 11/13/18	SAMPLING METHOD: SPT	ENERGY RATIO (%): 87.4	LAT / LONG: 40.070472 N, 80.740365 W	

MATERIAL DESCRIPTION AND NOTES	ELEV. 655.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
ASPHALT - 5 INCHES	654.7	1																
GRANULAR BASE - 4 INCHES	654.3																	
Fill: Stiff brown and black **SILTY CLAY**, some fine to coarse sand, trace to little fine to coarse gravel, damp.	652.1	2	2 2 3	7	72	SS-1	1.0-1.5	-	-	-	-	-	-	-	-	28	A-6b (V)	
FILL: Medium-stiff to stiff brown **SILT**, little to some clay, some fine sand, trace coarse sand, trace fine gravel, damp.	650.6	3	2 3 2	7	78	SS-2	0.75-1.5	2	1	24	53	20	24	19	5	20	A-4b (8)	
Fill: Stiff to very-stiff brown, light-brown and reddish-brown **SILTY CLAY**, little to some fine to coarse sand, trace to little fine to coarse gravel, few coal and red shale fragments, damp to moist.		4	1 2 2	6	22	SS-3	2.5-3.0	-	-	-	-	-	-	-	-	24	A-6b (V)	
		5	2 3 3	9	61	SS-4	1.5-3.0	-	-	-	-	-	-	-	-	22	A-6b (V)	
		6	1 2 2	6	61	SS-5	0.75-1.25	-	-	-	-	-	-	-	-	25	A-6b (V)	
	644.6	7	2 2 3	7	94	SS-6	1.0-4.0	-	-	-	-	-	-	-	-	27	A-6b (V)	
Very-stiff brown **CLAY**, "and" silt, trace fine to coarse sand, trace fine gravel, damp.		8	3 4 6	15	78	SS-7	2.0-25	0	0	7	52	41	42	23	19	23	A-7-6 (12)	
		9	4 5 7	17	89	SS-8	2.5-3.5	-	-	-	-	-	-	-	-	24	A-7-6 (V)	
	640.1	10 EOB	3 4 5	13	78	SS-9	2.0-3.0	-	-	-	-	-	-	-	-	24	A-7-6 (V)	

- On 11/12/18, rig broke down after encountering construction debris at approximately 2.0'. Boring completed on 11/13/18 in offset boring drilled immediately adjacent to original location.
- No groundwater noted.
- Boring caved at 11.4' after augers pulled.

NOTES: SEE ABOVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: SOIL CUTTINGS MIXED WITH BENTONITE

S&ME ODOT LOG (8.5X11) - SGE 07/2018 - OH DOT.GDT - 12/4/18 11:22 - T:\RESOURCES\CS\GINTWPROJECTS\117918026L.GPJ

PLATE 3

S&ME JOB: 1179-18-026L

PROJECT: BEL-7-19.75	DRILLING FIRM / OPERATOR: OTB / ALEX	DRILL RIG: OTB SKID D25	STATION / OFFSET: 164+00, 35' LT	EXPLORATION ID	B-003-0-18
TYPE: BRIDGE REHABILITATION	SAMPLING FIRM / LOGGER: S&ME / C. WEST	HAMMER: CME AUTOMATIC	ALIGNMENT: SR 7		
PID: 105324 BR ID:	DRILLING METHOD: 2.25" HSA	CALIBRATION DATE: 11/5/18	ELEVATION: 655.3 (MSL) EOB: 15.0 ft.	PAGE	1 OF 1
START: 11/13/18 END: 11/13/18	SAMPLING METHOD: SPT	ENERGY RATIO (%): 87.4	LAT / LONG: 40.070732 N, 80.740580 W		

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
ASPHALT - 5 INCHES	654.9																	
GRANULAR BASE - 9 INCHES	654.1																	
Fill: Stiff to very-stiff brown and dark-gray **CLAY**, some to "and" silt, some fine to coarse sand, little fine to coarse gravel, few brick and coal fragments, damp.		1	3 3 3	9	67	SS-1	1.5-2.5	-	-	-	-	-	-	-	-	23	A-7-6 (V)	
		2	1 2 1	4	67	SS-2	1.0-2.25	-	-	-	-	-	-	-	-	29	A-7-6 (V)	
	649.3	3 W 4 5	2 1 2	4	22	SS-3	1.25-2.0	14	13	14	29	30	43	25	18	25	A-7-6 (8)	
Fill: Loose dark-gray and black **GRAVEL WITH SAND, SILT AND CLAY**, few coal fragments, damp.	647.8	6	2 3 4	10	78	SS-4	-	-	-	-	-	-	-	-	-	23	A-2-6 (V)	
Possible Fill: Stiff dark-gray **SILTY CLAY**, some fine to coarse sand, trace to little fine to coarse gravel, few coal fragments, damp.	646.3	7	2 2 2	6	61	SS-5	1.5-2.0	-	-	-	-	-	-	-	-	20	A-6b (V)	
Stiff dark-brown and black **SILTY CLAY**, little fine to coarse sand, trace fine gravel, slightly organic, damp.	644.8	8	2 2 3	7	72	SS-6	1.0-1.5	-	-	-	-	-	-	-	-	29	A-6b (V)	
Stiff brown mottled with dark-gray **SILTY CLAY**, trace fine to coarse sand, damp.	643.3	9	2 3 5	12	100	SS-7	1.25-1.75	0	0	7	54	39	37	21	16	23	A-6b (10)	
Stiff to very-stiff brown mottled with gray **SILTY CLAY**, little fine to coarse sand, trace fine gravel, damp.		10	3 5 9	20	100	SS-8	3.0	-	-	-	-	-	-	-	-	24	A-6b (V)	
	640.3	11	2 4 7	16	100	SS-9	1.5-3.0	-	-	-	-	-	-	-	-	22	A-6b (V)	
	EOB	12 13 14 15																

- Encountered sight seepage at 5.5'.
- Boring "dry" at completion.
- Boring caved at 10.3' after augers pulled.

NOTES: SEE ABOVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: SOIL CUTTINGS MIXED WITH BENTONITE

S&ME ODOT LOG (8.5X11) - SGE 07/2018 - OH DOT.GDT - 12/4/18 11:22 - T:\RESOURCES\CS\GINTWPROJECTS\117918026L.GPJ

PLATE 4

S&ME JOB: 1179-18-026L

PROJECT: BEL-7-19.75	DRILLING FIRM / OPERATOR: OTB / ALEX	DRILL RIG: OTB SKID D25	STATION / OFFSET: 165+50, 35' RT	EXPLORATION ID	B-004-0-18
TYPE: BRIDGE REHABILITATION	SAMPLING FIRM / LOGGER: S&ME / C. WEST	HAMMER: CME AUTOMATIC	ALIGNMENT: SR 7		
PID: 105324 BR ID:	DRILLING METHOD: 2.25" HSA	CALIBRATION DATE: 11/5/18	ELEVATION: 651.8 (MSL) EOB: 15.0 ft.	PAGE	1 OF 1
START: 11/13/18 END: 11/13/18	SAMPLING METHOD: SPT	ENERGY RATIO (%): 87.4	LAT / LONG: 40.071169 N, 80.740340 W		

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
ROOTMAT/TOPSOIL - 3 INCHES	651.6					SS-1A	-	-	-	-	-	-	-	-	-	-	Visual (V)	
Fill: Very-stiff to hard brown, gray and dark-brown **SILTY CLAY**, some to "and" fine to coarse sand, little fine to coarse gravel, few coal and brick fragments, damp.		1	2 2 5	10	72	SS-1B	2.0-3.5	-	-	-	-	-	-	-	-	22	A-6b (V)	
		2	4 8 8	23	72	SS-2	4.0-4.5+	-	-	-	-	-	-	-	-	19	A-6b (V)	
	647.3	3 4	3 4 17	31	78	SS-3	2.0-2.5	-	-	-	-	-	-	-	-	22	A-6b (V)	
Fill: Loose to medium-dense brown **GRAVEL WITH SAND**, little silt, trace clay, few brick fragments, damp.	644.8	5	7 8 5	19	89	SS-4	-	-	-	-	-	-	-	-	-	18	A-1-b (V)	
		6 7	2 1 2	4	0	--	-	-	-	-	-	-	-	-	-	-		
Fill: Soft to medium-stiff black **ELASTIC CLAY**, some silt, some fine to coarse sand, some fine to coasre gravel, few bricks and coal fragments, slight hydrocarbone odor, moist.	642.8	8 W	4 2 3	7	89	SS-5	0.25-0.75	30	10	11	28	21	61	43	18	47	A-7-5 (7)	
Fill: Loose brown and gray **GRAVEL WITH SAND, SILT AND CLAY**, few brick fragments, damp.	641.3	9	2 2 2	6	56	SS-6	-	-	-	-	-	-	-	-	-	26	A-2-6 (V)	
Fill: Medium-stiff gray **SILTY CLAY**, little fine to coarse sand, trace fine to coarse gravel, few roots and wood fragments, few brick fragments, moist.	639.8	10	2 1 2	4	56	SS-7	0.5-1.0	-	-	-	-	-	-	-	-	43	A-6b (V)	
Stiff greenish-gray and dark-gray **SILTY CLAY**, little fine sand, trace coarse sand, trace fine gravel, slightly organic, damp.		11	1 3 4	10	67	SS-8	1.25-1.5	-	-	-	-	-	-	-	-	26	A-6b (V)	
	636.8	12 13	1 3 4	10	67	SS-9	1.0-1.5	0	0	11	49	40	38	20	18	24	A-6b (11)	
	EOB	14 15																

- Encountered slight seepage at 7.9'.
- Boring "dry" at completion.
- Boring caved at 11.9' after augers pulled.

NOTES: SEE ABOVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: SOIL CUTTINGS MIXED WITH BENTONITE

S&ME ODOT LOG (8.5X11) - SGE 07/2018 - OH DOT.GDT - 12/4/18 11:22 - T:\RESOURCES\CS\GINTWPROJECTS\117918026L.GPJ

PLATE 5

S&ME JOB: 1179-18-026L

PROJECT: BEL-7-19.75	DRILLING FIRM / OPERATOR: OTB / ALEX	DRILL RIG: OTB SKID D25	STATION / OFFSET: 169+75, 35' LT	EXPLORATION ID B-005-0-18
TYPE: BRIDGE REHABILITATION	SAMPLING FIRM / LOGGER: S&ME / C. WEST	HAMMER: CME AUTOMATIC	ALIGNMENT: SR 7	
PID: 105324 BR ID:	DRILLING METHOD: 2.25" HSA	CALIBRATION DATE: 11/5/18	ELEVATION: 655.4 (MSL) EOB: 15.0 ft.	PAGE 1 OF 1
START: 11/14/18 END: 11/14/18	SAMPLING METHOD: SPT	ENERGY RATIO (%): 87.4	LAT / LONG: 40.072398 N, 80.740481 W	

MATERIAL DESCRIPTION AND NOTES	ELEV. 655.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
ROOTMAT - 2 INCHES	655.2					SS-1A	-	-	-	-	-	-	-	-	-	-	Visual (V)	
Fill: Medium-dense brown and gray becoming reddish-brown **GRAVEL WITH SAND**, trace to little silt, trace clay, few to many brick fragments, dry to damp.		1	4 9 15	35	100	SS-1B	-	-	-	-	-	-	-	-	-	11	A-1-b (V)	
		2	8 10 9	28	72	SS-2	-	50	21	11	10	8	NP	NP	NP	15	A-1-b (0)	
		3	6 8 11	28	100	SS-3	-	-	-	-	-	-	-	-	-	18	A-1-b (V)	
	649.4	4	12 8 7	22	78	SS-4	-	-	-	-	-	-	-	-	-	11	A-1-b (V)	
Fill: Stiff dark-gray and reddish-brown **SILTY CLAY**, little to some fine to coarse sand, trace to little fine to coarse gravel, few brick fragments, damp.	647.9	5	5 8 3	16	78	SS-5	1.0-1.5	-	-	-	-	-	-	-	-	-	A-6b (V)	
Stiff to very-stiff brown **SILT AND CLAY**, little fine to coarse sand, trace fine gravel, few medium-stiff pockets, damp.		6	2 3 4	10	72	SS-6	1.0-2.0	-	-	-	-	-	-	-	-	25	A-6a (V)	
		7	2 3 4	10	89	SS-7	1.25-1.5	0	0	12	51	37	36	21	15	22	A-6a (10)	
		8	1 3 4	10	72	SS-8	0.75-2.25	-	-	-	-	-	-	-	-	23	A-6a (V)	
		9	3 4 6	15	78	SS-9	1.75-3.0	-	-	-	-	-	-	-	-	23	A-6a (V)	
	640.4	10	3 4 6	15	89	SS-10	2.0-3.25	-	-	-	-	-	-	-	-	21	A-6a (V)	
	EOB	11																

W

- Encountered slight seepage from 7.0' to 8.0'.
- Boring "dry" at completion.
- Boring caved at 10.3' after augers pulled.

NOTES: SEE ABOVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: SOIL CUTTINGS MIXED WITH BENTONITE

S&ME ODOT LOG (8.5X11) - SGE 07/2018 - OH DOT.GDT - 12/4/18 11:22 - T:\RESOURCES\CS\GINTWPROJECTS\117918026L.GPJ

PLATE 6

S&ME JOB: 1179-18-026L

PROJECT: BEL-7-19.75	DRILLING FIRM / OPERATOR: OTB / ALEX	DRILL RIG: OTB SKID D25	STATION / OFFSET: 171+00, 35' RT	EXPLORATION ID B-006-0-18
TYPE: BRIDGE REHABILITATION	SAMPLING FIRM / LOGGER: S&ME / C. WEST	HAMMER: CME AUTOMATIC	ALIGNMENT: SR 7	
PID: 105324 BR ID:	DRILLING METHOD: 2.25" HSA	CALIBRATION DATE: 11/5/18	ELEVATION: 658.0 (MSL) EOB: 15.0 ft.	PAGE 1 OF 1
START: 11/14/18 END: 11/14/18	SAMPLING METHOD: SPT	ENERGY RATIO (%): 87.4	LAT / LONG: 40.072649 N, 80.740267 W	

MATERIAL DESCRIPTION AND NOTES	ELEV. 658.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
ASPHALT - 3 INCHES	657.8																	
CONCRETE - 11 INCHES	656.8	1																
Fill: Stiff brown and reddish-brown **SILT AND CLAY**, little to some fine to coarse sand, little fine to coarse gravel, few brick fragments, damp.		2	3 3 3	9	56	SS-1	1.5-2.0	-	-	-	-	-	-	-	-	20	A-6a (V)	
	653.5	3	1 1 2	4	61	SS-2	1.0-1.5	-	-	-	-	-	-	-	-	31	A-6a (V)	
Probable Fill: Stiff to very-stiff reddish-brown **CLAY**, some to "and" silt, little fine to coarse sand, trace to little fine to coarse gravel, few shale fragments, damp.		4	2 2 3	7	56	SS-3	2.0-3.0	10	4	7	34	45	41	22	19	23	A-7-6 (12)	
	650.3	5	1 2 3	7	67	SS-4	1.0-2.5	-	-	-	-	-	-	-	-	20	A-7-6 (V)	
Possible Fill: Very-soft to stiff dark-gray and black **SILTY CLAY**, little fine to coarse sand, trace fine gravel, slightly organic, damp.		6	3 2 3	7	56	SS-5A SS-5B	1.5-2.5 0.5-1.0	-	-	-	-	-	-	-	-	20 31	A-7-6 (V) A-6b (V)	
	647.5	7	1 1 2	4	78	SS-6	0.0-0.25	-	-	-	-	-	-	-	-	37	A-6b (V)	
Stiff dark-gray **SILT AND CLAY**, little fine to coarse sand, trace fine gravel, damp.	646.0	8	1 2 4	9	72	SS-7	1.0-2.25	-	-	-	-	-	-	-	-	20	A-6a (V)	
Stiff to very-stiff brown mottled with gray **SILT AND CLAY**, little fine sand, trace coarse sand, trace fine gravel, few pockets of fine to coarse sand, damp.		9	3 3 4	10	78	SS-8	1.0-3.0	1	1	12	50	36	33	18	15	22	A-6a (10)	
	643.0	10	3 4 5	13	100	SS-9	1.25-2.5	-	-	-	-	-	-	-	-	21	A-6a (V)	
	EOB	11																

- Encountered slight seepage at 14.4' in fine to coarse sand seam.
- Boring "dry" at completion.
- Boring caved at 10.6' after augers pulled.

NOTES: SEE ABOVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: SOIL CUTTINGS MIXED WITH BENTONITE

S&ME ODOT LOG (8.5X11) - SGE 07/2018 - OH DOT.GDT - 12/4/18 11:22 - T:\RESOURCES\CS\GINTWPROJECTS\117918026L.GPJ

PLATE 7

S&ME JOB: 1179-18-026L

PROJECT: BEL-7-19.75 | DRILLING FIRM / OPERATOR: OTB / ALEX | DRILL RIG: OTB SKID D25 | STATION / OFFSET: 172+25, 35' LT | EXPLORATION ID: B-007-0-18
TYPE: BRIDGE REHABILITATION | SAMPLING FIRM / LOGGER: S&ME / C. WEST | HAMMER: CME AUTOMATIC | ALIGNMENT: SR 7 | PAGE: 1 OF 1
PID: 105324 BR ID: | DRILLING METHOD: 2.25" HSA | CALIBRATION DATE: 11/5/18 | ELEVATION: 657.2 (MSL) EOB: 15.0 ft.
START: 11/14/18 END: 11/14/18 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 87.4 | LAT / LONG: 40.073031 N, 80.740456 W

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
ASPHALT - 10 INCHES	656.4																	
CONCRETE - 8 INCHES	655.7																	
Fill: Stiff brown and black **SILT AND CLAY**, some fine to coarse sand, little to some fine to coarse gravel, few brick fragments, damp.	654.2	1	6 6 4	15	61	SS-1	1.0-1.5	-	-	-	-	-	-	-	-	-	A-6a (V)	
Fill: Loose black and brown **GRAVEL WITH SAND, SILT AND CLAY**, few glass fragments, damp.	651.2	2	4 3 3	9	56	SS-2	-	-	-	-	-	-	-	-	-	-	A-2-6 (V)	
Fill: Stiff brown and black **SILTY CLAY**, little fine to coarse sand, trace to little fine gravel, damp.	649.7	3	2 3 2	7	61	SS-3	-	-	-	-	-	-	-	-	-	-	A-2-6 (V)	
Probable Fill: Very-soft to medium-stiff dark-gray and gray **SILTY CLAY**, little to some fine to coarse sand, trace fine gravel, contains hydrocarbon odor, moist.	646.7	4	2 3 6	13	72	SS-4	1.0-1.5	-	-	-	-	-	-	-	-	-	A-6b (V)	
Stiff gray and brown **SILTY CLAY**, little fine to coarse sand, trace fine gravel, contains hydrocarbon odor, damp.	645.2	5	1 1 2	4	89	SS-5	0.5-1.0	-	-	-	-	-	-	-	-	-	A-6b (V)	
Stiff to very-stiff brown **SILTY CLAY**, little fine to coarse sand, trace fine gravel, contains hydrocarbon odor, damp.	642.2	6	1 2 2	6	56	SS-6	0.0-0.5	-	-	-	-	-	-	-	-	-	A-6b (V)	
		7	2 3 4	10	94	SS-7	1.0-2.0	-	-	-	-	-	-	-	-	-	A-6b (V)	
		8	3 3 6	13	78	SS-8	1.5-3.0	-	-	-	-	-	-	-	-	-	A-6b (V)	
		9	3 4 6	15	67	SS-9	2.0-3.0	-	-	-	-	-	-	-	-	-	A-6b (V)	
		10																
		11																
		12																
		13																
		14																
		15 EOB																

W

- Encountered slight seepage at 8.5'.
- Boring "dry" at completion.
- Placed bentonite chips through auger stem to bottom of boring. Additional chips added as auger reversed out of boring.

NOTES: SEE ABOVE.
ABANDONMENT METHODS, MATERIALS, QUANTITIES: 120 LB. BENTONITE CHIPS

S&ME ODOT LOG (8.5X11) - SGE 07/2018 - OH DOT.GDT - 12/4/18 11:22 - T:\RESOURCES\CS\GINTWPROJECTS\117918026L.GPJ

PLATE 8

S&ME JOB: 1179-18-026L

PROJECT: BEL-7-19.75 | DRILLING FIRM / OPERATOR: OTB / ALEX | DRILL RIG: OTB SKID D25 | STATION / OFFSET: 173+50, 35' RT | EXPLORATION ID: B-008-0-18
TYPE: BRIDGE REHABILITATION | SAMPLING FIRM / LOGGER: S&ME / C. WEST | HAMMER: CME AUTOMATIC | ALIGNMENT: SR 7 | PAGE: 1 OF 1
PID: 105324 BR ID: | DRILLING METHOD: 2.25" HSA | CALIBRATION DATE: 11/5/18 | ELEVATION: 656.9 (MSL) EOB: 15.0 ft.
START: 11/14/18 END: 11/14/18 | SAMPLING METHOD: SPT | ENERGY RATIO (%): 87.4 | LAT / LONG: 40.073349 N, 80.740231 W

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
ROOTMAT/TOPSOIL - 4 INCHES	656.6		5 5 6	16	72	SS-1A		-	-	-	-	-	-	-	-	-	Visual (V)	
Fill: Loose to medium-dense brown **GRAVEL WITH SAND SILT AND CLAY**, few roots, few brick and coal fragments, few pockets of silty clay, damp.	652.9	1				SS-1B	-	-	-	-	-	-	-	-	-	14	A-2-6 (V)	
Fill: Stiff brown and black **SILTY CLAY**, some fine to coarse sand, some fine to coarse gravel, few brick fragments, damp.	650.9	2	5 5 5	15	61	SS-2	-	-	-	-	-	-	-	-	-	16	A-2-6 (V)	
Fill: Loose brown **GRAVEL WITH SAND**, little silt, trace clay, few brick fragments, damp.	649.4	3	4 3 2	7	0	--	-	-	-	-	-	-	-	-	-	-		
Probable Fill: Loose to medium-dense brown **GRAVEL WITH SAND**, little silt, trace clay, dry.	644.9	4	2 2 2	6	100	SS-3	1.0-2.0	26	12	11	22	29	38	21	17	18	A-6b (6)	
		5	2 3 4	10	56	SS-4	-	-	-	-	-	-	-	-	-	12	A-1-b (V)	
		6	4 5 5	15	61	SS-5	-	-	-	-	-	-	-	-	-	6	A-1-b (V)	
		7	5 4 3	10	67	SS-6	-	-	-	-	-	-	-	-	-	9	A-1-b (V)	
		8	2 3 2	7	28	SS-7	-	-	-	-	-	-	-	-	-	8	A-1-b (V)	
Possible Fill: Medium-stiff to stiff brown and reddish-brown **CLAY**, some silt, some fine to coarse gravel, some fine to coarse sand, damp.	643.1	9	2 1 1	3	28	SS-8	0.5-0.75	31	4	16	23	26	50	29	21	30	A-7-6 (7)	
Medium-stiff gray and brownish-gray **CLAY**, some silt, little fine to coarse sand, trace fine gravel, damp.	641.9	10	2 2 2	6	61	SS-9A	1.5-1.75	-	-	-	-	-	-	-	-	22	A-7-6 (V)	
		11				SS-9B	0.5-0.75	-	-	-	-	-	-	-	-	27	A-7-6 (V)	
		12																
		13																
		14																
		15 EOB																

- No seepage noted.
- Boring caved at 10.4' after augers pulled.

NOTES: SEE ABOVE.
ABANDONMENT METHODS, MATERIALS, QUANTITIES: SOIL CUTTINGS MIXED WITH BENTONITE

S&ME ODOT LOG (8.5X11) - SGE 07/2018 - OH DOT.GDT - 12/4/18 11:22 - T:\RESOURCES\CS\GINTWPROJECTS\117918026L.GPJ

PLATE 9

APPENDIX G – EXISTING BRIDGE PHOTOGRAPHS (1 of 3)

Lincoln Avenue and BEL-7-1975 looking north

US40/US250 intersection with Lincoln Avenue looking south (BEL-7-1975 on left and I-70 Bridge in background)

Piers 6E & 6W (other piers similar) with basketball court in the foreground looking south

Joint between Rear Right Abutment and approach retaining wall looking west

APPENDIX G – EXISTING BRIDGE PHOTOGRAPHS (2 of 3)

Joint between Forward Left Abutment and approach retaining wall looking east

Joint between Forward Right Abutment and approach retaining wall looking west

Lincoln Avenue Park looking northeast

A-1 Towing office, fenced yard and storage area looking east

APPENDIX G – EXISTING BRIDGE PHOTOGRAPHS (3 of 3)

At grade Norfolk Southern Railroad crossing for Sewage Pump Station access road looking east

I-70 Bridge, BEL-7-1975 and Lincoln Avenue Bridge over Wheeling Creek looking west

BEL-7-1975, I-70 Bridge and Norfolk Southern Railroad Bridge over Wheeling Creek looking east from the Lincoln Avenue Bridge

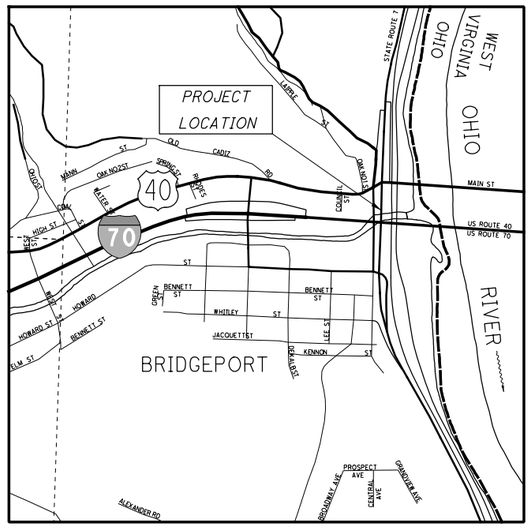
Wheeling & Lake Erie Railway Bridge over Wheeling Creek looking northeast

BURGESS & NIPLE
Engineers ■ Architects ■ Planners

5085 Reed Road
Columbus, OH 43220
614.459.2050

burgessniple.com

Attachment B



LOCATION MAP

LATITUDE: N 40° 04′ 10″ LONGITUDE: W 80° 44′ 25″

SCALE IN FEET

400 0 400 800 1200 1600

N

PORTION TO BE IMPROVED

INTERSTATE HIGHWAY

FEDERAL ROUTES

STATE ROUTES

COUNTY & TOWNSHIP ROADS

OTHER ROADS

DESIGN DESIGNATION

CURRENT ADT (2018)	45890
DESIGN YEAR ADT (2030)	68840
DESIGN HOURLY VOLUME (2030)	6200
DIRECTIONAL DISTRIBUTION	56%
TRUCKS (24 HOUR B & C)	7%
DESIGN SPEED	62 MPH
LEGAL SPEED	50 MPH

DESIGN FUNCTIONAL CLASSIFICATION -
URBAN PRINCIPAL ARTERIAL/EXPRESSWAY

DESIGN EXCEPTIONS

NONE REQUIRED

UNDERGROUND UTILITIES

CONTACT BOTH SERVICES TWO WORKING DAYS **BEFORE YOU DIG.**

OHIO Utilities Protection SERVICE
Call Before You Dig
1-800-362-2764
(Non-members must be called directly)

OIL & GAS PRODUCERS
UNDERGROUND PROTECTION SERVICE
1-800-925-0988

PLAN PREPARED BY:
BURGESS & NIPLE
5085 REED ROAD
COLUMBUS, OH 43220

ENGINEER'S SEAL:

STATE OF OHIO
JAI H. LEE
E-70217
REGISTERED
PROFESSIONAL ENGINEER

SIGNED: Jai H. Lee
DATE: 4/19/18

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION

BEL-7-19.75

BELMONT COUNTY

VILLAGE OF BRIDGEPORT

INDEX OF SHEETS:

PROJECT DESCRIPTION

PROJECT INCLUDES EXTERNAL POST-TENSIONING INSTALLATION FOR PIER STRENGTHENING AT PIER 8E, 8W, 11E, 11W, 16E AND 16W ON BEL-7-1975 BRIDGE.

PROJECT EARTH DISTURBED AREA:	N/A*	ACRES
ESTIMATED CONTRACTOR EARTH DISTURBED AREA:	N/A*	ACRES
NOTICE OF INTENT EARTH DISTURBED AREA:	N/A*	ACRES

* = MAINTENANCE PROJECT

STANDARD CONSTRUCTION DRAWINGS					SUPPLEMENTAL SPECIFICATIONS	SPECIAL PROVISIONS
					800 7/20/18	NONE
MT-97.10 7/18/14	DM-4.3 1/15/16				832 1/17/14	
MT-105.10 7/19/13	DM-4.4 1/15/16					
TC-41.20 10/18/13						
TC-42.20 10/18/13						
TC-52.10 10/18/13						
TC-52.20 1/19/18						

2016 SPECIFICATIONS

THE STANDARD SPECIFICATIONS OF THE STATE OF OHIO, DEPARTMENT OF TRANSPORTATION, INCLUDING SUPPLEMENTAL SPECIFICATIONS LISTED IN THE PLANS AND CHANGES LISTED IN THE PROPOSAL SHALL GOVERN THIS IMPROVEMENT.

I HEREBY APPROVED THESE PLANS AND DECLARE THAT THE MAKING OF THIS IMPROVEMENT WILL NOT REQUIRE THE CLOSING TO TRAFFIC OF THE HIGHWAY AND THAT PROVISIONS FOR THE MAINTENANCE AND SAFETY OF TRAFFIC WILL BE AS SET FORTH ON THE PLANS AND ESTIMATES.

APPROVED _____
DATE _____ DISTRICT DEPUTY DIRECTOR

APPROVED _____
DATE _____ DIRECTOR, DEPARTMENT OF TRANSPORTATION

FEDERAL PROJECT NO. E171(343)

PID NO. 105324

CONSTRUCTION PROJECT NO.

RAILROAD INVOLVEMENT NONE

BEL-7-19.75

1 / 12

GENERAL NOTES:

DESIGN SPECIFICATIONS: THIS STRUCTURE CONFORMS TO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES" ADOPTED BY THE AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, 17th EDITION 2002, AND THE ODOT BRIDGE DESIGN MANUAL, 2004.

DESIGN LOADING: HS20

DESIGN DATA:

STRUCTURAL STEEL: ASTM A709 50W OR A709 GRADE 50 - YIELD STRENGTH 50,000 PSI

CLASS QC5 CONCRETE: COMPRESSIVE STRENGTH 4.5 KSI

POST TENSIONING ALL-THREAD BAR: ASTM A722
YIELD STRESS 120 KSI
ULTIMATE STRESS 150 KSI

EXISTING STRUCTURE VERIFICATION: DETAILS AND DIMENSIONS SHOWN ON THESE PLANS PERTAINING TO THE EXISTING STRUCTURE HAVE BEEN OBTAINED FROM PLANS OF THE EXISTING STRUCTURE AND FROM FIELD OBSERVATIONS AND MEASUREMENTS. CONSEQUENTLY, THEY ARE INDICATIVE OF THE EXISTING STRUCTURE AND THE PROPOSED WORK BUT THEY SHALL BE CONSIDERED TENTATIVE AND APPROXIMATE. THE CONTRACTOR IS REFERRED TO C&MS SECTIONS 102.05, 105.02 AND 513.04.

BASE CONTRACT BID PRICES UPON RECOGNITION OF THE UNCERTAINTIES DESCRIBED ABOVE AND UPON A PREBID EXAMINATION OF THE EXISTING STRUCTURE. HOWEVER, THE DEPARTMENT WILL PAY FOR ALL PROJECT WORK BASED UPON ACTUAL DETAILS AND DIMENSIONS WHICH HAVE BEEN VERIFIED IN THE FIELD.

EXISTING BRIDGE PLANS MAY BE INSPECTED AT THE ODOT DISTRICT 11 OFFICE, 2201 REISER AVENUE, NEW PHILADELPHIA, OHIO 44663. PHONE: 330-339-6633.

ORIGINAL CONSTRUCTION: BEL-7-19.86 (1966)
BACKWALL REPAIR AND PARAPET REFACING (1988 METRIC)

THESE EXISTING PLANS CAN ALSO BE DOWNLOADED FROM THE FOLLOWING WEBSITE:

http://www.dot.state.oh.us/Divisions/ContractAdmin/Contracts/Pages/designfiles.aspx

UTILITIES:

LISTED BELOW ARE ALL THE UTILITIES LOCATED WITHIN THE PROJECT CONSTRUCTION LIMITS TOGETHER WITH THEIR RESPECTIVE OWNERS:

ELECTRIC:	GAS:
SOUTH CENTRAL POWER CO.	COLUMBIA GAS OF OHIO
37801 BARNESVILLE-BETHESDA ROAD	P.O. BOX 2318
BARNESVILLE, OH 43713	COLUMBUS, OH 43216-2318
OFFICE: 740-425-4018	OFFICE: 1-800-344-4077

THE LOCATION OF THE UNDERGROUND UTILITIES SHOWN ON THE PLANS ARE AS OBTAINED FROM THE OWNERS AS REQUIRED BY SECTION 153.64 O.R.C.

THE CONTRACTOR SHALL GIVE A 48-HOUR NOTICE TO THE OHIO UTILITIES PROTECTION SERVICE (OUPS) BY CALLING (800) 362-2764. 48-HOUR NOTICE SHALL BE GIVEN TO THE OWNERS OF UNDERGROUND UTILITIES SHOWN ON THE PLANS WHO ARE NOT MEMBERS OF A REGISTERED UNDERGROUND PROTECTION SERVICE IN ACCORDANCE WITH SECTION 153.64 OF THE OHIO REVISED CODE. THE ABOVE-MENTIONED NOTICE SHALL BE GIVEN AT LEAST TWO WORKING DAYS PRIOR TO THE START OF CONSTRUCTION.

UTILITY LINES:
THE UTILITY(IES) SHALL BEAR ALL EXPENSES INVOLVED IN RELOCATING (INSTALLING THE AFFECTED UTILITY LINES. THE CONTRACTOR AND UTILITY(IES) ARE TO COOPERATE BY ARRANGING THEIR WORK IN SUCH A MANNER THAT INCONVENIENCE TO EITHER WILL BE HELD TO A MINIMUM.

ASBESTOS NOTIFICATION: AN ASBESTOS SURVEY OF THE BRIDGE STRUCTURE SCHEDULED FOR REHABILITATION WAS CONDUCTED BY A CERTIFIED ASBESTOS HAZARD EVALUATION SPECIALIST. THE SURVEY DETERMINED THAT NO ASBESTOS IS PRESENT ON THE BRIDGE STRUCTURE.

A COPY OF THE OHIO ENVIRONMENTAL PROTECTION AGENCY (OEPA) NOTIFICATION OF DEMOLITION AND RENOVATION FORMS, PARTIALLY COMPLETED AND SIGNED BY THE BRIDGE OWNER, WILL BE PROVIDED TO THE SUCCESSFUL BIDDER. THE CONTRACTOR SHALL COMPLETE AND SUBMIT THE FORMS VIA OHIO EPA'S WEBSITE OR MAIL HARD COPIES TO THE ADDRESS BELOW AT LEAST TEN WORKING DAYS PRIOR TO THE START OF ANY DEMOLITION AND/OR RENOVATIONS.

ASBESTOS PROGRAM
OHIO EPA, DAPC
P.O. BOX 1049
COLUMBUS, OH 43216-1049

THE CONTRACTOR SHALL PROVIDE A COPY OF THE COMPLETED FORM TO THE ENGINEER. INFORMATION ON THE FORM WILL INCLUDE: 1) THE CONTRACTOR'S NAME AND ADDRESS, 2) THE SCHEDULED DATES FOR THE START AND COMPLETION OF THE BRIDGE REMOVAL AND 3) A DESCRIPTION OF THE PLANNED DEMOLITION WORK AND METHOD(S) TO BE USED. COPIES OF THE OPEA FORM AND BRIDGE INSPECTION REPORTS ARE AVAILABLE FOR REVIEW AT THE ODOT DISTRICT 11 OFFICE, 2201 REISER AVENUE, NEW PHILADELPHIA, OHIO 44663.

BASIS FOR PAYMENT - THE CONTRACTOR SHALL FURNISH ALL FEES, LABOR AND MATERIAL NECESSARY TO COMPLETE AND SUBMIT THE OEPA NOTIFICATION FORM. PAYMENT FOR THIS WORK SHALL BE INCLUDED IN ITEM 519 - PATCHING CONCRETE STRUCTURE, AS PER PLAN.

WATERS OF THE UNITED STATES: WATERS OF THE UNITED STATES HAVE BEEN IDENTIFIED WITHIN THE PROJECT AREA. THE CONTRACTOR SHALL EXERCISE CAUTION TO ENSURE THAT NO IMPACTS OCCUR TO WATERS OF THE UNITED STATES. NO TEMPORARY OR PERMANENT FILL OF ANY TYPE MAY BE PLACED IN ANY STREAM OR WETLAND AS PART OF THIS PROJECT. ANY ACTIVITIES OCCURRING IN STREAMS OR WETLANDS WOULD REQUIRE PERMITS FROM THE US ARMY CORPS OF ENGINEERS AND/OR THE OHIO EPA.

ANY OTHER SITE PROPOSED BY THE CONTRACTOR FOR OFF PROJECT ANCILLARY CONSTRUCTION (STAGING AREAS, WASTE LOCATIONS, AND/OR BORROW LOCATIONS) MUST MEET THE REQUIREMENTS OF C&MS 105.16.

ITEM 202 - REMOVAL MISC.: REMOVE AND REINSTALL MISCELLANEOUS ITEMS: VARIOUS EXISTING ITEMS ARE LOCATED ADJACENT TO THE EXISTING PIERS THAT REQUIRE EXTERNAL POST TENSIONING. THE CONTRACTOR SHALL REMOVE ONLY THE ITEMS REQUIRED TO PROVIDE ACCESS TO ADEQUATELY PERFORM THE WORK. AFTER THE EXTERNAL POST TENSIONING IS ACCEPTED, THE CONTRACTOR SHALL REERECT OR REPLACE THE ITEMS IN THEIR ORIGINAL LOCATION.

BASED ON DESIGN PHASE FIELD VISITS, THE FOLLOWING QUANTITIES HAVE BEEN PROVIDED FOR ESTIMATING PURPOSES ONLY.

202, GUARDRAIL REMOVED FOR REUSE	310 FT
606, GUARDRAIL REBUILT	310 FT
202, REMOVAL MISC.: WOOD GUARD POST REMOVAL AND RE-ERECTION	2 EACH
606, GUARDRAIL POST	23 EACH
607, FENCE REMOVED AND REBUILT	80 FT
202, REMOVAL MISC.: PARKING METER REMOVAL AND RE-ERECTION	14 EACH
202, REMOVAL MISC.: LIGHT POLE REMOVAL AND RE-ERECTION	1 EACH
630, REMOVAL OF GROUND MOUNTED SIGN AND RE-ERECTION	3 EACH

THE ITEM OF WORK SHALL INCLUDE THE REMOVAL OF, AND SUBSEQUENT REPLACEMENT OR RE-ERECTION OF, ONLY THE ITEMS THAT DIRECTLY INHIBIT THE CONTRACTOR'S ACCESS TO PERFORM THE NECESSARY WORK.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR RECORDING THE LOCATION OF EACH ITEM PRIOR ITS REMOVAL.

PARKING METERS ARE ASSUMED TO BE OWNED BY:

THE VILLAGE OF BRIDGEPORT
301 MAIN STREET
BRIDGEPORT, OH 43912
OFFICE: 740-635-2424

VILLAGE REPRESENTATIVES SHOULD BE CONTACTED PRIOR TO REMOVAL AND MAY REQUIRE SECURE STORAGE OF METERS AFTER REMOVAL AND PRIOR TO RE-INSTALLATION. INSTALL METER POSTS IN 2'-0" DEEP BY 10" DIAMETER HOLES FILLED WITH CONCRETE. THE HEIGHT OF THE POSTS ABOVE GROUND LINE TO THE BOTTOM OF THE METER HEAD SHOULD BE APPROXIMATELY 3'-4". VERIFY INSTALLATION REQUIREMENTS WITH VILLAGE REPRESENTATIVES PRIOR TO RE-INSTALLATION.

THE CONTRACTOR AND ENGINEER SHALL MEET ON SITE A MINIMUM OF 14 DAYS BEFORE ANY REMOVALS AND MUTUALLY AGREE UPON THE REQUIRED REMOVALS BEFORE WORK BEGINS.

THE DEPARTMENT WILL INCLUDE ALL MATERIALS, TOOLS, LABOR, EQUIPMENT AND INCIDENTALS NECESSARY TO COMPLETE THE ABOVE WORK FOR PAYMENT WITH ITEM 202, REMOVAL MISC.: REMOVE AND REINSTALL MISCELLANEOUS ITEMS: LUMP SUM.

ITEM 513 - STRUCTURAL STEEL, MISC: LEVEL UF, PIER CAP STRENGTHENING BY EXTERNAL POST TENSIONING: THIS ITEM CONSISTS OF FURNISHING ALL MATERIAL, LABOR AND EQUIPMENT NECESSARY TO FURNISH AND INSTALL EXTERNAL POST TENSIONING ASSEMBLIES TO STRENGTHEN THE PIER CAPS AT PIERS 8E, 8W, 11E, 11W, 16E AND 16W.

WELDING TO EXISTING STRUCTURAL STEEL IS PROHIBITED. ANY DAMAGE CAUSED TO THE PAINT SYSTEM DURING CONSTRUCTION SHALL BE REPAIRED PER C&MS ITEM 514.

THE 1 INCH DIAMETER (NOMINAL) ALL-THREAD BARS WITH A CROSS SECTIONAL AREA OF 0.85 SQUARE INCHES AND A MODULUS OF ELASTICITY OF 29,700 KSI SHALL BE ASTM A722 (TYPE II) GRADE 150 MANUFACTURED IN THE UNITED STATES. BAR COUPLERS WILL NOT BE PERMITTED. THE ANCHOR (SPHERICAL HEX) NUTS SHALL BE ASTM A536. ANCHOR (DISHED) PLATES SHALL BE ASTM A572 GRADE 50.

GALVANIZED DISHED ANCHOR PLATES AND GALVANIZED SPHERICAL HEX NUTS SHALL BE COMPATIBLE WITH THE GALVANIZED ALL-THREAD BARS AND SHALL MEET THE REQUIREMENTS OF THE ALL-THREAD BAR MANUFACTURER'S POST TENSIONING SYSTEM. DISHED ANCHOR PLATES, SPHERICAL HEX NUTS AND ALL-THREAD BARS SHALL BE HOT DIP GALVANIZED IN ACCORDANCE WITH ASTM A-153. ALL-THREAD BARS SHALL BE MECHANICALLY CLEANED (NOT ACID WASHED) TO AVOID PROBLEMS ASSOCIATED WITH HYDROGEN EMBRITTLEMENT.

END PLATE ASSEMBLIES SHALL BE HOT DIP GALVANIZED ACCORDING TO C&MS 711.02.

FABRIC PADS SHALL MEET THE REQUIREMENTS OF C&MS 711.21, PREFORMED BEARING PADS.

BAR CLAMPS SHALL BE 1⅛ INCH INSIDE DIAMETER VIBRATION-DAMPING ROUTING CLAMPS MADE FROM 304 STAINLESS STEEL WITH SBR (STYRENE-BUTADIENE) RUBBER CUSHIONS. PART NUMBER 8981T36 FROM McMASTER-CARR. SEE https://www.mcmaster.com FOR ADDITIONAL INFORMATION. ¼ INCH DIAMETER HOLES IN CLIPS SHALL BE MODIFIED/GROUND OUT TO ACCEPT ⅜ INCH DIAMETER EXPANSION ANCHORS. ENGINEER APPROVED EQUALS MAY BE CONSIDERED IF ALL REQUIREMENTS ARE SATISFIED.

EXPANSION ANCHORS SHALL BE ⅜ INCH DIAMETER BY 3 INCH LONG 304 STAINLESS STEEL WEDGE ANCHORS FOR CRACKED CONCRETE, KB-TZ PART NUMBER 387523 FROM HILTI. SEE https://www.hilti.com FOR ADDITIONAL INFORMATION. EXPANSION ANCHORS WITH EQUAL SPECIFICATIONS SUPPLIED BY OTHER MANUFACTURERS MAY BE CONSIDERED PENDING APPROVAL BY THE ENGINEER.

ALL-THREAD BARS SHALL BE TENSIONED BY HYDRAULIC JACKS SO AS TO PRODUCE THE INDICATED

EACH JACK USED TO TENSION THE BARS SHALL BE EQUIPPED WITH A PRESSURE GAUGE HAVING AN ACCURATE READING DIAL AT LEAST SIX INCHES IN DIAMETER FOR DETERMINING JACK PRESSURE. WITHIN 30 DAYS PRIOR TO USE FOR TENSIONING ON THE PROJECT, EACH JACK AND ITS GAUGE SHALL BE CALIBRATED AS A UNIT BY A TESTING LABORATORY APPROVED BY THE ENGINEER. CALIBRATION SHALL BE DONE WITH THE CYLINDER EXTENSION APPROXIMATELY IN THE POSITION THAT IT WILL BE WHEN APPLYING THE FINAL JACKING FORCE AND WITH THE JACK ASSEMBLY IN AN IDENTICAL CONFIGURATION TO THAT WHICH WILL BE USED AT THE JOB SITE (I.E. SAME LENGTH HYDRAULIC LINES). PERFORM THE CALIBRATION WITH THE JACK APPLYING LOAD TO THE TESTING MACHINE OR LOAD CELLS CALIBRATED WITHIN THE PAST 12 MONTHS. FURNISH CERTIFIED CALIBRATION CALCULATIONS AND CALIBRATION CHART, BOTH IN ENGLISH UNITS OF MEASURE, TO THE ENGINEER FOR EACH JACK. THESE CERTIFICATIONS SHALL STATE THAT THE CALIBRATION TESTING WAS PERFORMED IN ACCORDANCE WITH THE SPECIFICATIONS FOR THE PROJECT. PRESSURE GAUGE READINGS ARE TO BE WITHIN THREE PERCENT OF THE ACTUAL APPLIED FORCE DURING CALIBRATION. IF PRESSURE GAUGE READINGS ARE NOT WITHIN THREE PERCENT OF THE APPLIED FORCE, THE SOURCE OF ERROR IS TO BE DETERMINED AND CORRECTED AND THE GAUGE RECALIBRATED.

RECALIBRATION OF EACH JACK SHALL BE DONE AS REQUESTED BY THE ENGINEER (SIX MONTH MINIMUM INTERVAL). AT THE OPTION OF THE CONTRACTOR, CALIBRATIONS SUBSEQUENT TO THE INITIAL LABORATORY CALIBRATION MAY BE ACCOMPLISHED BY USE OF A MASTER GAUGE. THE MASTER GAUGE SHALL BE SUPPLIED BY THE CONTRACTOR IN A PROTECTIVE WATERPROOF CONTAINER CAPABLE OF PROTECTING THE CALIBRATION OF THE MASTER GAUGE DURING SHIPMENT TO A LABORATORY. THE CONTRACTOR SHALL PROVIDE A QUICK-ATTACH COUPLER NEXT TO THE PERMANENT GAUGE IN THE HYDRAULIC LINES, WHICH ENABLES THE QUICK AND EASY INSTALLATION OF THE MASTER GAUGE TO VERIFY THE PERMANENT GAUGE READINGS. THE MASTER GAUGE SHALL REMAIN IN THE POSSESSION OF AND BE CALIBRATED BY THE ENGINEER FOR THE DURATION OF THE PROJECT. IF ANY REPAIR TO OR MODIFICATION OF A JACK IS ACCOMPLISHED, SUCH AS REPLACING THE SEALS OR CHANGING THE LENGTH OF HYDRAULIC LINES, THE JACK SHALL BE RECALIBRATED BY THE APPROVED TESTING LABORATORY. JACKS AND GAUGES SHALL NOT BE INTERCHANGED WITHOUT RECALIBRATION OR PROOF LOADING USING LOAD CELLS, MASTER GAUGES OR OTHER METHODS APPROVED BY THE ENGINEER. NO EXTRA COMPENSATION WILL BE ALLOWED FOR THE INITIAL OR SUBSEQUENT JACK CALIBRATIONS OR FOR USE AND REQUIRED CALIBRATION OF A MASTER GAUGE.

A QUALIFIED REPRESENTATIVE OF THE BAR POST TENSIONING SYSTEM MANUFACTURER WHO IS SKILLED AND EXPERIENCED IN THE PROPOSED WORK SHALL BE PHYSICALLY ON SITE DURING BAR TENSIONING OPERATIONS FOR INSTALLATION OF THE FIRST TWELVE INDIVIDUAL BARS TENSIONED. THE REPRESENTATIVE SHALL HAVE A CURRENT LEVEL 2 CERTIFICATION UNDER THE POST-TENSIONING INSTITUTE'S (PTI) TRAINING AND CERTIFICATION OF FIELD PERSONNEL FOR BONDED POST-TENSIONING PROGRAM, HAS THREE YEARS VERIFIABLE JOB-SITE EXPERIENCE IN BRIDGE RELATED POST-TENSIONING OPERATIONS AND HAS EXPERIENCE ON AT LEAST FOUR PREVIOUS AND SATISFACTORILY COMPLETED PROJECTS OF A SIMILAR SIZE AND SCOPE IN THE SAME CAPACITY. FURNISH THE NAME OF THE REPRESENTATIVE, EXPERIENCE, AND CERTIFICATION ALONG WITH A DETAILED DESCRIPTION OF PROJECTS WORKED ON, ROLE IN THESE PROJECTS, AND OWNER REFERENCES WHICH CAN BE VERIFIED FOR APPROVAL BY THE ENGINEER THREE WEEKS PRIOR TO ANY POST TENSIONING STRESSING. THE REPRESENTATIVE SHALL PROVIDE CLOSE OBSERVATION (IMMEDIATE SUPERVISION), SHALL EXERCISE RIGID CONTROL OF THE OPERATION AS NECESSARY, BE EMPOWERED TO CONTROL ALL BAR TENSIONING OPERATIONS AS NECESSARY FOR FULL COMPLIANCE WITH THE SPECIFICATIONS AND TRAIN CONTRACTOR PERSONNEL TO OPERATE EQUIPMENT IN REPRESENTATIVE'S ABSENCE. THE REPRESENTATIVE SHALL FULLY FAMILIARIZE THE CONTRACTOR AND ENGINEER WITH ALL COMPONENTS AND THEIR PROPER INSTALLATION.

INITIALLY TIGHTEN ANCHOR NUTS TO A SNUG TIGHT CONDITION. THEN TENSION BARS BY JACKING USING TWO INCREMENTS. FIRST JACK EACH BAR TO 15 KIPS. FINISH BY JACKING EACH BAR TO 60 KIPS. USE A PATTERN AS DESCRIBED IN THE PROPOSED WORK/CONSTRUCTION SEQUENCE ON SHEET 3 OF 12 TO EQUALLY ENGAGE ALL ANCHOR NUTS AT EACH INCREMENTAL JACKING.

THE FOLLOWING VALUES WERE CALCULATED:

ELONGATION AT 15 KIP JACKING TENSION = 0.242 INCHES

FINAL JACKING TENSION = 60 KIPS
ELONGATION = 1.05 INCHES
ANCHOR SET = 0.07 INCHES
LONG TERM RELAXATION = 0.02%
SERVICE TENSION AFTER ALL LOSSES = 55 KIPS

CALCULATED CAS CHECKED JHL

GENERAL NOTES

BEL-7-19.75

GENERAL NOTES (CONTINUED):

MEASURE AND RECORD THE GAUGE PRESSURES AND ACTUAL BAR ELONGATION FOR EACH BAR AT EACH STAGE OF STRESSING. ELONGATIONS WILL BE MEASURED TO THE NEAREST 1/16 INCH USING A RIGID RULE. FLEXIBLE TAPES ARE NOT ALLOWED. COMPARE THE ACTUAL ELONGATION WITH THE PREDICTED ELONGATION SHOWN IN THE PLANS. A SIGNIFICANT DIFFERENCE IN ACTUAL ELONGATION VERSES PREDICTED ELONGATION COULD INDICATE IMPROPER JACKING OR TORQUEING TECHNIQUES, IMPROPER MATERIAL, FAULTY JACK, OR IMPROPER CALIBRATED JACK. IF THE DIFFERENCE IS MORE THAN 15% THE JACK WILL BE RECALIBRATED AND THE JACKING TECHNIQUES EVALUATED. IF, AFTER RECALIBRATION OF THE JACK AND ASSURANCES THE JACKING TECHNIQUES ARE SATISFACTORY, THE ELONGATION DIFFERENCE IS MORE THAN 10% FROM THE PREDICTED ELONGATION ALL WORK SHALL CEASE AND THE ENGINEER SHALL BE NOTIFIED. NO WORK SHALL BE RESUMED UNTIL THE ENGINEER HAS REVIEW THE SITUATION AND APPROVED THE CONTRACTORS REMEDY PLAN.

AFTER ALL STRESSING, A STRESSING REPORT SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL. THE STRESSING REPORT SHALL INCLUDE A RECORD OF THE FOLLOWING POST-TENSIONING OPERATIONS FOR EACH INSTALLATION:

1. PROJECT NAME, STATE PROJECT NUMBER;
2. CONTRACTOR AND/OR SUBCONTRACTOR;
3. BAR LOCATION, SIZE AND TYPE;
4. DATE BAR WAS FIRST INSTALLED;
5. HEAT NUMBER OF BARS;
6. TENDON CROSS-SECTIONAL AREA (ASSUMED AND ACTUAL);
7. MODULUS OF ELASTICITY (ASSUMED AND ACTUAL);
8. DATE STRESSED;
9. JACK AND GAUGE NUMBERS WITH BAR TENSIONED;
10. REQUIRED JACKING FORCE;
11. GAUGE PRESSURES;
12. ELONGATIONS (THEORETICAL AND ACTUAL);
13. ANCHOR SETS (ANTICIPATED AND ACTUAL);
14. STRESSING SEQUENCE;
15. STRESSING MODE;
16. WITNESS TO STRESSING OPERATION (CONTRACTOR AND INSPECTOR);
17. DATE OF APPROVED ELONGATIONS;
18. RECORD OF ANY OTHER RELEVANT INFORMATION

AFTER THE BARS HAVE BEEN TENSIONED, ANY DAMAGED GALVANIZING ON THE BARS OR ASSOCIATED HARDWARE SHALL BE REPAIRED IN ACCORDANCE WITH C&MS 711.02.

BASIS OF PAYMENT: THE WORK SHALL BE PAID FOR BY LUMP SUM FOR STRUCTURAL STEEL, MISC.: LEVEL UF, PIER CAP STRENGTHENING BY EXTERNAL POST TENSIONING. THE LUMP SUM UNIT SHALL INCLUDE ALL WORK NECESSARY TO STRENGTHEN THE PIER CAPS BY EXTERNAL POST TENSIONING, INCLUDING BUT NOT LIMITED TO THE FOLLOWING: ALL-THREAD BARS, DISHED ANCHOR PLATES, SPHERICAL HEX NUTS, END PLATE ASSEMBLIES, FABRIC PADS, GALVANIZING, BAR CLAMPS, EXPANSION ANCHORS, JACKING EQUIPMENT, CALIBRATING AND CERTIFYING JACKS, ON SITE MANUFACTURER REPRESENTATIVE SUPERVISION AND TRAINING AND ALL OTHER WORK NECESSARY TO PERFORM THE WORK AS SHOWN ON THE PLANS AND SPECIFIED HEREIN.

ITEM 519 - PATCHING CONCRETE STRUCTURE, AS PER PLAN: IN ADDITION TO THE PROVISIONS OF ITEM 519, SAW CUTS SHALL BE PROVIDED AROUND THE PERIMETER OF THE REMOVAL LIMITS AS INDICATED ON THE PLANS. ALSO, AT THE PIER CAP END REPAIRS THE DELAMINATED CONCRETE SHALL BE REMOVED TO PROVIDE UNDERCUT SHOULDERS AS SHOWN ON THE PLANS.

THIS ITEM SHALL ALSO INCLUDE FIELD VERIFICATION THAT THE CONCRETE SURFACES UNDER THE PROPOSED END PLATES ARE FLAT AND SMOOTH. IF GAPS GREATER THAN 1/16 INCH EXIST BETWEEN FLAT VERTICAL AND HORIZONTAL SURFACES BETWEEN THE LOCATION OF THE END PLATE AND THE CONCRETE SURFACE, THE CONCRETE SHALL BE GROUND TO PROVIDE A SMOOTH, FLAT SURFACE.

SEE ASBESTOS NOTIFICATION NOTE ON SHEET 2 OF 12 FOR ADDITIONAL WORK INCLUDED IN THIS ITEM.

PRIOR TO THE SURFACE CLEANING SPECIFIED IN C&MS 519.04 AND WITHIN 24 HOURS OF PLACING PATCHING MATERIAL, BLAST CLEAN ALL SURFACES TO BE PATCHED INCLUDING THE EXPOSED REINFORCING STEEL. ACCEPTABLE METHODS INCLUDE HIGH-PRESSURE WATER BLASTING WITH OR WITHOUT ABRASIVES IN THE WATER, ABRASIVE BLASTING WITH CONTAINMENT, OR VACUUM ABRASIVE BLASTING.

ITEM 607 - FENCE, MISC.: TEMPORARY WORK ZONE FENCE: THIS ITEM CONSISTS OF FURNISHING ALL MATERIALS, LABOR AND EQUIPMENT NECESSARY TO FURNISH, INSTALL AND REMOVE TEMPORARY FENCING AROUND THE PERIMETER OF THE WORK ZONE. PUBLIC PARKING AND A PUBLIC PARK ARE LOCATED UNDER THE STRUCTURE ADJACENT TO THE PIERS TO BE STRENGTHENED.

TEMPORARY FENCING SHALL BE CONSTRUCTED AROUND THE WORK ZONE TO DETER THE PUBLIC FROM ENTERING THE WORK AREA. TEMPORARY FENCING SHALL CONSIST OF 6'-0" HIGH (MINIMUM) CHAIN LINK FENCING. THE CONTRACTOR AND THE ENGINEER SHALL DETERMINE THE LIMITS OF THE WORK ZONE AREA. THE WORK ZONE AREA SHALL BE CLOSED OFF BY GATES OR OTHER MEANS WHEN THE CONTRACTOR IS NOT WORKING. TEMPORARY FENCING MAY BE ERECTED WITHOUT CONCRETE FOOTINGS, PULL POSTS, CORNER POSTS, ETC. REMOVE THE TEMPORARY FENCING AND APPURTENANCES FROM THE PROJECT SITE, WHEN DIRECTED BY THE ENGINEER. TEMPORARY FENCING MATERIALS WILL REMAIN THE PROPERTY OF THE CONTRACTOR. POST HOLES SHALL BE FILLED WITH SIMILAR MATERIAL THAT WAS DISTURBED (I.E. ASPHALT, CONCRETE, SOIL) AFTER CONSTRUCTION IS COMPLETED.

TRAFFIC CONTROL DEVICES (ORANGE REFLECTIVE CONES, BARRELS, ETC. AS APPROVED BY THE ENGINEER) SHALL BE PLACED AROUND THE PERIMETER OF THE FENCING AT LOCATIONS WHERE PARKING LOT TRAFFIC WILL BE ADJACENT TO THE FENCE.

BASIS OF PAYMENT: THE WORK SHALL BE PAID FOR BY LUMP SUM FOR FENCE, MISC.: TEMPORARY WORK ZONE FENCE. THE LUMP SUM UNIT SHALL INCLUDE ALL WORK NECESSARY TO FURNISH, INSTALL AND REMOVE TEMPORARY FENCING, TO THE SATISFACTION OF THE ENGINEER.

ITEM 614 - MAINTAINING TRAFFIC: THE BEL-7-1975 BRIDGES CAN REMAIN OPEN TO NORTH BOUND AND SOUTH BOUND S.R. 7 TRAFFIC DURING THE PIER CAP STRENGTHENING WORK.

LOCAL STREETS SHOULD NOT REQUIRE ANY CLOSURES, HOWEVER, IF NECESSARY DUE TO CONTRACTORS WORK ZONE REQUIREMENTS, ITEM 614 - MAINTENANCE OF TRAFFIC HAS BEEN PROVIDED. LANE CLOSURES AND SIGNING, IF NECESSARY, SHALL BE PERFORMED AS REQUIRED BY THE MT AND TC STANDARD DRAWINGS LISTED ON THE TITLE SHEET. IF ANY LOCAL STREETS ARE TO BE CLOSED, THE CONTRACTOR MUST PROVIDE NOTIFICATION TO THE ODOT DISTRICT OR PROJECT ENGINEER A MINIMUM OF FOURTEEN(14) DAYS PRIOR TO ANY LANE RESTRICTIONS. ALSO, THE CONTRACTOR SHALL NOTIFY TO THE VILLAGE OF BRIDGEPORT REPRESENTATIVES.

ALL WORK AND TRAFFIC CONTROL DEVICES SHALL BE IN ACCORDANCE WITH C&MS 614 AND OTHER APPLICABLE PORTIONS OF THE SPECIFICATIONS, AS WELL AS THE OHIO MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES. PAYMENT FOR ALL LABOR, EQUIPMENT AND MATERIALS SHALL BE INCLUDED IN THE LUMP SUM CONTRACT PRICE FOR ITEM 614 - MAINTAINING TRAFFIC, UNLESS SEPARATELY ITEMIZED IN THE PLANS.

ITEM 642 - NOTIFICATION OF TRAFFIC RESTRICTIONS:

THROUGHOUT THE DURATION OF THE PROJECT, THE CONTRACTOR SHALL NOTIFY THE PROJECT ENGINEER IN WRITING OF ALL TRAFFIC RESTRICTIONS AND UPCOMING MAINTENANCE OF TRAFFIC CHANGES. THE CONTRACTOR SHALL ENSURE THE WRITTEN NOTIFICATION IS SUBMITTED IN A TIMELY MANNER TO ALLOW THE PROJECT ENGINEER TO MEET THE REQUIRED TIME FRAMES SET FORTH IN THE TABLE BELOW TO INFORM THE SPECIAL HAULING PERMITS SECTION (Hauling.Permits@dot.ohio.gov) AND THE DISTRICT PUBLIC INFORMATION OFFICE (PIO). THIS NOTIFICATION SHALL BE RECEIVED BY THE PROJECT ENGINEER PRIOR TO THE PHYSICAL SETUP OF ANY APPLICABLE SIGNS OR MESSAGE BOARDS.

INFORMATION SHOULD INCLUDE, BUT IS NOT LIMITED TO, ALL CONSTRUCTION ACTIVITIES THAT IMPACT OR INTERFERE WITH TRAFFIC AND SHALL LIST THE SPECIFIC LOCATION, TYPE OF WORK, ROAD STATUS, DATE AND TIME OF RESTRICTION, DURATION OF RESTRICTION, NUMBER OF LANES MAINTAINED, NUMBER OF LANES CLOSED, MINIMUM VERTICAL CLEARANCE, MINIMUM WIDTH OF DRIVABLE PAVEMENT, DETOUR ROUTES, IF APPLICABLE, AND ANY OTHER INFORMATION REQUESTED BY THE PROJECT ENGINEER.

NOTIFICATION TIME TABLE

ITEM	DURATION OF CLOSURE	NOTICE DUE TO PERMITS & PIO
RAMP & ROAD CLOSURES	>= 2 WEEKS	21 CALENDAR DAYS PRIOR TO CLOSURE
	> 12 HOURS & < 2 WEEKS	14 CALENDAR DAYS PRIOR TO CLOSURE
	< 12 HOURS	4 BUSINESS DAYS PRIOR TO CLOSURE
LANE CLOSURE & RESTRICTIONS	>= 2 WEEKS	14 CALENDAR DAYS PRIOR TO CLOSURE
	< 2 WEEKS	5 BUSINESS DAYS PRIOR TO CLOSURE
START OF CONSTRUCTION & TRAFFIC PATTERN CHANGES	N/A	14 CALENDAR DAYS PRIOR TO IMPLEMENTATION

ANY UNFORESEEN CONDITIONS NOT SPECIFIED IN THE PLANS REQUIRING TRAFFIC RESTRICTIONS SHALL ALSO BE REPORTED TO THE PROJECT ENGINEER USING THE NOTIFICATION TIME TABLE.

PROPOSED WORK/CONSTRUCTION SEQUENCE:

WORK SHALL CONSIST OF BUT NOT BE LIMITED TO THE FOLLOWING AT PIERS 8E, 8W, 11E, 11W, 16E AND 16W:

1. CONSTRUCT TEMPORARY FENCING AND TRAFFIC CONTROL DEVICES AROUND WORK AREAS TO PROTECT PUBLIC FROM CONSTRUCTION ACTIVITIES (PUBLIC PARKING IS ADJACENT TO ALL PIERS AND LINCOLN AVENUE PARK IS UNDER THE BRIDGE ADJACENT TO PIERS 11E AND 11W). INSTALL EROSION CONTROL.
2. REMOVE MISCELLANEOUS ITEMS AS NECESSARY (I.E. STEEL BEAM GUARD RAIL, LIGHT POLES, ETC.).
3. PATCH SPALLED AND DELAMINATED CONCRETE AT THE PIER ENDS TO PROVIDE SOUND CONCRETE UNDER THE PROPOSED END PLATES (SEE DETAILS ON SHEET 8 / 8). ALSO PATCH SPALLED AND DELAMINATED CONCRETE ON NORTH AND SOUTH FACES OF PIER CAPS (SEE DETAILS ON SHEETS 5 - 7 / 8). CONCRETE PATCHES MUST OBTAIN DESIGN STRENGTH (4500 PSI) PRIOR TO TENSIONING IN STEP 10.
4. SEAL AREAS THAT HAVE BEEN PATCHED IN STEP 3 WITH EPOXY-URETHANE SEALER.
5. FIELD VERIFY THAT SURFACES UNDER PROPOSED END PLATES ARE FLAT AND SMOOTH. NO GAPS GREATER THAN 1/16 INCH MEASURED BETWEEN FLAT VERTICAL AND HORIZONTAL SURFACES BETWEEN THE END PLATES AND THE CONCRETE WILL BE PERMITTED. HIGH LOCATIONS SHALL BE GROUND TO PROVIDE A FLAT SURFACE.
6. PREPARE SHOP DRAWINGS ACCORDING TO THE REQUIREMENTS OF C&MS 513.06 AND 501.04.
7. ASSEMBLE THE ALL-THREAD BARS AND THE END PLATE ASSEMBLIES ON THE GROUND AROUND THE PIER. INSTALL ANCHOR PLATES AND NUTS. CAREFULLY LIFT AND HOLD THE ENTIRE ASSEMBLY TO THE REQUIRED, LEVEL POSITION ON THE PIER CAP.
8. INSTALL THE FABRIC PADS. SNUG TIGHTEN NUTS (AT THE WEST END OF THE WEST PIERS AND AT THE EAST END OF THE EAST PIERS) IN AN ALTERNATING PATTERN (TOP LEFT, BOTTOM RIGHT, BOTTOM LEFT, TOP RIGHT, MIDDLE LEFT AND MIDDLE RIGHT) TO FIRMLY HOLD ASSEMBLY ON THE PIER CAP. REMOVE TEMPORARY LIFTING AND HOLDING DEVICES.
9. REPEAT STEPS 7 AND 8 AT OTHER REQUIRED PIER CAPS.
10. AT THE OUTER END PLATE ASSEMBLIES (AT THE WEST END OF THE WEST PIERS AND AT THE EAST END OF THE EAST PIERS), INITIALLY TENSION THE BARS TO 15 KIPS IN AN ALTERNATING PATTERN (AS DESCRIBED IN STEP 8). THEN, TENSION TO A FINAL TENSION OF 60 KIPS IN AN ALTERNATING PATTERN.
11. INSTALL VIBRATION-DAMPING ROUTING CLAMPS.
12. REINSTALL ITEMS PREVIOUSLY REMOVED IN STEP 2.
13. REMOVE TEMPORARY WORK ZONE FENCE.

CALCULATED CAS CHECKED JHL

GENERAL NOTES

BEL-7-19.75

SHEET NUMBER								PARTICIPATION		ITEM	ITEM EXT.	GRAND TOTAL	UNIT	DESCRIPTION	SEE SHEET NO.
	2	3		9	10	11			01/NHS/BR						
														EROSION CONTROL	
									1000	832	30000	1000	EACH	EROSION CONTROL	
														STRUCTURES OVER 20 FOOT SPAN (SFN: 0700541)	
	LS								LS	202	98000	LS		REMOVAL MISC.: REMOVE AND REINSTALL MISCELLANEOUS ITEMS	2
				23	20	5			48	512	10100	48	SY	SEALING OF CONCRETE SURFACES (EPOXY-URETHANE)	
		LS							LS	513	95020	LS		STRUCTURAL STEEL, MISC: LEVEL UF, PIER CAP STRENGTHENING BY EXTERNAL POST TENSIONING	2, 3
				205	176	45			426	519	11101	426	SF	PATCHING CONCRETE STRUCTURE, AS PER PLAN	3
														MAINTENANCE OF TRAFFIC	
		LS							LS	607	98200	LS		FENCE, MISC.: TEMPORARY WORK ZONE FENCE	3
														INCIDENTALS	
		LS							LS	614	11000	LS		MAINTAINING TRAFFIC	3
									3	619	16000	3	MNTH	FIELD OFFICE TYPE A	
									LS	624	10000	LS		MOBILIZATION	

CALCULATED CAS CHECKED JHL

GENERAL SUMMARY

BEL-7-19.75

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12

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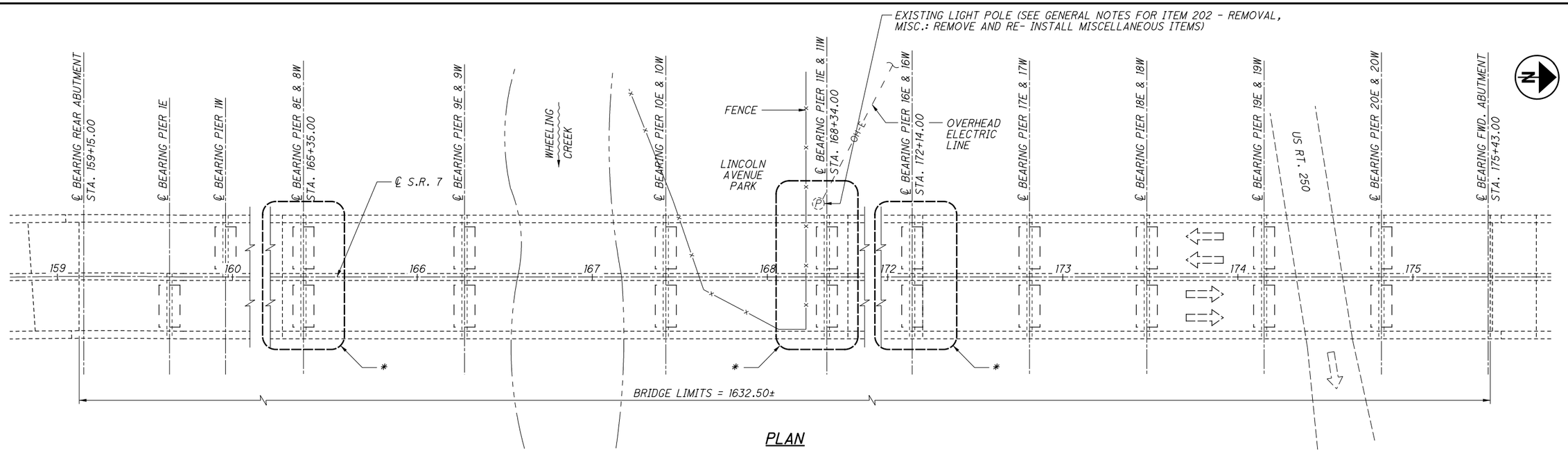
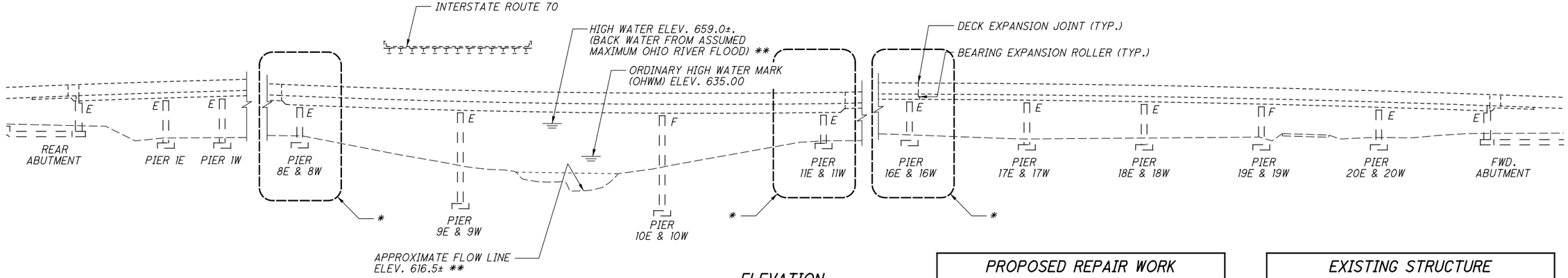


PLAN



ELEVATION

PROPOSED REPAIR WORK

PROJECT INCLUDES EXTERNAL POST-TENSIONING INSTALLATION FOR PIER STRENGTHENING AT PIER 8E, 8W, 11E, 11W, 16E AND 16W ON THE BEL-7-1975 BRIDGE.

LEGEND:

* = PIER CAPS TO BE STRENGTHENED
** = INFORMATION FROM ORIGINAL 1959 PLANS

E = EXPANSION
F = FIXED

EXISTING STRUCTURE

TYPE: CONTINUOUS ROLLED BEAM AND WELDED GIRDER WITH REINFORCED CONCRETE DECK AND SUBSTRUCTURES

SPANS: 21-SPAN (SB), 22-SPAN (NB)

ROADWAY: 62'-0" f/f CURB

LOADING: CF 200 (57)

SKEW: NONE

WEARING SURFACE: 1¾"± MICRO-SILICA MODIFIED CONCRETE ON 1"± MONOLITHIC CONCRETE

APPROACH SLABS: AS-1-54, 25'-0"± LONG

ALIGNMENT: VARIES

SUPERELEVATION: VARIES

DATE BUILT: 1968 REHABILITATED: 1998

DISPOSITION: PIERS 8E, 8W, 11E, 11W, 16E AND 16W TO BE STRENGTHENED

COORDINATES: 40°04'08.55" N
80°44'25.99" W

STRUCTURE FILE NUMBER: 0700541

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DESIGNED	DRAWN	REVIEWED	DATE
JHL	AAA	TAB	4/19/18
CHECKED	REVISED	STRUCTURE FILE NUMBER	
CAS		0700541	

BELMONT COUNTY
STA. 165+35.00
STA. 172+14.00

SITE PLAN
BRIDGE NO. BEL-7-1975
OVER US40, SR767 AND WHEELING CREEK

BEL-7-19.75
PID No. 105324

1 / 8

5
12

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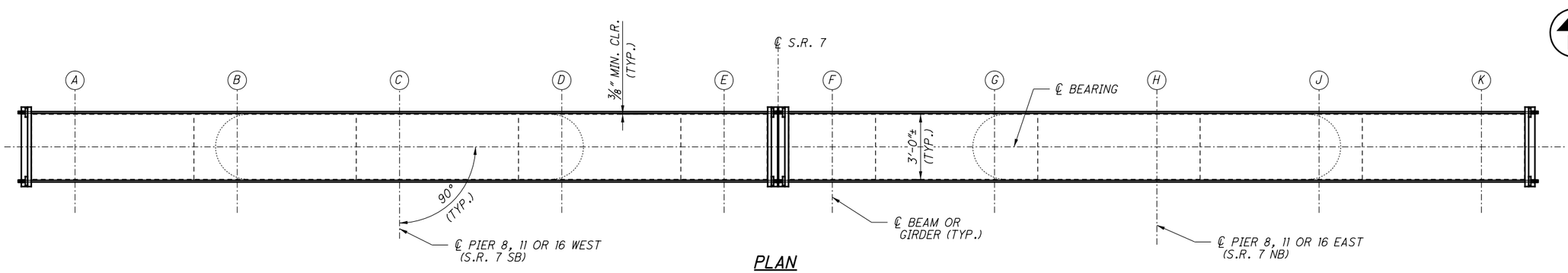
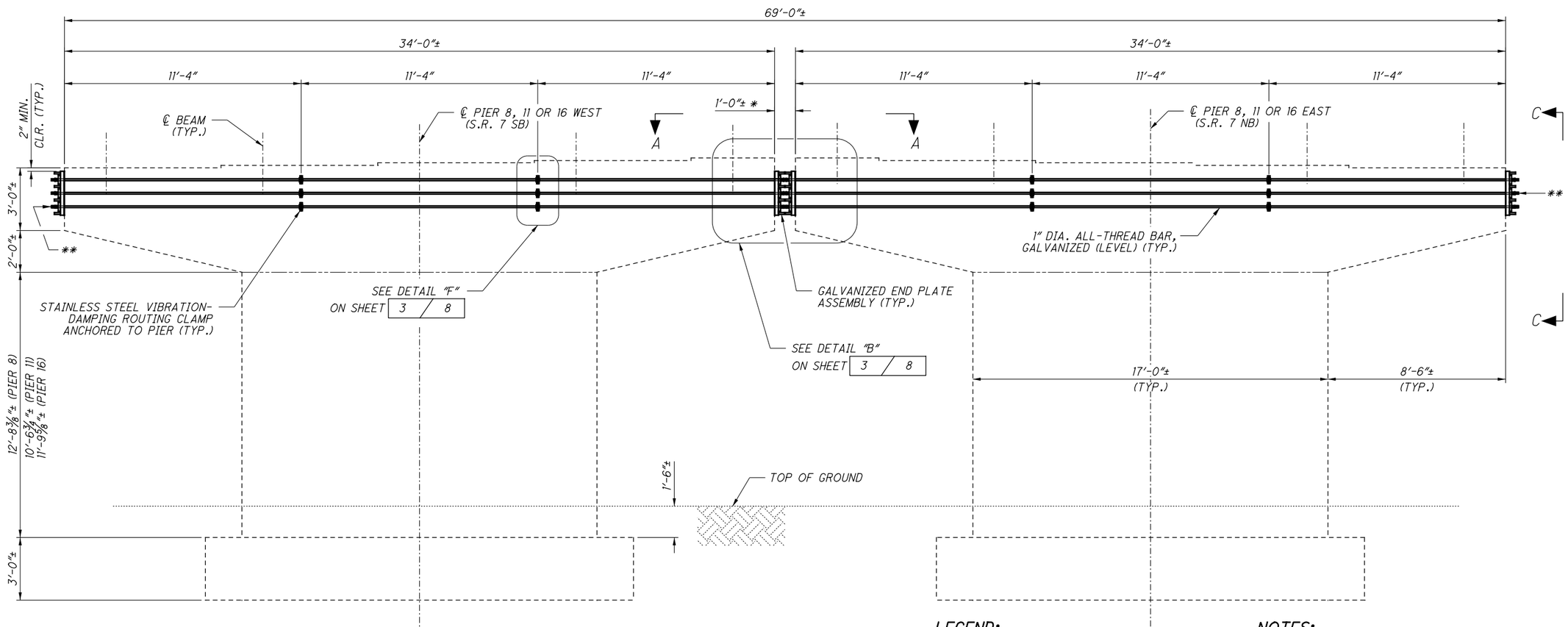


PLAN



ELEVATION

LEGEND:

* = FIELD VERIFY
** = BARS TENSIONED FROM THIS END. PROVIDE BAR LENGTH BEYOND NUT AS NECESSARY TO ATTACH JACKS
(_) = EXISTING BEAM OR GIRDER DESIGNATION

CLR. = CLEAR
DIA. = DIAMETER
NB = NORTHBOUND
SB = SOUTHBOUND
S.R. = STATE ROUTE

NOTES:

1. SEE SHEET 3 / 8 FOR VIEW A-A.
2. SEE SHEET 4 / 8 FOR VIEW C-C.
3. SEE SHEETS 5 - 7 / 8 FOR PATCHING DETAILS.
4. SEE SHEET 8 / 8 FOR PIER CAP END PATCHING AND GRINDING DETAILS.

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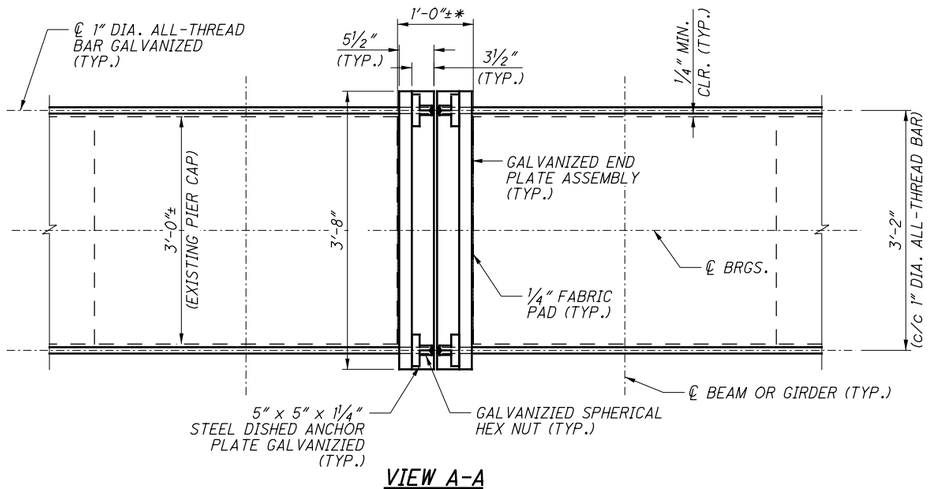
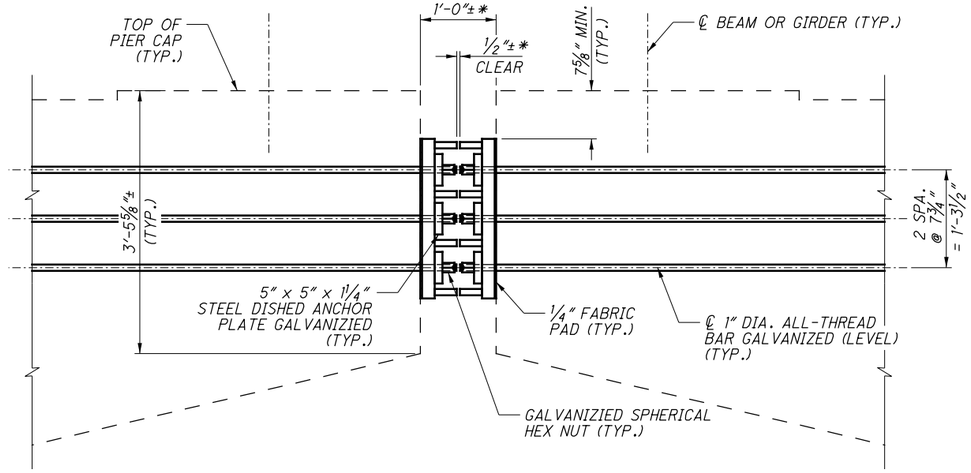
DESIGNED	DRAWN	REVIEWED	DATE
JHL	JHL	TAB	4/19/18
CHECKED	REVISED	STRUCTURE FILE NUMBER	
CAS		0700541	

PIER 8, 11 & 16 PLAN & ELEVATION
BRIDGE NO. BEL-7-1975
OVER US40, SR767 AND WHEELING CREEK

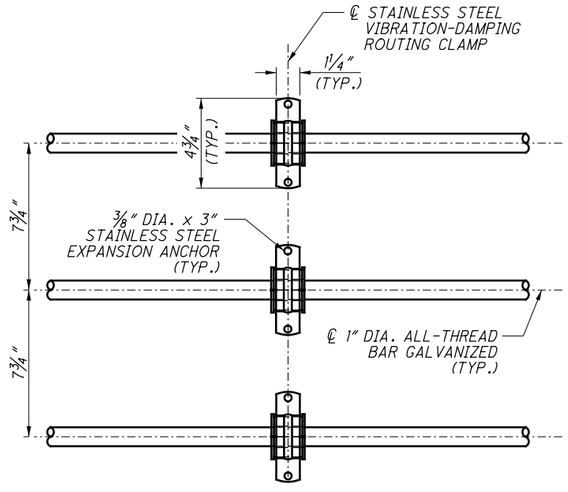
BEL-7-19.75
PID No. 105324



VIEW A-A



DETAIL "B"



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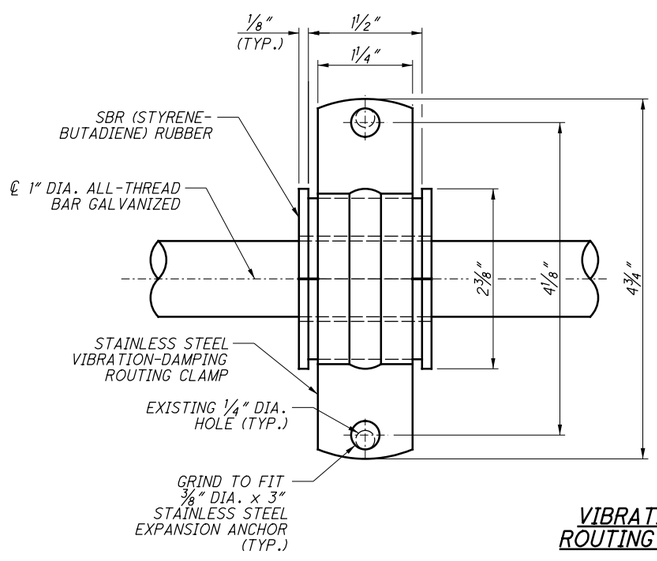

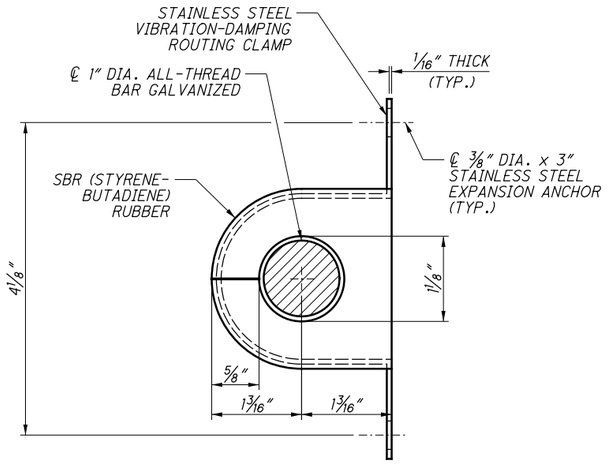

VIBRATION-DAMPING ROUTING CLAMP DETAIL

LEGEND:

* = FIELD VERIFY

CLR. = CLEAR
DIA. = DIAMETER
MIN. = MINIMUM

NOTES:

1. VIBRATION-DAMPING ROUTING CLAMPS SHALL BE INSTALLED AFTER THE ALL-THREAD BARS HAVE BEEN TENSIONED. SEE PROPOSED WORK/CONSTRUCTION SEQUENCE NOTE ON SHEET 3 OF 12. CARE SHALL BE TAKEN NOT TO DAMAGE THE ALL-THREAD BAR WHEN INSTALLING CLAMPS.

2. VIBRATION-DAMPING ROUTING CLAMP (PART NUMBER 8981T36) SHOWN HAS AN INSIDE RUBBER DIAMETER OF 1⅛". IF THIS OPENING IS NOT COMPATIBLE WITH THE ALL-THREAD BARS USED BY THE CONTRACTOR, OTHER DIAMETERS ARE AVAILABLE (1 1/16", 1¼", 1 5/16", 1⅜", ETC.) AND CAN BE SUBSTITUTED FOR BETTER FITMENT.

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DESIGNED	DRAWN	REVIEWED	DATE
JHL	JHL	TAB	4/19/18
CHECKED	REVISED	STRUCTURE FILE NUMBER	
CAS		0700541	

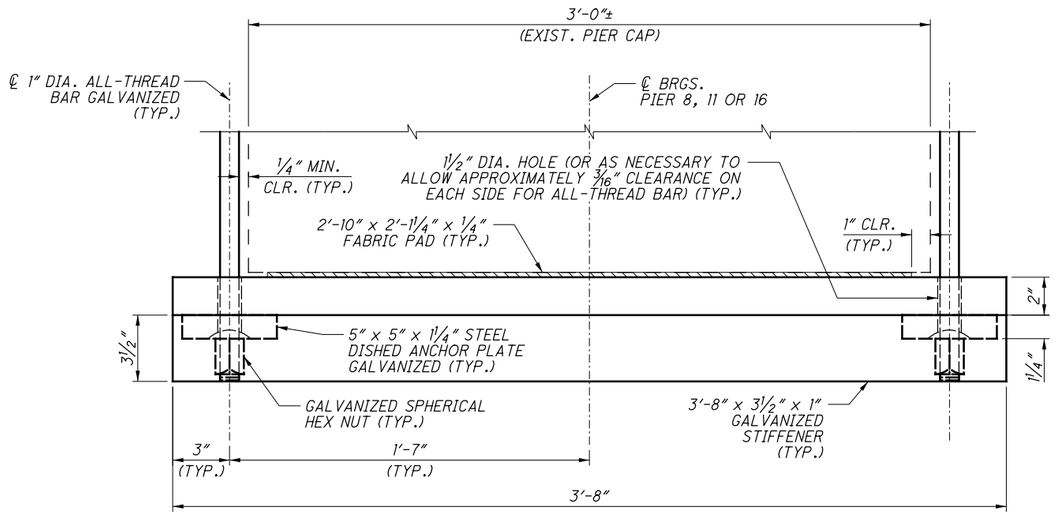
EXTERNAL POST-TENSIONING DETAILS - 1

BRIDGE NO. BEL-7-1975
OVER US40, SR767 AND WHEELING CREEK

BEL-7-19.75
PID No. 105324

3 / 8

7 / 12



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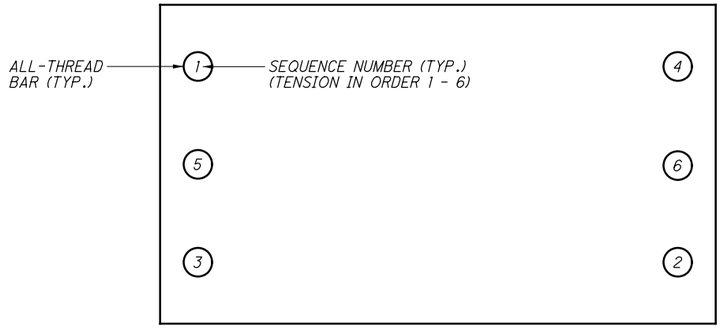
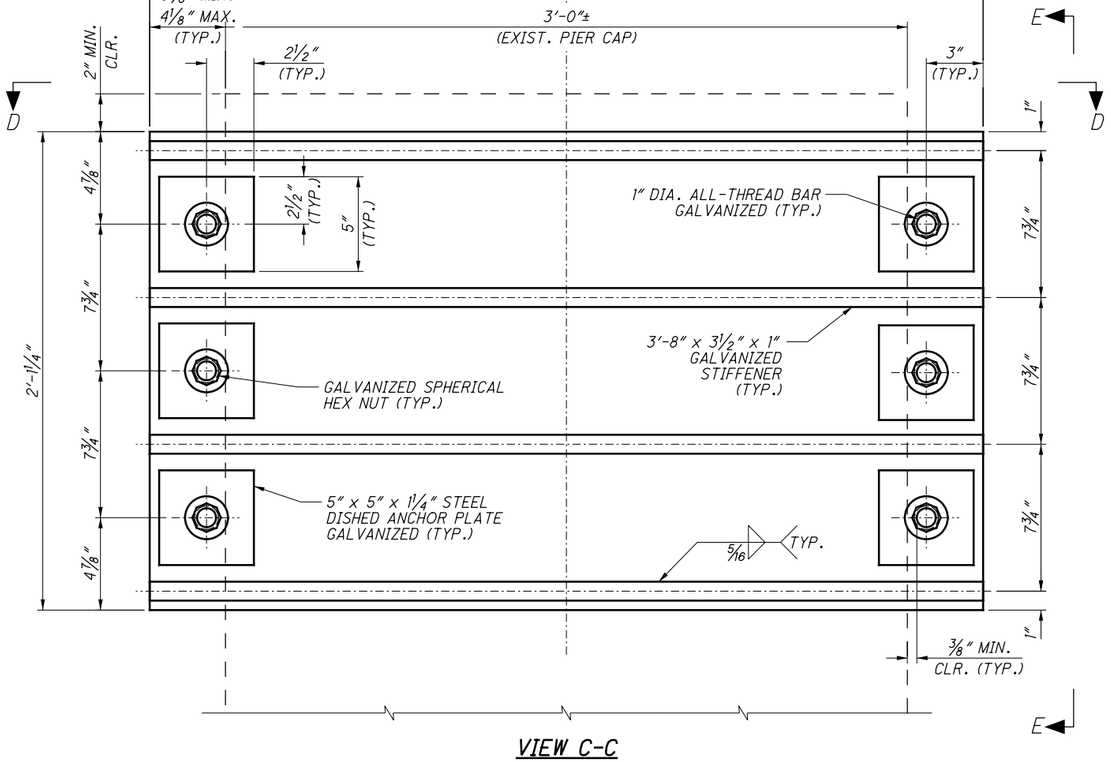


TENSIONING SEQUENCE

(INITIAL, INTERMEDIATE AND FINAL)
(SEE SHEETS 2 AND 3 OF 12 FOR ADDITIONAL NOTES AND REQUIREMENTS)

LEGEND:

CLR. = CLEAR
DIA. = DIAMETER
MIN. = MINIMUM



VIEW C-C

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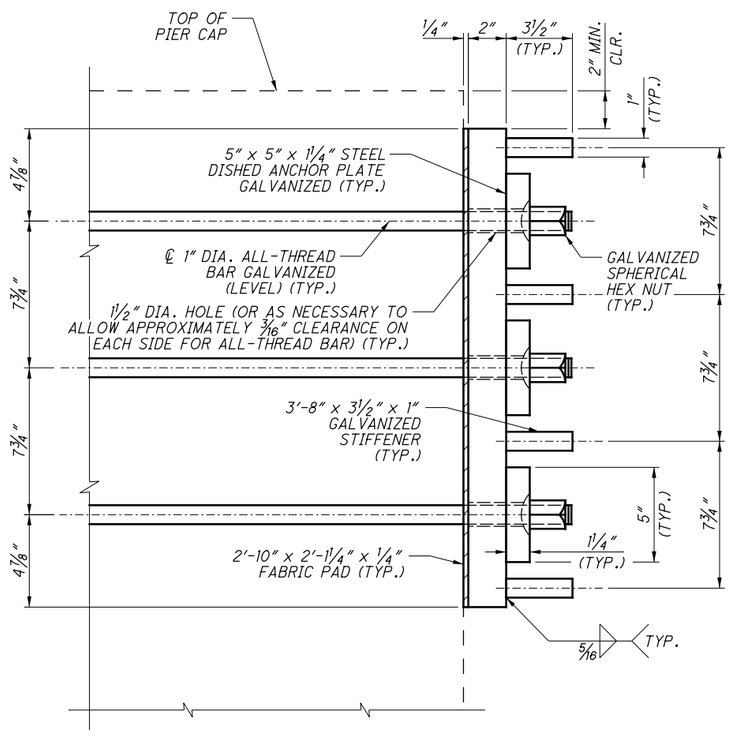

VIEW E-E

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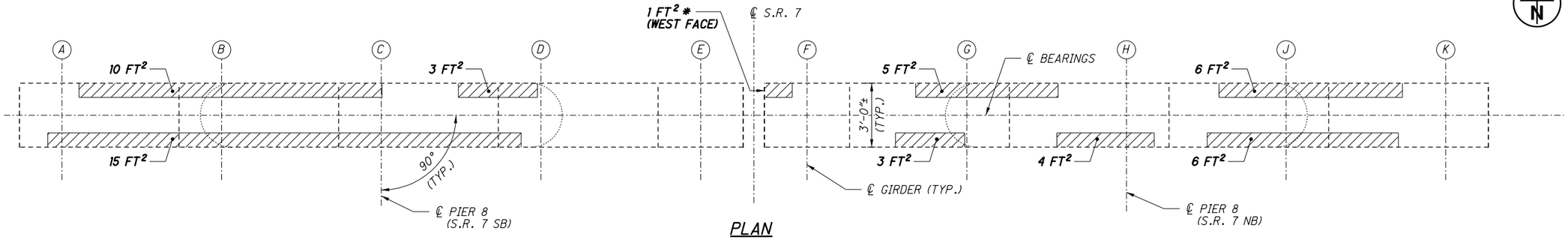
EXTERNAL POST-TENSIONING DETAILS - 2

BRIDGE NO. BEL-7-1975
OVER US40, SR767 AND WHEELING CREEK

BEL-7-19.75
PID No. 105324

4 / 8

8 / 12



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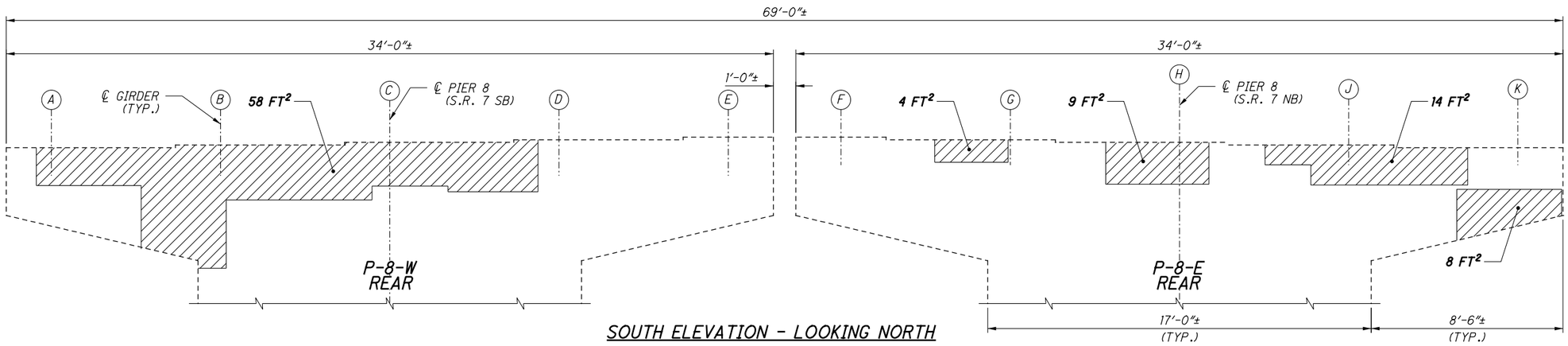
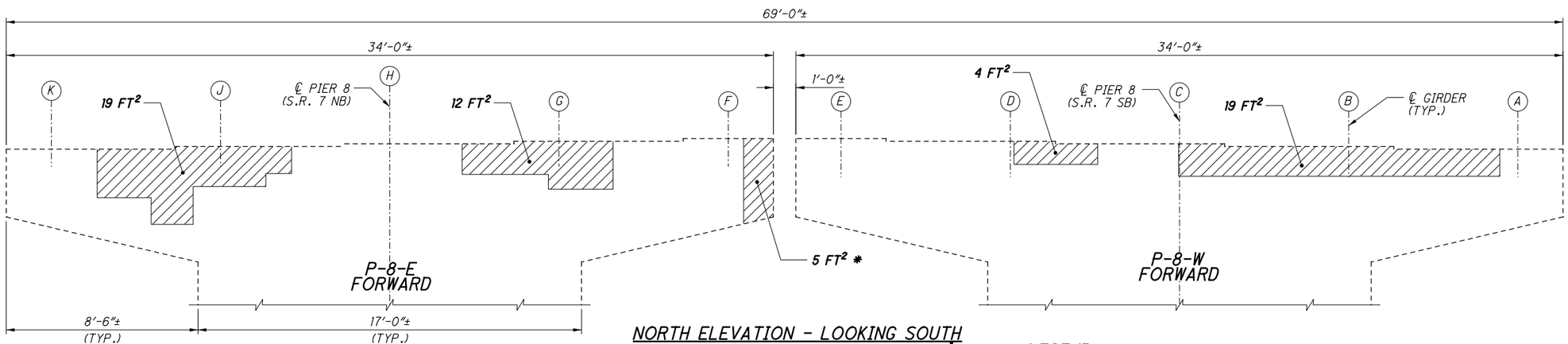


SOUTH ELEVATION - LOOKING NORTH



NORTH ELEVATION - LOOKING SOUTH

PIER CAP 8			
ITEM	ITEM DESCRIPTION	UNIT	QUANTITY
512	SEALING OF CONCRETE SURFACES (EPOXY-URETHANE)	SY	23
519	PATCHING CONCRETE STRUCTURE, AS PER PLAN	SF	205

LEGEND:

= DENOTES AREA OF DETERIORATED CONCRETE TO BE PATCHED AS PER ITEM 519 - PATCHING CONCRETE STRUCTURES, AS PER PLAN.

* = SEE SHEET 8 / 8 FOR ADDITIONAL DETAILS AT END PATCH.

(_) = EXISTING GIRDER DESIGNATION

NOTES:

1. PROVIDE 1" DEEP SAW CUTS AROUND THE PERIMETER OF THE AREAS TO BE PATCHED.
2. SEAL ALL SURFACES THAT HAVE BEEN PATCHED WITH ITEM 512 - SEALING OF CONCRETE SURFACES (EPOXY-URETHANE). SURFACES OUTSIDE OF PATCHING AREAS ARE NOT TO BE RE-SEALED.

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PIER CAP 8 PATCHING DETAILS
BRIDGE NO. BEL-7-1975
OVER US40, SR767 AND WHEELING CREEK

BEL-7-19.75
PID No. 105324

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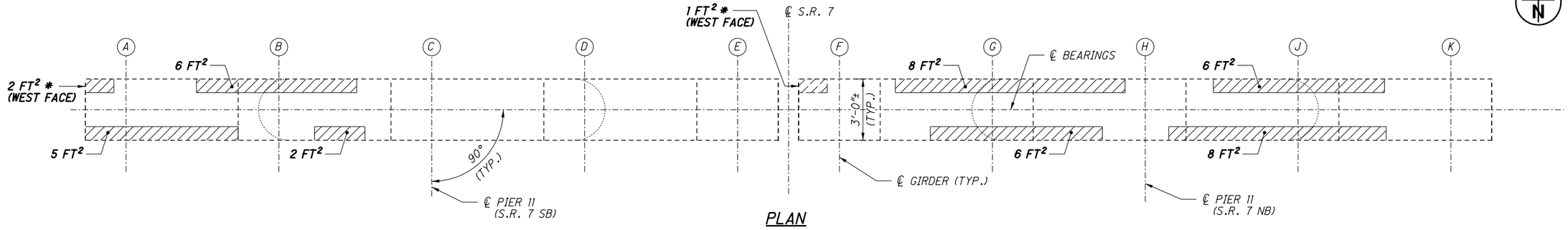

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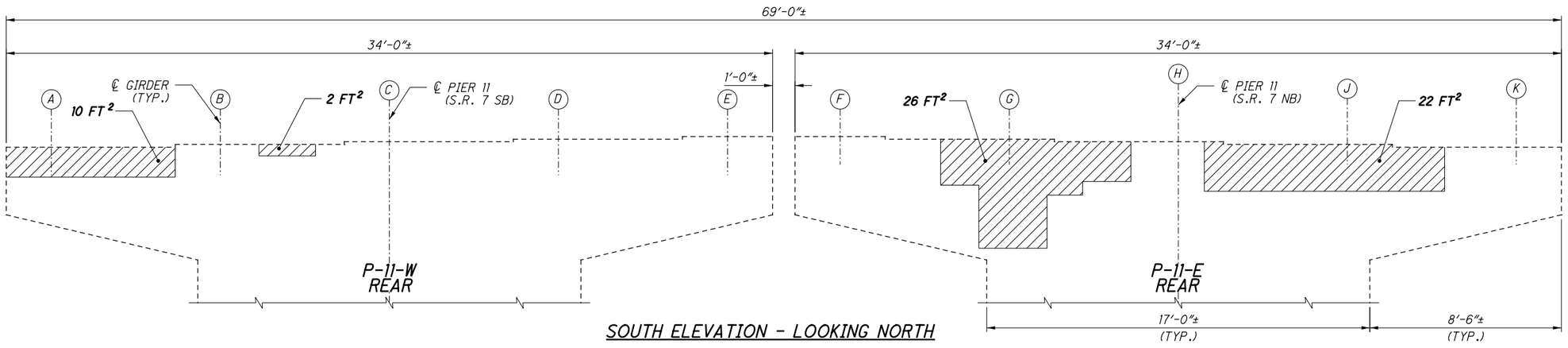
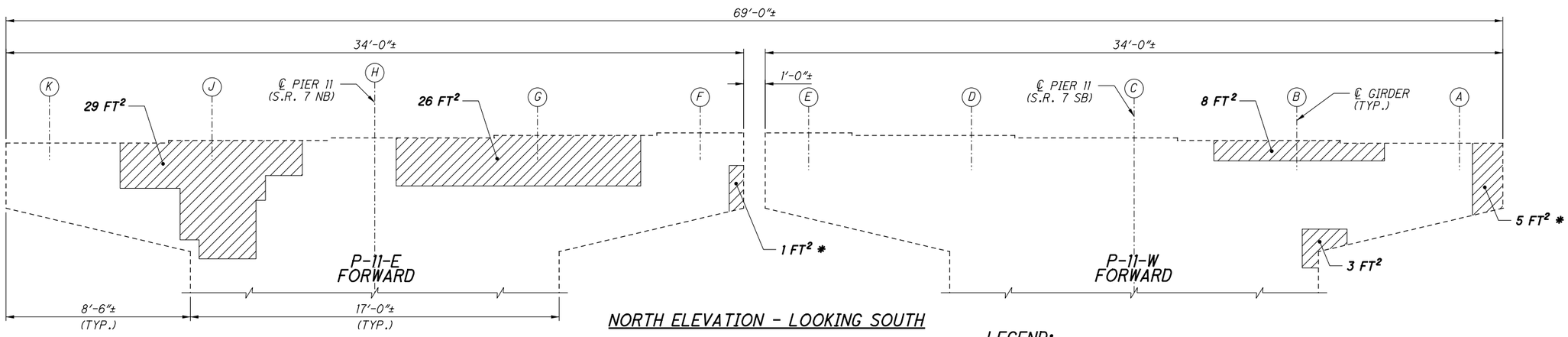


SOUTH ELEVATION - LOOKING NORTH



NORTH ELEVATION - LOOKING SOUTH

PIER CAP 11			
ITEM	ITEM DESCRIPTION	UNIT	QUANTITY
512	SEALING OF CONCRETE SURFACES (EPOXY-URETHANE)	SY	20
519	PATCHING CONCRETE STRUCTURE, AS PER PLAN	SF	176

LEGEND:

▨ = DENOTES AREA OF DETERIORATED CONCRETE TO BE PATCHED AS PER ITEM 519 - PATCHING CONCRETE STRUCTURES, AS PER PLAN.

* = SEE SHEET 8 / 8 FOR ADDITIONAL DETAILS AT END PATCH.

(_) = EXISTING GIRDER DESIGNATION

NOTES:

1. PROVIDE 1" DEEP SAW CUTS AROUND THE PERIMETER OF THE AREAS TO BE PATCHED.
2. SEAL ALL SURFACES THAT HAVE BEEN PATCHED WITH ITEM 512 - SEALING OF CONCRETE SURFACES (EPOXY-URETHANE). SURFACES OUTSIDE OF PATCHING AREAS ARE NOT TO BE RE-SEALED.

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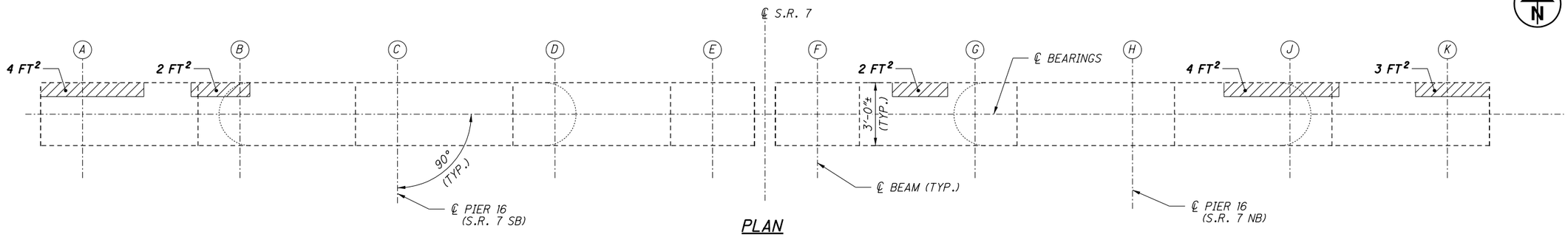
PIER CAP 11 PATCHING DETAILS
BRIDGE NO. BEL-7-1975
OVER US40, SR767 AND WHEELING CREEK

BEL-7-19.75
PID No. 105324

6 / 8

10 / 12



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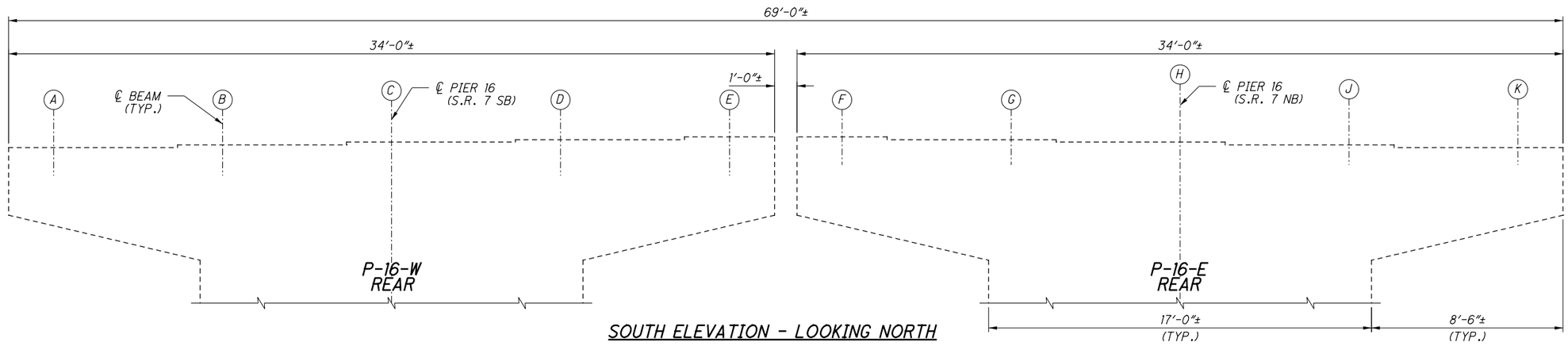
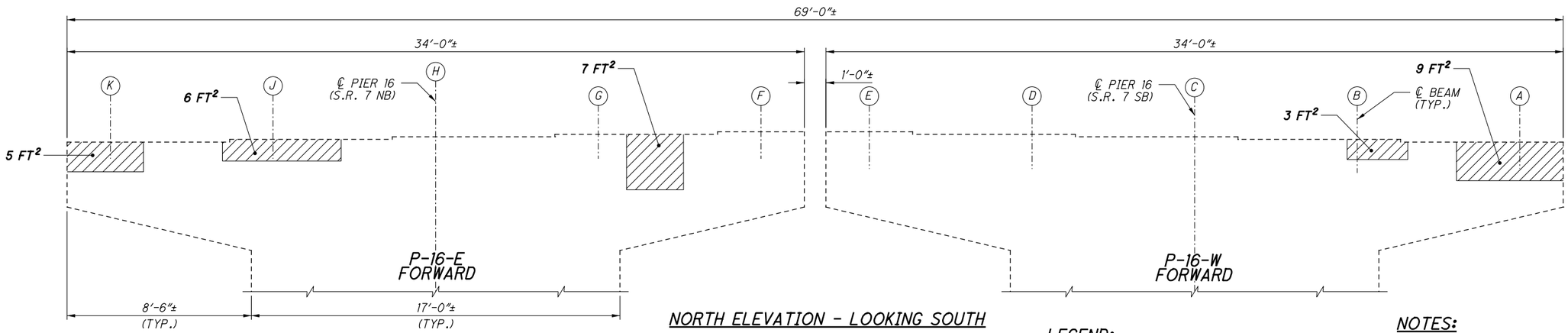


SOUTH ELEVATION - LOOKING NORTH



NORTH ELEVATION - LOOKING SOUTH

PIER CAP 16			
ITEM	ITEM DESCRIPTION	UNIT	QUANTITY
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519	PATCHING CONCRETE STRUCTURE, AS PER PLAN	SF	45

LEGEND:

= DENOTES AREA OF DETERIORATED CONCRETE TO BE PATCHED AS PER ITEM 519 - PATCHING CONCRETE STRUCTURES, AS PER PLAN.

(_) = EXISTING BEAM DESIGNATION

NOTES:

1. PROVIDE 1" DEEP SAW CUTS AROUND THE PERIMETER OF THE AREAS TO BE PATCHED.
2. SEAL ALL SURFACES THAT HAVE BEEN PATCHED WITH ITEM 512 - SEALING OF CONCRETE SURFACES (EPOXY-URETHANE). SURFACES OUTSIDE OF PATCHING AREAS ARE NOT TO BE RE-SEALED.

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DESIGNED	DRAWN	REVIEWED	DATE
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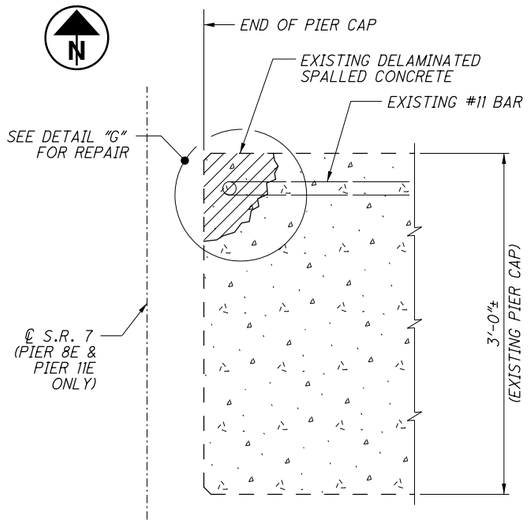
CHECKED	REVISED	STRUCTURE FILE NUMBER	
JHL		0700541	

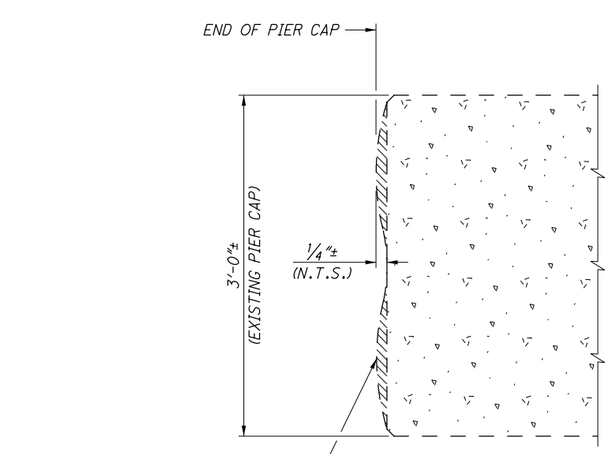
PIER CAP 16 PATCHING DETAILS
BRIDGE NO. BEL-7-1975
OVER US40, SR767 AND WHEELING CREEK

BEL-7-19.75
PID No. 105324



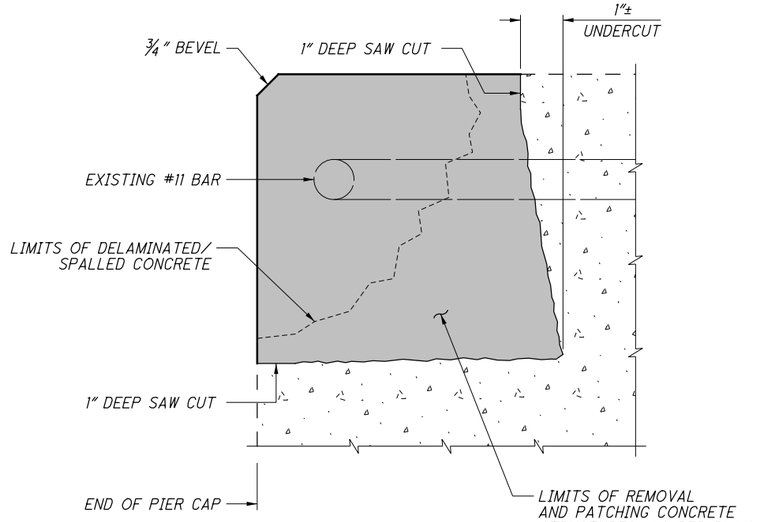
PIER CAP END PATCHING DETAIL - PLAN

(PIER 11W - FORWARD - WEST END - SHOWN,
PIER 11E - FORWARD - WEST END - SIMILAR
PIER 8E - FORWARD - WEST END - SIMILAR)



GRINDING DETAIL - PLAN

(PIER 11W - WEST END - SHOWN,
OTHERS MAY BE SIMILAR)



DETAIL "G"

(N.T.S.)

LEGEND:

N.T.S. = NOT TO SCALE

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DESIGNED	DRAWN	REVIEWED	DATE
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CHECKED	REVISED	STRUCTURE FILE NUMBER	
JHL		0700541	

PIER CAP REPAIR DETAILS
BRIDGE NO. BEL-7-1975
OVER US40, SR767 AND WHEELING CREEK

BEL-7-19.75
PID No. 105324

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12 / 12

Attachment C

BURGESS & NIPLE

5085 Reed Rd. | Columbus, OH 43220 | 614.459.2050

Mr. Waseem Khalifa, Ph.D., P.E.
Project Manager
Ohio Department of Transportation
District 11
2201 Reiser Avenue
New Philadelphia, OH 44663

Re: BEL-7-19.75 (PID 106237)
SR 7 & US 40/250
Interchange Evaluation Technical Memo

April 22, 2020

Dear Waseem,

B&N has completed a preliminary interchange evaluation study at SR 7 & US 40/US 250 in Bridgeport, Ohio. The goal of this study was to determine if a feasible interchange configuration exists that improved traffic operations and was consistent with the structure type study completed in March 2019. If an interchange configuration was determined to be feasible, this study also was to identify the impacts and potential construction cost of this improvement.

PROJECT OVERVIEW

The existing bridge carrying northbound and southbound SR 7 are viaduct-type structures crossing over several highways, Wheeling Creek, and various existing features. The SR 7 NB bridge is a twenty-two-span structure with a total length of 1,628 feet. The SR 7 SB bridge is a twenty-one-span structure with a total length of 1,628 feet. Nestled under these two bridges is an existing interchange between SR 7 and US 250 (Main Street) and US 250 (Cadiz Pike). This existing interchange is an unusual configuration where the northbound exit from SR 7 travels under the SR 7 bridge and intersects Main Street on the west side of the bridge. US 250 is split from Main Street in this interchange, and access to it from the interchange is made via a two-way roadway on the west side of SR 7 through a bi-directional ramp that also includes the SR 7 southbound exit to Main Street. Finally, a roadway connecting US 250 to the ramp to SR 7 northbound extends underneath the SR 7 bridges at the north end of its limits. The Ohio River parallels SR 7 east of the bridge. Two existing railroad lines are sandwiched between the SR 7 bridges and the Ohio River, immediately adjacent to the interchange. West of SR 7 are local businesses along Main Street and Lincoln Street, the north-south roadway south of Main Street that accommodates the northbound exit ramp. See ***Figure 1*** for an aerial view of the project site.

Figure 1 – Project Location

This study was initiated to evaluate if a different interchange configuration could be proposed that would reduce the overall structure length and improve the traffic operations without creating significant impact to the adjacent properties or infrastructure adjacent to the interchange. This memorandum is to summarize the assumptions, the anticipated traffic operations and geometric features of various interchange configurations that were evaluated, potential structure impacts, and preliminary construction costs for the viable ramp configurations.

Appendix A shows the conceptual schematic plan of the two interchange configurations that performed the best from a traffic operations perspective. ***Appendix B*** shows existing traffic counts. ***Appendix C*** shows a draft bridge pier layout for the single (circular) roundabout alternative since this was the only alternative that was feasible considering constructability and other factors. Finally, ***Appendix D*** shows the preliminary construction cost estimate for the bridge replacement project including the single roundabout interchange configuration as compared to the bridge replacement without any traffic improvements.

ASSUMPTIONS

The following items were assumed during the development of the interchange configurations for this study:

- The existing SR 7 bridges will be replaced, and pier locations could be shifted as necessary to accommodate a new interchange configuration.
- Full access between SR 7, Main Street, and US 250 would be provided at this location.
- The existing Main Street bridge over the Ohio River would not be impacted with the alternatives.
- Traffic analysis was conducted using existing traffic volumes based on existing traffic counts taken in 2019.
- Preliminary construction cost estimate for the new SR 7 bridge was based on the square foot of bridge deck costs used in the March 2019 Structure Type Study developed by B&N and inflated to account for the complexity of the new portion of the structure over the roundabout.

DESCRIPTION OF ALTERNATIVES

Initial interchange configurations were developed with three primary objectives. The first was to eliminate one or both of the following mainline SR 7 bridges:

- SR 7 over the northbound exit ramp to Main Street/US 250 (southern edge of the existing bridge)
- SR 7 over US 250 (northern edge of the existing bridge)

The second objective was to minimize additional widening outside of the existing interchange, especially Main Street through downtown Bridgeport and the Main Street bridge over the Ohio River. The third objective was to achieve traffic operations for the new interchange configurations that meet Level of Service (LOS) D or better and volume-to-capacity (v/c) ratios less than 0.90.

Existing Condition Capacity Analysis

The following intersections were included in the traffic analysis:

- US 250 & Main Street/Lincoln Avenue
- US 250/Main Street and NB SR 7

12-hour (6am to 6pm) turning movement traffic counts were collected at the study intersections on October 3, 2019. The AM peak hour for the study was identified as 7:15am to 8:15am and the PM peak hour was identified as 4:45pm to 5:45pm. Copies of the traffic counts and exhibits showing the existing traffic counts are included in **Appendix B**. Reviewing the existing traffic volumes showed that the PM peak hour volumes are equal or higher than the AM peak hour for all movements; therefore, capacity analysis was only conducted for the 2019 PM peak hour. Capacity analysis was conducted using Synchro software. **Table 1** shows the results of the capacity analysis for the study intersections for the 2019 Existing condition.

	2019 PM Existing		
	LOS	**Delay (sec/veh)**	**V/C**
US 250 & Main Street/Lincoln Avenue			
NB Approach	E	64.2	0.80
SB Approach	D	42.9	0.95
EB Approach	E	56.1	0.96
WB Approach	E	63.1	0.80
Overall Intersection	**D**	**52.5**	
US 250/Main Street & NB SR 7 On-Ramp (unsignalized)			
EB Approach	A	0.0	0.46
WB Approach	A	0.0	0.31

Table 1 - 2019 Existing Intersection Capacity Analysis

The existing condition for the intersection at US 250 & Main Street/Lincoln Avenue is operating at capacity. Level of service for three of the four approaches to the intersection are at LOS E and volume-to-capacity ratios are nearly 1.0. The intersection of US 250/Main Street & NB SR 7 is an unsignalized intersection and no vehicles traveling through the intersection are required to stop or yield to other vehicles. The delay for this intersection is essentially zero and the intersection operates very well.

This information became the starting point for developing various proposed interchange configurations. This study began with the assumption that the geometrics would drive the solution. What was determined very early in the process was that the traffic operations drove the solution away from most of the simple configurations developed and that geometrics and the resulting impacts were the defining criteria for later configurations developed that solved the traffic operation concern. These configurations were categorized into three basic groups based on the order they were developed to tell the story of how we arrived at the final configuration that could be advanced to further development.

Group 1 – Diamond Alternatives

This group of alternatives relocated the SR 7 NB exit ramp to Lincoln Avenue to the existing intersection of Main Street and the SR 7 NB entrance ramp. Three options were evaluated:

- Tight Diamond
- Tight Diamond with U-turn
- Paraflow Interchange

All these options placed an intersection between the SR 7 bridge and the existing railroad and Main Street bridge over the Ohio River. The **Tight Diamond** created two short bridges along SR 7 and brought a diamond ramp adjacent to the railroad right-of-way on the east side of SR 7, providing access from SR 7 NB to Main Street. The Main Street to SR 7 SB entrance ramp diverged from Lincoln Avenue north of the existing diverge and tied into the existing ramp prior to accessing SR 7. North of Main Street, the ramp to SR 7 NB maintained the existing diamond ramp configuration. The ramp from SR 7 SB to Main Street followed the existing ramp alignment that met the existing intersection with US 250 before continuing to SR 7 NB. US 250 traffic wishing to access SR 7 NB would pass under SR 7 via a short bridge and turn left at the adjacent intersection. Traffic from SR 7 NB or Main Street wishing to

access US 250 would utilize the roadway east of SR 7, then turn left and travel under that same short bridge. This maintained a one-way couplet on each side of SR 7. See ***Figure 2*** for a conceptual schematic of this interchange configuration.

Figure 2 – Conceptual Schematic of the Tight Diamond Interchange Configuration

To further reduce the number of proposed bridges along SR 7, a **Tight Diamond with U-Turn** configuration was developed. This alternative consolidated to a single bridge that spanned the creek, Main Street, and a U-turn maneuver that maintained connection to US 250. South of Main Street, the ramp configuration matched what was included in the Tight Diamond alternative. North of Main Street, the ramp to SR 7 NB maintained the existing diamond ramp configuration. The ramp from SR 7 SB to Main Street followed the existing ramp alignment that met the existing intersection with US 250, which was revised to a simple two-phase signal operation that only allowed for right turns from US 250 to travel southbound on Main Street. US 250 traffic wishing to access SR 7 NB would turn right and travel through the U-turn maneuver to loop around to access the existing ramp to SR 7 NB. See ***Figure 3*** for a conceptual schematic of this interchange configuration.

Figure 3 – Conceptual Schematic of the Tight Diamond with U-turn Interchange Configuration

The additional approach added to the intersection along Main Street east of SR 7 required it to be signalized. In addition, by bringing the SR 7 NB exit ramp to Main Street, traffic that uses the exit ramp and Howard Street to access Bridgeport in the existing condition would now use Main Street to access Bridgeport. This creates additional traffic at the already congested intersection of US 250 & Main Street/Lincoln Avenue. While the overall operation varies between alternatives, all alternatives in this group operate at LOS F with v/c ratios greater than 1.0. The cause of this poor operation is the short spacing between the intersections on either side of SR 7 and the new traffic signal at the NB SR 7 ramp terminal intersection. The spacing between the intersections can only accommodate three or four vehicles. Once this is full, no additional vehicles can enter from the upstream intersection. The intersection of US 250 & Main Street/Lincoln Avenue has a very heavy southbound left turn volume and eastbound through volume. This creates a steady stream of traffic leaving the intersection in the eastbound direction. However, it is not possible to provide a continuous eastbound green signal indication at the NB SR 7 ramp terminal intersection. This results in queues at the Main Street/Lincoln Avenue intersection that continually build during the PM peak hour. Likewise, the northbound left and westbound through movements at the NB SR 7 ramp terminal intersection create a steady stream of traffic leaving the intersection in the westbound direction and it is not possible to provide a continuous westbound green signal at the Main Street/Lincoln Avenue intersection. This creates queues at the NB SR 7 intersection that continually build during the PM peak hour. An innovative **Paraflow Interchange** concept, which crosses the left turns west of SR 7 similar to a Diverging Diamond Interchange (DDI) crossover intersection to the opposite side of the westbound through movement, was also evaluated. This would allow the Main Street eastbound traffic wishing to access SR 7 NB to cross over and then slip onto the NB entrance ramp without conflicting with the westbound through movement at the eastern intersection. Even in this scenario, there isn't enough green time we can allocate to the westbound through to make this a viable solution. ***Figure 4*** shows a screenshot of the SimTraffic analysis for the Tight Diamond alternative. Similar queues will develop for the Tight Diamond with U-turn and the Paraflow Interchange alternatives.

Figure 4 – Tight Diamond Queues

Group 2 – Innovative Alternatives

Given the traffic operational issues observed with the Group 1 alternatives, additional options were evaluated. These were intended to be innovative alternatives designed to accommodate higher traffic volumes by reducing the number of intersections or eliminating specific movements at intersections to simplify their operation. Three options were evaluated:

- Diverging Diamond Interchange (DDI)
- Single Point Urban Interchange (SPUI)
- Counterclockwise Rotary

All these options required greater footprint to implement, which resulted in significant impacts to the adjacent properties, railroad, and Main Street bridge over the Ohio River. See ***Figure 5*** and ***Figure 6*** for images of a typical DDI and SPUI configuration.

Figure 5 – Image of a typical DDI

Figure 6 – Image of a typical SPUI

The **DDI** followed the same general changes made in the Group 1 alternatives but converted the intersections of US 250 & Main Street/Lincoln Avenue and US 250/Main Street & NB SR 7 to a DDI. For this location, the DDI is slightly different than a typical one because northbound and southbound through movements need to be provided through the crossover intersections. This creates a third signal phase compared to the two phases at a traditional DDI. Operationally, the DDI performs similar to the Tight Diamond alternatives. It's not possible to provide enough green time at the downstream intersection to avoid queues at the upstream intersection. The intersections are over capacity and queues will build on the approaches to the intersections during the PM peak hour.

By combining the two intersections with SR 7 into a single intersection, the **SPUI** alternative eliminates the closely spaced signals that are causing problems with the traditional diamond interchange options. In order to achieve v/c ratios less than 1.0, a significant amount of widening is required at the interchange. Dual left turn lanes will be required for the eastbound and westbound approaches resulting in five lanes on Main Street under SR 7. In addition, the bridge over the Ohio River will need widened as will Main Street through downtown Bridgeport. With this widening, the interchange will operate at LOS E with v/c ratios of 0.91. This is equivalent to the operation of the existing condition. The expense of the SPUI will provide little benefit over the existing condition.

The final option in this group that was evaluated looked to utilize the existing infrastructure but create one-way roadways that form a circle around the interchange. This concept, the **Counterclockwise Rotary**, converted Main Street to one-way eastbound under SR 7, then utilized the roadway connecting US 250 to the east side of SR 7 as a one-way westbound movement. The two ramps on each side of SR 7 acted as one-way couplets, with the eastern roadway becoming one-way northbound and the western roadway becoming one-way southbound. This alternative attempts to eliminate some of the issues created with two closely spaced traffic signals. Eliminating the westbound movement between the intersections reduces the queues from the traditional diamond alternatives. However, there are still some queues related to the two signals. The intersections will operate at LOS E with v/c ratios approaching 1.0. While this is close to meeting the operational goals, it is essentially the same operation as the existing condition. It will operate at capacity using 2019 traffic volumes. See ***Figure 7*** for anticipated lane usage for the Counterclockwise Rotary alternative.

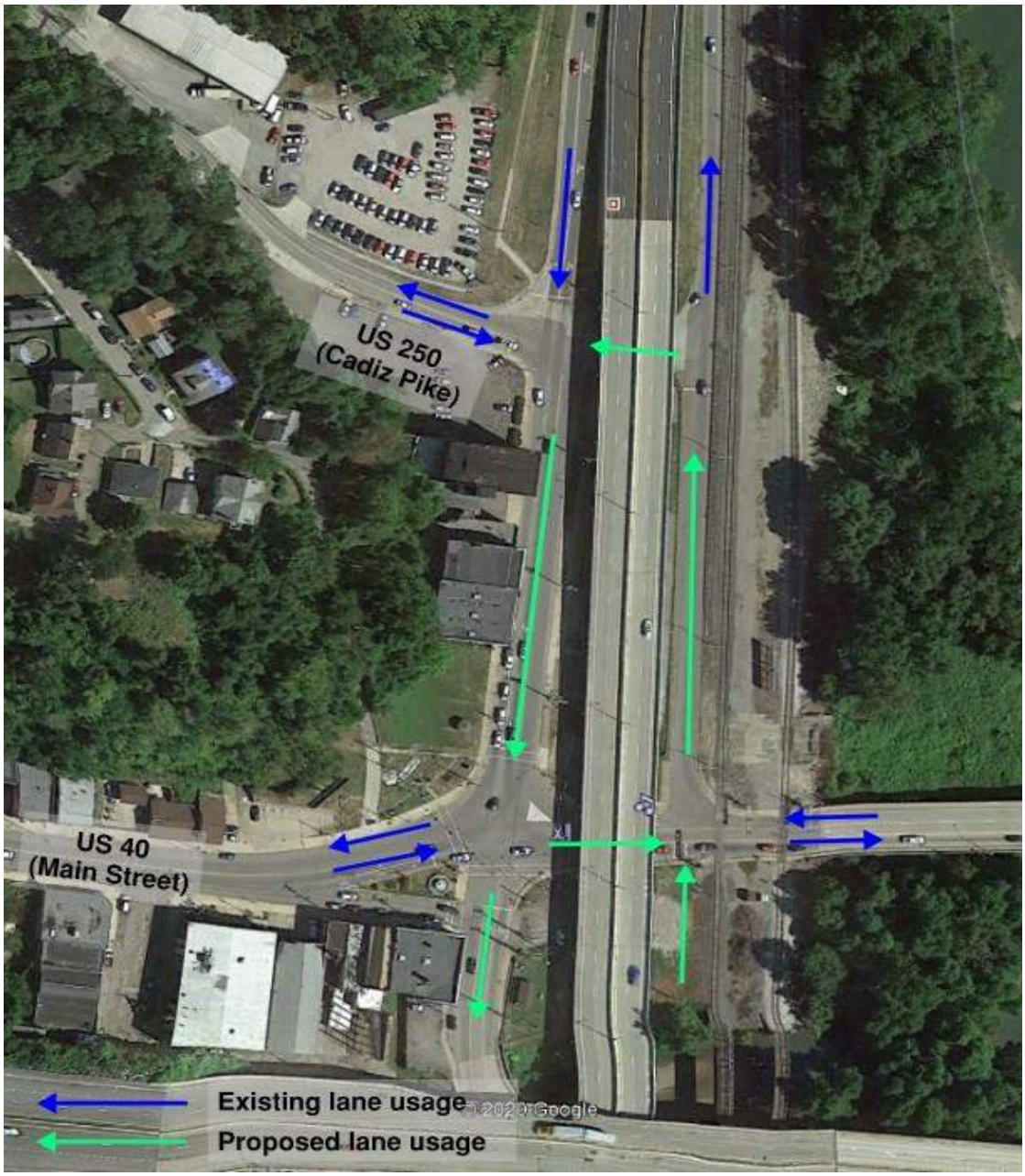


Figure 7 – Proposed lane usage for the Counterclockwise Rotary alternative

Group 3 – Roundabout Alternatives

This final group of alternatives was developed to identify low-impact options that could have latent capacity by modifying the intersection control to roundabouts instead of signalized intersections. Two options were evaluated:

- Teardrop Interchange
- Single Roundabout

Refer to ***Appendix A*** for a conceptual plan exhibit of the two Roundabout Alternatives. The **Teardrop Interchange** followed the same general changes made in the Group 1 alternatives but converted the traffic signals at the US 250 & Main Street/Lincoln Avenue and the US 250/Main Street & SR 7 NB ramp terminal intersections to roundabouts. The teardrop configuration eliminates the storage issues between the two intersections since traffic on these approaches does not have to yield to anyone and can enter the roundabouts as free-flowing movements. The capacity results for the Teardrop alternative are shown in **Table 2**. Both intersections will operate at LOS B and the highest v/c ratio is 0.90 with most approaches less than 0.75. However, this alternative showed significant impacts to the existing bridge over the river, the railroad crossings, and the land use on the west side of SR 7. This option also complicated the proposed SR 7 structures over Main Street due to the proximity of the roundabouts to the bridge. To avoid the impacts to the bridge over the Ohio River, the eastern roundabout had to be shifted west and would sit underneath the SR 7 bridge structures. This introduced challenges with pier placement, use of straddle bents, and vertical clearance concerns due to the long spans necessary to get over the roundabout.

While it was determined that this option functioned well operationally, it required too many impacts and introduced a vertical clearance safety concern that made this option infeasible to advance. Here is a summary of the concerns that this option has that made it infeasible to advance; Refer to Figure 8.

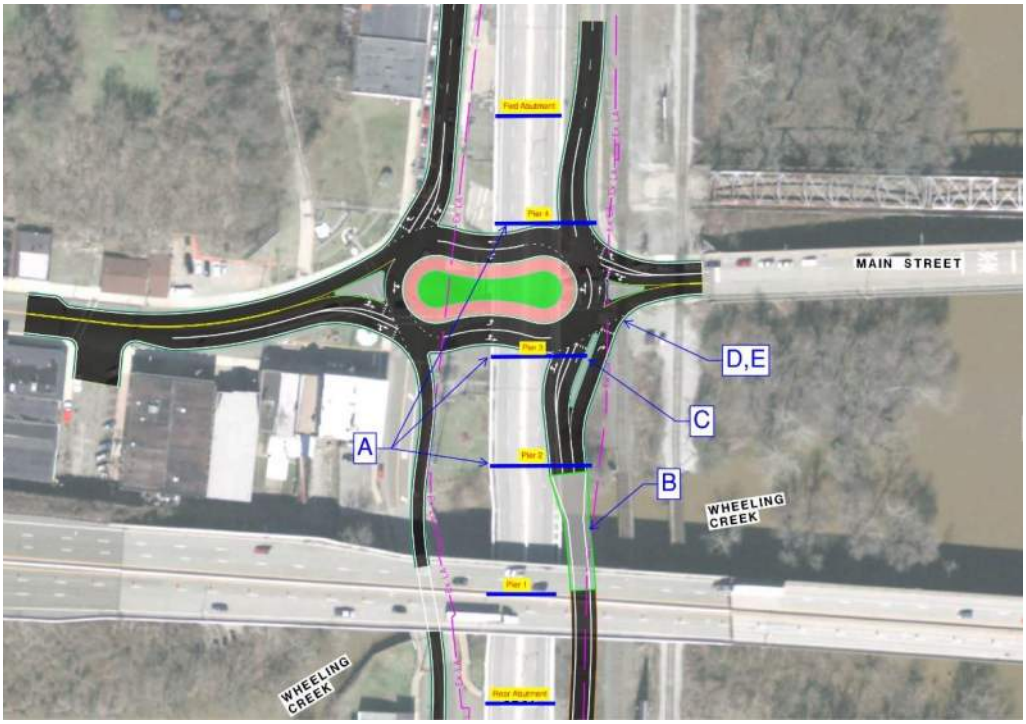


Figure 8 – Deficiencies of Teardrop Layout

A. The structure depth, especially at Pier 2, and likely at Pier 3, considering the needed profiles, bridge spans, and straddle bent pier cap depth, would not permit enough vertical clearance over the ramp; current estimate shows this proposed vertical clearance to be less than 12 feet.
B. This solution requires a variable width and likely expensive bridge over Wheeling Creek, with an added pier in the creek
C. A straddle bent pier column at Pier 2 would need to be placed in an undesirable location in the ramp banana island, obscuring visibility and introducing a safety concern
D. This alternative requires encroachment onto the railroad property
E. The feasibility of providing suitable railroad crossing gates looks questionable

For these reasons, the Teardrop interchange was eliminated from further consideration.

The **Single Roundabout** alternative retains the existing ramp configuration but changes the signalized intersection at US 250 & Main Street/Lincoln Avenue to a roundabout. The capacity results for the Single Roundabout alternative are shown in **Table 2**. For the 2019 PM peak, the intersection of US 250 & Main Street/Lincoln Avenue is expected to operate at LOS A with a maximum v/c ratio of 0.54. This is a significant improvement over the existing condition. To test the roundabouts ability to accommodate additional traffic, the existing traffic volumes were increased by 40%. Even with this increase, the intersection will operate at LOS C and the maximum v/c ratio would be 0.97. Should this occur, the lane use for the eastbound approach can be adjusted to accommodate dual left turn lanes. This would allow the intersection to perform well with an additional 15% increase in volumes.

	2019 PM Teardrop			2019 PM Single Roundabout			2019 PM Single Roundabout +40%		
	LOS	**Delay (sec/veh)**	**V/C**	**LOS**	**Delay (sec/veh)**	**V/C**	**LOS**	**Delay (sec/veh)**	**V/C**
US 250 & Main Street/Lincoln Avenue									
NB Approach	N/A	N/A	N/A	B	11.5	0.37	C	31.1	0.72
SB Approach	B	16.9	0.69	A	8.4	0.49	B	16.1	0.76
EB Approach	B	10.4	0.43	B	11.1	0.54	D	43.0	0.97
WB Approach	A	5.5	0.38	A	9.0	0.39	B	19.1	0.68
Overall Intersection	**B**	**12.0**		**A**	**9.7**		**C**	**25.5**	
US 250/Main Street & NB SR 7 On-Ramp									
NB Approach	C	21.7	0.75	N/A	N/A	N/A	N/A	N/A	N/A
EB Approach	A	6.3	0.45	A	0.0	0.46	A	0.0	0.65
WB Approach	C	34.4	0.90	A	0.0	0.31	A	0.0	0.44
Overall Intersection	**B**	**18.9**							

Table 2 – 2019 Roundabout Alternatives Capacity Analysis

This option not only performs well operationally but shows considerably less impacts than the Teardrop option. By utilizing the existing intersection on the east side of SR 7, the interaction with the railroad, including the placement of gates, is unchanged from the existing. When a train event occurs, only the eastbound departure and the westbound approach to the roundabout are impacted, similar to what is the case today. This roundabout is more appropriately sized, using an Inscribed Circle Diameter (ICD) of 160 feet, rather than the 130 feet that was proposed for the Teardrop. Like the Teardrop, this places some of the roundabout under the proposed SR 7 bridges, but with more room on the west side, the roundabout can be shifted out from under the bridge more so than in the teardrop alternative. The result is a bridge design and pier location that should better accommodate the concept and obtain the required vertical clearances. This concept would utilize straddle bents with pier columns, but the pier columns can be placed in more favorable locations within the roundabout footprint, either in the center island or the splitter islands, where there is more room to protect them and allow for visibility for the key traffic movements. Refer to ***Appendix C*** for the conceptual bridge pier locations for this interchange configuration.

PRELIMINARY CONSTRUCTION COST ESTIMATE

Given that through this study, only one option, the Single Roundabout, appeared to be a viable solution that met the goals of the study, a preliminary construction cost estimate was developed only for that option. The big-ticket items, such as pavement areas and bridge areas were quantified using CADD areas. Other items, such as drainage, earthwork, and MOT, were reported as a raw percentage of the total construction cost due to the lack of detailed design completed at this time. The cost estimate utilized 2019 bid tabs for unit costs, and no inflation was applied to the final cost estimate number, leaving the costs in 2019 dollars. A 20% contingency was applied to the construction cost subtotal due to the level of uncertainty that still exists with the design. See ***Appendix D*** for the preliminary construction cost estimate for the single roundabout option as compared to the cost estimate for just the SR 7 bridge replacement that was studied back in March 2019.

CONCLUSIONS AND NEXT STEPS

In summary, this study has shown that it could be feasible to implement a roundabout at the west ramp terminal intersection to improve traffic operations at the SR 7 & Main Street/US 250 interchange. Further investigation appending this study may be necessary to confirm the concept and determine if the impacts are palatable. Here are our recommendations for next steps:

1. Obtain Certified Traffic and complete the analysis to confirm the single roundabout option using the appropriate traffic growth projections.
2. Revise the Type Study that was completed in March 2019 to include the changes to the ramp configuration and inclusion of the roundabout.
3. Obtain detailed survey to determine existing and proposed vertical geometry of the SR 7 bridges and the roundabout to confirm the required vertical clearance can be achieved.
4. Confirm utilities in the project area to ensure no additional utilities beyond a couple of fire hydrants needs to be relocated.

If you have any questions or need additional information related to our analysis, please do not hesitate to contact us.

Sincerely,

Brian Toombs, PE
Project Manager

Appendices

Appendix A
Conceptual Alternatives - Roundabouts

N

0 25 50 100
HORIZONTAL SCALE IN FEET

CALCULATED

CHECKED

SR-7/MAIN STREET
ALTERNATIVE 1 - ROUNDABOUT

BEL-7

1
2

SR-7

MAIN STREET

MAIN STREET

OHIO RIVER

WHEELING CREEK

IR-70

WHEELING CREEK

SR-7

A-2

HORIZONTAL SCALE IN FEET
0 25 50 100

CALCULATED

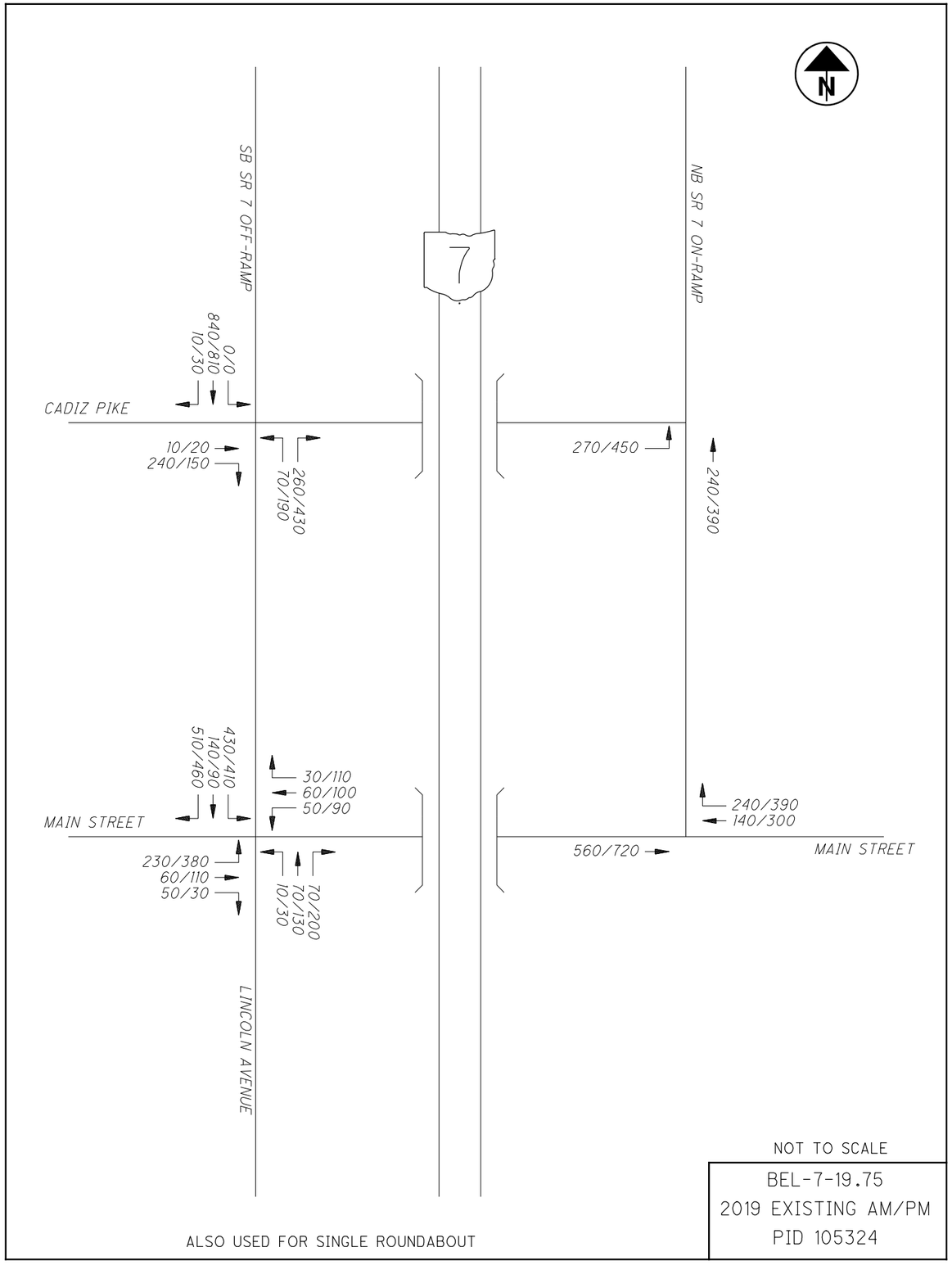
CHECKED

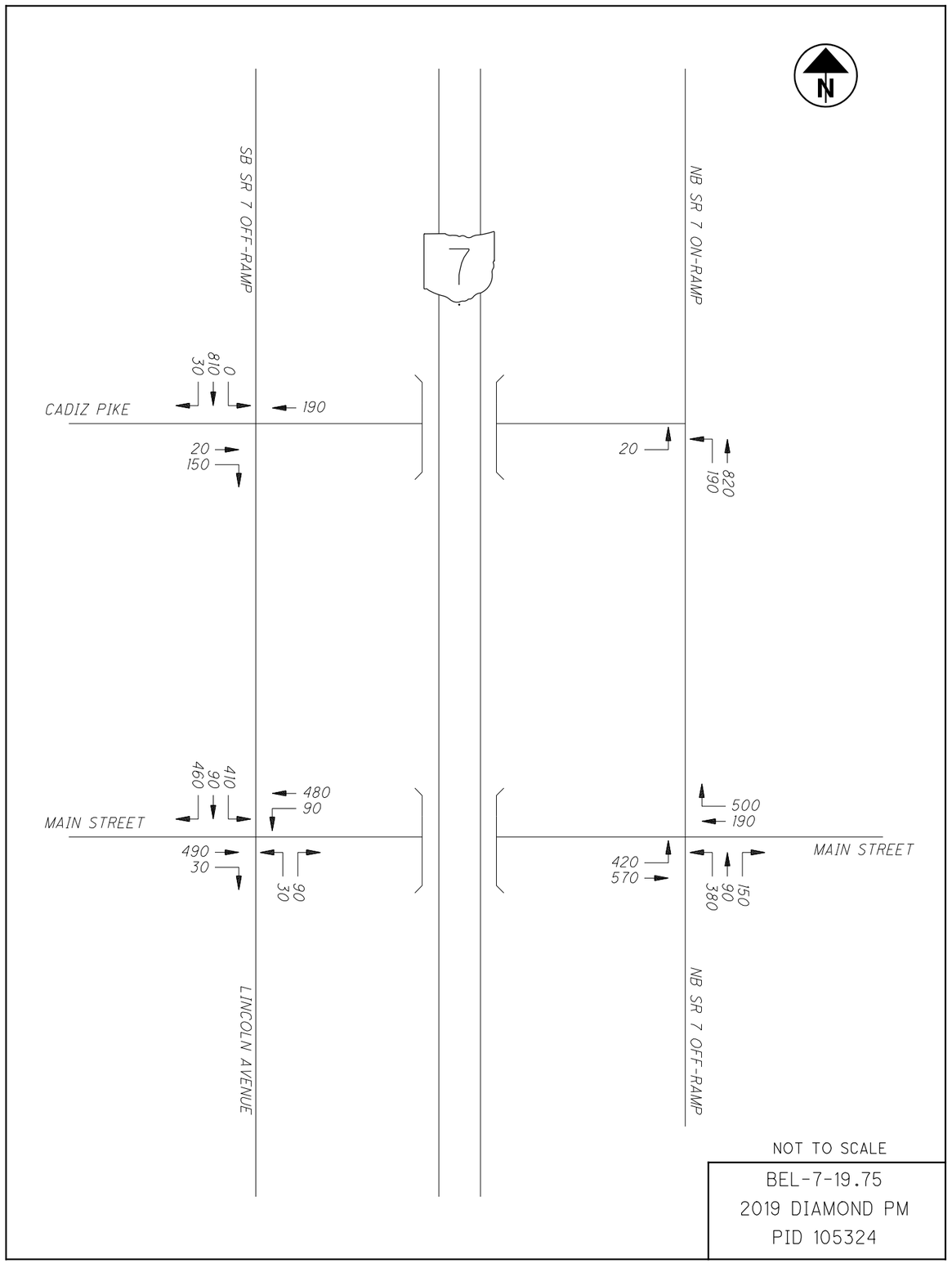
SR-7/MAIN STREET
ALTERNATIVE 2 - TEARDROP INTERCHANGE

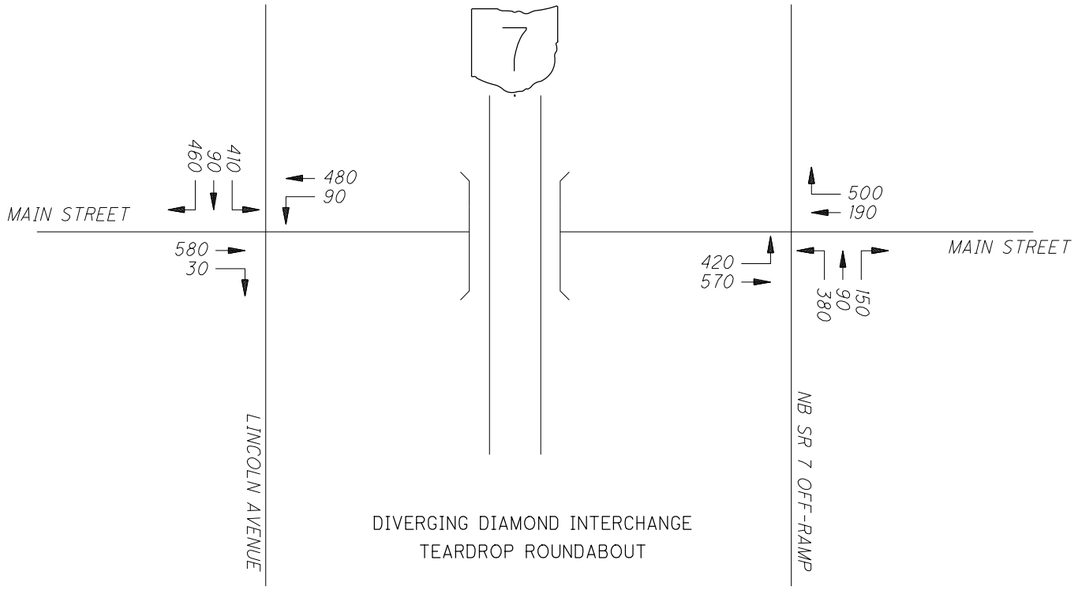
BEL-7

2/2

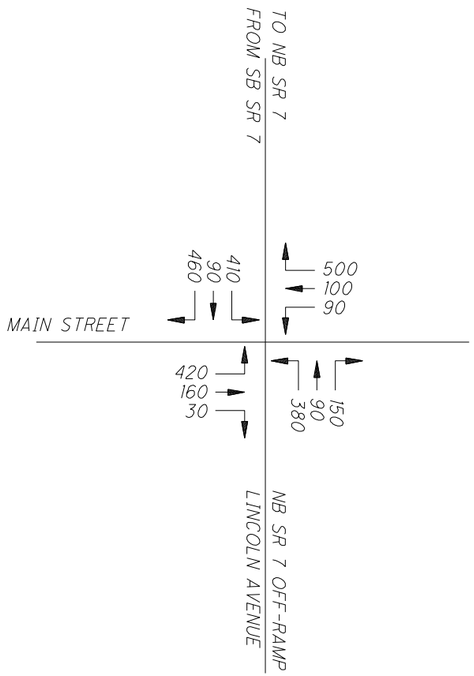
Appendix B
2019 Traffic Counts and Volumes


N
SB SR 7 OFF-RAMP
NB SR 7 ON-RAMP
7
CADIZ PIKE
0/0
840/810
10/30
10/20
240/150
260/430
70/190
270/450
240/390
MAIN STREET
430/410
140/90
510/460
30/110
60/100
50/90
230/380
60/110
50/30
70/200
70/130
10/30
240/390
140/300
560/720
MAIN STREET
LINCOLN AVENUE
ALSO USED FOR SINGLE ROUNDABOUT
NOT TO SCALE
BEL-7-19.75
2019 EXISTING AM/PM
PID 105324


N
SB SR 7 OFF-RAMP
NB SR 7 ON-RAMP
7
CADIZ PIKE
0
810
30
190
20
150
20
820
190
MAIN STREET
410
90
460
480
90
490
30
90
30
500
190
420
570
150
90
380
MAIN STREET
LINCOLN AVENUE
NB SR 7 OFF-RAMP
NOT TO SCALE
BEL-7-19.75
2019 DIAMOND PM
PID 105324



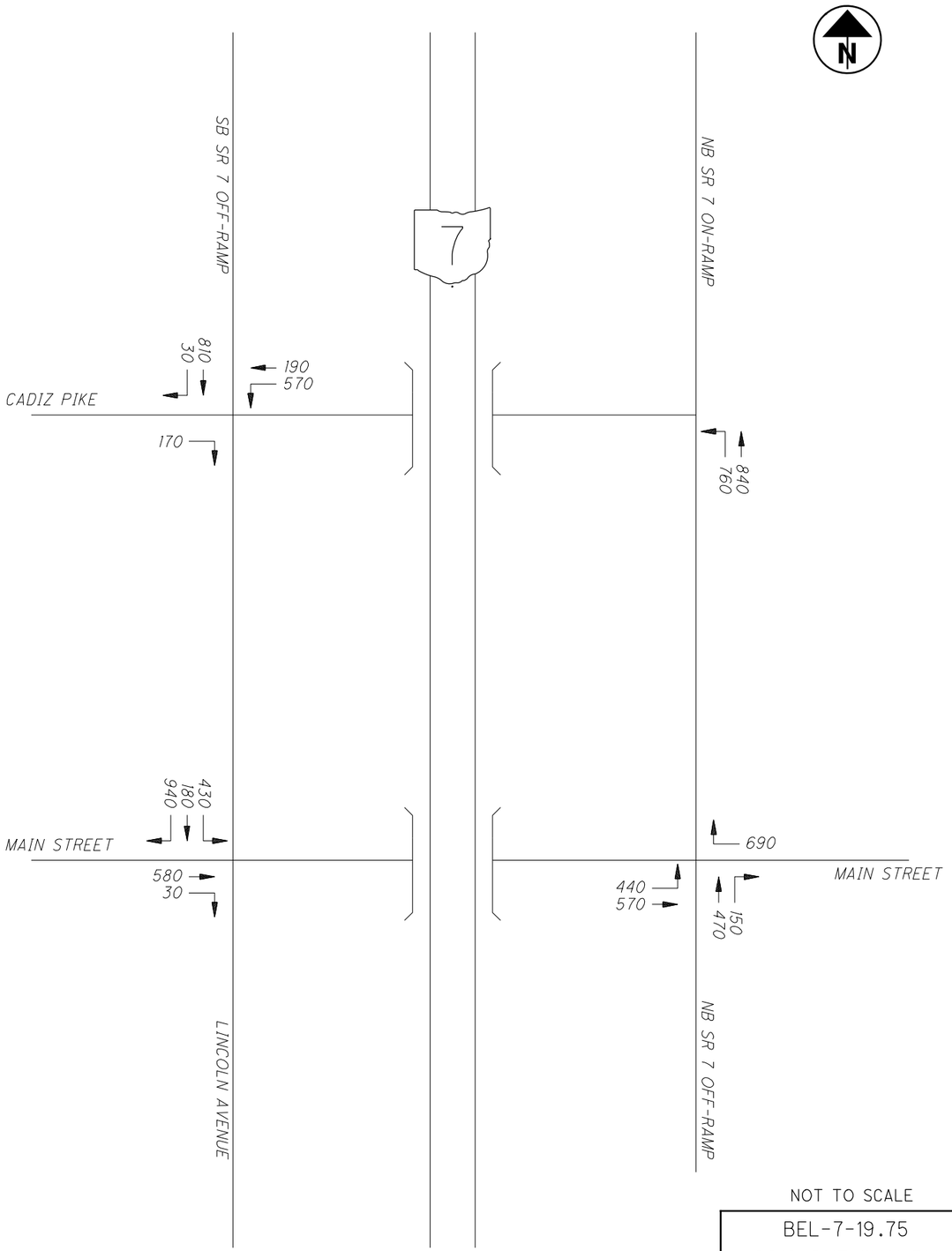
DIVERGING DIAMOND INTERCHANGE
TEARDROP ROUNDABOUT



SINGLE POINT URBAN INTERCHANGE

NOT TO SCALE

BEL-7-19.75
2019 DDI / SPUI PM
PID 105324



NOT TO SCALE

BEL-7-19.75
2019 ONE-WAY PM
PID 105324

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80 Degrees - Sunny
Schools in Session

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Start Date : 10/3/2019
Page No : 1

Groups Printed- Cars - Buses - Trucks

	SR7 From North					Main Street From East					Lincoln Street From South					Main Street From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
06:00 AM	59	13	95	0	167	5	5	10	0	20	6	4	1	0	11	2	9	57	0	68	266
06:15 AM	64	24	96	0	184	5	4	8	0	17	15	14	2	0	31	7	4	66	0	77	309
06:30 AM	100	30	109	0	239	11	11	10	0	32	16	15	1	0	32	3	8	61	0	72	375
06:45 AM	96	20	121	0	237	12	7	9	0	28	14	11	0	0	25	8	6	59	0	73	363
Total	319	87	421	0	827	33	27	37	0	97	51	44	4	0	99	20	27	243	0	290	1313
07:00 AM	96	29	111	0	236	4	6	14	0	24	13	13	5	0	31	3	10	48	0	61	352
07:15 AM	131	28	136	0	295	7	11	6	0	24	19	12	1	0	32	7	18	46	0	71	422
07:30 AM	137	37	95	0	269	6	16	13	0	35	15	19	2	0	36	19	11	45	0	75	415
07:45 AM	125	46	94	0	265	12	18	16	0	46	19	22	5	0	46	13	16	69	0	98	455
Total	489	140	436	0	1065	29	51	49	0	129	66	66	13	0	145	42	55	208	0	305	1644
08:00 AM	118	26	105	0	249	9	9	18	0	36	17	16	3	0	36	7	13	65	0	85	406
08:15 AM	101	16	107	0	224	8	11	17	0	36	12	3	3	0	18	6	8	76	0	90	368
08:30 AM	97	13	121	0	231	5	23	17	0	45	15	19	7	0	41	12	12	64	0	88	405
08:45 AM	108	33	107	0	248	7	15	13	0	35	12	14	3	0	29	4	16	60	0	80	392
Total	424	88	440	0	952	29	58	65	0	152	56	52	16	0	124	29	49	265	0	343	1571
09:00 AM	70	16	84	0	170	8	9	13	0	30	21	14	2	0	37	8	16	54	0	78	315
09:15 AM	87	17	98	0	202	8	11	14	0	33	14	12	4	0	30	10	16	68	0	94	359
09:30 AM	111	21	99	0	231	11	21	11	0	43	18	16	10	0	44	7	18	55	0	80	398
09:45 AM	93	11	87	0	191	9	22	21	0	52	21	14	1	0	36	8	18	65	0	91	370
Total	361	65	368	0	794	36	63	59	0	158	74	56	17	0	147	33	68	242	0	343	1442
10:00 AM	109	16	80	1	206	11	19	10	0	40	23	8	5	0	36	11	21	78	0	110	392
10:15 AM	114	13	68	0	195	9	18	19	0	46	34	22	5	0	61	10	23	74	0	107	409
10:30 AM	120	10	91	0	221	10	19	21	0	50	29	9	9	0	47	8	28	58	0	94	412
10:45 AM	115	14	87	0	216	13	32	22	0	67	20	21	5	0	46	14	23	71	0	108	437
Total	458	53	326	1	838	43	88	72	0	203	106	60	24	0	190	43	95	281	0	419	1650
11:00 AM	90	10	69	0	169	10	20	14	0	44	29	13	5	0	47	3	30	83	0	116	376
11:15 AM	95	14	64	0	173	14	38	18	0	70	30	20	7	0	57	10	25	76	0	111	411
11:30 AM	127	20	86	0	233	10	35	16	0	61	24	12	7	0	43	7	36	90	0	133	470
11:45 AM	86	15	72	0	173	6	22	22	0	50	31	18	1	0	50	13	29	81	0	123	396
Total	398	59	291	0	748	40	115	70	0	225	114	63	20	0	197	33	120	330	0	483	1653
12:00 PM	94	17	86	0	197	8	27	23	0	58	20	13	5	0	38	12	28	78	0	118	411
12:15 PM	78	19	67	0	164	8	23	16	0	47	27	15	4	0	46	13	34	81	0	128	385
12:30 PM	94	23	96	0	213	14	28	10	0	52	20	24	5	0	49	8	41	78	0	127	441
12:45 PM	96	18	87	0	201	16	28	18	0	62	22	16	6	0	44	14	21	94	0	129	436
Total	362	77	336	0	775	46	106	67	0	219	89	68	20	0	177	47	124	331	0	502	1673
01:00 PM	94	21	72	0	187	7	22	19	0	48	27	26	5	0	58	10	25	113	0	148	441
01:15 PM	103	23	86	0	212	10	26	28	0	64	36	26	7	0	69	12	31	81	0	124	469
01:30 PM	104	16	88	0	208	13	25	18	0	56	25	11	5	0	41	10	30	84	0	124	429
01:45 PM	108	9	87	0	204	13	18	13	0	44	36	14	9	0	59	6	29	76	0	111	418
Total	409	69	333	0	811	43	91	78	0	212	124	77	26	0	227	38	115	354	0	507	1757
02:00 PM	111	14	87	0	212	10	34	25	0	69	27	21	5	0	53	12	45	80	0	137	471
02:15 PM	113	17	82	0	212	17	26	21	0	64	21	18	5	0	44	11	30	86	0	127	447
02:30 PM	111	22	93	0	226	22	20	10	0	52	30	19	7	0	56	12	26	101	0	139	473
02:45 PM	109	12	91	0	212	19	21	19	0	59	27	19	6	0	52	4	18	96	0	118	441
Total	444	65	353	0	862	68	101	75	0	244	105	77	23	0	205	39	119	363	0	521	1832

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Groups Printed- Cars - Buses - Trucks

	SR7 From North					Main Street From East					Lincoln Street From South					Main Street From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
03:00 PM	105	21	94	0	220	23	36	20	0	79	25	27	3	0	55	9	26	105	0	140	494
03:15 PM	120	11	66	0	197	26	22	26	0	74	23	30	2	0	55	14	31	107	0	152	478
03:30 PM	119	20	100	0	239	26	31	19	0	76	33	32	7	0	72	4	29	90	0	123	510
03:45 PM	128	14	88	0	230	29	23	16	0	68	33	25	4	0	62	15	23	84	0	122	482
Total	472	66	348	0	886	104	112	81	0	297	114	114	16	0	244	42	109	386	0	537	1964
04:00 PM	90	23	63	0	176	24	25	14	6	69	25	33	2	0	60	10	31	93	0	134	439
04:15 PM	121	17	99	0	237	39	28	21	0	88	38	26	6	0	70	15	14	80	0	109	504
04:30 PM	119	22	97	0	238	25	29	26	0	80	27	29	2	0	58	10	28	87	0	125	501
04:45 PM	132	20	109	0	261	26	23	25	0	74	41	13	5	0	59	7	21	100	0	128	522
Total	462	82	368	0	912	114	105	86	6	311	131	101	15	0	247	42	94	360	0	496	1966
05:00 PM	117	20	104	0	241	33	25	25	0	83	55	38	5	0	98	10	31	84	0	125	547
05:15 PM	100	29	99	0	228	27	21	17	0	65	59	39	10	0	108	6	29	96	0	131	532
05:30 PM	116	26	100	0	242	25	27	17	0	69	45	39	9	0	93	6	29	99	0	134	538
05:45 PM	121	15	70	0	206	22	36	23	0	81	42	36	10	0	88	5	32	87	0	124	499
Total	454	90	373	0	917	107	109	82	0	298	201	152	34	0	387	27	121	366	0	514	2116
Grand Total	5052	941	4393	1	10387	692	1026	821	6	2545	1231	930	228	0	2389	435	1096	3729	0	5260	20581
Apprch %	48.6	9.1	42.3	0		27.2	40.3	32.3	0.2		51.5	38.9	9.5	0		8.3	20.8	70.9	0		
Total %	24.5	4.6	21.3	0	50.5	3.4	5	4	0	12.4	6	4.5	1.1	0	11.6	2.1	5.3	18.1	0	25.6	
Cars	4468	872	4269	1	9610	665	1008	797	6	2476	1198	888	204	0	2290	399	1067	3304	0	4770	19146
% Cars	88.4	92.7	97.2	100	92.5	96.1	98.2	97.1	100	97.3	97.3	95.5	89.5	0	95.9	91.7	97.4	88.6	0	90.7	93
Buses	14	5	17	0	36	16	2	0	0	18	1	5	10	0	16	13	3	9	0	25	95
% Buses	0.3	0.5	0.4	0	0.3	2.3	0.2	0	0	0.7	0.1	0.5	4.4	0	0.7	3	0.3	0.2	0	0.5	0.5
Trucks	570	64	107	0	741	11	16	24	0	51	32	37	14	0	83	23	26	416	0	465	1340
% Trucks	11.3	6.8	2.4	0	7.1	1.6	1.6	2.9	0	2	2.6	4	6.1	0	3.5	5.3	2.4	11.2	0	8.8	6.5

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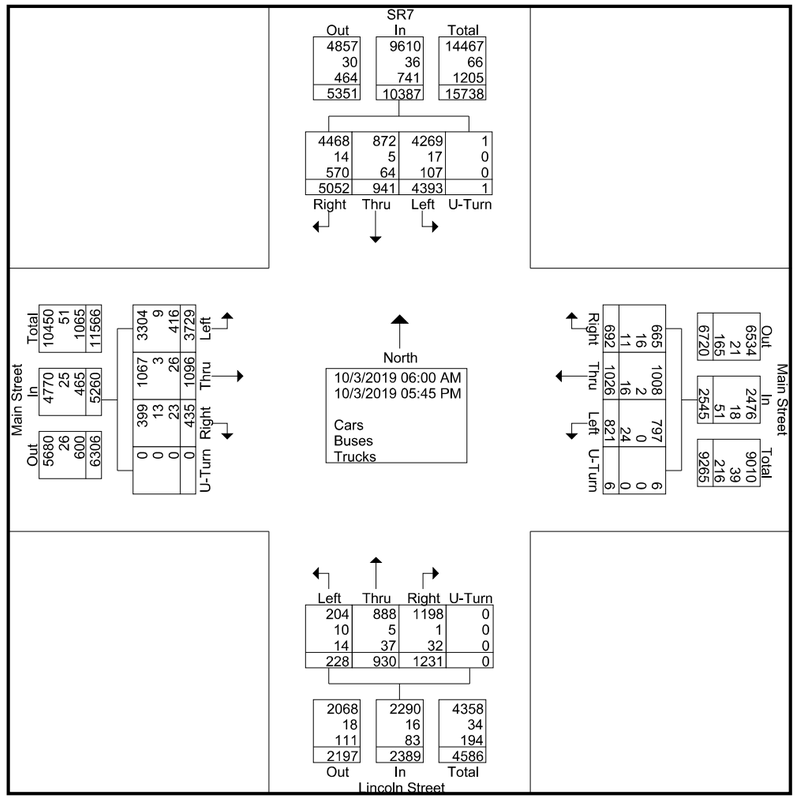

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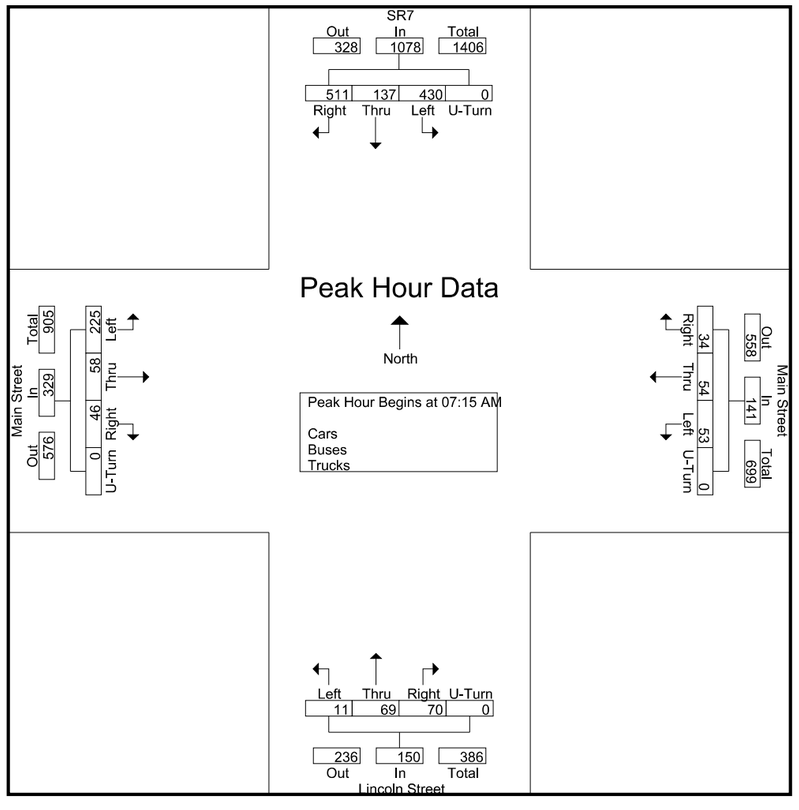
Page No : 4

	SR7 From North					Main Street From East					Lincoln Street From South					Main Street From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 09:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15 AM																					
07:15 AM	131	28	**136**	0	**295**	7	11	6	0	24	**19**	12	1	0	32	7	**18**	46	0	71	422
07:30 AM	**137**	37	95	0	269	6	16	13	0	35	15	19	2	0	36	**19**	11	45	0	75	415
07:45 AM	125	**46**	94	0	265	**12**	**18**	16	0	**46**	19	**22**	**5**	0	**46**	13	16	**69**	0	**98**	**455**
08:00 AM	118	26	105	0	249	9	9	**18**	0	36	17	16	3	0	36	7	13	65	0	85	406
Total Volume	511	137	430	0	1078	34	54	53	0	141	70	69	11	0	150	46	58	225	0	329	1698
% App. Total	47.4	12.7	39.9	0		24.1	38.3	37.6	0		46.7	46	7.3	0		14	17.6	68.4	0		
PHF	.932	.745	.790	.000	.914	.708	.750	.736	.000	.766	.921	.784	.550	.000	.815	.605	.806	.815	.000	.839	.933



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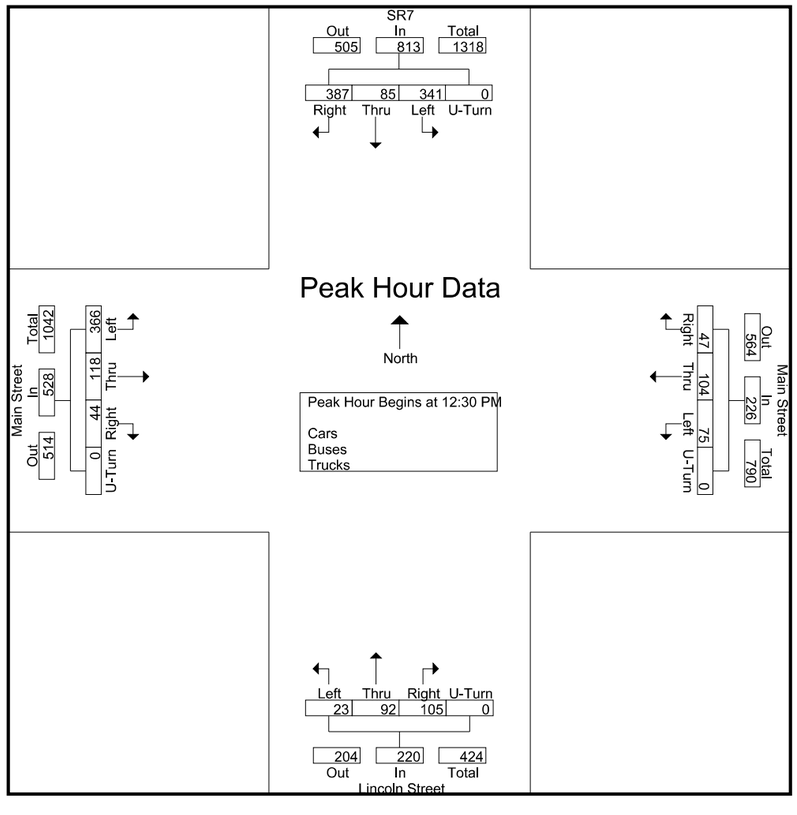
File Name : Main_Street_at_Lincoln_Street_705073_10-03-2019
Site Code : Site 1 - Thursday
Start Date : 10/3/2019
Page No : 5

	SR7 From North					Main Street From East					Lincoln Street From South					Main Street From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 10:00 AM to 01:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 12:30 PM																					
12:30 PM	94	**23**	**96**	0	**213**	14	**28**	10	0	52	20	24	5	0	49	8	**41**	78	0	127	441
12:45 PM	96	18	87	0	201	**16**	28	18	0	62	22	16	6	0	44	**14**	21	94	0	129	436
01:00 PM	94	21	72	0	187	7	22	19	0	48	27	**26**	5	0	58	10	25	**113**	0	**148**	441
01:15 PM	**103**	23	86	0	212	10	26	**28**	0	**64**	**36**	26	**7**	0	**69**	12	31	81	0	124	**469**
Total Volume	387	85	341	0	813	47	104	75	0	226	105	92	23	0	220	44	118	366	0	528	1787
% App. Total	47.6	10.5	41.9	0		20.8	46	33.2	0		47.7	41.8	10.5	0		8.3	22.3	69.3	0		
PHF	.939	.924	.888	.000	.954	.734	.929	.670	.000	.883	.729	.885	.821	.000	.797	.786	.720	.810	.000	.892	.953



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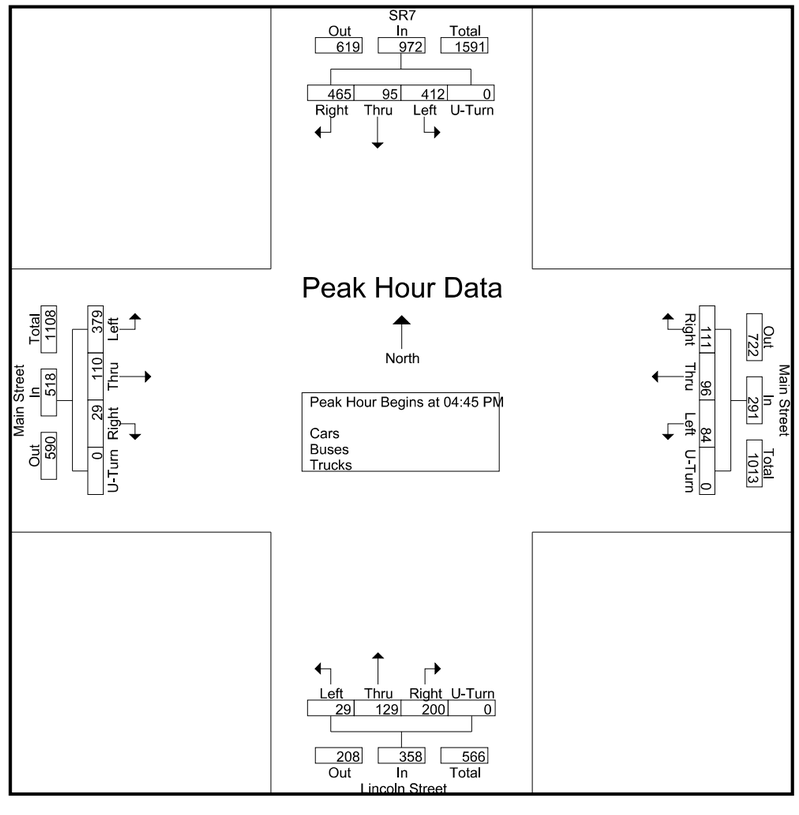
File Name : Main_Street_at_Lincoln_Street_705073_10-03-2019
Site Code : Site 1 - Thursday
Start Date : 10/3/2019
Page No : 6

	SR7 From North					Main Street From East					Lincoln Street From South					Main Street From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	**132**	20	**109**	0	**261**	26	23	**25**	0	74	41	13	5	0	59	7	21	**100**	0	128	522
05:00 PM	117	20	104	0	241	**33**	25	25	0	**83**	55	38	5	0	98	**10**	**31**	84	0	125	**547**
05:15 PM	100	**29**	99	0	228	27	21	17	0	65	**59**	**39**	**10**	0	**108**	6	29	96	0	131	532
05:30 PM	116	26	100	0	242	25	**27**	17	0	69	45	39	9	0	93	6	29	99	0	**134**	538
Total Volume	465	95	412	0	972	111	96	84	0	291	200	129	29	0	358	29	110	379	0	518	2139
% App. Total	47.8	9.8	42.4	0		38.1	33	28.9	0		55.9	36	8.1	0		5.6	21.2	73.2	0		
PHF	.881	.819	.945	.000	.931	.841	.889	.840	.000	.877	.847	.827	.725	.000	.829	.725	.887	.948	.000	.966	.978



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80 Degrees - Sunny
Schools in Session

File Name : Main_Street_at_SR7_704681_10-03-2019
Site Code : Site 3 - Thursday
Start Date : 10/3/2019

Groups Printed- Cars - Buses - Trucks

	SR7 From North				Main Street From East				Main Street From West				
Start Time	Right	Left	U-Turn	App. Total	Right	Thru	U-Turn	App. Total	Thru	Left	U-Turn	App. Total	Int. Total
06:00 AM	0	0	0	0	46	20	0	66	97	1	0	98	164
06:15 AM	0	0	0	0	34	17	0	51	113	1	0	114	165
06:30 AM	0	0	0	0	44	26	0	70	137	0	0	137	207
06:45 AM	0	0	0	0	37	33	0	70	141	0	0	141	211
Total	0	0	0	0	161	96	0	257	488	2	0	490	747
07:00 AM	0	0	0	0	56	26	0	82	132	2	0	134	216
07:15 AM	0	0	0	0	52	25	0	77	174	2	0	176	253
07:30 AM	0	0	0	0	63	36	0	99	133	0	0	133	232
07:45 AM	0	0	0	0	61	43	0	104	124	4	0	128	232
Total	0	0	0	0	232	130	0	362	563	8	0	571	933
08:00 AM	0	0	0	0	59	40	0	99	134	2	0	136	235
08:15 AM	0	0	0	0	60	38	0	98	137	1	0	138	236
08:30 AM	0	0	0	0	61	47	0	108	127	4	0	131	239
08:45 AM	0	0	0	0	50	34	0	84	126	1	0	127	211
Total	0	0	0	0	230	159	0	389	524	8	0	532	921
09:00 AM	0	0	0	0	60	34	0	94	130	2	0	132	226
09:15 AM	0	0	0	0	55	38	0	93	120	1	0	121	214
09:30 AM	0	0	0	0	46	43	0	89	142	1	0	143	232
09:45 AM	0	0	0	0	61	51	0	112	125	0	0	125	237
Total	0	0	0	0	222	166	0	388	517	4	0	521	909
10:00 AM	0	0	0	0	45	50	0	95	128	1	0	129	224
10:15 AM	0	0	0	0	49	41	0	90	133	1	0	134	224
10:30 AM	0	0	0	0	79	58	0	137	147	1	0	148	285
10:45 AM	0	0	0	0	64	61	0	125	136	2	0	138	263
Total	0	0	0	0	237	210	0	447	544	5	0	549	996
11:00 AM	0	0	0	0	66	48	0	114	110	1	0	111	225
11:15 AM	0	0	0	0	88	65	0	153	134	1	0	135	288
11:30 AM	0	0	0	0	72	65	0	137	142	0	0	142	279
11:45 AM	0	0	0	0	63	52	0	115	132	1	0	133	248
Total	0	0	0	0	289	230	0	519	518	3	0	521	1040
12:00 PM	0	0	0	0	100	65	0	165	126	0	0	126	291
12:15 PM	0	0	0	0	80	44	0	124	130	0	0	130	254
12:30 PM	0	0	0	0	65	56	0	121	156	2	0	158	279
12:45 PM	0	0	0	0	88	59	0	147	130	0	0	130	277
Total	0	0	0	0	333	224	0	557	542	2	0	544	1101
01:00 PM	0	0	0	0	72	50	0	122	132	1	0	133	255
01:15 PM	0	0	0	0	59	60	0	119	152	0	0	152	271
01:30 PM	0	0	0	0	78	57	0	135	143	1	0	144	279
01:45 PM	0	0	0	0	77	47	0	124	157	0	0	157	281
Total	0	0	0	0	286	214	0	500	584	2	0	586	1086
02:00 PM	0	0	0	0	65	68	0	133	166	1	0	167	300
02:15 PM	0	0	0	0	99	69	0	168	124	1	0	125	293
02:30 PM	0	0	0	0	90	54	0	144	147	4	0	151	295
02:45 PM	0	0	0	0	80	65	0	145	148	1	0	149	294
Total	0	0	0	0	334	256	0	590	585	7	0	592	1182

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File Name : Main_Street_at_SR7_704681_10-03-2019
Site Code : Site 3 - Thursday
Start Date : 10/3/2019

Groups Printed- Cars - Buses - Trucks

	SR7 From North				Main Street From East				Main Street From West				
Start Time	Right	Left	U-Turn	App. Total	Right	Thru	U-Turn	App. Total	Thru	Left	U-Turn	App. Total	Int. Total
03:00 PM	0	0	0	0	80	77	0	157	149	1	0	150	307
03:15 PM	0	0	0	0	102	75	0	177	125	1	0	126	303
03:30 PM	0	0	0	0	87	74	0	161	164	1	0	165	326
03:45 PM	0	0	0	0	96	73	0	169	146	3	0	149	318
Total	0	0	0	0	365	299	0	664	584	6	0	590	1254
04:00 PM	0	0	0	0	73	67	0	140	117	3	0	120	260
04:15 PM	0	0	0	0	93	93	0	186	156	4	0	160	346
04:30 PM	0	0	0	0	88	79	0	167	173	2	0	175	342
04:45 PM	0	0	0	0	96	79	0	175	174	1	0	175	350
Total	0	0	0	0	350	318	0	668	620	10	0	630	1298
05:00 PM	0	0	0	0	106	85	0	191	175	1	0	176	367
05:15 PM	0	0	0	0	101	70	0	171	192	0	0	192	363
05:30 PM	0	0	0	0	92	70	0	162	179	2	0	181	343
05:45 PM	0	0	0	0	80	77	0	157	149	2	0	151	308
Total	0	0	0	0	379	302	0	681	695	5	0	700	1381
Grand Total	0	0	0	0	3418	2604	0	6022	6764	62	0	6826	12848
Apprch %	0	0	0		56.8	43.2	0		99.1	0.9	0		
Total %	0	0	0	0	26.6	20.3	0	46.9	52.6	0.5	0	53.1	
Cars	0	0	0	0	3277	2543	0	5820	6603	53	0	6656	12476
% Cars	0	0	0	0	95.9	97.7	0	96.6	97.6	85.5	0	97.5	97.1
Buses	0	0	0	0	3	15	0	18	17	0	0	17	35
% Buses	0	0	0	0	0.1	0.6	0	0.3	0.3	0	0	0.2	0.3
Trucks	0	0	0	0	138	46	0	184	144	9	0	153	337
% Trucks	0	0	0	0	4	1.8	0	3.1	2.1	14.5	0	2.2	2.6

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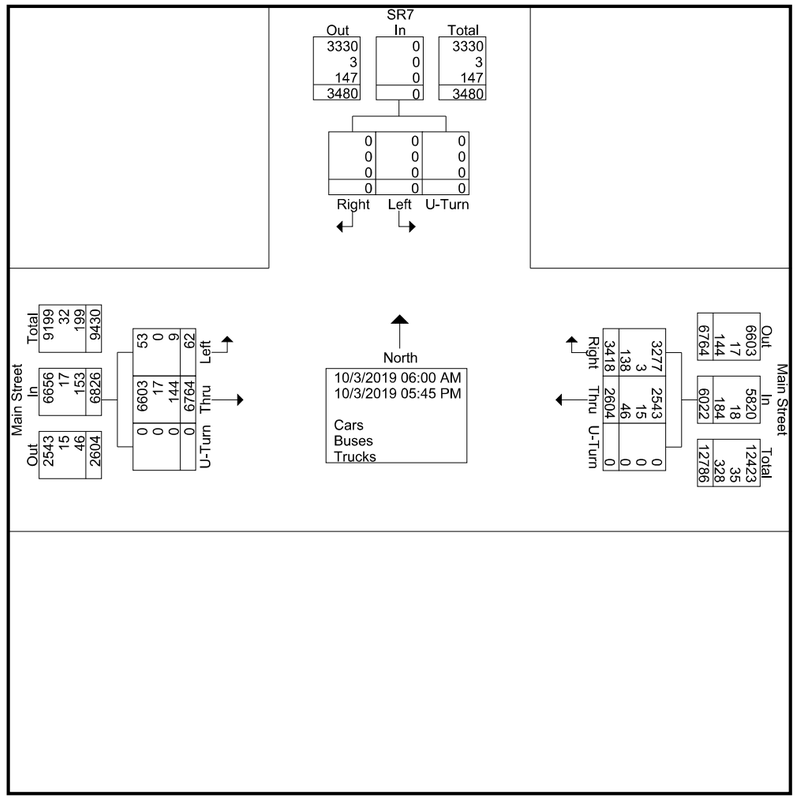
File Name : Main_Street_at_SR7_704681_10-03-2019
Site Code : Site 3 - Thursday
Start Date : 10/3/2019
Page No : 3



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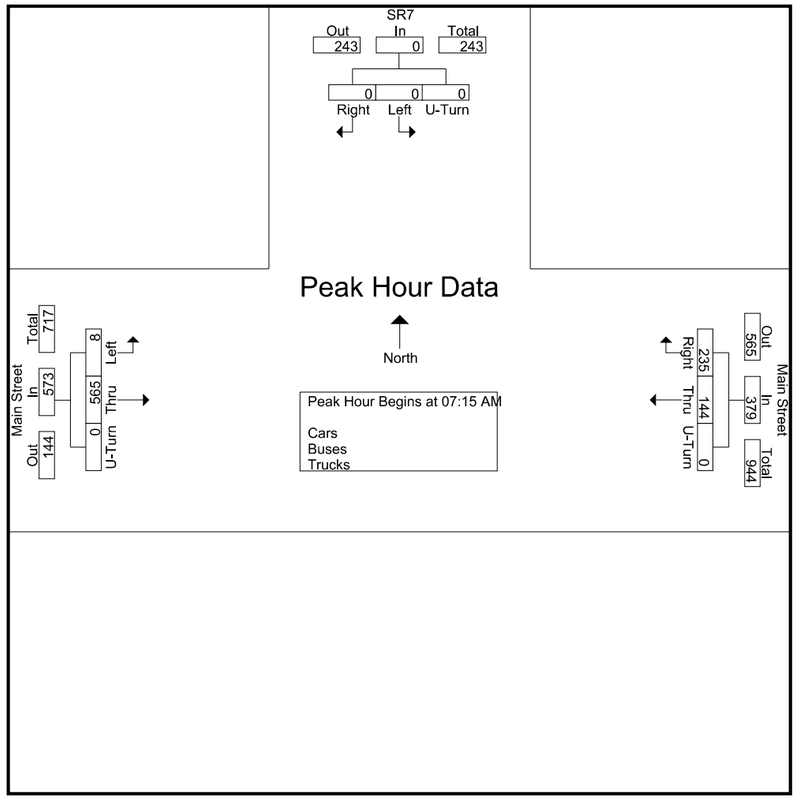
File Name : Main_Street_at_SR7_704681_10-03-2019
Site Code : Site 3 - Thursday
Start Date : 10/3/2019
Page No : 4

	SR7 From North				Main Street From East				Main Street From West				
Start Time	Right	Left	U-Turn	App. Total	Right	Thru	U-Turn	App. Total	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 09:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:15 AM													
07:15 AM	0	0	0	0	52	25	0	77	**174**	2	0	**176**	**253**
07:30 AM	0	0	0	0	**63**	36	0	99	133	0	0	133	232
07:45 AM	0	0	0	0	61	**43**	0	**104**	124	**4**	0	128	232
08:00 AM	0	0	0	0	59	40	0	99	134	2	0	136	235
Total Volume	0	0	0	0	235	144	0	379	565	8	0	573	952
% App. Total	0	0	0		62	38	0		98.6	1.4	0		
PHF	.000	.000	.000	.000	.933	.837	.000	.911	.812	.500	.000	.814	.941



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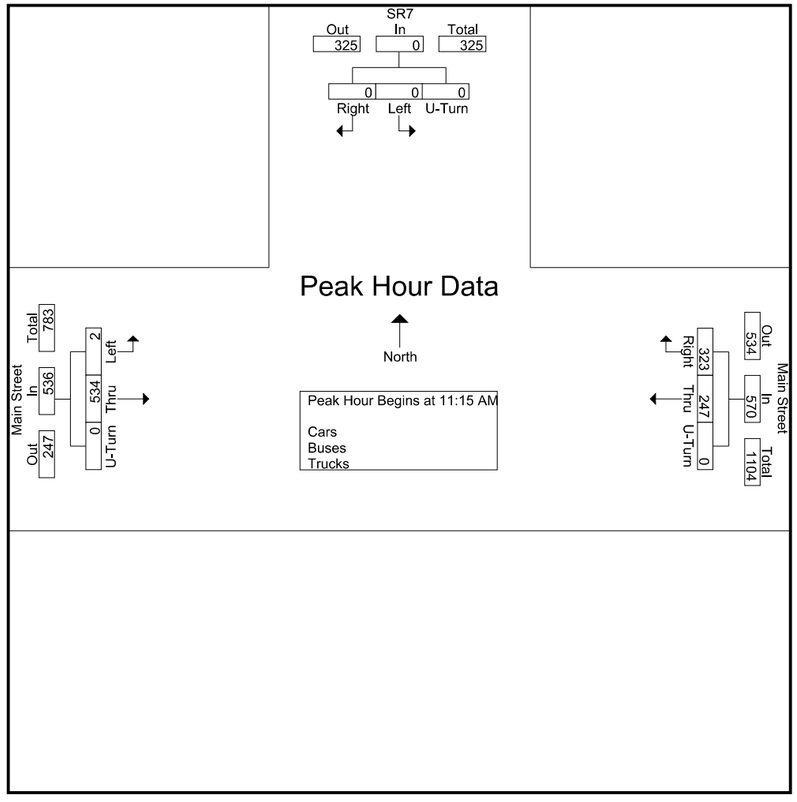
File Name : Main_Street_at_SR7_704681_10-03-2019
Site Code : Site 3 - Thursday
Start Date : 10/3/2019
Page No : 5

	SR7 From North				Main Street From East				Main Street From West				
Start Time	Right	Left	U-Turn	App. Total	Right	Thru	U-Turn	App. Total	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 10:00 AM to 01:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 11:15 AM													
11:15 AM	0	0	0	0	88	**65**	0	153	134	**1**	0	135	288
11:30 AM	0	0	0	0	72	65	0	137	**142**	0	0	**142**	279
11:45 AM	0	0	0	0	63	52	0	115	132	1	0	133	248
12:00 PM	0	0	0	0	**100**	65	0	**165**	126	0	0	126	**291**
Total Volume	0	0	0	0	323	247	0	570	534	2	0	536	1106
% App. Total	0	0	0		56.7	43.3	0		99.6	0.4	0		
PHF	.000	.000	.000	.000	.808	.950	.000	.864	.940	.500	.000	.944	.950



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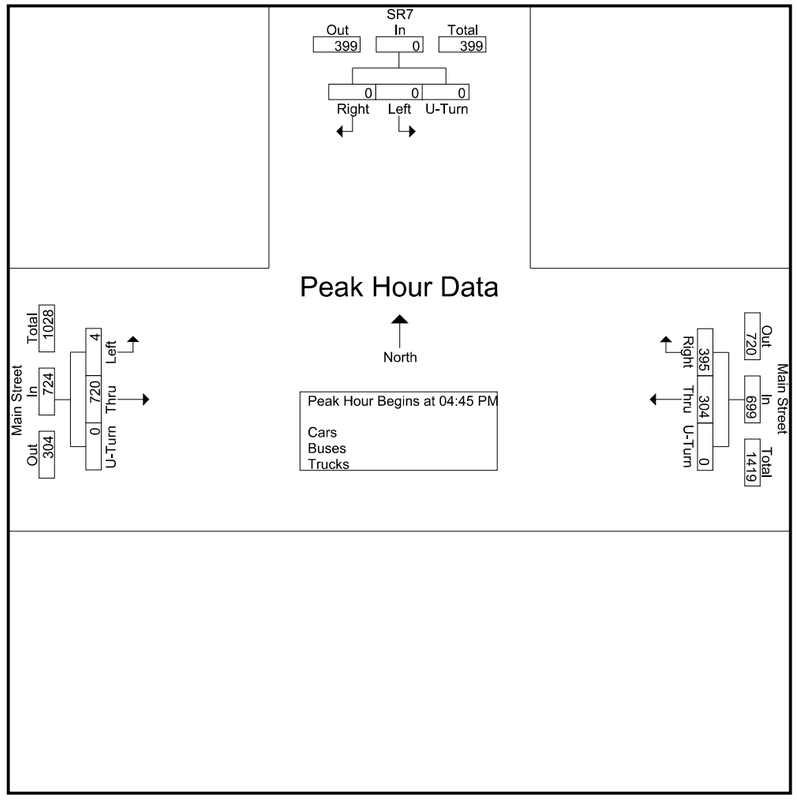
File Name : Main_Street_at_SR7_704681_10-03-2019
Site Code : Site 3 - Thursday
Start Date : 10/3/2019
Page No : 6

	SR7 From North				Main Street From East				Main Street From West				
Start Time	Right	Left	U-Turn	App. Total	Right	Thru	U-Turn	App. Total	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 05:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 04:45 PM													
04:45 PM	0	0	0	0	96	79	0	175	174	1	0	175	350
05:00 PM	0	0	0	0	**106**	**85**	0	**191**	175	1	0	176	**367**
05:15 PM	0	0	0	0	101	70	0	171	**192**	0	0	**192**	363
05:30 PM	0	0	0	0	92	70	0	162	179	**2**	0	181	343
Total Volume	0	0	0	0	395	304	0	699	720	4	0	724	1423
% App. Total	0	0	0		56.5	43.5	0		99.4	0.6	0		
PHF	.000	.000	.000	.000	.932	.894	.000	.915	.938	.500	.000	.943	.969



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80 Degrees - Sunny
Schools in Session

File Name : Cadiz_Pike_at_SR7_704684_10-03-2019
Site Code : Site 6 - Thursday
Start Date : 10/3/2019

Groups Printed- Cars - Buses - Trucks

	SR7 From North					Cadiz Pike From East					SR7 From South					Cadiz Pike From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
06:00 AM	3	114	0	0	117	0	0	0	0	0	59	0	9	0	68	58	6	0	0	64	249
06:15 AM	2	129	1	0	132	0	0	0	0	0	67	0	15	0	82	57	3	0	0	60	274
06:30 AM	3	171	0	0	174	0	0	0	0	0	65	0	23	0	88	65	2	0	0	67	329
06:45 AM	1	175	1	0	177	0	0	0	0	0	60	0	21	0	81	60	7	0	0	67	325
Total	9	589	2	0	600	0	0	0	0	0	251	0	68	0	319	240	18	0	0	258	1177
07:00 AM	0	189	0	0	189	0	0	0	0	0	55	0	7	0	62	58	3	0	0	61	312
07:15 AM	5	233	0	0	238	0	0	0	0	0	56	0	17	0	73	64	2	0	0	66	377
07:30 AM	1	213	0	0	214	0	0	0	0	0	53	0	15	0	68	71	3	0	0	74	356
07:45 AM	2	199	0	0	201	0	0	0	0	0	77	0	21	0	98	58	1	0	0	59	358
Total	8	834	0	0	842	0	0	0	0	0	241	0	60	0	301	251	9	0	0	260	1403
08:00 AM	2	201	2	0	205	0	0	0	0	0	75	0	14	0	89	51	1	0	0	52	346
08:15 AM	0	183	0	0	183	0	0	0	0	0	77	0	10	0	87	47	2	0	0	49	319
08:30 AM	2	179	0	0	181	0	0	0	0	0	88	0	18	0	106	34	6	0	0	40	327
08:45 AM	9	187	0	0	196	0	0	0	0	0	70	0	12	0	82	44	2	0	0	46	324
Total	13	750	2	0	765	0	0	0	0	0	310	0	54	0	364	176	11	0	0	187	1316
09:00 AM	11	152	0	0	163	0	1	0	0	1	60	0	15	0	75	33	3	0	0	36	275
09:15 AM	12	148	0	0	160	0	0	0	0	0	68	0	19	0	87	40	7	0	0	47	294
09:30 AM	1	178	1	0	180	0	0	0	0	0	57	0	28	0	85	45	2	0	0	47	312
09:45 AM	5	158	0	0	163	0	0	0	0	0	69	0	18	0	87	29	6	0	0	35	285
Total	29	636	1	0	666	0	1	0	0	1	254	0	80	0	334	147	18	0	0	165	1166
10:00 AM	4	185	1	0	190	0	0	0	0	0	81	0	20	0	101	43	3	0	0	46	337
10:15 AM	5	160	1	0	166	0	0	0	0	0	80	0	29	0	109	37	2	0	0	39	314
10:30 AM	6	191	0	0	197	0	0	0	0	0	61	0	20	0	81	34	2	0	0	36	314
10:45 AM	2	186	1	0	189	0	0	0	0	0	79	0	24	0	103	27	2	0	0	29	321
Total	17	722	3	0	742	0	0	0	0	0	301	0	93	0	394	141	9	0	0	150	1286
11:00 AM	5	145	0	0	150	0	0	0	0	0	94	0	15	0	109	14	2	0	0	16	275
11:15 AM	6	153	1	0	160	0	0	0	0	0	77	0	32	0	109	29	6	0	0	35	304
11:30 AM	8	185	1	0	194	0	0	0	0	0	93	0	19	0	112	36	2	0	0	38	344
11:45 AM	10	152	0	0	162	0	0	0	0	0	86	0	13	0	99	32	3	0	0	35	296
Total	29	635	2	0	666	0	0	0	0	0	350	0	79	0	429	111	13	0	0	124	1219
12:00 PM	8	152	0	0	160	0	0	0	0	0	88	0	20	0	108	30	3	0	0	33	301
12:15 PM	5	150	0	0	155	0	0	0	0	0	86	0	19	0	105	23	1	0	0	24	284
12:30 PM	5	181	1	0	187	0	0	0	0	0	90	0	28	0	118	22	4	0	0	26	331
12:45 PM	6	176	0	0	182	0	0	0	0	0	99	0	28	0	127	22	4	0	0	26	335
Total	24	659	1	0	684	0	0	0	0	0	363	0	95	0	458	97	12	0	0	109	1251
01:00 PM	8	171	3	0	182	0	0	0	0	0	121	0	26	0	147	22	7	0	0	29	358
01:15 PM	8	177	0	0	185	0	0	0	0	0	91	0	27	0	118	40	2	0	0	42	345
01:30 PM	6	177	0	0	183	0	0	0	0	0	83	0	27	0	110	31	4	0	0	35	328
01:45 PM	5	186	1	0	192	0	0	0	0	0	81	0	27	0	108	22	1	0	0	23	323
Total	27	711	4	0	742	0	0	0	0	0	376	0	107	0	483	115	14	0	0	129	1354
02:00 PM	9	185	0	0	194	0	0	0	0	0	89	0	19	0	108	26	4	0	0	30	332
02:15 PM	7	183	1	0	191	0	0	0	0	0	92	0	31	0	123	32	5	0	0	37	351
02:30 PM	6	189	2	0	197	0	0	0	0	0	104	0	37	0	141	34	0	0	0	34	372
02:45 PM	7	171	0	0	178	0	0	0	0	0	97	0	38	0	135	36	3	0	0	39	352
Total	29	728	3	0	760	0	0	0	0	0	382	0	125	0	507	128	12	0	0	140	1407

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File Name : Cadiz_Pike_at_SR7_704684_10-03-2019
Site Code : Site 6 - Thursday
Start Date : 10/3/2019

Groups Printed- Cars - Buses - Trucks

	SR7 From North					Cadiz Pike From East					SR7 From South					Cadiz Pike From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
03:00 PM	12	191	0	0	203	0	0	0	0	0	117	0	41	0	158	28	2	0	0	30	391
03:15 PM	6	172	1	0	179	0	0	0	0	0	110	0	54	0	164	38	4	0	0	42	385
03:30 PM	4	210	0	0	214	0	0	0	0	0	84	0	59	0	143	29	3	0	0	32	389
03:45 PM	12	200	2	0	214	0	0	0	0	0	93	0	46	0	139	30	3	0	0	33	386
Total	34	773	3	0	810	0	0	0	0	0	404	0	200	0	604	125	12	0	0	137	1551
04:00 PM	16	153	1	0	170	0	0	0	0	0	103	0	50	0	153	27	1	0	0	28	351
04:15 PM	16	198	0	0	214	0	0	0	0	0	100	0	57	0	157	33	6	0	0	39	410
04:30 PM	8	198	1	0	207	0	0	0	0	0	102	0	49	0	151	33	4	0	0	37	395
04:45 PM	9	209	1	0	219	0	0	0	0	0	102	0	38	0	140	34	6	0	0	40	399
Total	49	758	3	0	810	0	0	0	0	0	407	0	194	0	601	127	17	0	0	144	1555
05:00 PM	12	204	3	0	219	0	0	0	0	0	101	0	50	0	151	42	1	0	0	43	413
05:15 PM	3	186	0	0	189	0	0	0	0	0	114	0	50	0	164	46	6	0	0	52	405
05:30 PM	9	206	0	0	215	0	0	0	0	0	113	0	49	0	162	30	1	0	0	31	408
05:45 PM	4	177	0	0	181	0	0	0	0	0	96	0	51	0	147	26	5	0	0	31	359
Total	28	773	3	0	804	0	0	0	0	0	424	0	200	0	624	144	13	0	0	157	1585
Grand Total	296	8568	27	0	8891	0	1	0	0	1	4063	0	1355	0	5418	1802	158	0	0	1960	16270
Apprch %	3.3	96.4	0.3	0		0	100	0	0		75	0	25	0		91.9	8.1	0	0		
Total %	1.8	52.7	0.2	0	54.6	0	0	0	0	0	25	0	8.3	0	33.3	11.1	1	0	0	12	
Cars	280	7884	23	0	8187	0	1	0	0	1	3617	0	1295	0	4912	1726	149	0	0	1875	14975
% Cars	94.6	92	85.2	0	92.1	0	100	0	0	100	89	0	95.6	0	90.7	95.8	94.3	0	0	95.7	92
Buses	0	35	0	0	35	0	0	0	0	0	25	0	2	0	27	4	0	0	0	4	66
% Buses	0	0.4	0	0	0.4	0	0	0	0	0	0.6	0	0.1	0	0.5	0.2	0	0	0	0.2	0.4
Trucks	16	649	4	0	669	0	0	0	0	0	421	0	58	0	479	72	9	0	0	81	1229
% Trucks	5.4	7.6	14.8	0	7.5	0	0	0	0	0	10.4	0	4.3	0	8.8	4	5.7	0	0	4.1	7.6

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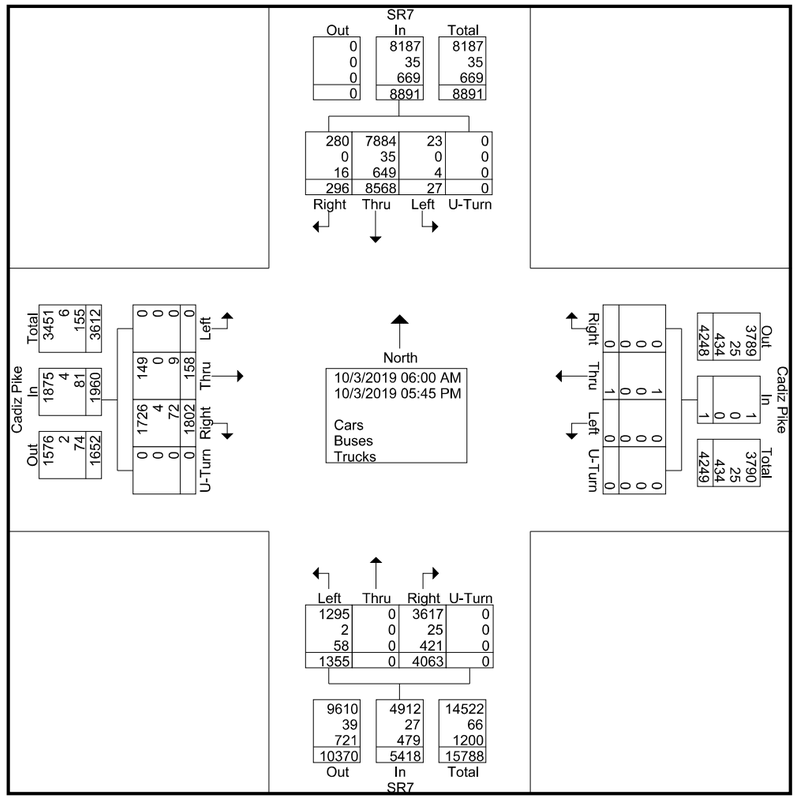
File Name : Cadiz_Pike_at_SR7_704684_10-03-2019
Site Code : Site 6 - Thursday
Start Date : 10/3/2019
Page No : 3



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File Name : Cadiz_Pike_at_SR7_704684_10-03-2019
Site Code : Site 6 - Thursday
Start Date : 10/3/2019
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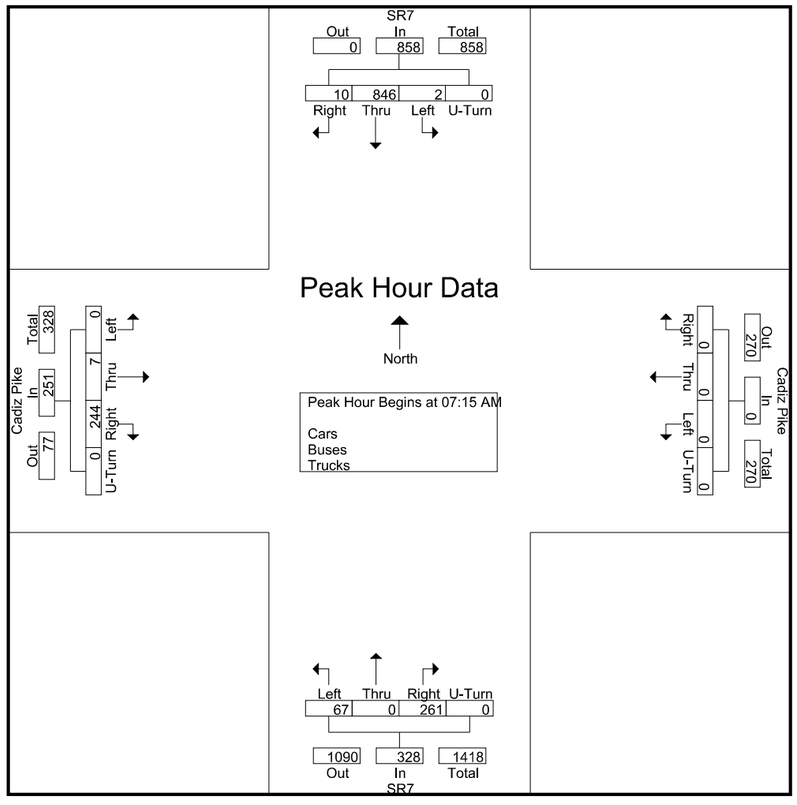
	SR7 From North					Cadiz Pike From East					SR7 From South					Cadiz Pike From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 09:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15 AM																					
07:15 AM	**5**	**233**	0	0	**238**	0	0	0	0	0	56	0	17	0	73	64	2	0	0	66	**377**
07:30 AM	1	213	0	0	214	0	0	0	0	0	53	0	15	0	68	**71**	**3**	0	0	**74**	356
07:45 AM	2	199	0	0	201	0	0	0	0	0	**77**	0	**21**	0	**98**	58	1	0	0	59	358
08:00 AM	2	201	**2**	0	205	0	0	0	0	0	75	0	14	0	89	51	1	0	0	52	346
Total Volume	10	846	2	0	858	0	0	0	0	0	261	0	67	0	328	244	7	0	0	251	1437
% App. Total	1.2	98.6	0.2	0		0	0	0	0		79.6	0	20.4	0		97.2	2.8	0	0		
PHF	.500	.908	.250	.000	.901	.000	.000	.000	.000	.000	.847	.000	.798	.000	.837	.859	.583	.000	.000	.848	.953



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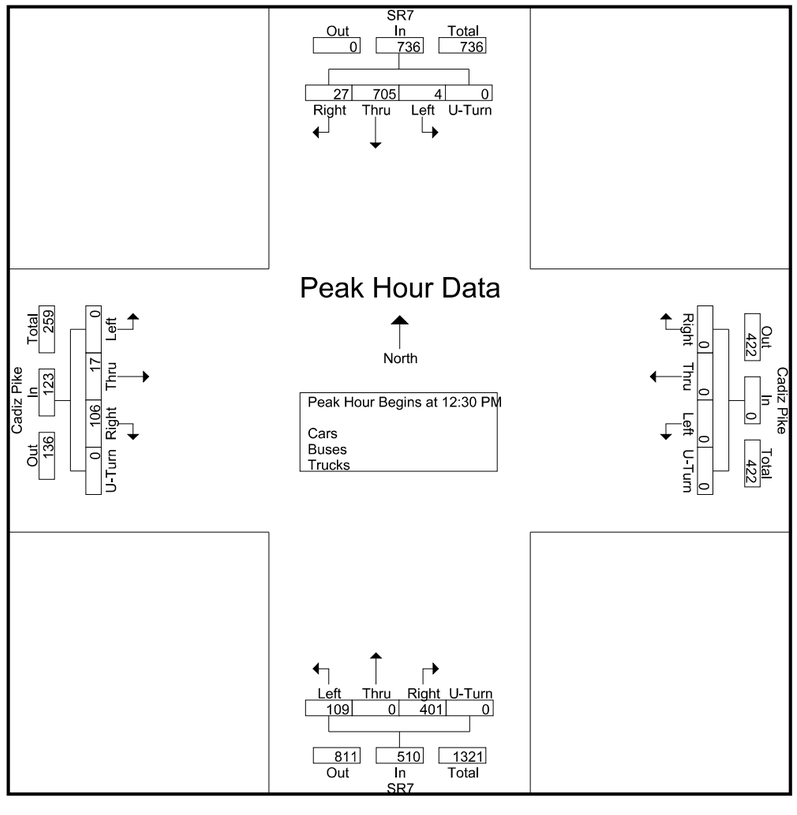
File Name : Cadiz_Pike_at_SR7_704684_10-03-2019
Site Code : Site 6 - Thursday
Start Date : 10/3/2019
Page No : 5

	SR7 From North					Cadiz Pike From East					SR7 From South					Cadiz Pike From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 10:00 AM to 01:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 12:30 PM																					
12:30 PM	5	**181**	1	0	**187**	0	0	0	0	0	90	0	**28**	0	118	22	4	0	0	26	331
12:45 PM	6	176	0	0	182	0	0	0	0	0	99	0	28	0	127	22	4	0	0	26	335
01:00 PM	**8**	171	**3**	0	182	0	0	0	0	0	**121**	0	26	0	**147**	22	**7**	0	0	29	**358**
01:15 PM	8	177	0	0	185	0	0	0	0	0	91	0	27	0	118	**40**	2	0	0	**42**	345
Total Volume	27	705	4	0	736	0	0	0	0	0	401	0	109	0	510	106	17	0	0	123	1369
% App. Total	3.7	95.8	0.5	0		0	0	0	0		78.6	0	21.4	0		86.2	13.8	0	0		
PHF	.844	.974	.333	.000	.984	.000	.000	.000	.000	.000	.829	.000	.973	.000	.867	.663	.607	.000	.000	.732	.956



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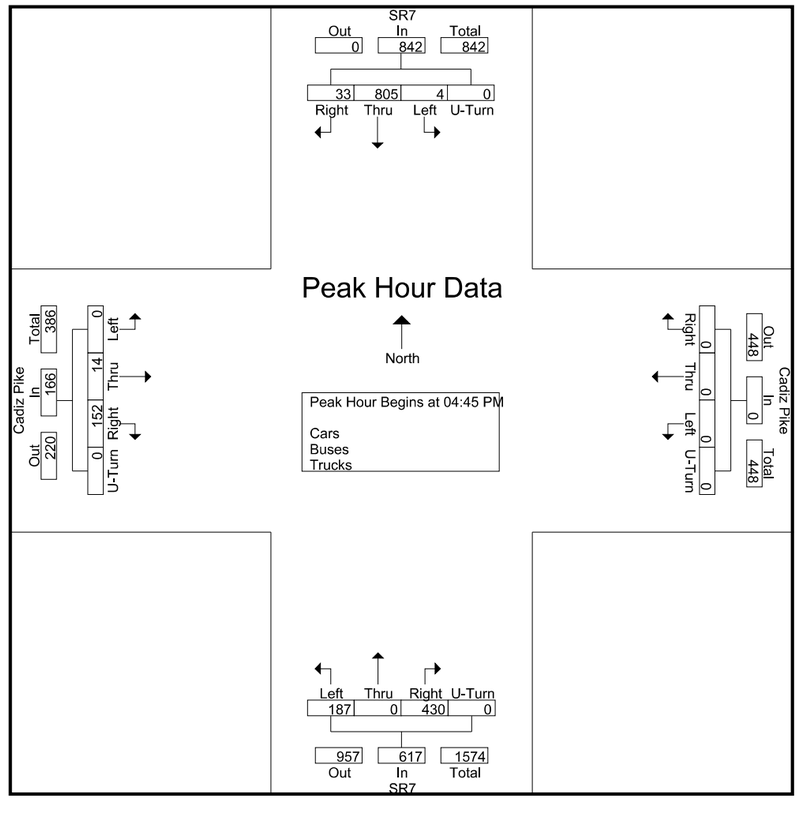
File Name : Cadiz_Pike_at_SR7_704684_10-03-2019
Site Code : Site 6 - Thursday
Start Date : 10/3/2019
Page No : 6

	SR7 From North					Cadiz Pike From East					SR7 From South					Cadiz Pike From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	9	**209**	1	0	**219**	0	0	0	0	0	102	0	38	0	140	34	**6**	0	0	40	399
05:00 PM	**12**	204	**3**	0	219	0	0	0	0	0	101	0	**50**	0	151	42	1	0	0	43	**413**
05:15 PM	3	186	0	0	189	0	0	0	0	0	**114**	0	50	0	**164**	**46**	6	0	0	**52**	405
05:30 PM	9	206	0	0	215	0	0	0	0	0	113	0	49	0	162	30	1	0	0	31	408
Total Volume	33	805	4	0	842	0	0	0	0	0	430	0	187	0	617	152	14	0	0	166	1625
% App. Total	3.9	95.6	0.5	0		0	0	0	0		69.7	0	30.3	0		91.6	8.4	0	0		
PHF	.688	.963	.333	.000	.961	.000	.000	.000	.000	.000	.943	.000	.935	.000	.941	.826	.583	.000	.000	.798	.984



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80 Degrees - Sunny
Schools in Session

File Name : Cadiz_Pike_at_SR7_2__704685_10-03-2019
Site Code : Site 7 - Thursday
Start Date : 10/3/2019

Groups Printed- Cars - Buses - Trucks

	SR7 From North				SR7 From South				Cadiz Pike From West				
Start Time	Right	Thru	U-Turn	App. Total	Thru	Left	U-Turn	App. Total	Right	Left	U-Turn	App. Total	Int. Total
06:00 AM	0	0	0	0	46	0	0	46	0	65	0	65	111
06:15 AM	0	0	0	0	35	0	0	35	0	72	0	72	107
06:30 AM	0	0	0	0	47	0	0	47	0	67	0	67	114
06:45 AM	0	0	0	0	31	0	0	31	0	70	0	70	101
Total	0	0	0	0	159	0	0	159	0	274	0	274	433
07:00 AM	0	0	0	0	61	0	0	61	0	58	0	58	119
07:15 AM	0	0	0	0	55	0	0	55	0	54	0	54	109
07:30 AM	0	0	0	0	61	0	0	61	0	55	0	55	116
07:45 AM	0	0	0	0	67	0	0	67	0	85	0	85	152
Total	0	0	0	0	244	0	0	244	0	252	0	252	496
08:00 AM	0	0	0	0	60	0	0	60	0	75	0	75	135
08:15 AM	0	0	0	0	66	0	0	66	0	80	0	80	146
08:30 AM	0	0	0	0	63	0	0	63	0	90	0	90	153
08:45 AM	0	0	0	0	55	0	0	55	0	72	0	72	127
Total	0	0	0	0	244	0	0	244	0	317	0	317	561
09:00 AM	0	0	0	0	60	1	0	61	0	63	0	63	124
09:15 AM	0	0	0	0	57	0	0	57	0	74	0	74	131
09:30 AM	0	0	0	0	43	0	0	43	0	63	0	63	106
09:45 AM	0	0	0	0	62	0	0	62	0	76	0	76	138
Total	0	0	0	0	222	1	0	223	0	276	0	276	499
10:00 AM	0	0	0	0	45	0	0	45	0	86	0	86	131
10:15 AM	0	0	0	0	50	0	0	50	0	88	0	88	138
10:30 AM	0	0	0	0	81	0	0	81	0	60	0	60	141
10:45 AM	0	0	0	0	64	0	0	64	0	91	0	91	155
Total	0	0	0	0	240	0	0	240	0	325	0	325	565
11:00 AM	0	0	0	0	67	0	0	67	0	95	0	95	162
11:15 AM	0	0	0	0	90	0	0	90	0	84	0	84	174
11:30 AM	0	0	0	0	77	1	0	78	0	98	0	98	176
11:45 AM	0	0	0	0	57	0	0	57	0	84	0	84	141
Total	0	0	0	0	291	1	0	292	0	361	0	361	653
12:00 PM	0	0	0	0	106	0	0	106	0	91	0	91	197
12:15 PM	0	0	0	0	73	0	0	73	0	92	0	92	165
12:30 PM	0	0	0	0	70	0	0	70	0	91	0	91	161
12:45 PM	0	0	0	0	90	0	0	90	0	105	0	105	195
Total	0	0	0	0	339	0	0	339	0	379	0	379	718
01:00 PM	0	0	0	0	75	0	0	75	0	131	0	131	206
01:15 PM	0	0	0	0	59	0	0	59	0	94	0	94	153
01:30 PM	0	0	0	0	75	0	0	75	0	87	0	87	162
01:45 PM	0	0	0	0	79	0	0	79	0	80	0	80	159
Total	0	0	0	0	288	0	0	288	0	392	0	392	680
02:00 PM	0	0	0	0	70	0	0	70	0	96	0	96	166
02:15 PM	0	0	0	0	96	0	0	96	0	99	0	99	195
02:30 PM	0	0	0	0	95	0	0	95	0	107	0	107	202
02:45 PM	0	0	0	0	81	0	0	81	0	99	0	99	180
Total	0	0	0	0	342	0	0	342	0	401	0	401	743

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File Name : Cadiz_Pike_at_SR7_2__704685_10-03-2019
Site Code : Site 7 - Thursday
Start Date : 10/3/2019

Groups Printed- Cars - Buses - Trucks

	SR7 From North				SR7 From South				Cadiz Pike From West				
Start Time	Right	Thru	U-Turn	App. Total	Thru	Left	U-Turn	App. Total	Right	Left	U-Turn	App. Total	Int. Total
03:00 PM	0	0	0	0	85	0	0	85	0	119	0	119	204
03:15 PM	0	0	0	0	95	0	0	95	0	111	0	111	206
03:30 PM	0	0	0	0	93	0	0	93	0	92	0	92	185
03:45 PM	0	0	0	0	93	0	0	93	0	97	0	97	190
Total	0	0	0	0	366	0	0	366	0	419	0	419	785
04:00 PM	0	0	0	0	79	0	0	79	0	104	0	104	183
04:15 PM	0	0	0	0	96	0	0	96	0	104	0	104	200
04:30 PM	0	0	0	0	97	0	0	97	0	104	0	104	201
04:45 PM	0	0	0	0	90	0	0	90	0	115	0	115	205
Total	0	0	0	0	362	0	0	362	0	427	0	427	789
05:00 PM	0	0	0	0	110	0	0	110	0	108	0	108	218
05:15 PM	0	0	0	0	99	0	0	99	0	116	0	116	215
05:30 PM	0	0	0	0	90	0	0	90	0	114	0	114	204
05:45 PM	0	0	0	0	83	0	0	83	0	102	0	102	185
Total	0	0	0	0	382	0	0	382	0	440	0	440	822
Grand Total	0	0	0	0	3479	2	0	3481	0	4263	0	4263	7744
Apprch %	0	0	0		99.9	0.1	0		0	100	0		
Total %	0	0	0	0	44.9	0	0	45	0	55	0	55	
Cars	0	0	0	0	3320	2	0	3322	0	3809	0	3809	7131
% Cars	0	0	0	0	95.4	100	0	95.4	0	89.4	0	89.4	92.1
Buses	0	0	0	0	1	0	0	1	0	25	0	25	26
% Buses	0	0	0	0	0	0	0	0	0	0.6	0	0.6	0.3
Trucks	0	0	0	0	158	0	0	158	0	429	0	429	587
% Trucks	0	0	0	0	4.5	0	0	4.5	0	10.1	0	10.1	7.6

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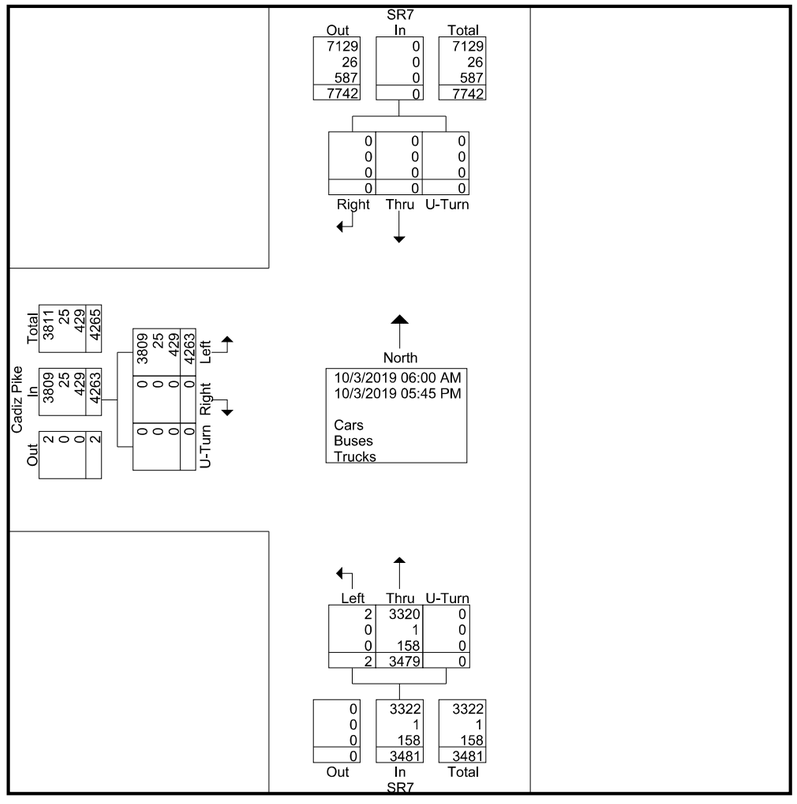
Site Code : Site 7 - Thursday
Start Date : 10/3/2019



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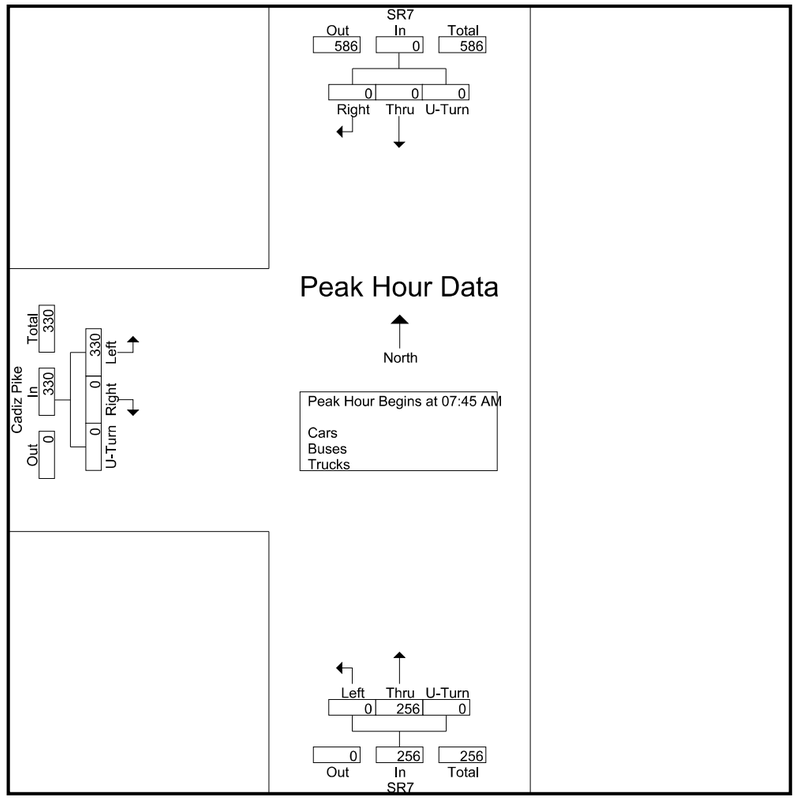
Site Code : Site 7 - Thursday
Start Date : 10/3/2019

	SR7 From North				SR7 From South				Cadiz Pike From West				
Start Time	Right	Thru	U-Turn	App. Total	Thru	Left	U-Turn	App. Total	Right	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 09:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:45 AM													
07:45 AM	0	0	0	0	**67**	0	0	**67**	0	85	0	85	152
08:00 AM	0	0	0	0	60	0	0	60	0	75	0	75	135
08:15 AM	0	0	0	0	66	0	0	66	0	80	0	80	146
08:30 AM	0	0	0	0	63	0	0	63	0	**90**	0	**90**	**153**
Total Volume	0	0	0	0	256	0	0	256	0	330	0	330	586
% App. Total	0	0	0		100	0	0		0	100	0		
PHF	.000	.000	.000	.000	.955	.000	.000	.955	.000	.917	.000	.917	.958



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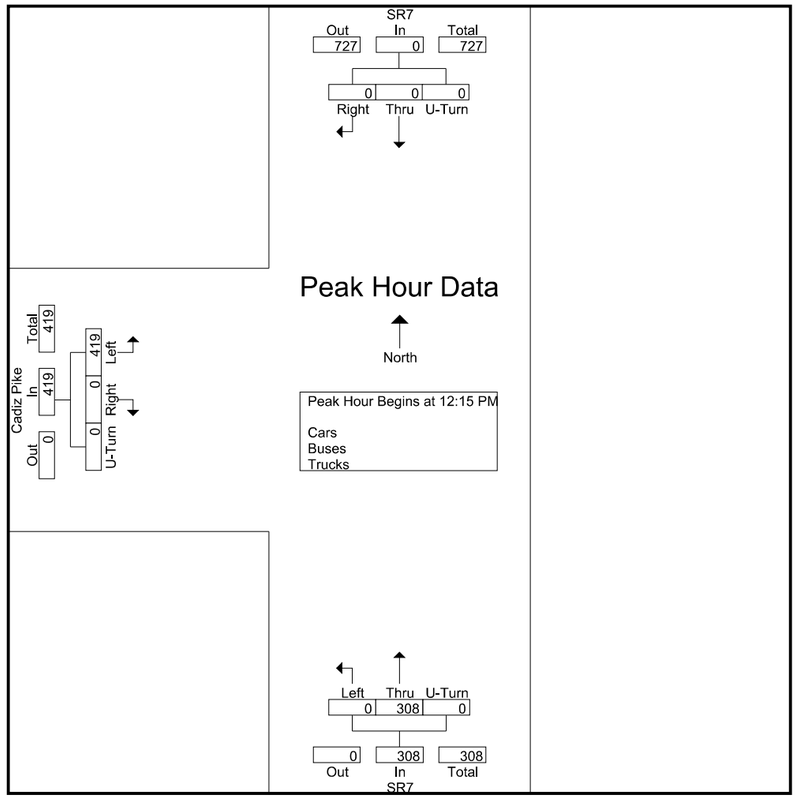
File Name : Cadiz_Pike_at_SR7_2__704685_10-03-2019
Site Code : Site 7 - Thursday
Start Date : 10/3/2019
Page No : 5

	SR7 From North				SR7 From South				Cadiz Pike From West				
Start Time	Right	Thru	U-Turn	App. Total	Thru	Left	U-Turn	App. Total	Right	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 10:00 AM to 01:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 12:15 PM													
12:15 PM	0	0	0	0	73	0	0	73	0	92	0	92	165
12:30 PM	0	0	0	0	70	0	0	70	0	91	0	91	161
12:45 PM	0	0	0	0	**90**	0	0	**90**	0	105	0	105	195
01:00 PM	0	0	0	0	75	0	0	75	0	**131**	0	**131**	**206**
Total Volume	0	0	0	0	308	0	0	308	0	419	0	419	727
% App. Total	0	0	0		100	0	0		0	100	0		
PHF	.000	.000	.000	.000	.856	.000	.000	.856	.000	.800	.000	.800	.882



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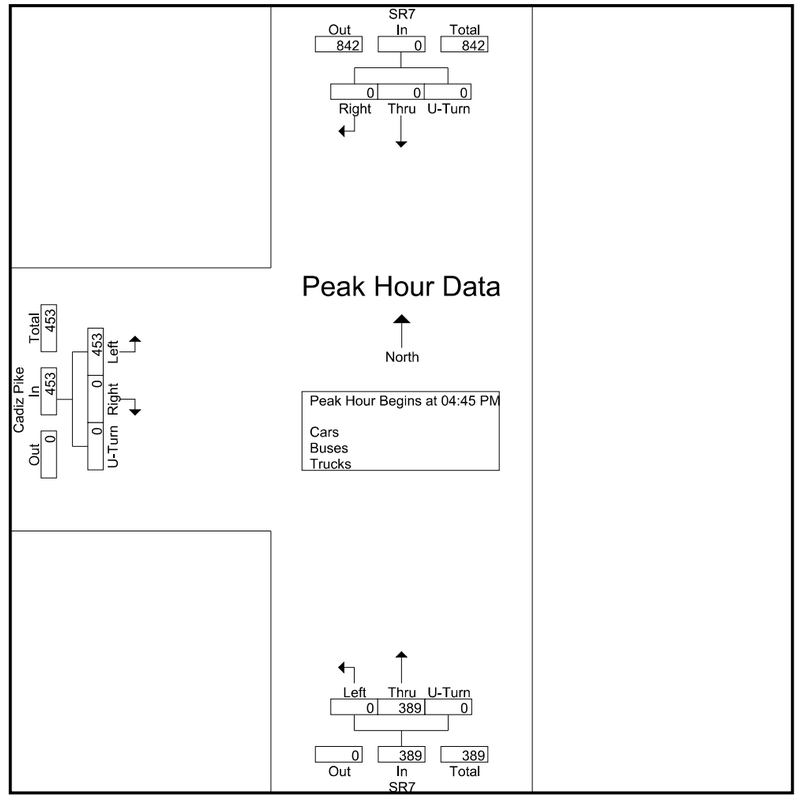
File Name : Cadiz_Pike_at_SR7_2__704685_10-03-2019
Site Code : Site 7 - Thursday
Start Date : 10/3/2019
Page No : 6

	SR7 From North				SR7 From South				Cadiz Pike From West				
Start Time	Right	Thru	U-Turn	App. Total	Thru	Left	U-Turn	App. Total	Right	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 05:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 04:45 PM													
04:45 PM	0	0	0	0	90	0	0	90	0	115	0	115	205
05:00 PM	0	0	0	0	**110**	0	0	**110**	0	108	0	108	**218**
05:15 PM	0	0	0	0	99	0	0	99	0	**116**	0	**116**	215
05:30 PM	0	0	0	0	90	0	0	90	0	114	0	114	204
Total Volume	0	0	0	0	389	0	0	389	0	453	0	453	842
% App. Total	0	0	0		100	0	0		0	100	0		
PHF	.000	.000	.000	.000	.884	.000	.000	.884	.000	.976	.000	.976	.966



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80 Degrees - Sunny
Schools in Session

File Name : Lincoln_Street_at_Howard_Street_704683_10-03-2019
Site Code : Site 5 - Thursday
Start Date : 10/3/2019

Groups Printed- Cars - Buses - Trucks

	Lincoln Street From North					Howard Street From East					Lincoln Street From South					Howard Street From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
06:00 AM	2	23	0	0	25	11	16	1	0	28	0	0	0	0	0	19	0	2	0	21	74
06:15 AM	1	31	0	0	32	28	26	0	0	54	0	1	1	0	2	13	0	3	0	16	104
06:30 AM	4	32	0	0	36	23	24	1	0	48	0	6	0	0	6	17	0	2	0	19	109
06:45 AM	5	24	0	0	29	23	37	0	0	60	0	3	1	0	4	15	0	2	0	17	110
Total	12	110	0	0	122	85	103	2	0	190	0	10	2	0	12	64	0	9	0	73	397
07:00 AM	8	35	0	0	43	17	32	0	0	49	0	6	0	0	6	20	0	7	0	27	125
07:15 AM	12	26	0	0	38	22	45	0	0	67	0	3	2	0	5	28	0	6	0	34	144
07:30 AM	29	45	0	0	74	21	38	1	0	60	0	6	1	0	7	15	0	7	0	22	163
07:45 AM	26	43	0	0	69	30	49	0	0	79	0	3	2	0	5	29	0	18	0	47	200
Total	75	149	0	0	224	90	164	1	0	255	0	18	5	0	23	92	0	38	0	130	632
08:00 AM	15	39	0	0	54	15	20	1	0	36	0	2	0	0	2	29	0	8	0	37	129
08:15 AM	8	32	0	0	40	18	33	2	0	53	0	3	0	0	3	26	0	4	0	30	126
08:30 AM	9	33	0	0	42	28	30	2	0	60	0	5	2	0	7	21	0	7	0	28	137
08:45 AM	14	26	0	0	40	16	35	0	0	51	0	3	3	0	6	30	0	10	0	40	137
Total	46	130	0	0	176	77	118	5	0	200	0	13	5	0	18	106	0	29	0	135	529
09:00 AM	14	31	0	0	45	28	30	0	0	58	0	3	2	0	5	25	0	4	0	29	137
09:15 AM	9	31	0	0	40	17	24	2	0	43	0	1	1	0	2	20	0	10	0	30	115
09:30 AM	10	30	0	0	40	23	33	2	0	58	0	13	3	0	16	13	0	6	0	19	133
09:45 AM	6	21	0	0	27	25	30	0	0	55	0	2	1	0	3	25	0	10	0	35	120
Total	39	113	0	0	152	93	117	4	0	214	0	19	7	0	26	83	0	30	0	113	505
10:00 AM	11	36	0	0	47	26	22	0	0	48	0	3	1	0	4	24	0	3	0	27	126
10:15 AM	12	26	0	0	38	42	38	1	0	81	0	4	1	0	5	23	0	11	0	34	158
10:30 AM	8	32	0	0	40	34	27	0	0	61	0	6	3	0	9	27	0	9	0	36	146
10:45 AM	9	30	0	0	39	27	40	1	0	68	0	7	0	0	7	17	0	8	0	25	139
Total	40	124	0	0	164	129	127	2	0	258	0	20	5	0	25	91	0	31	0	122	569
11:00 AM	9	22	0	0	31	28	19	1	0	48	0	5	0	0	5	23	0	6	0	29	113
11:15 AM	9	26	0	0	35	34	30	2	0	66	0	5	0	0	5	26	0	18	0	44	150
11:30 AM	7	31	0	0	38	28	30	1	0	59	0	4	1	0	5	23	0	8	0	31	133
11:45 AM	18	38	0	0	56	27	31	0	0	58	0	5	1	0	6	14	0	14	0	28	148
Total	43	117	0	0	160	117	110	4	0	231	0	19	2	0	21	86	0	46	0	132	544
12:00 PM	20	36	0	0	56	29	22	5	0	56	0	4	0	0	4	30	0	3	0	33	149
12:15 PM	17	23	0	0	40	33	37	3	0	73	0	3	4	0	7	18	0	5	0	23	143
12:30 PM	14	20	0	0	34	28	31	2	0	61	0	2	2	0	4	21	0	12	0	33	132
12:45 PM	13	30	0	0	43	26	33	5	0	64	0	5	1	0	6	23	0	7	0	30	143
Total	64	109	0	0	173	116	123	15	0	254	0	14	7	0	21	92	0	27	0	119	567
01:00 PM	13	35	0	0	48	30	29	2	0	61	0	8	3	0	11	25	0	15	0	40	160
01:15 PM	9	41	0	0	50	36	24	3	0	63	0	4	2	0	6	26	0	18	0	44	163
01:30 PM	5	34	0	0	39	37	35	2	0	74	0	0	1	0	1	31	0	7	0	38	152
01:45 PM	10	19	0	0	29	45	40	1	0	86	0	3	2	0	5	25	0	10	0	35	155
Total	37	129	0	0	166	148	128	8	0	284	0	15	8	0	23	107	0	50	0	157	630
02:00 PM	13	36	0	0	49	35	37	0	0	72	0	10	2	0	12	32	0	7	0	39	172
02:15 PM	15	36	0	0	51	30	41	3	0	74	0	4	1	0	5	31	0	10	0	41	171
02:30 PM	18	33	0	0	51	40	43	0	0	83	0	7	1	0	8	23	0	9	0	32	174
02:45 PM	7	24	0	0	31	38	55	3	0	96	0	2	2	0	4	43	0	13	0	56	187
Total	53	129	0	0	182	143	176	6	0	325	0	23	6	0	29	129	0	39	0	168	704

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File Name : Lincoln_Street_at_Howard_Street_704683_10-03-2019
Site Code : Site 5 - Thursday
Start Date : 10/3/2019

Groups Printed- Cars - Buses - Trucks

	Lincoln Street From North					Howard Street From East					Lincoln Street From South					Howard Street From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
03:00 PM	11	44	0	0	55	41	33	1	0	75	0	4	0	0	4	28	0	13	0	41	175
03:15 PM	15	32	0	0	47	40	40	1	0	81	0	5	2	0	7	37	0	9	0	46	181
03:30 PM	17	31	0	0	48	63	53	3	0	119	0	5	3	0	8	32	0	8	0	40	215
03:45 PM	12	29	0	0	41	48	51	4	0	103	0	2	1	0	3	26	0	12	0	38	185
Total	55	136	0	0	191	192	177	9	0	378	0	16	6	0	22	123	0	42	0	165	756
04:00 PM	19	33	0	0	52	53	46	2	0	101	0	10	0	0	10	19	0	15	0	34	197
04:15 PM	10	33	0	0	43	51	42	6	0	99	0	2	0	0	2	27	0	10	0	37	181
04:30 PM	20	41	0	0	61	42	79	2	0	123	0	9	1	0	10	34	0	8	0	42	236
04:45 PM	17	29	0	0	46	52	117	0	0	169	0	3	2	0	5	19	0	21	0	40	260
Total	66	136	0	0	202	198	284	10	0	492	0	24	3	0	27	99	0	54	0	153	874
05:00 PM	9	49	0	0	58	60	103	1	0	164	0	7	3	0	10	41	0	19	0	60	292
05:15 PM	15	38	0	0	53	72	107	4	0	183	0	12	0	0	12	34	0	30	0	64	312
05:30 PM	19	33	0	0	52	52	46	1	0	99	0	4	3	0	7	27	0	22	0	49	207
05:45 PM	12	29	0	0	41	61	67	3	0	131	0	4	3	0	7	30	0	12	0	42	221
Total	55	149	0	0	204	245	323	9	0	577	0	27	9	0	36	132	0	83	0	215	1032
Grand Total	585	1531	0	0	2116	1633	1950	75	0	3658	0	218	65	0	283	1204	0	478	0	1682	7739
Apprch %	27.6	72.4	0	0		44.6	53.3	2.1	0		0	77	23	0		71.6	0	28.4	0		
Total %	7.6	19.8	0	0	27.3	21.1	25.2	1	0	47.3	0	2.8	0.8	0	3.7	15.6	0	6.2	0	21.7	
Cars	556	1434	0	0	1990	1563	1825	74	0	3462	0	215	63	0	278	1129	0	447	0	1576	7306
% Cars	95	93.7	0	0	94	95.7	93.6	98.7	0	94.6	0	98.6	96.9	0	98.2	93.8	0	93.5	0	93.7	94.4
Buses	11	5	0	0	16	1	12	0	0	13	0	0	1	0	1	18	0	14	0	32	62
% Buses	1.9	0.3	0	0	0.8	0.1	0.6	0	0	0.4	0	0	1.5	0	0.4	1.5	0	2.9	0	1.9	0.8
Trucks	18	92	0	0	110	69	113	1	0	183	0	3	1	0	4	57	0	17	0	74	371
% Trucks	3.1	6	0	0	5.2	4.2	5.8	1.3	0	5	0	1.4	1.5	0	1.4	4.7	0	3.6	0	4.4	4.8

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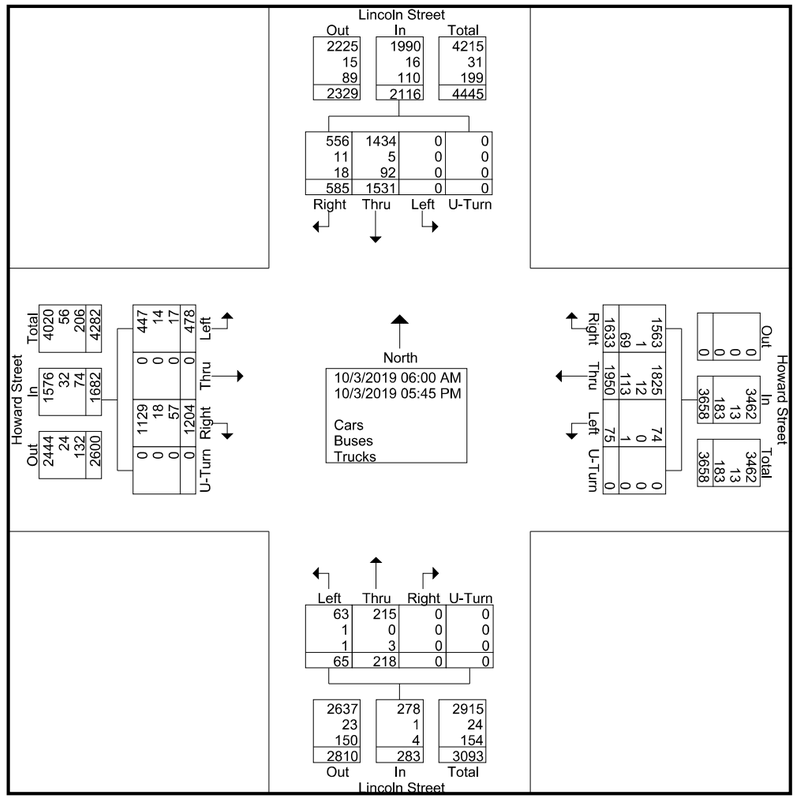
File Name : Lincoln_Street_at_Howard_Street_704683_10-03-2019
Site Code : Site 5 - Thursday
Start Date : 10/3/2019



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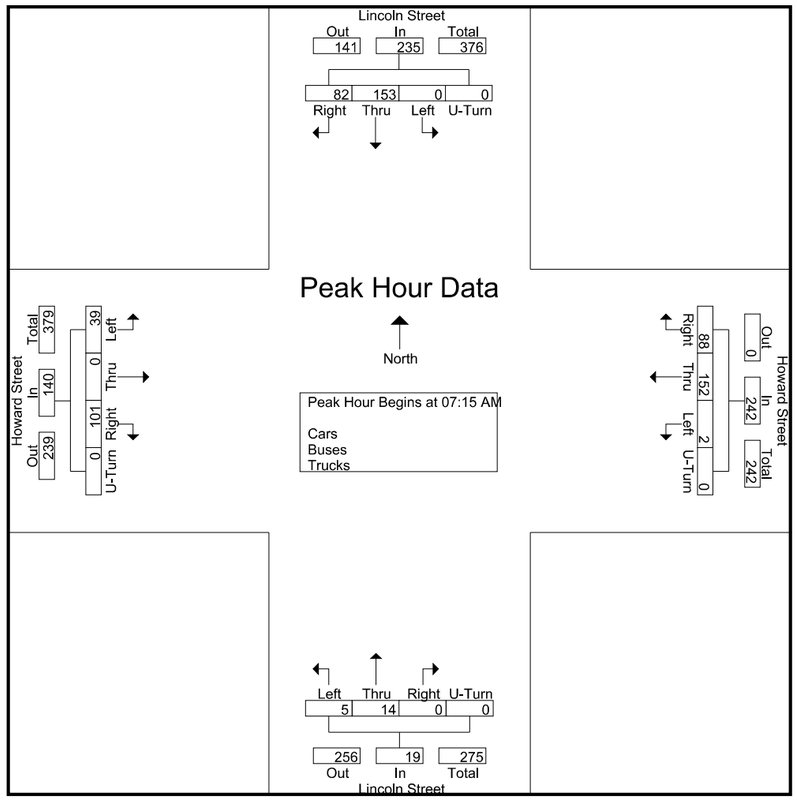
File Name : Lincoln_Street_at_Howard_Street_704683_10-03-2019
Site Code : Site 5 - Thursday
Start Date : 10/3/2019

	Lincoln Street From North					Howard Street From East					Lincoln Street From South					Howard Street From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 09:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15 AM																					
07:15 AM	12	26	0	0	38	22	45	0	0	67	0	3	**2**	0	5	28	0	6	0	34	144
07:30 AM	**29**	**45**	0	0	**74**	21	38	**1**	0	60	0	**6**	1	0	**7**	15	0	7	0	22	163
07:45 AM	26	43	0	0	69	**30**	**49**	0	0	**79**	0	3	2	0	5	**29**	0	**18**	0	**47**	**200**
08:00 AM	15	39	0	0	54	15	20	1	0	36	0	2	0	0	2	29	0	8	0	37	129
Total Volume	82	153	0	0	235	88	152	2	0	242	0	14	5	0	19	101	0	39	0	140	636
% App. Total	34.9	65.1	0	0		36.4	62.8	0.8	0		0	73.7	26.3	0		72.1	0	27.9	0		
PHF	.707	.850	.000	.000	.794	.733	.776	.500	.000	.766	.000	.583	.625	.000	.679	.871	.000	.542	.000	.745	.795



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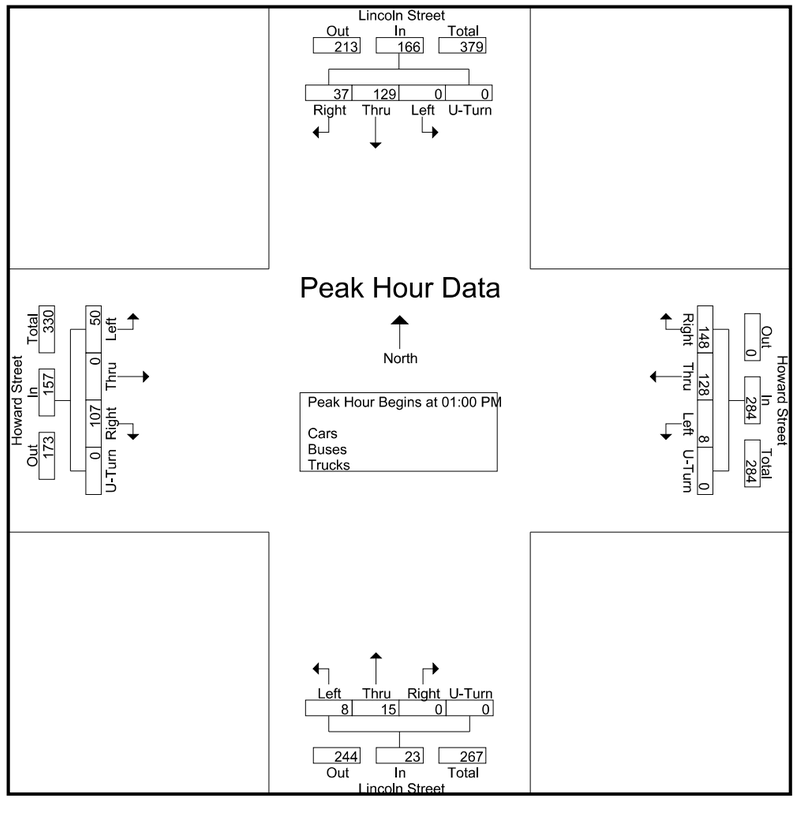
File Name : Lincoln_Street_at_Howard_Street_704683_10-03-2019
Site Code : Site 5 - Thursday
Start Date : 10/3/2019
Page No : 5

	Lincoln Street From North					Howard Street From East					Lincoln Street From South					Howard Street From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 10:00 AM to 01:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 01:00 PM																					
01:00 PM	**13**	35	0	0	48	30	29	2	0	61	0	**8**	**3**	0	**11**	25	0	15	0	40	160
01:15 PM	9	**41**	0	0	**50**	36	24	**3**	0	63	0	4	2	0	6	26	0	**18**	0	**44**	**163**
01:30 PM	5	34	0	0	39	37	35	2	0	74	0	0	1	0	1	**31**	0	7	0	38	152
01:45 PM	10	19	0	0	29	**45**	**40**	1	0	**86**	0	3	2	0	5	25	0	10	0	35	155
Total Volume	37	129	0	0	166	148	128	8	0	284	0	15	8	0	23	107	0	50	0	157	630
% App. Total	22.3	77.7	0	0		52.1	45.1	2.8	0		0	65.2	34.8	0		68.2	0	31.8	0		
PHF	.712	.787	.000	.000	.830	.822	.800	.667	.000	.826	.000	.469	.667	.000	.523	.863	.000	.694	.000	.892	.966



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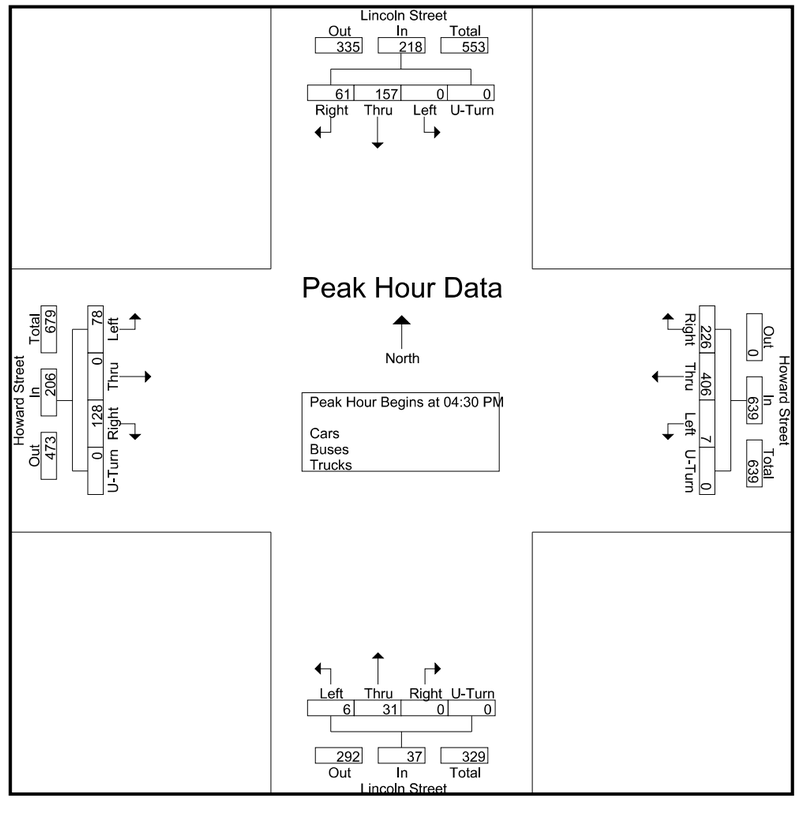
File Name : Lincoln_Street_at_Howard_Street_704683_10-03-2019
Site Code : Site 5 - Thursday
Start Date : 10/3/2019
Page No : 6

	Lincoln Street From North					Howard Street From East					Lincoln Street From South					Howard Street From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:30 PM																					
04:30 PM	**20**	41	0	0	**61**	42	79	2	0	123	0	9	1	0	10	34	0	8	0	42	236
04:45 PM	17	29	0	0	46	52	**117**	0	0	169	0	3	2	0	5	19	0	21	0	40	260
05:00 PM	9	**49**	0	0	58	60	103	1	0	164	0	7	**3**	0	10	**41**	0	19	0	60	292
05:15 PM	15	38	0	0	53	**72**	107	**4**	0	**183**	0	**12**	0	0	**12**	34	0	**30**	0	**64**	**312**
Total Volume	61	157	0	0	218	226	406	7	0	639	0	31	6	0	37	128	0	78	0	206	1100
% App. Total	28	72	0	0		35.4	63.5	1.1	0		0	83.8	16.2	0		62.1	0	37.9	0		
PHF	.763	.801	.000	.000	.893	.785	.868	.438	.000	.873	.000	.646	.500	.000	.771	.780	.000	.650	.000	.805	.881



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80 Degrees - Sunny
Schools in Session

File Name : Lincoln_Street_at_Whitley_Street_704682_10-03-2019
Site Code : Site 4 - Thursday
Start Date : 10/3/2019

Groups Printed- Cars - Buses - Trucks

	Lincoln Street From North					Whitely Street From East					Lincoln Street From South					Whitely Street From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
06:00 AM	2	1	42	0	45	0	0	0	0	0	0	1	1	0	2	0	0	0	0	0	47
06:15 AM	1	1	44	0	46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46
06:30 AM	1	0	53	0	54	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	55
06:45 AM	1	2	34	0	37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37
Total	5	4	173	0	182	0	0	0	0	0	1	1	1	0	3	0	0	0	0	0	185
07:00 AM	1	1	59	0	61	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	63
07:15 AM	3	4	52	0	59	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	60
07:30 AM	1	1	60	0	62	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	63
07:45 AM	0	4	74	0	78	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	79
Total	5	10	245	0	260	0	0	0	0	0	0	4	1	0	5	0	0	0	0	0	265
08:00 AM	2	4	64	0	70	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	71
08:15 AM	7	1	53	0	61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	61
08:30 AM	5	1	48	0	54	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	56
08:45 AM	1	1	57	0	59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	59
Total	15	7	222	0	244	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	247
09:00 AM	3	0	49	0	52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	52
09:15 AM	6	0	44	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50
09:30 AM	0	3	42	0	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45
09:45 AM	3	0	54	0	57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	57
Total	12	3	189	0	204	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	204
10:00 AM	4	2	43	0	49	0	0	0	0	0	1	1	1	0	3	0	0	0	0	0	52
10:15 AM	2	0	48	0	50	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	51
10:30 AM	3	1	54	0	58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	58
10:45 AM	1	1	45	0	47	0	0	0	0	0	1	1	0	0	2	0	0	0	0	0	49
Total	10	4	190	0	204	0	0	0	0	0	3	2	1	0	6	0	0	0	0	0	210
11:00 AM	4	3	41	0	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	48
11:15 AM	2	1	51	0	54	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	55
11:30 AM	1	6	45	0	52	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	54
11:45 AM	2	0	48	0	50	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	51
Total	9	10	185	0	204	0	0	0	0	0	2	2	0	0	4	0	0	0	0	0	208
12:00 PM	7	1	63	0	71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	71
12:15 PM	2	3	41	0	46	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	47
12:30 PM	3	2	40	0	45	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	46
12:45 PM	9	2	47	0	58	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	59
Total	21	8	191	0	220	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	223
01:00 PM	7	1	57	0	65	0	0	0	0	0	1	2	0	0	3	0	0	0	0	0	68
01:15 PM	8	3	66	0	77	0	0	0	0	0	0	2	1	0	3	0	0	0	0	0	80
01:30 PM	3	1	65	0	69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	69
01:45 PM	2	1	37	0	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40
Total	20	6	225	0	251	0	0	0	0	0	1	4	1	0	6	0	0	0	0	0	257
02:00 PM	4	0	67	0	71	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	73
02:15 PM	8	1	60	0	69	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	70
02:30 PM	3	3	45	0	51	0	0	0	0	0	1	3	0	0	4	0	0	0	0	0	55
02:45 PM	4	0	74	0	78	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	79
Total	19	4	246	0	269	0	0	0	0	0	1	4	3	0	8	0	0	0	0	0	277

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File Name : Lincoln_Street_at_Whitley_Street_704682_10-03-2019
Site Code : Site 4 - Thursday
Start Date : 10/3/2019

Groups Printed- Cars - Buses - Trucks

	Lincoln Street From North					Whitely Street From East					Lincoln Street From South					Whitely Street From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
03:00 PM	5	4	58	0	67	0	0	0	0	0	1	0	2	0	3	0	0	0	0	0	70
03:15 PM	5	2	71	0	78	0	0	0	0	0	1	0	2	0	3	0	0	0	0	0	81
03:30 PM	6	0	61	0	67	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	68
03:45 PM	4	5	53	0	62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	62
Total	20	11	243	0	274	0	0	0	0	0	2	1	4	0	7	0	0	0	0	0	281
04:00 PM	8	1	48	0	57	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	58
04:15 PM	3	6	59	0	68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	68
04:30 PM	5	4	64	0	73	0	0	0	0	0	2	1	0	0	3	0	0	0	0	0	76
04:45 PM	5	1	59	0	65	0	0	0	0	0	4	0	0	0	4	0	0	0	0	0	69
Total	21	12	230	0	263	0	0	1	0	1	6	1	0	0	7	0	0	0	0	0	271
05:00 PM	8	2	90	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
05:15 PM	8	0	76	0	84	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	85
05:30 PM	4	4	56	0	64	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	66
05:45 PM	7	4	58	0	69	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	70
Total	27	10	280	0	317	0	0	0	0	0	1	3	0	0	4	0	0	0	0	0	321
Grand Total	184	89	2619	0	2892	0	0	1	0	1	17	28	11	0	56	0	0	0	0	0	2949
Apprch %	6.4	3.1	90.6	0		0	0	100	0		30.4	50	19.6	0		0	0	0	0		
Total %	6.2	3	88.8	0	98.1	0	0	0	0	0	0.6	0.9	0.4	0	1.9	0	0	0	0	0	
Cars	183	89	2451	0	2723	0	0	1	0	1	17	28	11	0	56	0	0	0	0	0	2780
% Cars	99.5	100	93.6	0	94.2	0	0	100	0	100	100	100	100	0	100	0	0	0	0	0	94.3
Buses	1	0	21	0	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22
% Buses	0.5	0	0.8	0	0.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.7
Trucks	0	0	147	0	147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	147
% Trucks	0	0	5.6	0	5.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5

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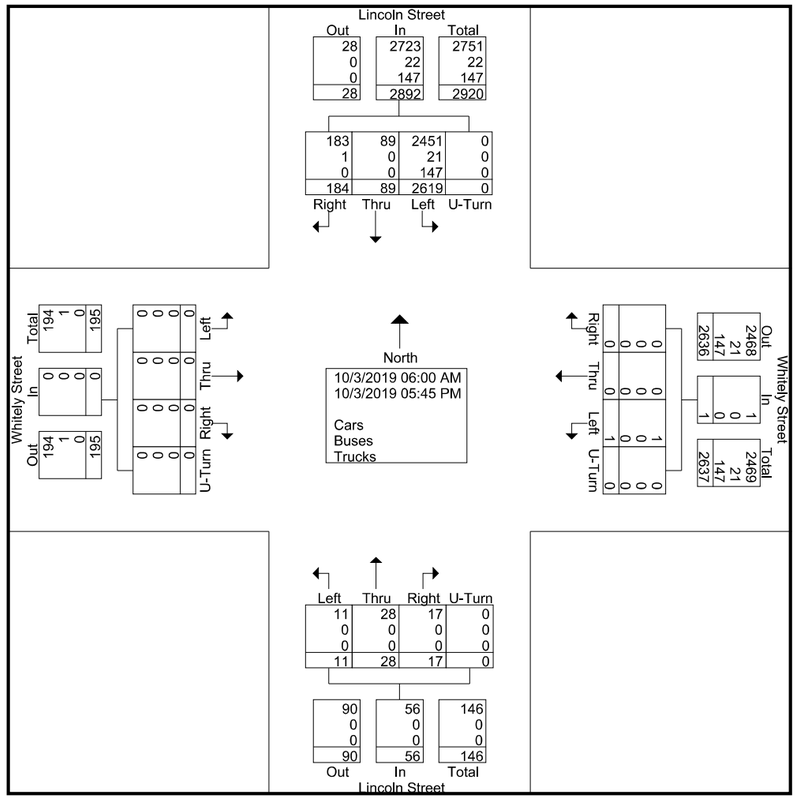
Page No : 3



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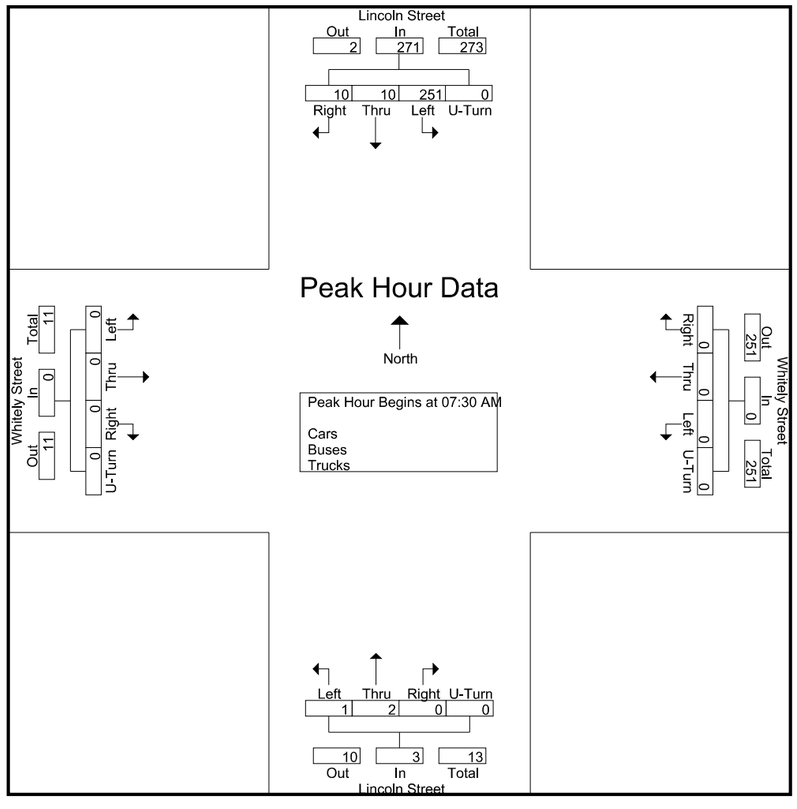
Page No : 4

	Lincoln Street From North					Whitely Street From East					Lincoln Street From South					Whitely Street From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 09:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	1	1	60	0	62	0	0	0	0	0	0	0	**1**	0	**1**	0	0	0	0	0	63
07:45 AM	0	**4**	**74**	0	**78**	0	0	0	0	0	0	**1**	0	0	1	0	0	0	0	0	**79**
08:00 AM	2	4	64	0	70	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	71
08:15 AM	**7**	1	53	0	61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	61
Total Volume	10	10	251	0	271	0	0	0	0	0	0	2	1	0	3	0	0	0	0	0	274
% App. Total	3.7	3.7	92.6	0		0	0	0	0		0	66.7	33.3	0		0	0	0	0		
PHF	.357	.625	.848	.000	.869	.000	.000	.000	.000	.000	.000	.500	.250	.000	.750	.000	.000	.000	.000	.000	.867



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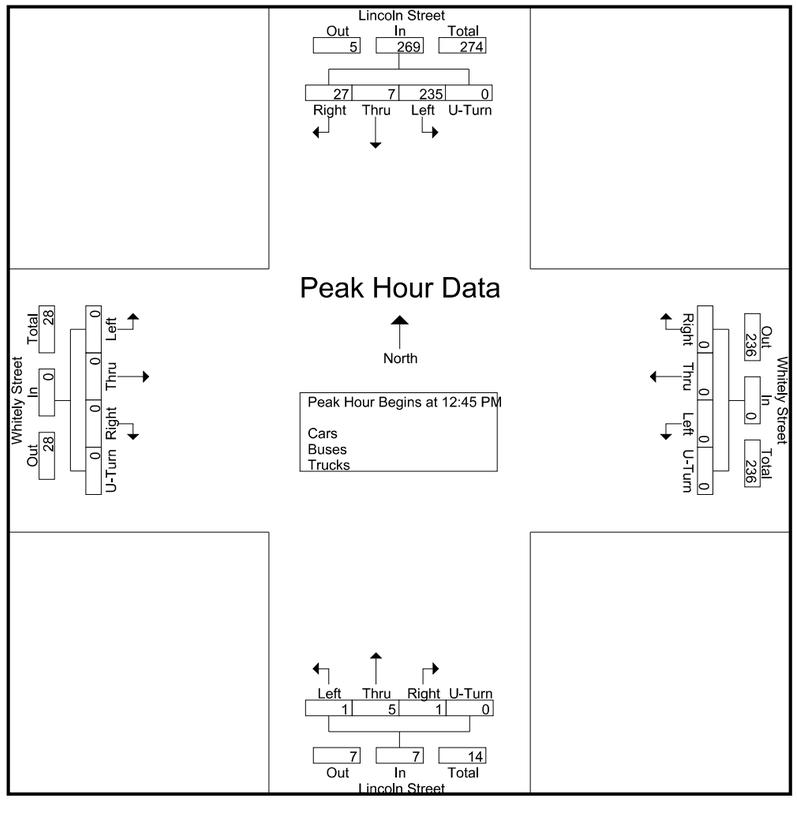
Start Date : 10/3/2019
Page No : 5

	Lincoln Street From North					Whitely Street From East					Lincoln Street From South					Whitely Street From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 10:00 AM to 01:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 12:45 PM																					
12:45 PM	**9**	2	47	0	58	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	59
01:00 PM	7	1	57	0	65	0	0	0	0	0	**1**	**2**	0	0	**3**	0	0	0	0	0	68
01:15 PM	8	**3**	**66**	0	**77**	0	0	0	0	0	0	2	**1**	0	3	0	0	0	0	0	**80**
01:30 PM	3	1	65	0	69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	69
Total Volume	27	7	235	0	269	0	0	0	0	0	1	5	1	0	7	0	0	0	0	0	276
% App. Total	10	2.6	87.4	0		0	0	0	0		14.3	71.4	14.3	0		0	0	0	0		
PHF	.750	.583	.890	.000	.873	.000	.000	.000	.000	.000	.250	.625	.250	.000	.583	.000	.000	.000	.000	.000	.863



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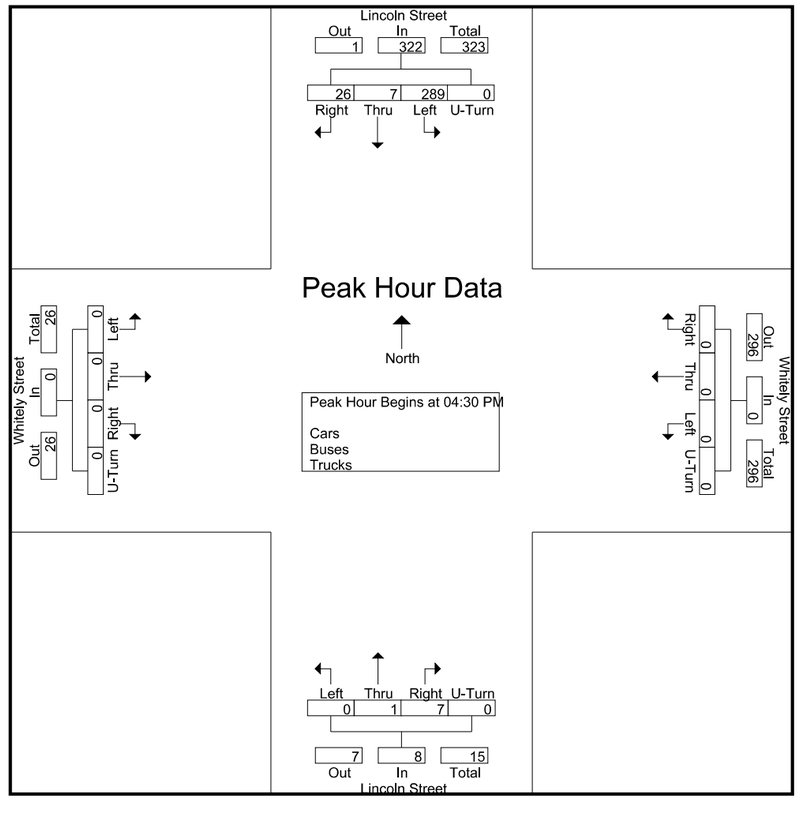
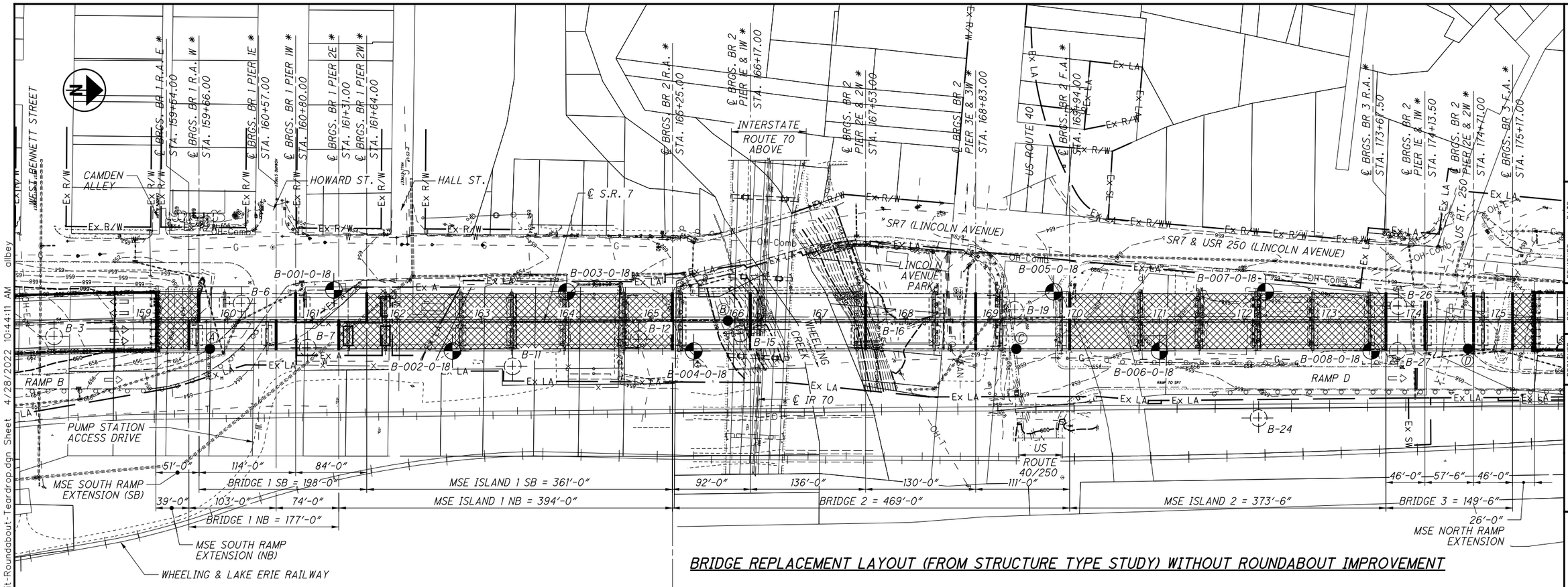
Page No : 6

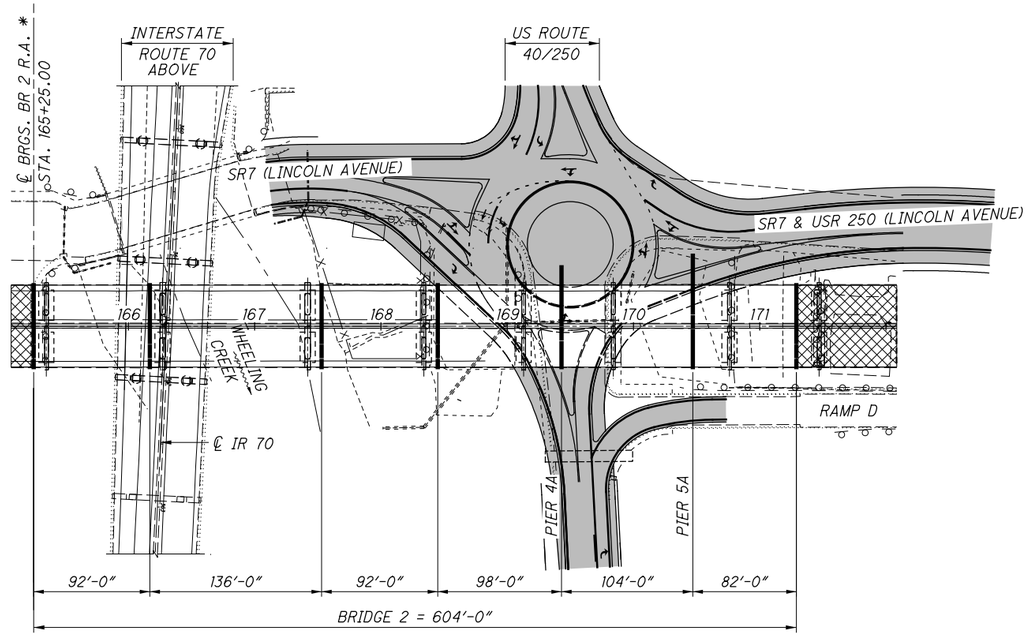
	Lincoln Street From North					Whitely Street From East					Lincoln Street From South					Whitely Street From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:30 PM																					
04:30 PM	5	**4**	64	0	73	0	0	0	0	0	2	**1**	0	0	3	0	0	0	0	0	76
04:45 PM	5	1	59	0	65	0	0	0	0	0	**4**	0	0	0	**4**	0	0	0	0	0	69
05:00 PM	**8**	2	**90**	0	**100**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**100**
05:15 PM	8	0	76	0	84	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	85
Total Volume	26	7	289	0	322	0	0	0	0	0	7	1	0	0	8	0	0	0	0	0	330
% App. Total	8.1	2.2	89.8	0		0	0	0	0		87.5	12.5	0	0		0	0	0	0		
PHF	.813	.438	.803	.000	.805	.000	.000	.000	.000	.000	.438	.250	.000	.000	.500	.000	.000	.000	.000	.000	.825



Appendix C
Conceptual Middle Bridge Layout for Single (Circular) Roundabout Alternative



BRIDGE REPLACEMENT LAYOUT (FROM STRUCTURE TYPE STUDY) WITHOUT ROUNDABOUT IMPROVEMENT



MIDDLE BRIDGE (BRIDGE 2) LAYOUT WITH ROUNDABOUT IMPROVEMENT

BURGESS & NIPLE
Engineers ■ Architects ■ Planners
5085 REED ROAD, COLUMBUS, OHIO 43220

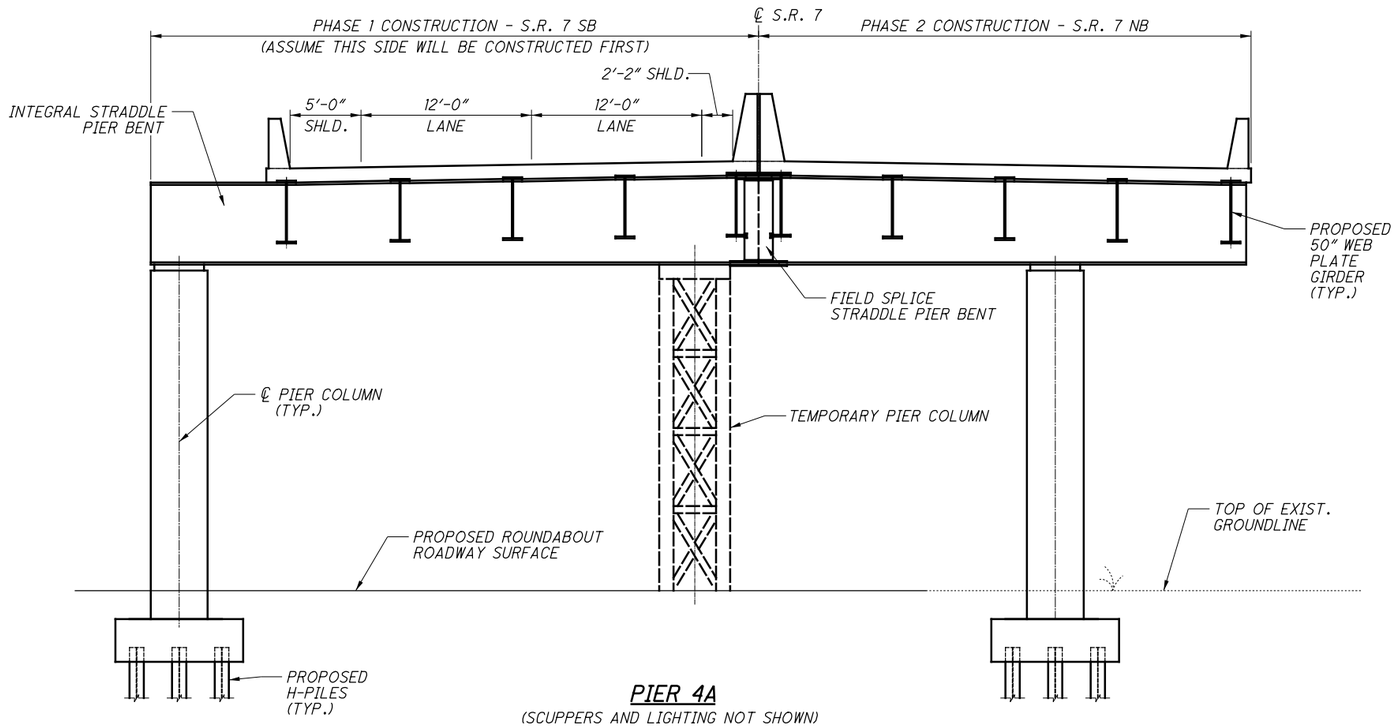
DESIGNED	DRAWN	REVIEWED	DATE
CAS	AAA	TAB	2/21/19
CHECKED	REVISED	STRUCTURE FILE NUMBER	
JHL		0700541	

BELMONT COUNTY
STA. VARIES
STA. VARIES

SITE PLAN – BRIDGE 2 WITH ROUNDABOUT
BRIDGE NO. BEL-7-1975
OVER RAMP B, WHEELING CREEK, US40/US250 AND RAMP D

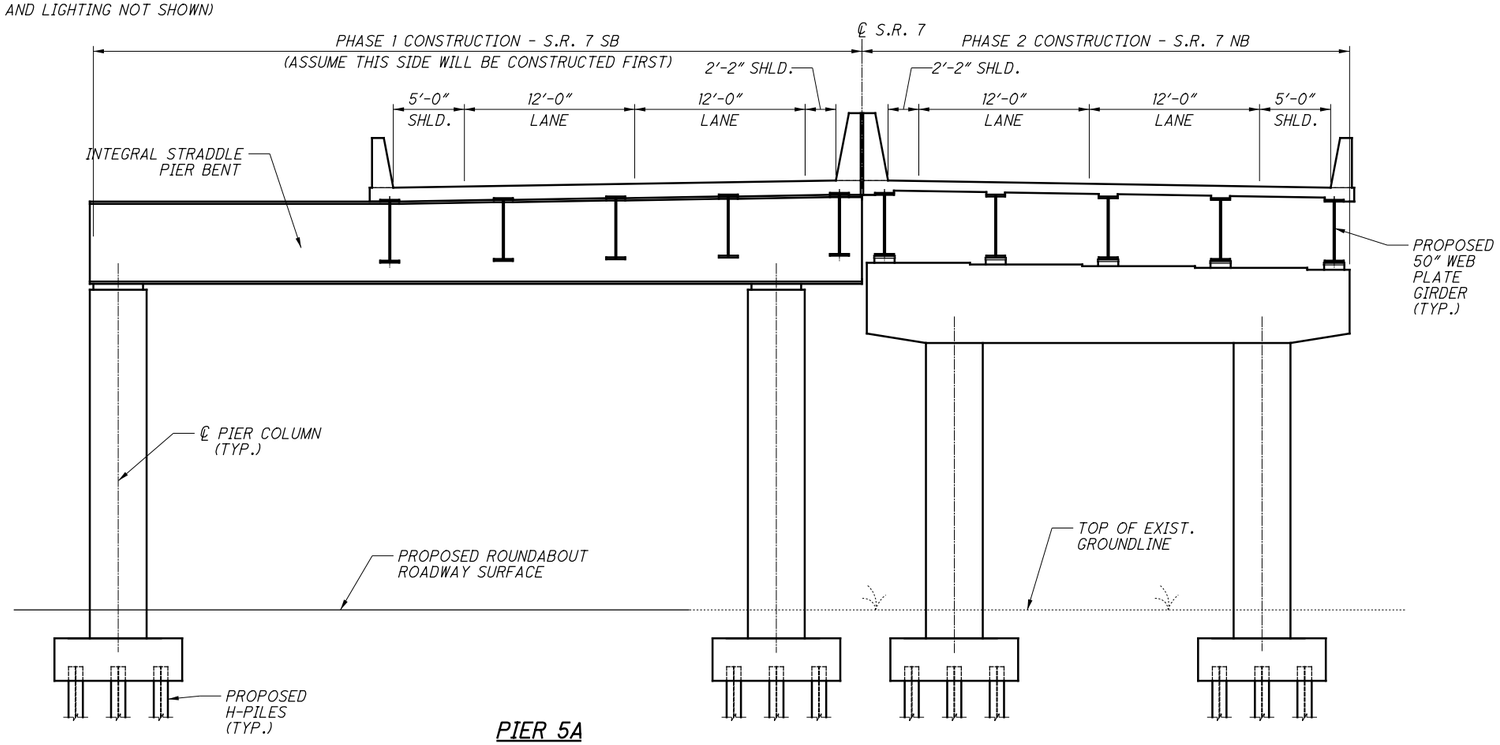
BEL-7-19.75
PID No. 105324

1 / 1



PIER 4A

(SCUPPERS AND LIGHTING NOT SHOWN)



PIER 5A

(SCUPPERS AND LIGHTING NOT SHOWN)

C - 2

P:\PR56046\BEL\105324\Design\Bridge\Interchange Traffic Studies\Sheets\Roundabout Study - Pier Elevation.dgn Sheet 3/17/2020 8:26:32 AM leej

BURGESS & NIPLE
Engineers ■ Architects ■ Planners
5085 REED ROAD, COLUMBUS, OHIO 43220

DESIGNED	DRAWN	REVIEWED	DATE
CAS	JHL	XXX	X/XX/XX
CHECKED	REVISED	STRUCTURE FILE NUMBER	
XXX		0700541	

PIER ELEVATION 2
BRIDGE NO. BEL-7-1975
OVER RAMP B, WHEELING CREEK, US40/US250 AND RAMP D

BEL-7-19.75
PID No. 105324

2 / 2

Appendix D
Preliminary Cost Estimate -
Single Roundabout Alternative

BEL-7-19.75 - BASE ALTERNATE COST ESTIMATE: BRIDGE REPLACEMENT WITHOUT ROUNDABOUT

ITEM	DESCRIPTION	TOTAL QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE (2019 dollars)
	ROADWAY				
201	CLEARING AND GRUBBING	1	LUMP	$10,000.00	$10,000
202	MISC. REMOVAL: BASKETBALL COURT REMOVED	1	EA	$7,500.00	$7,500
202	MISC. REMOVAL: PARKING METER REMOVED	44	EA	$100.00	$4,400
				ROADWAY SUBTOTAL	**$21,900**
	DRAINAGE				
	DRAINAGE	1	LUMP	$100,000.00	$100,000
	BMP ELEMENTS (WATER QUALITY BASINS, DETENTION)	1	LUMP	$80,000.00	$80,000
				DRAINAGE SUBTOTAL	**$180,000**
	PAVEMENT				
	PUMP STATION DRIVE RELOCATION				
442	ASPHALT CONCRETE SURFACE COURSE	6	CU YD	$155.00	$958
442	ASPHALT CONCRETE INTERMEDIATE COURSE	9	CU YD	$150.00	$1,298
302	ASPHALT CONCRETE BASE	45	CU YD	$160.00	$7,120
304	AGGREGATE BASE	30	CU YD	$60.00	$1,780
204	SUBGRADE COMPACTION	178	SQ YD	$4.00	$712
				PAVEMENT SUBTOTAL	**$11,900**
	MAINTENTANCE OF TRAFFIC				
	MAINTENTANCE OF TRAFFIC	1	LUMP	$2,100,000.00	$2,100,000
				MAINTENANCE OF TRAFFIC SUBTOTAL	**$2,100,000**
	TRAFFIC CONTROL				
	SIGNING/PAVEMENT MARKINGS	1	EACH	$12,000.00	$12,000
				TRAFFIC CONTROL SUBTOTAL	**$12,000**
	STRUCTURES				
	3 BRIDGES AND 2 MSE ISLANDS	1	LUMP	$17,272,182.00	$17,272,182
				STRUCTURES SUBTOTAL	**$17,272,200**
	LIGHTING				
	LIGHTING	1	LUMP	$220,000.00	$220,000
				LIGHTING SUBTOTAL	**$220,000**
	UTILITIES				
	30" SANITARY SEWER RELOCATION	1	LUMP	$70,000.00	$70,000
	2" WATER LINE RELOCATION	1	LUMP	$35,000.00	$35,000
	12" HIGH PRESSURE GAS RELOCATION	1	LUMP	$450,000.00	$450,000
				UTILITIES SUBTOTAL	**$555,000**
	CONSTRUCTION MISC.				
	PERMANENT R/W	1	LUMP	$128,000.00	$128,000
619	FIELD OFFICE, TYPE B	18	MONTH	$1,662.52	$29,925
	MOBILIZATION	1	LUMP	$100,000.00	$100,000
	CONSTRUCTION LAYOUT STAKES	1	LUMP	$156,000.00	$156,000
				CONSTRUCTION MISC. SUBTOTAL	**$414,000**
				CONSTRUCTION COST SUBTOTOAL	**$20,787,000**
	CONSTRUCTION COST CONTINGENCY - 20%				**$4,157,400**
	TOTAL COST, 2019 DOLLARS				**$24,950,000**

BEL-7-19.75 ALTERNATE 1 COST ESTIMATE: BRIDGE REPLACEMENT WITH ROUNDABOUT

ITEM	DESCRIPTION	TOTAL QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE (2019 dollars)
	ROADWAY				
201	CLEARING AND GRUBBING	1	LUMP	$10,000.00	$10,000
202	PAVEMENT REMOVED	7,405	SQ YD	$10.14	$75,089
202	CURB AND GUTTER REMOVED	5,800	FT	$4.81	$27,898
202	WALK REMOVED	17,250	SQ FT	$2.00	$34,500
202	MISC. REMOVAL: PARKING METER REMOVED	51	EA	$100.00	$5,100
202	MISC. REMOVAL: FOUNTAIN REMOVED	1	EA	$2,500.00	$2,500
202	MISC. REMOVAL: BASKETBALL COURT REMOVED	1	EA	$7,500.00	$7,500
203	EXCAVATION	3,000	CU YD	$12.50	$37,500
203	EMBANKMENT	3,000	CU YD	$11.87	$35,610
608	6" CONCRETE WALK	21,175	SQ FT	$8.92	$188,881
609	CURB, TYPE 6	220	FT	$22.16	$4,875
609	CURB & GUTTER, TYPE 2	2,350	FT	$24.55	$57,693
609	CURB & GUTTER, TYPE 9	320	FT	$25.00	$8,000
609	6" CONCRETE TRAFFIC ISLAND	587	SQ YD	$88.01	$51,633
659	SEEDING & MULCHING	18,000	SQ FT	$1.25	$22,500
690	PARKING METER REPLACED	15	EA	$250.00	$3,750
690	PAVILION REMOVED AND RELOCATED	1	EA	$20,000.00	$20,000
				ROADWAY SUBTOTAL	**$593,100**
	DRAINAGE				
	DRAINAGE	1	LUMP	$260,000.00	$260,000
	BMP ELEMENTS (WATER QUALITY BASINS, DETENTION)	1	LUMP	$120,000.00	$120,000
832	EROSION CONTROL	1	LUMP	$30,000.00	$30,000
				DRAINAGE SUBTOTAL	**$410,000**
	PAVEMENT				
	FULL-DEPTH FLEXIBLE BUILDUP				
442	ASPHALT CONCRETE SURFACE COURSE	205	CU YD	$155.00	$31,737
442	ASPHALT CONCRETE INTERMEDIATE COURSE	287	CU YD	$150.00	$42,999
302	ASPHALT CONCRETE BASE	1,621	CU YD	$160.00	$259,347
304	AGGREGATE BASE	1,081	CU YD	$60.00	$64,837
204	SUBGRADE COMPACTION	8,836	SQ YD	$4.00	$35,346
	FULL-DEPTH CONCRETE BUILDUP (FOR ROUNDABOUT TRUCK APRON)				
452	12" NON-REINFORCED CONCRETE	435	SQ YD	$90.00	$39,110
304	AGGREGATE BASE	72	CU YD	$60.00	$4,346
204	SUBGRADE COMPACTION	435	SQ YD	$4.00	$1,738
	PUMP STATION DRIVE RELOCATION				
442	ASPHALT CONCRETE SURFACE COURSE	6	CU YD	$155.00	$958
442	ASPHALT CONCRETE INTERMEDIATE COURSE	9	CU YD	$150.00	$1,298
302	ASPHALT CONCRETE BASE	45	CU YD	$160.00	$7,120
304	AGGREGATE BASE	30	CU YD	$60.00	$1,780
204	SUBGRADE COMPACTION	178	SQ YD	$4.00	$712
				PAVEMENT SUBTOTAL	**$491,400**
	MAINTENTANCE OF TRAFFIC				
	MAINTENTANCE OF TRAFFIC	1	LUMP	$2,500,000.00	$2,500,000
				MAINTENANCE OF TRAFFIC SUBTOTAL	**$2,500,000**
	TRAFFIC CONTROL				
	REMOVE EXISTING TRAFFIC SIGNAL	1	EACH	$15,000.00	$15,000
	SIGNING/PAVEMENT MARKINGS	1	EACH	$135,000.00	$135,000
				TRAFFIC CONTROL SUBTOTAL	**$150,000**
	STRUCTURES				
	3 BRIDGES AND 2 MSE ISLANDS	1	LUMP	$19,200,000.00	$19,200,000
				STRUCTURES SUBTOTAL	**$19,200,000**
	LIGHTING				
	LIGHTING	1	LUMP	$340,000.00	$340,000
				LIGHTING SUBTOTAL	**$340,000**
	UTILITIES				
	30" SANITARY SEWER RELOCATION	1	LUMP	$70,000.00	$70,000
	2" WATER LINE RELOCATION	1	LUMP	$35,000.00	$35,000
	12" HIGH PRESSURE GAS RELOCATION	1	LUMP	$450,000.00	$450,000
	FIRE HYDRANT REMOVED AND RELOCATED	3	EA	$4,000.00	$12,000
				UTILITIES SUBTOTAL	**$567,000**
	LANDSCAPING				
	LANDSCAPING	1	LUMP	$30,000.00	$30,000
				LANDSCAPING SUBTOTAL	**$30,000**
	CONSTRUCTION MISC.				
	TEMPORARY R/W	1	LUMP	$6,000.00	$6,000
	PERMANENT R/W	1	LUMP	$128,000.00	$128,000
619	FIELD OFFICE, TYPE B	18	MONTH	$1,662.52	$29,925
	MOBILIZATION	1	LUMP	$100,000.00	$100,000
	CONSTRUCTION LAYOUT STAKES	1	LUMP	$186,000.00	$186,000
				CONSTRUCTION MISC. SUBTOTAL	**$450,000**
				CONSTRUCTION COST SUBTOTOAL	**$24,731,500**
	CONSTRUCTION COST CONTINGENCY - 20%				**$4,946,300**
	TOTAL COST, 2019 DOLLARS				**$29,680,000**

Attachment D

BURGESS & NIPLE

5085 Reed Rd. | Columbus, OH 43220 | 614.459.2050

Mr. Waseem Khalifa, Ph.D., P.E.
Project Manager
Ohio Department of Transportation
District 11
2201 Reiser Avenue
New Philadelphia, OH 44663

Re: BEL-7-19.75 (PID 105324)
Main Street (US 40) & Lincoln Avenue
Traffic Operations Study

November 18, 2021

Dear Waseem,

B&N has completed a traffic operations study at the Main Street (US 40) & Lincoln Avenue intersection in Bridgeport, Ohio. The goal of this study was to evaluate the conversion of the intersection from traffic signal control to a roundabout.

PROJECT OVERVIEW

The existing northbound and southbound SR 7 bridges at the SR 7 & US 40/250 interchange are 1,628 feet in length and are scheduled for replacement. In April 2020, Burgess & Niple completed the SR 7 & US 40/250 Interchange Evaluation Technical Memorandum. This memo evaluated several interchange concepts for the existing interchange to identify feasible interchange improvements and associated impacts to the design of the SR 7 bridges. The conclusion from this memo was that the existing interchange configuration was the best fit for the interchange given the various physical and geometric constraints in the area. However, the memo did identify that the intersection of Main Street (US 40) & Lincoln Avenue is at capacity and improvements are necessary. A roundabout was identified as the feasible alternative for this intersection.

This traffic operations study further expands the evaluation of the roundabout alternative by developing certified traffic and expanding the study area to confirm that the roundabout will not impact adjacent signalized intersections. See ***Figure 1*** for an aerial view of the project site. ***Figure 2*** shows the recommended roundabout alternative at the intersection.

Figure 1 – Project Location

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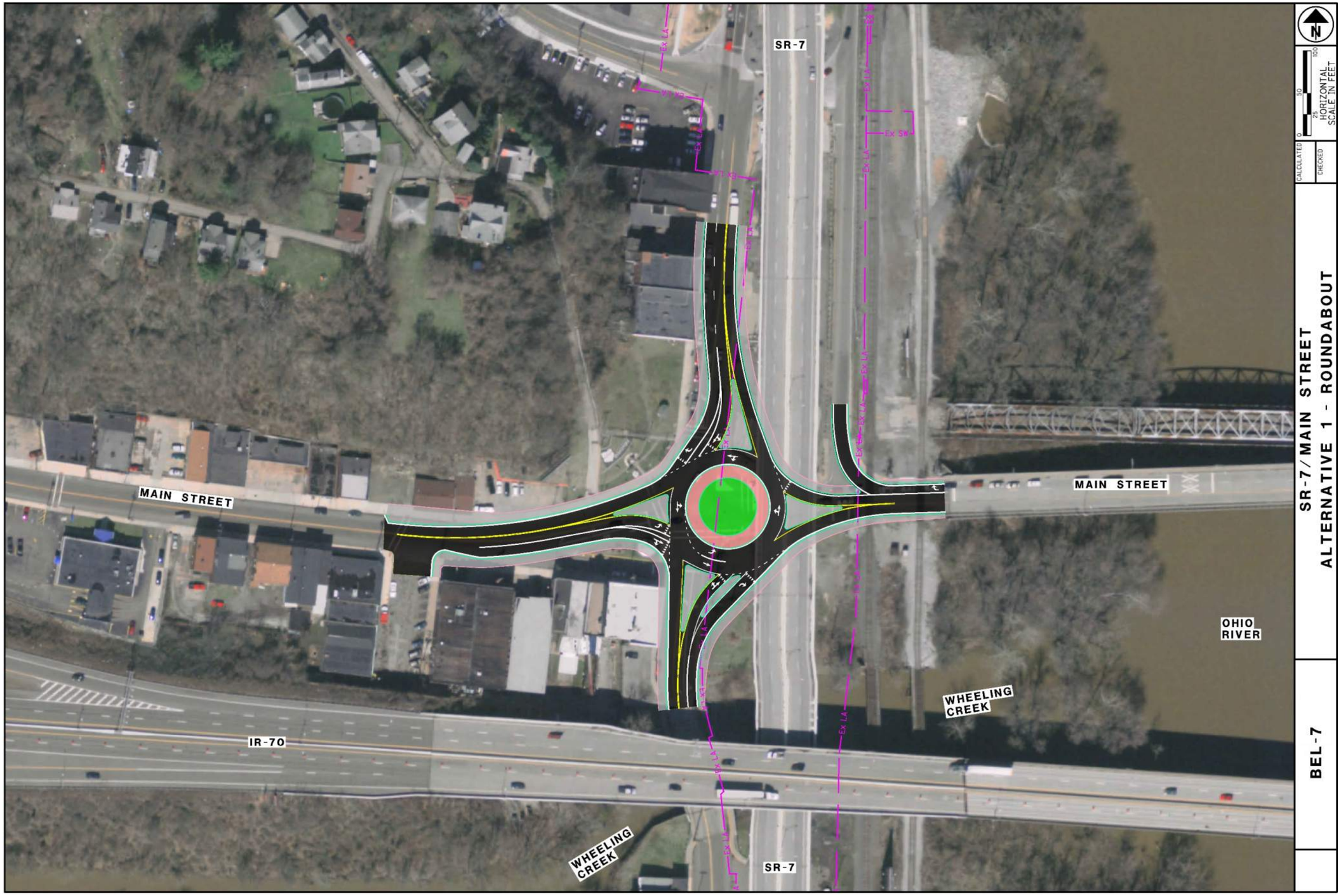


Figure 2 – Roundabout Alternative

STUDY INTERSECTIONS

The traffic analysis study area includes the following 6 intersections:

- Main Street & Marion Street
- Main Street/Council Street & Lincoln Avenue
- Zane Street & Huron Street (in West Virginia)
- Lincoln Avenue & Howard Street
- Cadiz Pike & SR 7 NB On-ramp
- Cadiz Pike & SR 7 SB Off-ramp

CERTIFIED TRAFFIC VOLUMES

Certified traffic was developed by Burgess & Niple, Inc. and submitted to the ODOT Office of Statewide Planning and Research, Modeling and Forecasting Section for review and approval. Because the roundabout increases the capacity at this intersection, additional traffic was drawn to the corridor in the travel demand model. Therefore, separate No-Build and Build future year traffic forecasts were developed for the corridor. Opening Year is 2025 and Design Year is 2045 certified traffic volumes can be found in ***Appendix A***.

CAPACITY ANALYSIS

Capacity analyses for the No-Build and Build conditions were conducted for the 2045 design year. All design year traffic analyses are based on the procedures outlined in the *Highway Capacity Manual 6th Edition (HCM).*

Per the ODOT OATS Manual, peak hour factors (PHF) for intersection analysis should be calculated using traffic counts. For the analysis in this memo, existing turning movement counts that were collected for the SR 7 & US 40/250 Interchange Evaluation Technical Memorandum were used to calculate PHFs. ***Table 1*** shows the calculated PHF at the study intersections.

Table 1: Intersection Peak Hour Factors

INTERSECTION	AM PHF	PM PHF
Main Street & Marion Street	0.92	0.92
Main Street & Lincoln Street	0.93	0.97
Zane Street & Huron Street (WV)	0.92	0.92
Lincoln Avenue & Howard Street	0.80	0.86
Cadiz Pike & SR 7 NB On-Ramp	0.84	0.96
Cadiz Pike & SR 7 SB Off-Ramp	0.95	0.98

Signalized intersection, unsignalized intersection and roundabout capacity analysis was conducted for the 2045 No-Build and Build condition using the *Highway Capacity Software version 7.9.5 (HCS)*. ***Table 2*** shows the results of the capacity analysis for the study intersections during the AM peak hour and ***Table 3*** shows the intersection capacity results during the PM peak hour. The operational goals for the traffic analysis are that the overall intersection operates with a Level of Service (LOS) of D or better and with each movement at LOS E or better. Capacity results are discussed below, and detailed capacity analysis outputs are contained in ***Appendix B***.

Table 2 – AM Peak Hour Intersection Operational Results

	2045 AM No-Build					2045 AM Build				
	LOS	Delay sec/veh	v/c	QSR	95th %ile	LOS	Delay Sec/veh	v/c	QSR	95th %ile
Main Street & Marion Street (Signalized)										
EBT	C	33.3	0.29	0.07	179'	C	31.4	0.29	0.08	186'
EBR	C	23.5	0.47	0.57	298'	C	21.0	0.43	0.52	275'
EB Approach	**C**	**26.6**				**C**	**24.6**			
WBL	D	44.3	0.94	0.45	542'	D	47.8	0.95	0.54	654'
WBT	A	2.3	0.22	0.03	38'	A	5.6	0.21	0.09	102'
WB Approach	**C**	**30.7**				**C**	**34.3**			
NBL	D	49.3	0.78	1.68	293'	D	49.2	0.78	1.67	293'
NBR	B	16.5	0.44	1.54	269'	B	18.0	0.45	1.56	273'
NB approach	**C**	**29.1**				**C**	**30.2**			
Intersection	**C**	**29.2**				**C**	**30.6**			
Main Street & Lincoln Street (Signalized No-Build, Roundabout Build)										
EBL	F	122.0	1.11	2.56	639'	C	20.8	0.65		118'
EBT/**EBTR**	C	31.0	0.11	0.08	97'	A	9.5	0.23		23'
EBR	C	24.6	0.11	0.67	67'					
EB Approach	**F**	**95.4**				**C**	**17.8**			
WBL/**WBLTR**	D	43.7	0.54	0.17	206'	A	6.9	0.22		20'
WBTR	F	83.3	0.98	0.41	495'					
WB Approach	**E**	**70.1**				**A**	**6.9**			
NBL/**NBLT**	E	60.5	0.18	0.05	16'	B	11.1	0.23		23'
NBTR/**NBR**	D	47.3	0.60	0.29	234'	A	8.6	0.14		13'
NB approach	**D**	**48.0**				**B**	**10.1**			
SBL/**SBLT**	C	32.7	0.86	1.27	478'	B	12.3	0.66		135'
SBTR/**SBR**	F	93.7	1.10	3.41	1278'	B	11.1	0.62		113'
SB approach	**E**	**70.6**				**B**	**11.7**			
Intersection	**E**	**73.6**				**B**	**12.5**			

XXX – No-Build Condition Lane Use
XXX – Build Condition Lane Use

Table 2 – AM Peak Hour Intersection Operational Results (continued)

	2045 AM No-Build					2045 AM Build				
	LOS	Delay sec/veh	v/c	QSR	95th %ile	LOS	Delay Sec/veh	v/c	QSR	95th %ile
Zane Street & Huron Street (Signalized)										
EBTR	B	15.1	0.52	0.36	438'	A	8.9	0.45	0.23	275'
EB Approach	B	15.1				A	8.9			
WBLT	A	7.4	0.34	0.58	202'	A	7.8	0.35	0.61	212'
WB Approach	A	7.4				A	7.8			
NBL	D	54.6	0.22	0.59	29'	D	54.6	0.22	0.59	29'
NBR	D	54.2	0.12	0.03	15'	D	54.2	0.12	0.03	15'
NB approach	D	54.5				D	54.5			
SBL	E	56.9	0.78	1.34	168'	E	56.6	0.79	1.46	183'
SBT	D	51.3	0.20	0.15	42'	D	50.6	0.19	0.15	42'
SBR	D	53.3	0.48	0.70	87'	D	52.4	0.45	0.67	87'
SB Approach	**D**	**55.0**				**D**	**54.5**			
Intersection	**B**	**19.9**				**B**	**17.6**			
Lincoln Avenue & Howard Street (Signalized)										
EBLR	B	18.8	0.48	0.14	115'	B	20.0	0.50	0.14	120'
EB Approach	**B**	**18.8**				**B**	**20.0**			
WBLTR	C	21.4	0.74	0.37	220'	C	22.0	0.72	0.34	205'
WB Approach	**C**	**21.4**				**C**	**22.0**			
NBLT	A	6.9	0.04	0.02	11'	A	6.3	0.04	0.04	10'
NB approach	**A**	**6.9**				**A**	**6.3**			
SBT	A	7.8	0.22	0.08	66'	A	7.6	0.25	0.09	75'
SBR	A	7.7	0.16	0.08	38'	A	7.0	0.15	0.08	35'
SB Approach	**A**	**7.9**				**A**	**7.4**			
Intersection	**B**	**15.6**				**B**	**15.3**			
Cadiz Pike & SR 7 NB On-Ramp (Signalized)										
EBL	A	3.5	0.48	0.54	54'	A	3.0	0.48	0.45	45'
EB Approach	**A**	**3.5**				**A**	**3.0**			
NBT	C	27.5	0.87	0.67	270'	C	27.5	0.87	0.67	270'
NB approach	**C**	**27.5**				**C**	**27.5**			
Intersection	**B**	**15.1**				**B**	**14.8**			
Cadiz Pike & SR 7 SB Off-Ramp (Signalized)										
EBTR	C	27.2	0.62	0.14	216'	C	31.2	0.67	0.15	223'
EB Approach	**C**	**27.2**				**C**	**31.2**			
NBLR	B	18.7	0.80	0.80	301'	B	18.6	0.82	0.83	312'
NB approach	**B**	**18.7**				**B**	**18.6**			
SBLTR	B	11.4	0.58	0.31	222'	B	10.5	0.60	0.33	231'
SB Approach	**B**	**11.4**				**B**	**10.5**			
Intersection	**B**	**15.7**				**B**	**15.5**			

Table 3 – PM Peak Hour Intersection Operational Results

	2045 PM No-Build					2045 PM Build				
	LOS	Delay sec/veh	v/c	QSR	95th %ile	LOS	Delay Sec/veh	v/c	QSR	95th %ile
Main Street & Marion Street (Signalized)										
EBT	D	39.8	0.55	0.13	328'	D	40.1	0.55	0.13	329'
EBR	B	17.4	0.37	0.44	233'	B	17.5	0.37	0.44	233'
EB Approach	**C**	**28.4**				**C**	**28.6**			
WBL	D	46.1	0.93	0.38	455'	D	48.2	0.94	0.49	587'
WBT	A	1.8	0.30	0.03	32'	A	9.5	0.30	0.16	195'
WB Approach	**C**	**27.8**				**C**	**32.2**			
NBL	D	50.0	0.89	2.56	448'	D	49.8	0.89	2.56	447'
NBR	B	17.0	0.53	1.87	327'	B	17.4	0.57	2.03	355'
NB approach	**C**	**31.9**				**C**	**31.5**			
Intersection	**C**	**29.4**				**C**	**31.0**			
Main Street & Lincoln Street (Signalized No-Build, Roundabout Build)										
EBL	F	242.1	1.41	4.71	1178'	C	23.2	0.75		173'
EBT/**EBTR**	B	19.8	0.18	0.13	155'	A	9.0	0.30		33'
EBR	B	12.7	0.05	0.25	25'					
EB Approach	**F**	**174.3**				**C**	**19.2**			
WBL/**WBLTR**	D	48.7	0.60	0.25	305'	C	17.5	0.62		108'
WBTR	F	220.9	1.37	1.27	1526'					
WB Approach	**F**	**175.6**				**C**	**17.5**			
NBL/**NBLT**	F	126.3	0.86	0.41	123'	C	19.6	0.51		70'
NBTR/**NBR**	F	178.1	1.24	1.02	819'	C	16.0	0.47		60'
NB approach	**F**	**172.3**				**C**	**17.8**			
SBL/**SBLT**	F	306.9	1.57	3.24	1214'	B	12.2	0.62		113'
SBTR/**SBR**	F	100.8	1.09	2.74	1028'	B	11.9	0.61		110'
SB approach	**F**	**187.3**				**B**	**12.1**			
Intersection	**F**	**178.9**				**C**	**15.5**			

XXX – No-Build Condition Lane Use
XXX – Build Condition Lane Use

Table 3 – PM Peak Hour Intersection Operational Results (continued)

	2045 PM No-Build					2045 PM Build				
	LOS	Delay sec/veh	v/c	QSR	95th %ile	LOS	Delay Sec/veh	v/c	QSR	95th %ile
Zane Street & Huron Street (Signalized)										
EBTR	B	13.0	0.53	0.26	317'	B	14.0	0.67	0.41	488'
EB Approach	**B**	**13.0**				**B**	**14.0**			
WBLT	B	12.5	0.60	1.22	426'	B	13.3	0.63	1.32	463'
WB Approach	**B**	**12.5**				**B**	**13.3**			
NBL	E	56.5	0.74	3.03	152'	E	56.5	0.76	3.03	152'
NBR	D	51.5	0.17	0.07	28'	D	51.5	0.17	0.07	28'
NB approach	**E**	**55.6**				**E**	**55.6**			
SBL	E	56.3	0.76	1.33	167'	E	56.3	0.76	1.33	167'
SBT	D	50.6	0.13	0.10	28'	D	50.6	0.13	0.10	28'
SBR	E	57.0	0.78	1.22	153'	E	57.0	0.78	1.22	153'
SB Approach	**E**	**56.1**				**E**	**56.1**			
Intersection	**C**	**21.8**				**C**	**21.6**			
Lincoln Avenue & Howard Street (Signalized)										
EBLR	C	26.2	0.78	0.31	260'	C	24.2	0.76	0.29	249'
EB Approach	**C**	**26.2**				**C**	**24.2**			
WBLTR	B	19.6	0.83	0.85	510'	B	19.0	0.81	0.79	472'
WB Approach	**B**	**19.6**				**B**	**19.0**			
NBLT	C	22.6	0.11	0.08	40'	C	21.2	0.10	0.08	38'
NB approach	**C**	**22.6**				**C**	**21.2**			
SBT	C	26.6	0.42	0.20	161'	C	24.4	0.36	0.18	144'
SBR	C	23.6	0.19	0.13	58'	C	22.4	0.20	0.14	65'
SB Approach	**C**	**25.8**				**C**	**23.7**			
Intersection	**C**	**22.2**				**C**	**21.1**			
Cadiz Pike & SR 7 NB On-Ramp (Signalized)										
EBL	C	23.5	0.61	4.50	450'	C	21.8	0.51	3.61	361'
EB Approach	**C**	**23.5**				**C**	**21.8**			
NBT	D	39.9	0.94	1.33	533'	D	38.7	0.94	1.41	564'
NB approach	**D**	**39.9**				**D**	**38.7**			
Intersection	**C**	**31.7**				**C**	**31.4**			
Cadiz Pike & SR 7 SB Off-Ramp (Signalized)										
EBTR	E	65.7	0.78	0.18	278'	E	78.2	0.85	0.19	287'
EB Approach	**E**	**65.7**				**E**	**78.2**			
NBLR	E	63.5	1.04	2.53	948'	F	129.3	1.21	3.74	1402'
NB approach	**E**	**63.5**				**F**	**129.3**			
SBLTR	A	5.5	0.40	0.25	181'	A	4.9	0.41	0.25	179'
SB Approach	**A**	**5.5**				**A**	**4.9**			
Intersection	**C**	**33.2**				**E**	**58.5**			

At Main Street (US 40) & Lincoln Avenue intersection, the No-Build condition is expected to operate at LOS E in the AM peak and LOS F in the PM peak with volume-to-capacity (v/c) ratios exceeding 1.50 and queue lengths greater than 1500 feet. With the addition of a roundabout, the intersection is expected to operate at LOS B in the AM peak and LOS C in the PM peak. All v/c ratios in the Build condition are expected to be 0.75 or lower. In addition, all queue lengths are expected to be less than 175 feet. **The roundabout alternative is a significant improvement compared to the No-Build condition**.

At the remaining intersections in the study area, no capacity improvements are proposed and the No-Build and Build volumes are almost the same. For this reason, the intersections generally operate almost the same in both the No-Build and Build conditions. The intersections of Cadiz Pike at the NB and SB SR 7 ramps are currently unsignalized. Initial analysis showed that these intersections will experience very long delays for the stop-controlled approaches in 2045. Therefore, it was assumed that traffic signals would be installed prior to 2045. As shown in ***Table 2***, the intersections will operate well in the AM peak with the addition of signals. However, ***Table 3*** shows that the intersections will operate at capacity with very long queues during the PM peak hour in both the No-Build and Build conditions. This poor operation is caused by the single northbound lane at the SR 7 SB ramp intersection. Northbound left turning vehicles block the right turning vehicles at the intersection, causing long queues. This creates the need to increase the cycle length, which in turn, increases the delays and queues at the SR 7 NB intersection. To improve the operation during the PM peak, it is recommended that a northbound right turn lane is added at the SR 7 SB ramp intersection when the traffic signals are installed. This additional lane will reduce the delay and queues for the SR 7 SB intersection and allow a shorter cycle length, which will benefit the SR 7 NB intersection. ***Table 4*** shows results of the capacity analysis for the Cadiz Pike & SR 7 intersections during the PM peak hour with the addition of a northbound right turn lane. There is one movement where the QSR is greater than 1.0, however, the queue length for this movement is only 64 feet longer than the available storage length. It is anticipated that aggressive signal coordination between the northbound right turning vehicles at the SR 7 SB intersection and the eastbound left turning vehicles at the SR 7 NB intersection would reduce the queue length.

Table 4 – PM Peak Hour Intersection Operational Results With a Northbound Right Turn Lane

	2045 PM No-Build					2045 PM Build				
	LOS	Delay sec/veh	v/c	QSR	95th %ile	LOS	Delay Sec/veh	v/c	QSR	95th %ile
Cadiz Pike & SR 7 NB On-Ramp (Signalized)										
EBL	B	10.2	0.71	1.51	151'	B	11.2	070	1.64	164'
EB Approach	**B**	**10.2**				**B**	**11.2**			
NBT	C	24.7	0.90	0.84	336'	C	23.9	0.91	0.88	354'
NB approach	**C**	**24.7**				**C**	**23.9**			
Intersection	**B**	**17.0**				**B**	**17.6**			
Cadiz Pike & SR 7 SB Off-Ramp (Signalized)										
EBTR	C	31.1	0.56	0.10	154'	D	39.8	0.68	0.11	170'
EB Approach	**C**	**31.1**				**D**	**39.8**			
NBL	B	18.1	0.60	0.32	118'	C	24.6	0.73	0.50	186'
NBR	A	8.3	0.58	0.48	179'	A	6.6	0.53	0.38	143'
NB approach	**B**	**10.9**				**B**	**12.3**			
SBLTR	A	7.5	0.48	0.20	148'	A	6.1	0.48	0.18	133'
SB Approach	**A**	**7.5**				**A**	**6.1**			
Intersection	**B**	**11.0**				**B**	**11.4**			

CONCLUSIONS

In summary, this traffic operations study has shown that converting the Main Street (US 40) & Lincoln Avenue intersection from a traffic signal to a roundabout would be a significant improvement at the intersection. Because, the adjacent intersections will operate with very similar delays and queues, the roundabout will not have a significant impact to the traffic operations on SR 7.

If you have any questions or need additional information related to our analysis, please do not hesitate to contact us.

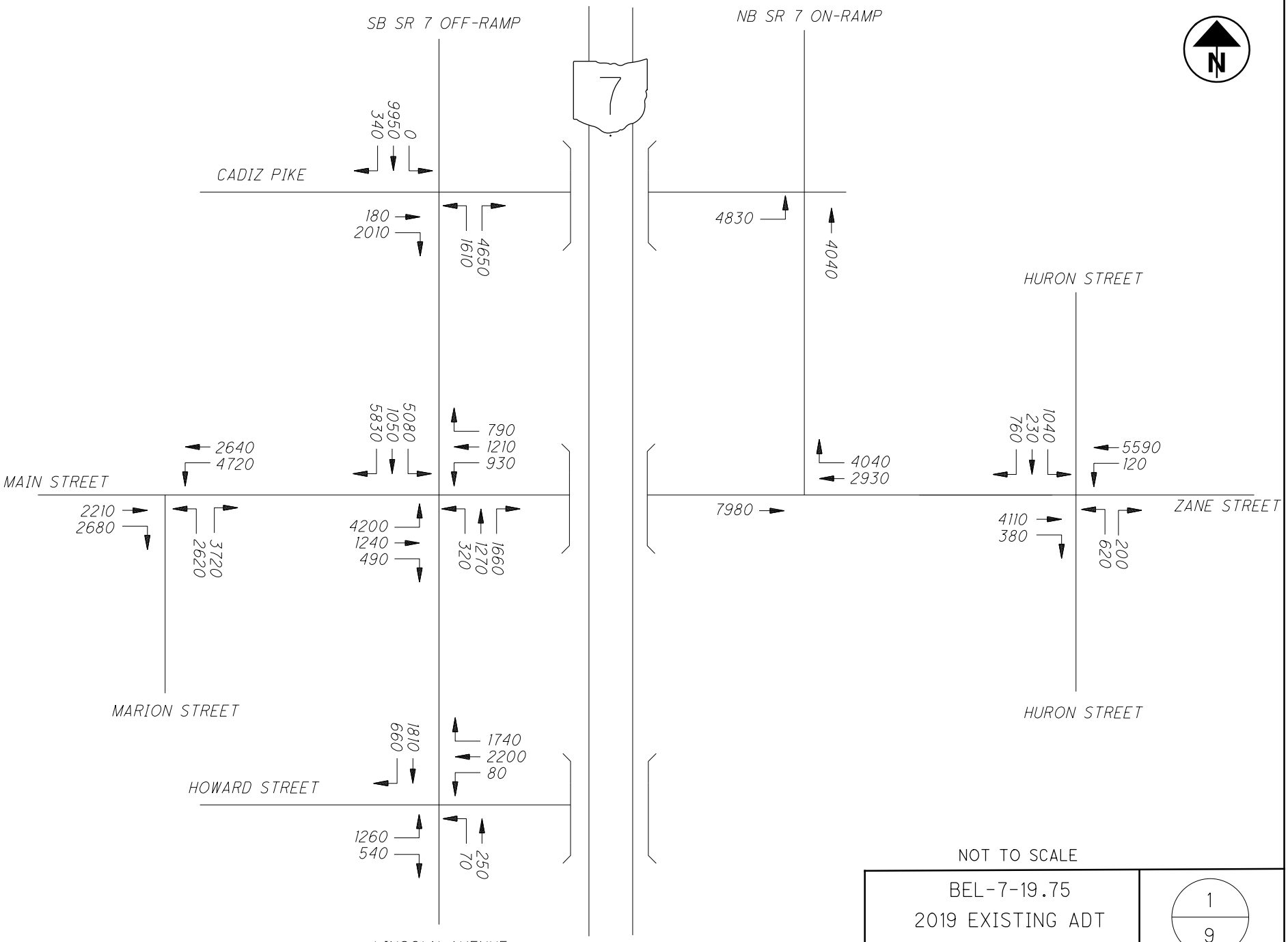
Sincerely,

Randy Kill

Randy Kill, PE, PTOE
Senior Traffic Engineer

APPENDIX A

CERTIFIED TRAFFIC



NOT TO SCALE

BEL-7-19.75
2019 EXISTING ADT
PID 105324

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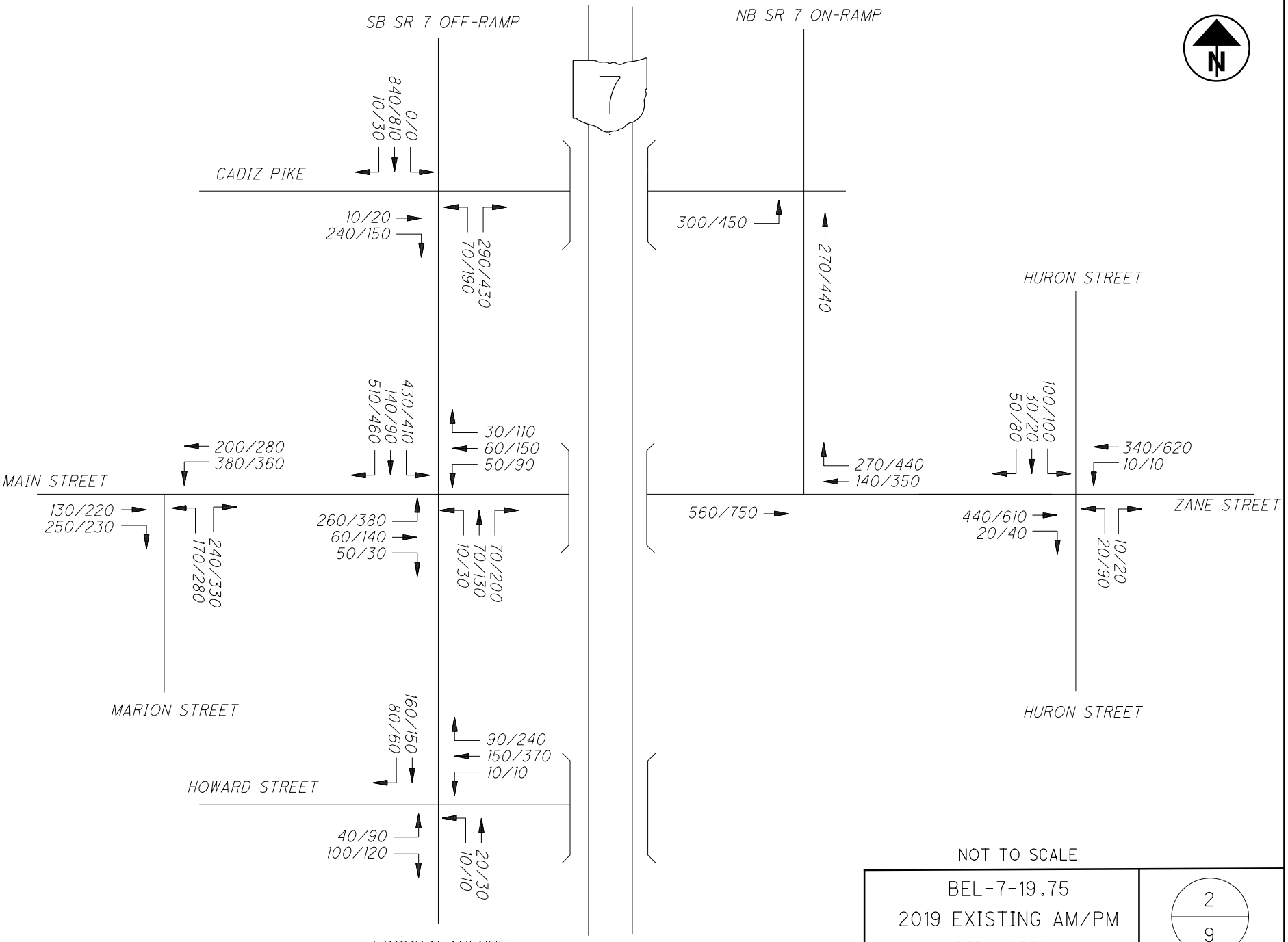
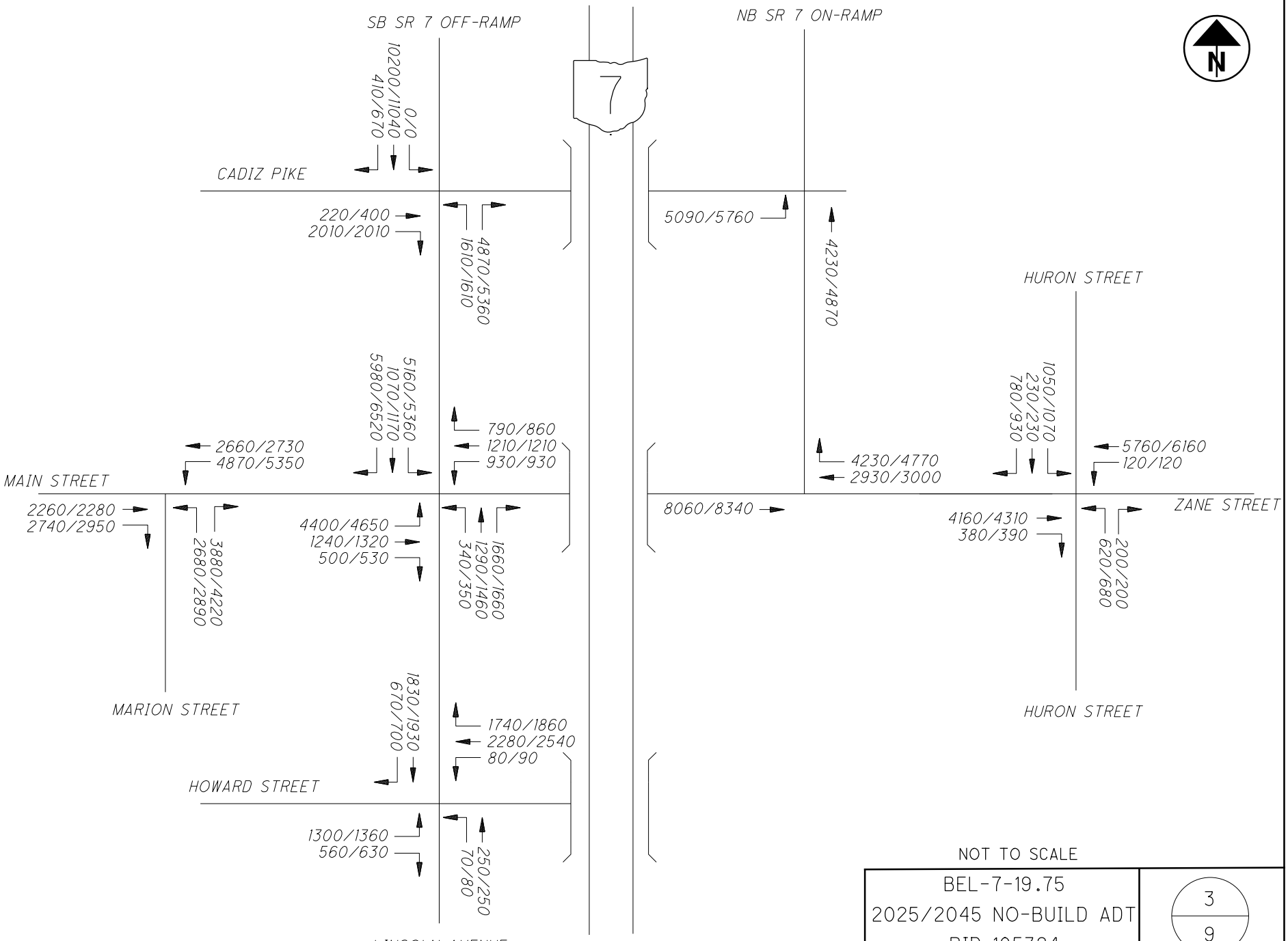


NOT TO SCALE

BEL-7-19.75
2019 EXISTING AM/PM
PID 105324



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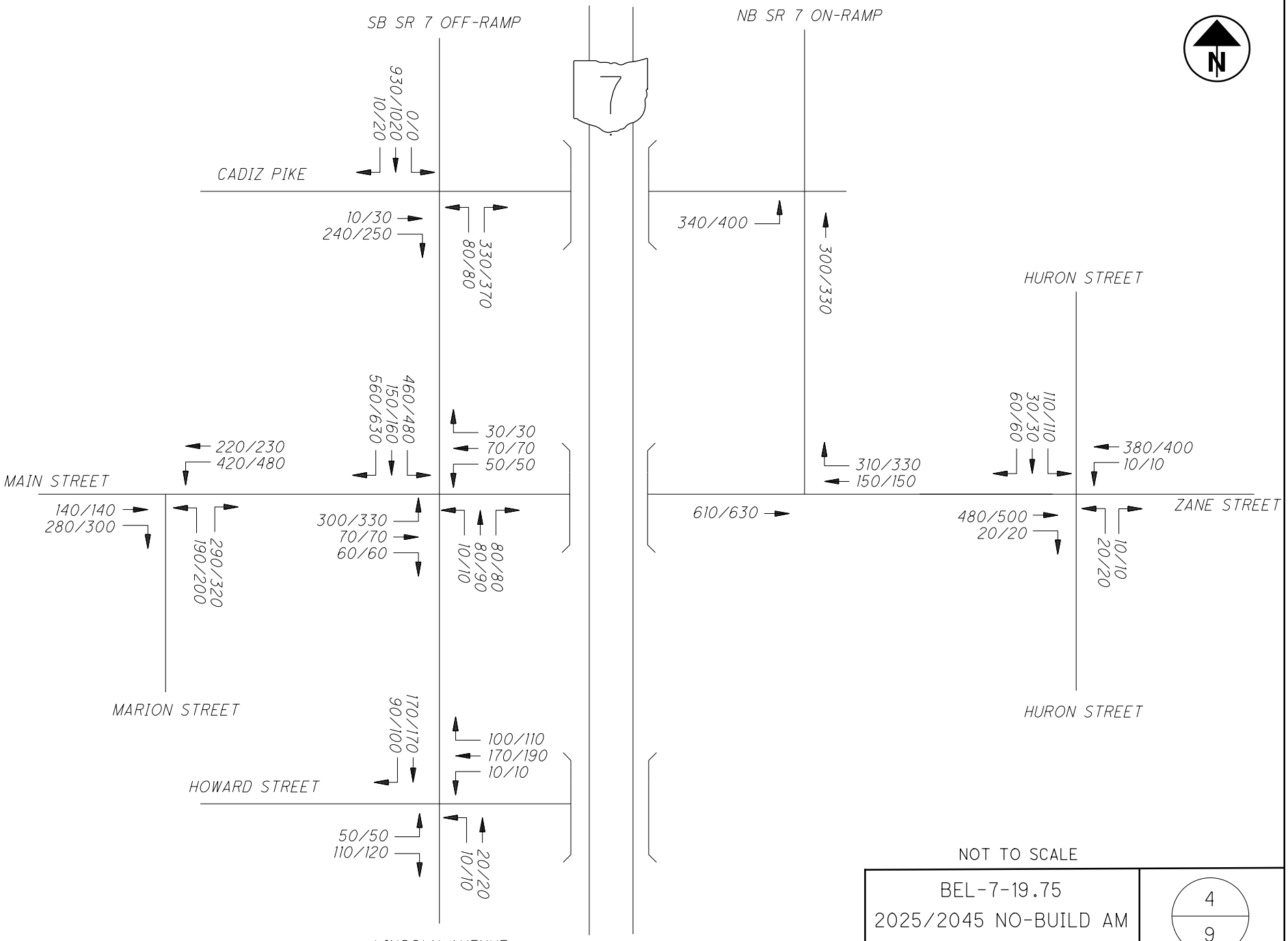
BEL-7-19.75 2025/2045 NO-BUILD ADT PID 105324	3 9



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BEL-7-19.75
2025/2045 NO-BUILD AM
PID 105324

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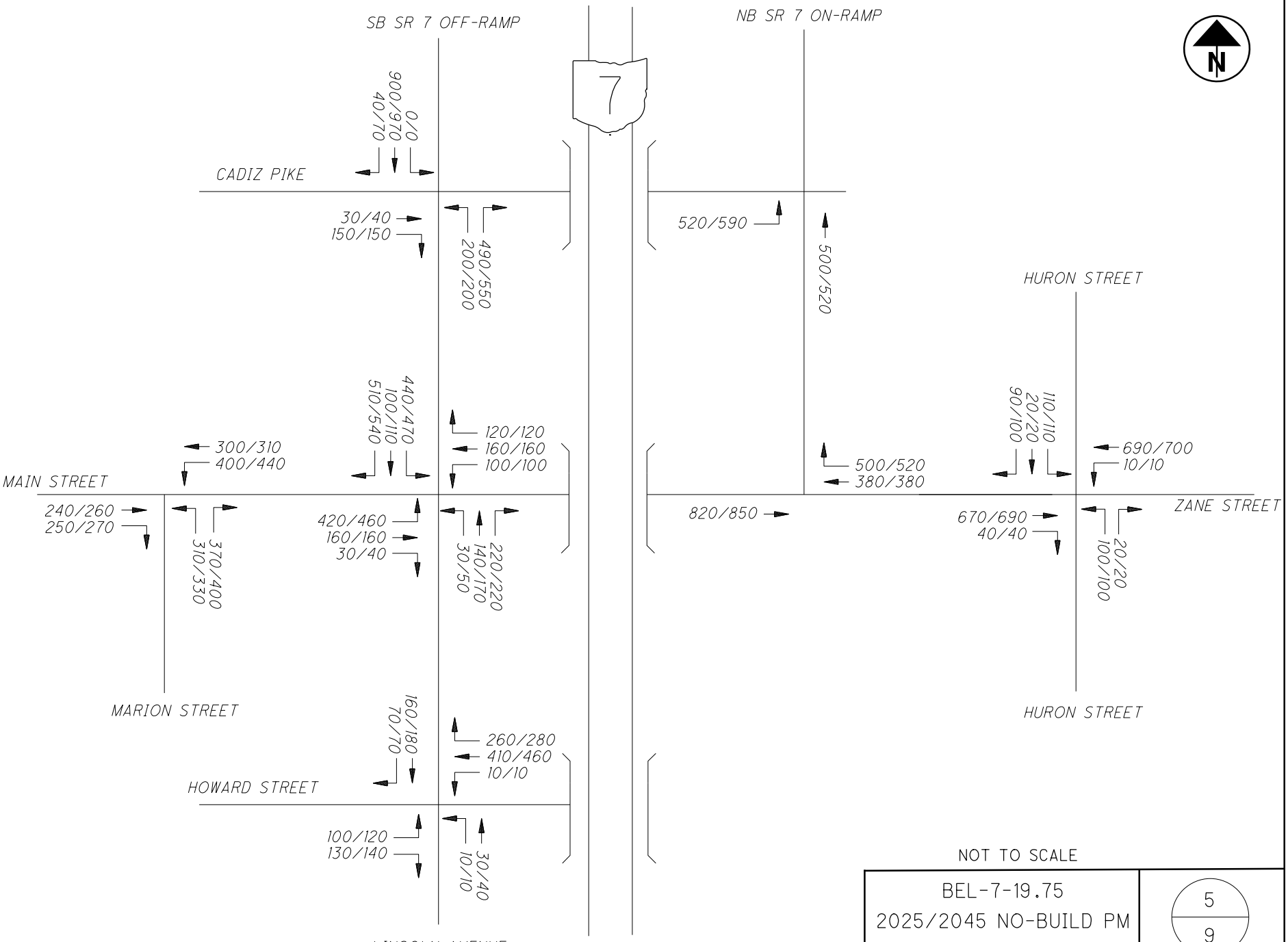

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BEL-7-19.75
2025/2045 NO-BUILD PM
PID 105324

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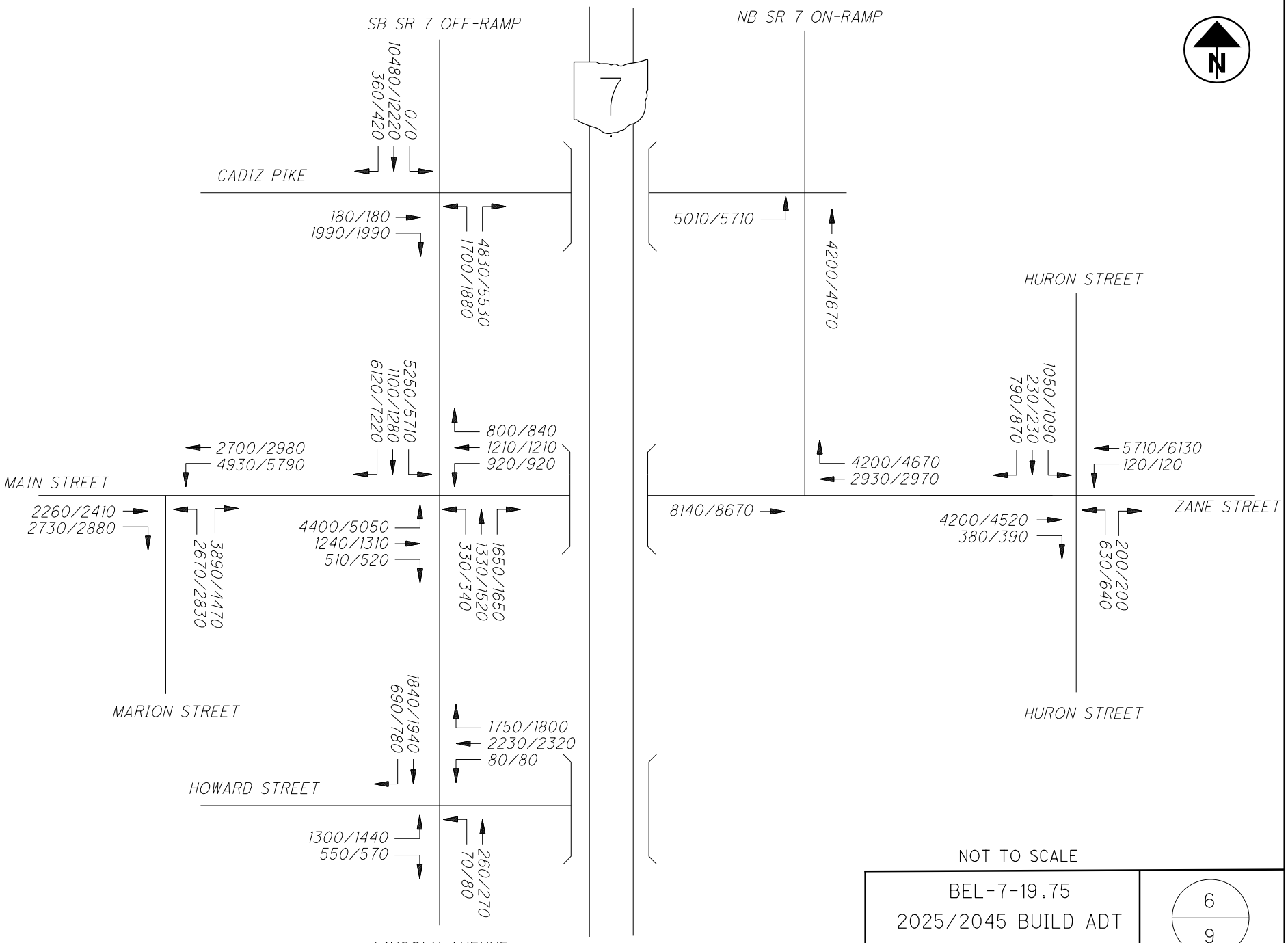

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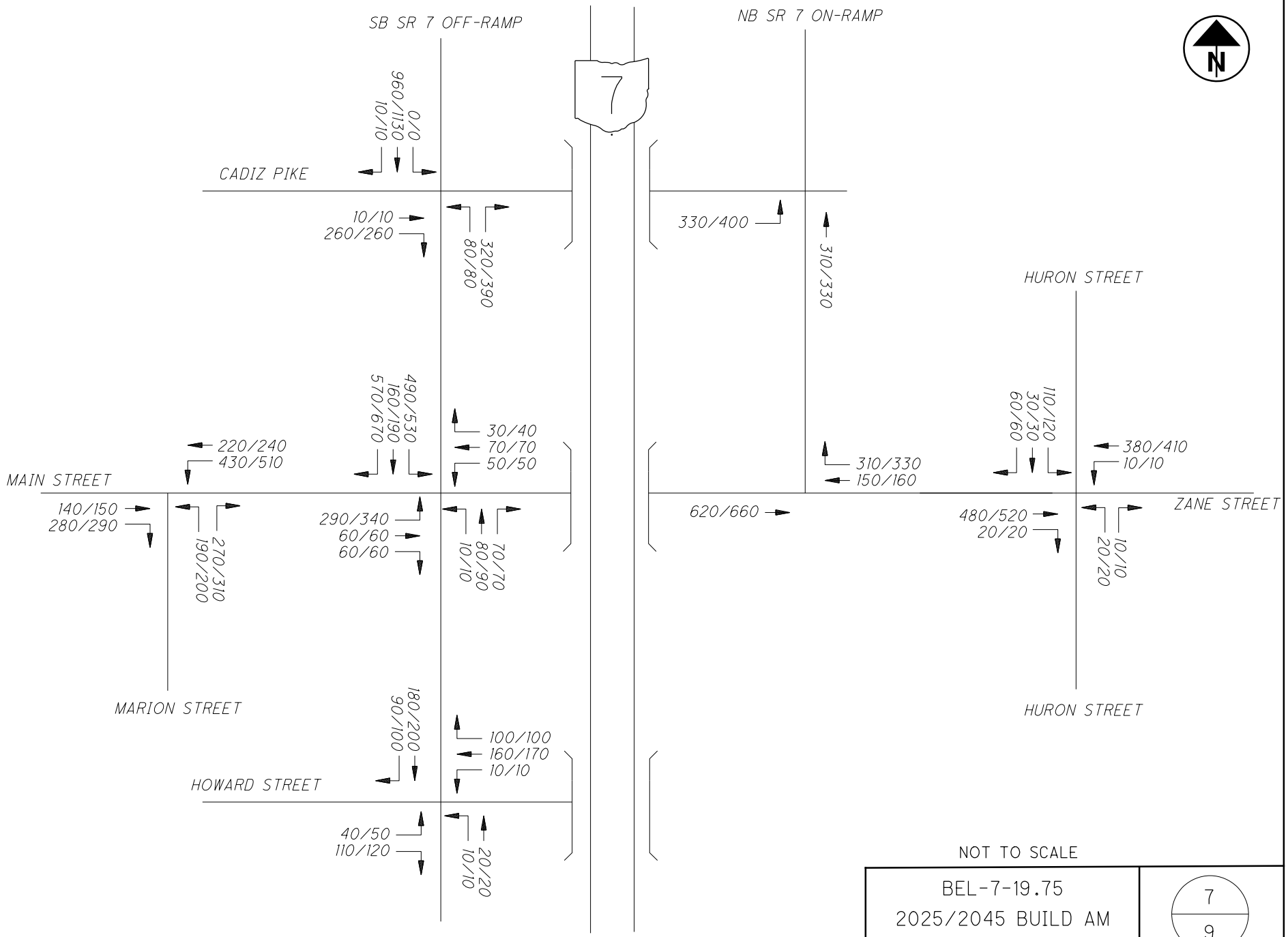
2025/2045 BUILD ADT
PID 105324



NOT TO SCALE

BEL-7-19.75
2025/2045 BUILD AM
PID 105324

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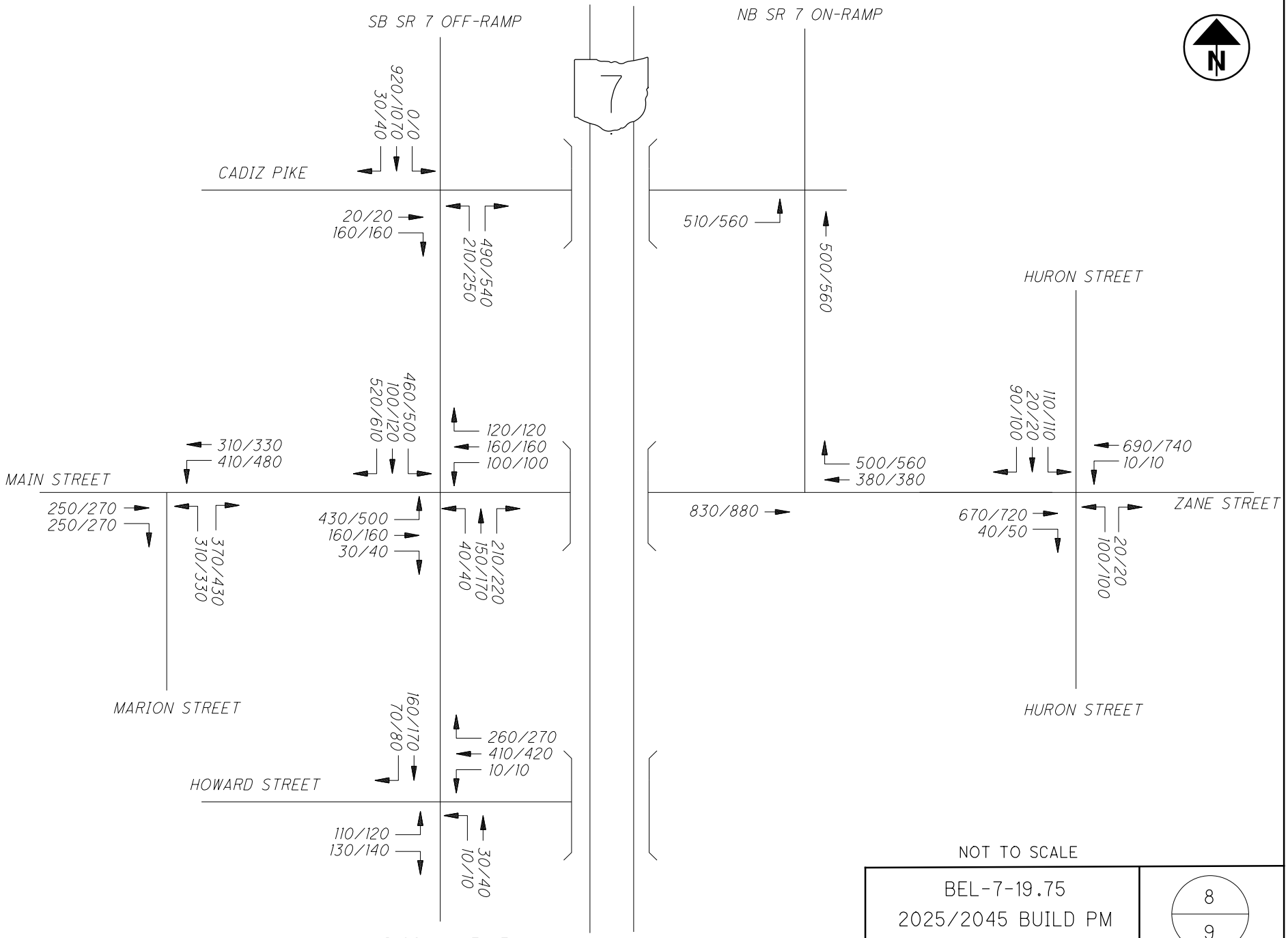

NOT TO SCALE

BEL-7-19.75
2025/2045 BUILD PM
PID 105324

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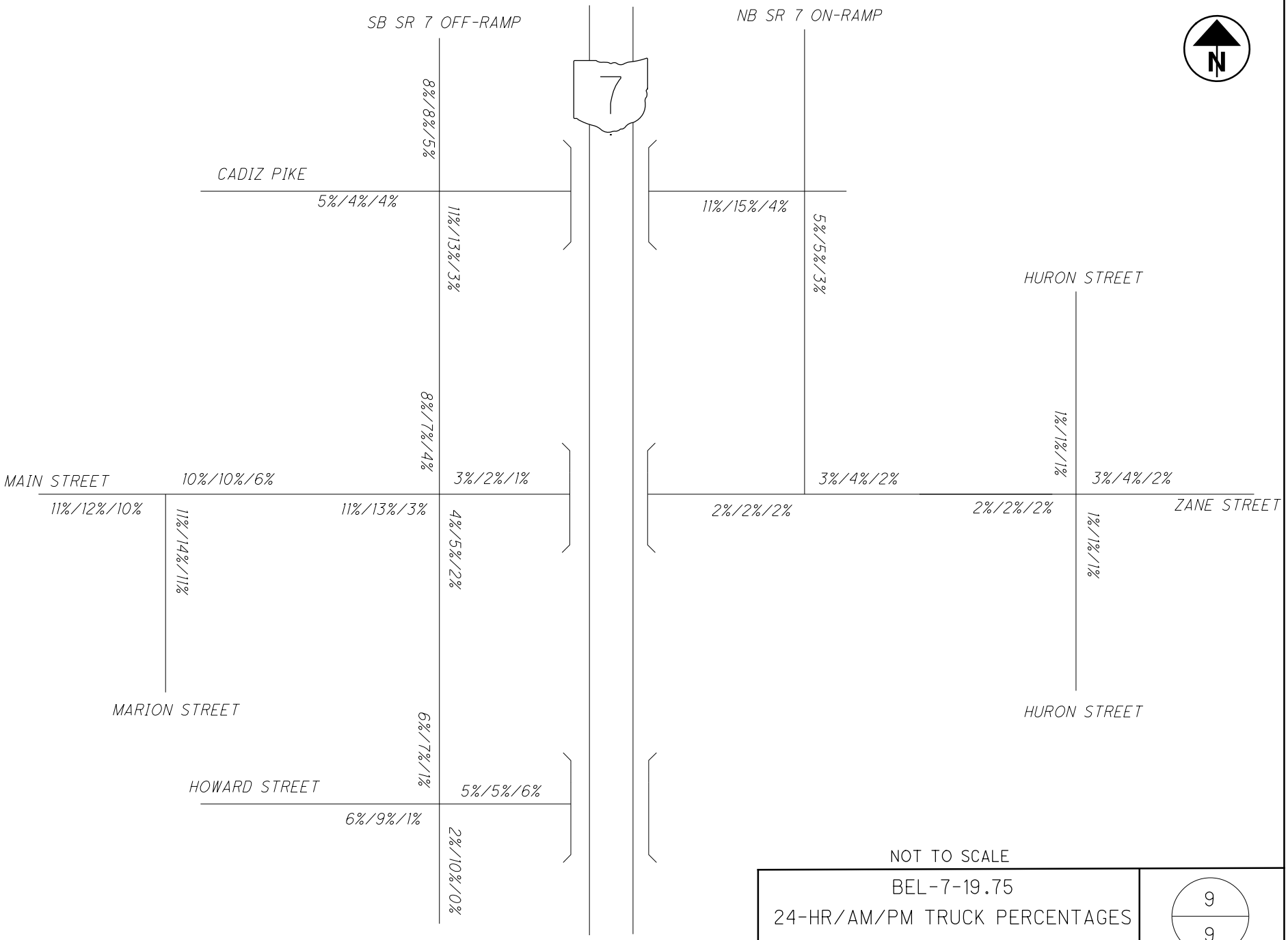


NOT TO SCALE

BEL-7-19.75
24-HR/AM/PM TRUCK PERCENTAGES
PID 105324

9
9

APPENDIX B

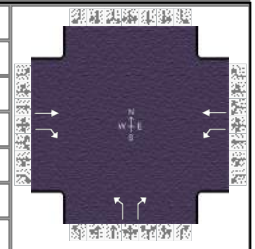
CAPACITY ANALYSIS

No-Build Intersection Analysis

AM Peak

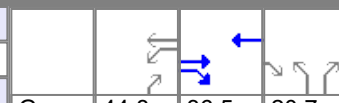
HCS7 Signalized Intersection Input Data

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	No-Build AM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Marion Street	File Name	Main Street Intersections - No-Build 2045 AM.xus		
Project Description	BEL-7-19.75				

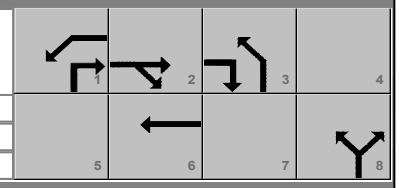


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		140	300	480	230		200		320			

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	44.8	36.5	20.7	0.0	0.0	0.0						
Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
Red	2.0	2.0	2.0	0.0	0.0	0.0						



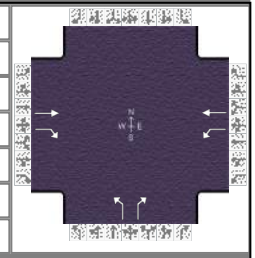
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		140	300	480	230		200		320			
Initial Queue (Q_b), veh/h		0	0	0	0		0		0			
Base Saturation Flow Rate (s_o), veh/h		1900	1900	1900	1900		1900		1900			
Parking (N_m), man/h		None			None			None				
Heavy Vehicles (P_{HV}), %		12	12	10	10		14		14			
Ped / Bike / RTOR, /h	0	0	0	0	0		0	0		0	0	
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0			
Arrival Type (*AT*)		3	3	3	3		3		3			
Upstream Filtering (*I*)		1.00	1.00	0.09	0.09		1.00		1.00			
Lane Width (*W*), ft		12.0	12.0	12.0	12.0		12.0		12.0			
Turn Bay Length, ft		2450	525	1200	1200		175		175			
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h		25	25	25	25		25		25			

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s		20.0	59.0	79.0	41.0	41.0		
Yellow Change Interval (*Y*), s		4.0	4.0	4.0	4.0	4.0		
Red Clearance Interval (R_c), s		2.0	2.0	2.0	2.0	2.0		
Minimum Green (G_{min}), s		10	7	10	7	10		
Start-Up Lost Time (*l1*), s		2.0	2.0	2.0	2.0			
Extension of Effective Green (*e*), s		2.0	2.0	2.0	2.0			
Passage (*PT*), s		2.0	2.0	2.0	2.0	2.0		
Recall Mode		Min	Off	Min	Off	Off		
Dual Entry		Yes	No	Yes	No	Yes		
Walk (*Walk*), s		0.0				0.0		0.0
Pedestrian Clearance Time (*PC*), s		0.0				0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25				0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0				9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0		No	0	0	No		0	
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0			
Pedestrian Signal / Occupied Parking	No	0.50			0.50		No	0.50		No		

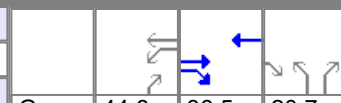
HCS7 Signalized Intersection Results Summary

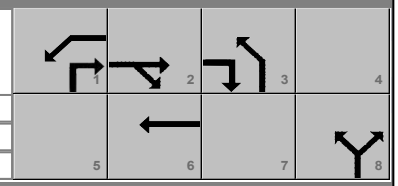
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	No-Build AM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Marion Street	File Name	Main Street Intersections - No-Build 2045 AM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		140	300	480	230		200		320			

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



										
Green	44.8	36.5	20.7	0.0	0.0	0.0	1	2	3	4
Yellow	4.0	4.0	4.0	0.0	0.0	0.0	5	6	7	8
Red	2.0	2.0	2.0	0.0	0.0	0.0				

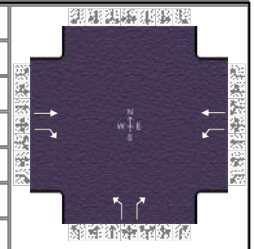
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		
Case Number		7.3	2.0	4.0		9.0		
Phase Duration, s		42.5	50.8	93.3		26.7		
Change Period, ($Y+R_c$), s		6.0	6.0	6.0		6.0		
Max Allow Headway (*MAH*), s		0.0	3.3	0.0		3.4		
Queue Clearance Time (g_s), s			43.5			19.4		
Green Extension Time (g_e), s		0.0	1.4	0.0		1.2		
Phase Call Probability			1.00			1.00		
Max Out Probability			0.00			0.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18			
Adjusted Flow Rate (*v*), veh/h		152	326	588	282		217		348			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1722	1459	1668	1752		1612		1434			
Queue Service Time (g_s), s		8.1	18.1	41.5	3.1		15.5		17.4			
Cycle Queue Clearance Time (g_c), s		8.1	18.1	41.5	3.1		15.5		17.4			
Green Ratio (*g/C*)		0.30	0.48	0.37	0.73		0.17		0.55			
Capacity (*c*), veh/h		523	695	623	1275		278		783			
Volume-to-Capacity Ratio (*X*)		0.291	0.469	0.943	0.221		0.783		0.444			
Back of Queue (*Q*), ft/ln (95 th percentile)		179.1	298	542	37.9		293.4		269.1			
Back of Queue (*Q*), veh/ln (95 th percentile)		6.5	10.9	20.1	1.4		10.6		9.7			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.07	0.57	0.45	0.03		1.68		1.54			
Uniform Delay (d_1), s/veh		31.9	21.2	43.0	2.3		47.5		16.3			
Incremental Delay (d_2), s/veh		1.4	2.3	1.3	0.0		1.8		0.1			
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0	0.0		0.0		0.0			
Control Delay (*d*), s/veh		33.3	23.5	44.3	2.3		49.3		16.5			
Level of Service (LOS)		C	C	D	A		D		B			
Approach Delay, s/veh / LOS	26.6	C		30.7	C		29.1	C		0.0		
Intersection Delay, s/veh / LOS	29.2						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.93	B	0.66	A	1.97	B	1.96	B
Bicycle LOS Score / LOS	1.28	A	1.76	B		F		

HCS7 Signalized Intersection Intermediate Values

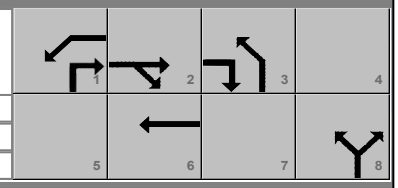
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	No-Build AM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Marion Street	File Name	Main Street Intersections - No-Build 2045 AM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		140	300	480	230		200		320			

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	44.8	36.5	20.7	0.0	0.0	0.0						
Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
Red	2.0	2.0	2.0	0.0	0.0	0.0						



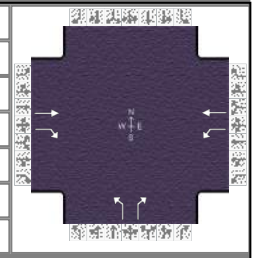
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Heavy Vehicles and Grade Factor (f_{HVg})	1.000	0.906	0.906	0.922	0.922	1.000	0.891	1.000	0.891			
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	1.000	1.000		0.952	0.000		0.952	0.000				
Right-Turn Adjustment Factor (f_{RT})		0.000	0.847		1.000	1.000		0.000	0.847			
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000			1.000			1.000					
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Movement Saturation Flow Rate (s), veh/h	0	1722	1459	1668	1752	0	1612	0	1434			
Proportion of Vehicles Arriving on Green (P)	0.00	0.30	0.30	0.26	0.87	0.00	0.17	0.00	0.17	0.00	0.00	0.00
Incremental Delay Factor (k)		0.50	0.50	0.16	0.50		0.04		0.04			

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		6.0	6.0	6.0		6.0		
Green Ratio (g/C)		0.30	0.37	0.73		0.17		
Permitted Saturation Flow Rate (s_p), veh/h/ln		1115	0	0		1612		
Shared Saturation Flow Rate (s_{sh}), veh/h/ln		0						
Permitted Effective Green Time (g_p), s		0.0	0.0	0.0		0.0		
Permitted Service Time (g_u), s		0.0	0.0	0.0		0.0		
Permitted Queue Service Time (g_{ps}), s								
Time to First Blockage (g_f), s		36.5	0.0	0.0		0.0		
Queue Service Time Before Blockage (g_{fs}), s								
Protected Right Saturation Flow (s_R), veh/h/ln		1459				1434		
Protected Right Effective Green Time (g_R), s		20.7				44.8		

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	1.198	0.000	0.000	0.000	1.198	0.000	1.198	0.000
Pedestrian F_s / F_{delay}	0.000	0.135	0.000	0.060	0.000	0.169	0.000	0.167
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	607.89	29.07	1455.30	4.45		67.20	-83.33	65.10
Bicycle F_w / F_v	-3.64	0.79	-3.64	1.27	-3.64		-3.64	

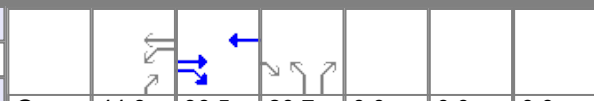
HCS7 Signalized Intersection Results Graphical Summary

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	No-Build AM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Marion Street	File Name	Main Street Intersections - No-Build 2045 AM.xus		
Project Description	BEL-7-19.75				



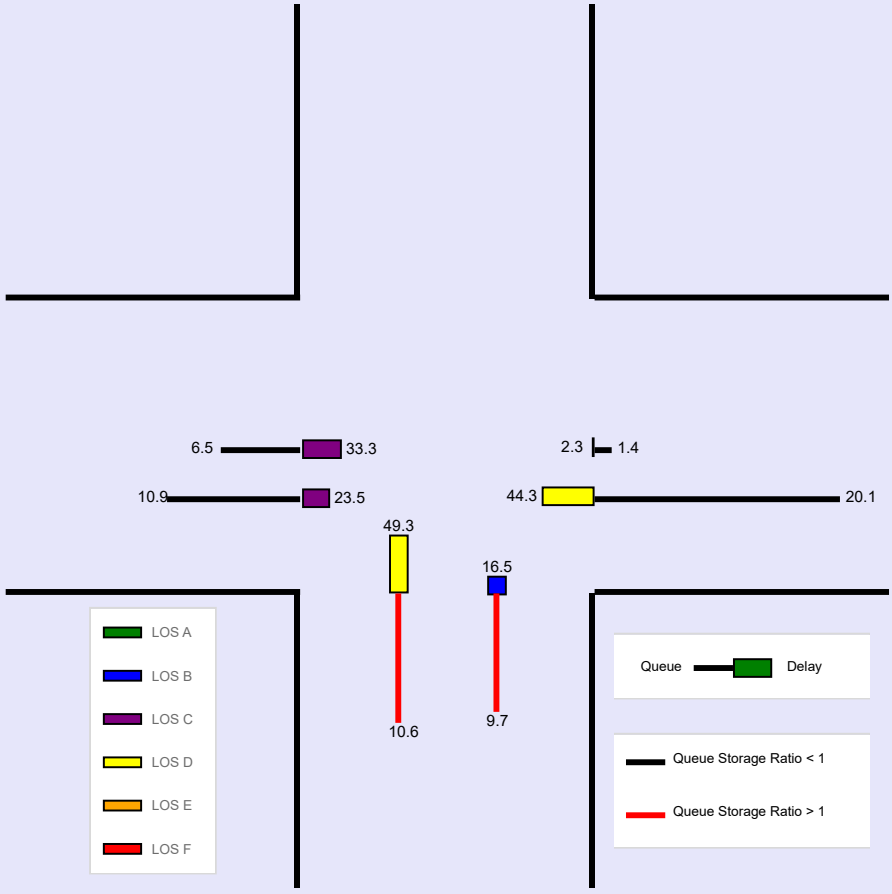
Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		140	300	480	230		200		320			

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	44.8	36.5	20.7	0.0	0.0	0.0	1	2	3	4		
Yellow	4.0	4.0	4.0	0.0	0.0	0.0	5	6	7	8		
Red	2.0	2.0	2.0	0.0	0.0	0.0						

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (*Q*), ft/ln (95 th percentile)		179.1	298	542	37.9		293.4		269.1			
Back of Queue (*Q*), veh/ln (95 th percentile)		6.5	10.9	20.1	1.4		10.6		9.7			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.07	0.57	0.45	0.03		1.68		1.54			
Control Delay (*d*), s/veh		33.3	23.5	44.3	2.3		49.3		16.5			
Level of Service (LOS)		C	C	D	A		D		B			
Approach Delay, s/veh / LOS	26.6	C		30.7	C		29.1	C		0.0		
Intersection Delay, s/veh / LOS	29.2						C					



--- Messages ---

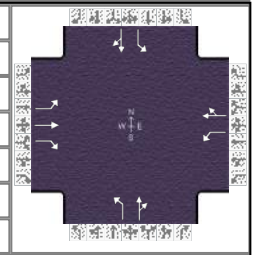
WARNING: Since queue spillover from turn lanes and spillback into upstream intersections is not accounted for in the HCM procedures, use of a simulation tool may be advised in situations where the Queue Storage Ratio exceeds 1.0.

WARNING: According to input data, upstream feeding volume is equal to 121% of downstream exit volume during time period #1, for thru movement #6.

--- Comments ---

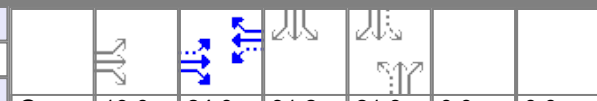
HCS7 Signalized Intersection Input Data

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	No-Build AM	PHF	0.93
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Lincoln Avenue	File Name	Main Street Intersections - No-Build 2045 AM.xus		
Project Description	BEL-7-19.75				

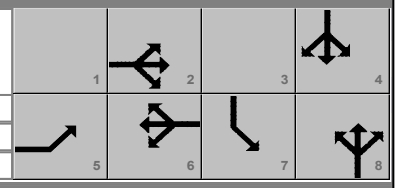


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	330	70	60	50	70	30	10	90	80	480	160	630

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	36	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	19.0	24.0	31.2	21.8	0.0	0.0
Yellow	4.0	4.0	4.0	4.0	0.0	0.0
Red	2.0	2.0	2.0	2.0	0.0	0.0



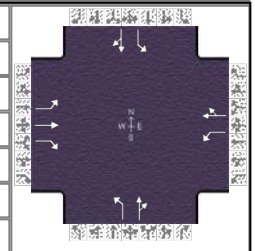
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	330	70	60	50	70	30	10	90	80	480	160	630
Initial Queue (Q_b), veh/h	0	0	0	0	0	0	0	0	0	0	0	0
Base Saturation Flow Rate (s_o), veh/h	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Parking (N_m), man/h		None			None			None			None	
Heavy Vehicles (P_{HV}), %	13	13	13	2	2		5	5		7	7	
Ped / Bike / RTOR, /h	0	0	0	0	0	0	0	0	0	0	0	0
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0	0	0	0
Arrival Type (*AT*)	3	3	3	3	3	3	3	3	3	3	3	3
Upstream Filtering (*I*)	0.96	0.96	0.96	0.94	0.94	0.94	1.00	1.00	1.00	1.00	1.00	1.00
Lane Width (*W*), ft	12.0	12.0	12.0	12.0	12.0		12.0	12.0		12.0	12.0	
Turn Bay Length, ft	250	1200	100	1200	1200		300	800		375	375	
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h	25	25	25	25	25	25	25	25	25	25	25	25

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s	25.0	55.0		30.0		14.0	51.0	65.0
Yellow Change Interval (*Y*), s	4.0	4.0		4.0		4.0	4.0	4.0
Red Clearance Interval (R_c), s	2.0	2.0		2.0		2.0	2.0	2.0
Minimum Green (G_{min}), s	7	7		7		7	7	7
Start-Up Lost Time (*l*t), s	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Extension of Effective Green (e), s	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Passage (*PT*), s	2.0	2.0		2.0		2.0	2.0	2.0
Recall Mode	Off	Min		Min		Off	Off	Off
Dual Entry	No	Yes		Yes		Yes	No	Yes
Walk (*Walk*), s		0.0		0.0		0.0		0.0
Pedestrian Clearance Time (*PC*), s		0.0		0.0		0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25	0	No	25	0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0	9.0	12	0	9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0	0	No	0	0	No	0	0	No
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0
Pedestrian Signal / Occupied Parking	No	0.50		No	0.50		No	0.50		No	0.50	

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	No-Build AM	PHF	0.93
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Lincoln Avenue	File Name	Main Street Intersections - No-Build 2045 AM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	330	70	60	50	70	30	10	90	80	480	160	630

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	36	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4
Green	19.0	24.0	31.2	21.8	0.0	0.0	5	6	7	8
Yellow	4.0	4.0	4.0	4.0	0.0	0.0				
Red	2.0	2.0	2.0	2.0	0.0	0.0				

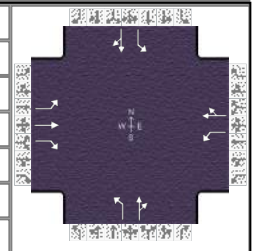
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8	7	4
Case Number	1.0	3.0		6.3		6.3	1.0	4.0
Phase Duration, s	25.0	55.0		30.0		27.8	37.2	65.0
Change Period, ($Y+R_c$), s	6.0	6.0		6.0		6.0	6.0	6.0
Max Allow Headway (*MAH*), s	3.3	0.0		0.0		3.4	3.3	3.4
Queue Clearance Time (g_s), s	21.0					23.8	30.1	61.0
Green Extension Time (g_e), s	0.0	0.0		0.0		0.0	1.1	0.0
Phase Call Probability	1.00					1.00	1.00	1.00
Max Out Probability	1.00					1.00	0.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	359	76	65	174	348		11	183		516	849	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1626	1707	1447	1323	1775		634	1683		1711	1571	
Queue Service Time (g_s), s	19.0	4.4	3.7	13.7	23.3		0.0	12.0		28.1	59.0	
Cycle Queue Clearance Time (g_c), s	19.0	4.4	3.7	13.7	23.3		21.8	12.0		28.1	59.0	
Green Ratio (*g/C*)	0.38	0.41	0.41	0.20	0.20		0.18	0.18		0.46	0.49	
Capacity (*c*), veh/h	323	697	591	325	355		60	306		599	772	
Volume-to-Capacity Ratio (*X*)	1.111	0.109	0.110	0.536	0.980		0.179	0.597		0.861	1.100	
Back of Queue (*Q*), ft/ln (95 th percentile)	639.3	97.3	66.9	205.7	494.6		15.8	233.5		477.9	1277.7	
Back of Queue (*Q*), veh/ln (95 th percentile)	23.2	3.5	2.4	8.1	19.5		0.6	9.0		18.1	48.4	
Queue Storage Ratio (*RQ*) (95 th percentile)	2.56	0.08	0.67	0.17	0.41		0.05	0.29		1.27	3.41	
Uniform Delay (d_1), s/veh	39.6	30.7	24.3	37.9	41.6		60.0	45.0		26.7	30.5	
Incremental Delay (d_2), s/veh	82.4	0.3	0.4	5.9	41.7		0.5	2.2		6.0	63.2	
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	122.0	31.0	24.6	43.7	83.3		60.5	47.3		32.7	93.7	
Level of Service (LOS)	F	C	C	D	F		E	D		C	F	
Approach Delay, s/veh / LOS	95.4	F		70.1	E		48.0	D		70.6	E	
Intersection Delay, s/veh / LOS	73.6						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.92	B	1.94	B	1.95	B	2.10	B
Bicycle LOS Score / LOS	1.30	A	0.75	A	0.81	A	2.74	C

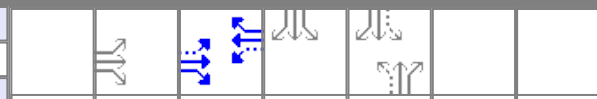
HCS7 Signalized Intersection Intermediate Values

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	No-Build AM	PHF	0.93
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Lincoln Avenue	File Name	Main Street Intersections - No-Build 2045 AM.xus		
Project Description	BEL-7-19.75				

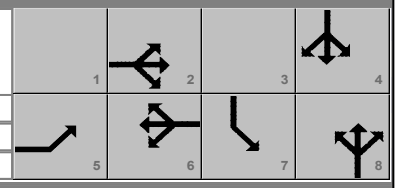


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	330	70	60	50	70	30	10	90	80	480	160	630

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	36	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	19.0	24.0	31.2	21.8	0.0	0.0
Yellow	4.0	4.0	4.0	4.0	0.0	0.0
Red	2.0	2.0	2.0	2.0	0.0	0.0



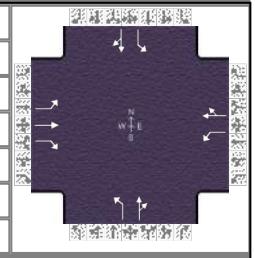
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles and Grade Factor (f_{HVg})	0.899	0.899	0.899	0.984	0.984	1.000	0.961	0.961	1.000	0.945	0.945	1.000
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	0.952	0.000		0.696	0.000		0.333	0.000		0.952	0.000	
Right-Turn Adjustment Factor (f_{RT})		0.000	0.847		0.949	0.949		0.922	0.922		0.874	0.874
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000			1.000			1.000			1.000		
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			1.000
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Movement Saturation Flow Rate (s), veh/h	1626	1707	1447	1323	1242	532	634	891	792	1711	318	1253
Proportion of Vehicles Arriving on Green (P)	0.06	0.19	0.35	0.31	0.29	0.33	0.18	0.18	0.18	0.26	0.49	0.49
Incremental Delay Factor (k)	0.50	0.50	0.50	0.50	0.50		0.04	0.13		0.18	0.50	

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)	6.0	6.0		6.0		6.0	6.0	6.0
Green Ratio (g/C)	0.38	0.41		0.20		0.18	0.46	0.49
Permitted Saturation Flow Rate (s_p), veh/h/ln	943	0		1323		634	1153	0
Shared Saturation Flow Rate (s_{sh}), veh/h/ln								
Permitted Effective Green Time (g_p), s	26.0	0.0		24.0		21.8	23.8	0.0
Permitted Service Time (g_u), s	0.7	0.0		24.0		0.0	9.9	0.0
Permitted Queue Service Time (g_{ps}), s	0.7			12.3		0.0	9.9	
Time to First Blockage (g_f), s	0.0	0.0		0.0		0.0	0.0	0.0
Queue Service Time Before Blockage (g_{fs}), s								
Protected Right Saturation Flow (s_R), veh/h/ln		0						
Protected Right Effective Green Time (g_R), s		0.0						

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	1.198	0.000	1.198	0.000	1.198	0.000	1.389	0.000
Pedestrian F_s / F_{delay}	0.000	0.122	0.000	0.146	0.000	0.148	0.000	0.110
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	816.67	21.00	400.00	38.40	364.04	40.15	983.33	15.50
Bicycle F_w / F_v	-3.64	0.82	-3.64	0.27	-3.64	0.32	-3.64	2.25

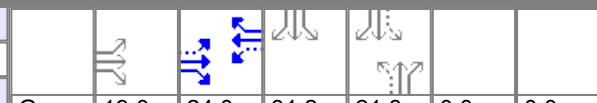
HCS7 Signalized Intersection Results Graphical Summary

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	No-Build AM	PHF	0.93
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Lincoln Avenue	File Name	Main Street Intersections - No-Build 2045 AM.xus		
Project Description	BEL-7-19.75				

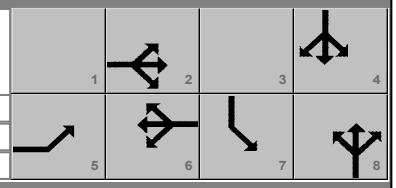


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	330	70	60	50	70	30	10	90	80	480	160	630

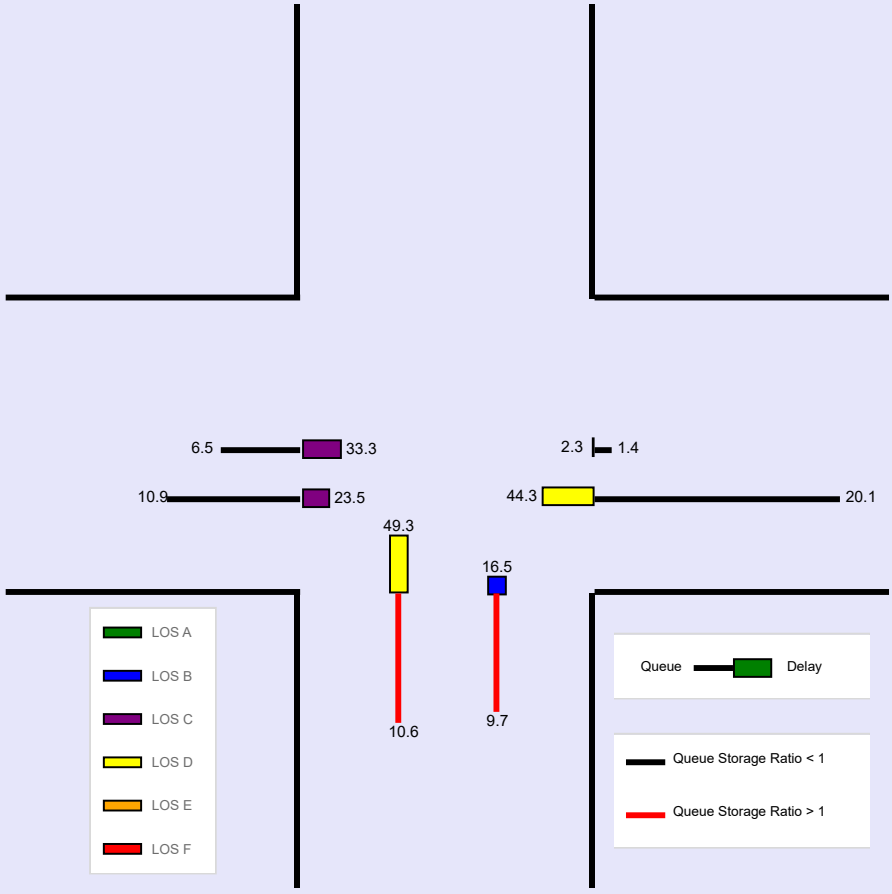
Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	36	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	19.0	24.0	31.2	21.8	0.0	0.0						
Yellow	4.0	4.0	4.0	4.0	0.0	0.0						
Red	2.0	2.0	2.0	2.0	0.0	0.0						



Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (*Q*), ft/ln (95 th percentile)	639.3	97.3	66.9	205.7	494.6		15.8	233.5		477.9	1277.7	
Back of Queue (*Q*), veh/ln (95 th percentile)	23.2	3.5	2.4	8.1	19.5		0.6	9.0		18.1	48.4	
Queue Storage Ratio (*RQ*) (95 th percentile)	2.56	0.08	0.67	0.17	0.41		0.05	0.29		1.27	3.41	
Control Delay (*d*), s/veh	122.0	31.0	24.6	43.7	83.3		60.5	47.3		32.7	93.7	
Level of Service (LOS)	F	C	C	D	F		E	D		C	F	
Approach Delay, s/veh / LOS	95.4	F		70.1	E		48.0	D		70.6	E	
Intersection Delay, s/veh / LOS	73.6						E					



--- Messages ---

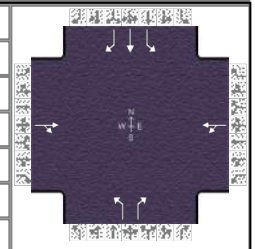
WARNING: Since queue spillover from turn lanes and spillback into upstream intersections is not accounted for in the HCM procedures, use of a simulation tool may be advised in situations where the Queue Storage Ratio exceeds 1.0.

WARNING: According to input data, upstream feeding volume is equal to 323% of downstream exit volume during time period #1, for thru movement #6.

--- Comments ---

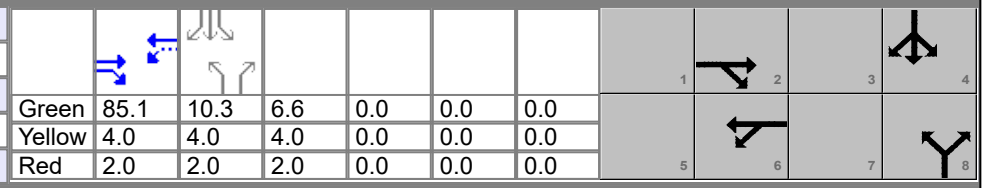
HCS7 Signalized Intersection Input Data

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	No-Build AM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Huron Street	File Name	Main Street Intersections - No-Build 2045 AM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		500	20	10	400		20		10	110	30	60

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	83	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



	EB			WB			NB			SB		
Green	85.1	10.3		6.6	0.0	0.0	0.0					
Yellow	4.0	4.0		4.0	0.0	0.0	0.0					
Red	2.0	2.0		2.0	0.0	0.0	0.0					

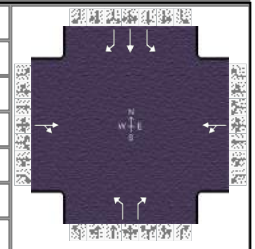
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		500	20	10	400		20		10	110	30	60
Initial Queue (Q_b), veh/h		0	0	0	0		0		0	0	0	0
Base Saturation Flow Rate (s_o), veh/h		1900	1900	1900	1900		1900		1900	1900	1900	1900
Parking (N_m), man/h		None			None			None			None	
Heavy Vehicles (P_{HV}), %		2			4		1		1	1	1	1
Ped / Bike / RTOR, /h	0	0	0	0	0		0	0		0	0	0
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0	0	0	0
Arrival Type (*AT*)		3	3	3	3		3		3	3	3	3
Upstream Filtering (*I*)		0.59	0.59	1.00	1.00		1.00		1.00	1.00	1.00	1.00
Lane Width (*W*), ft		12.0			12.0		12.0		12.0	12.0	12.0	12.0
Turn Bay Length, ft		1200			350		50		425	125	275	125
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h		25	25	25	25		25		25	25	25	25

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s		39.0		39.0		17.0		64.0
Yellow Change Interval (*Y*), s		4.0		4.0		4.0		4.0
Red Clearance Interval (R_c), s		2.0		2.0		2.0		2.0
Minimum Green (G_{min}), s		10		10		10		10
Start-Up Lost Time (*l*t), s		2.0	2.0	2.0	2.0		2.0	2.0
Extension of Effective Green (*e*), s		2.0	2.0	2.0	2.0		2.0	2.0
Passage (*PT*), s		2.0		2.0		2.0		2.0
Recall Mode		Min		Min		Off		Off
Dual Entry		Yes		Yes		Yes		Yes
Walk (*Walk*), s		0.0		0.0		0.0		0.0
Pedestrian Clearance Time (*PC*), s		0.0		0.0		0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25	0	No	25	0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0	9.0	12	0	9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0	0	No	0	0	No	0	0	No
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0
Pedestrian Signal / Occupied Parking	No	0.50		No	0.50		No	0.50		No	0.50	

HCS7 Signalized Intersection Results Summary

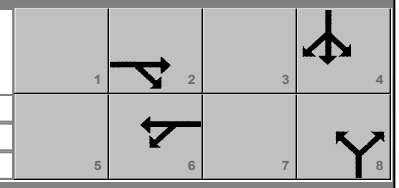
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	No-Build AM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Huron Street	File Name	Main Street Intersections - No-Build 2045 AM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		500	20	10	400		20		10	110	30	60

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	83	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	85.1	10.3	6.6	0.0	0.0	0.0	
Yellow	4.0	4.0	4.0	0.0	0.0	0.0	
Red	2.0	2.0	2.0	0.0	0.0	0.0	



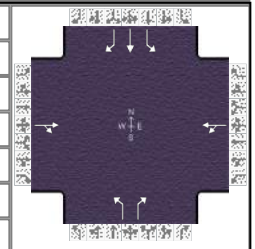
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		8.0		8.0		9.0		9.0
Phase Duration, s		91.1		91.1		12.6		16.3
Change Period, ($Y+R_c$), s		6.0		6.0		6.0		6.0
Max Allow Headway (*MAH*), s		0.0		0.0		3.3		3.3
Queue Clearance Time (g_s), s						3.4		9.8
Green Extension Time (g_e), s		0.0		0.0		0.1		0.5
Phase Call Probability						0.66		1.00
Max Out Probability						0.00		0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18	7	4	14
Adjusted Flow Rate (*v*), veh/h		678			446		22		11	120	33	65
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1858			1816		1795		1598	1795	1885	1598
Queue Service Time (g_s), s		27.8			0.0		1.4		0.8	7.8	1.9	4.7
Cycle Queue Clearance Time (g_c), s		27.8			11.1		1.4		0.8	7.8	1.9	4.7
Green Ratio (*g/C*)		0.71			0.71		0.06		0.06	0.09	0.09	0.09
Capacity (*c*), veh/h		1317			1319		99		88	154	161	137
Volume-to-Capacity Ratio (*X*)		0.515			0.338		0.219		0.123	0.778	0.202	0.477
Back of Queue (*Q*), ft/ln (95 th percentile)		437.9			202.3		29.3		14.6	167.8	42.3	87.4
Back of Queue (*Q*), veh/ln (95 th percentile)		17.2			7.8		1.2		0.6	6.7	1.7	3.5
Queue Storage Ratio (*RQ*) (95 th percentile)		0.36			0.58		0.59		0.03	1.34	0.15	0.70
Uniform Delay (d_1), s/veh		14.3			6.7		54.2		53.9	53.7	51.0	52.3
Incremental Delay (d_2), s/veh		0.9			0.7		0.4		0.2	3.2	0.2	1.0
Initial Queue Delay (d_3), s/veh		0.0			0.0		0.0		0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh		15.1			7.4		54.6		54.2	56.9	51.3	53.3
Level of Service (LOS)		B			A		D		D	E	D	D
Approach Delay, s/veh / LOS	15.1	B		7.4	A		54.5	D		55.0	D	
Intersection Delay, s/veh / LOS	19.9						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.86	B	1.86	B	1.74	B	1.73	B
Bicycle LOS Score / LOS	1.42	A	1.22	A		F	0.85	A

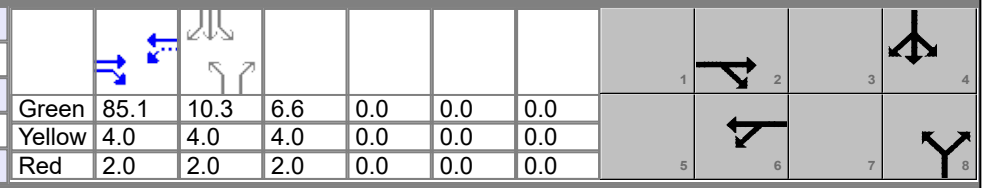
HCS7 Signalized Intersection Intermediate Values

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	No-Build AM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Huron Street	File Name	Main Street Intersections - No-Build 2045 AM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		500	20	10	400		20		10	110	30	60

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	83	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



	EB			WB			NB			SB		
Green	85.1	10.3		6.6	0.0	0.0	0.0					
Yellow	4.0	4.0		4.0	0.0	0.0	0.0					
Red	2.0	2.0		2.0	0.0	0.0	0.0					

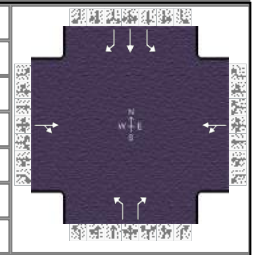
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles and Grade Factor (f_{HVg})	1.000	0.984	1.000	1.000	0.969	0.984	0.992	1.000	0.992	0.992	0.992	0.992
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	1.000	0.993		0.987	0.987		0.952	0.000		0.952	0.000	
Right-Turn Adjustment Factor (f_{RT})		0.000	0.993		0.000	0.987		0.000	0.847		0.000	0.847
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000			1.000			1.000			1.000		
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			1.000
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Movement Saturation Flow Rate (s), veh/h	0	1786	71	44	1772	0	1795	0	1598	1795	1885	1598
Proportion of Vehicles Arriving on Green (P)	0.00	0.54	0.62	0.71	0.71	0.00	0.06	0.00	0.06	0.09	0.09	0.09
Incremental Delay Factor (k)		0.50			0.50		0.04		0.04	0.04	0.04	0.04

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		6.0		6.0		6.0		4.0
Green Ratio (g/C)		0.71		0.71		0.06		0.09
Permitted Saturation Flow Rate (s_p), veh/h/ln		969		773		1795		1795
Shared Saturation Flow Rate (s_{sh}), veh/h/ln		1870		0				
Permitted Effective Green Time (g_p), s		0.0		85.1		0.0		0.0
Permitted Service Time (g_u), s		0.0		57.3		0.0		0.0
Permitted Queue Service Time (g_{ps}), s				0.0				
Time to First Blockage (g_f), s		85.1		52.0		0.0		0.0
Queue Service Time Before Blockage (g_{fs}), s				11.1				
Protected Right Saturation Flow (s_R), veh/h/ln						0		0
Protected Right Effective Green Time (g_R), s						0.0		0.0

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	1.198	0.000	1.198	0.000	0.972	0.000	0.972	0.000
Pedestrian F_s / F_{delay}	0.000	0.065	0.000	0.065	0.000	0.169	0.000	0.160
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	1418.30	5.08	1418.30	5.08		67.20	110.46	53.56
Bicycle F_w / F_v	-3.64	0.93	-3.64	0.74	-3.64		-3.64	0.36

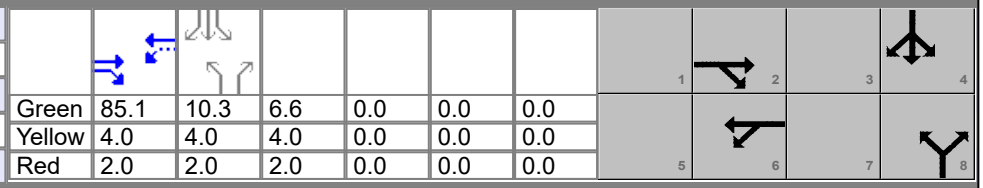
HCS7 Signalized Intersection Results Graphical Summary

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	No-Build AM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Huron Street	File Name	Main Street Intersections - No-Build 2045 AM.xus		
Project Description	BEL-7-19.75				



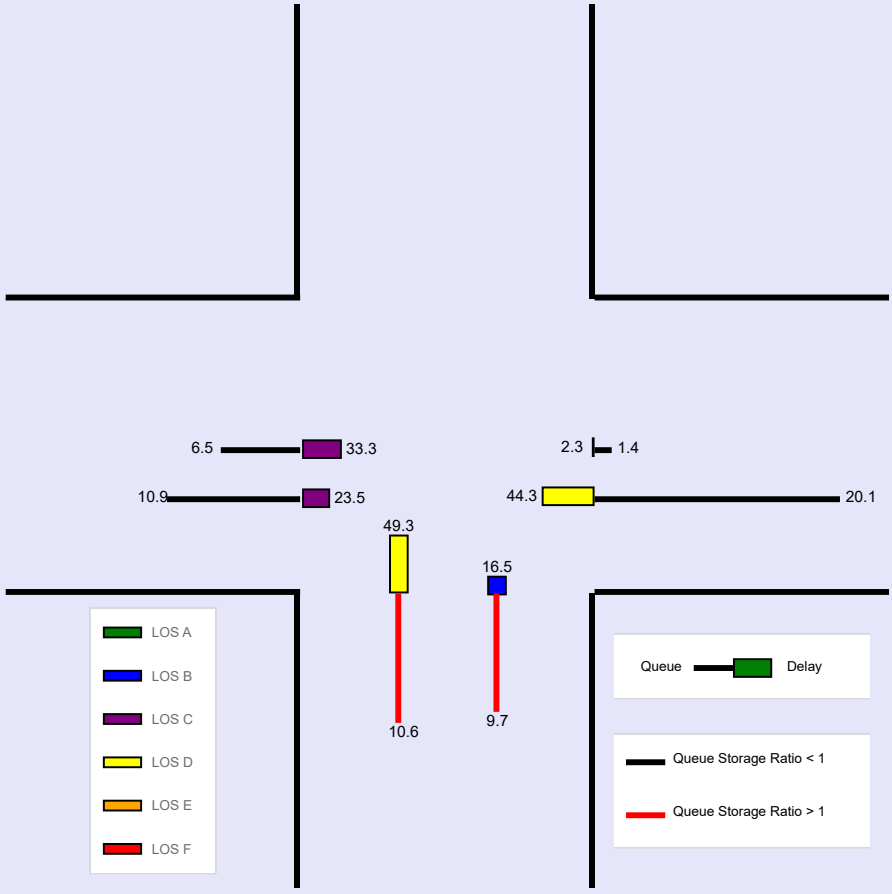
Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		500	20	10	400		20		10	110	30	60

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	83	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



	EB			WB			NB			SB		
Green	85.1	10.3		6.6	0.0	0.0	0.0					
Yellow	4.0	4.0		4.0	0.0	0.0	0.0					
Red	2.0	2.0		2.0	0.0	0.0	0.0					

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (*Q*), ft/ln (95 th percentile)		437.9			202.3		29.3		14.6	167.8	42.3	87.4
Back of Queue (*Q*), veh/ln (95 th percentile)		17.2			7.8		1.2		0.6	6.7	1.7	3.5
Queue Storage Ratio (*RQ*) (95 th percentile)		0.36			0.58		0.59		0.03	1.34	0.15	0.70
Control Delay (*d*), s/veh		15.1			7.4		54.6		54.2	56.9	51.3	53.3
Level of Service (LOS)		B			A		D		D	E	D	D
Approach Delay, s/veh / LOS	15.1	B		7.4	A		54.5	D		55.0	D	
Intersection Delay, s/veh / LOS	19.9						B					



--- Messages ---

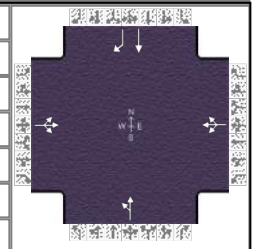
WARNING: Since queue spillover from turn lanes and spillback into upstream intersections is not accounted for in the HCM procedures, use of a simulation tool may be advised in situations where the Queue Storage Ratio exceeds 1.0.

WARNING: According to input data, upstream feeding volume is equal to 120% of downstream exit volume during time period #1, for thru movement #2.

--- Comments ---

HCS7 Signalized Intersection Input Data

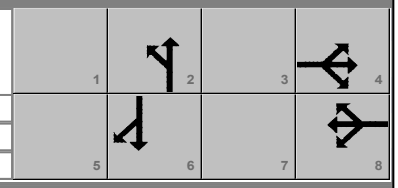
General Information				Intersection Information	
Agency	Burgess & Niple, Inc			Duration, h	0.250
Analyst	MEL	Analysis Date	11/17/2021	Area Type	Other
Jurisdiction		Time Period	No-Build AM	PHF	0.80
Urban Street	Lincoln Avenue	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Howard Street	File Name	Lincoln & Howard 2045 No-build AM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	50	0	120	10	190	110	10	20			170	100

Signal Information			
Cycle, s	60.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	31.7	16.3	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	2.0	2.0	0.0	0.0	0.0	0.0	



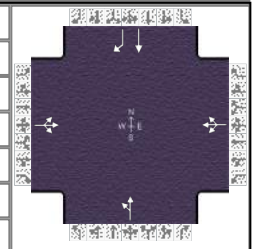
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	50	0	120	10	190	110	10	20			170	100
Initial Queue (Q_b), veh/h	0	0	0	0	0	0	0	0			0	0
Base Saturation Flow Rate (s_o), veh/h	1900	1900	1900	1900	1900	1900	1900	1900			1900	1900
Parking (N_m), man/h		None			None			None			None	
Heavy Vehicles (P_{HV}), %		9			5			10			7	7
Ped / Bike / RTOR, /h	0	0	0	0	0	0	0	0		0	0	0
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0	0	0	0
Arrival Type (*AT*)	3	3	3	3	3	3	3	3			3	3
Upstream Filtering (*I*)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Lane Width (*W*), ft		12.0			12.0			12.0			12.0	12.0
Turn Bay Length, ft		850			600			475			800	450
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h	25	25	25	25	25	25	25	25			25	25

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s		44.0		44.0		16.0		16.0
Yellow Change Interval (*Y*), s		4.0		4.0		4.0		4.0
Red Clearance Interval (R_c), s		2.0		2.0		2.0		2.0
Minimum Green (G_{min}), s		7		7		7		7
Start-Up Lost Time (*l1*), s	2.0	2.0	2.0	2.0	2.0	2.0		2.0
Extension of Effective Green (*e*), s	2.0	2.0	2.0	2.0	2.0	2.0		2.0
Passage (*PT*), s		2.0		2.0		2.0		2.0
Recall Mode		Off		Off		Min		Min
Dual Entry		Yes		Yes		Yes		Yes
Walk (*Walk*), s		0.0		0.0		0.0		0.0
Pedestrian Clearance Time (*PC*), s		0.0		0.0		0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25	0	No	25	0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0	9.0	12	0	9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0	0	No	0	0	No	0	0	No
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0
Pedestrian Signal / Occupied Parking	No	0.50		No	0.50		No	0.50		No	0.50	

HCS7 Signalized Intersection Results Summary

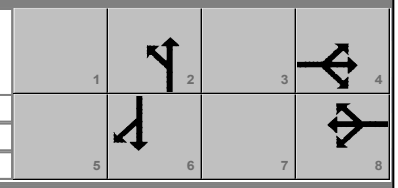
General Information				Intersection Information	
Agency	Burgess & Niple, Inc			Duration, h	0.250
Analyst	MEL	Analysis Date	11/17/2021	Area Type	Other
Jurisdiction		Time Period	No-Build AM	PHF	0.80
Urban Street	Lincoln Avenue	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Howard Street	File Name	Lincoln & Howard 2045 No-build AM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	50	0	120	10	190	110	10	20			170	100

Signal Information			
Cycle, s	60.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	31.7	16.3	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	2.0	2.0	0.0	0.0	0.0	0.0	



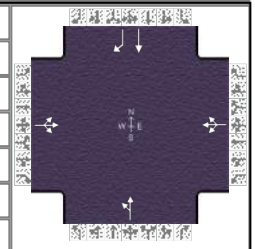
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8		2		6
Case Number		8.0		8.0		8.0		7.0
Phase Duration, s		22.3		22.3		37.7		37.7
Change Period, ($Y+R_c$), s		6.0		6.0		6.0		6.0
Max Allow Headway (*MAH*), s		3.4		3.4		0.0		0.0
Queue Clearance Time (g_s), s		9.5		14.8				
Green Extension Time (g_e), s		1.5		1.5		0.0		0.0
Phase Call Probability		1.00		1.00				
Max Out Probability		0.00		0.00				

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h		213			388			38			213	125
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1365			1706			1497			1796	1522
Queue Service Time (g_s), s		0.0			3.0			0.0			3.8	2.5
Cycle Queue Clearance Time (g_c), s		7.5			12.8			0.6			3.8	2.5
Green Ratio (*g/C*)		0.27			0.27			0.53			0.53	0.53
Capacity (*c*), veh/h		448			524			872			950	805
Volume-to-Capacity Ratio (*X*)		0.475			0.739			0.043			0.224	0.155
Back of Queue (*Q*), ft/ln (95 th percentile)		114.8			220.4			10.8			66.3	37.9
Back of Queue (*Q*), veh/ln (95 th percentile)		4.3			8.5			0.4			2.5	1.4
Queue Storage Ratio (*RQ*) (95 th percentile)		0.14			0.37			0.02			0.08	0.08
Uniform Delay (d_1), s/veh		18.5			20.6			6.8			7.6	7.3
Incremental Delay (d_2), s/veh		0.3			0.8			0.1			0.5	0.4
Initial Queue Delay (d_3), s/veh		0.0			0.0			0.0			0.0	0.0
Control Delay (*d*), s/veh		18.8			21.4			6.9			8.1	7.7
Level of Service (LOS)		B			C			A			A	A
Approach Delay, s/veh / LOS	18.8	B		21.4	C		6.9	A		7.9	A	
Intersection Delay, s/veh / LOS	15.6						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.68	B	1.91	B	1.65	B	1.65	B
Bicycle LOS Score / LOS	0.84	A	1.13	A	0.55	A	1.04	A

HCS7 Signalized Intersection Intermediate Values

General Information				Intersection Information	
Agency	Burgess & Niple, Inc			Duration, h	0.250
Analyst	MEL	Analysis Date	11/17/2021	Area Type	Other
Jurisdiction		Time Period	No-Build AM	PHF	0.80
Urban Street	Lincoln Avenue	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Howard Street	File Name	Lincoln & Howard 2045 No-build AM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	50	0	120	10	190	110	10	20			170	100

Signal Information			
Cycle, s	60.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

								1	2	3	4	
Green	31.7	16.3	0.0	0.0	0.0	0.0						
Yellow	4.0	4.0	0.0	0.0	0.0	0.0		5	6	7	8	
Red	2.0	2.0	0.0	0.0	0.0	0.0						

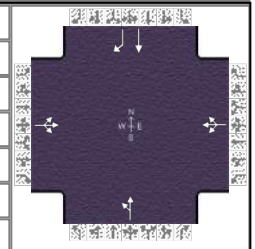
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles and Grade Factor (f_{HVg})	1.000	0.930	1.000	1.000	0.961	1.000	1.000	0.922	1.000	1.000	0.945	0.945
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	0.820	0.773		0.994	0.934		0.854	0.854		1.000	1.000	
Right-Turn Adjustment Factor (f_{RT})		0.000	0.773		0.000	0.934		0.000	0.854		0.000	0.847
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000			1.000			1.000			1.000		
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			1.000
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Movement Saturation Flow Rate (s), veh/h	402	0	964	55	1046	605	499	998	0	0	1796	1522
Proportion of Vehicles Arriving on Green (P)	0.27	0.00	0.27	0.27	0.27	0.27	0.53	0.53	0.00	0.00	0.53	0.53
Incremental Delay Factor (k)		0.04			0.04			0.50			0.50	0.50

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		6.0		6.0		6.0		6.0
Green Ratio (g/C)		0.27		0.27		0.53		0.53
Permitted Saturation Flow Rate (s_p), veh/h/ln		1024		1257		1188		1408
Shared Saturation Flow Rate (s_{sh}), veh/h/ln		1290		1796		0		1796
Permitted Effective Green Time (g_p), s		16.3		16.3		31.7		0.0
Permitted Service Time (g_u), s		3.5		8.8		27.9		0.0
Permitted Queue Service Time (g_{ps}), s		0.0		3.0		0.0		
Time to First Blockage (g_f), s		4.5		9.8		4.0		31.7
Queue Service Time Before Blockage (g_{fs}), s		2.3		6.2		0.6		
Protected Right Saturation Flow (s_R), veh/h/ln								0
Protected Right Effective Green Time (g_R), s								0.0

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	0.972	0.000	1.198	0.000	0.972	0.000	0.972	0.000
Pedestrian F_s / F_{delay}	0.000	0.111	0.000	0.111	0.000	0.076	0.000	0.076
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	542.13	15.94	542.13	15.94	1057.87	6.66	1057.87	6.66
Bicycle F_w / F_v	-3.64	0.35	-3.64	0.64	-3.64	0.06	-3.64	0.56

HCS7 Signalized Intersection Results Graphical Summary

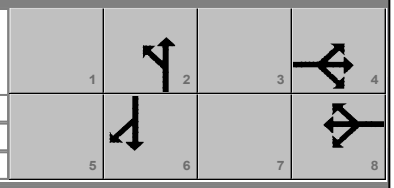
General Information				Intersection Information	
Agency	Burgess & Niple, Inc			Duration, h	0.250
Analyst	MEL	Analysis Date	11/17/2021	Area Type	Other
Jurisdiction		Time Period	No-Build AM	PHF	0.80
Urban Street	Lincoln Avenue	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Howard Street	File Name	Lincoln & Howard 2045 No-build AM.xus		
Project Description	BEL-7-19.75				



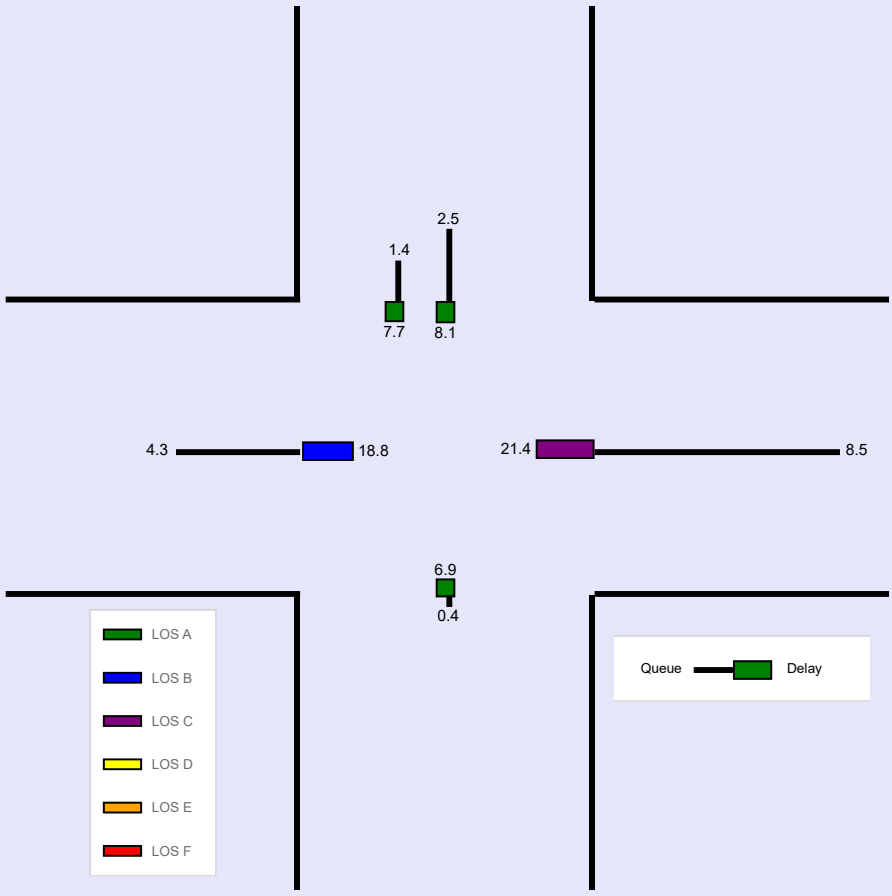
Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	50	0	120	10	190	110	10	20			170	100

Signal Information			
Cycle, s	60.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	31.7	16.3	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	2.0	2.0	0.0	0.0	0.0	0.0	



Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (*Q*), ft/ln (95 th percentile)		114.8			220.4			10.8			66.3	37.9
Back of Queue (*Q*), veh/ln (95 th percentile)		4.3			8.5			0.4			2.5	1.4
Queue Storage Ratio (*RQ*) (95 th percentile)		0.14			0.37			0.02			0.08	0.08
Control Delay (*d*), s/veh		18.8			21.4			6.9			8.1	7.7
Level of Service (LOS)		B			C			A			A	A
Approach Delay, s/veh / LOS	18.8		B	21.4		C	6.9		A	7.9		A
Intersection Delay, s/veh / LOS	15.6						B					



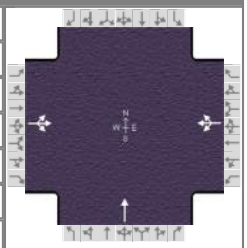
--- Messages ---

No errors or warnings exist.

--- Comments ---

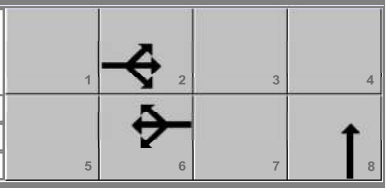
HCS7 Signalized Intersection Input Data

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 15, 2021	Area Type	Other
Jurisdiction		Time Period	No-Build AM	PHF	0.84
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	NB SR 7	File Name	Cadiz Pike Signals No-Build 2045 AM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	400	0	0	0	0	0		330				

Signal Information					EB			WB			NB			SB		
Cycle, s	70.0	Reference Phase	2													
Offset, s	66	Reference Point	End	Green	42.8	17.2		0.0	0.0		0.0	0.0				
Uncoordinated	No	Simult. Gap E/W	On	Yellow	4.0	4.0		0.0	0.0		0.0	0.0				
Force Mode	Fixed	Simult. Gap N/S	On	Red	0.0	2.0		0.0	0.0		0.0	0.0				



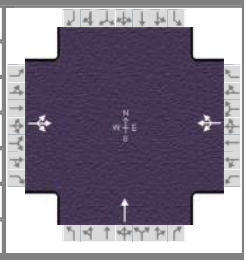
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	400	0	0	0	0	0		330				
Initial Queue (Q_b), veh/h	0	0	0	0	0	0		0				
Base Saturation Flow Rate (s_o), veh/h	1900	1900	1900	1900	1900	1900		1900				
Parking (N_m), man/h		None			None			None				
Heavy Vehicles (P_{HV}), %		15			0			5				
Ped / Bike / RTOR, /h	0	0		0	0		0	0		0	0	
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0			
Arrival Type (*AT*)	3	3	3	3	3	3		3				
Upstream Filtering (*I*)	1.00	1.00	1.00	1.00	1.00	1.00		1.00				
Lane Width (*W*), ft		12.0			12.0			12.0				
Turn Bay Length, ft		100			0			400				
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h	25	25	25	25	25	25		25				

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s		13.0		13.0		57.0		
Yellow Change Interval (*Y*), s		4.0		4.0		4.0		
Red Clearance Interval (R_c), s		0.0		0.0		2.0		
Minimum Green (G_{min}), s		6		6		7		
Start-Up Lost Time (*l1*), s	2.0	2.0	2.0	2.0		2.0		
Extension of Effective Green (*e*), s	2.0	2.0	2.0	2.0		2.0		
Passage (*PT*), s		2.0		2.0		2.0		
Recall Mode		Min		Min		Off		
Dual Entry		Yes		Yes		No		
Walk (*Walk*), s		0.0				0.0		0.0
Pedestrian Clearance Time (*PC*), s		0.0				0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25				0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0				9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0		No	0	0	No		0	
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0			
Pedestrian Signal / Occupied Parking	No	0.50			0.50		No	0.50		No		

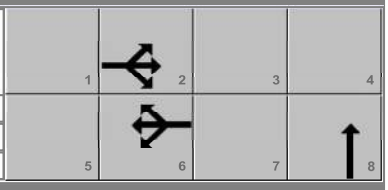
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 15, 2021	Area Type	Other
Jurisdiction		Time Period	No-Build AM	PHF	0.84
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	NB SR 7	File Name	Cadiz Pike Signals No-Build 2045 AM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	400	0	0	0	0	0		330				

Signal Information					EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Cycle, s	70.0	Reference Phase	2	Green	42.8	17.2		0.0	0.0	0.0	0.0					
Offset, s	66	Reference Point	End	Yellow	4.0	4.0		0.0	0.0	0.0	0.0					
Uncoordinated	No	Simult. Gap E/W	On	Red	0.0	2.0		0.0	0.0	0.0	0.0					
Force Mode	Fixed	Simult. Gap N/S	On													



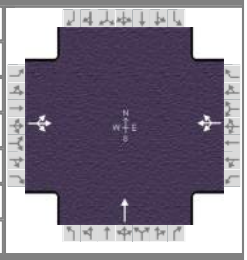
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		
Case Number		8.0		8.0		12.0		
Phase Duration, s		46.8		46.8		23.2		
Change Period, (*Y+R c*), s		4.0		4.0		6.0		
Max Allow Headway (*MAH*), s		0.0		0.0		3.2		
Queue Clearance Time (*g s*), s						16.5		
Green Extension Time (*g e*), s		0.0		0.0		0.8		
Phase Call Probability						1.00		
Max Out Probability						0.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16		8				
Adjusted Flow Rate (*v*), veh/h		421			0			393				
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1271			0			1826				
Queue Service Time (*g s*), s		4.7			0.0			14.5				
Cycle Queue Clearance Time (*g c*), s		4.7			0.0			14.5				
Green Ratio (*g/C*)		0.61						0.25				
Capacity (*c*), veh/h		879						450				
Volume-to-Capacity Ratio (*X*)		0.479			0.000			0.873				
Back of Queue (*Q*), ft/ln (95 th percentile)		53.5			0			269.7				
Back of Queue (*Q*), veh/ln (95 th percentile)		1.9			0.0			10.4				
Queue Storage Ratio (*RQ*) (95 th percentile)		0.54			0.00			0.67				
Uniform Delay (*d 1*), s/veh		1.7						25.3				
Incremental Delay (*d 2*), s/veh		1.9			0.0			2.1				
Initial Queue Delay (*d 3*), s/veh		0.0			0.0			0.0				
Control Delay (*d*), s/veh		3.5						27.5				
Level of Service (LOS)		A						C				
Approach Delay, s/veh / LOS	3.5	A		0.0			27.5	C		0.0		
Intersection Delay, s/veh / LOS	15.1						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.35	A	1.35	A	1.72	B	1.72	B
Bicycle LOS Score / LOS	1.27	A	0.49	A	1.14	A		

HCS7 Signalized Intersection Intermediate Values

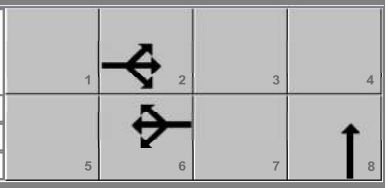
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 15, 2021	Area Type	Other
Jurisdiction		Time Period	No-Build AM	PHF	0.84
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	NB SR 7	File Name	Cadiz Pike Signals No-Build 2045 AM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	400	0	0	0	0	0		330				

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	66	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	42.8	17.2	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	0.0	2.0	0.0	0.0	0.0	0.0	



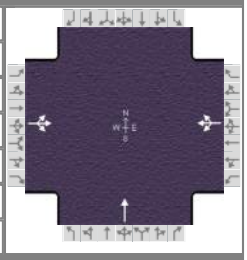
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Heavy Vehicles and Grade Factor (f_{HVg})	0.883	0.883	1.000	1.000	1.000	1.000	1.000	0.961	1.000			
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	0.758	0.758		1.000	1.000		1.000	1.000				
Right-Turn Adjustment Factor (f_{RT})		0.000	0.758		0.000	1.000		0.000	0.000			
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000			1.000			1.000					
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Movement Saturation Flow Rate (s), veh/h	1271	0	0	0	1900	0	0	1826	0			
Proportion of Vehicles Arriving on Green (P)	0.89	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00
Incremental Delay Factor (k)		0.50						0.04				

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		4.0		4.0		4.0		
Green Ratio (g/C)		0.61		0.61		0.25		
Permitted Saturation Flow Rate (s_p), veh/h/ln		1440		1440		0		
Shared Saturation Flow Rate (s_{sh}), veh/h/ln		0		1900				
Permitted Effective Green Time (g_p), s		42.8		0.0		0.0		
Permitted Service Time (g_u), s		42.7		0.0		0.0		
Permitted Queue Service Time (g_{ps}), s		4.7						
Time to First Blockage (g_f), s		0.0		42.8		0.0		
Queue Service Time Before Blockage (g_{fs}), s		0.0						
Protected Right Saturation Flow (s_R), veh/h/ln								
Protected Right Effective Green Time (g_R), s								

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	0.681	0.000	0.681	0.000	0.972	0.000	0.972	0.000
Pedestrian F_s / F_{delay}	0.000	0.067	0.000	0.067	0.000	0.150	0.000	0.148
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	1221.51	5.30	1221.51	5.30	-200.00	42.35		40.18
Bicycle F_w / F_v	-3.64	0.79	-3.64	0.00	-3.64	0.65	-3.64	

HCS7 Signalized Intersection Results Graphical Summary

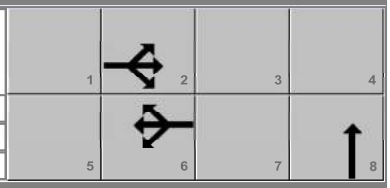
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 15, 2021	Area Type	Other
Jurisdiction		Time Period	No-Build AM	PHF	0.84
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	NB SR 7	File Name	Cadiz Pike Signals No-Build 2045 AM.xus		
Project Description	BEL-7-19.75				



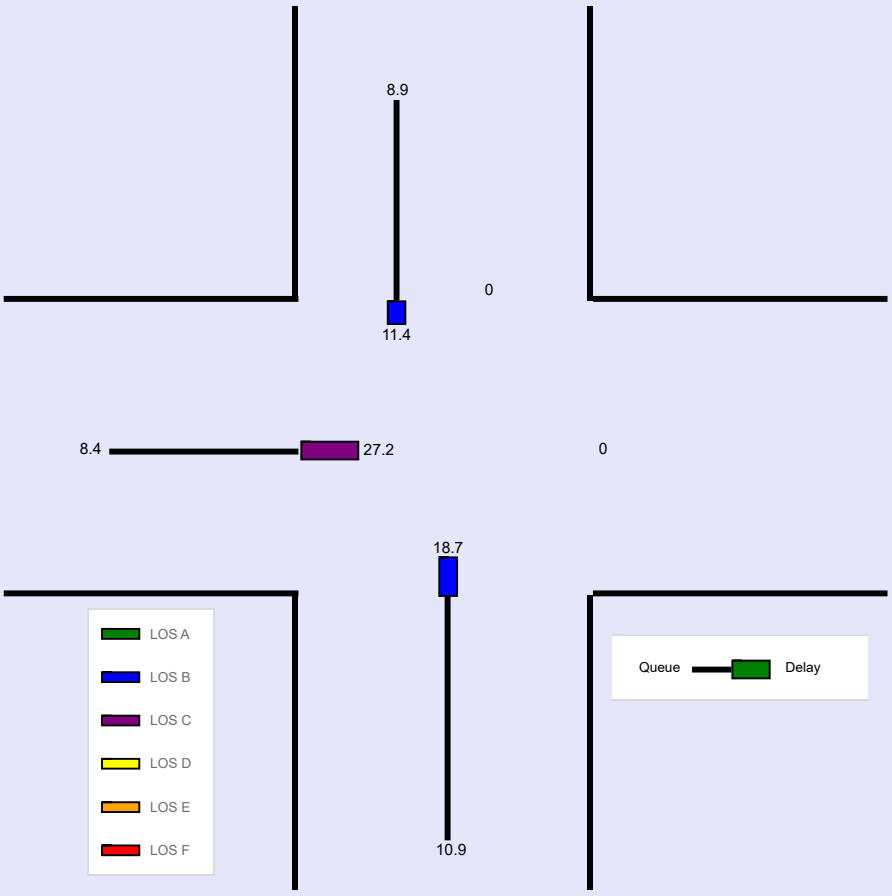
Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	400	0	0	0	0	0		330				

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	66	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	42.8	17.2	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	0.0	2.0	0.0	0.0	0.0	0.0	



Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (*Q*), ft/ln (95 th percentile)		53.5			0			269.7				
Back of Queue (*Q*), veh/ln (95 th percentile)		1.9			0.0			10.4				
Queue Storage Ratio (*RQ*) (95 th percentile)		0.54			0.00			0.67				
Control Delay (*d*), s/veh		3.5						27.5				
Level of Service (LOS)		A						C				
Approach Delay, s/veh / LOS	3.5	A		0.0			27.5	C		0.0		
Intersection Delay, s/veh / LOS	15.1						B					



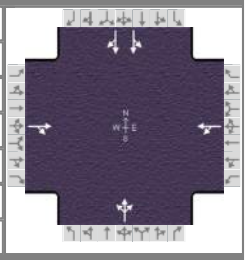
--- Messages ---

WARNING: According to input data, upstream feeding volume is equal to 88% of downstream exit volume during time period #1, for thru movement #2.

--- Comments ---

HCS7 Signalized Intersection Input Data

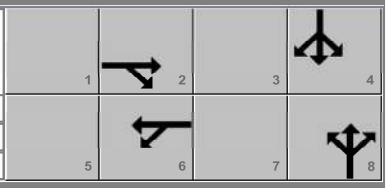
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 15, 2021	Area Type	Other
Jurisdiction		Time Period	No-Build AM	PHF	0.95
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	SB SR 7	File Name	Cadiz Pike Signals No-Build 2045 AM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		30	250	0	0		80	0	370	0	1020	20

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	21.1	36.9	0.0	0.0	0.0	0.0						
Yellow	4.0	4.0	0.0	0.0	0.0	0.0						
Red	2.0	2.0	0.0	0.0	0.0	0.0						



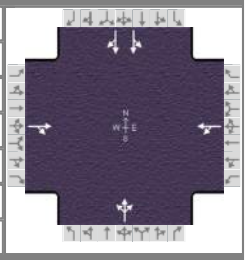
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		30	250	0	0		80	0	370	0	1020	20
Initial Queue (Q_b), veh/h		0	0	0	0		0	0	0	0	0	0
Base Saturation Flow Rate (s_o), veh/h		1900	1900	1900	1900		1900	1900	1900	1900	1900	1900
Parking (N_m), man/h		None			None			None			None	
Heavy Vehicles (P_{HV}), %		4			0			13			8	
Ped / Bike / RTOR, /h	0	0	0	0	0		0	0	0	0	0	0
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0	0	0	0
Arrival Type (*AT*)		3	3	3	3		3	3	3	3	3	3
Upstream Filtering (*I*)		1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Lane Width (*W*), ft		12.0			12.0			12.0			12.0	
Turn Bay Length, ft		1500			0			375			750	
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h		25	25	25	25		25	25	25	25	25	25

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s		18.0		18.0		52.0		52.0
Yellow Change Interval (*Y*), s		4.0		4.0		4.0		4.0
Red Clearance Interval (R_c), s		2.0		0.0		2.0		2.0
Minimum Green (G_{min}), s		7		6		7		7
Start-Up Lost Time (*lt*), s		2.0	2.0	2.0	2.0	2.0	2.0	2.0
Extension of Effective Green (*e*), s		2.0	2.0	2.0	2.0	2.0	2.0	2.0
Passage (*PT*), s		2.0		2.0		2.0		2.0
Recall Mode		Min		Min		Off		Off
Dual Entry		Yes		Yes		Yes		Yes
Walk (*Walk*), s		0.0		0.0		0.0		0.0
Pedestrian Clearance Time (*PC*), s		0.0		0.0		0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25	0	No	25	0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0	9.0	12	0	9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0	0	No	0	0	No	0	0	No
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0
Pedestrian Signal / Occupied Parking	No	0.50		No	0.50		No	0.50		No	0.50	

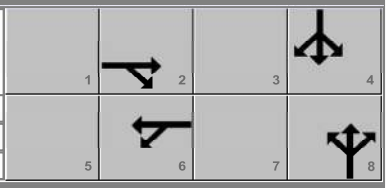
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 15, 2021	Area Type	Other
Jurisdiction		Time Period	No-Build AM	PHF	0.95
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	SB SR 7	File Name	Cadiz Pike Signals No-Build 2045 AM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		30	250	0	0		80	0	370	0	1020	20

Signal Information					EB		WB		NB		SB	
Cycle, s	70.0	Reference Phase	2									
Offset, s	0	Reference Point	End	Green	21.1	36.9	0.0	0.0	0.0	0.0		
Uncoordinated	No	Simult. Gap E/W	On	Yellow	4.0	4.0	0.0	0.0	0.0	0.0		
Force Mode	Fixed	Simult. Gap N/S	On	Red	2.0	2.0	0.0	0.0	0.0	0.0		



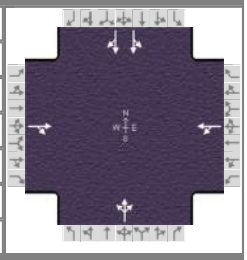
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		8.0		8.0		8.0		8.0
Phase Duration, s		27.1		27.1		42.9		42.9
Change Period, ($Y+R_c$), s		6.0		6.0		6.0		6.0
Max Allow Headway (*MAH*), s		0.0		0.0		3.5		3.5
Queue Clearance Time (g_s), s						32.6		16.7
Green Extension Time (g_e), s		0.0		0.0		4.1		4.8
Phase Call Probability						1.00		1.00
Max Out Probability						0.22		0.02

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h		295			0			474		0		546
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1586			0			997		0		1769
Queue Service Time (g_s), s		11.2			0.0			15.8		0.0		14.7
Cycle Queue Clearance Time (g_c), s		11.2			0.0			30.6		0.0		14.7
Green Ratio (*g/C*)		0.30						0.53				0.53
Capacity (*c*), veh/h		473						589				938
Volume-to-Capacity Ratio (*X*)		0.623			0.000			0.804		0.000		0.582
Back of Queue (*Q*), ft/ln (95 th percentile)		215.7			0			300.8		0		221.7
Back of Queue (*Q*), veh/ln (95 th percentile)		8.4			0.0			10.9		0.0		8.9
Queue Storage Ratio (*RQ*) (95 th percentile)		0.14			0.00			0.80		0.00		0.31
Uniform Delay (d_1), s/veh		21.2						14.3				11.2
Incremental Delay (d_2), s/veh		6.1			0.0			4.4		0.0		0.2
Initial Queue Delay (d_3), s/veh		0.0			0.0			0.0		0.0		0.0
Control Delay (*d*), s/veh		27.2						18.7				11.4
Level of Service (LOS)		C						B				B
Approach Delay, s/veh / LOS	27.2	C		0.0			18.7	B		11.4	B	
Intersection Delay, s/veh / LOS	15.7						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.91	B	1.91	B	1.65	B	1.65	B
Bicycle LOS Score / LOS	0.97	A	0.49	A	1.27	A	1.39	A

HCS7 Signalized Intersection Intermediate Values

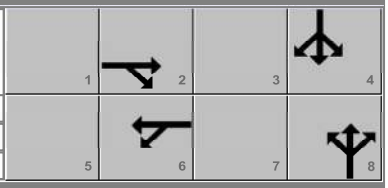
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 15, 2021	Area Type	Other
Jurisdiction		Time Period	No-Build AM	PHF	0.95
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	SB SR 7	File Name	Cadiz Pike Signals No-Build 2045 AM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		30	250	0	0		80	0	370	0	1020	20

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	21.1	36.9	0.0	0.0	0.0	0.0						
Yellow	4.0	4.0	0.0	0.0	0.0	0.0						
Red	2.0	2.0	0.0	0.0	0.0	0.0						



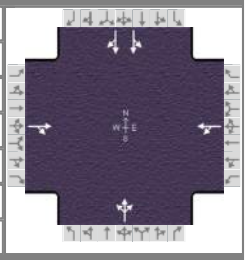
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles and Grade Factor (f_{HVg})	1.000	0.969	1.000	1.000	1.000	1.000	1.000	0.899	0.899	1.000	0.938	1.000
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	1.000	0.862		1.000	1.000		0.653	0.584		1.000	1.000	
Right-Turn Adjustment Factor (f_{RT})		0.000	0.862		0.000	1.000		0.000	0.584		0.993	0.993
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000			1.000			1.000			1.000		
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			1.000
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Movement Saturation Flow Rate (s), veh/h	0	170	1416	0	1900	0	177	0	819	0	3482	68
Proportion of Vehicles Arriving on Green (P)	0.00	0.30	0.30	0.30	0.30	0.30	0.53	0.00	0.53	0.00	0.53	0.53
Incremental Delay Factor (k)		0.50						0.18				0.04

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		6.0		6.0		6.0		6.0
Green Ratio (g/C)		0.30		0.30		0.53		0.53
Permitted Saturation Flow Rate (s_p), veh/h/ln		1440		1102		523		1010
Shared Saturation Flow Rate (s_{sh}), veh/h/ln		0		0		0		1781
Permitted Effective Green Time (g_p), s		0.0		0.0		37.1		0.0
Permitted Service Time (g_u), s		0.0		0.0		22.3		0.0
Permitted Queue Service Time (g_{ps}), s						15.8		
Time to First Blockage (g_f), s		20.9		20.9		9.0		37.1
Queue Service Time Before Blockage (g_{fs}), s						2.2		
Protected Right Saturation Flow (s_R), veh/h/ln								
Protected Right Effective Green Time (g_R), s								

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	1.198	0.000	1.198	0.000	0.972	0.000	0.972	0.000
Pedestrian F_s / F_{delay}	0.000	0.114	0.000	0.110	0.000	0.083	0.000	0.083
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	603.93	17.05	661.07	15.69	1053.21	7.84	1053.21	7.84
Bicycle F_w / F_v	-3.64	0.49	-3.64	0.00	-3.64	0.78	-3.64	0.90

HCS7 Signalized Intersection Results Graphical Summary

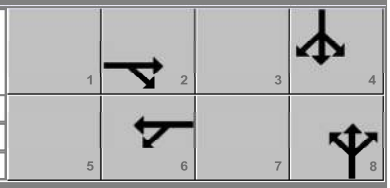
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 15, 2021	Area Type	Other
Jurisdiction		Time Period	No-Build AM	PHF	0.95
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	SB SR 7	File Name	Cadiz Pike Signals No-Build 2045 AM.xus		
Project Description	BEL-7-19.75				



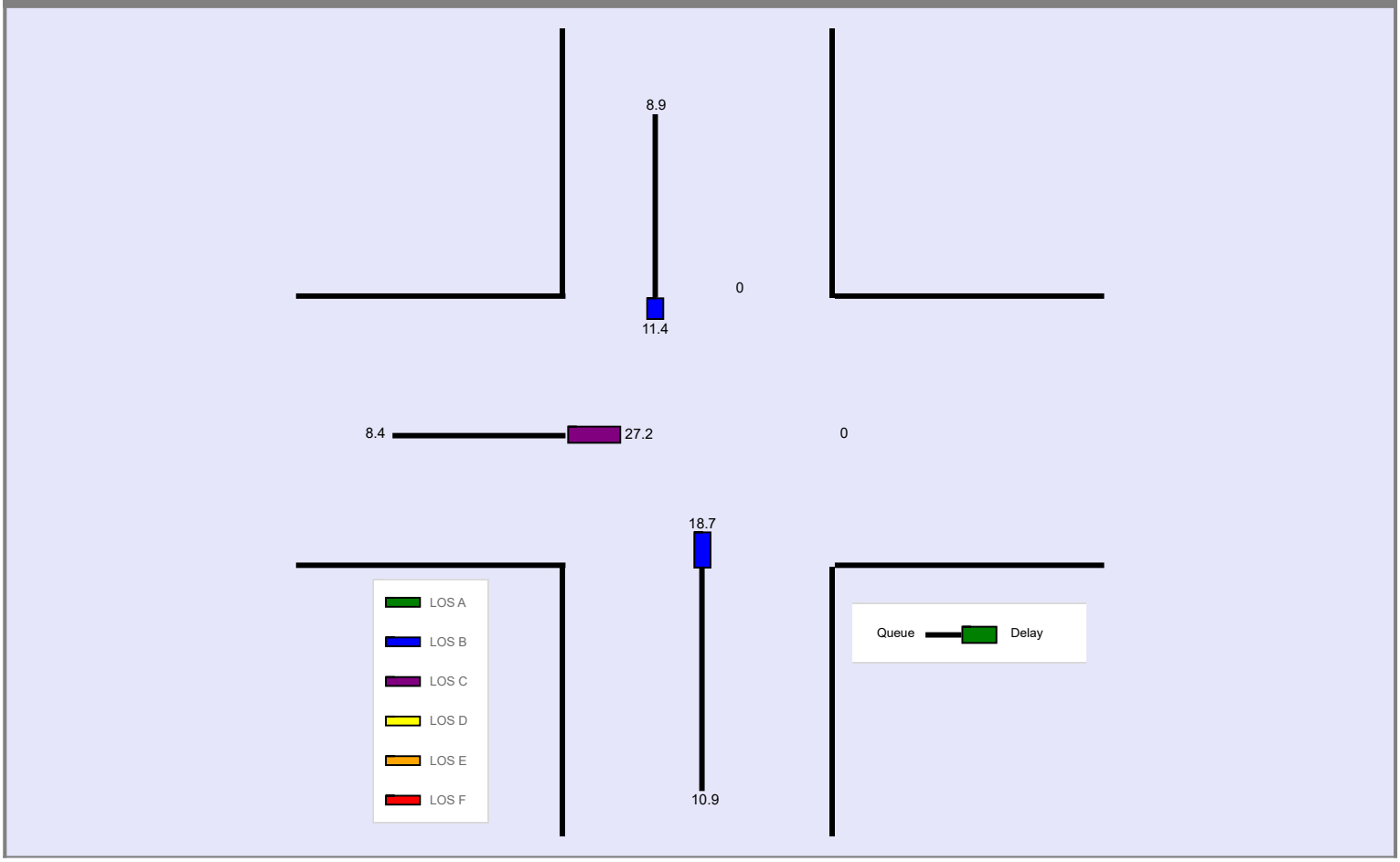
Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		30	250	0	0		80	0	370	0	1020	20

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	21.1	36.9	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	2.0	2.0	0.0	0.0	0.0	0.0	



Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (*Q*), ft/ln (95 th percentile)		215.7			0			300.8		0		221.7
Back of Queue (*Q*), veh/ln (95 th percentile)		8.4			0.0			10.9		0.0		8.9
Queue Storage Ratio (*RQ*) (95 th percentile)		0.14			0.00			0.80		0.00		0.31
Control Delay (*d*), s/veh		27.2						18.7				11.4
Level of Service (LOS)		C						B				B
Approach Delay, s/veh / LOS	27.2	C		0.0			18.7	B		11.4	B	
Intersection Delay, s/veh / LOS	15.7						B					



--- Messages ---

No errors or warnings exist.

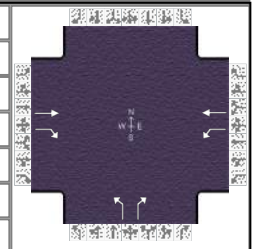
--- Comments ---

No-Build Intersection Analysis

PM Peak

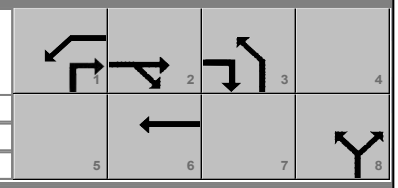
HCS7 Signalized Intersection Input Data

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 16:45
Intersection	Marion Street	File Name	Main Street Intersections - No-Build 2045 PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		260	270	440	310		330		400			

Signal Information					EB			WB			NB			SB		
Cycle, s	120.0	Reference Phase	2													
Offset, s	0	Reference Point	End	Green	37.6	35.3	29.1	0.0	0.0	0.0						
Uncoordinated	No	Simult. Gap E/W	On	Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
Force Mode	Fixed	Simult. Gap N/S	On	Red	2.0	2.0	2.0	0.0	0.0	0.0						



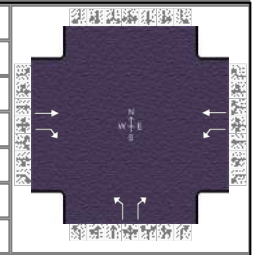
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		260	270	440	310		330		400			
Initial Queue (Q_b), veh/h		0	0	0	0		0		0			
Base Saturation Flow Rate (s_o), veh/h		1900	1900	1900	1900		1900		1900			
Parking (N_m), man/h		None			None			None				
Heavy Vehicles (P_{HV}), %		10	10	6	6		11		11			
Ped / Bike / RTOR, /h	0	0	0	0	0		0	0		0	0	
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0			
Arrival Type (*AT*)		3	3	3	3		3		3			
Upstream Filtering (*I*)		1.00	1.00	0.09	0.09		1.00		1.00			
Lane Width (*W*), ft		12.0	12.0	12.0	12.0		12.0		12.0			
Turn Bay Length, ft		2450	525	1200	1200		175		175			
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h		25	25	25	25		25		25			

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s		16.0	51.0	67.0	53.0	53.0		
Yellow Change Interval (*Y*), s		4.0	4.0	4.0	4.0	4.0		
Red Clearance Interval (R_c), s		2.0	2.0	2.0	2.0	2.0		
Minimum Green (G_{min}), s		10	7	10	7	10		
Start-Up Lost Time (*l1*), s		2.0	2.0	2.0	2.0			
Extension of Effective Green (*e*), s		2.0	2.0	2.0	2.0			
Passage (*PT*), s		2.0	2.0	2.0	2.0	2.0		
Recall Mode		Min	Off	Min	Off	Off		
Dual Entry		Yes	No	Yes	No	Yes		
Walk (*Walk*), s		0.0				0.0		0.0
Pedestrian Clearance Time (*PC*), s		0.0				0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25				0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0				9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0		No	0	0	No		0	
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0			
Pedestrian Signal / Occupied Parking	No	0.50			0.50		No	0.50		No		

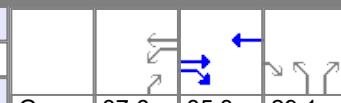
HCS7 Signalized Intersection Results Summary

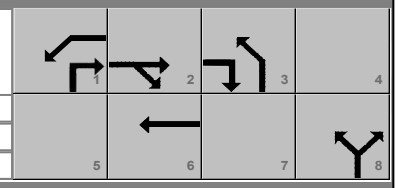
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 16:45
Intersection	Marion Street	File Name	Main Street Intersections - No-Build 2045 PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		260	270	440	310		330		400			

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



										
Green	37.6	35.3	29.1	0.0	0.0	0.0	1	2	3	4
Yellow	4.0	4.0	4.0	0.0	0.0	0.0	5	6	7	8
Red	2.0	2.0	2.0	0.0	0.0	0.0				

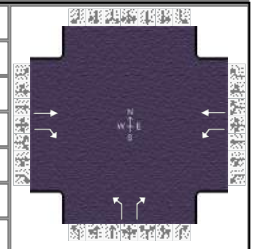
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		
Case Number		7.3	2.0	4.0		9.0		
Phase Duration, s		41.3	43.6	84.9		35.1		
Change Period, (*Y+R c*), s		6.0	6.0	6.0		6.0		
Max Allow Headway (*MAH*), s		0.0	3.3	0.0		3.4		
Queue Clearance Time (*g s*), s			36.5			27.2		
Green Extension Time (*g e*), s		0.0	1.1	0.0		1.9		
Phase Call Probability			1.00			1.00		
Max Out Probability			0.00			0.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18			
Adjusted Flow Rate (*v*), veh/h		283	293	505	356		359		435			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1752	1485	1725	1811		1654		1472			
Queue Service Time (*g s*), s		16.3	13.7	34.5	2.6		25.2		22.3			
Cycle Queue Clearance Time (*g c*), s		16.3	13.7	34.5	2.6		25.2		22.3			
Green Ratio (*g/C*)		0.29	0.54	0.31	0.66		0.24		0.56			
Capacity (*c*), veh/h		515	796	541	1191		401		819			
Volume-to-Capacity Ratio (*X*)		0.549	0.369	0.934	0.299		0.895		0.531			
Back of Queue (*Q*), ft/ln (95 th percentile)		328.3	232.7	454.9	32.3		448		327.2			
Back of Queue (*Q*), veh/ln (95 th percentile)		12.2	8.6	17.4	1.2		16.5		12.0			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.13	0.44	0.38	0.03		2.56		1.87			
Uniform Delay (*d 1*), s/veh		35.7	16.1	45.3	1.8		44.0		16.8			
Incremental Delay (*d 2*), s/veh		4.2	1.3	0.8	0.1		6.1		0.2			
Initial Queue Delay (*d 3*), s/veh		0.0	0.0	0.0	0.0		0.0		0.0			
Control Delay (*d*), s/veh		39.8	17.4	46.1	1.8		50.0		17.0			
Level of Service (LOS)		D	B	D	A		D		B			
Approach Delay, s/veh / LOS	28.4	C		27.8	C		31.9	C		0.0		
Intersection Delay, s/veh / LOS	29.4						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.93	B	0.68	A	1.97	B	1.96	B
Bicycle LOS Score / LOS	1.44	A	1.83	B		F		

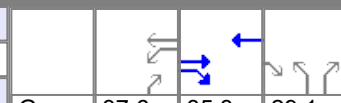
HCS7 Signalized Intersection Intermediate Values

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 16:45
Intersection	Marion Street	File Name	Main Street Intersections - No-Build 2045 PM.xus		
Project Description	BEL-7-19.75				

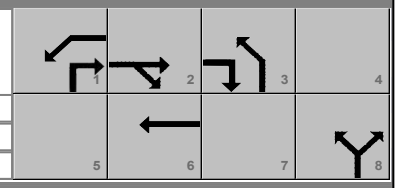


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		260	270	440	310		330		400			

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	37.6	35.3	29.1	0.0	0.0	0.0						
Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
Red	2.0	2.0	2.0	0.0	0.0	0.0						



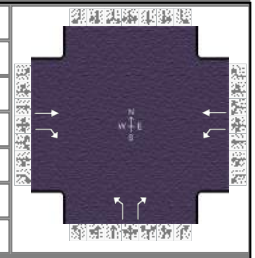
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Heavy Vehicles and Grade Factor (f_{HVg})	1.000	0.922	0.922	0.953	0.953	1.000	0.914	1.000	0.914			
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	1.000	1.000		0.952	0.000		0.952	0.000				
Right-Turn Adjustment Factor (f_{RT})		0.000	0.847		1.000	1.000		0.000	0.847			
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000			1.000			1.000					
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Movement Saturation Flow Rate (s), veh/h	0	1752	1485	1725	1811	0	1654	0	1472			
Proportion of Vehicles Arriving on Green (P)	0.00	0.29	0.29	0.22	0.92	0.00	0.24	0.00	0.24	0.00	0.00	0.00
Incremental Delay Factor (k)		0.50	0.50	0.09	0.50		0.09		0.04			

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		6.0	6.0	6.0		6.0		
Green Ratio (g/C)		0.29	0.31	0.66		0.24		
Permitted Saturation Flow Rate (s_p), veh/h/ln		1041	0	0		1654		
Shared Saturation Flow Rate (s_{sh}), veh/h/ln		0						
Permitted Effective Green Time (g_p), s		0.0	0.0	0.0		0.0		
Permitted Service Time (g_u), s		0.0	0.0	0.0		0.0		
Permitted Queue Service Time (g_{ps}), s								
Time to First Blockage (g_f), s		35.3	0.0	0.0		0.0		
Queue Service Time Before Blockage (g_{fs}), s								
Protected Right Saturation Flow (s_R), veh/h/ln		1485				1472		
Protected Right Effective Green Time (g_R), s		29.1				37.6		

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	1.198	0.000	0.000	0.000	1.198	0.000	1.198	0.000
Pedestrian F_s / F_{delay}	0.000	0.136	0.000	0.078	0.000	0.169	0.000	0.167
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	587.91	29.91	1315.34	7.03		67.20	-83.33	65.10
Bicycle F_w / F_v	-3.64	0.95	-3.64	1.35	-3.64		-3.64	

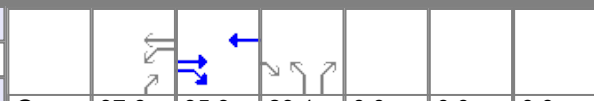
HCS7 Signalized Intersection Results Graphical Summary

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 16:45
Intersection	Marion Street	File Name	Main Street Intersections - No-Build 2045 PM.xus		
Project Description	BEL-7-19.75				

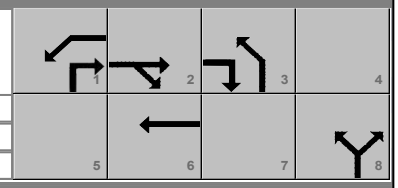


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		260	270	440	310		330		400			

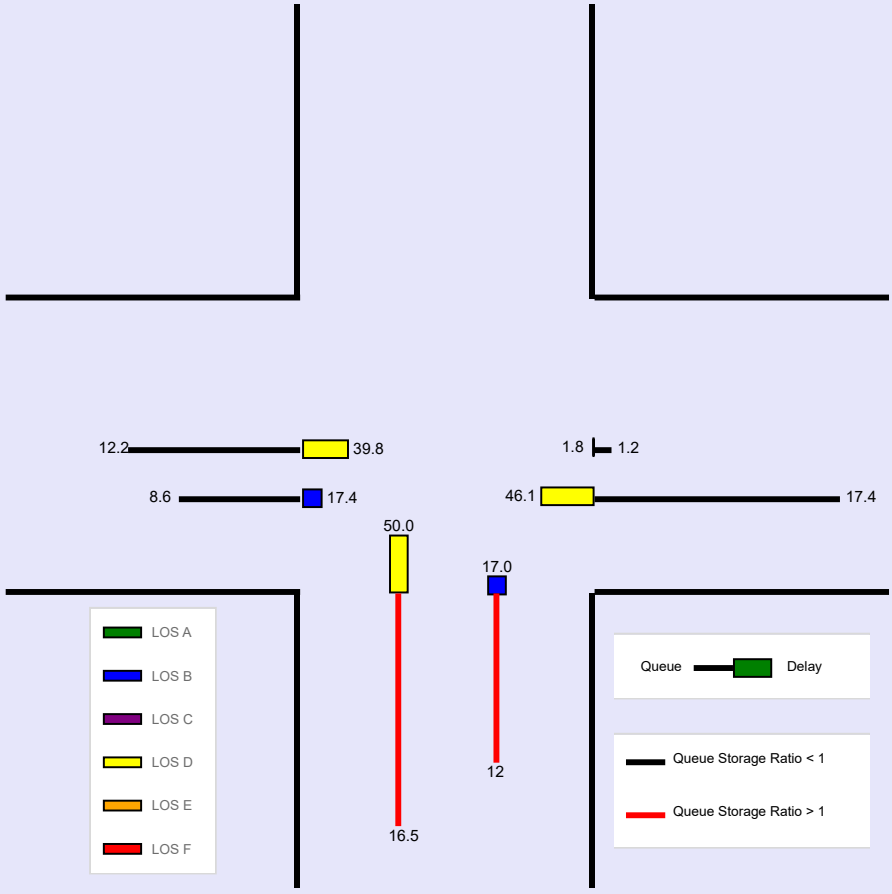
Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	37.6	35.3	29.1	0.0	0.0	0.0						
Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
Red	2.0	2.0	2.0	0.0	0.0	0.0						



Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (*Q*), ft/ln (95 th percentile)		328.3	232.7	454.9	32.3		448		327.2			
Back of Queue (*Q*), veh/ln (95 th percentile)		12.2	8.6	17.4	1.2		16.5		12.0			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.13	0.44	0.38	0.03		2.56		1.87			
Control Delay (*d*), s/veh		39.8	17.4	46.1	1.8		50.0		17.0			
Level of Service (LOS)		D	B	D	A		D		B			
Approach Delay, s/veh / LOS	28.4	C		27.8	C		31.9	C		0.0		
Intersection Delay, s/veh / LOS	29.4						C					



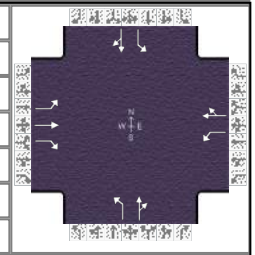
--- Messages ---

WARNING: Since queue spillover from turn lanes and spillback into upstream intersections is not accounted for in the HCM procedures, use of a simulation tool may be advised in situations where the Queue Storage Ratio exceeds 1.0.

--- Comments ---

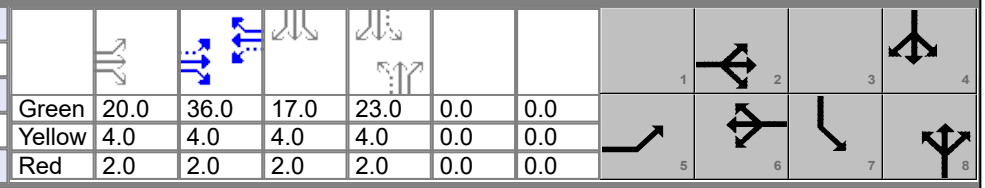
HCS7 Signalized Intersection Input Data

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM	PHF	0.97
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 16:45
Intersection	Lincoln Avenue	File Name	Main Street Intersections - No-Build 2045 PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	460	160	40	100	160	120	50	170	220	470	110	540

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	44	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	20.0	36.0	17.0	23.0	0.0	0.0						
Yellow	4.0	4.0	4.0	4.0	0.0	0.0						
Red	2.0	2.0	2.0	2.0	0.0	0.0						

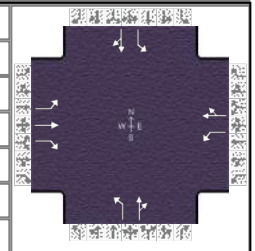
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	460	160	40	100	160	120	50	170	220	470	110	540
Initial Queue (Q_b), veh/h	0	0	0	0	0	0	0	0	0	0	0	0
Base Saturation Flow Rate (s_o), veh/h	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Parking (N_m), man/h		None			None			None			None	
Heavy Vehicles (P_{HV}), %	3	3	3	1	1		2	2		4	4	
Ped / Bike / RTOR, /h	0	0	0	0	0	0	0	0	0	0	0	0
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0	0	0	0
Arrival Type (*AT*)	3	3	3	3	3	3	3	3	3	3	3	3
Upstream Filtering (*I*)	0.89	0.89	0.89	0.73	0.73	0.73	1.00	1.00	1.00	1.00	1.00	1.00
Lane Width (*W*), ft	12.0	12.0	12.0	12.0	12.0		12.0	12.0		12.0	12.0	
Turn Bay Length, ft	250	1200	100	1200	1200		300	800		375	375	
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h	25	25	25	25	25	25	25	25	25	25	25	25

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s	26.0	68.0		42.0		29.0	23.0	52.0
Yellow Change Interval (*Y*), s	4.0	4.0		4.0		4.0	4.0	4.0
Red Clearance Interval (R_c), s	2.0	2.0		2.0		2.0	2.0	2.0
Minimum Green (G_{min}), s	7	7		7		7	7	7
Start-Up Lost Time (*l*t), s	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Extension of Effective Green (e), s	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Passage (*PT*), s	2.0	2.0		2.0		2.0	2.0	2.0
Recall Mode	Off	Min		Min		Off	Off	Off
Dual Entry	No	Yes		Yes		Yes	No	Yes
Walk (*Walk*), s		0.0		0.0		0.0		0.0
Pedestrian Clearance Time (*PC*), s		0.0		0.0		0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25	0	No	25	0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0	9.0	12	0	9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0	0	No	0	0	No	0	0	No
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0
Pedestrian Signal / Occupied Parking	No	0.50		No	0.50		No	0.50		No	0.50	

HCS7 Signalized Intersection Results Summary

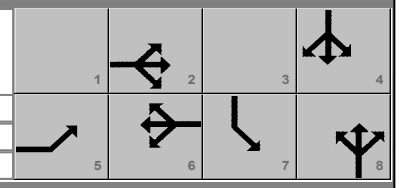
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM	PHF	0.97
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 16:45
Intersection	Lincoln Avenue	File Name	Main Street Intersections - No-Build 2045 PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	460	160	40	100	160	120	50	170	220	470	110	540

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	44	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	20.0	36.0	17.0	23.0	0.0	0.0	
Yellow	4.0	4.0	4.0	4.0	0.0	0.0	
Red	2.0	2.0	2.0	2.0	0.0	0.0	



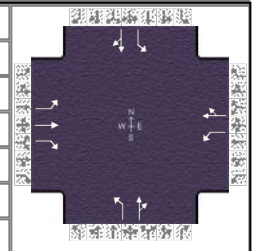
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8	7	4
Case Number	1.0	3.0		6.3		6.3	1.0	4.0
Phase Duration, s	26.0	68.0		42.0		29.0	23.0	52.0
Change Period, ($Y+R_c$), s	6.0	6.0		6.0		6.0	6.0	6.0
Max Allow Headway (*MAH*), s	3.3	0.0		0.0		3.5	3.3	3.5
Queue Clearance Time (g_s), s	22.0					25.0	19.0	48.0
Green Extension Time (g_e), s	0.0	0.0		0.0		0.0	0.0	0.0
Phase Call Probability	1.00					1.00	1.00	1.00
Max Out Probability	1.00					1.00	1.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	500	174	43	257	721		52	402		485	670	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1767	1856	1572	1220	1750		767	1698		1753	1601	
Queue Service Time (g_s), s	20.0	7.2	1.4	23.7	36.0		0.0	23.0		17.0	46.0	
Cycle Queue Clearance Time (g_c), s	20.0	7.2	1.4	23.7	36.0		23.0	23.0		17.0	46.0	
Green Ratio (*g/C*)	0.48	0.52	0.52	0.30	0.30		0.19	0.19		0.35	0.38	
Capacity (*c*), veh/h	355	959	812	426	525		60	325		308	614	
Volume-to-Capacity Ratio (*X*)	1.410	0.181	0.054	0.604	1.373		0.859	1.235		1.571	1.092	
Back of Queue (*Q*), ft/ln (95 th percentile)	1178.3	154.7	25.2	304.7	1525.6		122.7	819.3		1213.9	1027.7	
Back of Queue (*Q*), veh/ln (95 th percentile)	46.0	6.0	1.0	12.1	60.5		4.8	32.3		47.1	39.8	
Queue Storage Ratio (*RQ*) (95 th percentile)	4.71	0.13	0.25	0.25	1.27		0.41	1.02		3.24	2.74	
Uniform Delay (d_1), s/veh	43.1	19.4	12.5	44.1	44.4		60.0	48.5		34.7	37.0	
Incremental Delay (d_2), s/veh	199.1	0.4	0.1	4.6	176.5		66.3	129.6		272.3	63.8	
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	242.1	19.8	12.7	48.7	220.9		126.3	178.1		306.9	100.8	
Level of Service (LOS)	F	B	B	D	F		F	F		F	F	
Approach Delay, s/veh / LOS	174.3	F		175.6	F		172.3	F		187.3	F	
Intersection Delay, s/veh / LOS	178.9						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.90	B	1.93	B	1.94	B	2.11	B
Bicycle LOS Score / LOS	1.61	B	1.13	A	1.24	A	2.39	B

HCS7 Signalized Intersection Intermediate Values

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM	PHF	0.97
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 16:45
Intersection	Lincoln Avenue	File Name	Main Street Intersections - No-Build 2045 PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	460	160	40	100	160	120	50	170	220	470	110	540

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	44	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4		
Green	20.0	36.0	17.0	23.0	0.0	0.0	5	6	7	8		
Yellow	4.0	4.0	4.0	4.0	0.0	0.0						
Red	2.0	2.0	2.0	2.0	0.0	0.0						

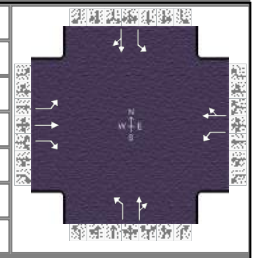
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles and Grade Factor (f_{HVg})	0.977	0.977	0.977	0.992	0.992	1.000	0.984	0.984	1.000	0.969	0.969	1.000
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	0.952	0.000		0.642	0.000		0.404	0.000		0.952	0.000	
Right-Turn Adjustment Factor (f_{RT})		0.000	0.847		0.928	0.928		0.908	0.908		0.870	0.870
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000			1.000			1.000			1.000		
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			1.000
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Movement Saturation Flow Rate (s), veh/h	1767	1856	1572	1220	1000	750	767	740	958	1753	271	1330
Proportion of Vehicles Arriving on Green (P)	0.08	0.40	0.58	0.18	0.33	0.16	0.19	0.19	0.19	0.14	0.38	0.38
Incremental Delay Factor (k)	0.50	0.50	0.50	0.50	0.50		0.37	0.50		0.50	0.50	

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)	6.0	6.0		6.0		6.0	6.0	6.0
Green Ratio (g/C)	0.48	0.52		0.30		0.19	0.35	0.38
Permitted Saturation Flow Rate (s_p), veh/h/ln	726	0		1220		767	967	0
Shared Saturation Flow Rate (s_{sh}), veh/h/ln								
Permitted Effective Green Time (g_p), s	38.0	0.0		36.0		23.0	25.0	0.0
Permitted Service Time (g_u), s	0.0	0.0		36.0		0.0	0.0	0.0
Permitted Queue Service Time (g_{ps}), s	0.0			27.5		0.0	0.0	
Time to First Blockage (g_f), s	0.0	0.0		0.0		0.0	0.0	0.0
Queue Service Time Before Blockage (g_{fs}), s								
Protected Right Saturation Flow (s_R), veh/h/ln		0						
Protected Right Effective Green Time (g_R), s		0.0						

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	1.198	0.000	1.198	0.000	1.198	0.000	1.389	0.000
Pedestrian F_s / F_{delay}	0.000	0.106	0.000	0.136	0.000	0.147	0.000	0.125
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	1033.33	14.02	600.00	29.40	383.33	39.20	766.67	22.82
Bicycle F_w / F_v	-3.64	1.12	-3.64	0.65	-3.64	0.75	-3.64	1.91

HCS7 Signalized Intersection Results Graphical Summary

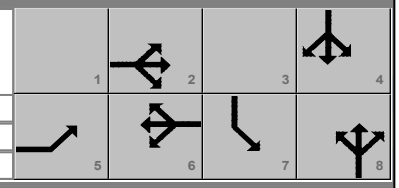
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM	PHF	0.97
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 16:45
Intersection	Lincoln Avenue	File Name	Main Street Intersections - No-Build 2045 PM.xus		
Project Description	BEL-7-19.75				



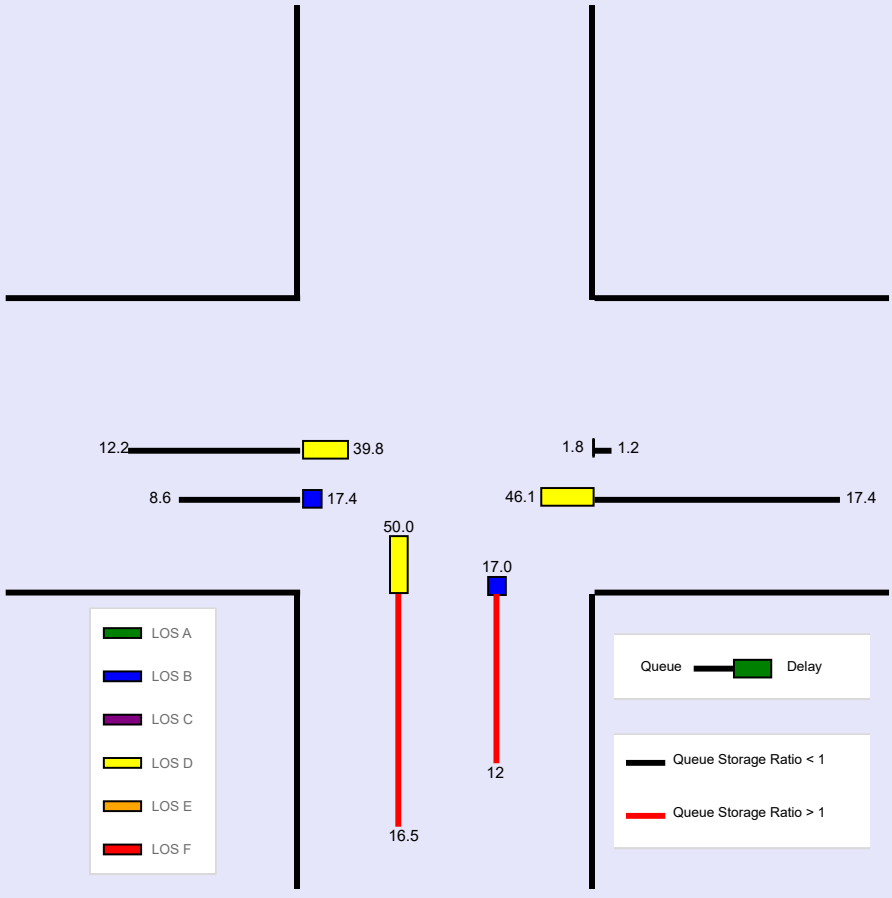
Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	460	160	40	100	160	120	50	170	220	470	110	540

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	44	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	20.0	36.0	17.0	23.0	0.0	0.0	
Yellow	4.0	4.0	4.0	4.0	0.0	0.0	
Red	2.0	2.0	2.0	2.0	0.0	0.0	



Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (*Q*), ft/ln (95 th percentile)	1178.3	154.7	25.2	304.7	1525.6		122.7	819.3		1213.9	1027.7	
Back of Queue (*Q*), veh/ln (95 th percentile)	46.0	6.0	1.0	12.1	60.5		4.8	32.3		47.1	39.8	
Queue Storage Ratio (*RQ*) (95 th percentile)	4.71	0.13	0.25	0.25	1.27		0.41	1.02		3.24	2.74	
Control Delay (*d*), s/veh	242.1	19.8	12.7	48.7	220.9		126.3	178.1		306.9	100.8	
Level of Service (LOS)	F	B	B	D	F		F	F		F	F	
Approach Delay, s/veh / LOS	174.3	F		175.6	F		172.3	F		187.3	F	
Intersection Delay, s/veh / LOS	178.9						F					



--- Messages ---

WARNING: Since queue spillover from turn lanes and spillback into upstream intersections is not accounted for in the HCM procedures, use of a simulation tool may be advised in situations where the Queue Storage Ratio exceeds 1.0.

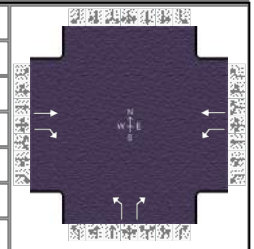
WARNING: If demand exceeds capacity, a multiple-period analysis should be conducted.

WARNING: According to input data, upstream feeding volume is equal to 250% of downstream exit volume during time period #1, for thru movement #6.

--- Comments ---

HCS7 Signalized Intersection Input Data

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 16:45
Intersection	Marion Street	File Name	Main Street Intersections - No-Build 2045 PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		260	270	440	310		330		400			

Signal Information					EB			WB			NB			SB		
Cycle, s	120.0	Reference Phase	2													
Offset, s	0	Reference Point	End	Green	37.6	35.3	29.1	0.0	0.0	0.0						
Uncoordinated	No	Simult. Gap E/W	On	Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
Force Mode	Fixed	Simult. Gap N/S	On	Red	2.0	2.0	2.0	0.0	0.0	0.0						

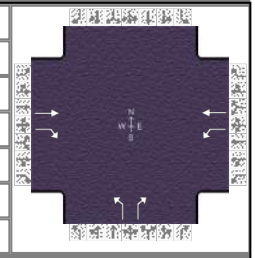
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		260	270	440	310		330		400			
Initial Queue (Q_b), veh/h		0	0	0	0		0		0			
Base Saturation Flow Rate (s_o), veh/h		1900	1900	1900	1900		1900		1900			
Parking (N_m), man/h		None			None			None				
Heavy Vehicles (P_{HV}), %		10	10	6	6		11		11			
Ped / Bike / RTOR, /h	0	0	0	0	0		0	0		0	0	
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0			
Arrival Type (*AT*)		3	3	3	3		3		3			
Upstream Filtering (*I*)		1.00	1.00	0.09	0.09		1.00		1.00			
Lane Width (*W*), ft		12.0	12.0	12.0	12.0		12.0		12.0			
Turn Bay Length, ft		2450	525	1200	1200		175		175			
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h		25	25	25	25		25		25			

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s		16.0	51.0	67.0	53.0	53.0		
Yellow Change Interval (*Y*), s		4.0	4.0	4.0	4.0	4.0		
Red Clearance Interval (R_c), s		2.0	2.0	2.0	2.0	2.0		
Minimum Green (G_{min}), s		10	7	10	7	10		
Start-Up Lost Time (*lt*), s		2.0	2.0	2.0	2.0			
Extension of Effective Green (*e*), s		2.0	2.0	2.0	2.0			
Passage (*PT*), s		2.0	2.0	2.0	2.0	2.0		
Recall Mode		Min	Off	Min	Off	Off		
Dual Entry		Yes	No	Yes	No	Yes		
Walk (*Walk*), s		0.0				0.0		0.0
Pedestrian Clearance Time (*PC*), s		0.0				0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25				0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0				9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0		No	0	0	No		0	
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0			
Pedestrian Signal / Occupied Parking	No	0.50			0.50		No	0.50		No		

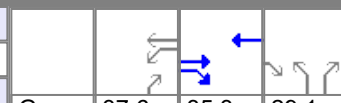
HCS7 Signalized Intersection Results Summary

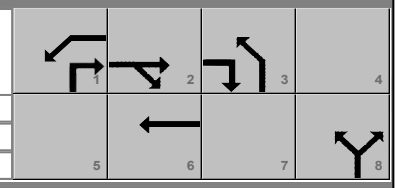
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 16:45
Intersection	Marion Street	File Name	Main Street Intersections - No-Build 2045 PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		260	270	440	310		330		400			

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



										
Green	37.6	35.3	29.1	0.0	0.0	0.0	1	2	3	4
Yellow	4.0	4.0	4.0	0.0	0.0	0.0	5	6	7	8
Red	2.0	2.0	2.0	0.0	0.0	0.0				

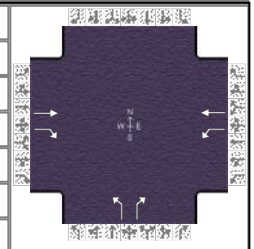
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		
Case Number		7.3	2.0	4.0		9.0		
Phase Duration, s		41.3	43.6	84.9		35.1		
Change Period, (*Y+R c*), s		6.0	6.0	6.0		6.0		
Max Allow Headway (*MAH*), s		0.0	3.3	0.0		3.4		
Queue Clearance Time (*g s*), s			36.5			27.2		
Green Extension Time (*g e*), s		0.0	1.1	0.0		1.9		
Phase Call Probability			1.00			1.00		
Max Out Probability			0.00			0.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18			
Adjusted Flow Rate (*v*), veh/h		283	293	505	356		359		435			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1752	1485	1725	1811		1654		1472			
Queue Service Time (*g s*), s		16.3	13.7	34.5	2.6		25.2		22.3			
Cycle Queue Clearance Time (*g c*), s		16.3	13.7	34.5	2.6		25.2		22.3			
Green Ratio (*g/C*)		0.29	0.54	0.31	0.66		0.24		0.56			
Capacity (*c*), veh/h		515	796	541	1191		401		819			
Volume-to-Capacity Ratio (*X*)		0.549	0.369	0.934	0.299		0.895		0.531			
Back of Queue (*Q*), ft/ln (95 th percentile)		328.3	232.7	454.9	32.3		448		327.2			
Back of Queue (*Q*), veh/ln (95 th percentile)		12.2	8.6	17.4	1.2		16.5		12.0			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.13	0.44	0.38	0.03		2.56		1.87			
Uniform Delay (*d 1*), s/veh		35.7	16.1	45.3	1.8		44.0		16.8			
Incremental Delay (*d 2*), s/veh		4.2	1.3	0.8	0.1		6.1		0.2			
Initial Queue Delay (*d 3*), s/veh		0.0	0.0	0.0	0.0		0.0		0.0			
Control Delay (*d*), s/veh		39.8	17.4	46.1	1.8		50.0		17.0			
Level of Service (LOS)		D	B	D	A		D		B			
Approach Delay, s/veh / LOS	28.4	C		27.8	C		31.9	C		0.0		
Intersection Delay, s/veh / LOS	29.4						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.93	B	0.68	A	1.97	B	1.96	B
Bicycle LOS Score / LOS	1.44	A	1.83	B		F		

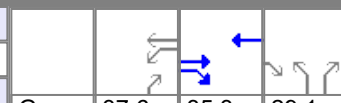
HCS7 Signalized Intersection Intermediate Values

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 16:45
Intersection	Marion Street	File Name	Main Street Intersections - No-Build 2045 PM.xus		
Project Description	BEL-7-19.75				

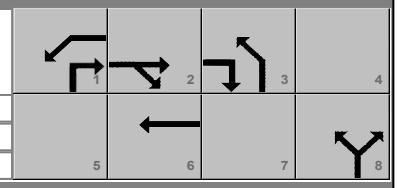


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		260	270	440	310		330		400			

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	37.6	35.3	29.1	0.0	0.0	0.0						
Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
Red	2.0	2.0	2.0	0.0	0.0	0.0						



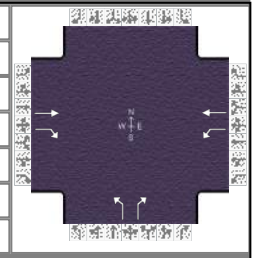
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Heavy Vehicles and Grade Factor (f_{HVg})	1.000	0.922	0.922	0.953	0.953	1.000	0.914	1.000	0.914			
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	1.000	1.000		0.952	0.000		0.952	0.000				
Right-Turn Adjustment Factor (f_{RT})		0.000	0.847		1.000	1.000		0.000	0.847			
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000			1.000			1.000					
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Movement Saturation Flow Rate (s), veh/h	0	1752	1485	1725	1811	0	1654	0	1472			
Proportion of Vehicles Arriving on Green (P)	0.00	0.29	0.29	0.22	0.92	0.00	0.24	0.00	0.24	0.00	0.00	0.00
Incremental Delay Factor (k)		0.50	0.50	0.09	0.50		0.09		0.04			

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		6.0	6.0	6.0		6.0		
Green Ratio (g/C)		0.29	0.31	0.66		0.24		
Permitted Saturation Flow Rate (s_p), veh/h/ln		1041	0	0		1654		
Shared Saturation Flow Rate (s_{sh}), veh/h/ln		0						
Permitted Effective Green Time (g_p), s		0.0	0.0	0.0		0.0		
Permitted Service Time (g_u), s		0.0	0.0	0.0		0.0		
Permitted Queue Service Time (g_{ps}), s								
Time to First Blockage (g_f), s		35.3	0.0	0.0		0.0		
Queue Service Time Before Blockage (g_{fs}), s								
Protected Right Saturation Flow (s_R), veh/h/ln		1485				1472		
Protected Right Effective Green Time (g_R), s		29.1				37.6		

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	1.198	0.000	0.000	0.000	1.198	0.000	1.198	0.000
Pedestrian F_s / F_{delay}	0.000	0.136	0.000	0.078	0.000	0.169	0.000	0.167
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	587.91	29.91	1315.34	7.03		67.20	-83.33	65.10
Bicycle F_w / F_v	-3.64	0.95	-3.64	1.35	-3.64		-3.64	

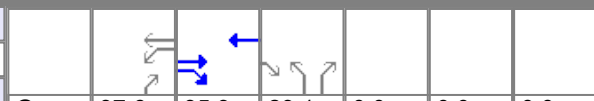
HCS7 Signalized Intersection Results Graphical Summary

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 16:45
Intersection	Marion Street	File Name	Main Street Intersections - No-Build 2045 PM.xus		
Project Description	BEL-7-19.75				

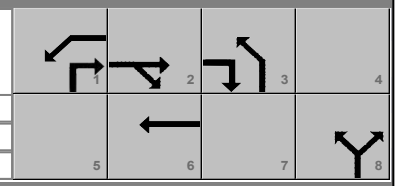


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		260	270	440	310		330		400			

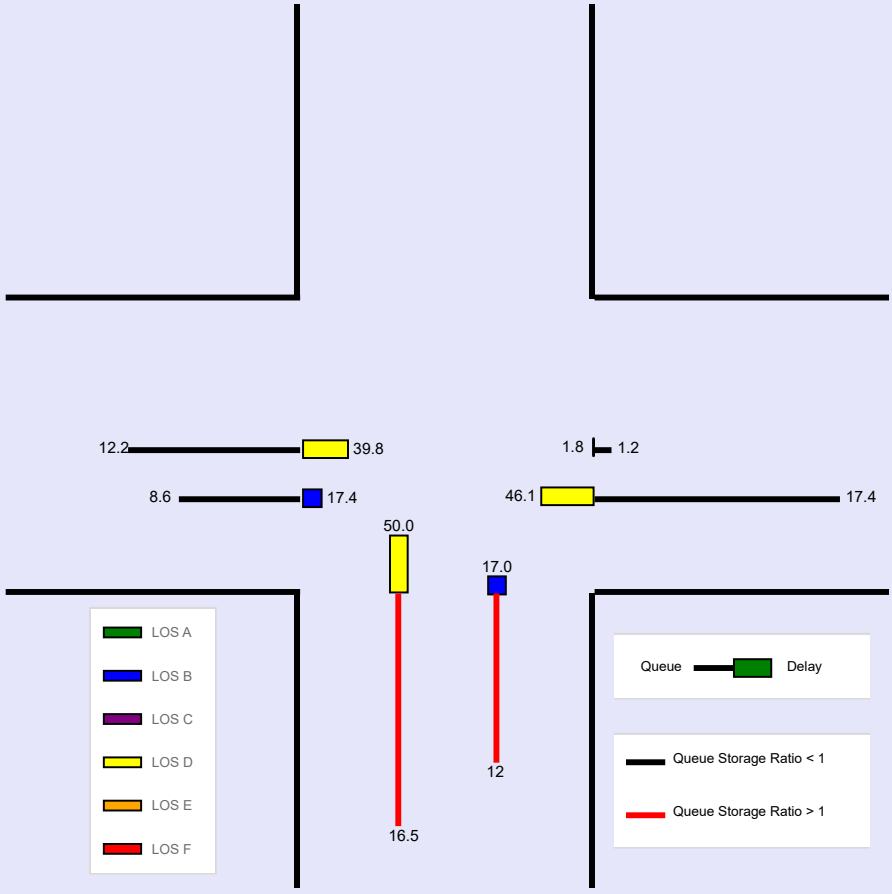
Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	37.6	35.3	29.1	0.0	0.0	0.0						
Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
Red	2.0	2.0	2.0	0.0	0.0	0.0						



Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (*Q*), ft/ln (95 th percentile)		328.3	232.7	454.9	32.3		448		327.2			
Back of Queue (*Q*), veh/ln (95 th percentile)		12.2	8.6	17.4	1.2		16.5		12.0			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.13	0.44	0.38	0.03		2.56		1.87			
Control Delay (*d*), s/veh		39.8	17.4	46.1	1.8		50.0		17.0			
Level of Service (LOS)		D	B	D	A		D		B			
Approach Delay, s/veh / LOS	28.4	C		27.8	C		31.9	C		0.0		
Intersection Delay, s/veh / LOS	29.4						C					



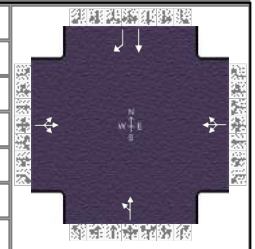
--- Messages ---

WARNING: Since queue spillover from turn lanes and spillback into upstream intersections is not accounted for in the HCM procedures, use of a simulation tool may be advised in situations where the Queue Storage Ratio exceeds 1.0.

--- Comments ---

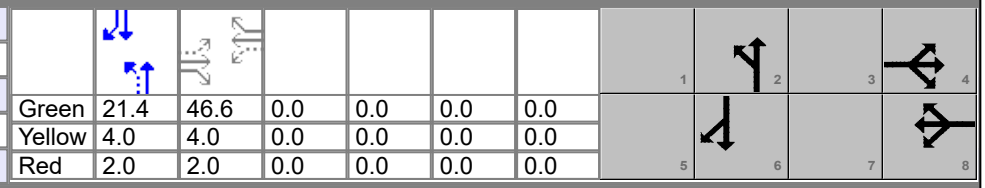
HCS7 Signalized Intersection Input Data

General Information				Intersection Information	
Agency	Burgess & Niple, Inc			Duration, h	0.250
Analyst	MEL	Analysis Date	11/17/2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM	PHF	0.86
Urban Street	Lincoln Avenue	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Howard Street	File Name	Lincoln & Howard 2045 No-Build PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	140	0	120	10	460	280	10	40			180	70

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	21.4	46.6	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	2.0	2.0	0.0	0.0	0.0	0.0	

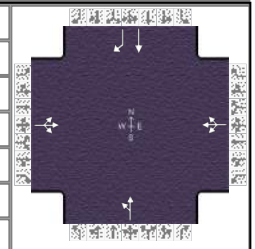
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	140	0	120	10	460	280	10	40			180	70
Initial Queue (Q_b), veh/h	0	0	0	0	0	0	0	0			0	0
Base Saturation Flow Rate (s_o), veh/h	1900	1900	1900	1900	1900	1900	1900	1900			1900	1900
Parking (N_m), man/h		None			None			None			None	
Heavy Vehicles (P_{HV}), %		1			6			1			1	1
Ped / Bike / RTOR, /h	0	0	0	0	0	0	0	0		0	0	0
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0	0	0	0
Arrival Type (*AT*)	3	3	3	3	3	3	3	3			3	3
Upstream Filtering (*I*)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Lane Width (*W*), ft		12.0			12.0			12.0			12.0	12.0
Turn Bay Length, ft		850			600			475			800	450
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h	25	25	25	25	25	25	25	25			25	25

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s		53.0		53.0		27.0		27.0
Yellow Change Interval (*Y*), s		4.0		4.0		4.0		4.0
Red Clearance Interval (R_c), s		2.0		2.0		2.0		2.0
Minimum Green (G_{min}), s		7		7		7		7
Start-Up Lost Time (*l*t), s	2.0	2.0	2.0	2.0	2.0	2.0		2.0
Extension of Effective Green (e), s	2.0	2.0	2.0	2.0	2.0	2.0		2.0
Passage (*PT*), s		2.0		2.0		2.0		2.0
Recall Mode		Off		Off		Min		Min
Dual Entry		Yes		Yes		Yes		Yes
Walk (*Walk*), s		0.0		0.0		0.0		0.0
Pedestrian Clearance Time (*PC*), s		0.0		0.0		0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25	0	No	25	0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0	9.0	12	0	9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0	0	No	0	0	No	0	0	No
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0
Pedestrian Signal / Occupied Parking	No	0.50		No	0.50		No	0.50		No	0.50	

HCS7 Signalized Intersection Results Summary

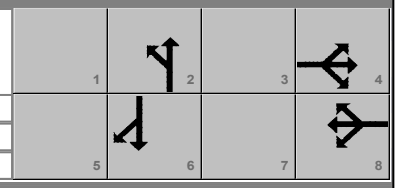
General Information				Intersection Information	
Agency	Burgess & Niple, Inc			Duration, h	0.250
Analyst	MEL	Analysis Date	11/17/2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM	PHF	0.86
Urban Street	Lincoln Avenue	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Howard Street	File Name	Lincoln & Howard 2045 No-Build PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	140	0	120	10	460	280	10	40			180	70

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	21.4	46.6	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	2.0	2.0	0.0	0.0	0.0	0.0	



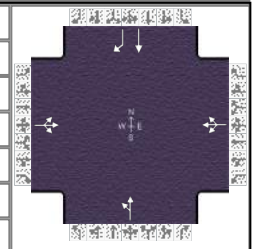
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8		2		6
Case Number		8.0		8.0		8.0		7.0
Phase Duration, s		52.6		52.6		27.4		27.4
Change Period, ($Y+R_c$), s		6.0		6.0		6.0		6.0
Max Allow Headway (*MAH*), s		3.7		3.7		0.0		0.0
Queue Clearance Time (g_s), s		46.2		36.8				
Green Extension Time (g_e), s		0.4		3.2		0.0		0.0
Phase Call Probability		1.00		1.00				
Max Out Probability		1.00		0.30				

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h		302			872			58			209	81
Adjusted Saturation Flow Rate (*s*), veh/h/ln		549			1725			1750			1885	1598
Queue Service Time (g_s), s		9.4			0.0			0.0			7.3	3.1
Cycle Queue Clearance Time (g_c), s		44.2			34.8			7.3			7.3	3.1
Green Ratio (*g/C*)		0.58			0.58			0.27			0.27	0.27
Capacity (*c*), veh/h		389			1050			522			505	428
Volume-to-Capacity Ratio (*X*)		0.777			0.830			0.111			0.415	0.190
Back of Queue (*Q*), ft/ln (95 th percentile)		260.1			509.7			39.8			161.2	58.2
Back of Queue (*Q*), veh/ln (95 th percentile)		10.3			19.5			1.6			6.4	2.3
Queue Storage Ratio (*RQ*) (95 th percentile)		0.31			0.85			0.08			0.20	0.13
Uniform Delay (d_1), s/veh		17.7			14.3			22.1			24.1	22.6
Incremental Delay (d_2), s/veh		8.5			5.3			0.4			2.5	1.0
Initial Queue Delay (d_3), s/veh		0.0			0.0			0.0			0.0	0.0
Control Delay (*d*), s/veh		26.2			19.6			22.6			26.6	23.6
Level of Service (LOS)		C			B			C			C	C
Approach Delay, s/veh / LOS	26.2	C		19.6	B		22.6	C		25.8	C	
Intersection Delay, s/veh / LOS	22.2						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.65	B	1.88	B	1.70	B	1.70	B
Bicycle LOS Score / LOS	0.99	A	1.93	B	0.58	A	0.97	A

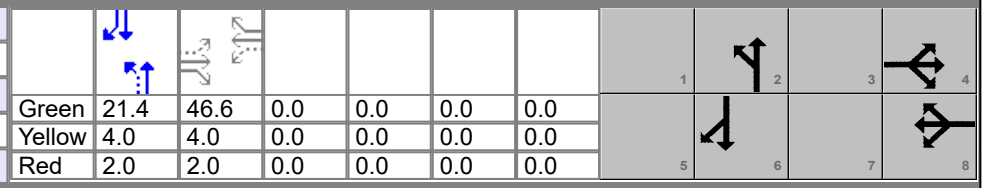
HCS7 Signalized Intersection Intermediate Values

General Information				Intersection Information	
Agency	Burgess & Niple, Inc			Duration, h	0.250
Analyst	MEL	Analysis Date	11/17/2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM	PHF	0.86
Urban Street	Lincoln Avenue	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Howard Street	File Name	Lincoln & Howard 2045 No-Build PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	140	0	120	10	460	280	10	40			180	70

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	21.4	46.6	0.0	0.0	0.0	0.0						
Yellow	4.0	4.0	0.0	0.0	0.0	0.0						
Red	2.0	2.0	0.0	0.0	0.0	0.0						

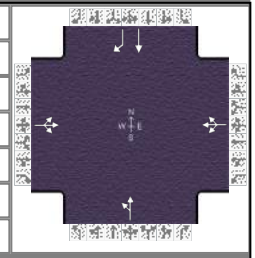
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles and Grade Factor (f_{HVg})	1.000	0.992	1.000	1.000	0.953	1.000	1.000	0.992	1.000	1.000	0.992	0.992
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	0.299	0.291		0.997	0.952		0.928	0.928		1.000	1.000	
Right-Turn Adjustment Factor (f_{RT})		0.000	0.291		0.000	0.952		0.000	0.928		0.000	0.847
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000			1.000			1.000			1.000		
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			1.000
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Movement Saturation Flow Rate (s), veh/h	296	0	253	23	1058	644	350	1400	0	0	1885	1598
Proportion of Vehicles Arriving on Green (P)	0.58	0.00	0.58	0.58	0.58	0.58	0.27	0.27	0.00	0.00	0.27	0.27
Incremental Delay Factor (k)		0.29			0.34			0.50			0.50	0.50

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		6.0		6.0		6.0		6.0
Green Ratio (g/C)		0.58		0.58		0.27		0.27
Permitted Saturation Flow Rate (s_p), veh/h/ln		652		1269		1191		1381
Shared Saturation Flow Rate (s_{sh}), veh/h/ln		366		1793		0		1885
Permitted Effective Green Time (g_p), s		46.6		46.6		21.4		0.0
Permitted Service Time (g_u), s		11.8		2.5		14.1		0.0
Permitted Queue Service Time (g_{ps}), s		9.4		0.0		0.0		
Time to First Blockage (g_f), s		1.7		30.3		7.3		21.4
Queue Service Time Before Blockage (g_{fs}), s		1.7		12.3		1.9		
Protected Right Saturation Flow (s_R), veh/h/ln								0
Protected Right Effective Green Time (g_R), s								0.0

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	0.972	0.000	1.198	0.000	0.972	0.000	0.972	0.000
Pedestrian F_s / F_{delay}	0.000	0.078	0.000	0.078	0.000	0.123	0.000	0.123
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	1165.29	6.97	1165.29	6.97	534.71	21.47	534.71	21.47
Bicycle F_w / F_v	-3.64	0.50	-3.64	1.44	-3.64	0.10	-3.64	0.48

HCS7 Signalized Intersection Results Graphical Summary

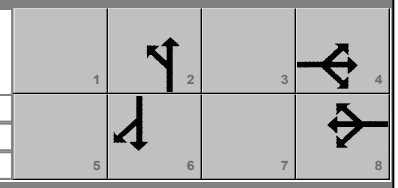
General Information				Intersection Information	
Agency	Burgess & Niple, Inc			Duration, h	0.250
Analyst	MEL	Analysis Date	11/17/2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM	PHF	0.86
Urban Street	Lincoln Avenue	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Howard Street	File Name	Lincoln & Howard 2045 No-Build PM.xus		
Project Description	BEL-7-19.75				



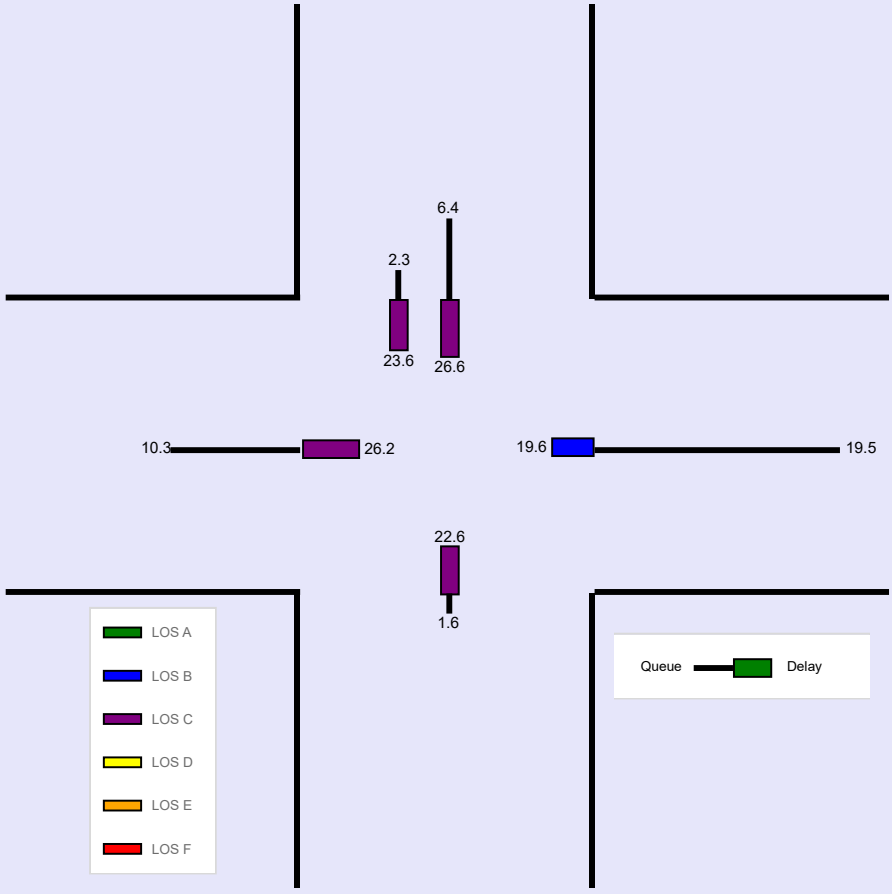
Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	140	0	120	10	460	280	10	40			180	70

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	21.4	46.6	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	2.0	2.0	0.0	0.0	0.0	0.0	



Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (*Q*), ft/ln (95 th percentile)		260.1			509.7			39.8			161.2	58.2
Back of Queue (*Q*), veh/ln (95 th percentile)		10.3			19.5			1.6			6.4	2.3
Queue Storage Ratio (*RQ*) (95 th percentile)		0.31			0.85			0.08			0.20	0.13
Control Delay (*d*), s/veh		26.2			19.6			22.6			26.6	23.6
Level of Service (LOS)		C			B			C			C	C
Approach Delay, s/veh / LOS	26.2	C		19.6	B		22.6	C		25.8	C	
Intersection Delay, s/veh / LOS	22.2						C					



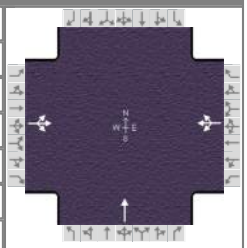
--- Messages ---

No errors or warnings exist.

--- Comments ---

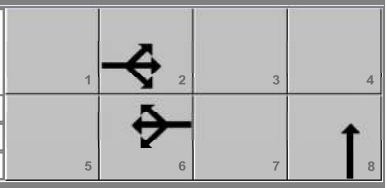
HCS7 Signalized Intersection Input Data

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM	PHF	0.96
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	NB SR 7	File Name	Cadiz Pike Signals No-Build 2045 PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	590	0	0	0	0	0		520				

Signal Information					EB		WB			
Cycle, s	110.0	Reference Phase	2							
Offset, s	25	Reference Point	End	Green	65.6	34.4	0.0	0.0	0.0	0.0
Uncoordinated	No	Simult. Gap E/W	On	Yellow	4.0	4.0	0.0	0.0	0.0	0.0
Force Mode	Fixed	Simult. Gap N/S	On	Red	0.0	2.0	0.0	0.0	0.0	0.0



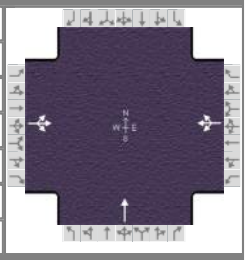
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	590	0	0	0	0	0		520				
Initial Queue (Q_b), veh/h	0	0	0	0	0	0		0				
Base Saturation Flow Rate (s_o), veh/h	1900	1900	1900	1900	1900	1900		1900				
Parking (N_m), man/h		None			None			None				
Heavy Vehicles (P_{HV}), %		4			0			3				
Ped / Bike / RTOR, /h	0	0		0	0		0	0		0	0	
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0			
Arrival Type (*AT*)	3	3	3	3	3	3		3				
Upstream Filtering (*I*)	1.00	1.00	1.00	1.00	1.00	1.00		1.00				
Lane Width (*W*), ft		12.0			12.0			12.0				
Turn Bay Length, ft		100			0			400				
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h	25	25	25	25	25	25		25				

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s		12.0		12.0		98.0		
Yellow Change Interval (*Y*), s		4.0		4.0		4.0		
Red Clearance Interval (R_c), s		0.0		0.0		2.0		
Minimum Green (G_{min}), s		6		6		7		
Start-Up Lost Time (*l1*), s	2.0	2.0	2.0	2.0		2.0		
Extension of Effective Green (*e*), s	2.0	2.0	2.0	2.0		2.0		
Passage (*PT*), s		2.0		2.0		2.0		
Recall Mode		Min		Min		Off		
Dual Entry		Yes		Yes		No		
Walk (*Walk*), s		0.0				0.0		0.0
Pedestrian Clearance Time (*PC*), s		0.0				0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25				0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0				9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0		No	0	0	No		0	
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0			
Pedestrian Signal / Occupied Parking	No	0.50			0.50		No	0.50		No		

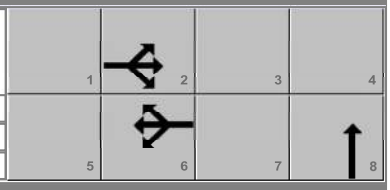
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM	PHF	0.96
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	NB SR 7	File Name	Cadiz Pike Signals No-Build 2045 PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	590	0	0	0	0	0		520				

Signal Information											
Cycle, s	110.0	Reference Phase	2								
Offset, s	25	Reference Point	End								
Uncoordinated	No	Simult. Gap E/W	On	Green	65.6	34.4	0.0	0.0	0.0	0.0	
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
				Red	0.0	2.0	0.0	0.0	0.0	0.0	



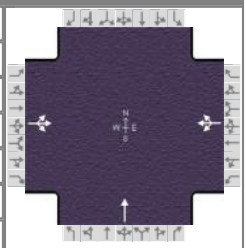
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		
Case Number		8.0		8.0		12.0		
Phase Duration, s		69.6		69.6		40.4		
Change Period, (*Y+R c*), s		4.0		4.0		6.0		
Max Allow Headway (*MAH*), s		0.0		0.0		3.2		
Queue Clearance Time (*g s*), s						33.2		
Green Extension Time (*g e*), s		0.0		0.0		1.2		
Phase Call Probability						1.00		
Max Out Probability						0.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16		8				
Adjusted Flow Rate (*v*), veh/h		550			0			542				
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1395			0			1856				
Queue Service Time (*g s*), s		33.2			0.0			31.2				
Cycle Queue Clearance Time (*g c*), s		33.2			0.0			31.2				
Green Ratio (*g/C*)		0.60						0.31				
Capacity (*c*), veh/h		898						580				
Volume-to-Capacity Ratio (*X*)		0.613			0.000			0.935				
Back of Queue (*Q*), ft/ln (95 th percentile)		449.5			0			532.8				
Back of Queue (*Q*), veh/ln (95 th percentile)		17.4			0.0			20.8				
Queue Storage Ratio (*RQ*) (95 th percentile)		4.50			0.00			1.33				
Uniform Delay (*d 1*), s/veh		20.4						36.7				
Incremental Delay (*d 2*), s/veh		3.1			0.0			3.2				
Initial Queue Delay (*d 3*), s/veh		0.0			0.0			0.0				
Control Delay (*d*), s/veh		23.5						39.9				
Level of Service (LOS)		C						D				
Approach Delay, s/veh / LOS	23.5	C		0.0			39.9	D		0.0		
Intersection Delay, s/veh / LOS	31.7	C										

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.37	A	1.37	A	1.74	B	1.74	B
Bicycle LOS Score / LOS	1.50	B	0.49	A	1.38	A		

HCS7 Signalized Intersection Intermediate Values

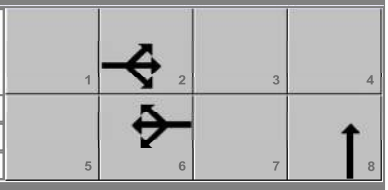
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM	PHF	0.96
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	NB SR 7	File Name	Cadiz Pike Signals No-Build 2045 PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	590	0	0	0	0	0		520				

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	25	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	65.6	34.4	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	0.0	2.0	0.0	0.0	0.0	0.0	



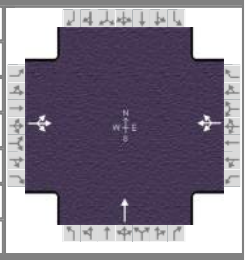
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Heavy Vehicles and Grade Factor (f_{HVg})	0.883	0.969	1.000	1.000	1.000	1.000	1.000	0.977	1.000			
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	0.758	0.758		1.000	1.000		1.000	1.000				
Right-Turn Adjustment Factor (f_{RT})		0.000	0.758		0.000	1.000		0.000	0.000			
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000			1.000			1.000					
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Movement Saturation Flow Rate (s), veh/h	1395	0	0	0	1900	0	0	1856	0			
Proportion of Vehicles Arriving on Green (P)	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.00	0.00	0.00	0.00
Incremental Delay Factor (k)		0.50						0.04				

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		4.0		4.0		4.0		
Green Ratio (g/C)		0.60		0.60		0.31		
Permitted Saturation Flow Rate (s_p), veh/h/ln		1440		1440		0		
Shared Saturation Flow Rate (s_{sh}), veh/h/ln		0		1900				
Permitted Effective Green Time (g_p), s		65.6		0.0		0.0		
Permitted Service Time (g_u), s		65.6		0.0		0.0		
Permitted Queue Service Time (g_{ps}), s		33.2						
Time to First Blockage (g_f), s		0.0		65.6		0.0		
Queue Service Time Before Blockage (g_{fs}), s		0.0						
Protected Right Saturation Flow (s_R), veh/h/ln								
Protected Right Effective Green Time (g_R), s								

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	0.681	0.000	0.681	0.000	0.972	0.000	0.972	0.000
Pedestrian F_s / F_{delay}	0.000	0.088	0.000	0.088	0.000	0.166	0.000	0.164
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	1193.54	8.94	1193.54	8.94		62.22	-90.91	60.11
Bicycle F_w / F_v	-3.64	1.01	-3.64	0.00	-3.64	0.89	-3.64	

HCS7 Signalized Intersection Results Graphical Summary

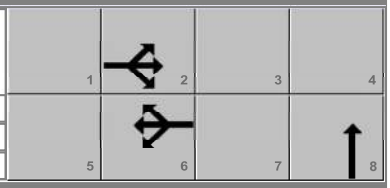
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM	PHF	0.96
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	NB SR 7	File Name	Cadiz Pike Signals No-Build 2045 PM.xus		
Project Description	BEL-7-19.75				



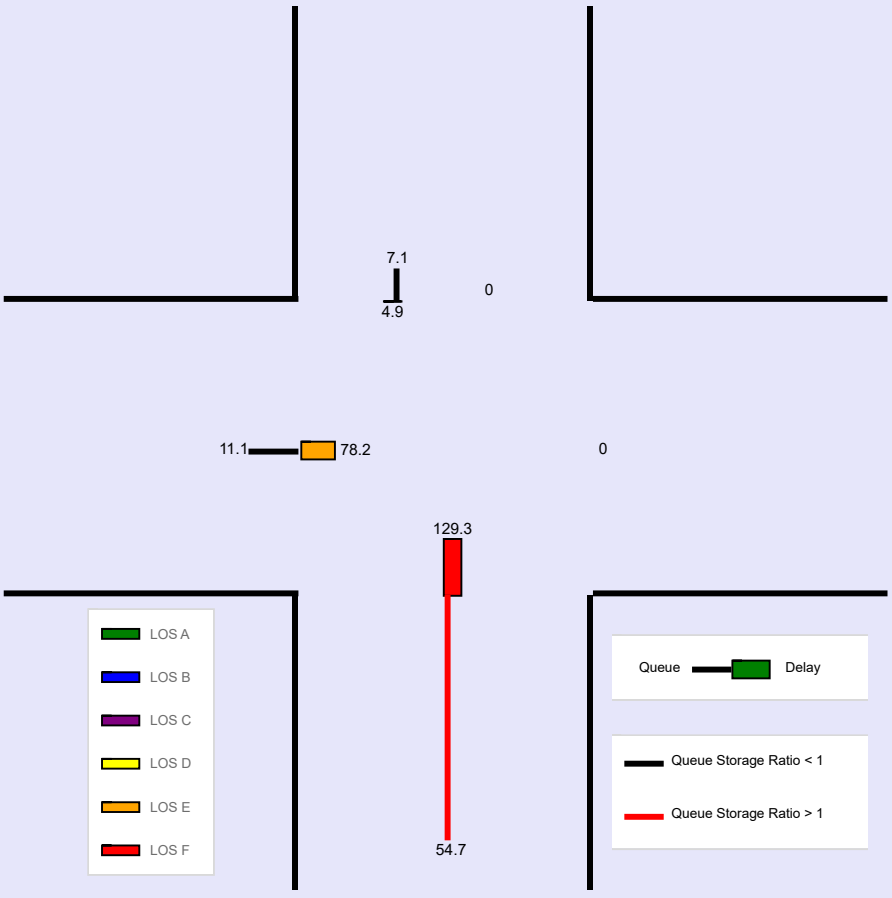
Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	590	0	0	0	0	0		520				

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	25	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	65.6	34.4	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	0.0	2.0	0.0	0.0	0.0	0.0	



Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (*Q*), ft/ln (95 th percentile)		449.5			0			532.8				
Back of Queue (*Q*), veh/ln (95 th percentile)		17.4			0.0			20.8				
Queue Storage Ratio (*RQ*) (95 th percentile)		4.50			0.00			1.33				
Control Delay (*d*), s/veh		23.5						39.9				
Level of Service (LOS)		C						D				
Approach Delay, s/veh / LOS	23.5		C	0.0			39.9		D	0.0		
Intersection Delay, s/veh / LOS	31.7					C						



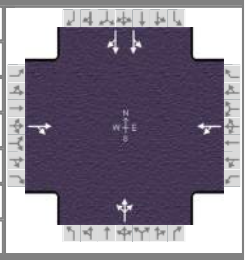
--- Messages ---

WARNING: Since queue spillover from turn lanes and spillback into upstream intersections is not accounted for in the HCM procedures, use of a simulation tool may be advised in situations where the Queue Storage Ratio exceeds 1.0.

--- Comments ---

HCS7 Signalized Intersection Input Data

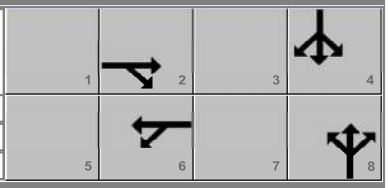
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM	PHF	0.98
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	SB SR 7	File Name	Cadiz Pike Signals No-Build 2045 PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		40	150	0	0		200	0	550	0	970	70

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	17.0	81.0	0.0	0.0	0.0	0.0						
Yellow	4.0	4.0	0.0	0.0	0.0	0.0						
Red	2.0	2.0	0.0	0.0	0.0	0.0						



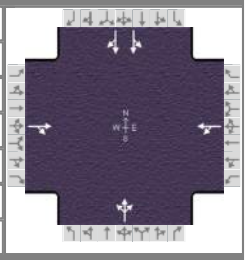
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		40	150	0	0		200	0	550	0	970	70
Initial Queue (Q_b), veh/h		0	0	0	0		0	0	0	0	0	0
Base Saturation Flow Rate (s_o), veh/h		1900	1900	1900	1900		1900	1900	1900	1900	1900	1900
Parking (N_m), man/h		None			None			None			None	
Heavy Vehicles (P_{HV}), %		4			0			3			5	
Ped / Bike / RTOR, /h	0	0	0	0	0		0	0	0	0	0	0
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0	0	0	0
Arrival Type (*AT*)		3	3	3	3		3	3	3	3	3	3
Upstream Filtering (*I*)		1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Lane Width (*W*), ft		12.0			12.0			12.0			12.0	
Turn Bay Length, ft		1500			0			375			750	
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h		25	25	25	25		25	25	25	25	25	25

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s		23.0		23.0		87.0		87.0
Yellow Change Interval (*Y*), s		4.0		4.0		4.0		4.0
Red Clearance Interval (R_c), s		2.0		0.0		2.0		2.0
Minimum Green (G_{min}), s		7		6		7		7
Start-Up Lost Time (*lt*), s		2.0	2.0	2.0	2.0	2.0	2.0	2.0
Extension of Effective Green (*e*), s		2.0	2.0	2.0	2.0	2.0	2.0	2.0
Passage (*PT*), s		2.0		2.0		2.0		2.0
Recall Mode		Min		Min		Off		Off
Dual Entry		Yes		Yes		Yes		Yes
Walk (*Walk*), s		0.0		0.0		0.0		0.0
Pedestrian Clearance Time (*PC*), s		0.0		0.0		0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25	0	No	25	0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0	9.0	12	0	9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0	0	No	0	0	No	0	0	No
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0
Pedestrian Signal / Occupied Parking	No	0.50		No	0.50		No	0.50		No	0.50	

HCS7 Signalized Intersection Results Summary

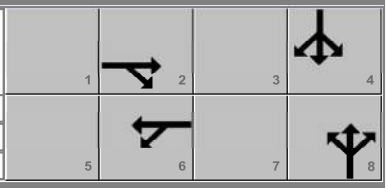
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM	PHF	0.98
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	SB SR 7	File Name	Cadiz Pike Signals No-Build 2045 PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		40	150	0	0		200	0	550	0	970	70

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	17.0	81.0	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	2.0	2.0	0.0	0.0	0.0	0.0	



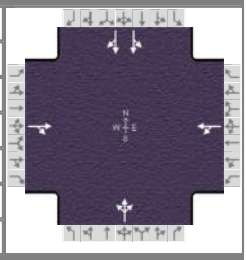
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		8.0		8.0		8.0		8.0
Phase Duration, s		23.0		23.0		87.0		87.0
Change Period, ($Y+R_c$), s		6.0		6.0		6.0		6.0
Max Allow Headway (*MAH*), s		0.0		0.0		3.8		3.8
Queue Clearance Time (g_s), s						83.0		14.1
Green Extension Time (g_e), s		0.0		0.0		0.0		8.2
Phase Call Probability						1.00		1.00
Max Out Probability						1.00		0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h		194			0			765		0		524
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1612			0			943		0		1782
Queue Service Time (g_s), s		12.7			0.0			68.9		0.0		12.1
Cycle Queue Clearance Time (g_c), s		12.7			0.0			81.0		0.0		12.1
Green Ratio (*g/C*)		0.15						0.74				0.74
Capacity (*c*), veh/h		249						736				1312
Volume-to-Capacity Ratio (*X*)		0.778			0.000			1.040		0.000		0.399
Back of Queue (*Q*), ft/ln (95 th percentile)		277.5			0			947.8		0		180.8
Back of Queue (*Q*), veh/ln (95 th percentile)		10.8			0.0			37.0		0.0		7.2
Queue Storage Ratio (*RQ*) (95 th percentile)		0.18			0.00			2.53		0.00		0.25
Uniform Delay (d_1), s/veh		44.7						19.5				5.4
Incremental Delay (d_2), s/veh		21.0			0.0			44.0		0.0		0.1
Initial Queue Delay (d_3), s/veh		0.0			0.0			0.0		0.0		0.0
Control Delay (*d*), s/veh		65.7						63.5				5.5
Level of Service (LOS)		E						F				A
Approach Delay, s/veh / LOS	65.7	E		0.0			63.5	E		5.5	A	
Intersection Delay, s/veh / LOS	33.2						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.94	B	1.94	B	1.63	B	1.63	B
Bicycle LOS Score / LOS	0.81	A	0.49	A	1.75	B	1.36	A

HCS7 Signalized Intersection Intermediate Values

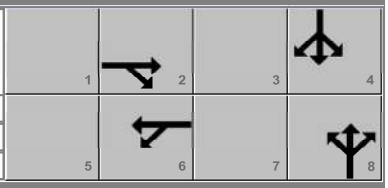
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM	PHF	0.98
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	SB SR 7	File Name	Cadiz Pike Signals No-Build 2045 PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		40	150	0	0		200	0	550	0	970	70

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	17.0	81.0	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	2.0	2.0	0.0	0.0	0.0	0.0	



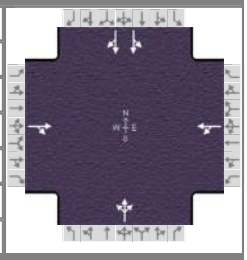
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles and Grade Factor (f_{HVg})	1.000	0.969	1.000	1.000	1.000	1.000	1.000	0.977	0.977	1.000	0.961	1.000
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	1.000	0.876		1.000	1.000		0.550	0.508		1.000	1.000	
Right-Turn Adjustment Factor (f_{RT})		0.000	0.876		0.000	1.000		0.000	0.508		0.976	0.976
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000			1.000			1.000			1.000		
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			1.000
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Movement Saturation Flow Rate (s), veh/h	0	339	1272	0	1900	0	251	0	692	0	3365	243
Proportion of Vehicles Arriving on Green (P)	0.00	0.15	0.15	0.15	0.15	0.15	0.74	0.00	0.74	0.00	0.74	0.74
Incremental Delay Factor (k)		0.50						0.50				0.04

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		6.0		6.0		6.0		6.0
Green Ratio (g/C)		0.15		0.15		0.74		0.74
Permitted Saturation Flow Rate (s_p), veh/h/ln		1440		1208		540		862
Shared Saturation Flow Rate (s_{sh}), veh/h/ln		0		0		0		1826
Permitted Effective Green Time (g_p), s		0.0		0.0		81.0		0.0
Permitted Service Time (g_u), s		0.0		0.0		68.9		0.0
Permitted Queue Service Time (g_{ps}), s						68.9		
Time to First Blockage (g_f), s		17.0		17.0		3.3		81.0
Queue Service Time Before Blockage (g_{fs}), s						1.6		
Protected Right Saturation Flow (s_R), veh/h/ln								
Protected Right Effective Green Time (g_R), s								

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	1.198	0.000	1.198	0.000	0.972	0.000	0.972	0.000
Pedestrian F_s / F_{delay}	0.000	0.147	0.000	0.145	0.000	0.054	0.000	0.054
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	309.09	39.31	345.45	37.64	1472.73	3.82	1472.73	3.82
Bicycle F_w / F_v	-3.64	0.32	-3.64	0.00	-3.64	1.26	-3.64	0.88

HCS7 Signalized Intersection Results Graphical Summary

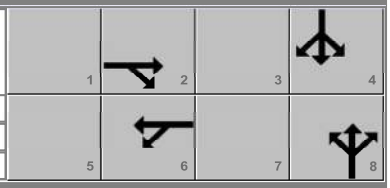
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM	PHF	0.98
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	SB SR 7	File Name	Cadiz Pike Signals No-Build 2045 PM.xus		
Project Description	BEL-7-19.75				



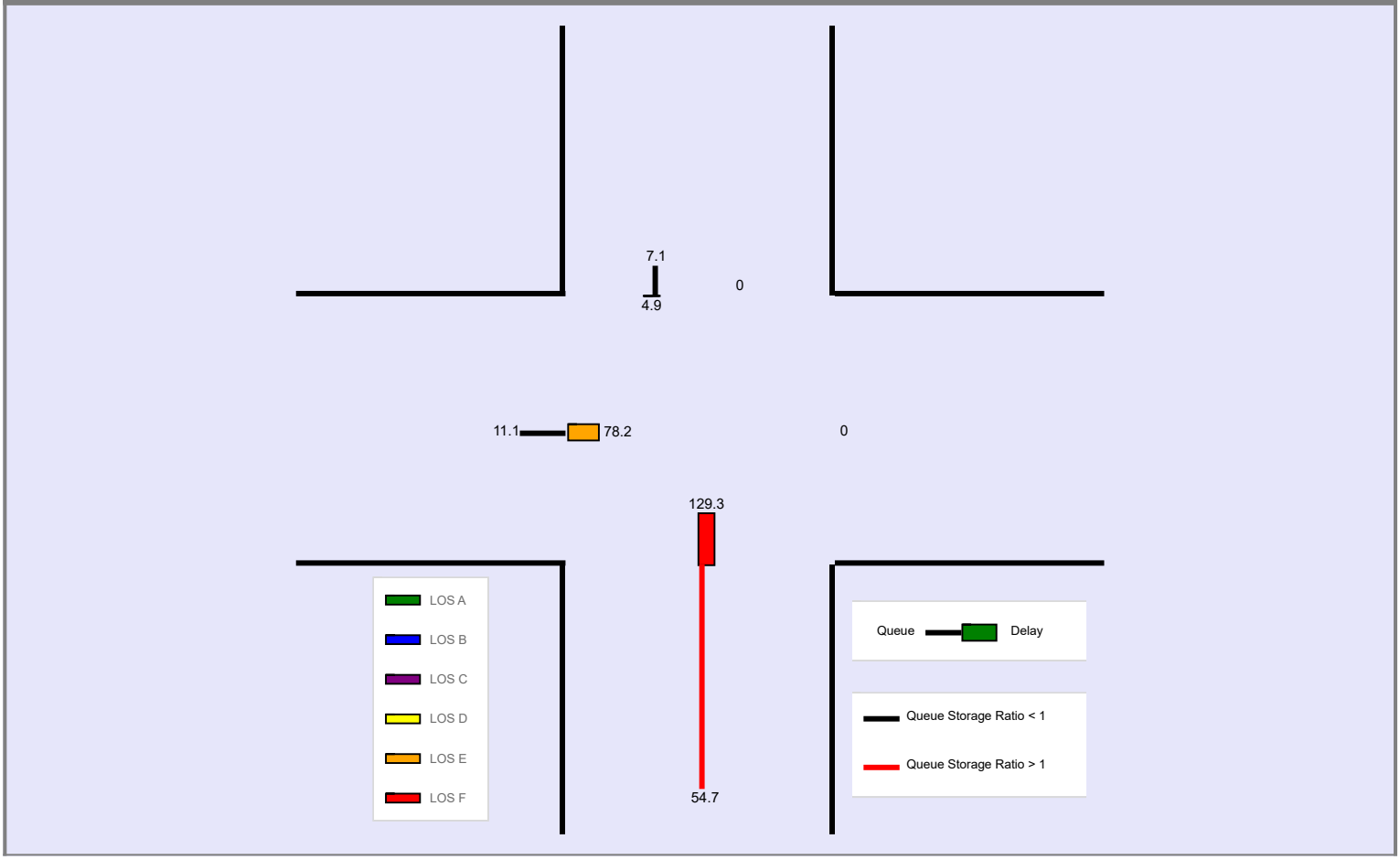
Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		40	150	0	0		200	0	550	0	970	70

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	17.0	81.0	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	2.0	2.0	0.0	0.0	0.0	0.0	



Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (*Q*), ft/ln (95 th percentile)		277.5			0			947.8		0		180.8
Back of Queue (*Q*), veh/ln (95 th percentile)		10.8			0.0			37.0		0.0		7.2
Queue Storage Ratio (*RQ*) (95 th percentile)		0.18			0.00			2.53		0.00		0.25
Control Delay (*d*), s/veh		65.7						63.5				5.5
Level of Service (LOS)		E						F				A
Approach Delay, s/veh / LOS	65.7		E	0.0			63.5		E	5.5		A
Intersection Delay, s/veh / LOS	33.2						C					



--- Messages ---

WARNING: Since queue spillover from turn lanes and spillback into upstream intersections is not accounted for in the HCM procedures, use of a simulation tool may be advised in situations where the Queue Storage Ratio exceeds 1.0.

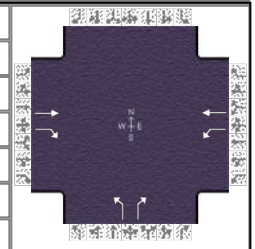
--- Comments ---

Build Intersection Analysis

AM Peak

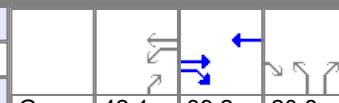
HCS7 Signalized Intersection Input Data

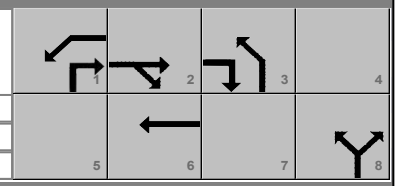
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	Build AM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Marion Street	File Name	Main & Marion Build 2045 AM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		150	290	510	240		200		310			

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



										
							1	2	3	4
Green	42.1	39.2	20.8	0.0	0.0	0.0				
Yellow	4.0	4.0	4.0	0.0	0.0	0.0				
Red	2.0	2.0	2.0	0.0	0.0	0.0				
							5	6	7	8

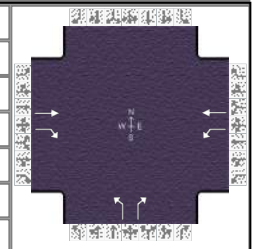
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		150	290	510	240		200		310			
Initial Queue (Q_b), veh/h		0	0	0	0		0		0			
Base Saturation Flow Rate (s_o), veh/h		1900	1900	1900	1900		1900		1900			
Parking (N_m), man/h		None			None			None				
Heavy Vehicles (P_{HV}), %		12	12	10	10		14		14			
Ped / Bike / RTOR, /h	0	0	0	0	0		0	0		0	0	
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0			
Arrival Type (*AT*)		3	3	3	3		3		3			
Upstream Filtering (*I*)		1.00	1.00	1.00	1.00		1.00		1.00			
Lane Width (*W*), ft		12.0	12.0	12.0	12.0		12.0		12.0			
Turn Bay Length, ft		2450	525	1200	1200		175		175			
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h		25	25	25	25		25		25			

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s		20.0	59.0	79.0	41.0	41.0		
Yellow Change Interval (*Y*), s		4.0	4.0	4.0	4.0	4.0		
Red Clearance Interval (R_c), s		2.0	2.0	2.0	2.0	2.0		
Minimum Green (G_{min}), s		10	7	10	7	10		
Start-Up Lost Time (*l1*), s		2.0	2.0	2.0	2.0			
Extension of Effective Green (*e*), s		2.0	2.0	2.0	2.0			
Passage (*PT*), s		2.0	2.0	2.0	2.0	2.0		
Recall Mode		Min	Off	Min	Off	Off		
Dual Entry		Yes	No	Yes	No	Yes		
Walk (*Walk*), s		0.0				0.0		0.0
Pedestrian Clearance Time (*PC*), s		0.0				0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25				0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0				9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0		No	0	0	No		0	
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0			
Pedestrian Signal / Occupied Parking	No	0.50			0.50		No	0.50		No		

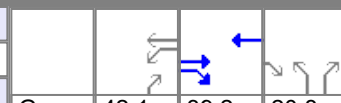
HCS7 Signalized Intersection Results Summary

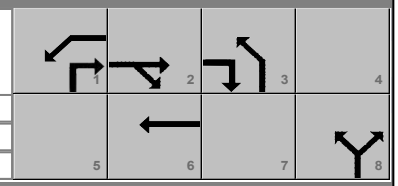
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	Build AM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Marion Street	File Name	Main & Marion Build 2045 AM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		150	290	510	240		200		310			

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



										
Green	42.1	39.2	20.8	0.0	0.0	0.0	1	2	3	4
Yellow	4.0	4.0	4.0	0.0	0.0	0.0	5	6	7	8
Red	2.0	2.0	2.0	0.0	0.0	0.0				

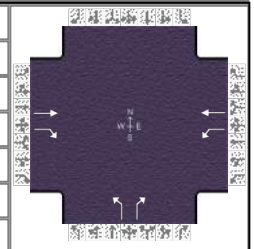
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		
Case Number		7.3	2.0	4.0		9.0		
Phase Duration, s		45.2	48.1	93.2		26.8		
Change Period, (*Y+R c*), s		6.0	6.0	6.0		6.0		
Max Allow Headway (*MAH*), s		0.0	3.3	0.0		3.4		
Queue Clearance Time (*g s*), s			40.8			19.6		
Green Extension Time (*g e*), s		0.0	1.3	0.0		1.2		
Phase Call Probability			1.00			1.00		
Max Out Probability			0.00			0.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18			
Adjusted Flow Rate (*v*), veh/h		163	315	554	261		217		337			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1722	1459	1668	1752		1612		1434			
Queue Service Time (*g s*), s		8.5	16.5	38.8	5.7		15.5		17.6			
Cycle Queue Clearance Time (*g c*), s		8.5	16.5	38.8	5.7		15.5		17.6			
Green Ratio (*g/C*)		0.33	0.50	0.35	0.73		0.17		0.52			
Capacity (*c*), veh/h		562	729	585	1273		279		751			
Volume-to-Capacity Ratio (*X*)		0.290	0.432	0.948	0.205		0.779		0.449			
Back of Queue (*Q*), ft/ln (95 th percentile)		185.8	275	653.7	102		293.1		273			
Back of Queue (*Q*), veh/ln (95 th percentile)		6.8	10.0	24.2	3.8		10.5		9.8			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.08	0.52	0.54	0.09		1.67		1.56			
Uniform Delay (*d 1*), s/veh		30.1	19.2	37.9	5.3		47.4		17.8			
Incremental Delay (*d 2*), s/veh		1.3	1.9	9.9	0.4		1.8		0.2			
Initial Queue Delay (*d 3*), s/veh		0.0	0.0	0.0	0.0		0.0		0.0			
Control Delay (*d*), s/veh		31.4	21.0	47.8	5.6		49.2		18.0			
Level of Service (LOS)		C	C	D	A		D		B			
Approach Delay, s/veh / LOS	24.6	C		34.3	C		30.2	C		0.0		
Intersection Delay, s/veh / LOS	30.6						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.93	B	0.66	A	1.97	B	1.96	B
Bicycle LOS Score / LOS	1.28	A	1.83	B		F		

HCS7 Signalized Intersection Intermediate Values

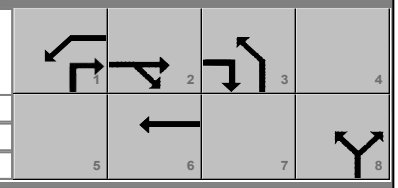
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	Build AM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Marion Street	File Name	Main & Marion Build 2045 AM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		150	290	510	240		200		310			

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	42.1	39.2	20.8	0.0	0.0	0.0						
Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
Red	2.0	2.0	2.0	0.0	0.0	0.0						



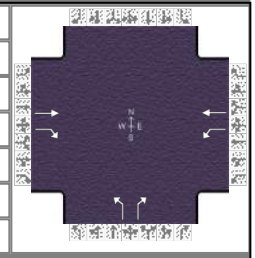
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Heavy Vehicles and Grade Factor (f_{HVg})	1.000	0.906	0.906	0.922	0.922	1.000	0.891	1.000	0.891			
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	1.000	1.000		0.952	0.000		0.952	0.000				
Right-Turn Adjustment Factor (f_{RT})		0.000	0.847		1.000	1.000		0.000	0.847			
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000			1.000			1.000					
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Movement Saturation Flow Rate (s), veh/h	0	1722	1459	1668	1752	0	1612	0	1434			
Proportion of Vehicles Arriving on Green (P)	0.00	0.33	0.33	0.35	0.73	0.00	0.17	0.00	0.17	0.00	0.00	0.00
Incremental Delay Factor (k)		0.50	0.50	0.13	0.50		0.04		0.04			

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		6.0	6.0	6.0		6.0		
Green Ratio (g/C)		0.33	0.35	0.73		0.17		
Permitted Saturation Flow Rate (s_p), veh/h/ln		1136	0	0		1612		
Shared Saturation Flow Rate (s_{sh}), veh/h/ln		0						
Permitted Effective Green Time (g_p), s		0.0	0.0	0.0		0.0		
Permitted Service Time (g_u), s		0.0	0.0	0.0		0.0		
Permitted Queue Service Time (g_{ps}), s								
Time to First Blockage (g_f), s		39.2	0.0	0.0		0.0		
Queue Service Time Before Blockage (g_{fs}), s								
Protected Right Saturation Flow (s_R), veh/h/ln		1459				1434		
Protected Right Effective Green Time (g_R), s		20.8				42.1		

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	1.198	0.000	0.000	0.000	1.198	0.000	1.198	0.000
Pedestrian F_s / F_{delay}	0.000	0.132	0.000	0.060	0.000	0.169	0.000	0.167
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	652.87	27.22	1453.91	4.47		67.20	-83.33	65.10
Bicycle F_w / F_v	-3.64	0.79	-3.64	1.35	-3.64		-3.64	

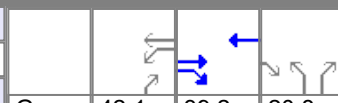
HCS7 Signalized Intersection Results Graphical Summary

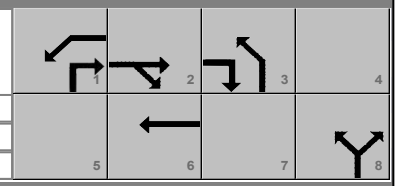
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	Build AM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Marion Street	File Name	Main & Marion Build 2045 AM.xus		
Project Description	BEL-7-19.75				



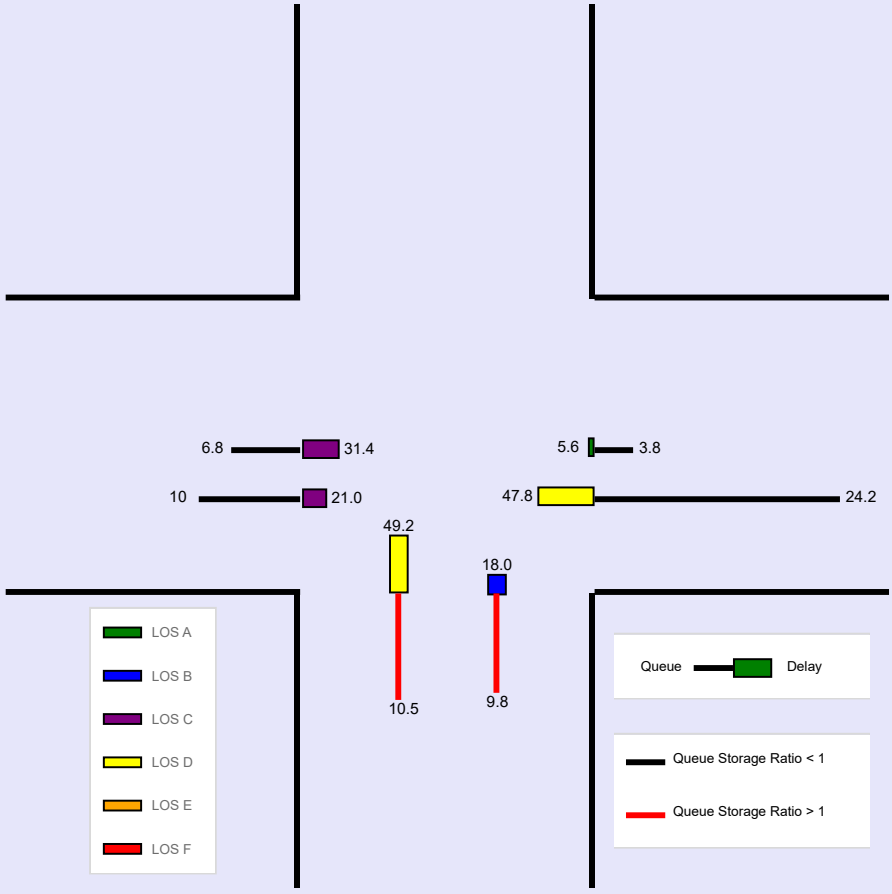
Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		150	290	510	240		200		310			

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



										
Green	42.1	39.2	20.8	0.0	0.0	0.0	1	2	3	4
Yellow	4.0	4.0	4.0	0.0	0.0	0.0	5	6	7	8
Red	2.0	2.0	2.0	0.0	0.0	0.0				

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (*Q*), ft/ln (95 th percentile)		185.8	275	653.7	102		293.1		273			
Back of Queue (*Q*), veh/ln (95 th percentile)		6.8	10.0	24.2	3.8		10.5		9.8			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.08	0.52	0.54	0.09		1.67		1.56			
Control Delay (*d*), s/veh		31.4	21.0	47.8	5.6		49.2		18.0			
Level of Service (LOS)		C	C	D	A		D		B			
Approach Delay, s/veh / LOS	24.6	C		34.3	C		30.2	C		0.0		
Intersection Delay, s/veh / LOS	30.6						C					



--- Messages ---

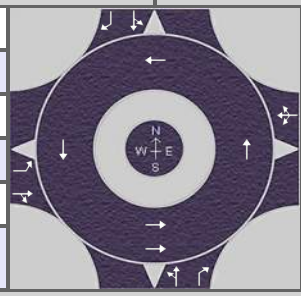
WARNING: Since queue spillover from turn lanes and spillback into upstream intersections is not accounted for in the HCM procedures, use of a simulation tool may be advised in situations where the Queue Storage Ratio exceeds 1.0.

--- Comments ---

HCS7 Roundabouts Report

General Information

Analyst	RMK
Agency or Co.	Burgess & Niple
Date Performed	11/13/2021
Analysis Year	2045
Time Analyzed	AM Build
Project Description	BEL-7-19.25



Site Information

Intersection	Main Street & Lincoln Ave
E/W Street Name	Main Street (US 40)
N/S Street Name	Lincoln Avenue
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.93
Jurisdiction	

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	1	1	0	0	0	1	0	0	0	1	1	0	0	1	1
Lane Assignment	L		TR				LTR		LT		R		LT		R	
Volume (V), veh/h	0	340	60	60	0	50	70	40	0	10	90	70	0	530	190	670
Percent Heavy Vehicles, %	13	13	13	13	2	2	2	2	5	5	5	5	7	7	7	7
Flow Rate (v_{PCE}), pc/h	0	413	73	73	0	55	77	44	0	11	102	79	0	610	219	771
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				2				1			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)	4.5436	4.5436			4.9763		4.6453	4.3276		4.5436	4.5436	
Follow-Up Headway (s)	2.5352	2.5352			2.6087		2.6667	2.5352		2.5352	2.5352	

Flow Computations, Capacity and v/c Ratios

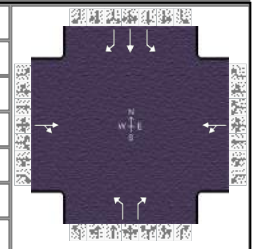
Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h	413	146			176		113	79		829	771	
Entry Volume, veh/h	365	129			173		108	75		775	721	
Circulating Flow (v_c), pc/h	884			526			1096			143		
Exiting Flow (v_{ex}), pc/h	762			859			559			347		
Capacity (c_{pce}), pc/h	635	635			807		493	559		1247	1247	
Capacity (c), veh/h	562	562			791		469	533		1165	1165	
v/c Ratio (x)	0.65	0.23			0.22		0.23	0.14		0.66	0.62	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh	20.8	9.5			6.9		11.1	8.6		12.3	11.1	
Lane LOS	C	A			A		B	A		B	B	
95% Queue, veh	4.7	0.9			0.8		0.9	0.5		5.4	4.5	
Approach Delay, s/veh	17.8			6.9			10.1			11.7		
Approach LOS	C			A			B			B		
Intersection Delay, s/veh | LOS	12.5						B					

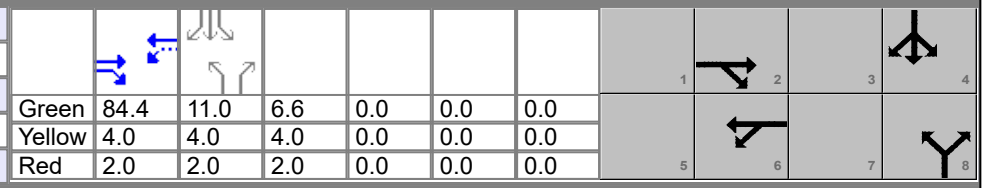
HCS7 Signalized Intersection Input Data

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	Build AM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Huron Street	File Name	Zane & Huron Build 2045 AM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		520	20	10	410		20		10	120	30	60

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	83	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	84.4	11.0	6.6	0.0	0.0	0.0						
Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
Red	2.0	2.0	2.0	0.0	0.0	0.0						

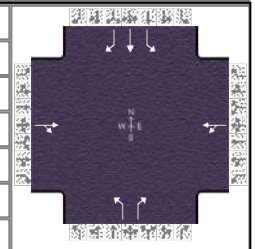
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		520	20	10	410		20		10	120	30	60
Initial Queue (Q_b), veh/h		0	0	0	0		0		0	0	0	0
Base Saturation Flow Rate (s_o), veh/h		1900	1900	1900	1900		1900		1900	1900	1900	1900
Parking (N_m), man/h		None			None			None			None	
Heavy Vehicles (P_{HV}), %		2			4		1		1	1	1	1
Ped / Bike / RTOR, /h	0	0	0	0	0		0	0		0	0	0
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0	0	0	0
Arrival Type (*AT*)		3	3	3	3		3		3	3	3	3
Upstream Filtering (*I*)		1.00	1.00	1.00	1.00		1.00		1.00	1.00	1.00	1.00
Lane Width (*W*), ft		12.0			12.0		12.0		12.0	12.0	12.0	12.0
Turn Bay Length, ft		1200			350		50		425	125	275	125
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h		25	25	25	25		25		25	25	25	25

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s		39.0		39.0		17.0		64.0
Yellow Change Interval (*Y*), s		4.0		4.0		4.0		4.0
Red Clearance Interval (R_c), s		2.0		2.0		2.0		2.0
Minimum Green (G_{min}), s		10		10		10		10
Start-Up Lost Time (*l*t), s		2.0	2.0	2.0	2.0		2.0	2.0
Extension of Effective Green (*e*), s		2.0	2.0	2.0	2.0		2.0	2.0
Passage (*PT*), s		2.0		2.0		2.0		2.0
Recall Mode		Min		Min		Off		Off
Dual Entry		Yes		Yes		Yes		Yes
Walk (*Walk*), s		0.0		0.0		0.0		0.0
Pedestrian Clearance Time (*PC*), s		0.0		0.0		0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25	0	No	25	0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0	9.0	12	0	9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0	0	No	0	0	No	0	0	No
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0
Pedestrian Signal / Occupied Parking	No	0.50		No	0.50		No	0.50		No	0.50	

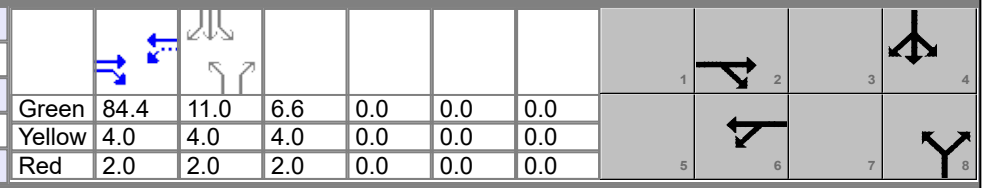
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	Build AM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Huron Street	File Name	Zane & Huron Build 2045 AM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		520	20	10	410		20		10	120	30	60

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	83	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	84.4	11.0	6.6	0.0	0.0	0.0						
Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
Red	2.0	2.0	2.0	0.0	0.0	0.0						

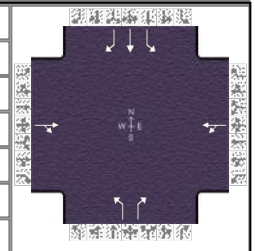
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		8.0		8.0		9.0		9.0
Phase Duration, s		90.4		90.4		12.6		17.0
Change Period, ($Y+R_c$), s		6.0		6.0		6.0		6.0
Max Allow Headway (*MAH*), s		0.0		0.0		3.3		3.3
Queue Clearance Time (g_s), s						3.4		10.5
Green Extension Time (g_e), s		0.0		0.0		0.1		0.5
Phase Call Probability						0.66		1.00
Max Out Probability						0.00		0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18	7	4	14
Adjusted Flow Rate (*v*), veh/h		587			457		22		11	130	33	65
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1858			1820		1795		1598	1795	1885	1598
Queue Service Time (g_s), s		16.5			0.0		1.4		0.8	8.5	1.9	4.6
Cycle Queue Clearance Time (g_c), s		16.5			11.8		1.4		0.8	8.5	1.9	4.6
Green Ratio (*g/C*)		0.70			0.70		0.06		0.06	0.09	0.09	0.09
Capacity (*c*), veh/h		1306			1310		99		88	165	173	147
Volume-to-Capacity Ratio (*X*)		0.449			0.348		0.219		0.123	0.792	0.189	0.445
Back of Queue (*Q*), ft/ln (95 th percentile)		275.3			211.8		29.3		14.6	182.7	42	86.6
Back of Queue (*Q*), veh/ln (95 th percentile)		10.8			8.2		1.2		0.6	7.3	1.7	3.4
Queue Storage Ratio (*RQ*) (95 th percentile)		0.23			0.61		0.59		0.03	1.46	0.15	0.69
Uniform Delay (d_1), s/veh		7.7			7.0		54.2		53.9	53.4	50.4	51.6
Incremental Delay (d_2), s/veh		1.1			0.7		0.4		0.2	3.2	0.2	0.8
Initial Queue Delay (d_3), s/veh		0.0			0.0		0.0		0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh		8.9			7.8		54.6		54.2	56.6	50.6	52.4
Level of Service (LOS)		A			A		D		D	E	D	D
Approach Delay, s/veh / LOS	8.9	A		7.8	A		54.5	D		54.5	D	
Intersection Delay, s/veh / LOS	17.6						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.86	B	1.86	B	1.74	B	1.73	B
Bicycle LOS Score / LOS	1.46	A	1.24	A		F	0.86	A

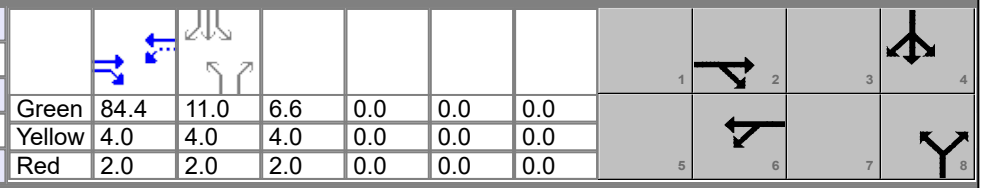
HCS7 Signalized Intersection Intermediate Values

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	Build AM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Huron Street	File Name	Zane & Huron Build 2045 AM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		520	20	10	410		20		10	120	30	60

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	83	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	84.4	11.0	6.6	0.0	0.0	0.0						
Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
Red	2.0	2.0	2.0	0.0	0.0	0.0						

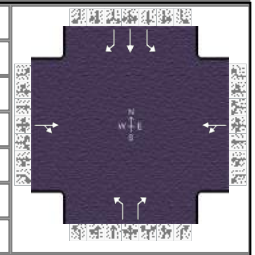
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles and Grade Factor (f_{HVg})	1.000	0.984	1.000	1.000	0.969	0.984	0.992	1.000	0.992	0.992	0.992	0.992
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	1.000	0.993		0.989	0.989		0.952	0.000		0.952	0.000	
Right-Turn Adjustment Factor (f_{RT})		0.000	0.993		0.000	0.989		0.000	0.847		0.000	0.847
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000			1.000			1.000			1.000		
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			1.000
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Movement Saturation Flow Rate (s), veh/h	0	1789	69	43	1777	0	1795	0	1598	1795	1885	1598
Proportion of Vehicles Arriving on Green (P)	0.00	0.70	0.70	0.70	0.70	0.00	0.06	0.00	0.06	0.09	0.09	0.09
Incremental Delay Factor (k)		0.50			0.50		0.04		0.04	0.04	0.04	0.04

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		6.0		6.0		6.0		4.0
Green Ratio (g/C)		0.70		0.70		0.06		0.09
Permitted Saturation Flow Rate (s_p), veh/h/ln		959		842		1795		1795
Shared Saturation Flow Rate (s_{sh}), veh/h/ln		1870		0				
Permitted Effective Green Time (g_p), s		0.0		84.4		0.0		0.0
Permitted Service Time (g_u), s		0.0		67.9		0.0		0.0
Permitted Queue Service Time (g_{ps}), s				0.0				
Time to First Blockage (g_f), s		84.4		51.6		0.0		0.0
Queue Service Time Before Blockage (g_{fs}), s				11.8				
Protected Right Saturation Flow (s_R), veh/h/ln						0		0
Protected Right Effective Green Time (g_R), s						0.0		0.0

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	1.198	0.000	1.198	0.000	0.972	0.000	0.972	0.000
Pedestrian F_s / F_{delay}	0.000	0.067	0.000	0.067	0.000	0.169	0.000	0.160
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	1406.06	5.29	1406.06	5.29		67.20	110.46	53.56
Bicycle F_w / F_v	-3.64	0.97	-3.64	0.75	-3.64		-3.64	0.38

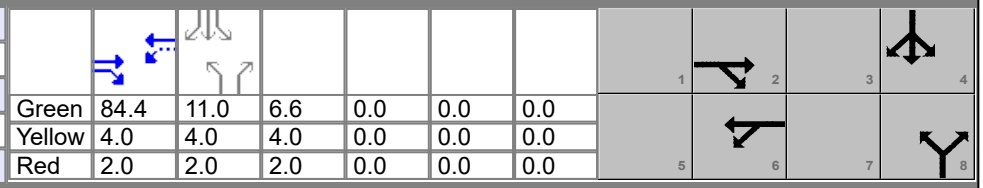
HCS7 Signalized Intersection Results Graphical Summary

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	Build AM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Huron Street	File Name	Zane & Huron Build 2045 AM.xus		
Project Description	BEL-7-19.75				



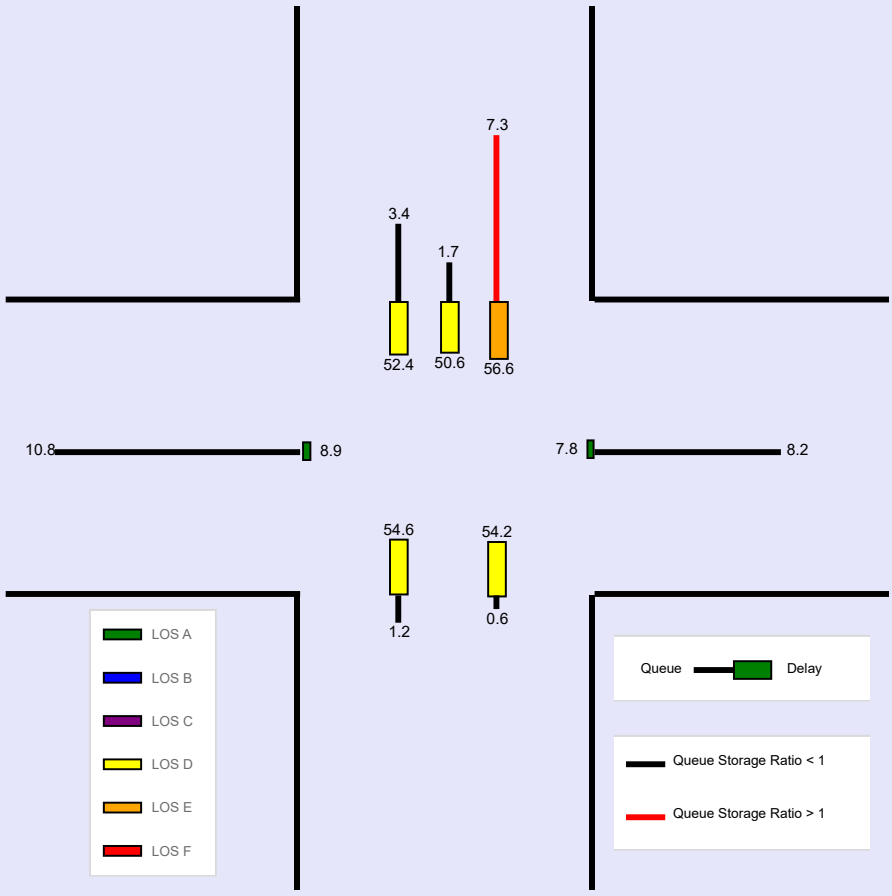
Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		520	20	10	410		20		10	120	30	60

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	83	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	84.4	11.0	6.6	0.0	0.0	0.0						
Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
Red	2.0	2.0	2.0	0.0	0.0	0.0						

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (*Q*), ft/ln (95 th percentile)		275.3			211.8		29.3		14.6	182.7	42	86.6
Back of Queue (*Q*), veh/ln (95 th percentile)		10.8			8.2		1.2		0.6	7.3	1.7	3.4
Queue Storage Ratio (*RQ*) (95 th percentile)		0.23			0.61		0.59		0.03	1.46	0.15	0.69
Control Delay (*d*), s/veh		8.9			7.8		54.6		54.2	56.6	50.6	52.4
Level of Service (LOS)		A			A		D		D	E	D	D
Approach Delay, s/veh / LOS	8.9	A		7.8	A		54.5	D		54.5	D	
Intersection Delay, s/veh / LOS	17.6						B					



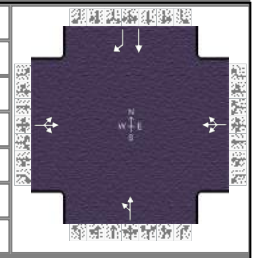
--- Messages ---

WARNING: Since queue spillover from turn lanes and spillback into upstream intersections is not accounted for in the HCM procedures, use of a simulation tool may be advised in situations where the Queue Storage Ratio exceeds 1.0.

--- Comments ---

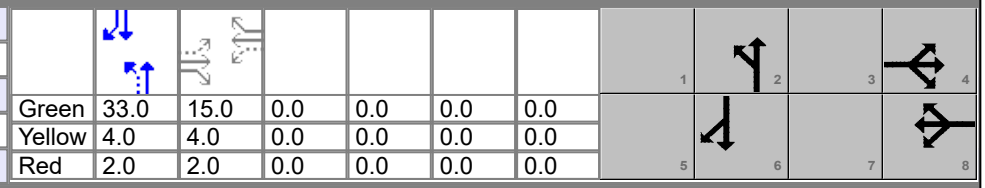
HCS7 Signalized Intersection Input Data

General Information				Intersection Information	
Agency	Burgess & Niple, Inc			Duration, h	0.250
Analyst	MEL	Analysis Date	11/17/2021	Area Type	Other
Jurisdiction		Time Period	Build AM	PHF	0.80
Urban Street	Lincoln Avenue	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Howard Street	File Name	Lincoln & Howard 2045 Build AM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	50	0	120	10	170	100	10	20			200	100

Signal Information			
Cycle, s	60.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	33.0	15.0	0.0	0.0	0.0	0.0						
Yellow	4.0	4.0	0.0	0.0	0.0	0.0						
Red	2.0	2.0	0.0	0.0	0.0	0.0						

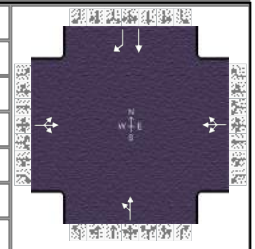
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	50	0	120	10	170	100	10	20			200	100
Initial Queue (Q_b), veh/h	0	0	0	0	0	0	0	0			0	0
Base Saturation Flow Rate (s_o), veh/h	1900	1900	1900	1900	1900	1900	1900	1900			1900	1900
Parking (N_m), man/h		None			None			None			None	
Heavy Vehicles (P_{HV}), %		9			5			10			7	7
Ped / Bike / RTOR, /h	0	0	0	0	0	0	0	0		0	0	0
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0	0	0	0
Arrival Type (*AT*)	3	3	3	3	3	3	3	3			3	3
Upstream Filtering (*I*)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Lane Width (*W*), ft		12.0			12.0			12.0			12.0	12.0
Turn Bay Length, ft		850			600			475			800	450
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h	25	25	25	25	25	25	25	25			25	25

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s		44.0		44.0		16.0		16.0
Yellow Change Interval (*Y*), s		4.0		4.0		4.0		4.0
Red Clearance Interval (R_c), s		2.0		2.0		2.0		2.0
Minimum Green (G_{min}), s		7		7		7		7
Start-Up Lost Time (*l1*), s	2.0	2.0	2.0	2.0	2.0	2.0		2.0
Extension of Effective Green (*e*), s	2.0	2.0	2.0	2.0	2.0	2.0		2.0
Passage (*PT*), s		2.0		2.0		2.0		2.0
Recall Mode		Off		Off		Min		Min
Dual Entry		Yes		Yes		Yes		Yes
Walk (*Walk*), s		0.0		0.0		0.0		0.0
Pedestrian Clearance Time (*PC*), s		0.0		0.0		0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25	0	No	25	0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0	9.0	12	0	9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0	0	No	0	0	No	0	0	No
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0
Pedestrian Signal / Occupied Parking	No	0.50		No	0.50		No	0.50		No	0.50	

HCS7 Signalized Intersection Results Summary

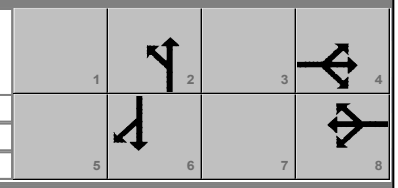
General Information				Intersection Information	
Agency	Burgess & Niple, Inc			Duration, h	0.250
Analyst	MEL	Analysis Date	11/17/2021	Area Type	Other
Jurisdiction		Time Period	Build AM	PHF	0.80
Urban Street	Lincoln Avenue	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Howard Street	File Name	Lincoln & Howard 2045 Build AM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	50	0	120	10	170	100	10	20			200	100

Signal Information			
Cycle, s	60.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	33.0	15.0	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	2.0	2.0	0.0	0.0	0.0	0.0	



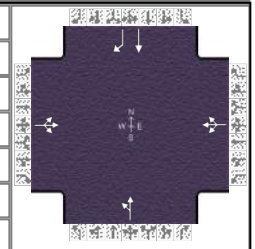
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8		2		6
Case Number		8.0		8.0		8.0		7.0
Phase Duration, s		21.0		21.0		39.0		39.0
Change Period, ($Y+R_c$), s		6.0		6.0		6.0		6.0
Max Allow Headway (*MAH*), s		3.4		3.4		0.0		0.0
Queue Clearance Time (g_s), s		9.6		13.6				
Green Extension Time (g_e), s		1.4		1.3		0.0		0.0
Phase Call Probability		1.00		1.00				
Max Out Probability		0.00		0.00				

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h		213			350			38			250	125
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1404			1704			1460			1796	1522
Queue Service Time (g_s), s		0.0			2.8			0.0			4.4	2.4
Cycle Queue Clearance Time (g_c), s		7.6			11.6			4.4			4.4	2.4
Green Ratio (*g/C*)		0.25			0.25			0.55			0.55	0.55
Capacity (*c*), veh/h		427			487			884			989	838
Volume-to-Capacity Ratio (*X*)		0.497			0.719			0.042			0.253	0.149
Back of Queue (*Q*), ft/ln (95 th percentile)		119.5			205.2			10			74.7	35.3
Back of Queue (*Q*), veh/ln (95 th percentile)		4.5			7.9			0.4			2.8	1.3
Queue Storage Ratio (*RQ*) (95 th percentile)		0.14			0.34			0.02			0.09	0.08
Uniform Delay (d_1), s/veh		19.6			21.3			6.2			7.0	6.6
Incremental Delay (d_2), s/veh		0.3			0.8			0.1			0.6	0.4
Initial Queue Delay (d_3), s/veh		0.0			0.0			0.0			0.0	0.0
Control Delay (*d*), s/veh		20.0			22.0			6.3			7.6	7.0
Level of Service (LOS)		B			C			A			A	A
Approach Delay, s/veh / LOS	20.0	B		22.0	C		6.3	A		7.4	A	
Intersection Delay, s/veh / LOS	15.3						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.69	B	1.91	B	1.64	B	1.64	B
Bicycle LOS Score / LOS	0.84	A	1.07	A	0.55	A	1.11	A

HCS7 Signalized Intersection Intermediate Values

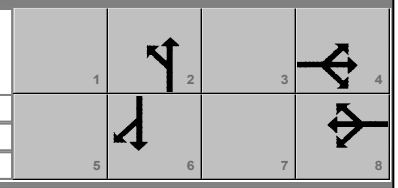
General Information				Intersection Information	
Agency	Burgess & Niple, Inc			Duration, h	0.250
Analyst	MEL	Analysis Date	11/17/2021	Area Type	Other
Jurisdiction		Time Period	Build AM	PHF	0.80
Urban Street	Lincoln Avenue	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Howard Street	File Name	Lincoln & Howard 2045 Build AM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	50	0	120	10	170	100	10	20			200	100

Signal Information			
Cycle, s	60.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	33.0	15.0	0.0	0.0	0.0	0.0						
Yellow	4.0	4.0	0.0	0.0	0.0	0.0						
Red	2.0	2.0	0.0	0.0	0.0	0.0						



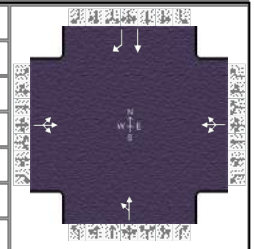
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles and Grade Factor (f_{HVg})	1.000	0.930	1.000	1.000	0.961	1.000	1.000	0.922	1.000	1.000	0.945	0.945
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	0.843	0.794		0.993	0.933		0.833	0.833		1.000	1.000	
Right-Turn Adjustment Factor (f_{RT})		0.000	0.794		0.000	0.933		0.000	0.833		0.000	0.847
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000			1.000			1.000			1.000		
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			1.000
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Movement Saturation Flow Rate (s), veh/h	413	0	991	61	1034	608	487	973	0	0	1796	1522
Proportion of Vehicles Arriving on Green (P)	0.25	0.00	0.25	0.25	0.25	0.25	0.55	0.55	0.00	0.00	0.55	0.55
Incremental Delay Factor (k)		0.04			0.04			0.50			0.50	0.50

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		6.0		6.0		6.0		6.0
Green Ratio (g/C)		0.25		0.25		0.55		0.55
Permitted Saturation Flow Rate (s_p), veh/h/ln		1059		1257		1148		1408
Shared Saturation Flow Rate (s_{sh}), veh/h/ln		1358		1793		0		1796
Permitted Effective Green Time (g_p), s		15.0		15.0		33.0		0.0
Permitted Service Time (g_u), s		3.4		7.4		28.7		0.0
Permitted Queue Service Time (g_{ps}), s		0.0		2.8		0.0		
Time to First Blockage (g_f), s		4.2		8.8		4.0		33.0
Queue Service Time Before Blockage (g_{fs}), s		2.2		5.6		0.6		
Protected Right Saturation Flow (s_R), veh/h/ln								0
Protected Right Effective Green Time (g_R), s								0.0

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	0.972	0.000	1.198	0.000	0.972	0.000	0.972	0.000
Pedestrian F_s / F_{delay}	0.000	0.113	0.000	0.113	0.000	0.072	0.000	0.072
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	498.37	16.91	498.37	16.91	1101.63	6.05	1101.63	6.05
Bicycle F_w / F_v	-3.64	0.35	-3.64	0.58	-3.64	0.06	-3.64	0.62

HCS7 Signalized Intersection Results Graphical Summary

General Information				Intersection Information	
Agency	Burgess & Niple, Inc			Duration, h	0.250
Analyst	MEL	Analysis Date	11/17/2021	Area Type	Other
Jurisdiction		Time Period	Build AM	PHF	0.80
Urban Street	Lincoln Avenue	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Howard Street	File Name	Lincoln & Howard 2045 Build AM.xus		
Project Description	BEL-7-19.75				

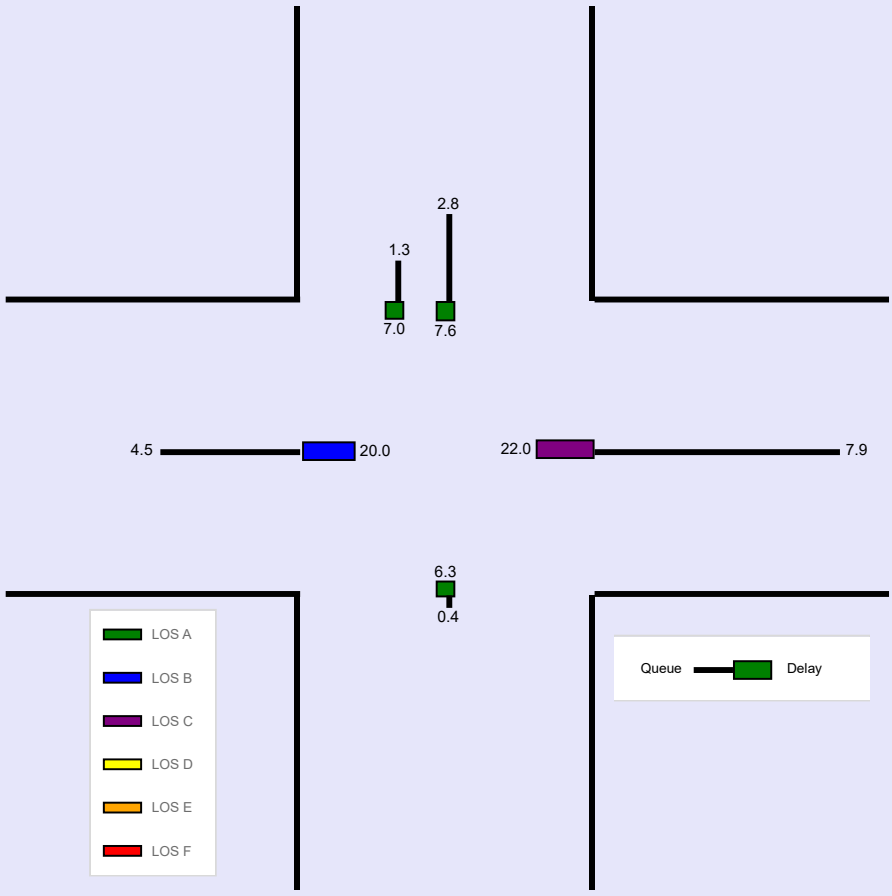


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	50	0	120	10	170	100	10	20			200	100

Signal Information			
Cycle, s	60.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

								1	2	3	4	
Green	33.0	15.0	0.0	0.0	0.0	0.0						
Yellow	4.0	4.0	0.0	0.0	0.0	0.0						
Red	2.0	2.0	0.0	0.0	0.0	0.0	5	6	7	8		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (*Q*), ft/ln (95 th percentile)		119.5			205.2			10			74.7	35.3
Back of Queue (*Q*), veh/ln (95 th percentile)		4.5			7.9			0.4			2.8	1.3
Queue Storage Ratio (*RQ*) (95 th percentile)		0.14			0.34			0.02			0.09	0.08
Control Delay (*d*), s/veh		20.0			22.0			6.3			7.6	7.0
Level of Service (LOS)		B			C			A			A	A
Approach Delay, s/veh / LOS	20.0	B		22.0	C		6.3	A		7.4	A	
Intersection Delay, s/veh / LOS	15.3						B					



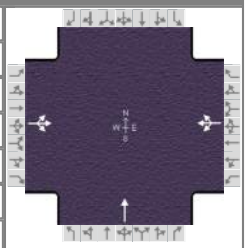
--- Messages ---

No errors or warnings exist.

--- Comments ---

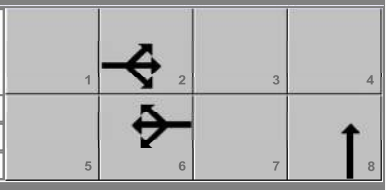
HCS7 Signalized Intersection Input Data

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 15, 2021	Area Type	Other
Jurisdiction		Time Period	Build AM	PHF	0.84
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	NB SR 7	File Name	Cadiz Pike Signals Build 2045 AM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	400	0	0	0	0	0		330				

Signal Information					EB			WB			NB			SB		
Cycle, s	70.0	Reference Phase	2													
Offset, s	66	Reference Point	End	Green	42.8	17.2		0.0	0.0		0.0	0.0				
Uncoordinated	No	Simult. Gap E/W	On	Yellow	4.0	4.0		0.0	0.0		0.0	0.0				
Force Mode	Fixed	Simult. Gap N/S	On	Red	0.0	2.0		0.0	0.0		0.0	0.0				



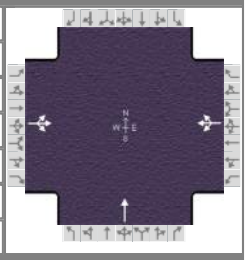
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	400	0	0	0	0	0		330				
Initial Queue (Q_b), veh/h	0	0	0	0	0	0		0				
Base Saturation Flow Rate (s_o), veh/h	1900	1900	1900	1900	1900	1900		1900				
Parking (N_m), man/h		None			None			None				
Heavy Vehicles (P_{HV}), %		15			0			5				
Ped / Bike / RTOR, /h	0	0		0	0		0	0		0	0	
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0			
Arrival Type (*AT*)	3	3	3	3	3	3		3				
Upstream Filtering (*I*)	1.00	1.00	1.00	1.00	1.00	1.00		1.00				
Lane Width (*W*), ft		12.0			12.0			12.0				
Turn Bay Length, ft		100			0			400				
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h	25	25	25	25	25	25		25				

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s		13.0		13.0		57.0		
Yellow Change Interval (*Y*), s		4.0		4.0		4.0		
Red Clearance Interval (R_c), s		0.0		0.0		2.0		
Minimum Green (G_{min}), s		6		6		7		
Start-Up Lost Time (*l1*), s	2.0	2.0	2.0	2.0		2.0		
Extension of Effective Green (*e*), s	2.0	2.0	2.0	2.0		2.0		
Passage (*PT*), s		2.0		2.0		2.0		
Recall Mode		Min		Min		Off		
Dual Entry		Yes		Yes		No		
Walk (*Walk*), s		0.0				0.0		0.0
Pedestrian Clearance Time (*PC*), s		0.0				0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25				0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0				9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0		No	0	0	No		0	
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0			
Pedestrian Signal / Occupied Parking	No	0.50			0.50		No	0.50		No		

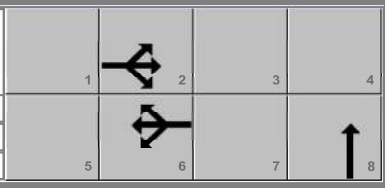
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 15, 2021	Area Type	Other
Jurisdiction		Time Period	Build AM	PHF	0.84
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	NB SR 7	File Name	Cadiz Pike Signals Build 2045 AM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	400	0	0	0	0	0		330				

Signal Information					EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Cycle, s	70.0	Reference Phase	2	Green	42.8	17.2		0.0	0.0	0.0	0.0					
Offset, s	66	Reference Point	End	Yellow	4.0	4.0		0.0	0.0	0.0	0.0					
Uncoordinated	No	Simult. Gap E/W	On	Red	0.0	2.0		0.0	0.0	0.0	0.0					
Force Mode	Fixed	Simult. Gap N/S	On													



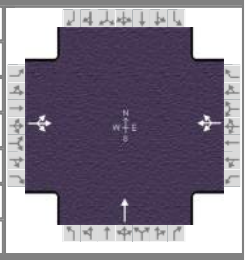
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		
Case Number		8.0		8.0		12.0		
Phase Duration, s		46.8		46.8		23.2		
Change Period, (*Y+R c*), s		4.0		4.0		6.0		
Max Allow Headway (*MAH*), s		0.0		0.0		3.2		
Queue Clearance Time (*g s*), s						16.5		
Green Extension Time (*g e*), s		0.0		0.0		0.8		
Phase Call Probability						1.00		
Max Out Probability						0.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16		8				
Adjusted Flow Rate (*v*), veh/h		421			0			393				
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1271			0			1826				
Queue Service Time (*g s*), s		3.6			0.0			14.5				
Cycle Queue Clearance Time (*g c*), s		3.6			0.0			14.5				
Green Ratio (*g/C*)		0.61						0.25				
Capacity (*c*), veh/h		879						450				
Volume-to-Capacity Ratio (*X*)		0.479			0.000			0.873				
Back of Queue (*Q*), ft/ln (95 th percentile)		44.7			0			269.7				
Back of Queue (*Q*), veh/ln (95 th percentile)		1.6			0.0			10.4				
Queue Storage Ratio (*RQ*) (95 th percentile)		0.45			0.00			0.67				
Uniform Delay (*d 1*), s/veh		1.2						25.3				
Incremental Delay (*d 2*), s/veh		1.9			0.0			2.1				
Initial Queue Delay (*d 3*), s/veh		0.0			0.0			0.0				
Control Delay (*d*), s/veh		3.0						27.5				
Level of Service (LOS)		A						C				
Approach Delay, s/veh / LOS	3.0	A		0.0			27.5	C		0.0		
Intersection Delay, s/veh / LOS	14.8						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.35	A	1.35	A	1.72	B	1.72	B
Bicycle LOS Score / LOS	1.27	A	0.49	A	1.14	A		

HCS7 Signalized Intersection Intermediate Values

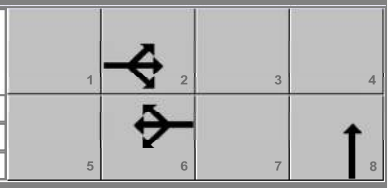
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 15, 2021	Area Type	Other
Jurisdiction		Time Period	Build AM	PHF	0.84
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	NB SR 7	File Name	Cadiz Pike Signals Build 2045 AM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	400	0	0	0	0	0		330				

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	66	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	42.8	17.2	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	0.0	2.0	0.0	0.0	0.0	0.0	



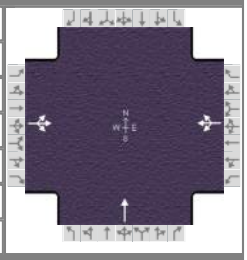
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Heavy Vehicles and Grade Factor (f_{HVg})	0.883	0.883	1.000	1.000	1.000	1.000	1.000	0.961	1.000			
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	0.758	0.758		1.000	1.000		1.000	1.000				
Right-Turn Adjustment Factor (f_{RT})		0.000	0.758		0.000	1.000		0.000	0.000			
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000			1.000			1.000					
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Movement Saturation Flow Rate (s), veh/h	1271	0	0	0	1900	0	0	1826	0			
Proportion of Vehicles Arriving on Green (P)	0.92	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00
Incremental Delay Factor (k)		0.50						0.04				

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		4.0		4.0		4.0		
Green Ratio (g/C)		0.61		0.61		0.25		
Permitted Saturation Flow Rate (s_p), veh/h/ln		1440		1440		0		
Shared Saturation Flow Rate (s_{sh}), veh/h/ln		0		1900				
Permitted Effective Green Time (g_p), s		42.8		0.0		0.0		
Permitted Service Time (g_u), s		42.7		0.0		0.0		
Permitted Queue Service Time (g_{ps}), s		3.6						
Time to First Blockage (g_f), s		0.0		42.8		0.0		
Queue Service Time Before Blockage (g_{fs}), s		0.0						
Protected Right Saturation Flow (s_R), veh/h/ln								
Protected Right Effective Green Time (g_R), s								

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	0.681	0.000	0.681	0.000	0.972	0.000	0.972	0.000
Pedestrian F_s / F_{delay}	0.000	0.067	0.000	0.067	0.000	0.150	0.000	0.148
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	1221.51	5.30	1221.51	5.30	-200.00	42.35		40.18
Bicycle F_w / F_v	-3.64	0.79	-3.64	0.00	-3.64	0.65	-3.64	

HCS7 Signalized Intersection Results Graphical Summary

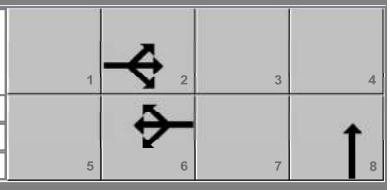
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 15, 2021	Area Type	Other
Jurisdiction		Time Period	Build AM	PHF	0.84
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	NB SR 7	File Name	Cadiz Pike Signals Build 2045 AM.xus		
Project Description	BEL-7-19.75				



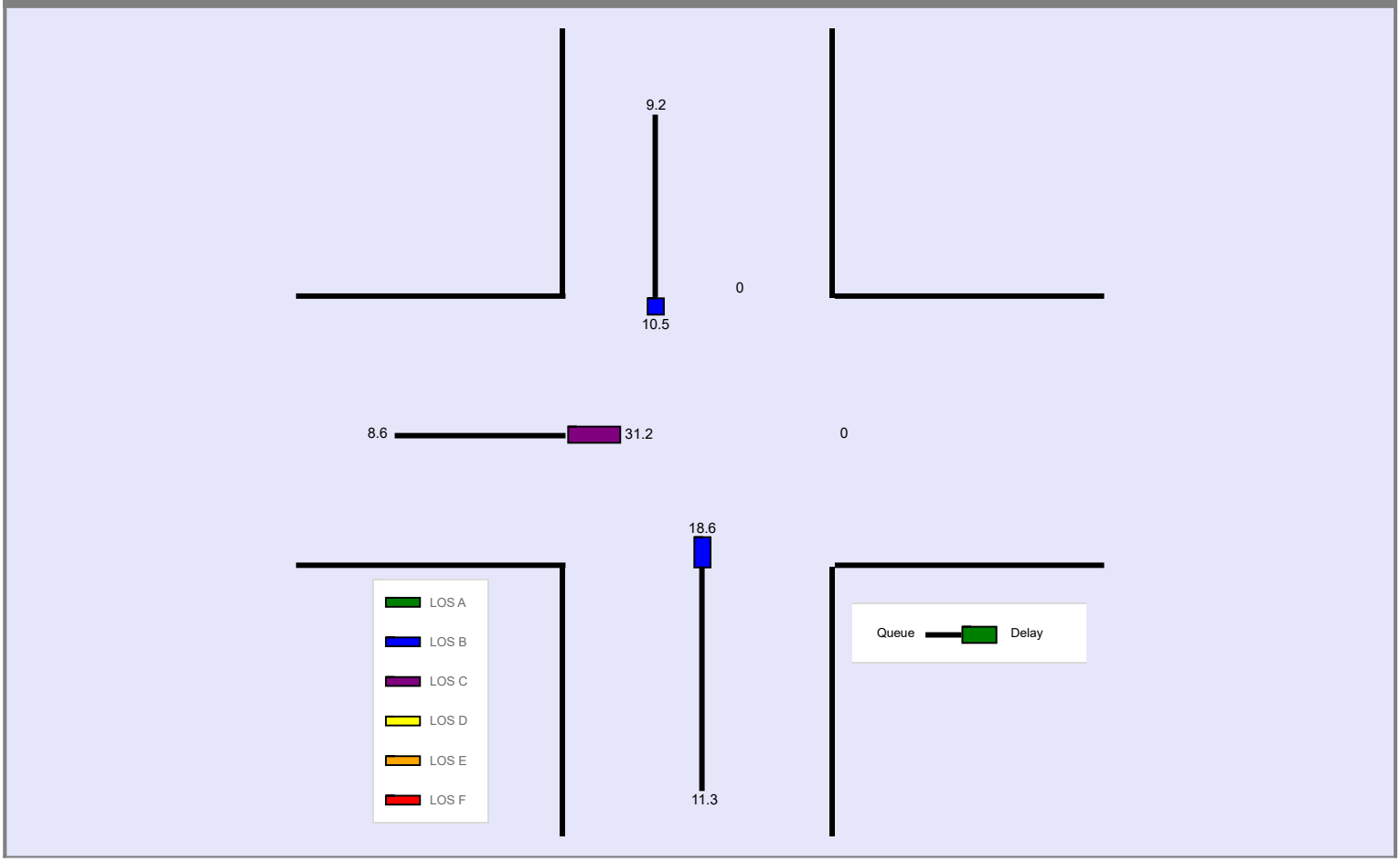
Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	400	0	0	0	0	0		330				

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	66	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	42.8	17.2	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	0.0	2.0	0.0	0.0	0.0	0.0	



Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (*Q*), ft/ln (95 th percentile)		44.7			0			269.7				
Back of Queue (*Q*), veh/ln (95 th percentile)		1.6			0.0			10.4				
Queue Storage Ratio (*RQ*) (95 th percentile)		0.45			0.00			0.67				
Control Delay (*d*), s/veh		3.0						27.5				
Level of Service (LOS)		A						C				
Approach Delay, s/veh / LOS	3.0	A		0.0			27.5	C		0.0		
Intersection Delay, s/veh / LOS	14.8	B										



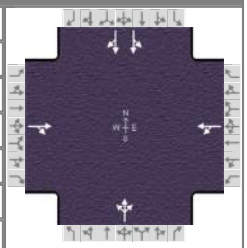
--- Messages ---

WARNING: According to input data, upstream feeding volume is equal to 88% of downstream exit volume during time period #1, for thru movement #2.

--- Comments ---

HCS7 Signalized Intersection Input Data

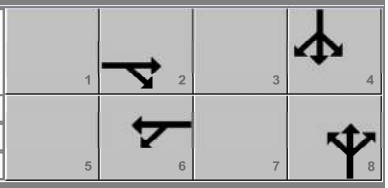
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 15, 2021	Area Type	Other
Jurisdiction		Time Period	Build AM	PHF	0.95
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	SB SR 7	File Name	Cadiz Pike Signals Build 2045 AM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		10	260	0	0		80	0	390	0	1130	10

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	19.1	38.9	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	2.0	2.0	0.0	0.0	0.0	0.0	



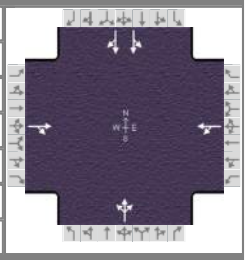
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		10	260	0	0		80	0	390	0	1130	10
Initial Queue (Q_b), veh/h		0	0	0	0		0	0	0	0	0	0
Base Saturation Flow Rate (s_o), veh/h		1900	1900	1900	1900		1900	1900	1900	1900	1900	1900
Parking (N_m), man/h		None			None			None			None	
Heavy Vehicles (P_{HV}), %		4			0			13			8	
Ped / Bike / RTOR, /h	0	0	0	0	0		0	0	0	0	0	0
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0	0	0	0
Arrival Type (*AT*)		3	3	3	3		3	3	3	3	3	3
Upstream Filtering (*I*)		1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Lane Width (*W*), ft		12.0			12.0			12.0			12.0	
Turn Bay Length, ft		1500			0			375			750	
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h		25	25	25	25		25	25	25	25	25	25

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s		18.0		18.0		52.0		52.0
Yellow Change Interval (*Y*), s		4.0		4.0		4.0		4.0
Red Clearance Interval (R_c), s		2.0		0.0		2.0		2.0
Minimum Green (G_{min}), s		7		6		7		7
Start-Up Lost Time (*lt*), s		2.0	2.0	2.0	2.0	2.0	2.0	2.0
Extension of Effective Green (*e*), s		2.0	2.0	2.0	2.0	2.0	2.0	2.0
Passage (*PT*), s		2.0		2.0		2.0		2.0
Recall Mode		Min		Min		Off		Off
Dual Entry		Yes		Yes		Yes		Yes
Walk (*Walk*), s		0.0		0.0		0.0		0.0
Pedestrian Clearance Time (*PC*), s		0.0		0.0		0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25	0	No	25	0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0	9.0	12	0	9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0	0	No	0	0	No	0	0	No
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0
Pedestrian Signal / Occupied Parking	No	0.50		No	0.50		No	0.50		No	0.50	

HCS7 Signalized Intersection Results Summary

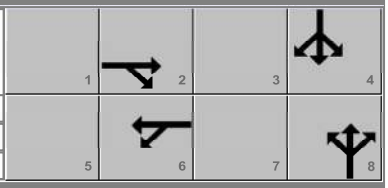
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 15, 2021	Area Type	Other
Jurisdiction		Time Period	Build AM	PHF	0.95
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	SB SR 7	File Name	Cadiz Pike Signals Build 2045 AM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		10	260	0	0		80	0	390	0	1130	10

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	19.1	38.9	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	2.0	2.0	0.0	0.0	0.0	0.0	



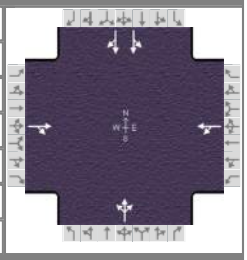
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		8.0		8.0		8.0		8.0
Phase Duration, s		25.1		25.1		44.9		44.9
Change Period, ($Y+R_c$), s		6.0		6.0		6.0		6.0
Max Allow Headway (*MAH*), s		0.0		0.0		3.5		3.5
Queue Clearance Time (g_s), s						34.4		17.7
Green Extension Time (g_e), s		0.0		0.0		4.3		5.5
Phase Call Probability						1.00		1.00
Max Out Probability						0.34		0.04

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h		284			0			495		0		599
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1569			0			977		0		1776
Queue Service Time (g_s), s		11.3			0.0			16.7		0.0		15.7
Cycle Queue Clearance Time (g_c), s		11.3			0.0			32.4		0.0		15.7
Green Ratio (*g/C*)		0.27						0.56				0.56
Capacity (*c*), veh/h		422						607				994
Volume-to-Capacity Ratio (*X*)		0.673			0.000			0.815		0.000		0.603
Back of Queue (*Q*), ft/ln (95 th percentile)		223.1			0			312		0		231
Back of Queue (*Q*), veh/ln (95 th percentile)		8.6			0.0			11.3		0.0		9.2
Queue Storage Ratio (*RQ*) (95 th percentile)		0.15			0.00			0.83		0.00		0.33
Uniform Delay (d_1), s/veh		22.8						13.1				10.2
Incremental Delay (d_2), s/veh		8.3			0.0			5.5		0.0		0.3
Initial Queue Delay (d_3), s/veh		0.0			0.0			0.0		0.0		0.0
Control Delay (*d*), s/veh		31.2						18.6				10.5
Level of Service (LOS)		C						B				B
Approach Delay, s/veh / LOS	31.2	C		0.0			18.6	B		10.5	B	
Intersection Delay, s/veh / LOS	15.5						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.91	B	1.91	B	1.65	B	1.65	B
Bicycle LOS Score / LOS	0.96	A	0.49	A	1.30	A	1.48	A

HCS7 Signalized Intersection Intermediate Values

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 15, 2021	Area Type	Other
Jurisdiction		Time Period	Build AM	PHF	0.95
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	SB SR 7	File Name	Cadiz Pike Signals Build 2045 AM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		10	260	0	0		80	0	390	0	1130	10

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

								1	2	3	4	
Green	19.1	38.9	0.0	0.0	0.0	0.0						
Yellow	4.0	4.0	0.0	0.0	0.0	0.0						
Red	2.0	2.0	0.0	0.0	0.0	0.0	5	6	7	8		

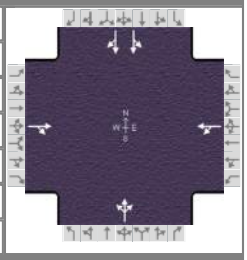
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles and Grade Factor (f_{HVg})	1.000	0.969	1.000	1.000	1.000	1.000	1.000	0.899	0.899	1.000	0.938	1.000
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	1.000	0.852		1.000	1.000		0.639	0.572		1.000	1.000	
Right-Turn Adjustment Factor (f_{RT})		0.000	0.852		0.000	1.000		0.000	0.572		0.997	0.997
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000			1.000			1.000			1.000		
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			1.000
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Movement Saturation Flow Rate (s), veh/h	0	58	1511	0	1900	0	166	0	811	0	3526	31
Proportion of Vehicles Arriving on Green (P)	0.00	0.27	0.27	0.27	0.27	0.27	0.56	0.00	0.56	0.00	0.56	0.56
Incremental Delay Factor (k)		0.50						0.22				0.05

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		6.0		6.0		6.0		6.0
Green Ratio (g/C)		0.27		0.27		0.56		0.56
Permitted Saturation Flow Rate (s_p), veh/h/ln		1440		1112		474		991
Shared Saturation Flow Rate (s_{sh}), veh/h/ln		0		0		0		1781
Permitted Effective Green Time (g_p), s		0.0		0.0		39.2		0.0
Permitted Service Time (g_u), s		0.0		0.0		23.5		0.0
Permitted Queue Service Time (g_{ps}), s						16.7		
Time to First Blockage (g_f), s		18.8		18.8		9.5		39.2
Queue Service Time Before Blockage (g_{fs}), s						1.7		
Protected Right Saturation Flow (s_R), veh/h/ln								
Protected Right Effective Green Time (g_R), s								

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	1.198	0.000	1.198	0.000	0.972	0.000	0.972	0.000
Pedestrian F_s / F_{delay}	0.000	0.117	0.000	0.114	0.000	0.078	0.000	0.078
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	546.10	18.50	603.24	17.07	1111.05	6.91	1111.05	6.91
Bicycle F_w / F_v	-3.64	0.47	-3.64	0.00	-3.64	0.82	-3.64	0.99

HCS7 Signalized Intersection Results Graphical Summary

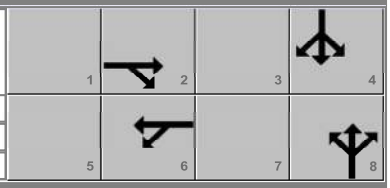
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 15, 2021	Area Type	Other
Jurisdiction		Time Period	Build AM	PHF	0.95
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	SB SR 7	File Name	Cadiz Pike Signals Build 2045 AM.xus		
Project Description	BEL-7-19.75				



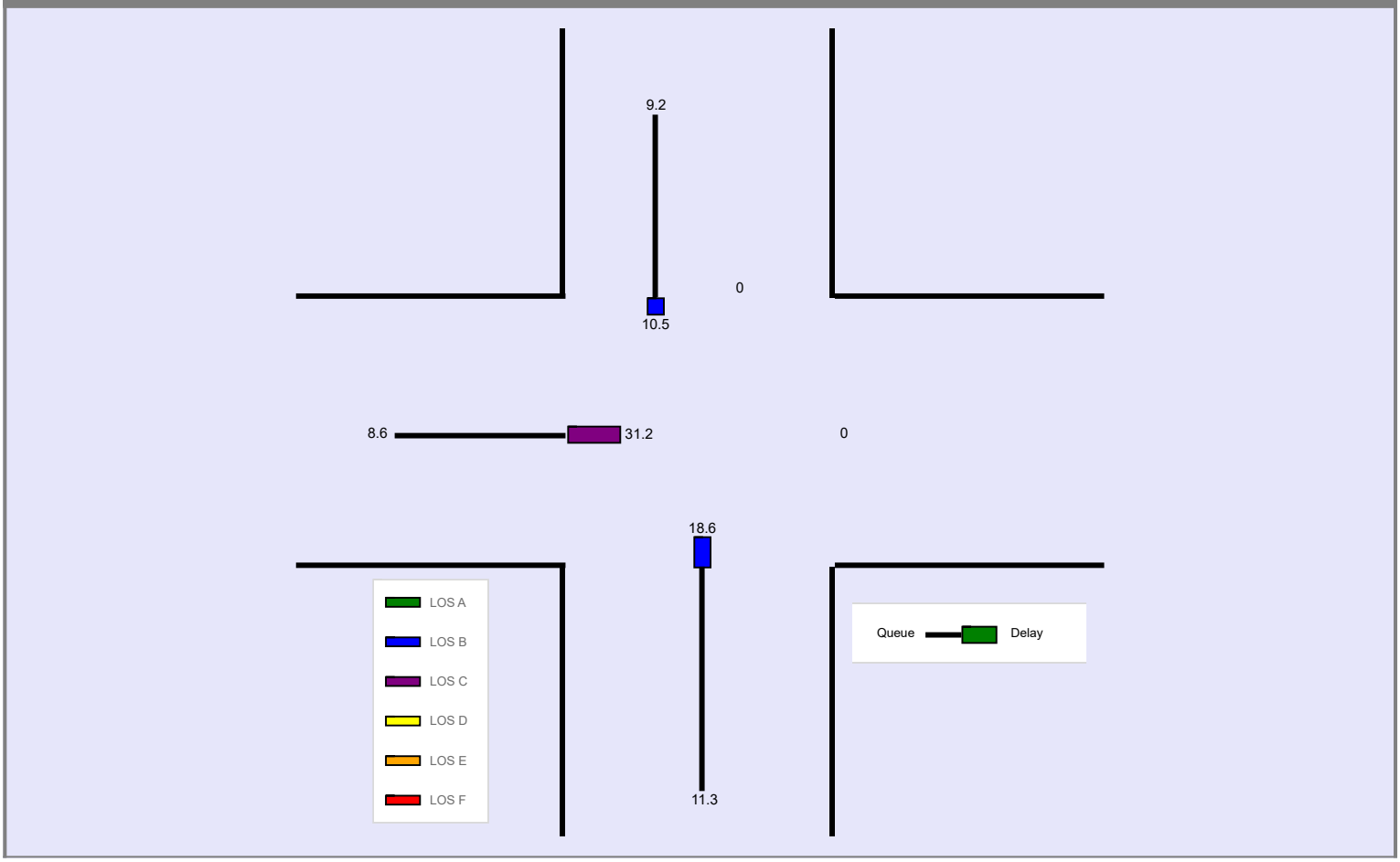
Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		10	260	0	0		80	0	390	0	1130	10

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	19.1	38.9	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	2.0	2.0	0.0	0.0	0.0	0.0	



Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (*Q*), ft/ln (95 th percentile)		223.1			0			312		0		231
Back of Queue (*Q*), veh/ln (95 th percentile)		8.6			0.0			11.3		0.0		9.2
Queue Storage Ratio (*RQ*) (95 th percentile)		0.15			0.00			0.83		0.00		0.33
Control Delay (*d*), s/veh		31.2						18.6				10.5
Level of Service (LOS)		C						B				B
Approach Delay, s/veh / LOS	31.2	C		0.0			18.6	B		10.5	B	
Intersection Delay, s/veh / LOS	15.5						B					



--- Messages ---

No errors or warnings exist.

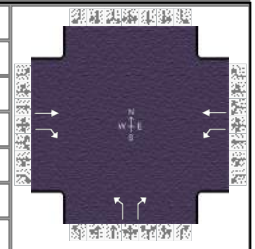
--- Comments ---

Build Intersection Analysis

PM Peak

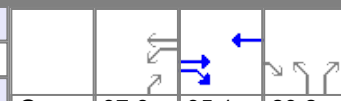
HCS7 Signalized Intersection Input Data

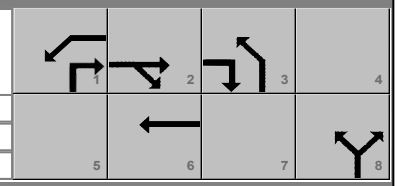
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	Build PM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 16:45
Intersection	Marion Street	File Name	Main & Marion Build 2045 PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		260	270	470	330		330		430			

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



										
Green	37.8	35.1	29.2	0.0	0.0	0.0	1	2	3	4
Yellow	4.0	4.0	4.0	0.0	0.0	0.0	5	6	7	8
Red	2.0	2.0	2.0	0.0	0.0	0.0				

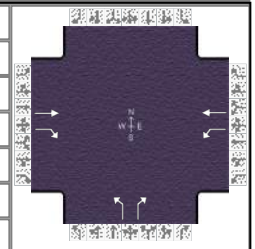
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		260	270	470	330		330		430			
Initial Queue (Q_b), veh/h		0	0	0	0		0		0			
Base Saturation Flow Rate (s_o), veh/h		1900	1900	1900	1900		1900		1900			
Parking (N_m), man/h		None			None			None				
Heavy Vehicles (P_{HV}), %		10	10	6	6		11		11			
Ped / Bike / RTOR, /h	0	0	0	0	0		0	0		0	0	
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0			
Arrival Type (*AT*)		3	3	3	3		3		3			
Upstream Filtering (*I*)		1.00	1.00	1.00	1.00		1.00		1.00			
Lane Width (*W*), ft		12.0	12.0	12.0	12.0		12.0		12.0			
Turn Bay Length, ft		2450	525	1200	1200		175		175			
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h		25	25	25	25		25		25			

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s		16.0	51.0	67.0	53.0	53.0		
Yellow Change Interval (*Y*), s		4.0	4.0	4.0	4.0	4.0		
Red Clearance Interval (R_c), s		2.0	2.0	2.0	2.0	2.0		
Minimum Green (G_{min}), s		10	7	10	7	10		
Start-Up Lost Time (*l1*), s		2.0	2.0	2.0	2.0			
Extension of Effective Green (*e*), s		2.0	2.0	2.0	2.0			
Passage (*PT*), s		2.0	2.0	2.0	2.0	2.0		
Recall Mode		Min	Off	Min	Off	Off		
Dual Entry		Yes	No	Yes	No	Yes		
Walk (*Walk*), s		0.0				0.0		0.0
Pedestrian Clearance Time (*PC*), s		0.0				0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25				0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0				9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0		No	0	0	No		0	
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0			
Pedestrian Signal / Occupied Parking	No	0.50			0.50		No	0.50		No		

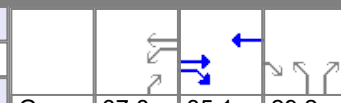
HCS7 Signalized Intersection Results Summary

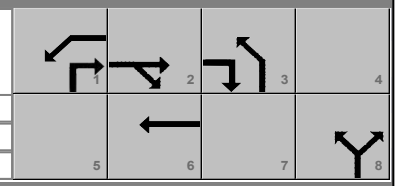
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	Build PM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 16:45
Intersection	Marion Street	File Name	Main & Marion Build 2045 PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		260	270	470	330		330		430			

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



										
Green	37.8	35.1	29.2	0.0	0.0	0.0	1	2	3	4
Yellow	4.0	4.0	4.0	0.0	0.0	0.0				
Red	2.0	2.0	2.0	0.0	0.0	0.0	5	6	7	8

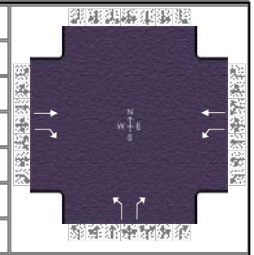
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		
Case Number		7.3	2.0	4.0		9.0		
Phase Duration, s		41.1	43.8	84.8		35.2		
Change Period, ($Y+R_c$), s		6.0	6.0	6.0		6.0		
Max Allow Headway (*MAH*), s		0.0	3.3	0.0		3.4		
Queue Clearance Time (g_s), s			36.6			27.1		
Green Extension Time (g_e), s		0.0	1.2	0.0		2.0		
Phase Call Probability			1.00			1.00		
Max Out Probability			0.00			0.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18			
Adjusted Flow Rate (*v*), veh/h		283	293	511	359		359		467			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1752	1485	1725	1811		1654		1472			
Queue Service Time (g_s), s		16.3	13.7	34.6	10.2		25.1		24.7			
Cycle Queue Clearance Time (g_c), s		16.3	13.7	34.6	10.2		25.1		24.7			
Green Ratio (*g/C*)		0.29	0.54	0.31	0.66		0.24		0.56			
Capacity (*c*), veh/h		512	795	543	1190		402		821			
Volume-to-Capacity Ratio (*X*)		0.552	0.369	0.941	0.301		0.892		0.569			
Back of Queue (*Q*), ft/ln (95 th percentile)		329.4	233.1	587.1	195.3		447.2		355			
Back of Queue (*Q*), veh/ln (95 th percentile)		12.2	8.6	22.4	7.5		16.4		13.1			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.13	0.44	0.49	0.16		2.56		2.03			
Uniform Delay (d_1), s/veh		35.8	16.1	40.0	8.8		43.9		17.2			
Incremental Delay (d_2), s/veh		4.2	1.3	8.2	0.7		5.9		0.2			
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0	0.0		0.0		0.0			
Control Delay (*d*), s/veh		40.1	17.5	48.2	9.5		49.8		17.4			
Level of Service (LOS)		D	B	D	A		D		B			
Approach Delay, s/veh / LOS	28.6	C		32.2	C		31.5	C		0.0		
Intersection Delay, s/veh / LOS	31.0						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.93	B	0.68	A	1.97	B	1.96	B
Bicycle LOS Score / LOS	1.44	A	1.92	B		F		

HCS7 Signalized Intersection Intermediate Values

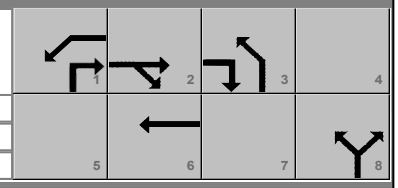
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	Build PM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 16:45
Intersection	Marion Street	File Name	Main & Marion Build 2045 PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		260	270	470	330		330		430			

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	37.8	35.1	29.2	0.0	0.0	0.0						
Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
Red	2.0	2.0	2.0	0.0	0.0	0.0						



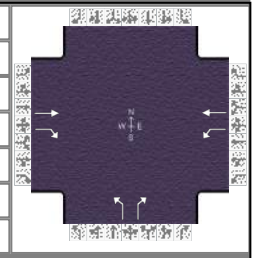
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Heavy Vehicles and Grade Factor (f_{HVg})	1.000	0.922	0.922	0.953	0.953	1.000	0.914	1.000	0.914			
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	1.000	1.000		0.952	0.000		0.952	0.000				
Right-Turn Adjustment Factor (f_{RT})		0.000	0.847		1.000	1.000		0.000	0.847			
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000			1.000			1.000					
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Movement Saturation Flow Rate (s), veh/h	0	1752	1485	1725	1811	0	1654	0	1472			
Proportion of Vehicles Arriving on Green (P)	0.00	0.29	0.29	0.31	0.66	0.00	0.24	0.00	0.24	0.00	0.00	0.00
Incremental Delay Factor (k)		0.50	0.50	0.10	0.50		0.09		0.04			

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		6.0	6.0	6.0		6.0		
Green Ratio (g/C)		0.29	0.31	0.66		0.24		
Permitted Saturation Flow Rate (s_p), veh/h/ln		1039	0	0		1654		
Shared Saturation Flow Rate (s_{sh}), veh/h/ln		0						
Permitted Effective Green Time (g_p), s		0.0	0.0	0.0		0.0		
Permitted Service Time (g_u), s		0.0	0.0	0.0		0.0		
Permitted Queue Service Time (g_{ps}), s								
Time to First Blockage (g_f), s		35.1	0.0	0.0		0.0		
Queue Service Time Before Blockage (g_{fs}), s								
Protected Right Saturation Flow (s_R), veh/h/ln		1485				1472		
Protected Right Effective Green Time (g_R), s		29.2				37.8		

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	1.198	0.000	0.000	0.000	1.198	0.000	1.198	0.000
Pedestrian F_s / F_{delay}	0.000	0.136	0.000	0.078	0.000	0.169	0.000	0.167
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	584.58	30.05	1313.96	7.06		67.20	-83.33	65.10
Bicycle F_w / F_v	-3.64	0.95	-3.64	1.43	-3.64		-3.64	

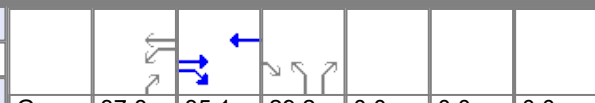
HCS7 Signalized Intersection Results Graphical Summary

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	Build PM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 16:45
Intersection	Marion Street	File Name	Main & Marion Build 2045 PM.xus		
Project Description	BEL-7-19.75				

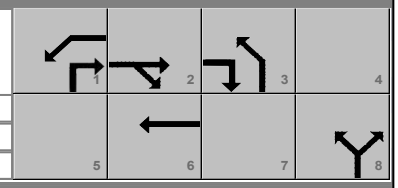


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		260	270	470	330		330		430			

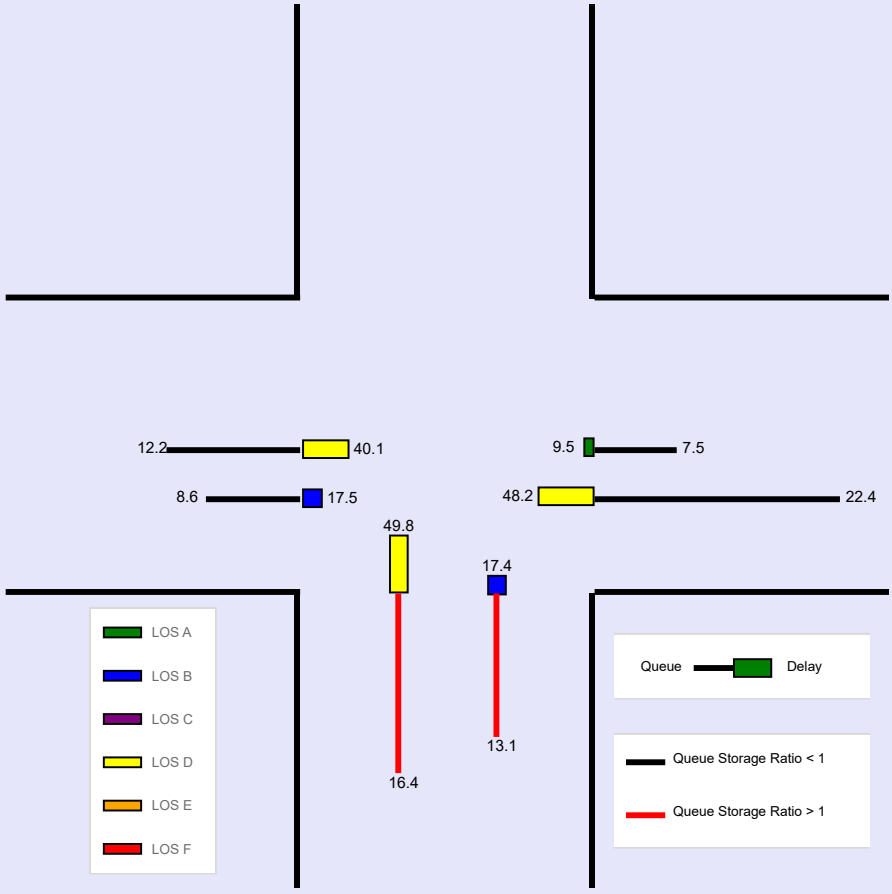
Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	37.8	35.1	29.2	0.0	0.0	0.0						
Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
Red	2.0	2.0	2.0	0.0	0.0	0.0						



Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (*Q*), ft/ln (95 th percentile)		329.4	233.1	587.1	195.3		447.2		355			
Back of Queue (*Q*), veh/ln (95 th percentile)		12.2	8.6	22.4	7.5		16.4		13.1			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.13	0.44	0.49	0.16		2.56		2.03			
Control Delay (*d*), s/veh		40.1	17.5	48.2	9.5		49.8		17.4			
Level of Service (LOS)		D	B	D	A		D		B			
Approach Delay, s/veh / LOS	28.6	C		32.2	C		31.5	C		0.0		
Intersection Delay, s/veh / LOS	31.0						C					



--- Messages ---

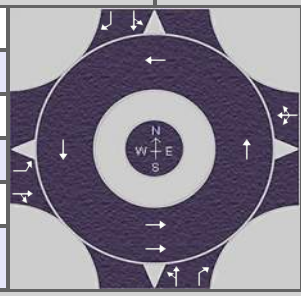
WARNING: Since queue spillover from turn lanes and spillback into upstream intersections is not accounted for in the HCM procedures, use of a simulation tool may be advised in situations where the Queue Storage Ratio exceeds 1.0.

--- Comments ---

HCS7 Roundabouts Report

General Information

Analyst	RMK
Agency or Co.	Burgess & Niple
Date Performed	11/13/2021
Analysis Year	2045
Time Analyzed	PM Build
Project Description	BEL-7-19.25



Site Information

Intersection	Main Street & Lincoln Ave
E/W Street Name	Main Street (US 40)
N/S Street Name	Lincoln Avenue
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.97
Jurisdiction	

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	1	1	0	0	0	1	0	0	0	1	1	0	0	1	1
Lane Assignment	L		TR				LTR		LT		R		LT		R	
Volume (V), veh/h	0	500	160	40	0	100	160	120	0	40	170	220	0	500	120	610
Percent Heavy Vehicles, %	3	3	3	3	1	1	1	1	2	2	2	2	4	4	4	4
Flow Rate (v_{PCE}), pc/h	0	531	170	42	0	104	167	125	0	42	179	231	0	536	129	654
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				2				1			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)	4.5436	4.5436			4.9763		4.6453	4.3276		4.5436	4.5436	
Follow-Up Headway (s)	2.5352	2.5352			2.6087		2.6667	2.5352		2.5352	2.5352	

Flow Computations, Capacity and v/c Ratios

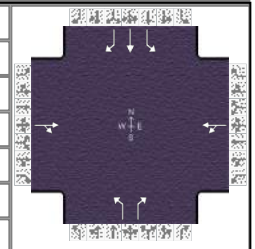
Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h	531	212			396		221	231		665	654	
Entry Volume, veh/h	516	206			392		217	226		639	629	
Circulating Flow (v_c), pc/h	769			752			1237			313		
Exiting Flow (v_{ex}), pc/h	937			863			835			275		
Capacity (c_{pce}), pc/h	705	705			641		433	496		1068	1068	
Capacity (c), veh/h	685	685			635		424	486		1027	1027	
v/c Ratio (x)	0.75	0.30			0.62		0.51	0.47		0.62	0.61	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh	23.2	9.0			17.5		19.6	16.0		12.2	11.9	
Lane LOS	C	A			C		C	C		B	B	
95% Queue, veh	6.9	1.3			4.3		2.8	2.4		4.5	4.4	
Approach Delay, s/veh	19.2			17.5			17.8			12.1		
Approach LOS	C			C			C			B		
Intersection Delay, s/veh | LOS	15.5						C					

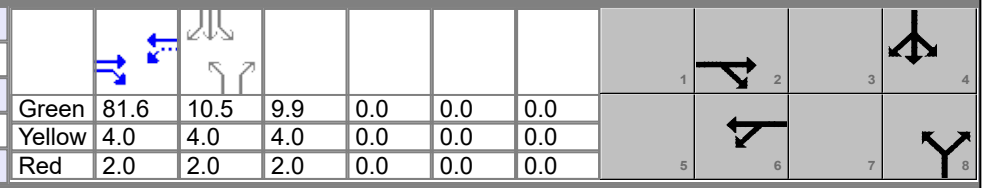
HCS7 Signalized Intersection Input Data

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	Build PM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 16:45
Intersection	Huron Street	File Name	Zane & Huron Build 2045 PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		720	50	10	740		100		20	110	20	100

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	108	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	81.6	10.5	9.9	0.0	0.0	0.0						
Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
Red	2.0	2.0	2.0	0.0	0.0	0.0						

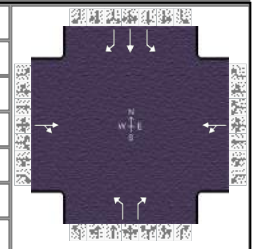
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		720	50	10	740		100		20	110	20	100
Initial Queue (Q_b), veh/h		0	0	0	0		0		0	0	0	0
Base Saturation Flow Rate (s_o), veh/h		1900	1900	1900	1900		1900		1900	1900	1900	1900
Parking (N_m), man/h		None			None			None			None	
Heavy Vehicles (P_{HV}), %		2			2		1		1	1	1	1
Ped / Bike / RTOR, /h	0	0	0	0	0		0	0		0	0	0
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0	0	0	0
Arrival Type (*AT*)		3	3	3	3		3		3	3	3	3
Upstream Filtering (*I*)		1.00	1.00	1.00	1.00		1.00		1.00	1.00	1.00	1.00
Lane Width (*W*), ft		12.0			12.0		12.0		12.0	12.0	12.0	12.0
Turn Bay Length, ft		1200			350		50		425	125	275	125
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h		25	25	25	25		25		25	25	25	25

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s		34.0		34.0		16.0		70.0
Yellow Change Interval (*Y*), s		4.0		4.0		4.0		4.0
Red Clearance Interval (R_c), s		2.0		2.0		2.0		2.0
Minimum Green (G_{min}), s		10		10		10		10
Start-Up Lost Time (*l*t), s		2.0	2.0	2.0	2.0		2.0	2.0
Extension of Effective Green (*e*), s		2.0	2.0	2.0	2.0		2.0	2.0
Passage (*PT*), s		2.0		2.0		2.0		2.0
Recall Mode		Min		Min		Off		Off
Dual Entry		Yes		Yes		Yes		Yes
Walk (*Walk*), s		0.0		0.0		0.0		0.0
Pedestrian Clearance Time (*PC*), s		0.0		0.0		0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25	0	No	25	0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0	9.0	12	0	9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0	0	No	0	0	No	0	0	No
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0
Pedestrian Signal / Occupied Parking	No	0.50		No	0.50		No	0.50		No	0.50	

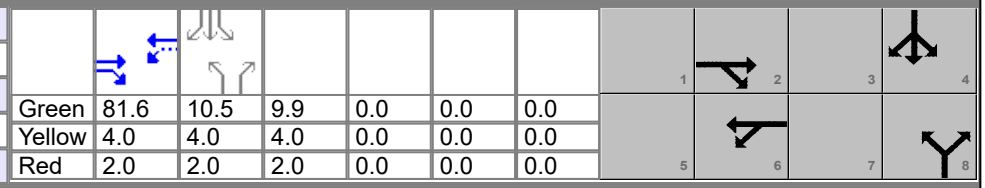
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	Build PM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 16:45
Intersection	Huron Street	File Name	Zane & Huron Build 2045 PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		720	50	10	740		100		20	110	20	100

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	108	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	81.6	10.5	9.9	0.0	0.0	0.0						
Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
Red	2.0	2.0	2.0	0.0	0.0	0.0						

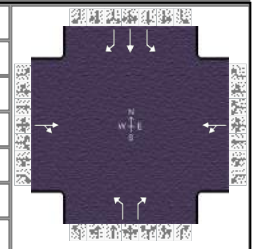
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		8.0		8.0		9.0		9.0
Phase Duration, s		87.6		87.6		15.9		16.5
Change Period, (*Y+R c*), s		6.0		6.0		6.0		6.0
Max Allow Headway (*MAH*), s		0.0		0.0		3.3		3.3
Queue Clearance Time (*g s*), s						9.1		10.0
Green Extension Time (*g e*), s		0.0		0.0		0.3		0.5
Phase Call Probability						0.99		1.00
Max Out Probability						0.00		0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18	7	4	14
Adjusted Flow Rate (*v*), veh/h		837			815		109		22	120	22	109
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1849			1853		1795		1598	1795	1885	1598
Queue Service Time (*g s*), s		31.8			0.0		7.1		1.5	7.8	1.3	8.0
Cycle Queue Clearance Time (*g c*), s		31.8			29.7		7.1		1.5	7.8	1.3	8.0
Green Ratio (*g/C*)		0.68			0.68		0.08		0.08	0.09	0.09	0.09
Capacity (*c*), veh/h		1257			1290		148		131	158	165	140
Volume-to-Capacity Ratio (*X*)		0.666			0.632		0.736		0.165	0.759	0.131	0.775
Back of Queue (*Q*), ft/ln (95 th percentile)		488.3			462.9		151.5		28.3	166.8	27.9	152.8
Back of Queue (*Q*), veh/ln (95 th percentile)		19.2			18.2		6.0		1.1	6.6	1.1	6.1
Queue Storage Ratio (*RQ*) (95 th percentile)		0.41			1.32		3.03		0.07	1.33	0.10	1.22
Uniform Delay (*d 1*), s/veh		11.2			10.9		53.8		51.2	53.5	50.5	53.6
Incremental Delay (*d 2*), s/veh		2.8			2.4		2.7		0.2	2.8	0.1	3.4
Initial Queue Delay (*d 3*), s/veh		0.0			0.0		0.0		0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh		14.0			13.3		56.5		51.5	56.3	50.6	57.0
Level of Service (LOS)		B			B		E		D	E	D	E
Approach Delay, s/veh / LOS	14.0	B		13.3	B		55.6	E		56.1	E	
Intersection Delay, s/veh / LOS	21.6						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.87	B	1.87	B	1.74	B	1.73	B
Bicycle LOS Score / LOS	1.87	B	1.83	B		F	0.90	A

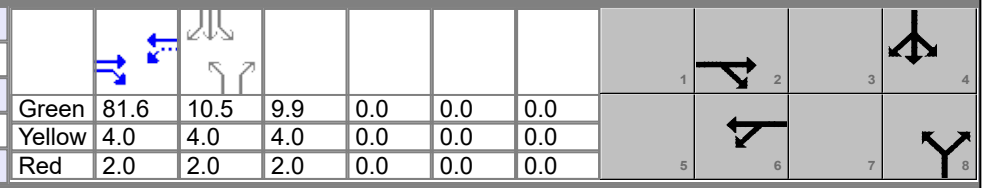
HCS7 Signalized Intersection Intermediate Values

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	Build PM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 16:45
Intersection	Huron Street	File Name	Zane & Huron Build 2045 PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		720	50	10	740		100		20	110	20	100

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	108	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	81.6	10.5	9.9	0.0	0.0	0.0						
Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
Red	2.0	2.0	2.0	0.0	0.0	0.0						

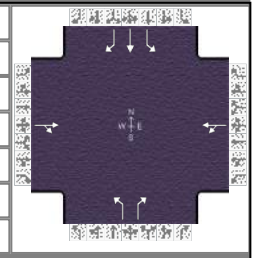
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles and Grade Factor (f_{HVg})	1.000	0.984	1.000	1.000	0.984	0.984	0.992	1.000	0.992	0.992	0.992	0.992
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	1.000	0.988		0.991	0.991		0.952	0.000		0.952	0.000	
Right-Turn Adjustment Factor (f_{RT})		0.000	0.988		0.000	0.991		0.000	0.847		0.000	0.847
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000			1.000			1.000			1.000		
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			1.000
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Movement Saturation Flow Rate (s), veh/h	0	1729	120	25	1828	0	1795	0	1598	1795	1885	1598
Proportion of Vehicles Arriving on Green (P)	0.00	0.68	0.68	0.68	0.68	0.00	0.08	0.00	0.08	0.09	0.09	0.09
Incremental Delay Factor (k)		0.50			0.50		0.04		0.04	0.04	0.04	0.04

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		6.0		6.0		6.0		4.0
Green Ratio (g/C)		0.68		0.68		0.08		0.09
Permitted Saturation Flow Rate (s_p), veh/h/ln		688		667		1795		1795
Shared Saturation Flow Rate (s_{sh}), veh/h/ln		1870		0				
Permitted Effective Green Time (g_p), s		0.0		81.6		0.0		0.0
Permitted Service Time (g_u), s		0.0		49.8		0.0		0.0
Permitted Queue Service Time (g_{ps}), s				0.0				
Time to First Blockage (g_f), s		81.6		49.8		0.0		0.0
Queue Service Time Before Blockage (g_{fs}), s				29.7				
Protected Right Saturation Flow (s_R), veh/h/ln						0		0
Protected Right Effective Green Time (g_R), s						0.0		0.0

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	1.198	0.000	1.198	0.000	0.972	0.000	0.972	0.000
Pedestrian F_s / F_{delay}	0.000	0.073	0.000	0.073	0.000	0.169	0.000	0.157
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	1360.00	6.14	1360.00	6.14		67.20	164.51	50.54
Bicycle F_w / F_v	-3.64	1.38	-3.64	1.35	-3.64		-3.64	0.41

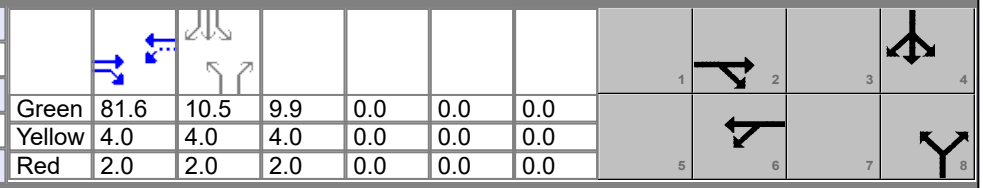
HCS7 Signalized Intersection Results Graphical Summary

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	11/16/2021	Area Type	Other
Jurisdiction		Time Period	Build PM	PHF	0.92
Urban Street	Main Street	Analysis Year	2045	Analysis Period	1> 16:45
Intersection	Huron Street	File Name	Zane & Huron Build 2045 PM.xus		
Project Description	BEL-7-19.75				



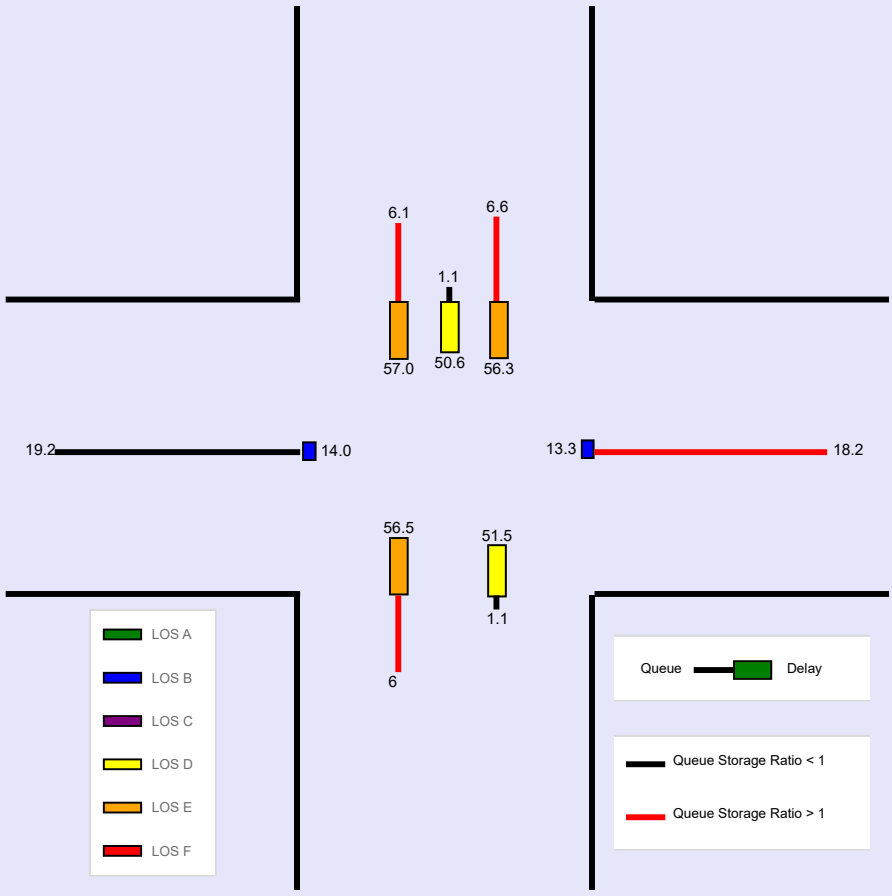
Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		720	50	10	740		100		20	110	20	100

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	108	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	81.6	10.5	9.9	0.0	0.0	0.0						
Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
Red	2.0	2.0	2.0	0.0	0.0	0.0						

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (*Q*), ft/ln (95 th percentile)		488.3			462.9		151.5		28.3	166.8	27.9	152.8
Back of Queue (*Q*), veh/ln (95 th percentile)		19.2			18.2		6.0		1.1	6.6	1.1	6.1
Queue Storage Ratio (*RQ*) (95 th percentile)		0.41			1.32		3.03		0.07	1.33	0.10	1.22
Control Delay (*d*), s/veh		14.0			13.3		56.5		51.5	56.3	50.6	57.0
Level of Service (LOS)		B			B		E		D	E	D	E
Approach Delay, s/veh / LOS	14.0		B	13.3		B	55.6		E	56.1		E
Intersection Delay, s/veh / LOS	21.6						C					



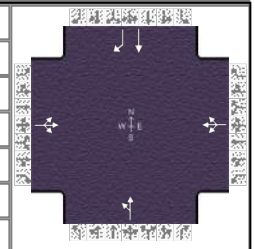
--- Messages ---

WARNING: Since queue spillover from turn lanes and spillback into upstream intersections is not accounted for in the HCM procedures, use of a simulation tool may be advised in situations where the Queue Storage Ratio exceeds 1.0.

--- Comments ---

HCS7 Signalized Intersection Input Data

General Information				Intersection Information	
Agency	Burgess & Niple, Inc			Duration, h	0.250
Analyst	MEL	Analysis Date	11/17/2021	Area Type	Other
Jurisdiction		Time Period	Build PM	PHF	0.86
Urban Street	Lincoln Avenue	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Howard Street	File Name	Lincoln & Howard 2045 Build PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	140	0	120	10	420	270	10	40			170	80

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

								1	2	3	4	
Green	23.2	44.8	0.0	0.0	0.0	0.0						
Yellow	4.0	4.0	0.0	0.0	0.0	0.0						
Red	2.0	2.0	0.0	0.0	0.0	0.0	5	6	7	8		

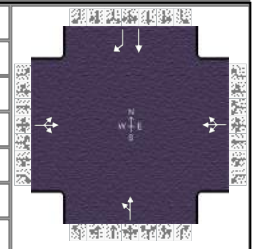
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	140	0	120	10	420	270	10	40			170	80
Initial Queue (Q_b), veh/h	0	0	0	0	0	0	0	0			0	0
Base Saturation Flow Rate (s_o), veh/h	1900	1900	1900	1900	1900	1900	1900	1900			1900	1900
Parking (N_m), man/h		None			None			None			None	
Heavy Vehicles (P_{HV}), %		1			6			1			1	1
Ped / Bike / RTOR, /h	0	0	0	0	0	0	0	0		0	0	0
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0	0	0	0
Arrival Type (*AT*)	3	3	3	3	3	3	3	3			3	3
Upstream Filtering (*I*)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Lane Width (*W*), ft		12.0			12.0			12.0			12.0	12.0
Turn Bay Length, ft		850			600			475			800	450
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h	25	25	25	25	25	25	25	25			25	25

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s		53.0		53.0		27.0		27.0
Yellow Change Interval (*Y*), s		4.0		4.0		4.0		4.0
Red Clearance Interval (R_c), s		2.0		2.0		2.0		2.0
Minimum Green (G_{min}), s		7		7		7		7
Start-Up Lost Time (*l1*), s	2.0	2.0	2.0	2.0	2.0	2.0		2.0
Extension of Effective Green (*e*), s	2.0	2.0	2.0	2.0	2.0	2.0		2.0
Passage (*PT*), s		2.0		2.0		2.0		2.0
Recall Mode		Off		Off		Min		Min
Dual Entry		Yes		Yes		Yes		Yes
Walk (*Walk*), s		0.0		0.0		0.0		0.0
Pedestrian Clearance Time (*PC*), s		0.0		0.0		0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25	0	No	25	0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0	9.0	12	0	9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0	0	No	0	0	No	0	0	No
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0
Pedestrian Signal / Occupied Parking	No	0.50		No	0.50		No	0.50		No	0.50	

HCS7 Signalized Intersection Results Summary

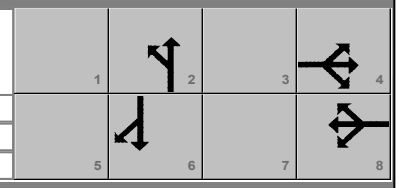
General Information				Intersection Information	
Agency	Burgess & Niple, Inc			Duration, h	0.250
Analyst	MEL	Analysis Date	11/17/2021	Area Type	Other
Jurisdiction		Time Period	Build PM	PHF	0.86
Urban Street	Lincoln Avenue	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Howard Street	File Name	Lincoln & Howard 2045 Build PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	140	0	120	10	420	270	10	40			170	80

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	23.2	44.8	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	2.0	2.0	0.0	0.0	0.0	0.0	



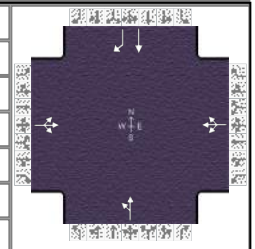
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8		2		6
Case Number		8.0		8.0		8.0		7.0
Phase Duration, s		50.8		50.8		29.2		29.2
Change Period, ($Y+R_c$), s		6.0		6.0		6.0		6.0
Max Allow Headway (*MAH*), s		3.7		3.7		0.0		0.0
Queue Clearance Time (g_s), s		43.2		34.2				
Green Extension Time (g_e), s		1.6		3.3		0.0		0.0
Phase Call Probability		1.00		1.00				
Max Out Probability		0.96		0.16				

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h		302			814			58			198	93
Adjusted Saturation Flow Rate (*s*), veh/h/ln		591			1720			1752			1885	1598
Queue Service Time (g_s), s		8.7			0.0			0.0			6.7	3.5
Cycle Queue Clearance Time (g_c), s		41.2			32.2			1.8			6.7	3.5
Green Ratio (*g/C*)		0.56			0.56			0.29			0.29	0.29
Capacity (*c*), veh/h		400			1009			562			547	463
Volume-to-Capacity Ratio (*X*)		0.756			0.807			0.103			0.362	0.201
Back of Queue (*Q*), ft/ln (95 th percentile)		248.5			472.3			38.4			144.3	64.5
Back of Queue (*Q*), veh/ln (95 th percentile)		9.9			18.0			1.5			5.7	2.6
Queue Storage Ratio (*RQ*) (95 th percentile)		0.29			0.79			0.08			0.18	0.14
Uniform Delay (d_1), s/veh		18.1			14.9			20.8			22.5	21.4
Incremental Delay (d_2), s/veh		6.2			4.1			0.4			1.9	1.0
Initial Queue Delay (d_3), s/veh		0.0			0.0			0.0			0.0	0.0
Control Delay (*d*), s/veh		24.2			19.0			21.2			24.4	22.4
Level of Service (LOS)		C			B			C			C	C
Approach Delay, s/veh / LOS	24.2	C		19.0	B		21.2	C		23.7	C	
Intersection Delay, s/veh / LOS	21.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.65	B	1.88	B	1.69	B	1.69	B
Bicycle LOS Score / LOS	0.99	A	1.83	B	0.58	A	0.97	A

HCS7 Signalized Intersection Intermediate Values

General Information				Intersection Information	
Agency	Burgess & Niple, Inc			Duration, h	0.250
Analyst	MEL	Analysis Date	11/17/2021	Area Type	Other
Jurisdiction		Time Period	Build PM	PHF	0.86
Urban Street	Lincoln Avenue	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Howard Street	File Name	Lincoln & Howard 2045 Build PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	140	0	120	10	420	270	10	40			170	80

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

								1	2	3	4	
Green	23.2	44.8	0.0	0.0	0.0	0.0						
Yellow	4.0	4.0	0.0	0.0	0.0	0.0		5	6	7	8	
Red	2.0	2.0	0.0	0.0	0.0	0.0						

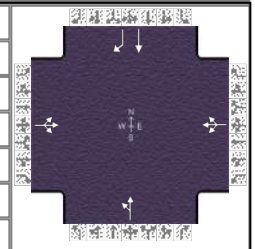
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles and Grade Factor (f_{HVg})	1.000	0.992	1.000	1.000	0.953	1.000	1.000	0.992	1.000	1.000	0.992	0.992
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	0.322	0.313		0.997	0.950		0.929	0.929		1.000	1.000	
Right-Turn Adjustment Factor (f_{RT})		0.000	0.313		0.000	0.950		0.000	0.929		0.000	0.847
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000			1.000			1.000			1.000		
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			1.000
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Movement Saturation Flow Rate (s), veh/h	318	0	273	25	1032	663	350	1402	0	0	1885	1598
Proportion of Vehicles Arriving on Green (P)	0.56	0.00	0.56	0.56	0.56	0.56	0.29	0.29	0.00	0.00	0.29	0.29
Incremental Delay Factor (k)		0.23			0.29			0.50			0.50	0.50

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		6.0		6.0		6.0		6.0
Green Ratio (g/C)		0.56		0.56		0.29		0.29
Permitted Saturation Flow Rate (s_p), veh/h/ln		689		1269		1204		1381
Shared Saturation Flow Rate (s_{sh}), veh/h/ln		391		1793		0		1885
Permitted Effective Green Time (g_p), s		44.8		44.8		23.2		0.0
Permitted Service Time (g_u), s		12.3		3.5		16.7		0.0
Permitted Queue Service Time (g_{ps}), s		8.7		0.0		0.0		
Time to First Blockage (g_f), s		1.7		29.0		7.4		23.2
Queue Service Time Before Blockage (g_{fs}), s		1.7		11.4		1.8		
Protected Right Saturation Flow (s_R), veh/h/ln								0
Protected Right Effective Green Time (g_R), s								0.0

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	0.972	0.000	1.198	0.000	0.972	0.000	0.972	0.000
Pedestrian F_s / F_{delay}	0.000	0.082	0.000	0.082	0.000	0.120	0.000	0.120
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	1119.63	7.75	1119.63	7.75	580.37	20.15	580.37	20.15
Bicycle F_w / F_v	-3.64	0.50	-3.64	1.34	-3.64	0.10	-3.64	0.48

HCS7 Signalized Intersection Results Graphical Summary

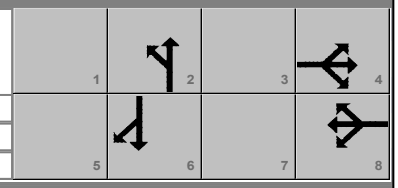
General Information				Intersection Information	
Agency	Burgess & Niple, Inc			Duration, h	0.250
Analyst	MEL	Analysis Date	11/17/2021	Area Type	Other
Jurisdiction		Time Period	Build PM	PHF	0.86
Urban Street	Lincoln Avenue	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Howard Street	File Name	Lincoln & Howard 2045 Build PM.xus		
Project Description	BEL-7-19.75				



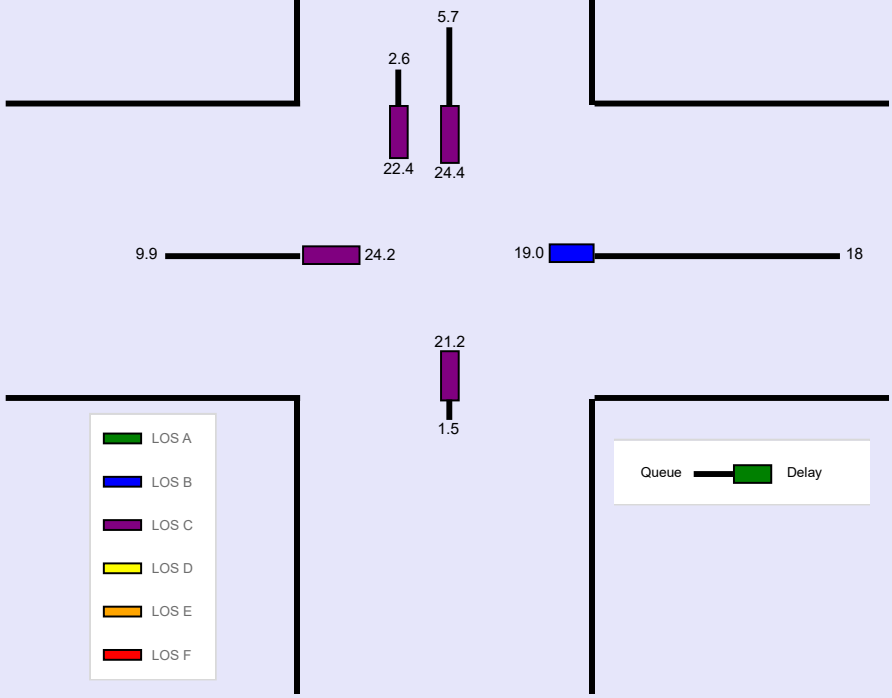
Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	140	0	120	10	420	270	10	40			170	80

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	23.2	44.8	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	2.0	2.0	0.0	0.0	0.0	0.0	



Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (*Q*), ft/ln (95 th percentile)		248.5			472.3			38.4			144.3	64.5
Back of Queue (*Q*), veh/ln (95 th percentile)		9.9			18.0			1.5			5.7	2.6
Queue Storage Ratio (*RQ*) (95 th percentile)		0.29			0.79			0.08			0.18	0.14
Control Delay (*d*), s/veh		24.2			19.0			21.2			24.4	22.4
Level of Service (LOS)		C			B			C			C	C
Approach Delay, s/veh / LOS	24.2	C		19.0	B		21.2	C		23.7	C	
Intersection Delay, s/veh / LOS	21.1						C					



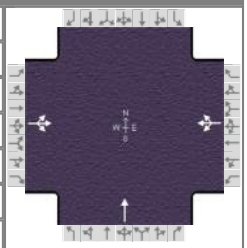
--- Messages ---

No errors or warnings exist.

--- Comments ---

HCS7 Signalized Intersection Input Data

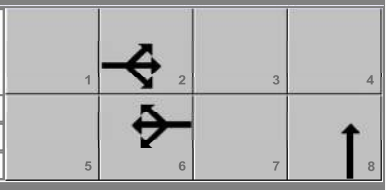
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	Build PM	PHF	0.96
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	NB SR 7	File Name	Cadiz Pike Signals Build 2045 PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	560	0	0	0	0	0		560				

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	21	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	63.2	36.8	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	0.0	2.0	0.0	0.0	0.0	0.0	



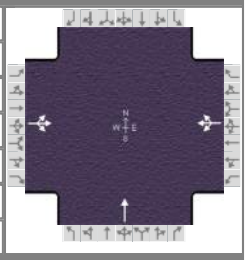
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	560	0	0	0	0	0		560				
Initial Queue (Q_b), veh/h	0	0	0	0	0	0		0				
Base Saturation Flow Rate (s_o), veh/h	1900	1900	1900	1900	1900	1900		1900				
Parking (N_m), man/h		None			None			None				
Heavy Vehicles (P_{HV}), %		4			0			3				
Ped / Bike / RTOR, /h	0	0		0	0		0	0		0	0	
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0			
Arrival Type (*AT*)	3	3	3	3	3	3		3				
Upstream Filtering (*I*)	1.00	1.00	1.00	1.00	1.00	1.00		1.00				
Lane Width (*W*), ft		12.0			12.0			12.0				
Turn Bay Length, ft		100			0			400				
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h	25	25	25	25	25	25		25				

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s		11.0		11.0		99.0		
Yellow Change Interval (*Y*), s		4.0		4.0		4.0		
Red Clearance Interval (R_c), s		0.0		0.0		2.0		
Minimum Green (G_{min}), s		6		6		7		
Start-Up Lost Time (*l1*), s	2.0	2.0	2.0	2.0		2.0		
Extension of Effective Green (*e*), s	2.0	2.0	2.0	2.0		2.0		
Passage (*PT*), s		2.0		2.0		2.0		
Recall Mode		Min		Min		Off		
Dual Entry		Yes		Yes		No		
Walk (*Walk*), s		0.0				0.0		0.0
Pedestrian Clearance Time (*PC*), s		0.0				0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25				0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0				9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0		No	0	0	No		0	
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0			
Pedestrian Signal / Occupied Parking	No	0.50			0.50		No	0.50		No		

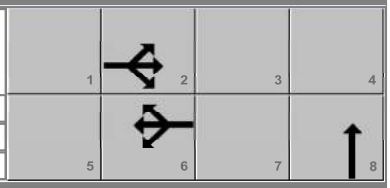
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	Build PM	PHF	0.96
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	NB SR 7	File Name	Cadiz Pike Signals Build 2045 PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	560	0	0	0	0	0		560				

Signal Information											
Cycle, s	110.0	Reference Phase	2								
Offset, s	21	Reference Point	End								
Uncoordinated	No	Simult. Gap E/W	On	Green	63.2	36.8	0.0	0.0	0.0	0.0	
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
				Red	0.0	2.0	0.0	0.0	0.0	0.0	



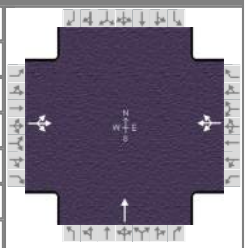
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		
Case Number		8.0		8.0		12.0		
Phase Duration, s		67.2		67.2		42.8		
Change Period, (*Y+R c*), s		4.0		4.0		6.0		
Max Allow Headway (*MAH*), s		0.0		0.0		3.2		
Queue Clearance Time (*g s*), s						35.5		
Green Extension Time (*g e*), s		0.0		0.0		1.3		
Phase Call Probability						1.00		
Max Out Probability						0.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16		8				
Adjusted Flow Rate (*v*), veh/h		445			0			583				
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1395			0			1856				
Queue Service Time (*g s*), s		25.5			0.0			33.5				
Cycle Queue Clearance Time (*g c*), s		25.5			0.0			33.5				
Green Ratio (*g/C*)		0.57						0.33				
Capacity (*c*), veh/h		866						621				
Volume-to-Capacity Ratio (*X*)		0.514			0.000			0.939				
Back of Queue (*Q*), ft/ln (95 th percentile)		361.2			0			564.3				
Back of Queue (*Q*), veh/ln (95 th percentile)		14.0			0.0			22.0				
Queue Storage Ratio (*RQ*) (95 th percentile)		3.61			0.00			1.41				
Uniform Delay (*d 1*), s/veh		19.6						35.5				
Incremental Delay (*d 2*), s/veh		2.2			0.0			3.2				
Initial Queue Delay (*d 3*), s/veh		0.0			0.0			0.0				
Control Delay (*d*), s/veh		21.8						38.7				
Level of Service (LOS)		C						D				
Approach Delay, s/veh / LOS	21.8	C		0.0			38.7	D		0.0		
Intersection Delay, s/veh / LOS	31.4						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.37	A	1.37	A	1.74	B	1.74	B
Bicycle LOS Score / LOS	1.45	A	0.49	A	1.45	A		

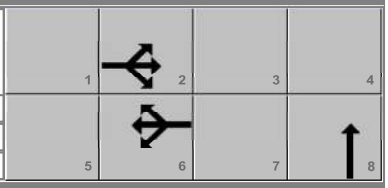
HCS7 Signalized Intersection Intermediate Values

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	Build PM	PHF	0.96
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	NB SR 7	File Name	Cadiz Pike Signals Build 2045 PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	560	0	0	0	0	0		560				

Signal Information											
Cycle, s	110.0	Reference Phase	2								
Offset, s	21	Reference Point	End	Green	63.2	36.8	0.0	0.0	0.0	0.0	
Uncoordinated	No	Simult. Gap E/W	On	Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Force Mode	Fixed	Simult. Gap N/S	On	Red	0.0	2.0	0.0	0.0	0.0	0.0	



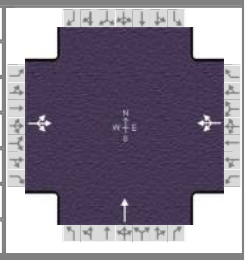
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Heavy Vehicles and Grade Factor (f_{HVg})	0.883	0.969	1.000	1.000	1.000	1.000	1.000	0.977	1.000			
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	0.758	0.758		1.000	1.000		1.000	1.000				
Right-Turn Adjustment Factor (f_{RT})		0.000	0.758		0.000	1.000		0.000	0.000			
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000			1.000			1.000					
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Movement Saturation Flow Rate (s), veh/h	1395	0	0	0	1900	0	0	1856	0			
Proportion of Vehicles Arriving on Green (P)	0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00
Incremental Delay Factor (k)		0.50						0.04				

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		4.0		4.0		4.0		
Green Ratio (g/C)		0.57		0.57		0.33		
Permitted Saturation Flow Rate (s_p), veh/h/ln		1440		1440		0		
Shared Saturation Flow Rate (s_{sh}), veh/h/ln		0		1900				
Permitted Effective Green Time (g_p), s		63.2		0.0		0.0		
Permitted Service Time (g_u), s		63.2		0.0		0.0		
Permitted Queue Service Time (g_{ps}), s		25.5						
Time to First Blockage (g_f), s		0.0		63.2		0.0		
Queue Service Time Before Blockage (g_{fs}), s		0.0						
Protected Right Saturation Flow (s_R), veh/h/ln								
Protected Right Effective Green Time (g_R), s								

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	0.681	0.000	0.681	0.000	0.972	0.000	0.972	0.000
Pedestrian F_s / F_{delay}	0.000	0.092	0.000	0.092	0.000	0.166	0.000	0.164
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	1148.50	9.97	1148.50	9.97		62.22	-90.91	60.11
Bicycle F_w / F_v	-3.64	0.96	-3.64	0.00	-3.64	0.96	-3.64	

HCS7 Signalized Intersection Results Graphical Summary

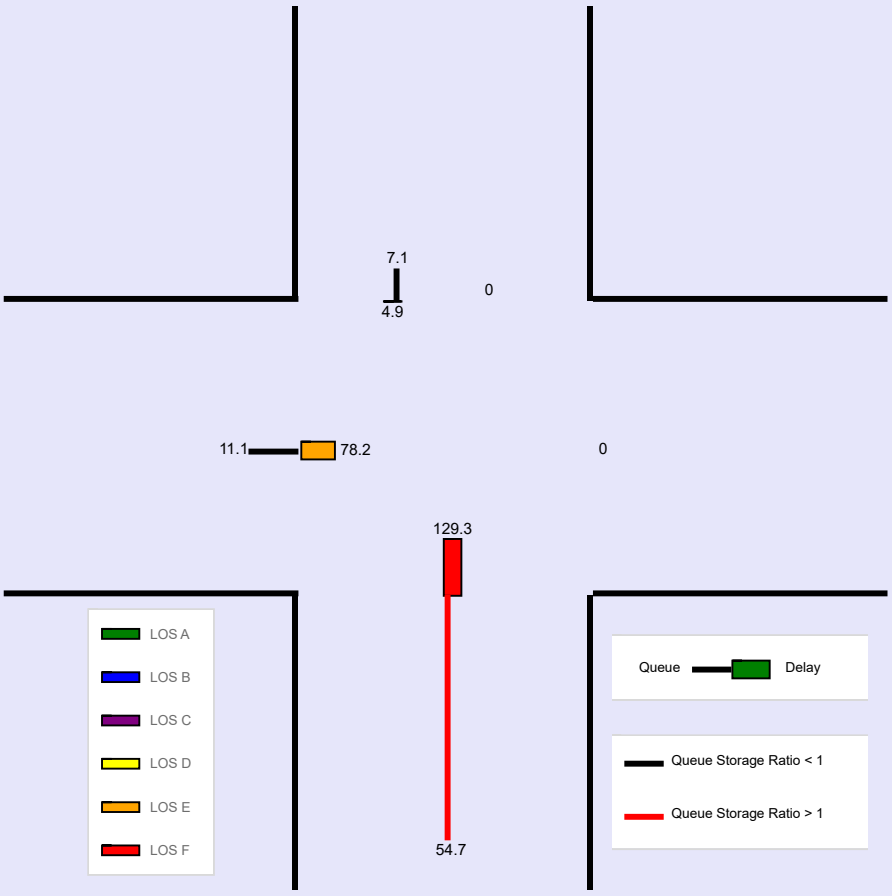
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	Build PM	PHF	0.96
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	NB SR 7	File Name	Cadiz Pike Signals Build 2045 PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	560	0	0	0	0	0		560				

Signal Information												
Cycle, s	110.0	Reference Phase	2									
Offset, s	21	Reference Point	End	Green	63.2	36.8	0.0	0.0	0.0	0.0		
Uncoordinated	No	Simult. Gap E/W	On	Yellow	4.0	4.0	0.0	0.0	0.0	0.0		
Force Mode	Fixed	Simult. Gap N/S	On	Red	0.0	2.0	0.0	0.0	0.0	0.0		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (*Q*), ft/ln (95 th percentile)		361.2			0			564.3				
Back of Queue (*Q*), veh/ln (95 th percentile)		14.0			0.0			22.0				
Queue Storage Ratio (*RQ*) (95 th percentile)		3.61			0.00			1.41				
Control Delay (*d*), s/veh		21.8						38.7				
Level of Service (LOS)		C						D				
Approach Delay, s/veh / LOS	21.8	C		0.0			38.7	D		0.0		
Intersection Delay, s/veh / LOS	31.4	C										



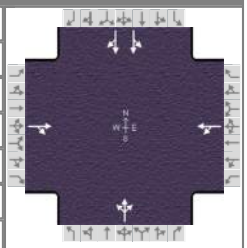
--- Messages ---

WARNING: Since queue spillover from turn lanes and spillback into upstream intersections is not accounted for in the HCM procedures, use of a simulation tool may be advised in situations where the Queue Storage Ratio exceeds 1.0.

--- Comments ---

HCS7 Signalized Intersection Input Data

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	Build PM	PHF	0.98
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	SB SR 7	File Name	Cadiz Pike Signals Build 2045 PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		20	160	0	0		250	0	540	0	1070	40

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	15.0	83.0	0.0	0.0	0.0	0.0	1 2 3 4	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	5 6 7 8	
Red	2.0	2.0	0.0	0.0	0.0	0.0		

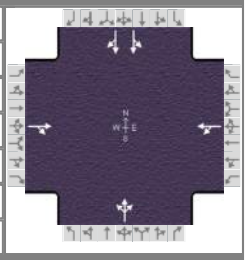
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		20	160	0	0		250	0	540	0	1070	40
Initial Queue (Q_b), veh/h		0	0	0	0		0	0	0	0	0	0
Base Saturation Flow Rate (s_o), veh/h		1900	1900	1900	1900		1900	1900	1900	1900	1900	1900
Parking (N_m), man/h		None			None			None			None	
Heavy Vehicles (P_{HV}), %		4			0			3			5	
Ped / Bike / RTOR, /h	0	0	0	0	0		0	0	0	0	0	0
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0	0	0	0
Arrival Type (*AT*)		3	3	3	3		3	3	3	3	3	3
Upstream Filtering (*I*)		1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Lane Width (*W*), ft		12.0			12.0			12.0			12.0	
Turn Bay Length, ft		1500			0			375			750	
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h		25	25	25	25		25	25	25	25	25	25

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s		21.0		21.0		89.0		89.0
Yellow Change Interval (*Y*), s		4.0		4.0		4.0		4.0
Red Clearance Interval (R_c), s		2.0		0.0		2.0		2.0
Minimum Green (G_{min}), s		7		6		7		7
Start-Up Lost Time (*l1*), s		2.0	2.0	2.0	2.0	2.0	2.0	2.0
Extension of Effective Green (*e*), s		2.0	2.0	2.0	2.0	2.0	2.0	2.0
Passage (*PT*), s		2.0		2.0		2.0		2.0
Recall Mode		Min		Min		Off		Off
Dual Entry		Yes		Yes		Yes		Yes
Walk (*Walk*), s		0.0		0.0		0.0		0.0
Pedestrian Clearance Time (*PC*), s		0.0		0.0		0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25	0	No	25	0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0	9.0	12	0	9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0	0	No	0	0	No	0	0	No
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0
Pedestrian Signal / Occupied Parking	No	0.50		No	0.50		No	0.50		No	0.50	

HCS7 Signalized Intersection Results Summary

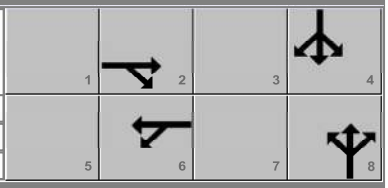
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	Build PM	PHF	0.98
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	SB SR 7	File Name	Cadiz Pike Signals Build 2045 PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		20	160	0	0		250	0	540	0	1070	40

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	15.0	83.0	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	2.0	2.0	0.0	0.0	0.0	0.0	



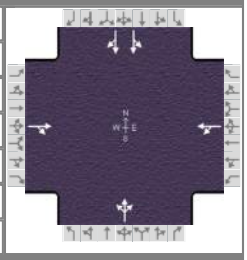
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		8.0		8.0		8.0		8.0
Phase Duration, s		21.0		21.0		89.0		89.0
Change Period, ($Y+R_c$), s		6.0		6.0		6.0		6.0
Max Allow Headway (*MAH*), s		0.0		0.0		3.9		3.9
Queue Clearance Time (g_s), s						85.0		14.3
Green Extension Time (g_e), s		0.0		0.0		0.0		10.3
Phase Call Probability						1.00		1.00
Max Out Probability						1.00		0.01

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h		184			0			806		0		563
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1587			0			824		0		1802
Queue Service Time (g_s), s		12.4			0.0			70.7		0.0		12.3
Cycle Queue Clearance Time (g_c), s		12.4			0.0			83.0		0.0		12.3
Green Ratio (*g/C*)		0.14						0.75				0.75
Capacity (*c*), veh/h		216						665				1360
Volume-to-Capacity Ratio (*X*)		0.849			0.000			1.212		0.000		0.414
Back of Queue (*Q*), ft/ln (95 th percentile)		287			0			1401.5		0		178.5
Back of Queue (*Q*), veh/ln (95 th percentile)		11.1			0.0			54.7		0.0		7.1
Queue Storage Ratio (*RQ*) (95 th percentile)		0.19			0.00			3.74		0.00		0.25
Uniform Delay (d_1), s/veh		46.4						20.2				4.8
Incremental Delay (d_2), s/veh		31.8			0.0			109.1		0.0		0.1
Initial Queue Delay (d_3), s/veh		0.0			0.0			0.0		0.0		0.0
Control Delay (*d*), s/veh		78.2						129.3				4.9
Level of Service (LOS)		E						F				A
Approach Delay, s/veh / LOS	78.2	E		0.0			129.3	F		4.9	A	
Intersection Delay, s/veh / LOS	58.5						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.95	B	1.94	B	1.62	B	1.62	B
Bicycle LOS Score / LOS	0.79	A	0.49	A	1.82	B	1.42	A

HCS7 Signalized Intersection Intermediate Values

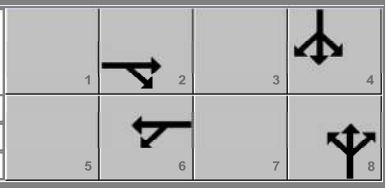
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	Build PM	PHF	0.98
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	SB SR 7	File Name	Cadiz Pike Signals Build 2045 PM.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		20	160	0	0		250	0	540	0	1070	40

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	15.0	83.0	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	2.0	2.0	0.0	0.0	0.0	0.0	



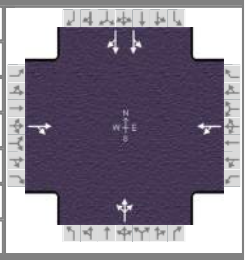
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles and Grade Factor (f_{HVg})	1.000	0.969	1.000	1.000	1.000	1.000	1.000	0.977	0.977	1.000	0.961	1.000
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	1.000	0.862		1.000	1.000		0.474	0.444		1.000	1.000	
Right-Turn Adjustment Factor (f_{RT})		0.000	0.862		0.000	1.000		0.000	0.444		0.987	0.987
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000			1.000			1.000			1.000		
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			1.000
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Movement Saturation Flow Rate (s), veh/h	0	176	1411	0	1900	0	261	0	563	0	3498	131
Proportion of Vehicles Arriving on Green (P)	0.00	0.14	0.14	0.14	0.14	0.14	0.75	0.00	0.75	0.00	0.75	0.75
Incremental Delay Factor (k)		0.50						0.50				0.04

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		6.0		6.0		6.0		6.0
Green Ratio (g/C)		0.14		0.14		0.75		0.75
Permitted Saturation Flow Rate (s_p), veh/h/ln		1440		1219		505		870
Shared Saturation Flow Rate (s_{sh}), veh/h/ln		0		0		0		1826
Permitted Effective Green Time (g_p), s		0.0		0.0		83.0		0.0
Permitted Service Time (g_u), s		0.0		0.0		70.7		0.0
Permitted Queue Service Time (g_{ps}), s						70.7		
Time to First Blockage (g_f), s		15.0		15.0		1.6		83.0
Queue Service Time Before Blockage (g_{fs}), s						1.6		
Protected Right Saturation Flow (s_R), veh/h/ln								
Protected Right Effective Green Time (g_R), s								

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	1.198	0.000	1.198	0.000	0.972	0.000	0.972	0.000
Pedestrian F_s / F_{delay}	0.000	0.149	0.000	0.147	0.000	0.048	0.000	0.048
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	272.73	41.02	309.09	39.31	1509.09	3.31	1509.09	3.31
Bicycle F_w / F_v	-3.64	0.30	-3.64	0.00	-3.64	1.33	-3.64	0.93

HCS7 Signalized Intersection Results Graphical Summary

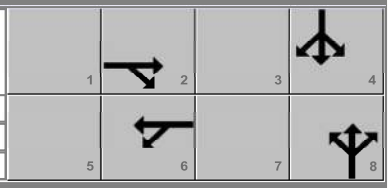
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	Build PM	PHF	0.98
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	SB SR 7	File Name	Cadiz Pike Signals Build 2045 PM.xus		
Project Description	BEL-7-19.75				



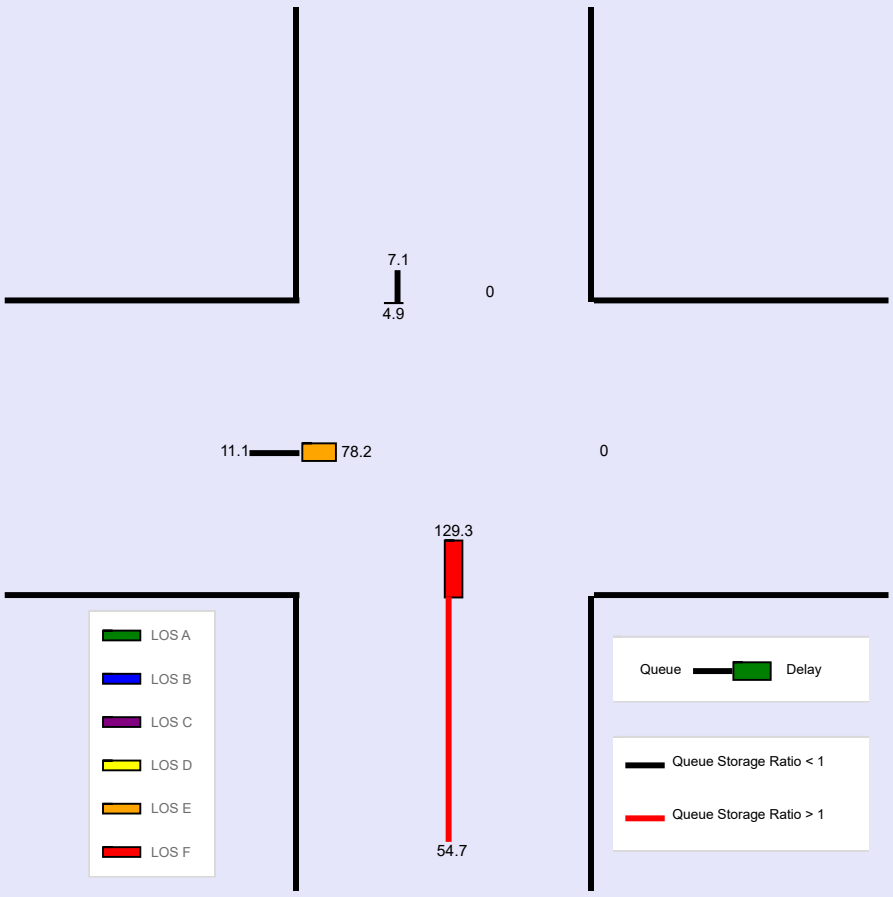
Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		20	160	0	0		250	0	540	0	1070	40

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	15.0	83.0	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	2.0	2.0	0.0	0.0	0.0	0.0	



Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (*Q*), ft/ln (95 th percentile)		287			0			1401.5		0		178.5
Back of Queue (*Q*), veh/ln (95 th percentile)		11.1			0.0			54.7		0.0		7.1
Queue Storage Ratio (*RQ*) (95 th percentile)		0.19			0.00			3.74		0.00		0.25
Control Delay (*d*), s/veh		78.2						129.3				4.9
Level of Service (LOS)		E						F				A
Approach Delay, s/veh / LOS	78.2		E	0.0			129.3		F	4.9		A
Intersection Delay, s/veh / LOS	58.5						E					



--- Messages ---

WARNING: Since queue spillover from turn lanes and spillback into upstream intersections is not accounted for in the HCM procedures, use of a simulation tool may be advised in situations where the Queue Storage Ratio exceeds 1.0.

WARNING: If demand exceeds capacity, a multiple-period analysis should be conducted.

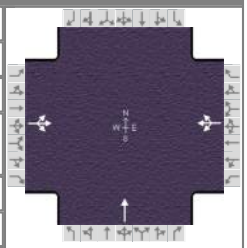
--- Comments ---

Cadiz Pike Intersection Analysis With NB Right

PM Peak

HCS7 Signalized Intersection Input Data

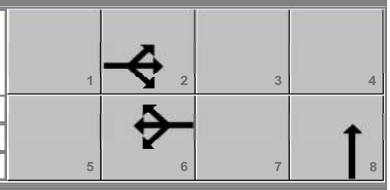
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM with NB Right	PHF	0.96
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	NB SR 7	File Name	Cadiz Pike Signals No-Build 2045 PM - With NBR…		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	590	0	0	0	0	0		520				

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	52	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	37.3	22.7	0.0	0.0	0.0	0.0						
Yellow	4.0	4.0	0.0	0.0	0.0	0.0						
Red	0.0	2.0	0.0	0.0	0.0	0.0						



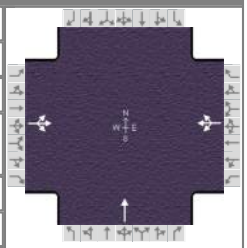
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	590	0	0	0	0	0		520				
Initial Queue (Q_b), veh/h	0	0	0	0	0	0		0				
Base Saturation Flow Rate (s_o), veh/h	1900	1900	1900	1900	1900	1900		1900				
Parking (N_m), man/h	0	L + R	0		None			None				
Heavy Vehicles (P_{HV}), %		4			0			3				
Ped / Bike / RTOR, /h	0	0		0	0		0	0		0	0	
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0			
Arrival Type (*AT*)	3	3	3	3	3	3		3				
Upstream Filtering (*I*)	1.00	1.00	1.00	1.00	1.00	1.00		1.00				
Lane Width (*W*), ft		12.0			12.0			12.0				
Turn Bay Length, ft		100			0			400				
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h	25	25	25	25	25	25		25				

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s		11.0		11.0		59.0		
Yellow Change Interval (*Y*), s		4.0		4.0		4.0		
Red Clearance Interval (R_c), s		0.0		0.0		2.0		
Minimum Green (G_{min}), s		6		6		7		
Start-Up Lost Time (*l1*), s	2.0	2.0	2.0	2.0		2.0		
Extension of Effective Green (*e*), s	2.0	2.0	2.0	2.0		2.0		
Passage (*PT*), s		2.0		2.0		2.0		
Recall Mode		Min		Min		Off		
Dual Entry		Yes		Yes		No		
Walk (*Walk*), s		0.0				0.0		0.0
Pedestrian Clearance Time (*PC*), s		0.0				0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25				0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0				9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0		No	0	0	No		0	
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0			
Pedestrian Signal / Occupied Parking	No	0.50			0.50		No	0.50		No		

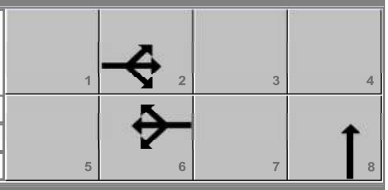
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM with NB Right	PHF	0.96
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	NB SR 7	File Name	Cadiz Pike Signals No-Build 2045 PM - With NBR…		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	590	0	0	0	0	0		520				

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	52	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	37.3	22.7	0.0	0.0	0.0	0.0		
Yellow	4.0	4.0	0.0	0.0	0.0	0.0		
Red	0.0	2.0	0.0	0.0	0.0	0.0		

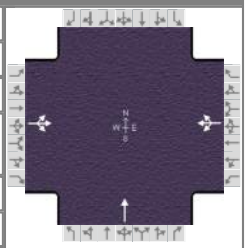
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		
Case Number		8.0		8.0		12.0		
Phase Duration, s		41.3		41.3		28.7		
Change Period, (*Y+R c*), s		4.0		4.0		6.0		
Max Allow Headway (*MAH*), s		0.0		0.0		3.2		
Queue Clearance Time (*g s*), s						21.5		
Green Extension Time (*g e*), s		0.0		0.0		1.2		
Phase Call Probability						1.00		
Max Out Probability						0.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16		8				
Adjusted Flow Rate (*v*), veh/h		602			0			542				
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1395			0			1856				
Queue Service Time (*g s*), s		17.4			0.0			19.5				
Cycle Queue Clearance Time (*g c*), s		17.4			0.0			19.5				
Green Ratio (*g/C*)		0.53						0.32				
Capacity (*c*), veh/h		847						601				
Volume-to-Capacity Ratio (*X*)		0.711			0.000			0.901				
Back of Queue (*Q*), ft/ln (95 th percentile)		151.2			0			335.7				
Back of Queue (*Q*), veh/ln (95 th percentile)		5.9			0.0			13.1				
Queue Storage Ratio (*RQ*) (95 th percentile)		1.51			0.00			0.84				
Uniform Delay (*d 1*), s/veh		5.1						22.6				
Incremental Delay (*d 2*), s/veh		5.0			0.0			2.1				
Initial Queue Delay (*d 3*), s/veh		0.0			0.0			0.0				
Control Delay (*d*), s/veh		10.2						24.7				
Level of Service (LOS)		B						C				
Approach Delay, s/veh / LOS	10.2	B		0.0			24.7	C		0.0		
Intersection Delay, s/veh / LOS	17.0						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.36	A	1.36	A	1.72	B	1.72	B
Bicycle LOS Score / LOS	1.50	B	0.49	A	1.38	A		

HCS7 Signalized Intersection Intermediate Values

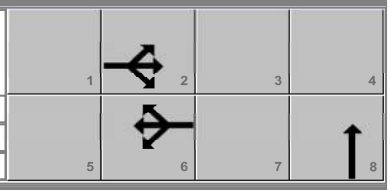
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM with NB Right	PHF	0.96
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	NB SR 7	File Name	Cadiz Pike Signals No-Build 2045 PM - With NBR…		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	590	0	0	0	0	0		520				

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	52	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	37.3	22.7	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	0.0	2.0	0.0	0.0	0.0	0.0	



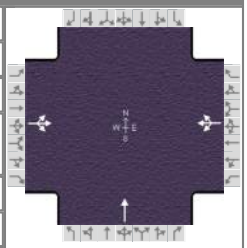
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Heavy Vehicles and Grade Factor (f_{HVg})	0.883	0.969	1.000	1.000	1.000	1.000	1.000	0.977	1.000			
Parking Activity Adjustment Factor (f_p)	1.000	0.900	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	0.758	0.758		1.000	1.000		1.000	1.000				
Right-Turn Adjustment Factor (f_{RT})		0.000	0.758		0.000	1.000		0.000	0.000			
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000			1.000			1.000					
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Movement Saturation Flow Rate (s), veh/h	1395	0	0	0	1900	0	0	1856	0			
Proportion of Vehicles Arriving on Green (P)	0.79	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.00	0.00	0.00	0.00
Incremental Delay Factor (k)		0.50						0.04				

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		4.0		4.0		4.0		
Green Ratio (g/C)		0.53		0.53		0.32		
Permitted Saturation Flow Rate (s_p), veh/h/ln		1440		1440		0		
Shared Saturation Flow Rate (s_{sh}), veh/h/ln		0		1900				
Permitted Effective Green Time (g_p), s		37.3		0.0		0.0		
Permitted Service Time (g_u), s		37.3		0.0		0.0		
Permitted Queue Service Time (g_{ps}), s		17.4						
Time to First Blockage (g_f), s		0.0		37.3		0.0		
Queue Service Time Before Blockage (g_{fs}), s		0.0						
Protected Right Saturation Flow (s_R), veh/h/ln								
Protected Right Effective Green Time (g_R), s								

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	0.681	0.000	0.681	0.000	0.972	0.000	0.972	0.000
Pedestrian F_s / F_{delay}	0.000	0.081	0.000	0.081	0.000	0.150	0.000	0.148
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	1066.48	7.63	1066.48	7.63	-200.00	42.35		40.18
Bicycle F_w / F_v	-3.64	1.01	-3.64	0.00	-3.64	0.89	-3.64	

HCS7 Signalized Intersection Results Graphical Summary

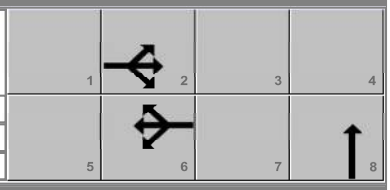
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM with NB Right	PHF	0.96
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	NB SR 7	File Name	Cadiz Pike Signals No-Build 2045 PM - With NBR…		
Project Description	BEL-7-19.75				



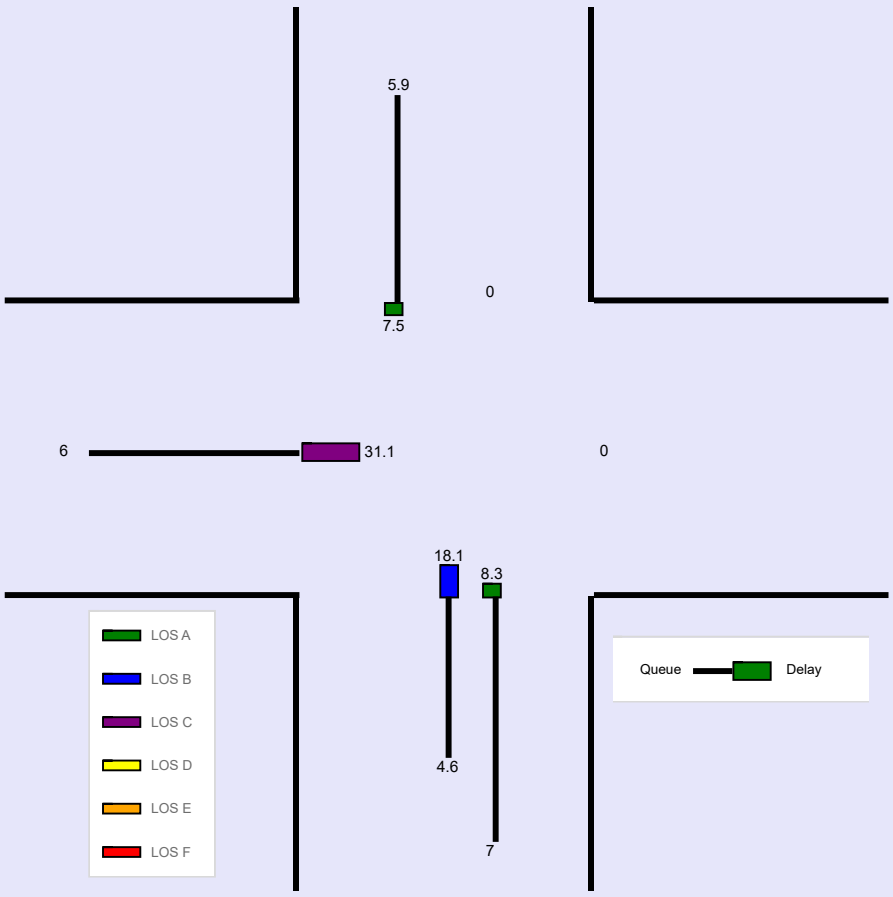
Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	590	0	0	0	0	0		520				

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	52	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	37.3	22.7	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	0.0	2.0	0.0	0.0	0.0	0.0	



Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (*Q*), ft/ln (95 th percentile)		151.2			0			335.7				
Back of Queue (*Q*), veh/ln (95 th percentile)		5.9			0.0			13.1				
Queue Storage Ratio (*RQ*) (95 th percentile)		1.51			0.00			0.84				
Control Delay (*d*), s/veh		10.2						24.7				
Level of Service (LOS)		B						C				
Approach Delay, s/veh / LOS	10.2		B	0.0			24.7		C	0.0		
Intersection Delay, s/veh / LOS	17.0					B						



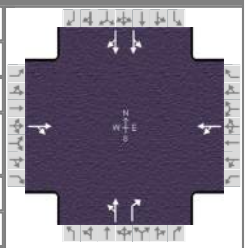
--- Messages ---

WARNING: Since queue spillover from turn lanes and spillback into upstream intersections is not accounted for in the HCM procedures, use of a simulation tool may be advised in situations where the Queue Storage Ratio exceeds 1.0.

--- Comments ---

HCS7 Signalized Intersection Input Data

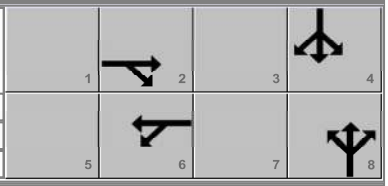
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM with NB Right	PHF	0.98
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	SB SR 7	File Name	Cadiz Pike Signals No-Build 2045 PM - With NBR…		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		40	150	0	0		200	0	550	0	970	70

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	15.0	43.0	0.0	0.0	0.0	0.0						
Yellow	4.0	4.0	0.0	0.0	0.0	0.0						
Red	2.0	2.0	0.0	0.0	0.0	0.0						



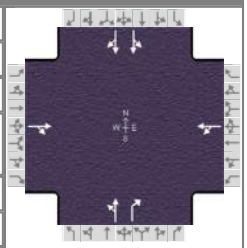
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		40	150	0	0		200	0	550	0	970	70
Initial Queue (Q_b), veh/h		0	0	0	0		0	0	0	0	0	0
Base Saturation Flow Rate (s_o), veh/h		1900	1900	1900	1900		1900	1900	1900	1900	1900	1900
Parking (N_m), man/h		None			None			None			None	
Heavy Vehicles (P_{HV}), %		4			0			3	3		5	
Ped / Bike / RTOR, /h	0	0	0	0	0		0	0	0	0	0	0
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0	0	0	0
Arrival Type (*AT*)		3	3	3	3		3	3	3	3	3	3
Upstream Filtering (*I*)		1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Lane Width (*W*), ft		12.0			12.0			12.0	12.0		12.0	
Turn Bay Length, ft		1500			0			375	375		750	
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h		35	35	35	35		35	35	35	35	35	35

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s		13.0		13.0		57.0		57.0
Yellow Change Interval (*Y*), s		4.0		4.0		4.0		4.0
Red Clearance Interval (R_c), s		2.0		0.0		2.0		2.0
Minimum Green (G_{min}), s		7		6		7		7
Start-Up Lost Time (*l1*), s		2.0	2.0	2.0	2.0	2.0	2.0	2.0
Extension of Effective Green (*e*), s		2.0	2.0	2.0	2.0	2.0	2.0	2.0
Passage (*PT*), s		2.0		2.0		2.0		2.0
Recall Mode		Min		Min		Off		Off
Dual Entry		Yes		Yes		Yes		Yes
Walk (*Walk*), s		0.0		0.0		0.0		0.0
Pedestrian Clearance Time (*PC*), s		0.0		0.0		0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25	0	No	25	0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0	9.0	12	0	9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0	0	No	0	0	No	0	0	No
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0
Pedestrian Signal / Occupied Parking	No	0.50		No	0.50		No	0.50		No	0.50	

HCS7 Signalized Intersection Results Summary

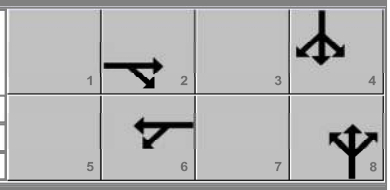
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM with NB Right	PHF	0.98
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	SB SR 7	File Name	Cadiz Pike Signals No-Build 2045 PM - With NBR…		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		40	150	0	0		200	0	550	0	970	70

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	15.0	43.0	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	2.0	2.0	0.0	0.0	0.0	0.0	



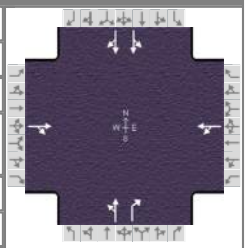
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		8.0		8.0		7.0		8.0
Phase Duration, s		21.0		21.0		49.0		49.0
Change Period, ($Y+R_c$), s		6.0		6.0		6.0		6.0
Max Allow Headway (*MAH*), s		0.0		0.0		3.6		3.6
Queue Clearance Time (g_s), s						38.0		13.2
Green Extension Time (g_e), s		0.0		0.0		5.0		6.5
Phase Call Probability						1.00		1.00
Max Out Probability						0.35		0.02

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h		194			0			204	561	0		524
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1612			0			385	1572	0		1782
Queue Service Time (g_s), s		7.5			0.0			24.4	15.0	0.0		11.2
Cycle Queue Clearance Time (g_c), s		7.5			0.0			36.0	15.0	0.0		11.2
Green Ratio (*g/C*)		0.21						0.61	0.61			0.61
Capacity (*c*), veh/h		345						340	967			1096
Volume-to-Capacity Ratio (*X*)		0.562			0.000			0.601	0.581	0.000		0.479
Back of Queue (*Q*), ft/ln (95 th percentile)		153.7			0			118.4	178.6	0		147.8
Back of Queue (*Q*), veh/ln (95 th percentile)		6.0			0.0			4.6	7.0	0.0		5.9
Queue Storage Ratio (*RQ*) (95 th percentile)		0.10			0.00			0.32	0.48	0.00		0.20
Uniform Delay (d_1), s/veh		24.6						17.4	8.1			7.4
Incremental Delay (d_2), s/veh		6.5			0.0			0.8	0.2	0.0		0.1
Initial Queue Delay (d_3), s/veh		0.0			0.0			0.0	0.0	0.0		0.0
Control Delay (*d*), s/veh		31.1						18.1	8.3			7.5
Level of Service (LOS)		C						B	A			A
Approach Delay, s/veh / LOS	31.1	C		0.0			10.9	B		7.5	A	
Intersection Delay, s/veh / LOS	11.0						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.11	B	1.92	B	1.64	B	1.64	B
Bicycle LOS Score / LOS	0.81	A	0.49	A	1.75	B	1.36	A

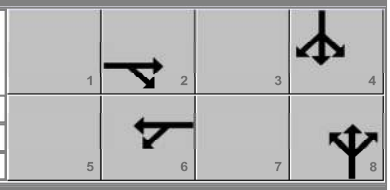
HCS7 Signalized Intersection Intermediate Values

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM with NB Right	PHF	0.98
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	SB SR 7	File Name	Cadiz Pike Signals No-Build 2045 PM - With NBR…		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		40	150	0	0		200	0	550	0	970	70

Signal Information												
Cycle, s	70.0	Reference Phase	2									
Offset, s	0	Reference Point	End									
Uncoordinated	No	Simult. Gap E/W	On	Green	15.0	43.0	0.0	0.0	0.0	0.0		
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	4.0	4.0	0.0	0.0	0.0	0.0		
				Red	2.0	2.0	0.0	0.0	0.0	0.0		



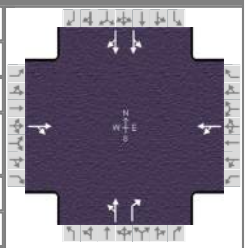
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles and Grade Factor (f_{HVg})	1.000	0.969	1.000	1.000	1.000	1.000	1.000	0.977	0.977	1.000	0.961	1.000
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	1.000	0.876		1.000	1.000		0.207	0.207		1.000	1.000	
Right-Turn Adjustment Factor (f_{RT})		0.000	0.876		0.000	1.000		0.000	0.847		0.976	0.976
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000			1.000			1.000			1.000		
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			1.000
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Movement Saturation Flow Rate (s), veh/h	0	339	1272	0	1900	0	385	0	1572	0	3365	243
Proportion of Vehicles Arriving on Green (P)	0.00	0.21	0.21	0.21	0.21	0.21	0.61	0.00	0.61	0.00	0.61	0.61
Incremental Delay Factor (k)		0.50						0.05	0.04			0.04

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		6.0		6.0		6.0		6.0
Green Ratio (g/C)		0.21		0.21		0.61		0.61
Permitted Saturation Flow Rate (s_p), veh/h/ln		1440		1208		540		1440
Shared Saturation Flow Rate (s_{sh}), veh/h/ln		0		0		0		1826
Permitted Effective Green Time (g_p), s		0.0		0.0		43.0		0.0
Permitted Service Time (g_u), s		0.0		0.0		31.4		0.0
Permitted Queue Service Time (g_{ps}), s						24.4		
Time to First Blockage (g_f), s		15.0		15.0		0.0		43.0
Queue Service Time Before Blockage (g_{fs}), s						0.0		
Protected Right Saturation Flow (s_R), veh/h/ln						0		
Protected Right Effective Green Time (g_R), s						0.0		

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	1.389	0.000	1.198	0.000	0.972	0.000	0.972	0.000
Pedestrian F_s / F_{delay}	0.000	0.123	0.000	0.120	0.000	0.066	0.000	0.066
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	428.60	21.61	485.74	20.06	1228.55	5.21	1228.55	5.21
Bicycle F_w / F_v	-3.64	0.32	-3.64	0.00	-3.64	1.26	-3.64	0.88

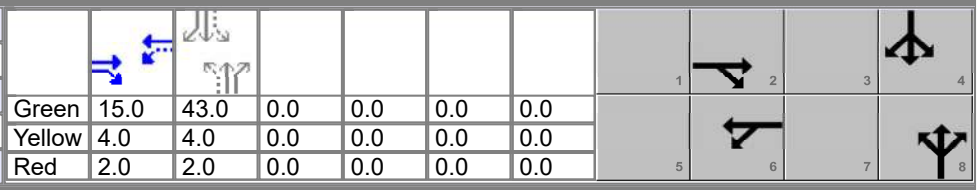
HCS7 Signalized Intersection Results Graphical Summary

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	No-Build PM with NB Right	PHF	0.98
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	SB SR 7	File Name	Cadiz Pike Signals No-Build 2045 PM - With NBR…		
Project Description	BEL-7-19.75				



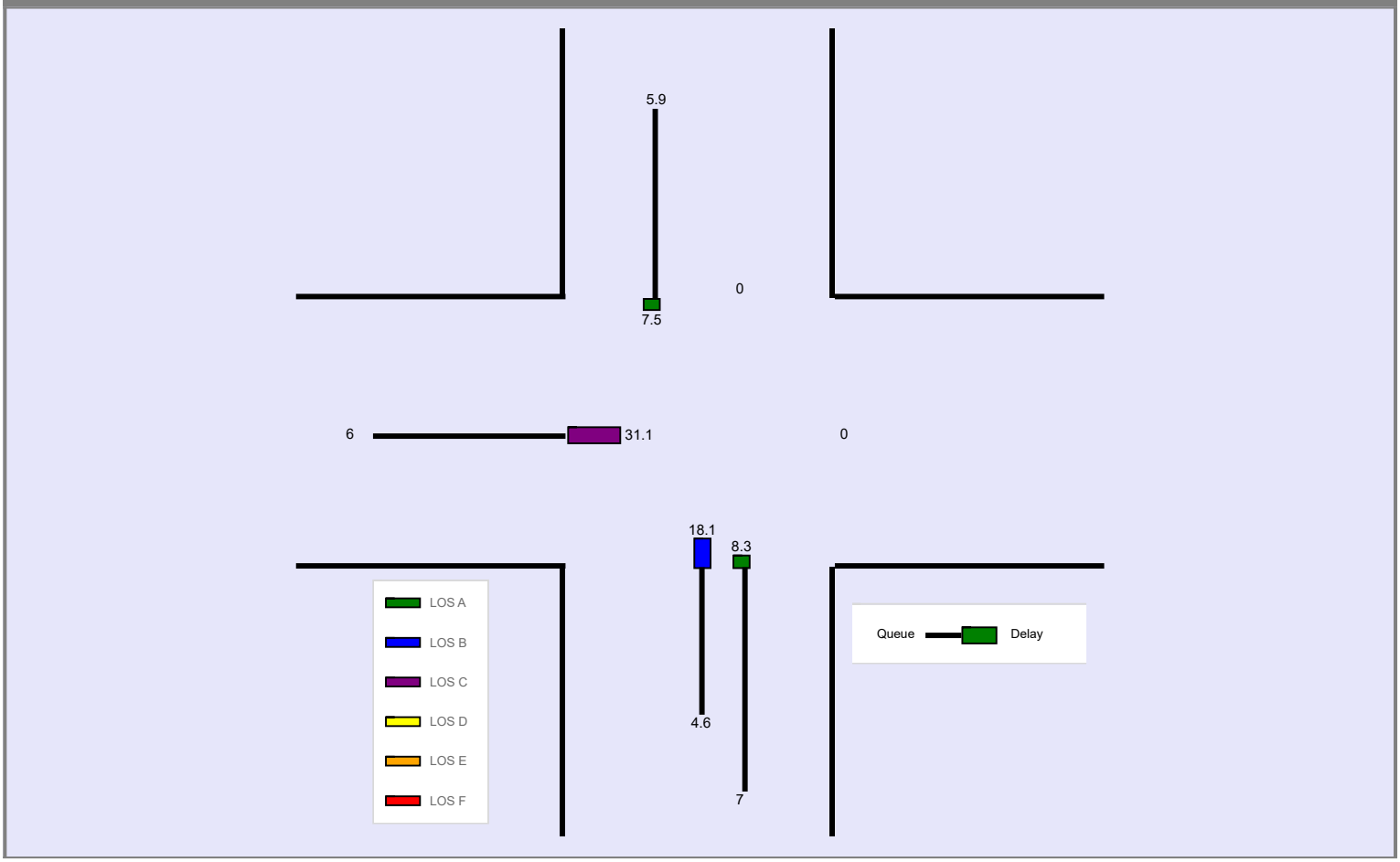
Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		40	150	0	0		200	0	550	0	970	70

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	15.0	43.0	0.0	0.0	0.0	0.0						
Yellow	4.0	4.0	0.0	0.0	0.0	0.0						
Red	2.0	2.0	0.0	0.0	0.0	0.0						

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (*Q*), ft/ln (95 th percentile)		153.7			0			118.4	178.6	0		147.8
Back of Queue (*Q*), veh/ln (95 th percentile)		6.0			0.0			4.6	7.0	0.0		5.9
Queue Storage Ratio (*RQ*) (95 th percentile)		0.10			0.00			0.32	0.48	0.00		0.20
Control Delay (*d*), s/veh		31.1						18.1	8.3			7.5
Level of Service (LOS)		C						B	A			A
Approach Delay, s/veh / LOS	31.1	C		0.0			10.9	B		7.5	A	
Intersection Delay, s/veh / LOS	11.0						B					



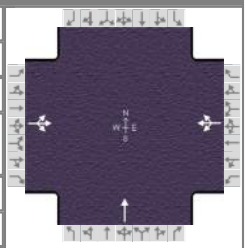
--- Messages ---

No errors or warnings exist.

--- Comments ---

HCS7 Signalized Intersection Input Data

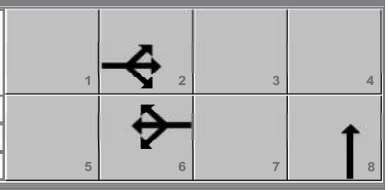
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	Build PM with NB Right	PHF	0.96
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	NB SR 7	File Name	Cadiz Pike Signals Build 2045 PM - With NBR.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	560	0	0	0	0	0		560				

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	52	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	35.8	24.2	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	0.0	2.0	0.0	0.0	0.0	0.0	



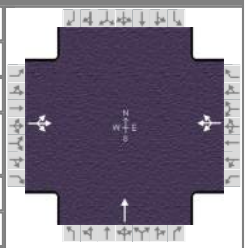
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	560	0	0	0	0	0		560				
Initial Queue (Q_b), veh/h	0	0	0	0	0	0		0				
Base Saturation Flow Rate (s_o), veh/h	1900	1900	1900	1900	1900	1900		1900				
Parking (N_m), man/h	0	L + R	0		None			None				
Heavy Vehicles (P_{HV}), %		4			0			3				
Ped / Bike / RTOR, /h	0	0		0	0		0	0		0	0	
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0			
Arrival Type (*AT*)	3	3	3	3	3	3		3				
Upstream Filtering (*I*)	1.00	1.00	1.00	1.00	1.00	1.00		1.00				
Lane Width (*W*), ft		12.0			12.0			12.0				
Turn Bay Length, ft		100			0			400				
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h	25	25	25	25	25	25		25				

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s		13.0		13.0		57.0		
Yellow Change Interval (*Y*), s		4.0		4.0		4.0		
Red Clearance Interval (R_c), s		0.0		0.0		2.0		
Minimum Green (G_{min}), s		6		6		7		
Start-Up Lost Time (*l1*), s	2.0	2.0	2.0	2.0		2.0		
Extension of Effective Green (*e*), s	2.0	2.0	2.0	2.0		2.0		
Passage (*PT*), s		2.0		2.0		2.0		
Recall Mode		Min		Min		Off		
Dual Entry		Yes		Yes		No		
Walk (*Walk*), s		0.0				0.0		0.0
Pedestrian Clearance Time (*PC*), s		0.0				0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25				0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0				9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0		No	0	0	No		0	
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0			
Pedestrian Signal / Occupied Parking	No	0.50			0.50		No	0.50		No		

HCS7 Signalized Intersection Results Summary

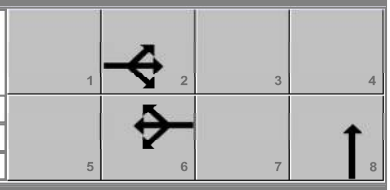
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	Build PM with NB Right	PHF	0.96
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	NB SR 7	File Name	Cadiz Pike Signals Build 2045 PM - With NBR.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	560	0	0	0	0	0		560				

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	52	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	35.8	24.2	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	0.0	2.0	0.0	0.0	0.0	0.0	



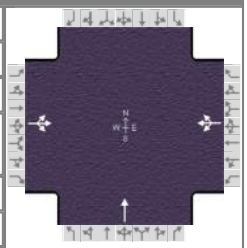
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		
Case Number		8.0		8.0		12.0		
Phase Duration, s		39.8		39.8		30.2		
Change Period, (*Y+R c*), s		4.0		4.0		6.0		
Max Allow Headway (*MAH*), s		0.0		0.0		3.2		
Queue Clearance Time (*g s*), s						23.0		
Green Extension Time (*g e*), s		0.0		0.0		1.3		
Phase Call Probability						1.00		
Max Out Probability						0.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16		8				
Adjusted Flow Rate (*v*), veh/h		571			0			583				
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1395			0			1856				
Queue Service Time (*g s*), s		17.7			0.0			21.0				
Cycle Queue Clearance Time (*g c*), s		17.7			0.0			21.0				
Green Ratio (*g/C*)		0.51						0.35				
Capacity (*c*), veh/h		815						643				
Volume-to-Capacity Ratio (*X*)		0.701			0.000			0.908				
Back of Queue (*Q*), ft/ln (95 th percentile)		164			0			353.6				
Back of Queue (*Q*), veh/ln (95 th percentile)		6.4			0.0			13.8				
Queue Storage Ratio (*RQ*) (95 th percentile)		1.64			0.00			0.88				
Uniform Delay (*d 1*), s/veh		6.3						21.8				
Incremental Delay (*d 2*), s/veh		5.0			0.0			2.1				
Initial Queue Delay (*d 3*), s/veh		0.0			0.0			0.0				
Control Delay (*d*), s/veh		11.2						23.9				
Level of Service (LOS)		B						C				
Approach Delay, s/veh / LOS	11.2		B	0.0			23.9		C	0.0		
Intersection Delay, s/veh / LOS	17.6						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.37	A	1.37	A	1.72	B	1.72	B
Bicycle LOS Score / LOS	1.45	A	0.49	A	1.45	A		

HCS7 Signalized Intersection Intermediate Values

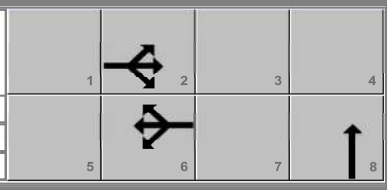
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	Build PM with NB Right	PHF	0.96
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	NB SR 7	File Name	Cadiz Pike Signals Build 2045 PM - With NBR.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	560	0	0	0	0	0		560				

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	52	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	35.8	24.2	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	0.0	2.0	0.0	0.0	0.0	0.0	



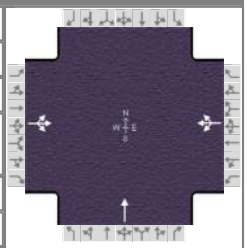
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Heavy Vehicles and Grade Factor (f_{HVg})	0.883	0.969	1.000	1.000	1.000	1.000	1.000	0.977	1.000			
Parking Activity Adjustment Factor (f_p)	1.000	0.900	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	0.758	0.758		1.000	1.000		1.000	1.000				
Right-Turn Adjustment Factor (f_{RT})		0.000	0.758		0.000	1.000		0.000	0.000			
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000			1.000			1.000					
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Movement Saturation Flow Rate (s), veh/h	1395	0	0	0	1900	0	0	1856	0			
Proportion of Vehicles Arriving on Green (P)	0.76	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.00	0.00	0.00	0.00
Incremental Delay Factor (k)		0.50						0.04				

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		4.0		4.0		4.0		
Green Ratio (g/C)		0.51		0.51		0.35		
Permitted Saturation Flow Rate (s_p), veh/h/ln		1440		1440		0		
Shared Saturation Flow Rate (s_{sh}), veh/h/ln		0		1900				
Permitted Effective Green Time (g_p), s		35.8		0.0		0.0		
Permitted Service Time (g_u), s		35.7		0.0		0.0		
Permitted Queue Service Time (g_{ps}), s		17.7						
Time to First Blockage (g_f), s		0.0		35.8		0.0		
Queue Service Time Before Blockage (g_{fs}), s		0.0						
Protected Right Saturation Flow (s_R), veh/h/ln								
Protected Right Effective Green Time (g_R), s								

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	0.681	0.000	0.681	0.000	0.972	0.000	0.972	0.000
Pedestrian F_s / F_{delay}	0.000	0.085	0.000	0.085	0.000	0.150	0.000	0.148
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	1021.47	8.38	1021.47	8.38	-200.00	42.35		40.18
Bicycle F_w / F_v	-3.64	0.96	-3.64	0.00	-3.64	0.96	-3.64	

HCS7 Signalized Intersection Results Graphical Summary

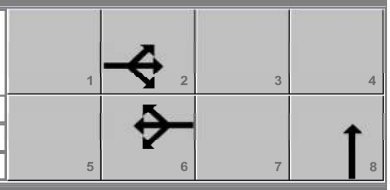
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	Build PM with NB Right	PHF	0.96
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	NB SR 7	File Name	Cadiz Pike Signals Build 2045 PM - With NBR.xus		
Project Description	BEL-7-19.75				



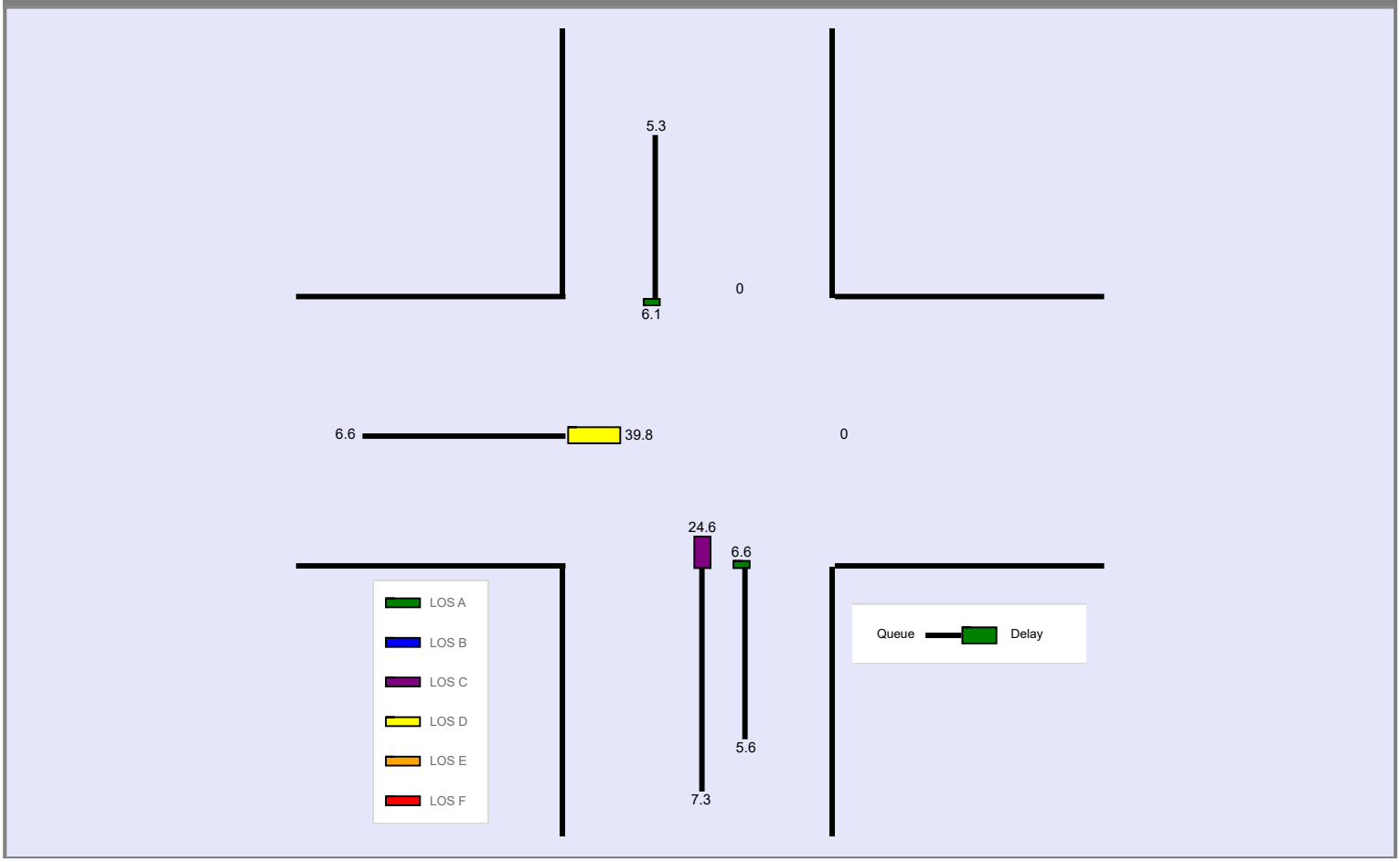
Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	560	0	0	0	0	0		560				

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	52	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	35.8	24.2	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	0.0	2.0	0.0	0.0	0.0	0.0	



Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (*Q*), ft/ln (95 th percentile)		164			0			353.6				
Back of Queue (*Q*), veh/ln (95 th percentile)		6.4			0.0			13.8				
Queue Storage Ratio (*RQ*) (95 th percentile)		1.64			0.00			0.88				
Control Delay (*d*), s/veh		11.2						23.9				
Level of Service (LOS)		B						C				
Approach Delay, s/veh / LOS	11.2		B	0.0			23.9		C	0.0		
Intersection Delay, s/veh / LOS	17.6						B					



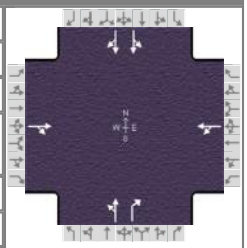
--- Messages ---

WARNING: Since queue spillover from turn lanes and spillback into upstream intersections is not accounted for in the HCM procedures, use of a simulation tool may be advised in situations where the Queue Storage Ratio exceeds 1.0.

--- Comments ---

HCS7 Signalized Intersection Input Data

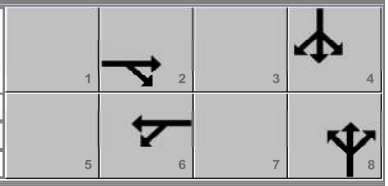
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	Build PM with NB Right	PHF	0.98
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	SB SR 7	File Name	Cadiz Pike Signals Build 2045 PM - With NBR.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		20	160	0	0		250	0	540	0	1070	40

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	12.0	46.0	0.0	0.0	0.0	0.0						
Yellow	4.0	4.0	0.0	0.0	0.0	0.0						
Red	2.0	2.0	0.0	0.0	0.0	0.0						



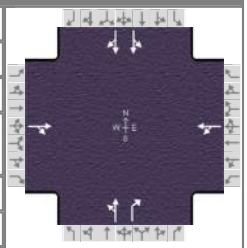
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		20	160	0	0		250	0	540	0	1070	40
Initial Queue (Q_b), veh/h		0	0	0	0		0	0	0	0	0	0
Base Saturation Flow Rate (s_o), veh/h		1900	1900	1900	1900		1900	1900	1900	1900	1900	1900
Parking (N_m), man/h		None			None			None			None	
Heavy Vehicles (P_{HV}), %		4			0			3	3		5	
Ped / Bike / RTOR, /h	0	0	0	0	0		0	0	0	0	0	0
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0	0	0	0
Arrival Type (*AT*)		3	3	3	3		3	3	3	3	3	3
Upstream Filtering (*I*)		1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Lane Width (*W*), ft		12.0			12.0			12.0	12.0		12.0	
Turn Bay Length, ft		1500			0			375	375		750	
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h		35	35	35	35		35	35	35	35	35	35

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s		18.0		18.0		52.0		52.0
Yellow Change Interval (*Y*), s		4.0		4.0		4.0		4.0
Red Clearance Interval (R_c), s		2.0		0.0		2.0		2.0
Minimum Green (G_{min}), s		7		6		7		7
Start-Up Lost Time (*lt*), s		2.0	2.0	2.0	2.0	2.0	2.0	2.0
Extension of Effective Green (*e*), s		2.0	2.0	2.0	2.0	2.0	2.0	2.0
Passage (*PT*), s		2.0		2.0		2.0		2.0
Recall Mode		Min		Min		Off		Off
Dual Entry		Yes		Yes		Yes		Yes
Walk (*Walk*), s		0.0		0.0		0.0		0.0
Pedestrian Clearance Time (*PC*), s		0.0		0.0		0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25	0	No	25	0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0	9.0	12	0	9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0	0	No	0	0	No	0	0	No
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0
Pedestrian Signal / Occupied Parking	No	0.50		No	0.50		No	0.50		No	0.50	

HCS7 Signalized Intersection Results Summary

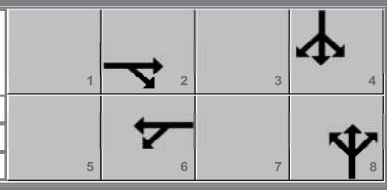
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	Build PM with NB Right	PHF	0.98
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	SB SR 7	File Name	Cadiz Pike Signals Build 2045 PM - With NBR.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		20	160	0	0		250	0	540	0	1070	40

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	12.0	46.0	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	2.0	2.0	0.0	0.0	0.0	0.0	



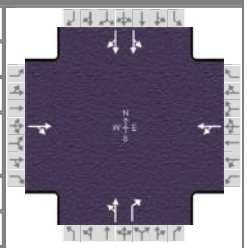
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		8.0		8.0		7.0		8.0
Phase Duration, s		18.0		18.0		52.0		52.0
Change Period, ($Y+R_c$), s		6.0		6.0		6.0		6.0
Max Allow Headway (*MAH*), s		0.0		0.0		3.7		3.7
Queue Clearance Time (g_s), s						48.0		12.9
Green Extension Time (g_e), s		0.0		0.0		0.0		7.7
Phase Call Probability						1.00		1.00
Max Out Probability						1.00		0.07

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h		184			0			255	551	0		563
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1587			0			376	1572	0		1802
Queue Service Time (g_s), s		7.6			0.0			35.1	12.9	0.0		10.9
Cycle Queue Clearance Time (g_c), s		7.6			0.0			46.0	12.9	0.0		10.9
Green Ratio (*g/C*)		0.17						0.66	0.66			0.66
Capacity (*c*), veh/h		272						350	1033			1184
Volume-to-Capacity Ratio (*X*)		0.675			0.000			0.729	0.533	0.000		0.475
Back of Queue (*Q*), ft/ln (95 th percentile)		169.8			0			185.8	142.7	0		132.5
Back of Queue (*Q*), veh/ln (95 th percentile)		6.6			0.0			7.3	5.6	0.0		5.3
Queue Storage Ratio (*RQ*) (95 th percentile)		0.11			0.00			0.50	0.38	0.00		0.18
Uniform Delay (d_1), s/veh		27.2						18.0	6.3			6.0
Incremental Delay (d_2), s/veh		12.7			0.0			6.6	0.3	0.0		0.1
Initial Queue Delay (d_3), s/veh		0.0			0.0			0.0	0.0	0.0		0.0
Control Delay (*d*), s/veh		39.8						24.6	6.6			6.1
Level of Service (LOS)		D						C	A			A
Approach Delay, s/veh / LOS	39.8	D		0.0			12.3	B		6.1	A	
Intersection Delay, s/veh / LOS	11.4						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.12	B	1.92	B	1.63	B	1.63	B
Bicycle LOS Score / LOS	0.79	A	0.49	A	1.82	B	1.42	A

HCS7 Signalized Intersection Intermediate Values

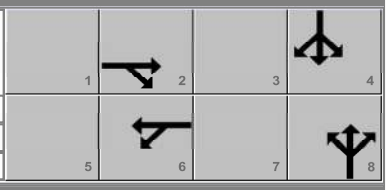
General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	Build PM with NB Right	PHF	0.98
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	SB SR 7	File Name	Cadiz Pike Signals Build 2045 PM - With NBR.xus		
Project Description	BEL-7-19.75				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		20	160	0	0		250	0	540	0	1070	40

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	12.0	46.0	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	2.0	2.0	0.0	0.0	0.0	0.0	



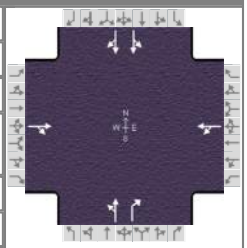
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles and Grade Factor (f_{HVg})	1.000	0.969	1.000	1.000	1.000	1.000	1.000	0.977	0.977	1.000	0.961	1.000
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	1.000	0.862		1.000	1.000		0.203	0.203		1.000	1.000	
Right-Turn Adjustment Factor (f_{RT})		0.000	0.862		0.000	1.000		0.000	0.847		0.987	0.987
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000			1.000			1.000			1.000		
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			1.000
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Movement Saturation Flow Rate (s), veh/h	0	176	1411	0	1900	0	376	0	1572	0	3498	131
Proportion of Vehicles Arriving on Green (P)	0.00	0.17	0.17	0.17	0.17	0.17	0.66	0.00	0.66	0.00	0.66	0.66
Incremental Delay Factor (k)		0.50						0.25	0.07			0.04

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		6.0		6.0		6.0		6.0
Green Ratio (g/C)		0.17		0.17		0.66		0.66
Permitted Saturation Flow Rate (s_p), veh/h/ln		1440		1219		505		1440
Shared Saturation Flow Rate (s_{sh}), veh/h/ln		0		0		0		1826
Permitted Effective Green Time (g_p), s		0.0		0.0		46.0		0.0
Permitted Service Time (g_u), s		0.0		0.0		35.1		0.0
Permitted Queue Service Time (g_{ps}), s						35.1		
Time to First Blockage (g_f), s		12.0		12.0		0.0		46.0
Queue Service Time Before Blockage (g_{fs}), s						0.0		
Protected Right Saturation Flow (s_R), veh/h/ln						0		
Protected Right Effective Green Time (g_R), s						0.0		

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	1.389	0.000	1.198	0.000	0.972	0.000	0.972	0.000
Pedestrian F_s / F_{delay}	0.000	0.127	0.000	0.125	0.000	0.057	0.000	0.057
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	342.86	24.03	400.00	22.40	1314.29	4.11	1314.29	4.11
Bicycle F_w / F_v	-3.64	0.30	-3.64	0.00	-3.64	1.33	-3.64	0.93

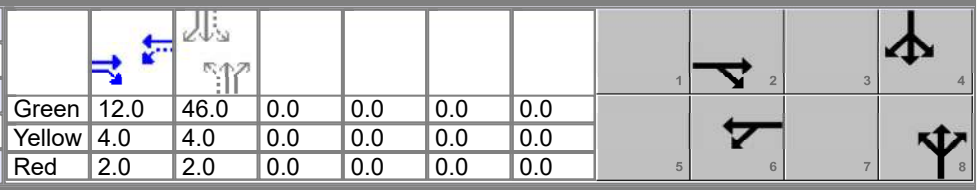
HCS7 Signalized Intersection Results Graphical Summary

General Information				Intersection Information	
Agency	Burgess & Niple, Inc.			Duration, h	0.250
Analyst	MEL	Analysis Date	Nov 16, 2021	Area Type	Other
Jurisdiction		Time Period	Build PM with NB Right	PHF	0.98
Urban Street	Cadiz Pike	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	SB SR 7	File Name	Cadiz Pike Signals Build 2045 PM - With NBR.xus		
Project Description	BEL-7-19.75				



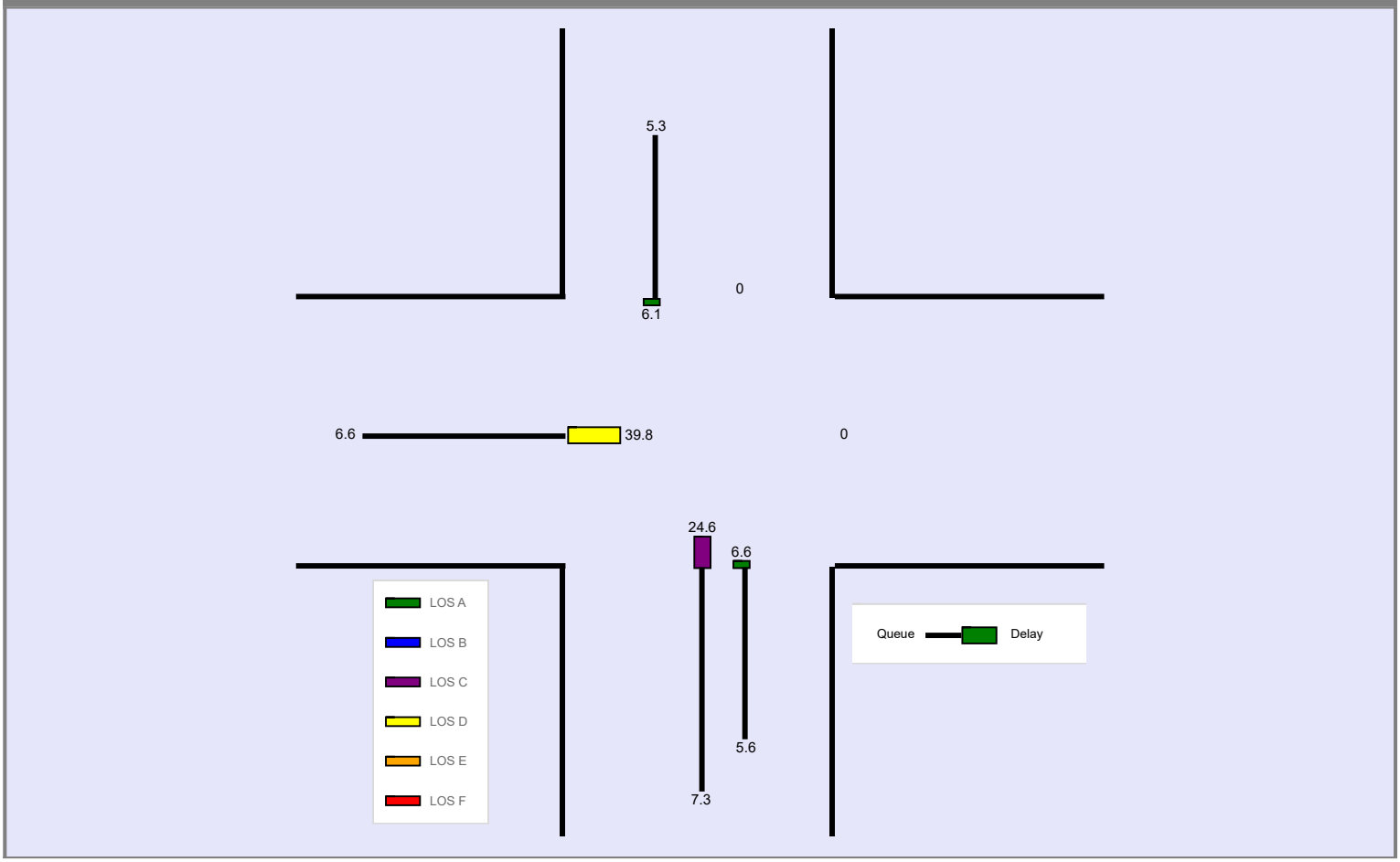
Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		20	160	0	0		250	0	540	0	1070	40

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	12.0	46.0	0.0	0.0	0.0	0.0						
Yellow	4.0	4.0	0.0	0.0	0.0	0.0						
Red	2.0	2.0	0.0	0.0	0.0	0.0						

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (*Q*), ft/ln (95 th percentile)		169.8			0			185.8	142.7	0		132.5
Back of Queue (*Q*), veh/ln (95 th percentile)		6.6			0.0			7.3	5.6	0.0		5.3
Queue Storage Ratio (*RQ*) (95 th percentile)		0.11			0.00			0.50	0.38	0.00		0.18
Control Delay (*d*), s/veh		39.8						24.6	6.6			6.1
Level of Service (LOS)		D						C	A			A
Approach Delay, s/veh / LOS	39.8	D		0.0			12.3	B		6.1	A	
Intersection Delay, s/veh / LOS	11.4						B					



--- Messages ---

No errors or warnings exist.

--- Comments ---

Attachment E

BEL-7-19.75 PID 105324

Teams Meeting January 27, 2022

Burgess & Niple, ODOT D11, ODOT. C.O.

Meeting Purpose

In this meeting Burgess & Niple presented various exhibits related to a proposed alternative that would construct a roundabout that would be built partially underneath the reconstructed Route 7 bridge. The roundabout concept resulted from traffic study work B&N performed at ODOT's request to see if traffic operations and capacity could be improved as part of the bridge reconstruction project. District 11 requested that B&N look further into other various "non-traffic" aspects of this roundabout alternative. The purpose of this meeting was to describe the status of B&N's examination into these items. The roundabout alternative is shown in Attachment A (note Attachment A is a layered PDF where the proposed work can be turned on or off).

Clear Zone/Sight Distance

Investigation: What are the clear zone requirement and sight distance issues for the proposed piers adjacent to the roundabout?

Response: In this roundabout alternative the reconstructed Route 7 bridge will be partially built over the roundabout with one pier column inside the center roundabout circle, one column in each of two splitter islands, and two other pier columns close to the roadways. The required clear zone for this application is 4 feet. B&N believe that with some minor adjustments to what is indicated on Attachment A, all of the pier columns can be placed outside of the clear zone.

A sight distance analysis was performed which is shown in Attachment B (This attachment is also a layered PDF). Zones needed to be unobstructed for sight distance (i.e., low or no obstructions) are shown in a cyan shade. Sight lines that would be obstructed by pier columns for vehicle approaching the roundabout (50 feet back of stop lines per L&D Vol. 1) are show in a reddish color. As can be seen by this analysis, sight distance is not an issue except for minor sight interruption intervals for 2 pier columns.

Experience in Other States

Investigation: What have other states done with regard to constructing bridges over roundabouts or otherwise place obstructions in proximity to roundabouts?

Response: B&N reached out to other B&N offices and also posted a question on the TRB roundabout ListServe, https://trbroundabouts.com/listserv/ asking for input. Examples of other projects around the country that resulted from this inquiry are shown in Attachment C. Links to these locations are shown below where available.

Location	Map Link	
Albany, NY	https://www.google.com/maps/@42.6926959,-73.8308741,3a,75y,28.57h,90.2t/data=!3m7!1e1!3m5!1spbqvf7Iax45PxlSYGbkJGQ!2e0!6s%2F%2Fgeo2.ggpht.com%2Fcbk%3Fpanoid%3Dpbqvf7Iax45PxlSYGbkJGQ%26output%3Dthumbnail%26cb_client%3Dmaps_sv.tactile.gps%26thumb%3D2%26w%3D203%26h%3D100%26yaw%3D45.081917%26pitch%3D0!7i13312!8i6656	
Madison, WI	https://www.google.com/maps/@43.0336633,-89.457558,3a,75y,156.74h,91.71t/data=!3m7!1e1!3m5!1sPsz31KGWVAgpoE7bipTP5Q!2e0!6shttps:%2F%2Fstreetviewpixels-pa.googleapis.com%2Fv1%2Fthumbnail%3Fpanoid%3DPsz31KGWVAgpoE7bipTP5Q%26cb_client%3Dmaps_sv.tactile.gps%26w%3D203%26h%3D100%26yaw%3D138.13138%26pitch%3D0%26thumbfov%3D100!7i16384!8i8192?hl=en&authuser=0	
Bloomington, MN	https://www.google.com/maps/@44.8580727,-93.3931378,82m/data=!3m1!1e3	
Emporia, KS	https://goo.gl/maps/S78TQU3hVkZaEQ54A	
Lincoln, NE	https://www.google.com/maps/@40.8224729,-96.7073406,3a,75y,229.47h,85.82t/data=!3m7!1e1!3m5!1shxBwt6kMawjGqEU6-M-pBA!2e0!6s%2F%2Fgeo3.ggpht.com%2Fcbk%3Fpanoid%3DhxBwt6kMawjGqEU6-M-pBA%26output%3Dthumbnail%26cb_client%3Dmaps_sv.tactile.gps%26thumb%3D2%26w%3D203%26h%3D100%26yaw%3D261.08533%26pitch%3D0!7i13312!8i6656?hl=en	
Racine, WI	Not supplied	
Green Bay, WI	https://www.google.com/maps/@44.5402329,-88.0796666,3a,75y,340.63h,87t/data=!3m7!1e1!3m5!1soskT3M3p5QGJitHDs4zYAg!2e0!6shttps:%2F%2Fstreetviewpixels-pa.googleapis.com%2Fv1%2Fthumbnail%3Fpanoid%3DoskT3M3p5QGJitHDs4zYAg%26cb_client%3Dmaps_sv.tactile.gps%26w%3D203%26h%3D100%26yaw%3D8.993994%26pitch%3D0%26thumbfov%3D100!7i16384!8i8192?hl=en&authuser=0	
Shawnee, KS	https://goo.gl/maps/i9JeWn4WC9cs2f2L9	
Locations unknown	Two images of crashes in roundabout supplied by responders on the ListServe	

As can be seen from these exhibits, other states have built bridges over roundabouts with substructures near the roundabout circle and approaching roadways.

Pier Cap Vulnerabilities

Investigation: How vulnerable would the steel pier caps shown be to vehicular collision, i.e., what amount of vertical clearance under the steel pier caps can be achieved? Is it feasible to use concrete pier caps in lieu of steel?

Response: B&N examined the Route 7 bridge profile to see if the grade could be raised and made preliminary estimates of pier cap depths and associate vertical clearances for concrete and steel pier caps.

In the roundabout alternative, there would be two straddle bent piers at Piers 4A and 5A (See Attachment A, Page 1 for pier locations and Page 2 for pier elevation views (steel pier caps shown). See also Attachment D.

The profile of the Route 7 bridge was previously established by getting under the I-70 bridge and additionally touching down near the existing North Abutment to facilitate maintenance of traffic on Route 7 during the bridge reconstruction. The established grade would require a design exception for sag vertical curve. A revised profile was explored and shown in Attachment D (Page 2) to gain more vertical clearance for the pier caps. This revised profile would also require a design exception. The minimum vertical clearance that we believe could be achieved for steel pier caps at Piers 4A and 5A is at least 16.5 feet.

We performed a preliminary analyses for feasibility of concrete pier caps for Pier 4A and 5A which resulted in pier caps approximately 6' wide and 6.2' high with the use of 6 ksi concrete to meet strength and stress criteria. The vertical clearance of such a cap would be at least 16.5 feet. Providing adequate room beneath the girders for anchorages may require the use of haunched girders to minimize girder depth at the integral caps. One significant issue appears to be constructability, specifically allocating room for splicing of tendons. Alternatively, a combination of full length tendons and tendons that end at phase joint may require wider cap to fit additional tendons. A concrete pier cap would require reduced clearances during construction.

Maintenance of Traffic

Investigation: How could the roundabout alternative be built in phases and what would temporary traffic consequences be?

Response: B&N developed the following conceptual construction sequence as shown in Attachment E, which is a layered PDF showing each phase of construction as a layer (other sequences could be possible also).

MOT Phase 1

- Maintain 2 lanes (1 lane each way) on Lincoln Avenue. The south end will need to be further evaluated to ensure adequate width can be provided due to the pinch point of the bridge. This will depend on the final roadway limits.
- Close the east leg of Main Street from Lincoln to the Main Street bridge.
    - Detour Main Street to I-70 - Zane Street eastbound to I-70 EB, exit at Main Street, reenter I-70 WB from Market Street to Marion Street.
    - Could be an opportunity for an incentive/disincentive clause for the contractor
- Construct the east half of the roundabout; possible duration of this construction along Main Street could be one to two months
- Construct the bridge above.
- Install temporary pavement for use in MOT Phase 2 (shown in blue in Attachment E)

MOT Phase 2

- Maintain 2 lanes (1 lane each way) on Lincoln Avenue on proposed and temporary pavement.
- Close the west leg of Main Street.
    - Detour Main Street to I-70 – Same route as above.
    - Could be an opportunity for an incentive/disincentive clause for the contractor
- Construct the west half of the roundabout; possible duration of this construction along Main Street could be one to two months

MOT Phase 3

- Open the roundabout to traffic.
- Remove the temporary pavement installed in MOT Phase 1.

Property

Investigation: What are property impacts associated with the proposed roundabout alternative?

Response: B&N performed a preliminary investigation of property impacts by obtaining and examining prior construction and right-of-way plans and the Belmont County GIS site. The only area of concern appears to be at the northwest quadrant of the roundabout alternative (Attachment E, Page 1). In this location, the GIS shows some non-ODOT or City owned parcels which overlap the proposed work. However, construction plans form the 1950's (Attachment E, Page 2) show that this area was acquired and that the proposed permanent work would be likely inside the R/W L/A line, except possibly for minor grading. It was pointed out that adjacent parcels with indication of "SL" like have slope easements that would permit such minor grading.

Attachment A

SR-7

MAIN STREET

MAIN STREET

IR-70

WHEELING CREEK

WHEELING CREEK

SR-7

OHIO RIVER

BRIDGE FORWARD ABUTMENT

BRIDGE PIER 5A (SEE NEXT SHEET FOR ELEVATION VIEW)

BRIDGE PIER 4A (SEE NEXT SHEET FOR ELEVATION VIEW)

BRIDGE PIER 3A

PIER COLUMN CONFLICT WITH SIDEWALK

BRIDGE PIER 2

BRIDGE PIER 1

BRIDGE REAR ABUTMENT

Ex LA

Ex SW

Ex R/W

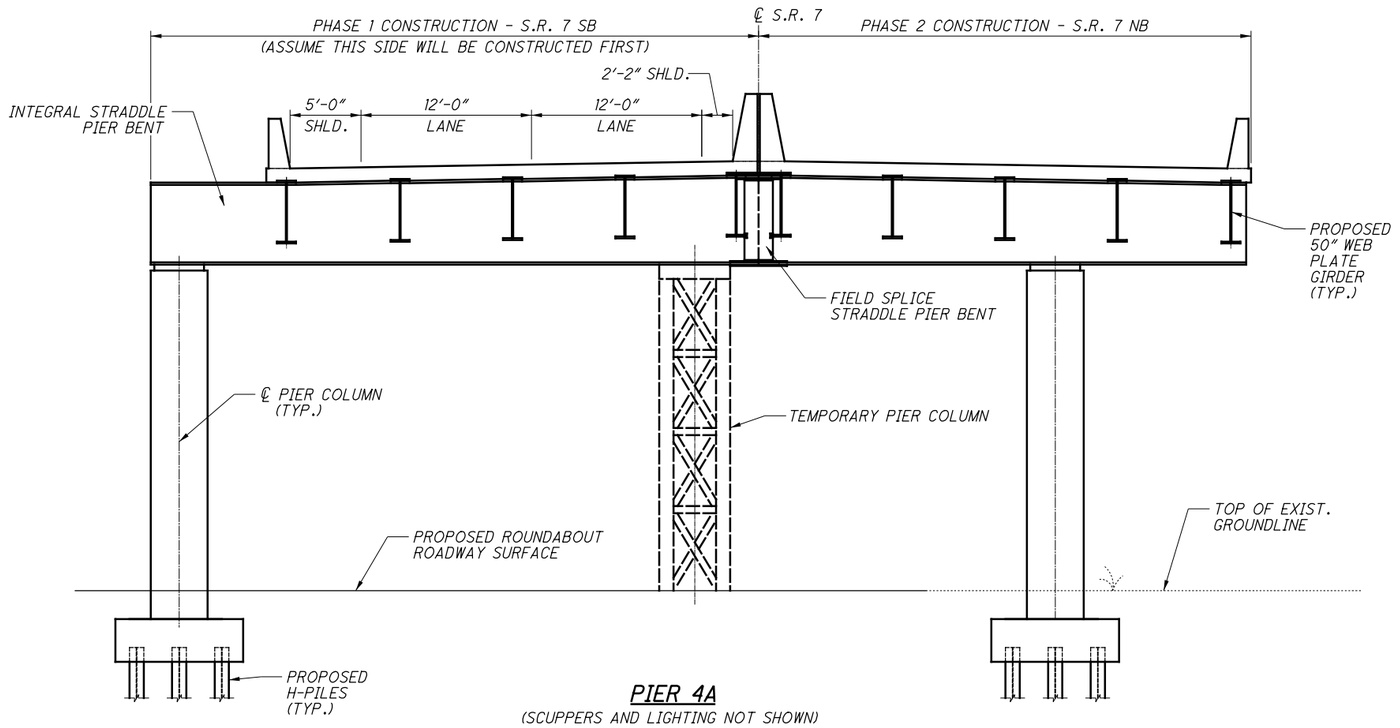
HORIZONTAL SCALE IN FEET
0 25 50 100

CALCULATED .
CHECKED .

SR-7/MAIN STREET
ALTERNATIVE 1 - ROUNDABOUT

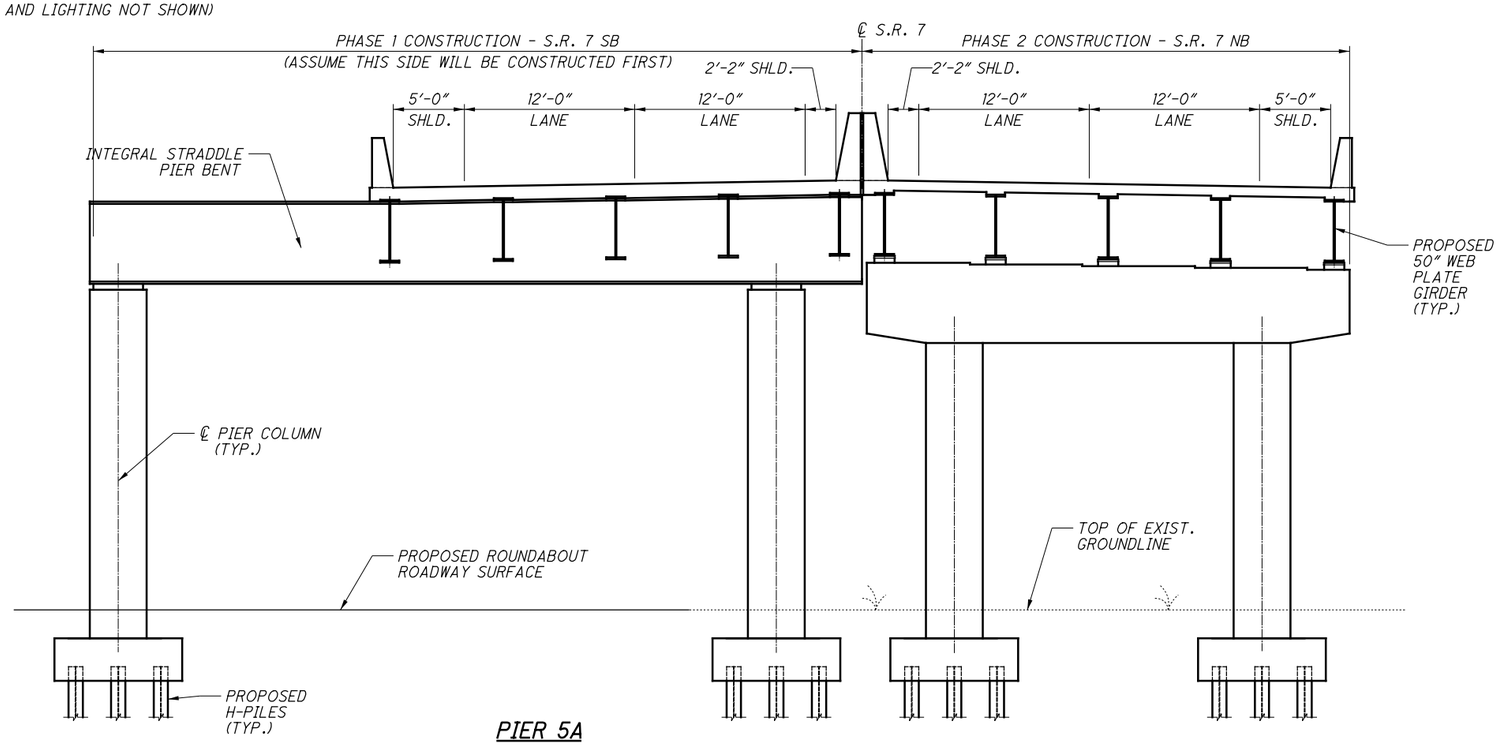
BEL-7

1
2



PIER 4A

(SCUPPERS AND LIGHTING NOT SHOWN)



PIER 5A

(SCUPPERS AND LIGHTING NOT SHOWN)

P:\PR56046\BEL\105324\Design\Bridge\Interchange Traffic Studies\Sheets\Roundabout Study - Pier Elevation.dgn Sheet 3/17/2020 8:26:32 AM leej

BURGESS & NIPLE
Engineers ■ Architects ■ Planners
5085 REED ROAD, COLUMBUS, OHIO 43220

DESIGNED	DRAWN	REVIEWED	DATE
CAS	JHL	XXX	X/XX/XX
CHECKED	REVISED	STRUCTURE FILE NUMBER	
XXX		0700541	

PIER ELEVATION 2
BRIDGE NO. BEL-7-1975
OVER RAMP B, WHEELING CREEK, US40/US250 AND RAMP D

BEL-7-19.75
PID No. 105324

2 / 2

Attachment B

REQUIRED ROUNDABOUT SIGHT DISTANCE (PER NCHRP 672 SECTION 6.7.3)

REQUIRED ROUNDABOUT SIGHT DISTANCE OBSTRUCTED BY BRIDGE PIER

SR-7

MAIN STREET

MAIN STREET

SR-7

BRIDGE FORWARD ABUTMENT

BRIDGE PIER 5A (SEE NEXT SHEET FOR ELEVATION VIEW)

BRIDGE PIER 4A (SEE NEXT SHEET FOR ELEVATION VIEW)

BRIDGE PIER 3A

PIER COLUMN CONFLICT WITH SIDEWALK

BRIDGE PIER 2

N

HORIZONTAL SCALE IN FEET
0 25 50 100

CALCULATED .
CHECKED .

SR-7/MAIN STREET
ALTERNATIVE 1 - ISD/SSD

BEL-7

1


Albany, NY
ALBANY
Fuller Rd
NY CREATES/ SUNY


Beltline Frontage Rd., WI
YIELD
ONE WAY
W Frontage Rd
YIELD
TO TRAFF
FROM LE
YIELD
W Beltline Frontage Rd
YIELD

Bloomington, MN


Emporia, KS
YIELD
NORTH
35


Lincoln, NE
Salt Creek Roadway
©2015 Google

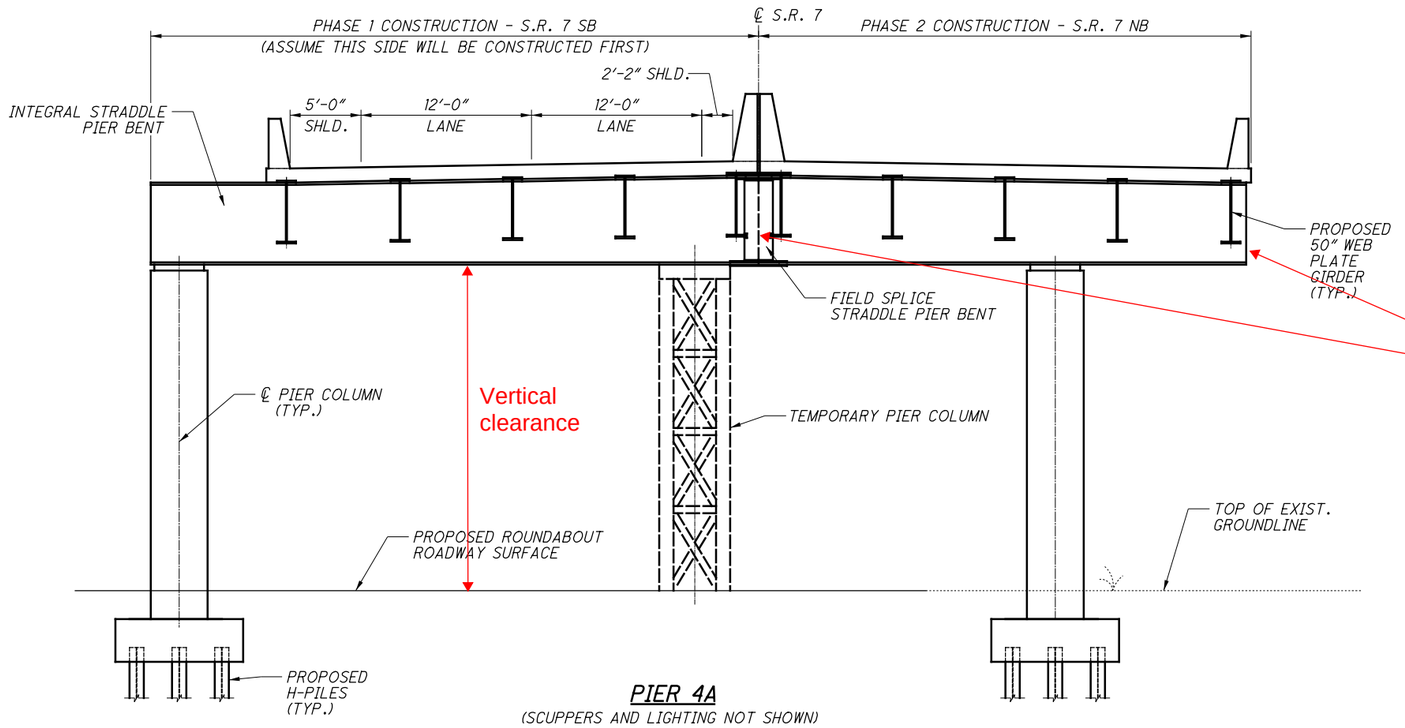
Historic Districts


Route 29, WI
YIELD
ONE WAY
YIELD
YIELD
WI-29 Trunk


Shawnee, KS


LIVE

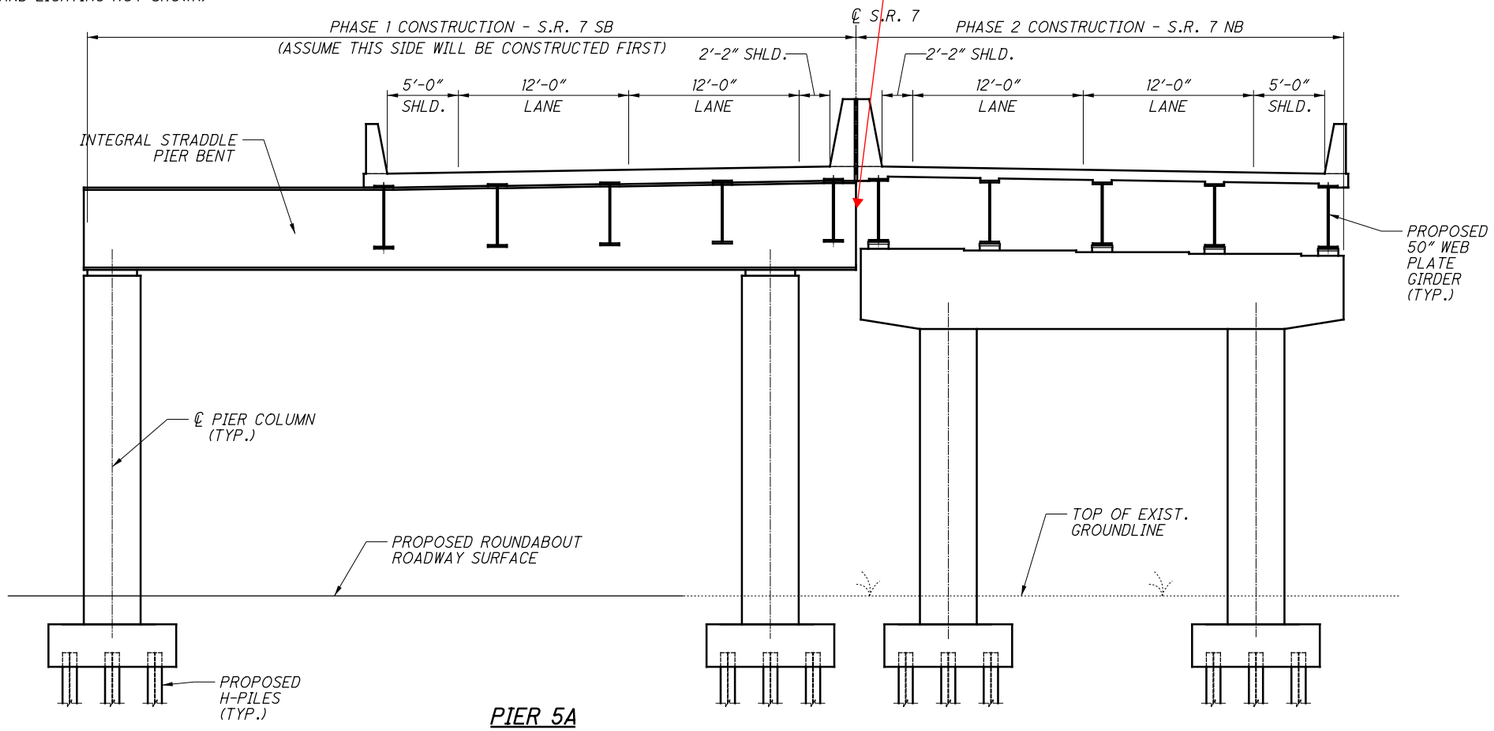
Attachment D



PIER 4A

(SCUPPERS AND LIGHTING NOT SHOWN)

More room needed for PT anchorages for a concrete pier cap



PIER 5A

(SCUPPERS AND LIGHTING NOT SHOWN)

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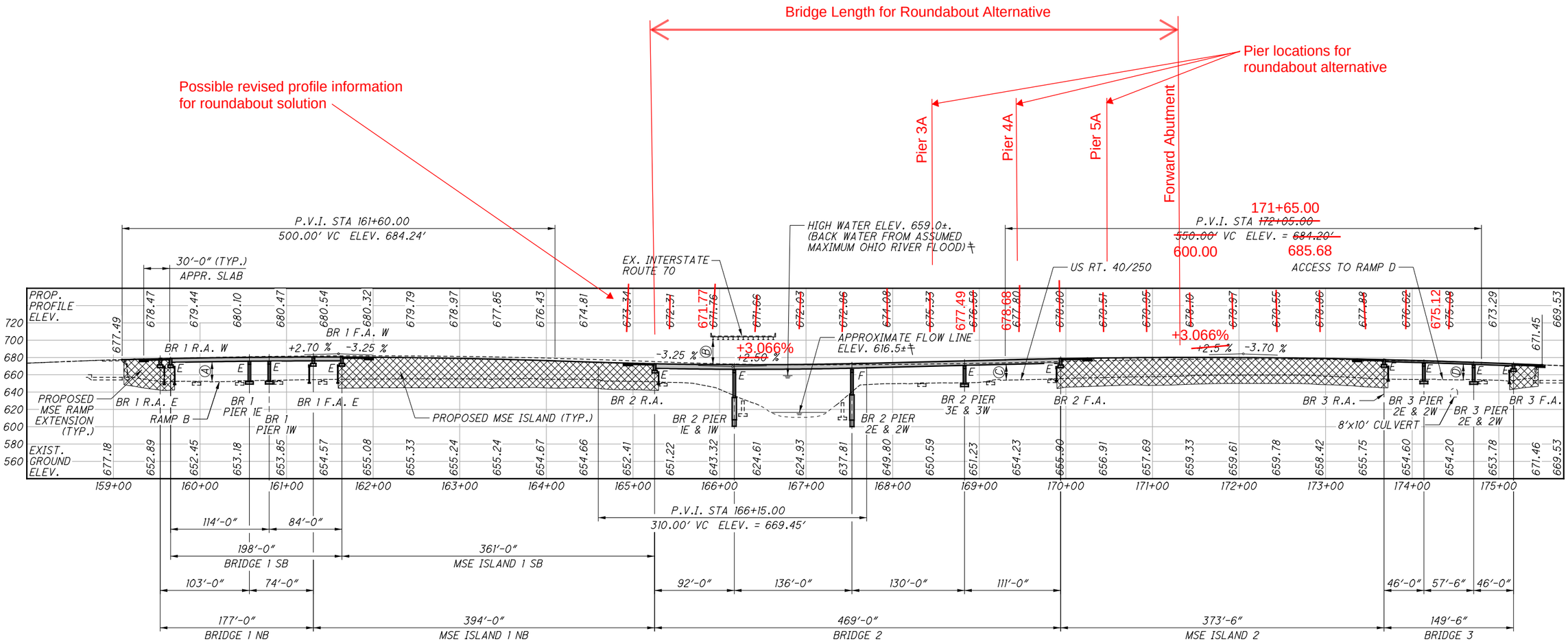
BURGESS & NIPLE
Engineers ■ Architects ■ Planners
5085 REED ROAD, COLUMBUS, OHIO 43220

DESIGNED	DRAWN	REVIEWED	DATE
CAS	JHL	XXX	X/XX/XX
CHECKED	REVISED	STRUCTURE FILE NUMBER	
XXX		0700541	

PIER ELEVATION 2
BRIDGE NO. BEL-7-1975
OVER RAMP B, WHEELING CREEK, US40/US250 AND RAMP D

BEL-7-19.75
PID No. 105324

2 / 2



ELEVATION

(SB MSE WALL STRUCTURE SHOWN, NB STRUCTURE SIMILAR)
(PARAPET & PILES NOT SHOWN)

NOTE:

1. SEE SHEET 1 / 5 FOR NOTES, LEGEND AND ADDITIONAL INFORMATION.

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5085 REED ROAD, COLUMBUS, OHIO 43220

DRAWN AAA | REVIEWED TAB | DATE 2/21/19
DESIGNED CAS | CHECKED JHL | REVISED | STRUCTURE FILE NUMBER 0700541

BELMONT COUNTY
STA. VARIES
STA. VARIES

SITE PLAN - REPLACEMENT OPTION-ELEVATION
BRIDGE NO. BEL-7-1975
OVER RAMP B, WHEELING CREEK, US40/US250 AND RAMP D

BEL-7-19.75
PID No. 105324

2 / 5

P:\PR56046\BEL\105324\Design\Bridge\Rehab vs Replacement Study\CADD\Final Sheets\105324 Site Plan-Replacement Elevation.dgn Sheet 3/1/2019 1:29:57 PM leej

Attachment E

Final Configuration

Phase 2 Construction

SR-7 / MAIN STREET
ALTERNATIVE 1 - ROUNDABOUT

BEL-7

1
2

HORIZONTAL SCALE IN FEET
0 25 50 100

CALCULATED | CHECKED

Lincoln Ave.

SR-7

MAIN STREET

Main St. Closed Detour to I-70

IR-70

WHEELING CREEK

OHIO RIVER

Ex LA

Ex SW

BRIDGE FORWARD ABUTMENT

BRIDGE PIER 5A (SEE NEXT SHEET FOR ELEVATION VIEW)

BRIDGE PIER 4A (SEE NEXT SHEET FOR ELEVATION VIEW)

BRIDGE PIER 3A

PIER COLUMN CONFLICT WITH SIDEWALK

BRIDGE PIER 2

BRIDGE PIER 1

BRIDGE REAR ABUTMENT

Attachment F

Potential R/W Impacts

SR-7

MAIN STREET

IR-70

WHEELING CREEK

OHIO RIVER

BRIDGE FORWARD ABUTMENT

BRIDGE PIER 5A (SEE NEXT SHEET FOR ELEVATION VIEW)

BRIDGE PIER 4A (SEE NEXT SHEET FOR ELEVATION VIEW)

BRIDGE PIER 3A

PIER COLUMN CONFLICT WITH SIDEWALK

BRIDGE PIER 2

BRIDGE PIER 1

BRIDGE REAR ABUTMENT

HORIZONTAL SCALE IN FEET
0 25 50 100

CALCULATED .
CHECKED .

SR-7/MAIN STREET
ALTERNATIVE 1 - ROUNDABOUT

BEL-7

1
2

3-13

VILLAGE OF BRIDGEPORT

Parcel No.	Owner	Area Sq. Ft.	Lot No.	Addition, Plat Book & Page	Exist. Bldgs.
1-LA	Sam Kefalos	2156	701	Plat of the Town of Canton Deed Book Vol A Page 507 May 9, 1806	Yes
2-LA	Sam Kefalos	2254	701		Yes
3-LA	J. I. Cilles et al	8325	702		Yes
4-LA	Wm. C. Freter et al	1640	703		Yes
5-LA	Christ Velas	1600	703A		Yes
6-LA	Nick A. George et al	1540	704		Yes
6-SL	Nick A. George et al	560	704		Yes
8-A	The Bp't. Nat'l. Bank	770	705		Yes
8-LA	The Bp't. Nat'l. Bank	635	705		Yes
8-SL	The Bp't. Nat'l. Bank	2595	705		Yes
9	Mary Milen	627	735		Yes
9-SL	Mary Milen	1308	735 & OL 6		Yes
10	The Standard Oil Co.	1031	736, 737, 738		—
11	William Shaheen	4473	OL 7		Yes
12-WA	Joseph J. Anuskewic	160	706		—
13	Pennsylvania R.R. Co.	3170	601		—

FED. RD. DIVISION	STATE	PROJECT	
2	OHIO		

1/1

BEL-40-(27.95-28.00)
R/W PLAN
Scale: 1" = 20'
Rev. 10-15-56.
Rev. 2-6-58

PI 77+13.42
Δ 40°
D 13°
T 160.42
L 307.69
E 28.29
R 440.74

PT 78+60.69

AVENUE SR 7 US 250

Essex Corporation
1 St. Brk. A & P
59

3 St. Brk.
3 St. Brk.
3 St. Brk.
1 St. Fr.
3 St. Brk.

O.L. 95
N. A. Shaheen
William Shaheen
O.L. 7
11
2 St. Fr. Res.

ALLEN ST.

Joseph J. Anuskewic
706
12-WA
8-A
3 St. Brk.
705
8-SL
3 St. Conc. Bldg.
The Bridgeport National Bank
8-LA
3 St. Brk.
704
6-SL
6-LA
Nick A. George et al
703A
Christ Velas
5-LA
3 St. Brk.
703
3 St. Brk.
4-LA
William C. Freter et al

BRIDGE ST.

US 40 & 250
S87°19' E
To Wheeling

STA. 81+45.79
END PROJECT

1-LA
701
Kefalos
1 St. Fr.
1 St. Fr.
2-LA
Sam
3 St. Brk.
3-LA
J. Irvin Cilles et al
702
2 St. Brk.
1 St. Tile Blk.
Jessie A. Cook
700
1 St. Conc. Blk.
1 St. Conc. Blk.

Anna E. Breitenstein et al
742
Anthony Moses et al
742
P.C. 75+53
Charles A. Maroon
740
739
738
The Standard Oil Co.
2 St. Brk.
2 St. Fr.
2 St. Fr.
2 St. Conc. Blk.
1 St. Conc. Blk. Gas Sta.
737
736
OL 6
735
Mary Milen
9-SL
2 St. Brk.
9
10

MAIN
U.S. 40
75
S82°40' E
To St. Clairsville

COUNCIL ST.

2 St. Fr.
2 St. Brk.
3 St. Brk.
2 St. Brk & Conc.
2 St. Brk
2½ St. Brk
2 St. Brk.
2 St. Conc. Slab

STA. 75+50
BEGIN PROJECT

Monument

79+49.10
203.70 Rt.
80+15.88
219.22 Rt.

38.0'

PI 80+03.68
Δ 35° 21'
D 13°
T 140.45
L 271.92
E 21.84
R 440.74

LINCOLN S.R. 7

604
2 St. Brk. Garage
603
602
Jessie A. Cook
Penna. R.R. R/W
Pennsylvania R.R. Co.
601
13
600

R.R. R/W
PENN. R.R.
B & O. R.R.
PT 81+35.19
1 St. Fr.

ST.

ADOLPH GROUP LIMITED PARTNERSHIP
PIN: 22-01250.000-708

ADOLPH GROUP LIMITED PARTNERSHIP
PIN: 22-01183.00-706

VILLAGE OF BRIDGEPORT
PIN: 22--705

NO PARCEL INFO.
PIN: 22--704

STATE OF OHIO
PIN: 22-60130.000-703-A

STATE OF OHIO
PIN: 22-60130.000-703-B

GLORIA J BARCALOW &
CHAD W OLLM SURV.
PIN: 22-01248.000-742-A
228 MAIN ST.
BRIDGEPORT OH 43912

GLORIA J BARCALOW &
CHAD W OLLM SURV.
PIN: 22-01190.000-740

GLORIA J BARCALOW &
CHAD W OLLM SURV.
PIN: 22-01190.000-739

GLORIA J BARCALOW &
CHAD W OLLM SURV.
PIN: 22-01189.000
*

GLORIA J BARCALOW &
CHAD W OLLM SURV.
PIN: 22-01188.000-737
*

GLORIA J BARCALOW &
CHAD W OLLM SURV.
PIN: 22-01187.000
*

MARY MILEN
PIN: 22-00738.00
*

ALLEN ST.

Ex LA
Ex R/W
Ex SL

NO PARCEL INFO.
PIN: 22--OL 250

STATE OF OHIO
PIN: 22-60129.000-702

STATE OF OHIO
PIN: 22-60128.000-701

NO PARCEL INFO.
22--700

NO PARCEL INFO.

171
170
169

Attachment F

BEL-7-19.75
PID 106237
Construction Cost Estimates

Original estimates were prepared using 2017 ODOT prices

Construction Cost Information from Ellis
Start Construction April 2025
End Construction November 2026
Inflate costs from 2017 to mid 2025.

Actual inflation from 2017 to 2021 (see attached "January 2022 Construction Cost Outlook and Forecast")

Year	Index
2017	107
2021	114.6

Percent Increase = ((114.6-107)/107) x 100 = 7.1%

Inflation Estimates for 2022-2026 (see attached)

Year	Percent
2022	8.0
2023	3.7
2024	2.5
2025	3.2

Inflation Multiplier 2017 to 2025 = 1.071 x 1.08 x 1.037 x 1.025 x 1.032 = **1.27**

Construction Cost Estimates

Include 20% contingency, do not include engineering or ROW costs)

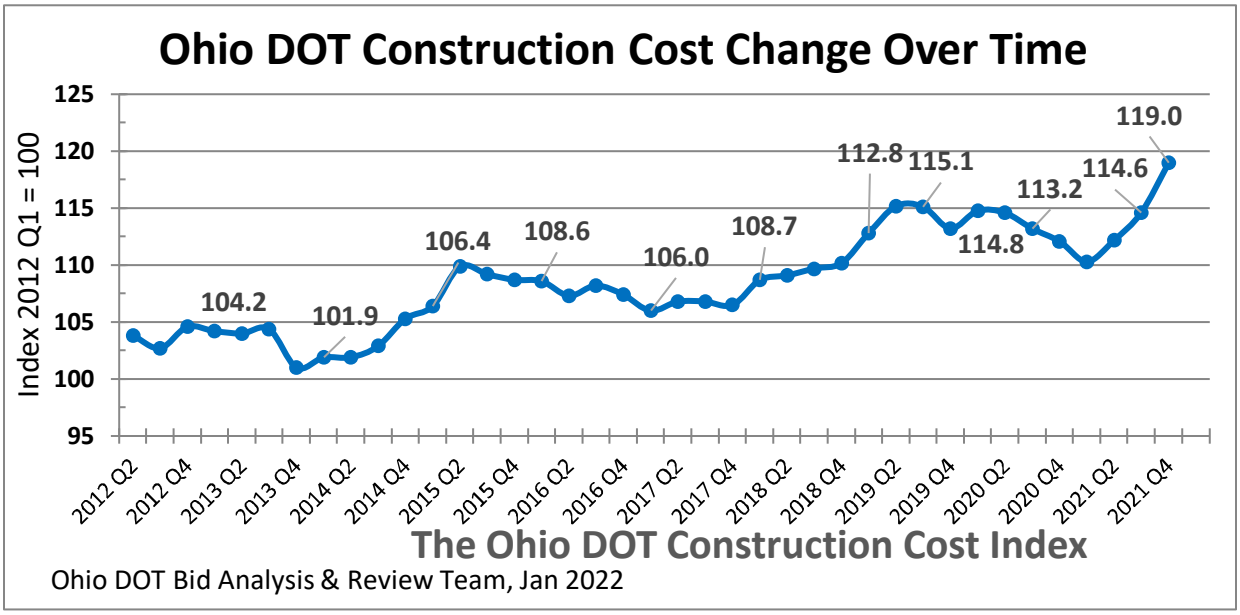
Item	**Cost**	
Comparative Bridge Costs (Bridge Only)	**2017**	**2025**
Bridge Rehabilitation	$ 21.1 M	$ 26.8 M
Bridge Replacement Option A (3 bridges w/ MSE Islands)	$ 20.1 M	$ 25.5 M
Bridge Replacement Option B (Single Full Length Bridge)	$ 24.5 M	$ 31.1 M
Bridge Replacement Option A Full Project (no roundabout)	$ 24.2 M	$ 30.7 M
Bridge Replacement Option A Full Project (with roundabout)	$ 28.8 M	$ 36.6 M

January 2022 Construction Cost Outlook and Forecast

January-2021 POST-FORECAST REVIEW:

The Ohio DOT Construction Cost Index measured inflation for CY2021 at 6.2%[1]. In January 2021, we forecast Ohio DOT's CY2021 construction cost inflation would be 2.0%. Consequentially, actual inflation was 4.2% higher than predicted. Figure 1 illustrates the construction inflation trend that began to rise in 2021. Year-over-year increases in asphalt, steel, and structures are the most significant factors that raised overall inflation in CY2021. The COVID-19 pandemic affected all aspects of construction in 2021. We expect the pandemic to continue affecting construction through 2022 as well.

Figure 1



January-2022 FORECAST OVERVIEW:

The Ohio DOT Construction Cost Inflation Forecast is presented in Table 1. We predict construction cost inflation to be 8% in CY2022, double the January 2021 forecast of 4.0%. Inflation is expected to be 3.7% in CY2023; 2.5% in CY2024; 3.2% in CY2025; and 3.5% in CY2026. From CY2027 through CY2031 inflation is forecast to be 3.0%, based upon average rates over 30 to 60 years as measured by the GDP deflator and the Consumer Price Index (CPI). The long-term forecast beyond CY2031 is 2.0%, based on the Federal Reserve's long run inflation target rate.

Table 1: January 2022—5-YEAR CONSTRUCTION COST INFLATION FORECAST

	CY2022	CY2023	CY2024	CY2025	CY2026
High	12.0	8.0	7.0	5.0	6.0
Most Likely	8.0	3.7	2.5	3.2	3.5
Low	5.0	1.4	0.5	0.5	1.0

The following is a narrative of major factors that will have an influence on construction costs through the forecast period: (1) economic activities globally, nationally, and throughout the state and (2) regional construction costs for labor, oil and diesel, liquid asphalt, and steel, among others.

[1] Ohio DOT Construction Cost Index published January 4, 2022