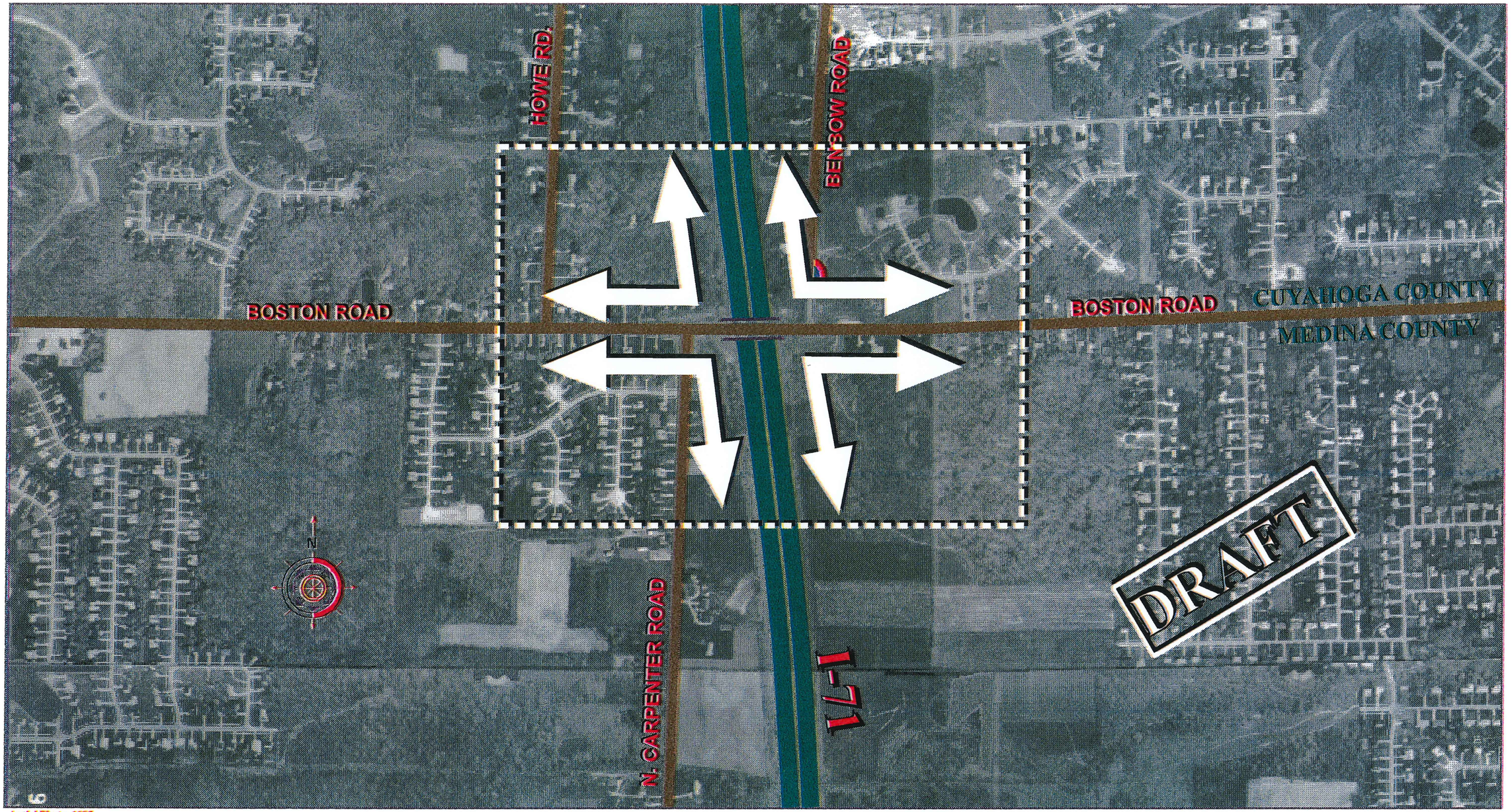
I-71 / BOSTON ROAD
POINT OF ACCESS JUSTIFICATION STUDY



Aerial Photo, 1985

Prepared By:
Northeast Ohio Areawide Coordinating Agency
1299 Superior Avenue, Cleveland, Ohio 44114

June, 1999

TRNSPRTN/Boston-Rd/B-RD-CVR99.Fh7

OHIO DEPARTMENT OF TRANSPORTATION

DISTRICT 12, 5500 TRANSPORTATION BLVD., GARFIELD HEIGHTS, OHIO 44125-5396
216-581-2333 FAX. 216-587-1730

November 21, 2000

Walter F. Ehrnfelt, Mayor
City of Strongsville
18688 Royalton Road
Strongsville, Ohio 44136

Re: I-71/Boston Road Interchange
Justification Study (IJS)

Dear Mayor Ehrnfelt:

In order to assist the cities of Strongsville and Brunswick in completing the IJS phase of the subject project interchange, the Department agreed to provide Planning monies to NOACA in their annual work program for work on this study. The draft 1999 IJS Study distributed July 13, 1999 completes our commitment.

The next action in accordance with NOACA policy required by the cities to advance this project is completion of a Major Investment Study (MIS). The IJS Study did not provide a recommended interchange configuration as this would occur as part of the MIS process.

Please be reminded traffic and other information in the IJS may need to be updated depending on the timing of your MIS.

If you have any questions please contact this office.

Respectfully,

Dale A. Schiavoni, P. E.
Transportation Planning &
Programs Administrator

DAS:kr

c: D. Coyle
L. Sutherland
P. Taylor
R. Chesla
H. Maier
file

OHIO DEPARTMENT OF TRANSPORTATION

DISTRICT 12, 5500 TRANSPORTATION BLVD., GARFIELD HEIGHTS, OHIO 44125-5396
216-581-2333 FAX. 216-587-1730

November 21, 2000

Robert Trimble, City Manager
City of Brunswick
4095 Center Road
Brunswick, Ohio 44212

Re: I-71/Boston Road Interchange
Justification Study (IJS)

Dear Sir:

In order to assist the cities of Strongsville and Brunswick in completing the IJS phase of the subject project interchange, the Department agreed to provide Planning monies to NOACA in their annual work program for work on this study. The draft 1999 IJS Study distributed July 13, 1999 completes our commitment.

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Please be reminded traffic and other information in the IJS may need to be updated depending on the timing of your MIS.

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H. Maier
file

NOACA

NORTHEAST OHIO AREAWIDE COORDINATING AGENCY
Serving all county, municipal and township governments in Cuyahoga, Geauga, Lake, Lorain and Medina Counties

July 13, 1999

Mr. David Coyle
District Deputy Director
Ohio Department of Transportation-District 12
5500 Transportation Boulevard
Garfield Heights, OH 44125

ATTENTION: Mr. Paul Taylor

RE: I-71/BOSTON ROAD INTERCHANGE JUSTIFICATION STUDY
PROJECT NO: 6054

Dear Director Coyle:

Enclosed is a copy of the update of the I-71/Boston Road Point-of-Access Justification study draft report. This update includes additional traffic analysis and a revised environmental overview for the suggested configurations of the proposed interchange. Four alternatives that your office provided have been evaluated for the configuration of the proposed I-71/Boston Road Interchange. Results of the level-of-service analysis reveal that all proposed ramp layouts presented with their associated roadway improvements will serve the future year 2020 at acceptable levels.

Please review this report. We would appreciate your comments, if any, to complete the study. If you have any questions, please feel free to call me at 241-2414, Extension 300, or Mahmoud Al-Lozi at Extension 270.

Sincerely,

Ronald Eckner

Ronald T. Eckner, P.E.
Director of Transportation

RTE/MA/mal/4185t

Enclosure

c: Honorable Walter Ehrnfelt, Mayor, City of Strongsville (1 copy of report)
Mr. Robert Trimble, City Manager, City of Brunswick (1 copy of report)

1299 Superior Avenue, Cleveland, Ohio 44114-3204 (216) 241-2414 FAX (216) 621-3024

I-71/BOSTON ROAD POINT-OF-ACCESS JUSTIFICATION STUDY

Prepared for
The Cities of Brunswick and Strongsville

DRAFT REPORT
June, 1999

by

NORTHEAST OHIO AREAWIDE COORDINATING AGENCY
1299 Superior Avenue
CLEVELAND, OHIO 44114

Principal Author.....Mona Aziz
Contributors.....Andy Vidra, David Owens,
Jim Armaline, Daniel Boyle (Graphics)
Group Manager.....Mahmoud Al-Lozi
Division Director.....Ronald T. Eckner
Executive Director.....Howard R. Maier

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

This report analyzes the existing and future Year 2020 traffic conditions with and without the proposed interchange at Boston Road and I-71. The following were concluded:

1. The mainline segments of IR-71, from SR-303 to north of SR-82, are experiencing traffic congestion under existing and future traffic conditions. ODOT is addressing the need for additional capacity with a project currently under design to add a third lane in each direction of IR-71 beginning at SR-303 in Medina County to US-42 in Cuyahoga County. The added capacity will be adequate for future year traffic volumes to operate at acceptable level-of-service except on the mainline segment north of SR-82 whether the proposed interchange is built or not.

2. SR-82/West 130th intersection is also experiencing traffic congestion under existing, future "No-Build" and future "Build" traffic conditions. The additional lanes on SR-82 with left-turn bays at the intersection will be adequate for both existing and future traffic volumes, with or without the proposed interchange at Boston Road.

3. The analysis of the ramp junctions did not reveal a significant change in the level-of-service at the congested locations under the "Build" scenario when comparing the results with the "No-Build" scenario. The interchange ramps of the IR-71/SR-82 (from and to the north) are operating at unacceptable levels-of-service under existing traffic conditions. Widening the mainline to three lanes will not affect the ramp junction operation. The poor operation is expected to continue under future traffic conditions due to the increase in the mainline traffic to and from the south. However, the proposed interchange at Boston Road will attract traffic from the SR-82 interchange, by that reducing congestion at the SR-82 interchange.

4. The IR-71/SR-303 interchange ramp from I-71 southbound to SR-303 is operating at an acceptable level-of-service under existing traffic conditions. The operation of this ramp will degrade to an unacceptable level under future traffic with or without the proposed interchange. However, this ramp will operate at level-of-service "C" under the "Build" scenario with a deceleration lane of 800 feet. Currently, this ramp has a deceleration lane of only 520 feet.

5. The intersection of SR-82 and US-42 will operate at an unacceptable level for the future traffic with or without the proposed interchange even with the planned lane additions at the intersection of SR-82/US-42. The intersection is operating at an acceptable level under existing traffic conditions.

6. Building the proposed interchange will require the widening of Boston Road to four or five lanes on the crossroad structure over IR-71, depending on the interchange configuration selected. Boston Road is planned to be widened to two standard lanes and a turning lane between Pearl Road and West 130th Street by a project currently under design.

7. Building the proposed interchange will eliminate the access of Benbow and Carpenter Roads to Boston Road at their existing intersections if a simple diamond or an urban style configuration were selected.

8. As a congestion management measure, building park-n-ride facilities is recommended to improve the operation of the SR-82 and SR-303 ramps to acceptable levels-of-service and to ease the existing and anticipated future congestion on IR-71 mainline whether the interchange is built or not. Also recommended is the promotion of other traffic reduction measures such as the use of carpool and vanpool and the coordination of inter-county transit services with park-n-ride lots.

9. Secondary environmental impacts, or those related to land changes, include major impacts on prime farmland in three of four build alternatives. See section VI, Environmental Overview.

The planned and the proposed improvements to the freeway and arterial systems are divided into two parts. The first part pertains to improvements needed for existing and future "No-Build" (without an interchange at IR-71/Boston Road) traffic conditions. These improvements include the following:

1. Widen IR-71 to six lanes between SR-82 and SR-303 (currently under construction from Cuyahoga/Medina County Line to US-42, and scheduled for construction in State Fiscal Year 2000 for the segment from SR-303 to the Cuyahoga/Medina County Line).

2. Widen and reconstruct Boston Road to two standard lanes and a two-way left turning lane between Pearl Road and West 130th Street (currently listed in the SFY 2000 TIP for construction in year 2003).

3. Widen and reconstruct SR-82/West 130th intersection (Partially funded by TEA 21 Priority).

4. Provide a park-n-ride facility in the vicinity of SR-303 and SR-18 interchanges as a congestion management measure.

5. Signalize Boston Road at Howe Road and North Carpenter Road intersections.

6. Reconstruct Boston Road/Pearl Road intersection to improve sight distance, reduce the grade, and provide left turn bays on Boston Road.

7. Provide a westbound right-turn bay for SR-303/North Carpenter intersection.

The second part of the improvements pertains to the future scenario if the interchange is built and include recommendations specific to each proposed alternative evaluated.

Based on the initial 1995 study, a preliminary configuration of the interchange with ramps terminating at Carpenter and Howe Roads was evaluated and includes the following recommendations:

1. Widen Boston Road to three lanes from Pearl Road to west of Howe Road and from east of the proposed interchange to West 130th Street; and to four or five lanes between Howe Road and east of the proposed interchange with selected turn lanes.

2. Provide an additional park-n-ride facility in the vicinity of SR-82 interchange.

3. Provide a southbound shared left-turn and right-turn bay on Howe Road/Boston Road intersection.

4. Add a northbound right-turn bay on North Carpenter Road/Boston Road intersection.

5. Modify the planned ramp meter at the loop ramp from SR-82 to IR-71 northbound to allow only 1,090 vehicles during the AM peak-hour.

6. Close access of Benbow Road at its intersection with Boston Road.

See Figure 12 for this preliminary alternative.

Currently, the study has been expanded to include four alternatives proposed by the Ohio Department of Transportation (ODOT). The following briefly summarize the suggested improvements specific to each of the proposed ODOT alternatives:

If a simple diamond interchange (Alternative A) or a single point urban interchange is constructed (the Urban Style Alternative) the following improvements will be required:

See Figures 21 and 22 for Alternative A and for the Urban Style Alternative.

1. Widen Boston Road to five lanes between Howe Road and the I-71 east ramps.

2. Close access of Benbow Road at its intersection with Boston Road to allow the construction of the proposed northeast ramp.

3. Close access of Carpenter Road at its intersection with Boston Road to allow the construction of the proposed southwest ramp.

4. Provide a Carpenter Road/Howe Road Connector through Sturbridge Lane.

5. Provide two standard lanes northbound at Howe Road Connector south of Boston Road.

If a modified diamond with entrance/exit ramps at Relocated Howe Road and Benbow Road Extension (Alternative C&D) is constructed, the following improvements will be required:

See Figure 23 for Alternative C&D.

1. Relocate Howe Road to the east to be realigned with Carpenter Road.

2. Extend Benbow Road south of Boston Road.

3. Widen Boston Road to five lanes between Carpenter and Benbow Roads.

4. Add two standard lanes on Carpenter Road northbound south of Boston Road.

5. Cul-de-sac Howe Road north of Boston Road.

If a modified diamond with entrance/exit ramps at Carpenter Road and Benbow Road Extension (Alternative D&E) is constructed the following improvements will be required:

See Figure 24 for Alternative D&E.

1. Widen Boston Road to four lanes between Carpenter Road and Benbow Road Extension and to three lanes between Carpenter and Howe Roads.

2. Add two standard lanes on Carpenter Road northbound north of the IR-71 west ramps to Sturbridge Lane; and one standard lane northbound north to Boston Road.

3. Provide turn lanes at Howe Road/Boston Road intersection.

4. Add a left-turn bay on Carpenter Road southbound at its intersection with the I-71 west ramps.

NOTE: According to the "NOACA Interim Guidance on Major Investment" adopted by the NOACA Governing Board on October 9, 1998, in Resolution 98-055, a Major Investment Study (MIS) is required for proposed new freeway or expressway interchanges. The project sponsor will conduct the MIS consistent with federal guidelines (23CFR450.318) and NOACA's Interim Guidance.

Figure 12: Suggested Schematic Improvements For Boston Road

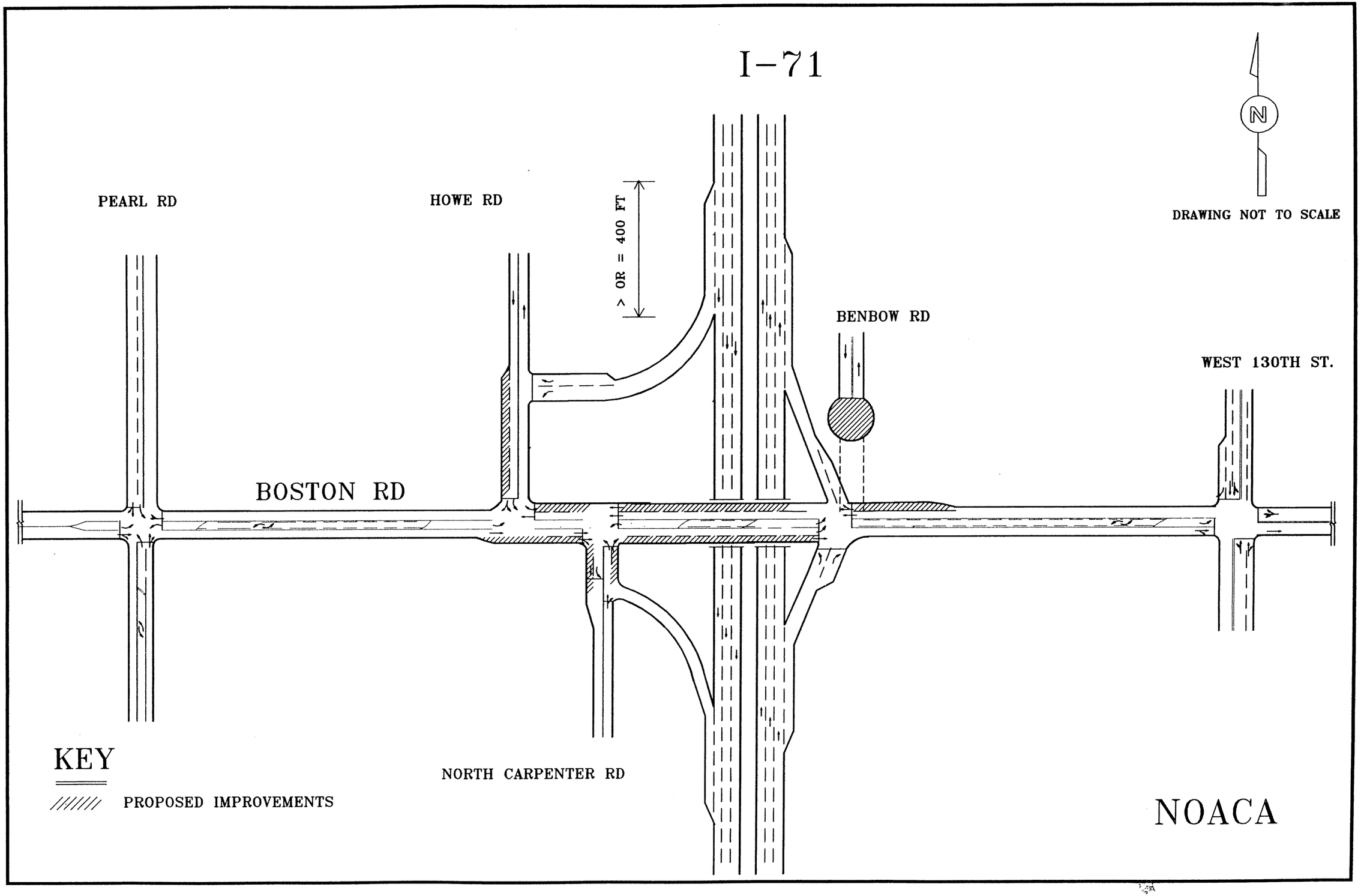


Figure: 21

Suggested Schematic Layout for Alternative A

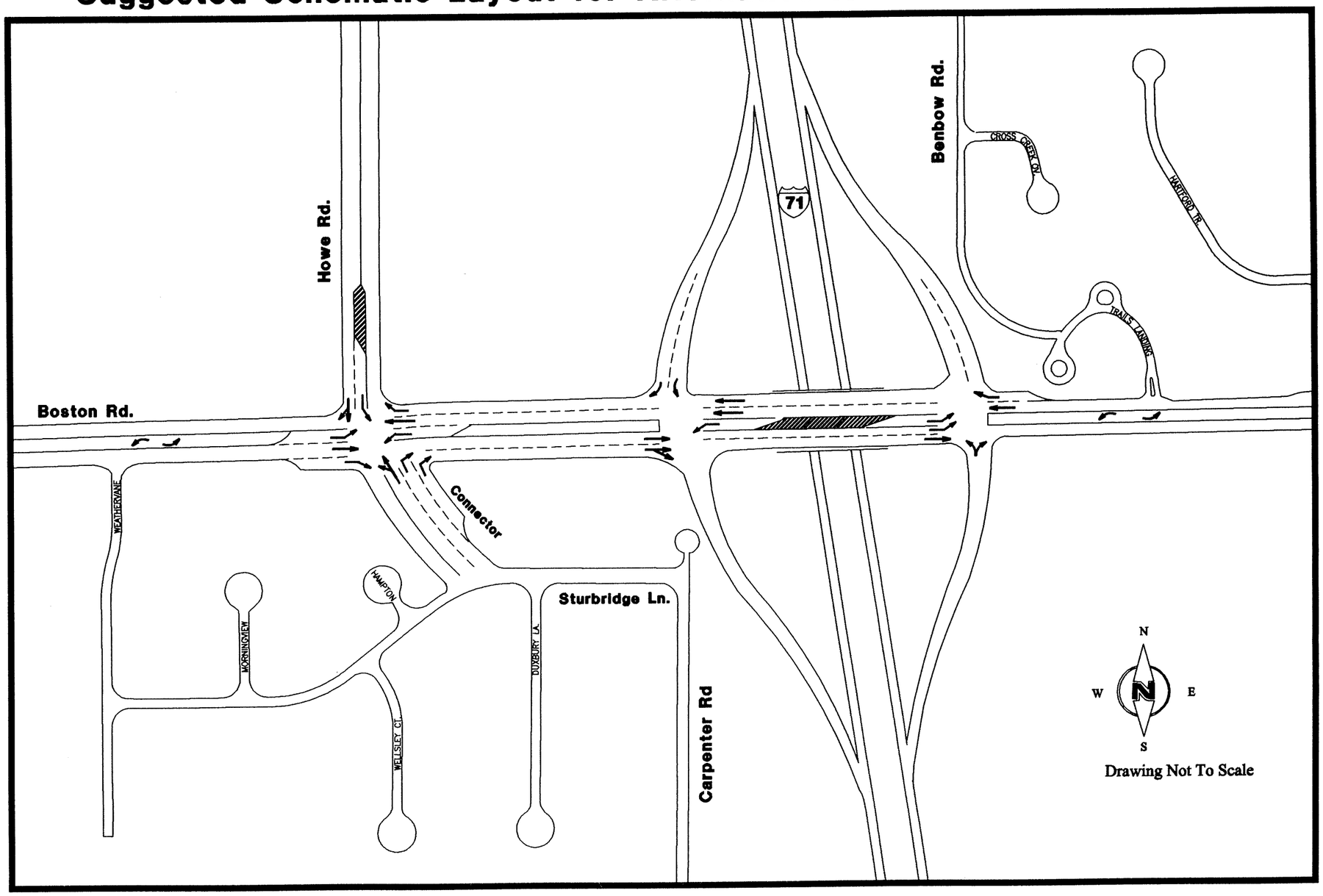


Figure: 22

Suggested Schematic Layout for Alternative (SPUI)

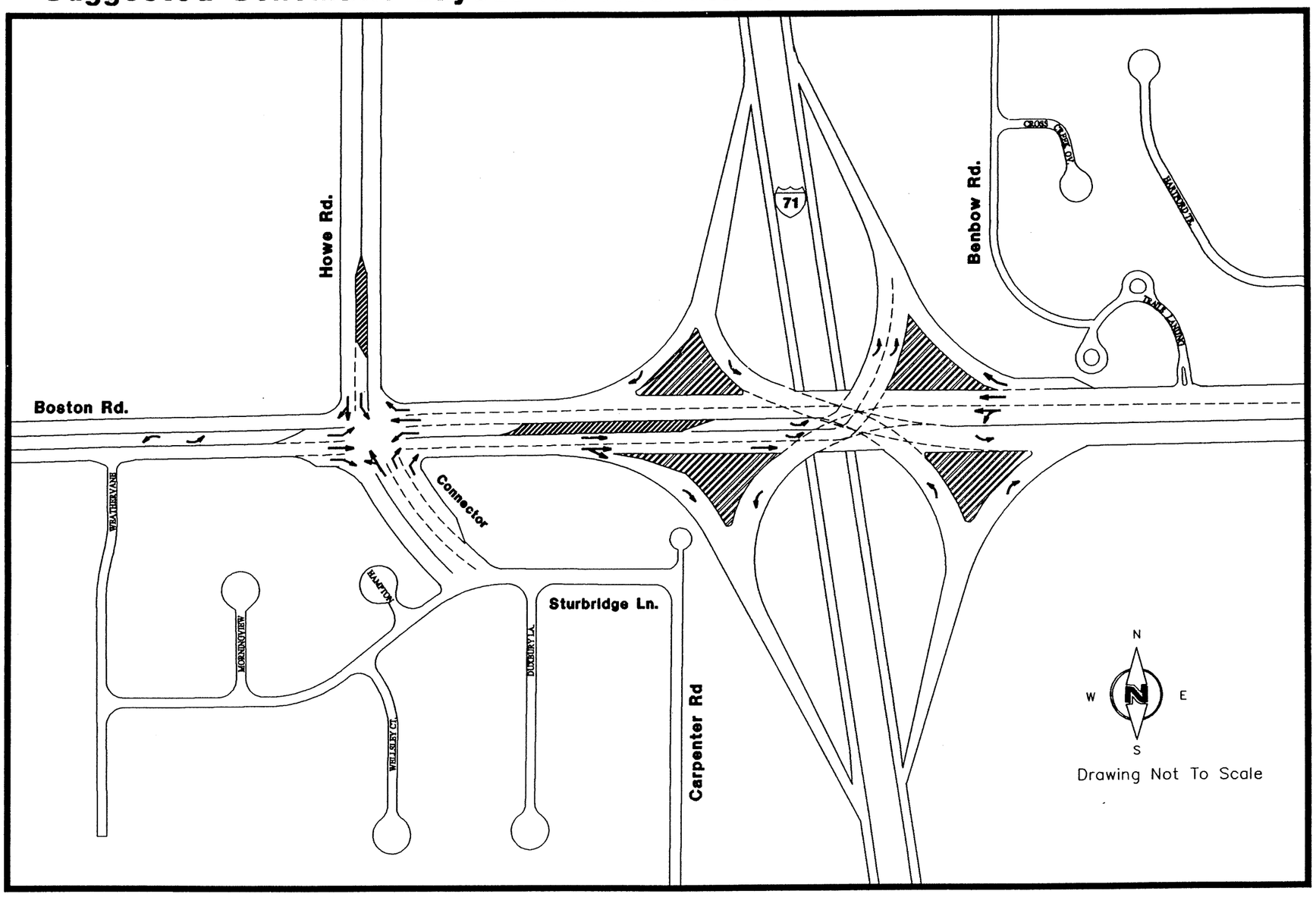


Figure: 23

Suggested Schematic Layout for Alternative C&D

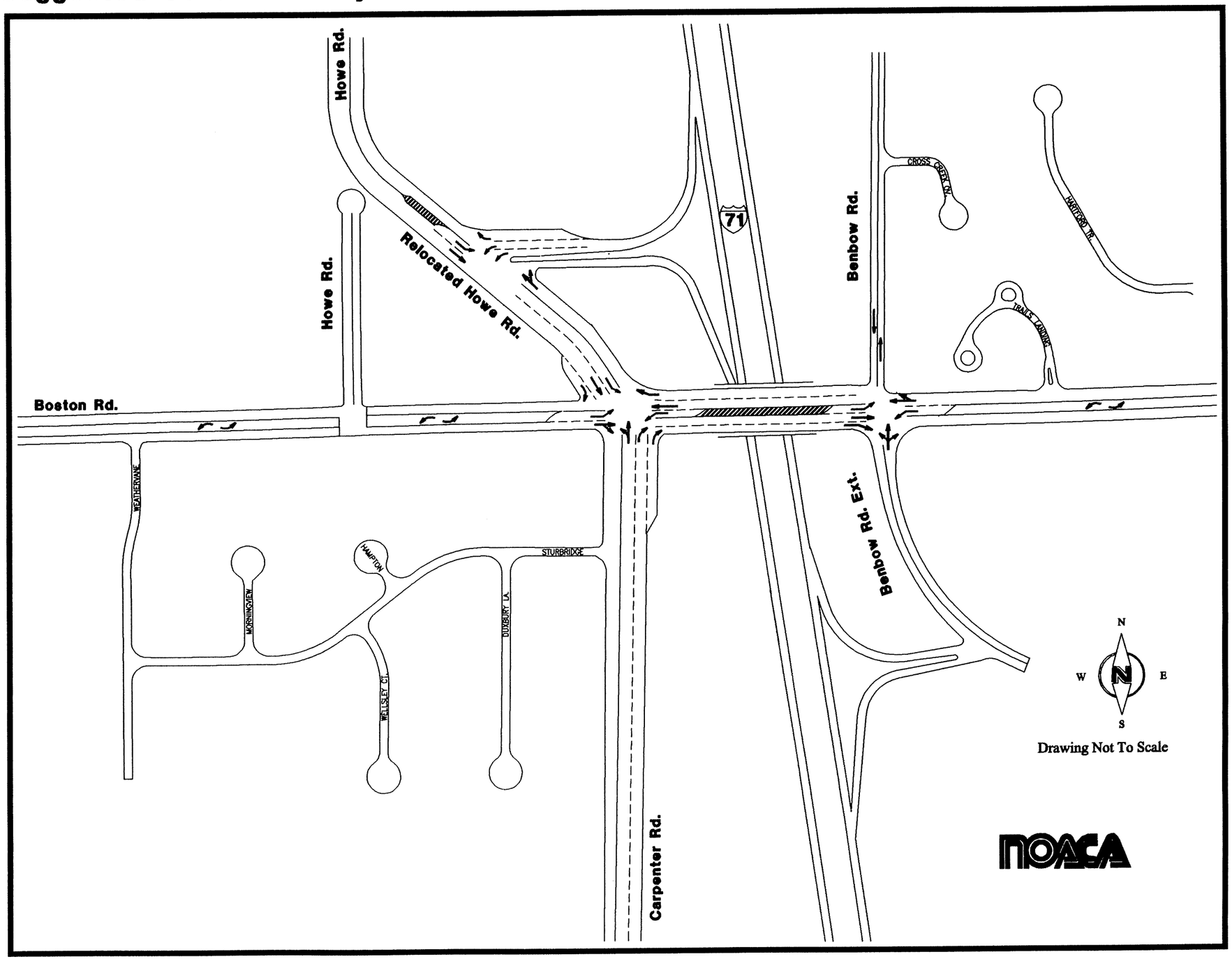
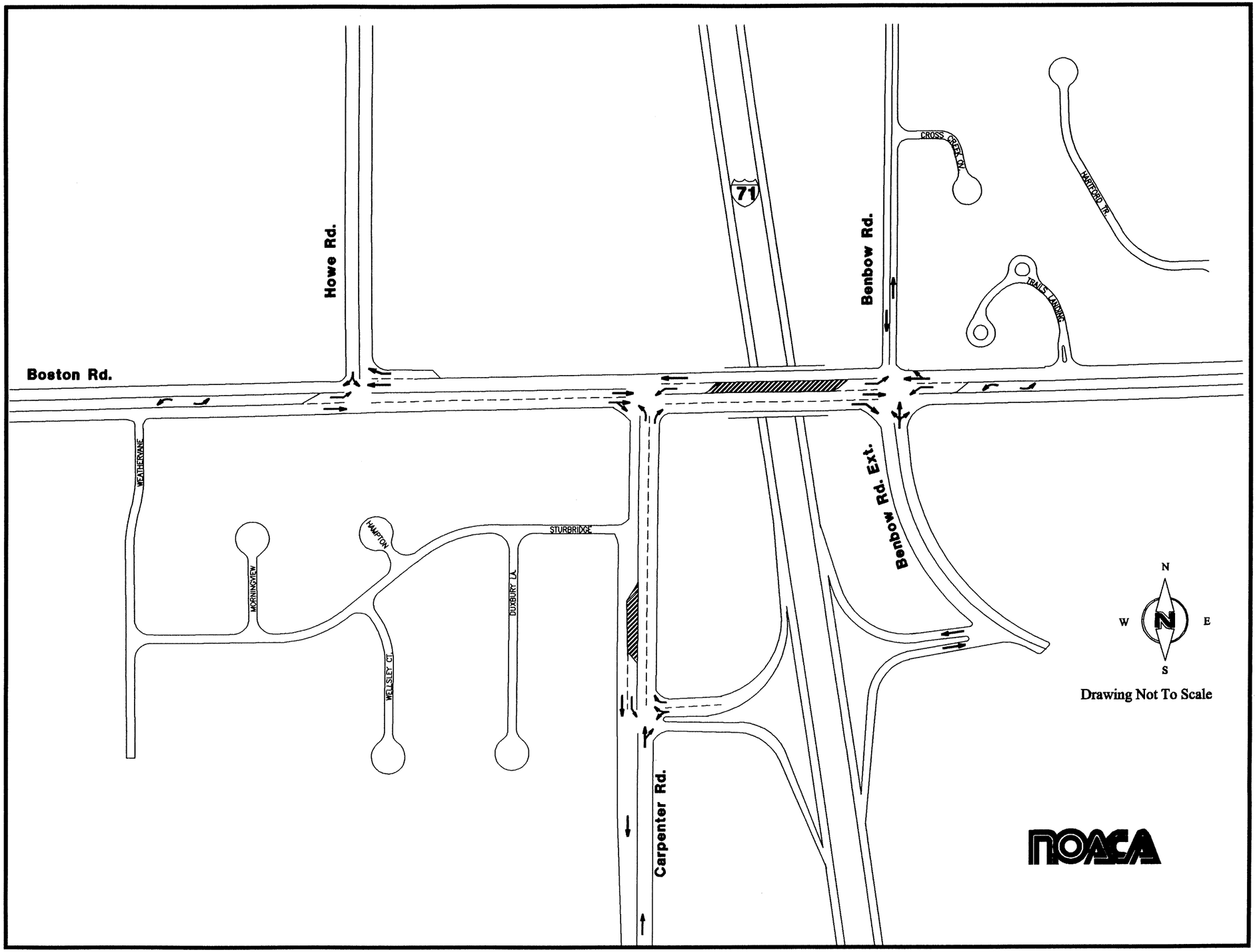


Figure: 24

Suggested Schematic Layout for Alternative D&E



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(Appendix I thru IX are part of 1995 draft report, Appendices X & XI are enclosed)

4180t

I. INTRODUCTION AND BACKGROUND

As part of NOACA's Fiscal Year 1999 Overall Work Program, the Ohio Department of Transportation (ODOT) requested an update of the 1995 Point-of-Access Justification Study for Boston Road at I-71 in Medina and Cuyahoga Counties. NOACA, upon the request of the Cities of Brunswick and Strongsville, began conducting this study in June 1995.

Traffic congestion in the area has been of great concern to local officials for many years. Since 1984, several studies have been prepared to address the traffic congestion problem and investigate the need for a new Point-of-Access to IR-71 at Boston Road.

The first report for a point of access at IR-71/Boston Road was done by NOACA in April 1984. The report concluded that there was sufficient justification for an additional access to I-71 at Boston Road. That justification was based primarily on a forecast increase in traffic from developments in Southwest Cuyahoga and Northern Medina Counties. A benefit-cost analysis was done and presented in a 1986 summary report. It showed a high economic benefit for the motorists using the proposed interchange in the area. In November 1989, a Part II IR-71/Boston Road interchange study, was also done by NOACA. Since the justification process for interstate highway access was revised in 1988 to require an impact study of such proposed access on the freeway mainline, adjacent interchanges, the arterial system, and the environment, NOACA prepared Part II of the IR-71/Boston Road interchange study to fulfill the requirements of the Ohio Division of FHWA. Also traffic studies by Barton-Aschman Consultants done in 1992 recommended the planned improvements to SR-82 and the IR-71/SR-82 interchange modification. This study addresses the impact of traffic associated with the new regional shopping mall (South Park Center) located at SR-82 and Howe Road.

A regional freeway accessibility study completed by NOACA in 1990, which reviewed all potential interchange locations in the region, recognized IR-71/Boston Road as one of the most likely locations for a new interchange with IR-71 in Cuyahoga and Medina Counties.

Traffic forecasts for Horizon Year 2020, certified by the Ohio Department of Transportation's Bureau of Transportation Technical Services (BTTS), were used for the future year analysis.

The study also considers peak traffic demand reduction measures as part of the solution for traffic congestion. NOACA staff examined demand reduction strategies such as ramp meters, park-n-ride lots, and the promotion of rideshare, vanpool, the use of transit and other modes of transportation.

II. GENERAL DISCUSSION

Freeway access to the Cities of Strongsville and Brunswick is being provided currently at Royalton Road (SR-82) and Center Road (SR-303) on I-71.

Recent developments, along with significant population growth in the last decade, have increased the traffic demand on IR-71 at SR-82 and SR-303 interchanges, causing the operation of these interchanges to diminish to unacceptable levels. The purpose of this report is, therefore, to determine the feasibility of providing another access to IR-71 at Boston Road to take part of the traffic burden off the SR-82 and SR-303 interchanges and to serve the recently developed area between the existing interchanges.

The proposed interchange location at I-71 and Boston Road is in the southern part of the City of Strongsville (1990 population: 35,308) and the northern part of the City of Brunswick (1990 population: 28,230) approximately 20 miles southwest of downtown Cleveland (1990 population: 505,616), within the Cleveland Urbanized Area.

The interchange location is in the vicinity of several major trip generators in the area that include South Park Center Mall (opened in 1996) on SR-82 north of the proposed interchange. Existing full interchanges with IR-71 that serve the area are located at SR-82, approximately 2.5 miles north of Boston Road, and at SR-303, approximately 2.6 miles to the south (see Figures 1 and 2). The proposed interchange will remove part of the traffic burden from the SR-82/IR-71 interchange, where traffic queues usually form on the southbound exit ramp in the afternoon rush hour extending to IR-71 mainline.

III. STUDY DESIGN

This study was designed to analyze and address the following elements.

1. Freeway Mainline;
2. Ramp junctions of adjacent interchanges;
3. Arterial System; and
4. Environmental issues.

The Freeway Ramp Junctions and Arterial Intersections were analyzed for the following traffic conditions:

I. Existing traffic counts (1990-1994 ODOT Counts)

II. Future traffic without an interchange at IR-71/Boston Road ("No-Build" scenario)

III. Future traffic with the proposed interchange at IR-71/Boston Road ("Build" scenario)

The level-of-service analyses for the future "Build" and "No-Build" scenarios were prepared taking into consideration the planned improvements on SR-82 including ramp metering and modifications to SR-82/IR-71 interchange as was proposed by previous studies and the lane additions to IR-71 from SR-303 to US-42.

V. METHODOLOGIES EMPLOYED

Traffic Forecasts - Year 2010 traffic forecasts (24-hour traffic) were provided by the Ohio Department of Transportation's Bureau of Transportation Technical Services (BTTS) and were used to obtain the future Year 2020 traffic for the future "Build" and "No-Build" conditions. Growth factors from the vehicle trip end summary for the traffic zones in the affected study area were applied in updating the forecasts from Year 2010 to Year 2020. The final Horizon Year 2020 forecasts were reviewed and certified by ODOT's Bureau of Technical Services.

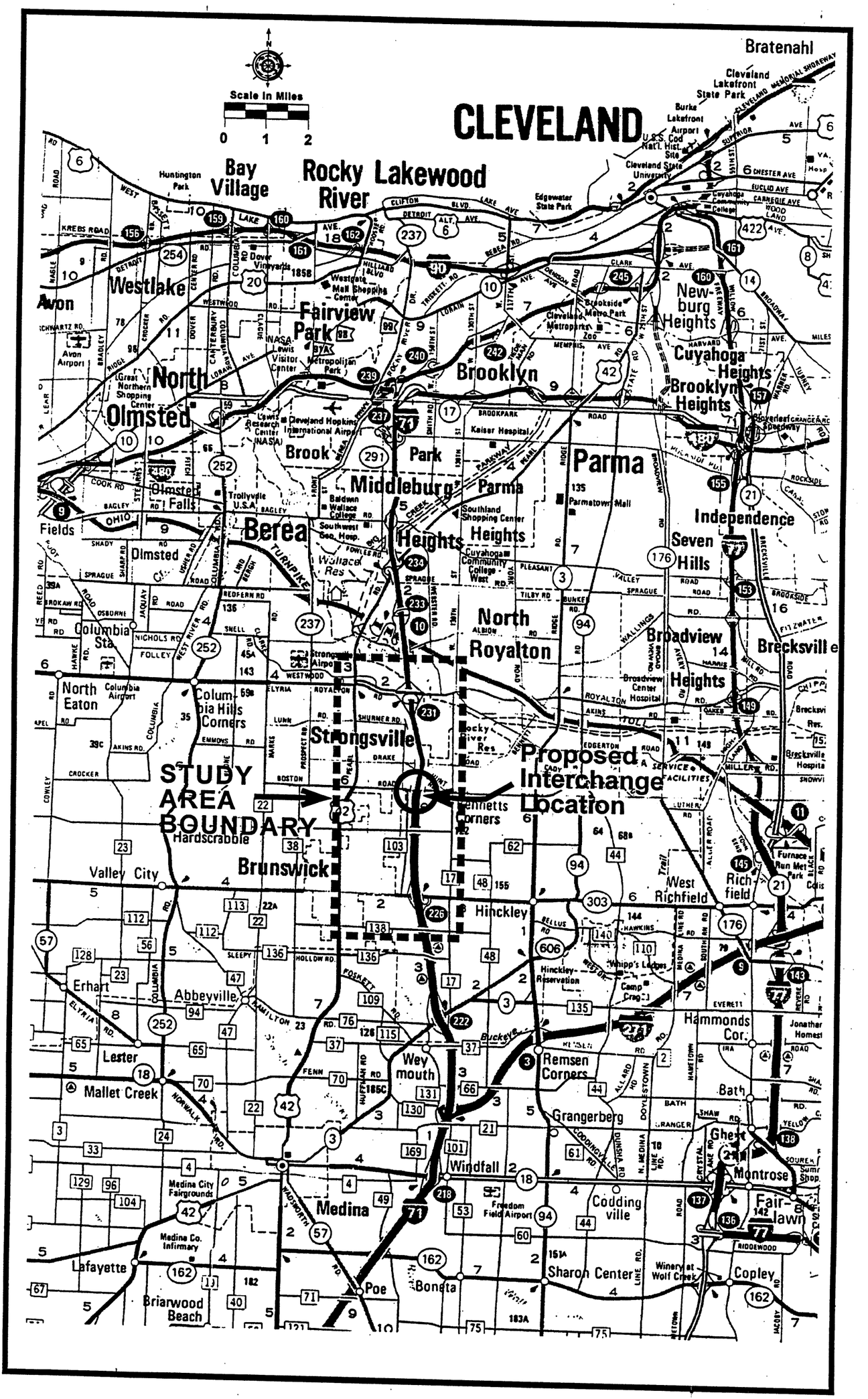
Level-of-Service Analysis - The 1994 update of the Highway Capacity Manual Software (HCS) was used to determine the Level-of-Service (LOS). The analyses were based on the operational methodologies for freeway mainline segments, ramp junctions, and arterial intersections. In all cases, attempts were made to find the number of lanes, turn lanes, and optimum signal timing needed to operate the peak forecast traffic at least to LOS "D". This level was considered both acceptable and desirable in urban areas. Table 1 contains a description of arterial level-of-service (LOS) criteria. In the analysis of the geometric layouts of the proposed Boston Road/I-71 interchange, HCM Cinema release 3.03 was used for the estimate of queues and Bay Lengths along Boston Road and the I-71 ramps.

Peak Hour Traffic Demand Reduction - Traffic demand reduction strategies were taken into consideration to reduce the peak traffic demand. This part of the study estimated the number of vehicles needed to be removed to achieve acceptable level of operation at the critical locations in the study area. Level-of-service calculations were repeatedly conducted with incremental reduction of the traffic until an acceptable level of operation was achieved.

Geometric Layout - The Ohio Department of Transportation, District 12 Planning Department will perform the geometric layout of the proposed interchange using Computer-Aided-Design (CAD). This task will be done to ensure that the recommended improvements can be constructed according to the AASHTO, FHWA's and ODOT's specifications.

FIGURE: 1

BOSTON ROAD INTERCHANGE STUDY LOCATION MAP



PROPOSED INTERCHANGE LOCATION AND INFLUENCE AREA

FIGURE: 2

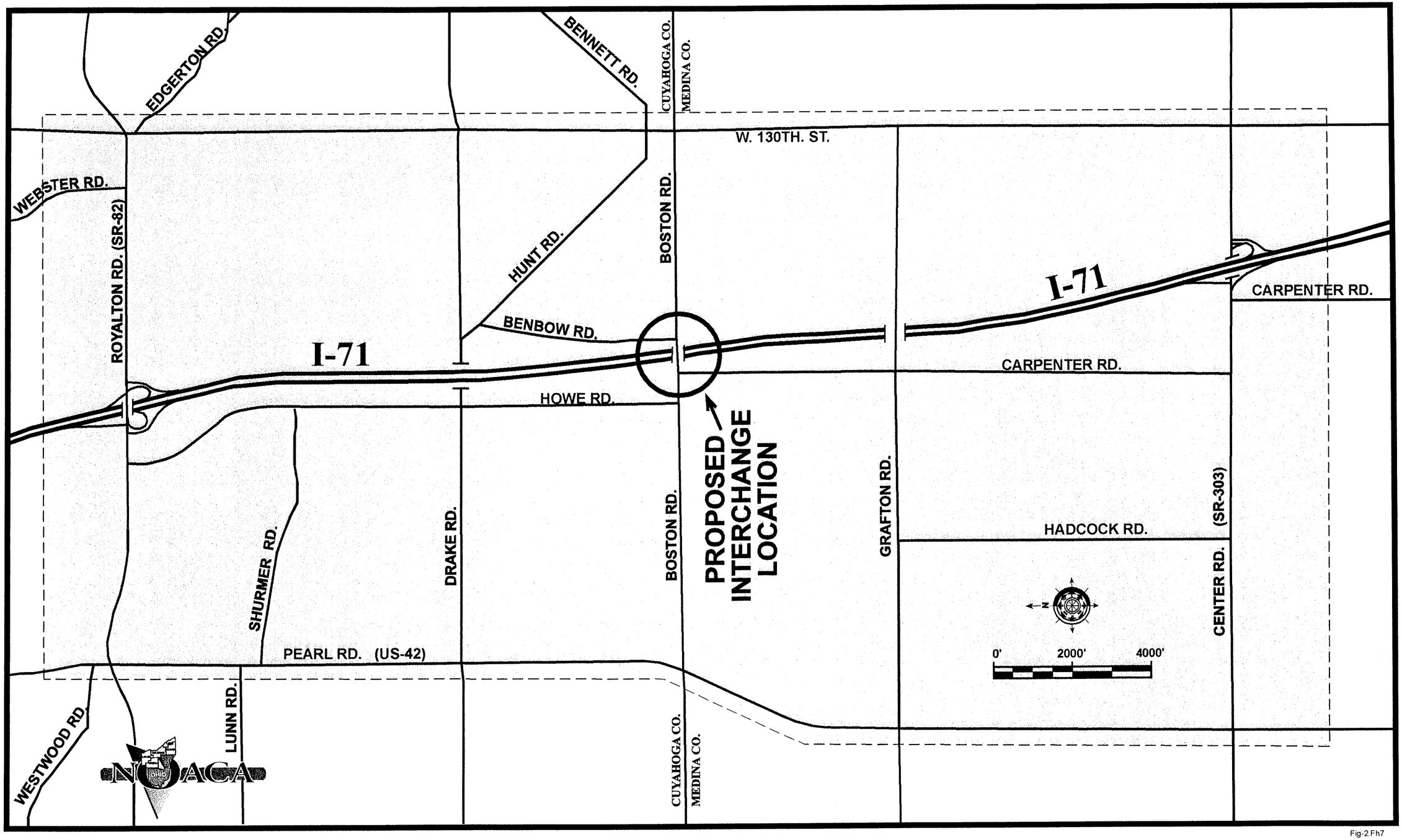


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TABLE 1
SIGNALIZED INTERSECTION
LEVEL-OF-SERVICE (LOS) CRITERIA

Signalized Intersection Level-of-Service is a qualitative measure describing the operational performance of intersections under prevailing, forecast or proposed operating conditions such as traffic volumes, geometrics and traffic control devices. The primary factor in determining this qualitative measure is vehicular delay. Delay is used as a measure to quantify driver discomfort and frustration and to estimate fuel consumption and lost travel time. Level-of-service criteria are stated in terms of specific ranges of average-stopped-delay per vehicle for a 15-minute analysis period. The table below shows the assignment of each range to each Level-of-Service designation and a description of the quality of flow.

Level-of-Service (LOS)	Average Stopped Delay Per Vehicle (Sec)	Quality of Flow
A	≤5.0	Smooth flow is easily achievable. Most vehicles do not experience unreasonable delays in their orderly movement during a traffic signal cycle.
B	>5.0 to ≤15.0	There is good traffic flow but is less easily achievable than under LOS "A" conditions.
C	>15.0 to ≤25.0	Fair traffic flow but more significant vehicular delays.
D	>25.0 to ≤40.0	As average stopped delay increases, congestion becomes more noticeable. Cycle failures become more eminent.
E	>40.0 to ≤60.0	Frequent cycle failures. Vehicles arrive at the intersection but cannot clear it during the green interval. They must wait through two or more cycles before they can traverse the intersection. Congestion becomes evident.
F	>60	Delay is so excessive that the intersection operates at breakdown condition (forced flow), but still at a volume/capacity (v/c) ratio of 1.2 or less.
* (An asterisk indicates that the v/c ratio is greater than 1.2)	Calculated delay is meaningless	A complete breakdown of intersection operation. Constant cycle failures, and so congestion becomes the norm.

LOS "D" or better, is usually considered an acceptable level of operation in urban areas. On heavily-used urban arterials, however, with predominately work-trip traffic during peak periods, LOS "D" is considered acceptable during such peak periods.

V. ANALYSES

1. Freeway Mainline and Ramp Junctions

A - Existing Traffic Volumes - Existing 24-hour traffic volumes were obtained from the (1990-1992) Ohio Department of Transportation counts.

Existing traffic volumes show that the IR-71/SR-82 ramps are handling 34,602 vehicles per day, of which 28,684 vehicles (83 percent of the total volume) are using the ramps from and to the north.

The same pattern of movements exists at the SR-303/IR-71 interchange where the ramps are handling 25,854 vehicles per day. The traffic pattern suggests that there be a great travel demand between the Brunswick and Strongsville areas and surrounding communities in Cuyahoga County. The mainline volume at its highest location in the study area (north of SR-82) is 76,038 vehicles per day (see Figure 3).

B - Year (2020) Traffic - Traffic forecasts for the Year 2010 traffic were done by the Ohio Department of Transportation's Bureau of Transportation Technical Services (BTTS) and were used to obtain forecast traffic for future Year 2020. Two highway network scenarios were considered. The first scenario was to forecast future traffic on the existing highway network without building the proposed interchange at Boston Road and IR-71 -- the "No-Build" scenario. The second scenario was to forecast the traffic on a highway network that includes the proposed interchange at Boston Road -- the "Build" scenario. Figures 4 and 5 show the forecast traffic on the "No-Build" and "Build" scenarios, respectively.

The "No-Build" scenario shows that the traffic on the IR-71/SR-82 ramps from and to the north will increase by 65 percent from an existing 28,684 vehicles per day to

47,420 vehicles per day. This forecast will further degrade the operation of these ramps. The traffic growth on the IR-71/SR-82 ramps from and to the south grew from 5,918 vehicles per day (vpd) to 21,140 vpd. This is a growth greatly attributed to South Park Center Mall and The Greens of Strongsville Plaza (located on SR-82).

Traffic on the IR-71/SR-303 ramps, from and to the north, grew from the existing 18,293 vpd to 29,890 vpd for the future "No-Build" scenario.

For the "Build" scenario, the traffic forecast show a decrease in traffic volumes on the IR-71/SR-82 ramps. Under the "No-Build" scenario, 47,420 vpd will use the ramps from and to the north compared with 40,230 vpd using the ramps under the "Build" scenario, also 21,140 vpd will use the ramps from and to the south compared with 16,010 vpd using the ramps under the "Build" scenario.

The proposed interchange is forecast to carry 14,860 vpd. The dominant traffic movements will use the ramps from and to the north as shown on Figure 5. The IR-71/SR-303 ramps' traffic is projected to be 42,270 for the "No-Build" and 39,600 vpd for the "Build" scenario.

The proposed interchange will attract approximately 12,000 vpd from the SR-82/IR-71 interchange and about 2,500 vpd from the SR-303/IR-71 interchange.

C - **Level-Of-Service (LOS) Analysis** - The 1994 update of the Highway Capacity Manual and its software (HCS) was used for the mainline and ramp junctions analysis. In this revised manual, the ideal capacity for a freeway lane has been increased to 2,200 passenger-cars per hour (pcph) for four-lane freeways and 2,300 pcph for six-lane freeways from 2,000 pcph. The methodology for analyzing the ramps includes a revised level-of-service boundaries based on density as shown in Table 2. The design hour traffic used for the LOS calculations was derived from the daily traffic volumes shown on Figures 3, 4, and 5. Design hour traffic factors provided by the Ohio Department of Transportation's Bureau of Transportation Technical Services (BTTS). The LOS were evaluated for existing, future "No-Build", and future "Build" traffic scenarios. The calculated LOS for the three scenarios are shown on Figures 6, 7 and 8.

Interstate 71 was a four-lane highway (two lanes in each direction) throughout the study area at the inception of this justification study. A third lane in each direction for IR-71 from SR-18 in Central Medina County to US-42 in Southwest Cuyahoga County was under design. Under foreseeable programming the additional lane will be open throughout the study area in 2002. The additional mainline lanes were considered in the evaluation of the future level-of-service (LOS) scenarios.

Level-Of-Service (LOS) "D" or better will be the acceptable criteria used in achieving optimum operating conditions for mainline traffic, and ramp junctions.

Tables 3 and 4 present a summary of the results of the freeway-ramp junction level-of-service (LOS) analysis for all scenarios examined.

Level-of-service (LOS) analysis for existing conditions shows that the freeway segments and the ramp junctions are operating at acceptable level-of-service, except at the following location:

1. IR-71 mainline segment, north of SR-82, the LOS is "F".
2. The IR-71/SR-82 interchange ramps, from and to the north, where the operation is at LOS "F" for the exit and entrance ramps. See Figure 6. The highway capacity software outputs for existing conditions are shown in Appendix I.

TABLE 2

LEVEL OF SERVICE CRITERIA FOR RAMP-FREEWAY JUNCTION AREAS OF INFLUENCE

LEVEL OF SERVICE	MAXIMUM DENSITY (PRIMARY MEASURE) (PC/MI/LN)*	MINIMUM SPEED (SECONDARY MEASURE) (MPH)
A	10	58
B	20	56
C	28	52
D	35	46
E	>35	42
F	a	a

a Demand flows exceed the capacity.
* Passenger car per mile per lane.

Level-of-service (LOS) analysis for future "No-Build" shows that the mainline segment north of SR-82 will operate at unacceptable levels-of-service during the peak hours. All other freeway segments will operate at an acceptable level-of-service. The freeway mainline in the study area is considered three lanes in each direction in this analysis.

The IR-71/SR-82 interchange southbound exit ramps will operate at an unacceptable level-of-service "F" during the highest peak hour. The poor level of operation is due to the high traffic volume using these ramps. The calculated levels-of-service are shown on Figure 7. The computer outputs for the future "No-Build" conditions are shown in Appendix II.

Level-of-Service (LOS) analysis for future "Build" shows that the mainline segment north of SR-82 will continue to operate at Level-of-Service "F" during the highest peak hour. The southbound segment of I-71 south of SR-82 will continue to operate at LOS "D" during the peak periods whether the proposed interchange is built or not.

The ramp junctions analyzed will operate at acceptable levels of service except at the SR-82/I-71 southbound exit and northbound loop ramps.

The level-of-service analysis results for this scenario are shown on Figure 8. Appendix III contains the computer output for this scenario.

The ramp junctions analysis did not produce significant change in the level of service at the congested locations under the "Build" scenario comparing the results with the "No-Build". However, the SR-82/I-71 interchange ramps from and to the north will be relieved. Peak hour traffic will be reduced by 19 percent, from 4,620 vehicles per hour for the "No-Build" to 3,740 vehicles per hour for the "Build" alternative.

The SR-303/I-71 southbound exit ramp will also be relieved by 8.5 percent during the peak hour, from 2,110 vehicles per hour for the "No-Build" to 1,930 vehicles per hour for the "Build" alternative.

The length of the acceleration or deceleration lane influences lane distribution and ramp operations in the immediate vicinity of the freeway ramp junction. Therefore, it is recommended to keep the length of acceleration and deceleration lanes as they exist currently especially the deceleration lane of the I-71 southbound exit ramp extended recently by the state to about 1,370 feet. For the proposed interchange at

FIGURE 3: EXISTING 24-HOUR TRAFFIC

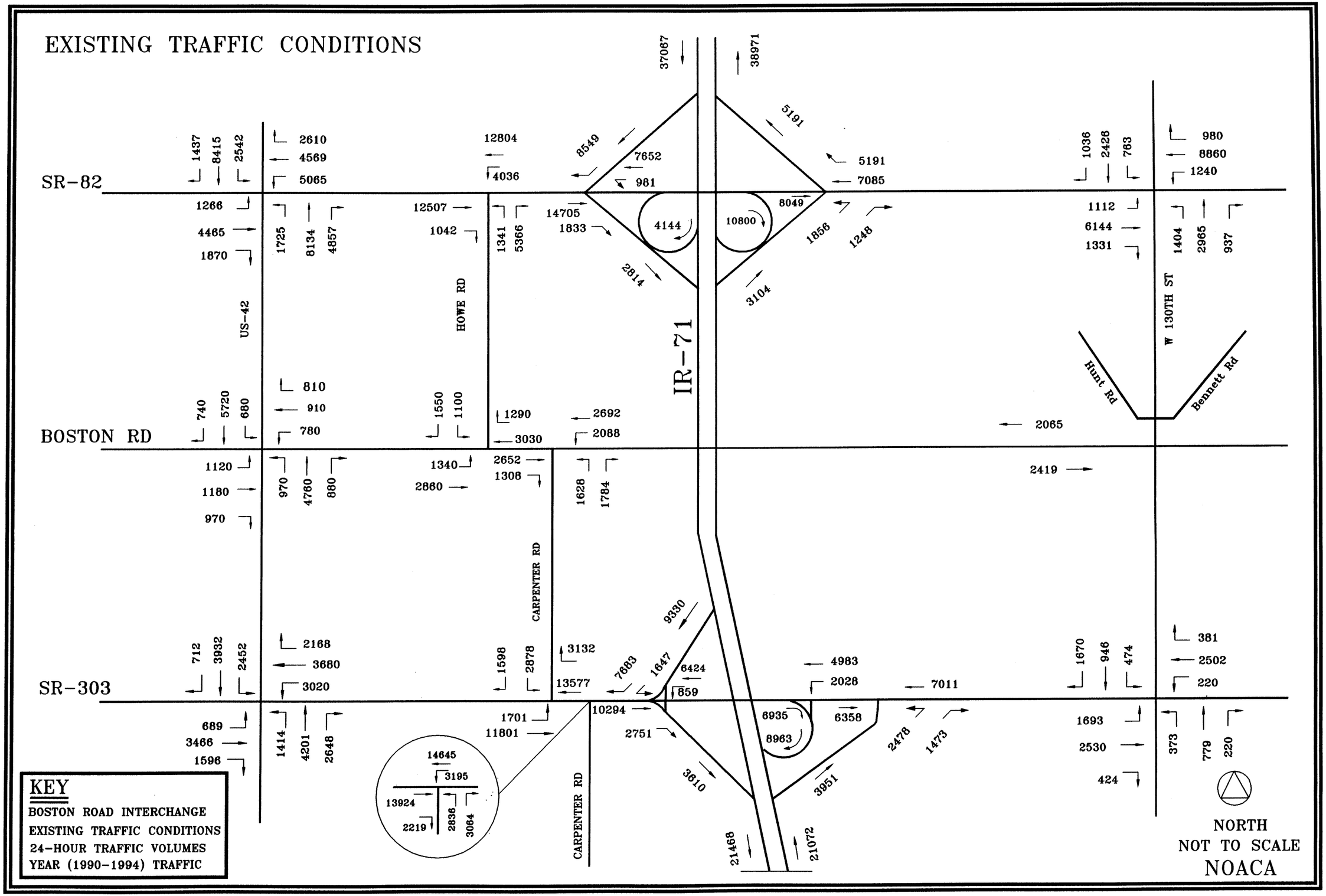


FIGURE 4: FUTURE YEAR (2020) 24-HOUR TRAFFIC

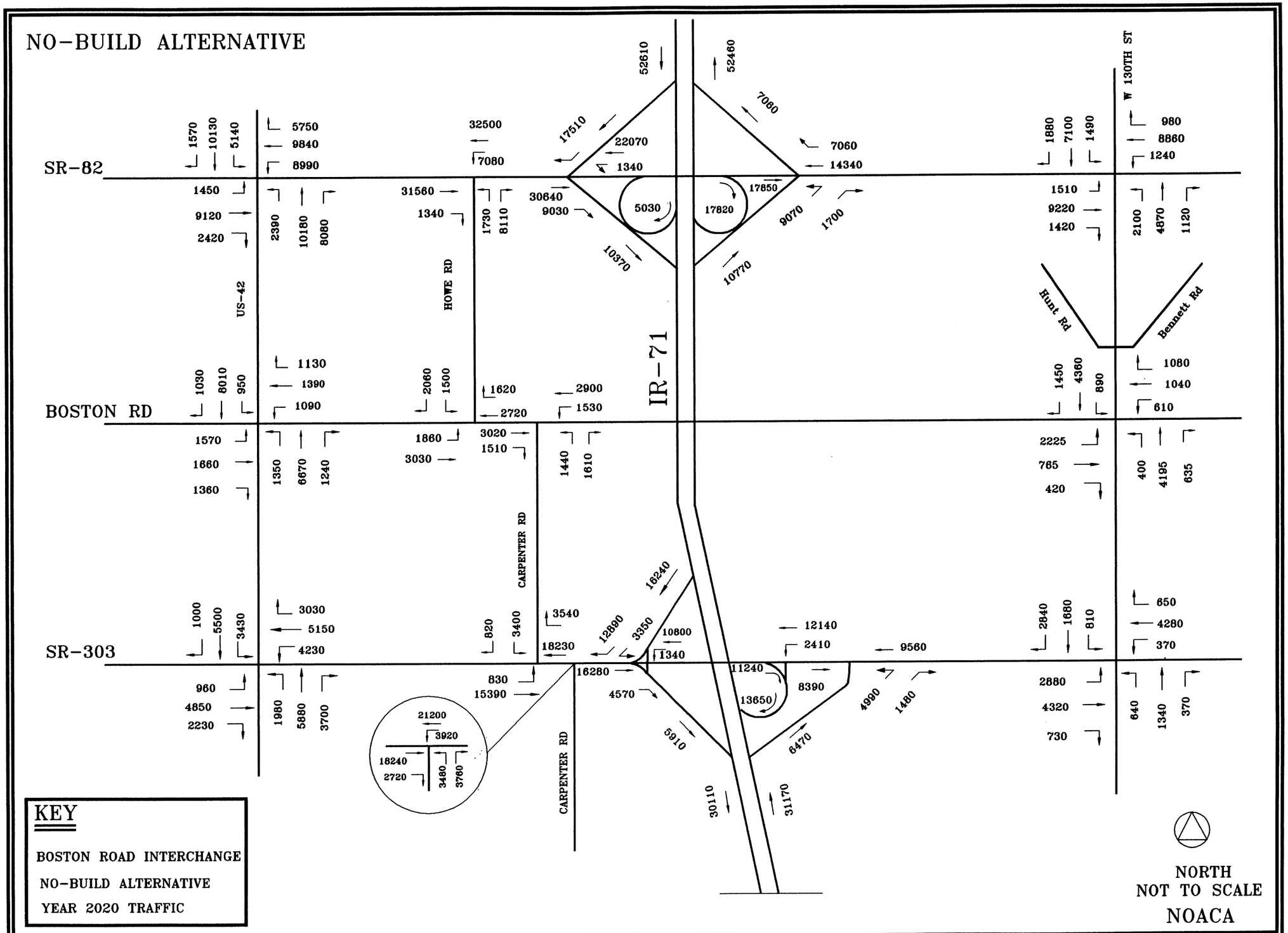


FIGURE 5: FUTURE YEAR (2020) 24-HOUR BUILD TRAFFIC

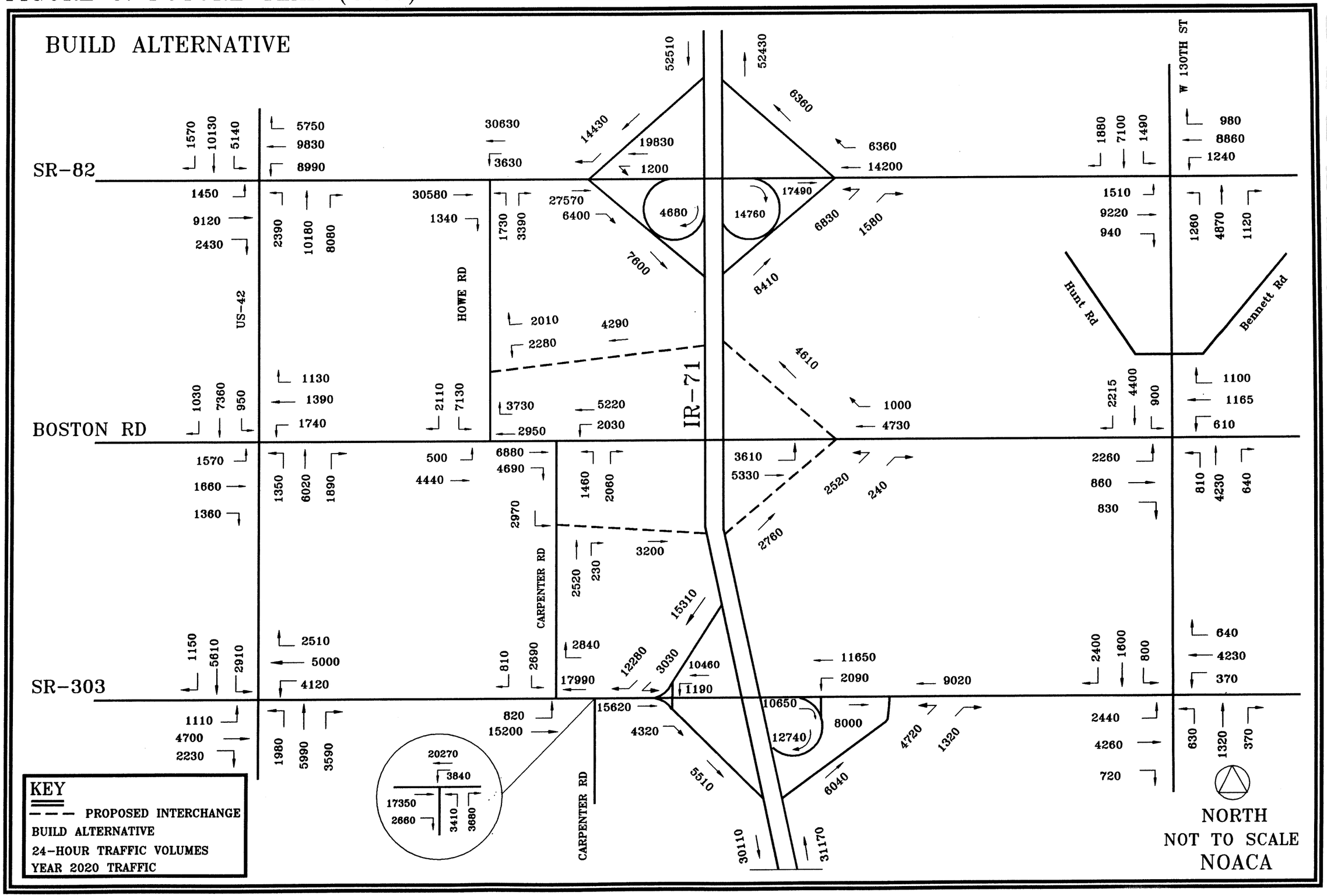


FIGURE 6: EXISTING A.M. (P.M.) PEAK HOURS TRAFFIC AND LEVEL OF SERVICE

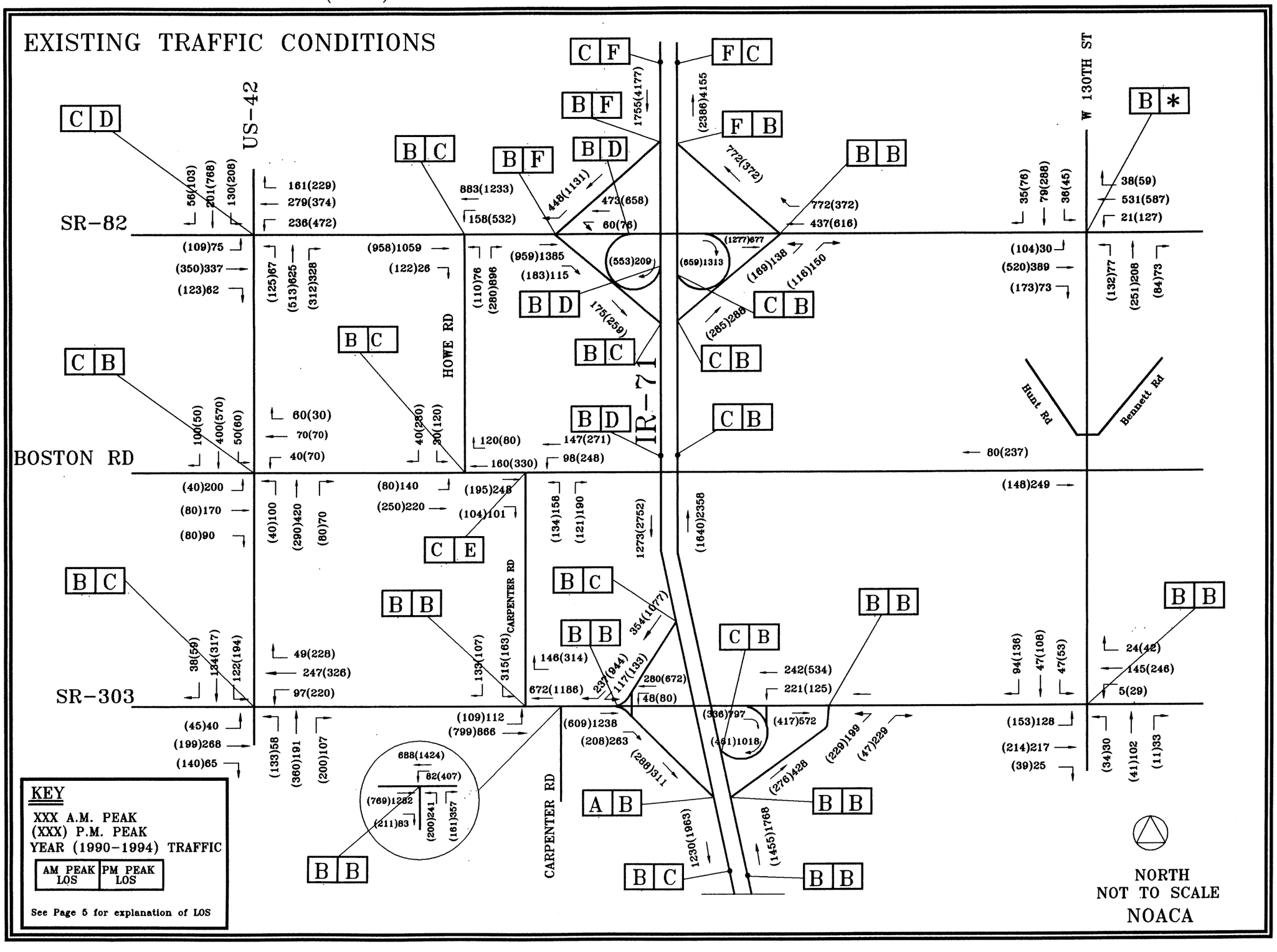
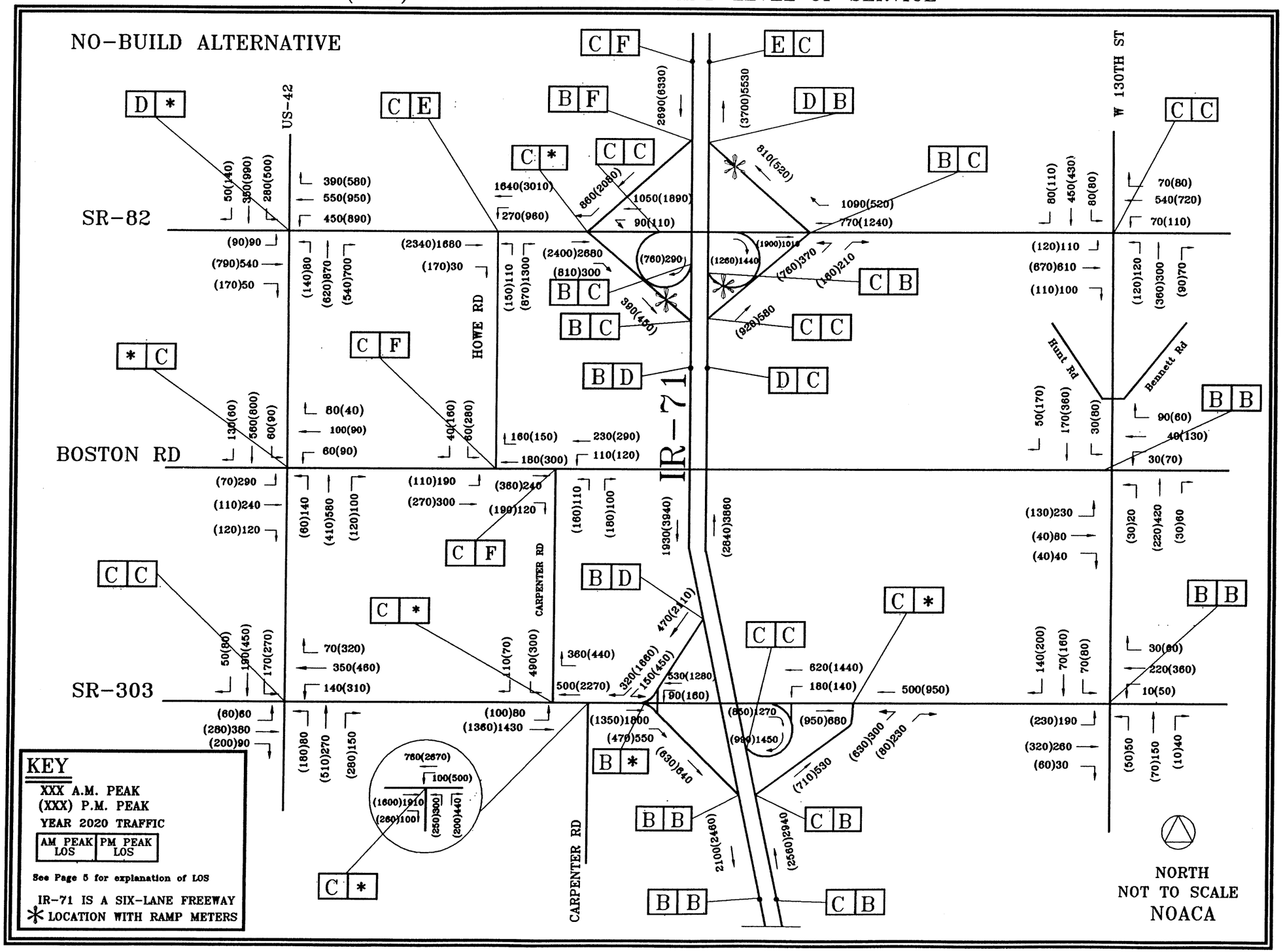


FIGURE 7: YEAR 2020 A.M. (P.M.) PEAK HOURS TRAFFIC AND LEVEL OF SERVICE



SR-82 INTERCHANGE WITHOUT RAMP METERING

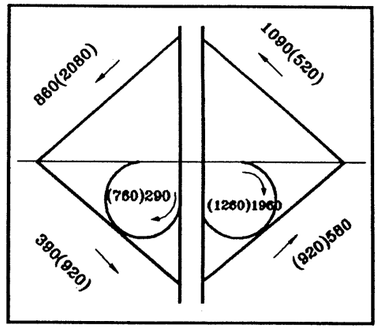
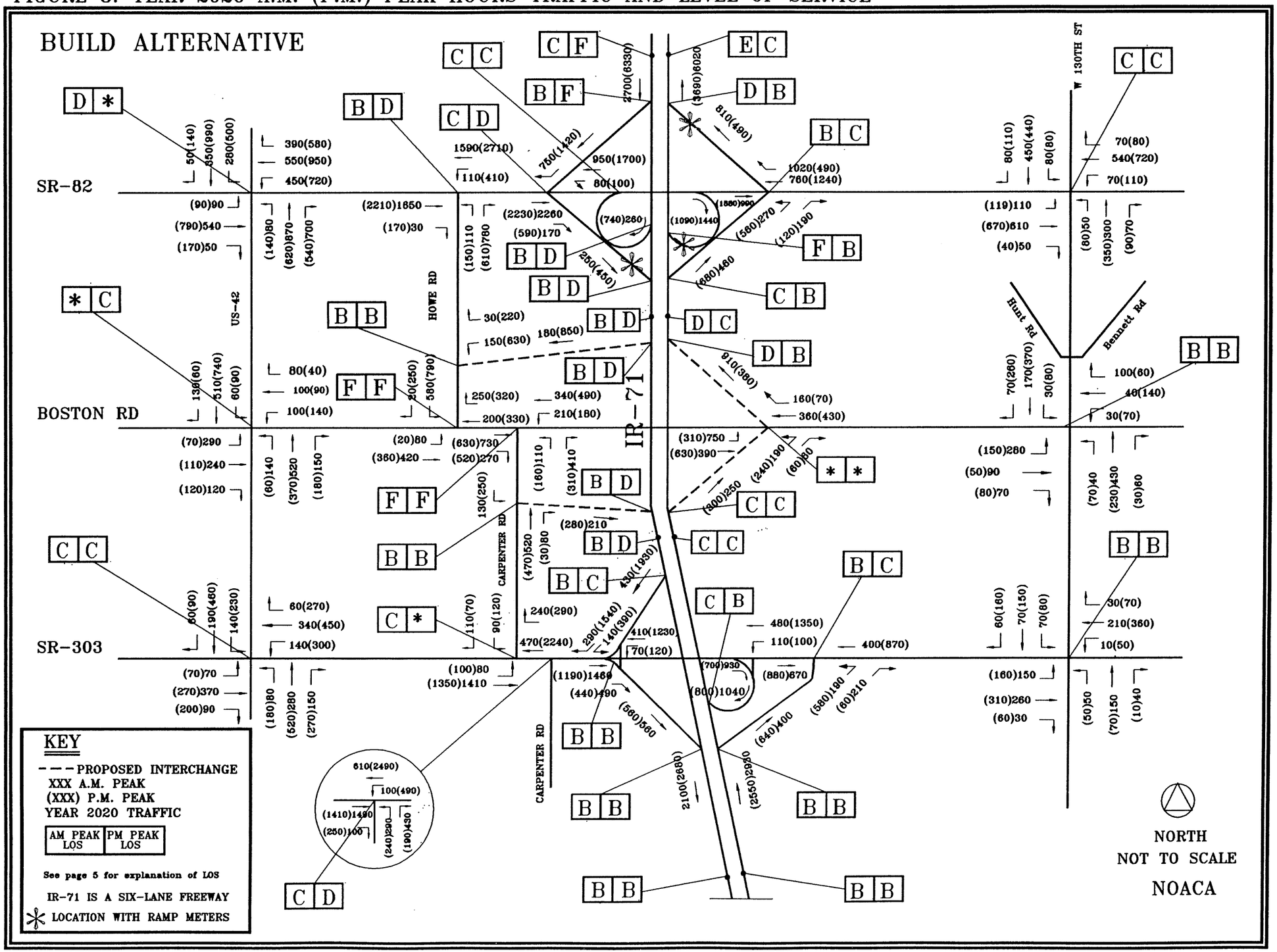


FIGURE 8: YEAR 2020 A.M. (P.M.) PEAK HOURS TRAFFIC AND LEVEL OF SERVICE



SR-82 INTERCHANGE WITHOUT RAMP METERING

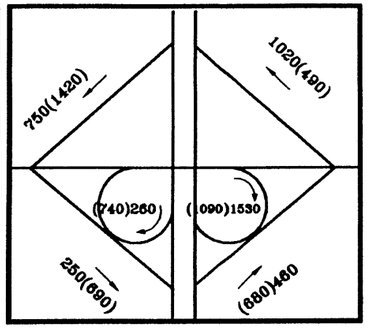


TABLE 3: FREEWAY LEVEL OF SERVICE BETWEEN NORTH OF SR-82 AND SOUTH OF SR-303

MAINLINE LOCATION	EXISTING TRAFFIC WITH 2-LANES EACH DIRECTION		YEAR 2020 NO-BUILD WITH 3-LANES EACH DIRECTION WITH PLANNED IMPROVEMENTS ON SR-82 INCLUDING RAMP METERS		YEAR 2020 NO-BUILD (3-LANES EACH DIRECTION) WITH TRAFFIC DEMAND REDUCTION & RAMP METERS		YEAR 2020 BUILD WITH 3-LANE EACH DIRECTION WITH PLANNED IMPROVEMENTS ON SR-82 INCLUDING RAMP METERS		YEAR 2020 BUILD WITH 3-LANES IN EACH DIRECTION WITH TRAFFIC DEMAND REDUCTION & RAMP METERS	
	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
	FREEWAY L.O.S	FREEWAY L.O.S	FREEWAY L.O.S	FREEWAY L.O.S	FREEWAY L.O.S	FREEWAY L.O.S	FREEWAY L.O.S	FREEWAY L.O.S	FREEWAY L.O.S	FREEWAY L.O.S
I-71 SB NORTH OF SR-82	C	F	C	F	C	E	C	F	C	E
I-71 SB FROM SR-82 TO BOSTON RD	B	D	B	D	B	C	B	D	B	D
I-71 SB FROM BOSTON RD TO SR-303	B	D	B	D	B	C	B	D	B	C
I-71 SB SOUTH OF SR-303	B	C	B	B	B	B	B	B	B	B
I-71 NB SOUTH OF SR-303	B	B	C	B	B	B	B	B	B	B
I-71 NB FROM SR-303 TO BOSTON RD	C	B	D	C	C	C	C	C	C	C
I-71 NB FROM BOSTON RD TO SR-82	C	B	D	C	C	C	D	C	D	C
I-71 NB NORTH OF SR-82	F	C	E	C	D	C	E	C	D	C

See Page 5 for explanation of LOS

TABLE 4: LEVEL OF SERVICE FOR I-71 RAMP JUNCTIONS BETWEEN SR-82 AND SR-303

RAMP JUNCTIONS LOCATIONS	EXISTING TRAFFIC WITH 2-LANE EACH DIRECTION		YEAR 2020 NO-BUILD WITH 3-LANE IN EACH DIRECTION WITH PLANNED IMPROVEMENTS INCLUDING RAMP METERS AT SR-82/I-71 INTERCHANGE *		YEAR 2020 NO-BUILD WITH 3-LANE IN EACH DIRECTION WITH TRAFFIC DEMAND REDUCTION		YEAR 2020 BUILD WITH 3-LANE EACH DIRECTION WITH PLANNED IMPROVEMENTS INCLUDING RAMP METERS AT SR-82/I-71 INTERCHANGE *		YEAR 2020 BUILD WITH 3-LANE IN EACH DIRECTION WITH TRAFFIC DEMAND REDUCTION	
	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
	RAMP L.O.S	RAMP L.O.S	RAMP L.O.S	RAMP L.O.S	RAMP L.O.S	RAMP L.O.S	RAMP L.O.S	RAMP L.O.S	RAMP L.O.S	RAMP L.O.S
RAMP FROM I-71 SB TO SR-82 WB	B	F	B	F	B	D	B	F	B	C
RAMP FROM SR-82 EB TO I-71 NB (LOOP)	C	B	C	B	C	B	C	B	C	B
RAMP FROM I-71 SB TO SR-82 EB (LOOP)	B	F	B	C	B	C	B	D	B	C
RAMP FROM SR-82 WB TO I-71 NB	F	B	D	B	D	B	D	B	C	B
RAMP FROM SR-82 TO I-71 SB	B	D	B	C	B	C	B	D	B	C
RAMP FROM I-71 NB TO SR-82	C	B	C	C	C	C	C	B	C	B
RAMP FROM I-71 NB TO BOSTON RD	–	–	–	–	–	–	C	C	C	C
RAMP FROM BOSTON RD TO I-71 NB	–	–	–	–	–	–	D	B	C	B
RAMP FROM I-71 SB TO BOSTON RD	–	–	–	–	–	–	B	D	B	C
RAMP FROM BOSTON RD TO I-71 SB	–	–	–	–	–	–	B	C	B	C
RAMP FROM I-71 SB TO SR-303	B	C	B	D	B	C	B	D	B	C
RAMP FROM SR-303 TO I-71 SB	B	C	B	B	B	B	B	B	B	B
RAMP FROM SR-303 TO I-71 NB (LOOP)	C	B	C	C	C	C	C	B	B	B
RAMP FROM I-71 NB TO SR-303	B	B	C	B	C	B	B	B	B	B

See Page 5 for explanation of LOS

* Planned Improvements on SR-82

Boston Road, it is recommended to provide a length of at least 400 feet for acceleration and deceleration lanes.

Table A represents a summary of different alternative improvements analyzed to improve the level of service at the I-71 southbound exit ramps to SR-82 westbound and to SR-303. The analysis was conducted for the future year (2020) "Build" and "No-Build" traffic conditions. The SR-82 ramp was analyzed as a two-lane ramp, as a drop lane and under existing geometry using traffic demand reduction. Under the "Build" condition, result of the analysis shows that the SR-82 ramp improves to level-of-service "D" as a drop-lane, and to level-of-service "C" using demand reduction strategies.

D - **<u>Traffic Demand Reduction Analysis</u>** - As a part of this study, and to reduce the future congestion during the peak periods, NOACA staff examined demand reduction strategies aimed at reducing peak hour traffic demand.

This analysis was conducted for the future year (2020) "Build" and "No-Build" traffic conditions on the improved roadway system. As a minimum for this part of the study, and to achieve peak hour level-of-service "D" or better on the mainline and at the ramp junctions, the peak hour traffic has been reduced during the AM and the PM peak hours until an acceptable level-of-service was reached at the critical locations along I-71 within the study area. The needed reduction in vehicles to achieve acceptable level of operation is 700 vehicles for the "No-Build" and 1,050 vehicles for the "Build" scenario.

For the "No-Build" scenario, the level-of-service analysis shows that 350 vehicles are needed to be removed from the I-71/SR-303 southbound exit and northbound loop ramps during the peak hours and 350 vehicles from I-71 mainline south of the SR-303 interchange. The reduction was then applied throughout the mainline in the study area. The freeway mainline and ramp junctions will operate at acceptable levels-of-service at all locations but the mainline segment north of SR-82 in the southbound direction during the PM peak.

For the "Build" scenario, results of the level-of-service analysis show that 350 vehicles are needed to be removed from the I-71/SR-82 southbound exit and northbound loop ramps and 350 vehicles are needed to be removed from the I-71/SR-303 southbound exit and northbound loop ramps and 350 vehicles are needed to be removed from I-71 mainline south of SR-303 during the peak hours. The reduction was then applied throughout the mainline in the study area. All freeway segments and ramp junctions will operate at acceptable levels-of-service but the mainline segment north of SR-82 that improves but still will operate at LOS "E" in the southbound direction during the peak hours.

Figures 9 and 10 show the results of the level-of-service analysis. Appendix IV and V show the computer output for this analysis.

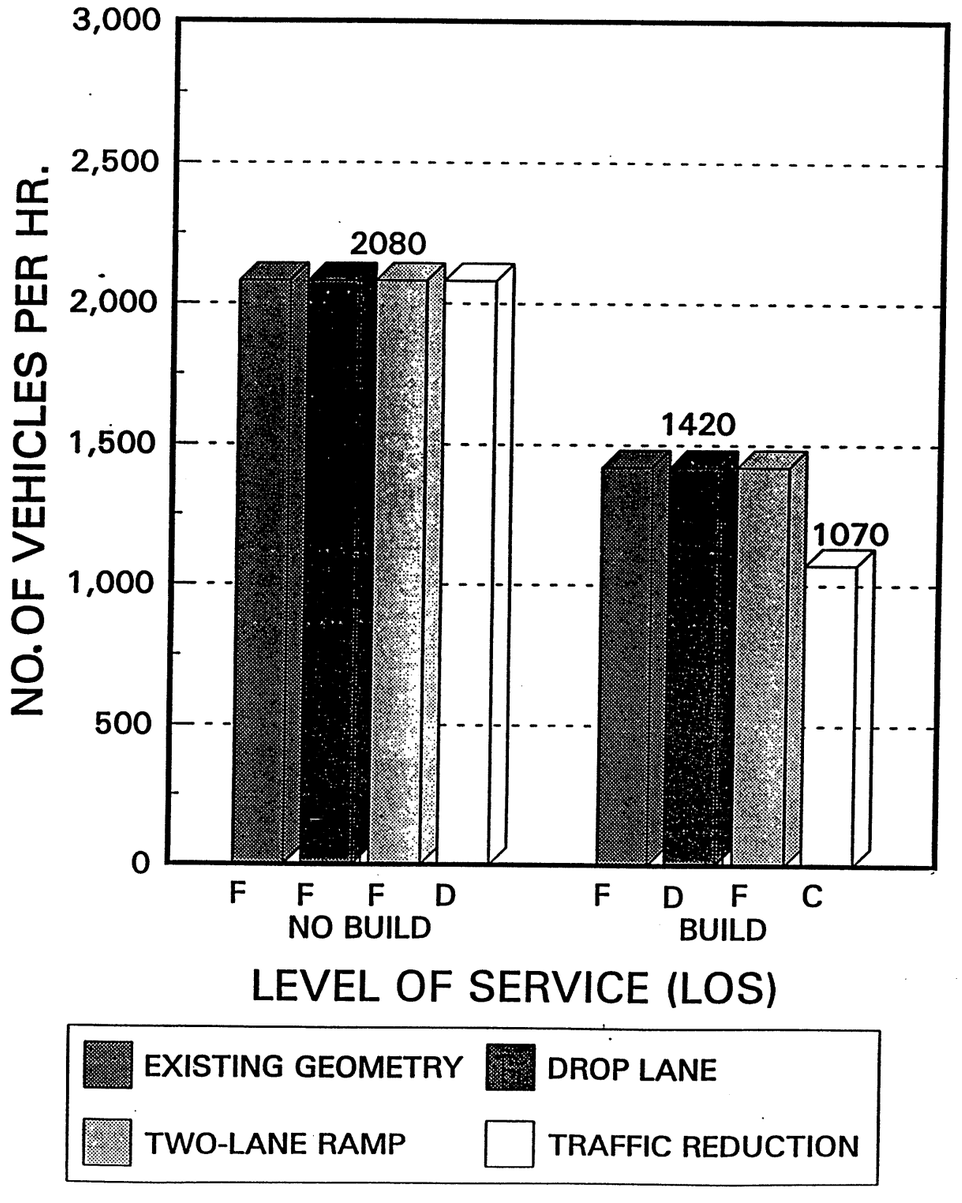
The traffic demand reduction effort can be achieved by building two park-n-ride lots in the vicinity of the SR-303 and SR-18 interchanges for the "No-Build" scenario and three park-n-ride lots in the vicinity of the SR-82, SR-303 and SR-18 interchanges for the "Build" scenario. The capacity of the park-n-ride facilities should be near to the number of vehicles needed to be removed to achieve acceptable levels-of-service at the critical locations within the study area. Figure 11 displays the level-of-service on I-71 mainline and its ramp junctions for year 2020 with and without the proposed interchange including the effect of traffic demand reduction measures.

TABLE A

PM PEAK VEHICLES / LOS
FOR POSSIBLE ALTERNATIVE IMPROVEMENTS
AT SR-82/I-71 AND SR-303/I-71 INTERCHANGES

RAMP FROM I-71 SB to SR 82 WEST

YEAR 2020 PM PEAK HOUR TRAFFIC



RAMP FROM I-71 SB TO SR-303

YEAR 2020 PM PEAK HOUR TRAFFIC

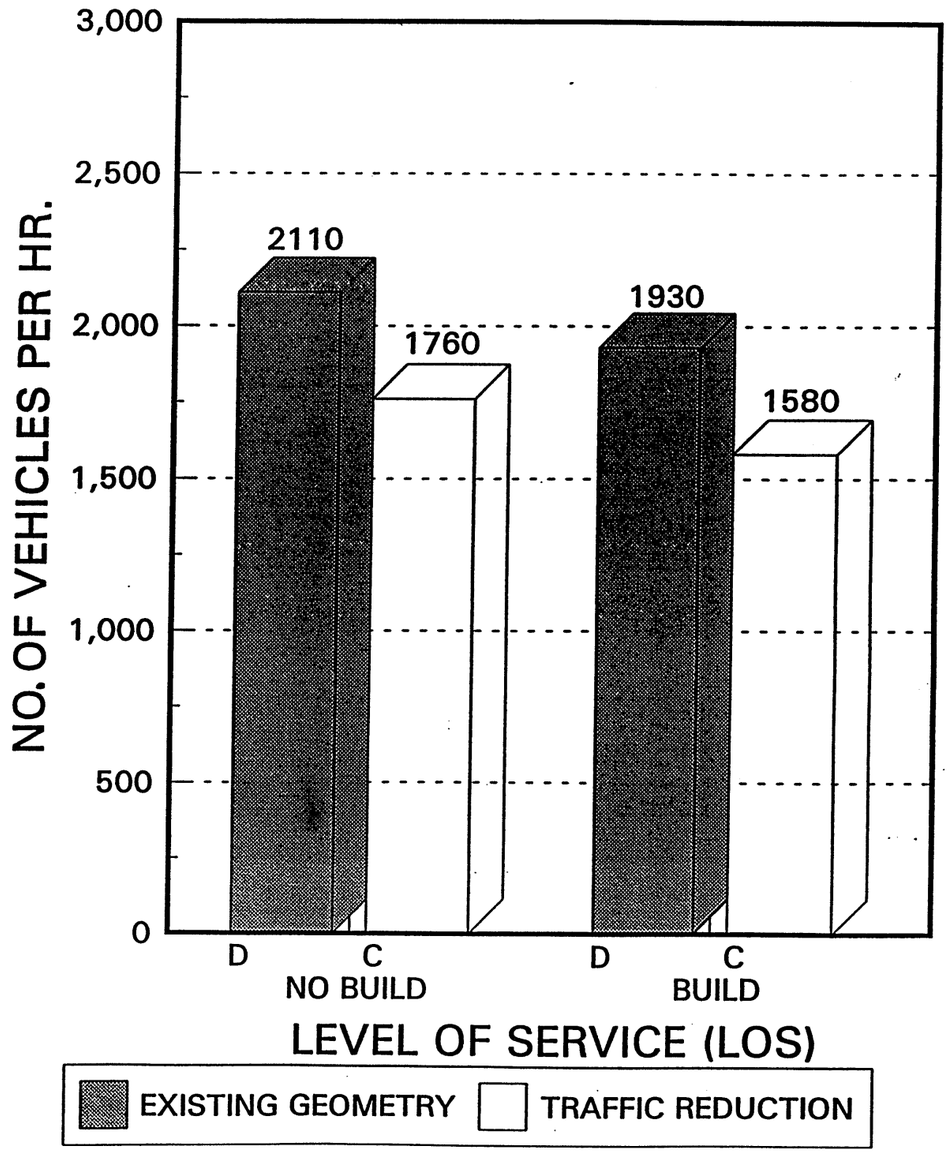


FIGURE 9: YEAR 2020 A.M. (P.M.) PEAK HOURS TRAFFIC AND LEVEL OF SERVICE
WITH TRAFFIC DEMAND REDUCTION AND PROPOSED ROADWAY IMPROVEMENTS

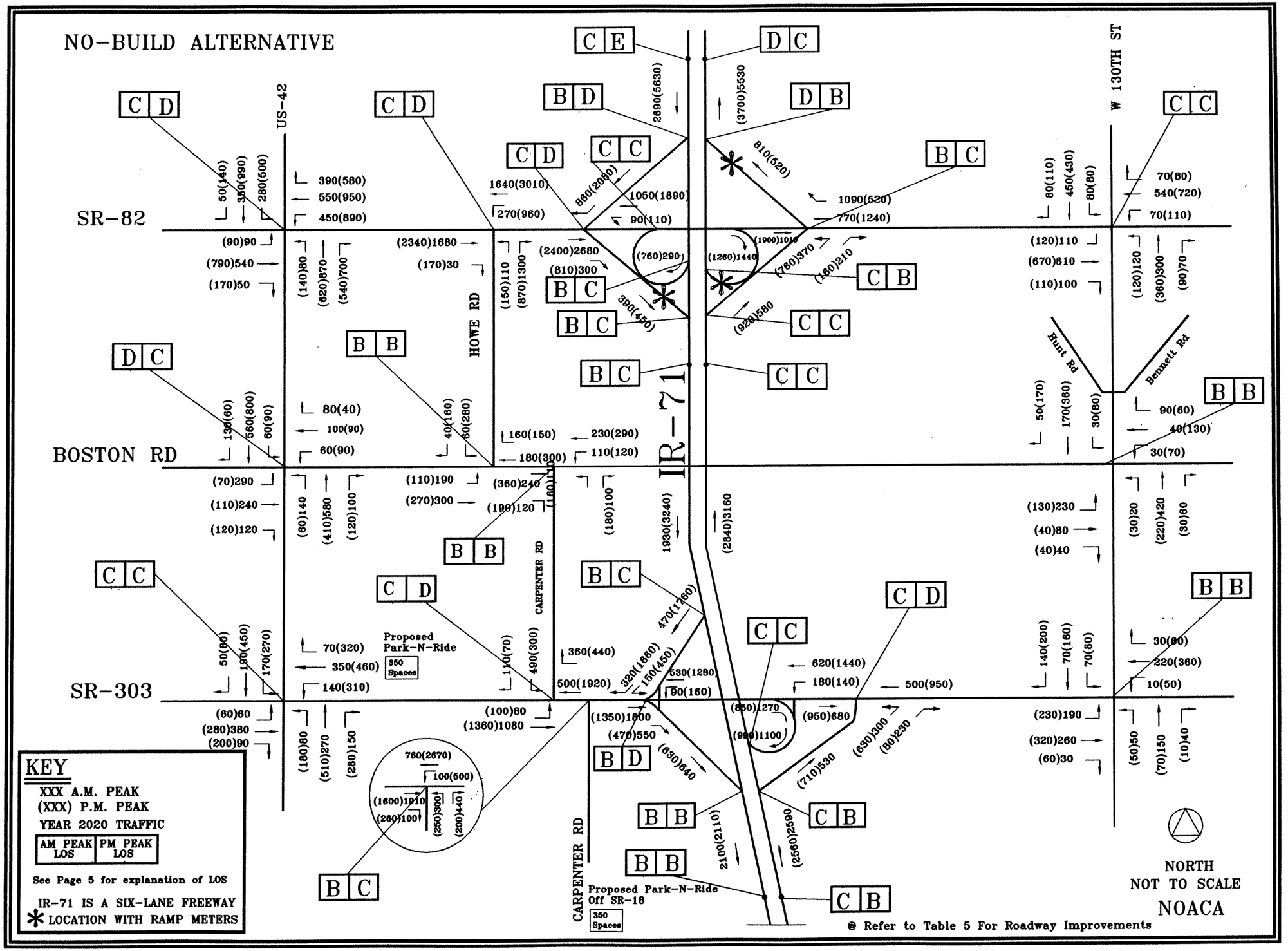


FIGURE 10: YEAR 2020 A.M. (P.M.) PEAK HOURS TRAFFIC AND LEVEL OF SERVICE WITH TRAFFIC DEMAND REDUCTION AND PROPOSED ROADWAY IMPROVEMENTS

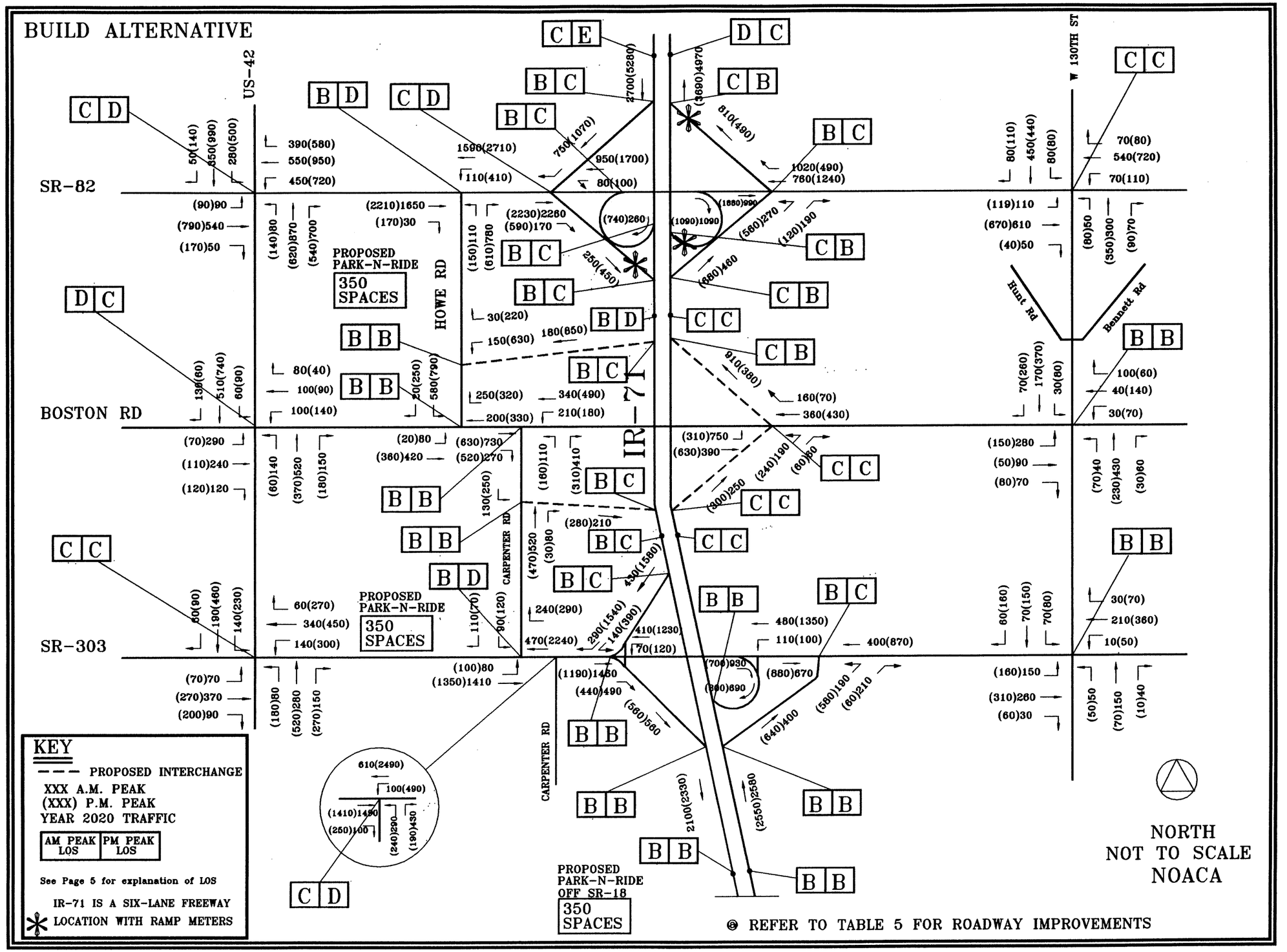
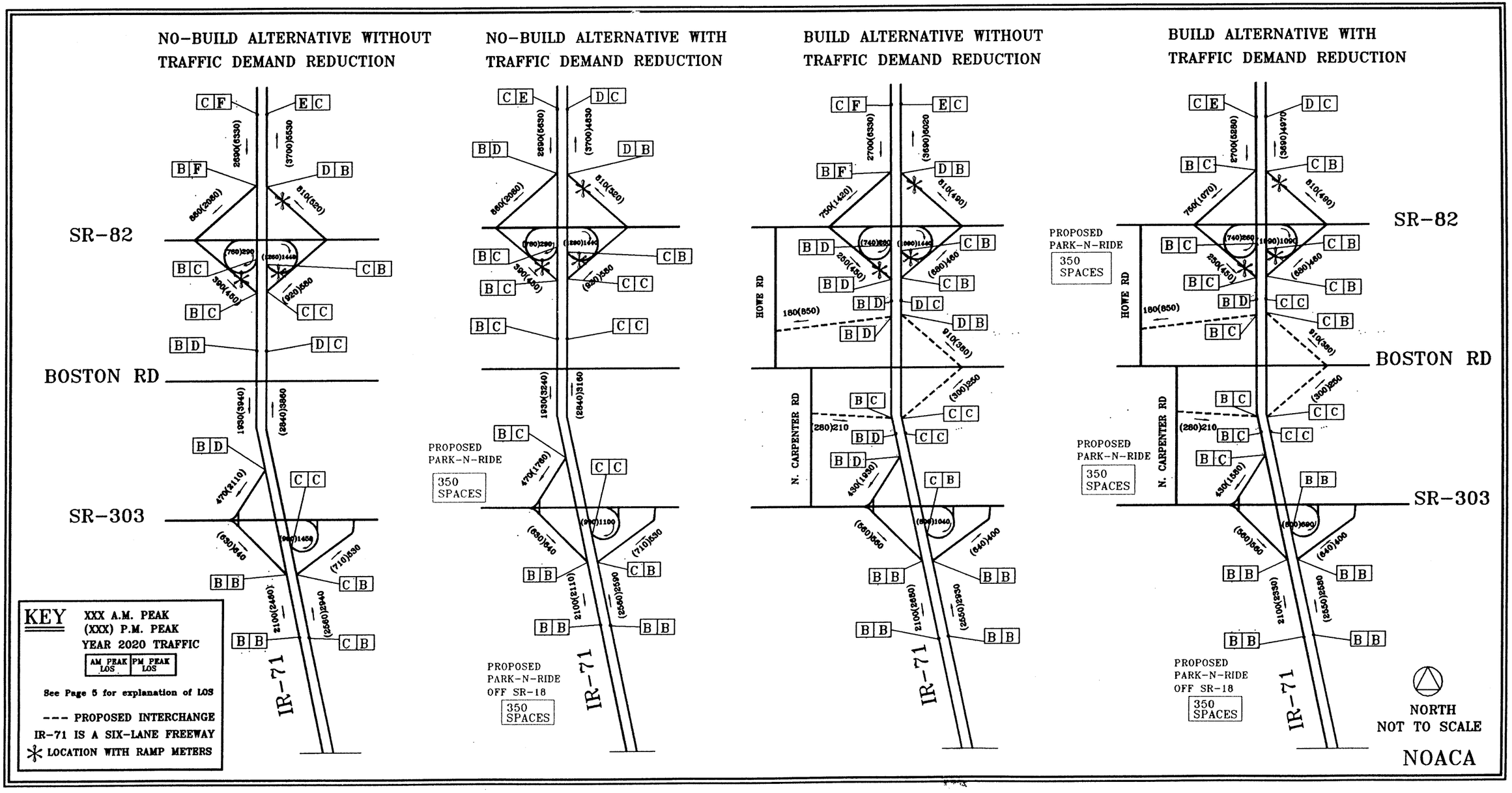


FIGURE 11: COMPARISON OF LEVEL-OF-SERVICE ON I-71 MAINLINE AND ITS RAMP JUNCTIONS WITH AND WITHOUT THE PROPOSED BOSTON ROAD INTERCHANGE AND THE EFFECT OF TRAFFIC DEMAND REDUCTION MEASURES



2. Description of Crossroad (Boston Road) and Proposed Interchange Layout

Boston Road is classified as an urban collector in the Federal-Aid Urban System (FAUS). Boston Road currently consists of two lanes and is the dividing line between Cuyahoga County and Medina County. Strongsville recognizes Boston Road as a collector and Brunswick designates it as a major arterial in its thoroughfare plan. Boston Road has an average daily traffic (ADT) ranging from 4,484 to 8,780 vehicles per day. Boston Road is a narrow road traversing over a steep hill at its intersection with Pearl Road (US-42).

For the "No-Build" scenario, the forecasted Year 2020 ADT is approximately 8,120 vehicles per day. Widening the two-lane roadway to standard lanes with improvements of its intersection with Pearl Road would be adequate to carry this forecasted traffic. In the "Build" scenario, the forecasted Year 2020 ADT is approximately 12,200 vehicles per day. The suggested Year 2020 "Build" alternative design width is four lanes between Howe Road and the east ramps of the proposed interchange and two standard lanes with a turn lane and geometric improvements to ease the vertical alignment west of Howe Road.

The geometric configuration of the proposed interchange is a non-conventional Diamond Interchange where the southbound exit ramp is connected to Howe Road and the southbound entrance ramp is connected to Carpenter Road instead of Boston Road due to physical site constraints. (See the diagram on Figure 5). This configuration is tentative for purposes of performing the analysis. Other configurations could be enumerated to suit site conditions. Four alternatives were provided by ODOT 12 which have been evaluated at the end of the report).

3. Arterial System Analysis

The purpose of this section is to analyze the peak-hour traffic (AM, PM peaks) at the major arterial intersections in the study area. This analysis will determine the effect of the proposed interchange on the surrounding intersections and arterials.

The operational module of the 1994 update of the Highway Capacity Software was used for the level-of-service analysis at the following intersections:

- US-42/SR-82
- Howe Road/SR-82
- IR-71 West Ramps/SR-82
- IR-71 East Ramps/SR-82
- West 130th Street/SR-82
- Boston Road/US-42
- Boston Road/Howe Road
- Boston Road/Carpenter Road
- Boston Road/I-71 East Ramps
- Boston Road/I-71 West Ramps
- Boston Road/West 130th Street/Hunt-Bennett Roads (Bennett's Corners' intersection)
- SR-303/US-42
- SR-303/North Carpenter Road
- SR-303/South Carpenter Road
- SR-303/IR-71 West Ramps
- SR-303/IR-71 East Ramps
- SR-303/West 130th Street

The level-of-service analysis was conducted for the following scenarios:

- Existing traffic conditions;
- Future traffic without the proposed interchange, ("No-Build" condition); and
- Future traffic with the proposed interchange ("Build" condition).

Level-of-Service "D" or better is considered an acceptable level of operations during peak hours.

Table 5 shows a summary of the arterial intersections level-of-service (LOS) results and

geometry for all scenarios.

A - **Existing Traffic Conditions** - Existing traffic volume data were obtained from records provided by the Ohio Department of Transportation. The actual traffic counts were taken in the period between 1990 and 1994.

The AM and PM peak periods were analyzed for all intersections under existing geometric conditions. Geometric data were obtained through actual field visits. Figure 6 shows the existing peak hours traffic volumes and the results of the level-of-service analysis.

Most intersections are operating at acceptable levels-of-service under existing traffic and geometric conditions. Results of the analysis of the unsignalized intersection of Boston Road at North Carpenter Road show that the northbound left turn movement is operating at LOS "E" during the PM peak hour. This intersection was affected by the additional traffic from Grafton Road that was closed at the time of the count. The intersection of SR-82 and the exit ramp from I-71 south to SR-82 west was operating at unacceptable level-of-service until year 1996. This intersection has been reconstructed as part of the Royalton Road (SR-82) widening project completed in 1996. Furthermore, a traffic signal has been installed at this location as part of the SR-82 project, and the analysis shows an acceptable level-of-service. It is recommended to have signal coordination of the signal at the exit ramp with the signal at Howe Road/SR-82 intersection.

The intersection of SR-82/West 130th Street is operating at failure condition during the PM peak hour. Oversaturated conditions occurred in the westbound, northbound and southbound directions. Adding left-turn bays to the westbound, northbound and southbound approaches will improve the operation of this intersection.

The intersection of West 130th Street, Boston Road, Bennett Road and Hunt Road referred to as Bennett's Corners was a six-legged intersection controlled by stop signs until year 1996. This intersection has been reconstructed on a new alignment. Hunt and Bennett Roads were rebuilt on new corridors north of the existing intersection and traffic using them is directed now to West 130th Street (see Table 5).

LOS calculation outputs are included in Appendix IV.

B - **Future "No-Build" Traffic Conditions** - The future Year 2020 traffic volumes certified by the Ohio Department of Transportation's Bureau of Transportation Technical Services were used in this analysis. Figure 7 shows the forecasted peak hours traffic volumes, and a summary of the level-of-service analysis.

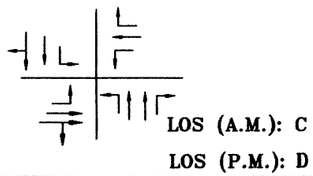
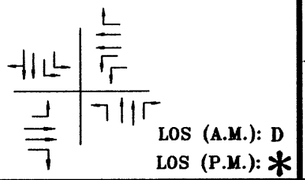
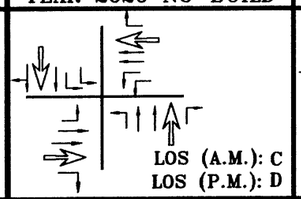
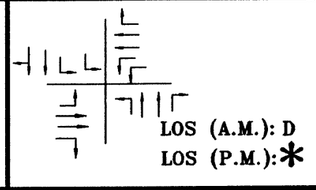
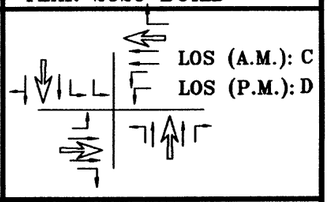
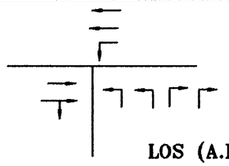
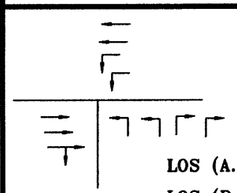
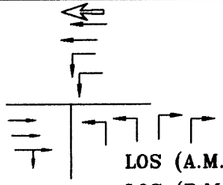
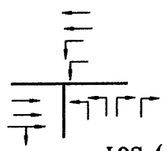
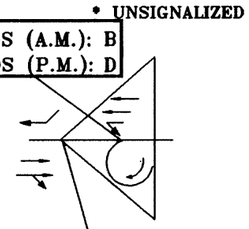
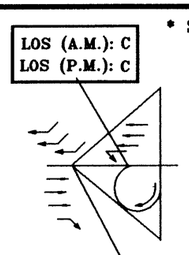
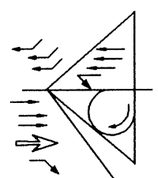
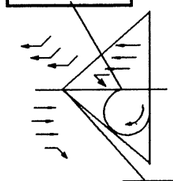
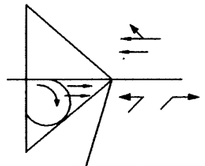
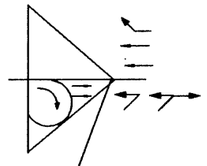
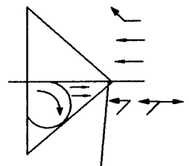
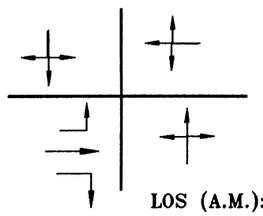
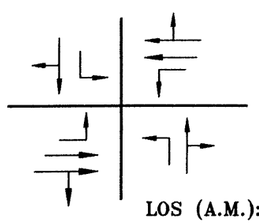
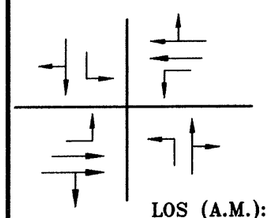
The future traffic will degrade the level-of-service to breakdown condition at the following locations:

- IR-71 West Ramps/SR-82 in the PM peak period;
- SR-82/West 130th Street during both peak periods;
- SR-82/Howe Road in the PM peak period;
- SR-82/US-42 in the PM peak period;
- SR-303/South Carpenter Road in the PM peak period;
- SR-303/North Carpenter Road in the PM peak period;
- Boston Road/US-42 in the AM peak period;
- Boston Road/Howe Road in the PM peak period; and
- Boston Road/North Carpenter Road in the PM peak period.

Geometric improvements needed to improve the operation of these intersections are contained in Table 5.

Computer outputs of the level-of-service (LOS) analyses are shown in Appendix VIII.

TABLE 5: SUMMARY OF THE LEVEL OF SERVICE (LOS) ANALYSIS
ARTERIAL INTERSECTIONS

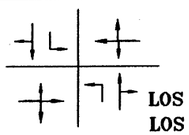
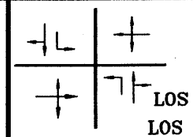
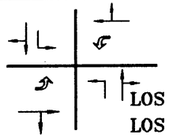
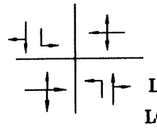
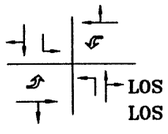
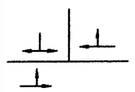
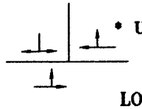
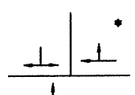
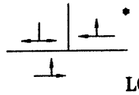
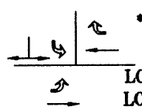
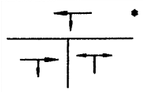
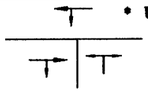
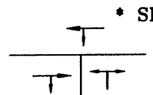
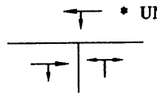
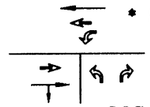
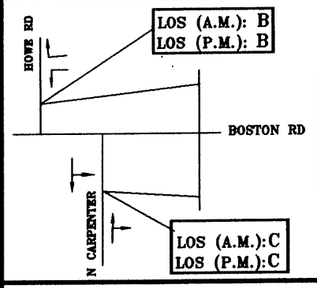
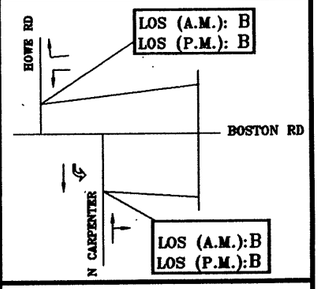
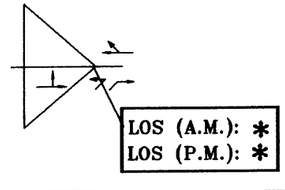
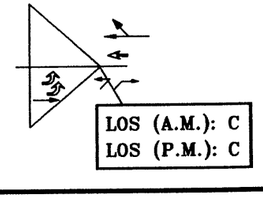
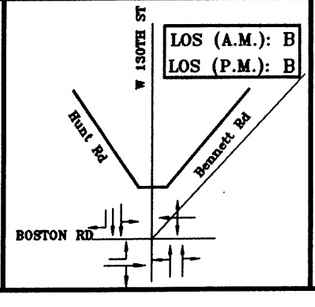
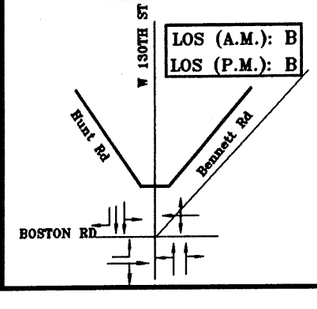
INTERSECTION LOCATION	EXISTING TRAFFIC CONDITIONS	YEAR 2020 NO-BUILD TRAFFIC WITH PLANNED IMPROVEMENTS	NEEDED ROADWAY IMPROVEMENTS FOR YEAR 2020 NO-BUILD	YEAR 2020 TRAFFIC WITH BUILD ALTERNATIVE	NEEDED ROADWAY IMPROVEMENTS FOR YEAR 2020 BUILD
SR-82/US-42	 LOS (A.M.): C LOS (P.M.): D	 LOS (A.M.): D LOS (P.M.): *	 LOS (A.M.): C LOS (P.M.): D	 LOS (A.M.): D LOS (P.M.): *	 LOS (A.M.): C LOS (P.M.): D
SR-82/HOWE ROAD	 LOS (A.M.): B LOS (P.M.): C	 LOS (A.M.): C LOS (P.M.): E	 LOS (A.M.): C LOS (P.M.): D	 LOS (A.M.): B LOS (P.M.): D	NO CHANGE
SR-82/IR-71 WEST RAMPS	* UNSIGNALIZED LOS (A.M.): B LOS (P.M.): D  LOS (A.M.): B LOS (P.M.): F	* SIGNALIZED LOS (A.M.): C LOS (P.M.): C  LOS (A.M.): C LOS (P.M.): *	* SIGNALIZED  LOS (A.M.): C LOS (P.M.): D	LOS (A.M.): C LOS (P.M.): C * SIGNALIZED  LOS (A.M.): C LOS (P.M.): D	NO CHANGE
SR-82/IR-71 EAST RAMPS	 LOS (A.M.): B LOS (P.M.): B	 LOS (A.M.): B LOS (P.M.): C	NO CHANGE	 LOS (A.M.): B LOS (P.M.): C	NO CHANGE
SR-82/W 130TH ST	 LOS (A.M.): B LOS (P.M.): *	 LOS (A.M.): C LOS (P.M.): C	NO CHANGE	 LOS (A.M.): C LOS (P.M.): C	NO CHANGE

See Page 5 for explanation of LOS

⇒ Needed Improvements

(CONTINUED)

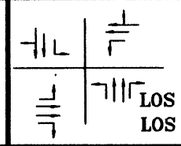
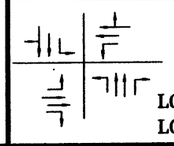
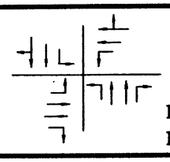
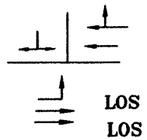
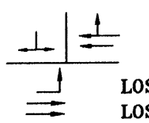
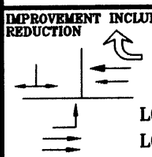
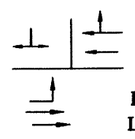
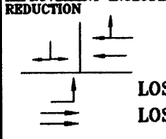
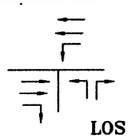
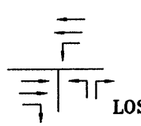
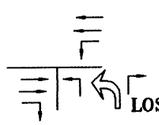
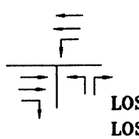
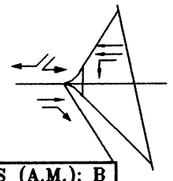
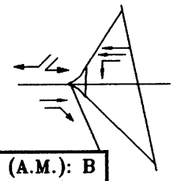
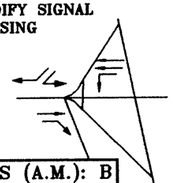
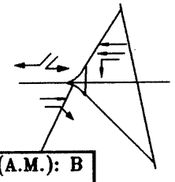
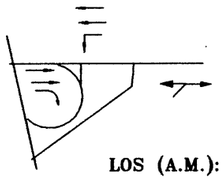
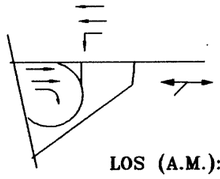
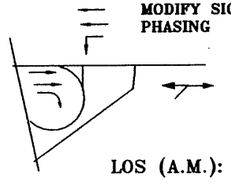
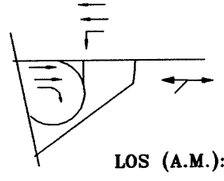
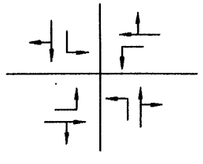
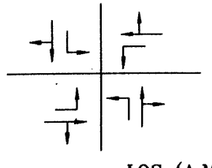
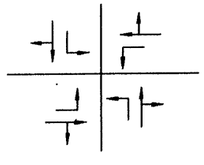
TABLE 5: SUMMARY OF THE LEVEL OF SERVICE (LOS) ANALYSIS
ARTERIAL INTERSECTIONS

INTERSECTION LOCATION	EXISTING TRAFFIC CONDITIONS	YEAR 2020 NO-BUILD TRAFFIC WITH PLANNED IMPROVEMENTS	NEEDED ROADWAY IMPROVEMENTS FOR YEAR 2020 NO-BUILD	YEAR 2020 TRAFFIC WITH BUILD ALTERNATIVE	NEEDED ROADWAY IMPROVEMENTS FOR YEAR 2020 BUILD
BOSTON RD/US-42	 LOS (A.M.): C LOS (P.M.): B	 LOS (A.M.):* LOS (P.M.): C	 LOS (A.M.): D LOS (P.M.): C	 LOS (A.M.): * LOS (P.M.): C	 LOS (A.M.): D LOS (P.M.): C
BOSTON RD/HOWE RD	 * UNSIGNALIZED LOS (A.M.): B LOS (P.M.): C	 * UNSIGNALIZED LOS (A.M.): C LOS (P.M.): F	 * SIGNALIZED LOS (A.M.): B LOS (P.M.): B	 * UNSIGNALIZED LOS (A.M.): F LOS (P.M.): F	 * SIGNALIZED LOS (A.M.): B LOS (P.M.): B
BOSTON RD /NORTH CARPENTER RD	 * UNSIGNALIZED LOS (A.M.): C LOS (P.M.): E	 * UNSIGNALIZED LOS (A.M.): C LOS (P.M.): F	 * SIGNALIZED LOS (A.M.): B LOS (P.M.): B	 * UNSIGNALIZED LOS (A.M.): F LOS (P.M.): F	 * SIGNALIZED LOS (A.M.): B LOS (P.M.): B
BOSTON RD/I-71 WEST RAMPS					
BOSTON RD/I-71 EAST RAMPS					
BENNETT'S CORNERS INTERSECTION	This intersection has been reconstructed on a new alignment in 1996.				

See Page 5 for explanation of LOS
→ Needed Improvements

(CONTINUED)

TABLE 5: SUMMARY OF THE LEVEL OF SERVICE (LOS) ANALYSIS
ARTERIAL INTERSECTIONS

INTERSECTION LOCATION	EXISTING TRAFFIC CONDITIONS	YEAR 2020 NO-BUILD TRAFFIC WITH PLANNED IMPROVEMENTS	NEEDED ROADWAY IMPROVEMENTS FOR YEAR 2020 NO-BUILD	YEAR 2020 TRAFFIC WITH BUILD ALTERNATIVE	NEEDED ROADWAY IMPROVEMENTS FOR YEAR 2020 BUILD
SR-303 /US-42	 LOS (A.M.): B LOS (P.M.): C	 LOS (A.M.): C LOS (P.M.): C	NO CHANGE	 LOS (A.M.): C LOS (P.M.): C	NO CHANGE
SR-303/NORTH CARPENTER RD	 LOS (A.M.): B LOS (P.M.): B	 LOS (A.M.): C LOS (P.M.): *	IMPROVEMENT INCLUDES TRAFFIC REDUCTION  @ LOS (A.M.): C LOS (P.M.): D	 LOS (A.M.): C LOS (P.M.): *	IMPROVEMENT INCLUDES TRAFFIC REDUCTION  @ LOS (A.M.): B LOS (P.M.): D
SR-303/SOUTH CARPENTER RD	 LOS (A.M.): B LOS (P.M.): B	 LOS (A.M.): C LOS (P.M.): *	 LOS (A.M.): C LOS (P.M.): D	 LOS (A.M.): C LOS (P.M.): D	NO CHANGE
SR-303/I-71 WEST RAMPS	 LOS (A.M.): B LOS (P.M.): B	 LOS (A.M.): B LOS (P.M.): *	MODIFY SIGNAL PHASING  LOS (A.M.): B LOS (P.M.): D	 LOS (A.M.): B LOS (P.M.): B	NO CHANGE
SR-303/I-71 EAST RAMPS	 LOS (A.M.): B LOS (P.M.): B	 LOS (A.M.): C LOS (P.M.): *	MODIFY SIGNAL PHASING  LOS (A.M.): C LOS (P.M.): D	 LOS (A.M.): B LOS (P.M.): C	NO CHANGE
SR-303/W 130TH ST	 LOS (A.M.): B LOS (P.M.): B	 LOS (A.M.): B LOS (P.M.): B	NO CHANGE	 LOS (A.M.): B LOS (P.M.): B	NO CHANGE

See Page 5 for explanation of LOS

⇨ Needed Improvements

@ The result assumes a park-n-ride lot of 350 vehicles west of this intersection

C - **Future "Build" Traffic Conditions** - Figure 8 shows the (AM) PM peak hour traffic volumes, and a summary of the level-of-service analysis. Acceptable peak hour Level-of-Service "D" or better was attained at most of the intersections under existing and planned geometry, except at intersections along Boston Road and at SR-82 intersecting US-42 and at SR-303 intersecting North Carpenter Road.

For the intersection of SR-82/US-42, as in the future "No-Build" scenario, additional capacity will be required to improve the operation of this intersection as shown in Table 5.

The expected increase of traffic on Boston Road forecasted for the new interchange will degrade the LOS to "unacceptable" at the intersections of Boston Road with Howe Road, North Carpenter Road and IR-71 East Ramps. Signalizing Boston Road at the intersections of Howe Road and North Carpenter Road with the addition of a southbound left-turn bay on Howe Road and a northbound left-turn bay on North Carpenter Road and turn lanes on Boston Road, will increase the capacity to produce an acceptable level-of-service. The intersection of Boston Road and US-42 will operate at breakdown condition during the AM peak period. Adding left-turn bays to Boston Road at the intersection will improve the operation of the intersection.

The intersection of Boston Road and the proposed I-71 east ramps will operate at breakdown condition during the peak hours with the existing geometry of Boston Road (one lane in each direction). Adding left-turn bays to the eastbound approach and a through lane to the westbound approach will improve the level- of- service to "C".

The roadway is forecasted to handle the following traffic volumes:

- 12,340 vehicles per day between US-42 and the proposed IR-71 west ramps;
- 16,190 vehicles per day over IR-71;
- 11,300 vehicles per day east of the proposed east ramps.

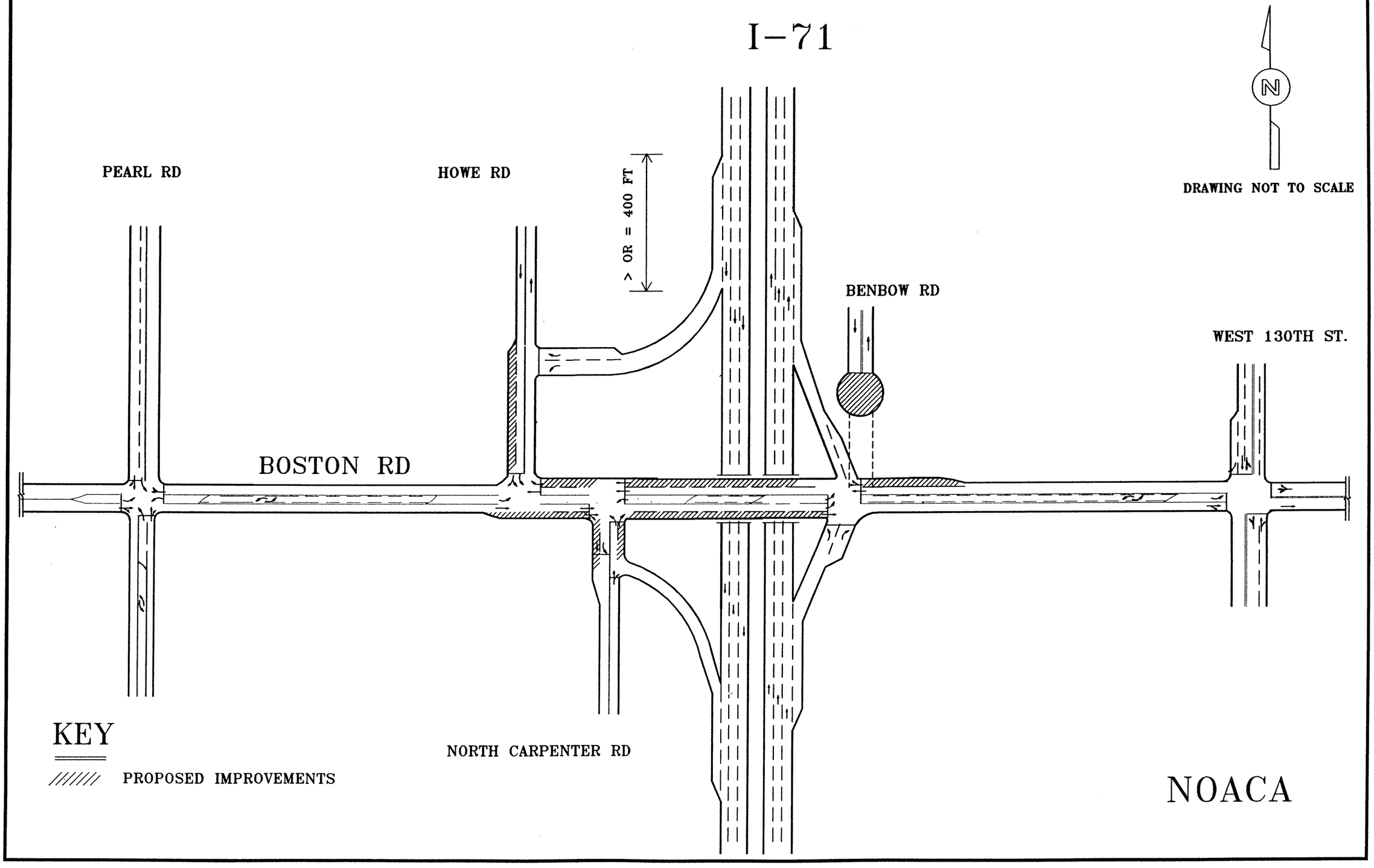
The existing two-lane roadway will not be adequate to handle the traffic of the proposed interchange. Level-of-service analysis shows that a four-lane roadway will be needed to handle the traffic at LOS "B" or "C" in the vicinity of the proposed interchange. It is recommended that Boston Road be widened to four lanes from east of Howe Road to east of the proposed interchange with a left-turn bay from Boston Road westbound to North Carpenter Road; and to a three-lane segment from Pearl Road to west of Howe Road and from east of the proposed interchange to West 130th Street. Figure 12 depicts the geometric improvements needed along Boston Road if the interchange is built.

Boston Road, between Pearl Road and West 130th Street, is being designed for widening to three lanes and expected to be reconstructed well before design year 2020. The proposed four-lane roadway improvement will be adequate to handle the forecast "Build" traffic volume. Appendix VIII shows the level-of-service (LOS) calculations for this scenario.

D - **Impact of the Proposed Point-of-Access on the Arterial Streets**

By comparing the 24-hour traffic volumes for year 2020 forecast shown in Figures 4 and 5, it was noted that certain arterial streets' sections will be impacted by building the proposed interchange at Boston Road. Howe Road, a collector street between SR-82 and Boston Road, will have a projected traffic volume varying between 18,260 vehicles per day as it approaches SR-82 and 7,040 vehicles per day as it approaches Boston Road under the "No-Build" alternative. However, with the proposed interchange, traffic along Howe Road will be redistributed more evenly between SR-82 and Boston Road varying from 10,090 to 12,700 vehicles per day. The addition of Boston Road access showed a diminution of

Figure 12: Suggested Schematic Improvements For Boston Road



problems on SR-82. The 24-hour traffic volume on SR-82 west of the I-71/SR-82 interchange will be reduced from 79,250 vehicles per day for the "No-Build" to 68,230 vehicles per day for the "Build" alternative improving its level-of-service from "F" to "D" and eliminating the need of additional capacity between Howe Road and IR-71 west ramps. Under year 2020 forecast traffic, Boston Road/IR-71 access will divert significant traffic to Boston Road east of Howe Road. The sections of Boston Road between Howe Road and east of the proposed interchange will be impacted in particular the abutting frontages, to serve forecast traffic. Where additional lanes will be necessary on Boston Road, reliefs of traffic congestion impacts by widening will require right-of-way acquisition impact as a trade-off.

It is important to note, in all the future forecasts, the land use was assumed to be the current land use information as planned by the cities, and included in our regional model. The predominant land use is residential. If the planned land use is changed based on the proposed access at Boston Road, then the traffic forecast may change. If the land use becomes as intense as it is along SR-82 then the relief that this interchange will bring this area will be heavily affected by the addition of traffic and by the future land use changes associated with a freeway access. In this analysis, the land use assumed to forecast the traffic is the current land use information planned by the cities. (See Appendix IX for land use information.)

4. Proposed Interchange Alternatives

The Ohio Department of Transportation, District 12 Planning Department, suggested four alternative geometric layouts to be evaluated for the configuration of the proposed IR-71/Boston Road Interchange. These four alternatives are:

1. Alternative A (simple diamond interchange) -- the configuration of this alternative is shown on Figures 13, 14 and 21 (24-hour traffic, peak hours traffic, and geometric layout). The exit ramp on southbound IR-71 is a one-lane diverging roadway that branches into two-lane ramps for surface street connections. One entrance ramp to northbound IR-71 would serve as freeway access from Boston Road, Howe and North Carpenter Roads. Its location would require a cul-de-sac treatment to Benbow Road north of Boston Road. Benbow Road would remain connected to Boston Road via existing streets: Trenton Avenue, Hartford Trail and Old Town Trail. A one-lane exit ramp from northbound IR-71 would connect Boston Road and provide both right and left turns for the south-to-east and south-to-west movements at Boston Road. A one-lane entrance ramp to southbound IR-71 would serve freeway access in this vicinity. Its location would require a cul-de-sac treatment for Carpenter Road (south of Boston Road) and the extension of Sturbridge Lane (west of Carpenter Road) to connect with Howe Road. Carpenter Road traffic will use Sturbridge Lane to get to Howe and Boston Roads. Between Howe Road and the east ramps, Boston Road would require a minimum of five standard lanes. The crossroad structure over IR-71 will be five lanes - two eastbound, two westbound and a turn-lane. In addition, two standard lanes northbound will be required at Howe Road Connector. (See the diagram on Figure 21). Satisfying these requirements would produce LOS "C" at all arterial junctions.

2. The Urban Style Alternative (Single-point Urban Interchange; also called SPUI) -- which is shown on Figures 15, 16 and 22 (24-hour traffic, peak hours traffic, and geometric layout). This is a modified diamond configuration that combines two separate diamond ramp intersections into one large at grade intersection. Where a diamond has two intersections at the surface street, the SPUI contains one signalized intersection through which all four left-turn and through movements operate on the road. This allows concurrent opposite left-turns to access or exit the freeway effectively. Its location would require a cul-de-sac treatment for Carpenter and Benbow Roads (same as the simple diamond configuration). This proposed layout will serve the future traffic at LOS "C".

3. Alternative C&D -- which is shown on Figures 17, 18 and 23 (24-hour traffic, peak hours traffic, and geometric layout). A modified diamond configuration where the southbound exit and entrance ramps are connected to relocated Howe Road. Howe Road is relocated east to be aligned with North Carpenter Road. The northbound exit and entrance ramps are provided at Benbow Road Extension south of Boston Road. Relocated Howe Road will require two standard lanes southbound between the IR-71 west ramps and Boston Road. The crossroad structure over IR-71 would be five standard lanes. Two standard lanes northbound will be required at North Carpenter Road south of Boston Road. This proposed layout will serve the future traffic at an acceptable level-of-service.

4. Alternative D&E --which is shown on Figures 19, 20 and 24 (24-hour traffic, peak hours traffic, and geometric layout). The geometric configuration is a modified diamond interchange where the southbound entrance and exit ramps are connected to Carpenter Road. The northbound exit and entrance ramps are provided at Benbow Road Extension south of Boston Road. A one-lane entrance ramp to southbound IR-71 is provided from relocated North Carpenter Road. The northerly North Carpenter Road is shown widened to three lanes north of the southbound exit ramp. The exit ramp on southbound IR-71 is a one-lane diverging roadway that branches into two-lane ramps for surface street connections. Turn lanes will be required at Howe/Boston Road intersection. Three standard lanes will be required between Carpenter Road and Howe Road. The crossroad structure over IR-71will be four lanes - two eastbound, one westbound, and a turn-lane. This proposed configuration will operate at an acceptable Level of service "B" at all arterial junctions except Carpenter Road/Boston Road intersection that will operate at an acceptable LOS "C". (See the diagram on Figure 24).

Comparisons of Level of Service analysis reveal that all proposed ramp layouts and the associated roadway improvements presented in Table 6 for design year 2020 will serve the future traffic at acceptable Levels of Service at all arterial junctions. Consequently, from the presentation of Figures 21, 22, 23 and 24 to select a preferred alternative, the study findings are as follows:

- Alternative A is a simple diamond interchange that will provide direct access to Boston Road. This alternative will require five lanes on the crossroad structure over I-71. It will also require the realignment of Carpenter/Boston Roads and Benbow/Boston Roads impacting approximately 29 existing properties.

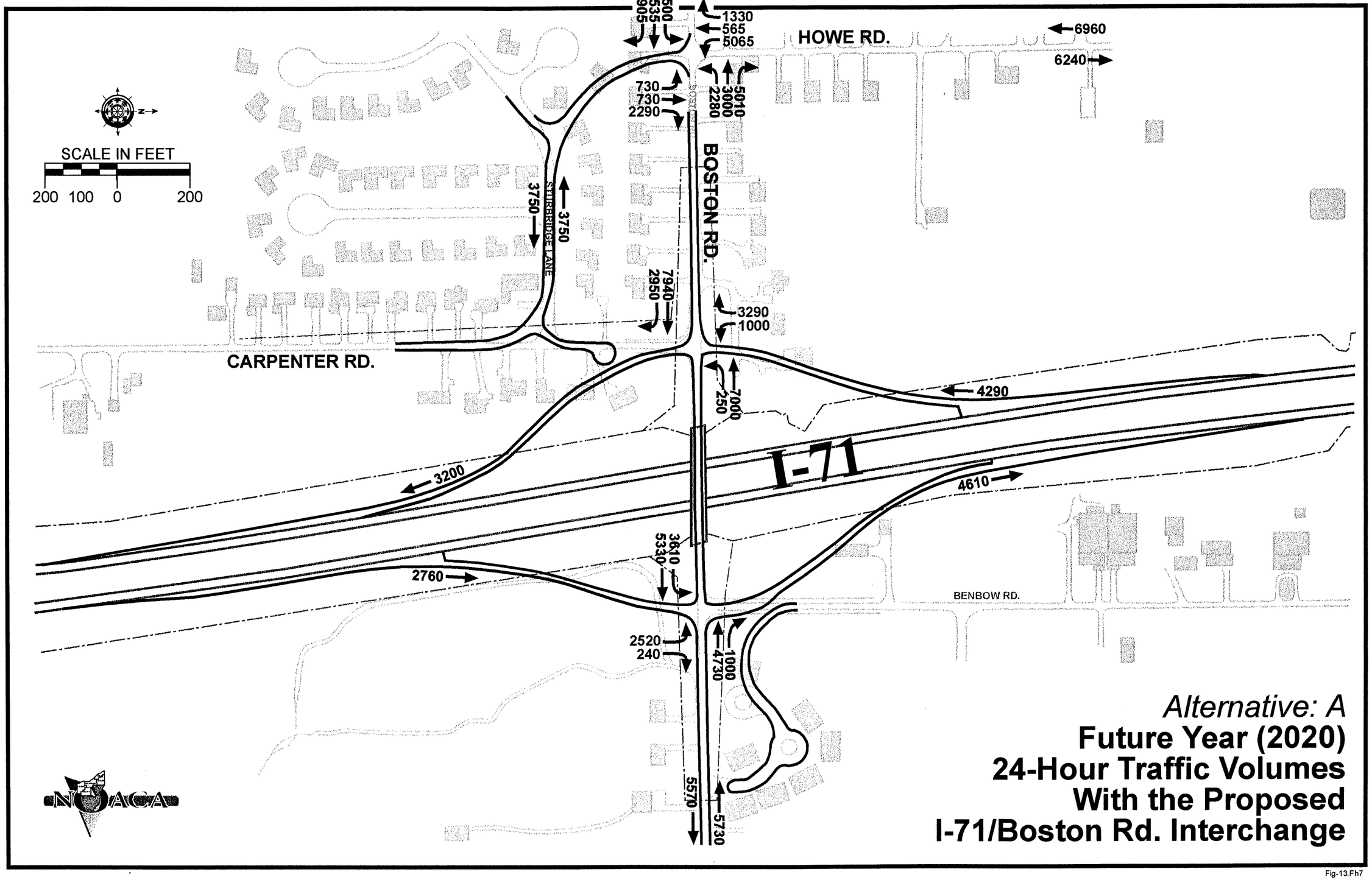
- The Urban Style Alternative will provide a direct access to Boston Road, and a continuous flow for the dominant traffic movement from the north to the west. The right-of-way needed for the urban interchange is less than that required to construct the other layouts. Similar to Alternative A, this alternative will require five lanes on the crossroad structure over I-71, and will require the realignment of Carpenter/Boston Roads and Benbow/Boston Roads impacting approximately 20 existing properties.

- Alternative C&D will not provide direct access to Boston Road. The IR-71 west ramps will connect to relocated Howe Road, and the IR-71 east ramps will connect to Benbow Road Extension south of Boston Road. This option would result in a significant realignment of Howe Road to the east. It will require five lanes between Carpenter and Benbow Roads, and will also require two standard lanes northbound at North Carpenter Road. This alternative will impact approximately 11 existing properties.

- Alternative D&E will not provide direct access to Boston Road, but it will not disrupt existing roadways. Having the entrance/exit ramps connected to Carpenter Road and to Benbow Road Extension, will provide better levels-of-Service than the other alternatives presented. Four lanes will be required on the crossroad structure over I-71. Carpenter Road will need to be widened to three lanes (two lanes northbound an one lane southbound) north of the IR-71 west ramps. This alternative will impact approximately 6 existing properties. This does not include the impact of any modification to the Carpenter Road/Boston Road and Howe Road/Boston Road intersections.

See Appendix X for the HCS and HCM Cinema outputs of the LOS and queue lengths for alternatives. Appendix XI contains the geometric layouts of the alternatives received from ODOT 12 to be evaluated for the configuration of the proposed I-71/Boston Road interchange.

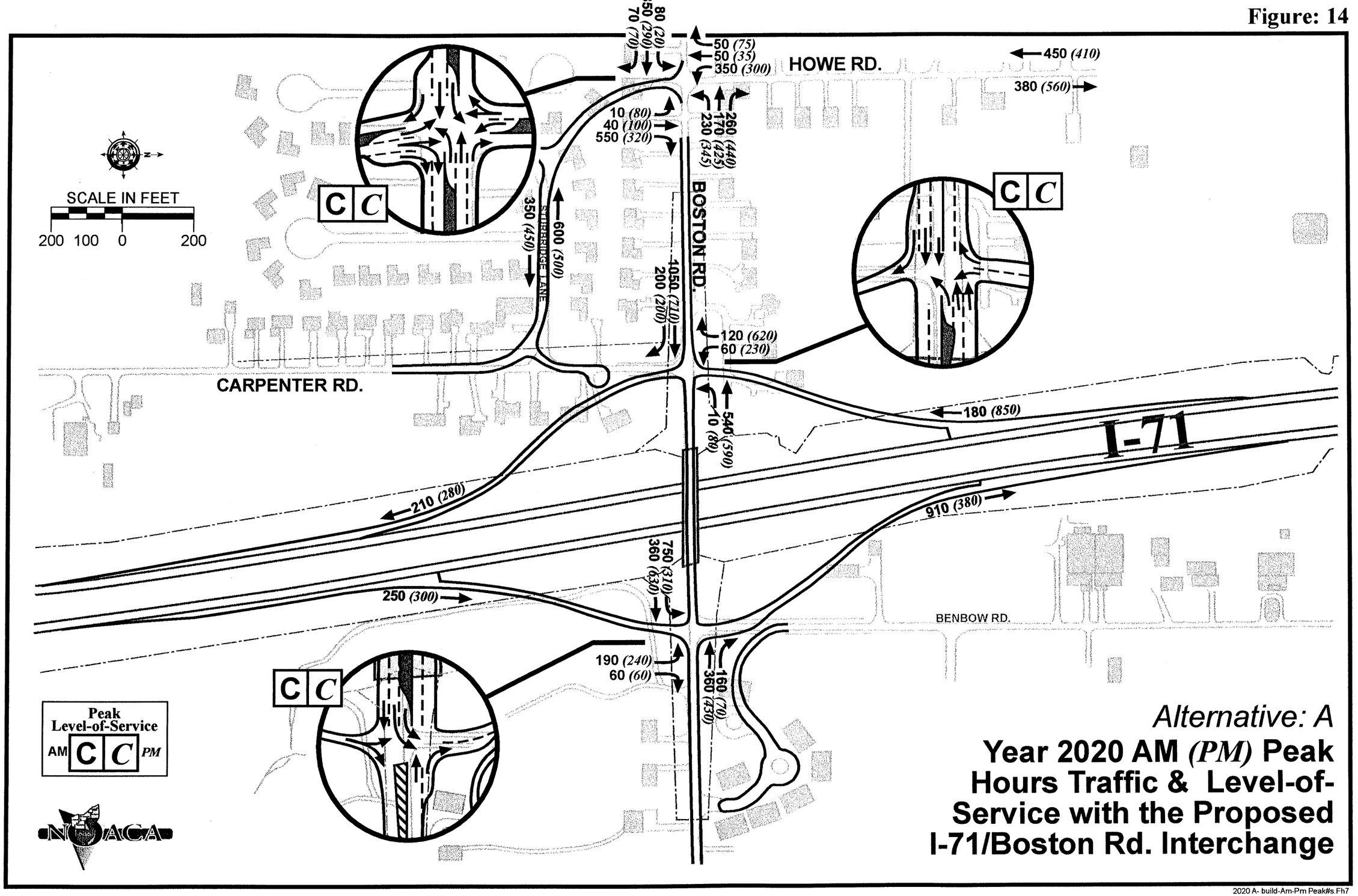
Appendix I through IX are contained in the 1995 draft report.



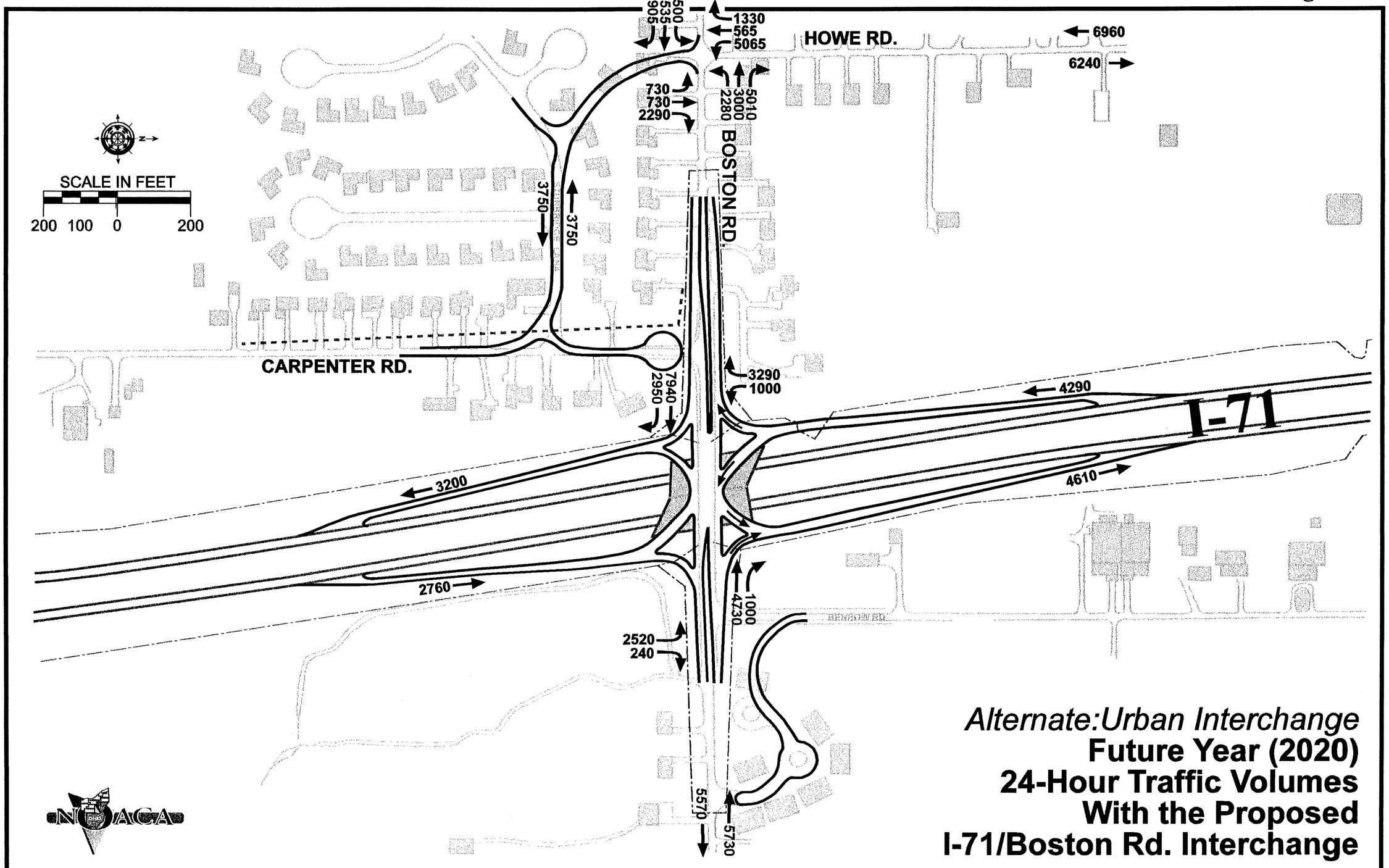
Alternative: A

Future Year (2020)
24-Hour Traffic Volumes
With the Proposed
I-71/Boston Rd. Interchange

Fig-13.Fh7

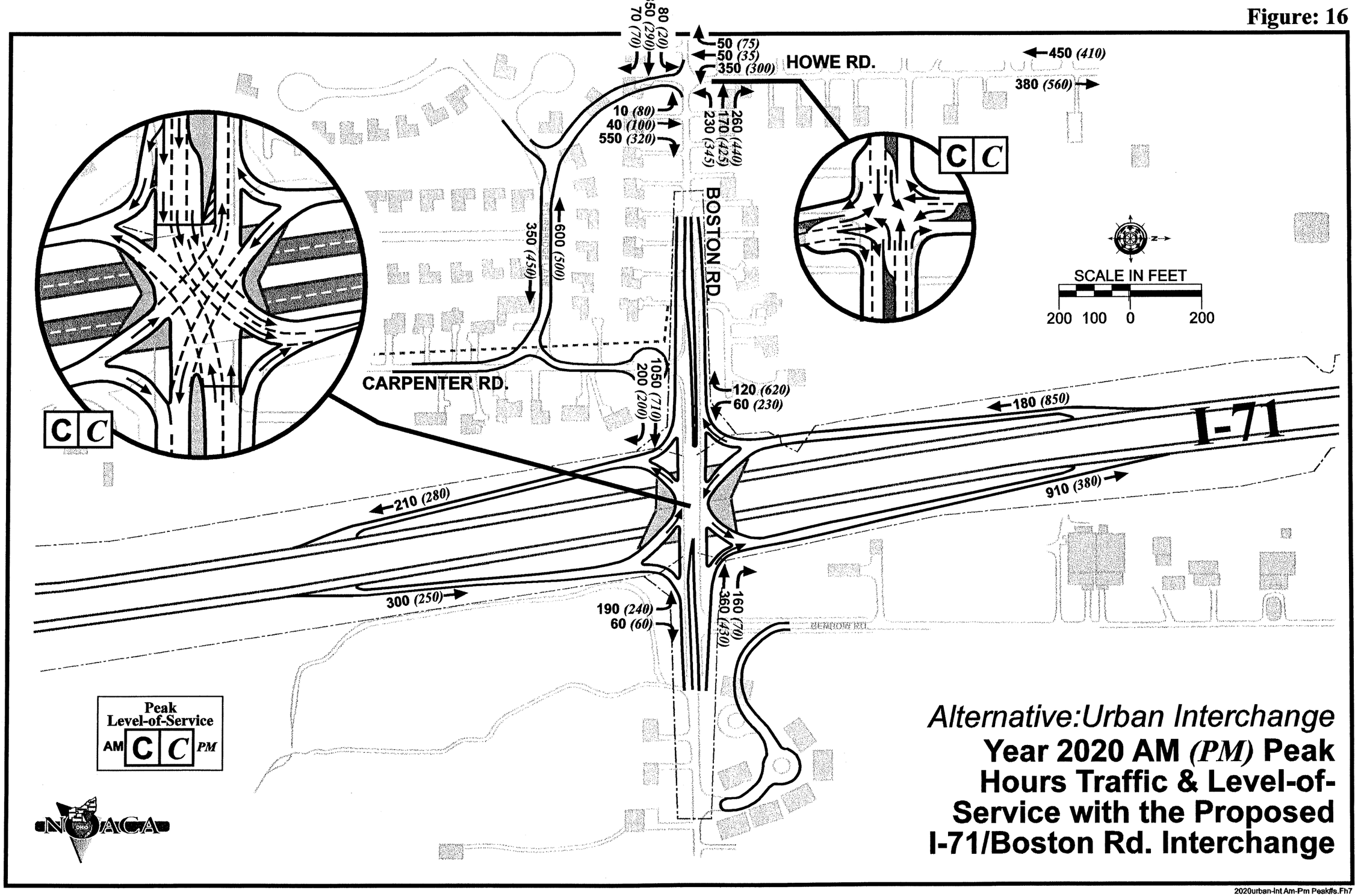


2020 A- build-Am-Pm Peak#s.Fh7



Alternate:Urban Interchange
Future Year (2020)
24-Hour Traffic Volumes
With the Proposed
I-71/Boston Rd. Interchange

2020Urban-Int build-24H-vol.Fh7

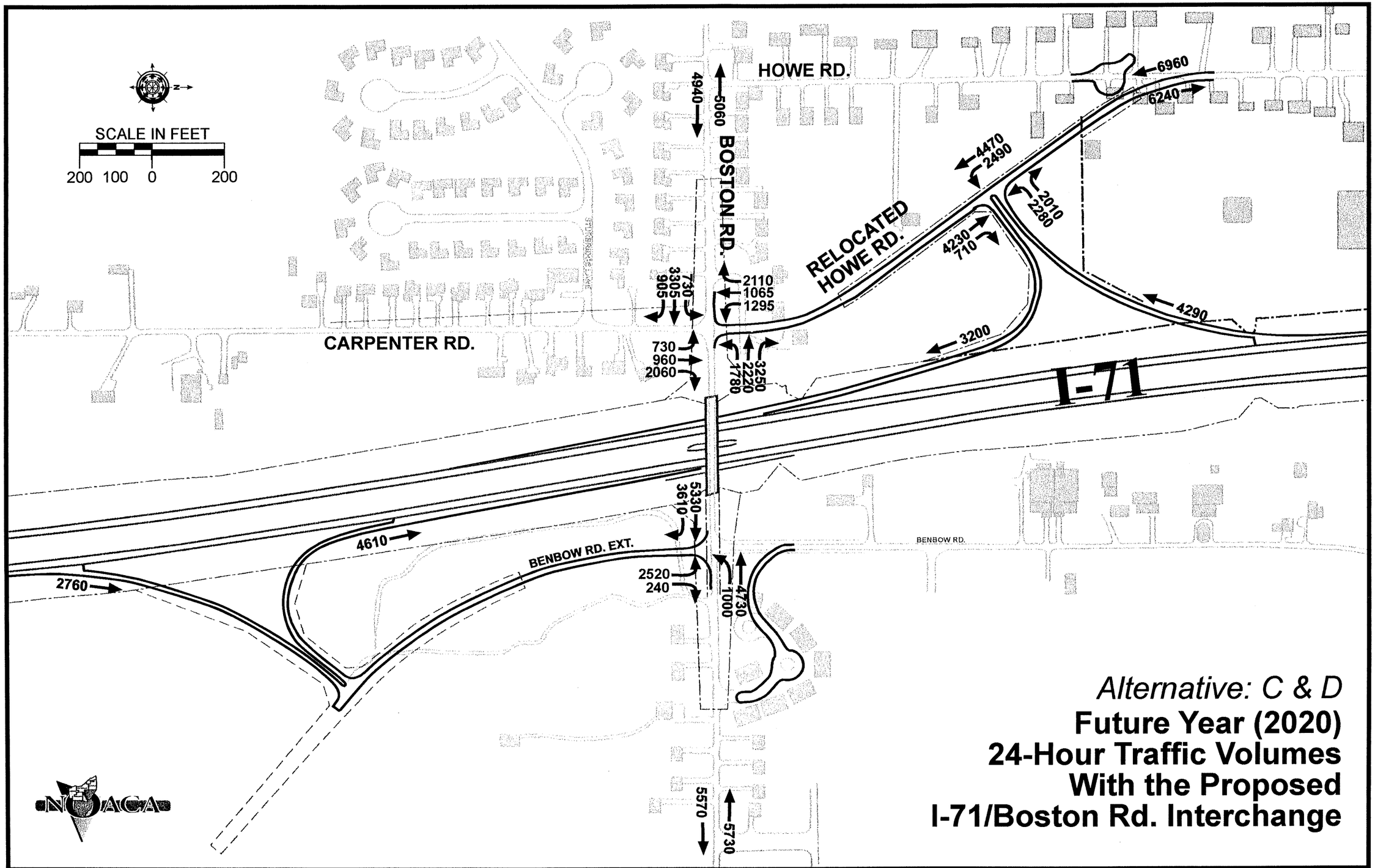


Alternative:Urban Interchange

Year 2020 AM *(PM)* Peak Hours Traffic & Level-of-Service with the Proposed I-71/Boston Rd. Interchange

2020urban-Int Am-Pm Peak#s.Fh7

Figure: 17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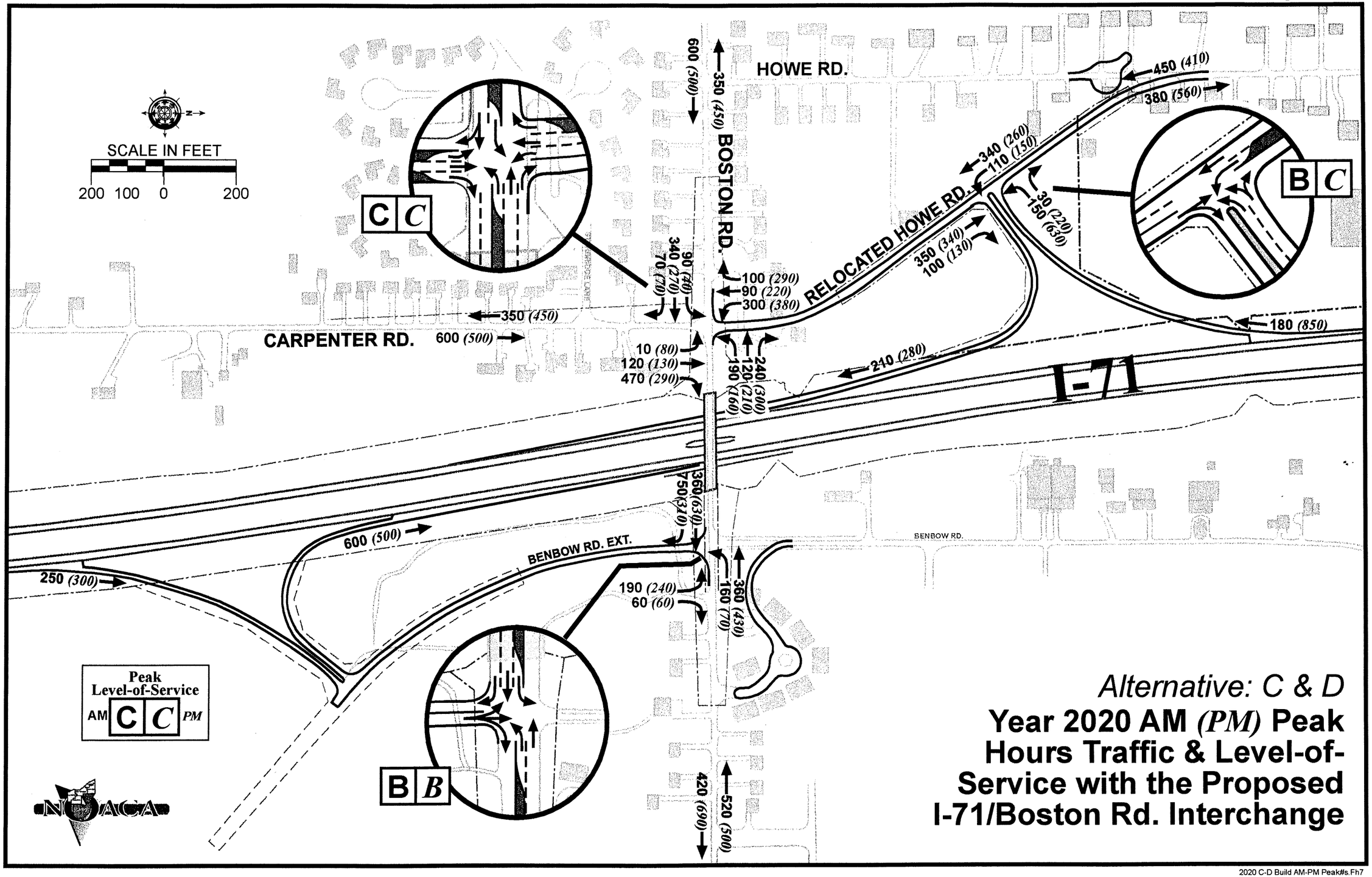
200 100 0 200
HOWE RD.
BOSTON RD.
RELOCATED HOWE RD.
CARPENTER RD.
I-71
BENBOW RD. EXT.
BENBOW RD.
4940
5060
6960
6240
4470
2490
2010
2280
4230
710
4290
3200
730
3305
905
2110
1065
1295
730
960
2060
3250
2220
1780
5330
3610
4610
2760
2520
240
4730
1000
5570
5730
Alternative: C & D
Future Year (2020)
24-Hour Traffic Volumes
With the Proposed
I-71/Boston Rd. Interchange
2020 C-D build-24H-vol.Fh7

Figure: 18


SCALE IN FEET
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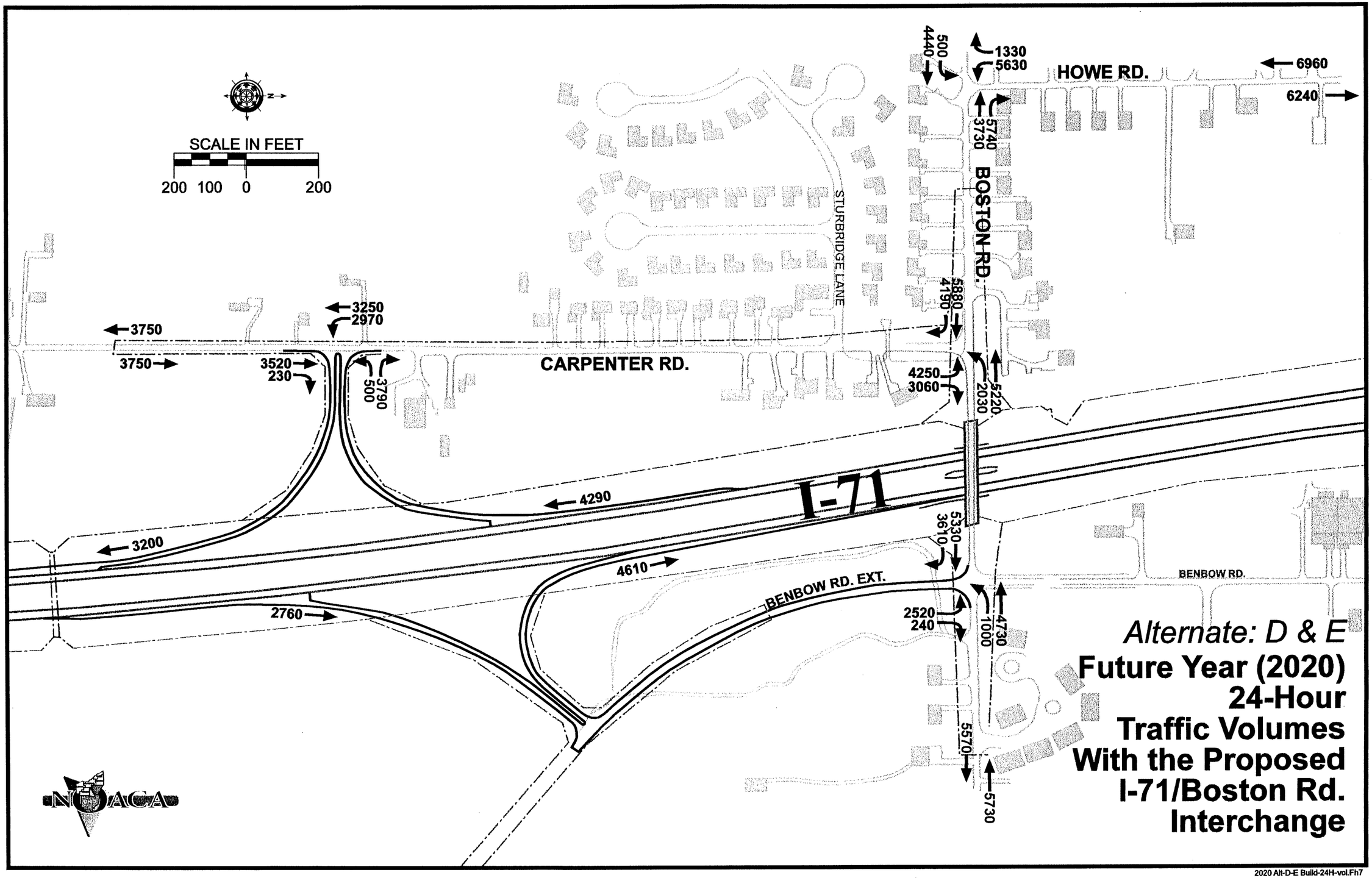
HOWE RD.
BOSTON RD.
CARPENTER RD.
RELOCATED HOWE RD.
BENBOW RD. EXT.
BENBOW RD.
I-71
600 (500)
350 (450)
340 (270)
90 (40)
70 (30)
100 (290)
90 (220)
300 (380)
350 (340)
100 (130)
340 (260)
110 (150)
450 (410)
380 (560)
30 (220)
150 (630)
180 (850)
240 (280)
10 (80)
120 (130)
470 (290)
190 (160)
120 (210)
240 (300)
360 (630)
450 (370)
250 (300)
190 (240)
60 (60)
160 (70)
360 (430)
420 (690)
520 (500)
C C
B C
B B
Peak Level-of-Service
AM C C PM
NOACA
Alternative: C & D
Year 2020 AM (PM) Peak Hours Traffic & Level-of-Service with the Proposed I-71/Boston Rd. Interchange
2020 C-D Build AM-PM Peak#s.Fh7


SCALE IN FEET
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HOWE RD.
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6240
500
4440
1330
5630
5740
3730
BOSTON RD.
STURBRIDGE LANE
5880
4190
3250
2970
3750
3750
3520
230
3790
500
CARPENTER RD.
4250
3060
5220
2030
I-71
4290
3200
5330
3610
4610
BENBOW RD. EXT.
BENBOW RD.
2760
2520
240
1000
4730
5570
5730
Alternate: D & E
Future Year (2020)
24-Hour
Traffic Volumes
With the Proposed
I-71/Boston Rd.
Interchange
2020 Alt-D-E Build-24H-vol.Fh7

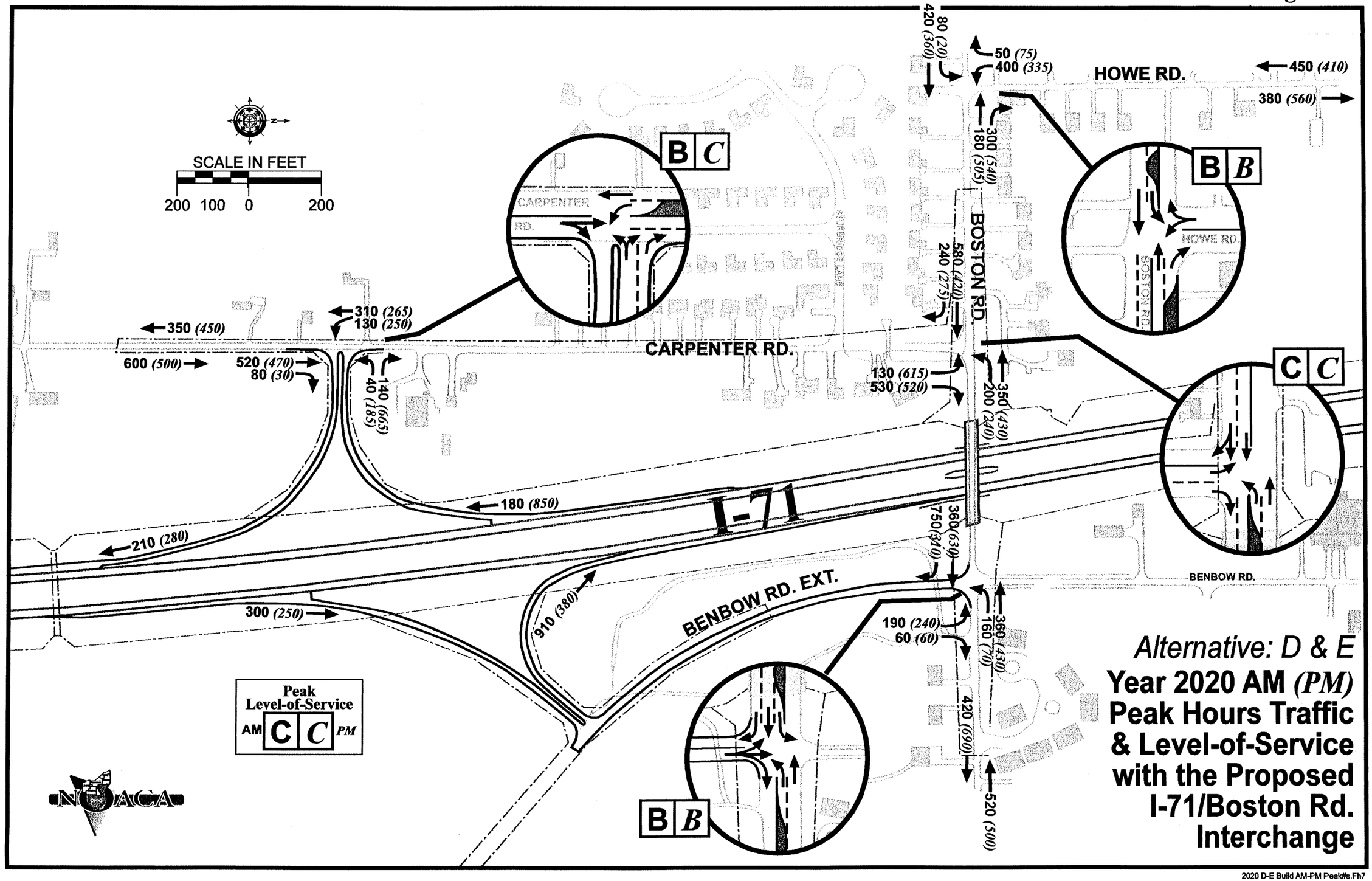

SCALE IN FEET
200 100 0 200
B C
CARPENTER RD.
B B
HOWE RD.
C C
BENBOW RD.
B B
80 (20)
420 (360)
50 (75)
400 (335)
450 (410)
380 (560)
300 (540)
180 (505)
BOSTON RD.
580 (420)
240 (275)
310 (265)
130 (250)
350 (450)
600 (500)
520 (470)
80 (30)
140 (665)
40 (185)
CARPENTER RD.
130 (615)
530 (520)
350 (430)
200 (240)
180 (850)
I-71
210 (280)
300 (250)
910 (380)
BENBOW RD. EXT.
360 (630)
750 (310)
190 (240)
60 (60)
360 (430)
160 (70)
420 (690)
520 (500)
Peak
Level-of-Service
AM C C PM
NOACA
Alternative: D & E
Year 2020 AM (PM)
Peak Hours Traffic
& Level-of-Service
with the Proposed
I-71/Boston Rd.
Interchange
2020 D-E Build AM-PM Peak#s.Fh7

Figure: 21

Suggested Schematic Layout for Alternative A

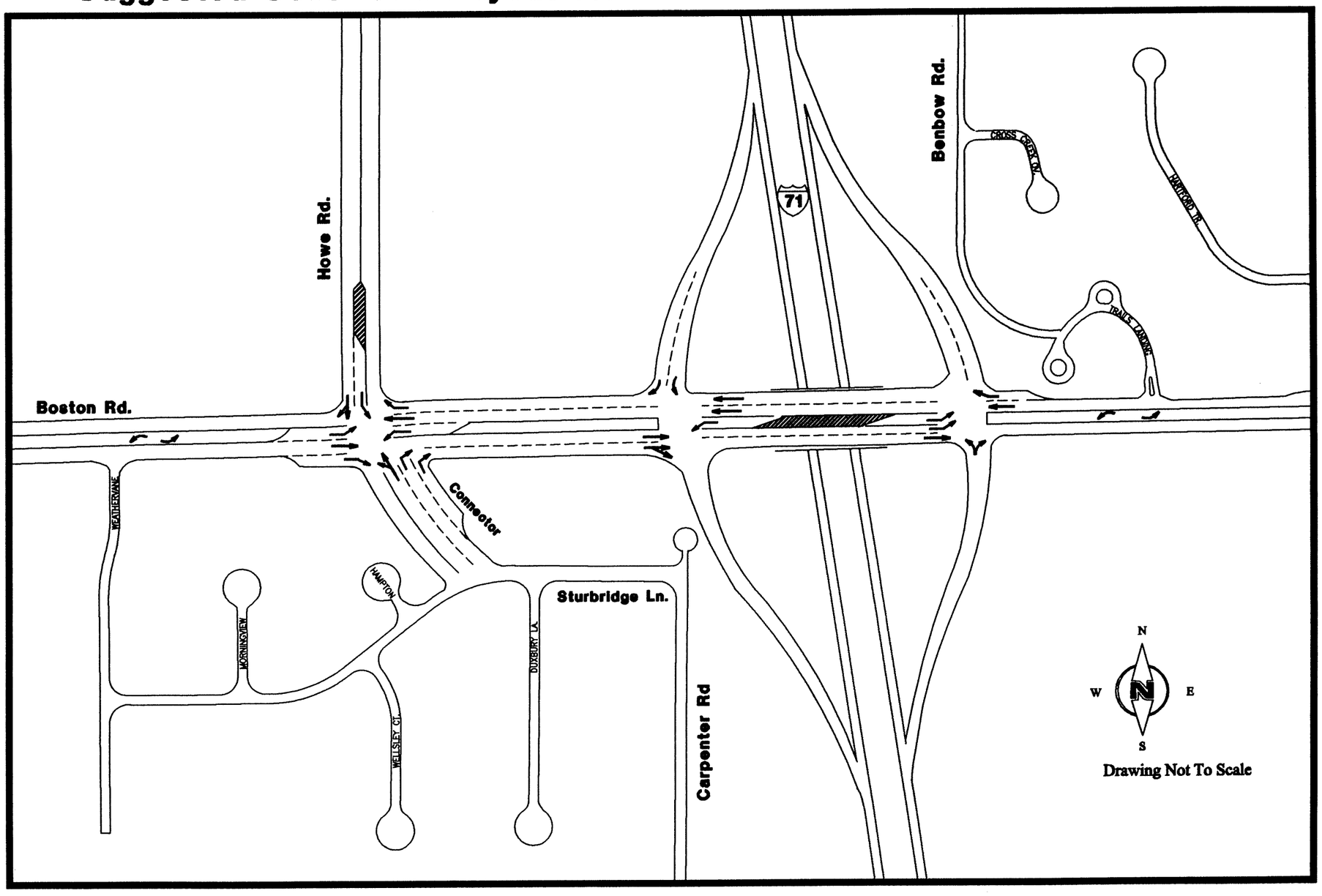


Figure: 22

Suggested Schematic Layout for Alternative (SPUI)

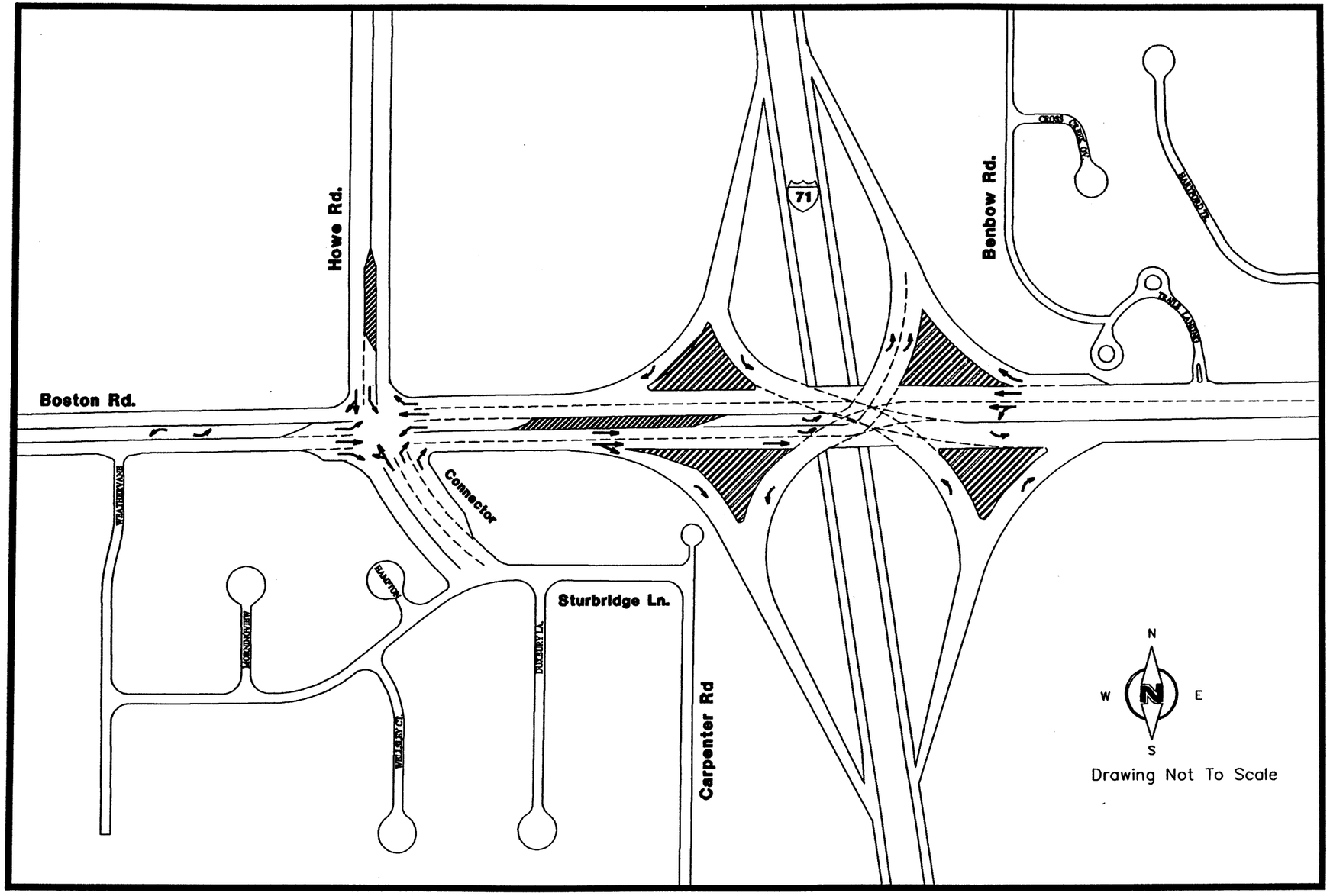


Figure: 23

Suggested Schematic Layout for Alternative C&D

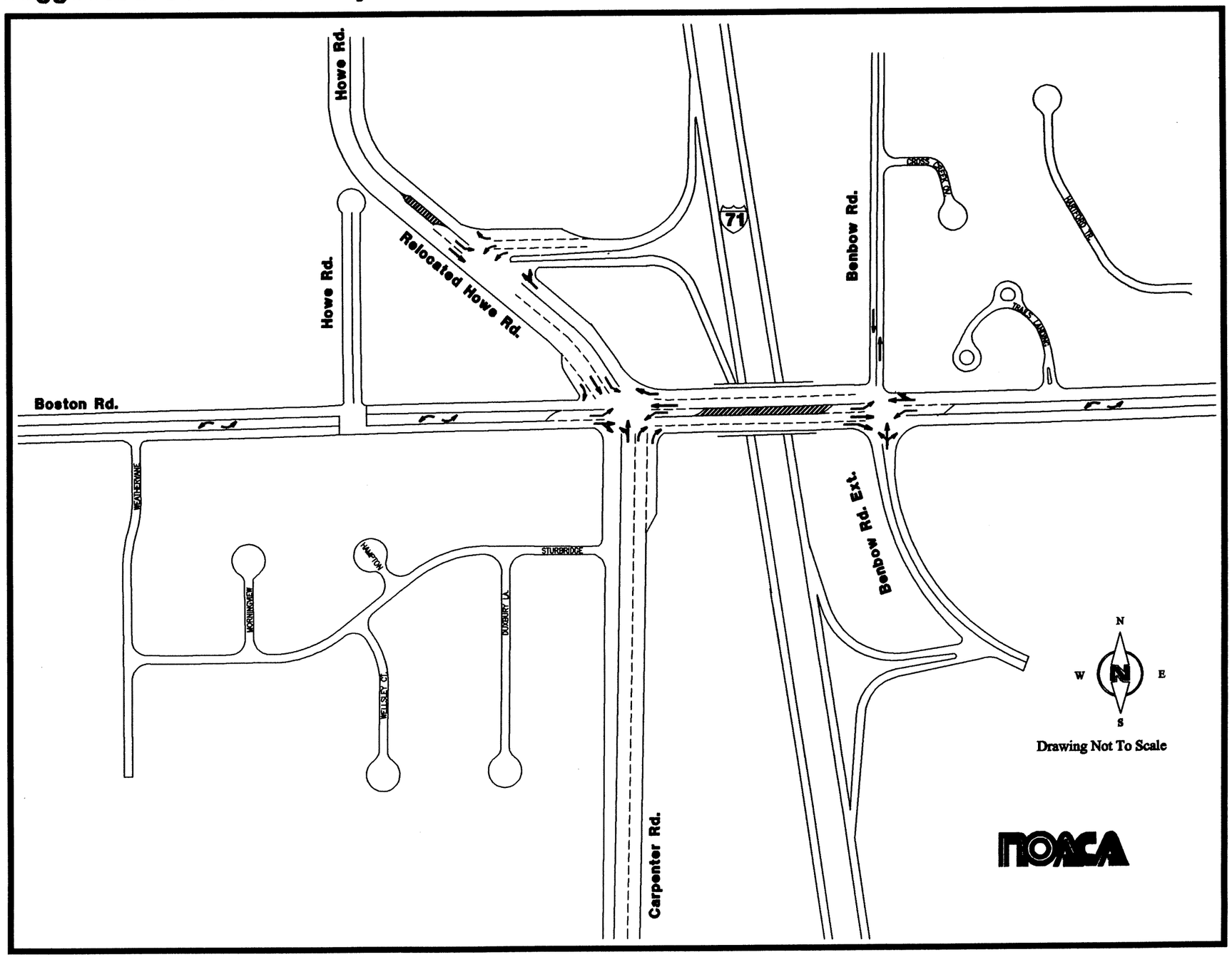


Figure: 24

Suggested Schematic Layout for Alternative D&E

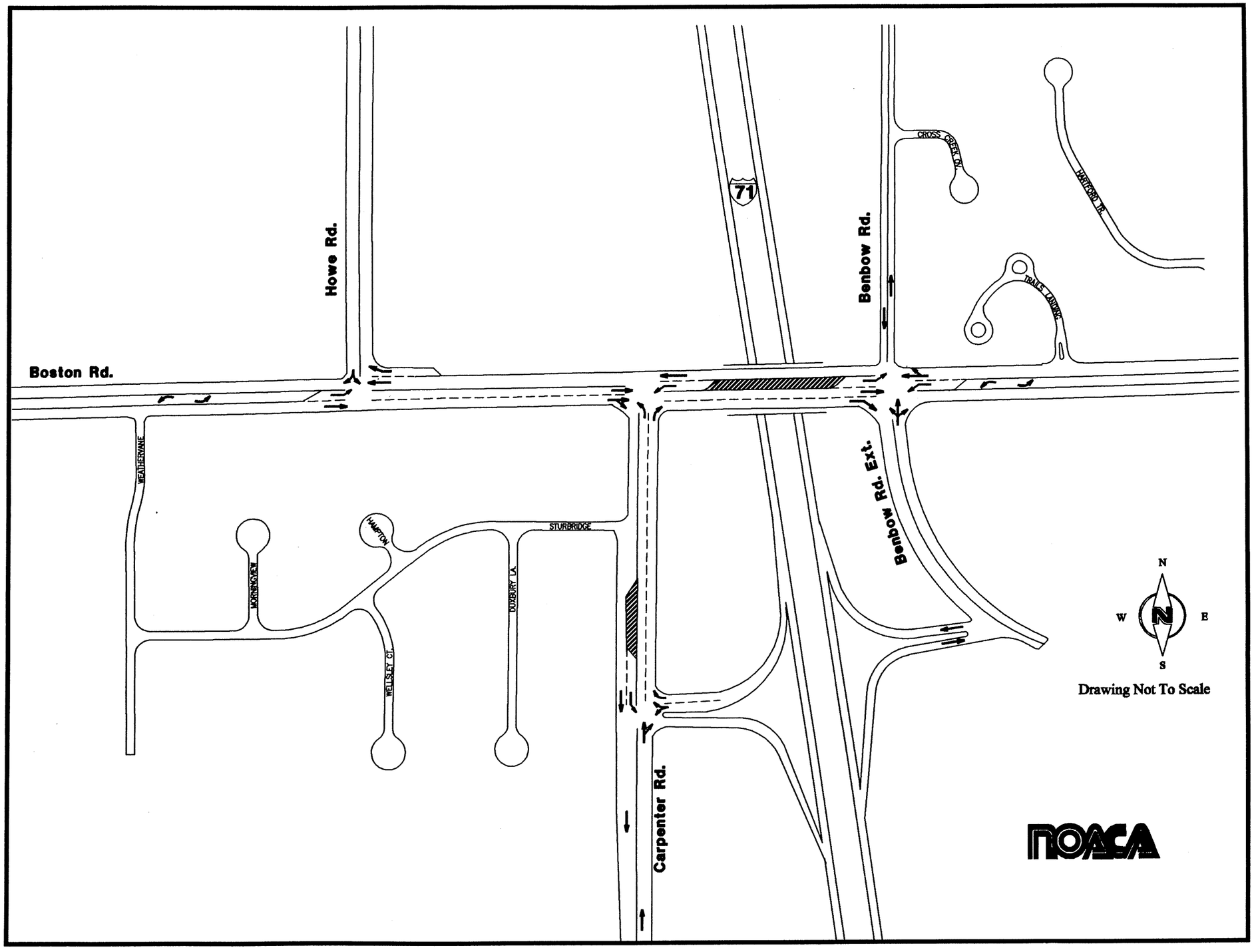


TABLE 6

SUMMARY OF THE LEVEL OF SERVICE (LOS) ANALYSIS
BOSTON RD/I-71 PROPOSED ALTERNATIVES

Alternative	Description	# Of Properties Impacted
A	Diamond at Boston Rd with Howe Extension	Approximately 20
Urban Interchange	Modified Diamond at Boston Rd with Howe Extension	Approximately 29
C+D	Entrance/Exit at Benbow Rd Extension and Relocated Howe Rd	Approximately 11
D+E	Entrance/Exit at Benbow Rd. Extension and Carpenter Rd	Approximately 6 (does not include the impact of any modifications to the Carpenter/Boston & Howe/Boston Intersections)

Alternative A	AM PEAK LOS	PM PEAK LOS
Boston Rd/I-71 W Ramps	C	C
Boston Rd/I-71 E Ramps	C	C
Boston/Howe-Sturbridge-Carpenter	C	C

Alternative: Urban Interchange	AM PEAK LOS	PM PEAK LOS
Boston Rd/I-71 Ramps	C	C
Boston/Howe-Sturbridge-Carpenter	C	C

Alternative: C+D	AM PEAK LOS	PM PEAK LOS
Howe Rd/I-71 W Ramps	B	B
Boston Rd/Benbow Rd Extension	C	C
Boston/Howe-Carpenter	C	C

Alternative: D+E	AM PEAK LOS	PM PEAK LOS
Carpenter Rd/I-71 W Ramps	B	C
Boston Rd/Carpenter Rd	B	C
Boston Rd/Benbow Rd Extension	B	B
Boston/Howe	B	B

See Page 5 for explanation of LOS

VI. ENVIRONMENTAL OVERVIEW

Summary of Study Area Environment

The environmental overview for the proposed interchange along IR-71 at Boston Road encompasses a project area bounded by SR-82 (Royalton Road) on the north, West 130th Street on the east, SR-303 (Center Road) on the south, and US-42 (Pearl Road) on the west. (See Figure 25).

The land use in the study area varies widely from intensely developed areas to large tracts of open space. The area has been subjected to intense developmental pressure during the past decade, and growth is expected to continue at a rapid pace with the existing road network. NOACA has estimated that 41.9 percent of the project area was devoted to residential and other developed uses in 1980. Projected future conditions show continued growth with 58.6 percent of the land area being in residential and other developed uses before year 2010.

Significant commercial/recreational/institutional facilities exist within the study area. Most of the northeast portions of the project area (the land east of IR-71 and north of Drake Road) lies within the Cleveland MetroParks Mill Stream Run Reservation. This reservation is one part of the interconnected chain of parks located along the Rocky River. Extensive commercial strip development is along SR-82 at and west of IR-71, along most of US-42 and SR-303, and at intersections along West 130th. Seven elementary and secondary schools lie within the borders of the project area.

The Ohio Department of Natural Resources' Northeast Ohio Water Plan identifies a potential that a section of an underground gas and/or oil pool lies under the southern and southwestern portion of the study area as shown on Figure 25.

Potential groundwater yields in the study area generally are in the 5-25 gallons/minute range from wells developed in the Cuyahoga formation. Locally, larger supplies may be developed if irregularly occurring sand and gravel deposits are encountered. Groundwater yields in excess of 25 gallons/minute can also be developed where the Sharon Conglomerate remains as the cap rock. This occurrence is generally limited to a small extent of the project area near the intersection of US-42 and Grafton Road as shown on Figure 26.

Groundwater supplies are used little in the study area due to the availability of water from the City of Cleveland, and from the Medina County-Northwest Water District (NWWD). The cities of Strongsville and Brunswick are currently serviced by water from the Cleveland system. Portions of Brunswick Hills Township are serviced by the NWWD which purchases its water from the Rural Lorain County Water Authority. Brunswick generally requires annexation of Brunswick Hills Township lands which desire tie-ins to the Cleveland system. The City of Cleveland and NWWD have adequate capacities to meet both the existing and year 2035 average and peak demands.

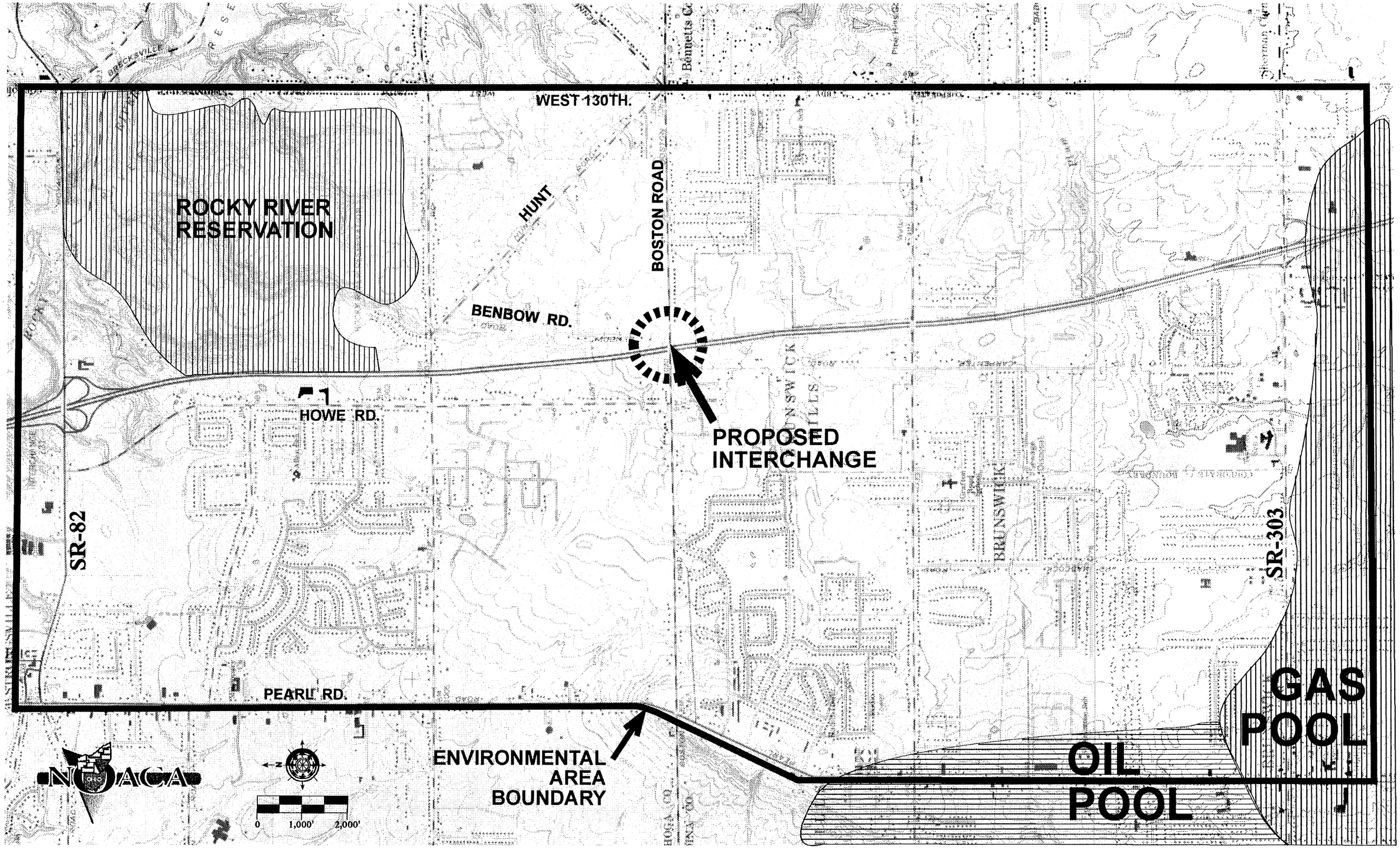
Surface drainage of the study area flows into the Rocky River via a complex drainage network as shown in Figure 26. A small portion of the western edge drains directly to the West Branch of the Rocky River through Baker Creek on the north and Cossett Creek on the south. The southern portion of the project area drains to the North Branch of the West Branch via Plum Creek. The majority of the project area drains to the East Branch of Rocky River. The proposed interchange lies within the East Branch watershed.

Several stretches of the surface waterways in the study area have been designated as flood prone areas under the National Flood Insurance Program. The extent of these areas are shown in Figure 27.

Much of the length of the East Branch of the Rocky River lies within the boundaries of the Cleveland MetroParks System. This includes the small portion of the East Branch which crosses the northeast corner of the study area. None of the surface waterways in or near the study area are

I-71 / BOSTON ROAD INTERCHANGE ENVIRONMENTAL STUDY AREA

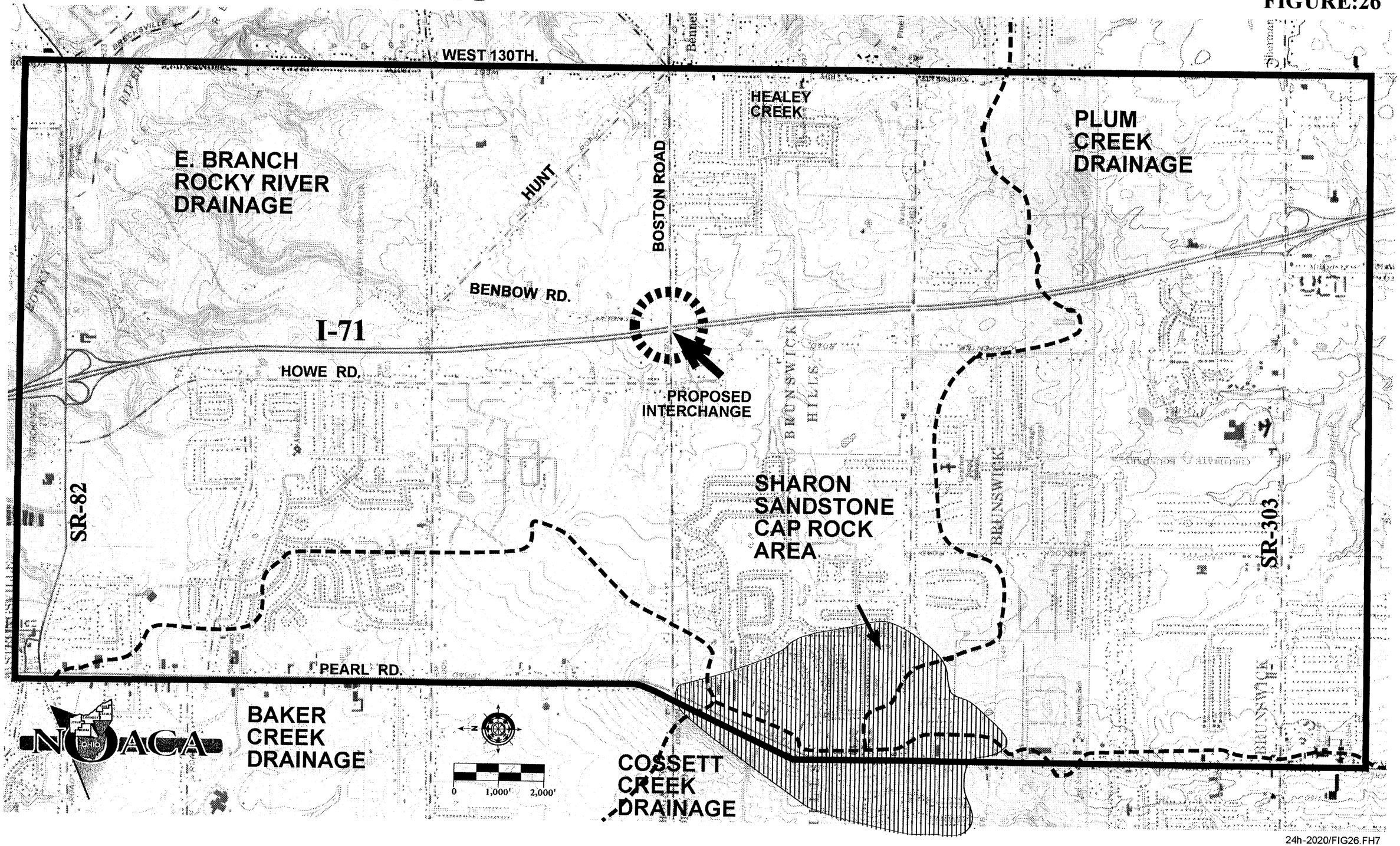
FIGURE:25



24h-2020/FIG-25.FH7

WATERSHED DIVIDES

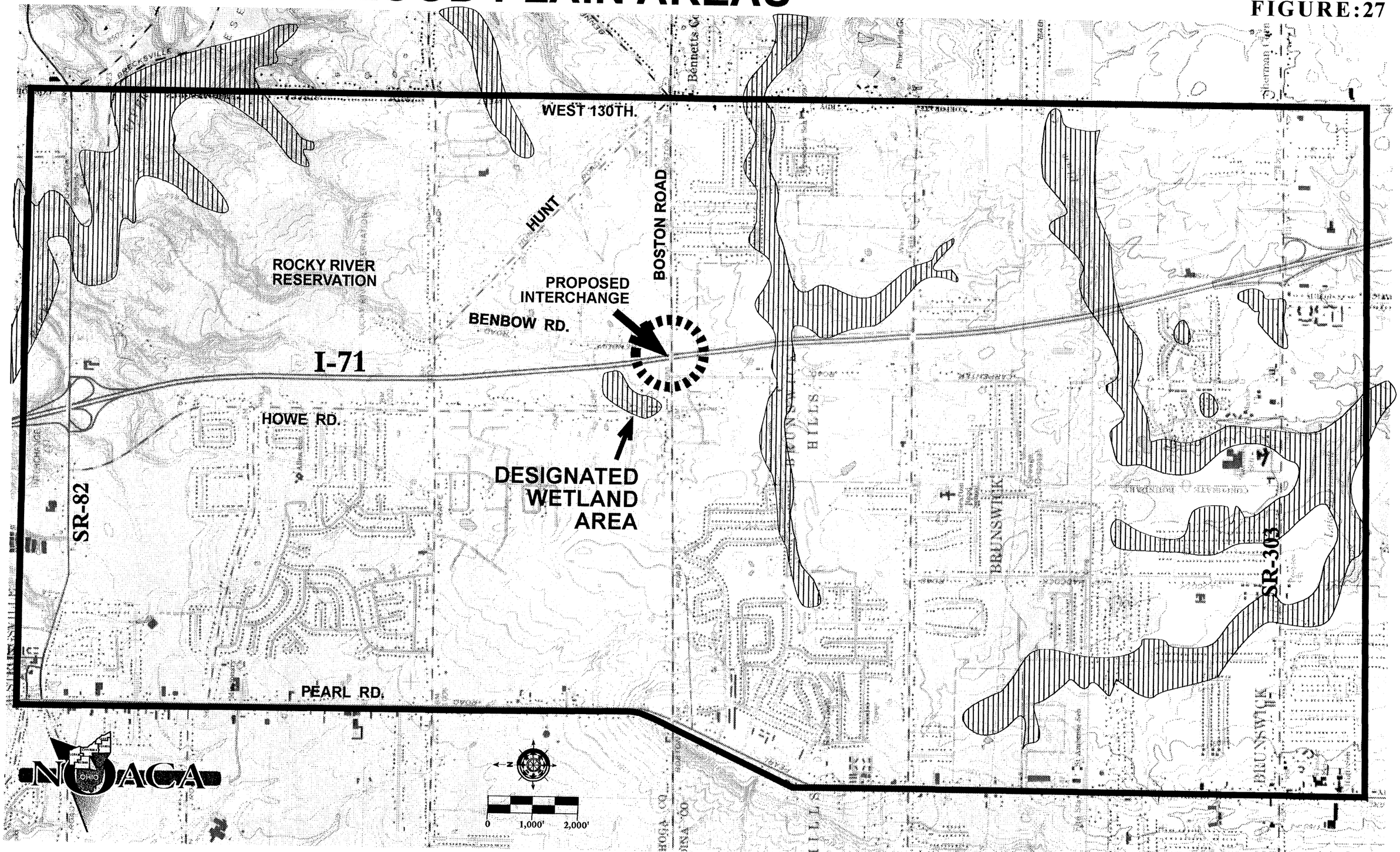
FIGURE:26



24h-2020/FIG26.FH7

DESIGNATED FLOOD PLAIN AREAS

FIGURE:27



24h-2020/FIG27.FH7

included in the State of Ohio's Scenic and Wild River Program.

There exists an excess of 60 small areas identified as wetland areas on the United States Fish and Wildlife Service National Wetlands inventory maps in the project area. Approximately one-half of these are classified as Palustrine-open water. These areas are generally identified as being small ponds. There are six riverine wetland areas identified, three of which lie in the MetroParks reservation. The remaining areas are classified as Palustrine with either forest cover, or shrub cover, or a combination of both.

The most recent USGS topographic maps show approximately 68 small lakes and ponds within the study area. None of these is of sufficient size to support public recreational use. Lake Brunswick is located along Plum Creek immediately south (downstream) of Center Street. This is just outside of the study area boundaries. Baldwin Lake lies along the mainstem of the East Branch of the Rocky River, approximately 5 miles downstream of the northernmost extent of the project area. Both of these lakes support recreational areas, with Baldwin Lake also serving as part of the City of Berea's water supply system.

Most of the land still devoted to crop production in the project area is classified as Prime Agricultural Land by the Soil Conservation Service. This includes the agricultural land in the immediate vicinity of the proposed interchange.

Municipal sanitary sewers are now, or will soon be available to all portions of the study area. The Medina Liverpool, Medina Hinckley, Strongsville A, and North Royalton B Plants provide service to portions of the study area at the present time. Several small package plants treat waste from isolated areas. The Southwest Interceptor in Cuyahoga County will eventually receive wastes from areas in Strongsville that cannot otherwise be efficiently treated. The Medina Liverpool and Hinckley Plants have capacity for future growth in the Medina County portion of the study area. The Hinckley Plant can also provide limited service to the southwestern corner of North Royalton.

There are several underground gas or oil pipelines in the study area. A crude oil and petroleum products line, and two natural gas pipelines owned by East Ohio Gas cut the project area in an east/west direction south of Grafton Road. Columbia Gas owns a natural gas pipeline that runs in a north/south direction immediately east of US-42. A petroleum products pipeline lies along the western edge of IR-71 within the right-of-way.

The existing water quality of the surface waters of the study area can be summarized with the use of the "Biological and Water Quality Study of the Rocky River and Selected Tributaries" published by the Ohio EPA in 1993.

Plum Creek, which receives the surface drainage from the lower portion of the study area, had depressed water quality conditions when it was last monitored in 1981. Dissolved oxygen and organic enrichment problems prevented the 2.9 mile stretch evaluated from attaining designated uses. Crop production and surface runoff are the assumed causes for the nonattainment noted. It is possible that residual effects from the now abandoned Plum Creek Wastewater Treatment Plant may have affected the 1981 measurements. Current conditions may show some improvement. However, urban runoff is still expected to adversely affect the stream, particularly in the upper reaches.

Water quality in Baker Creek is considered to be fair to marginally good. Malfunctioning septic tanks and urban runoff are responsible for the depressed water quality. Sediment loads are a problem.

That portion of Cossett Creek in the study area has not been evaluated for water quality conditions. The study area's urban runoff into this creek does contribute to the potential for impaired use.

The East Branch of the Rocky River is supporting, or partially supporting its designated use as a warmwater habitat in and near the study area. Portions of the East Branch downstream of the study area are not fully capable of supporting designated uses due to the influence of existing municipal sewage treatment facilities. Planned upgrades and the extension of the Southwest Interceptor will

eventually correct these problems. Surface runoff from urbanized lands, and from agricultural lands is largely responsible for the impairment noted in the East Branch and its tributaries in and around the project area.

Analysis of Potential Impacts: Boston Road Interchange

Environmental impacts can be classified as being either primary or secondary in nature. Primary impacts are those associated directly with the construction and/or presence of a development action. In the case of the proposed interchange, associated primary impacts are increased erosion during the construction of the entrance/exit lanes, changes in storm water runoff quantity and quality, and altered traffic patterns. They also include loss of farmland, woodlots, and shrubland due to construction.

Secondary impacts are those associated with land use changes which may be spurred by the presence of a new interchange. The evaluation of secondary impacts is speculative due to limitations in projecting the potential growth that one can associate directly with the building of the interchange at Boston Road. The study area is already experiencing significant growth which is according to local adopted Land Use Plans. For example five residential developments were underway along Carpenter Road in September, 1998. The potential for secondary impacts is further limited due to the proximity of access points to IR-71 at SR-82 and SR-303. The Boston Road Interchange is expected to have only a minor impact on the overall development of the project area. It may marginally increase the rate of development progress in the entire study area, and may increase that rate in the immediate area of the interchange.

A number of environmental factors were evaluated for potential impacts related to the proposed interchange. Potential impacts are summarized in Table 7. Impacts are categorized as unchanged, minor, moderate, major, or improved. Those factors which require investigations beyond a preliminary level are categorized as undetermined or unknown.

The community cohesion of the study area would generally remain unchanged. Boston Road is connected across IR-71 at this time providing continuity among existing neighborhoods. The construction of an interchange may cause road relocations an/or modifications that would marginally affect traffic flow in the immediate area of the interchange. Both the Urban Style Alternative and Alternative A would convert Benbow Road (in the northeast quadrant) into a cul-de-sac and would construct an alternative outlet to Boston Road. Alternative C+D would not disturb Benbow Road but would result in a significant realignment of Howe Road in the northwest quadrant of the interchange. All properties involved in this realignment would continue to have the same access to existing roadways, thereby minimizing any disruptions in neighborhood connections. Alternative D+E would not disrupt existing roadways. It would construct all required links to existing roadways. This would not affect community cohesion.

There are several properties which would require displacement or relocation if an interchange were added at Boston Road depending on the alternative selected. The displacement of existing residential structures will be necessary for ramp configurations in all four quadrants of the proposed interchange. The Urban Style Alternative would displace 20 residences. Alternative A would affect 29. Alternative C+D would displace 11 properties and D+E would affect 6 (displacements) and others moderately.

Some of the land that would be required for construction of the proposed interchange is now in agricultural use classified as Prime Agricultural. The remainder of the interchange area is covered by a combination of grass, shrubland, forested areas and single family residences. The effects of each alternative are shown in Table 7.

Changes to the aesthetics of the area are considered to be moderate to major. While the existence of IR-71 already affects the aesthetics of the area, the introduction of access ramps would extend the intrusion on the semi-rural character of the surrounding area. Secondary development around the interchange area providing a service station and convenient store services would intensify this effect if local zoning were changed to permit this land use. Increased traffic flow in the vicinity is principal

TABLE 7: SUMMARY OF ENVIRONMENTAL IMPACTS

FACTOR	NO BUILD	URBAN STYLE ALTERNATIVE	ALTERNATIVE A	ALTERNATIVE C+D	ALTERNATIVE D+E
Community Cohesion	Unchanged	Minor	Minor	Minor	Unchanged
Displacements	None	20 properties	29 properties	11 properties	6 properties
Energy Use	Undetermined *	Undetermined *	Undetermined *	Undetermined *	Undetermined *
Land Uses Affected * Based on land needed for interchange construction	None	Farmland-none Forested-none Grassland-none Single Family-major	Farmland -moderate Forested-moderate Grassland-minor Single Family-major	Farmland -major Forested-minor Grassland-moderate Single Family-major	Farmland -major Forested-minor Grassland-none Single Family-minor
Aesthetics	Unchanged	Moderate	Moderate	Moderate	Moderate
Prime Farmland Affected *	Unchanged	Major	Moderate	Major	Major
Recreation	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged
Water Quality	Unchanged	Minor	Minor	Minor	Minor
Water Supply	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged
Floodplains	Unchanged	Minor	Minor	Minor	Minor
Wetlands	Unchanged	Unchanged	Suitable	Suitable	Suitable
Wildlife	Unchanged	Minor	Minor	Minor	Minor
Air Quality	Undetermined *	Undetermined *	Undetermined *	Undetermined *	Undtermined *
Noise	Unchanged	Major	Major	Major	Major
Historic Sites Affected	None	None	None	None	None
Safety	Unchanged	Minor	Minor	Minor	Minor
Right-of-Way	None	Major	Major	Major	Major
Detours	Unchanged	Minor	Minor	Minor	Minor
Buildings Affected / Road Closures	None	Benbow Realignment / Howe/Carpenter	Benbow Realignment / Howe/Carpenter	Howe Road Relocation	None

* Undetermined means that an evaluation is beyond the scope of this analysis

consideration.

Active farmlands continue to exist within the project area. Some of this land is classified as Prime Agricultural Land. The construction of the proposed interchange could, depending on the preferred alternative, directly affect as much as 50 acres of prime agricultural land. Secondary impacts associated with growth that may spurred by the location of the interchange are limited due to existing development pressures of permitted (zoned) use. It is expected that existing development pressures will ultimately affect all agricultural land lying in the project area.

There are no factors associated with the proposed interchange that are considered to pose a potential impact on recreational activities within the project area.

The proposed interchange will directly affect water quality on the unnamed tributary to the East Branch of the Rocky River. These impacts are related to increased sedimentation during construction and to increased storm water runoff and pollutant loadings associated with vehicular traffic after construction. Secondary impacts could be associated with developmental activities due to construction erosion, storm water runoff, and the generation of additional sanitary waste volume delivered to the municipal wastewater treatment plants that serve the project area..

The availability of a municipal water supply to the entire project area from municipal systems results in no adverse impacts on water supply. Existing capacities, with planned improvements, are considered to be adequate to meet future demands. These improvements are required whether the interchange is added or not.

A portion of the interchange surface drainage will flow to the East Branch of the Rocky River which is a designated floodplain. Runoff controls will be required so as not to aggravate existing flood conditions. A forest-covered, designated wetland area in the northwest quadrant of the proposed interchange (see Figure 27) will require a Section 404 permit from the United States Army Corps of Engineers before earth moving activities may be undertaken.

There are no known soil or geologic limitations to the proposed construction. Soil and bedrock borings should be available from the IR-71 construction records and should be adequate to fully define site conditions.

The potential effects on vegetation types are moderate. Existing right-of-way and adjacent area vegetation is predominantly grass or shrubland south of Boston Road. Areas lying north of Boston Road have significant stands of secondary growth forests. Depending on ramp alignment, 20 acres or more of woodland may require clearing. No structures of historical architectural significance exist in the vicinity of the proposed interchange.

Consideration was given to adding one or more lanes to IR-71 north of SR-82. Several environmental issues are involved with such an action. It is expected that the lane addition project is primarily being accomplished within existing right-of-way. Such areas have already been environmentally disrupted. and further work is of limited consequence. Impacts which are expected to stem from increased erosion during construction, from increased storm water runoff. and from associated pollutant loadings following construction. Appropriate control technologies exist which can minimize the impacts from these activities. This study does not analyze the extent of widening IR-71 between SR-82 and the next access point which is the Ohio Turnpike Ramps.

The most environmentally susceptible areas potentially affected by a lane expansion project include Baldwin and Coe Lakes which serve as Berea's water supply. Neither are in or near the project right of way. Both do receive runoff from portions of the highway but no significant increases in runoff or highway related pollutants are expected.

VII. INTER-RELATIONS OF IMPROVEMENTS

The following phases are identified to describe probable construction sections in the context of a preliminary sequence of operation.

1. Widen IR-71 to six lanes between SR-82 and SR-303.
2. Widen and reconstruct Boston Road between Pearl Road and West 130 Street.
3. Promote all types of demand reduction strategies in the vicinity of the study area targeting especially the Strongsville area.
4. Provide three park-n-ride facilities in the vicinity of SR-82, SR-303 (west of North Carpenter Road) and SR-18 interchanges.
5. Construct Boston Road/I-71 interchange.

VIII. COMMITMENT PROCESS

A set of improvements has been recommended for the Boston Road/IR-71 proposed interchange. The Federal Highway Administration requires, as a condition of point-of-access approval, that commitments be made to implement the recommendations.

The cities and the state have to agree to their parts of implementing the recommendation. The commitment to the recommendations does not have to be physically in place before the Federal Highway Administration approves the point-of-access request.

The Cities of Brunswick and Strongsville have to enact consent legislation for the point-of-access at Boston Road/IR-71, since the proposed interchange will be located within both jurisdictions.

NOTE: According to the "NOACA Interim Guidance on Major Investment" adopted by the NOACA Governing Board on October 9, 1998, in Resolution 98-055, a Major Investment Study (MIS) is required for proposed new freeway or expressway interchanges. The project sponsor will conduct the MIS consistent with federal guidelines (23CFR450.318) and NOACA's Interim Guidance.

Appendix X

HCS & HCM Cinema Computer Outputs

Level-Of-Service & Queue Lengths of the Proposed Four Alternatives

Alternative A

(A Simple Diamond at Boston Road)

HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 07-08-1999
Northeast Ohio Areawide Coordinating Agency

Streets: (E-W) BOSTON RD (N-S) HOWE RD/STURBRIDGE
Analyst: NOACA File Name: HOWBOSAA.HC9
Area Type: Other 9-4-98 AM PEAK
Comment: FUTURE YEAR 2020 ALTERNATE: A

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	1	1	1	1	> 1		2	1	1	<
Volumes	80	350	70	230	170	260	10	40	550	350	50	50
Lane W (ft)	12.0	12.0	12.0	12.0	12.0	12.0		12.0	12.0	12.0	12.0	
RTOR Vols			0			0			0			0
Lost Time	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	*				NB Left	*		
Thru		*			Thru	*		
Right		*			Right	*		
Peds	*				Peds	*		
WB Left	*				SB Left		*	
Thru		*			Thru		*	
Right		*			Right		*	
Peds	*				Peds	*		
NB Right	*				EB Right	*		
SB Right					WB Right		*	
Green	15.0A	20.0A			Green	10.0A	20.0A	
Yellow/AR	5.0	5.0			Yellow/AR	5.0	5.0	

Cycle Length: 85 secs Phase combination order: #1 #2 #5 #6

Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
EB	L	354	1770	0.251	0.200	18.6	C	22.3	C
	T	482	1863	0.807	0.259	25.8	D		
	R	689	1583	0.113	0.435	9.2	B		
WB	L	354	1770	0.723	0.200	25.4	D	16.4	C
	T	482	1863	0.392	0.259	17.1	C		
	R	819	1583	0.353	0.518	7.9	B		
NB	LT	260	1844	0.211	0.141	20.9	C	16.5	C
	R	1081	3167	0.639	0.341	16.1	C		
SB	L	458	1770	0.849	0.259	29.1	D	26.2	D
	TR	446	1723	0.251	0.259	16.2	C		

Intersection Delay = 19.7 sec/veh Intersection LOS = C
Lost Time/Cycle, L = 12.0 sec Critical v/c(x) = 0.753

HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 07-08-1999
Northeast Ohio Areawide Coordinating Agency

Streets: (E-W) BOSTON RD (N-S) HOWE RD/STURBRIDGE
Analyst: NOACA File Name: HOWBOSAP.HC9
Area Type: Other 9-4-98 PM PEAK
Comment: FUTURE YEAR 2020 ALTERNATE: A

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	1	1	1	1	> 1		2	1	1	<
Volumes	20	290	70	345	425	440	80	100	320	300	35	75
Lane W (ft)	12.0	12.0	12.0	12.0	12.0	12.0		12.0	12.0	12.0	12.0	
RTOR Vols			0			0			0			0
Lost Time	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	*				NB Left	*		
Thru			*		Thru	*		
Right			*		Right	*		
Peds		*	*		Peds	*	*	
WB Left	*	*			SB Left		*	
Thru		*	*		Thru		*	
Right		*	*		Right		*	
Peds		*	*		Peds	*	*	
NB Right	*	*			EB Right	*		
SB Right					WB Right		*	
Green	13.0A	5.0A	19.0A		Green	13.0A	20.0A	
Yellow/AR	5.0	5.0	5.0		Yellow/AR	5.0	5.0	

Cycle Length: 95 secs Phase combination order: #1 #2 #3 #5 #6

Intersection Performance Summary

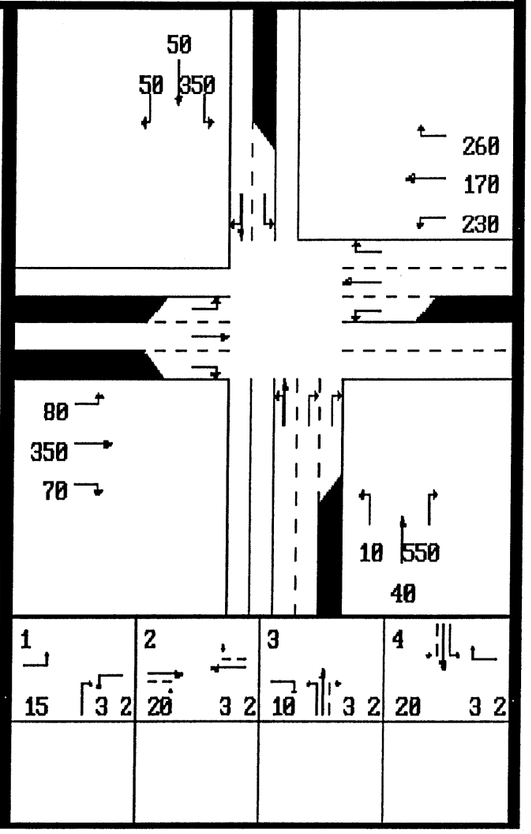
	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
EB	L	279	1770	0.079	0.158	22.0	C	25.3	D
	T	412	1863	0.782	0.221	29.0	D		
	R	650	1583	0.120	0.411	11.2	B		
WB	L	466	1770	0.822	0.263	29.1	D	19.7	C
	T	608	1863	0.776	0.326	23.0	C		
	R	883	1583	0.554	0.558	9.3	B		
NB	LT	288	1822	0.695	0.158	29.3	D	17.6	C
	R	1333	3167	0.301	0.421	11.8	B		
SB	L	410	1770	0.812	0.232	30.4	D	27.6	D
	TR	387	1673	0.315	0.232	19.7	C		

Intersection Delay = 21.4 sec/veh Intersection LOS = C
Lost Time/Cycle, L = 12.0 sec Critical v/c(x) = 0.786

HCM Summary Results for Case: HOWBODIA BOSTON RD /STURBRIDGE

FUTURE YEAR 2020 BUILD AM PEAK Version 3.03

	Lane Grp	v/s	X v/c	Delay (sec/veh)	L O S	App Delay (sec/veh)	App L O S
EB	L	0.05	0.25	18.6	C	22.5	C
	T	*0.21	0.81	25.8	D		
	R	0.05	0.12	10.4	B		
WB	L	*0.14	0.72	25.4	D	16.4	C
	T	0.10	0.39	17.1	C		
	R	0.18	0.35	7.9	B		
NB	LT	0.03	0.21	20.9	C	14.7	B
	R	*0.22	0.58	14.2	B		
SB	L	*0.22	0.85	29.1	D	26.2	D
	TR	0.07	0.25	16.2	C		
	Int.	0.79	0.92	19.2	C		



Input Data for Case: HOWBODIA BOSTON RD /STURBRIDGE

FUTURE YEAR 2020 BUILD AM PEAK Version 3.03

Intersection Geometry

1)Number of Lanes Including Pockets

	EB	WB	NB	SB
Approach Street	3	3	3	2
Outbound Street	2	1	1	1

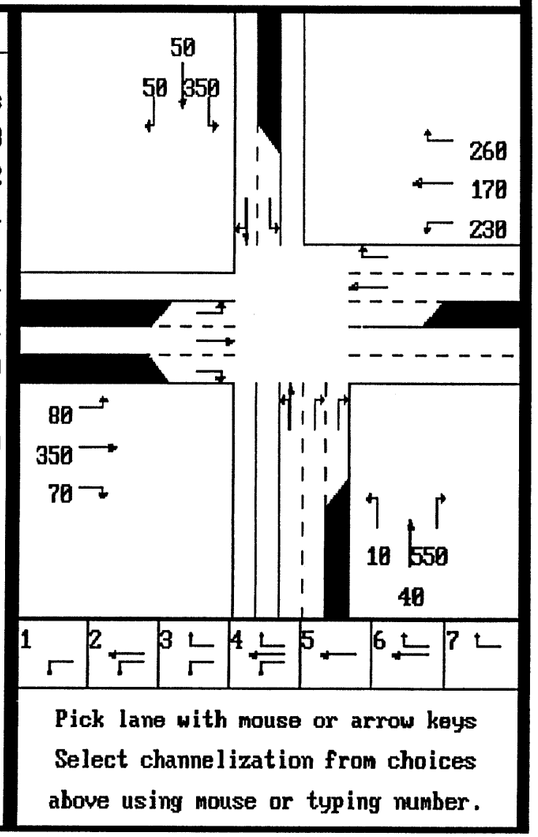
2)

	-Pkt Lanes- Left	Right	—Lane Lengths— Full L	Pkt R	Pkt
EB	1	1	600	160	160
WB	1	0	600	300	
NB	0	1	600		300
SB	1	0	600	300	

3)Need to Revise Channelization? Y

4) Lane Widths (Feet)

	Median	2	3	4	5	6
EB	12.0	12.0	12.0			
WB	12.0	12.0	12.0			
NB	12.0	12.0	12.0			
SB	12.0	12.0				



Pick lane with mouse or arrow keys
Select channelization from choices
above using mouse or typing number.

Input Data for Case: HOWBODIA BOSTON RD /STURBRIDGE
FUTURE YEAR 2020 BUILD AM PEAK Version 3.03

Signal and Phasing Data

Pretimed, Actuated, Semi-Actuated?A

Key in Allowed Movements by Phase:
L=Left; T=Thru; R=Right, no peds;
P=Right w ped conflicts. OR
click mouse on signal icon ->

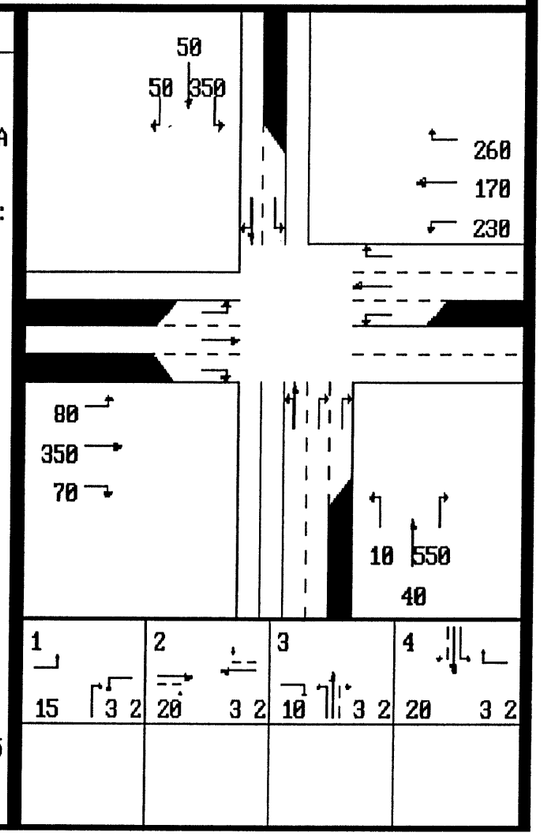
Traffic Movements by Phase

PH:	1	2	3	4	5	6	7	8
EB	L	TP	R					
WB	L	TP		R				
NB	R		LTP					
SB				LTP				

Phase Durations (Seconds)

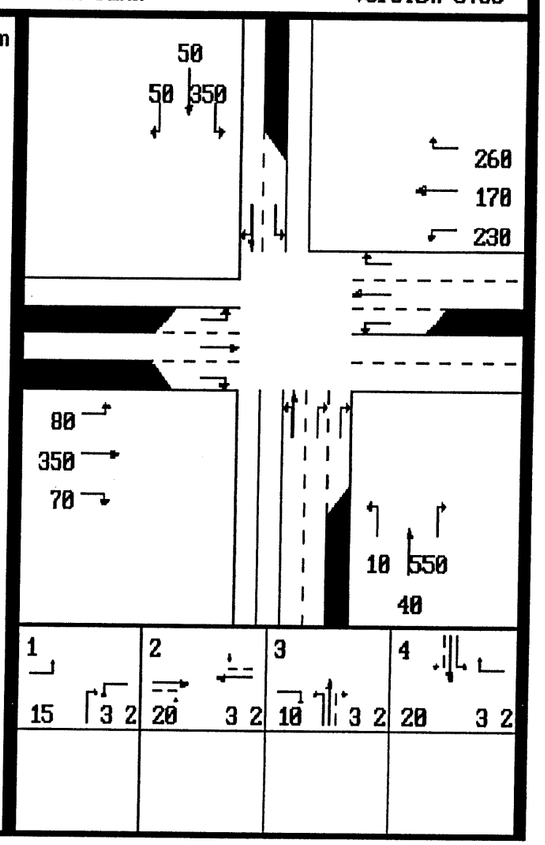
Grn	15	20	10	20
Yel	3	3	3	3
AR	2	2	2	2

Ped Only Phase Dur: 0 Cycle: 85
Lost Time/Phase: 3.0 Seq: 1234



NETSIM Summary for Case: HOWBODIA BOSTON RD /STURBRIDGE
FUTURE YEAR 2020 BUILD AM PEAK Version 3.03

App	Lane Group	Queues Per Lane Avg/Max (veh)	Avg Speed (mph)	Spillback in Worst Lane (% of Peak Period)
EB	L	3/ 4	3.6	0.0
	T	9/ 14	7.7	0.0
	R	2/ 3	6.4	0.0
	All		7.2	0.0
WB	L	5/ 8	4.8	0.0
	T	5/ 7	12.7	0.0
	R	3/ 5	13.5	0.0
	All		10.4	0.0
NB	LT	2/ 3	7.9	0.0
	R	3/ 4	13.2	0.0
	All		12.4	0.0
SB	L	8/ 10	5.3	0.0
	TR	2/ 4	16.7	0.0
	All		8.7	0.0
Intersect.			9.5	



Input Data for Case: HOWBODIP BOSTON RD /STURBRIDGE
FUTURE YEAR 2020 BUILD PM PEAK Version 3.03

Signal and Phasing Data

Pretimed, Actuated, Semi-Actuated?A

Key in Allowed Movements by Phase:
L=Left; T=Thru; R=Right, no peds;
P=Right w ped conflicts. OR
click mouse on signal icon ->

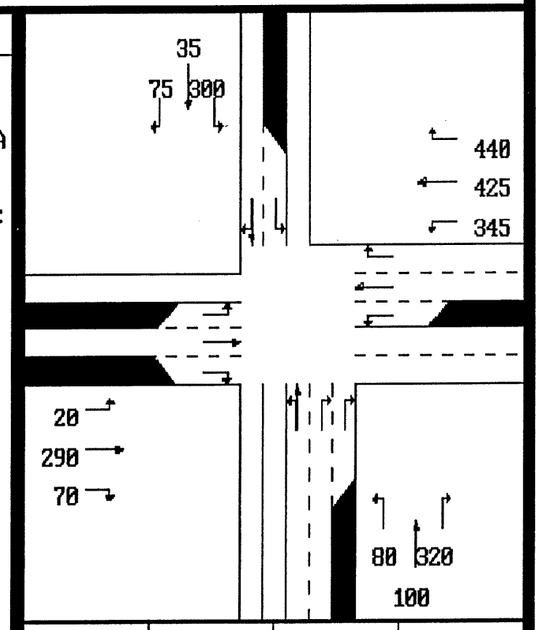
Traffic Movements by Phase

PH:	1	2	3	4	5	6	7	8
EB	L			TP	R			
WB	L		LTP	TP		R		
NB	R	R			LTP			
SB					LTP			

Phase Durations (Seconds)

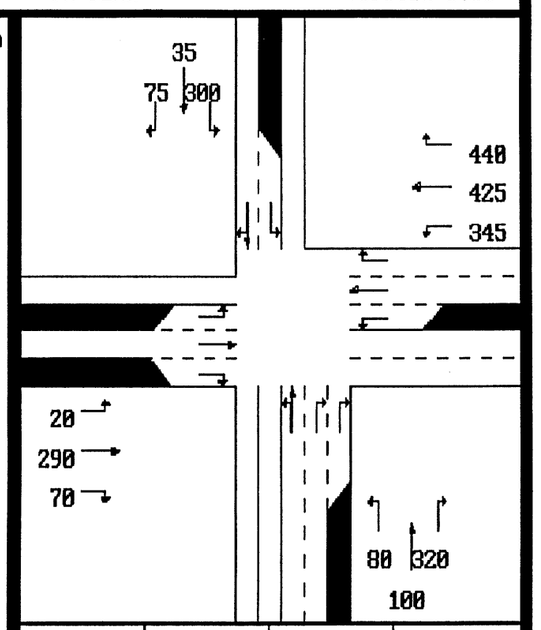
Grn	13	5	19	13	20
Yel	3	3	3	3	3
AR	2	2	2	2	2

Ped Only Phase Dur: 0 Cycle: 95
Lost Time/Phase: 3.0 Seq: 12345



NETSIM Summary for Case: HOWBODIP BOSTON RD /STURBRIDGE
FUTURE YEAR 2020 BUILD PM PEAK Version 3.03

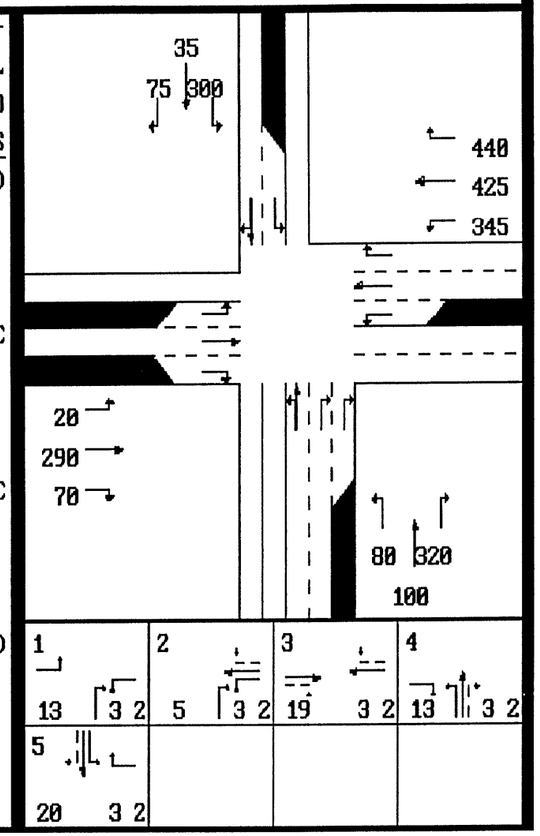
App	Lane Group	Queues Per Lane Avg/Max (veh)	Avg Speed (mph)	Spillback in Worst Lane (% of Peak Period)
EB	L	1/ 1	2.9	0.0
	T	7/ 9	8.4	0.0
	R	1/ 2	7.1	0.0
	All		8.2	0.0
WB	L	9/ 13	4.8	0.0
	T	11/ 14	10.6	0.0
	R	5/ 7	12.8	0.0
	All		9.5	0.0
NB	LT	6/ 10	6.1	0.0
	R	2/ 3	16.7	0.0
	All		9.8	0.0
SB	L	8/ 11	4.4	0.0
	TR	2/ 4	15.2	0.0
	All		7.7	0.0
Intersect.			9.0	



HCM Summary Results for Case: HOWBODIP BOSTON RD /STURBRIDGE

FUTURE YEAR 2020 BUILD PM PEAK Version 3.03

	Lane Grp	v/s	X v/c	Lane Grp Delay (sec/veh)	L O S	App Delay (sec/veh)	App L O S
EB	L	0.01	0.08	22.0	C	25.5	D
	T	*0.17	0.78	28.9	D		
	R	0.05	0.13	12.5	B		
WB	L	*0.22	0.82	29.1	D	19.7	C
	T	0.25	0.78	23.0	C		
	R	0.31	0.55	9.3	B		
NB	LT	0.11	0.69	29.3	D	17.6	C
	R	*0.13	0.30	11.8	B		
SB	L	*0.19	0.81	30.4	D	27.5	D
	TR	0.07	0.32	19.7	C		
	Int.	0.70	0.81	21.4	C		



Input Data for Case: HOWBODIP BOSTON RD /STURBRIDGE

FUTURE YEAR 2020 BUILD PM PEAK Version 3.03

Intersection Geometry

1)Number of Lanes Including Pockets

	EB	WB	NB	SB
Approach Street	3	3	3	2
Outbound Street	2	1	1	1

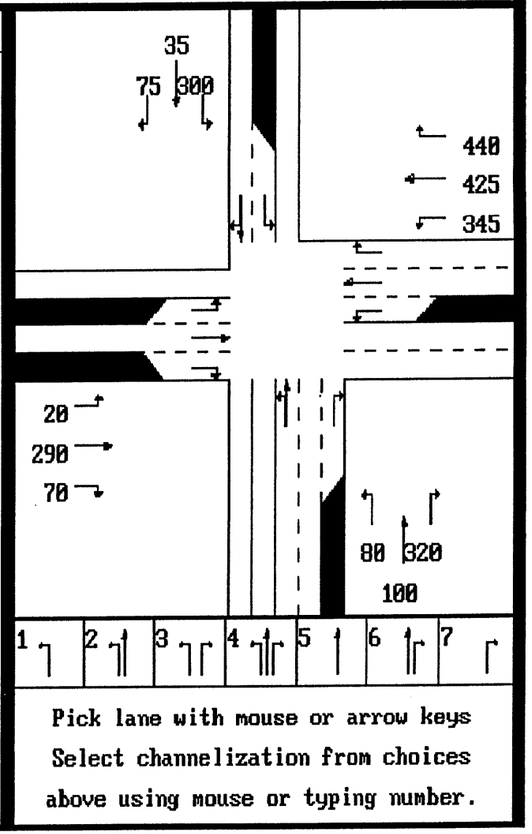
2)

	-Pkt Lanes- Left	Right	--Lane Lengths-- Full L	Pkt R	Pkt
EB	1	1	600	160	160
WB	1	0	600	300	
NB	0	1	600		300
SB	1	0	600	300	

3)Need to Revise Channelization? Y

4) Lane Widths (Feet)

	Median	2	3	4	5	6
EB		12.0	12.0	12.0		
WB		12.0	12.0	12.0		
NB		12.0	12.0	12.0		
SB		12.0	12.0			



Pick lane with mouse or arrow keys
Select channelization from choices
above using mouse or typing number.

HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 07-08-1999
Northeast Ohio Areawide Coordinating Agency

Streets: (E-W) BOSTON RD (N-S) I-71 WEST RAMPS
Analyst: NOACA File Name: BOS71WRA.HC9
Area Type: Other 9-4-98 AM PEAK
Comment: FUTURE YEAR 2020 ALTERNATE: A

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes		2	<	1	2					1		1
Volumes		1050	200	10	540					60		120
Lane W (ft)		12.0		12.0	12.0					12.0		12.0
RTOR Vols			0			0						0
Lost Time		3.00	3.00	3.00	3.00					3.00		3.00

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left					NB Left			
Thru	*				Thru			
Right	*				Right			
Peds	*				Peds			
WB Left		*			SB Left	*		
Thru		*			Thru			
Right					Right	*		
Peds		*			Peds	*		
NB Right					EB Right			
SB Right	*				WB Right			
Green	42.0A	22.0A			Green	16.0A		
Yellow/AR	5.0	5.0			Yellow/AR	5.0		

Cycle Length: 95 secs Phase combination order: #1 #2 #5

Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
EB	TR	1684	3636	0.866	0.463	18.4	C	18.4	C
WB	L	447	1770	0.025	0.253	17.2	C	21.8	C
	T	941	3725	0.669	0.253	21.9	C		
SB	L	335	1770	0.200	0.189	21.0	C	9.3	B
	R	1083	1583	0.123	0.684	3.3	A		

Intersection Delay = 18.5 sec/veh Intersection LOS = C
Lost Time/Cycle, L = 9.0 sec Critical v/c(x) = 0.672

HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 07-08-1999
Northeast Ohio Areawide Coordinating Agency

Streets: (E-W) BOSTON RD (N-S) I-71 WEST RAMPS
Analyst: NOACA File Name: BOS71WRP.HC9
Area Type: Other 9-4-98 PM PEAK
Comment: FUTURE YEAR 2020 ALTERNATE: A

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes		2	<	1	2					1		1
Volumes		710	200	80	590					230		620
Lane W (ft)		12.0		12.0	12.0					12.0		12.0
RTOR Vols			0			0						0
Lost Time		3.00	3.00	3.00	3.00					3.00		3.00

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left					NB Left			
Thru	*				Thru			
Right	*				Right			
Peds	*				Peds			
WB Left		*			SB Left	*		
Thru		*			Thru			
Right					Right	*		
Peds		*			Peds	*		
NB Right					EB Right			
SB Right	*				WB Right			
Green	32.0A	24.0A			Green	24.0A		
Yellow/AR	5.0	5.0			Yellow/AR	5.0		

Cycle Length: 95 secs Phase combination order: #1 #2 #5

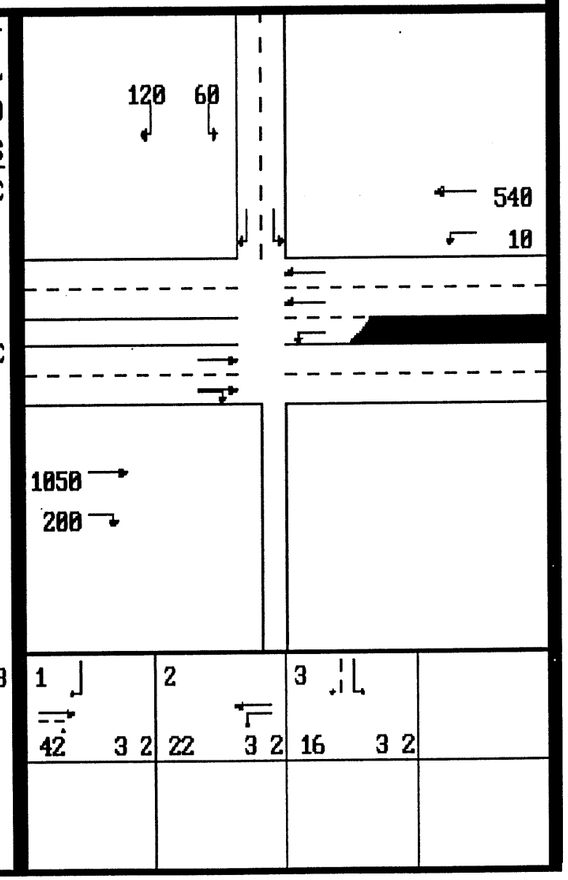
Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
EB	TR	1289	3603	0.824	0.358	21.1	C	21.1	C
WB	L	484	1770	0.184	0.274	17.1	C	20.7	C
	T	1019	3725	0.676	0.274	21.1	C		
SB	L	484	1770	0.528	0.274	19.8	C	10.6	B
	R	1050	1583	0.656	0.663	7.2	B		

Intersection Delay = 17.4 sec/veh Intersection LOS = C
Lost Time/Cycle, L = 9.0 sec Critical v/c(x) = 0.690

HCM Summary Results for Case: BOSI71WA BOSTON /I-71 W.RAMPS
YR 2020 BUILD DI AM Version 3.03

			- Lane Grp -		- App -	
			Delay	L	Delay	L
Lane		X	(sec/	O	(sec/	O
Grp	v/s	v/c	veh)	S	veh)	S
EB TR	*0.40	0.87	18.4	C	18.4	C
WB L	0.01	0.02	17.2	C	21.9	C
T	*0.17	0.67	21.9	C		
SB L	0.04	0.20	21.0	C	9.3	B
R	*0.08	0.12	3.3	A		
Int.	0.65	0.72	18.5	C		



Input Data for Case: BOSI71WA BOSTON /I-71 W.RAMPS
YR 2020 BUILD DI AM Version 3.03

Intersection Geometry

1)Number of Lanes Including Pockets

	EB	WB	NB	SB
Approach Street	2	3	0	2
Outbound Street	2	2	0	1

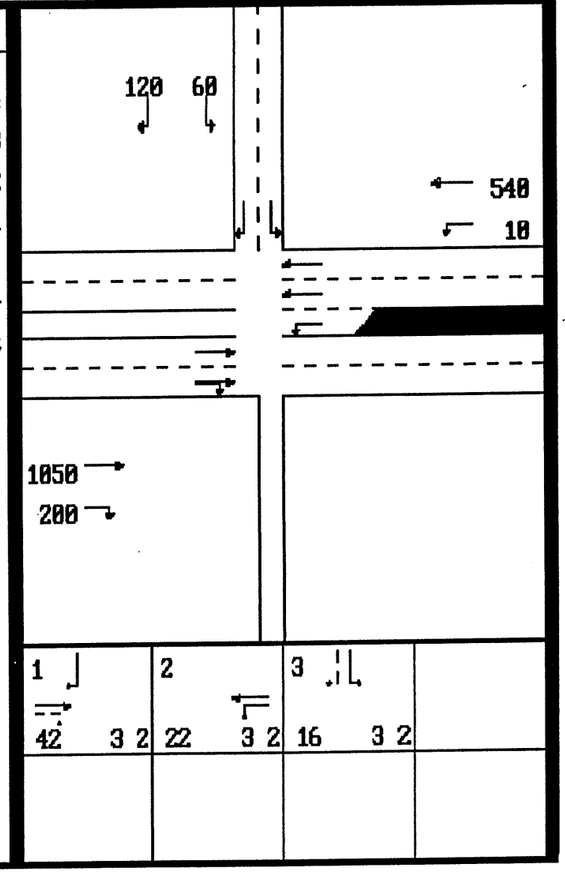
2)

	-Pkt Lanes-		—Lane Lengths—		
	Left	Right	Full L Pkt	R Pkt	
EB	0	0	600		
WB	1	0	600	150	
NB					
SB	0	0	600		

3)Need to Revise Channelization? N

4) Lane Widths (Feet)

	Median	2	3	4	5	6
EB		12.0	12.0			
WB		12.0	12.0	12.0		
NB						
SB		12.0	12.0			



Input Data for Case: BOSI71WA BOSTON /I-71 W.RAMPS
YR 2020 BUILD DI AM Version 3.03

Signal and Phasing Data

Pretimed, Actuated, Semi-Actuated?A

Key in Allowed Movements by Phase:
L=Left; T=Thru; R=Right, no peds;
P=Right w ped conflicts. OR
click mouse on signal icon ->

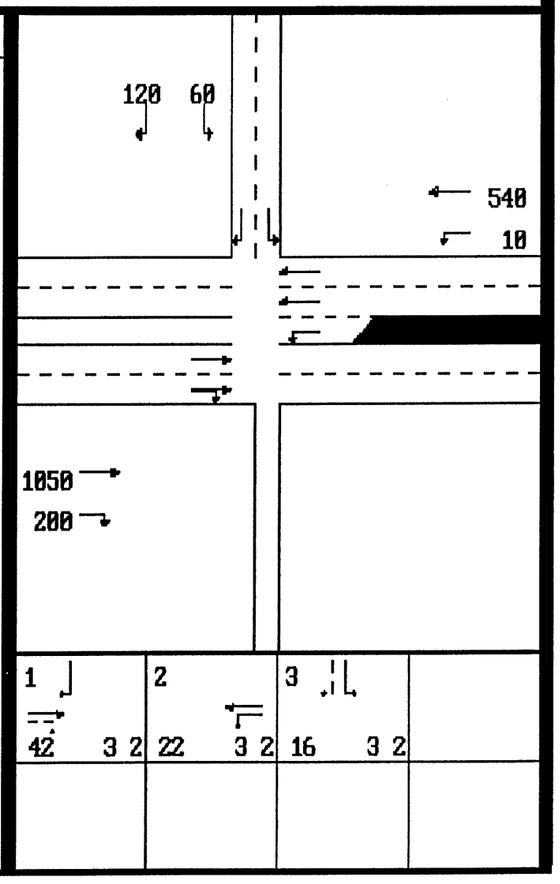
Traffic Movements by Phase

PH:	1	2	3	4	5	6	7	8
EB	TP							
WB		LT						
NB								
SB	R		L	P				

Phase Durations (Seconds)

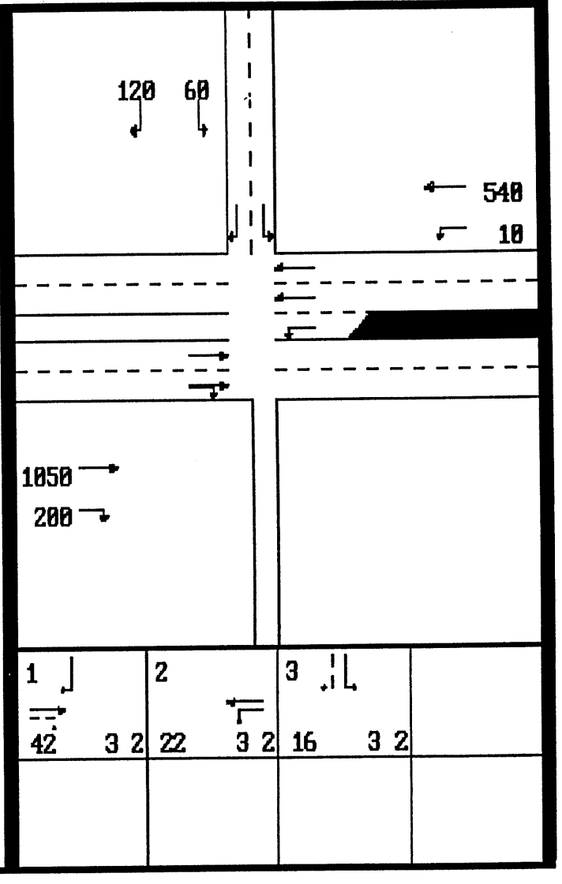
Grn	42	22	16
Yel	3	3	3
AR	2	2	2

Ped Only Phase Dur: 0 Cycle: 95
Lost Time/Phase: 3.0 Seq: 123



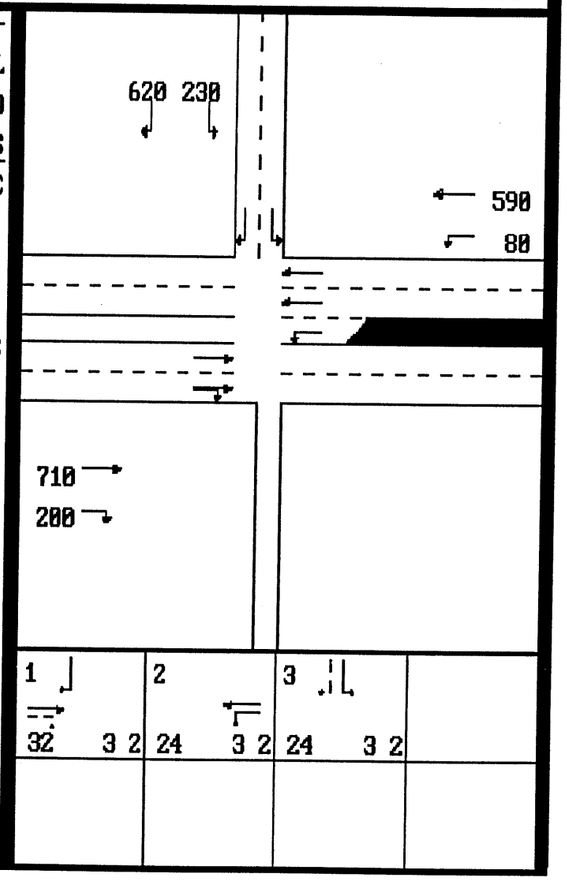
NETSIM Summary for Case: BOSI71WA BOSTON /I-71 W.RAMPS
YR 2020 BUILD DI AM Version 3.03

App	Lane Group	Queues Per Lane Avg/Max (veh)	Avg Speed (mph)	Spillback in Worst Lane (% of Peak Period)
EB	TR	12/ 15	9.3	0.0
	All		9.3	0.0
WB	L	1/ 2	2.5	0.0
	T	7/ 8	8.8	0.0
	All		8.6	0.0
SB	L	2/ 3	7.3	0.0
	R	1/ 3	18.3	0.0
	All		12.3	0.0
Intersect.			9.3	



HCM Summary Results for Case: BOSI71WP BOSTON /I-71 W.RAMPS
YR 2020 BUILD DI PM Version 3.03

	Lane Grp	v/s	X v/c	Lane Grp Delay (sec/veh)	L O S	App Delay (sec/veh)	App L O S
EB	TR	*0.29	0.82	21.1	C	21.1	C
WB	L	0.05	0.18	17.1	C	20.7	C
	T	*0.19	0.68	21.1	C		
SB	L	0.14	0.53	19.8	C	10.6	B
	R	*0.44	0.66	7.2	B		
	Int.	0.92	1.01	17.4	C		



Input Data for Case: BOSI71WP BOSTON /I-71 W.RAMPS
YR 2020 BUILD DI PM Version 3.03

Intersection Geometry

1)Number of Lanes Including Pockets

	EB	WB	NB	SB
Approach Street	2	3	0	2
Outbound Street	2	2	0	1

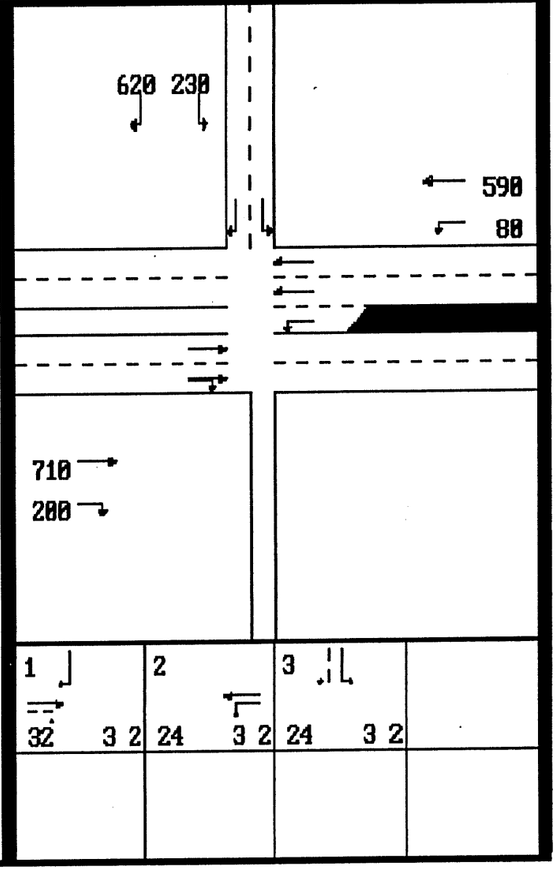
2)

	Pkt Lanes- Left	Right	Lane Lengths— Full L	Pkt R	Pkt
EB	0	0	600		
WB	1	0	600	150	
NB					
SB	0	0	600		

3)Need to Revise Channelization? N

4) Lane Widths (Feet)

	Median	2	3	4	5	6
EB		12.0	12.0			
WB		12.0	12.0	12.0		
NB						
SB		12.0	12.0			



Input Data for Case: BOSI71WP BOSTON /I-71 W.RAMPS
YR 2020 BUILD DI PM Version 3.03

Signal and Phasing Data

Pretimed, Actuated, Semi-Actuated?A

Key in Allowed Movements by Phase:
L=Left; T=Thru; R=Right, no peds;
P=Right w ped conflicts. OR
click mouse on signal icon ->

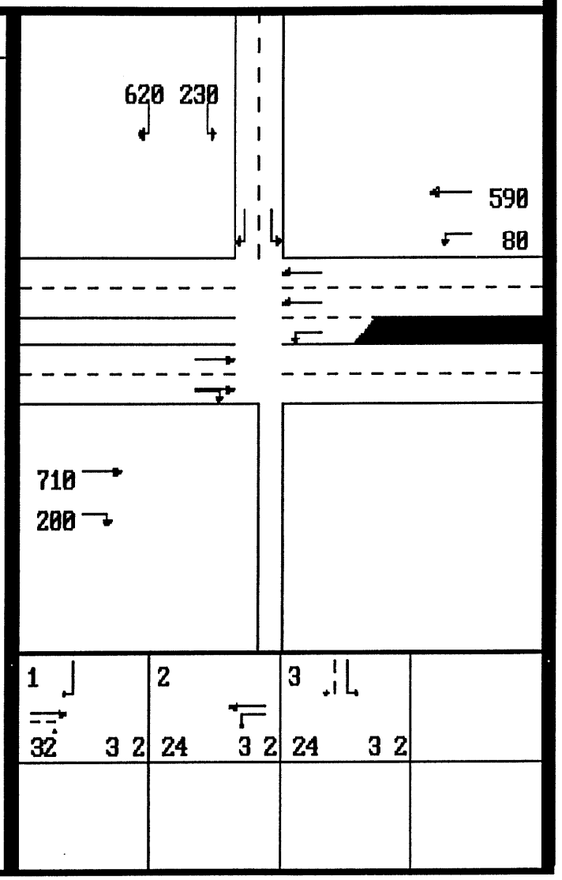
Traffic Movements by Phase

PH:	1	2	3	4	5	6	7	8
EB	TP							
WB		LT						
NB								
SB	R		L	P				

Phase Durations (Seconds)

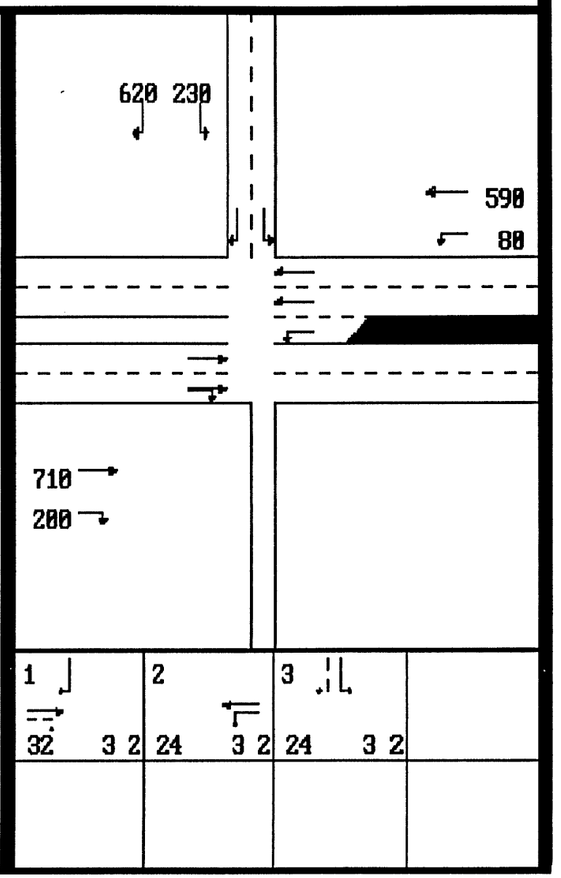
Grn	32	24	24
Yel	3	3	3
AR	2	2	2

Ped Only Phase Dur: 0 Cycle: 95
Lost Time/Phase: 3.0 Seq: 123



NETSIM Summary for Case: BOSI71WP BOSTON /I-71 W.RAMPS
YR 2020 BUILD DI PM Version 3.03

App	Lane Group	Queues Per Lane Avg/Max (veh)	Avg Speed (mph)	Spillback in Worst Lane (% of Peak Period)
EB	TR	11/ 12	8.1	0.0
	All		8.1	0.0
WB	L	1/ 2	5.2	0.0
	T	7/ 8	9.2	0.0
	All		9.0	0.0
SB	L	5/ 8	9.0	0.0
	R	8/ 10	12.7	0.0
	All		11.4	0.0
Intersect.			9.3	



HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 07-08-1999
Northeast Ohio Areawide Coordinating Agency

Streets: (E-W) BOSTON RD (N-S) I-71 EAST RAMPS
Analyst: NOACA File Name: BOS71ERA.HC9
Area Type: Other 9-4-98 AM PEAK
Comment: FUTURE YEAR 2020 ALTERNATE: A

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	2	1			1	1	>		<			
Volumes	750	360			360	160	190		60			
Lane W (ft)	12.0	12.0			12.0	12.0		12.0				
RTOR Vols			0			0			0			
Lost Time	3.00	3.00			3.00	3.00	3.00		3.00			

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	*				NB Left	*		
Thru	*	*			Thru			
Right					Right	*		
Peds		*			Peds	*		
WB Left					SB Left			
Thru		*			Thru			
Right		*			Right			
Peds	*				Peds	*		
NB Right					EB Right			
SB Right					WB Right	*		
Green	32.0A	30.0A			Green	28.0A		
Yellow/AR	5.0	5.0			Yellow/AR	5.0		

Cycle Length: 105 secs Phase combination order: #1 #2 #5

Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
EB	L	1146	3539	0.749	0.324	22.4	C	16.9	C
	T	1224	1863	0.327	0.657	5.1	B		
WB	T	568	1863	0.705	0.305	23.6	C	18.1	C
	R	980	1583	0.182	0.619	5.6	B		
NB	LR	445	1557	0.625	0.286	23.0	C	23.0	C

Intersection Delay = 18.0 sec/veh Intersection LOS = C
Lost Time/Cycle, L = 9.0 sec Critical v/c(x) = 0.695

HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 07-08-1999
Northeast Ohio Areawide Coordinating Agency

Streets: (E-W) BOSTON RD (N-S) I-71 EAST RAMPS
Analyst: NOACA File Name: BOS71ERP.HC9
Area Type: Other 9-4-98 PM PEAK
Comment: FUTURE YEAR 2020 ALTERNATE: A

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	2	1			1	1	>		<			
Volumes	310	630			430	70	240		60			
Lane W (ft)	12.0	12.0			12.0	12.0		12.0				
RTOR Vols			0			0			0			
Lost Time	3.00	3.00			3.00	3.00	3.00		3.00			

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left		*			NB Left	*		
Thru		*	*		Thru			
Right					Right	*		
Peds			*		Peds	*		
WB Left					SB Left			
Thru			*		Thru			
Right			*		Right			
Peds		*	*		Peds	*		
NB Right					EB Right			
SB Right					WB Right	*		
Green	22.0A	36.0A			Green	32.0A		
Yellow/AR	5.0	5.0			Yellow/AR	5.0		

Cycle Length: 105 secs Phase combination order: #1 #2 #5

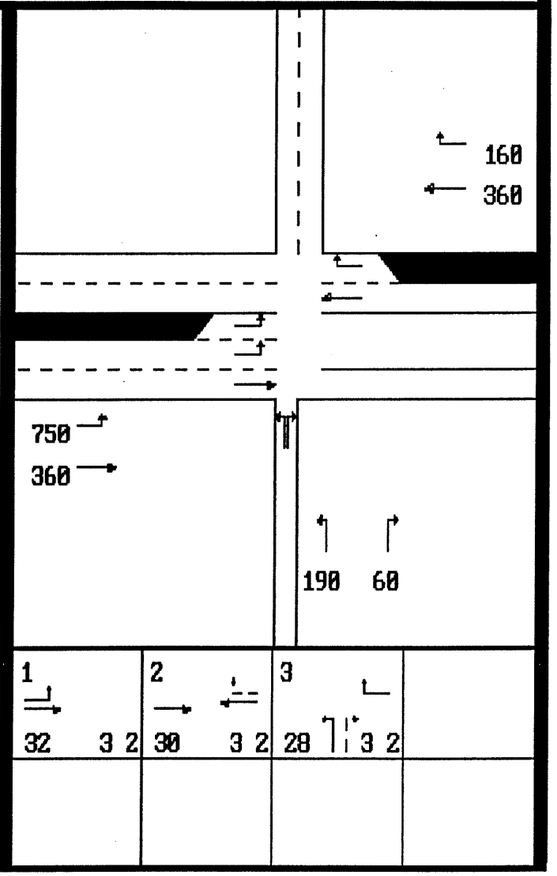
Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
EB	L	809	3539	0.438	0.229	22.7	C	13.3	B
	T	1153	1863	0.607	0.619	8.6	B		
WB	T	674	1863	0.709	0.362	21.0	C	18.4	C
	R	1131	1583	0.069	0.714	2.9	A		
NB	LR	506	1564	0.660	0.324	21.9	C	21.9	C

Intersection Delay = 16.3 sec/veh Intersection LOS = C
Lost Time/Cycle, L = 6.0 sec Critical v/c(x) = 0.625

HCM Summary Results for Case: BOSI71EA BOSTON RD /I-71 E RAMPS
YR 2020 BUILD AM Version 3.03

			- Lane Grp -		- App -	
	Lane Grp	v/s	X v/c	Delay (sec/ veh)	L O S	Delay (sec/ veh)	L O S
EB	L	*0.24	0.75	22.4	C	16.9	C
	T	0.21	0.33	5.1	B		
WB	T	*0.21	0.71	23.6	C	18.3	C
	R	0.11	0.19	6.4	B		
NB	LR	*0.18	0.63	23.0	C	23.0	C
Int.		0.64	0.70	18.1	C		



Input Data for Case: BOSI71EA BOSTON RD /I-71 E RAMPS
YR 2020 BUILD AM Version 3.03

Intersection Geometry

1)Number of Lanes Including Pockets

	EB	WB	NB	SB
Approach Street	3	2	1	0
Outbound Street	1	2	2	0

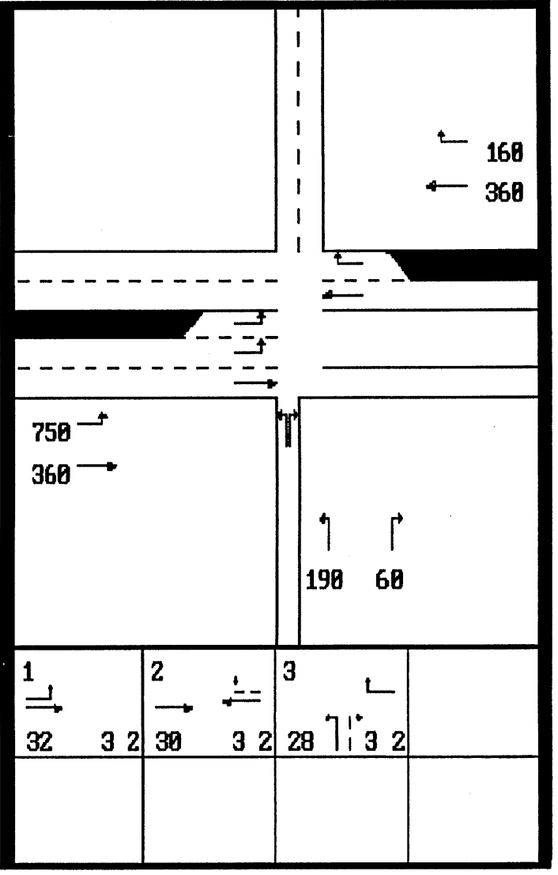
2)

	-Pkt Lanes- Left	Right	—Lane Lengths— Full L	Pkt	R Pkt
EB	1	0	600	160	
WB	0	1	600		160
NB	0	0	600		
SB					

3)Need to Revise Channelization? N

4) Lane Widths (Feet)

	Median	2	3	4	5	6
EB		12.0	12.0	12.0		
WB		12.0	12.0			
NB		12.0				
SB						



Input Data for Case: BOSI71EA BOSTON RD /I-71 E RAMPS
YR 2020 BUILD AM Version 3.03

Signal and Phasing Data

Pretimed, Actuated, Semi-Actuated?A

Key in Allowed Movements by Phase:
L=Left; T=Thru; R=Right, no peds;
P=Right w ped conflicts. OR
click mouse on signal icon ->

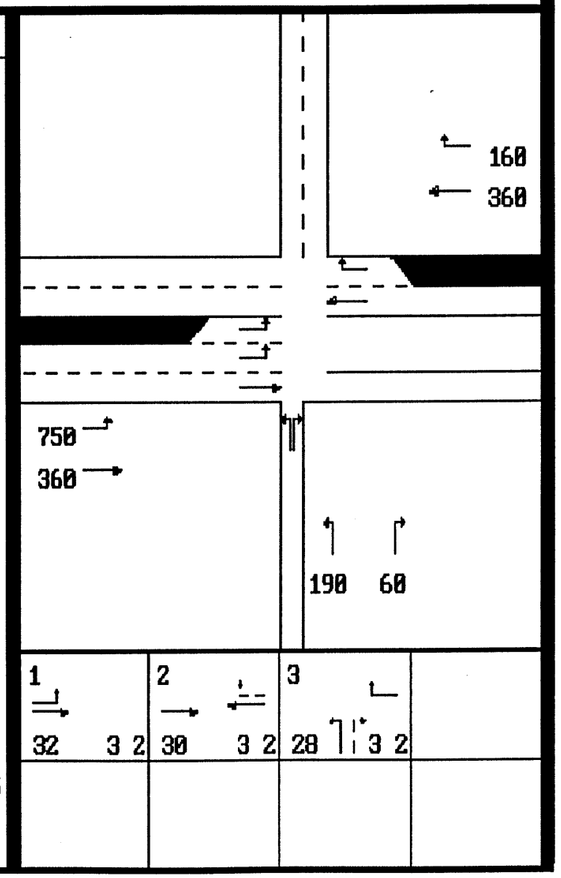
Traffic Movements by Phase

PH:	1	2	3	4	5	6	7	8
EB	LT	T						
WB		TP	R					
NB			L	P				
SB								

Phase Durations (Seconds)

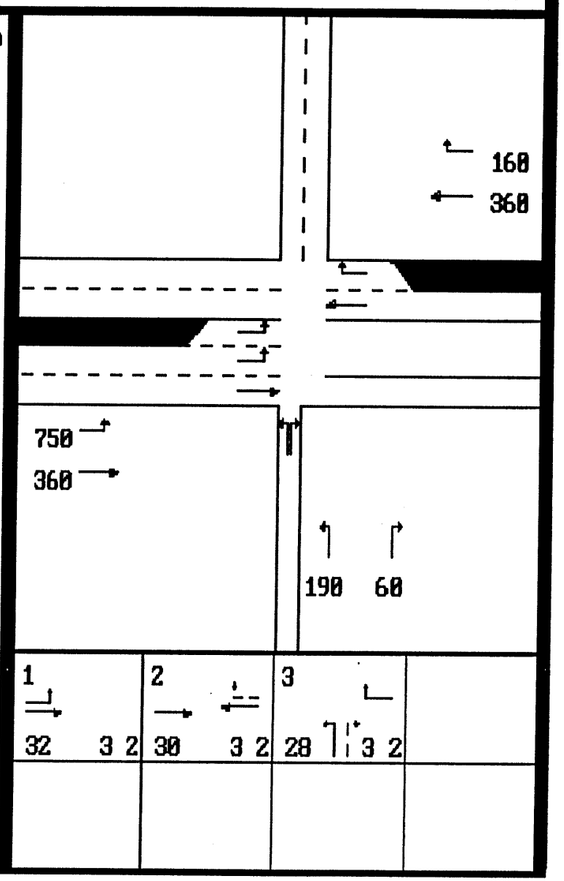
Grn	32	30	28
Yel	3	3	3
AR	2	2	2

Ped Only Phase Dur: 0 Cycle: 105
Lost Time/Phase: 3.0 Seq: 123



NETSIM Summary for Case: BOSI71EA BOSTON RD /I-71 E RAMPS
YR 2020 BUILD AM Version 3.03

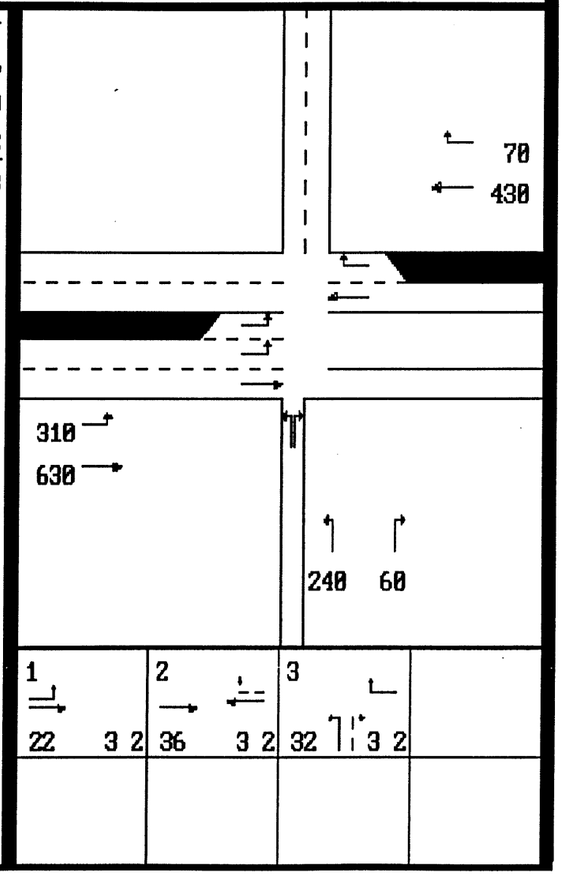
App	Lane Group	Queues Per Lane Avg/Max (veh)	Avg Speed (mph)	Spillback in Worst Lane (% of Peak Period)
EB	L	9/ 15	8.8	0.0
	T	5/ 6	17.0	0.0
	All		10.4	0.0
WB	T	8/ 13	10.8	0.0
	R	2/ 5	6.7	0.0
	All		10.2	0.0
NB	LR	6/ 7	7.8	0.0
	All		7.8	0.0
Intersect.			9.9	



HCM Summary Results for Case: BOSI71EP BOSTON RD /I-71 E RAMPS

YR 2020 BUILD PM Version 3.03

				- Lane Grp - Delay	LOS	- App - Delay	LOS
	Lane Grp	v/s	X v/c	(sec/ veh)		(sec/ veh)	
EB	L	0.10	0.44	22.7	C	13.3	B
	T	*0.38	0.61	8.6	B		
WB	T	0.26	0.71	21.0	C	18.5	C
	R	0.05	0.07	3.5	A		
NB	LR	*0.21	0.66	21.9	C	21.9	C
Int.		0.59	0.63	16.3	C		



Input Data for Case: BOSI71EP BOSTON RD /I-71 E RAMPS

YR 2020 BUILD PM Version 3.03

Intersection Geometry

1)Number of Lanes Including Pockets

	EB	WB	NB	SB
Approach Street	3	2	1	0
Outbound Street	1	2	2	0

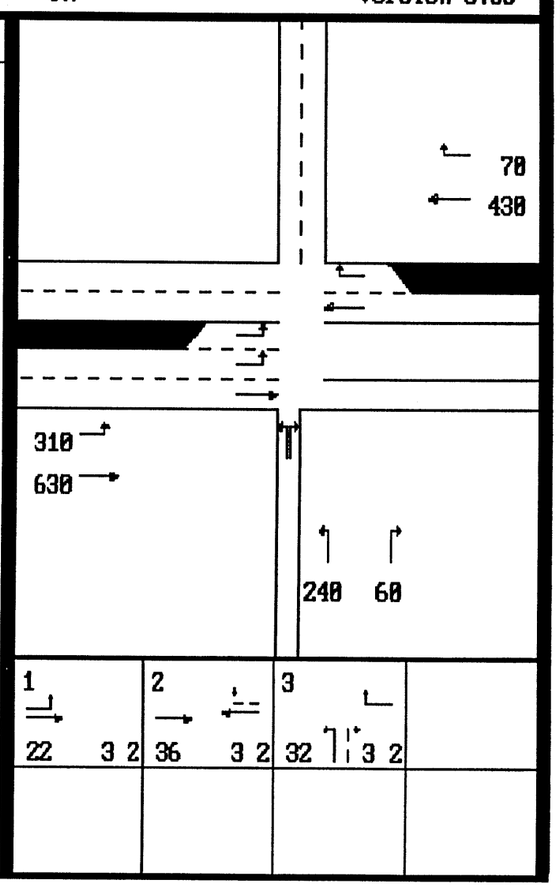
2)

	-Pkt Lanes- Left	Right	--Lane Lengths— Full L Pkt	R Pkt
EB	1	0	600	160
WB	0	1	600	160
NB	0	0	600	
SB				

3)Need to Revise Channelization? N

4) Lane Widths (Feet)

	Median	2	3	4	5	6
EB		12.0	12.0	12.0		
WB		12.0	12.0			
NB		12.0				
SB						



Input Data for Case: BOSI71EP BOSTON RD /I-71 E RAMPS
YR 2020 BUILD PM Version 3.03

Signal and Phasing Data

Pretimed, Actuated, Semi-Actuated?A

Key in Allowed Movements by Phase:
L=Left; T=Thru; R=Right, no peds;
P=Right w ped conflicts. OR
click mouse on signal icon ->

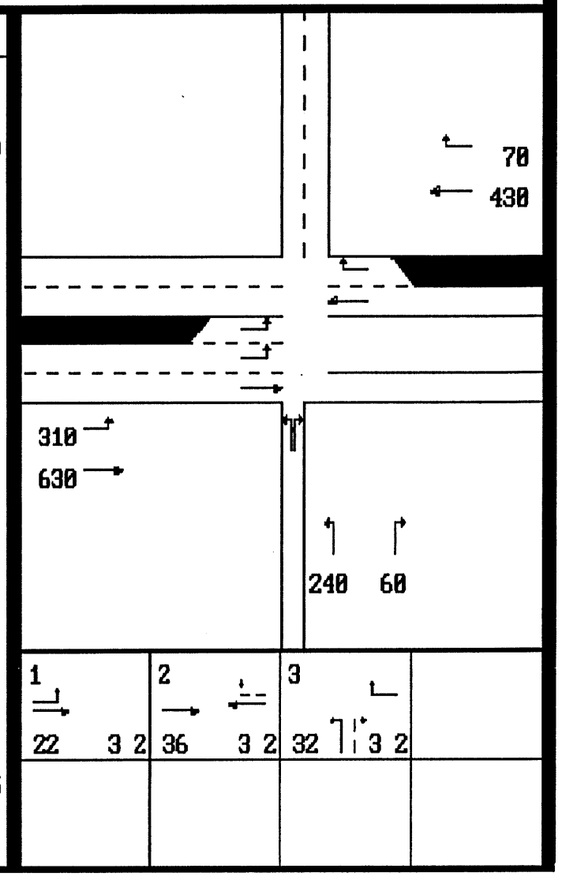
Traffic Movements by Phase

PH:	1	2	3	4	5	6	7	8
EB	LT	T						
WB		TP	R					
NB			L	P				
SB								

Phase Durations (Seconds)

Grn	22	36	32
Yel	3	3	3
AR	2	2	2

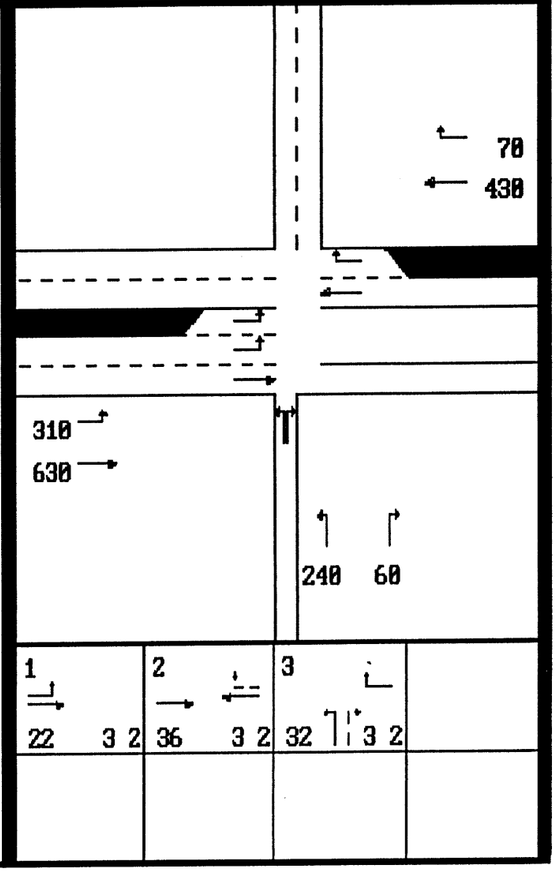
Ped Only Phase Dur: 0 Cycle: 105
Lost Time/Phase: 3.0 Seq: 123



NETSIM Summary for Case: BOSI71EP BOSTON RD /I-71 E RAMPS
YR 2020 BUILD PM Version 3.03

App	Lane Group	Queues Per Lane Avg/Max (veh)	Avg Speed (mph)	Spillback in Worst Lane (% of Peak Period)
EB	L	5/ 6	8.5	0.0
	T	8/ 12	15.2	0.0
	All		11.9	0.0
WB	T	9/ 11	9.6	0.0
	R	1/ 2	9.8	0.0
	All		9.6	0.0
NB	LR	7/ 8	9.1	0.0
	All		9.1	0.0

Intersect. 10.6



The Urban Style Alternative

(A Modified Diamond at Boston Rd)

HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 07-08-1999

Northeast Ohio Areawide Coordinating Agency

Streets: (E-W) BOSTON RD (N-S) HOWE RD/STURBRIDGE
Analyst: NOACA File Name: HOWBOSAA.HC9
Area Type: Other 9-4-98 AM PEAK
Comment: FUTURE YEAR 2020

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	1	1	1	1	> 1		2	1	1	<
Volumes	80	350	70	230	170	260	10	40	550	350	50	50
Lane W (ft)	12.0	12.0	12.0	12.0	12.0	12.0		12.0	12.0	12.0	12.0	
RTOR Vols			0			0			0			0
Lost Time	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	*				NB Left	*		
Thru		*			Thru	*		
Right		*			Right	*		
Peds	*				Peds	*		
WB Left	*				SB Left		*	
Thru		*			Thru		*	
Right		*			Right		*	
Peds	*				Peds	*		
NB Right	*				EB Right	*		
SB Right					WB Right		*	
Green	15.0A	20.0A			Green	10.0A	20.0A	
Yellow/AR	5.0	5.0			Yellow/AR	5.0	5.0	

Cycle Length: 85 secs Phase combination order: #1 #2 #5 #6

Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
EB	L	354	1770	0.251	0.200	18.6	C	22.3	C
	T	482	1863	0.807	0.259	25.8	D		
	R	689	1583	0.113	0.435	9.2	B		
WB	L	354	1770	0.723	0.200	25.4	D	16.4	C
	T	482	1863	0.392	0.259	17.1	C		
	R	819	1583	0.353	0.518	7.9	B		
NB	LT	260	1844	0.211	0.141	20.9	C	16.5	C
	R	1081	3167	0.639	0.341	16.1	C		
SB	L	458	1770	0.849	0.259	29.1	D	26.2	D
	TR	446	1723	0.251	0.259	16.2	C		

Intersection Delay = 19.7 sec/veh Intersection LOS = C

Lost Time/Cycle, L = 12.0 sec Critical v/c(x) = 0.753

HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 07-08-1999

Northeast Ohio Areawide Coordinating Agency

Streets: (E-W) BOSTON RD (N-S) HOWE RD/STURBRIDGE
Analyst: NOACA File Name: HOWBOSAP.HC9
Area Type: Other 9-4-98 PM PEAK
Comment: FUTURE YEAR 2020

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	1	1	1	1	> 1		2	1	1	<
Volumes	20	290	70	345	425	440	80	100	320	300	35	75
Lane W (ft)	12.0	12.0	12.0	12.0	12.0	12.0		12.0	12.0	12.0	12.0	
RTOR Vols			0			0			0			0
Lost Time	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	*				NB Left	*		
Thru			*		Thru	*		
Right			*		Right	*		
Peds		*	*		Peds	*	*	
WB Left	*	*			SB Left		*	
Thru		*	*		Thru		*	
Right		*	*		Right		*	
Peds		*	*		Peds	*	*	
NB Right	*	*			EB Right	*		
SB Right			*		WB Right		*	
Green	13.0A	5.0A	19.0A		Green	13.0A	20.0A	
Yellow/AR	5.0	5.0	5.0		Yellow/AR	5.0	5.0	

Cycle Length: 95 secs Phase combination order: #1 #2 #3 #5 #6

Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
EB	L	279	1770	0.079	0.158	22.0	C	25.3	D
	T	412	1863	0.782	0.221	29.0	D		
	R	650	1583	0.120	0.411	11.2	B		
WB	L	466	1770	0.822	0.263	29.1	D	19.7	C
	T	608	1863	0.776	0.326	23.0	C		
	R	883	1583	0.554	0.558	9.3	B		
NB	LT	288	1822	0.695	0.158	29.3	D	17.6	C
	R	1333	3167	0.301	0.421	11.8	B		
SB	L	410	1770	0.812	0.232	30.4	D	27.6	D
	TR	387	1673	0.315	0.232	19.7	C		

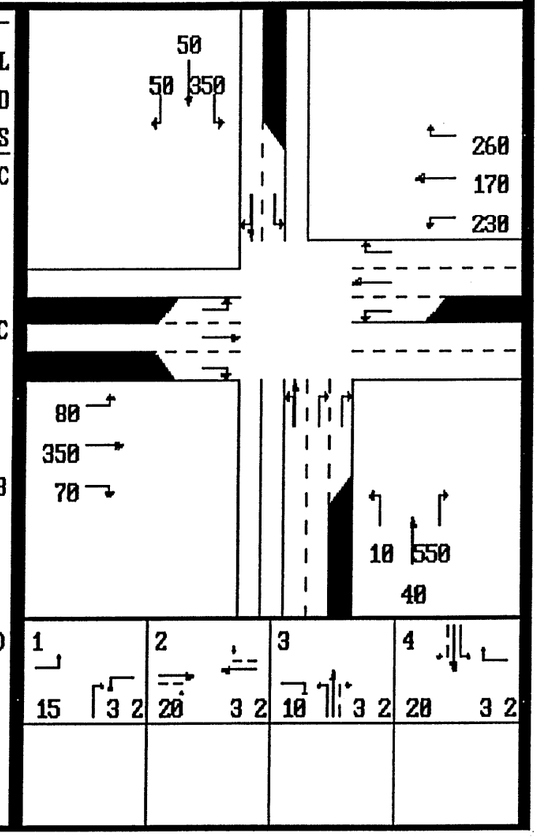
Intersection Delay = 21.4 sec/veh Intersection LOS = C

Lost Time/Cycle, L = 12.0 sec Critical v/c(x) = 0.786

HCM Summary Results for Case: HOWBODIA BOSTON RD /STURBRIDGE

FUTURE YEAR 2020 BUILD AM PEAK Version 3.03

	Lane Grp	v/s	X v/c	Delay (sec/veh)	L O S	App Delay (sec/veh)	L O S
EB	L	0.05	0.25	18.6	C	22.5	C
	T	*0.21	0.81	25.8	D		
	R	0.05	0.12	10.4	B		
WB	L	*0.14	0.72	25.4	D	16.4	C
	T	0.10	0.39	17.1	C		
	R	0.18	0.35	7.9	B		
NB	LT	0.03	0.21	20.9	C	14.7	B
	R	*0.22	0.58	14.2	B		
SB	L	*0.22	0.85	29.1	D	26.2	D
	TR	0.07	0.25	16.2	C		
	Int.	0.79	0.92	19.2	C		



Input Data for Case: HOWBODIA BOSTON RD /STURBRIDGE

FUTURE YEAR 2020 BUILD AM PEAK Version 3.03

Intersection Geometry

1)Number of Lanes Including Pockets

	EB	WB	NB	SB
Approach Street	3	3	3	2
Outbound Street	2	1	1	1

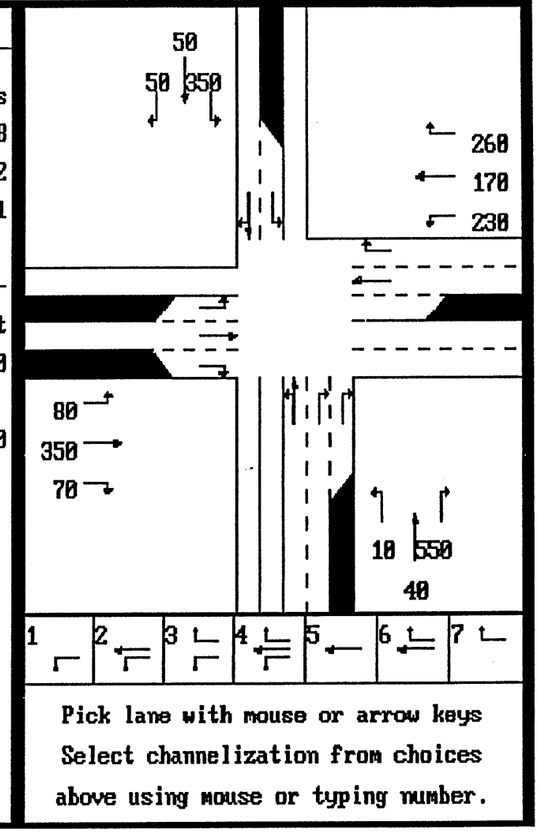
2)

	-Pkt Lanes- Left	Right	—Lane Lengths— Full L	Pkt	R Pkt
EB	1	1	600	160	160
WB	1	0	600	300	
NB	0	1	600		300
SB	1	0	600	300	

3)Need to Revise Channelization? Y

4) Lane Widths (Feet)

	Median	2	3	4	5	6
EB	12.0	12.0	12.0			
WB	12.0	12.0	12.0			
NB	12.0	12.0	12.0			
SB	12.0	12.0				



Pick lane with mouse or arrow keys
Select channelization from choices
above using mouse or typing number.

Input Data for Case: HOWBODIA BOSTON RD /STURBRIDGE
FUTURE YEAR 2020 BUILD AM PEAK Version 3.03

Signal and Phasing Data

Pretimed, Actuated, Semi-Actuated?A

Key in Allowed Movements by Phase:
L=Left; T=Thru; R=Right, no peds;
P=Right w ped conflicts. OR
click mouse on signal icon ->

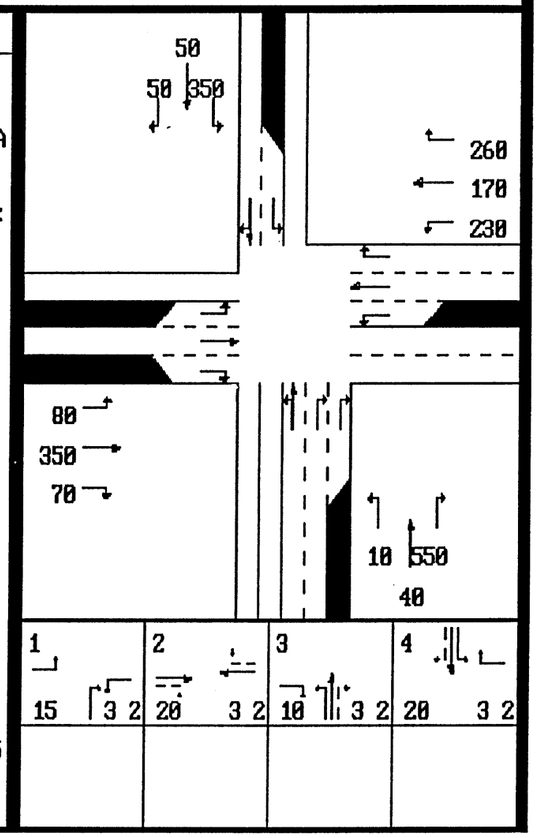
Traffic Movements by Phase

PH:	1	2	3	4	5	6	7	8
EB	L	TP	R					
WB	L	TP		R				
NB	R		LTP					
SB				LTP				

Phase Durations (Seconds)

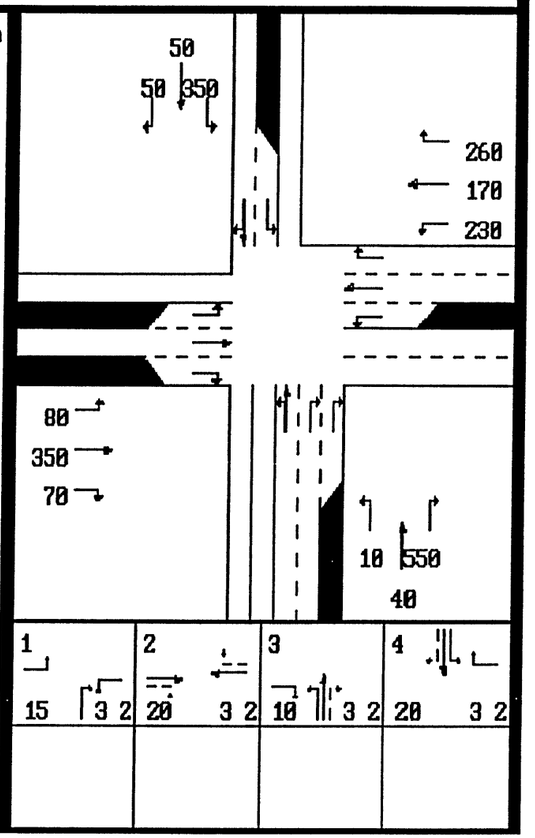
Grn	15	20	10	20
Yel	3	3	3	3
AR	2	2	2	2

Ped Only Phase Dur: 0 Cycle: 85
Lost Time/Phase: 3.0 Seq: 1234



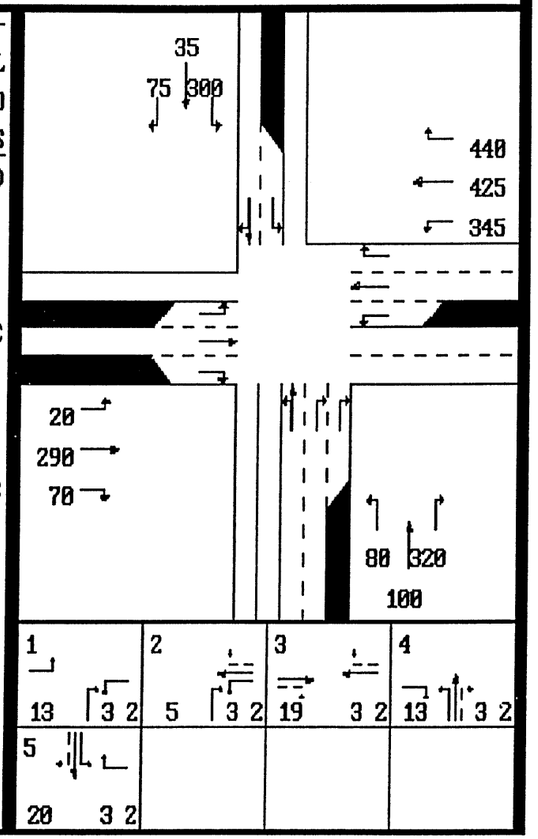
NETSIM Summary for Case: HOWBODIA BOSTON RD /STURBRIDGE
FUTURE YEAR 2020 BUILD AM PEAK Version 3.03

App	Lane Group	Queues Per Lane Avg/Max (veh)	Avg Speed (mph)	Spillback in Worst Lane (% of Peak Period)
EB	L	3/ 4	3.6	0.0
	T	9/ 14	7.7	0.0
	R	2/ 3	6.4	0.0
	All		7.2	0.0
WB	L	5/ 8	4.8	0.0
	T	5/ 7	12.7	0.0
	R	3/ 5	13.5	0.0
	All		10.4	0.0
NB	LT	2/ 3	7.9	0.0
	R	3/ 4	13.2	0.0
	All		12.4	0.0
SB	L	8/ 10	5.3	0.0
	TR	2/ 4	16.7	0.0
	All		8.7	0.0
Intersect.			9.5	



HCM Summary Results for Case: HOWBODIP BOSTON RD /STURBRIDGE
FUTURE YEAR 2020 BUILD PM PEAK Version 3.03

	Lane Grp	v/s	X v/c	- Lane Grp - Delay (sec/ veh)	L O S	- App - Delay (sec/ veh)	L O S
EB	L	0.01	0.08	22.8	C	25.5	D
	T	*0.17	0.78	28.9	D		
	R	0.05	0.13	12.5	B		
WB	L	*0.22	0.82	29.1	D	19.7	C
	T	0.25	0.78	23.8	C		
	R	0.31	0.55	9.3	B		
NB	LT	0.11	0.69	29.3	D	17.6	C
	R	*0.13	0.30	11.8	B		
SB	L	*0.19	0.81	30.4	D	27.5	D
	TR	0.07	0.32	19.7	C		
	Int.	0.70	0.81	21.4	C		



Input Data for Case: HOWBODIP BOSTON RD /STURBRIDGE
FUTURE YEAR 2020 BUILD PM PEAK Version 3.03

Intersection Geometry

1)Number of Lanes Including Pockets

	EB	WB	NB	SB
Approach Street	3	3	3	2
Outbound Street	2	1	1	1

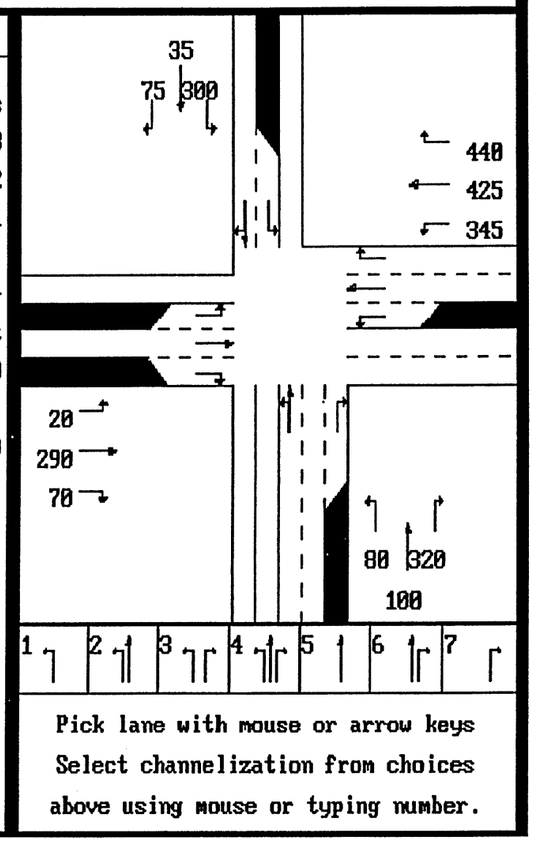
2)

	-Pkt Lanes- Left	Right	—Lane Lengths— Full L	Pkt R	Pkt
EB	1	1	600	160	160
WB	1	0	600	300	
NB	0	1	600		300
SB	1	0	600	300	

3)Need to Revise Channelization? Y

4) Lane Widths (Feet)

	Median	2	3	4	5	6
EB		12.0	12.0	12.0		
WB		12.0	12.0	12.0		
NB		12.0	12.0	12.0		
SB		12.0	12.0			



Pick lane with mouse or arrow keys
Select channelization from choices
above using mouse or typing number.

Input Data for Case: HOWBODIP BOSTON RD /STURBRIDGE
FUTURE YEAR 2020 BUILD PM PEAK Version 3.03

Signal and Phasing Data

Pretimed, Actuated, Semi-Actuated?A

Key in Allowed Movements by Phase:
L=Left; T=Thru; R=Right, no peds;
P=Right w ped conflicts. OR
click mouse on signal icon ->

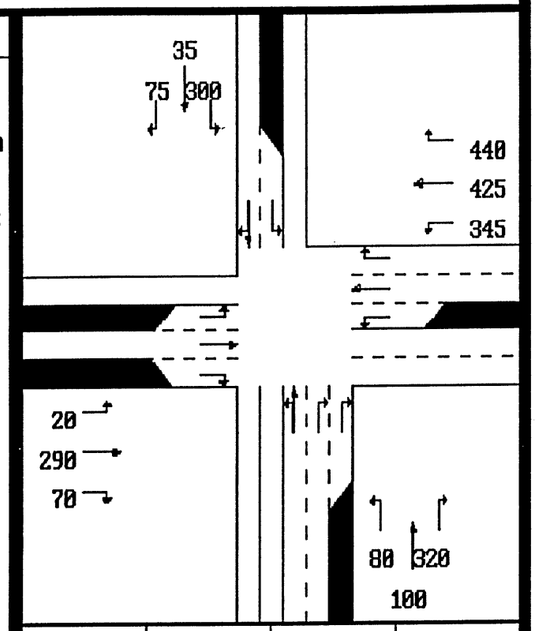
Traffic Movements by Phase

PH:	1	2	3	4	5	6	7	8
EB	L			TP	R			
WB	L		LTP	TP			R	
NB	R	R			LTP			
SB						LTP		

Phase Durations (Seconds)

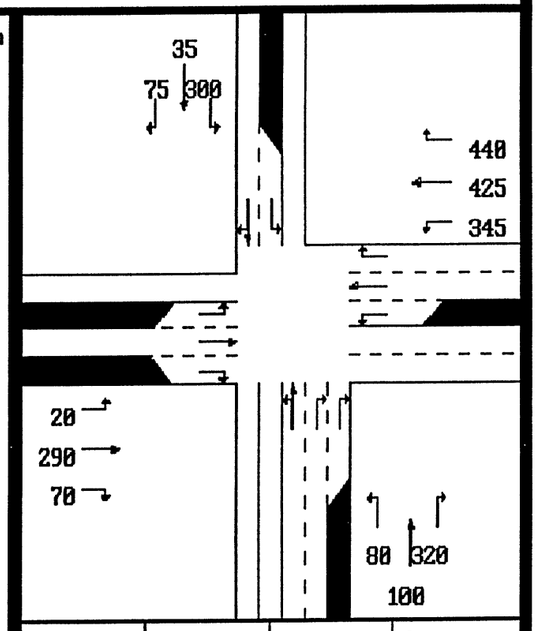
Grn	13	5	19	13	20
Yel	3	3	3	3	3
AR	2	2	2	2	2

Ped Only Phase Dur: 0 Cycle: 95
Lost Time/Phase: 3.0 Seq: 12345



NETSIM Summary for Case: HOWBODIP BOSTON RD /STURBRIDGE
FUTURE YEAR 2020 BUILD PM PEAK Version 3.03

App	Lane Group	Queues Per Lane Avg/Max (veh)	Avg Speed (mph)	Spillback in Worst Lane (% of Peak Period)
EB	L	1/ 1	2.9	0.0
	T	7/ 9	8.4	0.0
	R	1/ 2	7.1	0.0
	All		8.2	0.0
WB	L	9/ 13	4.8	0.0
	T	11/ 14	10.6	0.0
	R	5/ 7	12.8	0.0
	All		9.5	0.0
NB	LT	6/ 10	6.1	0.0
	R	2/ 3	16.7	0.0
	All		9.8	0.0
SB	L	8/ 11	4.4	0.0
	TR	2/ 4	15.2	0.0
	All		7.7	0.0
Intersect.			9.0	



HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 07-12-1999
Northeast Ohio Areawide Coordinating Agency

Streets: (E-W) BOSTON RD (N-S) I-71 RAMPS
Analyst: NOACA File Name: BOS71WRU.HC9
Area Type: Other 9-4-98 AM PEAK
Comment: FUTURE YEAR 2020 ALTERNATE: URBAN INTERCHANGE

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	2	1		> 2			1			1		
Volumes	750	300		10	540		190			60		
Lane W (ft)	12.0	12.0			12.0		12.0			12.0		
RTOR Vols			0			0			0			0
Lost Time	3.00	3.00		3.00	3.00		3.00			3.00		

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left	*				NB Left	*			
Thru	*				Thru				
Right					Right				
Peds	*	*			Peds	*			
WB Left		*			SB Left	*			
Thru		*			Thru				
Right					Right				
Peds	*	*			Peds	*			
NB Right					EB Right				
SB Right					WB Right				
Green	27.0A	28.0A			Green	20.0A			
Yellow/AR	5.0	5.0			Yellow/AR	5.0			

Cycle Length: 90 secs Phase combination order: #1 #2 #5

Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
EB	L	1140	3539	0.752	0.322	19.6	C	18.9	C
	T	600	1863	0.555	0.322	17.1	C		
WB	LT	1241	3722	0.517	0.333	15.9	C	15.9	C
NB	L	433	1770	0.488	0.244	19.6	C	19.6	C
SB	L	433	1770	0.155	0.244	17.3	C	17.3	C

Intersection Delay = 18.0 sec/veh Intersection LOS = C
Lost Time/Cycle, L = 9.0 sec Critical v/c(x) = 0.593

HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 07-12-1999
Northeast Ohio Areawide Coordinating Agency

Streets: (E-W) BOSTON RD (N-S) I-71 RAMPS
Analyst: NOACA File Name: BOS71RPU.HC9
Area Type: Other 9-4-98 PM PEAK
Comment: FUTURE YEAR 2020 ALTERNATE: URBAN STYLE

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	2	1		> 2			1			1		
Volumes	310	630		80	590		240			230		
Lane W (ft)	12.0	12.0			12.0		12.0			12.0		
RTOR Vols			0			0			0			0
Lost Time	3.00	3.00		3.00	3.00		3.00			3.00		

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left	*				NB Left	*			
Thru	*				Thru				
Right					Right				
Peds	*	*			Peds	*			
WB Left		*			SB Left	*			
Thru		*			Thru				
Right					Right				
Peds	*	*			Peds	*			
NB Right					EB Right				
SB Right					WB Right				
Green	36.0A	21.0A			Green	18.0A			
Yellow/AR	5.0	5.0			Yellow/AR	5.0			

Cycle Length: 90 secs Phase combination order: #1 #2 #5

Intersection Performance Summary

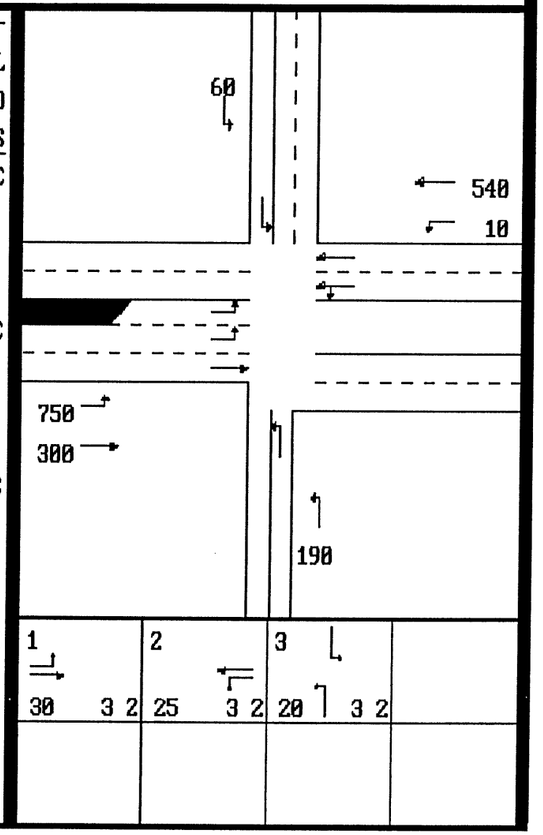
	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
EB	L	1494	3539	0.237	0.422	10.8	B	19.8	C
	T	787	1863	0.890	0.422	24.3	C		
WB	LT	946	3703	0.826	0.256	24.7	C	24.7	C
NB	L	393	1770	0.679	0.222	23.9	C	23.9	C
SB	L	393	1770	0.651	0.222	23.2	C	23.2	C

Intersection Delay = 22.2 sec/veh Intersection LOS = C
Lost Time/Cycle, L = 9.0 sec Critical v/c(x) = 0.820

HCM Summary Results for Case: URBANSTY BOSTON RD /I-71 RAMPS

BOSTON RD / IR-71 RAMPS AM PEAK Version 3.03

	Lane Grp	v/s	Lane Grp X v/c	Lane Grp Delay (sec/veh)	Lane Grp LOS	App Delay (sec/veh)	App LOS
EB	L	*0.27	0.76	18.6	C	18.8	C
	T	0.25	0.70	19.1	C		
WB	LT	*0.21	0.71	19.9	C	19.9	C
NB	L	*0.13	0.54	20.3	C	20.3	C
SB	L	0.04	0.17	17.3	C	17.3	C
	Int.	0.62	0.68	19.2	C		



Input Data for Case: URBANSTY BOSTON RD /I-71 RAMPS

BOSTON RD / IR-71 RAMPS AM PEAK Version 3.03

Intersection Geometry

1)Number of Lanes Including Pockets

	EB	WB	NB	SB
Approach Street	3	2	1	1
Outbound Street	2	2	2	1

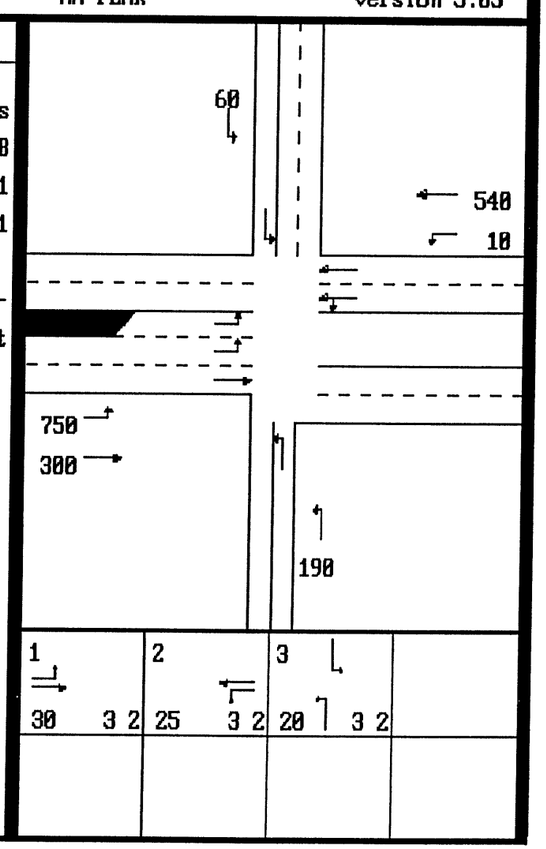
2)

	-Pkt Lanes- Left	Right	—Lane Lengths— Full L	Pkt L	Pkt R
EB	1	0	600	500	
WB	0	0	600		
NB	0	0	600		
SB	0	0	600		

3)Need to Revise Channelization? N

4) Lane Widths (Feet)

	Median	2	3	4	5	6
EB		12.0	12.0	12.0		
WB		12.0	12.0			
NB		12.0				
SB		12.0				



Input Data for Case: URBANSTY BOSTON RD /I-71 RAMPS

BOSTON RD / IR-71 RAMPS AM PEAK Version 3.03

Signal and Phasing Data

Pretimed, Actuated, Semi-Actuated?A

Key in Allowed Movements by Phase:
L=Left; T=Thru; R=Right, no peds;
P=Right w ped conflicts. OR
click mouse on signal icon ->

Traffic Movements by Phase

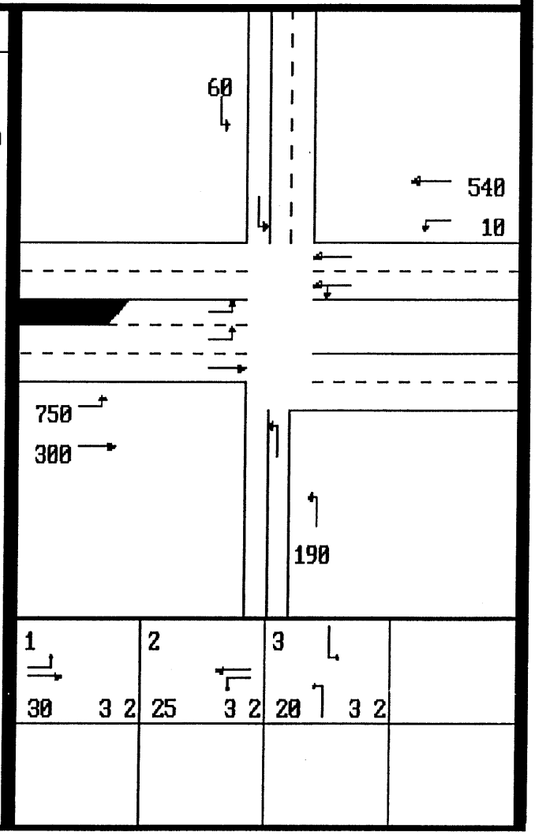
PH:	1	2	3	4	5	6	7	8
EB	LT							
WB		LT						
NB			L					
SB			L					

Phase Durations (Seconds)

Grn	30	25	20
Yel	3	3	3
AR	2	2	2

Ped Only Phase Dur: 0 Cycle: 90

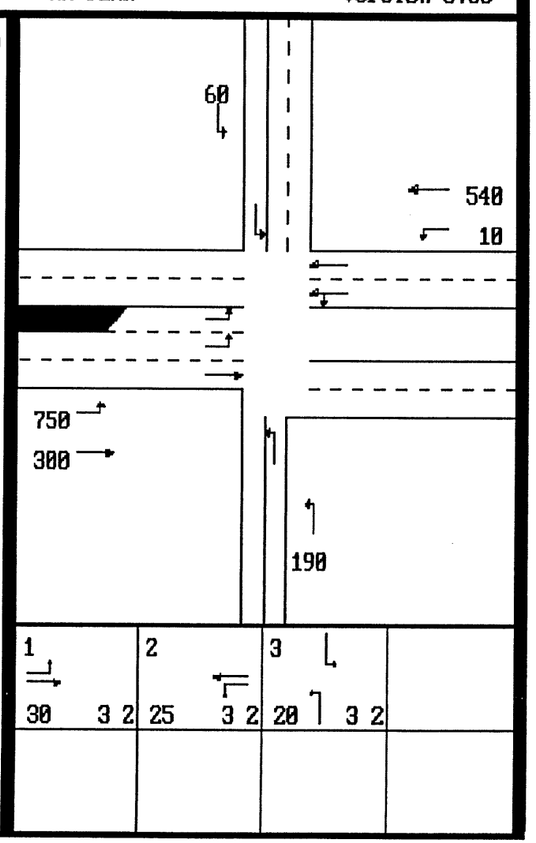
Lost Time/Phase: 3.0 Seq: 123



NETSIM Summary for Case: URBANSTY BOSTON RD /I-71 RAMPS

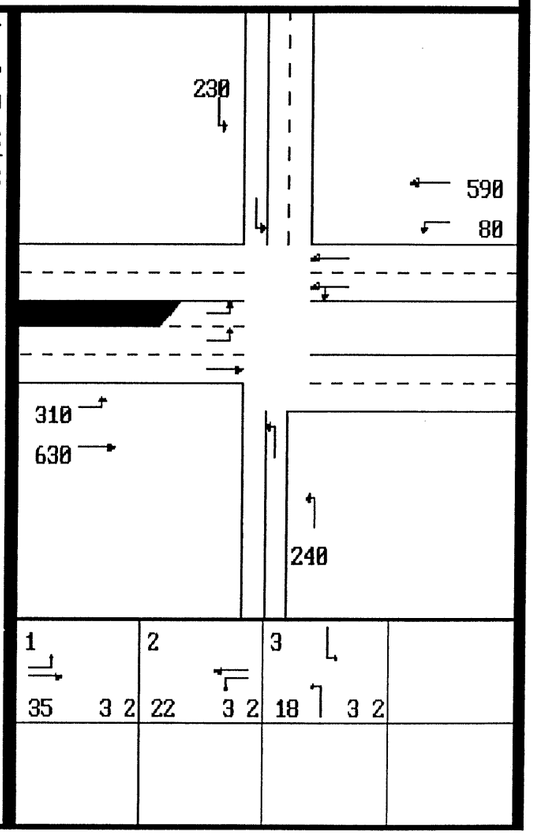
BOSTON RD / IR-71 RAMPS AM PEAK Version 3.03

App	Lane Group	Queues Per Lane Avg/Max (veh)	Avg Speed (mph)	Spillback in Worst Lane (% of Peak Period)
EB	L	8/ 10	9.9	0.0
	T	6/ 8	10.5	0.0
	All		10.1	0.0
WB	LT	6/ 7	9.1	0.0
	All		9.1	0.0
NB	L	4/ 5	9.1	0.0
	All		9.1	0.0
SB	L	1/ 2	9.7	0.0
	All		9.7	0.0
Intersect.			9.7	



HCM Summary Results for Case: BOSI71RP BOSTON RD /I-71 RAMPS
FUTURE YEAR 2020 THE URBAN STYLE PM PEAK Version 3.03

	Lane Grp	v/s	X v/c	Delay (sec/veh)	L O S	App Delay (sec/veh)	App L O S
EB	L	0.10	0.24	11.2	B	21.9	C
	T	*0.38	0.92	27.4	D		
WB	LT	*0.21	0.79	23.0	C	23.0	C
NB	L	*0.15	0.68	24.0	C	24.0	C
SB	L	0.14	0.65	23.2	C	23.2	C
	Int.	0.74	0.82	22.6	C		



Input Data for Case: BOSI71RP BOSTON RD /I-71 RAMPS
FUTURE YEAR 2020 THE URBAN STYLE PM PEAK Version 3.03

Intersection Geometry

1)Number of Lanes Including Pockets

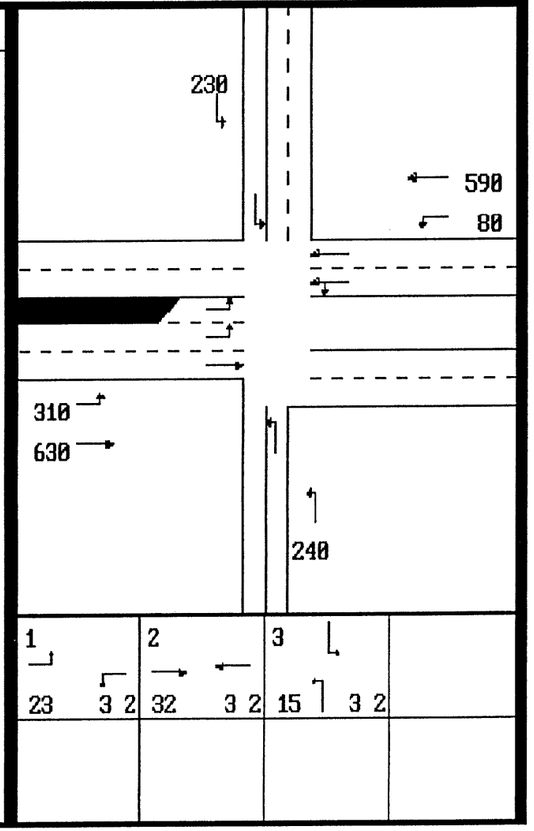
	EB	WB	NB	SB
Approach Street	3	2	1	1
Outbound Street	2	2	1	1

2)	-Pkt Lanes- Left	Right	--Lane Lengths-- Full L	Pkt R	Pkt
EB	1	0	600	150	
WB	0	0	600		
NB	0	0	600		
SB	0	0	600		

3)Need to Revise Channelization? N

4) Lane Widths (Feet)

	Median	2	3	4	5	6
EB		12.0	12.0	12.0		
WB		12.0	12.0			
NB		12.0				
SB		12.0				



Input Data for Case: BOSI71RP BOSTON RD /I-71 RAMPS
FUTURE YEAR 2020 THE URBAN STYLE PM PEAK Version 3.03

Signal and Phasing Data

Pretimed, Actuated, Semi-Actuated?A

Key in Allowed Movements by Phase:
L=Left; T=Thru; R=Right, no peds;
P=Right w ped conflicts. OR
click mouse on signal icon ->

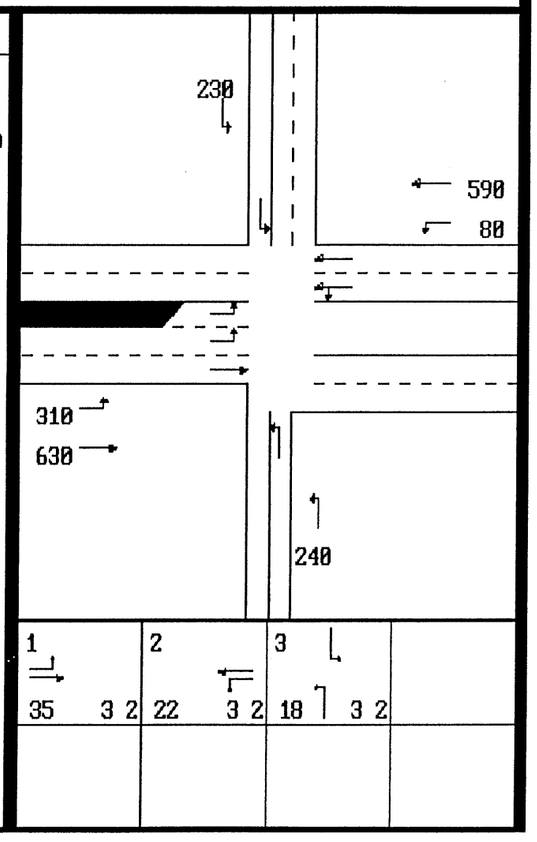
Traffic Movements by Phase

PH:	1	2	3	4	5	6	7	8
EB	LT							
WB		LT						
NB			L					
SB			L					

Phase Durations (Seconds)

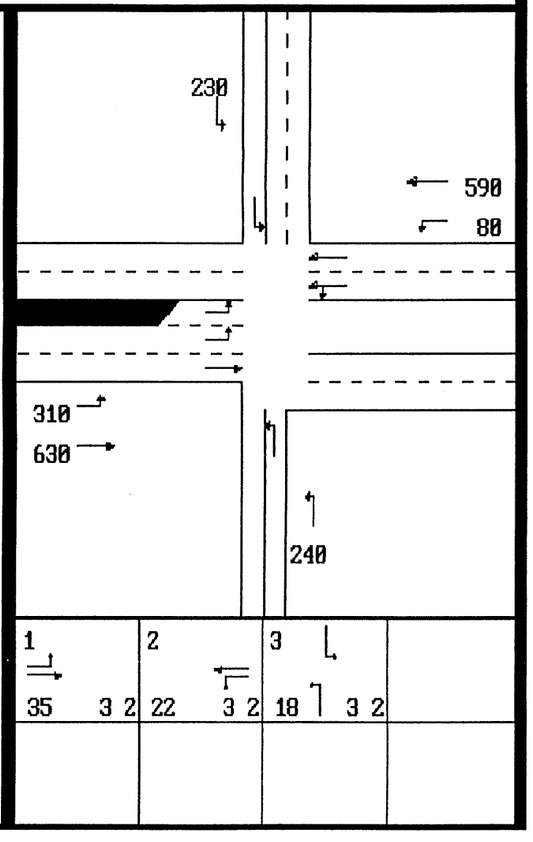
Grn	35	22	18
Yel	3	3	3
AR	2	2	2

Ped Only Phase Dur: 0 Cycle: 90
Lost Time/Phase: 3.0 Seq: 123



NETSIM Summary for Case: BOS71PMU BOSTON RD /I-71 RAMPS
FUTURE YEAR 2020 THE URBAN STYLE PM PEAK Version 3.03

App	Lane Group	Queues Per Lane Avg/Max (veh)	Avg Speed (mph)	Spillback in Worst Lane (% of Peak Period)
EB	L	4/ 5	11.4	0.0
	T	13/ 16	8.8	0.0
	All		9.6	0.0
WB	LT	7/ 10	8.8	0.0
	All		8.8	0.0
NB	L	6/ 6	8.2	0.0
	All		8.2	0.0
SB	L	5/ 6	8.6	0.0
	All		8.6	0.0
Intersect.			9.0	



Alternative C&D
(with Benbow Rd Extension & Entrance/Exit at Relocated Howe Rd)

HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 07-08-1999
Northeast Ohio Areawide Coordinating Agency

Streets: (E-W) Boston Rd (N-S) Howe Rd/Carpenter Rd
Analyst: NOACA File Name: BOSHOWCP.HC9
Area Type: Other 9-3-98 PM Peak
Comment: Future Year 2020 Alternate: C&D

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1 <		1	1	1	> 1	2		1	1	1
Volumes	40	270	70	160	210	300	80	130	290	380	220	290
Lane W (ft)	12.0	12.0		12.0	12.0	12.0		12.0	12.0	12.0	12.0	12.0
RTOR Vols			0			0			0			0
Lost Time	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	*							
Thru		*						
Right		*						
Peds		*						
WB Left	*							
Thru		*						
Right		*						
Peds		*						
NB Right		*						
SB Right		*						
Green	13.0A	23.0A						
Yellow/AR	5.0	5.0						

NB	Left			*	
	Thru			*	
	Right			*	
	Peds		*	*	
SB	Left		*		
	Thru		*		
	Right		*		
	Peds		*	*	
EB	Right				
WB	Right		*		
Green		25.0A	14.0A		
Yellow/AR		5.0	5.0		

Cycle Length: 95 secs Phase combination order: #1 #2 #5 #6

Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
EB	L	279	1770	0.157	0.158	22.3	C	26.9	D
	TR	475	1805	0.796	0.263	27.4	D		
WB	L	279	1770	0.637	0.158	27.5	D	15.9	C
	T	490	1863	0.475	0.263	19.6	C		
	R	916	1583	0.363	0.579	7.0	B		
NB	LT	308	1828	0.757	0.168	31.3	D	21.0	C
	R	1133	3167	0.321	0.358	14.4	B		
SB	L	503	1770	0.839	0.284	29.0	D	21.0	C
	T	529	1863	0.461	0.284	18.6	C		
	R	700	1583	0.460	0.442	12.3	B		

Intersection Delay = 20.5 sec/veh Intersection LOS = C
Lost Time/Cycle, L = 12.0 sec Critical v/c(x) = 0.774

HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 07-08-1999
Northeast Ohio Areawide Coordinating Agency

Streets: (E-W) Boston Rd (N-S) Howe Rd/Carpenter Rd
Analyst: NOACA File Name: BOSHOWC.HC9
Area Type: Other 9-3-98 AM PEAK
Comment: FUTURE YEAR 2020 ALTERNATE: C&D

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1 <		1	1	1	> 1	2		1	1	1
Volumes	90	340	70	190	120	240	10	120	470	300	90	100
Lane W (ft)	12.0	12.0		12.0	12.0	12.0		12.0	12.0	12.0	12.0	12.0
RTOR Vols			0			0			0			0
Lost Time	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	*							
Thru		*						
Right		*						
Peds		*						
WB Left	*							
Thru		*						
Right		*						
Peds		*						
NB Right		*						
SB Right		*						
Green	14.0A	27.0A						
Yellow/AR	5.0	5.0						

NB	Left			*	
	Thru			*	
	Right			*	
	Peds		*	*	
SB	Left		*		
	Thru		*		
	Right		*		
	Peds		*	*	
EB	Right				
WB	Right		*		
Green		22.0A	12.0A		
Yellow/AR		5.0	5.0		

Cycle Length: 95 secs Phase combination order: #1 #2 #5 #6

Intersection Performance Summary

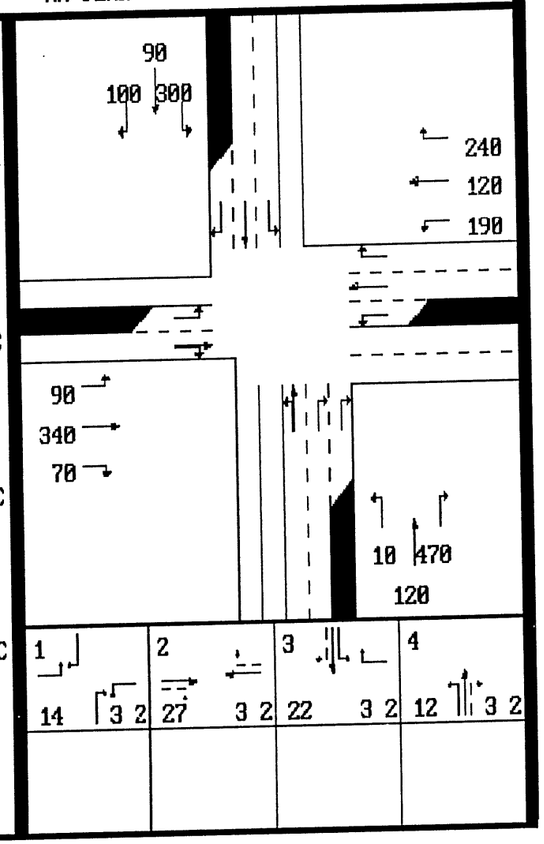
	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
EB	L	298	1770	0.335	0.168	22.8	C	25.9	D
	TR	554	1815	0.823	0.305	26.5	D		
WB	L	298	1770	0.708	0.168	29.2	D	16.3	C
	T	569	1863	0.234	0.305	16.0	C		
	R	933	1583	0.286	0.589	6.3	B		
NB	LT	274	1856	0.526	0.147	25.7	D	18.3	C
	R	1100	3167	0.536	0.347	16.5	C		
SB	L	447	1770	0.745	0.253	25.7	D	21.3	C
	T	471	1863	0.212	0.253	18.1	C		
	R	667	1583	0.167	0.421	11.1	B		

Intersection Delay = 20.2 sec/veh Intersection LOS = C
Lost Time/Cycle, L = 12.0 sec Critical v/c(x) = 0.728

HCM Summary Results for Case: BOSRELHA BOSTON RD /CARPENTER RD

YR-2020 BUILD AM PEAK Version 3.03

Lane Grp	v/s	X v/c	Lane Grp Delay (sec/veh)	Lane Grp LOS	App Delay (sec/veh)	App LOS
EB L	0.06	0.34	22.8	C	25.9	D
TR	*0.25	0.82	26.6	D		
WB L	*0.12	0.71	29.2	D	16.8	C
T	0.07	0.23	16.0	C		
R	0.17	0.30	7.3	B		
NB LT	0.08	0.53	25.7	D	18.3	C
R	*0.19	0.54	16.5	C		
SB L	*0.19	0.74	25.7	D	21.1	C
T	0.05	0.21	18.1	C		
R	0.07	0.15	9.9	B		
Int.	0.75	0.85	20.3	C		



Input Data for Case: BOSRELHA BOSTON RD /CARPENTER RD

YR-2020 BUILD AM PEAK Version 3.03

Intersection Geometry

1)Number of Lanes Including Pockets

	EB	WB	NB	SB
Approach Street	2	3	3	3
Outbound Street	2	1	1	1

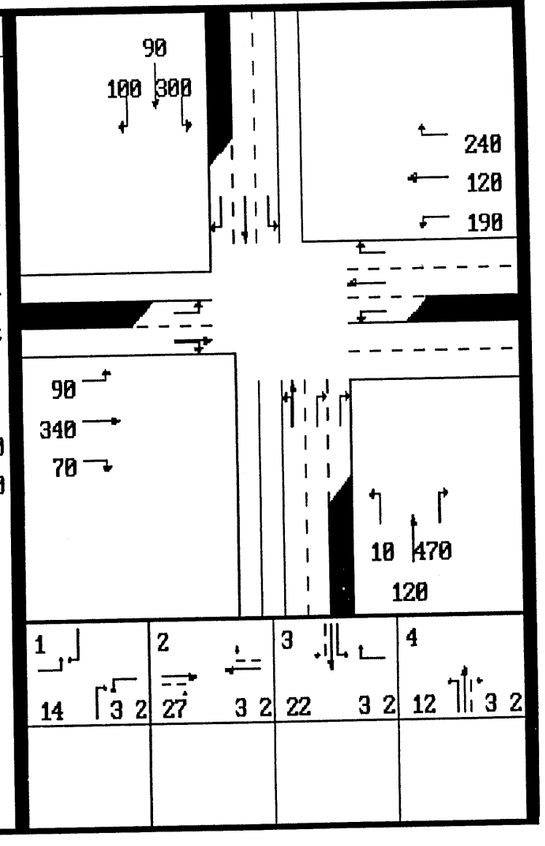
2)

	-Pkt Lanes- Left	Right	--Lane Lengths-- Full L	Pkt L	Pkt R
EB	1	0	600	160	
WB	1	0	600	160	
NB	0	1	600		300
SB	0	1	600		200

3)Need to Revise Channelization? N

4) Lane Widths (Feet)

	Median	2	3	4	5	6
EB		12.0	12.0			
WB		12.0	12.0	12.0		
NB		12.0	12.0	12.0		
SB		12.0	12.0	12.0		



Input Data for Case: BOSRELHA BOSTON RD /CARPENTER RD

YR-2020 BUILD AM PEAK Version 3.03

Signal and Phasing Data

Pretimed, Actuated, Semi-Actuated?A

Key in Allowed Movements by Phase:
L=Left; T=Thru; R=Right, no peds;
P=Right w ped conflicts. OR
click mouse on signal icon ->

Traffic Movements by Phase

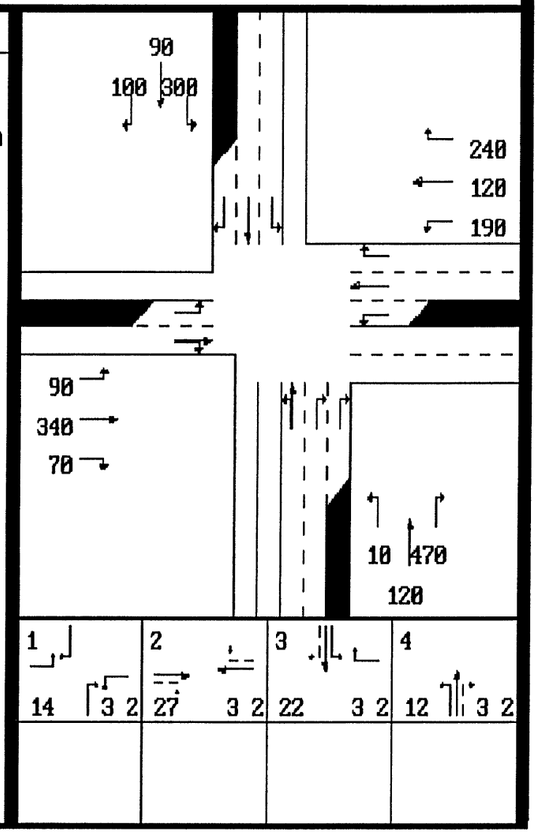
PH:	1	2	3	4	5	6	7	8
EB	L	TP						
WB	L	TP	R					
NB	R			LTP				
SB	R		LTP					

Phase Durations (Seconds)

Grn	14	27	22	12
Yel	3	3	3	3
AR	2	2	2	2

Ped Only Phase Dur: 0 Cycle: 95

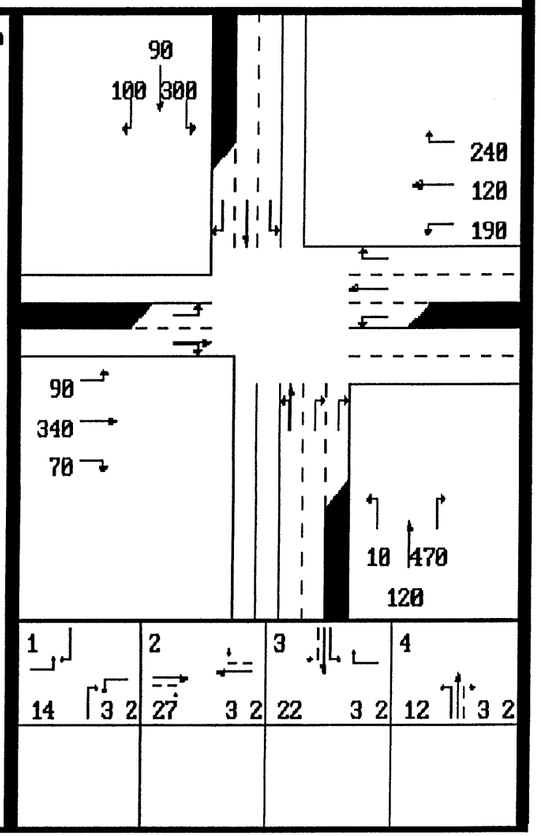
Lost Time/Phase: 3.0 Seq: 1234



NETSIM Summary for Case: BOSRELHA BOSTON RD /CARPENTER RD

YR-2020 BUILD AM PEAK Version 3.03

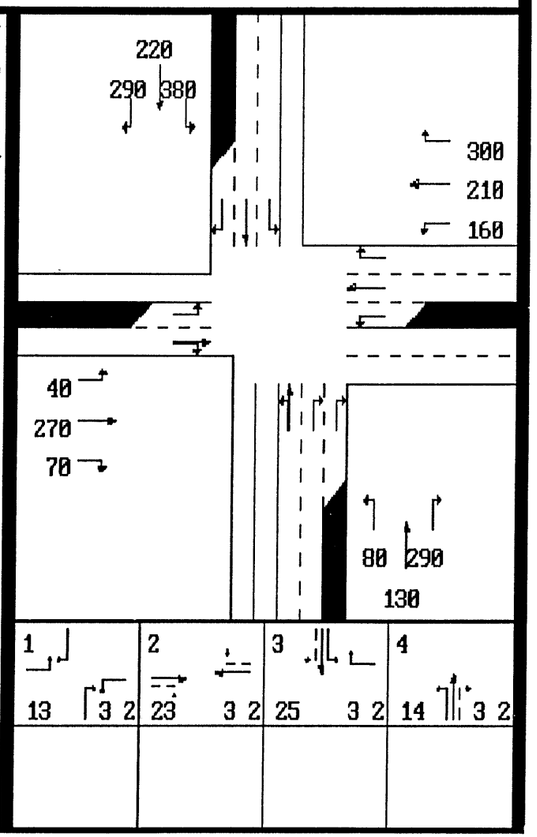
App	Lane Group	Queues Per Lane Avg/Max (veh)	Avg Speed (mph)	Spillback in Worst Lane (% of Peak Period)
EB	L	3/ 5	2.8	0.0
	TR	10/ 15	7.9	0.0
	All		7.2	0.0
WB	L	5/ 7	2.9	0.0
	T	5/ 6	11.7	0.0
	R	3/ 6	13.6	0.0
	All		9.9	0.0
NB	LT	4/ 9	6.0	0.0
	R	5/ 6	9.0	0.0
	All		8.1	0.0
SB	L	7/ 9	8.4	0.0
	T	2/ 5	13.0	0.0
	R	1/ 3	9.4	0.0
	All		9.5	0.0
Intersect.			8.6	



HCM Summary Results for Case: BOSRELHP BOSTON RD /CARPENTER RD

YR-2020 BUILD PM PEAK Version 3.03

	Lane Grp	v/s	X v/c	Lane Grp Delay (sec/ veh)	LOS	App Delay (sec/ veh)	App LOS
EB	L	0.02	0.16	22.3	C	26.9	D
	TR	0.21	0.80	27.4	D		
WB	L	*0.10	0.64	27.5	D	16.4	C
	T	0.13	0.48	19.6	C		
	R	*0.21	0.38	8.1	B		
NB	LT	*0.13	0.76	31.3	D	21.0	C
	R	0.12	0.32	14.4	B		
SB	L	*0.24	0.84	29.0	D	20.5	C
	T	0.13	0.46	18.6	C		
	R	0.20	0.43	10.9	B		
	Int.	0.68	0.77	20.5	C		



Input Data for Case: BOSRELHP BOSTON RD /CARPENTER RD

YR-2020 BUILD PM PEAK Version 3.03

Intersection Geometry

1)Number of Lanes Including Pockets

	EB	WB	NB	SB
Approach Street	2	3	3	3
Outbound Street	2	1	1	1

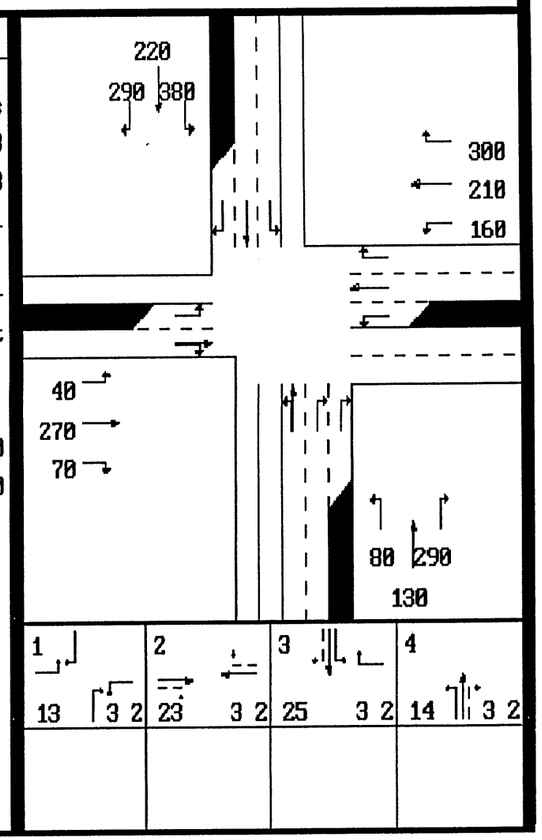
2)

	-Pkt Lanes- Left	Right	--Lane Lengths-- Full L	Pkt L	Pkt R
EB	1	0	600	160	
WB	1	0	600	160	
NB	0	1	600		300
SB	0	1	600		200

3)Need to Revise Channelization? N

4) Lane Widths (Feet)

	Median	2	3	4	5	6
EB		12.0	12.0			
WB		12.0	12.0	12.0		
NB		12.0	12.0	12.0		
SB		12.0	12.0	12.0		



Input Data for Case: BOSRELHP BOSTON RD /CARPENTER RD
YR-2020 BUILD PM PEAK Version 3.03

Signal and Phasing Data

Pretimed, Actuated, Semi-Actuated?A

Key in Allowed Movements by Phase:
L=Left; T=Thru; R=Right, no peds;
P=Right w ped conflicts. OR
click mouse on signal icon ->

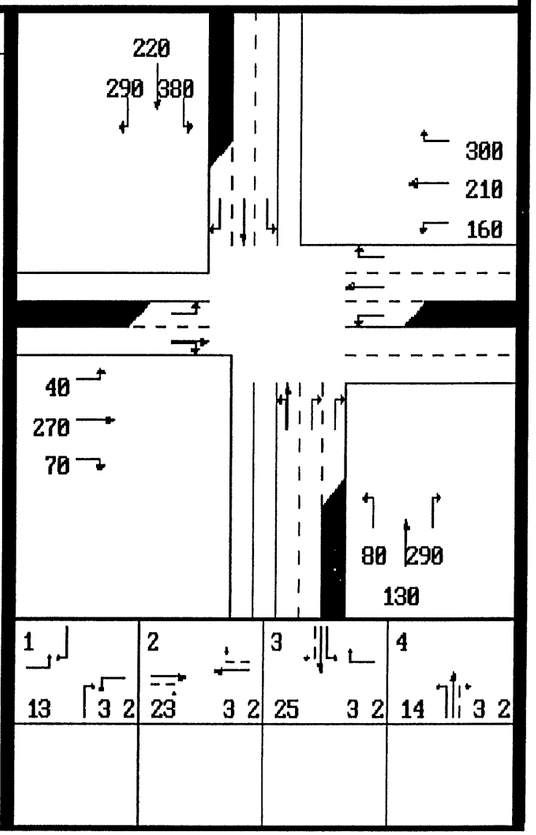
Traffic Movements by Phase

PH:	1	2	3	4	5	6	7	8
EB	L	TP						
WB	L	TP	R					
NB	R			LTP				
SB	R		LTP					

Phase Durations (Seconds)

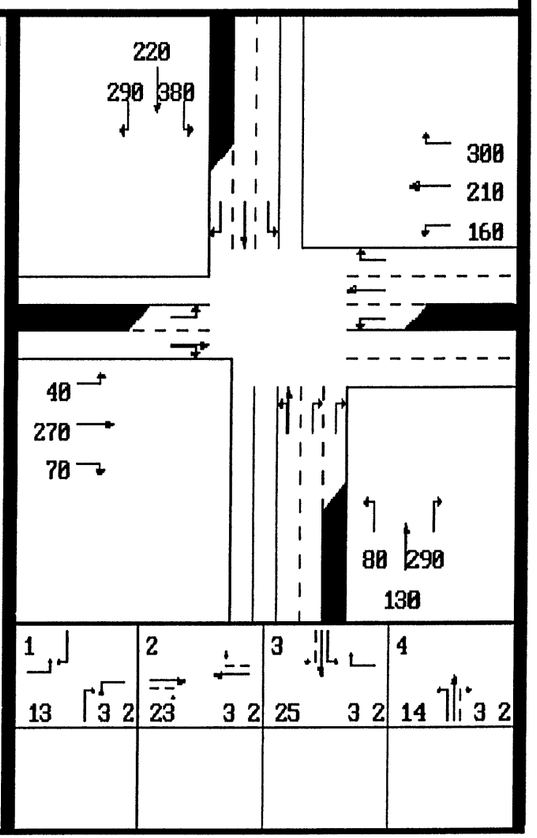
Grn	13	23	25	14
Yel	3	3	3	3
AR	2	2	2	2

Ped Only Phase Dur: 0 Cycle: 95
Lost Time/Phase: 3.0 Seq: 1234



NETSIM Summary for Case: BOSRELHP BOSTON RD /CARPENTER RD
YR-2020 BUILD PM PEAK Version 3.03

App	Lane Group	Queues Per Lane Avg/Max (veh)	Avg Speed (mph)	Spillback in Worst Lane (% of Peak Period)
EB	L	2/ 4	3.1	0.0
	TR	8/ 10	9.0	0.0
	All		8.3	0.0
WB	L	4/ 6	2.9	0.0
	T	5/ 7	11.3	0.0
	R	4/ 7	12.2	0.0
	All		9.9	0.0
NB	LT	6/ 10	7.2	0.0
	R	3/ 4	9.9	0.0
	All		8.4	0.0
SB	L	8/ 11	8.2	0.0
	T	5/ 7	13.4	0.0
	R	4/ 7	6.6	0.0
	All		9.6	0.0
Intersect.			9.2	



HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 07-08-1999

Northeast Ohio Areawide Coordinating Agency

Streets: (E-W) I-71 West Ramps (N-S) Howe Rd
Analyst: NOACA File Name: HOW71WRA.HC9
Area Type: Other 9-4-98 AM PEAK
Comment: FUTURE YEAR 2020 ALTERNATE: C&D

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes				2		1		1 <		1	1	
Volumes				150		30		350	100	110	340	
Lane W (ft)				12.0		12.0		12.0		12.0	12.0	
RTOR Vols						0			0			0
Lost Time				3.00		3.00		3.00	3.00	3.00	3.00	

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left					NB Left			
Thru					Thru	*		
Right					Right	*		
Peds	*				Peds	*	*	
WB Left	*				SB Left		*	
Thru					Thru	*	*	
Right	*				Right			
Peds	*				Peds	*	*	
NB Right					EB Right			
SB Right					WB Right		*	
Green	23.0A				Green	37.0A	20.0A	
Yellow/AR	5.0				Yellow/AR	5.0	5.0	

Cycle Length: 95 secs Phase combination order: #1 #5 #6

Intersection Performance Summary

Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
WB L	931	3539	0.185	0.263	17.5	C	15.8	C
R	833	1583	0.040	0.526	7.0	B		
NB TR	665	1621	0.751	0.411	18.7	C	18.7	C
SB L	410	1770	0.298	0.232	19.6	C	7.9	B
T	1255	1863	0.301	0.674	4.1	A		

Intersection Delay = 13.8 sec/veh Intersection LOS = B

Lost Time/Cycle, L = 9.0 sec Critical v/c(x) = 0.471

HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 07-08-1999

Northeast Ohio Areawide Coordinating Agency

Streets: (E-W) I-71 West Ramps (N-S) Howe Rd
Analyst: NOACA File Name: HOW71WRP.HC9
Area Type: Other 9-4-98 PM PEAK
Comment: FUTURE YEAR 2020 ALTERNATE: C&D

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes				2		1		1 <		1	1	
Volumes				630		220		340	130	150	260	
Lane W (ft)				12.0		12.0		12.0		12.0	12.0	
RTOR Vols						0			0			0
Lost Time				3.00		3.00		3.00	3.00	3.00	3.00	

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left					NB Left			
Thru					Thru	*		
Right					Right	*		
Peds	*				Peds	*	*	
WB Left	*				SB Left		*	
Thru					Thru	*	*	
Right	*				Right			
Peds	*				Peds	*	*	
NB Right					EB Right			
SB Right					WB Right		*	
Green	25.0A				Green	35.0A	20.0A	
Yellow/AR	5.0				Yellow/AR	5.0	5.0	

Cycle Length: 95 secs Phase combination order: #1 #5 #6

Intersection Performance Summary

Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
WB L	1006	3539	0.717	0.284	21.5	C	17.9	C
R	866	1583	0.282	0.547	7.5	B		
NB TR	626	1607	0.834	0.389	23.6	C	23.6	C
SB L	410	1770	0.407	0.232	20.4	C	10.3	B
T	1216	1863	0.238	0.653	4.4	A		

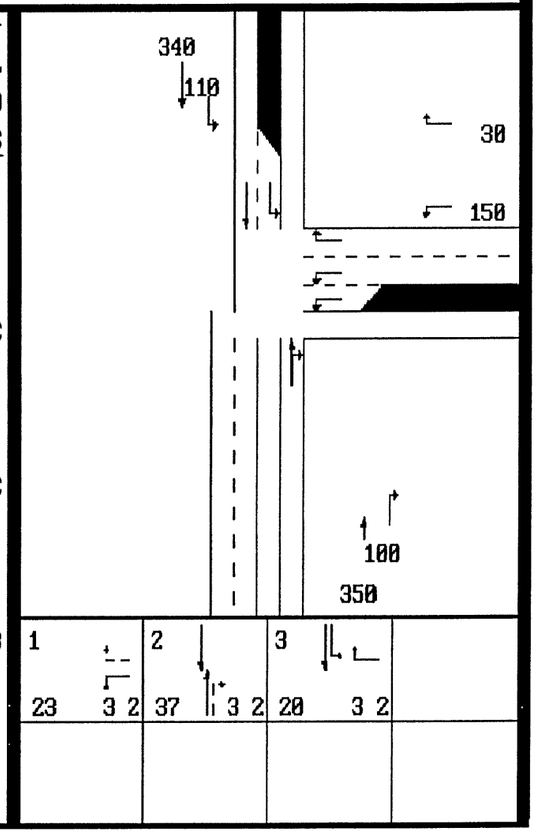
Intersection Delay = 17.6 sec/veh Intersection LOS = C

Lost Time/Cycle, L = 9.0 sec Critical v/c(x) = 0.688

HCM Summary Results for Case: HOWI71RA I71SB OFFRAM/HOWE RD

YR 2020 BUILD AM PEAK Version 3.03

Lane Grp	v/s	X v/c	Lane Grp Delay (sec/veh)	Lane Grp LOS	App Delay (sec/veh)	App LOS
WB L	*0.05	0.18	17.5	C	16.0	C
R	0.02	0.04	8.0	B		
NB TR	0.31	0.75	18.8	C	18.8	C
SB L	*0.07	0.30	19.6	C	7.9	B
T	0.20	0.30	4.1	A		
Int.	0.48	0.51	13.8	B		



Input Data for Case: HOWI71RA I71SB OFFRAM/HOWE RD

YR 2020 BUILD AM PEAK Version 3.03

Intersection Geometry

1)Number of Lanes Including Pockets

	EB	WB	NB	SB
Approach Street	0	3	1	2
Outbound Street	1	0	1	2

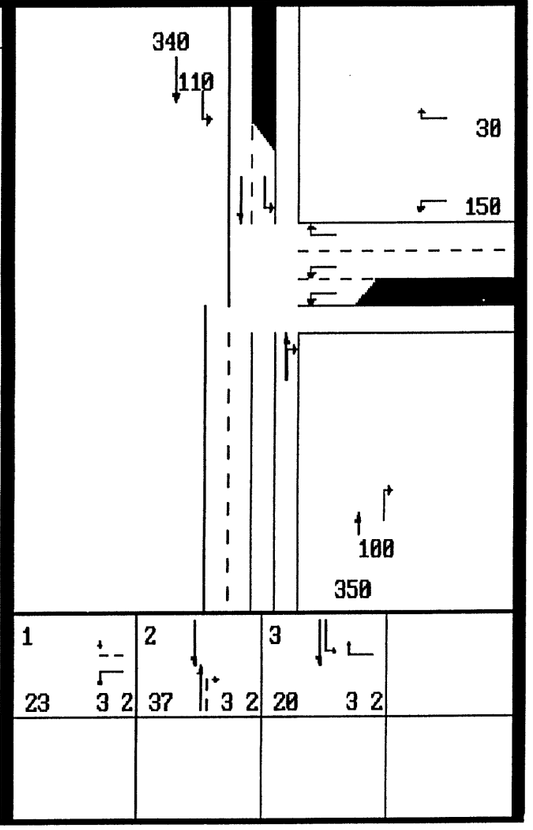
2)

	-Pkt Lanes- Left	Right	--Lane Lengths-- Full L	Pkt L	Pkt R
EB					
WB	1	0	600	100	
NB	0	0	600		
SB	1	0	600	200	

3)Need to Revise Channelization? N

4) Lane Widths (Feet)

	Median	2	3	4	5	6
EB						
WB		12.0	12.0	12.0		
NB		12.0				
SB		12.0	12.0			



Input Data for Case: HOWI71RA — I71SB OFFRAM/HOWE RD
YR 2020 BUILD — AM PEAK — Version 3.03

Signal and Phasing Data

Pretimed, Actuated, Semi-Actuated?A

Key in Allowed Movements by Phase:
L=Left; T=Thru; R=Right, no peds;
P=Right w ped conflicts. OR
click mouse on signal icon ->

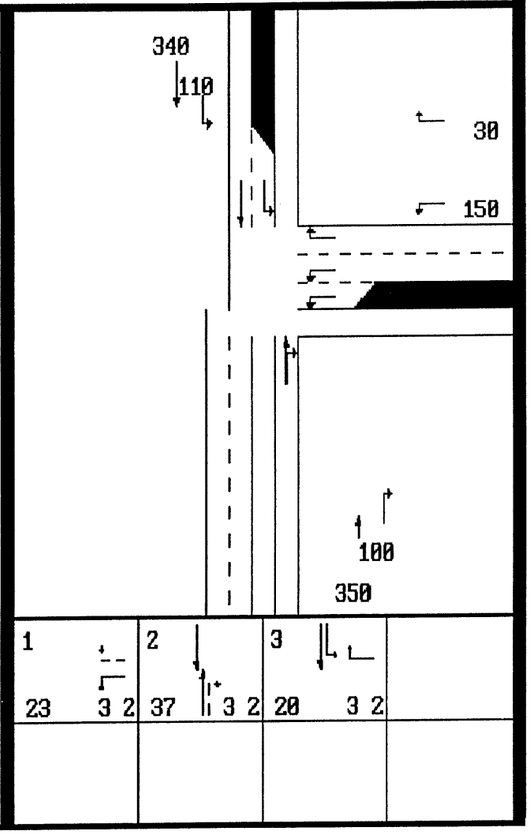
Traffic Movements by Phase

PH:	1	2	3	4	5	6	7	8
EB								
WB	L	P		R				
NB			TP					
SB			T		LT			

Phase Durations (Seconds)

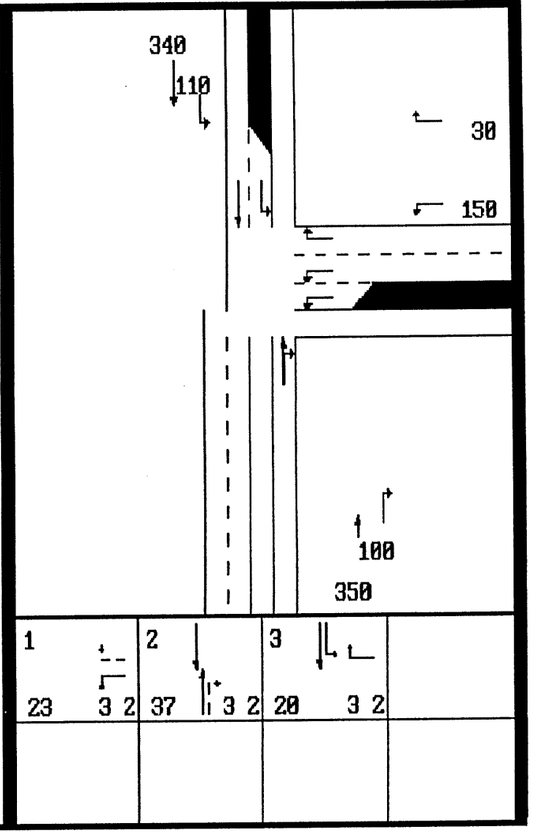
Grn	23	37	20
Yel	3	3	3
AR	2	2	2

Ped Only Phase Dur: 0 Cycle: 95
Lost Time/Phase: 3.0 Seq: 123



NETSIM Summary for Case: HOWI71RA — I71SB OFFRAM/HOWE RD
YR 2020 BUILD — AM PEAK — Version 3.03

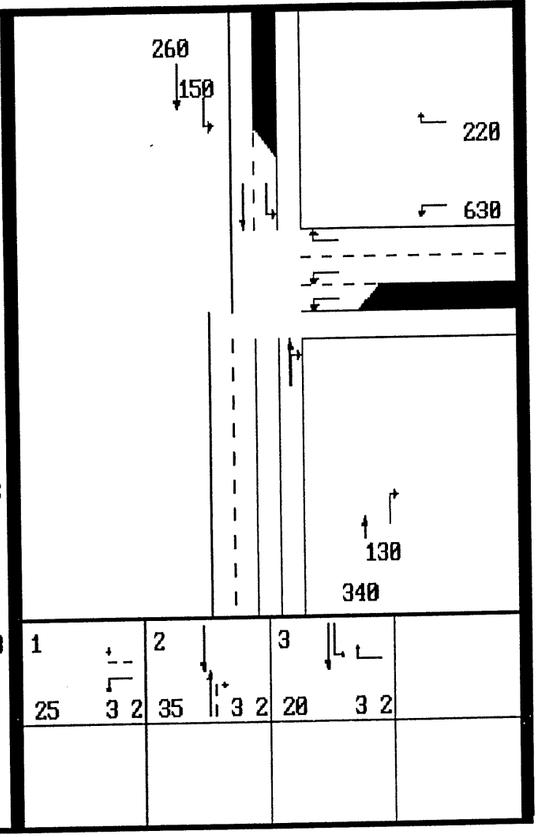
App	Lane Group	Queues Per Lane Avg/Max (veh)	Avg Speed (mph)	Spillback in Worst Lane (% of Peak Period)
WB	L	2/ 2	9.6	0.0
	R	1/ 2	13.6	0.0
	All		10.2	0.0
NB	TR	8/ 10	10.1	0.0
	All		10.1	0.0
SB	L	2/ 4	4.3	0.0
	T	3/ 5	19.9	0.0
	All		15.1	0.0
Intersect.			11.7	



HCM Summary Results for Case: HOWI71RP I71SB OFFRAM/HOWE RD

YR 2020 BUILD PM PEAK Version 3.03

Lane Grp	v/s	X v/c	Lane Grp Delay (sec/veh)	Lane Grp LOS	App Delay (sec/veh)	App LOS
WB L	*0.20	0.72	21.5	C	18.2	C
R	0.15	0.30	8.6	B		
NB TR	0.32	0.83	23.6	C	23.6	C
SB L	*0.09	0.41	20.4	C	10.3	B
T	0.16	0.24	4.4	A		
Int.	0.66	0.71	17.8	C		



Input Data for Case: HOWI71RP I71SB OFFRAM/HOWE RD

YR 2020 BUILD PM PEAK Version 3.03

Intersection Geometry

1)Number of Lanes Including Pockets

	EB	WB	NB	SB
Approach Street	0	3	1	2
Outbound Street	1	0	1	2

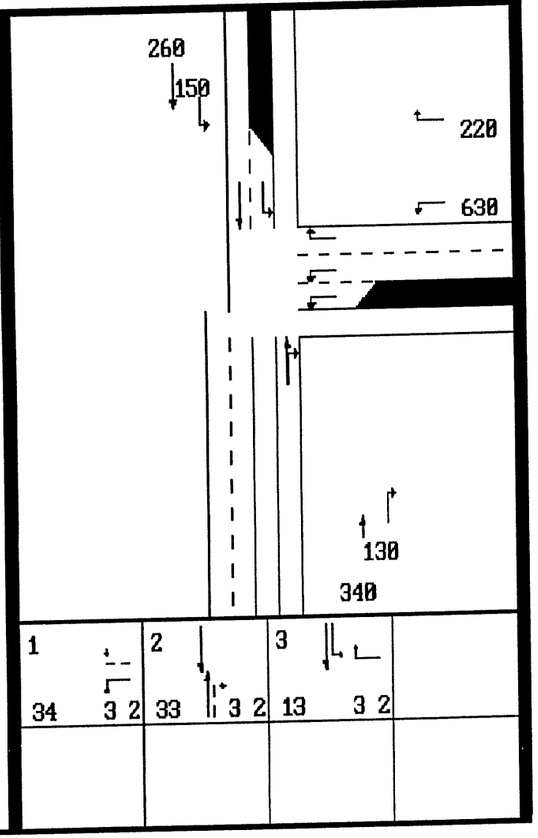
2)

	-Pkt Lanes- Left	Right	--Lane Lengths-- Full L	Pkt	R Pkt
EB					
WB	1	0	600	100	
NB	0	0	600		
SB	1	0	600	200	

3)Need to Revise Channelization? N

4) Lane Widths (Feet)

	Median	2	3	4	5	6
EB						
WB		12.0	12.0	12.0		
NB		12.0				
SB		12.0	12.0			



Input Data for Case: HOWI71RP — I71SB OFFRAM/HOWE RD
YR 2020 BUILD — PM PEAK — Version 3.03

Signal and Phasing Data

Pretimed, Actuated, Semi-Actuated?A

Key in Allowed Movements by Phase:
L=Left; T=Thru; R=Right, no peds;
P=Right w ped conflicts. OR
click mouse on signal icon ->

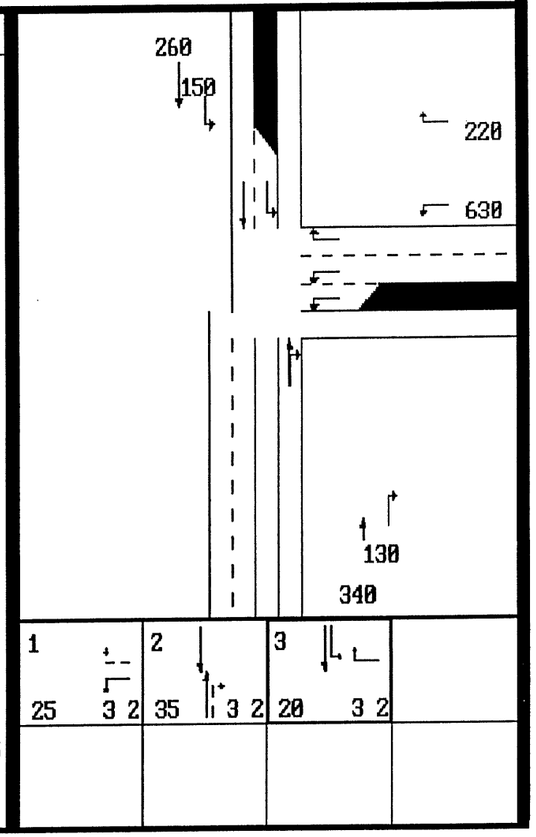
Traffic Movements by Phase

PH:	1	2	3	4	5	6	7	8
EB								
WB	L	P		R				
NB			TP					
SB			T	LT				

Phase Durations (Seconds)

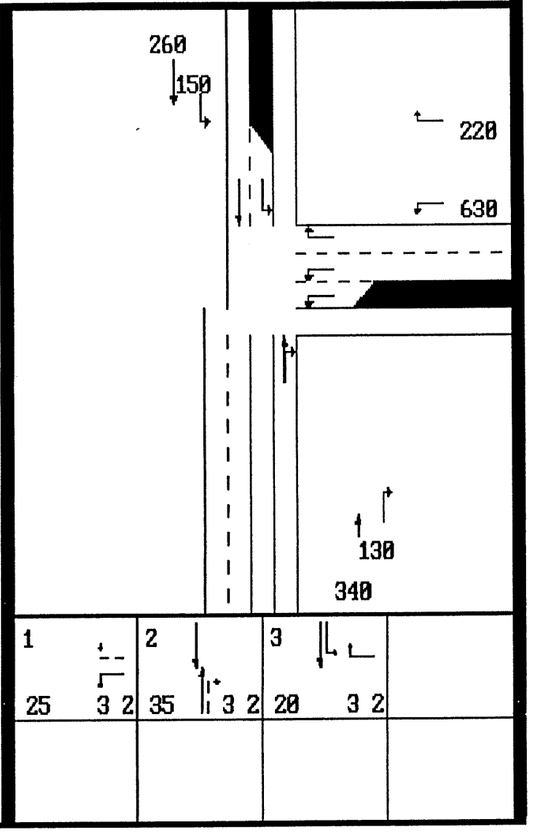
Grn	25	35	20
Yel	3	3	3
AR	2	2	2

Ped Only Phase Dur: 0 Cycle: 95
Lost Time/Phase: 3.0 Seq: 123



NETSIM Summary for Case: HOWI71RP — I71SB OFFRAM/HOWE RD
YR 2020 BUILD — PM PEAK — Version 3.03

App	Lane Group	Queues Per Lane Avg/Max (veh)	Avg Speed (mph)	Spillback in Worst Lane (% of Peak Period)
WB	L	8/ 11	8.7	0.0
	R	3/ 7	13.5	0.0
	All		9.6	0.0
NB	TR	10/ 11	9.1	0.0
	All		9.1	0.0
SB	L	4/ 8	3.4	0.0
	T	2/ 3	22.3	0.0
	All		12.4	0.0
Intersect.			10.0	



HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 07-07-1999
Northeast Ohio Areawide Coordinating Agency

Streets: (E-W) Boston Rd (N-S) Benbow Rd Extension
Analyst: NOACA File Name: BOSBENCA.HC9
Area Type: Other 9-3-98 AM PEAK
Comment: FUTURE YEAR 2020 ALTERNATE: C&D

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes		1	1	1	1		>		<			
Volumes		360	750	160	360		190		60			
Lane W (ft)		12.0	12.0	12.0	12.0			12.0				
RTOR Vols			0			0			0			
Lost Time		3.00	3.00	3.00	3.00		3.00		3.00			

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left					NB Left	*		
Thru	*				Thru			
Right	*				Right	*		
Peds	*				Peds	*		
WB Left		*			SB Left			
Thru	*	*			Thru			
Right					Right			
Peds	*	*			EB Right	*		
NB Right					WB Right			
SB Right								
Green	42.0A	15.0A			Green	23.0A		
Yellow/AR	5.0	5.0			Yellow/AR	5.0		

Cycle Length: 95 secs Phase combination order: #1 #2 #5

Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
EB	T	863	1863	0.464	0.463	11.6	B	7.1	B
	R	1200	1583	0.694	0.758	5.0	A		
WB	L	317	1770	0.562	0.179	24.7	C	10.5	B
	T	1255	1863	0.319	0.674	4.2	A		
NB	LR	410	1557	0.678	0.263	23.4	C	23.4	C

Intersection Delay = 10.2 sec/veh Intersection LOS = B

Lost Time/Cycle, L = 6.0 sec Critical v/c(x) = 0.669

HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 07-07-1999
Northeast Ohio Areawide Coordinating Agency

Streets: (E-W) Boston Rd (N-S) Benbow Rd Extension
Analyst: NOACA File Name: BOSBENCP.HC9
Area Type: Other 9-3-98 PM Peak
Comment: FUTURE YEAR 2020 ALTERNATE: C&D

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes		1	1	1	1		>		<			
Volumes		630	310	70	430		240		60			
Lane W (ft)		12.0	12.0	12.0	12.0			12.0				
RTOR Vols			0			0			0			
Lost Time		3.00	3.00	3.00	3.00		3.00		3.00			

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left					NB Left	*		
Thru	*				Thru			
Right	*				Right	*		
Peds	*				Peds	*		
WB Left		*			SB Left			
Thru	*	*			Thru			
Right					Right			
Peds	*	*			EB Right	*		
NB Right					WB Right			
SB Right								
Green	40.0A	12.0A			Green	28.0A		
Yellow/AR	5.0	5.0			Yellow/AR	5.0		

Cycle Length: 95 secs Phase combination order: #1 #2 #5

Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
EB	T	824	1863	0.850	0.442	21.2	C	14.8	B
	R	1250	1583	0.275	0.789	1.8	A		
WB	L	261	1770	0.299	0.147	23.5	C	8.5	B
	T	1157	1863	0.413	0.621	6.1	B		
NB	LR	494	1564	0.676	0.316	20.8	C	20.8	C

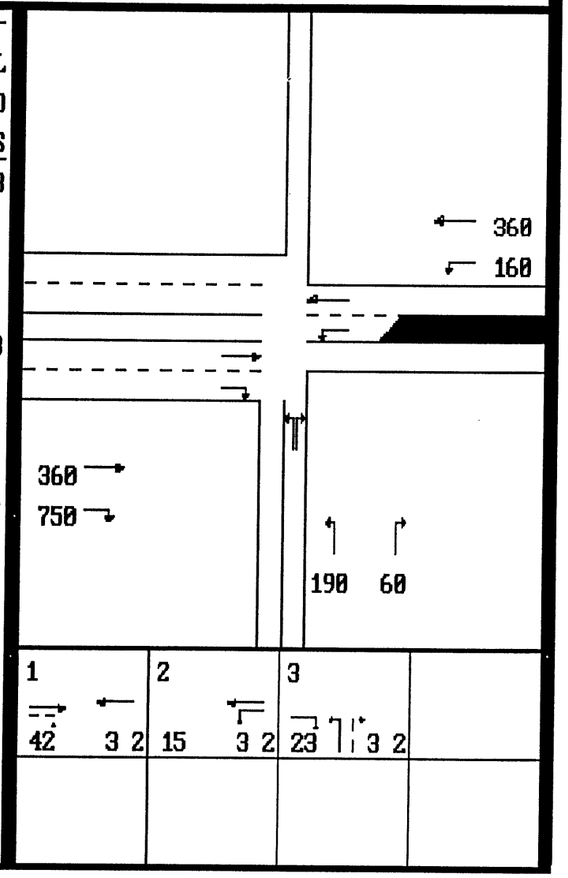
Intersection Delay = 14.0 sec/veh Intersection LOS = B

Lost Time/Cycle, L = 9.0 sec Critical v/c(x) = 0.700

HCM Summary Results for Case: BENEXDCA BOSTON RD /BENBOW EXTEN

YR 2020 BUILD TRAFFIC AM PEAK Version 3.03

Lane Grp	v/s	X v/c	Lane Grp Delay (sec/veh)	L O S	App Delay (sec/veh)	App L O S
EB T	0.21	0.46	11.6	B	8.1	B
R	*0.53	0.72	6.5	B		
WB L	*0.10	0.56	24.7	C	10.5	B
T	0.21	0.32	4.2	A		
NB LR	*0.18	0.68	23.4	C	23.4	C
Int.	0.81	0.89	10.8	B		



Input Data for Case: BENEXDCA BOSTON RD /BENBOW EXTEN

YR 2020 BUILD TRAFFIC AM PEAK Version 3.03

Intersection Geometry

1)Number of Lanes Including Pockets

	EB	WB	NB	SB
Approach Street	2	2	1	0
Outbound Street	1	2	1	1

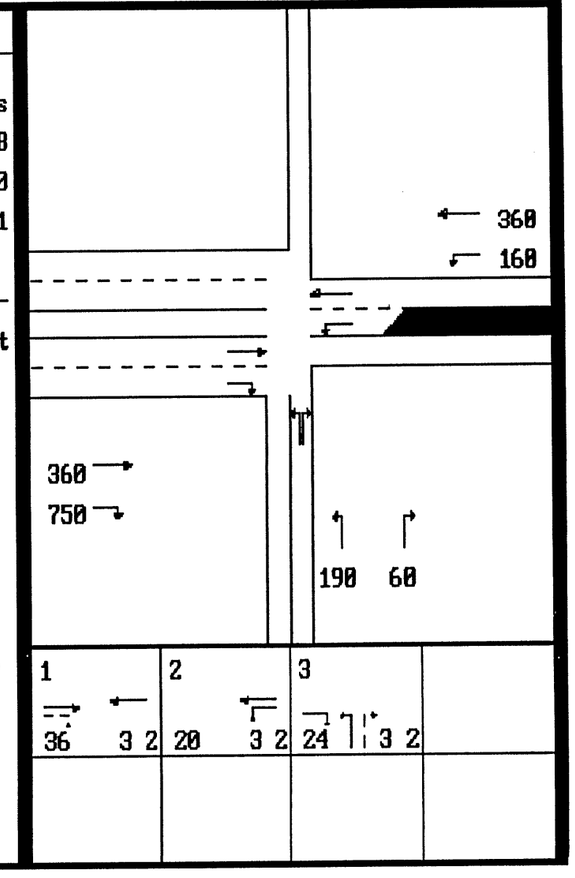
2)

	-Pkt Lanes- Left	Right	—Lane Lengths— Full L Pkt	R Pkt
EB	0	0	600	
WB	1	0	600	160
NB	0	0	600	
SB				

3)Need to Revise Channelization? N

4) Lane Widths (Feet)

	Median	2	3	4	5	6
EB		12.0	12.0			
WB		12.0	12.0			
NB		12.0				
SB						



Input Data for Case: BENEXDCA BOSTON RD /BENBOW EXTEN
YR 2020 BUILD TRAFFIC AM PEAK Version 3.03

Signal and Phasing Data

Pretimed, Actuated, Semi-Actuated?A

Key in Allowed Movements by Phase:
L=Left; T=Thru; R=Right, no peds;
P=Right w ped conflicts. OR
click mouse on signal icon ->

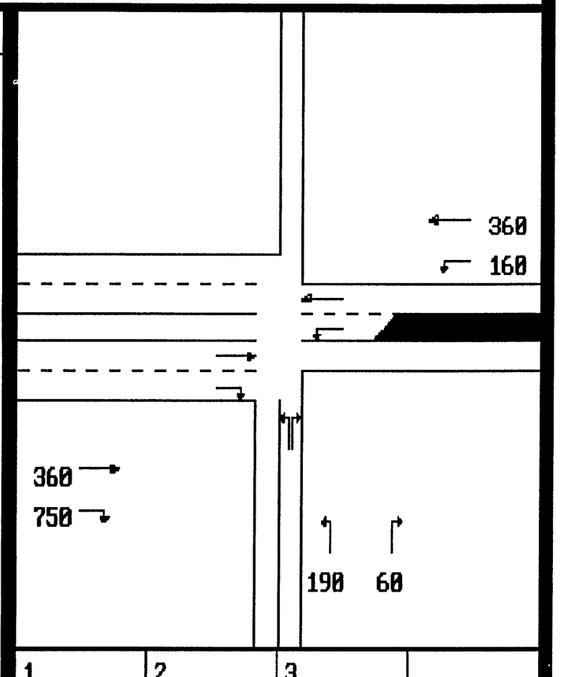
Traffic Movements by Phase

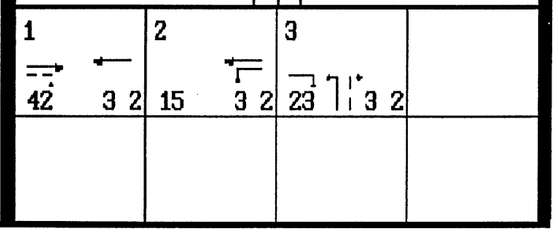
PH:	1	2	3	4	5	6	7	8
EB	TP		R					
WB	T	LT						
NB			L P					
SB								

Phase Durations (Seconds)

Grn	42	15	23
Yel	3	3	3
AR	2	2	2

Ped Only Phase Dur: 0 Cycle: 95
Lost Time/Phase: 3.0 Seq: 123

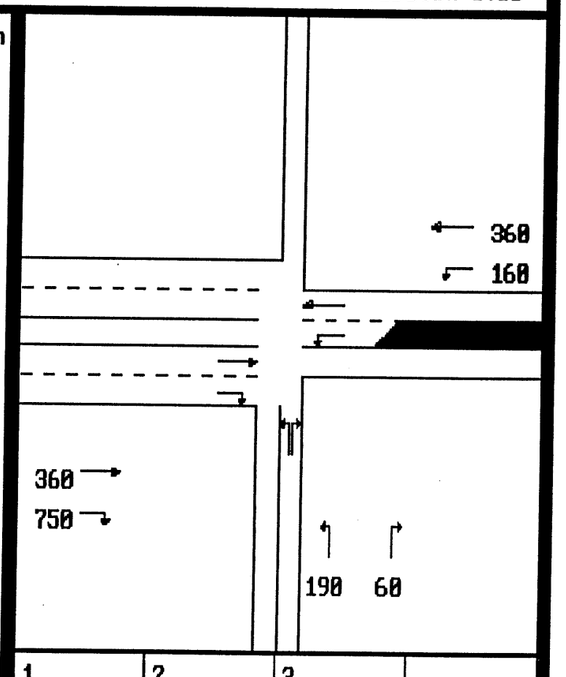


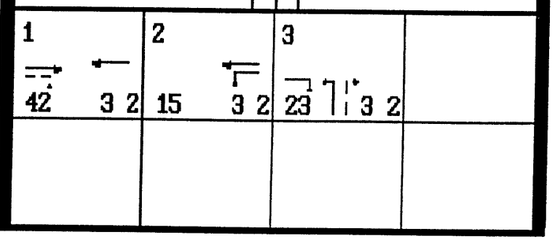


NETSIM Summary for Case: BENEXDCA BOSTON RD /BENBOW EXTEN
YR 2020 BUILD TRAFFIC AM PEAK Version 3.03

App	Lane Group	Queues Per Lane Avg/Max (veh)	Avg Speed (mph)	Spillback in Worst Lane (% of Peak Period)
EB	T	8/ 11	11.6	0.0
	R	11/ 22	8.2	0.0
	All		9.2	0.0
WB	L	3/ 5	3.1	0.0
	T	5/ 5	18.4	0.0
	All		14.1	0.0
NB	LR	5/ 6	8.6	0.0
	All		8.6	0.0

Intersect. 10.1

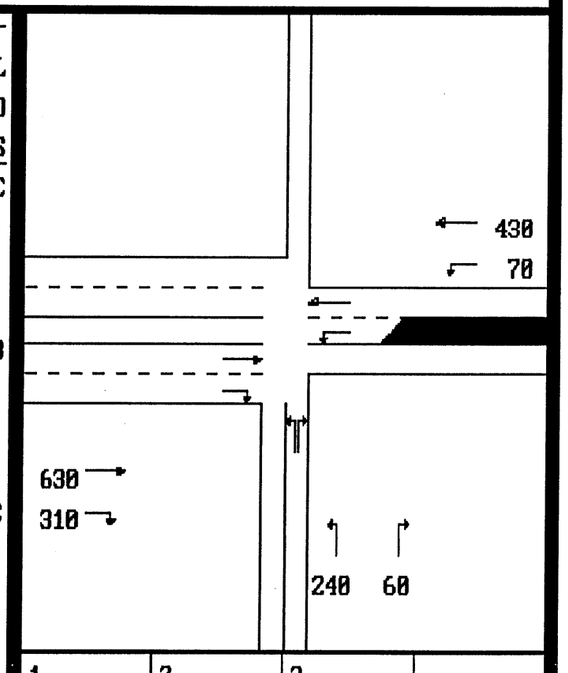




HCM Summary Results for Case: BENEXDCP BOSTON RD /BENBOW EXTEN

YR 2020 BUILD TRAFFIC PM PEAK Version 3.03

	Lane Grp	v/s	X v/c	- Lane Grp - Delay (sec/veh)	L O S	- App - Delay (sec/veh)	L O S
EB	T	*0.38	0.85	21.3	C	15.0	C
	R	0.22	0.29	2.3	A		
WB	L	*0.04	0.30	23.5	C	8.5	B
	T	0.26	0.41	6.1	B		
NB	LR	*0.21	0.68	20.8	C	20.8	C
Int.		0.63	0.70	14.2	B		



Input Data for Case: BENEXDCP BOSTON RD /BENBOW EXTEN

YR 2020 BUILD TRAFFIC PM PEAK Version 3.03

Intersection Geometry

1)Number of Lanes Including Pockets

	EB	WB	NB	SB
Approach Street	2	2	1	0
Outbound Street	1	2	1	1

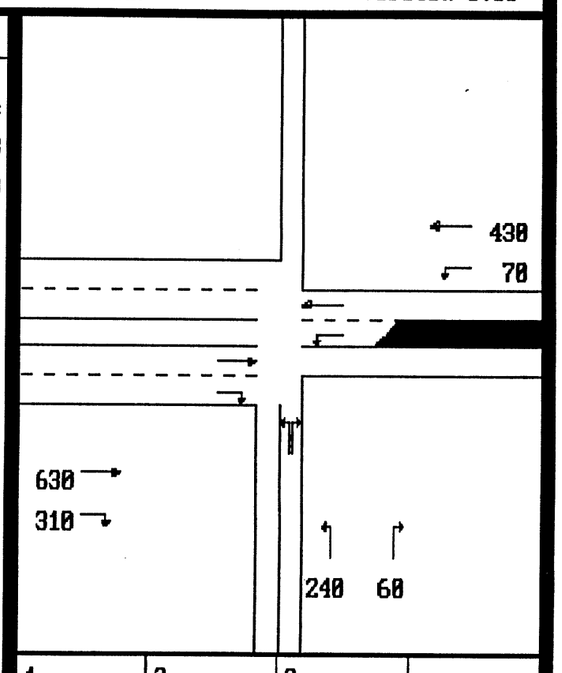
2)

	-Pkt Lanes- Left	Right	—Lane Lengths— Full L Pkt	R Pkt
EB	0	0	600	
WB	1	0	600	160
NB	0	0	600	
SB				

3)Need to Revise Channelization? N

4) Lane Widths (Feet)

	Median	2	3	4	5	6
EB		12.0	12.0			
WB		12.0	12.0			
NB		12.0				
SB						



Input Data for Case: BENEXDCP BOSTON RD /BENBOW EXTEN
YR 2020 BUILD TRAFFIC PM PEAK Version 3.03

Signal and Phasing Data

Pretimed, Actuated, Semi-Actuated?A

Key in Allowed Movements by Phase:
L=Left; T=Thru; R=Right, no peds;
P=Right w ped conflicts. OR
click mouse on signal icon ->

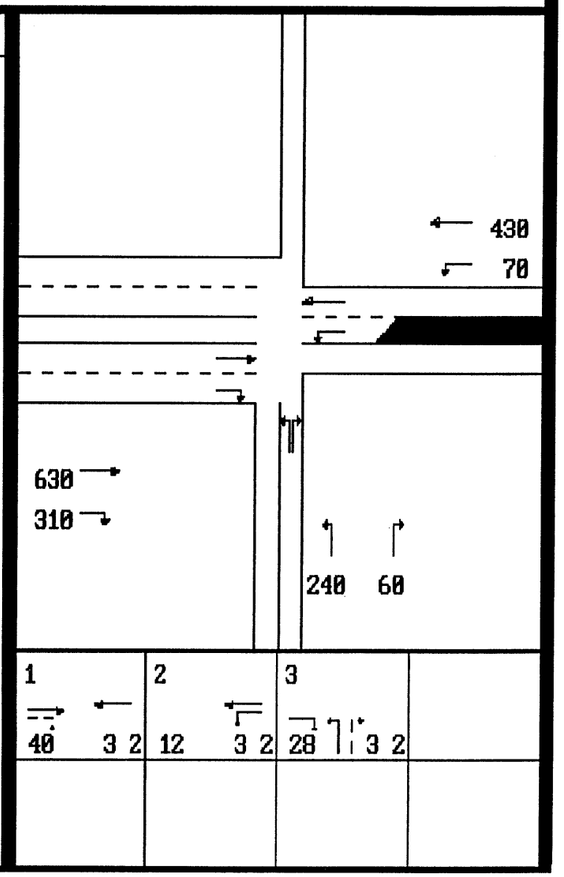
Traffic Movements by Phase

PH:	1	2	3	4	5	6	7	8
EB	TP		R					
WB	T	LT						
NB			L P					
SB								

Phase Durations (Seconds)

Grn	40	12	28
Yel	3	3	3
AR	2	2	2

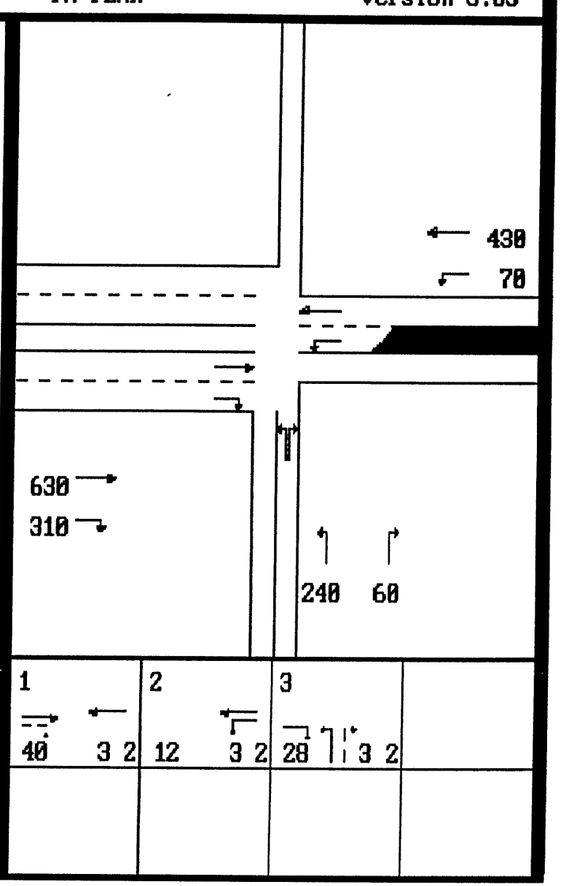
Ped Only Phase Dur: 0 Cycle: 95
Lost Time/Phase: 3.0 Seq: 123



NETSIM Summary for Case: BENEXDCP BOSTON RD /BENBOW EXTEN
YR 2020 BUILD TRAFFIC PM PEAK Version 3.03

App	Lane Group	Queues Per Lane Avg/Max (veh)	Avg Speed (mph)	Spillback in Worst Lane (% of Peak Period)
EB	T	13/ 17	9.9	0.0
	R	2/ 4	19.1	0.0
	All		11.8	0.0
WB	L	2/ 4	2.8	0.0
	T	6/ 7	17.1	0.0
	All		14.9	0.0
NB	LR	7/ 7	8.6	0.0
	All		8.6	0.0

Intersect. 11.7



Alternative D&E
(with Benbow Rd Extension & Entrance/Exit at Carpenter Rd)

HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 06-29-1999
Northeast Ohio Areawide Coordinating Agency

Streets: (E-W) BOSTON RD (N-S) HOWE RD
Analyst: NOACA File Name: BOSHOWA.HC9
Area Type: Other 9-9-98 AM PEAK
Comment: FUTURE YEAR 2020 ALTERNATE: D&E

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1			1	1					>	<
Volumes	80	420			180	300				400		50
Lane W (ft)	12.0	12.0			12.0	12.0					12.0	
RTOR Vols			0			0						0
Lost Time	3.00	3.00			3.00	3.00				3.00		3.00

Signal Operations

Phase Combination		1	2	3	4			5	6	7	8
EB	Left	*				NB	Left				
	Thru	*	*				Thru				
	Right						Right				
	Peds	*	*				Peds				
WB	Left					SB	Left	*			
	Thru		*				Thru				
	Right		*				Right	*			
	Peds		*				Peds	*			
NB	Right					EB	Right				
SB	Right					WB	Right	*			
Green		20.0A	27.0A			Green		43.0A			
Yellow/AR		5.0	5.0			Yellow/AR		5.0			

Cycle Length: 105 secs Phase combination order: #1 #2 #5

Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
EB	L	371	1770	0.240	0.210	22.4	C	12.8	B
	T	958	1863	0.487	0.514	11.0	B		
WB	T	515	1863	0.389	0.276	20.2	C	9.5	B
	R	1161	1583	0.287	0.733	3.1	A		
SB	LR	676	1578	0.739	0.429	19.2	C	19.2	C

Intersection Delay = 13.7 sec/veh Intersection LOS = B
Lost Time/Cycle, L = 6.0 sec Critical v/c(x) = 0.602

HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 06-29-1999
Northeast Ohio Areawide Coordinating Agency

Streets: (E-W) BOSTON RD (N-S) HOWE RD
Analyst: NOACA File Name: BOSHOWP.HC9
Area Type: Other 9-9-98 PM PEAK
Comment: FUTURE YEAR 2020 ALTERNATE: D&E

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1			1	1					>	<
Volumes	20	360			505	540				335		75
Lane W (ft)	12.0	12.0			12.0	12.0					12.0	
RTOR Vols			0			0						0
Lost Time	3.00	3.00			3.00	3.00				3.00		3.00

Signal Operations

Phase Combination		1	2	3	4			5	6	7	8
EB	Left	*				NB	Left				
	Thru	*	*				Thru				
	Right						Right				
	Peds	*	*				Peds				
WB	Left					SB	Left	*			
	Thru		*				Thru				
	Right		*				Right	*			
	Peds		*				Peds	*			
NB	Right					EB	Right				
SB	Right					WB	Right	*			
Green		16.0A	37.0A			Green		37.0A			
Yellow/AR		5.0	5.0			Yellow/AR		5.0			

Cycle Length: 105 secs Phase combination order: #1 #2 #5

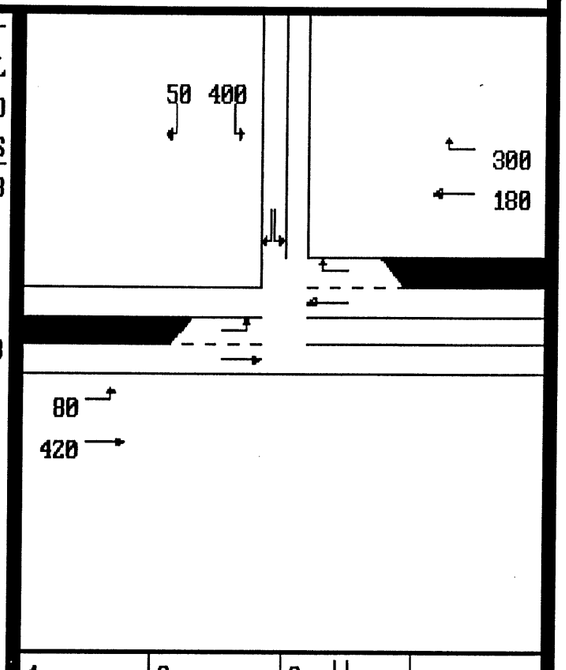
Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
EB	L	303	1770	0.073	0.171	23.6	C	8.9	B
	T	1065	1863	0.376	0.571	8.0	B		
WB	T	692	1863	0.811	0.371	24.2	C	13.3	B
	R	1221	1583	0.491	0.771	3.1	A		
SB	LR	582	1567	0.782	0.371	23.6	C	23.6	C

Intersection Delay = 14.7 sec/veh Intersection LOS = B
Lost Time/Cycle, L = 9.0 sec Critical v/c(x) = 0.661

HCM Summary Results for Case: BOSHWDEA BOSTON /HOWE RD
YR 2020 BUILD AM PEAK Version 3.03

	Lane Grp	v/s	X v/c	Lane Grp Delay (sec/veh)	L O S	App Delay (sec/veh)	App L O S
EB	L	*0.05	0.29	24.7	C	13.6	B
	T	0.25	0.50	11.5	B		
WB	T	0.11	0.35	18.5	C	8.8	B
	R	0.21	0.28	2.9	A		
SB	LR	*0.32	0.72	18.3	C	18.3	C
	Int.	0.64	0.71	13.4	B		



Input Data for Case: BOSHWDEA BOSTON /HOWE RD
YR 2020 BUILD AM PEAK Version 3.03

Intersection Geometry

1)Number of Lanes Including Pockets

	EB	WB	NB	SB
Approach Street	2	2	0	1
Outbound Street	1	1	1	0

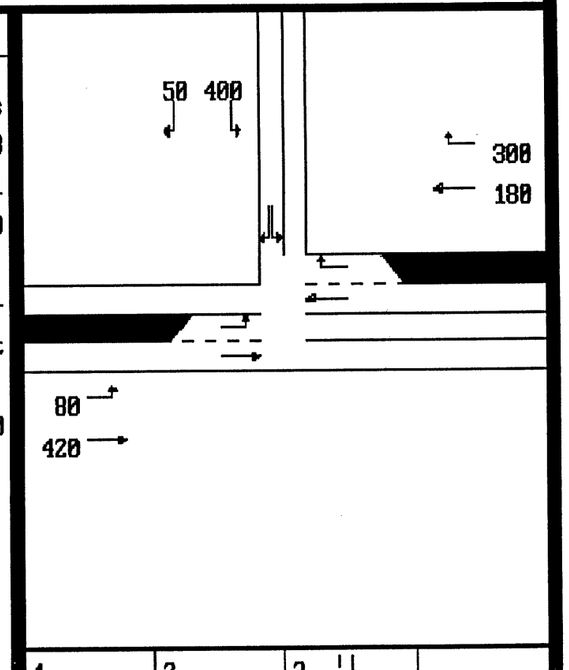
2) —Pkt Lanes— —Lane Lengths—

	Left	Right	Full	L Pkt	R Pkt
EB	1	0	600	160	
WB	0	1	600		200
NB					
SB	0	0	600		

3)Need to Revise Channelization? N

4) Lane Widths (Feet)

	Median	2	3	4	5	6
EB		12.0	12.0			
WB		12.0	12.0			
NB						
SB		12.0				



Input Data for Case: BOSHWDEA BOSTON /HOWE RD
YR 2020 BUILD AM PEAK Version 3.03

Signal and Phasing Data

Pretimed, Actuated, Semi-Actuated?A

Key in Allowed Movements by Phase:
L=Left; T=Thru; R=Right, no peds;
P=Right w ped conflicts. OR
click mouse on signal icon ->

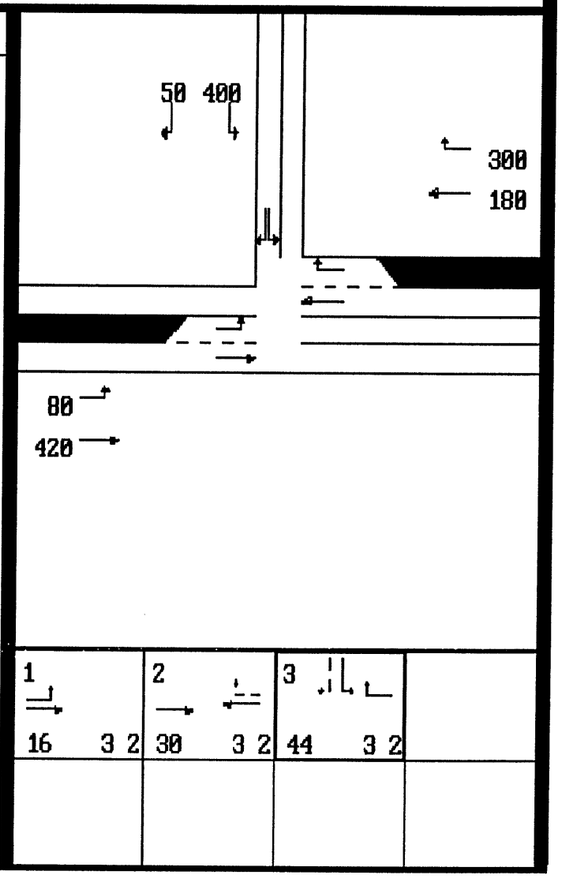
Traffic Movements by Phase

PH:	1	2	3	4	5	6	7	8
EB	LT	T						
WB		TP	R					
NB								
SB			L	P				

Phase Durations (Seconds)

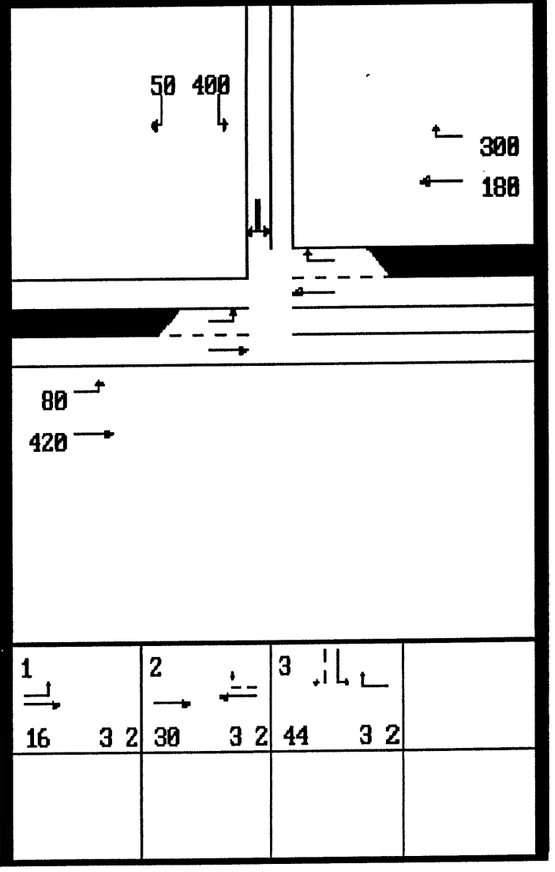
Grn	16	30	44
Yel	3	3	3
AR	2	2	2

Ped Only Phase Dur: 0 Cycle: 105
Lost Time/Phase: 3.0 Seq: 123



NETSIM Summary for Case: BOSHWDEA BOSTON /HOWE RD
YR 2020 BUILD AM PEAK Version 3.03

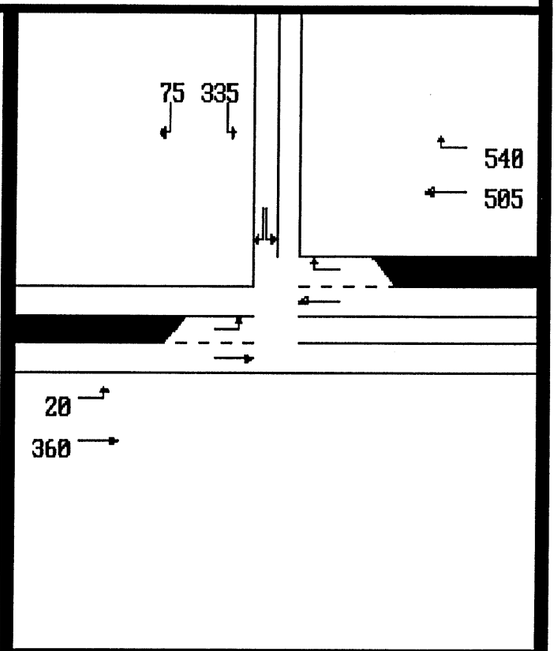
App	Lane Group	Queues Per Lane Avg/Max (veh)	Avg Speed (mph)	Spillback in Worst Lane (% of Peak Period)
EB	L	3/ 4	3.3	0.0
	T	8/ 9	13.6	0.0
	All		11.8	0.0
WB	T	4/ 6	15.5	0.0
	R	3/ 5	12.9	0.0
	All		14.8	0.0
SB	LR	9/ 10	9.2	0.0
	All		9.2	0.0
Intersect.			11.5	



HCM Summary Results for Case: BOSHWDEP BOSTON /HOWE RD

YR 2020 BUILD PM PEAK Version 3.03

	Lane Grp	v/s	X v/c	- Lane Grp - Delay (sec/ veh)	L O S	- App - Delay (sec/ veh)	L O S
EB	L	*0.01	0.08	24.1	C	8.9	B
	T	0.21	0.38	8.0	B		
WB	T	0.30	0.79	22.8	C	12.9	B
	R	*0.38	0.50	3.6	A		
SB	LR	*0.29	0.78	23.6	C	23.6	C
Int.		0.68	0.75	14.5	B		



Input Data for Case: BOSHWDEP BOSTON /HOWE RD

YR 2020 BUILD PM PEAK Version 3.03

Intersection Geometry

1)Number of Lanes Including Pockets

	EB	WB	NB	SB
Approach Street	2	2	0	1
Outbound Street	1	1	1	0

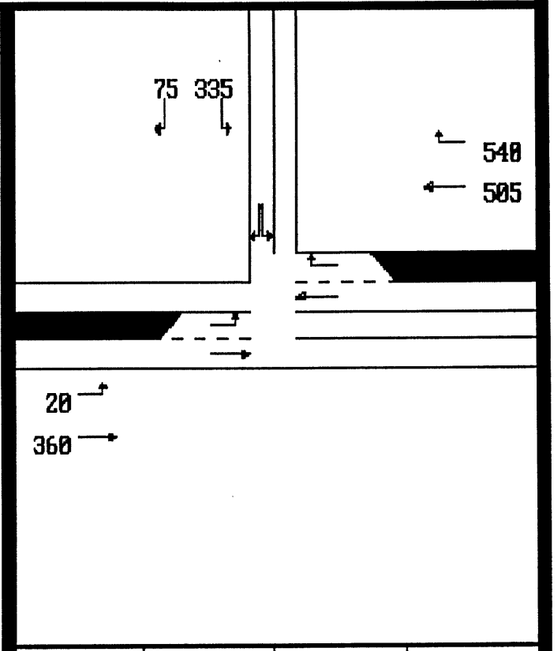
2)

	-Pkt Lanes- Left	Right	--Lane Lengths-- Full L	Pkt R	Pkt
EB	1	0	600	160	
WB	0	1	600		200
NB					
SB	0	0	600		

3)Need to Revise Channelization? N

4) Lane Widths (Feet)

	Median	2	3	4	5	6
EB		12.0	12.0			
WB		12.0	12.0			
NB						
SB		12.0				



Input Data for Case: BOSHWDEP BOSTON /HOWE RD
YR 2020 BUILD PM PEAK Version 3.03

Signal and Phasing Data

Pretimed, Actuated, Semi-Actuated?A

Key in Allowed Movements by Phase:
L=Left; T=Thru; R=Right, no peds;
P=Right w ped conflicts. OR
click mouse on signal icon ->

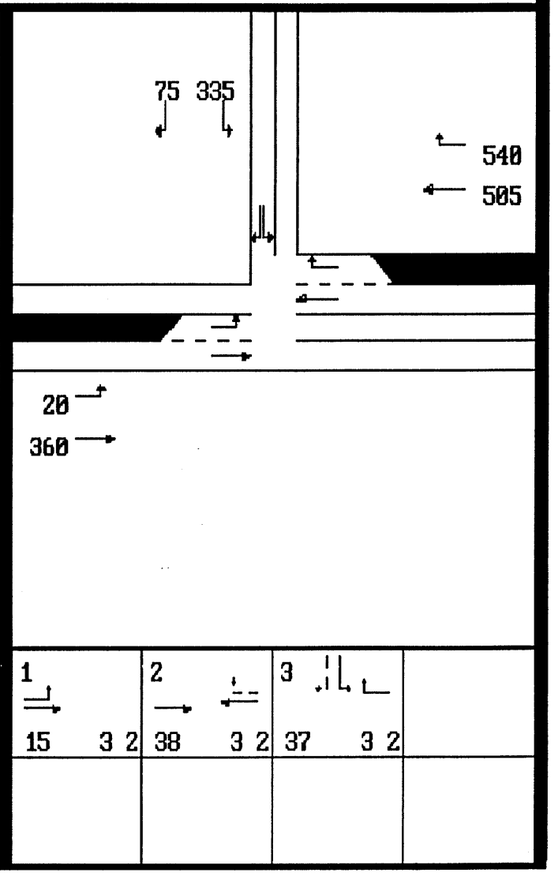
Traffic Movements by Phase

PH:	1	2	3	4	5	6	7	8
EB	LT	T						
WB		TP	R					
NB								
SB			L	P				

Phase Durations (Seconds)

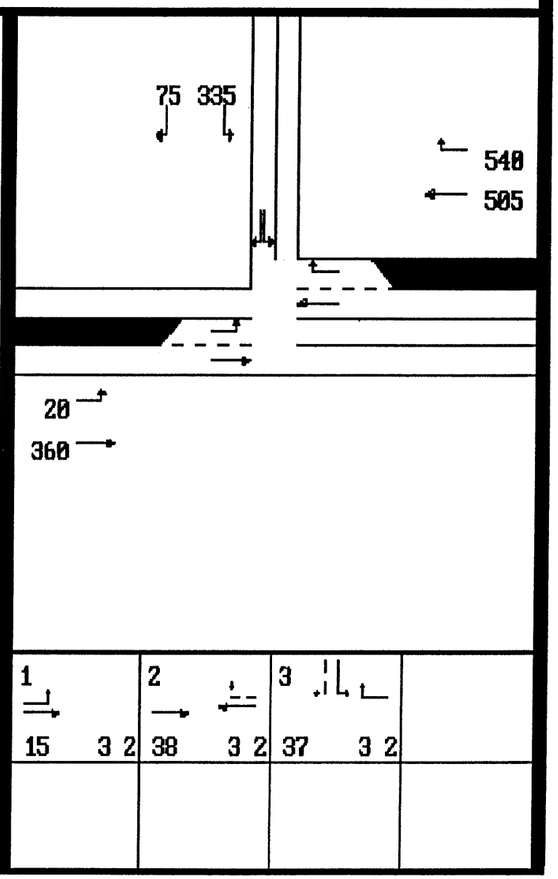
Grn	15	38	37
Yel	3	3	3
AR	2	2	2

Ped Only Phase Dur: 0 Cycle: 105
Lost Time/Phase: 3.0 Seq: 123



NETSIM Summary for Case: BOSHWDEP BOSTON /HOWE RD
YR 2020 BUILD PM PEAK Version 3.03

App	Lane Group	Queues Per Lane Avg/Max (veh)	Avg Speed (mph)	Spillback in Worst Lane (% of Peak Period)
EB	L	0/ 1	8.3	0.0
	T	6/ 7	15.0	0.0
	All		14.9	0.0
WB	T	11/ 15	11.2	0.0
	R	6/ 7	9.8	0.0
	All		10.9	0.0
SB	LR	9/ 10	8.3	0.0
	All		8.3	0.0
Intersect.			10.8	



HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 06-29-1999
Northeast Ohio Areawide Coordinating Agency

Streets: (E-W) RAMPS WEST OF I-71 (N-S) CARPENTER RD
Analyst: NOACA File Name: CARI71A.HC9
Area Type: Other 9-9-98 AM PEAK
Comment: FUTURE YEAR 2020 ALTERNATE: D&E

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes				>	< 1			1 <		1	1	
Volumes				40		140		520	80	130	310	
Lane W (ft)					12.0	12.0		12.0		12.0	12.0	
RTOR Vols						0			0			0
Lost Time				3.00		3.00		3.00	3.00	3.00	3.00	

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left					NB Left			
Thru					Thru	*		
Right					Right	*		
Peds					Peds	*		
WB Left	*				SB Left	*		
Thru					Thru	*	*	
Right	*				Right			
Peds	*				Peds	*		
NB Right					EB Right			
SB Right					WB Right			
Green	16.0A				Green	18.0A	46.0A	
Yellow/AR	5.0				Yellow/AR	5.0	5.0	

Cycle Length: 95 secs Phase combination order: #1 #5 #6

Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
WB	LR	316	1670	0.313	0.189	21.6	C	21.7	C
	R	300	1583	0.337	0.189	21.8	C		
NB	TR	830	1643	0.803	0.505	16.7	C	16.7	C
SB	L	373	1770	0.386	0.211	21.2	C	8.0	B
	T	1392	1863	0.247	0.747	2.4	A		

Intersection Delay = 14.3 sec/veh Intersection LOS = B
Lost Time/Cycle, L = 9.0 sec Critical v/c(x) = 0.609

HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 06-29-1999
Northeast Ohio Areawide Coordinating Agency

Streets: (E-W) RAMPS WEST OF I-71 (N-S) CARPENTER RD
Analyst: NOACA File Name: CARI71P.HC9
Area Type: Other 9-9-98 PM PEAK
Comment: FUTURE YEAR 2020 ALTERNATE: D&E

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes				>	< 1			1 <		1	1	
Volumes				185		665		470	30	250	265	
Lane W (ft)					12.0	12.0		12.0		12.0	12.0	
RTOR Vols						0			0			0
Lost Time				3.00		3.00		3.00	3.00	3.00	3.00	

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left					NB Left			
Thru					Thru	*		
Right					Right	*		
Peds					Peds	*		
WB Left	*				SB Left	*		
Thru					Thru	*	*	
Right	*				Right			
Peds	*				Peds	*		
NB Right					EB Right			
SB Right					WB Right			
Green	27.0A				Green	14.0A	29.0A	
Yellow/AR	5.0				Yellow/AR	5.0	5.0	

Cycle Length: 85 secs Phase combination order: #1 #5 #6

Intersection Performance Summary

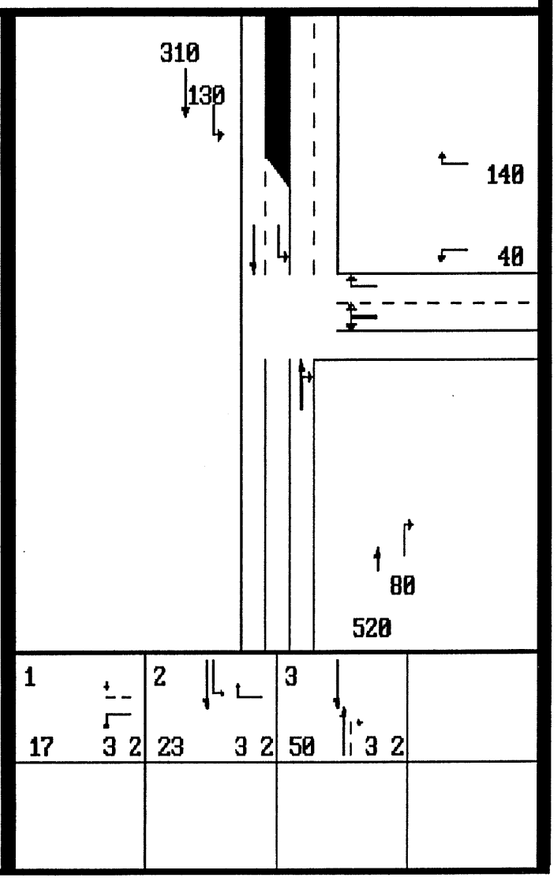
	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
WB	LR	569	1668	0.842	0.341	24.4	C	25.3	D
	R	540	1583	0.863	0.341	26.4	D		
NB	TR	606	1662	0.916	0.365	30.1	D	30.1	D
SB	L	333	1770	0.834	0.188	32.8	D	18.8	C
	T	1096	1863	0.268	0.588	5.6	B		

Intersection Delay = 24.8 sec/veh Intersection LOS = C
Lost Time/Cycle, L = 9.0 sec Critical v/c(x) = 0.878

HCM Summary Results for Case: I71CARAM I-71 W RAMP /CARPENTER RD

YEAR 2020 BUILD TRAFFIC AM PEAK Version 3.03

Lane Grp	v/s	X v/c	Lane Grp Delay (sec/veh)	Lane Grp LOS	App Delay (sec/veh)	App LOS
WB LR	0.05	0.26	24.0	C	17.2	C
R	*0.07	0.18	12.4	B		
NB TR	*0.41	0.82	19.3	C	19.3	C
SB L	*0.08	0.34	21.6	C	8.1	B
T	0.18	0.24	2.4	A		
Int.	0.56	0.61	14.9	B		



Input Data for Case: I71CARAM I-71 W RAMP /CARPENTER RD

YEAR 2020 BUILD TRAFFIC AM PEAK Version 3.03

Intersection Geometry

1)Number of Lanes Including Pockets

	EB	WB	NB	SB
Approach Street	0	2	1	2
Outbound Street	1	0	2	1

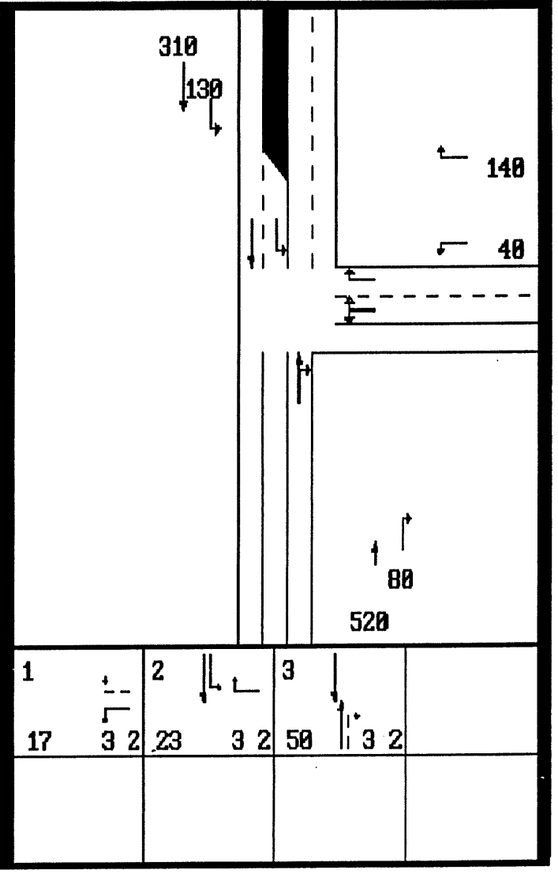
2)

	-Pkt Lanes- Left	Right	—Lane Lengths— Full L	Pkt L	Pkt R
EB					
WB	0	0	600		
NB	0	0	600		
SB	1	0	600	220	

3)Need to Revise Channelization? N

4) Lane Widths (Feet)

	Median	2	3	4	5	6
EB						
WB	12.0	12.0				
NB	12.0					
SB	12.0	12.0				



Input Data for Case: I71CARAM — I-71 W RAMP /CARPENTER RD
YEAR 2020 BUILD TRAFFIC — AM PEAK — Version 3.03

Signal and Phasing Data

Pretimed, Actuated, Semi-Actuated?A

Key in Allowed Movements by Phase:
L=Left; T=Thru; R=Right, no peds;
P=Right w ped conflicts. OR
click mouse on signal icon ->

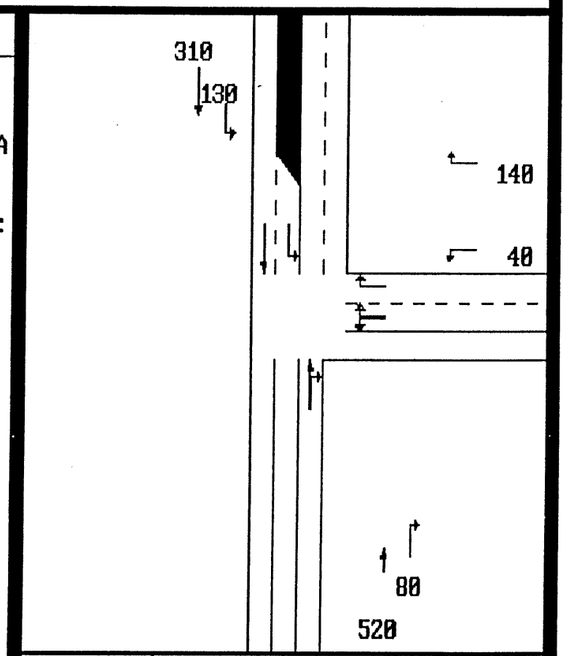
Traffic Movements by Phase

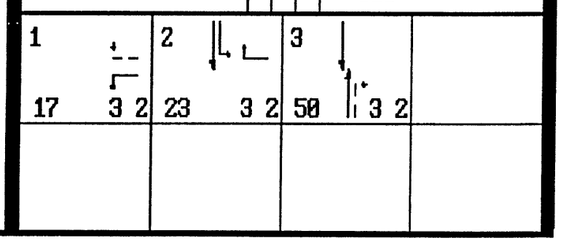
PH:	1	2	3	4	5	6	7	8
EB								
WB	L	P	R					
NB					TP			
SB			LT	T				

Phase Durations (Seconds)

Grn	17	23	50
Yel	3	3	3
AR	2	2	2

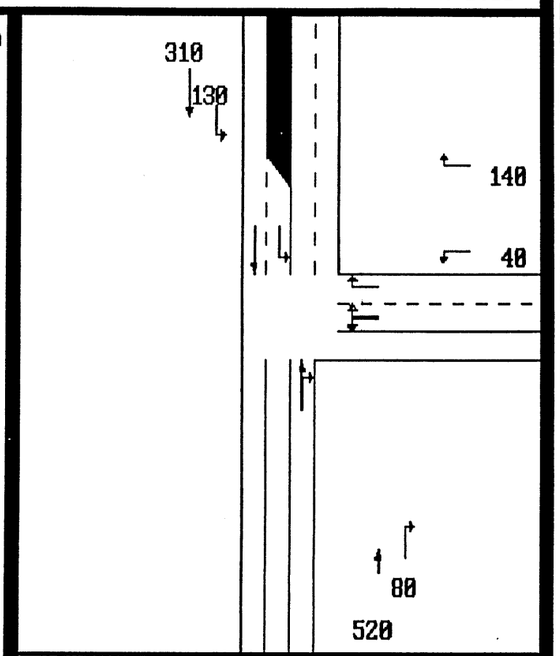
Ped Only Phase Dur: 0 Cycle: 105
Lost Time/Phase: 3.0 Seq: 123

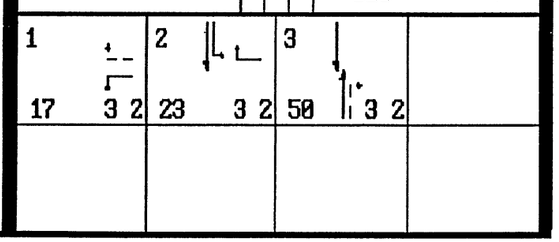




NETSIM Summary for Case: I71CARAM — I-71 W RAMP /CARPENTER RD
YEAR 2020 BUILD TRAFFIC — AM PEAK — Version 3.03

App	Lane Group	Queues Per Lane Avg/Max (veh)	Avg Speed (mph)	Spillback in Worst Lane (% of Peak Period)
WB	LR	2/ 4	10.2	0.0
	R	2/ 3	12.4	0.0
	All		11.1	0.0
NB	TR	11/ 12	10.3	0.0
	All		10.3	0.0
SB	L	3/ 4	4.6	0.0
	T	2/ 4	23.3	0.0
	All		15.7	0.0
Intersect.			11.9	

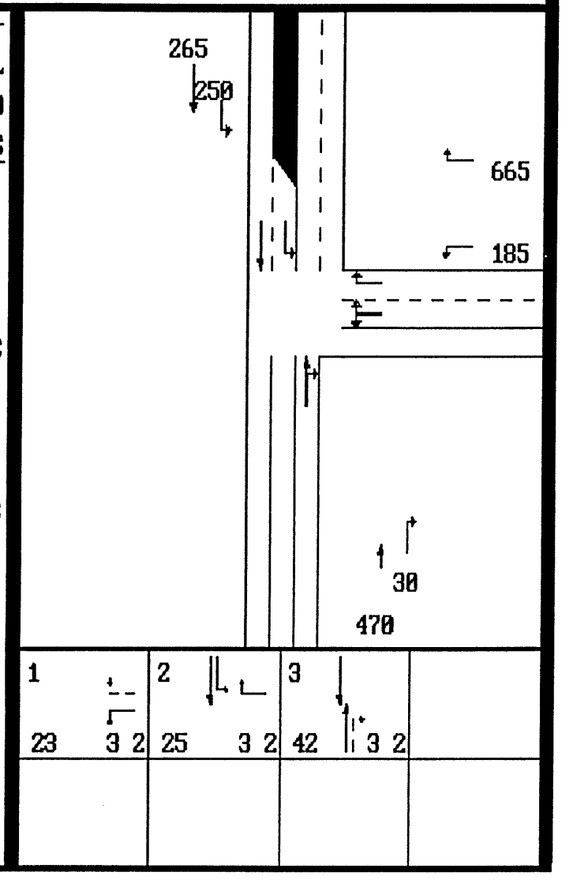




HCM Summary Results for Case: I71CARPM I-71 W RAMP /CARPENTER RD

YEAR 2020 BUILD TRAFFIC PM PEAK Version 3.03

Lane Grp	v/s	X v/c	Lane Grp Delay (sec/veh)	Lane Grp LOS	App Delay (sec/veh)	App LOS
WB LR	0.14	0.58	24.3	C	24.6	C
R	*0.44	0.90	24.7	C		
NB TR	0.33	0.80	21.7	C	21.7	C
SB L	*0.16	0.61	23.9	C	13.4	B
T	0.16	0.22	3.5	A		
Int.	0.99	1.08	20.8	C		



Input Data for Case: I71CARPM I-71 W RAMP /CARPENTER RD

YEAR 2020 BUILD TRAFFIC PM PEAK Version 3.03

Intersection Geometry

1)Number of Lanes Including Pockets

	EB	WB	NB	SB
Approach Street	0	2	1	2
Outbound Street	1	0	2	1

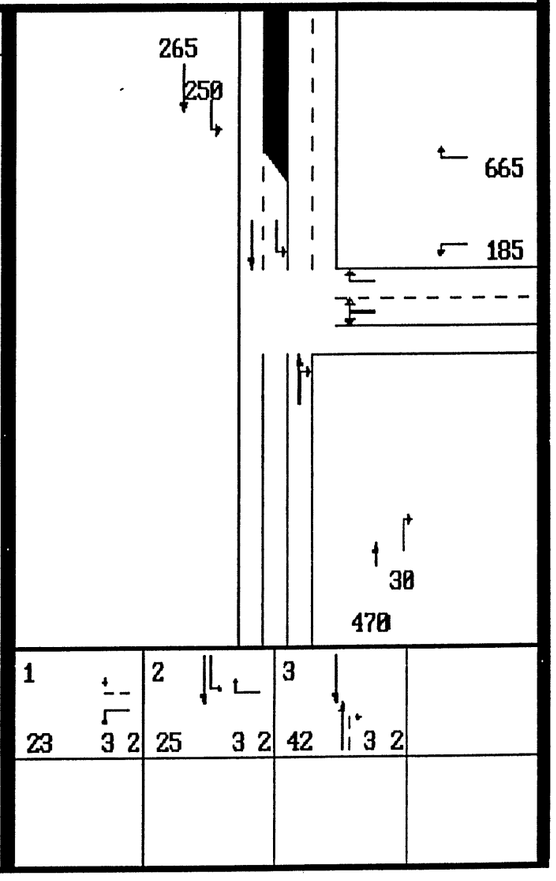
2)

	-Pkt Lanes- Left	Right	—Lane Lengths— Full L	Pkt R	Pkt
EB					
WB	0	0	600		
NB	0	0	600		
SB	1	0	600	220	

3)Need to Revise Channelization? N

4) Lane Widths (Feet)

	Median	2	3	4	5	6
EB						
WB		12.0	12.0			
NB		12.0				
SB		12.0	12.0			



Input Data for Case: I71CARPM — I-71 W RAMP /CARPENTER RD
YEAR 2020 BUILD TRAFFIC — PM PEAK — Version 3.03

Signal and Phasing Data

Pretimed, Actuated, Semi-Actuated?A

Key in Allowed Movements by Phase:
L=Left; T=Thru; R=Right, no peds;
P=Right w ped conflicts. OR
click mouse on signal icon ->

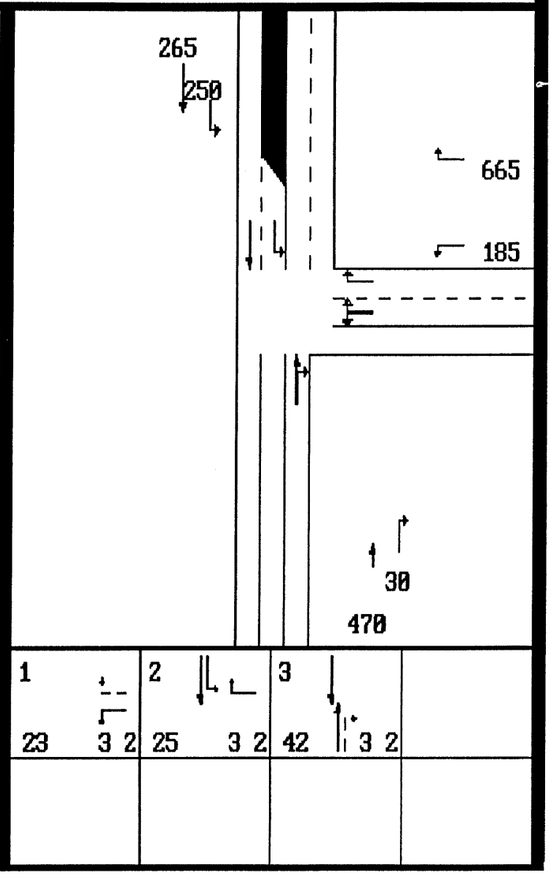
Traffic Movements by Phase

PH:	1	2	3	4	5	6	7	8
EB								
WB	L	P	R					
NB					TP			
SB			LT	T				

Phase Durations (Seconds)

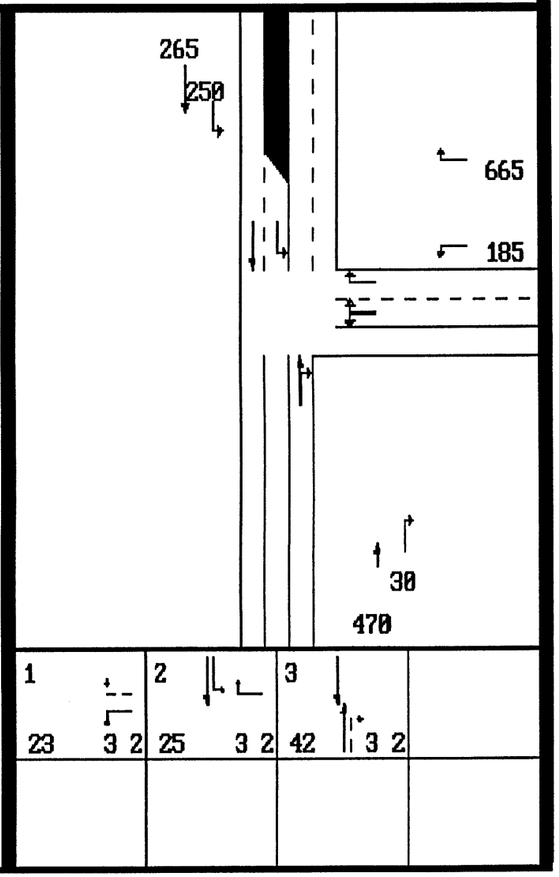
Grn	23	25	42
Yel	3	3	3
AR	2	2	2

Ped Only Phase Dur: 0 Cycle: 105
Lost Time/Phase: 3.0 Seq: 123



NETSIM Summary for Case: I71CARPM — I-71 W RAMP /CARPENTER RD
YEAR 2020 BUILD TRAFFIC — PM PEAK — Version 3.03

App	Lane Group	Queues Per Lane Avg/Max (veh)	Avg Speed (mph)	Spillback in Worst Lane (% of Peak Period)
WB	LR	10/ 11	8.3	0.0
	R	12/ 15	6.5	0.0
	All		7.4	0.0
NB	TR	10/ 12	9.0	0.0
	All		9.0	0.0
SB	L	7/ 11	4.1	0.0
	T	3/ 4	22.0	0.0
	All		11.0	0.0
Intersect.			8.6	



HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 06-29-1999
Northeast Ohio Areawide Coordinating Agency

Streets: (E-W) BOSTON RD (N-S) CARPENTER RD
Analyst: NOACA File Name: CARBOSA.HC9
Area Type: Other 9-9-98 AM PEAK
Comment: FUTURE YEAR 2020 ALTERNATE: D&E

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes		2	<	1	1		1		1			
Volumes		580	240	200	350		130		530			
Lane W (ft)		12.0		12.0	12.0		12.0		12.0			
RTOR Vols			0			0			0			
Lost Time		3.00	3.00	3.00	3.00		3.00		3.00			

Signal Operations

Phase Combination		1	2	3	4	5	6	7	8
EB	Left					*			
	Thru	*							
	Right	*				*			
	Peds	*				*			
WB	Left		*						
	Thru	*	*						
	Right								
	Peds		*						
NB	Right		*						
SB	Right								
Green		32.0A	28.0A			20.0A			
Yellow/AR		5.0	5.0			5.0			

Cycle Length: 95 secs Phase combination order: #1 #2 #5

Intersection Performance Summary

Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
EB TR	1275	3562	0.751	0.358	19.1	C	19.1	C
WB L	559	1770	0.397	0.316	16.7	C	8.2	B
T	1314	1863	0.296	0.705	3.4	A		
NB L	410	1770	0.351	0.232	19.9	C	11.8	B
R	916	1583	0.643	0.579	9.8	B		

Intersection Delay = 13.9 sec/veh Intersection LOS = B
Lost Time/Cycle, L = 6.0 sec Critical v/c(x) = 0.684

HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 06-28-1999
Northeast Ohio Areawide Coordinating Agency

Streets: (E-W) BOSTON RD (N-S) CARPENTER RD
Analyst: NOACA File Name: CARBOSP.HC9
Area Type: Other 9-9-98 PM PEAK
Comment: FUTURE YEAR 2020 ALTERNATE: D&E

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes		2	<	1	1		1		1			
Volumes		420	275	240	430		615		520			
Lane W (ft)		12.0		12.0	12.0		12.0		12.0			
RTOR Vols			0			0			0			
Lost Time		3.00	3.00	3.00	3.00		3.00		3.00			

Signal Operations

Phase Combination		1	2	3	4	5	6	7	8
EB	Left					*			
	Thru	*							
	Right	*				*			
	Peds	*				*			
WB	Left		*						
	Thru	*	*						
	Right								
	Peds		*						
NB	Right		*						
SB	Right								
Green		29.0A	19.0A			42.0A			
Yellow/AR		5.0	5.0			5.0			

Cycle Length: 105 secs Phase combination order: #1 #2 #5

Intersection Performance Summary

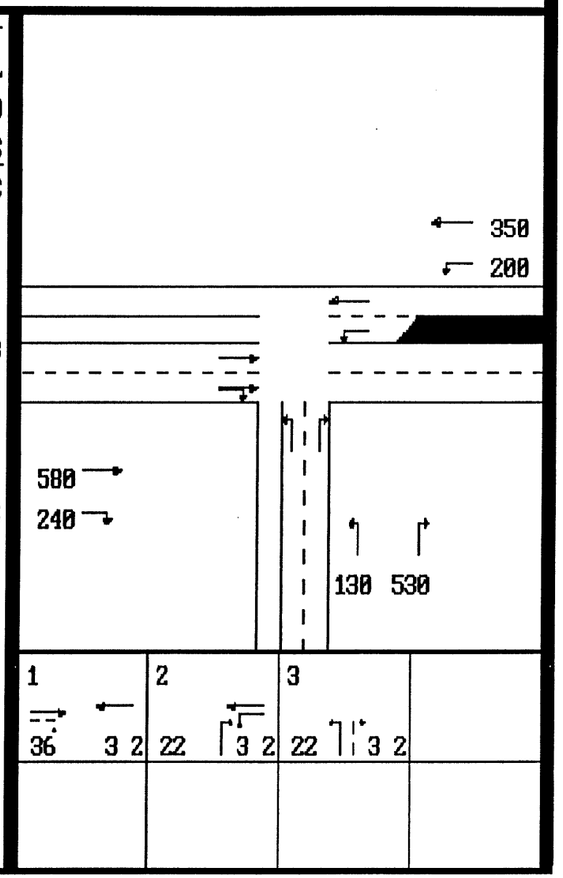
Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
EB TR	1035	3504	0.785	0.295	24.8	C	24.8	C
WB L	354	1770	0.754	0.200	31.6	D	18.2	C
T	976	1863	0.490	0.524	10.7	B		
NB L	742	1770	0.921	0.419	30.7	D	19.9	C
R	1025	1583	0.564	0.648	7.2	B		

Intersection Delay = 20.9 sec/veh Intersection LOS = C
Lost Time/Cycle, L = 9.0 sec Critical v/c(x) = 0.841

HCM Summary Results for Case: BOSCARPA BOSTON RD /CARPENTER RD

YR-2020 BUILD TRAFFIC AM PEAK Version 3.03

Lane Grp	v/s	X v/c	Lane Grp Delay (sec/veh)	L O S	App Delay (sec/veh)	L O S
EB TR	0.27	0.67	16.0	C	16.0	C
WB L	*0.13	0.50	20.3	C	9.9	B
T	0.21	0.31	3.9	A		
NB L	0.08	0.32	18.8	C	15.3	C
R	*0.37	0.74	14.5	B		
Int.	0.78	0.83	14.2	B		



Input Data for Case: BOSCARPA BOSTON RD /CARPENTER RD

YR-2020 BUILD TRAFFIC AM PEAK Version 3.03

Intersection Geometry

1)Number of Lanes Including Pockets

	EB	WB	NB	SB
Approach Street	2	2	2	0
Outbound Street	2	1	0	1

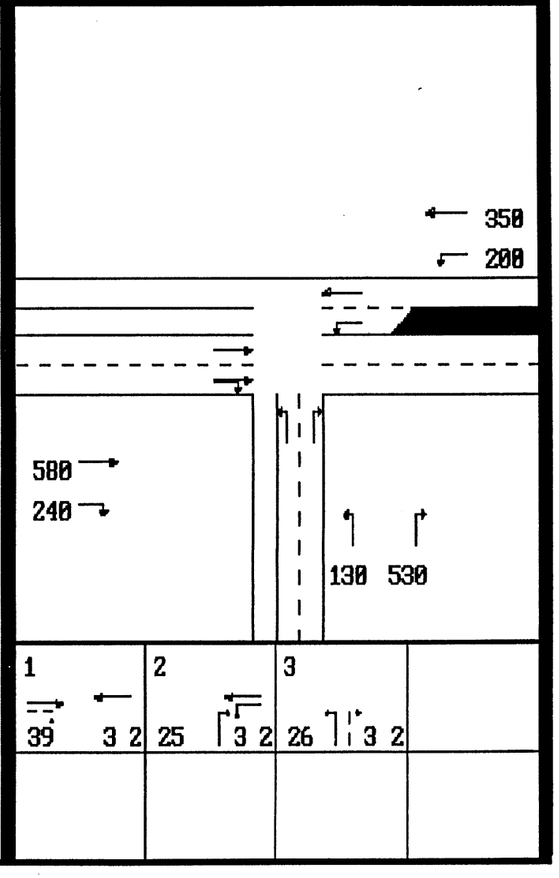
2)

	-Pkt Lanes- Left	Right	—Lane Lengths— Full L	Pkt L	Pkt R
EB	0	0	600		
WB	1	0	600	160	
NB	0	0	600		
SB					

3)Need to Revise Channelization? N

4) Lane Widths (Feet)

	Median	2	3	4	5	6
EB	12.0	12.0				
WB	12.0	12.0				
NB	12.0	12.0				
SB						



Input Data for Case: BOSCARPA — BOSTON RD /CARPENTER RD
YR-2020 BUILD TRAFFIC — AM PEAK — Version 3.03

Signal and Phasing Data

Pretimed, Actuated, Semi-Actuated?A

Key in Allowed Movements by Phase:
L=Left; T=Thru; R=Right, no peds;
P=Right w ped conflicts. OR
click mouse on signal icon ->

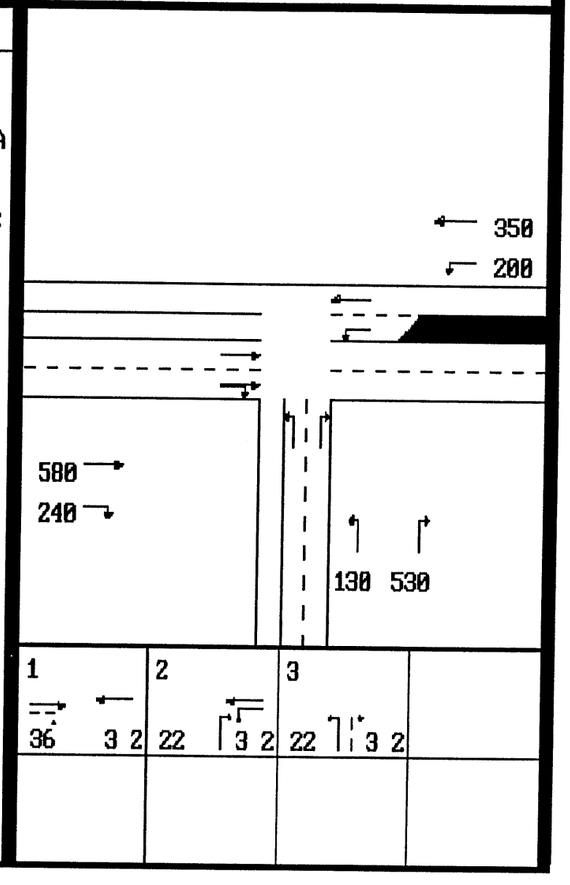
Traffic Movements by Phase

PH:	1	2	3	4	5	6	7	8
EB	TP							
WB	T	LT						
NB		R	L	P				
SB								

Phase Durations (Seconds)

Grn	36	22	22
Yel	3	3	3
AR	2	2	2

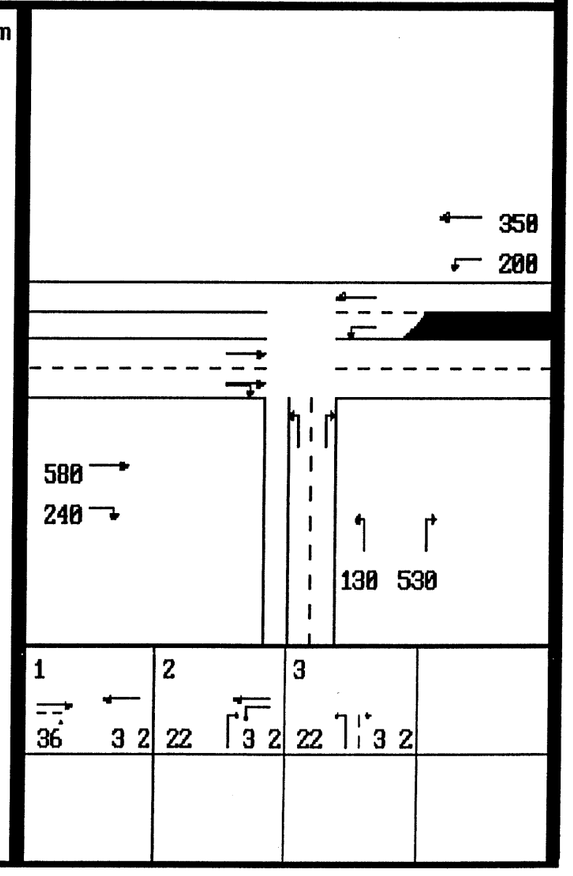
Ped Only Phase Dur: 0 Cycle: 95
Lost Time/Phase: 3.0 Seq: 123



NETSIM Summary for Case: BOSCARPA — BOSTON RD /CARPENTER RD
YR-2020 BUILD TRAFFIC — AM PEAK — Version 3.03

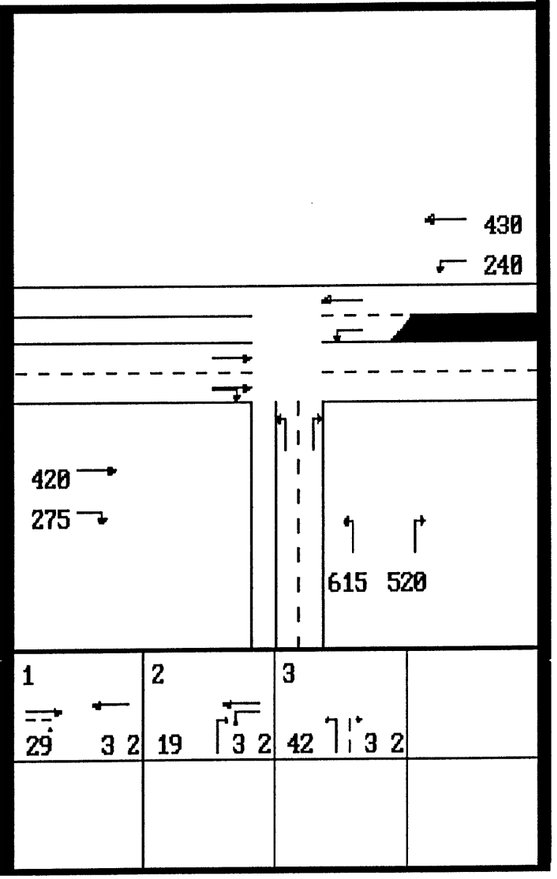
App	Lane Group	Queues Per Lane Avg/Max (veh)	Avg Speed (mph)	Spillback in Worst Lane (% of Peak Period)
EB	TR	9/ 11	10.0	0.0
	All		10.0	0.0
WB	L	3/ 5	3.9	0.0
	T	4/ 5	20.3	0.0
	All		15.4	0.0
NB	L	4/ 6	7.7	0.0
	R	9/ 11	8.7	0.0
	All		8.4	0.0

Intersect. 10.3



HCM Summary Results for Case: BOSCARPP BOSTON RD /CARPENTER RD
YR-2020 BUILD TRAFFIC PM PEAK Version 3.03

	Lane Grp	v/s	X v/c	Lane Grp Delay (sec/veh)	L O S	App Delay (sec/veh)	L O S
EB	TR	0.23	0.78	24.7	C	24.7	C
WB	L	*0.15	0.75	31.6	D	18.2	C
	T	0.26	0.49	10.7	B		
NB	L	*0.39	0.92	30.9	D	20.6	C
	R	0.37	0.59	8.4	B		
Int.		0.81	0.86	21.1	C		



Input Data for Case: BOSCARPP BOSTON RD /CARPENTER RD
YR-2020 BUILD TRAFFIC PM PEAK Version 3.03

Intersection Geometry

1)Number of Lanes Including Pockets

	EB	WB	NB	SB
Approach Street	2	2	2	0
Outbound Street	2	1	0	1

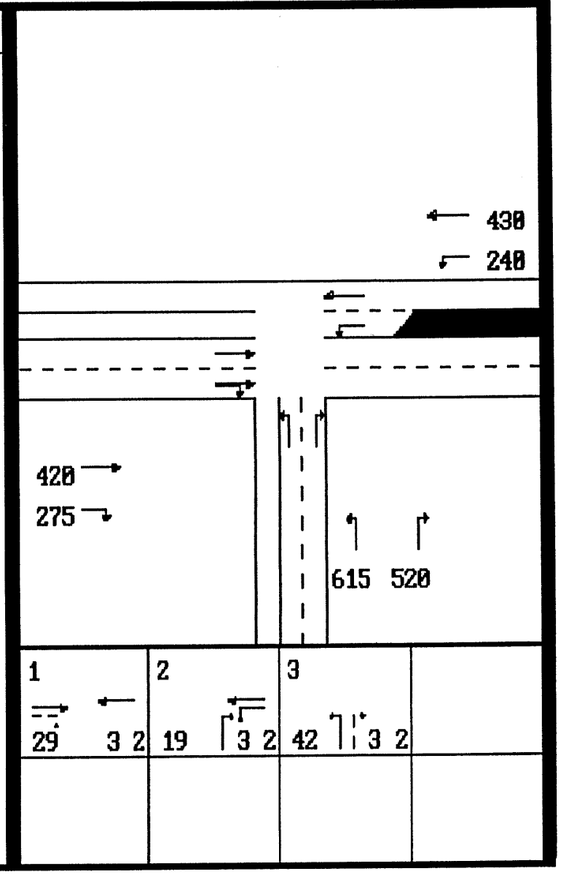
2)

	-Pkt Lanes- Left	Right	—Lane Lengths— Full L	Pkt	R Pkt
EB	0	0	600		
WB	1	0	600	160	
NB	0	0	600		
SB					

3)Need to Revise Channelization? N

4) Lane Widths (Feet)

	Median	2	3	4	5	6
EB	12.0	12.0				
WB	12.0	12.0				
NB	12.0	12.0				
SB						



Input Data for Case: BOSCARPP BOSTON RD /CARPENTER RD
YR-2020 BUILD TRAFFIC PM PEAK Version 3.03

Signal and Phasing Data

Pretimed, Actuated, Semi-Actuated?A

Key in Allowed Movements by Phase:
L=Left; T=Thru; R=Right, no peds;
P=Right w ped conflicts. OR
click mouse on signal icon ->

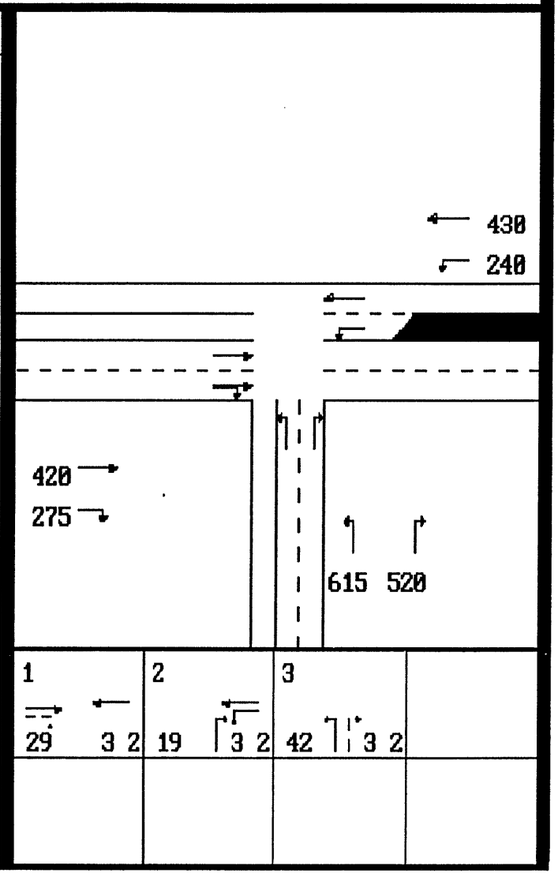
Traffic Movements by Phase

PH:	1	2	3	4	5	6	7	8
EB	TP							
WB	T	LT						
NB		R	L	P				
SB								

Phase Durations (Seconds)

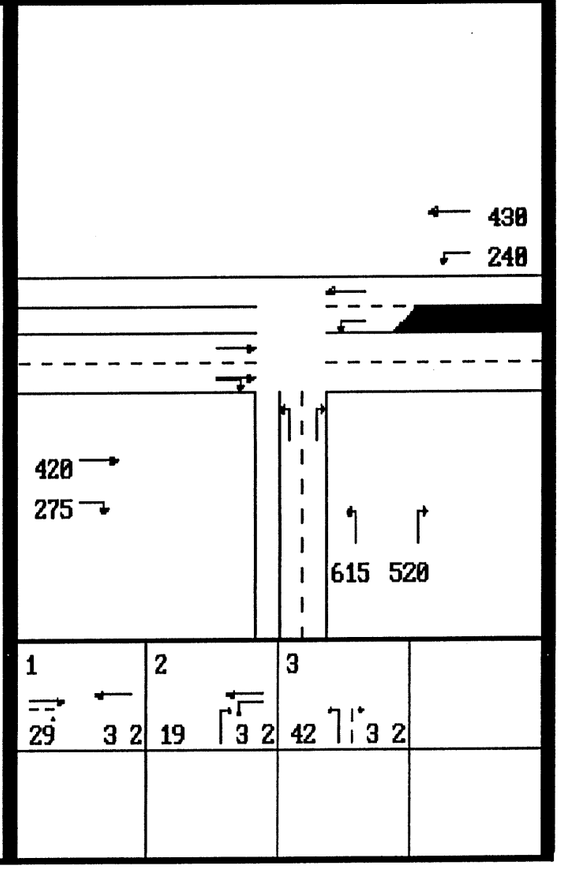
Grn	29	19	42
Yel	3	3	3
AR	2	2	2

Ped Only Phase Dur: 0 Cycle: 105
Lost Time/Phase: 3.0 Seq: 123



NETSIM Summary for Case: BOSCARPP BOSTON RD /CARPENTER RD
YR-2020 BUILD TRAFFIC PM PEAK Version 3.03

App	Lane Group	Queues Per Lane Avg/Max (veh)	Avg Speed (mph)	Spillback in Worst Lane (% of Peak Period)
EB	TR	10/ 14	7.3	0.0
	All		7.3	0.0
WB	L	5/ 6	3.5	0.0
	T	10/ 11	12.3	0.0
	All		10.2	0.0
NB	L	14/ 18	7.7	0.0
	R	8/ 11	12.0	0.0
	All		9.2	0.0
Intersect.			8.8	



HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 06-29-1999
Northeast Ohio Areawide Coordinating Agency

Streets: (E-W) Boston Rd (N-S) Benbow Rd Extension
Analyst: NOACA File Name: BOSBENCA.HC9
Area Type: Other 9-3-98 AM PEAK
Comment: FUTURE YEAR 2020 ALTERNATE: D&E

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes		1	1	1	1		>		<			
Volumes		360	750	160	360		190		60			
Lane W (ft)		12.0	12.0	12.0	12.0			12.0				
RTOR Vols			0			0			0			
Lost Time		3.00	3.00	3.00	3.00		3.00		3.00			

Signal Operations

Phase Combination		1	2	3	4	5	6	7	8
EB	Left								
	Thru	*							
	Right	*							
	Peds	*							
WB	Left		*						
	Thru	*	*						
	Right								
	Peds	*	*						
NB	Right								
SB	Right								
Green		35.0A	25.0A						
Yellow/AR		5.0	5.0						

NB	Left	*			
	Thru				
	Right	*			
	Peds	*			
SB	Left				
	Thru				
	Right				
	Peds	*			
EB	Right	*			
WB	Right				
Green		30.0A			
Yellow/AR		5.0			

Cycle Length: 105 secs Phase combination order: #1 #2 #5

Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
EB	T	656	1863	0.609	0.352	19.3	C	12.6	B
	R	1085	1583	0.767	0.686	9.4	B		
WB	L	455	1770	0.391	0.257	21.1	C	10.5	B
	T	1189	1863	0.336	0.638	5.7	B		
NB	LR	475	1557	0.586	0.305	21.3	C	21.3	C

Intersection Delay = 13.2 sec/veh Intersection LOS = B
Lost Time/Cycle, L = 6.0 sec Critical v/c(x) = 0.665

HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 06-29-1999
Northeast Ohio Areawide Coordinating Agency

Streets: (E-W) Boston Rd (N-S) Benbow Rd Extension
Analyst: NOACA File Name: BOSBENCP.HC9
Area Type: Other 9-3-98 PM Peak
Comment: FUTURE YEAR 2020 ALTERNATE: D&E

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes		1	1	1	1		>		<			
Volumes		630	310	70	430		240		60			
Lane W (ft)		12.0	12.0	12.0	12.0			12.0				
RTOR Vols			0			0			0			
Lost Time		3.00	3.00	3.00	3.00		3.00		3.00			

Signal Operations

Phase Combination		1	2	3	4	5	6	7	8
EB	Left								
	Thru	*							
	Right	*							
	Peds	*							
WB	Left		*						
	Thru	*	*						
	Right								
	Peds	*	*						
NB	Right								
SB	Right								
Green		40.0A	13.0A						
Yellow/AR		5.0	5.0						

NB	Left	*			
	Thru				
	Right	*			
	Peds	*			
SB	Left				
	Thru				
	Right				
	Peds	*			
EB	Right	*			
WB	Right				
Green		27.0A			
Yellow/AR		5.0			

Cycle Length: 95 secs Phase combination order: #1 #2 #5

Intersection Performance Summary

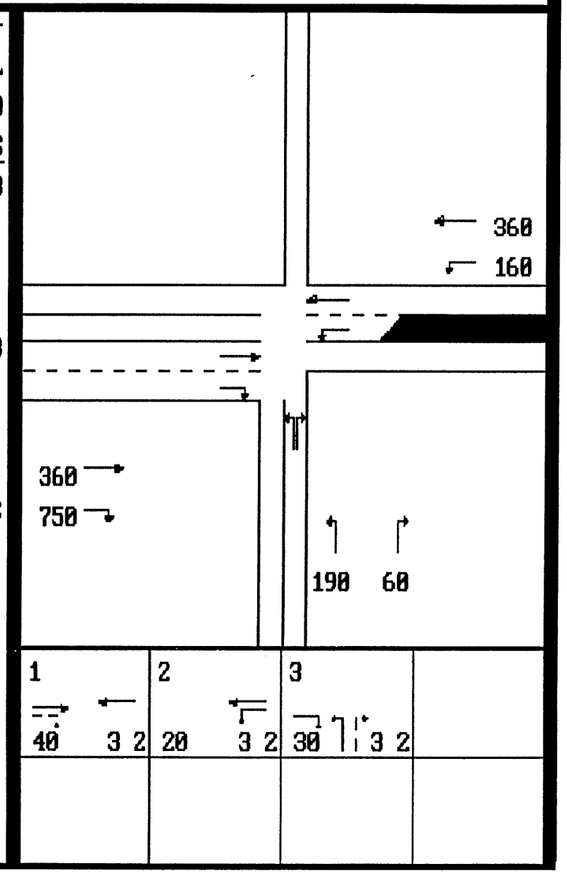
	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
EB	T	824	1863	0.850	0.442	21.2	C	14.9	B
	R	1233	1583	0.279	0.779	1.9	A		
WB	L	279	1770	0.279	0.158	22.9	C	8.1	B
	T	1177	1863	0.406	0.632	5.7	B		
NB	LR	477	1564	0.700	0.305	21.9	C	21.9	C

Intersection Delay = 14.2 sec/veh Intersection LOS = B
Lost Time/Cycle, L = 9.0 sec Critical v/c(x) = 0.700

HCM Summary Results for Case: BOSBENBA BOSTON RD /BENBOW EXTEN

YR 2020 BUILD TRAFFIC AM PEAK Version 3.03

			- Lane Grp - Delay (sec/ veh)	LOS	- App - Delay (sec/ veh)	LOS
Lane Grp	v/s	X v/c				
EB T	0.21	0.54	16.2	C	10.8	B
R	*0.53	0.75	8.2	B		
WB L	*0.10	0.48	24.3	C	11.5	B
T	0.21	0.34	5.7	B		
NB LR	*0.18	0.59	21.3	C	21.3	C
Int.	0.81	0.88	12.4	B		



Input Data for Case: BOSBENBA BOSTON RD /BENBOW EXTEN

YR 2020 BUILD TRAFFIC AM PEAK Version 3.03

Intersection Geometry

1)Number of Lanes Including Pockets

	EB	WB	NB	SB
Approach Street	2	2	1	0
Outbound Street	1	1	1	1

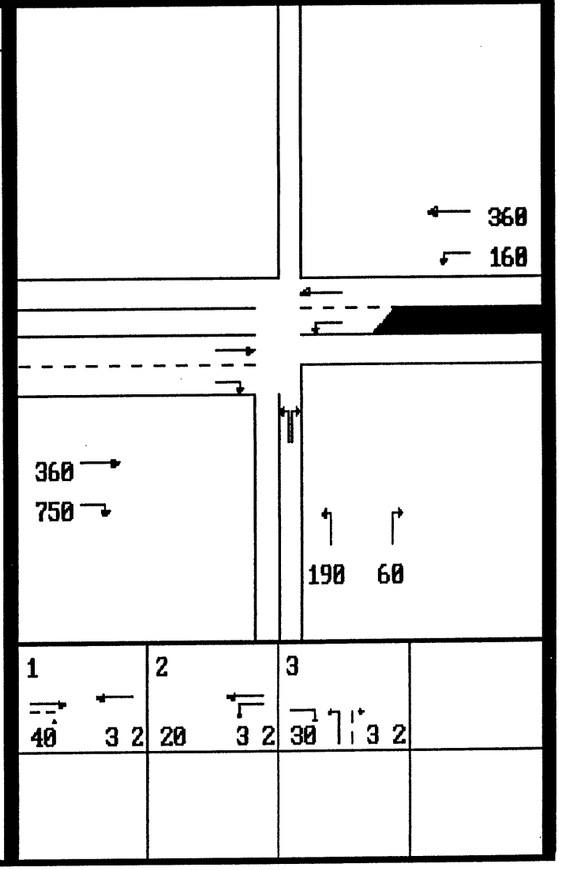
2)

	-Pkt Lanes- Left	Right	—Lane Lengths— Full L	Pkt	R Pkt
EB	0	0	600		
WB	1	0	600	160	
NB	0	0	600		
SB					

3)Need to Revise Channelization? N

4) Lane Widths (Feet)

	Median	2	3	4	5	6
EB		12.0	12.0			
WB		12.0	12.0			
NB		12.0				
SB						



Input Data for Case: BOSBENP BOSTON RD /BENBOW EXTEN
YR 2020 BUILD TRAFFIC PM PEAK Version 3.03

Signal and Phasing Data

Pretimed, Actuated, Semi-Actuated?A

Key in Allowed Movements by Phase:
L=Left; T=Thru; R=Right, no peds;
P=Right w ped conflicts. OR
click mouse on signal icon ->

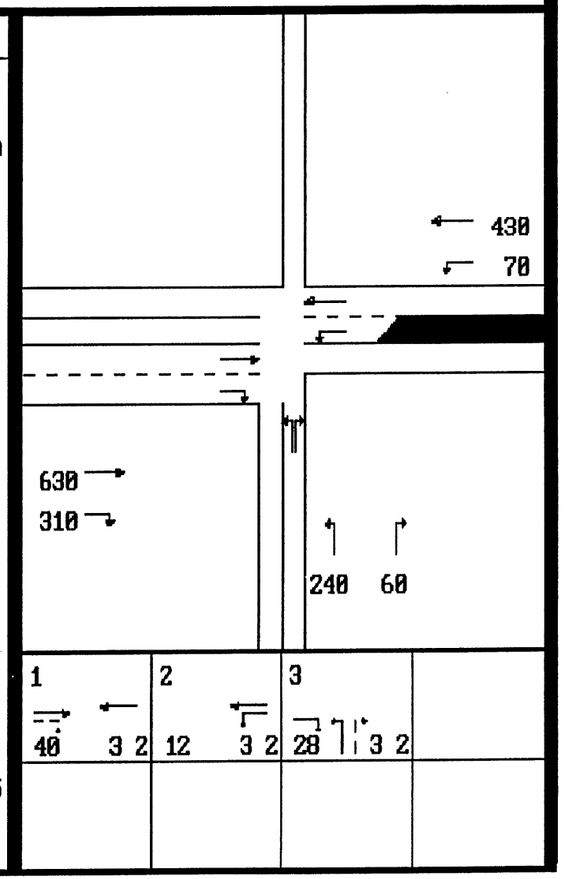
Traffic Movements by Phase

PH:	1	2	3	4	5	6	7	8
EB	TP		R					
WB	T	LT						
NB			L P					
SB								

Phase Durations (Seconds)

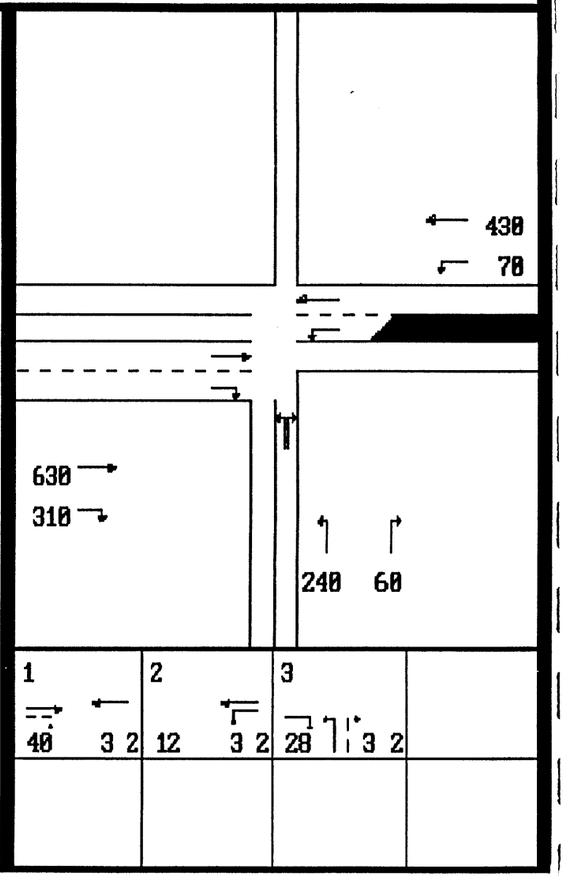
Grn	40	12	28
Yel	3	3	3
AR	2	2	2

Ped Only Phase Dur: 0 Cycle: 95
Lost Time/Phase: 3.0 Seq: 123



NETSIM Summary for Case: BOSBENP BOSTON RD /BENBOW EXTEN
YR 2020 BUILD TRAFFIC PM PEAK Version 3.03

App	Lane Group	Queues Per Lane Avg/Max (veh)	Avg Speed (mph)	Spillback in Worst Lane (% of Peak Period)
EB	T	13/ 17	9.9	0.0
	R	2/ 4	19.0	0.0
	All		11.8	0.0
WB	L	2/ 4	2.8	0.0
	T	6/ 7	17.1	0.0
	All		14.9	0.0
NB	LR	7/ 7	8.6	0.0
	All		8.6	0.0
Intersect.			11.7	



APPENDIX XI

Copies of the Four Alternatives Provided By ODOT 12 for the Configuration of the Proposed IR-71/Boston Road Interchange

OHIO
FHWA REGION 5
FEDERAL PROJECT

HOWE RD

CARPENTER RD

BOSTON RD

71

BENBOW RD

200 100 0 200 400 600

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION
DISTRICT 12 LOCATION & DESIGN

I-71 AT BOSTON RD

ALTERNATE A

CUYAHOGA COUNTY OHIO

DESIGNED	TRACED	CHECKED	REVIEWED	REVISED
DATE	DATE	DATE	DATE	SHEET 1

OHIO
FHWA REGION 5
FEDERAL PROJECT

HOWE

STUMBAUGH RD

CARPENTER RD

BOSTON RD

FENBLOW RD

200 100 0 200 400 600

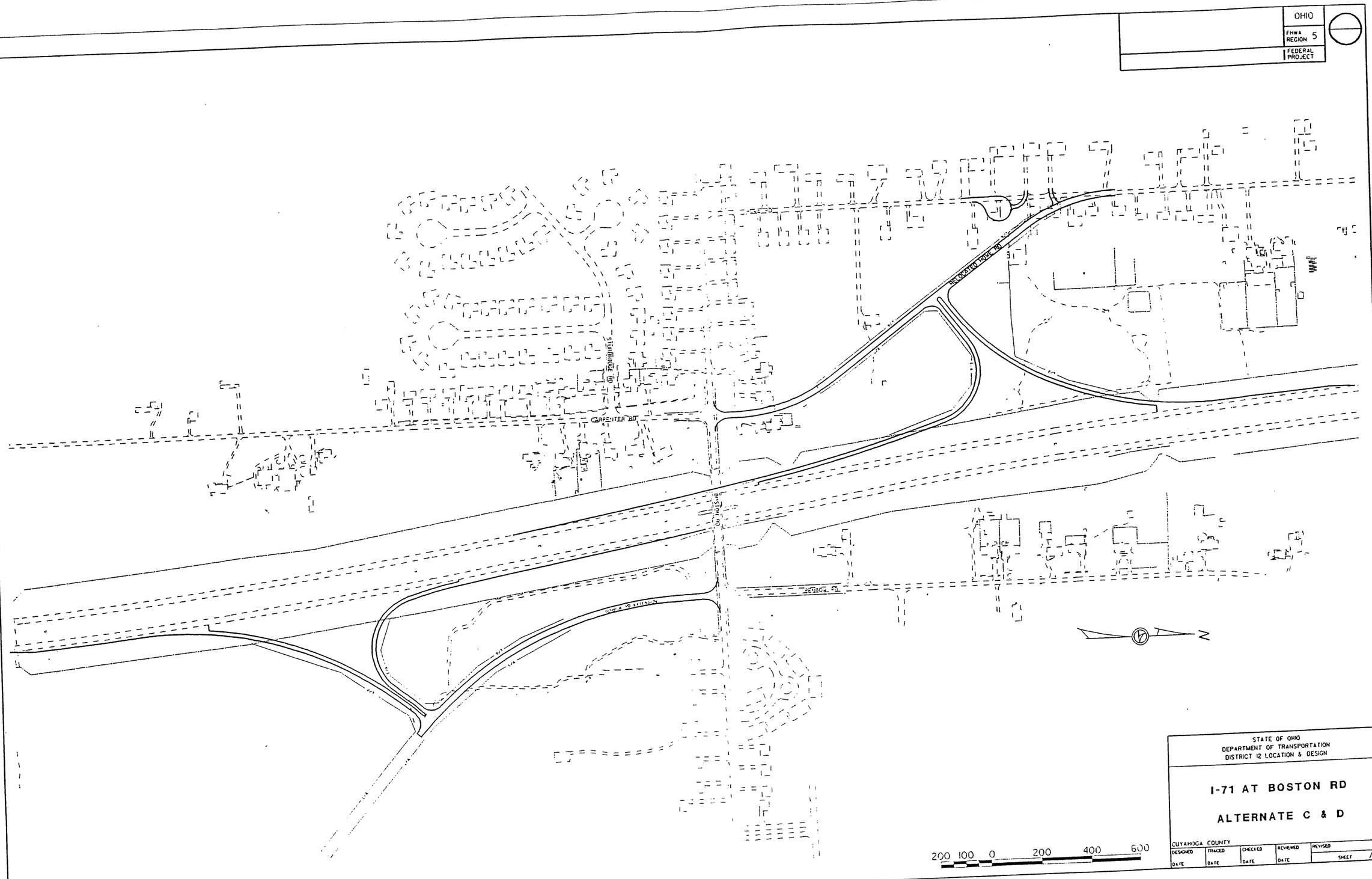
STATE OF OHIO
DEPARTMENT OF TRANSPORTATION
DISTRICT 12 LOCATION & DESIGN

I-71 AT BOSTON RD
URBAN INTERCHANGE

CUYAHOGA COUNTY OHIO

DESIGNED	TRACED	CHECKED	REVIEWED	REVISED
DATE	DATE	DATE	DATE	SHEET 1

OHIO
FHWA REGION 5
FEDERAL PROJECT



200 100 0 200 400 600

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION
DISTRICT 12 LOCATION & DESIGN

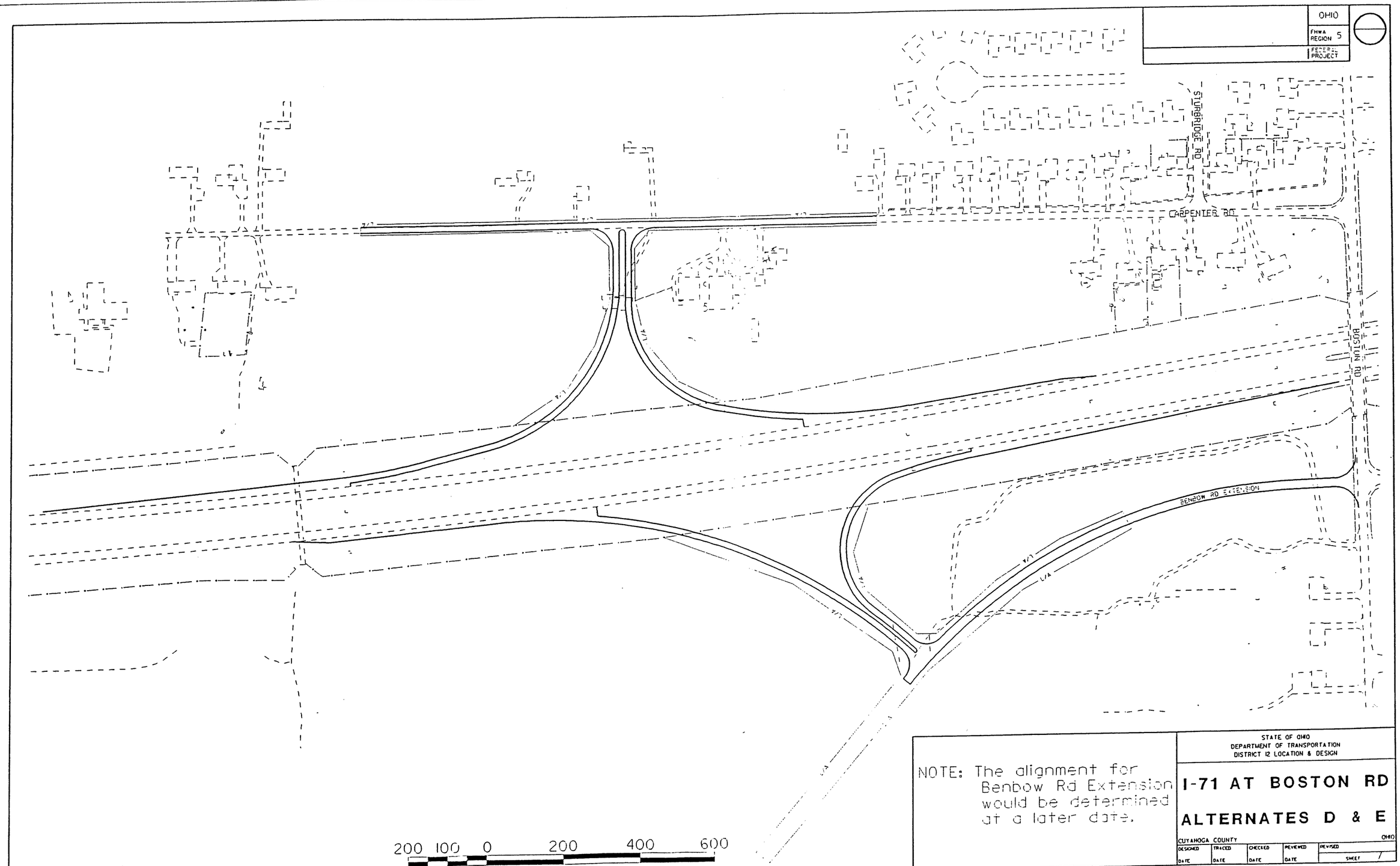
I-71 AT BOSTON RD

ALTERNATE C & D

CUYAHOGA COUNTY — OHIO

DESIGNED	TRACED	CHECKED	REVIEWED	REVISED
DATE	DATE	DATE	DATE	SHEET /

OHIO
FHWA REGION 5
FEDERAL PROJECT



NOTE: The alignment for Benbow Rd Extension would be determined at a later date.

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION
DISTRICT 12 LOCATION & DESIGN

I-71 AT BOSTON RD

ALTERNATES D & E

CUYAHOGA COUNTY — OHIO

DESIGNED	TRACED	CHECKED	REVIEWED	REVISED
DATE	DATE	DATE	DATE	SHEET 1