OHIO DEPARTMENT OF TRANSPORTATION
2017 REHABILITATION FEASIBILITY STUDY
PID NO 99972

DETROIT-SUPERIOR BRIDGE OVER CUYAHOGA RIVER
BRIDGE NO. CUY-6-1456

SFN: 1800930

REVISED MAY 2017

PREPARED BY:

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I. EXECUTIVE SUMMARY

The original feasibility study did not meet budget constraints for this project. The intent of the revised feasibility study is to summarize several additional Alternative No. 2's and their associated costs so that the District can make an informed decision for rehabilitation.

CUY-6-1456 (SFN 1800930), commonly known as the Detroit-Superior Bridge and later renamed the Veteran's Memorial Bridge, is a 1917 double-deck structure carrying vehicular and pedestrian traffic over the Cuyahoga River Valley (**Photos 1 & 2**). The bridge is approximately 2,880 feet long, including 1,673 feet of subway tunnel that is linked by the lower deck. In its original design, the upper deck carried vehicular and pedestrian traffic while the lower deck had four streetcar lines and capacity for two future tracks. The streetcar lines across the Detroit-Superior Bridge were discontinued in 1953. The Detroit-Superior Bridge is included on the National Register of Historic Places. With the bridge reaching it's 100th year of service, one of the goals is to provide a rehabilitation scheme that will allow the bridge to be of service for the next 50 years.

Pennoni was charged with the following tasks for the Feasibility Study:

1. Document the extent of the deterioration of the concrete on the approach spans.
2. Research the use Fiber Reinforced Polymer (FRP) to contain the concrete repairs and future deterioration over the public areas.
3. Identify the right-of-way needs for the rehabilitation.
4. Miscellaneous items such as, MOT, Navigation Lights, additional security for the Central Street Bridge Tenders Garage and vandal proofing the lower portions of the approach spans.
5. Provide alternates for the necessary repair.

In addition to the in-depth Inspections made in 2015 and in 2016, Pennoni documented the extensive concrete deterioration in the West Station, Spans 1A, 1B and 1 through 13 and the East Station. Several rehabilitation projects have been completed throughout the 100-year life span, including major rehabilitations in 1967-1970 and 1995-1997. The most recent rehabilitation from 2014-2016 was to repair concrete deterioration throughout the structure. Most of the deteriorated areas, including some repaired in the 1995-97 rehabilitation showed signs of reinforcing steel oxidation, or rusting. Several of those areas are in the West Station and lower deck area that get no salt. Therefore, non-chloride related concrete corrosion is likely present. Concrete corrosion is the chemical, colloidal or physicochemical deterioration and disintegration of solid concrete components and structures, due to attack by reactive liquids and gases. One type of concrete corrosion, carbonation, is a potential contributor of the ongoing deterioration. To verify this assumption, samples of the spalled concrete were tested for pH content (**Appendix C**). The concrete material of the samples show low alkalinity levels (< 12), suggesting that carbonation may be occurring. Carbonation is the result of CO_2 absorption into the concrete. In cities like Cleveland, carbonization can permeate concrete as

much as 0.04 inches per year, or 3 inches before the epoxy-urethane sealer was applied in 1997.

Several different FRP materials were investigated. Because the goal is to contain the deteriorated concrete and not to strengthen the members, it was determined that a low strength FRP wrap would be adequate for this application. The wrap would not alter the existing load paths. It should be noted that ODOT Central Office is studying FRP wrap for seismic containment on bridge columns. This assessment is outside the scope of our work and no consideration of seismic loading was taken into consideration.

Pennoni also looked at cathodic protection to stabilize the increasing concrete corrosion rate, and possibly to reverse it. Cathodic protection can be obtained with passive induction using anode pucks or active induction such as impressed current. Both have been used successfully over the past two decades. For this application, the active cathodic protection would provide the best results.

Primary construction tasks of the three alternates in this feasibility study are:

1. Maintenance Alternate: Replace upper deck wearing surface, Remove the deteriorated concrete but not patch the deteriorated concrete on the entire bridge.
2. FRP Alternate: Research the use of Fiber Reinforced Polymer (FRP) wraps to contain the concrete repairs and future deterioration over public areas. Replace upper deck wearing surface, Remove and patch the deteriorated concrete, Use of fiber wrap on the entire bridge.
3. Cathodic Protection Alternate. Replace upper deck wearing surface, patch deteriorated concrete, and apply active cathodic protection.

Alternate No. 1, at $2.6 Million, does meet the purpose and need of the project, and will only provide a 5-year service life since further deterioration is not inhibited. Alternate No. 2, at $26.0 Million, does meet the purpose and need of the project, and will provide 25 to 50-year service life and enhanced public safety. This alternate will not stop the current deterioration. Potentially, periodic small projects will be needed to secure loose or damaged FRP wrap. Both FRP suppliers that we spoke with cautioned us on the permeability of the FRP material. While both glass and carbon FRP wraps do have some permeability, it is not as great as exposed concrete. This may lead to further deterioration and higher rehabilitation cost in the future.

Alternate No. 2 has been broken down into smaller projects to meet the budget needs of the District. The recommended alternative is **Alternative No. 2C** based on addressing public safety, extending the service life of the bridge, and economic analysis.

Alternate No. 3 is at $33.2 Million. While it may be the best solution for extending the life of the existing concrete for another 50 years, it does not meet our budget constraints.

All alternatives include the Maintenance Work Task 1 that were requested. A summary of Estimated Construction Costs is included in **Appendix A**. All estimates have been projected to construction in Year 2020.

Photo 1– North Elevation, Spans 4 through 6.

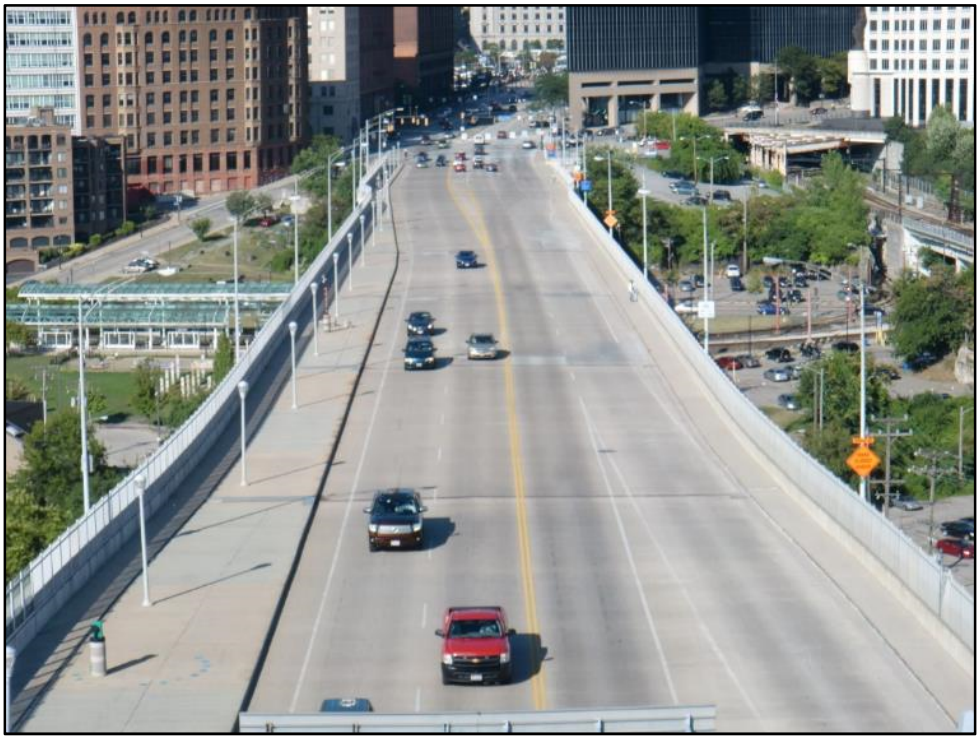

Photo 2– East Approach Spans Deck, Looking East.

II. PURPOSE & NEED

This project is being performed to restore the integrity of the bridge's concrete portions by arresting the deterioration of the concrete superstructure and substructure. On occasion, loose concrete has fallen, creating a hazard to the public safety below. In its most recent bridge inspection, the bridge, CUY-6-1456 (SFN 1800930) General Appraisal Rating was a ***5*** or ***Fair*** Condition. With this rehabilitation project, ODOT expects to maintaining the structure in good condition for a service life of 50 years.

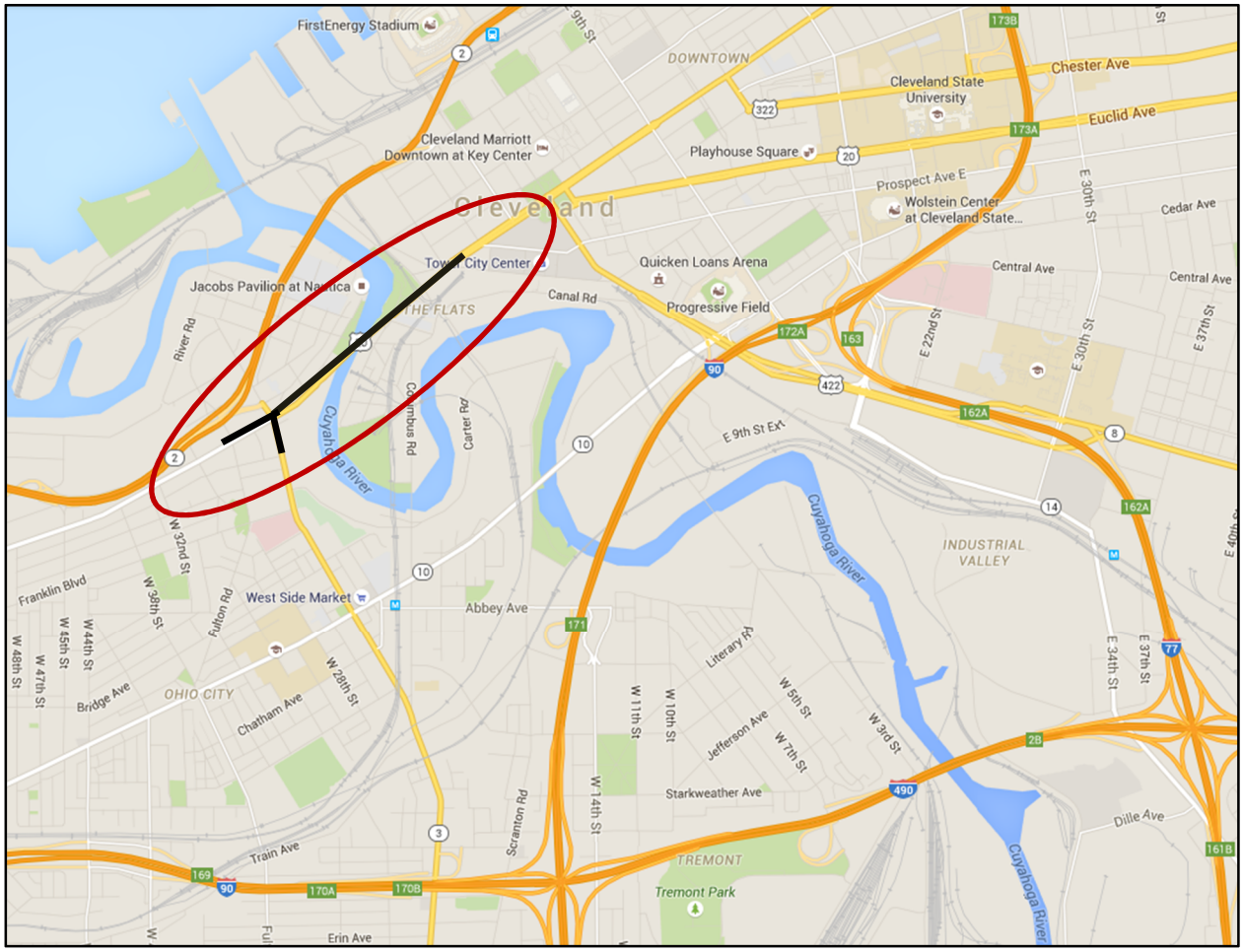

Figure 1 – Location of CUY-6-1456 (Circled).

Scope of Repairs

The repairs discussed in this feasibility study are as follows:

- Patching or replacement of the upper deck concrete wearing surface.
- Elimination of falling concrete over public areas.
- Investigation of FRP wrap on lower superstructure components.
- Continuation of repairs in the West Station, West 25th Street Tunnel and Detroit Avenue Tunnel.
- Placement of masonry block wall in Span 1A to prevent unauthorized access.
- Placement of a vandal resistant barrier to restrict unauthorized access from the Center Street Swing Bridge operator's car shelter to the Pier 4 pedestals.

Definition of Public Spaces

For this feasibility study, the defined public spaces below the structure are shown in **Appendix B**. Areas designated as public space meet the following criteria:

1. Areas below or within 10 feet of concrete arch spans, and
2. Areas commonly occupied by vehicular and/or pedestrian traffic.

Following this guide, Span 1 and Span 4 are not considered public space. Following the recent announcement that the Cleveland Metroparks plan to create a new Irishtown Bend park, 75% of the area beneath Span 2 has been added to the public space inventory. [1]

[1] Cleveland Plain Dealer, *Port hires design team to envision transformation of Irishtown Bend,* February 9, 2017.

III. BRIDGE CONDITION

Bridge Description

CUY-6-1456 (SFN 1800930), commonly known as the Detroit-Superior Bridge and later renamed the Veteran's Memorial Bridge, is a 1917 double-deck structure carrying vehicular and pedestrian traffic over the Cuyahoga River Valley **(See Photos 1 & 2**). The bridge is approximately 2,880 feet long, including 1,673 feet of subway tunnel that is linked by the lower deck. In its original design, the upper deck carried vehicular and pedestrian traffic while the lower deck had four streetcar lines and capacity for two future tracks. The streetcar lines across the Detroit-Superior Bridge were discontinued in 1953. The Detroit-Superior Bridge is included on the National Register of Historic Places.

General plan and elevation views of the Detroit-Superior Bridge are included in **Figure 2**. **Figure 3** contains the typical nomenclature of the concrete elements of the main concrete spans.

The Detroit-Superior Bridge is composed of three distinct units. The first unit, the West Approach, is comprised of the West Station area spanning a total of 350 feet west of Tower A and two abandoned subway tunnels: the Detroit Avenue Tunnel (660 feet long) and the West 25th Street Tunnel (480 feet long). Several utilities are pass through the West Station and tunnels. Since the late 1980s, the West Station has been opened to the public for tours and festivals.

The main unit is Spans 1A, 1B and 1 through 13. Spans 1A and 1B are transition structures from the subterranean West Station to the double-deck approach and main spans. These two concrete cellular spans total 220 feet long and each has enclosed cellular construction below the lower deck.

The main spans, Span 1 through 13, are double-deck spans with vehicular and pedestrian traffic on the upper deck and utilities and maintenance access on the lower deck. Spans 1 through 3, 5 through 11 and Span 13 are concrete open spandrel arch spans, and Span 12 is a concrete encased steel half through arch. The main span, Span 4, is a 591-foot, three-hinged steel half-through arch truss in a Pratt configuration.

The third unit, the East Station, is a concrete cellular span that extends 165 feet past the East Abutment. A three panel long, cellular construction is present under the East Station lower deck immediately behind the East Abutment.

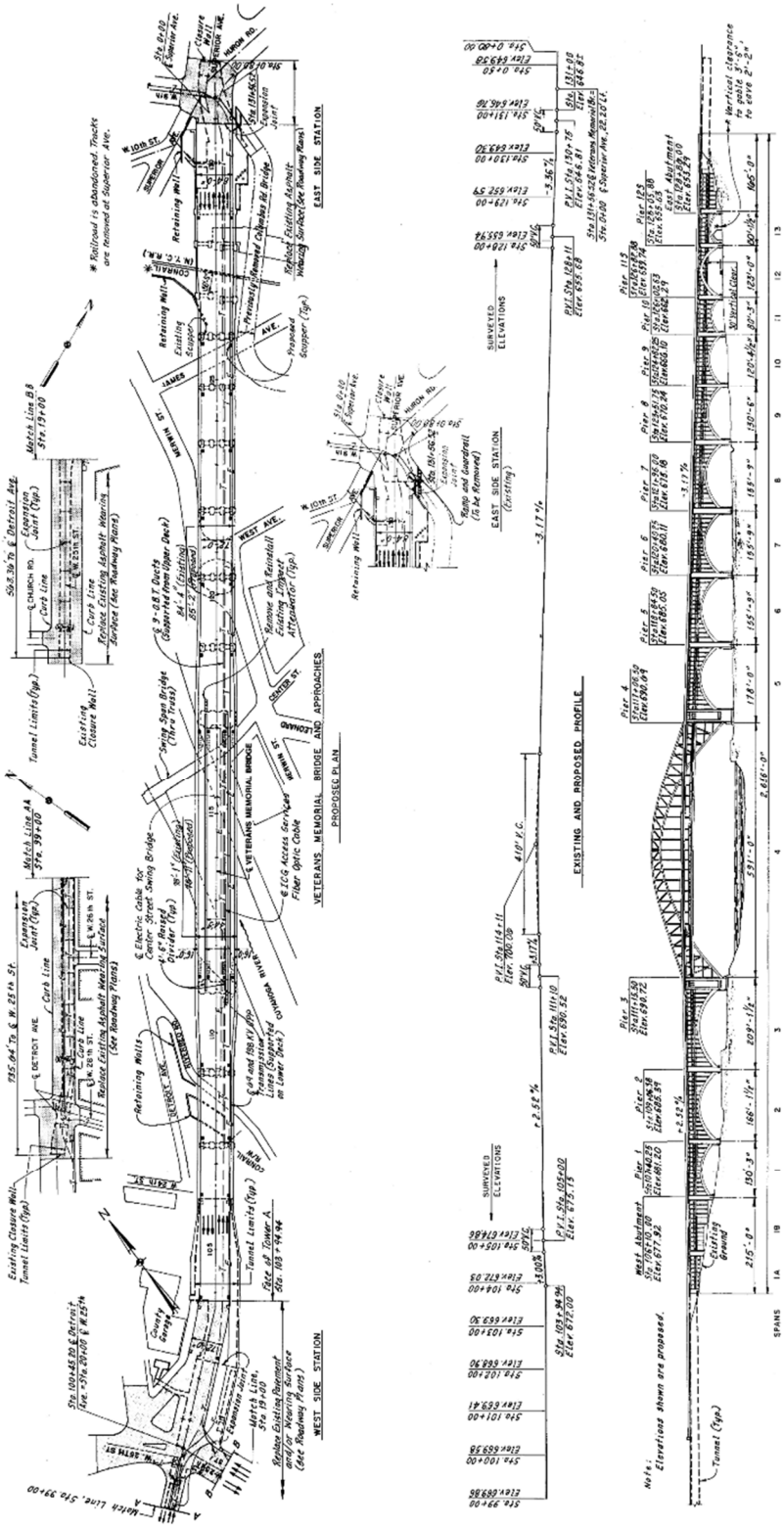

Figure 2 – CUY-6-1456 Plan & Elevation (Veterans Memorial Bridge Rehabilitation Plans, 1994).

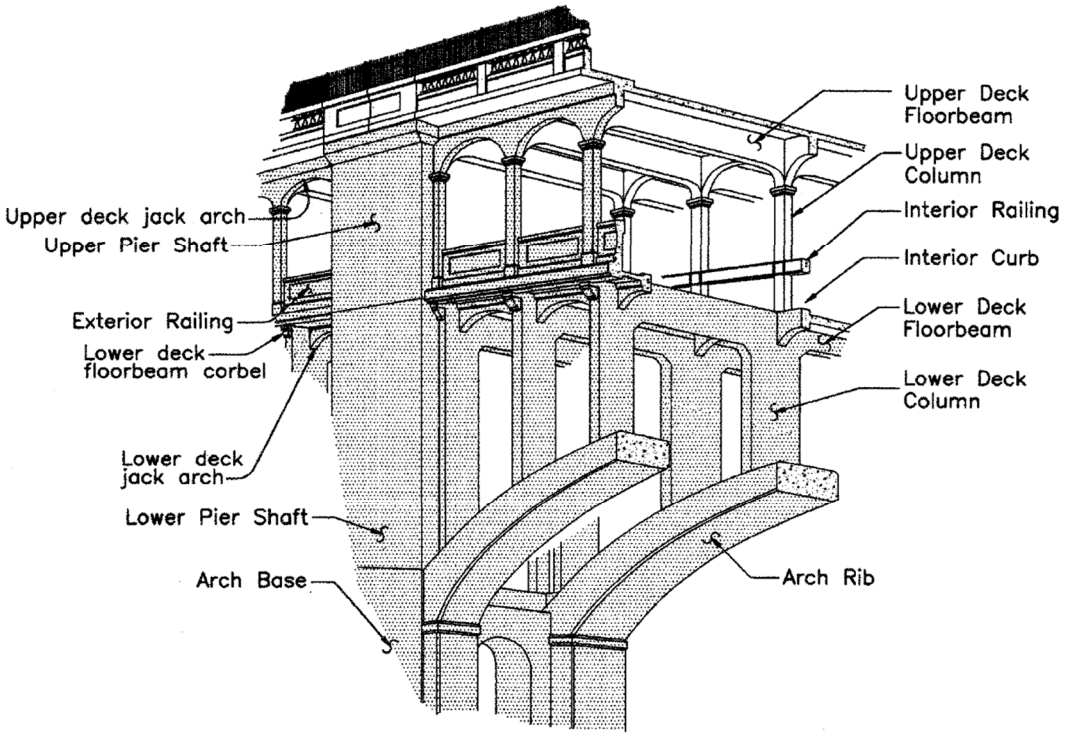

Figure 3 – Upper & Lower Deck Element Nomenclature, Approach Spans.

Inspection Procedure

Pennoni performed an in-depth inspection of the concrete components included in the scope of this feasibility study in conjunction with the 2016 in-depth inspection previously included in Project No. PID 93400 during September 13 through 16, 2016. Additional inspection was performed December 6 through January 10. Personnel included William J. Vermes PE, Christian Lunt, PE, Dale Arnold PE, Matthew Paroda EI, and Elizabeth Trapp, EI, Jessica Sizemore, EI and Alisha Ruff, EI. Inspection access was achieved as follows:

Detroit Avenue & W. 25th Street Tunnels – Extension ladders and delamtech sounding tool.
West Station – 30-foot electric manlift.
Spans 1-3, 5-13 Upper Deck superstructure – 40-foot electric manlift.
Spans 3, 5-12 Lower Deck superstructure – 80-foot diesel manlift and snooper.
East Station & Subway - Extension ladders and delamtech sounding tool.

Lighting in the tunnels, West Station and East Station and Subway was provided by two LED light stands, medium duty extension cords and a portable gasoline generator. Between October 6 and November 8, vandals destroyed the electric conduits and lighting in the West Station.

The presence, or lack of, top and bottom reinforcing steel was investigated in Spans 1 - 3 and 5 - 9 using a commercial metal detector.

Construction & Rehabilitation History

The Detroit-Superior Bridge was constructed from 1914 through 1917 to provide a high level vehicular and streetcar crossing over the Cuyahoga River, connecting the Ohio City community and Downtown Cleveland. The bridge replaced the Superior Viaduct, opened in 1878. Construction of the foundation began in 1913. The steel arch truss, Span 4, was erected from July 24 to November 6, 1915. On October 8, 1915, the two halves of the main truss were connected[2]. Construction of the arch ribs began in May 1915 in Span 6 and proceeded eastward. The bridge opened to traffic on December 24, 1917.

By the mid-1930s, spalled concrete was occurring due to improper drainage. Repairs were discussed but postponed due to the needs of World War II, and ultimately not performed until the 1960s.

The Detroit-Superior Bridge has received a series of various major and minor rehabilitations as follows[3]:

1. 1967-70 Major Rehabilitation
    a. Removal of the original upper deck consisting of four vehicular lanes and two 15-foot wide sidewalks.
    b. Strengthening or replacement of all upper deck concrete floorbeams.
    c. Span 4: Erection of new steel floorbeam cantilevers.
    d. Construction of the new upper deck with six vehicular lanes and two five-foot wide sidewalks.
2. 1995-97 Major Rehabilitation
    a. Replacement of the upper and lower deck floors.
    b. Replacement of select upper and lower concrete floorbeams, columns, jack arches and pier shafts (**Table 1**).
    c. Patching over 70,000 SF of concrete superstructure.
    d. Application of epoxy-urethane or non-epoxy sealer to most exposed concrete surfaces.
    e. Span 4: Replacement of all steel hangers, Panel Points 6 through 6'.
    f. Replacement of Upper Deck and Lower Deck Floor Beams 5 and 5' and stringers.
    g. Painting of all steel superstructure components.

[2] Beyer, William E, The History of the Veterans Memorial Bridge, 90th Anniversary Edition, Bookmasters, Inc, Ashland, Ohio.
[3] Vermes, William J., Gasparini, Dario A. & Conley, Natalie, *Cleveland's Historic Bridges: Architectural & Engineering Masterpieces*, Publication of the 7th Historic Bridge Conference, Cleveland, Ohio, 2001.

h. Installation of new drainage system.
i. Installation of architectural lighting.

3. 2003 North Sidewalk Linear Park Conversion.
   a. Conversion of vehicular traffic to two westbound and one eastbound lane between the steel trusses and on eastbound lane on the Span 4 south cantilever.
   b. Widening of the north sidewalk. With longitudinal trench drainage.
   c. Installation of public art and benches along the modified north sidewalk.

Member	Total Members	Members Replaced	Total Percent Replaced
Upper Deck Floor Beams	686	316	38%
Upper Deck Columns	693	179	26%
Upper Deck Jack Arches	564	260	45%
Lower Deck Floor Beams	548	50.5	11%
Lower Deck Corbels	279	79	28%
Lower Deck Jack Arches	520	176	34%
Lower Deck Columns	488	8	2%
Upper Exterior Pier Shafts	32	17.5	55%
Lower Exterior Pier Shafts	28	5.5	20%

Table 1 – 1995-97 Detroit-Superior Bridge Rehabilitation Concrete Superstructure Member Replacement Summary, Spans 1 to 3, 5 to 13 & East Station.[4]

4. 2014-16 Rehabilitation Work Summary

In 2014, a minor rehabilitation project began to address deteriorating concrete surfaces. Local patching was performed of the upper deck wearing surface. Significant and minor patching was performed on the lower deck superstructure and piers in Span 2 and from Span 7 to the East Abutment. In the West Station, four columns, C13, C14, C20 and C21, were replaced in kind along with patching from

[4] Vermes, William J., *Rehabilitation of The Detroit-Superior Bridge*, Proceedings of an International Conference on Historic Bridges to Celebrate the 150th Anniversary of the Wheeling Suspension Bridge, West Virginia University Press, 1999, pp. 117-132.

column lines 25 to 31. Painting of the Span 4 superstructure between the upper and lower deck was also performed.

Work for this rehabilitation was suspended in early 2016 to reassess the repair needs of the structure and address safety concerns in public areas below the bridge. For the remainder of this report, the 1995-97 and 2014-16 rehabilitations will be referred to as the 1995 rehabilitation and the 2014 rehabilitation, respectively.

IV. STRUCTURE REPAIR NEEDS

Discussion of repair needs begins with maintenance repairs of Alternate No. 1. The work tasks associated with the deterioration of the concrete superstructure and public safety below the bridge is discussed as each repair need is approached, west to east and top to bottom.

Upper Deck Wearing Surface

The upper deck wearing surface was poured in 1995 and placed into service January 1997. Records show the wearing surface began exhibiting significant deterioration after 2010. Following patching in 2014, the wearing surface continued to deteriorate at increasing rates, especially in Spans 7 through 10 (**Table 2**). Soundings showed that the delamination patterns generally follow the wheel paths. Further observations show that the deck is subjected to impact loads as commercial trucks cross the bridge, especially east bound traffic, at speeds greater than the posted speed limit. At 20 years, the overlay is nearing the end of the expected service of 25 years. Because the rehabilitation project is scheduled for start in 2019, removal of the deficient wearing surface via hydro-demolition and placement of a micro-silica wearing surface is the recommended repair for the wearing surface. Since few signs of distress are present on the upper deck underside are present, no deck cores are recommended.

Span	Wearing Surface Deterioration (SF)		WB Area of Deck (SF)	EB Area of Deck (SF)	Concrete Repair (%)		
	WB	EB			WB	EB	Total
Span 1A	36	128	2890	2890	1.2	4.4	2.8
Span 1B	81	162	3607	3607	2.2	4.5	3.4
Span 1	450	627	3718	3718	12.1	16.9	14.5
Span 2	0	0	4685	4685	0.0	0.0	0.0
Span 3	56	59	6368	6368	0.9	0.9	0.9
Span 4	1495	2441	17228	17228	8.7	14.2	11.4
Span 5	0	19	5186	5186	0.0	0.4	0.2
Span 6	259	8	4191	4191	6.2	0.2	3.2
Span 7	1367	664	4117	4117	***33.2***	***16.1***	***24.7***
Span 8	1724	1792	4170	4170	***41.3***	***43.0***	***42.2***
Span 9	814	354	3698	3698	***22.0***	***9.6***	***15.8***
Span 10	642	754	3688	3688	***17.4***	***20.4***	***18.9***
Span 11	76	360	2864	2864	2.7	12.6	7.6
Span 12	108	229	3444	6642	3.1	3.4	3.3
Span 13	28	0	2245	4331	1.2	0.0	0.4
East Station	44	0	8904	17172	0.5	0.0	0.2
Direction Subtotals:	**7,180**	**7,597**	**81,003**	**94,555**			

Total: **14,777** **SF**

Total % Deteriorated = **8.42%**

Table 2 – Upper Deck Wearing Surface Deterioration Summary

W. 25th Street & Detroit Avenue Tunnels

The tunnels have received little rehabilitation during their service. Intermittent spalls present along the wall bases have changed little since the late 1980s, and may be caused by acidic ballast used for the street car lines but now removed since the 1950s. Wall deterioration is primarily located at the wall panel joints. The roof of the West 25th Street Tunnel exhibits little delamination. The original roof of the Detroit Avenue Tunnel is heavily spalled, however a new structural slab was placed above this slab during the 1995 rehabilitation. Since this is not a public area when the West Station is open to the public, no repair to the Detroit Avenue Tunnel is recommended.

West Station Columns & Jack Arches

Due to budgetary reasons, only essential repairs were performed in the West Station and tunnels during the 1995 rehabilitation. Since then, deterioration of the West Station columns and longitudinal beams (jack arches) has steadily increased despite repair of the roof slab and placement of a Type 2 waterproofing membrane.

Most West Station deterioration is present on the jack arches and columns of Lines A, B, C and D, roughly centered on the expansion joint and sag point between Columns 20 and 21. Location of deterioration is included in **Appendix F**. As shown in **Appendix G**, the deterioration has been steadily migrating east and west from this centroid of corrosion.

Along the north face of the Line A jack arches, a longitudinal construction joint has allowed water and salt infiltration, resulting in accelerated deterioration of the jack arches and columns below (**Figure 4**). This construction joint is part of the West Station original construction to facilitate a new rail line and expansion of the station northward.

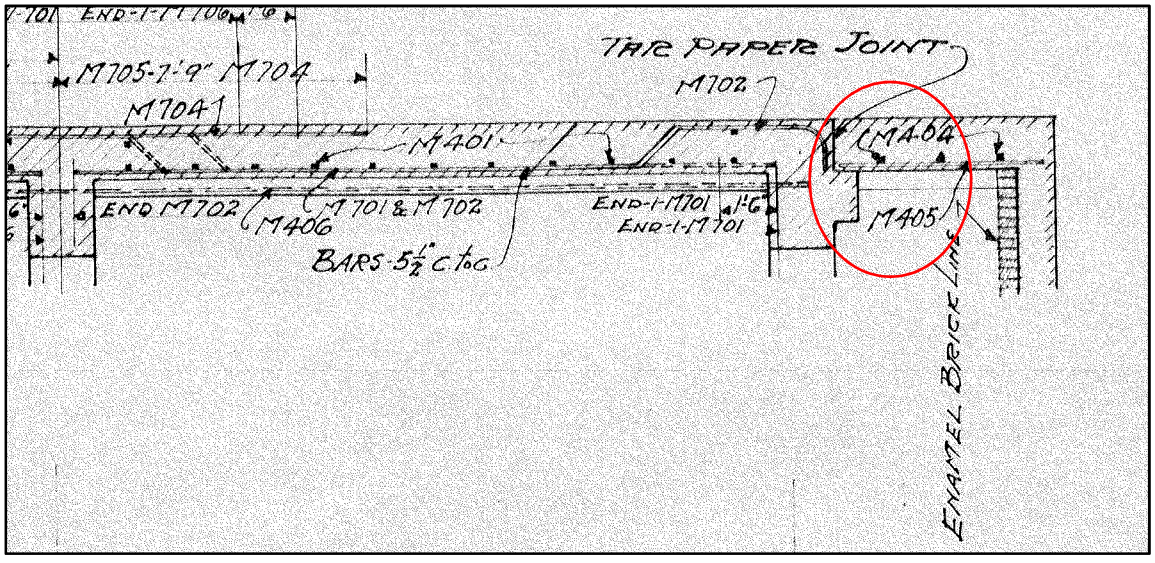

Figure 4 – Longitudinal Construction Joint (Circled, referenced as Tar Paper Joint), Above Line A North Face, Original Construction Drawing No. A2246.

Lower Deck Columns

The cause and magnitude of deterioration present among the lower deck columns is based on the column location. Away from the piers, spandrel columns have isolated delaminations and spalls commonly due to corrosion of the $^1/_2$-inch square horizontal square bars. Several exterior columns have larger deterioration areas due to corrosion of the main steel reinforcement with 3-inch cover. On several exterior columns, lower deck corbel deterioration has propagated to the adjoining column surfaces below.

For the lower deck columns adjacent to piers, several columns have large delaminated surfaces likely due to the chloride contamination up through the beginning of the 1995 rehabilitation. The column surfaces facing the piers patched in 1995 are often delaminated now due either to continuing reinforcement corrosion or the insufficient space to perform proper shotcreting.

Estimated FRP lower column wrap quantities are based on the surface area form top of the arch pedestal up to the bottom of the lower floorbeam fillet. Following this delineation of the lower columns, any column less than two feet tall or non-existent at the center of the arch rib, are assumed to be too short to merit FRP wrapping and are not included in the quantities. Observation of the column pedestals showed no deficiencies, likely due to the increased reinforcement cover they provide. No FRP wrap of the pedestals is recommended due to durability and complexity of wrapping.

Lower Deck Floor Beams

During the 1995 rehabilitation, most lower deck floorbeam patching was for shallow (cover less than 1") over stirrup reinforcement. Now, new delaminations and spalls have occurred where stirrup cover is $1\ ^1/_4$ to $1\ ^1/_2$ inches, indicating that the corrosion mechanism has not stopped with the applied sealer (**Photo 3**). Elsewhere, ongoing corrosion of the bottom tensile reinforcement has resulted in 1995 several shotcrete patch failures, as the patches have been forced from the floorbeam bottoms (**Photo 4**). With the likelihood of eventual global concrete corrosion, it is recommended that FRP anchors be placed along the top of lower floorbeams to prevent a full-face failure of the wrap.

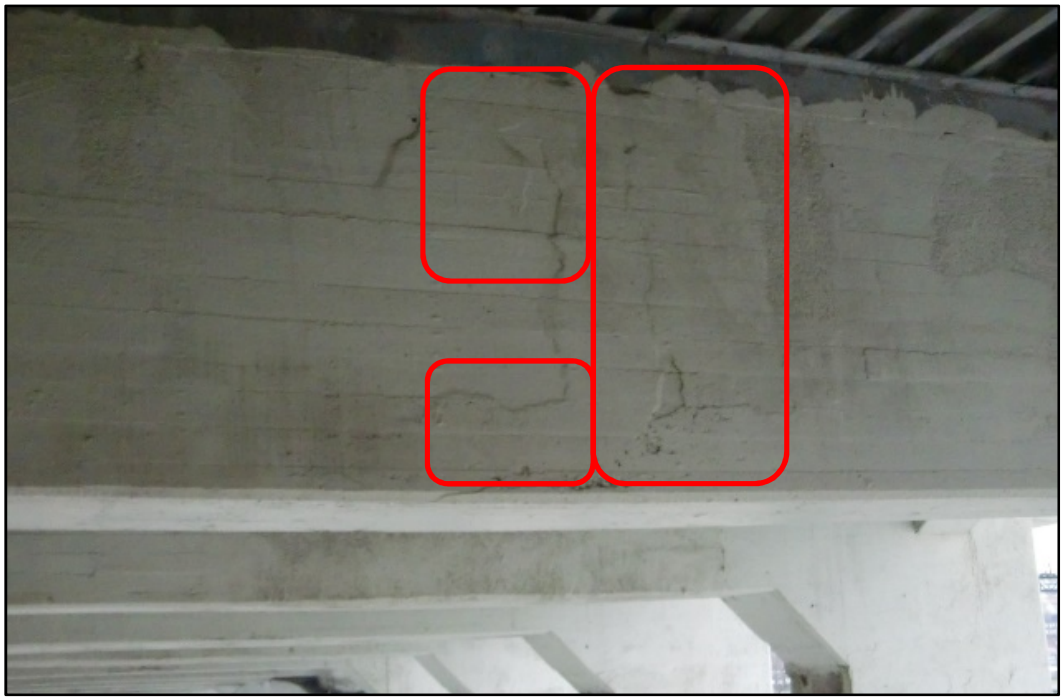

Photo 3 – Newly Developing Lower Deck Floor Beam Delaminations (Circled), South Bay, Span 8.

Photo 4 – Reinforcing Steel with Active Corrosion, Lower Deck Floorbeam 14, South Bay, Span 6.

Lower Deck Corbels

The lower deck corbels perform as part of a structural cantilever of the lower deck floor beams, supporting the upper deck columns and loads above. During the 1995 rehabilitation, 20% of the corbels were replaced. Currently, additional corbels have delaminated or spalled primarily due to the following causes:

1. Lack of Cover: One architectural feature of the corbels is that they are stepped down two inches on each side, thus providing significantly less cover for the slanted vertical anchorage reinforcement of the upper deck columns.

2. End Span Lower Deck Corbels: During the 1995 rehabilitation, construction of new corbel and/or lower deck exterior pier shafts used a thin felt bond breaker fabric between the adjoining surfaces (**Photo 5**). This bond breaker has not performed adequately, resulting in spalls in either the corbels, lightly reinforced pier shafts, or both. The first occurrences of this failure mode appeared by 2000 and have been steadily progressing since.

Replacement and/or patching of deficient corbels will be performed. Adjacent to the pier shafts, all corbel/pier shaft interface will be modified, regardless if repair is needed or not. A $^{3}/_{8}$-inch paraffin bond breaker is recommended to be placed between the concrete surfaces.

Arch Ribs

The arch ribs exhibit spalls and isolated delaminations and spalls along the corners of the arch ribs (**Photo 5**). Additional delaminations are present on the intrados (underside) of the arches. Generally, no deterioration is present along the arch ribs side since no shear reinforcement is present throughout the arches. Furthermore, the field inspection verified that contrary to the original construction plans, top and bottom mat steel was placed continuously in the arches of Span 1 through 3, 5, and 7 through 9. In Span 6, however, no main reinforcement was detected in the North Exterior and Interior arch ribs between Columns 3 and 5, and Columns 11 and 13. Span 6 was the first concrete span constructed, and therefore likely the only span to have discontinuous reinforcement.

Lower Deck Pier Shafts

Most upper deck pier shaft and some lower deck pier shaft were replaced during the 1995 rehabilitation. Generally, the exterior lower deck pier shafts have little deterioration except for two occurrences. First, areas cast in concrete with the insufficient bond breaker have spalled due to thermal movement of the adjacent spandrel column (**Photo 6**). Next, on the Pier 6 South Exterior Lower Pier Shaft, a 140 SF spalled area exhibits an apparent deep scaling.

This is likely a due to failure of the original encased drain pipe within this shaft. It is anticipated sound concrete is not present until at least a depth of two feet.
(**Photo 7 & Figure 5**).

Photo 5 – Spalled Original Concrete & Secure 1996 Shotcrete Patch, Span 7 South Interior Arch Rib.

Photo 6 – Spalled & Loose Concrete Due to Ineffective Bond Breaker (Location denoted in yellow), Pier 5 Lower Deck Pier Shaft & South Lower Deck Corbel 1, Span 6.

Photo 7 – Deep Concrete Deterioration, Pier 6 South Lower Deck Pier Shaft.

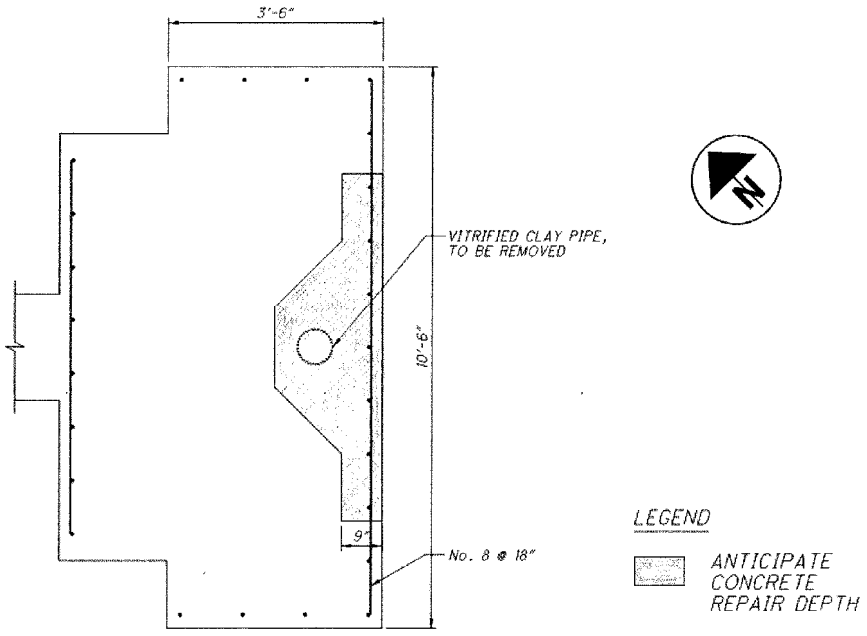

Figure 5 – Estimated Deterioration Depth, Pier 6 South Lower Deck Pier Shaft.

East Subway

Column M22, located along the north wall of the East Subway, adjacent to the compression seal deck joint between the East Station and the East Subway, has more than 60% section loss (**Photo 8**). Columns M27, East Subway, and South Exterior Column 20, also have advanced deterioration and require replacement. Approximately 30% of the north wall of the East Subway is spalled or delaminated, and requires patching.

Photo 8 – 60% Section Loss, Column M22, East Station.

Lower Deck Masonry Wall

Vandals have been accessing the lower deck and West Station increasingly the last several years along the southwest corner of Span 1A. Efforts to secure this area with chain link fencing and perforated steel plates have not been successful. More recently, vandals have set up step ladders at the northeast corner of Span 13 (**Photo 9**). The preferred method of securing the access to the lower deck via these points is placement of masonry block wall on top of the lower deck railing. The recommended location of the masonry block wall is shown in **Figure 6.**

Center Street Bridge Tender's Car Shelter

Within the last decade, a chain-link car shelter, measuring 17'-4" wide by 22'-6" deep with a roof, has been built adjacent to the west face of Pier 4. This shelter provides a secure parking area for the Center Street Swing Bridge operators. Vandals have accessed the interior of the shelter and pushed open a hole in the roof, gaining access to the south pedestal of Pier 4 and on up the Span 4 steel superstructure. Implementation of recent security measures on the Detroit-Superior and Lorain-Carnegie Bridges shows that construction of such features emboldens trespassers to damage and pass through these barriers. Therefore, it is recommended that instead constructing a vandal-proof fence atop of the shelter, the east half of the shelter be rebuilt, narrowing the shelter by four feet and removing trespasser access to the pedestal. This reduced shelter size is comparable to the bridge operator car shelter at the West 3rd Street Lift Bridge.

Photo 9 – Ladder Used by Vandals to Access Lower Deck, Span 13 at East Abutment.

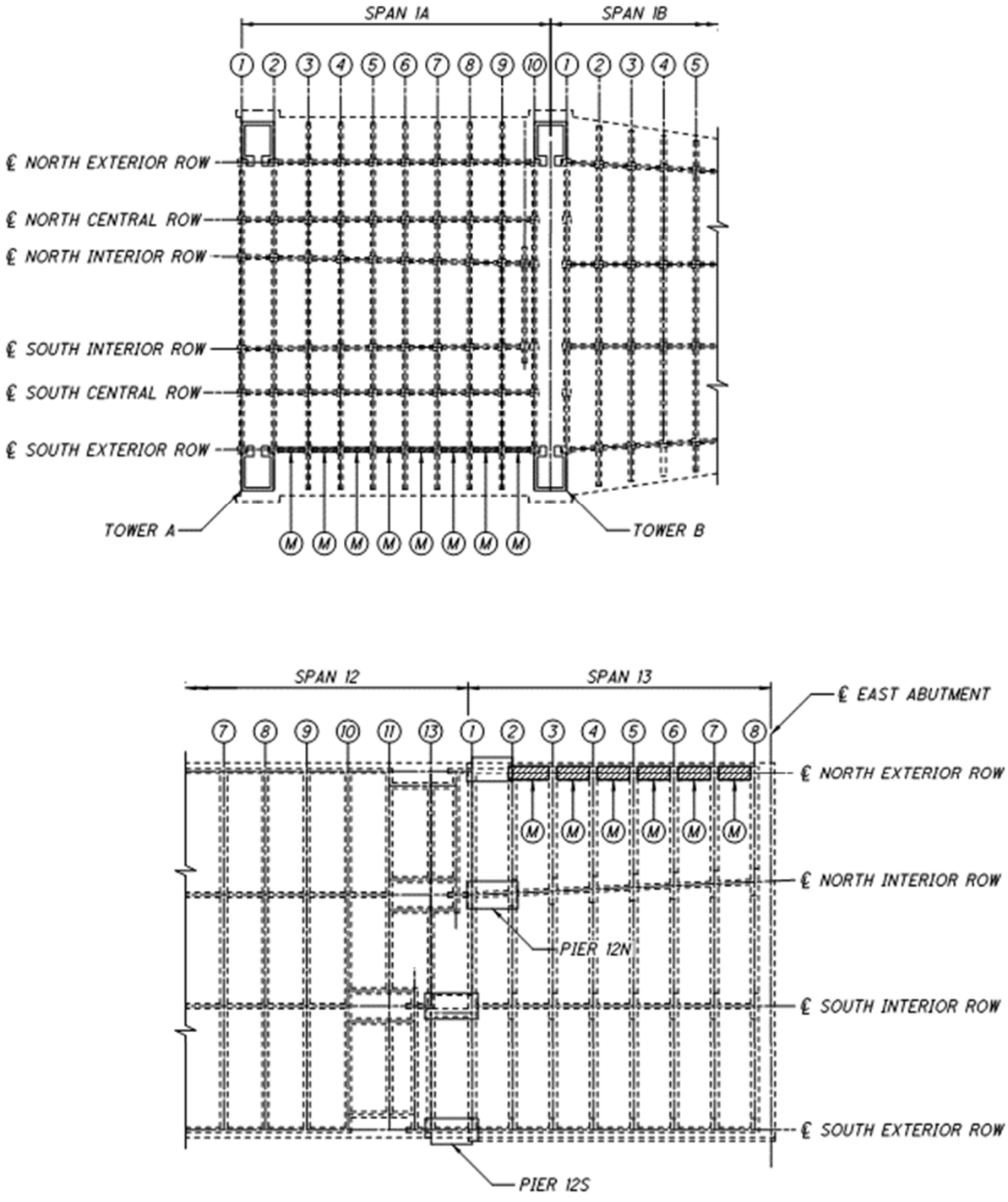

Figure 6 – Recommended Location of Security Wall.

V. RECOMMENDED REPAIR STRATEGIES

General

The field inspection revealed that the delamination currently present does not follow the common opinion that concrete patches tend to fail. Throughout the lower superstructure, few examples of shotcrete patch failure due to debonding are present. In fact, several areas shotcrete failure are due the continued reinforcement corrosion or failure of the adjacent original concrete, also from reinforcement corrosion.

During the 1995 rehabilitation, the epoxy-urethane sealer placed on all lower superstructure exterior and upper superstructure components as well as piers as a barrier protection, is mostly intact after nearly 20 years of exposure. However, the sealer at best only slowed the rate of corrosion within these concrete elements, including those that have not been subjected to poor drainage and chlorides attack.

Thirteen concrete pH tests were performed on samples obtained from various delaminated lower superstructure elements (**Table 3 & Appendix C**). Several samples exhibited pH levels less than 12, suggesting that the passivation layer protecting the steel reinforcement has been broken due to hydroxide ion transfer, resulting in concrete corrosion. Due to the random nature of the pH results, it is not possible to conclusively determine if carbonation is the cause for the pH lower pH readings.

Sample No.	Span	Member	Location	Material	Predominant pH Level		Comments
					Near Surface	Int.	
1A	7	Arch Rib	South Interior	Concrete	9 - 10	9 - 10	Bottom North Corner, near center
1B	7	Arch Rib	South Interior	Shotcrete	9	12	Bottom North Corner, near center
2	7	LD Floor Beam	4 North Bay	Shotcrete	9	9, 12	
3	7	LD Column	N. Int. 14	Concrete	9	12	
4	8	Jack Arch	N. Int. 8-9	Shotcrete	9	9, 12	
5	8	LD Floor Beam	9 Center Bay	Concrete	10 - 11	9 - 12	1 1/2" cover total
6	8	LD Floor Beam	10 Center Bay	Concrete	10 - 11	9, 12	2 1/2" cover total
7	8	LD Floor Beam	11 Center Bay	Concrete	10 - 11	9, 12	2 1/2" cover total
8	8	LD Floor Beam	14 South Bay	Concrete	9 - 10	12	
9	9	LD Column	N. Int. 13	Concrete	Aggregates: 10-11 Sand & Cement: 9		West Face
10	10	LD Floor Beam	1 South Bay	Shotcrete	Mostly 12; Some aggregates, 9		
11	10	LD Floor Beam	2 South Bay	Concrete	Aggregates: 10-11 Sand & Cement: 9		From above Sample No. 10
12	10	LD S. Ext. Pier Shaft	West Face	Shotcrete	Mostly 12; Some aggregates, 9		West face, near corbel

Table 3 – Concrete pH Tests Summary

Appendix D contains both a summary and estimated patching quantities calculations for superstructure and pier elements. **Appendix E** contains a summary of the estimated FRP wrap quantities and the associated calculations.

Discussion of the recommended structural repairs materials are divided among specific objectives: repair, protection and prevention. Each material is discussed as follows:

Concrete Patching/Replacement Materials (Repair)

Concrete patching shall be prepared, formed and finished in accordance with Item 519. Concrete members that are identified to require complete replacement including select columns, West Station beams and lower deck corbels shall be in accordance with Item 511. Recognizing the varying level of effort for patching or repairing concrete elements of the Detroit-Superior Bridge, the following repair/replacement items have been included in the

rehabilitation quantities. For cost estimating, concrete patching has been divided among the following items:

- Patching Concrete Structure: West Station, Tunnels and Upper Deck Superstructure
- Patching Concrete Structure: Lower Superstructure, Vertical Surfaces
- Patching Concrete Structure: Lower Superstructure, Bottom & Curved Surfaces
- Patching Concrete Structure: Deep Pier Shaft Deterioration
- Concrete, Misc.: West Station Concrete Beam Replacement
- Concrete, Misc.: Column Replacement
- Concrete, Misc.: Lower Deck Corbel Replacement

Fiber Reinforced Polymer Wrap (Protection)

Fiber reinforced polymer (FRP) wraps are composite systems made up of a glass fiber or carbon fiber material woven into sheets and saturated with a polymer bonding liquid (typically a two-part epoxy resin) and adhered to a concrete surface. Carbon fiber weaves generally have a higher unit tensile strength (100 ksi to over 200 ksi) with glass fiber weaves generally ranging from 30 ksi to 100 ksi. Due to their high tensile strength, FRP wraps are engineered to act as external reinforcement. Woven sheets may be engineered as unidirectional (designed to carry load in one direction) or bidirectional (designed to carry load in two or more directions). Containment is the primary consideration for FRP wrapping on this project to prevent future concrete delaminations from becoming dislodged and falling on public areas below the concrete arch spans. ODOT Central Office has a list of fiber wrap materials independently evaluated by ICC-ES.

Three options for applying the FRP wrap to the arch ribs over public areas have been developed (**Figure 7**). In each option, the FRP wrap must extend past a suspected future delamination area with a development length onto sound concrete. Generally, FRP wraps need a development length of one to two feet past concrete that will remain sound. If the FRP wrap is not developed correctly, a delamination could form and simply take the FRP wrap with it. As discussed previously, FRP wrap is not recommended on the lower deck column bases. Due to the structural nature and past corrosion history, placement of preformed shields over the lower deck corbels is recommended instead of application of an FRP wrap. Proposed areas of the FRP wraps on the lower pier shafts is shown in **Figure 8**.

Option No. 1 provides confinement of the arch intrados and extends upward on the sides with 1'-6" of adhesion development past potential corner spalls. This option provides containment for the areas of the arch ribs that would be most likely to fall.

Option No. 2 adds top corner FRP strip wraps as a means of containing edge spalls. This option does not cover the entire extrados because:

1. Inner extrados spalls are rare and when present, and are less likely to fall to the ground below, and

2. Greater surface preparation is required due to its very irregular surface.

Option No. 3 is a U-wrap of the arch ribs with development across two feet past the top corner. This option includes approximately 45,000 square feet of FRP wrap over Option No. 2.

Due to both coverage of the rib areas prone to spalling and overall economy, the quantities of Option No. 2 have been included in the development of the Alternative No. 2 cost estimate.

Surface preparation and installation of the FRP wrap systems vary from one manufacturer to another and among manufacturers' systems but some generalizations may apply. In the design of the FRP wrap system the bond between the existing concrete and the composite wrap is critical. Surface preparation of the existing concrete is important. Generally, the surfaces must be clean and free of contaminates and debris that would be detrimental to the bond between the wrap and the concrete. On this project, the existing epoxy-urethane sealer will need to be removed before the FRP wrap is installed. Another important issue is the profile or smoothness of the concrete surfaces. While some waviness, curvature or other unevenness of the concrete surface may be acceptable, sudden and abrupt changes in the surface profile and sharp corners greater than $^{1}/_{16}$-inch are not acceptable. Sharp corners can tear the fabric during installation and surface profile irregularities can create air pockets under the FRP wrap.

The American Concrete Institute has surface profile specifications that some FRP wrap manufacturers reference. Generally abrupt surface profile changes or ridges larger than $^{1}/_{16}$" are not acceptable. In the case of this project the arch rib sides are smooth but the top and bottom are generally not. The bottom surface of the arch ribs was formed using boards laid transversely. In some areas, the form boards did not butt up perfectly and the bottom surface of the concrete exhibits a stepped profile with ridges measuring up to $^{1}/_{2}$-inch tall. These bottom surface irregularities will need to be remedied by some combination of grinding and or an epoxy paste applied to the ridges. The top surface of the arch ribs was roughly finished and has scattered debris embedded. The top surface irregularities will be addressed by some combination of mortar, grinding or epoxy paste. Finally, the corners between surfaces may require some grinding to provide a smoother corner. The existing concrete coating removal and surface profiling will take time and represents a significant portion of the final complete installed cost of the FRP wrap system.

Installation of the fiber sheets varies from one manufacturer to another and among manufacturers' systems but generally involves saturating the fiber sheets with resin either before or after applied to the concrete surface. Bubbles and voids under the fiber sheets are removed by rolling before the epoxy resin cures. After the FRP wrap is installed, epoxy-urethane sealer should be applied to provide UV protection for the fiber sheets and to the

match the color of the existing sealer on adjacent unwrapped areas. The epoxy-urethane sealer may be applied to the FPR wrap areas as they are curing and still tacky. If the epoxy-urethane sealer is applied after the FPR wrap has cure, the surface of the FRP wrap may require a light sanding or roughening for the epoxy-urethane sealer to bond properly.

The FRP wrap will be relatively impervious and moisture becoming trapped in the wrapped concrete is a concern. Gaps up to 1" wide between the fiber sheets will be provided to give moisture inside the concrete a chance to escape.

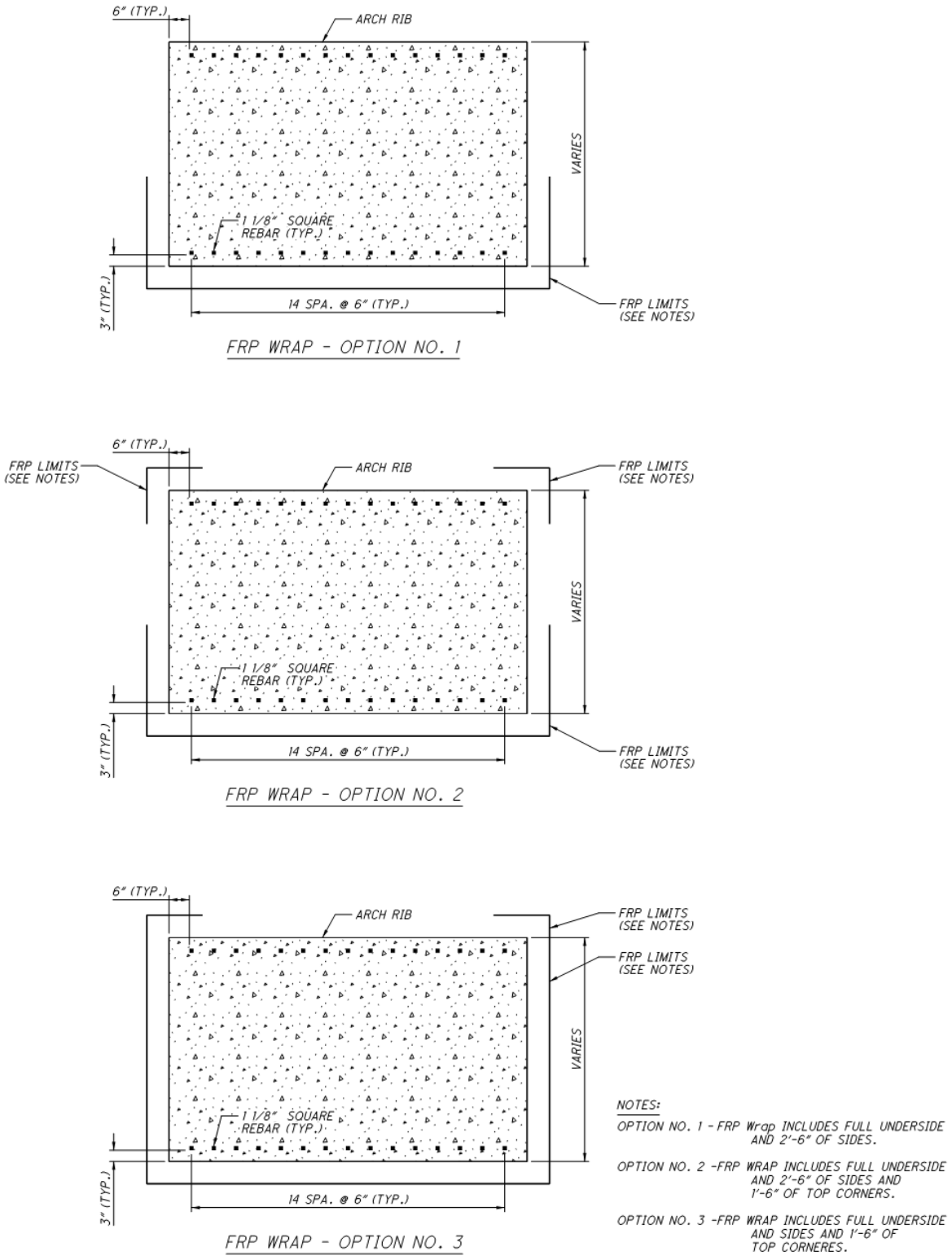

Figure 7 – Feasible FRP Wrap Options on Arch Ribs
(Note: Arch height not to scale.)

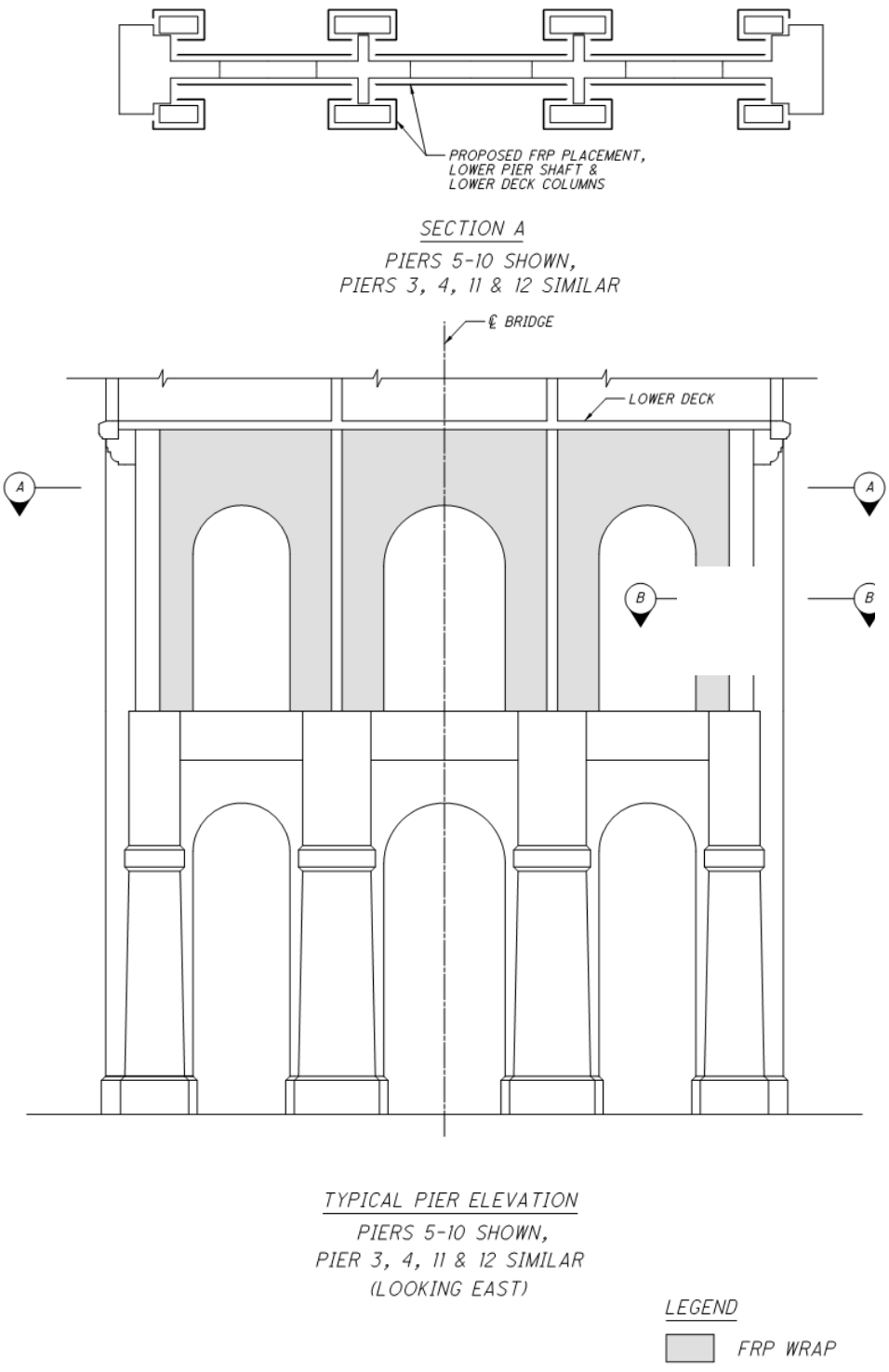

Figure 8 – Proposed FRP Wrap Placement, Lower Pier Shafts.

Research published in 2002 and 2006 concluded that while FRP warps slow the rate of reinforcement corrosion due to chloride attack, FRP wraps do not stop corrosion. An example of active concrete corrosion within a confining FRP application is present at the bridge carrying Fulton Road over I-71 (**Photo 10**). Furthermore, Section 1.2.1 – General of AASHTO's *Guide Specifications for Design of Bonded FRP Systems for Repair and Strengthening of Concrete Bridge Elements* (First Edition, 2012) states the following:

> *The application of FRP systems will not stop the ongoing corrosion of existing steel reinforcement. The cause of corrosion to internal steel reinforcement should be addressed and corrosion-related deterioration should be repaired prior to application of any FRP system.*

For the above reasons, a passive cathodic protection system following ODOT's *Supplemental Specification 844 – Concrete Patching with Embedded Anode Protection* has been included in the Alternate 2 cost estimate.

Photo 10 – Active Concrete Corrosion Beneath FRP Wrap, Pier 1, CUY-71-1679 (Fulton Road over I-71).

Cathodic Protection – Impressed Current (Prevention)

A third means of concrete protection, active cathodic protection, is a technology that has been developing since the 1970s. Active cathodic protection systems include impressed current, chloride extraction, realkinization and thermally sprayed zinc coating. Each method of cathodic protection has its strengths and weaknesses.

Alternate 3 includes an estimated cost of an impressed current cathodic protection system in lieu of a FRP wrap and a passive galvanic anode form of cathodic protection. Of the active systems, impressed current is the most common. Impressed works by neutralizing the electric current flowing though the subject reinforcing steel that produces the corrosion mechanism. However, prescription of an appropriate active cathodic protection system can best be determined with additional and proper concrete testing.

VI. MISCELLANEOUS ASSESSMENTS

Right-of-Way Impacts

Properties that will require temporary right-of-way easements during construction, and are summarized in **Tables 4 and 5**. The costs associated with them do not include damages. Several of the properties impacted are parking lots. The temporary loss of parking revenue is not included in the costs but we have included a table summarizing the current cost to park along with the number of spaces that will be impacted.

Property Owner	Parcel No.	Temporary Access (SF)	Temp. Access Cost (per SF)	COST
Stonebridge Waterfront, LLC	003-20-008	5,653	$1.75	$9,900
No Information (Newly created Parcel)	003-20-009	656	$1.75	$1,150
Board of Park Commissioners of the Cleveland Metropolitan Park District	101-15-002	26,445	$1.75	$46,300
City of Cleveland	101-15-021	33,264	$1.75	$58,250
Flats East Development LLC	101-15-009	14,245	$1.75	$25,000
Greater Cleveland Regional Transit Authority	101-15-028	908	$1.75	$1,600
United Stated of America	101-15-011	4,348	$1.75	$7,600

Table 4 - Temporary Right-of-Way Impacts

Span	Lot Owner	Estimated No. of Parking Spaces Impacted	Daily Rate	Notes
3	Stonebridge Properties	30 - 35	---	
5	Cleveland Metroparks	33	$3.00	
6	Cleveland Metroparks	15	$3.00	
8	Canal Basin Parking Lot	15 - 18	$2.00	Open Monday-Friday
9	Canal Basin Parking Lot	45	$2.00	Open Monday-Friday
12	US Parking	6	$4.00	
13	US Parking	34	$4.00	

Table 5 - Parking Lots Impacted

Maintenance of Traffic

Maintenance of Traffic (MOT) during repair work will be handled the same way regardless of the method of repair both for deck work and below deck work. Conceptual MOT drawings are in included in **Appendix H**.

Deck: With the recommended wearing course replacement, MOT will be handled by closing one to two lanes at a time on the bridge, providing for part-width removal of the existing wearing surface and placement of the new. Given the proximity to the West 25th Street intersection and the West 9th/Superior/Huron intersection, the recommendation will be to position traffic for the lane closures prior to the intersections as shown in **Appendix B**.

Beneath the Bridge: Repair work on the piers and lower deck will be on Spans 2, 3, and 5 through 13 as indicated on the Public Areas Exhibit in **Appendix B**. Contractor access will be via manlift on the ground beneath the bridge. This will result in the following:

Span 2 – Riverbed Road will be closed for duration of work. Coordination with the Irishtown Bend Park development will be performed.

Span 3 –The closure of a portion of the parking lot for contractor access and equipment will be required. Work will be performed between the hours of 9:00 AM and 3:30 PM to minimize disruption to the residents.

Span 5 – Cleveland Metroparks Parking lot. Lot will be closed for duration of the work of the work above.

Span 6 - Cleveland Metroparks Parking lot. Lot will be closed for duration of the work of the work above.

Spans 6 and 7 – Public Roadways Merwin Avenue and West Avenue will be closed for the duration of work as shown in **Appendix B**. Pedestrian traffic will be maintained or detoured as needed.

Spans 8 and 9 – Portions of the parking lots will be closed for the duration of the work.

Span 10 – Pedestrian traffic will be detoured.

Span 11 – RTA Waterfront line – Coordination with GCRTA will take place to determine the best approach to maintaining rail traffic during repair work.

Span 12, Robert Lockwood Drive – There are several possibilities for maintaining traffic on Robert Lockwood Drive during construction. They include two way one lane traffic with flagger 9:00 AM to 3:30 PM, otherwise open to traffic, or utilizing weekend closures. Coordination with the City of Cleveland are necessary.

Span 13 - The closure of a portion of the parking lot will be required.

Navigation Lighting

There are six navigation lights mounted on the bridge which hang below the lower deck. Four are 180° red lights marking the channel edge and two are 360° green lights marking the channel center. Pennoni visited the site December 9, 2016 and inspected the navigation lighting. The lights were raised and the globes were removed, verifying that the fixtures have power (**Photo 11**). A night time visit later also verified the lights are on though with inadequate illumination (**Photo 12**). Further investigation by an electrician is warranted to determine the cause, whether it be the lights or the power service. An evaluation will then be done to determine the feasibility of repair or if replacement is warranted. We will coordinate with ODOT personnel and an electrician to perform a more thorough inspection of the lights and power service.

Photo 11 - Power Verification of Navigation Light (West Edge of Channel, South Face shown).

Photo 12 – Typical Ineffective Illumination of Navigation Light (East Edge of Channel, South Face circled).

RTA Waterfront Line

The RTA Waterfront Line under Span 11 is constructed with concrete ties, has an overhead catenary system utilizing 600V DC, signal equipment on and around the track and a glass station north of the bridge. Once repair sites on finalized, coordination with the GCRTA is required. Conformance to RTA standards and specifications along with submitting proper request forms are required. Access within this area may be restricted to hours when the line is not in use, normally 11:00 PM to 6:00 AM although these hours would reduce during special events. A special event is defined as any event expected to draw 3,000 or more spectators to an area located within ¼ mile of an RTA Waterfront Rail Line.

VII. CONCEPTUAL ALTERNATIVES

Three alternates have been identified that would meet the purpose and need of the project. The criteria these alternatives should be judge by is the following:

1. Public Safety
2. Extend the life of the bridge for 50 years
3. Cost

Alternates No. 1 will maintain the structure in ***Fair*** condition. Alternates Nos. 2 and 3 will maintain the structure in ***Satisfactory*** condition or better.

Cost estimates have been extrapolated from current estimates to July 1, 2020 using ODOT's 2017-2021 Business Plan Inflation Calculator.

Alternative No. 1

This alternate project includes general maintenance work such as removal of loose overhead concrete in and around the defined public spaces, fixing the broken drain pipes at Pier 2 & 3. The upper deck that was replaced in the 1995-97 rehabilitation is showing signs of accelerating deterioration. It is recommended that the top 1 $^{1}/_{4}$" of the deck be removed by hydro demolition and a new micro silica wearing surface be placed. This will extend the life of the deck for another 25 years.

Currently, the Center Street Bridge tender has a fenced enclosure at Pier 4. This enclosure abuts Pier 4 and allows vandals to access the steel superstructure. It is proposed the enclosure be reduced in size and pulled away from the pier. This should prevent vandals from using the enclosure to access the pier. Additionally, the proximity of south face of Span 1A and the north face of Span 13 to the ground line allows vandals to enter the lower deck area with minimal effort. Currently, supplemental fencing has been unsuccessfully used to prevent entry onto the lower deck. These areas will be blocked up using concrete masonry units (CMU) to create a barrier. The CMU's will receive a mortar coat and a graffiti-resistant sealant.

The repair of the Navigation Lights will be further investigated. Although all are on during the night, the brightness of the lights is ineffective.

While Alternative No. 1 would provide a temporary solution to the falling concrete, it does not provide for future spalling and deterioration. This option does not extend the life of the structure.

This alternate is estimated to cost $2,569,000.

Alternative No. 2

As with Alternative No. 1, all general maintenance items including the hydro-demolition and overlay of the upper deck will be included in Alternative No. 2. Alternative No. 2 introduces new major work items including concrete patching with localized passive cathodic protection, FRP wrapping the bottom surfaces of the lower concrete superstructure to protect the public access areas, and sealing these limits of concrete surfaces with an epoxy-urethane sealer. Work under the concrete patching includes patching all cracked, loose and spalled concrete on the bridge and installing passive cathodic protection to prevent advancing local concrete corrosion. Work under FRP wrapping includes preparing and wrapping the lower concrete superstructure to prevent concrete spalls from falling onto public access areas below. The preparation of the concrete for the FRP wrap will include removal of the existing epoxy-urethane sealant and smoothing the raised concrete form marks. Work under sealing the concrete surfaces includes sealing all areas that have been patched or FRP wrapped with an epoxy-urethane sealer. It is important to note that no epoxy-urethane sealing will be performed on the concrete patches in the Tunnels, West Station, Span 1A and 1B upper deck superstructure, and the East Station and subway.

Alternative No. 2 was originally estimated to cost $25,984,000 and included FRP wrapping all concrete surfaces in the lower concrete superstructure. Since this cost was significantly over the original budget allotted for this project, Alternative No. 2 has been scaled back and further broken down into five (5) sub-alternatives to present the District with various options and their associated costs for rehabilitation. The following quantities were removed from Alternative No. 2 options due to limited effective and economy:

- Application of epoxy urethane sealer on patched surfaces of concrete components in the West Tunnel, West Station, upper deck approach spans, East Station and East Subway
- Arch patching and FRP wrapping in Spans 11, 12 and 13
- Lower Deck floorbeam patching and FRP wrapping in Spans 11 and 12
- Railroad coordination and flagging

Alternative No. 2A

- Micro-silica modified concrete overlay using hydro-demolition
- Patching concrete surfaces with localized passive cathodic protection
- Sealing concrete patching limits with an epoxy-urethane sealer

Alternative No. 2B

- Micro-silica modified concrete overlay using hydro-demolition
- Patching concrete surfaces with localized passive cathodic protection
- Fiber wrap bottom of arch ribs only over public access areas
- Sealing concrete patching and FRP limits with an epoxy-urethane sealer

Alternative No. 2C

- Micro-silica modified concrete overlay using hydro-demolition
- Patching concrete surfaces with localized passive cathodic protection
- Fiber wrap bottom of arch ribs and lower deck floor beams over public access areas
- Sealing concrete patching and FRP limits with an epoxy-urethane sealer

Alternative No. 2D

- Micro-silica modified concrete overlay using hydro-demolition
- Patching concrete surfaces with localized passive cathodic protection
- Fiber wrap bottom of arch ribs and lower deck floor beams over public access areas
- Fiber wrap end columns of piers
- Sealing concrete patching and FRP limits with an epoxy-urethane sealer

Alternative No. 2E

- Micro-silica modified concrete overlay using hydro-demolition
- Patching concrete surfaces with localized passive cathodic protection
- Fiber wrap bottom of arch ribs and lower deck floor beams over public access areas
- Fiber wrap end columns of piers and lower deck support columns

Each sub-alternative is described in further detail on the following pages. A breakdown of costs is also presented with each sub-alternative. Each sub-alternative includes all work items from the previous alternative and adds new work items.

The recommended alternative is **Alternative No. 2C** based on addressing public safety, extending the service life of the bridge, and economic analysis.

Alternative No. 2A

Alternative No. 2A includes all the general maintenance items presented in Alternative No. 1 and includes concrete patching with localized passive cathodic protection and sealing these concrete patching limits with an epoxy-urethane sealer (Note: all repair surfaces have been increased by 20% to account for future deterioration). Concrete patching with localized passive cathodic protection is the most feasible solution to repair the existing locations of failing concrete. Concrete patching will remove and replace all existing cracked, loose, and spalled concrete on the bridge. Localized passive cathodic protection will help to impede the concrete corrosion from advancing which will help prevent future spalling and deterioration in these areas only. It is important to note that this alternative repairs the existing problem areas only. It does not provide repairs or safety measures to address any concrete that may crack, spall, or fall to the ground in the future. Given the history and the patterns of concrete spalling on the bridge, we anticipate that there will be future locations where cracks and spalls develop which will result in additional repair work necessary to address these future locations. This alternate extends the service life of the bridge an estimated 20 years before future repair work is necessary.

This alternate is estimated to cost **$6,660,000**.

ALTERNATIVE No. 2A						
ITEM	EXT	QTY	UNIT	DESCRIPTION	2017 UNIT COST	2017 COST
511	81100	170	FT	CONCRETE, MISC.: WEST STATION CONCRETE BEAM REPLACEMENT	$400.00	$68,000
511	81300	25	EACH	CONCRETE, MISC.: LOWER DECK CORBEL REPLACEMENT	$3,000.00	$75,000
511	81300	7	EACH	CONCRETE, MISC.: COLUMN REPLACEMENT	$8,500.00	$59,500
512	10101	3780	SY	SEALING OF CONCRETE SURFACES (EPOXY-URETHANE), AS PER PLAN	$15.00	$56,700
512	10600	800	FT	CONCRETE REPAIR BY EPOXY INJECTION (ARCH RIB)	$70.00	$56,000
516	47000	LUMP	-	JACKING AND TEMPORARY SUPPORT OF SUPERSTRUCTURE	$20,000.00	$20,000
519	11600	15300	SF	SPECIAL - PATCHING CONCRETE STRUCTURE (WEST STATION, TUNNELS AND UPPER DECK)	$90.00	$1,377,000
519	11600	9590	SF	SPECIAL - PATCHING CONCRETE STRUCTURE (LOWER SUPERSTRUCTURE, VERTICAL SURFACES)	$100.00	$959,000
519	11600	5560	SF	SPECIAL - PATCHING CONCRETE STRUCTURE (LOWER SUPERSTRUCTURE, BOTTOM AND CURVED SURFACES)	$125.00	$695,000
519	11900	6	CY	SPECIAL - PATCHING CONCRETE STRUCTURE (DEEP PIER SHAFT DETERIORATION)	$5,000.00	$30,000
530	00200	LUMP	-	SPECIAL - STRUCTURES BRIDGE OPERATOR'S CAR SHELTER	$5,000.00	$5,000
530	00400	200	EACH	SPECIAL - STRUCTURES CORBEL SHIELD	$200.00	$40,000
530	00600	900	SF	SPECIAL - STRUCTURES MASONRY BLOCK WALL	$10.00	$9,000
625	98200	LUMP	-	LIGHTING, MISC.: NAVIGATION LIGHTING REPAIR	$20,000.00	$20,000
844	10001	30450	SF	CONCRETE PATCHING WITH GALVANIC ANODE PROTECTION, AS PER PLAN	$20.00	$609,000
848	10000	17750	SY	MICRO SILICA MODIFIED CONCRETE OVERLAY USING HYDRODEMOLITION	$25.00	$443,750
848	50320	17750	SY	EXISTING CONCRETE OVERLAY REMOVED	$10.00	$177,500
614	11000	LUMP	-	MAINTAINING TRAFFIC	$100,000.00	$100,000
619	16020	24	MNTH	FIELD OFFICE, TYPE C	$2,500.00	$60,000
624	10000	LUMP	-	MOBILIZATION	$100,000.00	$100,000
					SUBTOTAL:	**$4,960,000**
					20% CONTINGENCY:	**$992,000**
					2017 TOTAL:	**$5,952,000**
					FUTURE WORTH (AT AN INFLATION RATE OF 11.9%)	**$6,660,000**

Alternative No. 2B

Alternative No. 2B includes all the work items presented in Alternative No. 2A and includes FRP wrapping the bottom surfaces of the concrete arch ribs which will partially protect the public access below. In this alternative, FRP wrap will be used to contain future concrete delaminations from becoming dislodged and falling on public areas below the concrete arch spans. It is important to note that the lower deck floor beams are not protected in this alternative and therefore, the public areas between the concrete arch spans remain unprotected. Estimated quantities were calculated by assuming the FRP would cover the entire bottom of the arch intrados and the FRP would extend upward on the sides with a 1'-6" development length past potential corner spalls.

While the application of FRP will assist in confining the concrete members and protect the public from falling concrete, it's use will not stop the continual degradation of the concrete from reinforcement. Periodic repair work will be necessary to reapply the FRP in areas. This alternate extends the service life of the bridge an estimated 25 to 40 years before future repair work is necessary.

This alternate is estimated to cost **$10,347,000**.

ALTERNATIVE No. 2B						
ITEM	EXT	QTY	UNIT	DESCRIPTION	2017 UNIT COST	2017 COST
511	81100	170	FT	CONCRETE, MISC.: WEST STATION CONCRETE BEAM REPLACEMENT	$400.00	$68,000
511	81300	25	EACH	CONCRETE, MISC.: LOWER DECK CORBEL REPLACEMENT	$3,000.00	$75,000
511	81300	7	EACH	CONCRETE, MISC.: COLUMN REPLACEMENT	$8,500.00	$59,500
512	10101	10590	SY	SEALING OF CONCRETE SURFACES (EPOXY-URETHANE), AS PER PLAN	$15.00	$158,850
512	10600	800	FT	CONCRETE REPAIR BY EPOXY INJECTION (ARCH RIB)	$70.00	$56,000
512	74000	6860	SY	REMOVAL OF EXISTING COATINGS FROM CONCRETE SURFACES	$20.00	$137,200
516	47000	LUMP	-	JACKING AND TEMPORARY SUPPORT OF SUPERSTRUCTURE	$20,000.00	$20,000
519	00100	55693	SF	SPECIAL - COMPOSITE FIBER WRAP SYSTEM (ARCH RIBS)	$45.00	$2,506,203
519	11600	15300	SF	SPECIAL - PATCHING CONCRETE STRUCTURE (WEST STATION, TUNNELS AND UPPER DECK)	$90.00	$1,377,000
519	11600	9590	SF	SPECIAL - PATCHING CONCRETE STRUCTURE (LOWER SUPERSTRUCTURE, VERTICAL SURFACES)	$100.00	$959,000
519	11600	5560	SF	SPECIAL - PATCHING CONCRETE STRUCTURE (LOWER SUPERSTRUCTURE, BOTTOM AND CURVED SURFACES)	$125.00	$695,000
519	11900	6	CY	SPECIAL - PATCHING CONCRETE STRUCTURE (DEEP PIER SHAFT DETERIORATION)	$5,000.00	$30,000
530	00200	LUMP	-	SPECIAL - STRUCTURES BRIDGE OPERATOR'S CAR SHELTER	$5,000.00	$5,000
530	00400	200	EACH	SPECIAL - STRUCTURES CORBEL SHIELD	$200.00	$40,000
530	00600	900	SF	SPECIAL - STRUCTURES MASONRY BLOCK WALL	$10.00	$9,000
625	98200	LUMP	-	LIGHTING, MISC.: NAVIGATION LIGHTING REPAIR	$20,000.00	$20,000
844	10001	30450	SF	CONCRETE PATCHING WITH GALVANIC ANODE PROTECTION, AS PER PLAN	$20.00	$609,000
848	10000	17750	SY	MICRO SILICA MODIFIED CONCRETE OVERLAY USING HYDRODEMOLITION	$25.00	$443,750
848	50320	17750	SY	EXISTING CONCRETE OVERLAY REMOVED	$10.00	$177,500
614	11000	LUMP	-	MAINTAINING TRAFFIC	$100,000.00	$100,000
619	16020	24	MNTH	FIELD OFFICE, TYPE C	$2,500.00	$60,000
624	10000	LUMP	-	MOBILIZATION	$100,000.00	$100,000
					SUBTOTAL:	$7,706,000
					20% CONTINGENCY:	$1,541,000
					2017 TOTAL:	$9,247,000
					FUTURE WORTH (AT AN INFLATION RATE OF 11.9%)	$10,347,000

Alternative No. 2C

Alternative No. 2C includes all the work items presented in Alternative No. 2B and includes the additional FRP wrapping of the bottom surfaces of the concrete lower deck floor beams which will further protect the public access below. In this alternative, FRP wrap will be used to contain future concrete delaminations from becoming dislodged and falling onto public areas between the concrete arch spans. The lower deck floor beams are open to public access areas below and as a result, concrete would likely fall onto the public access areas below if it becomes dislodged. It is important to note that the bottom surfaces of most concrete members above public access areas are protected in this alternative. Estimated quantities were calculated by assuming the FRP would cover the entire bottom of the lower deck floor beams and the FRP would extend upward on the sides with a 1'-0" development length past potential corner spalls. This alternate extends the service life of the bridge an estimated 25 to 40 years before future repair work is necessary.

This alternate is estimated to cost **$14,047,000**.

ALTERNATIVE No. 2C						
ITEM	EXT	QTY	UNIT	DESCRIPTION	2017 UNIT COST	2017 COST
511	81100	170	FT	CONCRETE, MISC.: WEST STATION CONCRETE BEAM REPLACEMENT	$400.00	$68,000
511	81300	25	EACH	CONCRETE, MISC.: LOWER DECK CORBEL REPLACEMENT	$3,000.00	$75,000
511	81300	7	EACH	CONCRETE, MISC.: COLUMN REPLACEMENT	$8,500.00	$59,500
512	10101	17430	SY	SEALING OF CONCRETE SURFACES (EPOXY-URETHANE), AS PER PLAN	$15.00	$261,450
512	10600	800	FT	CONCRETE REPAIR BY EPOXY INJECTION (ARCH RIB)	$70.00	$56,000
512	74000	13680	SY	REMOVAL OF EXISTING COATINGS FROM CONCRETE SURFACES	$20.00	$273,600
516	47000	LUMP	-	JACKING AND TEMPORARY SUPPORT OF SUPERSTRUCTURE	$20,000.00	$20,000
519	00100	55693	SF	SPECIAL - COMPOSITE FIBER WRAP SYSTEM (ARCH RIBS)	$45.00	$2,506,203
519	00100	55919	SF	SPECIAL - COMPOSITE FIBER WRAP SYSTEM (FLOOR BEAMS)	$45.00	$2,516,355
519	11600	15300	SF	SPECIAL - PATCHING CONCRETE STRUCTURE (WEST STATION, TUNNELS AND UPPER DECK)	$90.00	$1,377,000
519	11600	9590	SF	SPECIAL - PATCHING CONCRETE STRUCTURE (LOWER SUPERSTRUCTURE, VERTICAL SURFACES)	$100.00	$959,000
519	11600	5560	SF	SPECIAL - PATCHING CONCRETE STRUCTURE (LOWER SUPERSTRUCTURE, BOTTOM AND CURVED SURFACES)	$125.00	$695,000
519	11900	6	CY	SPECIAL - PATCHING CONCRETE STRUCTURE (DEEP PIER SHAFT DETERIORATION)	$5,000.00	$30,000
530	00200	LUMP	-	SPECIAL - STRUCTURES BRIDGE OPERATOR'S CAR SHELTER	$5,000.00	$5,000
530	00400	200	EACH	SPECIAL - STRUCTURES CORBEL SHIELD	$200.00	$40,000
530	00600	900	SF	SPECIAL STRUCTURES MASONRY BLOCK WALL	$10.00	$9,000
625	98200	LUMP	-	LIGHTING, MISC.: NAVIGATION LIGHTING REPAIR	$20,000.00	$20,000
844	10001	30450	SF	CONCRETE PATCHING WITH GALVANIC ANODE PROTECTION, AS PER PLAN	$20.00	$609,000
848	10000	17750	SY	MICRO SILICA MODIFIED CONCRETE OVERLAY USING HYDRODEMOLITION	$25.00	$443,750
848	50320	17750	SY	EXISTING CONCRETE OVERLAY REMOVED	$10.00	$177,500
614	11000	LUMP	-	MAINTAINING TRAFFIC	$100,000.00	$100,000
619	16020	24	MNTH	FIELD OFFICE, TYPE C	$2,500.00	$60,000
624	10000	LUMP	-	MOBILIZATION	$100,000.00	$100,000
				SUBTOTAL:		**$10,461,000**
				20% CONTINGENCY:		**$2,092,000**
				2017 TOTAL:		**$12,553,000**
				FUTURE WORTH (AT AN INFLATION RATE OF 11.9%)		**$14,047,000**

Alternative No. 2D

Alternative No. 2D includes all the work items presented in Alternative No. 2C and includes additional protection of the public access areas by also wrapping the vertical surfaces of the end columns located at the piers. The location of the end columns on the piers are such that dislodged concrete has a high probability of falling onto the public access areas. These safety concerns, coupled with the fact that of all the vertical surfaces the end columns located at the piers are in the most critical shape, resulted in presenting this alternative to show the additional costs required to perform this work. This alternate extends the service life of the bridge an estimated 25 to 40 years before future repair work is necessary.

This alternate is estimated to cost **$15,409,000**.

ALTERNATIVE No. 2D						
ITEM	EXT	QTY	UNIT	DESCRIPTION	2017 UNIT COST	2017 COST
511	81100	170	FT	CONCRETE, MISC.: WEST STATION CONCRETE BEAM REPLACEMENT	$400.00	$68,000
511	81300	25	EACH	CONCRETE, MISC.: LOWER DECK CORBEL REPLACEMENT	$3,000.00	$75,000
511	81300	7	EACH	CONCRETE, MISC.: COLUMN REPLACEMENT	$8,500.00	$59,500
512	10101	19910	SY	SEALING OF CONCRETE SURFACES (EPOXY-URETHANE), AS PER PLAN	$15.00	$298,650
512	10600	800	FT	CONCRETE REPAIR BY EPOXY INJECTION (ARCH RIB)	$70.00	$56,000
512	74000	16210	SY	REMOVAL OF EXISTING COATINGS FROM CONCRETE SURFACES	$20.00	$324,200
516	47000	LUMP	-	JACKING AND TEMPORARY SUPPORT OF SUPERSTRUCTURE	$20,000.00	$20,000
519	00100	55693	SF	SPECIAL - COMPOSITE FIBER WRAP SYSTEM (ARCH RIBS)	$45.00	$2,506,203
519	00100	20568	SF	SPECIAL - COMPOSITE FIBER WRAP SYSTEM (END COLUMNS)	$45.00	$925,560
519	00100	55919	SF	SPECIAL - COMPOSITE FIBER WRAP SYSTEM (FLOOR BEAMS)	$45.00	$2,516,355
519	11600	15300	SF	SPECIAL - PATCHING CONCRETE STRUCTURE (WEST STATION, TUNNELS AND UPPER DECK)	$90.00	$1,377,000
519	11600	9590	SF	SPECIAL - PATCHING CONCRETE STRUCTURE (LOWER SUPERSTRUCTURE, VERTICAL SURFACES)	$100.00	$959,000
519	11600	5560	SF	SPECIAL - PATCHING CONCRETE STRUCTURE (LOWER SUPERSTRUCTURE, BOTTOM AND CURVED SURFACES)	$125.00	$695,000
519	11900	6	CY	SPECIAL - PATCHING CONCRETE STRUCTURE (DEEP PIER SHAFT DETERIORATION)	$5,000.00	$30,000
530	00200	LUMP	-	SPECIAL - STRUCTURES BRIDGE OPERATOR'S CAR SHELTER	$5,000.00	$5,000
530	00400	200	EACH	SPECIAL - STRUCTURES CORBEL SHIELD	$200.00	$40,000
530	00600	900	SF	SPECIAL - STRUCTURES MASONRY BLOCK WALL	$10.00	$9,000
625	98200	LUMP	-	LIGHTING, MISC.: NAVIGATION LIGHTING REPAIR	$20,000.00	$20,000
844	10001	30450	SF	CONCRETE PATCHING WITH GALVANIC ANODE PROTECTION, AS PER PLAN	$20.00	$609,000
848	10000	17750	SY	MICRO SILICA MODIFIED CONCRETE OVERLAY USING HYDRODEMOLITION	$25.00	$443,750
848	50320	17750	SY	EXISTING CONCRETE OVERLAY REMOVED	$10.00	$177,500
614	11000	LUMP	-	MAINTAINING TRAFFIC	$100,000.00	$100,000
619	16020	24	MNTH	FIELD OFFICE, TYPE C	$2,500.00	$60,000
624	10000	LUMP	-	MOBILIZATION	$100,000.00	$100,000
					SUBTOTAL:	**$11,475,000**
					20% CONTINGENCY:	**$2,295,000**
					2017 TOTAL:	**$13,770,000**
					FUTURE WORTH (AT AN INFLATION RATE OF 11.9%)	**$15,409,000**

Alternative No. 2E

Alternative No. 2E includes all the work items presented in Alternative No. 2D and includes additional protection of the public access areas by also wrapping the vertical surfaces of the lower deck support columns. The lower deck support columns are located over public access areas and dislodged concrete may potentially fall on to the public access areas below if it does not land on the concrete arch ribs below. This additional work would result in containing all the concrete with a high probability of falling on the public access areas below. Since all the existing problematic areas are addressed by concrete patching with cathodic protection and future areas are addressed by containment with FRP wrapping, this alternate extends the service life of the bridge an estimated 25 to 50 years before future repair work is necessary.

This alternate is estimated to cost **$19,515,000**.

ALTERNATIVE No. 2E						
ITEM	EXT	QTY	UNIT	DESCRIPTION	2017 UNIT COST	2017 COST
511	81100	170	FT	CONCRETE, MISC.: WEST STATION CONCRETE BEAM REPLACEMENT	$400.00	$68,000
511	81300	25	EACH	CONCRETE, MISC.: LOWER DECK CORBEL REPLACEMENT	$3,000.00	$75,000
511	81300	7	EACH	CONCRETE, MISC.: COLUMN REPLACEMENT	$8,500.00	$59,500
512	10101	27480	SY	SEALING OF CONCRETE SURFACES (EPOXY-URETHANE), AS PER PLAN	$15.00	$412,200
512	10600	800	FT	CONCRETE REPAIR BY EPOXY INJECTION (ARCH RIB)	$70.00	$56,000
512	74000	23790	SY	REMOVAL OF EXISTING COATINGS FROM CONCRETE SURFACES	$20.00	$475,800
516	47000	LUMP	-	JACKING AND TEMPORARY SUPPORT OF SUPERSTRUCTURE	$20,000.00	$20,000
519	00100	55693	SF	SPECIAL - COMPOSITE FIBER WRAP SYSTEM (ARCH RIBS)	$45.00	$2,506,203
519	00100	62060	SF	SPECIAL - COMPOSITE FIBER WRAP SYSTEM (LOWER DECK SUPPORT COLUMNS)	$45.00	$2,792,700
519	00100	20568	SF	SPECIAL - COMPOSITE FIBER WRAP SYSTEM (END COLUMNS)	$45.00	$925,560
519	00100	55919	SF	SPECIAL - COMPOSITE FIBER WRAP SYSTEM (FLOOR BEAMS)	$45.00	$2,516,355
519	11600	15300	SF	SPECIAL - PATCHING CONCRETE STRUCTURE (WEST STATION, TUNNELS AND UPPER DECK)	$90.00	$1,377,000
519	11600	9590	SF	SPECIAL - PATCHING CONCRETE STRUCTURE (LOWER SUPERSTRUCTURE, VERTICAL SURFACES)	$100.00	$959,000
519	11600	5560	SF	SPECIAL - PATCHING CONCRETE STRUCTURE (LOWER SUPERSTRUCTURE, BOTTOM AND CURVED SURFACES)	$125.00	$695,000
519	11900	6	CY	SPECIAL - PATCHING CONCRETE STRUCTURE (DEEP PIER SHAFT DETERIORATION)	$5,000.00	$30,000
530	00200	LUMP	-	SPECIAL - STRUCTURES BRIDGE OPERATOR'S CAR SHELTER	$5,000.00	$5,000
530	00400	200	EACH	SPECIAL - STRUCTURES CORBEL SHIELD	$200.00	$40,000
530	00600	900	SF	SPECIAL - STRUCTURES MASONRY BLOCK WALL	$10.00	$9,000
625	98200	LUMP	-	LIGHTING, MISC.: NAVIGATION LIGHTING REPAIR	$20,000.00	$20,000
844	10001	30450	SF	CONCRETE PATCHING WITH GALVANIC ANODE PROTECTION, AS PER PLAN	$20.00	$609,000
848	10000	17750	SY	MICRO SILICA MODIFIED CONCRETE OVERLAY USING HYDRODEMOLITION	$25.00	$443,750
848	50320	17750	SY	EXISTING CONCRETE OVERLAY REMOVED	$10.00	$177,500
614	11000	LUMP	-	MAINTAINING TRAFFIC	$100,000.00	$100,000
619	16020	24	MNTH	FIELD OFFICE, TYPE C	$2,500.00	$60,000
624	10000	LUMP	-	MOBILIZATION	$100,000.00	$100,000
					SUBTOTAL:	**$14,533,000**
					20% CONTINGENCY:	**$2,907,000**
					2017 TOTAL:	**$17,440,000**
					FUTURE WORTH (AT AN INFLATION RATE OF 11.9%)	**$19,515,000**

Alternative No. 3

As with Alternate No. 1 and 2, all general maintenance items including the hydro- demolition and overlay of the upper deck will be included. In Spans 2 through 13, excluding Span 4, all cracked, loose and deteriorated concrete will be patched. The areas in the West Station will be patched and/or replaced. As opposed to Alternate 2, in lieu of wrap, active impressed cathodic protection be employed to counteract and stabilize the corrosion. Once in place, this system can restore the concrete to its original composition and halt the ongoing concrete corrosion.

If installed and maintained properly, it is estimated that the service life would be greater than 50 years. Several bridges throughout the United States have this system in place and appear to be functioning as designed.

This alternate is estimated to cost $33,226,000. This estimated cost does not include maintenance of the active cathodic protection system.

The estimated costs for all alternates have been projected to the 2020 construction year.

OHIO DEPARTMENT OF TRANSPORTATION
2017 REHABILITATION FEASIBILITY STUDY
APPENDICES
PID NO 99972

DETROIT-SUPERIOR BRIDGE OVER CUYAHOGA RIVER
BRIDGE NO. CUY-6-1456

SFN: 1800930

FEBRUARY 2017

PREPARED BY:

1655 W. Market Street, Suite 355 | Akron, OH 44313

BRIDGE NO. CUY-6-1456
DETROIT-SUPERIOR BRIDGE OVER CUYAHOGA RIVER
2017 REHABILITATION FEASIBILITY STUDY

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APPENDIX A

SUMMARY OF ESTIMATED COST

Summary of Estimated Cost				
Alternative	**Description**	**February 15, 2015 Estimate**	**Construction Mid-Point**	**July 1, 2020 Estimate**
1	Maintenance Only	$2,282.400	41 Month	$2,569,000
2	Rehabilitation w/Patching and FRP Wrap	$22,907.400	41 Month	$25,984,000
3	Rehabilitation w/Patching Cathodic Protection	$29,519.400	41 Month	$33,226,000

2A	Maintenance plus patching	$5,952,000	38 Months	$6,660,000
2B	2A plus FRP Wrap Arch Ribs	$9,247,000	38 Months	$10,347,000
2C	2B plus FRP Wrap Floor Beams	$12,553,000	38 Months	$14,047,000
2D	2C plus FRP Wrap End Columns	$13,770,000	38 Months	$15,409,000
2E	2D plus FRP Wrap L.D. Columns	$17,440,000	38 Months	$19,515,000

CY 2017-2021 Business Plan Inflation Calculator:

Not sure if you have the latest calculator? Click here.

Last Modified: 1/19/2017

Today's Date:
February 15, 2017

Please Enter Values in the Yellow Areas Only:

Estimation Start Date:
Less than or Equal to Today's Date
(mm/dd/yyyy)

2/15/2017
Start Date:

Enter Construction Mid-Point Date:
(cannot exceed 02/15/2042)
(mm/dd/yyyy)

7/1/2020
Construction Mid-Point Date:

Present-Day Estimated Cost:

$2,282,400.00
Estimated Dollar Amount:

Estimate Start Date to Construction Mid-Point Date: **41** **Months**

Inflation - Start to Mid-Point of Construction:

	(compounded growth rate)	Inflated Dollar Amount:
Business Plan	**12.6%**	**$2,568,995.13**

Estimator's Name:

County - Route - Section: CUY-6-1456

PID: 99972

Estimator's Notes: Alternate 1 - Maintenance Only

Estimate ODOT1602

Estimated Cost:$1,902,000.00

Contingency: 20.00%

Estimated Total: $2,282,400.00

ALTERNATE 1 - MAINTENANCE ONLY

Base Date: 02/13/17

Spec Year: 16

Unit System: E

Work Type: BRIDGE REHABILITATION

Highway Type:

Urban/Rural Type:

Season:

County: CUYAHOGA

Latitude of Midpoint: 412929

Longitude of Midpoint: -814242

District: 12

Federal/State Project Number: 99972

Prepared by DEA on 02/13/17
Checked by WJV on 02/14/17

Line #	Item Number	Quantity	Units	Unit Price	Extension
	Description				
	Supplemental Description				

Group 0001: STRUCTURE

0005	530E00200	1.000	LS	$5,000.00000	$5,000.00
	SPECIAL - STRUCTURES				
	BRIDGE OPERATOR'S CAR SHELTER				
0006	530E00600	900.000	SF	$10.00000	$9,000.00
	SPECIAL - STRUCTURES				
	MASONRY BLOCK WALL				
0007	530E00600	15,000.000	SF	$22.00000	$330,000.00
	SPECIAL - STRUCTURES				
	REMOVE LOOSE AND DELAMINATED CONCRETE				
0008	625E98200	1.000	LS	$20,000.00000	$20,000.00
	LIGHTING, MISC.:				
	NAVIGATION LIGHTING REPAIR				
0009	848E10000	19,400.000	SY	$60.00000	$1,164,000.00
	MICRO SILICA MODIFIED CONCRETE OVELAY USING HYDRODEMOLITION				
0010	848E50320	19,400.000	SY	$10.00000	$194,000.00
	EXISTING CONCRETE OVERLAY REMOVED				

Total for Group 0001:$1,722,000.00

Group 0002: INCIDENTAL

0011	614E11000	1.000	LS	$100,000.00000	$100,000.00
	MAINTAINING TRAFFIC				
0012	619E16020	12.000	MNTH	$2,500.00000	$30,000.00
	FIELD OFFICE, TYPE C				
0013	624E10000	1.000	LS	$50,000.00000	$50,000.00
	MOBILIZATION				

Total for Group 0002:$180,000.00

CY 2017-2021 Business Plan Inflation Calculator:

Not sure if you have the latest calculator? Click here.

Last Modified: 1/19/2017

Today's Date:
February 15, 2017

Please Enter Values in the Yellow Areas Only:

Estimation Start Date:
Less than or Equal to Today's Date
(mm/dd/yyyy)

2/15/2017
Start Date:

Enter Construction Mid-Point Date:
(cannot exceed 02/15/2042)
(mm/dd/yyyy)

7/1/2020
Construction Mid-Point Date:

Present-Day Estimated Cost:

$22,907,400.00
Estimated Dollar Amount:

Estimate Start Date to Construction Mid-Point Date: **41** **Months**

Inflation - Start to Mid-Point of Construction:

	(compounded growth rate)	Inflated Dollar Amount:
Business Plan	**12.6%**	**$25,783,823.60**

Estimator's Name:

County - Route - Section: CUY-6-1456

PID: 99972

Estimator's Notes: Alternate 2 - Rehab w/ Patching and Fiber Wrap

Estimate ODOT1602

Estimated Cost:$19,089,500.00

Contingency: 20.00%

Estimated Total: $22,907,400.00

ALTERNATE 2 - REHAB W/ PATCHING AND FIBER WRAP

Base Date: 02/13/17

Spec Year: 16

Unit System: E

Work Type: BRIDGE REHABILITATION

Highway Type:

Urban/Rural Type:

Season:

County: CUYAHOGA

Latitude of Midpoint: 412929

Longitude of Midpoint: -814242

District: 12

Federal/State Project Number: 99972

Prepared by DEA on 02/13/17
Checked by WJV on 02/14/17

Line #	Item Number	Quantity	Units	Unit Price	Extension
	Description				
	Supplemental Description				

Group 0001: STRUCTURE

0005	511E81100	150.000	FT	$400.00000	$60,000.00
	CONCRETE, MISC.:				
	WEST STATION CONCRETE BEAM REPLACEMENT				
0006	511E81300	25.000	EACH	$3,000.00000	$75,000.00
	CONCRETE, MISC.:				
	LOWER DECK CORBEL REPLACEMENT				
0007	511E81300	4.000	EACH	$8,500.00000	$34,000.00
	CONCRETE, MISC.:				
	COLUMN REPLACEMENT				
0008	512E10101	31,000.000	SY	$15.00000	$465,000.00
	SEALING OF CONCRETE SURFACES (EPOXY-URETHANE), AS PER PLAN				
0009	512E10600	800.000	FT	$70.00000	$56,000.00
	CONCRETE REPAIR BY EPOXY INJECTION				
	ARCH RIB				
0010	512E74000	31,000.000	SY	$20.00000	$620,000.00
	REMOVAL OF EXISTING COATINGS FROM CONCRETE SURFACES				
0011	516E47000	1.000	LS	$20,000.00000	$20,000.00
	JACKING AND TEMPORARY SUPPORT OF SUPERSTRUCTURE				
0012	519E00100	275,000.000	SF	$45.00000	$12,375,000.00
	SPECIAL - COMPOSITE FIBER WRAP SYSTEM				
0013	519E11600	15,000.000	SF	$90.00000	$1,350,000.00
	SPECIAL - PATCHING CONCRETE STRUCTURE				
	WEST STATION, TUNNELS AND UPPER DECK				
0014	519E11600	9,500.000	SF	$100.00000	$950,000.00
	SPECIAL - PATCHING CONCRETE STRUCTURE				
	LOWER SUPERSTRUCTURE, VERTICAL SURFACES				
0015	519E11600	5,500.000	SF	$125.00000	$687,500.00
	SPECIAL - PATCHING CONCRETE STRUCTURE				
	LOWER SUPERSTRUCTURE - BOTTOM AND CURVED SURFACES				
0016	519E11900	6.000	CY	$5,000.00000	$30,000.00
	SPECIAL - PATCHING CONCRETE STRUCTURE				
	DEEP PIER SHAFT DETERIORATION				
0017	530E00200	1.000	LS	$5,000.00000	$5,000.00
	SPECIAL - STRUCTURES				
	BRIDGE OPERATOR'S CAR SHELTER				
0018	530E00400	200.000	EACH	$200.00000	$40,000.00
	SPECIAL - STRUCTURES				
	CORBEL SHIELD				
0019	530E00600	900.000	SF	$10.00000	$9,000.00
	SPECIAL - STRUCTURES				
	MASONRY BLOCK WALL				
0020	625E98200	1.000	LS	$20,000.00000	$20,000.00
	LIGHTING, MISC.:				
	NAVIGATION LIGHTING REPAIR				
0021	844E10001	30,000.000	SF	$20.00000	$600,000.00
	CONCRETE PATCHING WITH GALVANIC ANODE PROTECTION, AS PER PLA N				

Line #	Item Number Description *Supplemental Description*	Quantity	Units	Unit Price	Extension
0022	848E10000 *MICRO SILICA MODIFIED CONCRETE OVELAY USING HYDRODEMOLITION*	19,400.000	SY	$60.00000	$1,164,000.00
0023	848E50320 EXISTING CONCRETE OVERLAY REMOVED	19,400.000	SY	$10.00000	$194,000.00

Total for Group 0001:$18,754,500.00

Group 0002: INCIDENTAL

0024	614E11000 MAINTAINING TRAFFIC	1.000	LS	$100,000.00000	$100,000.00
0025	614E18002 MAINTAINING TRAFFIC, MISC.: *RAILROAD FLAGGER*	1.000	LS	$50,000.00000	$50,000.00
0026	614E18002 MAINTAINING TRAFFIC, MISC.: *RAILROAD COORDINATION*	1.000	LS	$25,000.00000	$25,000.00
0027	619E16020 FIELD OFFICE, TYPE C	24.000	MNTH	$2,500.00000	$60,000.00
0028	624E10000 MOBILIZATION	1.000	LS	$100,000.00000	$100,000.00

Total for Group 0002:$335,000.00

CY 2017-2021 Business Plan Inflation Calculator:

Not sure if you have the latest calculator? Click here.

Last Modified: 1/19/2017

Today's Date:
May 17, 2017

Please Enter Values in the Yellow Areas Only:

Estimation Start Date:
Less than or Equal to Today's Date
(mm/dd/yyyy)

5/17/2017
Start Date:

Enter Construction Mid-Point Date:
(cannot exceed 05/17/2042)
(mm/dd/yyyy)

7/1/2020
Construction Mid-Point Date:

Present-Day Estimated Cost:

$5,952,000.00
Estimated Dollar Amount:

Estimate Start Date to Construction Mid-Point Date: **38** **Months**

Inflation - Start to Mid-Point of Construction:

	(compounded growth rate)	Inflated Dollar Amount:
Business Plan	**11.9%**	**$6,658,148.51**

Estimator's Name:

County - Route - Section: CUY-6-14.56

PID: 99972

Estimator's Notes: Alternative No. 2A

Estimate ODOT1602

Estimated Cost:$4,960,450.00

Contingency: 20.00%

Estimated Total: $5,952,540.00

Alternative No. 2A

Base Date: 05/17/17

Spec Year: 16

Unit System: E

Work Type: BRIDGE REHABILITATION

Highway Type:

Urban/Rural Type: URBAN CLASS

Season: SUMMER

County: CUYAHOGA

Latitude of Midpoint: 412929

Longitude of Midpoint: -814242

District: 12

Federal/State Project Number: 99972

Prepared by BPS on 05/17/17
Checked by WJV on 05/17/17

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
Group 0001: STRUCTURE					
0001	511E81100 CONCRETE, MISC.: *WEST STATION CONCRETE BEAM REPLACEMENT*	170.000	FT	$400.00000	$68,000.00
0002	511E81300 CONCRETE, MISC.: *LOWER DECK CORBEL REPLACEMENT*	25.000	EACH	$3,000.00000	$75,000.00
0003	511E81300 CONCRETE, MISC.: *COLUMN REPLACEMENT*	7.000	EACH	$8,500.00000	$59,500.00
0004	512E10101 SEALING OF CONCRETE SURFACES (EPOXY-URETHANE), AS PER PLAN	3,780.000	SY	$15.00000	$56,700.00
0005	512E10600 CONCRETE REPAIR BY EPOXY INJECTION *(ARCH RIB)*	800.000	FT	$70.00000	$56,000.00
0006	516E47000 JACKING AND TEMPORARY SUPPORT OF SUPERSTRUCTURE	1.000	LS	$20,000.00000	$20,000.00
0007	519E11600 SPECIAL - PATCHING CONCRETE STRUCTURE *(WEST STATION, TUNNELS, AND UPPER DECK)*	15,300.000	SF	$90.00000	$1,377,000.00
0008	519E11600 SPECIAL - PATCHING CONCRETE STRUCTURE *(LOWER SUPERSTRUCTURE, VERTICAL SURFACES)*	9,590.000	SF	$100.00000	$959,000.00
0009	519E11600 SPECIAL - PATCHING CONCRETE STRUCTURE *(LOWER SUPERSTRUCTURE, BOTTOM AND CURVED SURFACES)*	5,560.000	SF	$125.00000	$695,000.00
0010	519E11900 SPECIAL - PATCHING CONCRETE STRUCTURE *(DEEP PIER SHAFT DETERIORATION)*	6.000	CY	$5,000.00000	$30,000.00
0011	530E00200 SPECIAL - STRUCTURES *BRIDGE OPERATOR'S CAR SHELTER*	1.000	LS	$5,000.00000	$5,000.00
0012	530E00400 SPECIAL - STRUCTURES *CORBEL SHIELD*	200.000	EACH	$200.00000	$40,000.00
0013	530E00600 SPECIAL - STRUCTURES *MASONRY BLOCK WALL*	900.000	SF	$10.00000	$9,000.00
0014	625E98200 LIGHTING, MISC.: *NAVIGATION LIGHTING REPAIR*	1.000	LS	$20,000.00000	$20,000.00
0015	844E10001 CONCRETE PATCHING WITH GALVANIC ANODE PROTECTION, AS PER PLA N	30,450.000	SF	$20.00000	$609,000.00
0016	848E10000 MICRO SILICA MODIFIED CONCRETE OVERLAY USING HYDRODEMOLITION	17,750.000	SY	$25.00000	$443,750.00
0017	848E50320 EXISTING CONCRETE OVERLAY REMOVED	17,750.000	SY	$10.00000	$177,500.00
0018	614E11000 MAINTAINING TRAFFIC	1.000	LS	$100,000.00000	$100,000.00

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
0019	619E16020 FIELD OFFICE, TYPE C	24.000	MNTH	$2,500.00000	$60,000.00
0020	624E10000 MOBILIZATION	1.000	LS	$100,000.00000	$100,000.00

Total for Group 0001:$4,960,450.00

CY 2017-2021 Business Plan Inflation Calculator:

Not sure if you have the latest calculator? Click here.

Last Modified: 1/19/2017

Today's Date:
May 17, 2017

Please Enter Values in the Yellow Areas Only:

Estimation Start Date:
Less than or Equal to Today's Date
(mm/dd/yyyy)

5/17/2017
Start Date:

Enter Construction Mid-Point Date:
(cannot exceed 05/17/2042)
(mm/dd/yyyy)

7/1/2020
Construction Mid-Point Date:

Present-Day Estimated Cost:

$9,247,000.00
Estimated Dollar Amount:

Estimate Start Date to Construction Mid-Point Date: **38** **Months**

Inflation - Start to Mid-Point of Construction:

	(compounded growth rate)	Inflated Dollar Amount:
Business Plan	**11.9%**	**$10,344,069.10**

Estimator's Name:

County - Route - Section: CUY-6-14.56

PID: 99972

Estimator's Notes: Alternative No. 2B

Estimate ODOT1602

Estimated Cost:$7,705,985.00

Contingency: 20.00%

Estimated Total: $9,247,182.00

Alternative No. 2B

Base Date: 05/17/17

Spec Year: 16

Unit System: E

Work Type: BRIDGE REHABILITATION

Highway Type:

Urban/Rural Type: URBAN CLASS

Season: SUMMER

County: CUYAHOGA

Latitude of Midpoint: 412929

Longitude of Midpoint: -814242

District: 12

Federal/State Project Number: 99972

Prepared by BPS on 05/17/17
Checked by WJV on 05/17/17

Line #	Item Number	Quantity	Units	Unit Price	Extension
	Description				
	Supplemental Description				

Group 0001: STRUCTURE

0001	511E81100	170.000	FT	$400.00000	$68,000.00
	CONCRETE, MISC.:				
	WEST STATION CONCRETE BEAM REPLACEMENT				
0002	511E81300	25.000	EACH	$3,000.00000	$75,000.00
	CONCRETE, MISC.:				
	LOWER DECK CORBEL REPLACEMENT				
0003	511E81300	7.000	EACH	$8,500.00000	$59,500.00
	CONCRETE, MISC.:				
	COLUMN REPLACEMENT				
0004	512E10101	10,590.000	SY	$15.00000	$158,850.00
	SEALING OF CONCRETE SURFACES (EPOXY-URETHANE), AS PER PLAN				
0005	512E10600	800.000	FT	$70.00000	$56,000.00
	CONCRETE REPAIR BY EPOXY INJECTION				
	(ARCH RIB)				
0006	512E74000	6,860.000	SY	$20.00000	$137,200.00
	REMOVAL OF EXISTING COATINGS FROM CONCRETE SURFACES				
0007	516E47000	1.000	LS	$20,000.00000	$20,000.00
	JACKING AND TEMPORARY SUPPORT OF SUPERSTRUCTURE				
0008	519E00100	55,693.000	SF	$45.00000	$2,506,185.00
	SPECIAL - COMPOSITE FIBER WRAP SYSTEM				
	(ARCH RIBS)				
0009	519E11600	15,300.000	SF	$90.00000	$1,377,000.00
	SPECIAL - PATCHING CONCRETE STRUCTURE				
	(WEST STATION, TUNNELS, AND UPPER DECK)				
0010	519E11600	9,590.000	SF	$100.00000	$959,000.00
	SPECIAL - PATCHING CONCRETE STRUCTURE				
	(LOWER SUPERSTRUCTURE, VERTICAL SURFACES)				
0011	519E11600	5,560.000	SF	$125.00000	$695,000.00
	SPECIAL - PATCHING CONCRETE STRUCTURE				
	(LOWER SUPERSTRUCTURE, BOTTOM AND CURVED SURFACES)				
0012	519E11900	6.000	CY	$5,000.00000	$30,000.00
	SPECIAL - PATCHING CONCRETE STRUCTURE				
	(DEEP PIER SHAFT DETERIORATION)				
0013	530E00200	1.000	LS	$5,000.00000	$5,000.00
	SPECIAL - STRUCTURES				
	BRIDGE OPERATOR'S CAR SHELTER				
0014	530E00400	200.000	EACH	$200.00000	$40,000.00
	SPECIAL - STRUCTURES				
	CORBEL SHIELD				
0015	530E00600	900.000	SF	$10.00000	$9,000.00
	SPECIAL - STRUCTURES				
	MASONRY BLOCK WALL				
0016	625E98200	1.000	LS	$20,000.00000	$20,000.00
	LIGHTING, MISC.:				
	NAVIGATION LIGHTING REPAIR				
0017	844E10001	30,450.000	SF	$20.00000	$609,000.00
	CONCRETE PATCHING WITH GALVANIC ANODE PROTECTION, AS PER PLA N				
0018	848E10000	17,750.000	SY	$25.00000	$443,750.00
	MICRO SILICA MODIFIED CONCRETE OVERLAY USING HYDRODEMOLITION				

Line #	Item Number	Quantity	Units	Unit Price	Extension
	Description				
	Supplemental Description				
0019	848E50320	17,750.000	SY	$10.00000	$177,500.00
	EXISTING CONCRETE OVERLAY REMOVED				
0020	614E11000	1.000	LS	$100,000.00000	$100,000.00
	MAINTAINING TRAFFIC				
0021	619E16020	24.000	MNTH	$2,500.00000	$60,000.00
	FIELD OFFICE, TYPE C				
0022	624E10000	1.000	LS	$100,000.00000	$100,000.00
	MOBILIZATION				

Total for Group 0001:$7,705,985.00

CY 2017-2021 Business Plan Inflation Calculator:

Not sure if you have the latest calculator? Click here.

Last Modified: 1/19/2017

Today's Date:
May 17, 2017

Please Enter Values in the Yellow Areas Only:

Estimation Start Date:
Less than or Equal to Today's Date
(mm/dd/yyyy)

5/17/2017
Start Date:

Enter Construction Mid-Point Date:
(cannot exceed 05/17/2042)
(mm/dd/yyyy)

7/1/2020
Construction Mid-Point Date:

Present-Day Estimated Cost:

$12,553,000.00
Estimated Dollar Amount:

Estimate Start Date to Construction Mid-Point Date: **38** **Months**

Inflation - Start to Mid-Point of Construction:

	(compounded growth rate)	Inflated Dollar Amount:
Business Plan	**11.9%**	**$14,042,294.74**

Estimator's Name:

County - Route - Section: CUY-6-14.56

PID: 99972

Estimator's Notes: Alternative No. 2C

Estimate ODOT1602

Estimated Cost:$10,461,340.00

Contingency: 20.00%

Estimated Total: $12,553,608.00

Alternative No. 2C

Base Date: 05/17/17

Spec Year: 16

Unit System: E

Work Type: BRIDGE REHABILITATION

Highway Type:

Urban/Rural Type: URBAN CLASS

Season: SUMMER

County: CUYAHOGA

Latitude of Midpoint: 412929

Longitude of Midpoint: -814242

District: 12

Federal/State Project Number: 99972

Prepared by BPS on 05/17/17
Checked by WJV on 05/17/17

Line #	Item Number	Quantity	Units	Unit Price	Extension
	Description				
	Supplemental Description				

Group 0001: STRUCTURE

0001	511E81100	170.000	FT	$400.00000	$68,000.00
	CONCRETE, MISC.:				
	WEST STATION CONCRETE BEAM REPLACEMENT				
0002	511E81300	25.000	EACH	$3,000.00000	$75,000.00
	CONCRETE, MISC.:				
	LOWER DECK CORBEL REPLACEMENT				
0003	511E81300	7.000	EACH	$8,500.00000	$59,500.00
	CONCRETE, MISC.:				
	COLUMN REPLACEMENT				
0004	512E10101	17,430.000	SY	$15.00000	$261,450.00
	SEALING OF CONCRETE SURFACES (EPOXY-URETHANE), AS PER PLAN				
0005	512E10600	800.000	FT	$70.00000	$56,000.00
	CONCRETE REPAIR BY EPOXY INJECTION				
	(ARCH RIB)				
0006	512E74000	13,680.000	SY	$20.00000	$273,600.00
	REMOVAL OF EXISTING COATINGS FROM CONCRETE SURFACES				
0007	516E47000	1.000	LS	$20,000.00000	$20,000.00
	JACKING AND TEMPORARY SUPPORT OF SUPERSTRUCTURE				
0008	519E00100	55,693.000	SF	$45.00000	$2,506,185.00
	SPECIAL - COMPOSITE FIBER WRAP SYSTEM				
	(ARCH RIBS)				
0009	519E00100	55,919.000	SF	$45.00000	$2,516,355.00
	SPECIAL - COMPOSITE FIBER WRAP SYSTEM				
	(FLOOR BEAMS)				
0010	519E11600	15,300.000	SF	$90.00000	$1,377,000.00
	SPECIAL - PATCHING CONCRETE STRUCTURE				
	(WEST STATION, TUNNELS, AND UPPER DECK)				
0011	519E11600	9,590.000	SF	$100.00000	$959,000.00
	SPECIAL - PATCHING CONCRETE STRUCTURE				
	(LOWER SUPERSTRUCTURE, VERTICAL SURFACES)				
0012	519E11600	5,560.000	SF	$125.00000	$695,000.00
	SPECIAL - PATCHING CONCRETE STRUCTURE				
	(LOWER SUPERSTRUCTURE, BOTTOM AND CURVED SURFACES)				
0013	519E11900	6.000	CY	$5,000.00000	$30,000.00
	SPECIAL - PATCHING CONCRETE STRUCTURE				
	(DEEP PIER SHAFT DETERIORATION)				
0014	530E00200	1.000	LS	$5,000.00000	$5,000.00
	SPECIAL - STRUCTURES				
	BRIDGE OPERATOR'S CAR SHELTER				
0015	530E00400	200.000	EACH	$200.00000	$40,000.00
	SPECIAL - STRUCTURES				
	CORBEL SHIELD				
0016	530E00600	900.000	SF	$10.00000	$9,000.00
	SPECIAL - STRUCTURES				
	MASONRY BLOCK WALL				
0017	625E98200	1.000	LS	$20,000.00000	$20,000.00
	LIGHTING, MISC.:				
	NAVIGATION LIGHTING REPAIR				
0018	844E10001	30,450.000	SF	$20.00000	$609,000.00
	CONCRETE PATCHING WITH GALVANIC ANODE PROTECTION, AS PER PLA N				

Line #	Item Number	Quantity	Units	Unit Price	Extension
	Description				
	Supplemental Description				
0019	848E10000	17,750.000	SY	$25.00000	$443,750.00
	MICRO SILICA MODIFIED CONCRETE OVERLAY USING HYDRODEMOLITION				
0020	848E50320	17,750.000	SY	$10.00000	$177,500.00
	EXISTING CONCRETE OVERLAY REMOVED				
0021	614E11000	1.000	LS	$100,000.00000	$100,000.00
	MAINTAINING TRAFFIC				
0022	619E16020	24.000	MNTH	$2,500.00000	$60,000.00
	FIELD OFFICE, TYPE C				
0023	624E10000	1.000	LS	$100,000.00000	$100,000.00
	MOBILIZATION				

Total for Group 0001:$10,461,340.00

CY 2017-2021 Business Plan Inflation Calculator:

Not sure if you have the latest calculator? Click here.

Last Modified: 1/19/2017

Today's Date:
May 17, 2017

Please Enter Values in the Yellow Areas Only:

Estimation Start Date:
Less than or Equal to Today's Date
(mm/dd/yyyy)

5/17/2017
Start Date:

Enter Construction Mid-Point Date:
(cannot exceed 05/17/2042)
(mm/dd/yyyy)

7/1/2020
Construction Mid-Point Date:

Present-Day Estimated Cost:

$13,770,000.00
Estimated Dollar Amount:

Estimate Start Date to Construction Mid-Point Date: **38** **Months**

Inflation - Start to Mid-Point of Construction:

	(compounded growth rate)	Inflated Dollar Amount:
Business Plan	**11.9%**	**$15,403,680.28**

Estimator's Name:

County - Route - Section: CUY-6-14.56

PID: 99972

Estimator's Notes: Alternative No. 2D

Estimate ODOT1602

Estimated Cost:$11,474,700.00

Contingency: 20.00%

Estimated Total: $13,769,640.00

Alternative No. 2D

Base Date: 05/17/17

Spec Year: 16

Unit System: E

Work Type: BRIDGE REHABILITATION

Highway Type:

Urban/Rural Type: URBAN CLASS

Season: SUMMER

County: CUYAHOGA

Latitude of Midpoint: 412929

Longitude of Midpoint: -814242

District: 12

Federal/State Project Number: 99972

Prepared by BPS on 05/17/17
Checked by WJV on 05/17/17

Line #	Item Number	Quantity	Units	Unit Price	Extension
	Description				
	Supplemental Description				

Group 0001: STRUCTURE

0001	511E81100	170.000	FT	$400.00000	$68,000.00
	CONCRETE, MISC.:				
	WEST STATION CONCRETE BEAM REPLACEMENT				
0002	511E81300	25.000	EACH	$3,000.00000	$75,000.00
	CONCRETE, MISC.:				
	LOWER DECK CORBEL REPLACEMENT				
0003	511E81300	7.000	EACH	$8,500.00000	$59,500.00
	CONCRETE, MISC.:				
	COLUMN REPLACEMENT				
0004	512E10101	19,910.000	SY	$15.00000	$298,650.00
	SEALING OF CONCRETE SURFACES (EPOXY-URETHANE), AS PER PLAN				
0005	512E10600	800.000	FT	$70.00000	$56,000.00
	CONCRETE REPAIR BY EPOXY INJECTION				
	(ARCH RIB)				
0006	512E74000	16,210.000	SY	$20.00000	$324,200.00
	REMOVAL OF EXISTING COATINGS FROM CONCRETE SURFACES				
0007	516E47000	1.000	LS	$20,000.00000	$20,000.00
	JACKING AND TEMPORARY SUPPORT OF SUPERSTRUCTURE				
0008	519E00100	55,693.000	SF	$45.00000	$2,506,185.00
	SPECIAL - COMPOSITE FIBER WRAP SYSTEM				
	(ARCH RIBS)				
0009	519E00100	20,568.000	SF	$45.00000	$925,560.00
	SPECIAL - COMPOSITE FIBER WRAP SYSTEM				
	(END COLUMNS)				
0010	519E00100	55,919.000	SF	$45.00000	$2,516,355.00
	SPECIAL - COMPOSITE FIBER WRAP SYSTEM				
	(FLOOR BEAMS)				
0011	519E11600	15,300.000	SF	$90.00000	$1,377,000.00
	SPECIAL - PATCHING CONCRETE STRUCTURE				
	(WEST STATION, TUNNELS, AND UPPER DECK)				
0012	519E11600	9,590.000	SF	$100.00000	$959,000.00
	SPECIAL - PATCHING CONCRETE STRUCTURE				
	(LOWER SUPERSTRUCTURE, VERTICAL SURFACES)				
0013	519E11600	5,560.000	SF	$125.00000	$695,000.00
	SPECIAL - PATCHING CONCRETE STRUCTURE				
	(LOWER SUPERSTRUCTURE, BOTTOM AND CURVED SURFACES)				
0014	519E11900	6.000	CY	$5,000.00000	$30,000.00
	SPECIAL - PATCHING CONCRETE STRUCTURE				
	(DEEP PIER SHAFT DETERIORATION)				
0015	530E00200	1.000	LS	$5,000.00000	$5,000.00
	SPECIAL - STRUCTURES				
	BRIDGE OPERATOR'S CAR SHELTER				
0016	530E00400	200.000	EACH	$200.00000	$40,000.00
	SPECIAL - STRUCTURES				
	CORBEL SHIELD				
0017	530E00600	900.000	SF	$10.00000	$9,000.00
	SPECIAL - STRUCTURES				
	MASONRY BLOCK WALL				
0018	625E98200	1.000	LS	$20,000.00000	$20,000.00
	LIGHTING, MISC.:				

Line #	Item Number	Quantity	Units	Unit Price	Extension
	Description				
	Supplemental Description				
	NAVIGATION LIGHTING REPAIR				
0019	844E10001	30,450.000	SF	$20.00000	$609,000.00
	CONCRETE PATCHING WITH GALVANIC ANODE PROTECTION, AS PER PLA N				
0020	848E10000	17,750.000	SY	$25.00000	$443,750.00
	MICRO SILICA MODIFIED CONCRETE OVERLAY USING HYDRODEMOLITION				
0021	848E50320	17,750.000	SY	$10.00000	$177,500.00
	EXISTING CONCRETE OVERLAY REMOVED				
0022	614E11000	1.000	LS	$100,000.00000	$100,000.00
	MAINTAINING TRAFFIC				
0023	619E16020	24.000	MNTH	$2,500.00000	$60,000.00
	FIELD OFFICE, TYPE C				
0024	624E10000	1.000	LS	$100,000.00000	$100,000.00
	MOBILIZATION				

Total for Group 0001:$11,474,700.00

CY 2017-2021 Business Plan Inflation Calculator:

Not sure if you have the latest calculator? Click here.

Last Modified: 1/19/2017

Today's Date:
May 17, 2017

Please Enter Values in the Yellow Areas Only:

Estimation Start Date:
Less than or Equal to Today's Date
(mm/dd/yyyy)

5/17/2017
Start Date:

Enter Construction Mid-Point Date:
(cannot exceed 05/17/2042)
(mm/dd/yyyy)

7/1/2020
Construction Mid-Point Date:

Present-Day Estimated Cost:

$17,440,000.00
Estimated Dollar Amount:

Estimate Start Date to Construction Mid-Point Date: **38** **Months**

Inflation - Start to Mid-Point of Construction:

	(compounded growth rate)	Inflated Dollar Amount:
Business Plan	**11.9%**	**$19,509,091.07**

Estimator's Name:

County - Route - Section: CUY-6-14.56

PID: 99972

Estimator's Notes: Alternative No. 2E

Estimate ODOT1602

Estimated Cost:$14,532,550.00

Contingency: 20.00%

Estimated Total: $17,439,060.00

Alternative No. 2E

Base Date: 05/17/17

Spec Year: 16

Unit System: E

Work Type: BRIDGE REHABILITATION

Highway Type:

Urban/Rural Type: URBAN CLASS

Season: SUMMER

County: CUYAHOGA

Latitude of Midpoint: 412929

Longitude of Midpoint: -814242

District: 12

Federal/State Project Number: 99972

Prepared by BPS on 05/17/17
Checked by WJV on 05/17/17

Line #	Item Number	Quantity	Units	Unit Price	Extension
	Description				
	Supplemental Description				

Group 0001: STRUCTURE

0001	511E81100	170.000	FT	$400.00000	$68,000.00
	CONCRETE, MISC.:				
	WEST STATION CONCRETE BEAM REPLACEMENT				
0002	511E81300	25.000	EACH	$3,000.00000	$75,000.00
	CONCRETE, MISC.:				
	LOWER DECK CORBEL REPLACEMENT				
0003	511E81300	7.000	EACH	$8,500.00000	$59,500.00
	CONCRETE, MISC.:				
	COLUMN REPLACEMENT				
0004	512E10101	27,480.000	SY	$15.00000	$412,200.00
	SEALING OF CONCRETE SURFACES (EPOXY-URETHANE), AS PER PLAN				
0005	512E10600	800.000	FT	$70.00000	$56,000.00
	CONCRETE REPAIR BY EPOXY INJECTION				
	(ARCH RIB)				
0006	512E74000	23,790.000	SY	$20.00000	$475,800.00
	REMOVAL OF EXISTING COATINGS FROM CONCRETE SURFACES				
0007	516E47000	1.000	LS	$20,000.00000	$20,000.00
	JACKING AND TEMPORARY SUPPORT OF SUPERSTRUCTURE				
0008	519E00100	55,693.000	SF	$45.00000	$2,506,185.00
	SPECIAL - COMPOSITE FIBER WRAP SYSTEM				
	(ARCH RIBS)				
0009	519E00100	62,060.000	SF	$45.00000	$2,792,700.00
	SPECIAL - COMPOSITE FIBER WRAP SYSTEM				
	(LOWER DECK SUPPORT COLUMNS)				
0010	519E00100	20,568.000	SF	$45.00000	$925,560.00
	SPECIAL - COMPOSITE FIBER WRAP SYSTEM				
	(END COLUMNS)				
0011	519E00100	55,919.000	SF	$45.00000	$2,516,355.00
	SPECIAL - COMPOSITE FIBER WRAP SYSTEM				
	(FLOOR BEAMS)				
0012	519E11600	15,300.000	SF	$90.00000	$1,377,000.00
	SPECIAL - PATCHING CONCRETE STRUCTURE				
	(WEST STATION, TUNNELS, AND UPPER DECK)				
0013	519E11600	9,590.000	SF	$100.00000	$959,000.00
	SPECIAL - PATCHING CONCRETE STRUCTURE				
	(LOWER SUPERSTRUCTURE, VERTICAL SURFACES)				
0014	519E11600	5,560.000	SF	$125.00000	$695,000.00
	SPECIAL - PATCHING CONCRETE STRUCTURE				
	(LOWER SUPERSTRUCTURE, BOTTOM AND CURVED SURFACES)				
0015	519E11900	6.000	CY	$5,000.00000	$30,000.00
	SPECIAL - PATCHING CONCRETE STRUCTURE				
	(DEEP PIER SHAFT DETERIORATION)				
0016	530E00200	1.000	LS	$5,000.00000	$5,000.00
	SPECIAL - STRUCTURES				
	BRIDGE OPERATOR'S CAR SHELTER				
0017	530E00400	200.000	EACH	$200.00000	$40,000.00
	SPECIAL - STRUCTURES				
	CORBEL SHIELD				
0018	530E00600	900.000	SF	$10.00000	$9,000.00
	SPECIAL - STRUCTURES				

Line #	Item Number	Quantity	Units	Unit Price	Extension
	Description				
	Supplemental Description				
	MASONRY BLOCK WALL				
0019	625E98200	1.000	LS	$20,000.00000	$20,000.00
	LIGHTING, MISC.: *NAVIGATION LIGHTING REPAIR*				
0020	844E10001	30,450.000	SF	$20.00000	$609,000.00
	CONCRETE PATCHING WITH GALVANIC ANODE PROTECTION, AS PER PLA N				
0021	848E10000	17,750.000	SY	$25.00000	$443,750.00
	MICRO SILICA MODIFIED CONCRETE OVERLAY USING HYDRODEMOLITION				
0022	848E50320	17,750.000	SY	$10.00000	$177,500.00
	EXISTING CONCRETE OVERLAY REMOVED				
0023	614E11000	1.000	LS	$100,000.00000	$100,000.00
	MAINTAINING TRAFFIC				
0024	619E16020	24.000	MNTH	$2,500.00000	$60,000.00
	FIELD OFFICE, TYPE C				
0025	624E10000	1.000	LS	$100,000.00000	$100,000.00
	MOBILIZATION				

Total for Group 0001:$14,532,550.00

CY 2017-2021 Business Plan Inflation Calculator:

Not sure if you have the latest calculator? Click here.

Last Modified: 1/19/2017

Today's Date:
February 15, 2017

Please Enter Values in the Yellow Areas Only:

Estimation Start Date:
Less than or Equal to Today's Date
(mm/dd/yyyy)

2/15/2017
Start Date:

Enter Construction Mid-Point Date:
(cannot exceed 02/15/2042)
(mm/dd/yyyy)

7/1/2020
Construction Mid-Point Date:

Present-Day Estimated Cost:

$29,519,400.00
Estimated Dollar Amount:

Estimate Start Date to Construction Mid-Point Date: **41** **Months**

Inflation - Start to Mid-Point of Construction:

	(compounded growth rate)	Inflated Dollar Amount:
Business Plan	**12.6%**	**$33,226,075.52**

Estimator's Name:

County - Route - Section: CUY-6-1456

PID: 99972

Estimator's Notes: Alternate 3 - Rehab w/ Patching and Cathodic Protection

Estimate ODOT1602

Estimated Cost:$24,599,500.00

Contingency: 20.00%

Estimated Total: $29,519,400.00

ALTERNATE 3 - REHAB W/ PATCHING AND ACTIVE CATHODIC PROTECTION

Base Date: 02/13/17

Spec Year: 16

Unit System: E

Work Type: BRIDGE REHABILITATION

Highway Type:

Urban/Rural Type:

Season:

County: CUYAHOGA

Latitude of Midpoint: 412929

Longitude of Midpoint: -814242

District: 12

Federal/State Project Number:

Prepared by DEA on 02/13/17
Checked by WJV on 02/14/17

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
Group 0001: STRUCTURE					
0005	511E81100 CONCRETE, MISC.: *WEST STATION CONCRETE BEAM REPLACEMENT*	150.000	FT	$400.00000	$60,000.00
0006	511E81300 CONCRETE, MISC.: *LOWER DECK CORBEL REPLACEMENT*	25.000	EACH	$3,000.00000	$75,000.00
0007	511E81300 CONCRETE, MISC.: *COLUMN REPLACEMENT*	4.000	EACH	$8,500.00000	$34,000.00
0008	512E10101 SEALING OF CONCRETE SURFACES (EPOXY-URETHANE), AS PER PLAN	2,000.000	SY	$15.00000	$30,000.00
0009	512E10600 CONCRETE REPAIR BY EPOXY INJECTION *ARCH RIB*	800.000	FT	$70.00000	$56,000.00
0010	512E74000 REMOVAL OF EXISTING COATINGS FROM CONCRETE SURFACES	2,000.000	SY	$20.00000	$40,000.00
0011	516E47000 JACKING AND TEMPORARY SUPPORT OF SUPERSTRUCTURE	1.000	LS	$20,000.00000	$20,000.00
0013	519E11600 SPECIAL - PATCHING CONCRETE STRUCTURE *WEST STATION, TUNNELS AND UPPER DECK*	15,000.000	SF	$90.00000	$1,350,000.00
0014	519E11600 SPECIAL - PATCHING CONCRETE STRUCTURE *LOWER SUPERSTRUCTURE, VERTICAL SURFACES*	9,500.000	SF	$100.00000	$950,000.00
0015	519E11600 SPECIAL - PATCHING CONCRETE STRUCTURE *LOWER SUPERSTRUCTURE - BOTTOM AND CURVED SURFACES*	5,500.000	SF	$125.00000	$687,500.00
0016	519E11900 SPECIAL - PATCHING CONCRETE STRUCTURE *DEEP PIER SHAFT DETERIORATION*	6.000	CY	$5,000.00000	$30,000.00
0017	530E00200 SPECIAL - STRUCTURES *BRIDGE OPERATOR'S CAR SHELTER*	1.000	LS	$5,000.00000	$5,000.00
0018	530E00400 SPECIAL - STRUCTURES *CORBEL SHIELD*	200.000	EACH	$200.00000	$40,000.00
0019	530E00600 SPECIAL - STRUCTURES *MASONRY BLOCK WALL*	900.000	SF	$10.00000	$9,000.00
0020	530E00600 SPECIAL - STRUCTURES *CATHODIC PROTECTION WITH IMPRESSED CURRENT*	325,000.000	SF	$60.00000	$19,500,000.00
0021	625E98200 LIGHTING, MISC.: *NAVIGATION LIGHTING REPAIR*	1.000	LS	$20,000.00000	$20,000.00
0023	848E10000 *MICRO SILICA MODIFIED CONCRETE OVELAY USING HYDRODEMOLITION*	19,400.000	SY	$60.00000	$1,164,000.00

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
0024	848E50320 EXISTING CONCRETE OVERLAY REMOVED	19,400.000	SY	$10.00000	$194,000.00

Total for Group 0001:$24,264,500.00

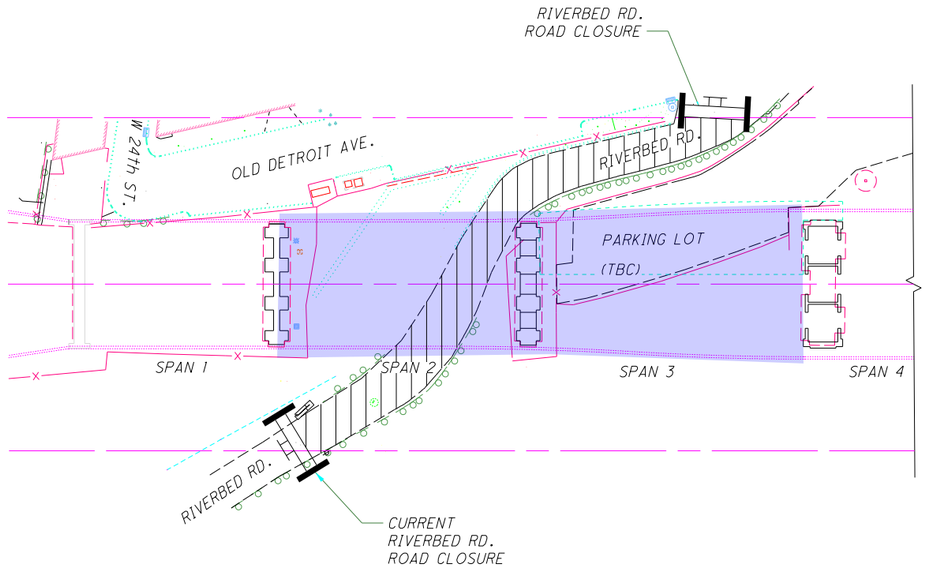
Group 0002: INCIDENTAL

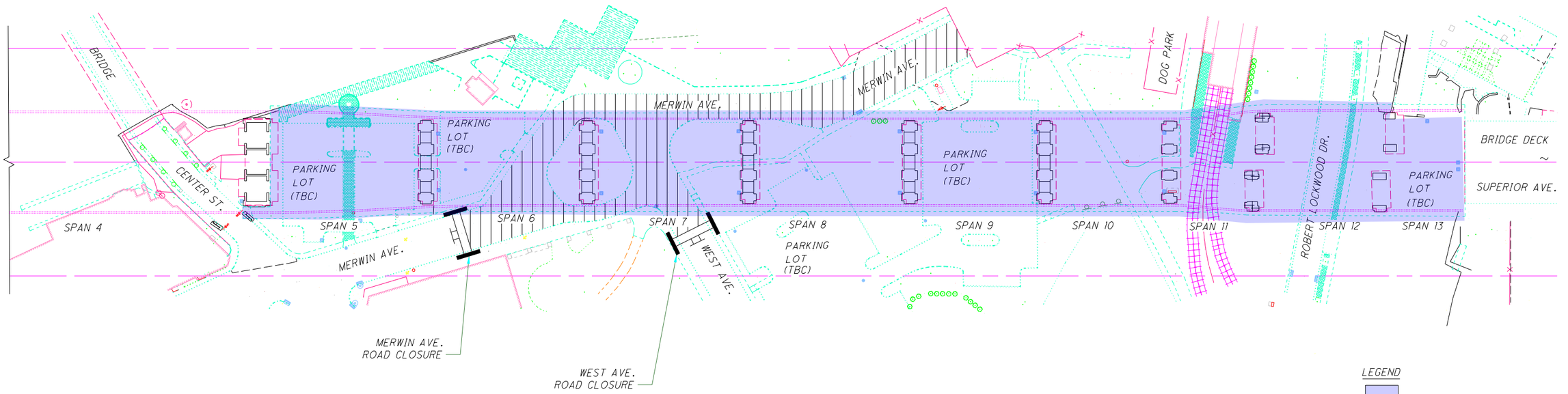
0025	614E11000 MAINTAINING TRAFFIC	1.000	LS	$100,000.00000	$100,000.00
0026	614E18002 MAINTAINING TRAFFIC, MISC.: *RAILROAD FLAGGER*	1.000	LS	$50,000.00000	$50,000.00
0027	614E18002 MAINTAINING TRAFFIC, MISC.: *RAILROAD COORDINATION*	1.000	LS	$25,000.00000	$25,000.00
0028	619E16020 FIELD OFFICE, TYPE C	24.000	MNTH	$2,500.00000	$60,000.00
0029	624E10000 MOBILIZATION	1.000	LS	$100,000.00000	$100,000.00

Total for Group 0002:$335,000.00

APPENDIX B

PUBLIC AREA BELOW STRUCTURE





LEGEND

- PUBLIC AREAS
- ROAD CLOSED
- ROAD CLOSURE BARRIER AND ROAD CLOSED SIGN
- (TBC) - TO BE CLOSED, WHEN REQUIRED

0 25 50 100 HORIZONTAL SCALE IN FEET

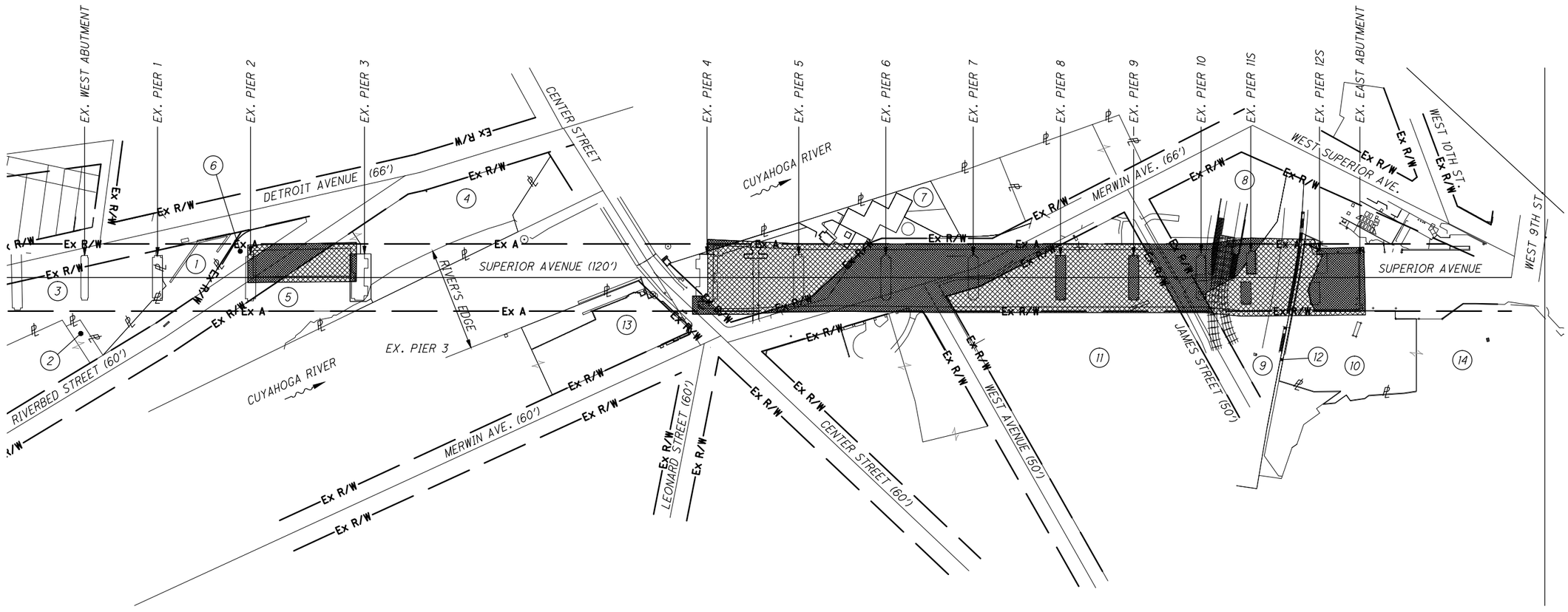
CALCULATED SJD
CHECKED JMZ

MAINTAINENCE OF TRAFFIC
PUBLIC AREAS AND CLOSURES

CUY-6-14.56

P:\Projects\ODOT\ODOT1602-CUY-6-14.56\DESIGN\CT\ProjectData\99972\Design\MOT\Sheets\99972MP004.dgn Model 2/14/2017 3:01:07 PM SDudek

CUY-006-14.56
CITY OF CLEVELAND
CUYAHOGA COUNTY



1. *003-20-002*
   L.A.N.D. STUDIO INC.
2. *003-20-003*
   CLEVELAND METRO HOUSING AUTHORITY
3. *003-20-004*
   CUYAHOGA COUNTY BOARD OF COMMISSIONERS
4. *003-20-006*
   STONEBRIDGE WATERFRONT, LLC
5. *003-20-008*
   STONEBRIDGE WATERFRONT, LLC
6. *003-20-009*
   NO INFORMATION (NEWLY CREATED PARCEL)
7. *101-15-002*
   BOARD OF PARK COMMISSIONERS OF CLEVELAND METROPOLITAN PARK DISTRICT
8. *101-15-008*
   THE GREATER CLEVELAND REGIONAL TRANSIT AUTHORITY
9. *101-15-009*
   FLATS EAST DEVELOPMENT, LLC
10. *101-15-011*
    UNITED STATES OF AMERICA
11. *101-15-021*
    CITY OF CLEVELAND
12. *101-15-028*
    R.T.A.
13. *101-16-001*
    MARLIN INVESTMENT GROUP, LLC
14. *101-20-013*
    UNITED STATES OF AMERICA

HORIZONTAL SCALE IN FEET
0 50 100 200

CALCULATED VMB
CHECKED ARP

PROPERTY MAP EXHIBIT

CUY-006-14.56

1/1

F:\Jobs\997 - CUY-6 Survey and RW\Right of Way\997-PROPMAP.dwg 16-May-17 8:21 AM

APPENDIX C

CONCRETE pH RESULTS

pH TEST

per

GERMANN INSTRUMENTS Manual

Pro Geotech, Inc.

Project	Superior Avenue Bridge Rehabilitation	**Location**	Cuyahoga County, OH
Client	Jones Stuckey	**Project No.**	G17005T
Sample No.	1A	**Date.**	1/30/2017
Core Location	Span 7, Arch Rib, South Interior Concrete (Bottom North Corner, Near Center)		

Rainbow Indicator

BEFORE	AFTER
	

Shown in the photo to the right, the pH profile was evaluated by the **Rainbow Indicator** on a newly cut area of the concrete sample provided by the client. Top surface is indicated by zero on measuring Tape.

The aggregates in the concrete in between depths of 0 to 3.5 inches have dominant green color with less purple color indicating a pH of 9 to 10.

In surrounding area of the aggregates have a dark purple color indicating a pH of 11.

pH TEST

per

GERMANN INSTRUMENTS Manual

Pro Geotech, Inc.

Project	Superior Avenue Bridge Rehabilitation	**Location**	Cuyahoga County, OH
Client	Jones Stuckey	**Project No.**	G17005T
Sample No.	1B	**Date.**	1/30/2017
Core Location	Span 7, Arch Rib, South Interior Shotcrete (Bottom North Corner, Near Center)		

Rainbow Indicator

BEFORE	AFTER
	

Shown in the photo to the right, the pH profile was evaluated by the **Rainbow Indicator** on a newly cut area of the shotcrete sample provided by the client. Top surface is indicated by zero on measuring Tape.

The upper depth of shotcrete from 0.0 to 0.25 inches has dominant green color indicating a pH of 9.

The inner part of shotcrete from 0.25 to 1.5 inches has a dominant dark purple color indicating a pH of 12.

pH TEST

per

GERMANN INSTRUMENTS Manual

Pro Geotech, Inc.

Project	Superior Avenue Bridge Rehabilitation	**Location**	Cuyahoga County, OH
Client	Pennoni	**Project No.**	G17005T
Sample No.	2	**Date.**	1/30/2017
Core Location	Span 7, LD Floor Beam, 4 North Bay Shotcrete		

Rainbow Indicator

BEFORE	AFTER
	

Shown in the photo to the right, the pH profile was evaluated by the **Rainbow Indicator** on a newly cut area of the shotcrete sample provided by the client. Top surface is indicated by zero on measuring Tape.

The upper depth of shotcrete from 0.0 to 0.25 inches has a green color indicating a pH of 9.

The inner part of shotcrete from 0.25 to 1.5 inches has a dominant dark purple color indicating a pH of 12.

Also note that the aggregates in between depths of 0.25 and 1.5 inches have a green color indicating a pH of 9.

pH TEST

per

GERMANN INSTRUMENTS Manual

Pro Geotech, Inc.

Project	Superior Avenue Bridge Rehabilitation	**Location**	Cuyahoga County, OH
Client	Jones Stuckey	**Project No.**	G17005T
Sample No.	3	**Date.**	1/30/2017
Core Location	Span 7, LD Column, North Interior 14 Concrete		

Rainbow Indicator

BEFORE	AFTER
	

Shown in the photo to the right, the pH profile was evaluated by the **Rainbow Indicator** on a newly cut area of the concrete sample provided by the client. Top surface is indicated by zero on measuring Tape.

The upper depth of the concrete from 0.0 to 0.5 inches has a dominant green color indicating a pH of 9.

The lower depth of the concrete from 0.5 to 1.25 inches has a dominant dark purple color indicating a pH of 12.

The aggregates in concrete between depths of 0 to 1.25 inches have green and purple colors indicating a pH of 9 to 10.

pH TEST

per

GERMANN INSTRUMENTS Manual

Pro Geotech, Inc.

Project	Superior Avenue Bridge Rehabilitation	**Location**	Cuyahoga County, OH
Client	Jones Stuckey	**Project No.**	G17005T
Sample No.	4	**Date.**	1/30/2017
Core Location	Span 8, Jack Arch, North Interior Shotcrete		

Rainbow Indicator

BEFORE	AFTER
	

Shown in the photo to the right, the pH profile was evaluated by the **Rainbow Indicator** on a newly cut area of the shotcrete sample provided by the client. Top surface is indicated by zero on measuring Tape.

The upper depth of shotcrete from 0.0 to 0.15 inches has a dominant green color indicating a pH of 9.

The inner part of shotcrete from 0.15 to 1.0 inches has a dominant dark purple color indicating a pH of 12.

Also note that the aggregates in between depths of 0.15 to 1.0 inches have green color indicating a pH of 9.

pH TEST

per

GERMANN INSTRUMENTS Manual

Pro Geotech, Inc.

Project	Superior Avenue Bridge Rehabilitation	**Location**	Cuyahoga County, OH
Client	Jones Stuckey	**Project No.**	G17005T
Sample No.	5	**Date.**	1/30/2017
Core Location	Span 8, LD Floor Beam, 9 Center Bay Concrete		

Rainbow Indicator

BEFORE	AFTER
	

Shown in the photo to the right, the pH profile was evaluated by the **Rainbow Indicator** on a newly cut area of the concrete sample provided by the client. Top surface is indicated by zero on measuring Tape.

Most of the aggregates between depths of 0 to 1.0 inches have a dominant purple color with less green color in the surrounding area indicating a pH of 10 to 11.

Some of the aggregates in between depths of 1.0 to 2.0 inches have a green color indicating a pH of 9.

The dark purple color corresponding to a pH of 12 is dominant between depths of 1.0 to 2.0 inches.

pH TEST

per

GERMANN INSTRUMENTS Manual

Pro Geotech, Inc.

Project	Superior Avenue Bridge Rehabilitation	**Location**	Cuyahoga County, OH
Client	Jones Stuckey	**Project No.**	G17005T
Sample No.	6	**Date.**	1/30/2017
Core Location	Span 8, LD Floor Beam, 10 Center Bay Concrete		

Rainbow Indicator

BEFORE	AFTER
	

Shown in the photo to the right, the pH profile was evaluated by the **Rainbow Indicator** on a newly cut area of the concrete sample provided by the client. Top surface is indicated by zero on measuring Tape.

Most of the aggregates between depths of 0 to 1.0 inches have a dominant purple color with less green color in the surrounding area indicating a pH of 10 to 11.

The dark purple color, corresponding to a pH of 12, is dominant between depths of 1.0 to 3.0 inches.

Also note that some of the aggregates in between depths of 2 to 3.5 inches have a green color indicating a pH of 9.

pH TEST

per

GERMANN INSTRUMENTS Manual

Pro Geotech, Inc.

Project	Superior Avenue Bridge Rehabilitation	**Location**	Cuyahoga County, OH
Client	Jones Stuckey	**Project No.**	G17005T
Sample No.	7	**Date.**	1/30/2017
Core Location	Span 8, LD Floor Beam, 11 Center Bay Concrete		

Rainbow Indicator

BEFORE	AFTER
	

Shown in the photo to the right, the pH profile was evaluated by the **Rainbow Indicator** on a newly cut area of the concrete sample provided by the client. Top surface is indicated by zero on measuring Tape.

Most of the aggregates between depths of 0 to 2 inches have a dominant purple color with less green color in the surrounding area indicating a pH of 10 to 11.

The dark purple color, corresponding to a pH of 12, is dominant between depths of 2 to 3.0 inches.

Also note that some of the aggregates in between depths of 2 to 3.0 inches have a green color indicating a pH of 9.

pH TEST

per

GERMANN INSTRUMENTS Manual

Pro Geotech, Inc.

Project	Superior Avenue Bridge Rehabilitation	**Location**	Cuyahoga County, OH
Client	Jones Stuckey	**Project No.**	G17005T
Sample No.	8	**Date.**	1/30/2017
Core Location	Span 8, LD Floor Beam, 14 South Bay Concrete		

Rainbow Indicator

BEFORE	AFTER
	

Shown in the photo to the right, the pH profile was evaluated by the **Rainbow Indicator** on a newly cut area of the concrete sample provided by the client. Top surface is indicated by zero on measuring Tape.

The depth between 0 and 0.75 inches have green and purple colors indicating a pH of 9 to 10.

The dark purple color, corresponding to a pH of 12, is dominant at depth 0.75 to 1.5 inches.

Also note that the aggregates in between depths of 0 to 1.5 inches have green and purple colors indicating a pH of 9 to 10.

pH TEST

per

GERMANN INSTRUMENTS Manual

Pro Geotech, Inc.

Project	Superior Avenue Bridge Rehabilitation	**Location**	Cuyahoga County, OH
Client	Jones Stuckey	**Project No.**	G17005T
Sample No.	9	**Date.**	1/30/2017
Core Location	Span 9, LD Column, North Interior 13 Concrete		

Rainbow Indicator

BEFORE	AFTER
	

Shown in the photo to the right, the pH profile was evaluated by the **Rainbow Indicator** on a newly cut area of the concrete sample provided by the client. Top surface is indicated by zero on measuring Tape.

Most of the aggregates between depths of 0 to 1.5 inches have dominant purple color indicating a pH of 10 to 11 with surrounding area having green color indicating a pH of 9.

pH TEST

per

GERMANN INSTRUMENTS Manual

Pro Geotech, Inc.

Project	Superior Avenue Bridge Rehabilitation	**Location**	Cuyahoga County, OH
Client	Jones Stuckey	**Project No.**	G17005T
Sample No.	10	**Date.**	1/30/2017
Core Location	Span 10, LD Floor Beam, 1 South Bay Shotcrete		

Rainbow Indicator

BEFORE	AFTER
	

Shown in the photo to the right, the pH profile was evaluated by the **Rainbow Indicator** on a newly cut area of the shotcrete sample provided by the client. Top surface is indicated by zero on measuring Tape.

The entire depth from 0.0 to 3.5 inches has a dominant dark purple color indicating a pH of 12.

Also note that some of the aggregates have a green color indicating a pH of 9.

pH TEST

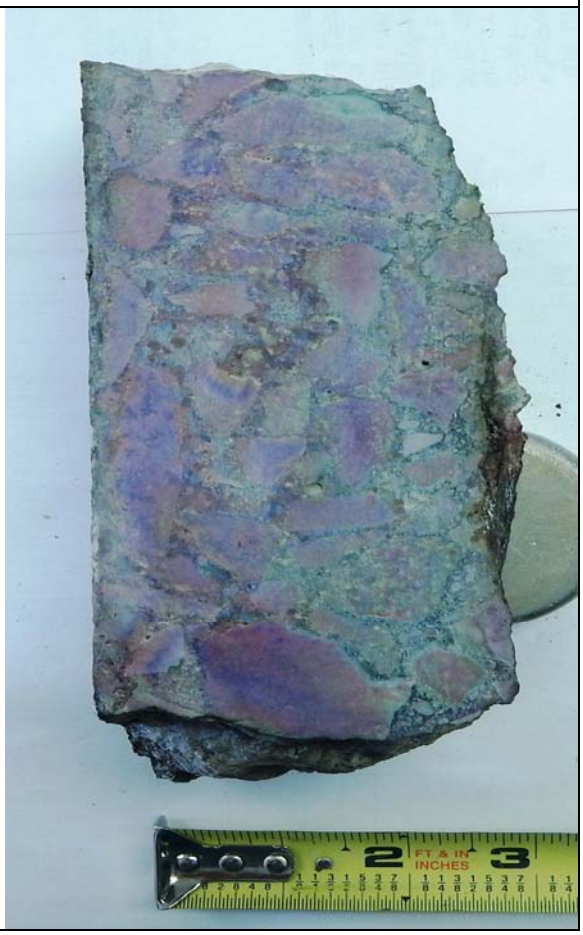
per

GERMANN INSTRUMENTS Manual

Pro Geotech, Inc.

Project	Superior Avenue Bridge Rehabilitation	**Location**	Cuyahoga County, OH
Client	Jones Stuckey	**Project No.**	G17005T
Sample No.	11	**Date.**	1/30/2017
Core Location	Span 10, LD Floor Beam, 2 South Bay Concrete		

Rainbow Indicator

BEFORE	AFTER
	

Shown in the photo to the right, the pH profile was evaluated by the **Rainbow Indicator** on a newly cut area of the concrete sample provided by the client. Top surface is indicated by zero on measuring Tape.

Most of the aggregates between depths of 0 to 3.0 inches have dominant purple color indicating a pH of 10 to 11 with the surrounding area having green color indicating a pH of 9.

pH TEST

per

GERMANN INSTRUMENTS Manual

Pro Geotech, Inc.

Project	Superior Avenue Bridge Rehabilitation	**Location**	Cuyahoga County, OH
Client	Jones Stuckey	**Project No.**	G17005T
Sample No.	12	**Date.**	1/30/2017
Core Location	Span 10, LD Pier Shaft Shotcrete		

Rainbow Indicator

BEFORE	AFTER
	

Shown in the photo to the right, the pH profile was evaluated by the **Rainbow Indicator** on a newly cut area of the shotcrete sample provided by the client. Top surface is indicated by zero on measuring Tape.

The entire depth from 0.0 to 7.0 inches has dominant dark purple color indicating a pH of 12.

Also note that the aggregates have a green color indicating a pH of 9.

APPENDIX D

ESTIMATED CONCRETE PATCHING QUANTITIES

CUY-6-1456 ARCH REPAIR

Span	Location	Total (SF)	North Exterior Bay	North Interior Bay	South Interior Bay	South Exterior Bay
1	Vertical	672	206	106	140	220
	Bottom	537	165	100	104	168
2	Vertical	22	22	0	0	0
	Bottom	44	44	0	0	0
3	Vertical	10	0	10		
	Bottom	25	25	0		
5	Vertical	123	16	39	68	0
	Bottom	136	16	17	25	78
6	Vertical	246	130	42	74	0
	Bottom	303	84	97	20	102
7	Vertical	0	0	0	0	0
	Bottom	432	86	16	198	132
8	Vertical	0	0	0	0	0
	Bottom	579	162	163	92	162
9	Vertical	26	0	0	26	0
	Bottom	116	0	70	26	20
10	Vertical	0	0	0	0	0
	Bottom	445	0	0	271	174
11	Vertical	27	18	0	0	9
	Bottom	0	0	0	0	0
12	Vertical	71	10	0	26	35
	Bottom	374	144	16	90	124
13	Vertical	81		24	14	43
	Bottom	308		119	62	127

Vertical Patches Total = 1278 SF

Bottom Patches Total = 3299 SF

Total = **4577** SF

Span 3 South & Exterior Arches are Difficult to Access, Span 13 North Exterior Arch Rib Does Not Exist

CUY-6-1456 Lower Deck Column Patching

Total Deterioration: 2,143 SF

Span	Col. No.	North Exterior										Col. No.	North Interior										Col. No.	South Interior										Col. No.	South Exterior										Span
		Surface Total	Area 1 (SF)	Area 2 (SF)	Area 3 (SF)	Deterioration							Surface Total	Area 1 (SF)	Area 2 (SF)	Area 3 (SF)	Deterioration							Surface Total	Area 1 (SF)	Area 2 (SF)	Area 3 (SF)	Deterioration							Surface Total	Area 1 (SF)	Area 2 (SF)	Area 3 (SF)	Deterioration							
						H (in.)	W (in.)	H (in.)	W (in.)	H (in.)	W (in.)						H (in.)	W (in.)	H (in.)	W (in.)	H (in.)	W (in.)						H (in.)	W (in.)	H (in.)	W (in.)	H (in.)	W (in.)						H (in.)	W (in.)	H (in.)	W (in.)	H (in.)	W (in.)	
Span 3	1	0	0	0	0							1	16	4	12	0	48	12	112	16			1	0	0	0	0							1	0	0	0	0							*Span 3*
	2	206	27	13	166	160	24	161	12	155	155	2	13	1	4	8	16	13	36	16	48	24	2	0	0	0	0							2	0	0	0	0							
	3	21	12	9	0	70	24	113	12			3	0	0	0	0							3	0	0	0	0							3	0	0	0	0							
	4	5	5	0	0	30	24					4	0	0	0	0							4	0	0	0	0							4	0	0	0	0							
	5	0	0	0	0							5	0	0	0	0							5	0	0	0	0							5	0	0	0	0							
	6	0	0	0	0							6	0	0	0	0							6	0	0	0	0							6	0	0	0	0							
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	17	0	0	0	0							17	0	0	0	0							17	0	0	0	0							17	0	0	0	0							
	18	12	12	0	0	70	24					18	0	0	0	0							18	0	0	0	0							18	0	0	0	0							
	Subtotal	244										Subtotal	36										Subtotal	0										Subtotal	0										
	Span Total	280																																											
Span 5	1	0	0	0	0							1	0	0	0	0							1	0	0	0	0							1	10	6	4	0	24	36	24	24			*Span 5*
	2	0	0	0	0							2	0	0	0	0							2	0	0	0	0							2	0	0	0	0							
	3	0	0	0	0							3	0	0	0	0							3	0	0	0	0							3	12	12	0	0	42	42					
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	10	0	0	0	0							10	0	0	0	0							10	0	0	0	0							10	0	0	0	0							
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	15	0	0	0	0							15	0	0	0	0							15	0	0	0	0							15	5	5	0	0	36	18					
	Subtotal	0										Subtotal	0										Subtotal	0										Subtotal	62										
	Span Total	62																																											
Span 6	1	180	13	2	165	70	26	24	12	331	72	1	2	2	0	0	24	12					1	0	0	0	0							1	22	12	10	0	72	24	60	24			*Span 6*
	2	0	0	0	0							2	0	0	0	0							2	0	0	0	0							2	0	0	0	0							
	3	0	0	0	0							3	0	0	0	0							3	0	0	0	0							3	14	14	0	0	42	48					
	4	0	0	0	0							4	2	1	1	0	12	12	12	12			4	0	0	0	0							4	4	4	0	0	24	24					
	5	0	0	0	0							5	12	12	0	0	76	22					5	0	0	0	0							5	0	0	0	0							
	6	0	0	0	0							6	0	0	0	0							6	0	0	0	0							6	0	0	0	0							
	7	0	0	0	0							7	0	0	0	0							7	0	0	0	0							7	0	0	0	0							
	8	0	0	0	0							8	0	0	0	0							8	0	0	0	0							8	0	0	0	0							
	9	0	0	0	0							9	0	0	0	0							9	0	0	0	0							9	1	1	0	0	12	12					
	10	0	0	0	0							10	0	0	0	0							10	0	0	0	0							10	0	0	0	0							
	11	0	0	0	0							11	0	0	0	0							11	0	0	0	0							11	0	0	0	0							
	12	0	0	0	0							12	0	0	0	0							12	0	0	0	0							12	8	8	0	0	48	24					
	13	0	0	0	0							13	16	16	0	0	54	42					13	0	0	0	0							13	3	3	0	0	21	21					
	14	0	0	0	0							14	0	0	0	0							14	0	0	0	0							14	32	10	8	14	60	24	48	24	36	54	
	15	0	0	0	0							15	35	35	0	0	210	24					15	0	0	0	0							15	4	4	0	0	24	24					
	Subtotal	180										Subtotal	66										Subtotal	0										Subtotal	88										
	Span Total	334																																											
Span 7	1	28	13	6	9	72	25	58	16	80	16	1	30	23	7	0	84	40	60	16			1	32	32	0	0	192	24					1	11	4	4	3	48	12	48	12	36	12	*Span 7*
	2	2	1	1	0	12	12	12	12			2	4	2	2	0	12	24	12	24			2	0	0	0	0							2	8	8	0	0	48	24					
	3	7	4	3	0	24	24	30	12			3	7	7	0	0	20	50					3	0	0	0	0							3	0	0	0	0							
	4	0	0	0	0							4	0	0	0	0							4	0	0	0	0							4	0	0	0	0							
	5	0	0	0	0							5	0	0	0	0							5	0	0	0	0							5	0	0	0	0							
	6	0	0	0	0							6	0	0	0	0							6	0	0	0	0							6	30	20	10	0	60	48	27	54			
	7	0	0	0	0							7	0	0	0	0							7	0	0	0	0							7	0	0	0	0							
	8	0	0	0	0							8	0	0	0	0							8	0	0	0	0							8	0	0	0	0							
	9	0	0	0	0							9	0	0	0	0							9	0	0	0	0							9	0	0	0	0							
	10	0	0	0	0							10	0	0	0	0							10	1	1	0	0	11	12					10	0	0	0	0							
	11	5	5	0	0	41	16					11	0	0	0	0							11	0	0	0	0							11	3	3	0	0	21	21					
	12	0	0	0	0							12	1	1	0	0	12	12					12	0	0	0	0							12	0	0	0	0							
	13	2	2	0	0	18	18					13	0	0	0	0							13	0	0	0	0							13	0	0	0	0							
	14	0	0	0	0							14	13	4	10	0	16	32	45	31			14	0	0	0	0							14	5	5	0	0	45	16					
	15	145	145	0	0	145	145					15	0	0	0	0							15	0	0	0	0							15	39	27	4	9	64	60	40	15	82	15	
	Subtotal	188										Subtotal	55										Subtotal	33										Subtotal	97										
	Span Total	373																																											

Span	Col. No.	North Exterior										Col. No.	North Interior										Col. No.	South Interior										Col. No.	South Exterior										Span
		Surface Total	Area 1 (SF)	Area 2 (SF)	Area 3 (SF)	Deterioration							Surface Total	Area 1 (SF)	Area 2 (SF)	Area 3 (SF)	Deterioration							Surface Total	Area 1 (SF)	Area 2 (SF)	Area 3 (SF)	Deterioration							Surface Total	Area 1 (SF)	Area 2 (SF)	Area 3 (SF)	Deterioration							
						H (in.)	W (in.)	H (in.)	W (in.)	H (in.)	W (in.)						H (in.)	W (in.)	H (in.)	W (in.)	H (in.)	W (in.)						H (in.)	W (in.)	H (in.)	W (in.)	H (in.)	W (in.)						H (in.)	W (in.)	H (in.)	W (in.)	H (in.)	W (in.)	
Span 8	1	0	0	0	0							1	33	6	14	13	36	24	58	34	94	20	1	191	9	182	0	112	12	162	162			1	11	11	0	0	132	12					*Span 8*
	2	19	18	1	0	112	23	8	18			2	0	0	0	0							2	0	0	0	0							2	1	1	0	0	12	12				
	3	0	0	0	0							3	0	0	0	0							3	0	0	0	0							3	0	0	0	0						
	4	0	0	0	0							4	0	0	0	0							4	0	0	0	0							4	0	0	0	0						
	5	0	0	0	0							5	2	2	0	0	24	12					5	0	0	0	0							5	0	0	0	0						
	6	0	0	0	0							6	0	0	0	0							6	0	0	0	0							6	0	0	0	0						
	7	0	0	0	0							7	0	0	0	0							7	0	0	0	0							7	8	2	6	0	18	18	20	42		
	8	0	0	0	0							8	0	0	0	0							8	0	0	0	0							8	0	0	0	0						
	9	0	0	0	0							9	0	0	0	0							9	0	0	0	0							9	0	0	0	0						
	10	0	0	0	0							10	0	0	0	0							10	0	0	0	0							10	0	0	0	0						
	11	0	0	0	0							11	0	0	0	0							11	0	0	0	0							11	0	0	0	0						
	12	0	0	0	0							12	0	0	0	0							12	0	0	0	0							12	0	0	0	0						
	13	20	20	0	0	72	40					13	0	0	0	0							13	0	0	0	0							13	8	8	0	0	66	18				
	14	15	15	0	0	66	32					14	0	0	0	0							14	0	0	0	0							14	0	0	0	0						
	15	32	15	17	0	84	25	138	18			15	0	0	0	0							15	35	35	0	0	120	42					15	87	23	5	60	180	18	60	12	168	51	
	Subtotal	85										Subtotal	35										Subtotal	226										Subtotal	115										
	Span Total	462																																											
Span 9	1	17	7	10	0	48	20	60	24			1	6	6	0	0	48	18					1	83	5	43	36	48	14	153	40	144	36	1	105	28	22	55	149	27	48	66	89	89	*Span 9*
	2	0	0	0	0							2	5	5	0	0	58	12					2	0	0	0	0							2	0	0	0	0						
	3	67	13	36	17	96	20	96	54	57	44	3	0	0	0	0							3	0	0	0	0							3	0	0	0	0						
	4	52	20	32	0	54	54	84	54			4	0	0	0	0							4	0	0	0	0							4	0	0	0	0						
	5	0	0	0	0							5	0	0	0	0							5	0	0	0	0							5	0	0	0	0						
	6	0	0	0	0							6	0	0	0	0							6	0	0	0	0							6	0	0	0	0						
	7	0	0	0	0							7	0	0	0	0							7	0	0	0	0							7	0	0	0	0						
	8	0	0	0	0							8	0	0	0	0							8	0	0	0	0							8	0	0	0	0						
	9	0	0	0	0							9	0	0	0	0							9	0	0	0	0							9	0	0	0	0						
	10	0	0	0	0							10	0	0	0	0							10	0	0	0	0							10	0	0	0	0						
	11	0	0	0	0							11	0	0	0	0							11	0	0	0	0							11	0	0	0	0						
	12	0	0	0	0							12	0	0	0	0							12	0	0	0	0							12	0	0	0	0						
	13	32	7	2	23	60	17	15	15	208	16	13	24	3	11	10	16	30	84	18	48	30	13	39	25	10	4	152	24	72	20	32	16	13	49	18	2	29	72	36	12	24	65	65	
	Subtotal	167										Subtotal	35										Subtotal	122										Subtotal	153										
	Span Total	477																																											
Span 10	1	0	0	0	0							1	0	0	0	0							1	75	34	19	22	144	34	80	34	57	57	1	57	23	20	14	84	40	108	27	44	44	*Span 10*
	2	0	0	0	0							2	0	0	0	0							2	0	0	0	0							2	0	0	0	0						
	3	0	0	0	0							3	0	0	0	0							3	0	0	0	0							3	0	0	0	0						
	4	0	0	0	0							4	0	0	0	0							4	0	0	0	0							4	0	0	0	0						
	5	0	0	0	0							5	0	0	0	0							5	0	0	0	0							5	5	1	4	0	12	12	24	24		
	6	0	0	0	0							6	0	0	0	0							6	0	0	0	0							6	0	0	0	0						
	7	0	0	0	0							7	0	0	0	0							7	0	0	0	0							7	0	0	0	0						
	8	0	0	0	0							8	0	0	0	0							8	0	0	0	0							8	0	0	0	0						
	9	0	0	0	0							9	0	0	0	0							9	0	0	0	0							9	0	0	0	0						
	10	0	0	0	0							10	0	0	0	0							10	0	0	0	0							10	0	0	0	0						
	11	0	0	0	0							11	0	0	0	0							11	0	0	0	0							11	0	0	0	0						
	12	0	0	0	0							12	0	0	0	0							12	0	0	0	0							12	18	18	0	0	108	24				
	Subtotal	0										Subtotal	0										Subtotal	75										Subtotal	80										
	Span Total	155																																											
Span 11 NE & NI	1	0	0	0	0							1	0	0	0	0							1	0	0	0	0							1	0	0	0	0						*Span 11 NE & NI*
	2	0	0	0	0							2	0	0	0	0							2	0	0	0	0							2	0	0	0	0						
	3	0	0	0	0							3	0	0	0	0							3	0	0	0	0							3	0	0	0	0						
	4	0	0	0	0							4	0	0	0	0							4	0	0	0	0							4	0	0	0	0						
	5	0	0	0	0							5	0	0	0	0							5	0	0	0	0							5	0	0	0	0						
	6	0	0	0	0							6	0	0	0	0							6	0	0	0	0							6	0	0	0	0						
	7	0	0	0	0							7	0	0	0	0							7	0	0	0	0							7	0	0	0	0						
	8	0	0	0	0							8	0	0	0	0							8	0	0	0	0							8	0	0	0	0						
	9	0	0	0	0							9	0	0	0	0							9	0	0	0	0							9	0	0	0	0						
	Subtotal	0										Subtotal	0										Subtotal	0										Subtotal	0										
Span 11 SE & SI	1	0	0	0	0							1	0	0	0	0							1	0	0	0	0							1	0	0	0	0						*Span 11 NE & NI*
	2											2											2											2										
	3											3											3											3										
	4											4											4											4										
	5											5											5											5										
	6											6											6											6										
	7											7											7											7										
	8											8											8											8										
	Subtotal											Subtotal											Subtotal											Subtotal										
	Span Total	0																																											

CUY-6-1456 Lower Deck Floor Beam Quantities

Total Estimated Lower Deck Floor Beam Deterioration: ***4338 SF***

Vertical Face Deterioration: ***3200 SF***
Bottom Face Deterioration: ***1138 SF***

* *Floor beam replaced during 1995 rehabilitation*
Green Quantity - Estimated average deficiency
Red quantiuty - Visually estimated dificiency

Span	Floor Beam No.	Surface	Surface Total	Area 1	Area 2	Area 3	North Bay H (in.)	North Bay W (in.)	North Bay H (in.)	North Bay W (in.)	North Bay H (in.)	North Bay W (in.)	Floor Beam No.	Surface	Surface Total	Area 1	Area 2	Area 3	Center Bay H (in.)	Center Bay W (in.)	Center Bay H (in.)	Center Bay W (in.)	Center Bay H (in.)	Center Bay W (in.)	Floor Beam No.	Surface	Surface Total	Area 1	Area 2	Area 3	South Bay H (in.)	South Bay W (in.)	South Bay H (in.)	South Bay W (in.)	South Bay H (in.)	South Bay W (in.)	Span
Span 1																																					*Span 1*
	1*												1*												1*												
	2*												2*												2*												
	3		10										3		10										3		10										
	4		10										4		10										4		10										
	5		10										5		10										5		10										
	6		10										6		10										6		10										
	7		10										7		10										7		10										
	8		10										8		10										8		10										
	9		10										9		10										9*												
	10*												10		10										10*												
	11*												11*												11		10										
	12*												12		10										12		10										
	13*												13*												13		10										
		Subtotal	70		Vert. Total	167								Subtotal	90											Subtotal	90										
		Span Total	250		Bot Total	83																															
Span 2																																					*Span 2*
	1*												1		10										1*												
	2*												2		10										2*												
	3		10										3		10										3		10										
	4		10										4		10										4		10										
	5		10										5		10										5		10										
	6		10										6		10										6*												
	7		10										7		10										7*												
	8		10										8		10										8		10										
	9		10										9		10										9		10										
	10		10										10		10										10		10										
	11*												11		10										11		10										
	12		10										12		10										12		10										
	13		10										13		10										13		10										
	14		10										14		10										14		10										
	15		10										15		10										15		10										
	16		10										16		10										16		10										
		Subtotal	130		Vert. Total	273								Subtotal	160											Subtotal	120										
		Span Total	410		Bot Total	137																															

CUY-6-1456 Lower Deck Floor Beam Quantities

Total Estimated Lower Deck Floor Beam Deterioration: ***4338 SF***

Vertical Face Deterioration: ***3200 SF***

Bottom Face Deterioration: ***1138 SF***

* *Floor beam replaced during 1995 rehabilition*

\#\# Green Quantity - Estimated average deficiency

\#\# Red quantiuty - Visually estimated dificiency

Span	Floor Beam No.	Surface	Surface Total	North Bay Area 1	North Bay Area 2	North Bay Area 3	North Bay H (in.)	North Bay W (in.)	North Bay H (in.)	North Bay W (in.)	North Bay H (in.)	North Bay W (in.)	Floor Beam No.	Surface	Surface Total	Center Bay Area 1	Center Bay Area 2	Center Bay Area 3	Center Bay H (in.)	Center Bay W (in.)	Center Bay H (in.)	Center Bay W (in.)	Center Bay H (in.)	Center Bay W (in.)	Floor Beam No.	Surface	Surface Total	South Bay Area 1	South Bay Area 2	South Bay Area 3	South Bay H (in.)	South Bay W (in.)	South Bay H (in.)	South Bay W (in.)	South Bay H (in.)	South Bay W (in.)	Span
Span 3	1	West	0	0	0	0							1	West	0	0	0	0							1	West	0	0	0	0							*Span 3*
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	2	West	13	7	2	5	42	24	16	16	18	36	2	West	0	0	0	0							2	West	0	0	0	0							
		Bottom	13	13	0	0	78	24						Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	6	2	2	2	12	24	12	24	12	24		East	0	0	0	0								East	0	0	0	0							
	3	West	9	3	3	3	24	18	24	18	32	12	3	West	0	0	0	0							3	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	7	2	2	3	12	24	12	24	18	24		East	0	0	0	0								East	0	0	0	0							
	4	West	0	0	0	0							4	West	0	0	0	0							4	West	0	0	0	0							
		Bottom	7	7	0	0	42	24						Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	5	West	0	0	0	0							5	West	0	0	0	0							5	West	0	0	0	0							
		Bottom	2	2	0	0	36	8						Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	10	9	1	0	32	42	12	12				East	0	0	0	0								East	0	0	0	0							
	6	West	6	2	2	2	24	12	12	24	18	18	6	West	0	0	0	0							6	West	0	0	0	0							
		Bottom	9	9	0	0	102	12						Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	4	4	0	0	102	6						East	0	0	0	0								East	0	0	0	0							
	7	West	1	1	0	0	12	17					7	West	0	0	0	0							7	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	7	3	2	3	36	12	15	18	12	30		East	0	0	0	0								East	0	0	0	0							
	8	West	1	1	0	0	12	12					8	West	0	0	0	0							8	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	9	West	0	0	0	0							9	West	0	0	0	0							9	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	10	West	0	0	0	0							10	West	0	0	0	0							10	West	0	0	0	0							
		Bottom	4	4	0	0	24	24						Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	2	2	0	0	12	24						East	0	0	0	0								East	0	0	0	0							
	11	West	2	2	0	0	18	18					11	West	0	0	0	0							11	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	12	West	2	2	0	0	18	18					12	West	0	0	0	0							12	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	13	West	0	0	0	0							13	West	0	0	0	0							13	West	0	0	0	0							
		Bottom	7	7	0	0	42	24						Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	2	2	0	0	12	24						East	0	0	0	0								East	0	0	0	0							
	14	West	6	6	0	0	36	24					14	West	0	0	0	0							14	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	15	West	9	5	3	2	42	16	24	16	12	24	15	West	0	0	0	0							15	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	1	1	0	0	12	12						East	0	0	0	0								East	0	0	0	0							
	16	West	5	5	0	0	28	28					16	West	0	0	0	0							16	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	9	2	8	0	18	12	30	36				East	0	0	0	0								East	0	0	0	0							
	17	West	0	0	0	0							17	West	0	0	0	0							17	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	18	West	0	0	0	0							18	West	0	0	0	0							18	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
		Subtotal	146		Vert. Total	105								Subtotal	0											Subtotal	0										
		Span Total	146		Bot Total	42																															

CUY-6-1456 Lower Deck Floor Beam Quantities

Total Estimated Lower Deck Floor Beam Deterioration: ***4338 SF***

Vertical Face Deterioration: ***3200 SF***

Bottom Face Deterioration: ***1138 SF***

* *Floor beam replaced during 1995 rehabilitation*

\#\# Green Quantity - Estimated average deficiency

\#\# Red quantiuty - Visually estimated dificiency

Span	Floor Beam No.	Surface	Surface Total	Area 1	Area 2	Area 3	North Bay H (in.)	North Bay W (in.)	North Bay H (in.)	North Bay W (in.)	North Bay H (in.)	North Bay W (in.)	Floor Beam No.	Surface	Surface Total	Area 1	Area 2	Area 3	Center Bay H (in.)	Center Bay W (in.)	Center Bay H (in.)	Center Bay W (in.)	Center Bay H (in.)	Center Bay W (in.)	Floor Beam No.	Surface	Surface Total	Area 1	Area 2	Area 3	South Bay H (in.)	South Bay W (in.)	South Bay H (in.)	South Bay W (in.)	South Bay H (in.)	South Bay W (in.)	Span
Span 5	1	West	0	0	0	0							1	West	0	0	0	0							1	West	0	0	0	0							*Span 5*
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	2	West	0	0	0	0							2	West	51	41	10	0	30	195	60	24			2	West	7	7	0	0	44	24					
		Bottom	0	0	0	0								Bottom	41	41	0	0	30	195						Bottom	14	14	0	0	84	24					
		East	0	0	0	0								East	41	41	0	0	30	195						East	18	4	11	4	24	24	54	28	30	18	
	3	West		0	0	0							3	West	11	11	0	0	55	30					3	West		0	0	0							
		Bottom	10	0	0	0								Bottom	0	0	0	0								Bottom	10	0	0	0							
		East		0	0	0								East	0	0	0	0								East		0	0	0							
	4	West		0	0	0							4	West		0	0	0							4	West		0	0	0							
		Bottom	10	0	0	0								Bottom	10	0	0	0								Bottom	10	0	0	0							
		East		0	0	0								East		0	0	0								East		0	0	0							
	5	West		0	0	0							5	West		0	0	0							5	West		0	0	0							
		Bottom	10	0	0	0								Bottom	10	0	0	0								Bottom	10	0	0	0							
		East		0	0	0								East		0	0	0								East		0	0	0							
	6	West		0	0	0							6	West		0	0	0							6	West		0	0	0							
		Bottom	10	0	0	0								Bottom	10	0	0	0								Bottom	10	0	0	0							
		East		0	0	0								East		0	0	0								East		0	0	0							
	7	West		0	0	0							7	West		0	0	0							7	West		0	0	0							
		Bottom	10	0	0	0								Bottom	10	0	0	0								Bottom	10	0	0	0							
		East		0	0	0								East		0	0	0								East		0	0	0							
	8	West		0	0	0							8	West		0	0	0							8	West		0	0	0							
		Bottom	10	0	0	0								Bottom	10	0	0	0								Bottom	10	0	0	0							
		East		0	0	0								East		0	0	0								East		0	0	0							
	9	West		0	0	0							9	West		0	0	0							9	West		0	0	0							
		Bottom	10	0	0	0								Bottom	10	0	0	0								Bottom	10	0	0	0							
		East		0	0	0								East		0	0	0								East		0	0	0							
	10	West		0	0	0							10	West		0	0	0							10	West		0	0	0							
		Bottom	10	0	0	0								Bottom	10	0	0	0								Bottom	10	0	0	0							
		East		0	0	0								East		0	0	0								East		0	0	0							
	11	West	0	0	0	0							11	West		0	0	0							11	West		0	0	0							
		Bottom	10	10	0	0	38	38						Bottom	10	0	0	0								Bottom	10	0	0	0							
		East	0	0	0	0								East		0	0	0								East		0	0	0							
	12	West		0	0	0							12	West		0	0	0							12	West		0	0	0							
		Bottom	10	0	0	0								Bottom	10	0	0	0								Bottom	10	0	0	0							
		East		0	0	0								East		0	0	0								East		0	0	0							
	13	West		0	0	0							13	West		0	0	0							13	West		0	0	0							
		Bottom	10	0	0	0								Bottom	10	0	0	0								Bottom	10	0	0	0							
		East		0	0	0								East		0	0	0								East		0	0	0							
	14	West	2	2	0	0	15	15					14	West		0	0	0							14	West		0	0	0							
		Bottom	0	0	0	0								Bottom	10	0	0	0								Bottom	10	0	0	0							
		East	0	0	0	0								East		0	0	0								East		0	0	0							
	15	West	5	5	0	0	24	30					15	West	0	0	0	0							15	West	0	0	0	0							
		Bottom	3	3	0	0	47	10						Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	17	2	15	0	12	24	47	45				East	0	0	0	0								East	0	0	0	0							
		Subtotal	137		Vert. Total	372								Subtotal	253											Subtotal	160										
		Span Total	549		Bot Total	177																															

CUY-6-1456 Lower Deck Floor Beam Quantities

Total Estimated Lower Deck Floor Beam Deterioration: ***4338 SF***

Vertical Face Deterioration: ***3200 SF***

Bottom Face Deterioration: ***1138 SF***

* *Floor beam replaced during 1995 rehabilition*

\#\# Green Quantity - Estimated average deficiency

\#\# Red quantiuty - Visually estimated dificiency

Span	Floor Beam No.	Surface	Surface Total	North Bay Area 1	North Bay Area 2	North Bay Area 3	North Bay H (in.)	North Bay W (in.)	North Bay H (in.)	North Bay W (in.)	North Bay H (in.)	North Bay W (in.)	Floor Beam No.	Surface	Surface Total	Center Bay Area 1	Center Bay Area 2	Center Bay Area 3	Center Bay H (in.)	Center Bay W (in.)	Center Bay H (in.)	Center Bay W (in.)	Center Bay H (in.)	Center Bay W (in.)	Floor Beam No.	Surface	Surface Total	South Bay Area 1	South Bay Area 2	South Bay Area 3	South Bay H (in.)	South Bay W (in.)	South Bay H (in.)	South Bay W (in.)	South Bay H (in.)	South Bay W (in.)	Span
Span 6	1	West	10	10	0	0	24	60					1	West	0	0	0	0							1	West	0	0	0	0							*Span 6*
		Bottom	11	11	0	0	64	24						Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	11	5	3	2	32	24	24	18	18	18		East	0	0	0	0								East	0	0	0	0							
	2	West	0	0	0	0							2	West		0	0	0							2	West		0	0	0							
		Bottom	0	0	0	0								Bottom	10	0	0	0								Bottom	10	0	0	0							
		East	0	0	0	0								East		0	0	0								East		0	0	0							
	3	West	0	0	0	0							3	West		0	0	0							3	West		0	0	0							
		Bottom	0	0	0	0								Bottom	10	0	0	0								Bottom	10	0	0	0							
		East	0	0	0	0								East		0	0	0								East		0	0	0							
	4	West	7	7	0	0	48	21					4	West	0	0	0	0							4	West		0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	10	0	0	0							
		East	0	0	0	0								East	12	12	0	0	36	48						East		0	0	0							
	5	West	0	0	0	0							5	West	1	1	0	0	2	72					5	West		0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	10	0	0	0							
		East	2	2	0	0	12	24						East	0	0	0	0								East		0	0	0							
	6	West	1	1	0	0	12	12					6	West		0	0	0							6	West		0	0	0							
		Bottom	0	0	0	0								Bottom	10	0	0	0								Bottom	10	0	0	0							
		East	0	0	0	0								East		0	0	0								East		0	0	0							
	7	West		0	0	0							7	West		0	0	0							7	West		0	0	0							
		Bottom	10	0	0	0								Bottom	10	0	0	0								Bottom	10	0	0	0							
		East		0	0	0								East		0	0	0								East		0	0	0							
	8	West	2	2	0	0	12	24					8	West		0	0	0							8	West		0	0	0							
		Bottom	0	0	0	0								Bottom	10	0	0	0								Bottom	10	0	0	0							
		East	2	2	0	0	12	24						East		0	0	0								East		0	0	0							
	9	West	0	0	0	0							9	West		0	0	0							9	West	0	0	0	0							
		Bottom	8	8	0	0	45	24						Bottom	10	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East		0	0	0								East	6	6	0	0	29	29					
	10	West	7	7	0	0	48	20					10	West		0	0	0							10	West	0	0	0	0							
		Bottom	5	5	0	0	48	16						Bottom	10	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East		0	0	0								East	6	6	0	0	29	29					
	11	West	0	0	0	0							11	West		0	0	0							11	West		0	0	0							
		Bottom	51	51	0	0	24	303						Bottom	10	0	0	0								Bottom	10	0	0	0							
		East	0	0	0	0								East		0	0	0								East		0	0	0							
	12	West		0	0	0							12	West		0	0	0							12	West		0	0	0							
		Bottom	10	0	0	0								Bottom	10	0	0	0								Bottom	10	0	0	0							
		East		0	0	0								East		0	0	0								East		0	0	0							
	13	West		0	0	0							13	West		0	0	0							13	West		0	0	0							
		Bottom	10	0	0	0								Bottom	10	0	0	0								Bottom	10	0	0	0							
		East		0	0	0								East		0	0	0								East		0	0	0							
	14	West	0	0	0	0							14	West	0	0	0	0							14	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	51	51	0	0	24	303					
		East	11	7	4	0	30	32	24	24				East	5	5	0	0	30	24						East	0	0	0	0							
	15	West	5	5	0	0	122	6					15	West	0	0	0	0							15	West	25	25	0	0	12	303					
		Bottom	20	20	0	0	122	24						Bottom	0	0	0	0								Bottom	51	51	0	0	24	303					
		East	17	5	12	0	122	6	42	42				East	0	0	0	0								East	25	25	0	0	12	303					
		Subtotal	199		Vert. Total	308								Subtotal	118											Subtotal	264										
		Span Total	580		Bot Total	272																															

CUY-6-1456 Lower Deck Floor Beam Quantities

Total Estimated Lower Deck Floor Beam Deterioration: ***4338 SF***

Vertical Face Deterioration: ***3200 SF***

Bottom Face Deterioration: ***1138 SF***

* *Floor beam replaced during 1995 rehabilitation*

\#\# Green Quantity - Estimated average deficiency

\#\# Red quantiuty - Visually estimated dificiency

Span	Floor Beam No.	Surface	Surface Total	Area 1	Area 2	Area 3	North Bay H (in.)	North Bay W (in.)	North Bay H (in.)	North Bay W (in.)	North Bay H (in.)	North Bay W (in.)	Floor Beam No.	Surface	Surface Total	Area 1	Area 2	Area 3	Center Bay H (in.)	Center Bay W (in.)	Center Bay H (in.)	Center Bay W (in.)	Center Bay H (in.)	Center Bay W (in.)	Floor Beam No.	Surface	Surface Total	Area 1	Area 2	Area 3	South Bay H (in.)	South Bay W (in.)	South Bay H (in.)	South Bay W (in.)	South Bay H (in.)	South Bay W (in.)	Span
Span 7	1	West	32	8	19	4	48	24	32	87	30	21	1	West	0	0	0	0							1	West	22	16	6	0	60	38	36	24			*Span 7*
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	3	3	0	0	48	8					
		East	4	4	0	0	24	24						East	0	0	0	0								East	13	3	10	0	48	8	45	32			
	2	West	2	2	0	0	18	15					2	West	10	0	0	0							2	West	32	32	0	0	133	35					
		Bottom	0	0	0	0								Bottom		0	0	0								Bottom	0	0	0	0							
		East	2	2	0	0	24	10						East		0	0	0								East	0	0	0	0							
	3	West	28	8	21	0	36	30	68	44			3	West	10	0	0	0							3	West		0	0	0							
		Bottom	0	0	0	0								Bottom		0	0	0								Bottom	10	0	0	0							
		East	0	0	0	0								East		0	0	0								East		0	0	0							
	4	West	24	24	0	0	34	102					4	West	10	0	0	0							4	West		0	0	0							
		Bottom	21	21	0	0	24	128						Bottom		0	0	0								Bottom	10	0	0	0							
		East	0	0	0	0								East		0	0	0								East		0	0	0							
	5	West	6	6	0	0	72	12					5	West	12	12	0	0	36	48					5	West		0	0	0							
		Bottom	1	1	0	0	12	12						Bottom	4	4	0	0	12	48						Bottom	10	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East		0	0	0							
	6	West	0	0	0	0							6	West		0	0	0							6	West		0	0	0							
		Bottom	0	0	0	0								Bottom	10	0	0	0								Bottom	10	0	0	0							
		East	0	0	0	0								East		0	0	0								East		0	0	0							
	7	West	16	16	0	0	24	96					7	West		0	0	0							7	West	20	20	0	0	54	54					
		Bottom	0	0	0	0								Bottom	10	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East		0	0	0								East	0	0	0	0							
	8	West	6	6	0	0	12	72					8	West		0	0	0							8	West		0	0	0							
		Bottom	30	30	0	0	24	180						Bottom	10	0	0	0								Bottom	10	0	0	0							
		East	0	0	0	0								East		0	0	0								East		0	0	0							
	9	West	0	0	0	0							9	West		0	0	0							9	West		0	0	0							
		Bottom	51	51	0	0	24	303						Bottom	10	0	0	0								Bottom	10	0	0	0							
		East	4	4	0	0	24	24						East		0	0	0								East		0	0	0							
	10	West	8	5	3	0	48	16	12	36			10	West	0	0	0	0							10	West		0	0	0							
		Bottom	3	3	0	0	48	8						Bottom	0	0	0	0								Bottom	10	0	0	0							
		East	0	0	0	0								East	6	6	0	0	22	38						East		0	0	0							
	11	West		0	0	0							11	West	0	0	0	0							11	West		0	0	0							
		Bottom	10	0	0	0								Bottom	0	0	0	0								Bottom	10	0	0	0							
		East		0	0	0								East	0	0	0	0								East		0	0	0							
	12	West		0	0	0							12	West	33	4	17	12	24	22	75	32	56	32	12	West		0	0	0							
		Bottom	10	0	0	0								Bottom	1	1	0	0	30	6						Bottom	10	0	0	0							
		East		0	0	0								East	3	3	0	0	30	12						East		0	0	0							
	13	West		0	0	0							13	West	4	2	2	0	12	24	12	24			13	West		0	0	0							
		Bottom	10	0	0	0								Bottom	0	0	0	0								Bottom	10	0	0	0							
		East		0	0	0								East	0	0	0	0								East		0	0	0							
	14	West		0	0	0							14	West		0	0	0							14	West		0	0	0							
		Bottom	10	0	0	0								Bottom	10	0	0	0								Bottom	10	0	0	0							
		East		0	0	0								East		0	0	0								East		0	0	0							
	15	West	0	0	0	0							15	West	0	0	0	0							15	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	12	12	0	0	42	42					
		East	43	20	5	18	36	80	21	34	44	60		East	0	0	0	0								East	0	0	0	0							
		Subtotal	321		Vert. Total	472								Subtotal	142											Subtotal	211										
		Span Total	675		Bot Total	203																															

CUY-6-1456 Lower Deck Floor Beam Quantities

Total Estimated Lower Deck Floor Beam Deterioration: ***4338 SF***

Vertical Face Deterioration: ***3200 SF***

Bottom Face Deterioration: ***1138 SF***

* *Floor beam replaced during 1995 rehabilition*

\#\# Green Quantity - Estimated average deficiency

\#\# Red quantiuty - Visually estimated dificiency

Span	Floor Beam No.	Surface	Surface Total	Area 1	Area 2	Area 3	North Bay H (in.)	North Bay W (in.)	North Bay H (in.)	North Bay W (in.)	North Bay H (in.)	North Bay W (in.)	Floor Beam No.	Surface	Surface Total	Area 1	Area 2	Area 3	Center Bay H (in.)	Center Bay W (in.)	Center Bay H (in.)	Center Bay W (in.)	Center Bay H (in.)	Center Bay W (in.)	Floor Beam No.	Surface	Surface Total	Area 1	Area 2	Area 3	South Bay H (in.)	South Bay W (in.)	South Bay H (in.)	South Bay W (in.)	South Bay H (in.)	South Bay W (in.)	Span
Span 8	1	West	4	4	0	0	6	90					1	West	0	0	0	0							1	West	4	4	0	0	84	6					*Span 8*
		Bottom	4	4	0	0	6	90						Bottom	0	0	0	0								Bottom	7	7	0	0	84	12					
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	2	West	2	2	0	0	48	7					2	West	0	0	0	0							2	West	20	20	0	0	48	60					
		Bottom	5	5	0	0	48	16						Bottom	0	0	0	0								Bottom	5	5	0	0	12	60					
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	3	West	17	4	14	0	44	12	54	36			3	West	0	0	0	0							3	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	4	West	0	0	0	0							4	West	0	0	0	0							4	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	5	West	0	0	0	0							5	West	0	0	0	0							5	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	6	West	0	0	0	0							6	West	0	0	0	0							6	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	7	West	3	3	0	0	30	12					7	West	0	0	0	0							7	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	8	West	0	0	0	0							8	West	0	0	0	0							8	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	8	8	0	0	48	24						East	2	2	0	0	24	12						East	0	0	0	0							
	9	West	39	39	0	0	116	48					9	West	7	7	0	0	44	24					9	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	10	West	0	0	0	0							10	West	0	0	0	0							10	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	11	West	0	0	0	0							11	West	0	0	0	0							11	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	12	West	1	1	0	0	24	6					12	West	0	0	0	0							12	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	13	West	8	8	0	0	38	30					13	West	0	0	0	0							13	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	14	West	10	10	0	0	36	39					14	West	0	0	0	0							14	West	16	16	0	0	43	54					
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	3	3	0	0	36	12					
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	15	West	1	1	0	0	12	6					15	West	0	0	0	0							15	West	28	23	5	0	44	74	21	34			
		Bottom	2	2	0	0	36	6						Bottom	0	0	0	0								Bottom	5	5	0	0	30	24					
		East	0	0	0	0								East	0	0	0	0								East	8	8	0	0	48	24					
		Subtotal	102		Vert. Total	176								Subtotal	9											Subtotal	95										
		Span Total	207		Bot Total	31																															

CUY-6-1456 Lower Deck Floor Beam Quantities

Total Estimated Lower Deck Floor Beam Deterioration: ***4338 SF***

Vertical Face Deterioration: ***3200 SF***

Bottom Face Deterioration: ***1138 SF***

* *Floor beam replaced during 1995 rehabilition*

\#\# Green Quantity - Estimated average deficiency

\#\# Red quantiuty - Visually estimated dificiency

Span	Floor Beam No.	Surface	Surface Total	Area 1	Area 2	Area 3	North Bay H (in.)	North Bay W (in.)	North Bay H (in.)	North Bay W (in.)	North Bay H (in.)	North Bay W (in.)	Floor Beam No.	Surface	Surface Total	Area 1	Area 2	Area 3	Center Bay H (in.)	Center Bay W (in.)	Center Bay H (in.)	Center Bay W (in.)	Center Bay H (in.)	Center Bay W (in.)	Floor Beam No.	Surface	Surface Total	Area 1	Area 2	Area 3	South Bay H (in.)	South Bay W (in.)	South Bay H (in.)	South Bay W (in.)	South Bay H (in.)	South Bay W (in.)	Span
Span 9	1	West	4	4	0	0	24	24					1	West	47	29	18	0	94	44	59	44			1	West	22	19	3	0	72	38	12	36			*Span 9*
		Bottom	0	0	0	0								Bottom	6	6	0	0	69	12						Bottom	0	0	0	0							
		East	5	5	0	0	28	24						East	10	8	3	0	36	30	69	6				East	26	5	18	3	24	30	58	44	18	24	
	2	West	18	1	2	15	12	12	18	18	180	12	2	West	2	1	1	0	24	6	12	6			2	West	7	5	2	0	27	28	15	15			
		Bottom	6	6	0	0	72	12						Bottom	3	2	1	0	24	12	12	12				Bottom	1	1	0	0	15	12					
		East	0	0	0	0	10	6						East	2	2	0	0	24	12						East	0	0	0	0							
	3	West	11	2	4	6	18	18	20	26	15	#######	3	West	2	2	0	0	24	12					3	West	2	2	0	0	42	6					
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	3	3	0	0	42	9					
		East	14	5	4	5	36	18	24	24	12	60		East	5	4	1	0	18	30	12	12				East	0	0	0	0							
	4	West	24	24	0	0	72	48					4	West	26	2	22	3	15	15	134	24	12	30	4	West	5	5	0	0	36	18					
		Bottom	0	0	0	0								Bottom	3	3	0	0	60	6						Bottom	0	0	0	0							
		East	5	3	2	0	24	18	24	12				East	6	2	3	2	15	15	60	6	14	21		East	0	0	0	0							
	5	West	12	3	1	8	16	24	12	17	12	95	5	West	0	0	0	0							5	West	9	3	4	2	80	6	24	24	15	15	
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	3	3	0	0	80	6					
		East	0	0	0	0								East	0	0	0	0								East	2	2	0	0	15	15					
	6	West	0	0	0	0							6	West	2	2	0	0	15	15					6	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	4	2	2	0	16	16	12	24				East	0	0	0	0								East	0	0	0	0							
	7	West	3	2	1	0	24	12	12	12			7	West	2	2	0	0	16	18					7	West	1	1	0	0	12	12					
		Bottom	7	6	1	0	92	10	12	12				Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	3	1	2	0	12	12	28	12				East	0	0	0	0								East	6	1	2	3	12	12	15	18	12	36	
	8	West	20	20	0	0	64	46					8	West	2	2	0	0	12	24					8	West	3	3	0	0	21	21					
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	9	West	0	0	0	0							9	West	0	0	0	0							9	West	4	2	2	0	18	12	12	24			
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	10	West	0	0	0	0							10	West	5	5	0	0	6	108					10	West	2	2	0	0	16	16					
		Bottom	0	0	0	0								Bottom	7	7	0	0	9	108						Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	11	West	0	0	0	0							11	West	4	4	0	0	94	6					11	West	12	6	4	2	24	36	12	44	18	18	
		Bottom	0	0	0	0								Bottom	7	7	0	0	94	10						Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	12	West	0	0	0	0							12	West	0	0	0	0							12	West	11	7	4	0	42	24	24	24			
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	2	2	0	0	15	15					
	13	West	0	0	0	0							13	West	0	0	0	0							13	West	38	24	14	0	80	43	42	48			
		Bottom	28	28	0	0	24	#######						Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	18	18	0	0	72	36						East	0	0	0	0								East	0	0	0	0							
		Subtotal	183		Vert. Total	404								Subtotal	138											Subtotal	156										
		Span Total	477		Bot Total	73																															

CUY-6-1456 Lower Deck Floor Beam Quantities

Total Estimated Lower Deck Floor Beam Deterioration: ***4338 SF***

Vertical Face Deterioration: ***3200 SF***

Bottom Face Deterioration: ***1138 SF***

* *Floor beam replaced during 1995 rehabilitation*

\#\# Green Quantity - Estimated average deficiency

\#\# Red quantiuty - Visually estimated dificiency

Span	Floor Beam No.	Surface	Surface Total	North Bay Area 1	North Bay Area 2	North Bay Area 3	North Bay H (in.)	North Bay W (in.)	North Bay H (in.)	North Bay W (in.)	North Bay H (in.)	North Bay W (in.)	Floor Beam No.	Surface	Surface Total	Center Bay Area 1	Center Bay Area 2	Center Bay Area 3	Center Bay H (in.)	Center Bay W (in.)	Center Bay H (in.)	Center Bay W (in.)	Center Bay H (in.)	Center Bay W (in.)	Floor Beam No.	Surface	Surface Total	South Bay Area 1	South Bay Area 2	South Bay Area 3	South Bay H (in.)	South Bay W (in.)	South Bay H (in.)	South Bay W (in.)	South Bay H (in.)	South Bay W (in.)	Span
Span 10	1	West	5	3	3	0	24	15	28	14			1	West	12	9	3	0	30	42	36	12			1	West	9	9	0	0	36	36					*Span 10*
		Bottom	2	2	0	0	28	8						Bottom	0	0	0	0								Bottom	17	17	0	0	102	24					
		East	4	1	3	0	12	15	12	30				East	3	2	1	0	15	15	12	12				East	20	20	0	0	53	53					
	2	West	2	1	1	0	12	17	12	12			2	West	7	2	4	1	15	15	24	24	12	12	2	West	2	2	0	0	10	32					
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	5	5	0	0	15	48					
	3	West	4	4	0	0	18	30					3	West	1	1	0	0	12	12					3	West	4	4	0	0	24	24					
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	2	2	0	0	16	16					
	4	West	0	0	0	0							4	West	10	4	4	2	24	24	20	32	12	24	4	West	17	17	0	0	44	55					
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	2	2	0	0	10	24					
		East	0	0	0	0								East	0	0	0	0								East	1	1	0	0	12	16					
	5	West	0	0	0	0							5	West	0	0	0	0							5	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	4	4	0	0	32	16						East	6	6	0	0	16	52					
	6	West	0	0	0	0							6	West	8	8	0	0	35	35					6	West	10	10	0	0	24	58					
		Bottom	0	0	0	0								Bottom	9	9	0	0	53	24						Bottom	0	0	0	0							
		East	0	0	0	0								East	14	12	2	0	30	58	24	12				East	18	18	0	0	44	60					
	7	West	0	0	0	0							7	West	22	15	3	4	36	60	10	48	32	18	7	West	46	9	37	0	44	30	44	120			
		Bottom	0	0	0	0								Bottom	13	13	0	0	80	24						Bottom	0	0	0	0							
		East	0	0	0	0								East	33	7	26	0	30	34	44	84				East	12	12	0	0	44	38					
	8	West	26	20	6	0	44	65	32	27			8	West	3	3	0	0	26	18					8	West	7	7	0	0	44	24					
		Bottom	4	4	0	0	24	24						Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	8	4	4	0	24	24	24	24				East	0	0	0	0							
	9	West	0	0	0	0							9	West	11	11	0	0	44	35					9	West	29	29	0	0	44	96					
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	7	4	3	0	44	12	30	16				East	70	22	26	22	44	72	86	44	56	56	
	10	West	8	3	5	0	36	12	24	30			10	West	26	26	0	0	85	44					10	West	47	16	1	31	62	36	18	9	100	44	
		Bottom	16	16	0	0	96	24						Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	11	2	6	3	12	24	34	24	24	20		East	0	0	0	0							
	11	West	0	0	0	0							11	West	2	2	0	0	15	15					11	West	0	0	0	0							
		Bottom	10	10	0	0	58	24						Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	6	3	3	0	36	12	36	12				East	2	2	0	0	10	32					
	12	West	0	0	0	0							12	West	0	0	0	0							12	West	39	21	18	0	36	84	38	70			
		Bottom	26	26	0	0	24	158						Bottom	0	0	0	0								Bottom	9	9	0	0	53	24					
		East	0	0	0	0								East	28	28	0	0	44	90						East	2	2	0	0	24	12					
		Subtotal	107		Vert. Total	612								Subtotal	237											Subtotal	376										
		Span Total	719		Bot Total	107																															

CUY-6-1456 Lower Deck Floor Beam Quantities

Vertical Face Deterioration: *3200 SF*

Bottom Face Deterioration: *1138 SF*

Total Estimated Lower Deck Floor Beam Deterioration: *4338 SF*

* *Floor beam replaced during 1995 rehabilition*

\#\# Green Quantity - Estimated average deficiency

\#\# Red quantiuty - Visually estimated dificiency

Span	Floor Beam No.	Surface	Surface Total	Area 1	Area 2	Area 3	North Bay H (in.)	North Bay W (in.)	North Bay H (in.)	North Bay W (in.)	North Bay H (in.)	North Bay W (in.)	Floor Beam No.	Surface	Surface Total	Area 1	Area 2	Area 3	Center Bay H (in.)	Center Bay W (in.)	Center Bay H (in.)	Center Bay W (in.)	Center Bay H (in.)	Center Bay W (in.)	Floor Beam No.	Surface	Surface Total	Area 1	Area 2	Area 3	South Bay H (in.)	South Bay W (in.)	South Bay H (in.)	South Bay W (in.)	South Bay H (in.)	South Bay W (in.)	Span
Span 11	1	West	0	0	0	0							1	West	0	0	0	0							1	West	0	0	0	0							*Span 11*
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	2	West	8	8	0	0	48	24					2	West	0	0	0	0							2	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	3	West	26	16	10	0	48	48	12	120			3	West	0	0	0	0							3	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	4	West	8	8	0	0	48	24					4	West	0	0	0	0							4	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	5	West	0	0	0	0							5	West	0	0	0	0							5	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	6	West	0	0	0	0							6	West	0	0	0	0							6	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	7	West	7	4	4	0	42	12	42	12			7	West	0	0	0	0							7	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	8	West	4	4	0	0	42	12					8	West	0	0	0	0							8	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	4	4	0	0	42	12						East	0	0	0	0								East	0	0	0	0							
	9	West	0	0	0	0							9	West	0	0	0	0							9	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	10	West	0	0	0	0							10	West	0	0	0	0							10	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	11	West	0	0	0	0							11	West	0	0	0	0							11	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
		Subtotal	56		Vert. Total	56								Subtotal	0											Subtotal	0										
		Span Total	56		Bot Total	0																															

CUY-6-1456 Lower Deck Floor Beam Quantities

Total Estimated Lower Deck Floor Beam Deterioration: ***4338 SF***

Vertical Face Deterioration: ***3200 SF***

Bottom Face Deterioration: ***1138 SF***

* *Floor beam replaced during 1995 rehabilition*

\#\# Green Quantity - Estimated average deficiency

\#\# Red quantiuty - Visually estimated dificiency

Span	Floor Beam No.	Surface	Surface Total	Area 1	Area 2	Area 3	North Bay H (in.)	North Bay W (in.)	North Bay H (in.)	North Bay W (in.)	North Bay H (in.)	North Bay W (in.)	Floor Beam No.	Surface	Surface Total	Area 1	Area 2	Area 3	Center Bay H (in.)	Center Bay W (in.)	Center Bay H (in.)	Center Bay W (in.)	Center Bay H (in.)	Center Bay W (in.)	Floor Beam No.	Surface	Surface Total	Area 1	Area 2	Area 3	South Bay H (in.)	South Bay W (in.)	South Bay H (in.)	South Bay W (in.)	South Bay H (in.)	South Bay W (in.)	Span
Span 12	1	West	0	0	0	0							1	West	0	0	0	0							1	West	0	0	0	0							*Span 12*
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	2	West	0	0	0	0							2	West	17	17	0	0	40	60					2	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	5	5	0	0	12	60						Bottom	0	0	0	0							
		East	0	0	0	0								East	17	17	0	0	40	60						East	0	0	0	0							
	3	West	1	1	0	0	12	12					3	West	3	3	0	0	40	12					3	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	2	2	0	0	12	24						Bottom	0	0	0	0							
		East	0	0	0	0								East	3	3	0	0	40	12						East	0	0	0	0							
	4	West	0	0	0	0							4	West	9	4	1	3	32	20	12	17	26	15	4	West	16	3	14	0	26	15	26	75			
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	5	West	0	0	0	0							5	West	0	0	0	0							5	West	6	6	0	0	16	50					
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	4	2	2	0	26	9	18	18				East	9	5	4	0	9	72	32	18			
	6	West	0	0	0	0							6	West	0	0	0	0							6	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	1	1	0	0	12	12						Bottom	0	0	0	0							
		East	5	5	0	0	32	24						East	2	2	0	0	24	12						East	0	0	0	0							
	7	West	16	16	0	0	12	188					7	West	2	2	0	0	16	16					7	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	37	18	4	15	30	87	27	22	26	82		East	4	4	0	0	30	20						East	0	0	0	0							
	8	West	0	0	0	0							8	West	16	4	2	10	32	20	20	12	38	38	8	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	10	10	0	0	40	36						East	0	0	0	0							
	9	West	4	4	0	0	24	24					9	West	3	3	0	0	24	18					9	West	13	3	1	9	9	48	10	12	40	34	
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	4	4	0	0	24	24						East	3	3	0	0	24	18						East	7	7	0	0	40	26					
	10	West	1	1	0	0	12	12					10	West	0	0	0	0							10	West	3	1	2	0	12	12	12	24			
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	11	West	20	20	0	0	40	72					11	West	0	0	0	0							11	West	0	0	0	0							
		Bottom	6	6	0	0	12	72						Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	20	20	0	0	40	72						East	0	0	0	0								East	0	0	0	0							
	12	West	0	0	0	0							12	West	0	0	0	0							12	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
	13	West	0	0	0	0							13	West	0	0	0	0							13	West	0	0	0	0							
		Bottom	0	0	0	0								Bottom	0	0	0	0								Bottom	0	0	0	0							
		East	0	0	0	0								East	0	0	0	0								East	0	0	0	0							
		Subtotal	114		Vert. Total	254								Subtotal	100											Subtotal	54										
		Span Total	268		Bot Total	14																															

CUY-6-1456 Pier Patching Quantities

Pier	Total (SF)	N. Exterior Shaft	S. Exterior Shaft	E. Face				W. Face			
				North Bay	Center Bay	South Bay	Subtotal	North Bay	Center Bay	South Bay	Subtotal
Pier 1	0						0				0
Pier 2	0						0				0
Pier 3	26		13				0	13			13
Pier 4	49		49				0				0
Pier 5	180		138				0	36		6	42
Pier 6	166		139			23	23	4			4
Pier 7	275		28				0			246	246
Pier 8	312	14	166				0			132	132
Pier 9	101	15	69			17	17				0
Pier 10	18		18				0				0
Pier 11	0						0				0
Pier 12	0						0				0
Pier 13	0						0				0

Total **1,127** **SF**

CUY-6-1456

Wearing Surface Survey

Span	Concrete Repairs (SF)		WB Area of Deck (SF)	EB Area of Deck (SF)	Concrete Repair (%)		
	WB	EB			WB	EB	Total
Span 1A	36	128	2890	2890	1.2	4.4	2.8
Span 1B	81	162	3607	3607	2.2	4.5	3.4
Span 1	450	627	3718	3718	12.1	16.9	14.5
Span 2	0	0	4685	4685	0.0	0.0	0.0
Span 3	56	59	6368	6368	0.9	0.9	0.9
Span 4	1495	2441	17228	17228	8.7	14.2	11.4
Span 5	0	19	5186	5186	0.0	0.4	0.2
Span 6	259	8	4191	4191	6.2	0.2	3.2
Span 7	1367	664	4117	4117	33.2	16.1	24.7
Span 8	1724	1792	4170	4170	41.3	43.0	42.2
Span 9	814	354	3698	3698	22.0	9.6	15.8
Span 10	642	754	3688	3688	17.4	20.4	18.9
Span 11	76	360	2864	2864	2.7	12.6	7.6
Span 12	108	229	3444	6642	3.1	3.4	3.3
Span 13	28	0	2245	4331	1.2	0.0	0.4
East Station	44	0	8904	17172	0.5	0.0	0.2
Direction Subtotals:	**7,180**	**7,597**	**81,003**	**94,555**			

Total: **14,777** **SF**

Total % Deteriorated = **8.42%**

APPENDIX E

ESTIMATED FRP WRAP QUANTITIES

CUY-6-1456 Arch Rib

Estimated FRP Wrap Quantities

Side Wrap Ht.

Future Spall Ht.	1.00	Ft.
FRP Development	1.50	Ft.
	2.50	Ft.

Rough Form Length Factor:
50% Form board length

Span	Intrados Length (ft)	Arch Side Surface Area (ft^2)	Exterior Arch Ribs		Interior Arch Ribs		FRP Wrap - Alternate No. 1		FRP Wrap - Alternate No. 2			FRP Wrap - Alternate No. 3		Estmated Board Form Length (ft.)	Estimated Rough Form Length (ft.)
			No. of Ribs	Arch Rib Width (ft.)	No. of Ribs	Arch Rib Width (ft.)	Side Wrap Height (ft.)	Wrap Area (ft^2)	Top Corners - Horiz Width (ft.) *	Top Corners - Side Height (ft.)	Wrap Area (ft^2)	Full Side Wrap Height (ft.) *	Wrap Area (ft^2)		
1	138.9	744.4	0	6.75		9.00								0	0
2	180.0	1061.0	1.5	6.75	1.5	9.00	2.50	6952.5	1.50	2.50	7672.5	7986.0	12238.5	17010	8505
3	201.2	1379.4	1	6.75	1	9.00	2.50	5180.9	1.50	2.50	5985.7	6724.8	9893.7	12676	6338
5	178.3	1020.2	2	6.00	2	8.00	2.50	8558.4	1.50	2.50	9271.6	10301.2	15293.6	19970	9985
6 **	172.1	996.1	2	6.00	2	8.00	2.50	6340.8	1.50	2.50	7029.2	10034.0	14852.8	19275	9638
7	170.3	1051.9	2	6.00	2	8.00	2.50	8174.4	1.50	2.50	8855.6	10458.8	15227.2	19074	9537
8	165.4	964.3	2	6.00	2	8.00	2.50	7939.2	1.50	2.50	8600.8	9699.2	14330.4	18525	9262
9	137.5	728.7	2	6.00	2	8.00	2.50	6600.0	1.50	2.50	7150.0	7479.6	11329.6	15400	7700
10	123.9	618.2	2	6.00	2	8.00	2.50	5947.2	1.50	2.50	6442.8	6432.4	9901.6	13877	6938
11	84.9	318.1	2	5.63	2	6.63	2.50	3778.1	1.50	2.50	4117.7	3563.6	5643.7	8320	4160
12	67.0	382.4	2	5.50	2	5.50	2.50	2814.0	1.50	2.50	3082.0	3863.4	5337.4	5896	2948
13	81.7	338.0	1	5.50	2	6.75	2.50	2777.8	1.50	2.50	3104.6	2763.3	4315.6	6209	3105

* Includes top corner overlap of 1.5 ft.

** FRP Wrap calculations do not includes areas between Columns 3 to 5 and 11 to 13 since no steel reinforcement is present at these locations.

Alt. 1 Total = 65,063 ft^2 **Alt. 2 Total = 71,312 ft^2** **Total = 78,116 ft^2**

Alt 3. Total = 118,364 ft^2

CUY-6-1456 Lower Deck Column
FRP Wrap Quantities

* & **Red Text** : No FRP wrap is recommended for column heights less than 2.0 feet. Several lower deck columns do not exist either.

Span	Col. No.	Column Height. (ft.)	Column Width (ft.)	No. of Exterior Columns	Exterior Column Width (ft.)	No. of Interior Columns	Interior Column Width (ft.)	FRP Wrap Area (ft^2)
Span 2	1	26.75	2.00	1	4.50	1	6.00	776
	2	18.69	2.00	1	4.50	1	6.00	542
	3	12.37	2.00	1	4.50	1	6.00	359
	4	7.40	2.00	1	4.50	1	6.00	215
	5	3.64	2.00	1	4.50	1	6.00	106
	6*	0.92	2.00	1	4.50	2	6.00	0
	7*	**-0.67**	2.00	1	4.50	2	6.00	0
	8*	**-1.30**	2.00	2	4.50	2	6.00	0
	9*	**-1.04**	2.00	2	4.50	2	6.00	0
	10*	**0.11**	2.00	2	4.50	2	6.00	0
	11	2.21	2.00	2	4.50	2	6.00	128
	12	5.45	2.00	2	4.50	2	6.00	316
	13	9.73	2.00	2	4.50	2	6.00	565
	14	15.22	2.00	2	4.50	2	6.00	883
	15	22.06	2.00	2	4.50	2	6.00	1280
	16	30.64	2.00	2	4.50	2	6.00	1777
Span 3	1	35.86	2.00	0	4.5	1	6.0	538
	2	26.74	2.00	1	4.5	1	6.0	775
	3	19.44	2.00	1	4.5	1	6.0	564
	4	13.30	2.00	1	4.5	1	6.0	386
	5	8.49	2.00	1	4.5	1	6.0	246
	6	4.77	2.00	1	4.5	1	6.0	138
	7	2.13	2.00	1	4.5	1	6.0	62
	8*	**0.48**	2.00	1	4.5	1	6.0	0
	9*	**-0.10**	2.00	1	4.5	1	6.0	0
	10*	**0.09**	2.00	1	4.5	1	6.0	0
	11*	**1.06**	2.00	1	4.5	1	6.0	0
	12	3.10	2.00	1	4.5	1	6.0	90
	13	6.12	2.00	1	4.5	1	6.0	177
	14	10.23	2.00	1	4.5	1	6.0	297
	15	15.43	2.00	1	4.5	1	6.0	447
	16	21.95	2.00	1	4.5	1	6.0	636
	17	29.64	2.00	1	4.5	1	6.0	860
	18	39.15	2.00	0	4.5	0	6.0	0

CUY-6-1456 Lower Deck Column
FRP Wrap Quantities

* & **Red Text** : No FRP wrap is recommended for column heights less than 2.0 feet. Several lower deck columns do not exist either.

Span	Col. No.	Column Height. (ft.)	Column Width (ft.)	No. of Exterior Columns	Exterior Column Width (ft.)	No. of Interior Columns	Interior Column Width (ft.)	FRP Wrap Area (ft^2)
Span 5	1	35.02	2.00	2	4.5	2	6.0	1786
	2	28.30	2.00	2	4.5	2	6.0	1641
	3	20.80	2.00	2	4.5	2	6.0	1206
	4	14.92	2.00	2	4.5	2	6.0	865
	5	10.46	2.00	2	4.5	2	6.0	607
	6	7.26	2.00	2	4.5	2	6.0	421
	7	5.34	2.00	2	4.5	2	6.0	310
	8	4.51	2.00	2	4.5	2	6.0	262
	9	4.85	2.00	2	4.5	2	6.0	281
	10	6.27	2.00	2	4.5	2	6.0	363
	11	8.97	2.00	2	4.5	2	6.0	520
	12	12.93	2.00	2	4.5	2	6.0	750
	13	18.31	2.00	2	4.5	2	6.0	1062
	14	25.31	2.00	2	4.5	2	6.0	1468
	15	31.54	2.00	2	4.5	2	6.0	1609
Span 6	1	34.23	2.00	2	4.5	2	6.0	1403
	2	24.40	2.00	2	4.5	2	6.0	1415
	3	16.82	2.00	2	4.5	2	6.0	976
	4	10.86	2.00	2	4.5	2	6.0	630
	5	6.32	2.00	2	4.5	2	6.0	367
	6	3.04	2.00	2	4.5	2	6.0	177
	7*	**1.05**	2.00	2	4.5	2	6.0	0
	8*	**0.14**	2.00	2	4.5	2	6.0	0
	9*	**0.39**	2.00	2	4.5	2	6.0	0
	10	2.52	2.00	2	4.5	2	6.0	146
	11	4.35	2.00	2	4.5	2	6.0	252
	12	8.23	2.00	2	4.5	2	6.0	477
	13	13.53	2.00	2	4.5	2	6.0	785
	14	20.96	2.00	2	4.5	2	6.0	1215
	15	29.63	2.00	2	4.5	2	6.0	1511

CUY-6-1456 Lower Deck Column
FRP Wrap Quantities

* & **Red Text** : No FRP wrap is recommended for column heights less than 2.0 feet. Several lower deck columns do not exist either.

Span	Col. No.	Column Height. (ft.)	Column Width (ft.)	No. of Exterior Columns	Exterior Column Width (ft.)	No. of Interior Columns	Interior Column Width (ft.)	FRP Wrap Area (ft^2)
Span 7	1	31.67	2.00	2	4.5	2	6.0	1299
	2	22.70	2.00	2	4.5	2	6.0	1316
	3	15.48	2.00	2	4.5	2	6.0	898
	4	9.81	2.00	2	4.5	2	6.0	569
	5	5.42	2.00	2	4.5	2	6.0	314
	6	2.27	2.00	2	4.5	2	6.0	132
	7*	**0.32**	2.00	2	4.5	2	6.0	0
	8*	**-0.56**	2.00	2	4.5	2	6.0	0
	9*	**-0.34**	2.00	2	4.5	2	6.0	0
	10*	**0.95**	2.00	2	4.5	2	6.0	0
	11	3.44	2.00	2	4.5	2	6.0	200
	12	7.18	2.00	2	4.5	2	6.0	416
	13	12.18	2.00	2	4.5	2	6.0	707
	14	18.75	2.00	2	4.5	2	6.0	1087
	15	27.07	2.00	2	4.5	2	6.0	1381
Span 8	1	30.26	2.00	2	4.5	2	6.0	1240
	2	21.76	2.00	2	4.5	2	6.0	1262
	3	14.94	2.00	2	4.5	2	6.0	866
	4	9.49	2.00	2	4.5	2	6.0	550
	5	5.28	2.00	2	4.5	2	6.0	306
	6	2.23	2.00	2	4.5	2	6.0	129
	7*	**0.38**	2.00	2	4.5	2	6.0	0
	8*	**-0.50**	2.00	2	4.5	2	6.0	0
	9*	**-0.28**	2.00	2	4.5	2	6.0	0
	10*	**0.91**	2.00	2	4.5	2	6.0	0
	11	3.31	2.00	2	4.5	2	6.0	192
	12	6.86	2.00	2	4.5	2	6.0	398
	13	11.65	2.00	2	4.5	2	6.0	676
	14	17.81	2.00	2	4.5	2	6.0	1033
	15	25.65	2.00	2	4.5	2	6.0	1308

CUY-6-1456 Lower Deck Column
FRP Wrap Quantities

* & **Red Text** : No FRP wrap is recommended for column heights less than 2.0 feet. Several lower deck columns do not exist either.

Span	Col. No.	Column Height. (ft.)	Column Width (ft.)	No. of Exterior Columns	Exterior Column Width (ft.)	No. of Interior Columns	Interior Column Width (ft.)	FRP Wrap Area (ft^2)
Span 9	1	25.89	2.00	2	4.5	2	6.0	1061
	2	17.91	2.00	2	4.5	2	6.0	1039
	3	11.80	2.00	2	4.5	2	6.0	684
	4	7.04	2.00	2	4.5	2	6.0	408
	5	3.65	2.00	2	4.5	2	6.0	212
	6*	**1.60**	2.00	2	4.5	2	6.0	0
	7*	**0.64**	2.00	2	4.5	2	6.0	0
	8*	**0.97**	2.00	2	4.5	2	6.0	0
	9	2.38	2.00	2	4.5	2	6.0	138
	10	5.14	2.00	2	4.5	2	6.0	298
	11	9.26	2.00	2	4.5	2	6.0	537
	12	14.74	2.00	2	4.5	2	6.0	855
	13	22.62	2.00	2	4.5	2	6.0	1154
Span 10	1	22.16	2.00	2	4.5	2	6.0	909
	2	14.73	2.00	2	4.5	2	6.0	854
	3	8.90	2.00	2	4.5	2	6.0	516
	4	4.41	2.00	2	4.5	2	6.0	256
	5*	**1.35**	2.00	2	4.5	2	6.0	0
	6*	**-0.19**	2.00	2	4.5	2	6.0	0
	7*	**-0.51**	2.00	2	4.5	2	6.0	0
	8*	**0.40**	2.00	2	4.5	2	6.0	0
	9	2.83	2.00	2	4.5	2	6.0	164
	10	6.68	2.00	2	4.5	2	6.0	387
	11	11.87	2.00	2	4.5	2	6.0	689
	12	18.68	2.00	2	4.5	2	6.0	952
Span 11 NE & NI	1	16.20	2.00	1	4.5	1	6.0	332
	2	8.96	2.00	1	4.5	1	6.0	260
	3	3.97	2.00	1	4.5	1	6.0	115
	4*	**0.89**	2.00	1	4.5	1	6.0	0
	5*	**-0.36**	2.00	1	4.5	1	6.0	0
	6*	**-0.02**	2.00	1	4.5	1	6.0	0
	7	2.19	2.00	1	4.5	1	6.0	63
	8	6.14	2.00	1	4.5	1	6.0	178
	9	12.38	2.00	1	4.5	1	6.0	316
Span 11 SE & SI	1	16.20	2.00	1	4.5	1	6.0	332
	2	8.63	2.00	1	4.5	1	6.0	250
	3	4.14	2.00	1	4.5	1	6.0	120
	4*	**1.75**	2.00	1	4.5	1	6.0	0
	5*	**1.34**	2.00	1	4.5	1	6.0	0
	6	2.81	2.00	1	4.5	1	6.0	82
	7	6.32	2.00	1	4.5	1	6.0	183
	8	12.70	2.00	1	4.5	1	6.0	324

Note: No lower deck columns are present in Spans 12 & 13.

Total = 64,616 ft^2

CUY-6-1456 Lower Deck Floor Beam
FRP Wrap Quantities

* No FRP Wrap, 1995 Floorbeam

Rough Form Length Factor:
25% of form board length

Span	Floor Beam No.	Interior Floor Beam Length (ft.)	Exterior Floor Beam Length (ft.)	Floor Beam Width (ft.)	Floor Beam Height (ft.)	Fillet Area (ft^2)	FRP Wrap Area (ft^2)	Rough Surface Length (ft.)	Rough Surface Length (ft.)
Span 2	1*	25.25	26.63	2.00	3.67	76.5	561	2243	561
	2*	25.25	26.63	2.00	3.67	76.5	561	2243	561
	3	25.25	26.63	2.00	3.67	76.5	809	3237	809
	4	25.25	26.63	2.00	3.67	76.5	809	3237	809
	5	25.25	26.63	2.00	3.67	76.5	809	3237	809
	6*	25.25	26.63	2.00	3.67	76.5	561	2243	561
	7*	25.25	26.63	2.00	3.67	76.5	561	2243	561
	8	25.25	26.63	2.00	3.67	76.5	809	3237	809
	9	25.25	26.63	2.00	3.67	76.5	809	3237	809
	10	25.25	26.63	2.00	3.67	76.5	809	3237	809
	11*	25.25	26.63	2.00	3.67	76.5	561	2243	561
	12	25.25	26.63	2.00	3.67	76.5	809	3237	809
	13	25.25	26.63	2.00	3.67	76.5	809	3237	809
	14	25.25	26.63	2.00	3.67	76.5	809	3237	809
	15	25.25	26.63	2.00	3.67	76.5	809	3237	809
	16	25.25	26.63	2.00	3.67	76.5	809	3237	809
Span 3	1*	25.25	26.63	2.00	3.67	76.5	0	0	0
	2	25.25	26.63	2.00	3.67	76.5	809	3237	809
	3	25.25	26.63	2.00	3.67	76.5	809	3237	809
	4	25.25	26.63	2.00	3.67	76.5	809	3237	809
	5	25.25	26.63	2.00	3.67	76.5	809	3237	809
	6	25.25	26.63	2.00	3.67	76.5	809	3237	809
	7	25.25	26.63	2.00	3.67	76.5	809	3237	809
	8	25.25	26.63	2.00	3.67	76.5	809	3237	809
	9	25.25	26.63	2.00	3.67	76.5	809	3237	809
	10	25.25	26.63	2.00	3.67	76.5	809	3237	809
	11	25.25	26.63	2.00	3.67	76.5	809	3237	809
	12	25.25	26.63	2.00	3.67	76.5	809	3237	809
	13	25.25	26.63	2.00	3.67	76.5	809	3237	809
	14	25.25	26.63	2.00	3.67	76.5	809	3237	809
	15	25.25	26.63	2.00	3.67	76.5	809	3237	809
	16	25.25	26.63	2.00	3.67	76.5	809	3237	809
	17*	25.25	26.63	2.00	3.67	76.5	0	0	0
	18*	25.25	26.63	2.00	3.67	76.5	0	0	0
Span 5	1*	25.25	26.63	2.00	3.67	76.5	0	0	0
	2*	25.25	26.63	2.00	3.67	76.5	561	2243	561
	3	25.25	26.63	2.00	3.67	76.5	809	3237	809
	4	25.25	26.63	2.00	3.67	76.5	809	3237	809
	5	25.25	26.63	2.00	3.67	76.5	809	3237	809
	6	25.25	26.63	2.00	3.67	76.5	809	3237	809
	7	25.25	26.63	2.00	3.67	76.5	809	3237	809
	8	25.25	26.63	2.00	3.67	76.5	809	3237	809
	9	25.25	26.63	2.00	3.67	76.5	809	3237	809
	10	25.25	26.63	2.00	3.67	76.5	809	3237	809
	11	25.25	26.63	2.00	3.67	76.5	809	3237	809
	12	25.25	26.63	2.00	3.67	76.5	809	3237	809
	13	25.25	26.63	2.00	3.67	76.5	809	3237	809
	14	25.25	26.63	2.00	3.67	76.5	809	3237	809
	15	25.25	26.63	2.00	3.67	76.5	809	3237	809
Span 6	1	25.25	26.63	2.00	3.67	38.3	771	3084	771
	2	25.25	26.63	2.00	3.67	76.5	809	3237	809
	3	25.25	26.63	2.00	3.67	76.5	809	3237	809
	4	25.25	26.63	2.00	3.67	76.5	809	3237	809
	5	25.25	26.63	2.00	3.67	76.5	809	3237	809
	6	25.25	26.63	2.00	3.67	76.5	809	3237	809
	7	25.25	26.63	2.00	3.67	76.5	809	3237	809
	8	25.25	26.63	2.00	3.67	76.5	809	3237	809
	9	25.25	26.63	2.00	3.67	76.5	809	3237	809
	10	25.25	26.63	2.00	3.67	76.5	809	3237	809
	11	25.25	26.63	2.00	3.67	76.5	809	3237	809
	12	25.25	26.63	2.00	3.67	76.5	809	3237	809
	13	25.25	26.63	2.00	3.67	76.5	809	3237	809
	14	25.25	26.63	2.00	3.67	76.5	809	3237	809
	15	25.25	26.63	2.00	3.67	76.5	809	3237	809
Span 7	1	25.25	26.63	2.00	3.67	76.5	809	3237	809
	2	25.25	26.63	2.00	3.67	76.5	809	3237	809
	3	25.25	26.63	2.00	3.67	76.5	809	3237	809
	4	25.25	26.63	2.00	3.67	76.5	809	3237	809
	5	25.25	26.63	2.00	3.67	76.5	809	3237	809
	6	25.25	26.63	2.00	3.67	76.5	809	3237	809
	7	25.25	26.63	2.00	3.67	76.5	809	3237	809
	8	25.25	26.63	2.00	3.67	76.5	809	3237	809
	9	25.25	26.63	2.00	3.67	76.5	809	3237	809
	10	25.25	26.63	2.00	3.67	76.5	809	3237	809
	11	25.25	26.63	2.00	3.67	76.5	809	3237	809
	12	25.25	26.63	2.00	3.67	76.5	809	3237	809
	13	25.25	26.63	2.00	3.67	76.5	809	3237	809
	14	25.25	26.63	2.00	3.67	76.5	809	3237	809
	15	25.25	26.63	2.00	3.67	76.5	809	3237	809

CUY-6-1456 Lower Deck Floor Beam
FRP Wrap Quantities

* No FRP Wrap, 1995 Floorbeam

Rough Form Length Factor:
25% of form board length

Span	Floor Beam No.	Interior Floor Beam Length (ft.)	Exterior Floor Beam Length (ft.)	Floor Beam Width (ft.)	Floor Beam Height (ft.)	Fillet Area (ft^2)	FRP Wrap Area (ft^2)	Rough Surface Length (ft.)	Rough Surface Length (ft.)
Span 8	1	25.25	26.63	2.00	3.67	76.5	809	3237	809
	2	25.25	26.63	2.00	3.67	76.5	809	3237	809
	3	25.25	26.63	2.00	3.67	76.5	809	3237	809
	4	25.25	26.63	2.00	3.67	76.5	809	3237	809
	5	25.25	26.63	2.00	3.67	76.5	809	3237	809
	6	25.25	26.63	2.00	3.67	76.5	809	3237	809
	7	25.25	26.63	2.00	3.67	76.5	809	3237	809
	8	25.25	26.63	2.00	3.67	76.5	809	3237	809
	9	25.25	26.63	2.00	3.67	76.5	809	3237	809
	10	25.25	26.63	2.00	3.67	76.5	809	3237	809
	11	25.25	26.63	2.00	3.67	76.5	809	3237	809
	12	25.25	26.63	2.00	3.67	76.5	809	3237	809
	13	25.25	26.63	2.00	3.67	76.5	809	3237	809
	14	25.25	26.63	2.00	3.67	76.5	809	3237	809
	15	25.25	26.63	2.00	3.67	76.5	809	3237	809
Span 9	1	25.25	26.63	2.00	3.67	76.5	809	3237	809
	2	25.25	26.63	2.00	3.67	76.5	809	3237	809
	3	25.25	26.63	2.00	3.67	76.5	809	3237	809
	4	25.25	26.63	2.00	3.67	76.5	809	3237	809
	5	25.25	26.63	2.00	3.67	76.5	809	3237	809
	6	25.25	26.63	2.00	3.67	76.5	809	3237	809
	7	25.25	26.63	2.00	3.67	76.5	809	3237	809
	8	25.25	26.63	2.00	3.67	76.5	809	3237	809
	9	25.25	26.63	2.00	3.67	76.5	809	3237	809
	10	25.25	26.63	2.00	3.67	76.5	809	3237	809
	11	25.25	26.63	2.00	3.67	76.5	809	3237	809
	12	25.25	26.63	2.00	3.67	76.5	809	3237	809
	13	25.25	26.63	2.00	3.67	76.5	809	3237	809
Span 10	1	25.25	26.63	2.00	3.67	76.5	809	3237	809
	2	25.25	26.63	2.00	3.67	76.5	809	3237	809
	3	25.25	26.63	2.00	3.67	76.5	809	3237	809
	4	25.25	26.63	2.00	3.67	76.5	809	3237	809
	5	25.25	26.63	2.00	3.67	76.5	809	3237	809
	6	25.25	26.63	2.00	3.67	76.5	809	3237	809
	7	25.25	26.63	2.00	3.67	76.5	809	3237	809
	8	25.25	26.63	2.00	3.67	76.5	809	3237	809
	9	25.25	26.63	2.00	3.67	76.5	809	3237	809
	10	25.25	26.63	2.00	3.67	76.5	809	3237	809
	11	25.25	26.63	2.00	3.67	76.5	809	3237	809
	12	25.25	26.63	2.00	3.67	76.5	809	3237	809
Span 11	1	*26.38*	*33.60*	2.00	3.67	76.5	950	3799	950
	2	*26.38*	*33.60*	2.00	3.67	76.5	950	3799	950
	3	*26.38*	*33.60*	2.00	3.67	76.5	950	3799	950
	4	*26.38*	*33.60*	2.00	3.67	76.5	950	3799	950
	5	*26.38*	*33.60*	2.00	3.67	76.5	950	3799	950
	6	*26.38*	*33.60*	2.00	3.67	76.5	950	3799	950
	7	*26.38*	*33.60*	2.00	3.67	76.5	950	3799	950
	8	*26.38*	*33.60*	2.00	3.67	76.5	950	3799	950
	9	*26.38*	*33.60*	2.00	3.67	76.5	950	3799	950
	10	*26.38*	*33.60*	2.00	3.67	76.5	950	3799	950
Span 12	1*	26.38	33.60	1.50	4.00	0	0	0	0
	2*	26.38	33.60	1.50	4.00	0	570	2279	570
	3	26.38	33.60	1.50	4.00	0	889	3556	889
	4	26.38	33.60	1.50	4.00	0	889	3556	889
	5	26.38	33.60	1.50	4.00	0	889	3556	889
	6	26.38	33.60	1.50	4.00	0	889	3556	889
	7	26.38	33.60	1.83	4.00	0	920	3680	920
	8	26.38	33.60	1.50	4.00	0	889	3556	889
	9	26.38	33.60	1.50	4.00	0	889	3556	889
	10	26.38	33.60	1.50	4.00	0	889	3556	889
	11	26.38	33.60	1.50	4.00	0	889	3556	889
	12	26.38	33.60	1.50	4.00	0	889	3556	889
	13	26.38	33.60	1.50	4.00	0	889	3556	889
	14	26.38	33.60	1.50	4.00	0	889	3556	889
Span 13	1	26.38	30.75	2.58	3.67	0	741	2963	741
	2	26.38	30.75	2.58	3.67	0	566	2266	566
	3	26.38	30.75	2.58	3.67	0	566	2266	566
	4	26.38	30.75	2.58	3.67	0	566	2266	566
	5	26.38	30.75	2.58	3.67	0	566	2266	566
	6	26.38	30.75	2.58	3.67	0	566	2266	566
	7	26.38	30.75	2.58	3.67	0	566	2266	566
	8	26.38	30.75	2.58	3.67	0	871	3486	871
						Totals =	**117,303**	**469,213**	**117,303** **ft.**

CUY-6-1456 PIERS

FRP Wrap Quantities

Location	North Exterior Bay (ft^2)	Interior Bay	South Exterior Bay
West Abut.	0	0	0
Pier 1	0	0	0
Pier 2	0	0	0
Pier 3	0	0	0
Pier 4	200	200	200
Pier 5	1098	1133	1098
Pier 6	1098	1133	1098
Pier 7	1098	1133	1098
Pier 8	1098	1133	1098
Pier 9	1098	1133	1098
Pier 10	1098	1133	1098
Pier 11	0	0	0
Pier 12	0	0	0
East Abut.	0	0	0
	6,785	**6,998**	**6,785**

Total **20,569** **SF**

CUY-6-1456 FRP Wrap Totals

Element	Estimated FRP Wrap Area			Rough Surface Length (ft)
	With Arch Rib Alt. No. 1 (ft^2)	With Arch Rib Alt. No. 2 (ft^2)	With Arch Rib Alt. No. 3 (ft^2)	
Arch Ribs	65,063	71,312	118,364	78,116
Columns	64,616	64,616	64,616	20,000
Floor Beams	117,303	117,303	117,303	117,303
Lower Pier Shafts				5,000
Total	**246,983**	**253,232**	**300,284**	**215,419**

APPENDIX F

WEST STATION
DETERIORATION DRAWINGS

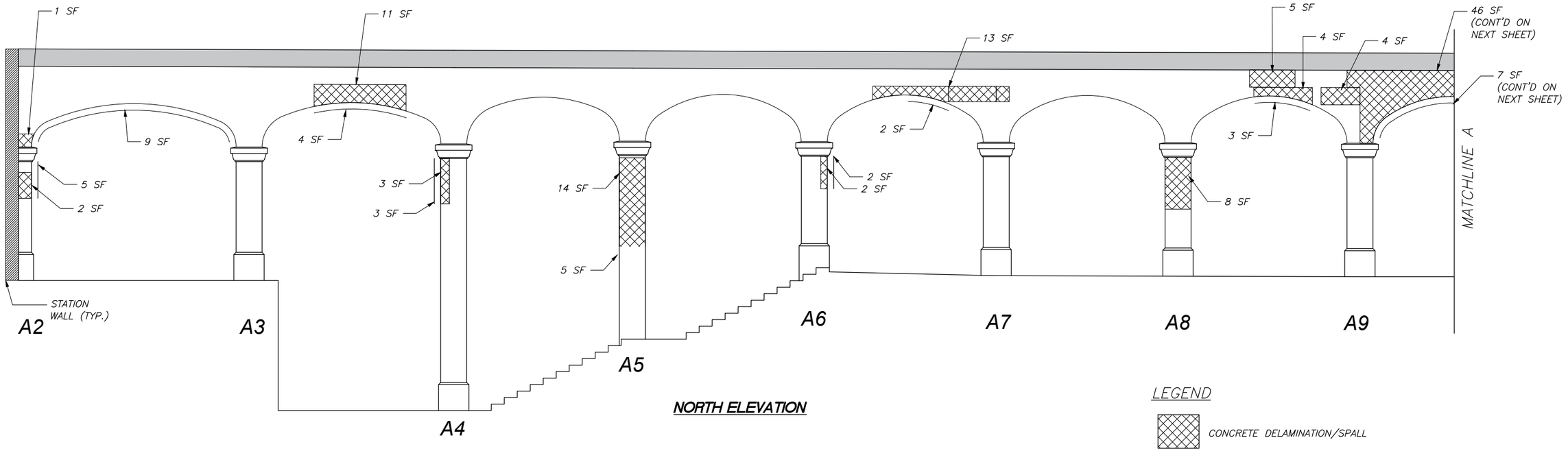
CUY-6-1456

2016 West Station Patching

Detroit Tunnel			
Bay	Concrete Repairs (SF)		
	North Wall	Ceiling	South Wall
1	407	16	279
2	347	150	353
3	225	220.5	204
4	203.25	36	410
5	171.25	98	343.5
6	260.75	108	371.5
7	350.5	294	422.25
8	153	588	224
9	184	844.5	131
10	300	171.5	614
Sub-Totals	2,602	2,527	3,352

Totals **11,329** **SF**

W. 25th Tunnel			
Bay	Concrete Repairs (SF)		
	West Wall	Ceiling	East Wall
11	136	32	386
12	133	0	131
13	65	16	292.5
14	182	0	163
15	81	0	92
16	166	16	159
17	363	280	155
Sub-Totals	1,126	344	1,379



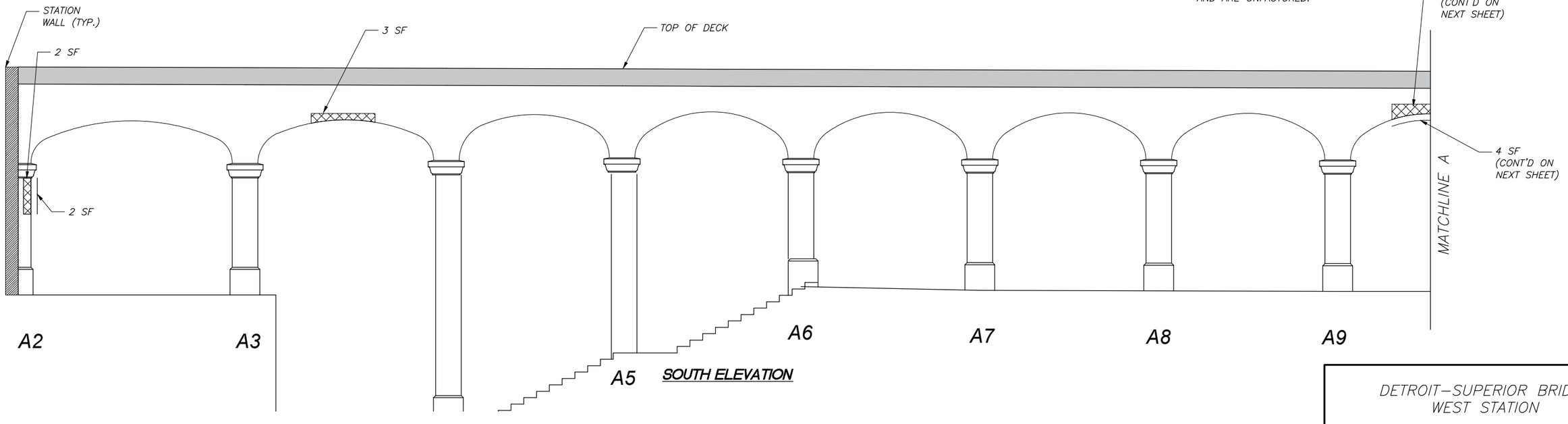
NORTH ELEVATION

LEGEND

CONCRETE DELAMINATION/SPALL

CONCRETE DELAMINATION/SPALL ON VERTICAL FACE

NOTE: ALL DETERIORATION QUANTITIES ARE FROM FIELD MEASUREMENTS AND ARE UNFACTORED.

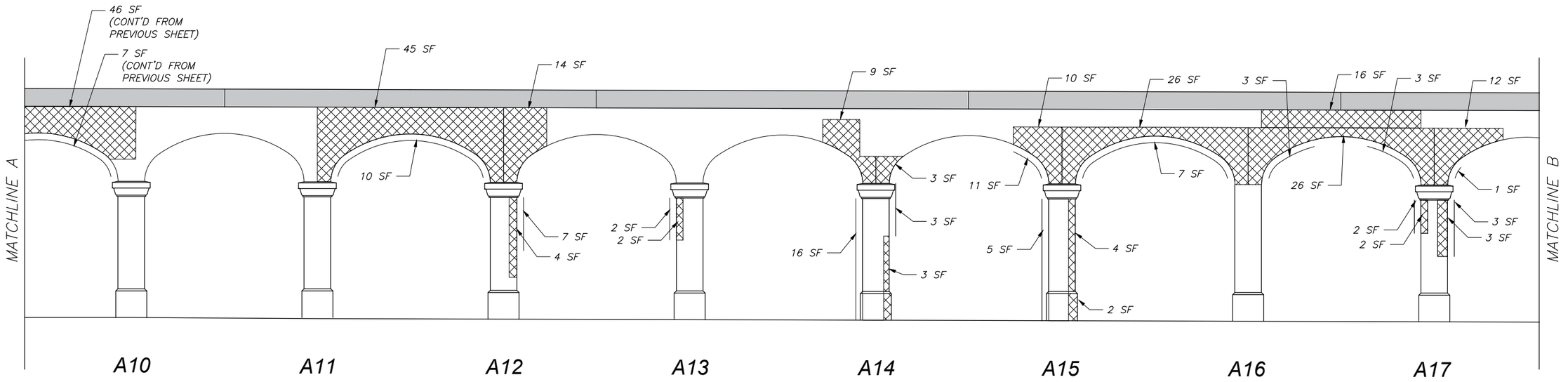


SOUTH ELEVATION

DETROIT–SUPERIOR BRIDGE
WEST STATION

LINE A, COLUMNS A2 TO A9

1



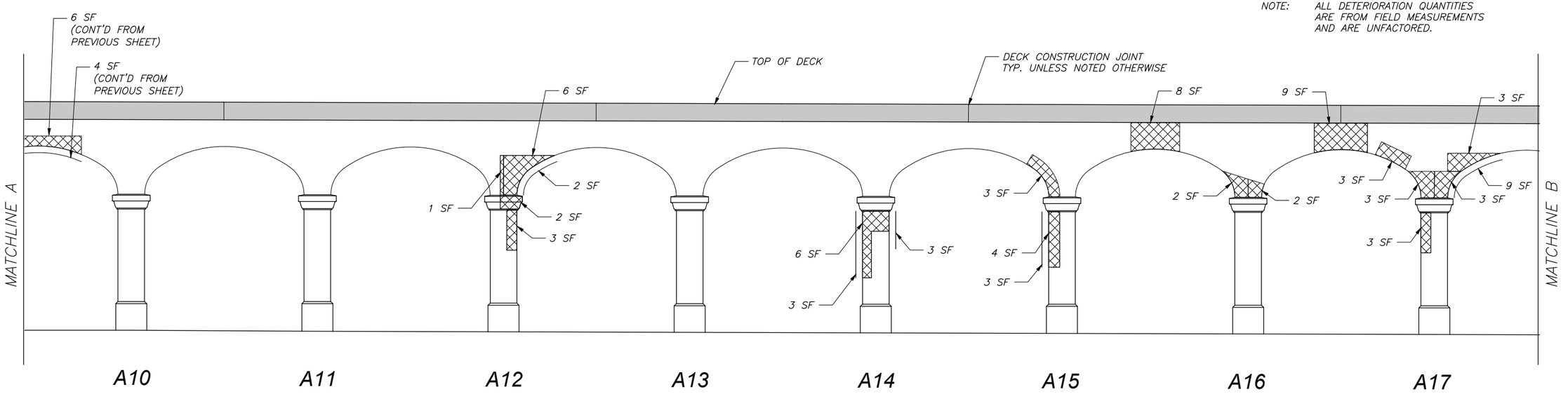
NORTH ELEVATION

LEGEND

CONCRETE DELAMINATION/SPALL

CONCRETE DELAMINATION/SPALL ON VERTICAL FACE

NOTE: ALL DETERIORATION QUANTITIES ARE FROM FIELD MEASUREMENTS AND ARE UNFACTORED.

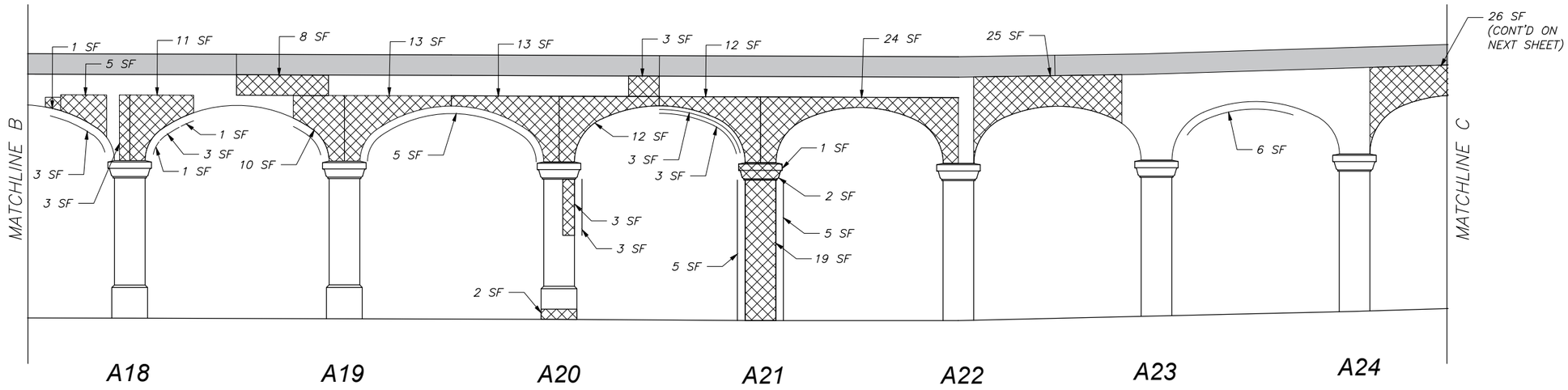


SOUTH ELEVATION

DETROIT–SUPERIOR BRIDGE
WEST STATION

LINE A, COLUMNS A10 TO A17

2



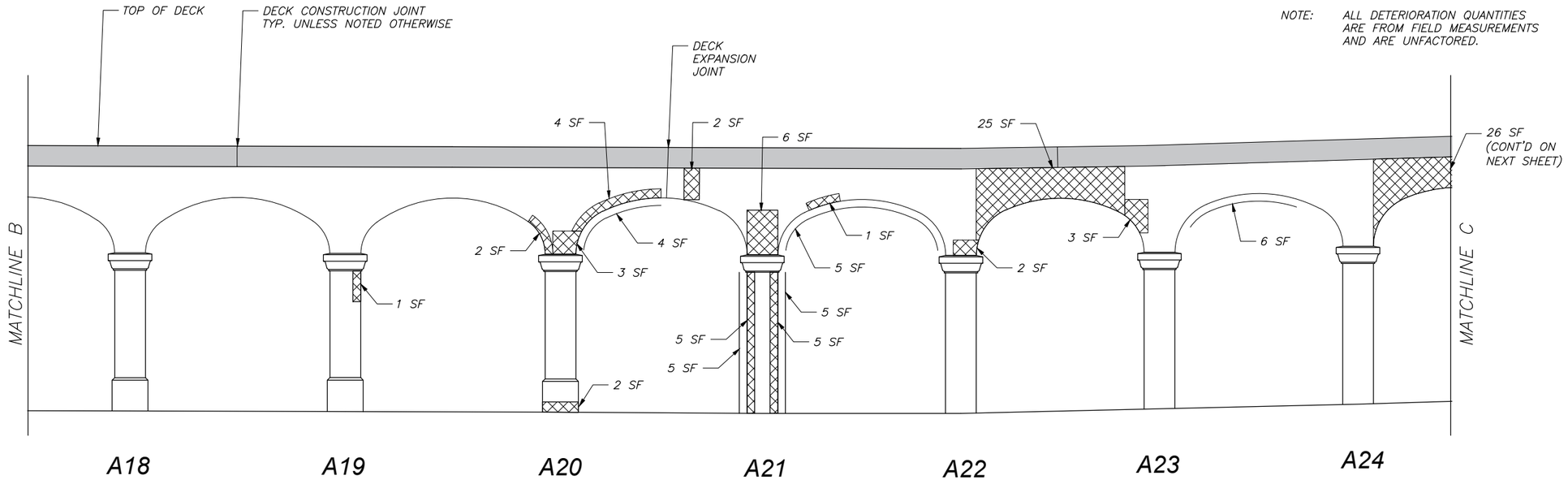
NORTH ELEVATION

LEGEND

CONCRETE DELAMINATION/SPALL

CONCRETE DELAMINATION/SPALL ON VERTICAL FACE

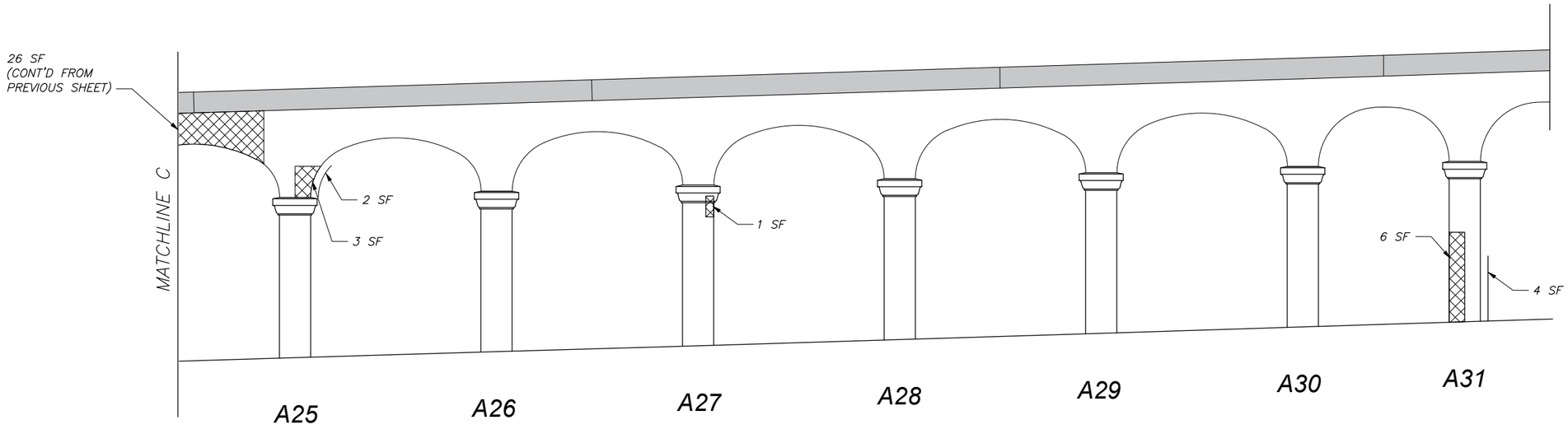
NOTE: ALL DETERIORATION QUANTITIES ARE FROM FIELD MEASUREMENTS AND ARE UNFACTORED.



SOUTH ELEVATION

DETROIT–SUPERIOR BRIDGE
WEST STATION

LINE A, COLUMNS A18 TO A24



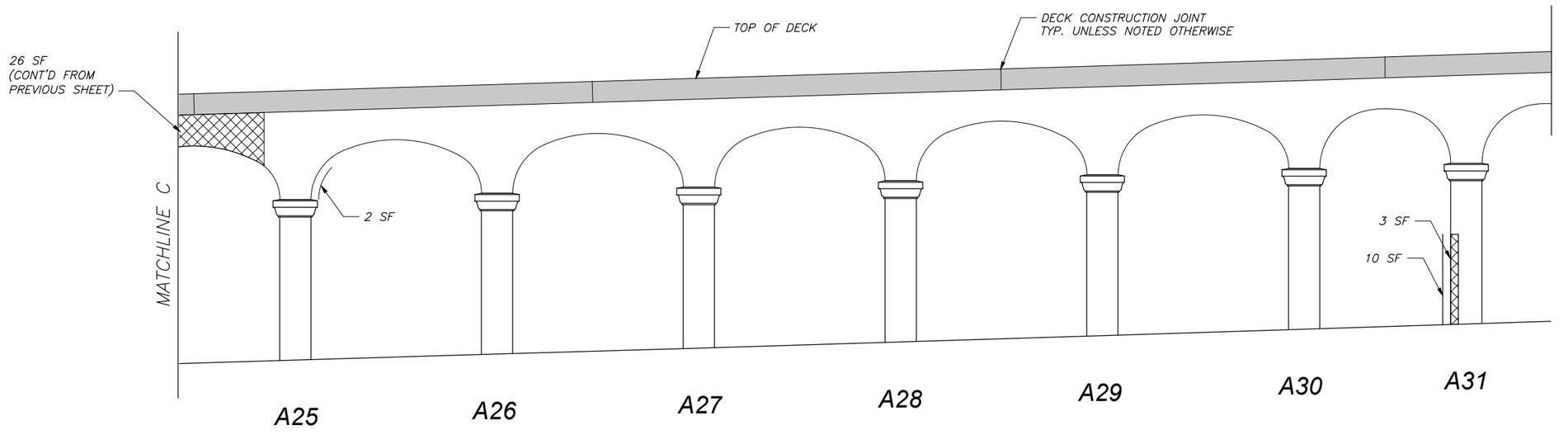
NORTH ELEVATION

LEGEND

CONCRETE DELAMINATION/SPALL

CONCRETE DELAMINATION/SPALL ON VERTICAL FACE

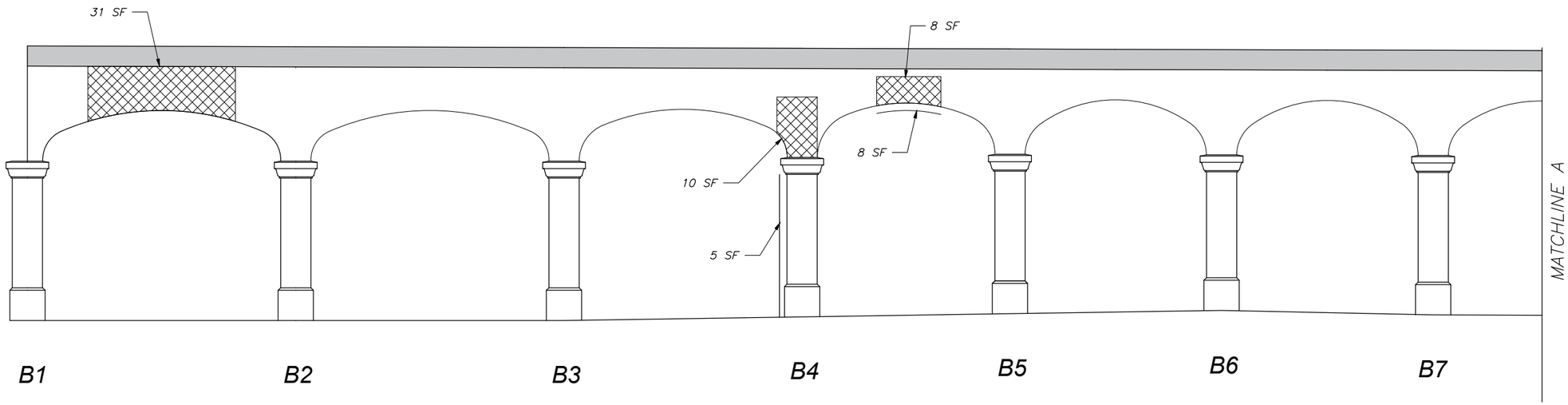
NOTE: ALL DETERIORATION QUANTITIES ARE FROM FIELD MEASUREMENTS AND ARE UNFACTORED.



SOUTH ELEVATION

DETROIT–SUPERIOR BRIDGE
WEST STATION

LINE A, COLUMNS A25 TO A31



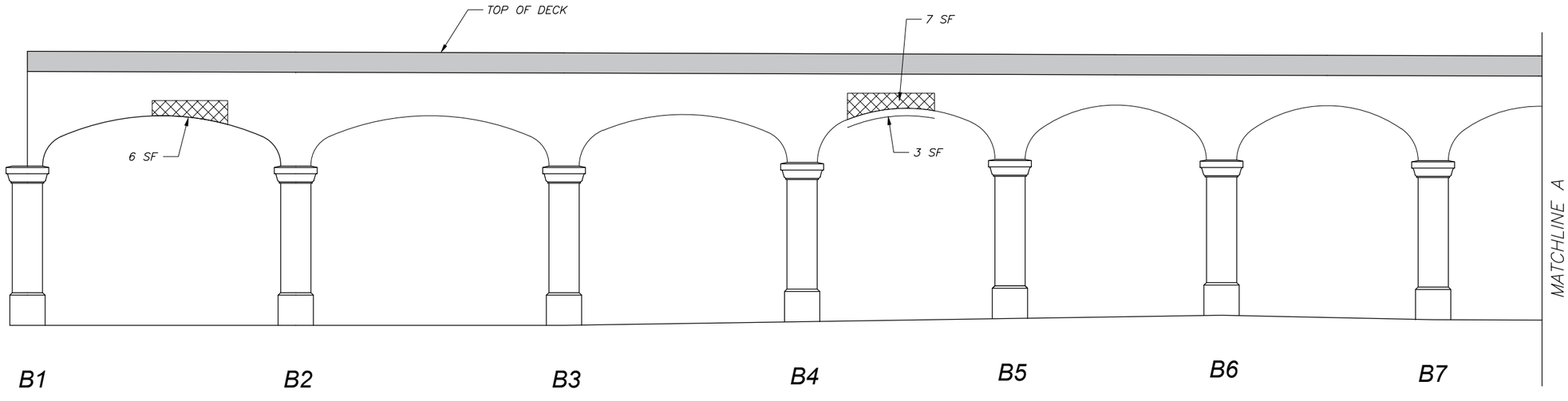
NORTH ELEVATION

LEGEND

CONCRETE DELAMINATION/SPALL

CONCRETE DELAMINATION/SPALL ON VERTICAL FACE

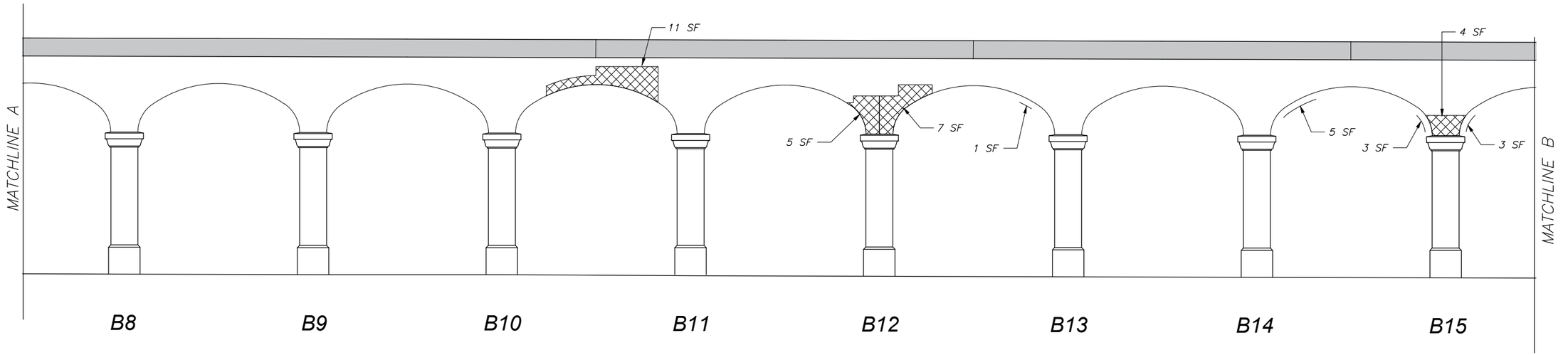
NOTE: ALL DETERIORATION QUANTITIES ARE FROM FIELD MEASUREMENTS AND ARE UNFACTORED.



SOUTH ELEVATION

DETROIT–SUPERIOR BRIDGE
WEST STATION

LINE B, COLUMNS B1 TO B7



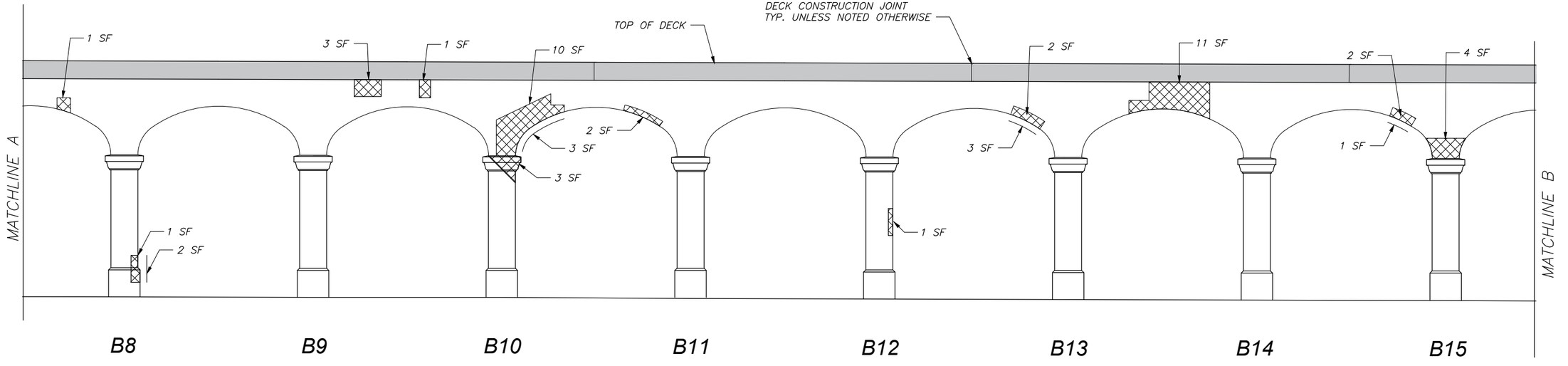
NORTH ELEVATION

LEGEND

CONCRETE DELAMINATION/SPALL

CONCRETE DELAMINATION/SPALL ON VERTICAL FACE

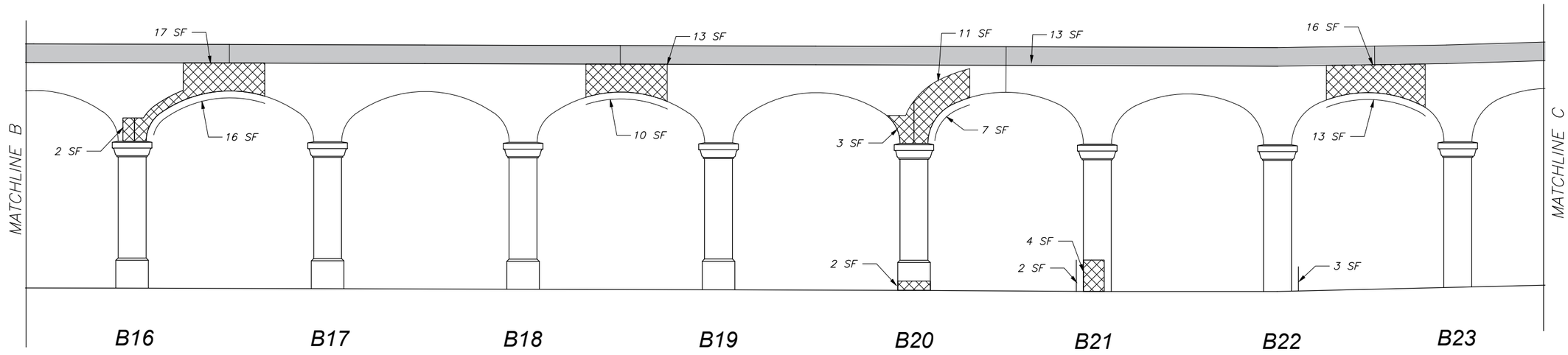
NOTE: ALL DETERIORATION QUANTITIES ARE FROM FIELD MEASUREMENTS AND ARE UNFACTORED.



SOUTH ELEVATION

DETROIT–SUPERIOR BRIDGE
WEST STATION

LINE B, COLUMNS B8 TO B15



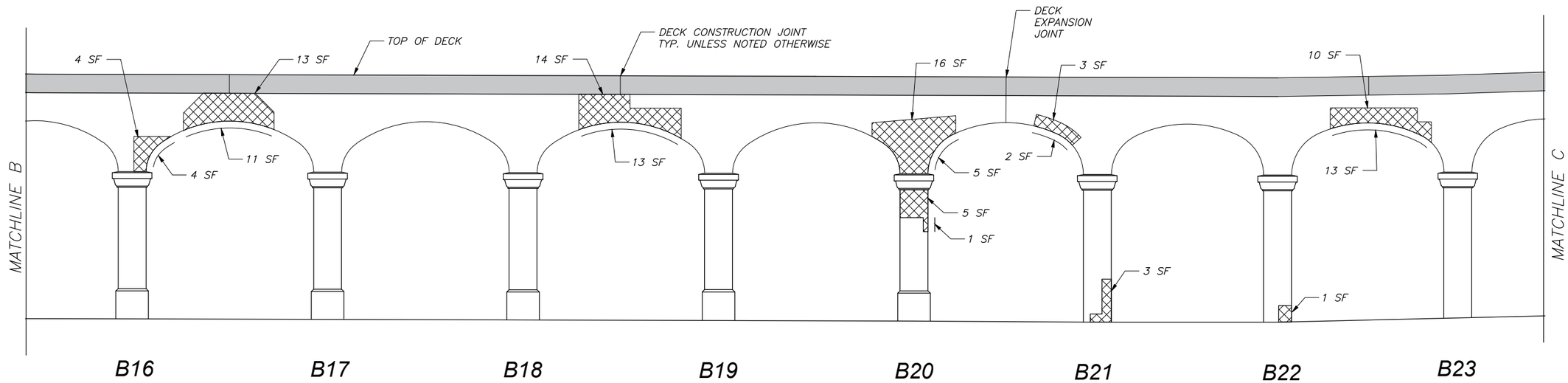
NORTH ELEVATION

LEGEND

CONCRETE DELAMINATION/SPALL

CONCRETE DELAMINATION/SPALL ON VERTICAL FACE

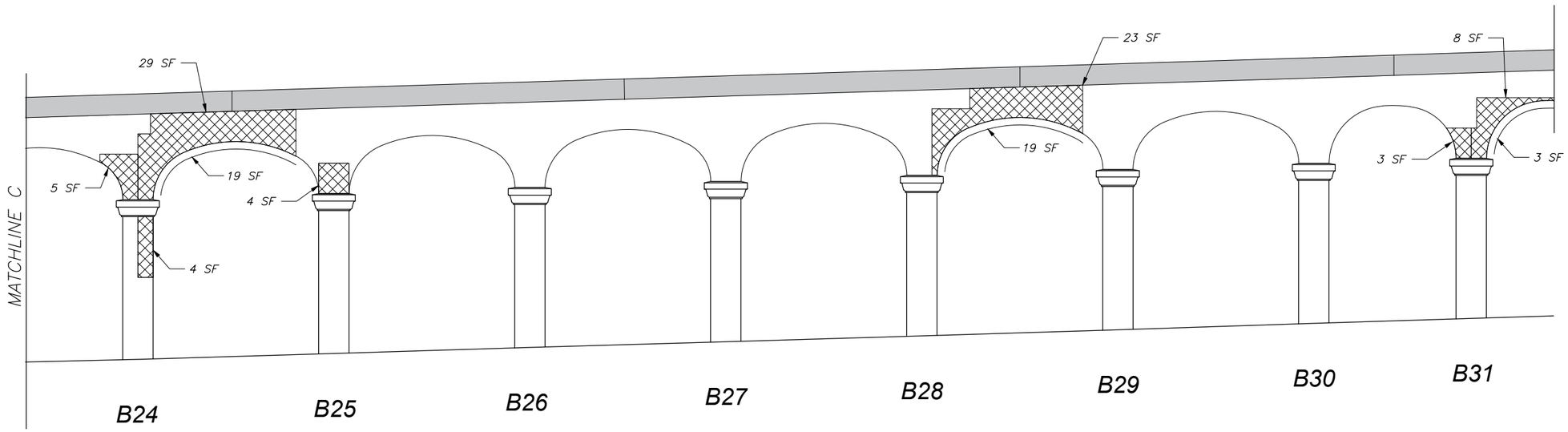
NOTE: ALL DETERIORATION QUANTITIES ARE FROM FIELD MEASUREMENTS AND ARE UNFACTORED.



SOUTH ELEVATION

DETROIT–SUPERIOR BRIDGE
WEST STATION

LINE B, COLUMNS B16 TO B23



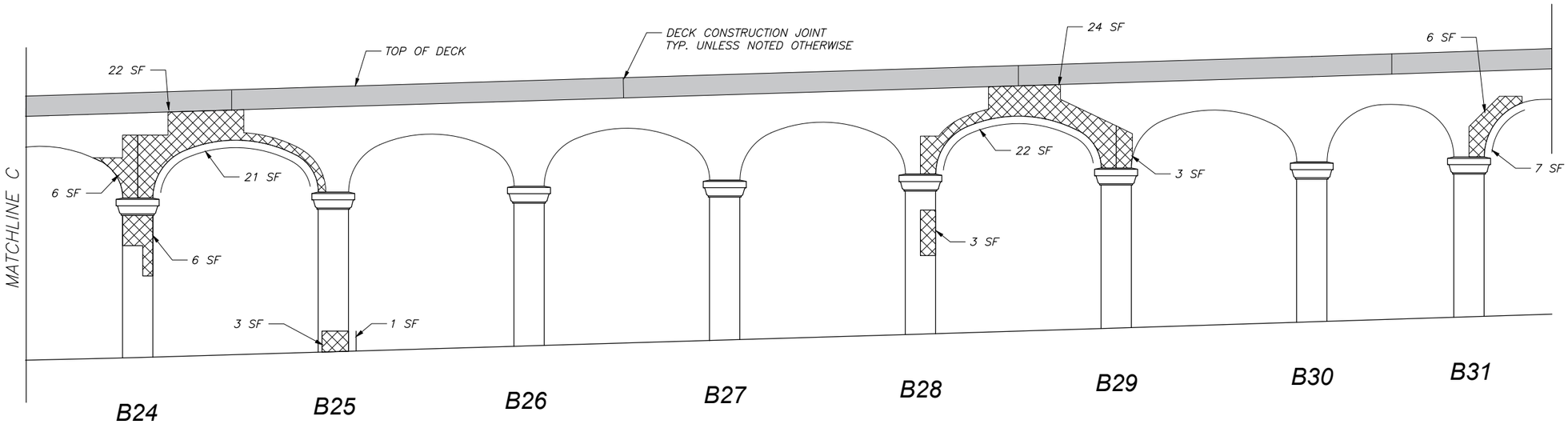
NORTH ELEVATION

LEGEND

CONCRETE DELAMINATION/SPALL

CONCRETE DELAMINATION/SPALL ON VERTICAL FACE

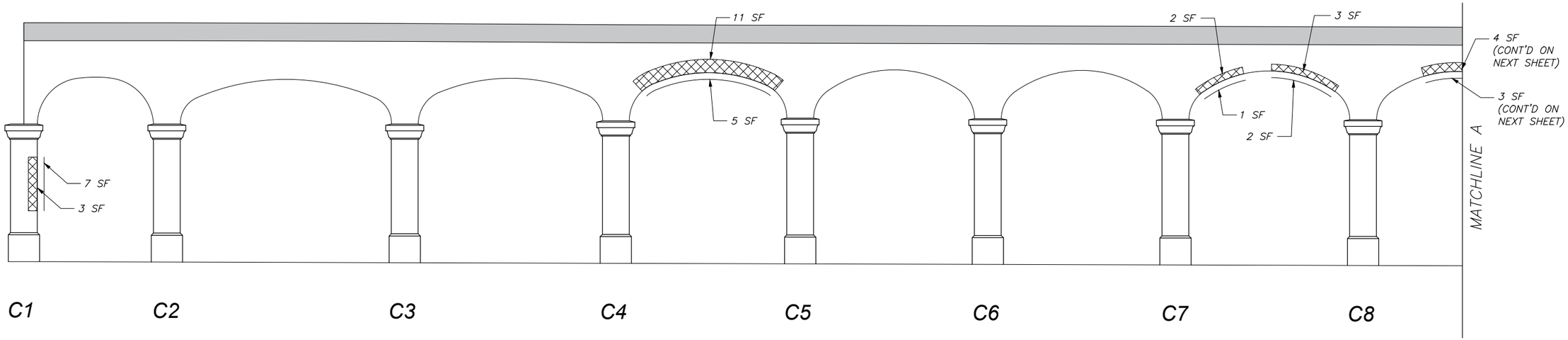
NOTE: ALL DETERIORATION QUANTITIES ARE FROM FIELD MEASUREMENTS AND ARE UNFACTORED.



SOUTH ELEVATION

DETROIT–SUPERIOR BRIDGE
WEST STATION

LINE B, COLUMNS B24 TO B31



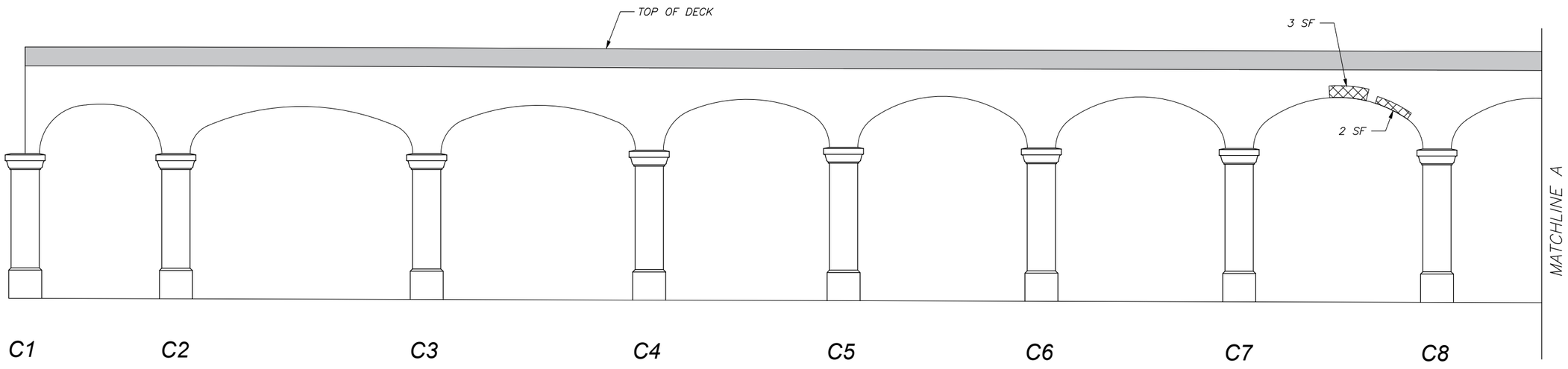
NORTH ELEVATION

LEGEND

CONCRETE DELAMINATION/SPALL

CONCRETE DELAMINATION/SPALL ON VERTICAL FACE

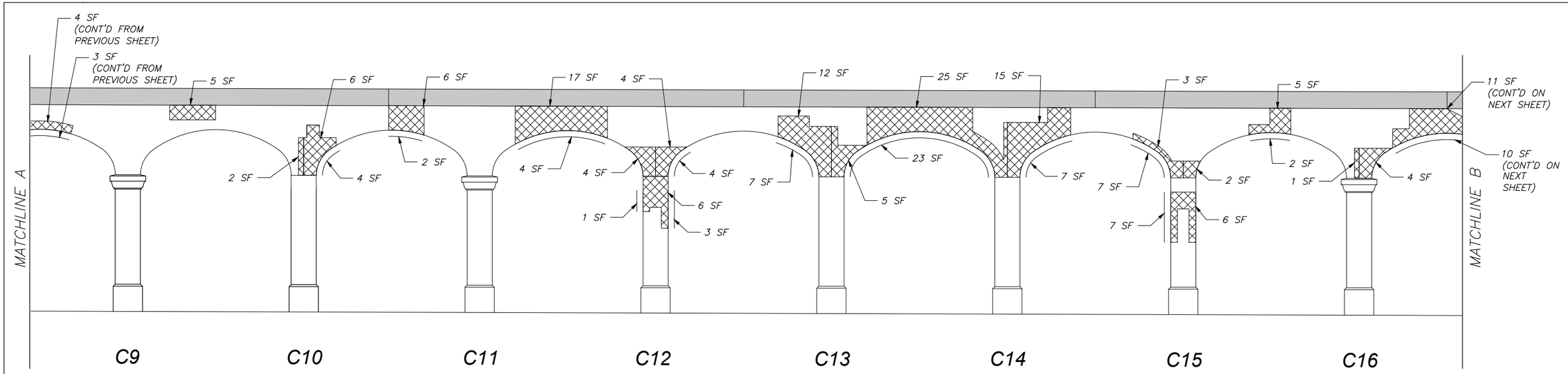
NOTE: ALL DETERIORATION QUANTITIES ARE FROM FIELD MEASUREMENTS AND ARE UNFACTORED.



SOUTH ELEVATION

DETROIT–SUPERIOR BRIDGE
WEST STATION

LINE C, COLUMNS C1 TO C8



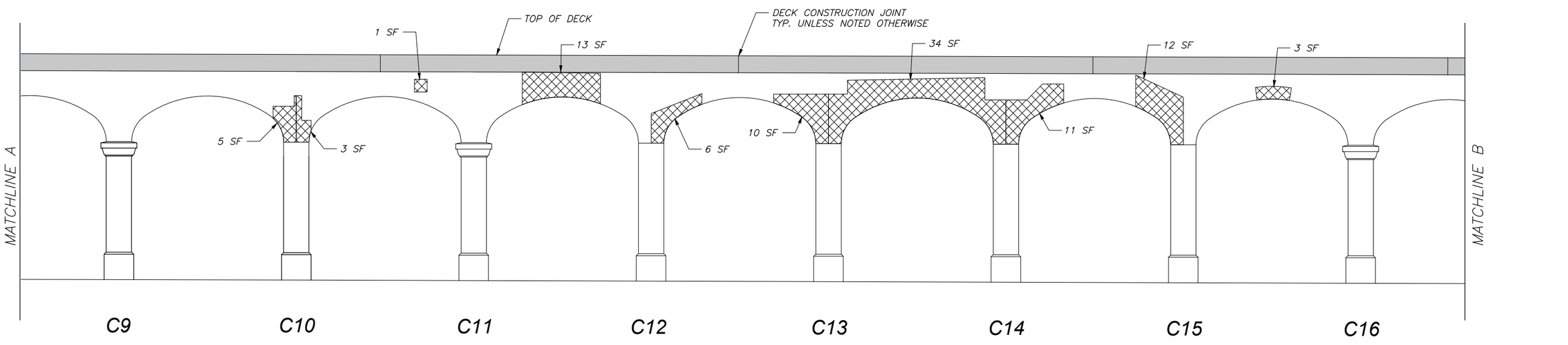
NORTH ELEVATION

LEGEND

CONCRETE DELAMINATION/SPALL

CONCRETE DELAMINATION/SPALL ON VERTICAL FACE

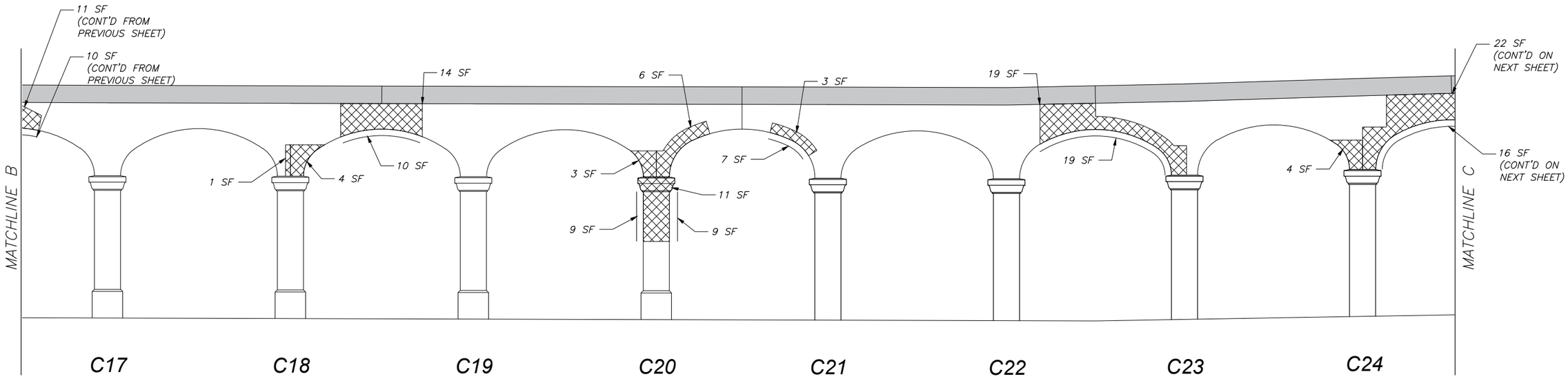
NOTE: ALL DETERIORATION QUANTITIES ARE FROM FIELD MEASUREMENTS AND ARE UNFACTORED.



SOUTH ELEVATION

DETROIT–SUPERIOR BRIDGE
WEST STATION

LINE C, COLUMNS C9–C16



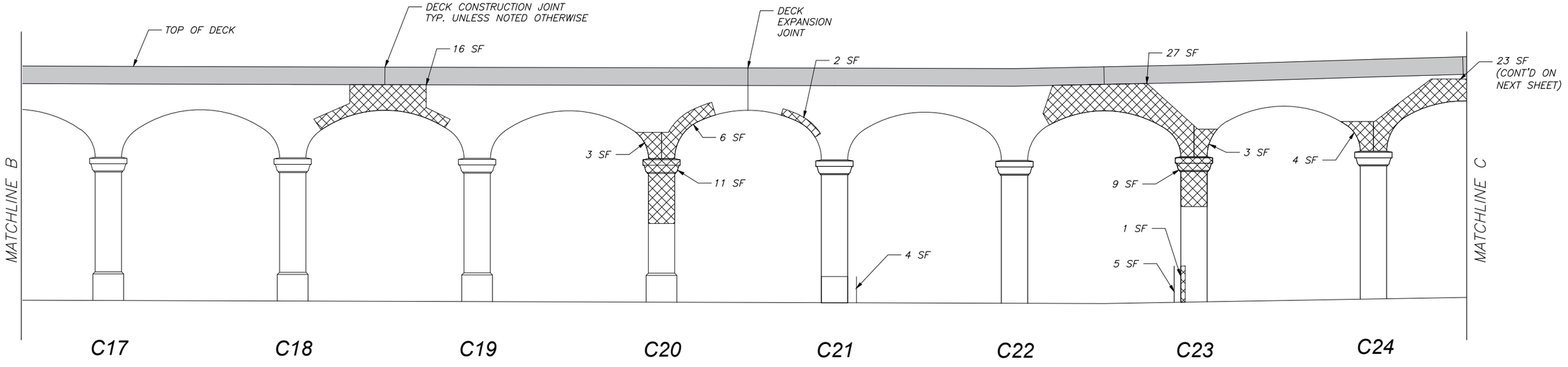
NORTH ELEVATION

LEGEND

CONCRETE DELAMINATION/SPALL

CONCRETE DELAMINATION/SPALL ON VERTICAL FACE

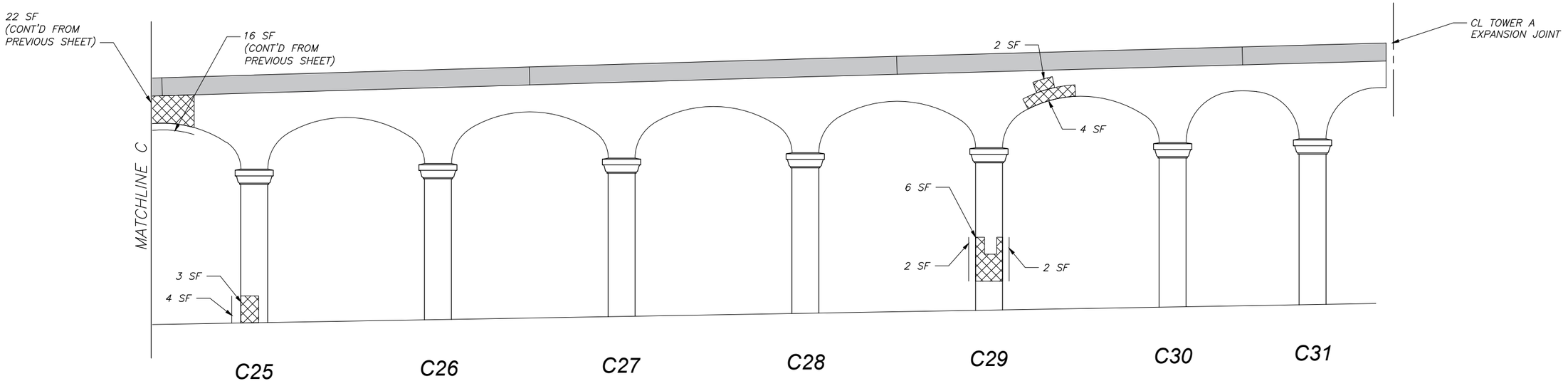
NOTE: ALL DETERIORATION QUANTITIES ARE FROM FIELD MEASUREMENTS AND ARE UNFACTORED.



SOUTH ELEVATION

DETROIT–SUPERIOR BRIDGE
WEST STATION

LINE C, COLUMNS C17 TO C24



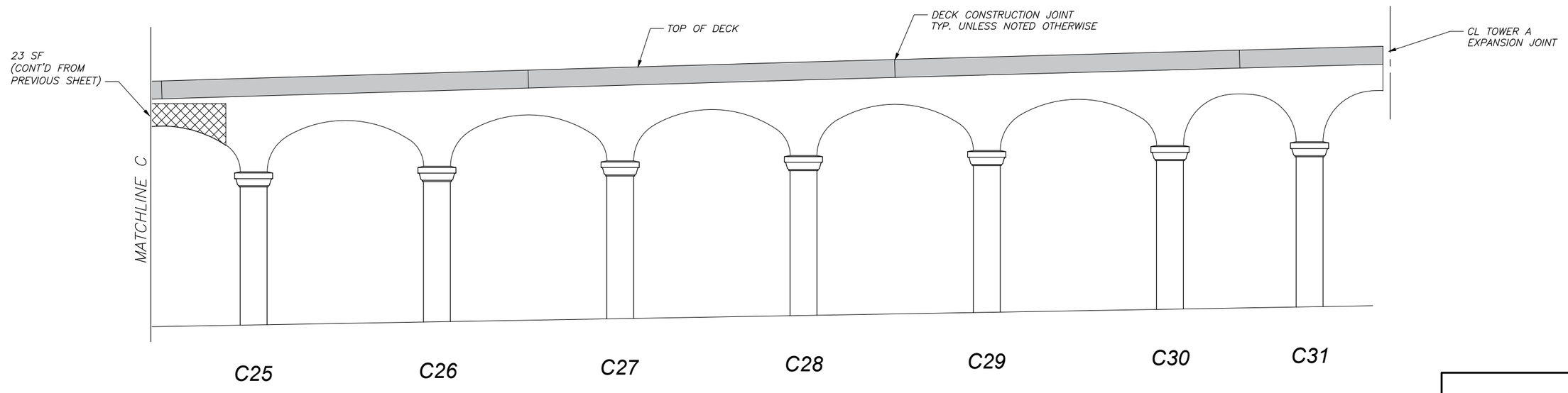
NORTH ELEVATION

LEGEND

CONCRETE DELAMINATION/SPALL

CONCRETE DELAMINATION/SPALL ON VERTICAL FACE

NOTE: ALL DETERIORATION QUANTITIES ARE FROM FIELD MEASUREMENTS AND ARE UNFACTORED.

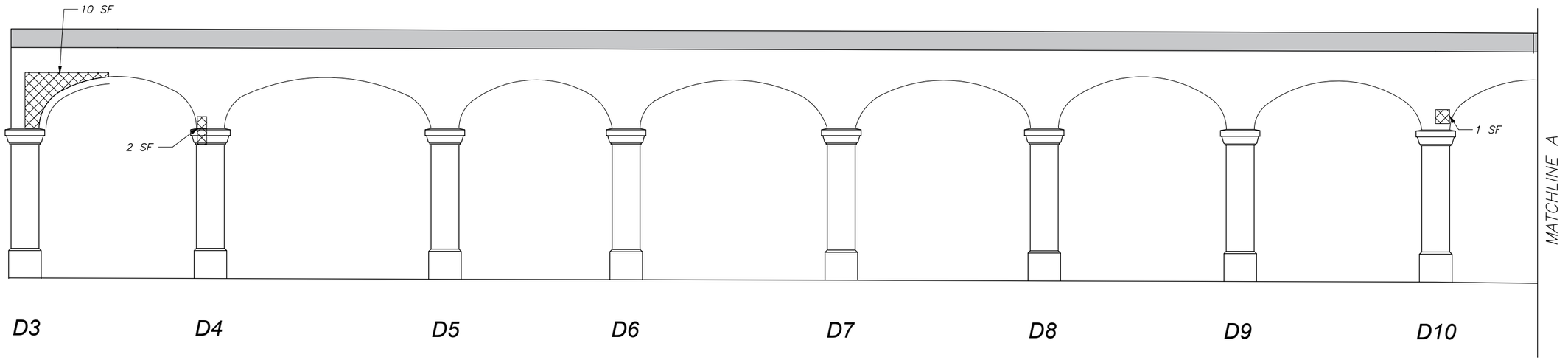


SOUTH ELEVATION

DETROIT–SUPERIOR BRIDGE
WEST STATION

LINE C, COLUMNS C25–C31

12



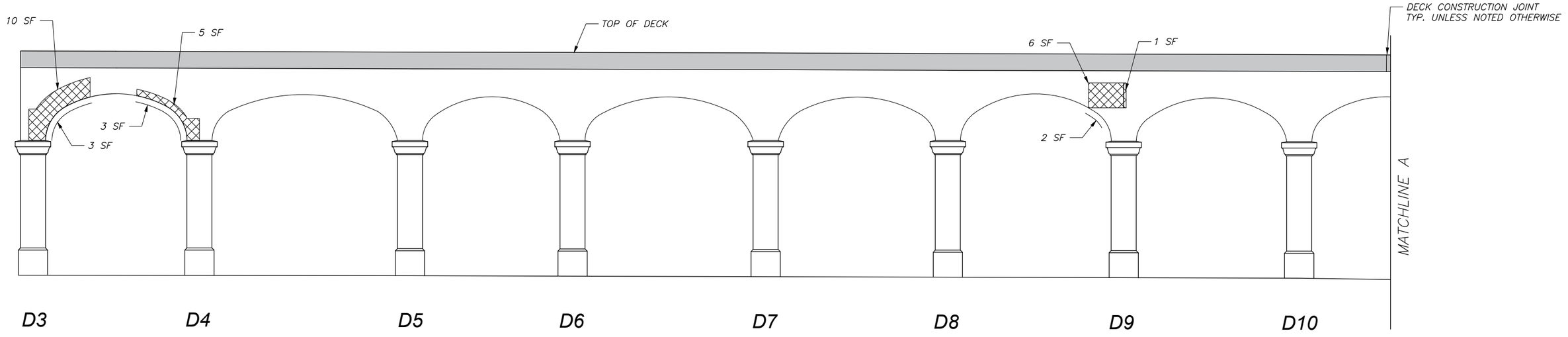
NORTH ELEVATION

LEGEND

CONCRETE DELAMINATION/SPALL

CONCRETE DELAMINATION/SPALL ON VERTICAL FACE

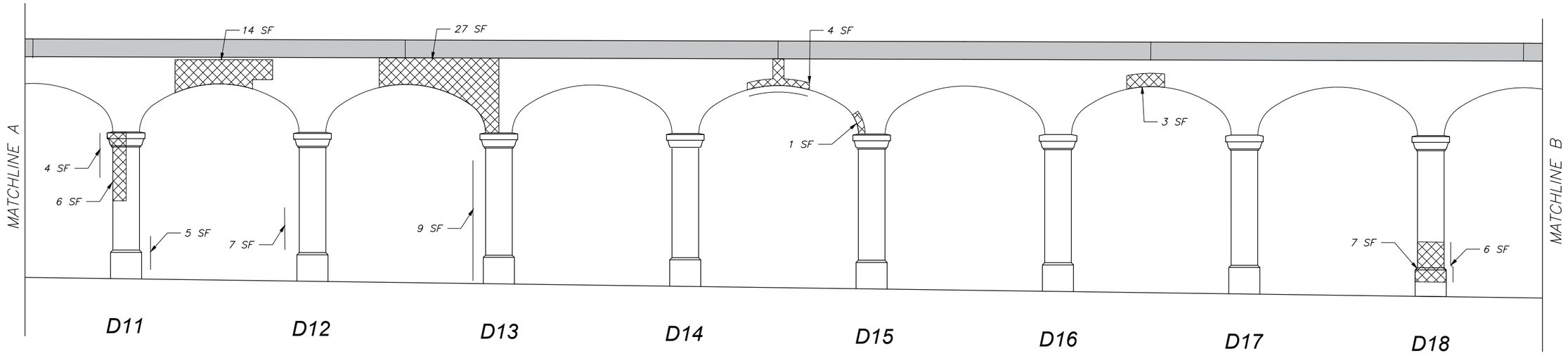
NOTE: ALL DETERIORATION QUANTITIES ARE FROM FIELD MEASUREMENTS AND ARE UNFACTORED.



SOUTH ELEVATION

DETROIT–SUPERIOR BRIDGE
WEST STATION

LINE D, COLUMNS D3 TO D10



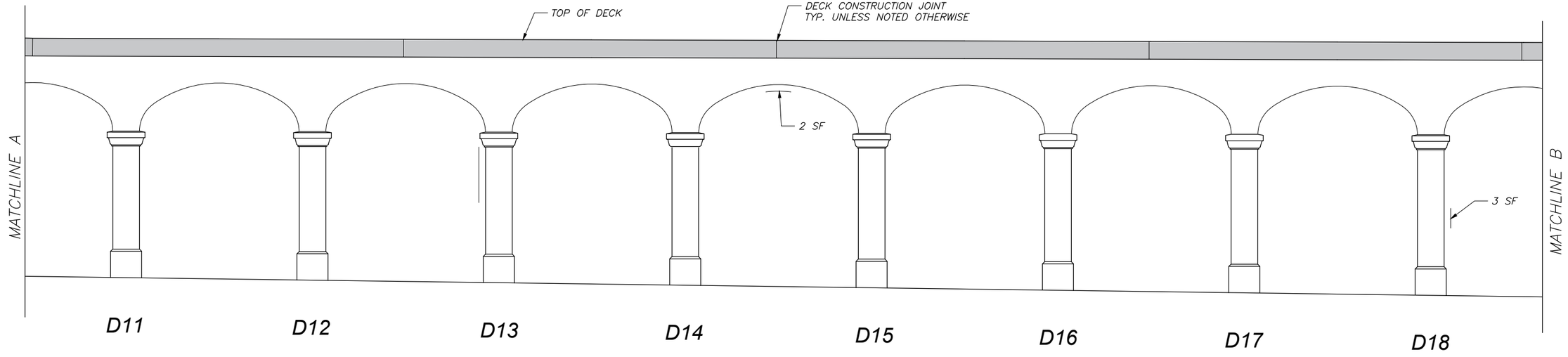
NORTH ELEVATION

LEGEND

CONCRETE DELAMINATION/SPALL

CONCRETE DELAMINATION/SPALL ON VERTICAL FACE

NOTE: ALL DETERIORATION QUANTITIES ARE FROM FIELD MEASUREMENTS AND ARE UNFACTORED.

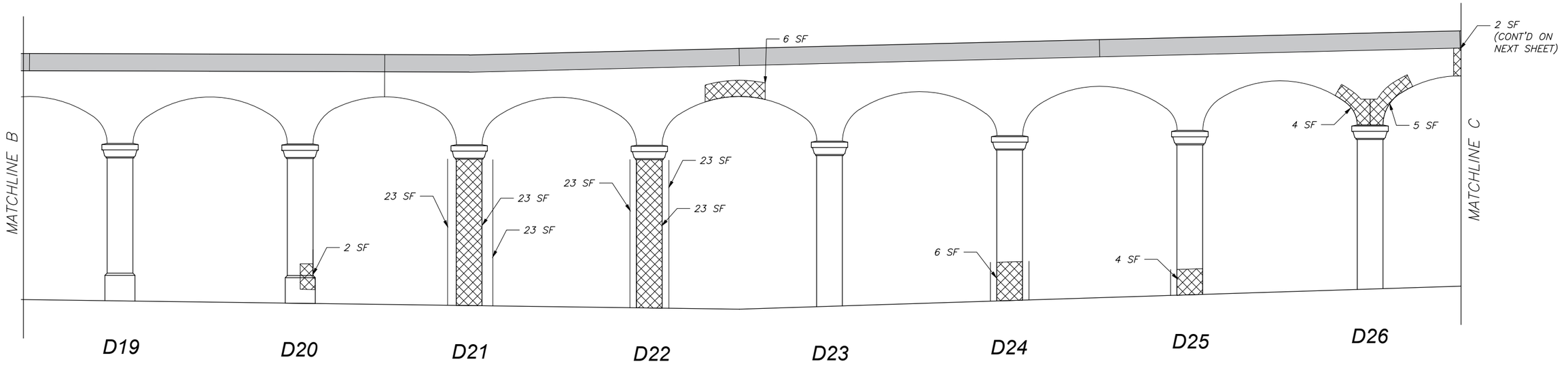


SOUTH ELEVATION

DETROIT–SUPERIOR BRIDGE
WEST STATION

LINE D, COLUMNS D11 TO D18

14



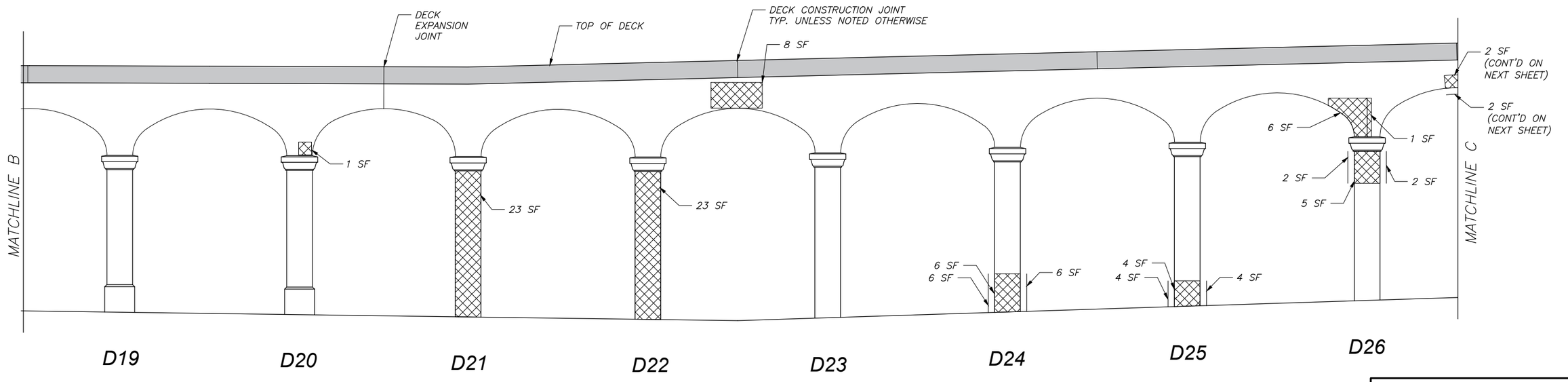
NORTH ELEVATION

LEGEND

CONCRETE DELAMINATION/SPALL

CONCRETE DELAMINATION/SPALL ON VERTICAL FACE

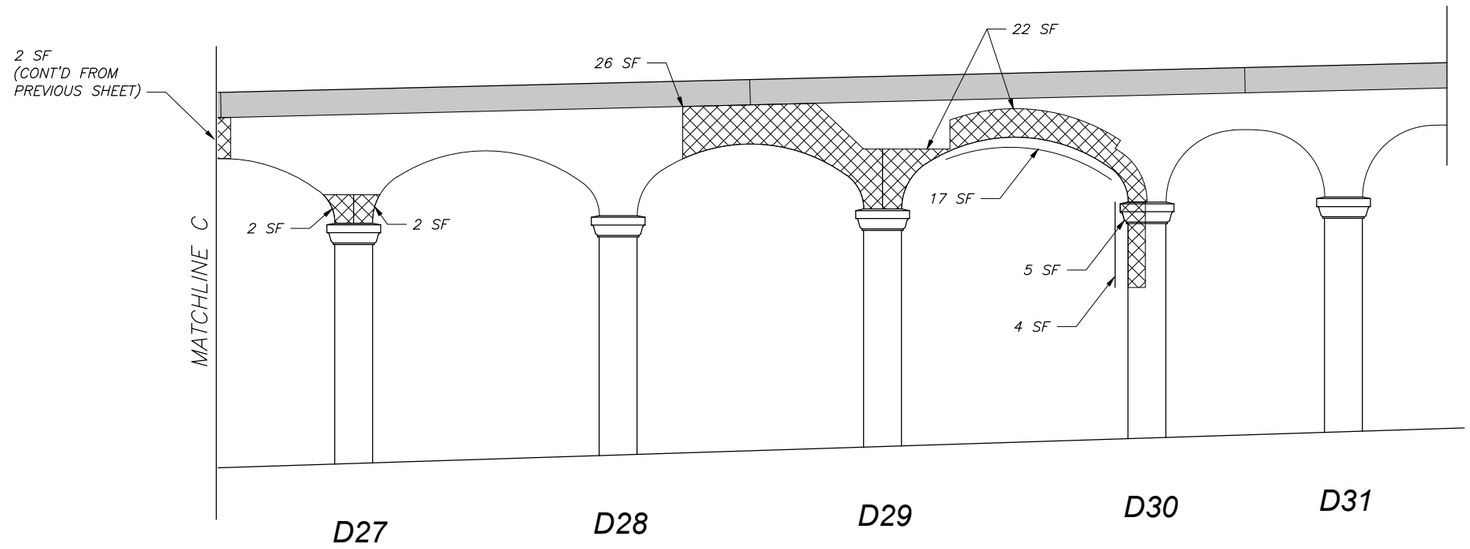
NOTE: ALL DETERIORATION QUANTITIES ARE FROM FIELD MEASUREMENTS AND ARE UNFACTORED.



SOUTH ELEVATION

DETROIT–SUPERIOR BRIDGE
WEST STATION

LINE D, COLUMNS D19 TO D26



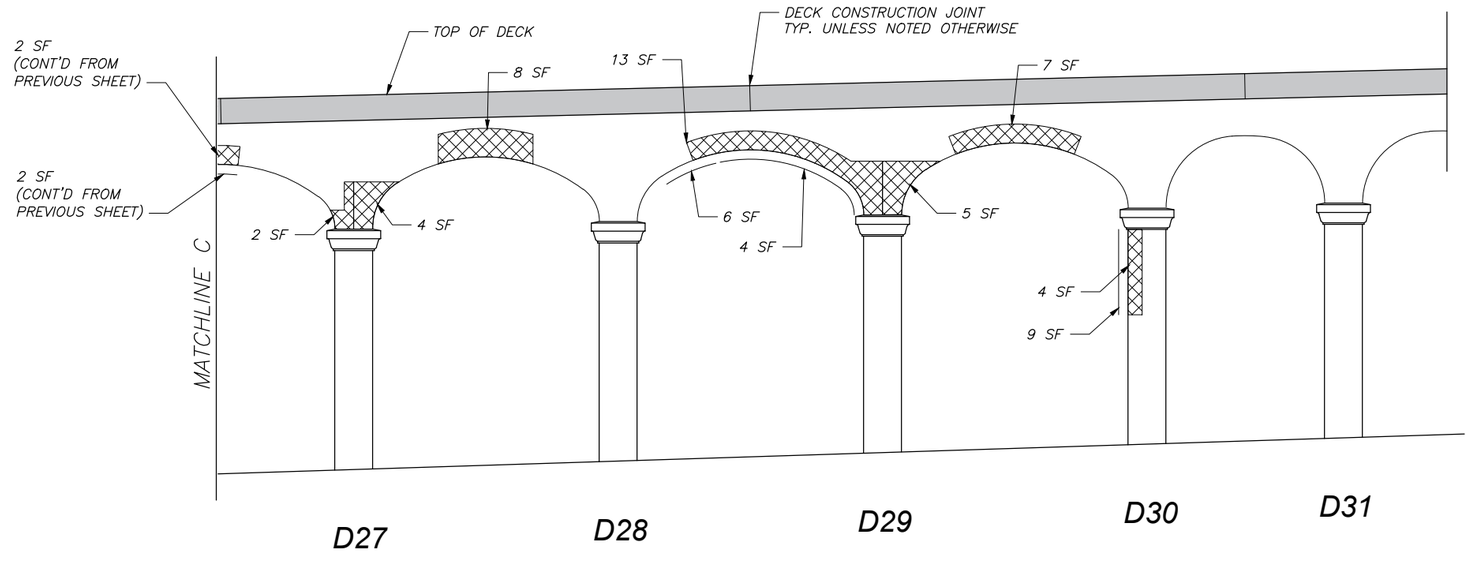
NORTH ELEVATION

LEGEND

CONCRETE DELAMINATION/SPALL

CONCRETE DELAMINATION/SPALL ON VERTICAL FACE

NOTE: ALL DETERIORATION QUANTITIES ARE FROM FIELD MEASUREMENTS AND ARE UNFACTORED.



SOUTH ELEVATION

DETROIT–SUPERIOR BRIDGE
WEST STATION

LINE D, COLUMNS D27 TO D31

APPENDIX G

WEST STATION
DETERIORATION HISTORY

CUY-6-1456 West Station

Jack Arch Deterioration Summary, 1995-2016

Part. Rep. - Partial Replacement

R - Replacement

Jack Arch No.	1995	2012	2016	Jack Arch No.	1995	2012	2016	Jack Arch No.	1995	2012	2016	Jack Arch No.	1995	2012	2016	Jack Arch No.	1995	2012	2016	Jack Arch No.	1995	2012	2016
				B 1-2	15			**C 1-2**	PR														
A 2-3	14	20	10	**B 2-3**				**C 2-3**	5														
A 3-4	17	5	17	**B 3-4**			5	**C 3-4**				**D 3-4**		3	29								
A 4-5	4			**B 4-5**	4		25	**C 4-5**	6		16	**D 4-5**											
A 5-6	3			**B 5-6**				**C 5-6**				**D 5-6**	2										
A 6-7	4	10	16	**B 6-7**				**C 6-7**				**D 6-7**				**E 6-7**	2						
A 7-8			1	**B 7-8**			1	**C 7-8**	4		11	**D 7-8**				**E 7-8**	5						
A 8-9	2		15	**B 8-9**	Part. Rep.			**C 8-9**	5		6	**D 8-9**	Part. Rep.		8	**E 8-9**	R						
A 9-10	14		58	**B 9-10**	3	4	4	**C 9-10**	5	4	10	**D 9-10**	3			**E 9-10**	8						
A 10-11	R			**B 10-11**	Part. Rep.	10	24	**C 10-11**	Part. Rep.		21	**D 10-11**	Part. Rep.		1	**E 10-11**	2						
A 11-12	14	50	55	**B 11-12**	8		4	**C 11-12**	6	20	36	**D 11-12**			14	**E 11-12**	6						
A 12-13	R		21	**B 12-13**	Part. Rep.	33	11	**C 12-13**	Part. Rep.	11	41	**D 12-13**	15	10	27	**E 12-13**	5						
A 13-14	R		9	**B 13-14**			11	**C 13-14**	10	72	85	**D 13-14**	3			**E 13-14**	3						
A 14-15	R		20	**B 14-15**	Part. Rep.		13	**C 14-15**	Part. Rep.		53	**D 14-15**	6		6	**E 14-15**	3						
A 15-16	16		42	**B 15-16**		14	7	**C 15-16**		2	12	**D 15-16**				**E 15-16**	3			**F 15-16**			
A 16-17	22		61	**B 16-17**	15	31	47	**C 16-17**	12	43	24	**D 16-17**	6		3	**E 16-17**	5			**F 16-17**			
A 17-18	3	62	37	**B 17-18**				**C 17-18**			1	**D 17-18**				**E 17-18**	3			**F 17-18**			
A 18-19	Part. Rep.	12	32	**B 18-19**	12	56	38	**C 18-19**	14	69	43	**D 18-19**	6			**E 18-19**	3			**F 18-19**			
A 19-20	12	24	32	**B 19-20**			11	**C 19-20**			5	**D 19-20**	2			**E 19-20**	3			**F 19-20**			
A 20-21	Part. Rep.		46	**B 20-21**	Part. Rep.	23	28	**C 20-21**	Part. Rep.	62	23	**D 20-21**	Part. Rep.		1	**E 20-21**	Part. Rep.			**F 20-21**	4		
A 21-22	4		32	**B 21-22**				**C 21-22**				**D 21-22**				**E 21-22**				**F 21-22**			
A 22-23	9	11	76	**B 22-23**	6	35	39	**C 22-23**	15	64	64	**D 22-23**	8		14	**E 22-23**				**F 22-23**			
A 23-24	5		6	**B 23-24**	3		10	**C 23-24**	2		9	**D 23-24**				**E 23-24**				**F 23-24**			
A 24-25	5		75	**B 24-25**	12	40	73	**C 24-25**	5	30	60	**D 24-25**	3			**E 24-25**	4			**F 24-25**			
A 25-26	4		4	**B 25-26**	2		2	**C 25-26**				**D 25-26**	5		10	**E 25-26**				**F 25-26**	5	6	
A 26-27	4			**B 26-27**	16	33		**C 26-27**	18	32		**D 26-27**	9	4	16	**E 26-27**	6			**F 26-27**	6		
A 27-28				**B 27-28**				**C 27-28**	4			**D 27-28**	8		13	**E 27-28**	6			**F 27-28**	R		
A 28-29	8			**B 28-29**	12	35	68	**C 28-29**	21	55		**D 28-29**	16	36	49	**E 28-29**				**F 28-29**	R		
A 29-30	8	17		**B 29-30**			3	**C 29-30**	2		4	**D 29-30**	8	5	50	**E 29-30**				**F 29-30**	R		
A 30-31				**B 30-31**			2	**C 30-31**	3	19		**D 30-31**				**E 30-31**	R			**F 30-31**	R		
A 31-Jt.	10	7		**B 31-Jt.**	11	10	20	**C 31-Jt.**	12	20		**D 31-Jt.**	5			**E 31-Jt.**	R			**F 31-Jt.**	R		
Totals	**182**	**218**	**665**		**119**	**324**	**446**		**149**	**503**	**524**		**105**	**58**	**241**		**67**	**0**	**0**		**15**	**6**	**0**
West Station Totals	**637**	**1109**	**1876**																				

CUY-6-1456 West Station

2016 Column Repair Summary

Replacement Recommended

Column No.	Total Deficiency (SF)	Surface	Subtotal (SF)	Area 1 (SF)	Area 2 (SF)	Area 3 (SF)
A2	8	North	2.0	2.0		
		Sides	4.7	4.7		
		South	1.7	1.7		
A3	0	North	0.0	0.0		
		Sides	0.0	0.0		
		South	0.0	0.0		
A4	5	North	2.3	2.3		
		Sides	2.3	2.3		
		South	0.0			
A5	19	North	18.7	18.7		
		Sides	0.0			
		South	0.0			
A6	3	North	1.3	1.3		
		Sides	1.9	1.9		
		South	0.0			
A7	0	North	0.0			
		Sides	0.0			
		South	0.0			
A8	8	North	8.0	8.0		
		Sides	0.0			
		South	0.0			
A9	0	North	0.0			
		Sides	0.0			
		South	0.0			
A10	0	North	0.0			
		Sides	0.0			
		South	0.0			
A11	0	North	0.0			
		Sides	0.0			
		South	0.0			
A12	14	North	3.5	3.5		
		Sides	6.7	6.7		
		South	3.9	1.6	2.3	
A13	4	North	1.6	1.6		
		Sides	2.1	2.1		
		South	0.0			
A14	44	North	15.7	15.7		
		Sides	23.3	5.1	15.3	2.9
		South	5.3	5.3		
A15	22	North	13.7	13.7		
		Sides	4.3	4.3		
		South	3.5	3.5		
A16	0	North	0.0			
		Sides	0.0			
		South	0.0			
A17	11	North	4.4	1.3	3.2	
		Sides	4.1	1.3	2.8	
		South	2.3	2.3		
A18	0	North	0.0			
		Sides	0.0			
		South	0.0			
A19	1	North	0.0			
		Sides	0.0			
		South	1.0	1.0		
A20	9	North	4.3	1.6	2.8	
		Sides	2.8	2.8		
		South	1.6	1.6		
A21	46	North	18.4	18.4		
		Sides	18.4	9.2	4.6	4.6
		South	9.2	4.6	4.6	
A22	0	North	0.0			
		Sides	0.0			
		South	0.0			
A23	0	North	0.0			
		Sides	0.0			
		South	0.0			
A24	0	North	0.0			
		Sides	0.0			
		South	0.0			
A25	0	North	0.0			
		Sides	0.0			
		South	0.0			
A26	0	North	0.0			
		Sides	0.0			
		South	0.0			
A27	0	North	0.0			
		Sides	0.0			
		South	0.0			
A28	0	North	0.0			
		Sides	0.0			
		South	0.0			
A29	0	North	0.0			
		Sides	0.0			
		South	0.0			
A30	0	North	0.0			
		Sides	0.0			
		South	0.0			
A31	22	North	5.7	5.7		
		Sides	13.1	9.6	3.5	
		South	2.9	2.9		
Totals	214					

Column No.	Total Deficiency (SF)	Surface	Subtotal (SF)	Area 1 (SF)	Area 2 (SF)	Area 3 (SF)
B1	0	North	0.0			
		Sides	0.0			
		South	0.0			
B2	0	North	0.0			
		Sides	0.0			
		South	0.0			
B3	0	North	0.0			
		Sides	0.0			
		South	0.0			
B4	5	North	0.0			
		Sides	4.7	4.7		
		South	0.0			
B5	0	North	0.0			
		Sides	0.0			
		South	0.0			
B6	0	North	0.0			
		Sides	0.0			
		South	0.0			
B7	0	North	0.0			
		Sides	0.0			
		South	0.0			
B8	3	North	0.0			
		Sides	1.5	1.5		
		South	1.2	1.2		
B9	0	North	0.0			
		Sides	0.0			
		South	0.0			
B10	2	North	0.0			
		Sides	0.0			
		South	2.3	2.3		
B11	0	North	0.0			
		Sides	0.0			
		South	0.0			
B12	1	North	0.0			
		Sides	0.0			
		South	0.7	0.7		
B13	0	North	0.0			
		Sides	0.0			
		South	0.0			
B14	0	North	0.0			
		Sides	0.0			
		South	0.0			
B15	0	North	0.0			
		Sides	0.0			
		South	0.0			
B16	0	North	0.0			
		Sides	0.0			
		South	0.0			
B17	0	North	0.0			
		Sides	0.0			
		South	0.0			
B18	0	North	0.0			
		Sides	0.0			
		South	0.0			
B19	0	North	0.0			
		Sides	0.0			
		South	0.0			
B20	6	North	1.6	1.6		
		Sides	0.3	0.3		
		South	4.3	4.3		
B21	8	North	3.4	3.4		
		Sides	1.7	1.7		
		South	2.5	2.5		
B22	4	North	0.0			
		Sides	2.6	2.6		
		South	1.1	1.1		
B23	0	North	0.0			
		Sides	0.0			
		South	0.0			
B24	9	North	4.0	4.0		
		Sides	0.0			
		South	5.3	5.3		
B25	0	North	0.0			
		Sides	0.0			
		South	0.0			
B26	0	North	0.0			
		Sides	0.0			
		South	0.0			
B27	0	North	0.0			
		Sides	0.0			
		South	0.0			
B28	3	North	0.0			
		Sides	0.0			
		South	3.0	3.0		
B29	0	North	0.0			
		Sides	0.0			
		South	0.0			
B30	0	North	0.0			
		Sides	0.0			
		South	0.0			
B31	0	North	0.0			
		Sides	0.0			
		South	0.0			
	40					

Column No.	Total Deficiency (SF)	Surface	Subtotal (SF)	Area 1 (SF)	Area 2 (SF)	Area 3 (SF)
C1	9	North	2.7	2.7		
		Sides	6.7	6.7		
		South	0.0			
C2	0	North	0.0			
		Sides	0.0			
		South	0.0			
C3	0	North	0.0			
		Sides	0.0			
		South	0.0			
C4	0	North	0.0			
		Sides	0.0			
		South	0.0			
C5	0	North	0.0			
		Sides	0.0			
		South	0.0			
C6	0	North	0.0			
		Sides	0.0			
		South	0.0			
C7	0	North	0.0			
		Sides	0.0			
		South	0.0			
C8	0	North	0.0			
		Sides	0.0			
		South	0.0			
C9	0	North	0.0			
		Sides	0.0			
		South	0.0			
C10	0	North	0.0			
		Sides	0.0			
		South	0.0			
C11	0	North	0.0			
		Sides	0.0			
		South	0.0			
C12	9	North	6.0	6.0		
		Sides	3.0	0.8	2.2	
		South	0.0			
C13	0	North	0.0			
		Sides	0.0			
		South	0.0			
C14	0	North	0.0			
		Sides	0.0			
		South	0.0			
C15	12	North	5.6	5.6		
		Sides	6.7	6.7		
		South	0.0			
C16	0	North	0.0			
		Sides	0.0			
		South	0.0			
C17	0	North	0.0			
		Sides	0.0			
		South	0.0			
C18	0	North	0.0			
		Sides	0.0			
		South	0.0			
C19	0	North	0.0			
		Sides	0.0			
		South	0.0			
C20	37	North	10.5	10.5		
		Sides	16.4	8.2	8.2	
		South	10.5	10.5		
C21	7	North	0.0			
		Sides	3.3	3.3		
		South	4.0	4.0		
C22	0	North	0.0			
		Sides	0.0			
		South	0.0			
C23	14	North	0.0			
		Sides	4.6	4.6		
		South	9.2	8.3	0.9	
C24	0	North	0.0			
		Sides	0.0			
		South	0.0			
C25	6	North	2.7	2.7		
		Sides	3.3	3.3		
		South	0.0			
C26	0	North	0.0			
		Sides	0.0			
		South	0.0			
C27	0	North	0.0			
		Sides	0.0			
		South	0.0			
C28	0	North	0.0			
		Sides	0.0			
		South	0.0			
C29	8	North	5.4	5.4		
		Sides	3.0	1.6	1.4	
		South	0.0			
C30	0	North	0.0			
		Sides	0.0			
		South	0.0			
C31	0	North	0.0			
		Sides	0.0			
		South	0.0			
	103					

Column No.	Total Deficiency (SF)	Surface	Subtotal (SF)	Area 1 (SF)	Area 2 (SF)	Area 3 (SF)
D3	0	North	0.0			
		Sides	0.0			
		South	0.0			
D4	1	North	0.8	0.8		
		Sides	0.0			
		South	0.0			
D5	0	North	0.0			
		Sides	0.0			
		South	0.0			
D6	0	North	0.0			
		Sides	0.0			
		South	0.0			
D7	0	North	0.0			
		Sides	0.0			
		South	0.0			
D8	0	North	0.0			
		Sides	0.0			
		South	0.0			
D9	0	North	0.0			
		Sides	0.0			
		South	0.0			
D10	0	North	0.0			
		Sides	0.0			
		South	0.0			
D11	14	North	5.5	5.5		
		Sides	8.3	3.3	5.0	
		South	0.0			
D12	6	North	0.0			
		Sides	6.3	6.3		
		South	0.0			
D13	9	North	0.0			
		Sides	9.0	9.0		
		South	0.0			
D14	0	North	0.0			
		Sides	0.0			
		South	0.0			
D15	0	North	0.0			
		Sides	0.0			
		South	0.0			
D16	0	North	0.0			
		Sides	0.0			
		South	0.0			
D17	0	North	0.0			
		Sides	0.0			
		South	0.0			
D18	15	North	6.3	6.3		
		Sides	9.0	3.0	6.0	
		South	0.0			
D19	0	North	0.0			
		Sides	0.0			
		South	0.0			
D20	2	North	2.2	2.2		
		Sides	0.0			
		South	0.0			
D21	91	North	22.7	22.7		
		Sides	45.4	22.7	22.7	
		South	22.7	22.7		
D22	92	North	23.0	23.0		
		Sides	46.0	23.0	23.0	
		South	23.0	23.0		
D23	0	North	0.0			
		Sides	0.0			
		South	0.0			
D24	24	North	6.0	6.0		
		Sides	12.0	6.0	6.0	
		South	6.0	6.0		
D25	16	North	4.0	4.0		
		Sides	8.0	4.0	4.0	
		South	4.0	4.0		
D26	9	North	0.0			
		Sides	3.5	1.9	1.7	
		South	5.0	5.0		
D27	0	North	0.0			
		Sides	0.0			
		South	0.0			
D28	0	North	0.0			
		Sides	0.0			
		South	0.0			
D29	0	North	0.0			
		Sides	0.0			
		South	0.0			
D30	21	North	4.5	4.5		
		Sides	13.1	9.0	4.1	
		South	3.4	3.4		
D31	0	North	0.0			
		Sides	0.0			
		South	0.0			
	300					

CUY-6-1456 West Station Column Deteroration History

R - Replaced

Column No.	1995	2012	2016	Column No.	1995	2012	2016	Column No.	1995	2012	2016	Column No.	1995	2012	2016	Column No.	1995	2012	2016	Column No.	1995	2012	2016
				B1				**C1**		6	9												
A2			8	**B2**				**C2**															
A3				**B3**				**C3**															
A4	8		5	**B4**		5	5	**C4**				**D4**	2		1								
A5	3		19	**B5**	3			**C5**				**D5**	3										
A6			3	**B6**	6			**C6**	1			**D6**				**E6**							
A7				**B7**				**C7**				**D7**				**E7**							
A8			8	**B8**			3	**C8**	2			**D8**	16			**E8**	R						
A9				**B9**		2		**C9**				**D9**				**E9**	R						
A10	R			**B10**			2	**C10**	4	20		**D10**	R			**E10**							
A11				**B11**				**C11**	2			**D11**	15	2	14	**E11**	12	12					
A12	14	65	14	**B12**	4		1	**C12**	7	13	9	**D12**			6	**E12**	3						
A13			4	**B13**				**C13**	18	R		**D13**		15	9	**E13**							
A14	10	50	44	**B14**		4		**C14**	11	R		**D14**				**E14**							
A15	11	60	22	**B15**				**C15**		10	12	**D15**				**E15**				**F15**			
A16	4	R		**B16**				**C16**		2		**D16**				**E16**				**F16**			
A17	2		11	**B17**				**C17**				**D17**				**E17**	2			**F17**			
A18				**B18**				**C18**	3	8		**D18**	17	6	15	**E18**				**F18**			
A19			1	**B19**				**C19**				**D19**				**E19**				**F19**			
A20	2	2	9	**B20**			6	**C20**	15		37	**D20**		2	2	**E20**				**F20**			
A21	4	100	46	**B21**			8	**C21**	4		7	**D21**	16	12	91	**E21**				**F21**			
A22	2			**B22**	4		4	**C22**	4			**D22**	10	16	92	**E22**				**F22**	5	4	
A23				**B23**				**C23**			14	**D23**				**E23**		2		**F23**			
A24				**B24**	10		9	**C24**	2	R		**D24**	6	18	24	**E24**	3	5		**F24**	8	4	
A25				**B25**	2			**C25**	3		6	**D25**	10	14	16	**E25**				**F25**			
A26				**B26**				**C26**		7		**D26**	26	12	9	**E26**	8	24	24	**F26**			
A27	3			**B27**				**C27**		13		**D27**	6	9		**E27**	8	9		**F27**		19	20
A28	3			**B28**		3	3	**C28**				**D28**		9		**E28**	R			**F28**	R		
A29	5	6		**B29**	4	7		**C29**			8	**D29**	R			**E29**	R			**F29**	R		
A30				**B30**	12	10		**C30**		2		**D30**	R		21	**E30**	R			**F30**	R		
A31	4		22	**B31**	10			**C31**		36		**D31**				**E31**	R			**F31**	R		
	75	**283**	**216**		**55**	**31**	**41**		**76**	**117**	**102**		**127**	**115**	**300**		**36**	**52**	**24**		**13**	**27**	**20**
West Station Totals	**382**	**625**	**703**																				

CUY-6-1456 West Station

Jack Arch Repair Summary

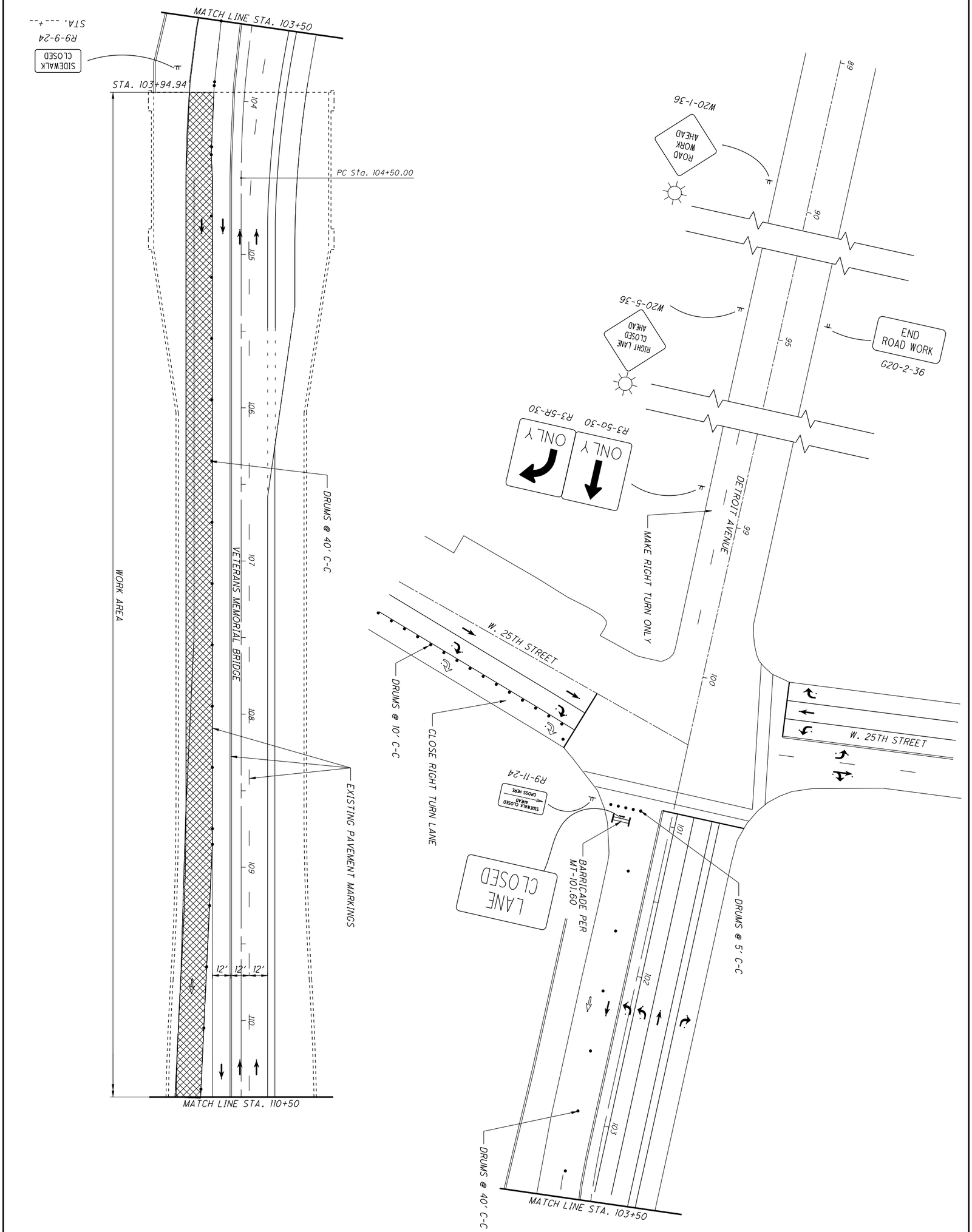
REPLACEMENT RECOMMENDED

Jack Arch No.	Total Deficiency (SF)	Surface	Subtotal (SF)	Area 1 (SF)	Area 2 (SF)	Area 3 (SF)	Jack Arch No.	Total Deficiency (SF)	Surface	Subtotal (SF)	Area 1 (SF)	Area 2 (SF)	Area 3 (SF)	Jack Arch No.	Total Deficiency (SF)	Surface	Subtotal (SF)	Area 1 (SF)	Area 2 (SF)	Area 3 (SF)	Jack Arch No.	Total Deficiency (SF)	Surface	Subtotal (SF)	Area 1 (SF)	Area 2 (SF)	Area 3 (SF)
									North	30.7	30.7					North	0.0										
							B 1-2	0	Bottom	0.0				C 1-2	0	Bottom	0.0										
									South	5.8	5.8					South	0.0										
		North	1.1	1.1					North	0.0						North	0.0										
A 2-3	10	Bottom	8.5	8.5			B 2-3	0	Bottom	0.0				C 2-3	0	Bottom	0.0										
		South	0.0						South	0.0						South	0.0										
		North	11.0	11.0					North	5.0	5.0					North	0.0						North	10.2	9.6	0.6	
A 3-4	17	Bottom	3.6	3.6			B 3-4	5	Bottom	0.0				C 3-4	0	Bottom	0.0				D 3-4	29	Bottom	4.9	2.4	2.5	
		South	2.9	2.9					South	0.0						South	0.0						South	14.3	10.1	4.3	
		North	0.0						North	7.7	7.7					North	11.1	11.1					North	0.0			
A 4-5	0	Bottom	0.0				B 4-5	25	Bottom	10.3	2.8	7.5		C 4-5	16	Bottom	4.8	4.8			D 4-5	0	Bottom	0.0			
		South	0.0						South	6.8	6.8					South	0.0						South	0.0			
		North	0.0						North	0.0						North	0.0						North	0.0			
A 5-6	0	Bottom	0.0				B 5-6	0	Bottom	0.0				C 5-6	0	Bottom	0.0				D 5-6	0	Bottom	0.0			
		South	0.0						South	0.0						South	0.0						South	0.0			
		North	14.6	4.9	9.7				North	0.0						North	0.0						North	0.0			
A 6-7	16	Bottom	1.5	1.5			B 6-7	0	Bottom	0.0				C 6-7	0	Bottom	0.0				D 6-7	0	Bottom	0.0			
		South	0.0						South	0.0						South	0.0						South	0.0			
		North	1.2	1.2					North	0.0						North	4.5	1.9	2.6				North	0.0			
A 7-8	1	Bottom	0.0				B 7-8	1	Bottom	0.0				C 7-8	11	Bottom	2.8	1.1	1.8		D 7-8	0	Bottom	0.0			
		South	0.0						South	1.0	1.0					South	3.6	2.3	1.3				South	0.0			
		North	12.4	4.7	3.8	4.0			North	0.0						North	3.5	3.5					North	0.0			
A 8-9	15	Bottom	2.3	2.3			B 8-9	0	Bottom	0.0				C 8-9	6	Bottom	2.4	2.4			D 8-9	8	Bottom	2.0	2.0		
		South	0.0						South	0.0						South	0.0						South	5.6	5.6		
		North	45.5	45.5					North	0.0						North	5.5	4.3	1.3				North	0.0			
A 9-10	58	Bottom	7.0	7.0			B 9-10	4	Bottom	0.0				C 9-10	10	Bottom	0.0				D 9-10	0	Bottom	0.0			
		South	5.6	5.6					South	3.6	2.5	1.1				South	4.3	4.3					South	0.4	0.4		
		North	0.0						North	10.7	10.7					North	12.0	6.1	5.9				North	1.0	1.0		
A 10-11	0	Bottom	0.0				B 10-11	24	Bottom	2.3	2.3			C 10-11	21	Bottom	5.5	4.2	1.4		D 10-11	1	Bottom	0.0			
		South	0.0						South	11.2	9.9	1.3				South	3.7	2.7	1.0				South	0.0			
		North	44.8	44.8					North	4.3	4.3					North	19.8	16.4	3.3				North	13.9	13.9		
A 11-12	55	Bottom	9.3	9.3			B 11-12	4	Bottom	0.0				C 11-12	36	Bottom	3.6	3.6			D 11-12	14	Bottom	0.0			
		South	0.8	0.8					South	0.0						South	13.0	13.0					South	0.0			
		North	13.9	13.9					North	6.9	6.9					North	15.1	3.4	11.7				North	26.5	26.5		
A 12-13	21	Bottom	1.9	1.9			B 12-13	11	Bottom	2.7	2.7			C 12-13	41	Bottom	11.1	4.0	7.1		D 12-13	27	Bottom	0.0			
		South	5.4	5.4					South	1.7	1.7					South	15.2	5.9	9.3				South	0.0			
		North	9.2	9.2					North	0.0						North	29.1	4.6	24.5				North	0.0			
A 13-14	9	Bottom	0.0				B 13-14	11	Bottom	0.0				C 13-14	85	Bottom	22.9	22.9			D 13-14	0	Bottom	0.0			
		South	0.0						South	11.1	11.1					South	33.4	33.4					South	0.0			
		North	12.8	2.7	10.1				North	1.8	1.8					North	17.3	14.3	3.0				North	4.4	3.6	0.8	
A 14-15	20	Bottom	4.3	4.3			B 14-15	13	Bottom	8.1	0.6	5.0	2.5	C 14-15	53	Bottom	13.3	6.7	6.7		D 14-15	6	Bottom	1.3	1.3		
		South	3.0	3.0					South	3.0	1.2	1.8				South	22.0	10.5	11.5				South	0.0			
		North	26.1	26.1					North	3.1	1.8	1.4				North	6.9	1.5	4.5	0.9			North	0.0			
A 15-16	42	Bottom	6.5	6.5			B 15-16	7	Bottom	2.5	2.5			C 15-16	12	Bottom	1.9	1.9			D 15-16	0	Bottom	0.0			
		South	9.6	7.6	2.0				South	1.8	1.8					South	2.7	2.7					South	0.0			
		North	42.1	26.1	16.0				North	16.4	16.4					North	14.3	3.5	10.8				North	2.9	2.9		
A 16-17	61	Bottom	4.5	2.3	2.3		B 16-17	47	Bottom	14.4	4.0	10.5		C 16-17	24	Bottom	9.9	9.9			D 16-17	3	Bottom	0.0			
		South	14.8	3.9	8.3	2.6			South	15.9	3.5	12.4				South	0.0						South	0.0			
		North	20.5	11.8	5.9	2.9			North	0.0						North	0.9	0.9					North	0.0			
A 17-18	37	Bottom	11.3	8.3	0.5	2.5	B 17-18	0	Bottom	0.0				C 17-18	1	Bottom	0.0				D 17-18	0	Bottom	0.0			
		South	5.7	2.6	3.1				South	0.0						South	0.0						South	0.0			
		North	0.0						North	12.7	12.7					North	16.9	3.5	13.4				North	0.0			
A 18-19	32	Bottom	3.3	1.0	2.3		B 18-19	38	Bottom	12.5	12.5			C 18-19	43	Bottom	10.0	10.0			D 18-19	0	Bottom	0.0			
		South	28.4	10.8	9.6	8.0			South	13.2	13.2					South	16.0	16.0					South	0.0			
		North	1.4	1.4					North	2.9	2.9					North	2.6	2.6					North	0.0			
A 19-20	32	Bottom	4.6	4.6			B 19-20	11	Bottom	0.0				C 19-20	5	Bottom	0.0				D 19-20	0	Bottom	0.0			
		South	26.1	13.1	13.1				South	7.7	7.7					South	2.6	2.6					South	0.0			
		North	26.0	11.7	11.7	2.7			North	10.7	10.7					North	8.8	5.9	2.9				North	0.0			
A 20-21	46	Bottom	9.3	3.3	3.0	3.0	B 20-21	28	Bottom	6.6	5.0	1.6		C 20-21	23	Bottom	6.7	6.7			D 20-21	1	Bottom	0.0			
		South	11.1	6.1	2.1	2.9			South	10.5	7.7	2.8				South	7.6	5.9	1.7				South	1.0	1.0		
		North	23.7	23.7					North	0.0						North	0.0						North	0.0			
A 21-22	32	Bottom	4.6	4.6			B 21-22	0	Bottom	0.0				C 21-22	0	Bottom	0.0				D 21-22	0	Bottom	0.0			
		South	4.0	2.9	1.1				South	0.0						South	0.0						South	0.0			
		North	24.7	24.7					North	16.1	16.1					North	19.1	19.1					North	5.9	5.9		
A 22-23	76	Bottom	23.0	23.0			B 22-23	38	Bottom	12.5	12.5			C 22-23	64	Bottom	18.7	18.7			D 22-23	14	Bottom	0.0			
		South	28.8	1.6	24.6	2.6			South	9.2	9.2					South	26.3	26.3					South	8.0	8.0		
		North	0.0						North	4.9	4.9					North	3.2	3.2					North	0.0			
A 23-24	6	Bottom	6.0	6.0			B 23-24	10	Bottom	0.0				C 23-24	9	Bottom	0.0				D 23-24	0	Bottom	0.0			
		South	0.0						South	5.6	5.6					South	5.8	2.6	3.2				South	0.0			
		North	25.5	25.5					North	30.5	28.5	2.0				North	22.1	22.1					North	0.0			
A 24-25	75	Bottom	24.0	24.0			B 24-25	73	Bottom	20.8	20.8			C 24-25	60	Bottom	15.5	15.5			D 24-25	0	Bottom	0.0			
		South	25.5	25.5					South	21.7	21.7					South	22.5	22.5					South	0.0			
		North	2.4	2.4					North	2.0	2.0					North	0.0						North	4.0	4.0		
A 25-26	4	Bottom	1.6	1.6			B 25-26	2	Bottom	0.0				C 25-26	0	Bottom	0.0				D 25-26	10	Bottom	0.0			
		South	0.0						South	0.0						South	0.0						South	5.6	5.6		
		North	0.0						North	0.0						North	0.0						North	8.8	4.9	2.2	1.8
A 26-27	0	Bottom	0.0				B 26-27	0	Bottom	0.0				C 26-27	0	Bottom	0.0				D 26-27	16	Bottom	2.0	2.0		
		South	0.0						South	0.0						South	0.0						South	4.7	1.0	1.9	1.8
		North	0.0						North	0.0						North	0.0						North	1.7	1.7		
A 27-28	0	Bottom	0.0				B 27-28	0	Bottom	0.0				C 27-28	0	Bottom	0.0				D 27-28	13	Bottom	0.0			
		South	0.0						South	0.0						South	0.0						South	11.1	3.5	7.6	
		North	0.0						North	23.2	23.2					North	0.0						North	25.6	25.6		
A 28-29	0	Bottom	0.0				B 28-29	68	Bottom	21.7	21.7			C 28-29	0	Bottom	0.0				D 28-29	49	Bottom	10.0	6.0	4.0	
		South	0.0						South	23.3	23.3					South	0.0						South	12.9	12.9		
		North	0.0						North	0.0						North	4.4	1.2	3.2				North	22.0	22.0		
A 29-30	0	Bottom	0.0				B 29-30	3	Bottom	0.0				C 29-30	4	Bottom	0.0				D 29-30	50	Bottom	17.0	17.0		
		South	0.0						South	2.7	2.7					South	0.0						South	11.2	4.4	6.8	
		North	0.0						North	2.4	2.4					North	0.0						North	0.0			
A 30-31	0	Bottom	0.0				B 30-31	2	Bottom	0.0				C 30-31	0	Bottom	0.0				D 30-31	0	Bottom	0.0			
		South	0.0						South	0.0						South	0.0						South	0.0			
		North	0.0						North	7.3	7.3					North	0.0						North	0.0			
A 31-Jt.	0	Bottom	0.0				B 31-Jt.	20	Bottom	6.7	6.7			C 31-Jt.	0	Bottom	0.0				D 31-Jt.	0	Bottom	0.0			
		South	0.0						South	5.5	5.5					South	0.0						South	0.0			
Totals	667	0						445							525							239					

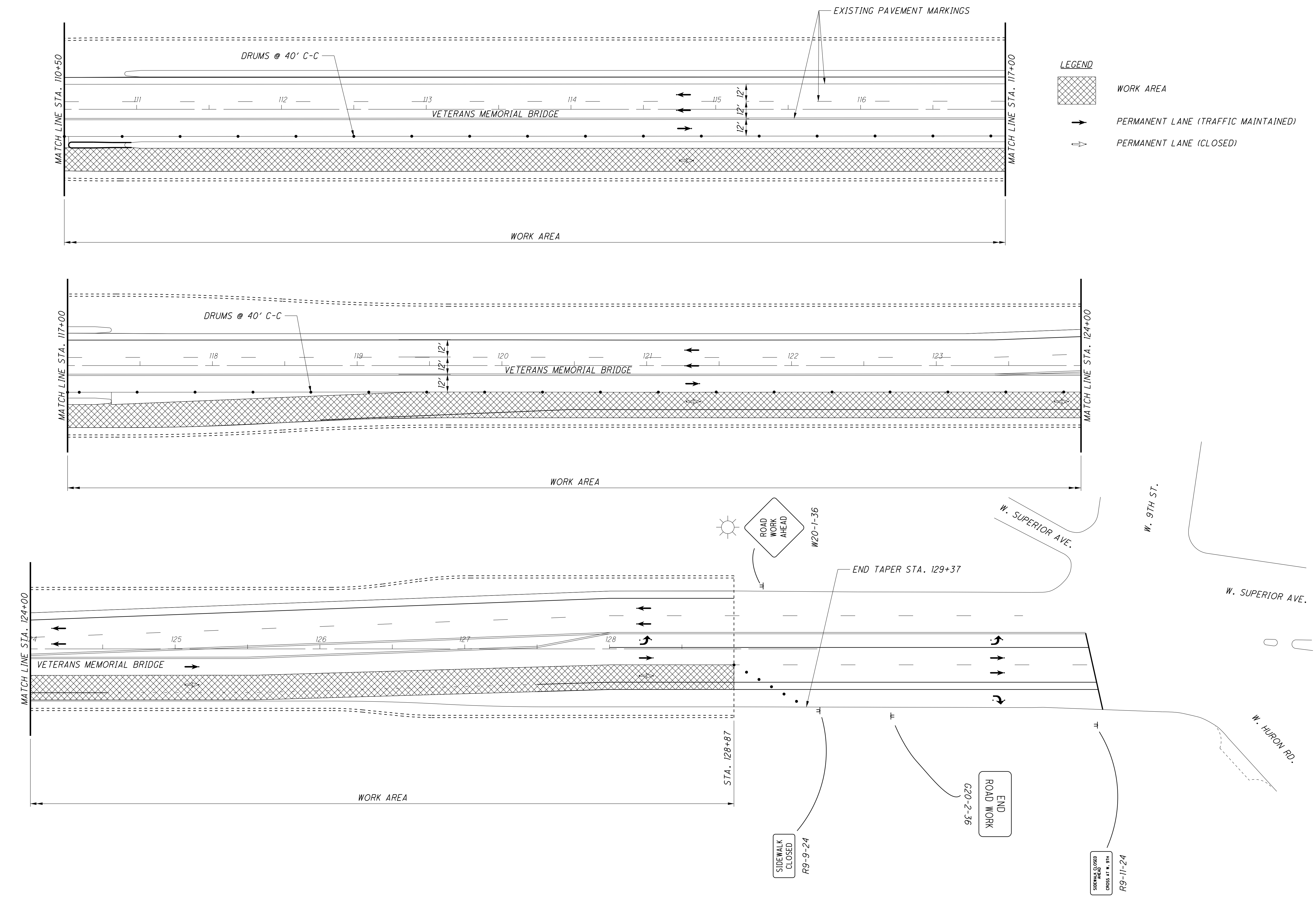
Lines A-D: Total Deterioration = 1875.4 SF

APPENDIX H

MAINTENANCE OF TRAFFIC



	CUY-6-14.56	MAINTENANCE OF TRAFFIC PHASE 1	CALCULATED SJD CHECKED JMZ	0 15 30 60 HORIZONTAL SCALE IN FEET



HORIZONTAL SCALE IN FEET

CALCULATED SJD
CHECKED JMZ

MAINTENANCE OF TRAFFIC
PHASE 1

CUY-6-14.56

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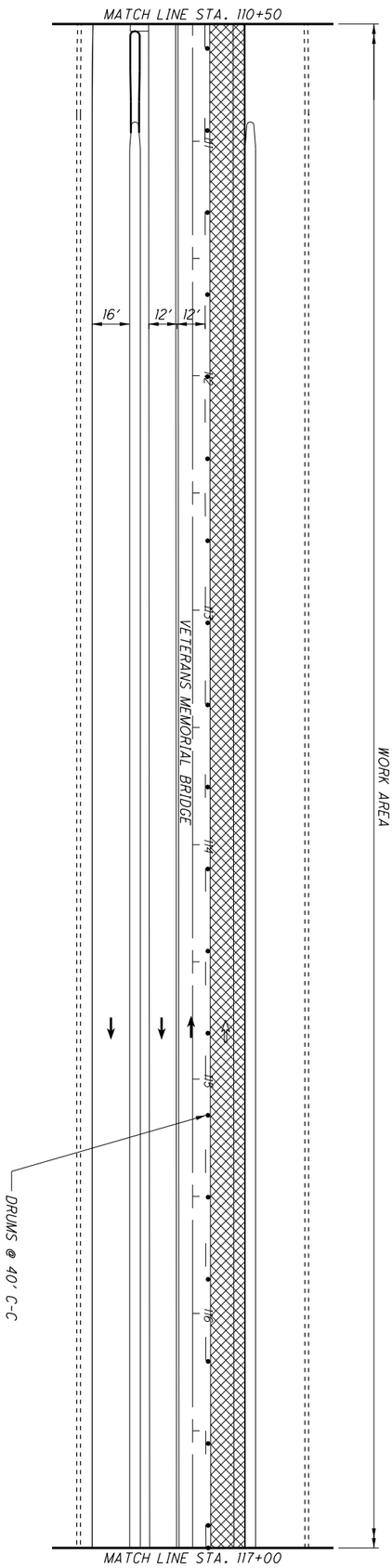
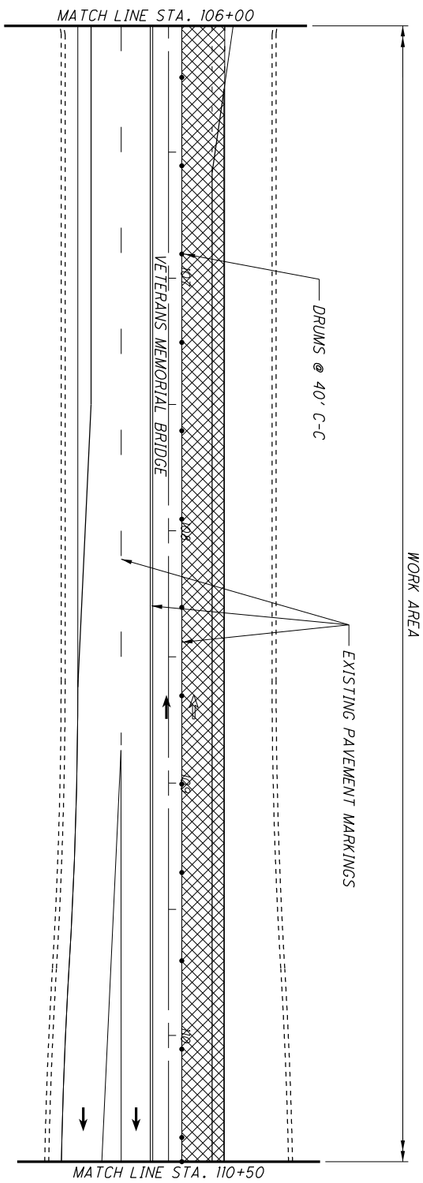
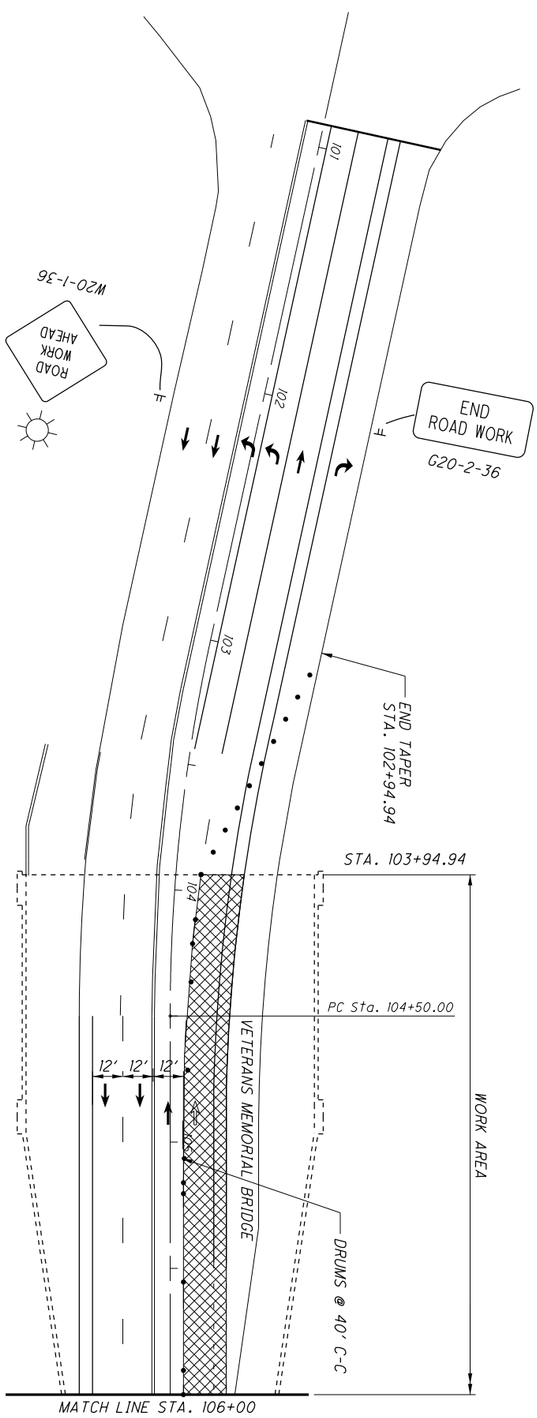
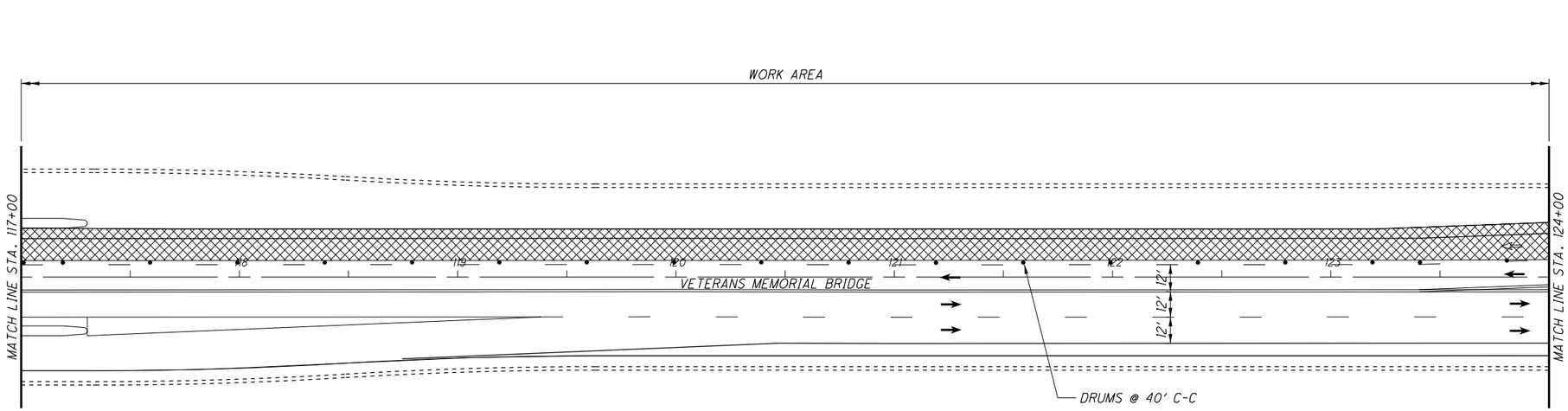
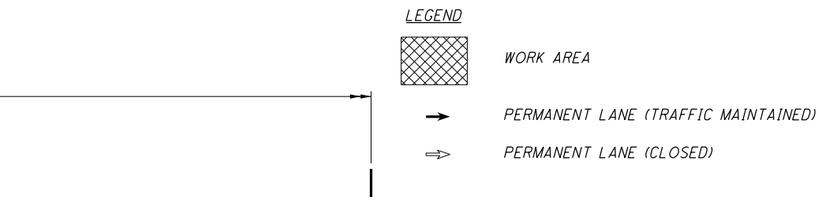






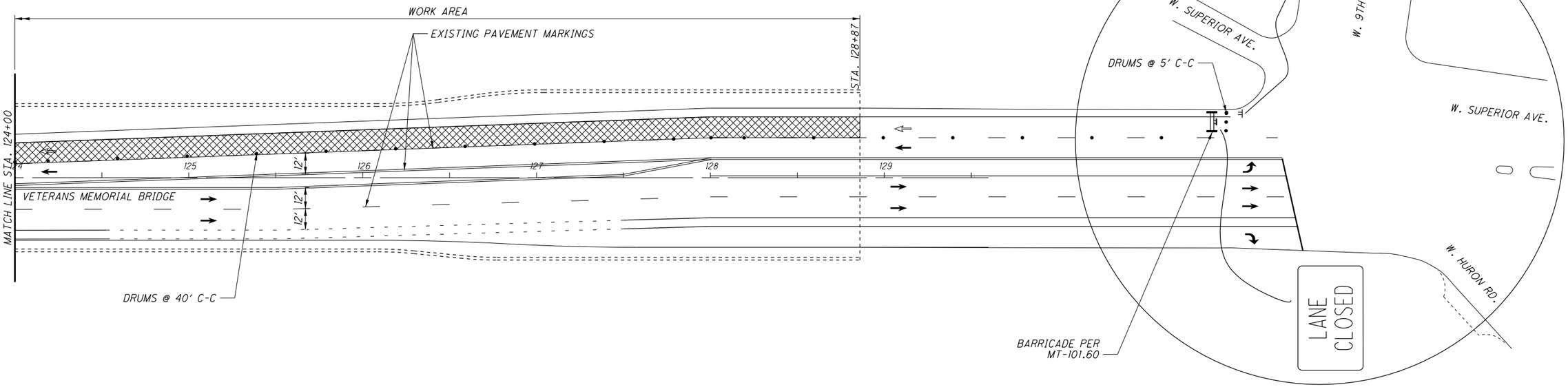
CUY-6-14.56	MAINTENANCE OF TRAFFIC PHASE 2	CALCULATED SJD CHECKED JMZ	0 15 30 60 HORIZONTAL SCALE IN FEET	

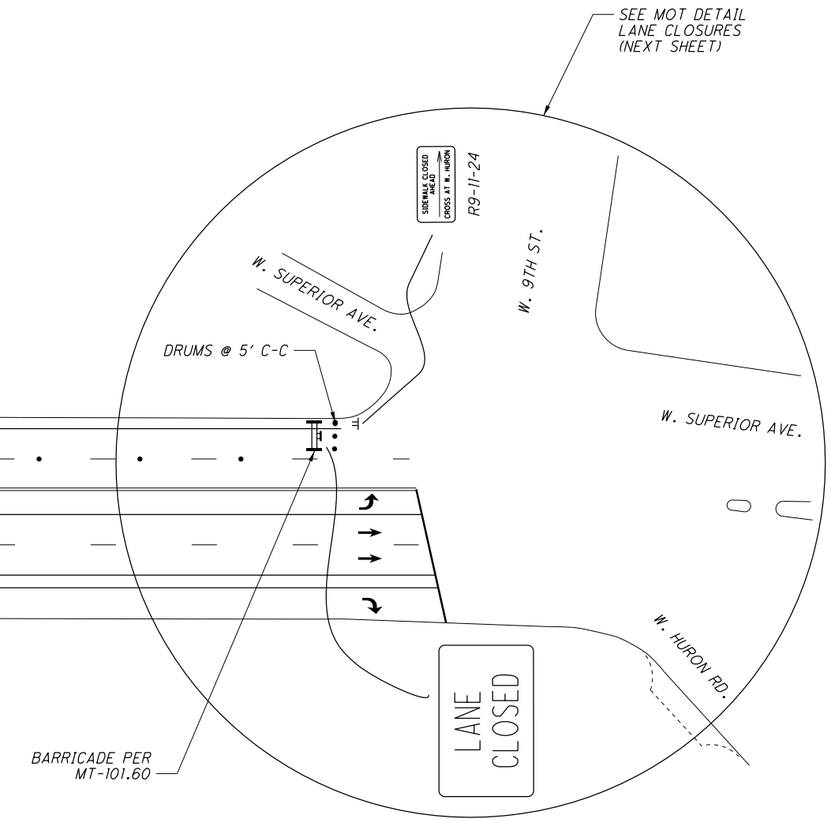




CALCULATED SJD
CHECKED JMZ

MAINTENANCE OF TRAFFIC PHASE 2





CUY-6-14.56

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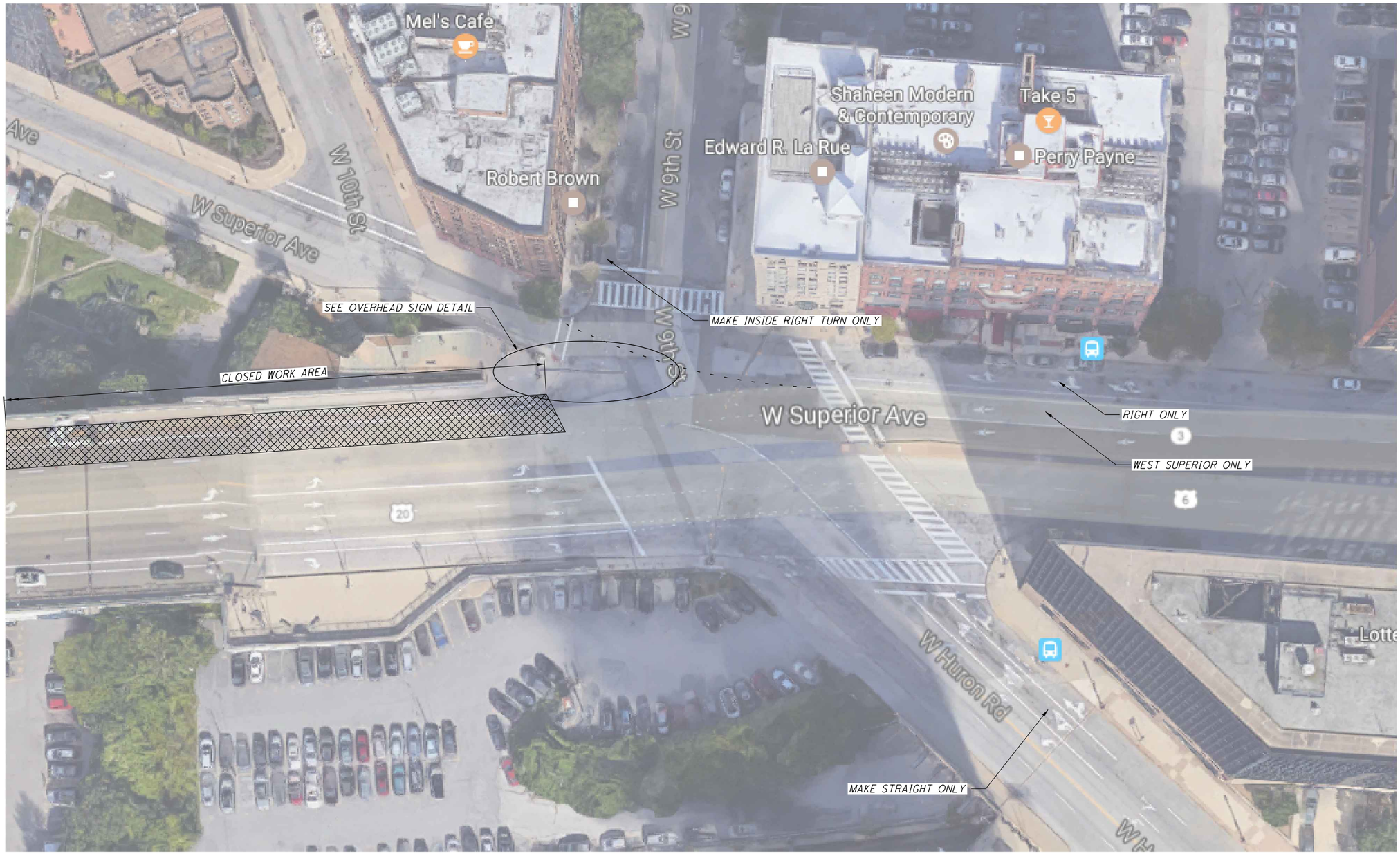
OVERHEAD SIGN DETAIL
W. 9TH ST.



MOT DETAIL LANE CLOSURES

HORIZONTAL SCALE IN FEET
0

CALCULATED SJD
CHECKED JMZ

MAINTENANCE OF TRAFFIC
PHASE 2

CUY-6-14.56

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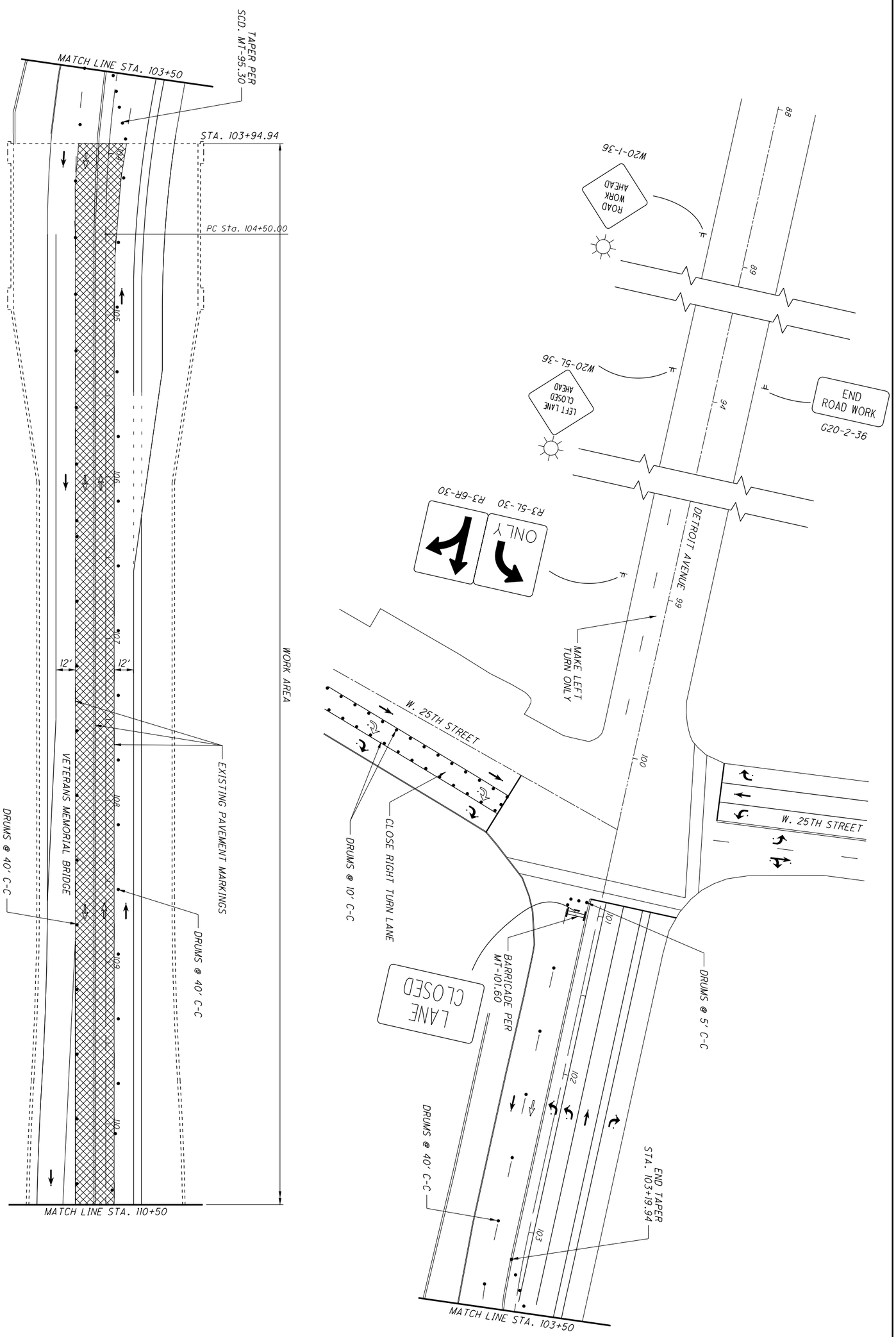
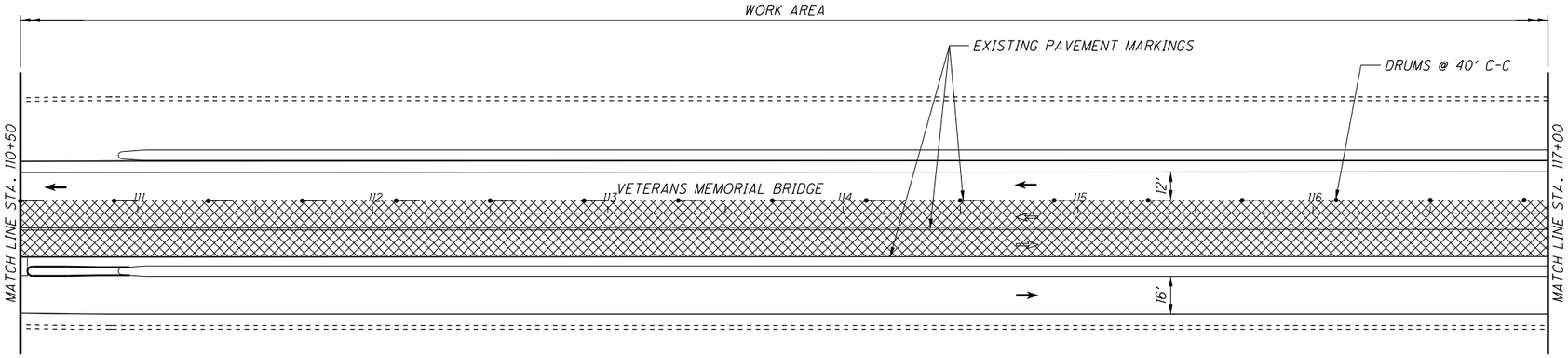
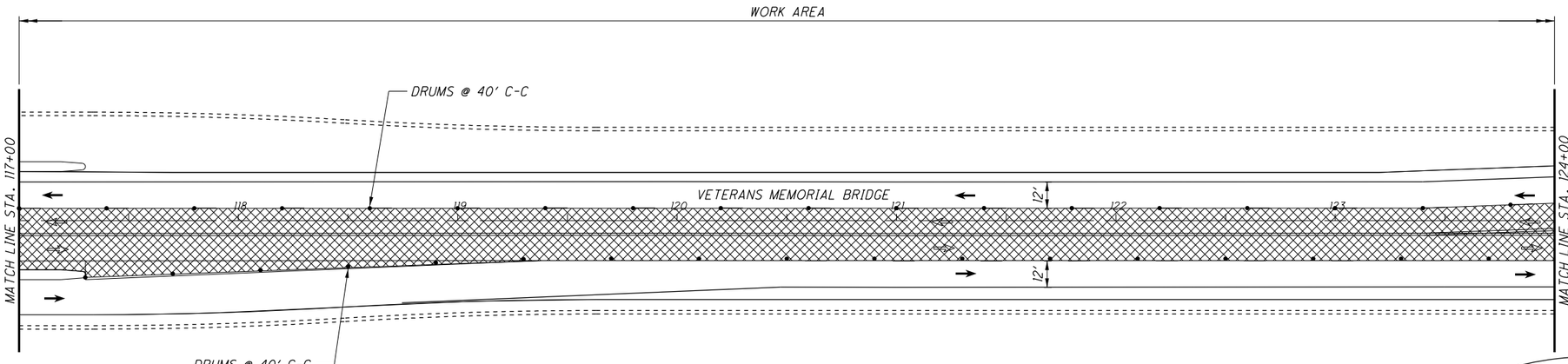
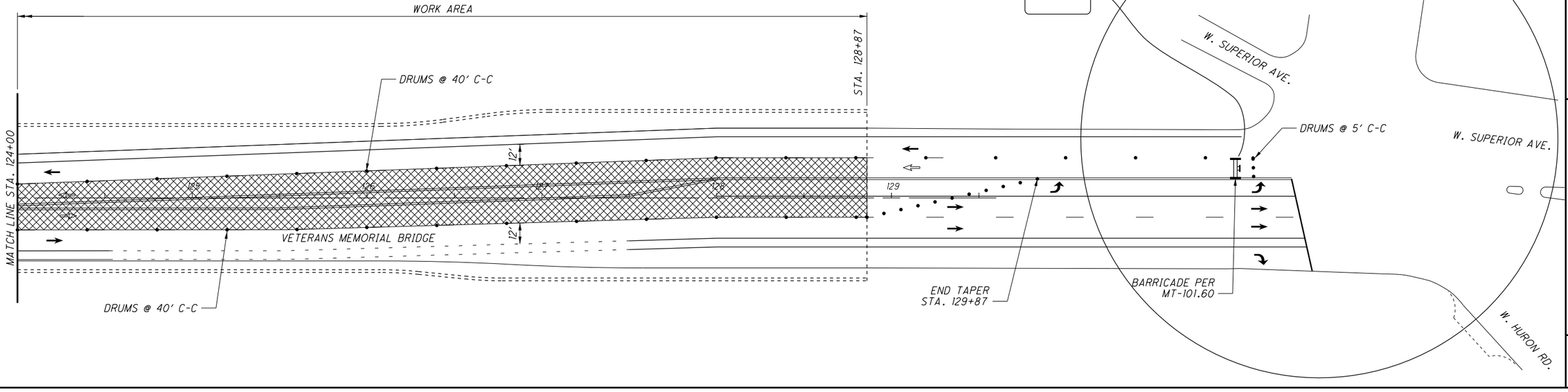
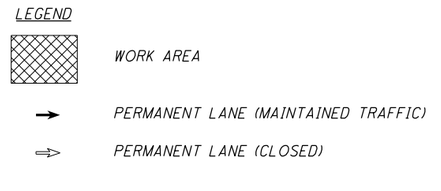


CUY-6-14.56	MAINTENANCE OF TRAFFIC PHASE 3	CALCULATED SJD / CHECKED JMZ	0 15 30 60 HORIZONTAL SCALE IN FEET









SEE MOT DETAIL
LANE CLOSURES
(NEXT SHEET)

LANE
CLOSED

0 15 30 60
HORIZONTAL
SCALE IN FEET

CALCULATED SJD
CHECKED JMZ

MAINTENANCE OF TRAFFIC
PHASE 3

CUY-6-14.56

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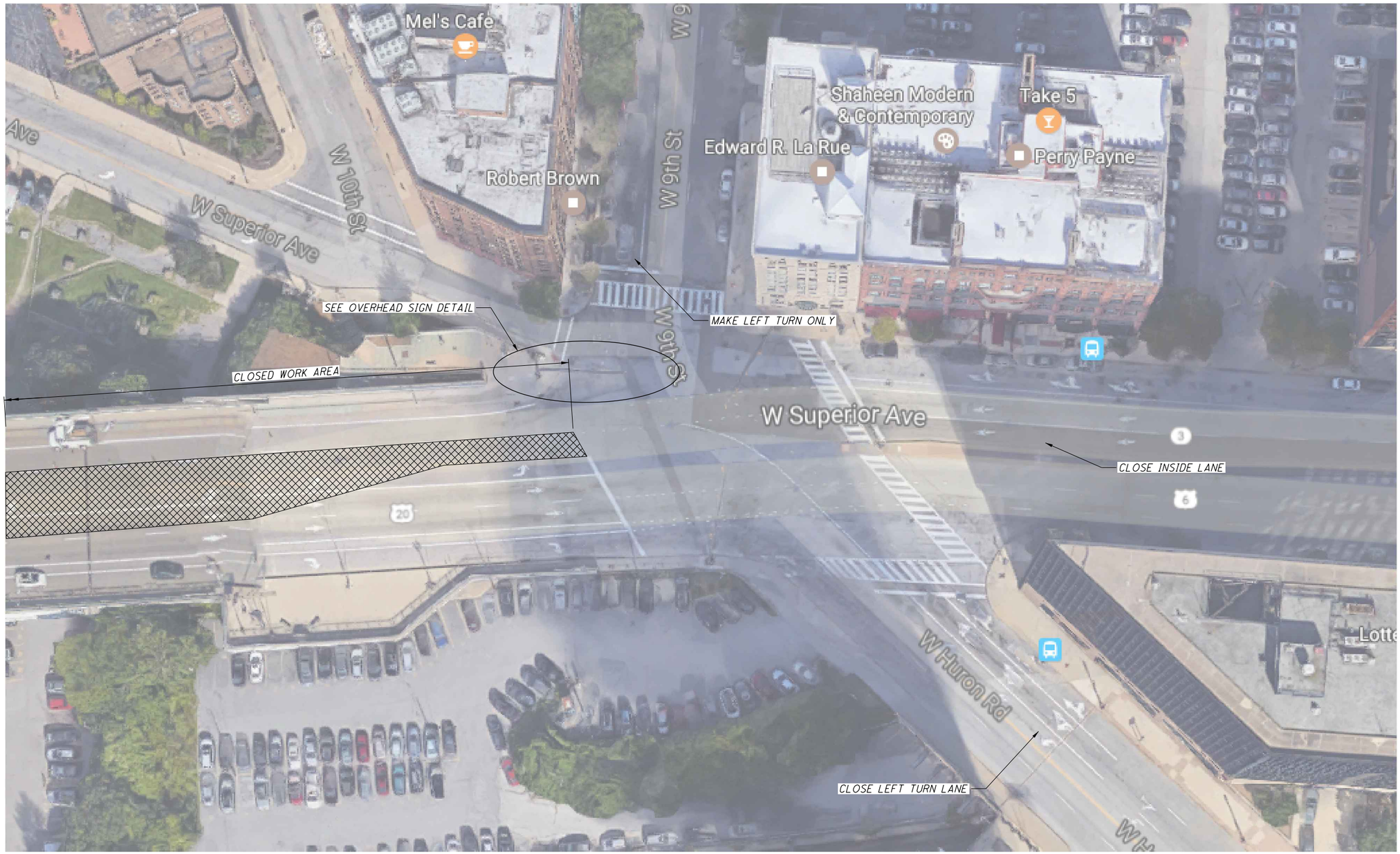
OVERHEAD SIGN DETAIL



MOT DETAIL LANE CLOSURES

MAINTENANCE OF TRAFFIC
PHASE 3

CUY-6-14.56

HORIZONTAL SCALE IN FEET
0

CALCULATED SJD
CHECKED JMZ

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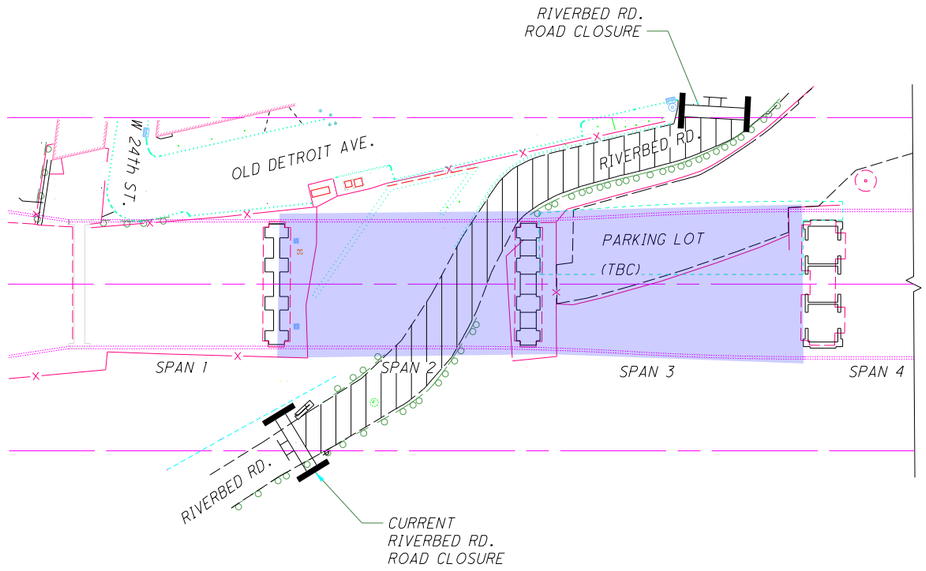

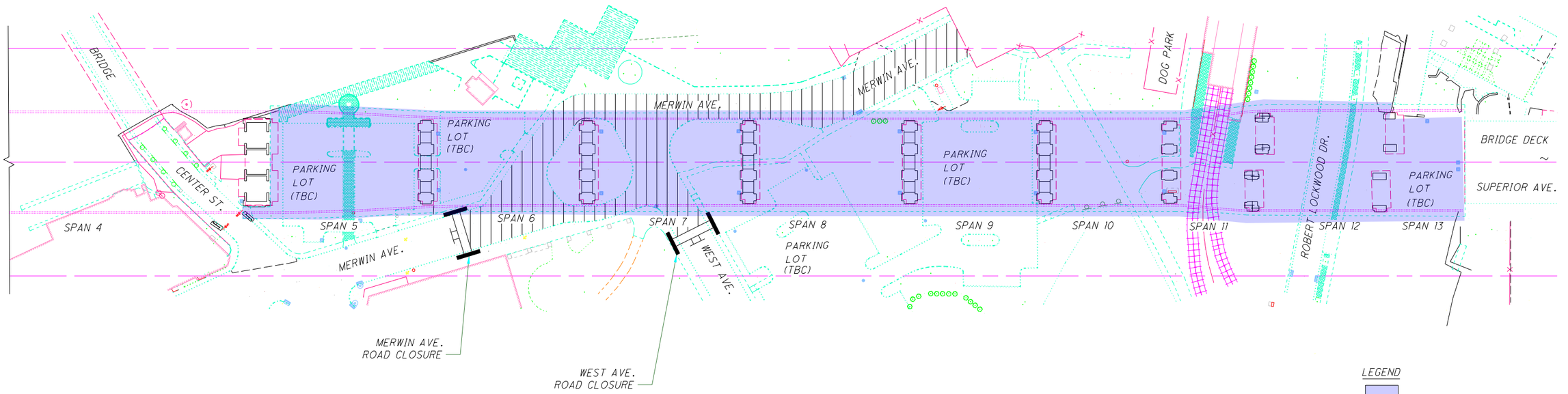

LEGEND

- PUBLIC AREAS
- ROAD CLOSED
- ROAD CLOSURE BARRIER AND ROAD CLOSED SIGN
- (TBC) - TO BE CLOSED, WHEN REQUIRED

0 25 50 100 HORIZONTAL SCALE IN FEET

CALCULATED SJD
CHECKED JMZ

MAINTAINENCE OF TRAFFIC
PUBLIC AREAS AND CLOSURES

CUY-6-14.56

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