MAINTENANCE OF TRAFFIC ALTERNATIVES ANALYSIS

CUY-480-18.42 L/R, PID No. 90591

Interstate Route 480 over Cuyahoga River Valley

Independence, Valley View, and Garfield Heights
Cuyahoga County, Ohio

November 21, 2013

RICHLAND ENGINEERING LIMITED

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PID No. 90951

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Introduction

The proposed project is a deck replacement on the twin structures carrying IR 480 over the Cuyahoga River Valley. The bridge crosses over the CSX Railroad, the Cuyahoga River, Cleveland Metroparks Ohio and Erie Canal Reservation and Towpath Trail, West Canal Road, the Ohio Canal, and Canal Road.

The CUY-480-1842 L&R, Valley View Bridge was opened to traffic in 1978. Each four lane structure consists of a 73 feet wide concrete deck supported by continuous steel stringers, trussed steel floorbeams, and built-up haunched continuous steel plate girders on 75 to 185 feet tall concrete piers and abutments. The twin structures are 4,155 feet long. The original black steel reinforced concrete decks are 35 years old and have reached the end of their useful life. A superplasticized dense concrete overlay placed in 1990 has preserved the decks to this age. The decks are deteriorating and in need of replacement to continue in a safe operating condition. The proposed project is complete deck replacement with minor bridge repair and rehabilitation work. New approach slabs and pavement work will blend the new decks to the highway.

The certified traffic on the CUY-480-1842 L&R Bridge is 146,190 vehicles per day with 8% trucks. Maintenance of traffic during construction with minimal disruption to the traveling public is a major concern for completing the project.

Background Information

The CUY-480-1842 L&R structure deck replacement was previously studied by E. L. Robinson in 2012 as a Deck Rehabilitation Study. The purpose of the E. L. Robinson study was to determine the optimum approach for the future bridge deck replacement that would provide the least inconvenience to and be the safest for the traveling public. As stated in the E. L. Robinson Deck Rehabilitation Study, *3-D FEM Deck Replacement Report*, the deck replacement can only be accomplished in segments and in a manner that leaves only enough space for seven lanes of traffic (instead of the normal eight lanes) to be maintained during each construction phase. The recommended maintenance of traffic scheme from the report is a "5+2" format, with 5 lanes contra-flow on one bridge and 2 lanes on the bridge being reconstructed. This scheme was determined by the space available for maintaining lanes without any structure widening. Three westbound lanes and four eastbound lanes are to be maintained at all times during peak AM and PM traffic times. Additional lane closures will be per the District 12 Permitted Lane Closure Chart.

The segmented deck replacement that was included in the *3-D FEM Deck Replacement Report* as well as the MOT phased construction concept referred to as "5+2" was indicated to be ODOT's preferred MOT concept in the Scope posting in September 2012. Additionally a "6+2" MOT scheme, maintaining 4 lanes in each direction was mentioned for evaluation to determine the feasibility, benefits, and cost of maintaining the fourth westbound travel lane. The "6+2" MOT scheme requires widening of one existing bridge and one or both new bridges. The Scope also included a concept of extending the westbound MOT lane restriction eastward to the Broadway underpass in conjunction with closing or metering westbound entrance ramps at Broadway/Libby/Transportation Boulevard interchanges.

Shortly after the project initiation a progress meeting was held on April 18, 2013 at which time additional MOT alternatives were discussed and determined to be beneficial to include in the MOTAA. These additional alternatives included:

- Providing 7 MOT travel lanes and moveable barrier to shift a fourth directional travel lane from eastbound in the morning to westbound in the afternoon.
- Rapid deck replacement which shuts down one complete bridge while maintaining 3 eastbound and 2 westbound lanes of traffic on the remaining bridge.
- Build a new bridge in the median to maintain four lanes of MOT traffic. The new bridge would be used in the future as express lanes on IR 480. The new bridge would replace the lane capacity of one of the existing bridges during one construction season while the deck is replaced.

These additional MOT alternatives have been included in the MOTAA to determine the feasibility, benefits, and costs of these additional scenarios.

During the development of the MOTAA two additional scenarios were considered. Construct a new westbound bridge in the median and widen the eastbound bridge substructure and superstructure. These two additional MOT scenarios allow for bridge deck widening and the maintenance of 4 eastbound and 4 westbound lanes in all MOT Phases. The new westbound bridge is constructed in the previous seasons and is utilized to carry four lanes of traffic on the eastbound bridge which is being re-decked. Once the eastbound bridge is re-decked, eastbound traffic is returned to the bridge, the westbound four lanes are re-aligned and placed on the new bridge, and the existing westbound bridge is removed.

Another MOT design consideration determined to have a significant impact on the feasibility of several of the above mentioned MOT scenarios is MOT drainage. The bridge deck replacement concepts need to maximize the number of MOT travel lanes between the bridge parapets and therefore reduce shoulder widths. Travel lanes are shifted to utilize the existing bridge width and subsequently the existing scupper spacing and corresponding drainage spread impacts the use of the MOT lanes. ODOT's Location and Design Manual, Volume Two, Drainage, Section 1010, currently states that a 2 year design frequency storm be used and a minimum 10 foot dry travel lane be provided during MOT. These drainage requirements impact the number of lanes, the lane widths, the necessity to incorporate additional bridge deck drainage into the existing deck, providing additional scuppers in the proposed bridge deck, and consideration of the modification of the pavement cross slope (existing and new) on the shoulders adjacent to the parapets. These drainage considerations lead to MOT alternatives that include: widening the existing bridge deck; grinding the existing and constructing the new bridge deck with increased shoulder cross slope; as well as determining an efficient number of additional scuppers to install to limit the drainage spread.

Therefore based upon the above requirements and conditions the following MOT alternatives have been numbered and described as follows in the Maintenance of Traffic Alternatives Analysis:

Alternative 1.a(70) -	Same Width Deck Replacement – Maintain 3 Lanes WB (on bridge only) & 4 Lanes EB (“5+2”) - Modify existing and proposed shoulder cross slope.
Alternative 1.a(76) -	Widen Existing and New Bridge - Deck Replacement- Maintain 3 Lanes WB (on bridge only) & 4 Lanes EB (“5+2”)
Alternative 1.b(70) -	Same Width Deck Replacement – Maintain 3 Lanes WB (from Broadway) & 4 Lanes EB (“5+2”) - Modify existing and proposed shoulder cross slope.
Alternative 1.b(76) -	Widen Existing and New Bridge - Deck Replacement- Maintain 3 Lanes WB (from Broadway) & 4 Lanes EB (“5+2”)
Alternative 2 -	Movable Median Barrier- Maintain 3 Lanes EB & WB; Provide One Additional Rush Hour Directional Lane (“5+2”)
Alternative 3.a(72)	Widen Existing and New Bridge - Deck Replacement- Maintain 4 (min. 10’) Lanes WB & EB (“6+2”) - Modify existing and proposed shoulder cross slope
Alternative 3.a(76) -	Widen Existing and New Bridge - Deck Replacement- Maintain 4 Lanes WB & EB (“6+2”)
Alternative 3.b(72)	Widen New Bridge - Deck Replacement- Phases 1 & 2 Maintain 3 Lanes WB & 4 Lanes EB (“5+2”); Phases 3 & 4 Maintain 4 Lanes WB & EB & (“6+2”) – Modify existing and proposed shoulder cross slope
Alternative 3.b(76) -	Widen New Bridge - Deck Replacement- Phases 1 & 2 Maintain 3 Lanes WB & 4 Lanes EB (“5+2”); Phases 3 & 4 Maintain 4 Lanes WB & EB & (“6+2”)
Alternative 3.c -	Widen EB Substructure and Superstructure - Deck Replacement- Maintain 4 Lanes WB & EB all Phases; Phases 1 & 3 (“5+3”); Phase 2 (“4+4”); Phases 4 & 5 (“6+2”)
Alternative 4 -	Rapid Deck Replacement - Maintain 2 Lanes WB & 3 Lanes EB
Alternative 5 -	New WB Bridge in Median - Maintain 4 Lanes WB & EB
Alternative 6 -	New EB/WB Express Lane Bridge in Median - Maintain 4 Lanes WB & EB

Description of Alternatives

Alternative 1.a(70) – One half deck replacement per year while maintaining three westbound and four eastbound IR 480 lanes. The distance of the three lane restriction in the westbound direction is minimized to impact only the project length adjacent to the crossovers. Crossovers are required to allow for contra flow of traffic on the existing bridge decks in different phases. A pre–Phase 1 pavement grinding operation will be required on the existing bridge deck along both the westbound bridge parapets and along the eastbound inside bridge deck parapet. The grinding will modify the bridge deck cross slope to ½” per foot within four feet of the parapet to better accommodate the drainage.

Phase 1 & 2 will have 2 lanes of eastbound traffic crossing over to the existing westbound bridge. Five total lanes of traffic will be maintained on the existing westbound bridge in phases 1 & 2. Westbound traffic will be separated from the eastbound traffic using 50” portable barrier. The three westbound travel lanes have a minimum width of 11 feet and a 4.25 foot wide shoulder. The two eastbound travel lanes have a minimum width of 11 feet and a 4.25 foot wide shoulder. Phase 1 will construct the outside portion of the eastbound bridge while maintaining two lanes of eastbound traffic on the bridge. The work zone will be separated from the travel lanes using 32” portable barrier. A one foot barrier offset will be provided along the travel lane side of the barrier. The two eastbound travel lanes are a minimum of 11 feet wide with a 4 foot shoulder to the toe of the existing bridge parapet. See MOTAA, Alternative 1.a(70) - Phase 1, Transverse Section D-D for dimensions. Phase 1 will be completed at the end of the first construction season and traffic will be returned to the pre-construction lane configurations and alignments prior to the winter.

Phase 2 will re-establish the MOT lane configuration on the westbound bridge from Phase 1 and construct the inside portion of the eastbound bridge while maintaining two lanes of eastbound traffic on the new bridge roadway constructed in Phase 1. The work zone will be separated from the travel lanes using 32” portable barrier. A one foot barrier offset will be provided along the travel lane side of the barrier. The two eastbound travel lanes are a minimum of 11 feet wide with a 4 foot shoulder to the toe of the new bridge parapet. See MOTAA, Alternative 1.a(70) – Phase 2, Transverse Section D-D for dimensions. The width of the completed eastbound bridge deck is 70 feet toe to toe of parapet. Phase 2 will be completed at the end of the second construction season and traffic will be returned to the pre-construction lane configurations and alignments prior to the winter.

Phases 3 & 4 will be constructed in the third and fourth seasons. Phases 3 & 4 will have one lane of westbound traffic crossing over to the re-decked eastbound bridge. Five total lanes of traffic will be maintained on the re-decked eastbound bridge in phases 3 & 4. Eastbound traffic will be separated from the westbound traffic using 50” portable barrier. A one foot barrier offset will be provided along both sides of the barrier. Four eastbound travel lanes have a minimum width of 11 feet and a 4 foot wide shoulder. The one westbound travel lane has a width of 12 feet and a 5 foot wide shoulder. Phase 3 will construct the outside portion of the westbound bridge while maintaining two lanes of westbound traffic

on the bridge in the same configuration as Phase 1 described above. See MOTAA, Alternative 1.a(70) – Phase 3, Transverse Section D-D for dimensions. Phase 3 will be completed at the end of the third construction season and traffic will be returned to the pre-construction lane configurations and alignments prior to the winter.

Phase 4 will construct the inside portion of the westbound bridge while maintaining two lanes of westbound traffic on the bridge in the same configuration as Phase 2 described above. The width of the completed westbound bridge roadway is 70 feet toe to toe of parapet. See MOTAA, Alternative 1.a(70) – Phase 4, Transverse Section D-D for dimensions. Phase 4 will be completed at the end of the fourth construction season and traffic will be returned to the pre-construction lane configurations and alignments prior to the winter.

Alternative 1.a(76) – One half deck replacement per year while maintaining three westbound and four eastbound IR 480 lanes. The distance of the three lane restriction in the westbound direction is minimized to impact only the project length adjacent to the crossovers. Crossovers are required to allow for contra flow of traffic on the existing bridge decks in different phases. This alternative is essentially the same as 1.a.(70) with the exception that a significant pre-phase 1 construction phase is required to widen the existing westbound bridge deck 6.5 feet toward the median. Options for widening the existing and the new bridge deck considered extending the deck cantilever beyond the outside girder on each side, or adding a cantilever bracket and stringer on one or both outside girders. The additional bridge deck width allows for additional shoulder width (7.5 feet) during Phase 1 & 2 MOT on the westbound bridge which has the same configuration as described in Alternative 1.a(70) above. The additional shoulder width is useful in minimizing the frequency of temporary scuppers that will be required to meet L & D Volume 2, Section 1010, Maintenance of Traffic Drainage requirements.

Alternative 1.b(70) – The bridge deck replacement concept is identical to Alternative 1.a(70). The difference between Alternative 1.a(70) and 1.b(70) is that the restriction to three westbound travel lanes will begin at the Broadway Avenue exit ramp and continue west through the work zone. At the Broadway Avenue entrance ramp the existing add lane configuration for the entrance ramp will be eliminated and the Broadway Avenue westbound entrance ramp traffic will be forced to merge into the three lanes of IR 480 WB.

Alternative 1.b(76) – The bridge deck replacement concept is identical to Alternative 1.a(76). The difference between Alternative 1.a(76) and 1.b(76) is that the restriction to three westbound travel lanes will begin at the Broadway Avenue exit ramp and continue west through the work zone. At the Broadway Avenue entrance ramp the existing add lane configuration for the entrance ramp will be eliminated and the Broadway Avenue westbound entrance ramp traffic will be forced to merge into the three lanes of IR 480 WB.

Alternative 2 – This alternative is essentially the same as 1.a.(70) with the exception that moveable median barrier will be used on the contra flow bridge deck to maintain three westbound and four eastbound lanes in the morning rush hours and four westbound and three eastbound lanes in the evening rush hours. One half deck replacement per year will be completed while maintaining seven IR 480 lanes on the bridges. The distance of the lane restriction across the bridge will be minimized to impact only the project adjacent to the crossovers. Crossovers are required to allow for contra flow of traffic on the existing bridge decks in different phases.

Alternative 3.a(72) - One half deck replacement per year while maintaining four westbound and four eastbound IR 480 lanes. Crossovers are required to allow for contra flow of traffic on the existing bridge decks in different phases. This alternative is essentially the same as 1.a.(70) with the exceptions that a significant pre-phase 1 construction phase is required to widen the existing westbound bridge roadway 2 feet toward the median. The widened bridge deck allows for six, 10 foot (minimum lane width) MOT lanes to be provided on the westbound bridge. Widening the existing bridge deck will be by extending the deck cantilever beyond the outside girder and utilizing light weight concrete. The widened bridge deck will incorporate the improved shoulder cross slope of 4% which improves the MOT drainage capacity. The additional bridge deck width and cross slope modifications allow for additional shoulder width (3 feet) during phase 1 & 2 MOT on the westbound bridge. The additional shoulder width and cross slope is useful in minimizing the frequency of temporary scuppers that will be required to meet L & D Volume 2, Section 1010, Maintenance of Traffic Drainage requirements.

Phase 1 will construct the outside portion of the eastbound bridge while maintaining two, 12 foot lanes of eastbound traffic on the bridge. See MOTAA, Alternative 3.a(72) – Phase 1, Transverse Section D-D for dimensions. Phase 1 will be completed at the end of the first construction season and traffic will be returned to the pre-construction lane configurations and alignments prior to the winter.

Phase 2 will re-establish the MOT lane configuration on the westbound bridge and construct the inside portion of the eastbound bridge while maintaining two 12 foot lanes of eastbound traffic on the new bridge deck constructed in Phase 1. MOT travel lane configuration on the eastbound bridge will provide a 3 foot shoulder from the toe of the new bridge parapet and a 1 foot offset to the 32” portable barrier. The width of the completed eastbound bridge roadway is 72 feet toe to toe of parapet. A 4% cross slope will be constructed into the new bridge deck within 4 feet of the new parapet to improve drainage. See MOTAA, Alternative 3.a(72) – Phase 2, Transverse Section D-D for dimensions. Phase 2 will be completed at the end of the second construction season and traffic will be returned to the pre-construction lane configurations and alignments prior to the winter.

Phases 3 & 4 will be constructed in the third and fourth construction seasons. Phases 3 & 4 will have two lanes of westbound traffic crossing over to the re-decked eastbound bridge. Six, 10 foot (minimum MOT lane widths) lanes of traffic will be maintained on the re-decked eastbound bridge in phases 3 & 4. Eastbound traffic will be separated from the westbound traffic using 50” portable barrier. A one foot barrier offset will be provided along both sides of the barrier. A 3 foot shoulder from the edge of the travel lane to the toe of the new bridge parapet is provided for both eastbound and westbound traffic. Phase 3 will construct the outside portion of the westbound bridge while maintaining two 12 foot lanes of westbound traffic on the widened portion of the bridge from pre-phase 1. The work area will be separated from the travel lanes using 32” portable barrier. A two foot barrier offset will be provided along the travel lane side of the barrier. Two 12 foot westbound travel lanes will be provided. The remaining 3.0 feet from the edge of travel lane to the toe of the widened bridge deck parapet is utilized for shoulder width. See MOTAA, Alternative 3.a(72) – Phase 3, Transverse Section D-D for dimensions. Phase 3 will be completed at the end of the third construction season and traffic will be returned to the pre-construction lane configurations and alignments prior to the winter.

Phase 4 will construct the inside portion of the westbound bridge while maintaining two lanes of westbound traffic on the bridge deck constructed in Phase 3. The width of the completed westbound bridge roadway is 72 feet toe to toe of parapet. A 4% cross slope will be constructed into the new bridge deck within 4 feet of the new parapet to improve drainage. Phase 4 work area will be separated from

the westbound MOT travel lanes using 32” portable barrier. A one foot barrier offset will be provided along the travel lane side of the barrier. Two 12 foot westbound travel lanes will be provided on the completed bridge deck from Phase 3. The remaining 3 feet from the edge of travel lane to the toe of the new bridge parapet is utilized for shoulder width. See MOTAA, Alternative 3.a(72) – Phase 4, Transverse Section D-D for dimensions. Phase 4 will be completed at the end of the fourth construction season and traffic will be returned to the pre-construction lane configurations and alignments prior to the winter.

Alternative 3.a(76) – One half deck replacement per year while maintaining four westbound and four eastbound IR 480 lanes. This alternative requires widening the deck of one existing bridge and one re-decked bridge. Options for widening the existing and the new bridge deck considered extending the deck cantilever beyond the outside girder on each side, or adding a cantilever bracket and stringer on one or both outside girders. Crossovers are required to allow for contra flow of traffic on the existing bridge decks in different phases.

Phase 1 & 2 will have 2 lanes of eastbound traffic crossing over to the existing westbound bridge. Six total lanes of traffic (11 foot wide minimum) will be maintained on the existing westbound bridge in Phases 1 & 2. Two foot wide shoulders are provided for drainage. Westbound traffic will be separated from the eastbound traffic using 50” portable barrier. Phase 1 will be completed at the end of the first construction season and traffic will be returned to the pre-construction lane configurations and alignments prior to the winter.

Phase 2 will re-establish the MOT lane configuration on the westbound bridge from Phase 1 and construct the inside portion of the eastbound bridge while maintaining two lanes of eastbound traffic on the new bridge deck constructed in Phase 1. Two 12 foot lanes of traffic will be maintained on the new eastbound bridge. Three foot wide shoulders are provided for drainage. The work zone will be separated from the travel lanes using 32” portable barrier. The width of the completed eastbound bridge deck is 76 feet toe to toe of parapet. Phase 2 will be completed at the end of the second construction season and traffic will be returned to the pre-construction lane configurations and alignments prior to the winter.

Phases 3 & 4 will be constructed in the third and fourth construction seasons. Phases 3 & 4 will have two lanes of westbound traffic crossing over to the widened and re-decked eastbound bridge. Six total lanes of traffic (11 foot minimum lane width) will be maintained on the widened and re-decked eastbound bridge in Phases 3 & 4. Eastbound traffic will be separated from the westbound traffic using 50” portable barrier. A 2 foot shoulder will be provided for drainage. Phase 3 will construct the outside portion of the westbound bridge while maintaining two lanes of westbound traffic on the bridge. The work zone will be separated from the travel lanes using 32” portable barrier. The remaining 3 feet from the edge of travel lane to the toe of the existing bridge parapet is utilized for shoulder width. Phase 3 will be completed at the end of the third construction season and traffic will be returned to the pre-construction lane configurations and alignments prior to the winter.

Phase 4 will construct the inside portion of the westbound bridge while maintaining two lanes of westbound traffic on the new bridge deck constructed in Phase 3. The work zone will be separated from the travel lanes using 32” portable barrier. The remaining 6 feet from the edge of travel lane to the toe of the new bridge parapet is utilized for shoulder width. The width of the completed westbound bridge deck is 76 feet toe to toe of parapet. Phase 4 will be completed at the end of the fourth construction season and traffic will be returned to the pre-construction lane configurations and alignments prior to the winter.

Alternative 3.b(72) - One half deck replacement per year while maintaining three westbound and four eastbound IR 480 lanes in Phases 1 & 2 and four westbound and four eastbound IR 480 lanes in Phases 3 & 4. This alternative is a combination of Alternative 1.a(70) for Phases 1 & 2 and Alternative 3.a(72) for Phases 3 & 4. See MOTAA, Alternative 3.b(72) – Phase 1 through 4, Transverse Section D-D for dimensions.

Alternative 3.b(76) - One half deck replacement per year while maintaining three westbound and four eastbound IR 480 lanes in Phases 1 & 2 and four westbound and four eastbound IR 480 lanes in Phases 3 & 4. This alternative requires widening the deck of the eastbound re-decked bridge. Options for widening the new bridge deck considered extending the deck cantilever beyond the outside girder on each side, or adding a cantilever bracket and stringer on one or both outside girders. The bridge deck replacement concept for this alternative is identical to Alternative 1.a(70) for Phase 1 & 2 westbound and Phase 1 eastbound. Due to the widening of the eastbound bridge deck to a total width of 76 feet in Phase 1 additional deck width is available for Phase 2 eastbound. Phase 1 will be completed at the end of the first construction season and traffic will be returned to the pre-construction lane configurations and alignments prior to the winter.

Phase 2 will re-establish the MOT lane configuration on the westbound bridge and construct the inside portion of the eastbound bridge while maintaining two lanes of eastbound traffic on the new bridge deck constructed in Phase 1. The work zone will be separated from the travel lanes using 32” portable barrier. A two foot barrier offset will be provided along the travel lane side of the barrier. Two 12 foot eastbound travel lanes will flank the barrier. The remaining 3 feet from the edge of travel lane to the toe of the new bridge parapet is utilized for shoulder width. Phase 2 will be completed at the end of the second construction season and traffic will be returned to the pre-construction lane configurations and alignments prior to the winter.

Phases 3 & 4 will be constructed in the third and fourth construction seasons. Phases 3 & 4 will have two lanes of westbound traffic crossing over to the widened and re-decked eastbound bridge. Six total lanes of traffic will be maintained on the widened and re-decked eastbound bridge in Phases 3 & 4. Eastbound traffic will be separated from the westbound traffic using 50” portable barrier. A one foot barrier offset will be provided along both sides of the barrier. Four 11 foot (minimum MOT lane width) eastbound travel lanes will be provided. The remaining 2 feet from the edge of travel lane to the toe of the new bridge parapet is utilized for shoulder width. Two 11 foot (minimum MOT lane width) westbound travel lanes will be provided. The remaining 2 feet from the edge of travel lane to the toe of the existing bridge parapet is utilized for shoulder width. Phase 3 will construct the outside portion of the westbound bridge while maintaining two lanes of westbound traffic on the bridge in the same configuration as Phase 1 described above. Phase 3 will be completed at the end of the third construction season and traffic will be returned to the pre-construction lane configurations and alignments prior to the winter.

Phase 4 will construct the inside portion of the westbound bridge while maintaining two lanes of westbound traffic on the new bridge deck constructed in Phase 3. The work zone will be separated from the travel lanes using 32” portable barrier. A one foot barrier offset will be provided along the travel lane side of the barrier. Two 11 foot (minimum MOT lane width) westbound travel lanes will be provided. The remaining 2 feet from the edge of travel lane to the toe of the new bridge parapet is

utilized for shoulder width. The width of the completed eastbound bridge deck is 70 feet toe to toe of parapet. Phase 4 will be completed at the end of the fourth construction season and traffic will be returned to the pre-construction lane configurations and alignments prior to the winter.

Alternative 3.c - This alternative requires widening the substructure and the superstructure of the eastbound bridge. The widening of the eastbound bridge allows for the bridge deck replacement on both the westbound and eastbound bridges while maintaining four westbound and four eastbound IR 480 lanes in all phases. A minimum lane width of 11 foot will be maintained in all MOT phases.

Pre-Phase 1 will construct the substructure widening necessary to support the widened eastbound bridge deck. Crossovers are required and will be constructed in pre-Phase 1 to allow for contra flow of traffic on the existing bridge decks in different phases. Pre–Phase 1 also requires a pavement grinding operation along both the westbound bridge parapets. The grinding will modify the bridge deck cross slope to ½" per foot within four feet of the parapet to better accommodate the drainage. All Pre-Phase 1 work will be accomplished with minimal disruption of the IR 480 traffic during the first year of construction.

Phase 1 beginning in the second construction season will require 1 lane of eastbound traffic crossing over to the existing westbound bridge. Five total lanes of traffic will be maintained on the existing westbound bridge in Phase 1. Westbound traffic will be separated from the eastbound traffic using 50" portable barrier. A one foot barrier offset will be provided along both sides of the barrier. Westbound travel lanes will have a minimum width of 11 feet. The remaining 3.5 feet from the edge of travel lane to the toe of the existing bridge parapet is utilized for shoulder width. One 12 foot eastbound travel lane will flank the 50" portable barrier. The remaining 5 feet from the edge of travel lane to the toe of the existing bridge parapet is utilized for shoulder width. Phase 1 will construct the inside, widened portion of the eastbound bridge while maintaining three lanes of eastbound traffic on the bridge. The work zone will be separated from the travel lanes using 32" portable barrier. A two foot barrier offset will be provided along the travel lane side of the barrier. Three 11 foot (minimum lane width) eastbound travel lanes will be provided. The remaining 7.5 feet from the edge of travel lane to the toe of the existing bridge parapet is utilized for shoulder width. See MOTAA, Alternative 3.c – Phase 1, Transverse Section D-D for dimensions. Phase 1 will be completed during the second construction season and traffic will be re-established to the pre-construction lane configurations on alignments shown for Phase 2.

Phase 2 MOT lane alignment for the westbound bridge is the same as the pre-construction condition. The Phase 2 MOT lane alignment on the eastbound bridge shifts the four travel lanes 3.75 feet right, onto the outside shoulder (11.25 feet outside shoulder in the existing condition and 7.5 feet outside shoulder in the MOT, Phase 2, condition). The minimum MOT lane width is 11 feet. A portable barrier is placed 2 feet from the left most lane. There is approximately 4.25 feet of new bridge deck constructed in Phase 1 behind the portable barrier. See MOTAA, Alternative 3.c – Phase 2, Transverse Section D-D for dimensions. This work area remains in place through the remainder of the second construction season and over the winter. During Phase 2 the remainder of the superstructure for the widened eastbound bridge is constructed. Phase 2 remains in place for the third construction season and the widened portion of the eastbound bridge is completed. Phase 2 will be completed at the end of the third construction season and traffic will be returned to the pre-construction lane configurations and alignments prior to the winter.

Phase 3 re-establishes the Phase 1 MOT lane configuration on the westbound bridge (4 westbound lanes and one eastbound lane). Three lanes of eastbound traffic are maintained on the widened bridge deck constructed in Phase 2. The outside portion of the existing eastbound bridge deck is removed and replaced. The work zone will be separated from the travel lanes using 32" portable barrier. A two foot barrier offset will be provided along the travel lane side of the barrier. Three 11 foot (minimum lane width) eastbound travel lanes will be provided. The remaining 8 feet from the edge of travel lane to the toe of the new bridge parapet is utilized for shoulder width. See MOTAA, Alternative 3.c – Phase 3, Transverse Section D-D for dimensions. Phase 3 will be completed during the fourth construction season and traffic will be returned to the pre-construction lane configurations and alignments prior to the winter.

Phases 4 & 5 will be constructed in the fifth and sixth construction seasons. Phases 4 & 5 will have two lanes of westbound traffic crossing over to the widened and re-decked eastbound bridge. Six total lanes of traffic will be maintained on the re-decked eastbound bridge in Phases 4 & 5. Eastbound traffic will be separated from the westbound traffic using 50" portable barrier. A two foot barrier offset will be provided along both sides of the barrier. Four 11 foot (minimum MOT lane width) eastbound travel lanes will be provided. The remaining 8 feet from the edge of travel lane to the toe of the new bridge parapet is utilized for shoulder width. The two westbound lanes will be marked 12 feet in width. A 10 foot shoulder from the edge of the westbound travel lane to the toe of the new bridge parapet is provided. See MOTAA, Alternative 3.c – Phase 4, Transverse Section D-D for dimensions. Phase 4 will construct the outside portion of the westbound bridge while maintaining two lanes of westbound traffic on the bridge. Likewise, Phase 5 will construct the inside portion of the westbound bridge while maintaining two lanes of westbound traffic on the new bridge deck from Phase 4. The width of the completed westbound bridge deck is 70 feet toe to toe of parapet. See MOTAA, Alternative 3.c – Phase 5, Transverse Section D-D for dimensions. Phase 5 will be completed at the end of the sixth construction season and traffic will be returned to the pre-construction lane configurations and alignments prior to the winter.

Alternative 4 – Rapid deck replacement with no traffic on the bridge under construction. Maintain two westbound and three eastbound IR 480 lanes for as short a time as possible. One complete deck can be completed in a construction season. Use incentive/disincentive contracting techniques to encourage contractor to minimize impacts. IR 480 Crossovers and temporary ramp alignments and pavement are required to allow for contra flow of traffic on the existing bridge decks in different phases.

Phase 1 will have 3 lanes of eastbound traffic crossing over to the existing westbound bridge. Five total lanes of traffic will be maintained on the existing westbound bridge in Phase 1. Westbound traffic will be separated from the eastbound traffic using 50" portable barrier. A one foot barrier offset will be provided along both sides of the barrier. Two 11 foot (minimum MOT lane width) westbound travel lanes will be provided. The remaining 4.25 feet from the edge of travel lane to the toe of the existing outside bridge parapet is utilized for shoulder width. The eastbound traffic crossed over to the westbound bridge will have three 11 foot (minimum MOT lane width) lanes. A 4.25 foot shoulder is provided adjacent to the toe of the existing inside parapet. Temporary alignments and pavement will be required for the IR 77 entrance ramps to eastbound IR 480. Temporary alignments and pavement will be required for the eastbound IR 480 exit ramps to East 98th Street. Phase 1 will be completed at the end of the first construction season and traffic will be returned to the pre-construction lane configurations and alignments prior to the winter.

Phase 2 will be constructed in the second season. Phase 2 will have two lanes of westbound traffic crossing over to the re-decked eastbound bridge. Five total lanes of traffic will be maintained on the re-decked eastbound bridge in phase 2. Eastbound traffic will be separated from the westbound traffic using 50" portable barrier. A one foot barrier offset will be provided along both sides of the barrier. Three 11 foot (minimum MOT lane width) eastbound travel lanes will be provided. The remaining 4.5 feet from the edge of travel lane to the toe of the new outside bridge parapet is utilized for shoulder width. The two westbound MOT lanes will be 11 feet (minimum lane width) in width. A 4.5 foot shoulder from the edge of the westbound travel lane to the toe of the new inside bridge parapet is provided. Temporary alignments and pavement will be required for the IR 480 exit ramps to IR 77. Temporary alignments and pavement will be required for the East 98th Street entrance ramp to westbound IR 480. Phase 2 will be completed at the end of the second construction season and traffic will be returned to the pre-construction lane configurations and alignments prior to the winter.

Alternative 5 – Build a new four lane bridge in the median adjacent to the existing westbound bridge to be used for the maintenance of traffic during the re-decking of the eastbound bridge, ultimately replacing the existing westbound bridge. Maintain four lanes of traffic in each direction with minimal disruption. The IR 480 eastbound bridge deck is replaced in two years with no traffic on the bridge during construction. Temporary IR 480 alignments, temporary ramp alignments and temporary pavement will be required at both ends of the new four lane bridge to allow for MOT on the new bridge in Phase 1. The permanent re-alignment of IR 480 westbound, the IR 77 exit ramps, and the East 98th Street entrance ramp will be required as a part of the project to shift the existing IR 480 westbound traffic onto the new bridge constructed in the median.

Pre-Phase 1 will construct the new four lane IR 480 westbound bridge adjacent to the existing IR 480 westbound bridge. The new westbound bridge will be constructed 72 feet toe to toe of parapet to provide for four 12 foot lanes and 12 foot left and right shoulders in the final condition. Four lanes of traffic will be maintained on the existing IR 480 westbound and eastbound bridges during Pre-Phase 1. At the completion of new IR 480 westbound bridge in the median temporary pavement for temporary alignments in Phase 1 will be constructed. The tie-in of the temporary pavement across the existing eastbound alignment may require short duration lane restrictions or short term closures of IR 480 eastbound, the Ramps from IR 77 to IR 480 eastbound and the exit to East 98th Street from IR 480 eastbound.

Phase 1 will maintain the existing IR 480 westbound four lanes of traffic on the existing IR 480 westbound bridge in the normal locations. The IR 480 eastbound alignment will be transitioned on temporary pavement west of the new bridge constructed in Pre-Phase 1. The three IR 480 eastbound lanes will follow a temporary alignment on temporary pavement to the new bridge in the median. The two ramp lanes from IR 77 will be reduced to a single lane and follow a temporary alignment on temporary pavement to the new bridge in the median. Four lanes of IR 480 eastbound traffic will be maintained on the new bridge. During Phase 1 MOT the lane configuration on the new bridge will be shifted 4 feet to the left to allow for portable barrier and a contractor access lane on the new bridge to facilitate the re-decking of the adjoining eastbound bridge. See MOTAA, Alternative 5 – Phase 1, Transverse Section D-D for dimensions. The exit to East 98th Street from IR 480 eastbound will be maintained on a temporary alignment with temporary pavement from the new bridge in the median. The existing IR 480 eastbound bridge will have the deck replacement in a single season with no traffic on the bridge during construction. After the completion of the bridge deck the temporary alignments on temporary pavement constructed for Phase 1 will be removed and eastbound traffic will be restored the pre-construction lane configurations. The restoration of the eastbound pavement may require short duration lane restrictions or short term closures of IR 480 eastbound, the Ramps from IR 77 to IR 480 eastbound and the exit to East 98th Street from IR 480 eastbound. Phase 1 will be completed at the end of the construction season and traffic will be returned to the pre-construction lane configurations and alignments prior to the winter.

The following construction will construct the permanent westbound pavement on the new alignments in the median. The construction of the new westbound pavement tie-ins may require short duration lane restrictions or short term closures of IR 480 westbound, the ramps from IR 480 westbound to IR 77 and the entrance from East 98th Street to IR 480 westbound.

Alternative 6 – Build a new four lane bridge in the median and maintain four lanes of traffic in each direction with minimal disruption. The new bridge in the median would remain for future use as express lanes. One complete deck replacement will be completed in two years with no traffic on the bridge under construction. Temporary IR 480 alignments, temporary ramp alignments and temporary pavement will be required at both ends of the new four lane bridge to allow for MOT on the new bridge in Phase 1.

Pre-Phase 1 will construct the new four lane, IR 480, bridge in the median. The new bridge will be constructed 85 feet toe to toe of parapet to provide for four 12 foot lanes, 12 foot outside shoulders, 5 foot inside shoulders, and bridge parapets separating directional traffic in the final condition. Four lanes of traffic will be maintained on the existing IR 480 westbound and eastbound bridges during Pre-Phase 1. At the completion of new IR 480 westbound bridge in the median temporary pavement for temporary alignments in Phase 1 will be constructed. The tie-in of the temporary pavement across the existing eastbound alignment may require short duration lane restrictions or short term closures of IR 480 eastbound, the Ramps from IR 77 to IR 480 eastbound and the exit to East 98th Street from IR 480 eastbound.

Phase 1 will maintain the existing IR 480 westbound four lanes of traffic on the existing IR 480 westbound bridge in the normal locations. The three IR 480 eastbound lanes will follow a temporary alignment on temporary pavement to the new bridge in the median. Two ramp lanes from IR 77 will be reduced to a single lane and follow a temporary alignment on temporary pavement to the new bridge in the median. Four lanes of IR 480 eastbound traffic will be maintained on the new bridge. During Phase 1 MOT the lane configuration on the new bridge will be shifted to the left of the bridge to allow for portable barrier and a contractor access lane on the new bridge to facilitate the re-decking of the adjoining eastbound bridge. The shift of the travel lanes results in an 8 foot left shoulder, four 12 foot MOT travel lanes, a 4 foot right shoulder, 32 inch portable barrier, and a 23 foot space for contractor activities. The exit to East 98th Street from IR 480 eastbound will be maintained on a temporary alignment with temporary pavement from the new bridge in the median. The existing IR 480 eastbound bridge will have the deck replacement in a season with no traffic on the bridge during construction.

Phase 2 will re-establish eastbound traffic on the new eastbound bridge deck. This phase will un-do the temporary alignments of temporary pavement constructed for Phase 1 and temporary pavement for temporary alignments in Phase 2 will be constructed. The Phase 2 tie-in of the temporary pavement

across the exiting westbound alignment may require short duration lane restrictions or short term closures of IR 480 westbound, the ramps from IR 480 westbound to IR 77 and the entrance from East 98th Street to IR 480 westbound. The Phase 2 MOT lane configuration on the new bridge will be shifted to the right, a mirror of the lane configuration described in Phase 1 above, to allow for portable barrier and a contractor access lane on the new bridge to facilitate the re-decking of the adjoining westbound bridge. The existing IR 480 westbound bridge will have the deck replacement in a season with no traffic on the bridge during construction.

Phase 3 will re-establish westbound traffic on the new westbound bridge deck. This phase will un-do the temporary alignments on temporary pavement constructed for Phase 2 and restore the pre-construction lane configurations. The restoration of the westbound pavement may require short duration lane restrictions or short term closures of IR 480 westbound, the Ramps from IR 480 westbound to IR 77 and the entrance from East 98th Street to IR 480 westbound. After the restoration of the westbound traffic on the re-decked westbound bridge the temporary alignments and temporary pavement constructed for Phase 2 will be removed. The completed project will maintain the existing travel lanes in the existing configuration on the new re-deck eastbound and westbound bridges. The new bridge constructed in the median would be maintained for future use as express lanes, carrying four lanes of traffic, two eastbound and two westbound.

Existing Bridge Deck Widening for the Maintenance of Traffic

Several of the maintenance of traffic alternatives identified above for analysis requires the widening of the existing bridge deck to accommodate the required MOT lane configurations. Evaluation of the existing superstructure indicates that only minimal widening of approximately 2 feet can be achieved. See the *Structure Assessment, Bridge Capacity for Widening* in the Alternative Evaluation Report for a description.

The non-favorable result of the widening evaluation for the existing bridge deck to accommodate the Maintenance of Traffic lane configurations eliminates the pursuit of MOT Alternative 1.a(76), Alternative 1.b(76) and Alternative 3.a(76), which provide additional bridge deck width on the existing superstructure abutting the existing non-composite bridge deck. These three MOT Alternatives will no longer be considered as viable alternatives for the construction of the project.

Proposed Bridge Deck Widening for the Maintenance of Traffic

Maintenance of traffic Alternative 3.b(76) identified above for analysis requires the widening of the proposed bridge deck to accommodate the required MOT lane configurations. Options similar to the widening of the existing bridge deck above were considered for the widening. Additionally, the new bridge deck was considered as composite, and composite with light weight concrete. As with the evaluation of the widening of the existing bridge deck, the evaluation of the existing superstructure with the proposed bridge deck widening indicates that only minimal widening of 2'± can be achieved. See the *Structure Assessment, Bridge Capacity for Widening* in the Alternative Evaluation Report for a description.

The non-favorable result of the widening evaluation for the widening of the proposed bridge deck to accommodate the Maintenance of Traffic lane configurations eliminates the pursuit of MOT Alternative 3.b(76) which provided additional proposed bridge deck width on the existing superstructure. This MOT Alternative will no longer be considered as a viable alternative for the construction of the project.

Maintenance of Traffic Bridge Deck Drainage

Existing Bridge Deck Drainage

The existing bridge deck grade is approximately 2.62%. The bridge roadway drainage system consists of scuppers, drain troughs and downspouts. Scuppers are located in the shoulders near the rear abutment, pier 3, pier 6, pier 9 and pier 12. There are 5 existing scuppers in each shoulder at the rear abutment and Pier 12. There are 6 existing scuppers in each shoulder at Piers 3, 6 and 9. Existing scuppers are 3.375' wide with 6" diameter pipe. Drainage troughs are under each finger joint near piers 3, 6, 9 and 12. The scuppers and drain troughs are collected by one pipe downspout per bridge at piers 3, 6, 9 and 12. The downspouts are collected in an underground storm sewer and conducted to the Cuyahoga River. Scuppers are located in span 1, near the rear abutment, with no drainage collection system.

The existing drainage spread was calculated for a 2 year rainfall frequency and a 10 year rainfall frequency. The criteria are a 10 minute time of concentration and Intensity Zone A per ODOT Location and Design Manual, Section 1101. The existing drainage spread is 9.5' for a 2 year storm and 10.5 ft for a 10 year storm. The existing outside shoulders are 11.25' wide and the existing inside shoulders are 10.25' wide.

Bridge Deck Drainage During Construction

The bridge drainage for the existing bridge deck during maintenance of traffic was designed for Unit 1, Unit 2 (Units 3 & 4 similar) and Unit 5 for the existing bridge deck. Allowable drainage spreads of 2', 3', 4', 6' and 8' were calculated in an effort to determine a feasible allowable drainage spread and the shoulder widths that will be required during maintenance of traffic. The bridge drainage design for the proposed bridge deck during maintenance of traffic will be similar to the bridge drainage design for the existing deck. A two year design frequency was used to determine the spread of water on the pavement per ODOT Location and Design Manual, Section 1010. Per Section 1010 of the ODOT Location and Design Manual, a dry lane width of 10 feet shall be provided during maintenance of traffic. Added temporary scuppers will be collected in a temporary closed drainage system. Temporary horizontal conductors, hoppers, and downspouts to the ground will be utilized to collect runoff on the bridge from pier 3 through pier 12. The downspouts will be collected with temporary conduits (above or below ground) connected to the storm sewer trunk line. The end units will use scuppers free falling to the ground.

Three options were considered to reduce the drainage spread during maintenance of traffic:

a) The first option is to drill 8 inch diameter holes in the existing deck and provide a closed drainage system to capture the runoff. The proposed deck would have new scuppers installed. The maximum flange width for the exterior girders is 2.83 feet. For the existing deck width and a top flange width of 2.83 feet, the girder top flange extends beyond the toe of parapet. The drilled holes during many phases of construction would have to be cut at a steep angle to avoid the girder top flange, or a portion of the parapet could be cut out to provide clearance to the girder top flange and place the drilled holes vertically. If the drilled holes were placed vertically it would be possible to plate over the hole and grind the concrete to make the plate flush with the parapet. This option would have complex construction, would require two to three times the number of drilled holes compared to scuppers and would extend the length of the closed drainage system along the longitudinal length of the bridge. The option to drill holes in the existing deck is not feasible.

b) The second option is to replace a portion of the existing deck and install additional scuppers to capture the runoff. This option would require cutting out enough of the existing deck to provide reinforcing around the new scuppers, installing new scuppers, constructing new deck around the scuppers, constructing a closed drainage system at the piers that have no existing collection, and tying into the existing closed drainage system. The proposed deck would have new scuppers installed. The scupper width will vary depending on the deck overhang distance. For the purposes of this discussion, the scupper width for new scuppers is 3.5 feet in the existing and proposed decks. The existing scuppers are 3.375 feet wide and will be re-used for maintenance of traffic supported by the existing deck.

c) The third option incorporates the second option to add scuppers. But, milling and reshaping the shoulder cross slope is included. The outer four feet of shoulder on the existing bridge deck would be ground to provide a 1/2” per foot cross slope. The existing cross slope is 3/16” per foot. The grinding depth would vary from 1 1/4” at the toe of barrier to nothing four feet out from the barrier. The finger joints would not be changed. Existing scuppers would be cut to conform to the new cross slope. The new bridge decks would be constructed with the same four feet wide 1/2” per foot cross slope in each shoulder.

The drainage spread with the existing scuppers is 9.5 feet for a 2 year storm. The existing groups of scuppers are only located upgrade from the finger expansion joints, so they are about 900 feet apart. In order to evaluate the maintenance of traffic bridge drainage, the design considered total allowable spreads of 2’, 3’, 4’, 6’ and 8’. The number of scuppers required to meet these allowable spread widths during maintenance of traffic were determined for the existing deck and proposed deck; and for 3/16” and 1/2” per foot shoulder cross slopes. Additionally, the distance from the pier to the most distant scupper was considered to determine the feasibility of providing horizontal conductors for a closed drainage system.

The following Table lists the approximate maximum distance from a pier to a scupper, the approximate number of scuppers (in addition to the existing scuppers) required for maintenance of traffic in the existing deck, the approximate number of scuppers required for maintenance of traffic in the proposed deck, and the number of additional substructure units that will require a closed drainage system for total allowable spreads of 2’, 3’, 4’, 6’ and 8’:

New Scuppers in Existing and Proposed Decks for Maintenance of Traffic				
Allowable Spread (feet)	**Maximum Distance from Pier to Scupper (feet)**	**Number of Added Scuppers in Existing Deck Per Shoulder**	**Number of Added Scuppers in Proposed Deck Per Shoulder**	**Number of Additional Piers Requiring Closed Drainage System**
3/16” per foot Shoulder Cross Slope				
4	150*	58	61	12
6	50	22	22	12
8	10	9	9	12
1/2” per foot Shoulder Cross Slope				
2	148*	70	75	12
3	65	27	27	12
4	2	9	9	12
5	2	3	3	3

*Note - The allowable spread requirement is too low to space new scuppers only around piers. A closed drainage system with horizontal conductors is not feasible.

The tabulated information is for comparison of the options and quantities may vary for specific alternatives. Grinding or constructing the shoulders to the steeper cross slope decreases the drainage spread up to 4 feet.

The scuppers required for the proposed deck during maintenance of traffic will be re-used in the final structure. Scuppers that will not be required for the final bridge conditions will be plugged and temporary downspouts removed to reduce future maintenance of the drainage system. The values listed above for the new scuppers in the proposed deck are only those scuppers required for maintenance of traffic in addition to the existing or proposed scuppers.

The cost to provide reduced drainage spread on the bridge deck and a new/modified bridge deck drainage collection system to the ground during the Maintenance of Traffic decreases significantly with an increased allowable spread. Once to the ground the bridge deck drainage will be collected in the existing/new enclosed storm sewer system and tied into the existing storm sewer trunk line which discharges to the Cuyahoga River. Estimated costs for installing the required deck drainage system for Maintenance of Traffic is calculated for each MOTAA and shown in the Cost Comparison spreadsheet.

Maintenance of Traffic Crossovers

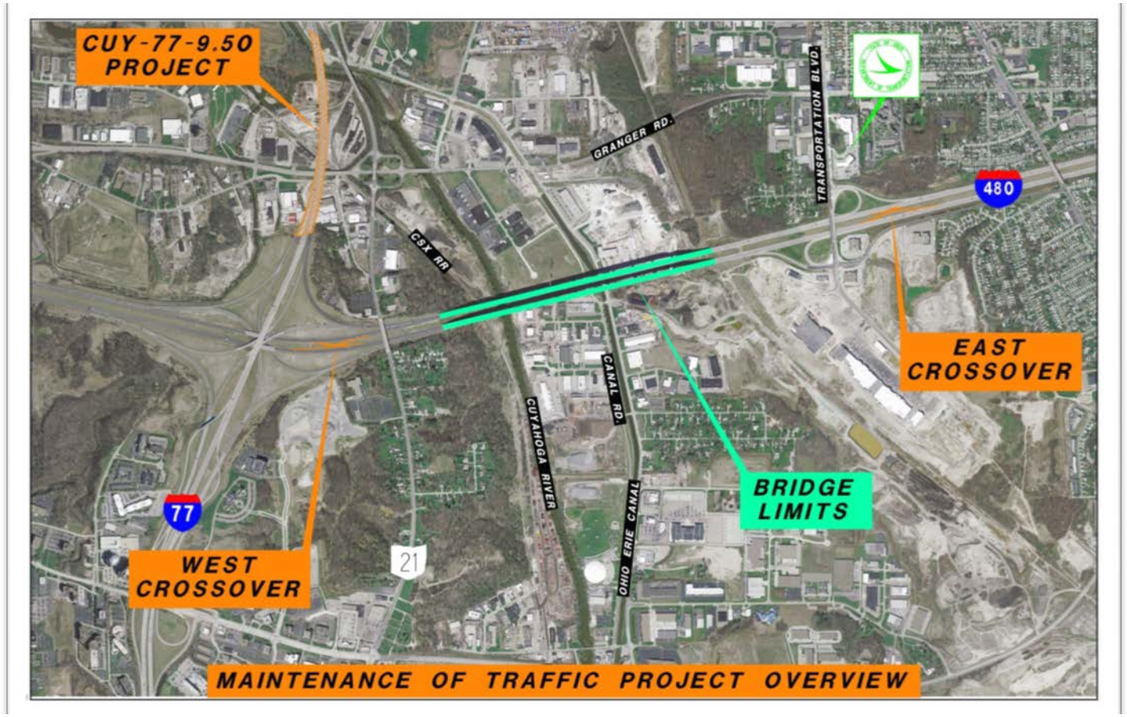
The maintenance of traffic alternatives included above require the shifting of traffic from eastbound to westbound and westbound to eastbound alignments in different MOT phases. Crossovers will be required to accomplish these MOT travel lane re-alignments.

The location of the crossovers on the west end of the project is between the IR 480 bridge over the IR 77 ramps and the SR 21 bridge over IR 480. The location of the crossovers on the east end of the project is to the east of the Transportation Boulevard interchange.

The location of the west crossover was selected after an alternate location to the west of the IR 77 interchange was reviewed and determined to be less desirable. The alternate location for the west crossover has some distinct advantages over the selected location such as: location on a tangent, normal crown pavement cross slopes, clear view of the approaching crossover, available sign truss to utilize for the crossover signing, a ¾ mile section of IR 480 eastbound that will be unused during various MOT alternatives, including bridge 480-1786R. However, there are some concerns with the placement of the cross over at this alternate location, notably a steep downhill grade into the cross over location (1.8%) in the eastbound direction would make it more difficult to maintain speed while negotiating the crossover. Shifting the crossover to the west effectively lengthens the work zone and shifts the anticipated queue to the west into the area of the eastbound IR 480 split with IR 77. This would impact the ability of IR 480 eastbound traffic to access the exit to IR 77. Additionally the alternate crossover location would require the placement of contra flow traffic on bridge 480-1787L in phases 1 and 2. This bridge is located in a curve to the left with full cross slope superelevation to the left (all drainage to the low side), a toe to toe distance of 56'-6" (narrow for 4 lanes of contra flow traffic), and the piers for the mid-level IR 77 ramp lanes are incorporated into the high side parapets on the bridge (which restricts the opening) and would require at a minimum the recommended clearance from the toe of the parapet of 2 feet.

The preferred west side crossover location between the IR 480 bridge over the IR 77 ramps and the SR 21 bridge over IR 480 is not an ideal location for a crossover due to the location within a horizontal curve, superelevation of 0.036, and the view from the approaching traffic being obstructed by the bridges within the IR 480/IR 77 interchange. However, the restricted view will be mitigated by closing the left lane of IR 480 eastbound approaching the crossover and shifting the two lanes of traffic into the crossover from the two most right lanes allowing for additional sight distance from the mid-level IR 77 ramp bridge piers. The vertical grade of the crossover location is within an uphill 2.69% and will naturally have a slowing effect on the traffic approaching the crossover. The preferred crossover location is nearer to the project construction limits and reduces the distance for which the IR 480 traffic is impacted. The location of the crossover in relation to the IR 480 eastbound to IR 77 exit ramps allows for an approximate queue length of 1\2 mile prior to impacting the IR 480 eastbound/IR 77 ramp traffic. The existing bridges on IR 480 1878R & L would not be impacted by the crossover, and the westbound traffic on IR 480 would be returned to the normal lane configuration approximately ½ mile closer the end of the project and allow traffic to disperse into the available three lanes providing more gaps for the entrance of the traffic from IR 77 onto IR 480 westbound. These considerations went into the selection of the preferred crossover location between the IR 480 bridge over the IR 77 ramps and the SR 21 bridge over IR 480.

The location of the east crossover to the east of the Transportation Boulevard interchange was selected after consideration of the existing conditions and the mechanics of an MOT alternative utilizing a crossover concept. The location is on a tangent horizontal alignment, just beyond the area affected by the work, outside the limits of the Transportation Boulevard interchange, and between two overhead bridges. Traffic approaching the work area from the east (downhill grade of 2.69%) will have a clear view of the upcoming crossover and ample reaction time to select a lane option. The functionality of the Transportation Boulevard ramps to the east of the interchange will remain similar to the existing condition in all MOT phases.



Maintenance of Traffic Alternatives – Initial Evaluation

Through the development of the project thirteen maintenance of traffic alternatives have been identified for evaluation. The above criteria, along with other MOT considerations will be evaluated for each alternative and a determination as to the advancement of the alternative will be made below. Those alternatives selected for advancement will be further evaluated in the ODOT MOTAA spreadsheets for "Work Zone Constraints", "Ramp information", "Bridge Information", and "Cost Comparison".

Maintenance of Traffic Alternative 1.a(70) - Same Width Deck Replacement – Maintain 3 Lanes Westbound and 4 Lanes Eastbound. This is the MOT Alternative that ODOT noted in the project Scope

as the preferred option. This is the MOT alternative referred to as "5+2" in the E. L. Robinson Deck Rehabilitation Study. Further evaluation of the transverse section and the impacts that reduced shoulder widths have on the MOT drainage criteria have been considered. Options to mitigate the reduced shoulder width on the drainage spread included adding additional MOT scuppers on the bridge and increasing the shoulder cross slope. Evaluation of the two drainage options has determined that it is less costly to modify the existing and the proposed shoulder cross slopes. Modification of the shoulder cross slope to ½" per foot and adjustment of the existing scuppers to match the revised cross slope will be required. This MOT Alternative will be advanced for further evaluation.

Maintenance of Traffic Alternative 1.a(76) - Widen Existing and New Bridge (approximately 6 feet of widening required) - Deck Replacement - Maintain 3 Lanes Westbound and 4 Lanes Eastbound. This is a modification of the above alternative that eliminates the need to modify the existing and proposed shoulder cross slopes to accommodate the MOT drainage. Based upon the *Structure Assessment, Bridge Capacity for Widening* in the Alternative Evaluation Report widening on the bridge of 6 feet is not an option. Therefore MOT Alternative 1.a(76) will no longer be considered for further MOT evaluation.

Maintenance of Traffic Alternative 1.b(70) - Same Width Deck Replacement – Maintain 3 Lanes Westbound and 4 Lanes Eastbound. This is the same maintenance of traffic concept on the bridge as Alternative 1.a(70) above with the exception that the distance of the lane reduction leading into the work area for the westbound traffic will be restricted at the Broadway Avenue interchange.

Extending the restriction of the third lane from 2.0 miles to 5.1 miles to the east has no impact on the QUEWZ output for traffic volume through the work zone. Therefore the queues generated in the ODOT spreadsheet remain the same. The difference between the 2.0 mile and the 5.1 mile work zone (lane restriction length) (3.1 miles) can be directly added to the anticipated queue. In Alternative 1.a(70) above, the 1.5 mile allowable queue is backed up from the lane reduction/crossover to the east of the Transportation Boulevard Interchange to near the Broadway entrance ramp. Applying the 1.5 mile allowable queue to Alternative 1.b(70) and extending the third lane restriction to the Broadway Avenue interchange will shift the backup to near the McCracken Rd. exit ramp. The shifting of the lane restriction to the east along IR 480 westbound only limits the storage capacity on IR 480 and pushes the backup farther to the east. This in turn impacts the traffic that would normally be entering and exiting at the McCracken and Broadway interchanges. It does not appear that the extension of the IR 480 westbound lane restriction provides any positive advantages to the efficiency of this MOT alternative and therefore MOT Alternative 1.b(76) will no longer be considered for further MOT evaluation.

Additional interchange accessibility recommendations were requested that included ramp metering and ramp closures that will be discussed here. The metering of IR 480 westbound ramps during the AM and PM may provide some greater efficiency of ramp performance for those ramps outside the limits of the IR 480 lane restrictions but within the limits of the anticipated queue. These locations would include the entrance ramps at Granger and Broadway. Providing ramp metering for entrance ramps inside the limits of the IR 480 lane reduction in the AM and PM peaks would be inconsequential due to the proximity of the ramps being in the midst of the queues and the lane reduction providing limited openings for ramp merges.

The closure of ramps within the limits of the anticipated IR 480 westbound queues could discourage some of the local traffic from using IR 480 westbound and encourage them to access the interstate system from alternate locations away from the work area. Approximately 23,000 ADT access IR 480 westbound from the Transportation Boulevard, Granger Road, and Broadway Avenue interchanges. The closure of entrance ramps accessing IR 480 westbound may have a detrimental effect on the other entrance ramps remaining open.

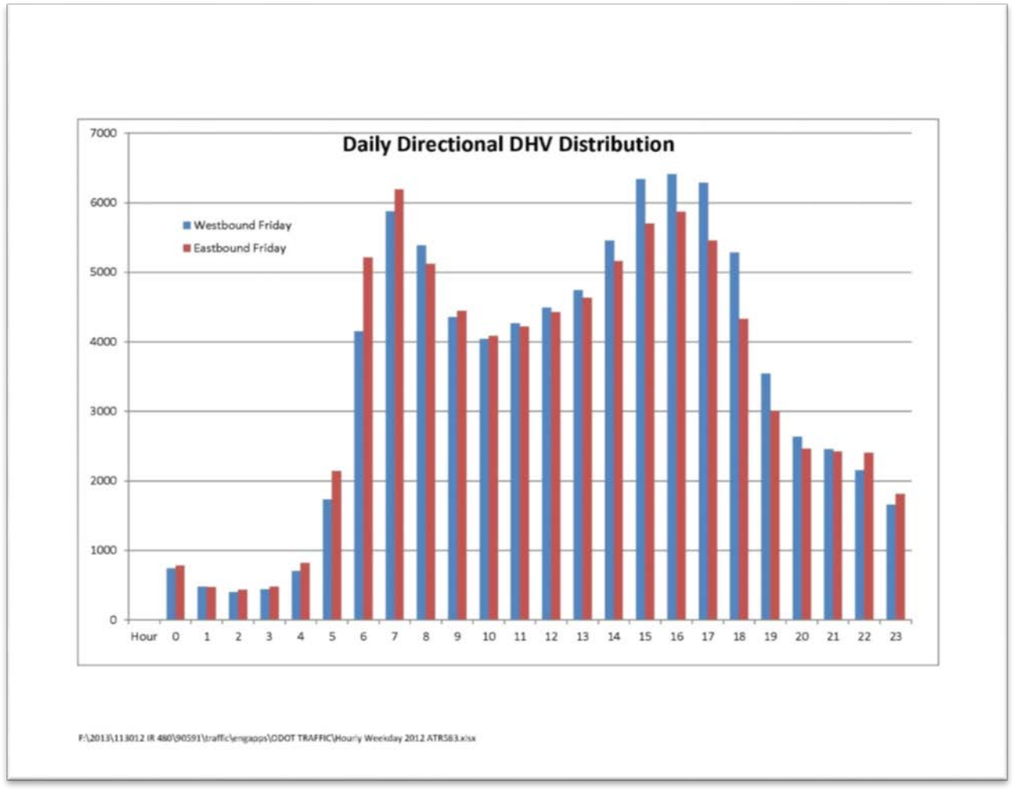
This corridor is a heavily travelled route and most users are familiar with navigation through and around the area. The project will last over multiple years and impact the westbound users to a greater extent than the eastbound users. Limiting or eliminating ramp access for these extended periods of time does not appear to be an acceptable solution. It would be anticipated that IR 480 westbound traffic users entering IR 480 will alter their travel patterns to avoid the area during those times when access is most affected. During non-peak, weekend and holidays IR 480 westbound traffic users entering IR 480 should have unrestricted access to IR 480 westbound.

It appears that the most efficient means to minimize the impact of the queue length and maintain the accessibility to IR 480 westbound is to minimize the length of the three lane restriction, utilize as many of the existing IR 480 lanes as possible for the greatest length possible, and maintain access to IR 480 westbound at all the existing locations.

Alternative 1.b(76) - Widen Existing and New Bridge (approximately 6 feet of widening required) - Deck Replacement - Maintain 3 Lanes Westbound and 4 Lanes Eastbound. This is the same maintenance of traffic concept on the bridge as Alternative 1.a(76) above with the exception that the distance of the lane reduction leading into the work area for the westbound traffic will be restricted at the Broadway Avenue interchange. Based upon the *Structure Assessment, Bridge Capacity for Widening* in the Alternative Evaluation Report widening on the bridge of 6 feet is not an option. Therefore MOT Alternative 1.b(76) will no longer be considered for further MOT evaluation.

Alternative 2 - Movable Median Barrier- Maintain 3 Lanes eastbound and westbound at all times with one additional lane for rush hour directional traffic ("5+2"). The efficient application of movable barrier is predicated upon a substantial variation of directional traffic volumes. Review of the traffic volumes from ATR # 583 directly east of the IR 480 bridge project site indicates that there is a slight directional traffic variation. Review of the average Friday directional hourly volume distribution is shown in the graph below. The graph indicates that there is a slight variation in the directional distribution with eastbound traffic greater in the AM peak hours and westbound traffic greater in the PM peak hours. This is the typical traffic distribution trend for all normal weekdays. The general trend of the hourly traffic volumes is similar in the eastbound and westbound directions. The graph indicates that the need for additional directional MOT lanes peak at the same time in both directions at the same times of the day. Therefore, alternating the direction of an MOT lane to provide additional capacity at peak times of the day would only accentuate the poor performance in the opposite direction.

Based upon the lack of directional traffic distribution MOT Alternative 2 will no longer be considered for further MOT evaluation.



Alternative 3.a(72) - Widen Existing and New Bridge Deck – Deck Replacement – Maintain 4 Lanes Westbound and 4 Lanes Eastbound. This is a modification of Alternative 1.a(70) above that provides existing and new bridge deck widening. The 2 foot bridge deck widening on the existing bridge will be accomplished in a Pre-Phase 1 MOT. The bridge deck widening is the maximum widening that can be accomplished utilizing the existing superstructure, see the *Structure Assessment, Bridge Capacity for Widening* in the Alternative Evaluation Report. The widened bridge decks allow for the maintenance of 4 (10' minimum lane width) lanes of traffic in each direction during the deck replacement ("6+2"). Modification of the shoulder cross slope to ½" per foot and adjustment of the existing scuppers to match the revised cross slope will be required. This MOT Alternative will be advanced for further evaluation.

Alternative 3.a(76) - Widen Existing and New Bridge Deck – Deck Replacement- Maintain 4 Lanes Westbound and 4 Lanes Eastbound. This is a modification of the above Alternative 3.a(72) that eliminates the need to modify the existing and proposed shoulder cross slopes to accommodate the MOT drainage. Based upon the *Structure Assessment, Bridge Capacity for Widening* in the Alternative Evaluation Report widening on the bridge of 6 feet is not an option. Therefore MOT Alternative 3.a(76) will no longer be considered for further MOT evaluation.

Alternative 3.b(72) - Widen New Bridge Deck - Deck Replacement- Phases 1 and 2 will Maintain 3 Lanes Westbound and 4 Lanes Eastbound ("5+2"); Phases 3 and 4 will Maintain 4 Lanes Westbound and Eastbound ("6+2"). This is a combination of Alternative 1.a(70) and Alternative 3.a(72). This alternative does not require a Pre-phase 1 MOT sequence to widen the existing bridge deck. Modification of the shoulder cross slope to ½" per foot and adjustment of the existing scuppers to match the revised cross slope will be required. This MOT Alternative will be advanced for further evaluation.

Alternative 3.b(76) - Widen New Bridge Deck - Deck Replacement- Phases 1 and 2 will Maintain 3 Lanes Westbound and 4 Lanes Eastbound ("5+2"); Phases 3 and 4 will Maintain 4 Lanes Westbound and Eastbound ("6+2"). This is a modification of the above Alternative 3.b(72) that eliminates the need to modify the existing and proposed shoulder cross slopes to accommodate the MOT drainage. Based upon the *Structure Assessment, Bridge Capacity for Widening* in the Alternative Evaluation Report widening on the bridge of 6 feet is not an option. Therefore MOT Alternative 3.b(76) will no longer be considered for further MOT evaluation.

Alternative 3.c - Widen Eastbound Substructure and Superstructure – Widen Eastbound Bridge Deck – Deck Replacement. Maintain 4 Lanes Westbound and Eastbound all Phases. Phases 1 and 3 utilize a ("5+3") MOT concept; Phase 2 is ("4+4"); and Phases 4 and 5 utilize a ("6+2") MOT concept. The eastbound substructure widening will be accomplished in a Pre-Phase 1 MOT. Modification of the existing shoulders cross slope on the westbound bridge to ½" per foot and adjustment of the existing scuppers to match the revised cross slope will be required. The eastbound proposed bridge deck will be widened to 93 feet toe to toe of parapet. The widened bridge deck allows for the maintenance of 4 (11' minimum lane width) lanes of traffic at all times, in each direction during the deck replacements. This MOT Alternative will be advanced for further evaluation.

Alternative 4 - Rapid Deck Replacement - Maintain 2 Lanes Westbound and 3 Lanes Eastbound. Modification of the existing shoulders cross slope on the westbound bridge to ½" per foot and adjustment of the existing scuppers to match the revised cross slope will be required. Construction of the proposed shoulder cross slopes on the eastbound bridge to ½" per foot will be required. The reduction of the eastbound lanes to 3 and the westbound lanes to 2 has major impacts on the queue lengths anticipated during construction. QUEWZ 98 for Alternative 4 (see attached) indicates that the volume capacity for the two westbound lanes is 1482 vehicles per lane per hour and 1413 vehicles per lane per hour for the three eastbound lanes. These volume capacities input into the ODOT queue spreadsheet for the maintenance of traffic of the 2 westbound lanes results in queues in excess of 47 miles in the 6 PM peak. The queue begins at 7 AM and recovery of the queue does not occur until 2 AM. The percentage of traffic diversion required to limit the queue to a 1.5 mile maximum backup beyond the existing condition is 26%, an average of 1800 vehicles per hour during the PM peak hours. Maintaining 3 lanes eastbound results in a maximum queue of 43.9 miles in the 6 PM hour, three hours after the PM peak at 4:00 pm. The queue begins at 6:00 am and does not clear until 2:00 am. The percentage of traffic diversion required to limit the queue to a 1.5 mile maximum backup beyond the existing condition is 26%, an average of 1520 vehicles per hour during the PM peak hours. The

associated user cost calculated by QUEWZ for the eastbound direction is $395,000 per day, westbound direction user cost per day is $382,000. The queue lengths generated by the ODOT spreadsheet and the associate user costs from QUEWZ are excessive for this interstate section. There are no good interstate options to use as an alternate route and few good local parallel surface street options to use for the local traffic. Therefore MOT Alternative 4 will no longer be considered for further MOT evaluation.

Alternative 5 - New Westbound Bridge in Median - Maintain 4 Lanes Westbound and Eastbound. A new 72 foot wide westbound bridge would be constructed in the existing median between the existing bridges in a Pre-Phase construction sequence. This construction will have no impact on the existing traffic patterns. At the completion of the new westbound bridge the existing eastbound traffic will be shifted onto temporary alignments and placed on the new bridge. The existing eastbound bridge will be re-decked. Eastbound traffic placed back onto the re-decked eastbound bridge. Westbound traffic will be shifted onto a new alignment and utilize the new bridge constructed in Pre-Phase 1. The existing westbound bridge and approach pavement will be removed. This MOT Alternative 5 will be advanced for further evaluation.

Alternative 6 - New Eastbound and Westbound Express Lane Bridge in Median -Maintain 4 Lanes Westbound and Eastbound. A new 85 foot wide bridge would be constructed in the median between the existing bridges in a Pre-Phase 1 construction sequence. The construction of the new bridge in the median will have no impact on the existing traffic patterns. At the completion of the new bridge the existing eastbound traffic will be shifted onto temporary alignments and placed on the new bridge. The existing eastbound bridge will be re-decked. Eastbound traffic placed back onto the re-decked eastbound bridge. Westbound traffic will be shifted onto temporary alignments and placed on the new bridge. The existing westbound bridge will be re-decked. Westbound traffic placed back onto the re-decked westbound bridge. The new bridge constructed in the median will be taken out of service until future IR 480 express lanes are constructed. This alternative is very high cost and an inefficient means to provide the MOT for the project. MOT Alternative 6 will no longer be considered for further MOT evaluation.

The initial evaluation of the maintenance of traffic alternatives has eliminated four alternatives because the existing bridge deck cannot be widened more than 2 feet. Other MOT alternatives were eliminated from consideration due to: no added benefit in extending the lane restriction, little variation in directional traffic distribution, excessive queues due to limited available MOT lanes, and the high cost of construction for an express lane bridge that will go unused after the re-decking.

The remaining maintenance of traffic alternatives will be further considered as possible strategies to accomplish the project's bridge deck replacement.

Alternative 1.a(70) -	Same Width Deck Replacement – Maintain 3 Lanes WB (on bridge only) & 4 Lanes EB ("5+2") - Modify existing and proposed shoulder cross slope.
Alternative 3.a(72) -	Widen Existing and New Bridge - Deck Replacement- Maintain 4 (min. 10') Lanes WB & EB ("6+2") - Modify existing and proposed shoulder cross slope
Alternative 3.b(72) -	Widen New Bridge - Deck Replacement- Phases 1 & 2 Maintain 3 Lanes WB & 4 Lanes EB ("5+2"); Phases 3 & 4 Maintain 4 Lanes WB & EB & ("6+2") – Modify existing and proposed shoulder cross slope
Alternative 3.c -	Widen EB Substructure and Superstructure - Deck Replacement- Maintain 4 Lanes WB & EB all Phases; Phases 1 & 3 ("5+3"); Phase 2 ("4+4"); Phases 4 & 5 ("6+2")
Alternative 5 -	New WB Bridge in Median - Maintain 4 Lanes WB & EB

Each of the remaining maintenance of traffic alternatives has been developed in accordance with the ODOT Traffic Engineering Manual, Section 600, Temporary Traffic Control, 630-5 Maintenance of Traffic Alternative Analysis (MOTAA). Included in the Appendix of the Maintenance of Traffic Alternatives Analysis Report are the components as required by the TEM. The Appendix includes:

- Lane Configuration Diagrams and cross sections for each alternative at critical locations. The cross sections include lane widths, barrier locations, clear distance dimensions for each alternative. Transverse sections on the bridge deck under construction to show the substructure components and the relationship to the MOT configuration.
- Constraint Table Form (Form 696-1a) comparing the five remaining alternatives.
- Bridge Information Form (Form 696-2a) comparing the five alternatives.
- Ramp Information Form (Form 696-3a) comparing the five alternatives.
- Cost Comparison Form (Form 696-4a) comparing the alternatives.

Additionally included in the Appendix is QUEWZ-98 work zone lane closure analysis output for each of the five remaining MOT Alternatives and the associated ODOT queue spreadsheet reflecting the anticipated queues for each alternative. A Work Zone Alternatives - Operational Comparison Form has been assembled and included in the Appendix to compare the relative delays associated with each MOT alternative. A baseline for the form includes analysis for the existing condition. The existing condition was analyzed to determine how the existing number of lanes and the hourly traffic volumes would be represented by QUEWZ, the ODOT queue spreadsheet, and HCS. The results of the existing condition from QUEWZ, ODOT queue spreadsheet, and HCS can then be compared to the MOT alternative restrictions.

Maintenance of Traffic QUEWZ and ODOT Queue Spreadsheet

The development of the MOTAA requires the comparative evaluation of traffic backups in multiple MOT traffic configurations. The initial step in the comparative MOT backup evaluation is to utilize computer software "QUEWZ" for the multiple MOT scenarios and utilize the output data for the volume of traffic through the work zone represented in "vehicles per lane per hour". An initial look at QUEWZ and the input data needed, along with supplemental information provided by ODOT in the TEM, Section 640-13.2 includes the following items:

1. Number of directions in which lanes are closed. In multiple scenarios we will maintain four lanes in the eastbound direction which is the same as the existing condition. However, due to the lane reductions and the distractions in the work zone it is not expected that the volume of traffic able to travel in the four lanes during the MOT will be the same as the traffic volume in the normal condition. To allow us to manipulate the QUEWZ input data for the maintenance of the four existing lanes we need to state that there are five lanes of existing traffic in the eastbound direction. This allows us to vary some of the input to account for narrower lanes, the presence of ramps, and passenger car equivalents for heavy vehicles on uphill grades, and work zone lengths.
2. Number of lanes in each direction across the bridge is 4.
3. Number of lanes open in the work zone for each direction will vary per individual MOT scenarios.
4. Length of closure. This will vary based upon direction and MOT scenario.
5. Time of lane closure and work zone activity. Time of closure will be 24 hours and due to the intensity of the work involved and the short timeline to complete the construction we are assuming work zone activity in all 24 hours.
6. Traffic volumes. Certified traffic for the project (2018) 146,190 ADT. Per the Traffic Academy for the Maintenance of Traffic handouts (2005 version) the analysis for the queue lengths must be calculated based on hourly data adjusted to a Friday in August (typically the busiest day of the year) to provide conservative queue length predictions. There is an ATR #583, located immediately to the east of the project limits which has daily hourly volumes. The 2012 average week day ADT is 163,000 and the average weekend ADT is 104,000. The 2012 hourly volume from ATR #583 for Friday, August 24th, which recorded a daily traffic total of 180,236 vehicles, was used in QUEWZ to generate user costs for each of the MOT scenarios.
7. Cost update factor. Used U.S. Bureau of Labor Statistics and the CPI Inflation Calculator. $1.00 in 1990 has the same buying power as $1.78 in 2013. See attached.
8. Percentage of trucks, from certified traffic the T24=8%, the TD=5%, since the volume input is hourly use the TD of 5%.
9. Design speeds and work zone speeds, use the defaults.

Additionally, other QUEWZ input information was used to generate data for the MOTAA evaluation process as follows:

10. QUEWZ input information: “inbound” is “westbound” traffic and “outbound” is “eastbound” traffic.
11. User costs generated from QUEWZ based upon the “Cost Update Factor” were used as a comparison for MOT evaluation factor.

Work Zone capacity adjustment factors were applied in QUEWZ to account for specific conditions that exist in different phases or directions of travel.

12. Passenger car equivalent signified by an “E” in QUEWZ is based on profile grade in the work zone. An adjustment for the +2.69% grade in the eastbound direction was considered. From the Highway Capacity Manual (HCM) Exhibit 11-11 PCE’s for trucks and busses (Et) on Upgrades, a factor of 2.5 was used for the eastbound direction and a value of 1.5 was used for the westbound direction.
13. Work Zone Intensity “I” as it relates to work zone lane widths was applied per the “EVALUATION OF TRAFFIC FLOW ANALYSIS TOOLS APPLIED TO WORK ZONES BASED ON FLOW DATA COLLECTED IN THE FIELD” also known as the Iowa Study. To judge what the existing condition is on the road during normal operating conditions a Work Zone Intensity of I=0 was used to indicate a 12’ travel lane. During the MOT phases an intensity of I=80 was used to indicate an 11’ lane and I=160 was used to represent a 10’ lane.
14. Adjustments for the presence of Ramps “R” was left as a default value of 0 for all existing and MOT QUEWZ calculations.

The ODOT Queue spreadsheet was utilized to predict traffic queues in the multiple MOT scenarios. The vehicles per lane per hour, generated from QUEWZ was input into the ODOT spreadsheet along with actual hourly traffic volumes from ATR #583. A Maintenance of Traffic Alternatives Analysis (MOTAA) is required to meet ODOT Policy 516-003(P) for queue standards. Three queuing thresholds must be met for a successful MOT concept. The three queue thresholds are; a queue length of 0.75 miles is acceptable for an unlimited portion of the day, a queue length between 0.75 to 1.5 miles is acceptable for a maximum duration of 2 hours per day, and a queue length greater than 1.5 miles in not acceptable. Additionally, per the project scope a goal of providing a MOT concept capable of limiting traffic backups to less than ¼ mile during non-peak hours (assuming 4 busiest consecutive AM hours and 4 busiest consecutive PM hours are considered the peak hours) was also requested. ODOT Policy 516-003(P) also states that where queues are normally present even without lane closures, the analysis shall compare existing queues to expected queues caused by the lane closures. These parameters were reviewed for each of the MOT scenarios and the percentage of traffic required to be diverted to meet the requirement for less than an additional 1.5 mile backup beyond the existing condition and the less than ¼ mile backup during non-peak hours was developed in the ODOT spreadsheet.

Maintenance of Traffic – Analysis of Existing Conditions

An initial application of QUEWZ and the ODOT Queue spreadsheet was run to determine how the existing 4 lanes of traffic in each direction cope with the traffic volumes. A QUEWZ file was created and processed to evaluate the existing condition on the bridge on a normal day and on a day when a work zone is introduced. The inbound and outbound number of lanes was input as 5 in order to reduce them both to 4 and analyze the existing condition with and without a work zone. QUEWZ calculated the capacity of the westbound four lanes as 1800 vehicles per lane per hour without a work zone and 1560 vehicles per lane per hour within a work zone. The eastbound capacity was calculated as 1800 vehicles per lane per hour without a work zone and 1488 vehicles per lane per hour within a work zone. The difference in the capacity between the westbound and the eastbound work zone is the uphill grade to the east and an adjustment to the “E” (passenger car equivalent) from 1.5 in the westbound direction to 2.5 in the eastbound direction.

The vehicles per lane per hour capacity from QUEWZ was input into the ODOT spreadsheet for freeway work zone queues. With no work zone the 1800 vehicles per lane per hour result in no queues in the eastbound or the westbound direction. Introducing a work zone and reduced capacity in the westbound direction with 0% traffic diverted the result of the queue in the AM was 1.3 miles in the 7 AM hour and 7.0 miles in the 4 PM hour. In the eastbound direction with 0% traffic diverted the result of the queue in the AM was 1.8 miles in the 7 AM hour and 2.0 miles in the 5 PM hour. Therefore, relying on the calculations provided by QUEWZ and the ODOT queue spreadsheet, the existing traffic condition (4

(12') lanes eastbound and westbound) within a work zone do not function adequately (maximum queue of over 1.5 miles) for the Friday in August traffic volumes. QUEWZ and the ODOT queue spreadsheet indicate that queues in excess of 1.5 miles are present during the peak demand times when any MOT restrictions are introduced.

The findings of the performance for the existing condition within a work zone lead us to consider the existing condition within a work zone for a low volume day during construction, and the calculations QUEWZ and the ODOT queue spreadsheet will yield. The QUEWZ capacity does not change based upon the traffic volumes, therefore the westbound four lanes remain at 1560 vehicles per lane per hour and the eastbound lanes at 1488, the same volumes as calculated for a Friday from above. Traffic volumes were input into the ODOT spreadsheet for freeway work zone queues for a Monday in the month of April, 2012. In the westbound direction with 0% traffic diverted the result of the queue in the AM was 1.3 miles in the 7 AM hour and 4.5 miles in the 5 PM hour. In the eastbound direction with 0% traffic diverted the result of the queue in the AM was 2.1 miles in the 7 AM hour and 2.3 miles in the 5 PM hour.

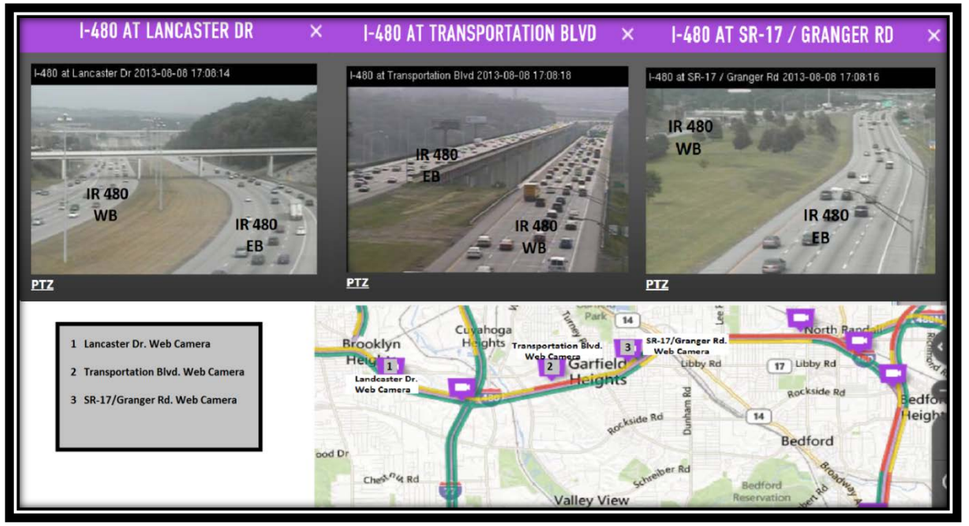
The results of the QUEWZ and ODOT queue spreadsheet indicate that when a work zone is introduced and the 4 (12') existing lanes of traffic are maintained in each direction the traffic volumes for a Monday in April and a Friday in August result in traffic queues in excess of 1.5 miles in various instances. Non-peak hour queues of less than ¼ mile in length are present in only one of the existing lane configurations. See the table below for a summary.

EXISTING IR 480 LANE CONFIGURATION - ABILITY TO MEET MOT THRESHOLDS

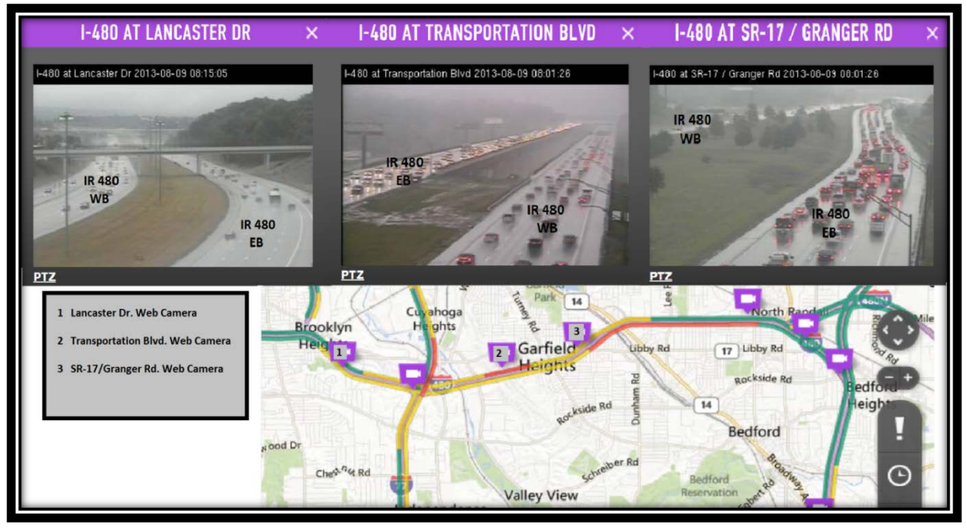
MOT Queue Thresholds	Westbound				Eastbound			
	Monday in April		Friday in August		Monday in April		Friday in August	
	AM	PM	AM	PM	AM	PM	AM	PM
Number of occurrences of queue greater than 1.5 miles	0	3	0	3	1	1	1	2
Number of occurrences of 1/4 mile queue in non-peak hour	0	0	0	1	0	0	0	0

To help gauge the results of QUEWZ and the ODOT queue spreadsheet to predict the potential backups the existing condition was monitored during the AM and PM peak hours during the month of August, 2013 to visually determine the existing density and become comfortable with the computer generated queues resulting from reduced densities within the work zones. To accomplish the field observation REL utilized the ODOT OHGO Real-time Ohio traffic web site and the available web cameras along the IR 480 corridor near the project limits. Screen captures were collected every thirty minutes during the AM and PM peaks. ATR data for the corresponding days and times was collected. The video evidence of AM and PM peak traffic volumes (capacities) and how this correlates to queues is shown below. The table above indicates that in the westbound direction with a volume of 1560 vehicles per lane per hour there are 3 PM hours where the queue is calculated to exceed 1.5 miles, 4 PM through 6 PM. Video collected during these hours in August 2013 indicates that the existing traffic in the westbound direction currently operates above 1650 vehicles per lane per hour and queues along the corridor are present.

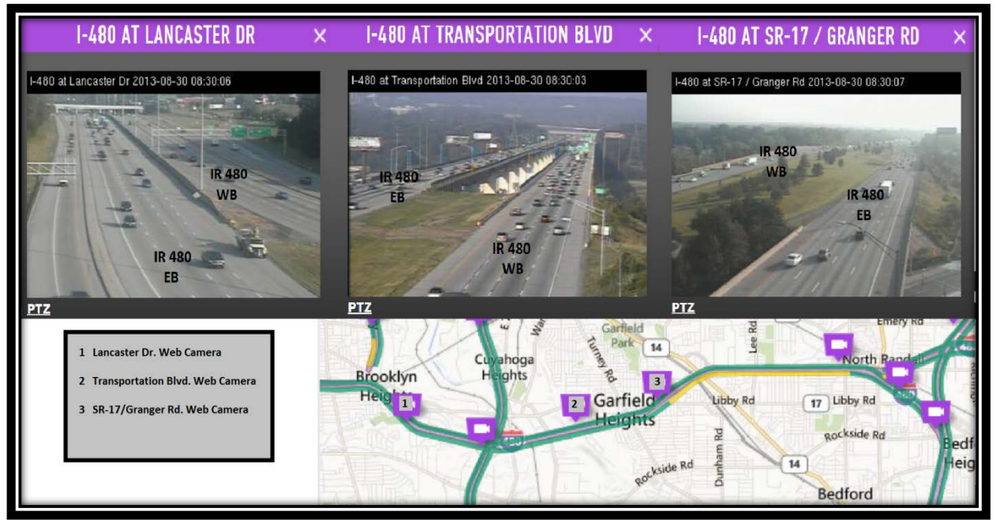
Below are screen captures of a typical AM and PM traffic volume (capacities) in August showing the traffic on the bridge in the top middle view and the resulting slowdown indicated by the colored segment of IR 480 WB on the lower map near the "Garfield Heights" label. The actual hourly traffic volumes collected during the web cam screen shots are shown below each. Red segments indicates prevailing traffic speeds of between 0 and 25 mph, although during the collection of data there never appeared to be traffic approaching a complete stop on the IR 480 corridor. See pictures below.



OHGO web camera screen captures – IR 480 – Thursday, August 8, 2013, 5:08pm
Actual Hourly Traffic Volumes:
6231 Eastbound = 1558 vehicles per lane per hour
6663 Westbound = 1666 vehicles per lane per hour



OHGO web camera screen captures – IR 480 – Friday, August 9, 2013, 8:00am
Actual Hourly Traffic Volumes:
4829 Eastbound = 1207 vehicles per lane per hour
5630 Westbound = 1408 vehicles per lane per hour



OHGO web camera screen captures – IR 480 – Friday, August 30, 2013, 8:30am
Actual Hourly Traffic Volumes:
5763 Eastbound = 1441 vehicles per lane per hour
5736 Westbound = 1434 vehicles per lane per hour

OHGO web camera screen captures – IR 480 – Friday, August 30, 2013, 5:00pm
Actual Hourly Traffic Volumes:
6617 Eastbound = 1654 vehicles per lane per hour
7354 Westbound = 1839 vehicles per lane per hour

It appears that the results provided by QUEWZ and the ODOT Queue spreadsheet for the existing condition without a work zone are not reflective of the actual conditions. AM and PM peak hours routinely appeared to have traffic slowing as the volumes approached 1600 vehicles per lane per hour. As a comparison the peak AM and PM hourly traffic volumes used in the ODOT Queue spreadsheet were input into HCS Basic Freeway Segments Operational Analysis. The results of the HCS analysis represented in capacity (vehicles per lane per hour), level of service and average passenger car speed through the segment are shown on the Work Zone Alternatives – Operational Comparison spreadsheet. HCS indicates that the freeway segment operates at a level of service D for the AM and the PM peak hours with an average passenger car speed of over 60 mph. The HCS input was not adjusted to consider the impact that the IR 77 ramps and the Transportation Boulevard Ramps may have on the efficiency of the roadway segment. Therefore it is assumed that the capacity, level of service, and average speed are slightly optimistic for the actual field conditions.

The QUEWZ and the ODOT Queue spreadsheet results were also compared to the ODOT permitted Lane Closure Chart (PLCM) to determine the correlation between these two analysis tools. The capacity calculated for the eastbound direction in QUEWZ is essentially the same as the capacity shown on the PLCM (1488 veh/lane/hour in QUEWZ vs. 1490 veh/lane/hour in PLCM). In the westbound direction QUEWZ calculates a larger work zone capacity than what is shown on the PLCM (1560 veh/lane/hour in QUEWZ vs. 1490 veh/lane/hour in PLCM). The AM and PM peak hours from the ATR used in the ODOT Queue spreadsheet fall within the limits of the PLCM closure restriction times.

The result of these operational comparisons is that the QUEWZ and ODOT Queue spreadsheet offer a conservative calculation for the actual conditions that could be expected in the field. The results of the ODOT Queue spreadsheet represented in queue lengths provide a relative comparison between the different MOT scenarios and do not necessarily indicate the queue lengths calculated will be present during construction.

Maintenance of Traffic Alternatives – QUEWZ Evaluation

For each of the five MOT alternatives being developed a QUEWZ evaluation was completed and the associated MOT traffic volumes were calculated. The MOT traffic volumes from QUEWZ were input into the ODOT Queue spreadsheet along with the hourly traffic volumes from ATR #583 for a Friday in August, 2012 and MOT queues were calculated. Below is a summary of the QUEWZ and ODOT spreadsheet results for each of the five MOT Alternatives:

Alternative 1.a(70) - Same Width Deck Replacement – Maintain 3 Lanes WB (on bridge only) & 4 Lanes EB ("5+2") - Modify existing and proposed shoulder cross slope. Phase 1 and 2 MOT traffic configuration and Phase 3 and 4 MOT traffic configurations are essentially the same.

Phase 1 and 2 provides 3 (11') westbound MOT travel lanes and 2 (11') eastbound travel lanes on the left bridge. The eastbound (right) bridge is under construction and provides for 2 (11') eastbound MOT travel lanes. QUEWZ output file ir480_23.out was prepared for the right bridge and file ir480_24.out was prepared for the left bridge. The right bridge carries the IR 480 eastbound through traffic and the left bridge carries the IR 480 traffic that is from the IR 77 ramps. The results from QUEWZ for the volume of traffic through the work zone is the same based upon the direction of travel. Westbound MOT traffic volume is 1482 vehicles per lane per hour and eastbound MOT traffic volume is 1413 vehicles per lane per hour.

Using the MOT traffic volumes from QUEWZ the ODOT Queue spreadsheet queue lengths for the MOT traffic was calculated. Excel file CUY480WB_2Aug_Fri for the westbound traffic indicates a maximum queue of 47.4 miles in the PM peak. The percentage of traffic diversion required to limit the queue to a 1.5 mile maximum backup beyond the existing condition is 26%, an average of 1650 vehicles per hour during the PM peak hours. The queue length for the IR 480 through traffic crossed over to the left bridge is in Excel file CUY480EB_2Aug_Fri and indicates a maximum queue of 12.2 miles in the AM peak. The percentage of traffic diversion required to limit the queue to a 1.5 mile maximum backup beyond the existing condition is 18%, an average of 500 vehicles per hour during the AM peak hours. The queue length for the IR 480 eastbound traffic from the IR 77 ramps on the right bridge has a maximum queue of 3.6 miles in the PM peak. The percentage of traffic diversion required to limit the queue to a 1.5 mile maximum backup beyond the existing condition is 1%, an average of 30 vehicles per hour during the PM peak hours.

Phases 3 and 4 provide 4 (11') eastbound MOT travel lanes and 1 (12') westbound travel lane on the right bridge. The westbound (left) bridge is under construction and provides for 2 (11') westbound MOT travel lanes. QUEWZ output file ir480_25.out was prepared for the right bridge and file ir480_26.out was prepared for the left bridge. The right bridge carries 4 lanes of IR 480 eastbound traffic and one through lane of IR 480 westbound traffic, the left bridge carries westbound IR 480 through traffic or westbound IR 480 traffic to the IR 77 ramps. The results from QUEWZ for the volume of traffic through the work zone is the same based upon the direction of travel. Westbound MOT traffic volume is 1482 vehicles per lane per hour and eastbound MOT traffic volume is 1413 vehicles per lane per hour.

Using the MOT traffic volumes from QUEWZ the ODOT Queue spreadsheet queue lengths for the MOT traffic was calculated. Excel file CUY480EB_2Aug_Fri for the eastbound traffic indicates a maximum queue of 4.1 miles in the PM peak. The percentage of traffic diversion required to limit the queue to a 1.5 mile maximum backup beyond the existing condition is 2%, an average of 120 vehicles per hour during the PM peak hours. The queue length for the IR 480 through traffic crossed over to the right bridge is in Excel file CUY480WB_2Aug_Fri. The hourly traffic volumes used for the single lane crossover is approximately a third of the total westbound traffic. The ODOT Queue spreadsheet indicates a maximum queue of 48.9 miles in the PM peak. The percentage of traffic diversion required to limit the queue to a 1.5 mile maximum backup beyond the existing condition is 26%, an average of 560 vehicles per hour during the PM peak hours. The queue length for the IR 480 westbound traffic on the right bridge has a maximum queue of 48.9 miles in the PM peak. The percentage of traffic diversion required to limit the queue to a 1.5 mile maximum backup beyond the existing condition is 26%, an average of 1110 vehicles per hour during the PM peak hours.

The results of QUEWZ and the ODOT spreadsheet indicate that the reduction of the westbound traffic from 4 lanes to 3 lanes results in anticipated queue lengths in excess of 45 miles with the duration of the queues lasting 18 hours of the day. The 4 lane MOT eastbound lane configurations result in slightly larger queues and durations than the existing condition.

Alternative 3.a(72) - Widen Existing and New Bridge - Deck Replacement- Maintain 4 (min. 10') Lanes WB & EB ("6+2") - Modify existing and proposed shoulder cross slope. Phase 1 and 2 MOT traffic configuration and Phase 3 and 4 MOT traffic configurations are essentially the same.

Phase 1 and 2 provides 4 (10') westbound MOT travel lanes and 2 (10') eastbound travel lanes on the left bridge. The eastbound (right) bridge is under construction and provides for 2 (12') eastbound MOT travel lanes. QUEWZ output file ir480_31.out was prepared for the right bridge and file ir480_32.out was prepared for the left bridge. The left bridge carries the IR 480 eastbound through traffic and the right bridge carries the IR 480 traffic that is from the IR 77 ramps. The results from QUEWZ for the eastbound volume of traffic through the work zone on the right bridge maintaining 12 foot MOT lanes is 1488 vehicles per lane per hour. The MOT eastbound traffic volume on the left bridge maintaining 10 foot MOT lanes is 1339 vehicles per lane per hour. Westbound MOT traffic volumes are the same, 1404 vehicles per lane per hour.

Using the MOT traffic volumes from QUEWZ the ODOT Queue spreadsheet queue lengths for the MOT traffic was calculated. Excel file CUY480WB_2Aug_Fri_ALT3a72 for the westbound traffic indicates a maximum queue of 12.7 miles in the PM peak. The percentage of traffic diversion required to limit the queue to a 1.5 mile maximum backup beyond the existing condition is 6%, an average of 380 vehicles per hour during the PM peak hours. The queue length for the IR 480 through traffic crossed over to the left bridge is in Excel file CUY480EB_2Aug_Fri_ALT3a72 and indicates a maximum queue of 18.1 miles in the PM peak. The percentage of traffic diversion required to limit the queue to a 1.5 mile maximum backup beyond the existing condition is 21%, an average of 780 vehicles per hour during the AM peak hours. The queue length for the IR 480 eastbound traffic from the IR 77 ramps on the right

bridge has a maximum queue of 2.2 miles in the PM peak. The 2 (12') MOT lanes with the ramp traffic only function better than the current condition, therefore no traffic diversion is necessary.

Phases 3 and 4 provide 4 (10') eastbound MOT travel lanes and 2 (10') westbound travel lanes on the right bridge. The westbound (left) bridge is under construction and provides for 2 (12') westbound MOT travel lanes. QUEWZ output file ir480_33.out was prepared for the right bridge and file ir480_34.out was prepared for the left bridge. The right bridge carries 4 lanes of IR 480 eastbound traffic and two through lanes of IR 480 westbound traffic, the left bridge carries westbound IR 480 through traffic or westbound IR 480 traffic to the IR 77 ramps. The results from QUEWZ for the westbound volume of traffic through the work zone on the left bridge maintaining 12 foot MOT lanes is 1560 vehicles per lane per hour. The MOT westbound traffic volume on the right bridge maintaining 10 foot MOT lanes is 1404 vehicles per lane per hour. Eastbound MOT traffic volumes are the same, 1339 vehicles per lane per hour.

Using the MOT traffic volumes from QUEWZ the ODOT Queue spreadsheet queue lengths for the MOT traffic was calculated. Excel file CUY480WB_2Aug_Fri_ALT3a72 for the eastbound traffic indicates a maximum queue of 6.2 miles in the PM peak. The percentage of traffic diversion required to limit the queue to a 1.5 mile maximum backup beyond the existing condition is 3%, an average of 360 vehicles per hour during the PM peak hours. The queue length for the IR 480 through traffic crossed over to the right bridge is in Excel file CUY480WB_2Aug_Fri_ALT3a72. The hourly traffic volumes used for the cross over is half of the total westbound traffic. The ODOT Queue spreadsheet indicates a maximum queue of 12.7 miles in the PM peak. The percentage of traffic diversion required to limit the queue to a 1.5 mile maximum backup beyond the existing condition is 6%, an average of 190 vehicles per hour during the PM peak hours. The queue length for the IR 480 westbound traffic on the right bridge has a maximum queue of 6.2 miles in the PM peak. The 2 (12') MOT lanes on the left bridge with half of the westbound traffic volume functions better than the current condition, therefore no traffic diversion is necessary.

The results of QUEWZ and the ODOT spreadsheet indicate that the split of the IR 480 eastbound traffic on the cross over in Phases 1 and 2 results in anticipated queue lengths in excess of 18 miles with the duration of the queues lasting 15 hours of the day. The IR 480 westbound traffic in Phases 1 and 2 with 4 (10') MOT lanes functions the same as the two westbound cross over lanes in Phase 3 and 4 with anticipated queue lengths in excess of 12 miles with the duration of the queues lasting 10 hours of the day.

Alternative 3.b(72) - Widen New Bridge - Deck Replacement- Phases 1 & 2 Maintain 3 Lanes WB & 4 Lanes EB ("5+2"); Phases 3 & 4 Maintain 4 Lanes WB & EB & ("6+2") – Modify existing and proposed shoulder cross slope. Alternative 3.b(72) is a combination of Alternative 1(70) in Phases 1 and 2 and Alternative 3.a(72) in Phases 3 and 4. MOT traffic configurations are the same and the resulting MOT traffic volumes, queues and required diversions are the same as the other MOT alternatives.

Alternative 3.c - Widen EB Substructure and Superstructure – Deck Replacement- Maintain 4 Lanes WB & EB all Phases; Phases 1 & 3 ("5+3"); Phase 2 ("4+4"); Phases 4 & 5 ("6+2"). Phase 1 and 3 MOT traffic configuration and Phase 4 and 5 MOT traffic configurations are essentially the same. Phase 2 MOT traffic configuration is similar to the existing lane configuration with a slight reduction in the eastbound volume due to narrow lane widths.

Phase 1 and 3 provides 4 (11') westbound MOT travel lanes and one (10') eastbound travel lane on the left bridge. The eastbound (right) bridge is under construction and provides for 3 (11') eastbound MOT travel lanes. QUEWZ output file ir480_35.out was prepared for the right bridge and file ir480_36.out was prepared for the left bridge. The left bridge carries one lane of IR 480 eastbound through traffic. In Phase 1 the right bridge carries the remaining two lanes of IR 480 through traffic and two lanes of IR 77 ramp traffic which merge with IR 480 traffic similar to the existing condition. In Phase 3 the right bridge carries the remaining IR 480 through traffic in one lane and two lanes from the IR 77 ramps. The results from QUEWZ for the eastbound volume of traffic through the work zone on the right bridge maintaining 11 foot MOT lanes is 1413 vehicles per lane per hour. The MOT eastbound traffic volume on the left bridge maintaining a 12 foot MOT lane is 1488 vehicles per lane per hour. Westbound MOT traffic volumes are the same, 1482 vehicles per lane per hour.

Using the MOT traffic volumes from QUEWZ the ODOT Queue spreadsheet queue lengths for the MOT traffic was calculated. Excel file CUY480WB_2Aug_Fri_ALT3c for the westbound traffic indicates a maximum queue of 9.1 miles in the PM peak. The percentage of traffic diversion required to limit the queue to a 1.5 mile maximum backup beyond the existing condition is 1%, an average of 65 vehicles per hour during the PM peak hours. The queue length for the IR 480 through traffic crossed over to the left bridge is in Excel file CUY480EB_2Aug_Fri and indicates a maximum queue of 2.5 miles in the AM peak. This queue was generated using 45% of the IR 480 eastbound traffic hourly volumes. The single lane carrying 45% of the through traffic functions better than the current condition, therefore no traffic diversion is necessary. The queue length for 55% of IR 480 eastbound traffic and IR 77 ramp traffic on the right bridge has a maximum queue of 8.1 miles in the PM peak. The percentage of traffic diversion required to limit the queue to a 1.5 mile maximum backup beyond the existing condition is 7%, an average of 340 vehicles per hour during the PM peak hours.

Phase 2 MOT traffic configuration is similar to the existing lane configuration with a slight reduction in the eastbound volume due to the 11 foot lane widths. The 4 (11') eastbound MOT lanes are the same as the eastbound MOT lane configuration and result in the same traffic volumes, queues and required diversions MOT Alternative 1(70), Phase 3 and 4. The westbound MOT lane configuration is the same as the existing condition.

Phase 4 and 5 provides 4 (11') eastbound MOT travel lanes and 2 (12') westbound travel lanes on the right bridge. The westbound (left) bridge is under construction and provides for 2 (11') westbound MOT travel lanes. QUEWZ output file ir480_37.out was prepared for the right bridge and file ir480_38.out was prepared for the left bridge. The left bridge carries 2 lanes of IR 480 westbound traffic and IR 77 exit ramp traffic. The right bridge carries the remaining IR 480 through traffic. The MOT westbound traffic volume on the left bridge maintaining 2 (11') MOT lanes is 1482 vehicles per lane per hour. Westbound MOT traffic on the right bridge maintaining 2 (12') lanes is 1560 vehicles per lane per hour. The 4 (11') eastbound MOT lanes are the same as MOT Alternative 1(70), Phase 3 and 4 and result in the same traffic volumes, queues and required diversions as MOT Alternative 1(70), Phase 3 and 4.

Using the MOT traffic volumes from QUEWZ the ODOT Queue spreadsheet queue lengths for the MOT traffic was calculated. The queues for the westbound traffic hourly volumes were generated using 50% split of the total IR 480 westbound hourly traffic volumes. Excel file CUY480WB_2Aug_Fri_ALT3c for the westbound through traffic on the right bridge indicates a

maximum queue of 6.2 miles in the PM peak. The 2 (12') MOT lanes on the right bridge with half of the westbound traffic volume functions better than the current condition, therefore no traffic diversion is necessary. The queue length for the IR 480 through traffic and IR 77 ramp traffic remaining on the left bridge is in Excel file CUY480WB_2Aug_Fri_ALT3c and indicates a maximum queue of 9.1 miles in the PM peak. The percentage of traffic diversion required to limit the queue to a 1.5 mile maximum backup beyond the existing condition is 1%, an average of 35 vehicles per hour during the PM peak hours.

Alternative 3.c maintains four lanes of traffic in all MOT phases. The results of QUEWZ and the ODOT spreadsheet indicate that the reduction of lane widths in all phases produce a slight increase in the anticipated queues. The overall number of hours for which queues are calculated during the MOT phases are the same as the existing condition with the exception of Phase 3 eastbound IR 480 which will reduce the number of through lanes from 3 to 2 prior to the bridge. Phase 3 will result in queue lengths similar to Alternative 1.a Phases 1 and 2.

Alternative 5 - New WB Bridge in Median - Maintain 4 Lanes WB & EB. Alternative 5 maintains four lanes of traffic in all MOT phases. The lane widths in all MOT conditions will be 12 feet, theoretically, the hourly volume of traffic per lane per hour during the construction should be the same as the existing condition. Alternative 5 should have no impact on traffic on the bridge. The IR 77 ramp lanes to IR 480 eastbound will be merged from 2 lanes to 1 lane prior to entering the mainline in Phase 1 when the eastbound lanes are moved onto the new bridge constructed in the median. The single ramp lane will become an add lane to the IR 480 eastbound traffic.

Maintenance of Traffic Alternatives – Summary

Five maintenance of traffic alternatives have been developed in accordance with the ODOT Traffic Engineering Manual, Section 600, Temporary Traffic Control, 630-5 Maintenance of Traffic Alternative Analysis (MOTAA). Included in the Appendix of the Maintenance of Traffic Alternatives Analysis Report are the components as required by the TEM. The Appendix includes:

- Lane Configuration Diagrams and typical sections for each alternative at critical locations.
- Constraint Table Form (Form 696-1a)
- Bridge Information Form (Form 696-2a)
- Ramp Information Form (Form 696-3a)
- Cost Comparison Form (Form 696-4a)
- Work Zone Alternatives - Operational Comparison Form

A summary of the information for each Maintenance of Traffic Alternative compiled on the forms is provided below. Information presented on the forms which may be interpreted as significant will be mentioned. Information that is similar to all alternatives or considered medium impact will not be noted. Conditions that have very little impact or may be considered an improvement will be noted.

Maintenance of Traffic Alternative 1.a(70) - Same Width Deck Replacement – Maintain 3 Lanes Westbound and 4 Lanes Eastbound.

Constraint Table
- Does not meet the Work Zone Policy. MOTEC required. Only 3 lanes maintained westbound across the bridge. Four lanes of MOT traffic are maintained on the eastbound bridge. However, in Phases 1 and 2 IR 480 eastbound through lanes are reduced from 3 to 2 prior to the bridge.

Bridge Information
- The new IR 480-18.42 L & R bridge deck widths will match the existing deck widths.

Ramp Information
- Improved operation of ramps from IR 77 to eastbound IR 480 in Phases 1 and 2 (No merge required).
- Restricted access from the IR 480 westbound exit ramps to IR 77 in Phases 3 and 4.
- No access to the Transportation Boulevard exit in Phases 1 and 2 from eastbound IR 480 through lanes crossed over to the left bridge.
- Transportation Boulevard entrance ramp will merge into reduced lanes on IR 480 westbound, three lanes in Phases 1 and 2, and two lanes in Phases 3 and 4.

Cost Comparison
- $21,687,221

Operational Comparison
- The 3 westbound MOT lanes in all four phases produce queue lengths that are over six times longer than the existing condition with a work zone introduced.

Alternative 3.a(72) - Widen Existing and New Bridge Deck – Deck Replacement – Maintain 4 Lanes Westbound and 4 Lanes Eastbound.

Constraint Table
- Does not meet the Work Zone Policy. MOTEC required. Four lanes of MOT traffic are maintained on the bridge eastbound. However, in Phases 1 and 2 IR 480 eastbound through lanes are reduced from 3 to 2 prior to the bridge.

Bridge Information
- The existing IR 480-18.42 L bridge deck will be widened in a pre-phase to maintain four westbound MOT lanes in Phases 1 and 2.
- The new IR 480-18.42 L & R bridge decks will be widened two feet to maintain four westbound lanes during construction.

Ramp Information
- Improved operation of ramps from IR 77 to eastbound IR 480 in Phases 1 and 2 (No merge required).
- Restricted access from the IR 480 westbound exit ramps to IR 77 in Phases 3 and 4.
- No access to the Transportation Boulevard exit in Phases 1 and 2 from eastbound IR 480 through lanes crossed over to the left bridge.
- Transportation Boulevard entrance ramp will merge into 2 lanes on IR 480 westbound in Phases 3 and 4.

Cost Comparison
- $29,154,159

Operational Comparison

- The westbound MOT lanes produce queue lengths that are almost double the existing condition due to the reduction in lane width.
- The eastbound MOT lanes crossed over to the left bridge in Phases 1 and 2 produce queue lengths that are nine times the existing condition due to the reduction in lane widths.

Alternative 3.b(72) - Widen New Bridge Deck - Deck Replacement- Phases 1 and 2 will Maintain 3 Lanes Westbound and 4 Lanes Eastbound ("5+2"); Phases 3 and 4 will Maintain 4 Lanes Westbound and Eastbound ("6+2").

Constraint Table
- Does not meet the Work Zone Policy. MOTEC required. Only 3 lanes maintained westbound across the bridge in Phases 1 and 2. Four lanes of MOT traffic are maintained on the bridge eastbound. However, in Phases 1 and 2 IR 480 eastbound through lanes are reduced from 3 to 2 prior to the bridge.

Bridge Information
- The new IR 480-18.42 R bridge decks will be widened two feet to accommodate maintaining four westbound lanes during Phases 3 and 4.
- Maintenance of Traffic Phases 1 and 2 are similar to Alternative 1 Phases 1 and 2; Maintenance of Traffic phases 3 and 4 are similar to Alternative 3.a Phases 3 and 4

Ramp Information
- Improved operation of ramps from IR 77 to eastbound IR 480 in Phases 1 and 2 (No merge required).
- Restricted access from IR 480 westbound to the IR 77 ramps in Phases 3 and 4
- No access to the Transportation Boulevard exit in Phases 1 and 2 from eastbound IR 480 through lanes crossed over to the left bridge.
- Transportation Boulevard entrance ramp will merge into reduced lanes on IR 480 westbound, 3lanes in Phases 1 and 2, and 2 lanes in Phases 3 and 4.

Cost Comparison
- $30,068,768

Operational Comparison
- The 3 westbound MOT lanes in Phases 1 and 2 produce queue lengths that are over six times higher than the existing condition.

Alternative 3.c - Widen Eastbound Substructure and Superstructure – Widen Eastbound Bridge Deck – Deck Replacement. Maintain 4 Lanes Westbound and Eastbound all Phases. Phases 1 and 3 utilize a ("5+3") MOT concept; Phase 2 is ("4+4"); and Phases 4 and 5 utilize a ("6+2") MOT concept.

Constraint Table
- Does not meet the Work Zone Policy. MOTEC required. Four lanes of MOT traffic are maintained on the bridge for both eastbound and westbound. However, in Phase 3 one IR 480 eastbound lane is crossed over the left bridge. The two eastbound lanes remaining in the normal lane locations are reduced to a single lane west of the bridge to eliminate a merge with the two IR 77 ramp lanes. Therefore only 2 eastbound IR 480 lanes are maintained for a short distance west of the bridge.

Bridge Information
- Additional cost to widen the substructure and superstructure.
- Additional 23 feet of bridge deck width to be underutilized in existing lane configuration.
- An additional eastbound could be marked and utilized by the IR 77 entrance ramp traffic. The additional lane would become a drop lane at Transportation Boulevard.
- Phase 2 will remain in place over a winter season with reduced lane and shoulder widths and portable concrete barrier.

Ramp Information
- IR 480 eastbound is reduced from three lanes to two lanes west of the bridge in Phases 4 and 5.
- Restricted access from IR 480 westbound to the IR 77 ramps in Phases 4 and 5.

Cost Comparison
- $71,079,381

Operational Comparison
- The operation of the westbound and eastbound MOT lanes produce queue lengths and number of queue hours that are only slightly above the existing condition.

Alternative 5 - New Westbound Bridge in Median - Maintain 4 Lanes Westbound and Eastbound.

Constraint Table
- Meets the Work Zone policy. Four lanes maintained on the bridge at all times. New westbound alignments and pavement will be required accommodated the new westbound bridge.

Bridge Information
- Expensive to replace the existing westbound bridge with a new westbound bridge.

Ramp Information
- The ramps from IR 77 to eastbound IR 480 in Phase 1 will be merged into a single lane prior to the bridge and become an add lane.

Cost Comparison
- $111,996,569

Operational Comparison
- The MOT traffic volumes and queues will be the same as the existing condition.

The MOTAA has been provided for 13 Alternatives. Numerous Alternatives were not considered after an initial evaluation determined that there were fatal flaws that eliminated them from further consideration. Five alternatives were carried forwarded and the components as outlined in the ODOT Traffic Engineering Manual were assembled for each. Additionally, an operational comparison was prepared to determine the efficiency which each could be constructed while maintaining traffic. The information has been presented and based upon the information ODOT will select a preferred maintenance of traffic alternative.

MAINTENANCE OF TRAFFIC ALTERNATIVE ANALYSIS

CUY-480-18.42 L/R, PID No. 90591

APPENDIX

ODOT Permitted Lane Closure Chart – IR 480
District 12 Permitted Lane Closure Chart – IR 480
Lane Configuration Diagrams and Cross Sections
Work Zone Constraint Table
Bridge Information Table
Ramp Information Table
Cost Comparison Table
Operational Comparison Table
QUEWZ output
ODOT Queue spreadsheet output

ODOT Permitted Lane Closure

Print

District: 12	County: CUY	Route: IR-480	DIR: EAST	Calculation Year: 2013	Section: 21 over pass to Camden (EAST)

COUNTY BEGIN LOG 17.890
COUNTY END LOG 21.540
STATE BEGIN LOG 20.060
STATE END LOG 23.710

Calculation Method: A — ATR-Actual Hourly Breakdowns with ADT
Road Class: URBAN (Urban or Rural)
Terrain: LEVEL
Lanes per direction: 4

ATR#: 583
ATR Year: 2012
Percent Trucks: 5
Annualized ADT: 0

Seasonal Traffic Adjustment

	Weekday	Weekend	
ATR	89114	61397	Summer
ATR	82191	62173	Spring/Fall
ATR	79368	57798	Winter

Capacity 1490 per lane

There shall be no lane closures on Holidays or Holiday weekends. The following are considered holidays. Memorial Day, Fourth of July, Labor Day, Thanksgiving, Christmas , New Years, Easter. No lane closures are allowed after 12 noon on the day preceding a holiday. For holiday weekends no lane closures are allowed after 12 noon on the day preceding the Holiday weekend until 6 am the day after the holiday weekend. Ex. Holiday falls on a Monday then no lane closures from 12 noon on Friday until 6 am Tuesday.

Ratio of Lanes	4:3	Traffic Volume per open lane				
Season	Summer Weekday	Summer Weekend	Spring/Fall Weekday	Spring/Fall Weekend	Winter Weekday	Winter Weekend
Hour of the Day	MON-FRI	SAT-SUN	MON-FRI	SAT-SUN	MON-FRI	SAT-SUN
0-1AM	261	414	271	423	229	353
1-2AM	161	263	162	263	136	212
2-3AM	144	244	148	243	138	208
3-4AM	157	192	160	188	156	145
4-5AM	273	185	258	212	290	168
5-6AM	763	317	722	337	775	299
6-7AM	* **1883**	568	* **1700**	580	* **1731**	473
7-8AM	* **2246**	778	* **1945**	792	* **1791**	733
8-9AM	* **1879**	918	* **1766**	990	* **1634**	896
9-10AM	* **1500**	1023	* **1518**	1085	1376	1021
10-11AM	1450	1120	1399	1149	1324	1089
11-12PM	1442	1245	1433	1255	1369	1242
12-1PM	* **1504**	1343	* **1503**	1361	1450	1343
1-2PM	* **1621**	1354	* **1550**	1339	* **1550**	1326
2-3PM	* **1793**	1347	* **1721**	1234	* **1634**	1335
3-4PM	* **2117**	1333	* **1790**	1406	* **1699**	1360
4-5PM	* **2129**	1359	* **1849**	1381	* **1770**	1317
5-6PM	* **1994**	1258	* **1891**	1217	* **1887**	1215
6-7PM	* **1557**	1143	1403	1107	1374	983
7-8PM	1106	952	1040	1017	978	834
8-9PM	833	854	891	801	831	702
9-10PM	909	857	867	880	907	733
10-11PM	1011	752	755	813	904	746
11-12AM	973	646	656	651	522	532

Legend

* = Lane Closure(s) Not Permitted

4:3 : Ratio Of Lanes
4 : Available Lanes
3 : Lanes Open

Season	Period
Summer	June 1 - Aug 31
Spring/Fall	Mar 1 - May 31 & Sept 1 - Nov 30
Winter	Dec 1 - Feb 29

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Ratio of Lanes	4:2	Traffic Volume per open lane				
Season	Summer Weekday	Summer Weekend	Spring/Fall Weekday	Spring/Fall Weekend	Winter Weekday	Winter Weekend
Hour of the Day	MON-FRI	SAT-SUN	MON-FRI	SAT-SUN	MON-FRI	SAT-SUN
0-1AM	392	621	406	635	344	530
1-2AM	241	394	243	395	204	318
2-3AM	216	366	222	365	207	312
3-4AM	235	288	241	281	234	217
4-5AM	410	278	387	318	435	252
5-6AM	1144	476	1083	505	1163	448
6-7AM	* **2825**	852	* **2550**	870	* **2597**	709
7-8AM	* **3369**	1168	* **2918**	1189	* **2687**	1100
8-9AM	* **2819**	1377	* **2649**	1486	* **2451**	1345
9-10AM	* **2251**	* **1535**	* **2277**	* **1628**	* **2064**	* **1532**
10-11AM	* **2175**	* **1680**	* **2098**	* **1724**	* **1987**	* **1634**
11-12PM	* **2163**	* **1868**	* **2150**	* **1883**	* **2054**	* **1863**
12-1PM	* **2256**	* **2015**	* **2255**	* **2042**	* **2175**	* **2015**
1-2PM	* **2432**	* **2031**	* **2325**	* **2009**	* **2326**	* **1990**
2-3PM	* **2690**	* **2021**	* **2582**	* **1851**	* **2452**	* **2003**
3-4PM	* **3176**	* **1999**	* **2686**	* **2108**	* **2549**	* **2040**
4-5PM	* **3193**	* **2039**	* **2774**	* **2072**	* **2655**	* **1976**
5-6PM	* **2991**	* **1886**	* **2836**	* **1826**	* **2831**	* **1823**
6-7PM	* **2336**	* **1714**	* **2105**	* **1660**	* **2061**	1475
7-8PM	* **1659**	1428	* **1560**	* **1525**	1468	1251
8-9PM	1249	1282	1336	1201	1247	1053
9-10PM	1363	1286	1301	1321	1361	1100
10-11PM	* **1517**	1129	1133	1219	1356	1118
11-12AM	1460	969	984	976	783	798

12: *Shoulder closures shall only be allowed at the times specified for lane closures*
12.09: *The contractor will be accessed Road User Costs in the amount determined by Quewz-98 for lanes that are closed outside of the PLCM. Road user costs are very high, most will be $3,000. to $6,000. per hour. In some cases road users costs may be higher.*
12.11: *Three lane closures may be taken on any 4 lane section from 1 a.m. to 5 a.m..*

Home Search

ODOT Permitted Lane Closure

Print

District: 12	County: CUY	Route: IR-480	DIR: WEST	Calculation Year: 2013	Section: Broadway on ramp to SR 21 overpass (WEST)

COUNTY BEGIN LOG 18.280
COUNTY END LOG 21.370
STATE BEGIN LOG 20.450
STATE END LOG 23.540

Calculation Method: B — ATR-Hourly Breakdowns (with similar functionality)
Road Class: URBAN (Urban or Rural)
Terrain: LEVEL
Lanes per direction: 4

ATR#: 583
ATR Year: 2012
Percent Trucks: 5
Annualized ADT: 145740

Seasonal Traffic Adjustment

	Weekday	Weekend	
ATR	179926	134944	Summer
ATR	175590	128973	Spring/Fall
ATR	153411	110409	Winter

Capacity 1490 per lane

There shall be no lane closures on Holidays or Holiday weekends. The following are considered holidays. Memorial Day, Fourth of July, Labor Day, Thanksgiving, Christmas , New Years, Easter. No lane closures are allowed after 12 noon on the day preceding a holiday. For holiday weekends no lane closures are allowed after 12 noon on the day preceding the Holiday weekend until 6 am the day after the holiday weekend. Ex. Holiday falls on a Monday then no lane closures from 12 noon on Friday until 6 am Tuesday.

Ratio of Lanes	4:3	Traffic Volume per open lane				
Season	Summer Weekday	Summer Weekend	Spring/Fall Weekday	Spring/Fall Weekend	Winter Weekday	Winter Weekend
Hour of the Day	MON-FRI	SAT-SUN	MON-FRI	SAT-SUN	MON-FRI	SAT-SUN
0-1AM	253	431	228	339	199	290
1-2AM	160	270	156	216	136	185
2-3AM	138	180	127	187	111	160
3-4AM	145	150	178	151	156	129
4-5AM	226	142	282	170	247	146
5-6AM	580	274	719	254	628	217
6-7AM	1447	515	* 1495	496	1306	425
7-8AM	* 2208	703	* 1913	708	* 1671	606
8-9AM	* 1949	910	* 1748	908	* 1527	777
9-10AM	* 1503	1096	* 1556	1130	1359	968
10-11AM	1356	1233	1412	1272	1233	1089
11-12PM	1418	1380	* 1561	1422	1364	1218
12-1PM	* 1535	1465	* 1620	* 1574	1415	1347
1-2PM	* 1606	* 1514	* 1717	* 1499	* 1500	1283
2-3PM	* 1942	* 1535	* 1919	* 1505	* 1677	1288
3-4PM	* 2226	* 1583	* 2110	* 1507	* 1844	1290
4-5PM	* 2368	* 1495	* 2153	1442	* 1881	1235
5-6PM	* 2302	* 1538	* 2287	1462	* 1998	1251
6-7PM	* 2203	1428	* 1912	1360	* 1671	1164
7-8PM	1247	1195	1167	1058	1020	905
8-9PM	894	1033	888	849	776	727
9-10PM	902	928	833	802	728	687
10-11PM	791	844	745	655	651	560
11-12AM	588	650	539	529	471	453

Legend

* = Lane Closure(s) Not Permitted

4:3 : Ratio Of Lanes
4 : Available Lanes
3 : Lanes Open

Season	Period
Summer	June 1 - Aug 31
Spring/Fall	Mar 1 - May 31 & Sept 1 - Nov 30
Winter	Dec 1 - Feb 29

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Ratio of Lanes	4:2	Traffic Volume per open lane				
Season	Summer Weekday	Summer Weekend	Spring/Fall Weekday	Spring/Fall Weekend	Winter Weekday	Winter Weekend
Hour of the Day	MON-FRI	SAT-SUN	MON-FRI	SAT-SUN	MON-FRI	SAT-SUN
0-1AM	380	646	342	509	298	436
1-2AM	240	406	234	324	205	277
2-3AM	206	270	190	281	166	240
3-4AM	218	225	268	226	234	194
4-5AM	340	212	424	255	370	219
5-6AM	870	411	1078	380	942	326
6-7AM	* 2171	773	* 2243	744	* 1960	637
7-8AM	* 3312	1054	* 2869	1062	* 2506	909
8-9AM	* 2924	1364	* 2622	1362	* 2291	1166
9-10AM	* 2254	* 1644	* 2334	* 1695	* 2039	1451
10-11AM	* 2034	* 1849	* 2118	* 1909	* 1850	* 1634
11-12PM	* 2127	* 2069	* 2342	* 2134	* 2046	* 1827
12-1PM	* 2302	* 2198	* 2430	* 2361	* 2123	* 2021
1-2PM	* 2408	* 2271	* 2575	* 2249	* 2250	* 1925
2-3PM	* 2913	* 2303	* 2879	* 2257	* 2515	* 1932
3-4PM	* 3338	* 2374	* 3165	* 2260	* 2765	* 1935
4-5PM	* 3553	* 2243	* 3229	* 2163	* 2821	* 1852
5-6PM	* 3453	* 2307	* 3430	* 2193	* 2997	* 1877
6-7PM	* 3304	* 2143	* 2868	* 2040	* 2506	* 1746
7-8PM	* 1870	* 1792	* 1751	* 1586	* 1530	1358
8-9PM	1341	* 1549	1332	1274	1164	1090
9-10PM	1353	1392	1250	1204	1092	1030
10-11PM	1186	1267	1118	982	977	840
11-12AM	882	974	808	794	706	680

12: *Shoulder closures shall only be allowed at the times specified for lane closures*
12.09: *The contractor will be accessed Road User Costs in the amount determined by Quewz-98 for lanes that are closed outside of the PLCM. Road user costs are very high, most will be $3,000. to $6,000. per hour. In some cases road users costs may be higher.*
12.11: *Three lane closures may be taken on any 4 lane section from 1 a.m. to 5 a.m..*

Home Search

 Revision #12			WEEKDAYS		WEEKENDS	
LOCATION	DIRECTION	LANES	1 LANE CLOSED	2 LANES CLOSED	1 LANE CLOSED	2 LANES CLOSED
I-77 exit ramps to I-77entrance ramps	East	3	9am-3pm 7pm-6am	7:30pm-6am	8pm Fri-6am Mon	9pm Fri-8am Sat 8pm Sat-10am Sun 8pm Sun-6am Mon
I-77exit ramps to I-77 entrance ramps	West	3	10am -2pm 7pm-6am	8pm-6am	8pm Fri-6am Mon	9pm Fri-8am Sat 8pm Sat-10am Sun 8pm Sun-6am Mon
I-77 to Broadway	East & West	4	10am – 1pm:*Fridays 10am to 12pm. 7pm - 6am	8pm - 6am	7pm Fri - 6am Mon	8pm Fri - 10am Sat 8pm Sat - 12pm Sun 8pm Sun - 6am Mon
*** No day time closures of Lane #4 across the I-480 bridge to Turney Ave. in the Eastbound direction.**						
Under Broadway	West	3	8:30pm - 6am	11:30pm - 5am	9pm Fri - 10:30am Sat 8pm Sat - 12pm Sun 8pm Sun - 6am Mon	12am Sat - 7am Sat 12am Sun - 9am Sun 11:30pm Sun - 5am Mon
Broadway Ramps to Camden	East	4	10am -1 pm 7pm - 6am	9pm - 6am	7pm Fri - 6am Mon	9pm Fri - 10am Sat 8pm Sat - 12pm Sun 8pm Sun - 6am Mon
Camden to Broadway Ramps	West	4	10am-1pm 7pm - 6am	9pm - 6am	7pm Fri - 6am Mon	10pm Fri - 9am Sat 9pmSat - 11am Sun 8pm Sun - 6am Mon

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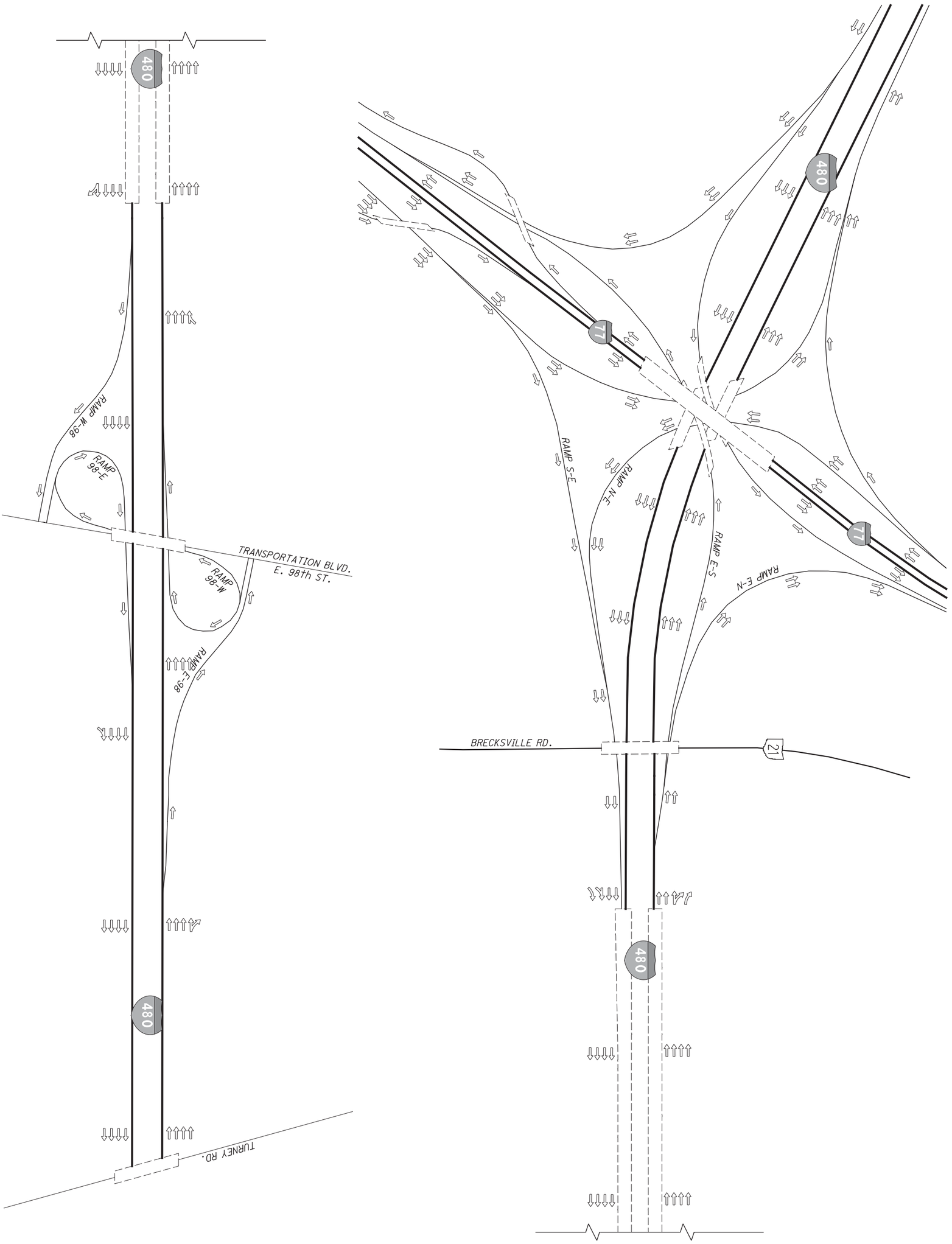

	CUY-480-1842	MAINTENANCE OF TRAFFIC EXISTING CONDITIONS

0 250
125 500
HORIZONTAL
SCALE IN FEET

N

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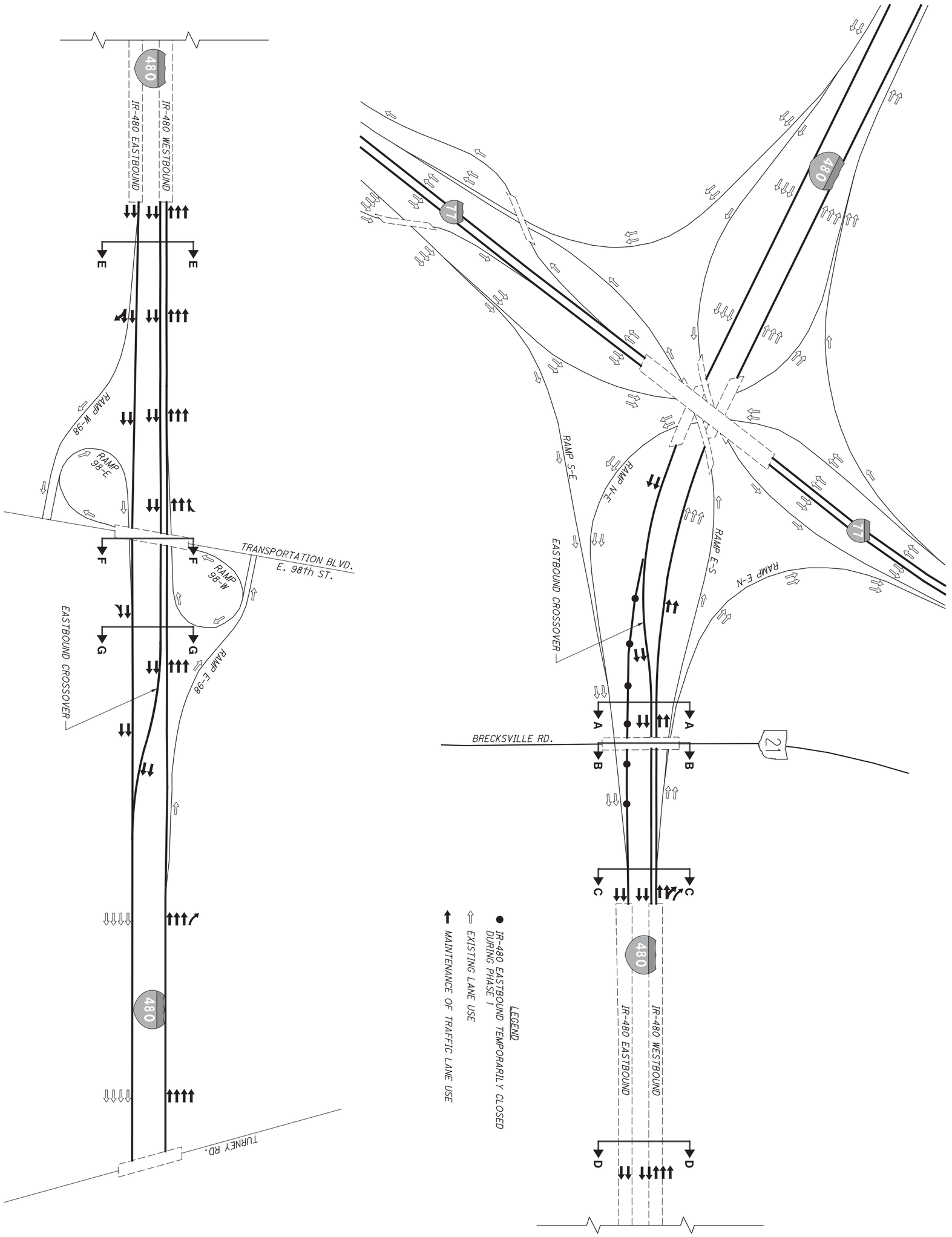

	CUY-480-1842	MAINTENANCE OF TRAFFIC ALTERNATIVE 1 - PHASES 1 & 2

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HORIZONTAL SCALE IN FEET

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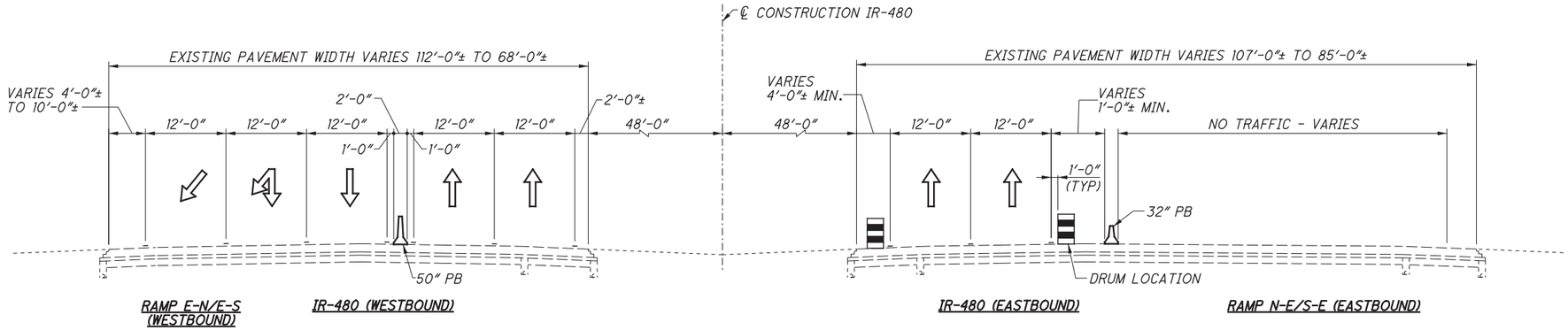
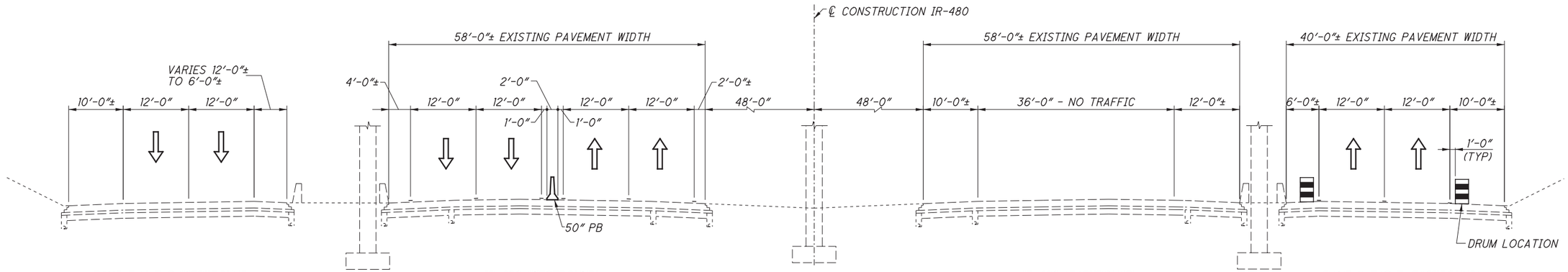


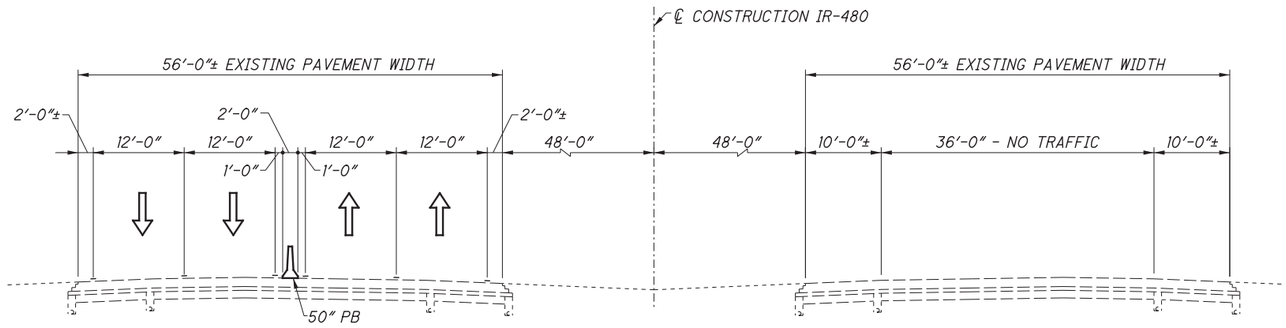
EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 1 - PHASE 1
SECTION C-C



EXISTING TYPICAL SECTION
UNDER BRECKSVILLE ROAD BRIDGE

MAINTENANCE OF TRAFFIC ALTERNATIVE 1 - PHASE 1
SECTION B-B

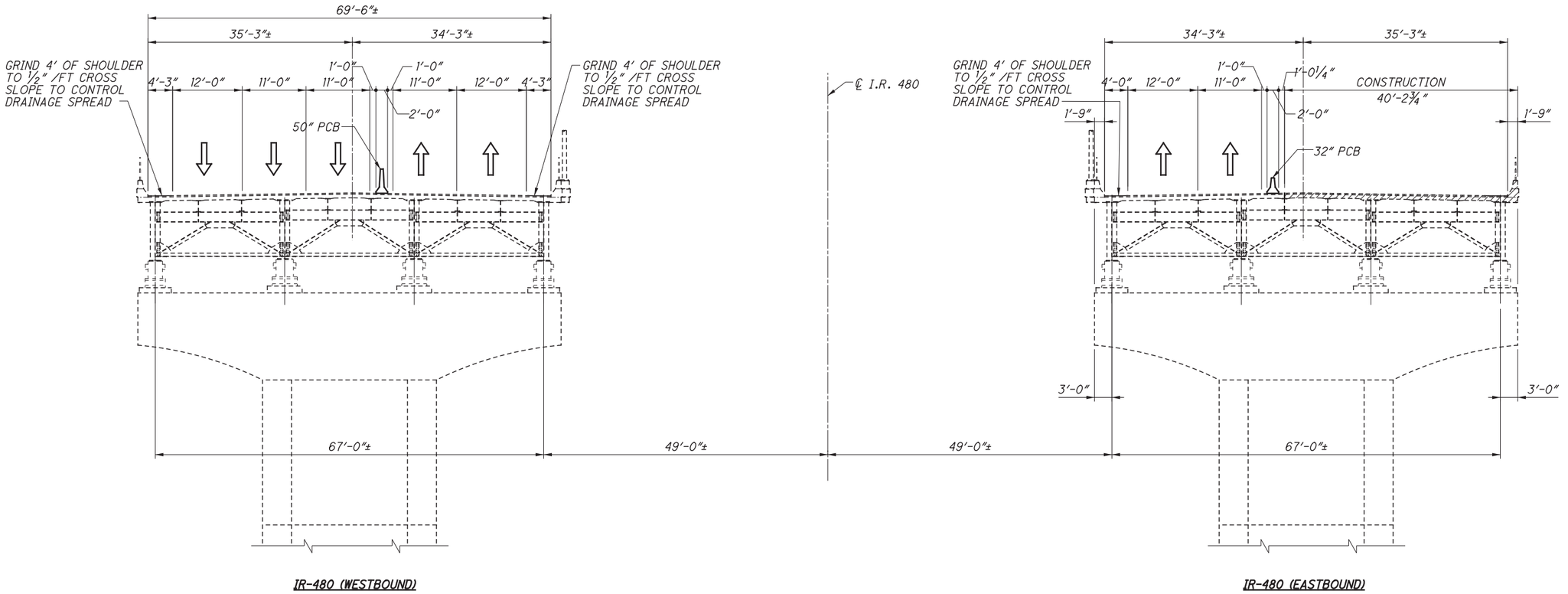


EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 1 - PHASE 1
SECTION A-A

MAINTENANCE OF TRAFFIC
ALTERNATIVE 1 TYPICAL SECTIONS - PHASE 1

CUY-480-18.42



IR-480 (WESTBOUND)

IR-480 (EASTBOUND)

TRANSVERSE SECTION
SECTION D-D

MAINTENANCE OF TRAFFIC ALTERNATIVE 1 - PHASE 1

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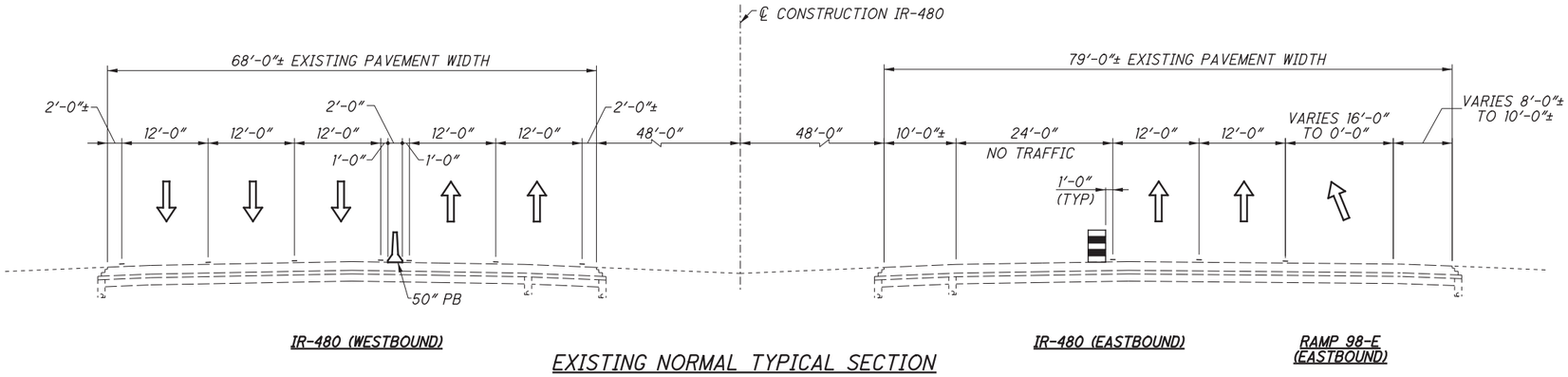
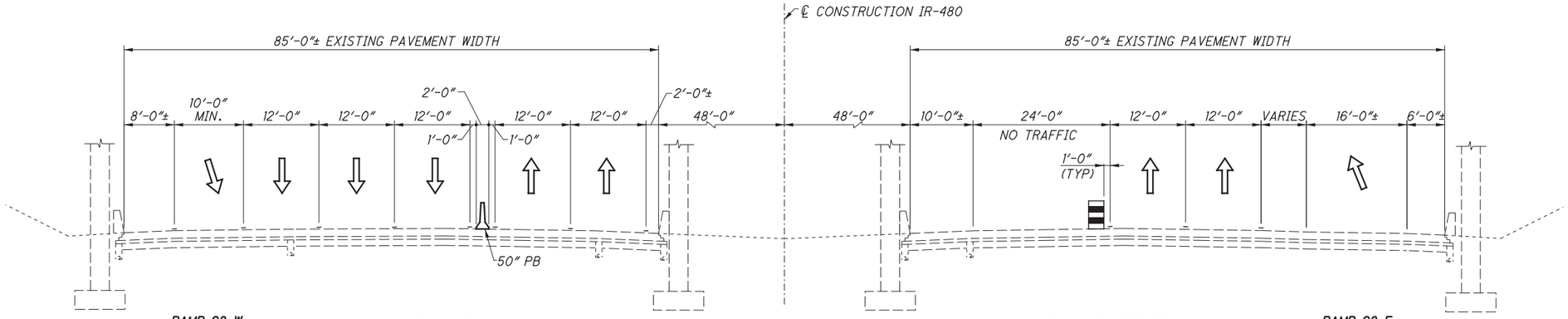
MAINTENANCE OF TRAFFIC
ALTERNATIVE 1 BRIDGE TRANSVERSE SECTION - PHASE 1

CUY-480-18.42



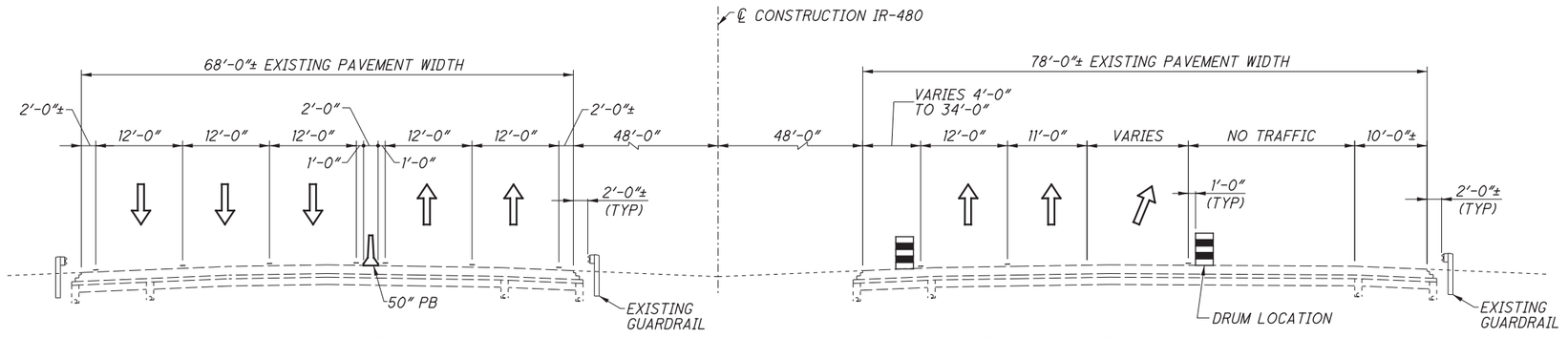
EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 1 - PHASE 1
SECTION G-G



EXISTING TYPICAL SECTION
UNDER E. 98TH STREET BRIDGE

MAINTENANCE OF TRAFFIC ALTERNATIVE 1 - PHASE 1
SECTION F-F

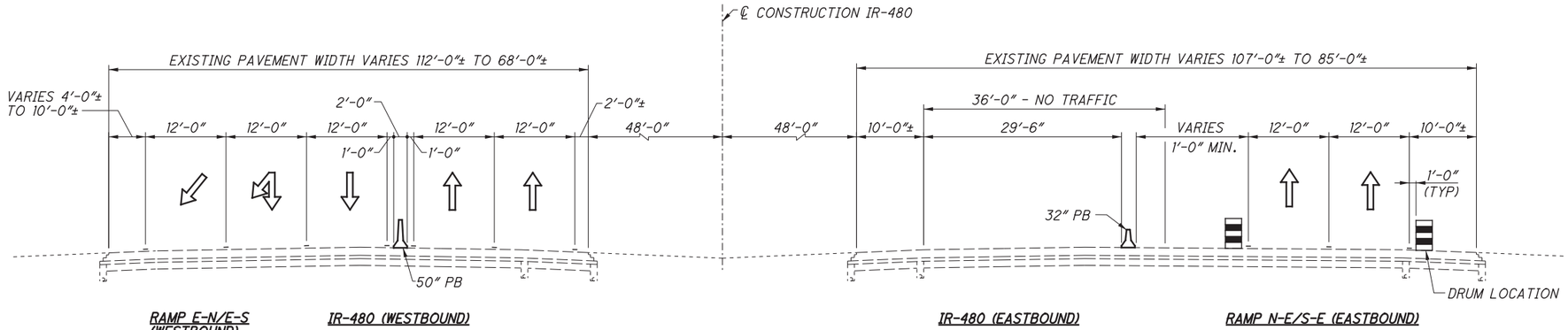


EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 1 - PHASE 1
SECTION E-E

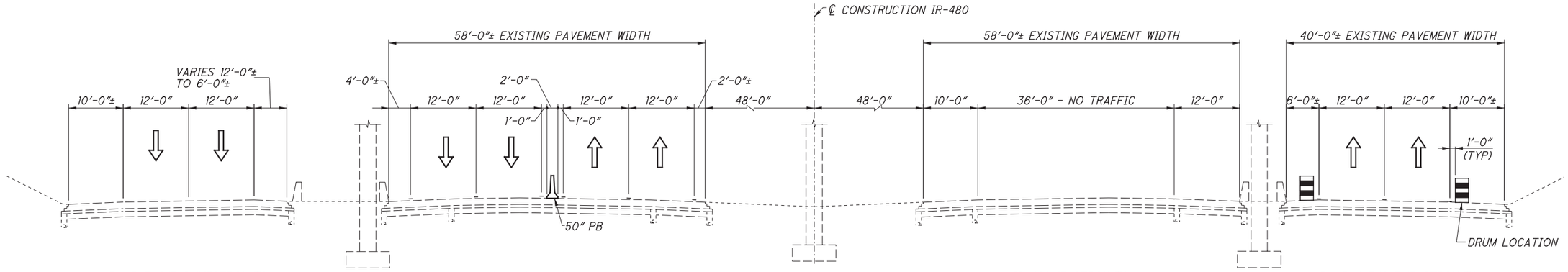
MAINTENANCE OF TRAFFIC
ALTERNATIVE 1 TYPICAL SECTIONS - PHASE 1

CUY-480-18.42

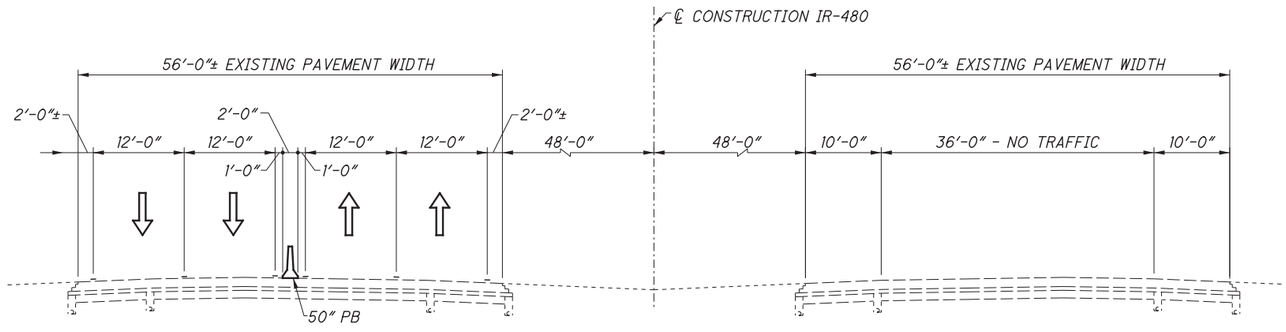


EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 1 - PHASE 2
SECTION C-C



EXISTING TYPICAL SECTION
UNDER BRECKSVILLE ROAD BRIDGE
MAINTENANCE OF TRAFFIC ALTERNATIVE 1 - PHASE 2
SECTION B-B

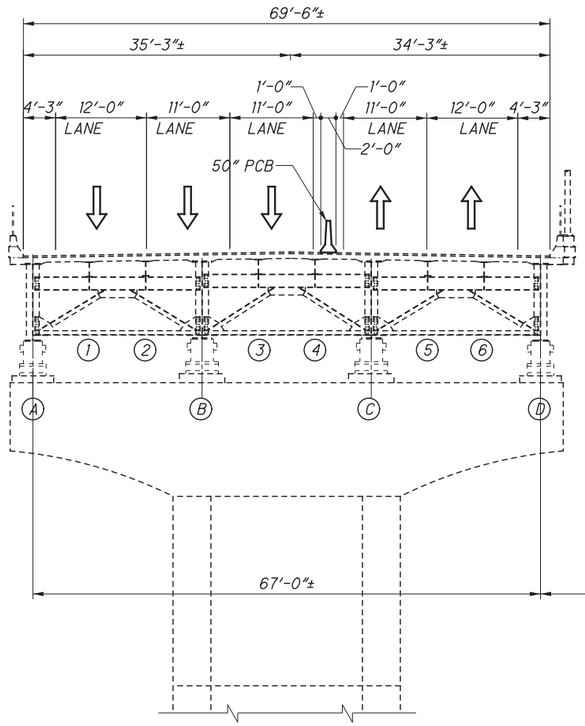


EXISTING NORMAL TYPICAL SECTION

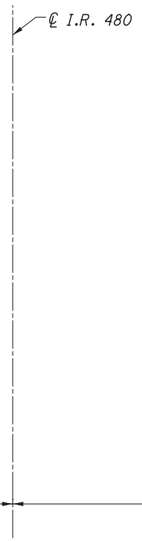
MAINTENANCE OF TRAFFIC ALTERNATIVE 1 - PHASE 2
SECTION A-A

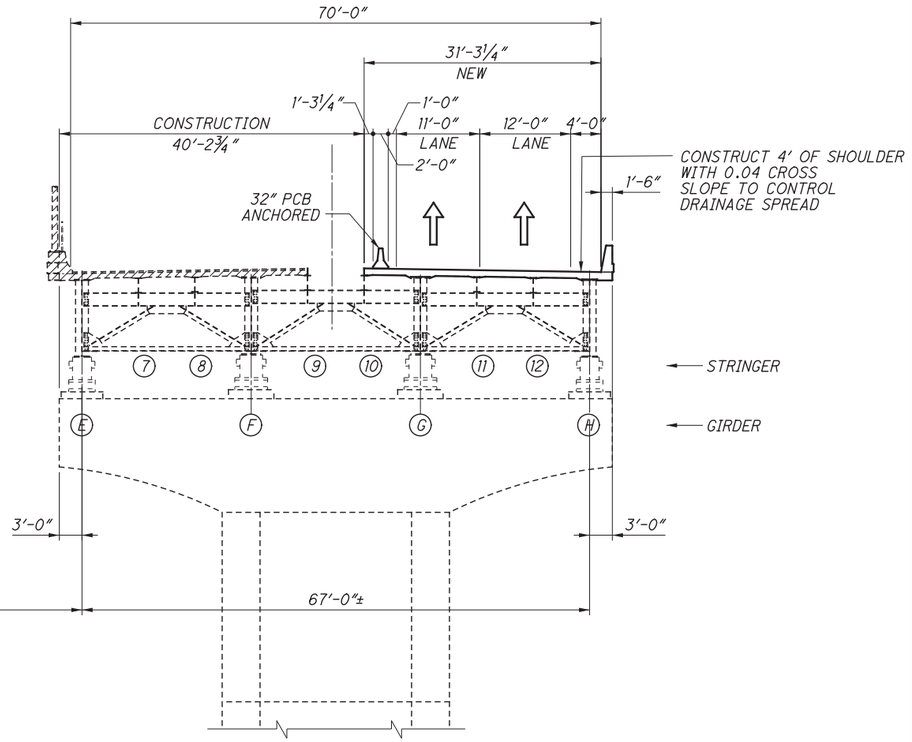
MAINTENANCE OF TRAFFIC
ALTERNATIVE 1 TYPICAL SECTIONS - PHASE 2

CUY-480-18.42



IR-480 (WESTBOUND)





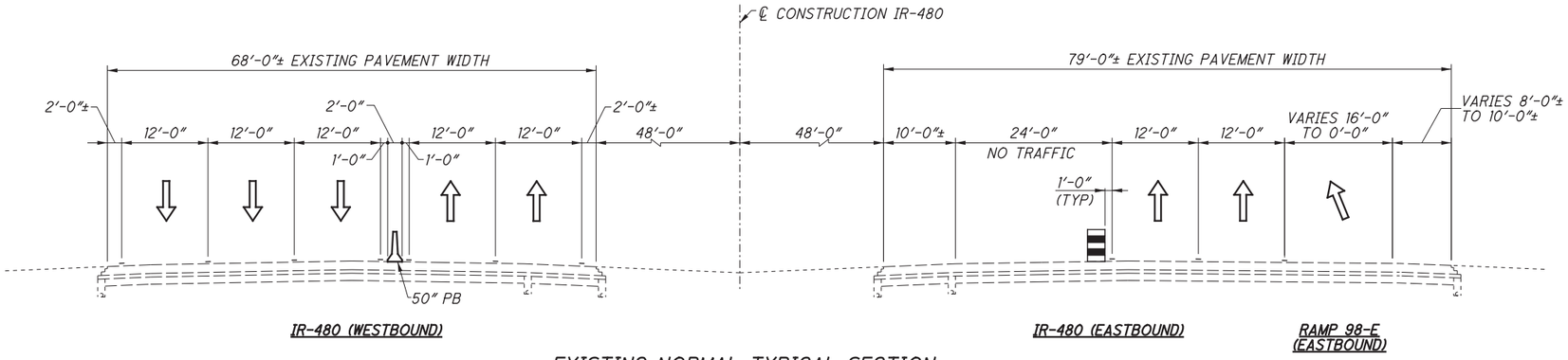
IR-480 (EASTBOUND)

TRANSVERSE SECTION
SECTION D-D

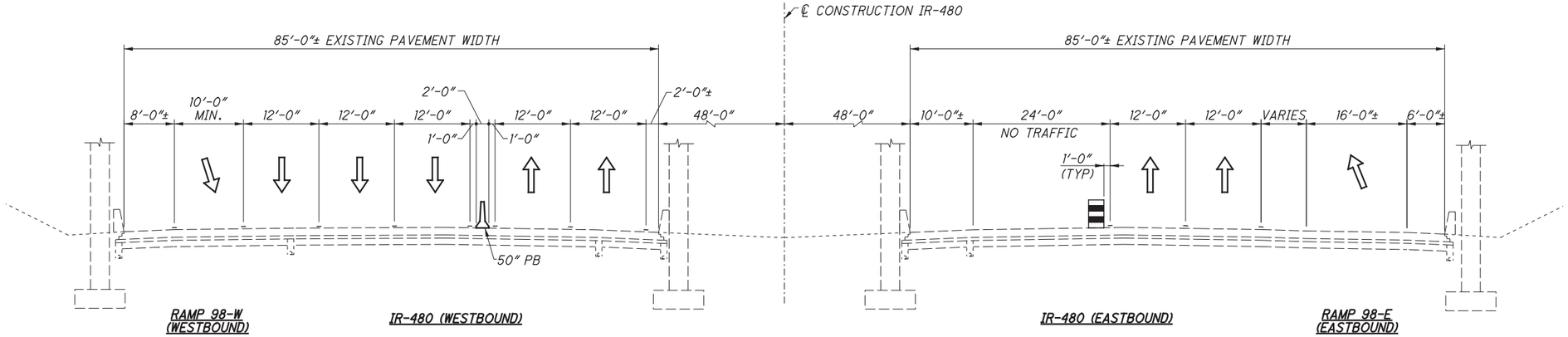
MAINTENANCE OF TRAFFIC ALTERNATIVE 1 - PHASE 2

MAINTENANCE OF TRAFFIC
ALTERNATIVE 1 BRIDGE TRANSVERSE SECTION - PHASE 2

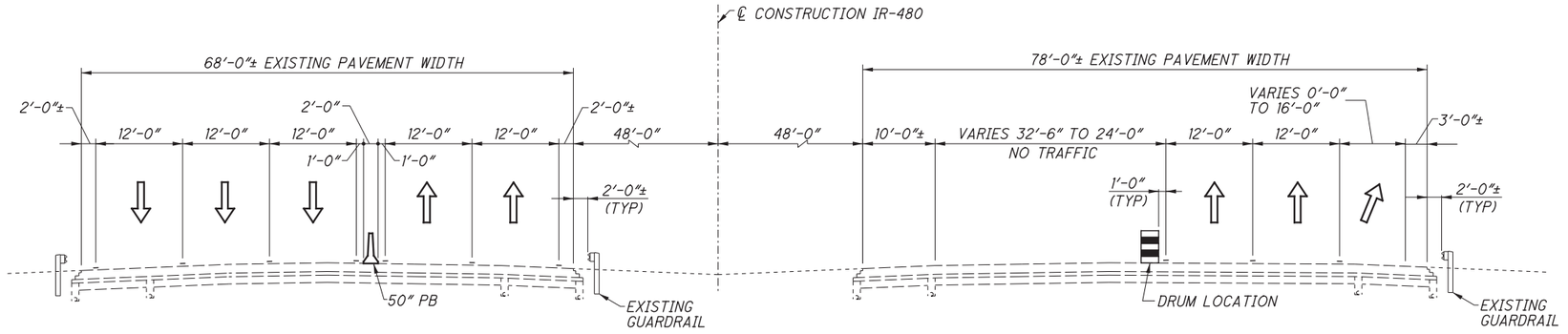
CUY-480-18.42



EXISTING NORMAL TYPICAL SECTION
MAINTENANCE OF TRAFFIC ALTERNATIVE 1 - PHASE 2
SECTION G-G



EXISTING TYPICAL SECTION
UNDER E. 98TH STREET BRIDGE
MAINTENANCE OF TRAFFIC ALTERNATIVE 1 - PHASE 2
SECTION F-F



EXISTING NORMAL TYPICAL SECTION
MAINTENANCE OF TRAFFIC ALTERNATIVE 1 - PHASE 2
SECTION E-E

MAINTENANCE OF TRAFFIC
ALTERNATIVE 1 TYPICAL SECTIONS - PHASE 2

CUY-480-18.42

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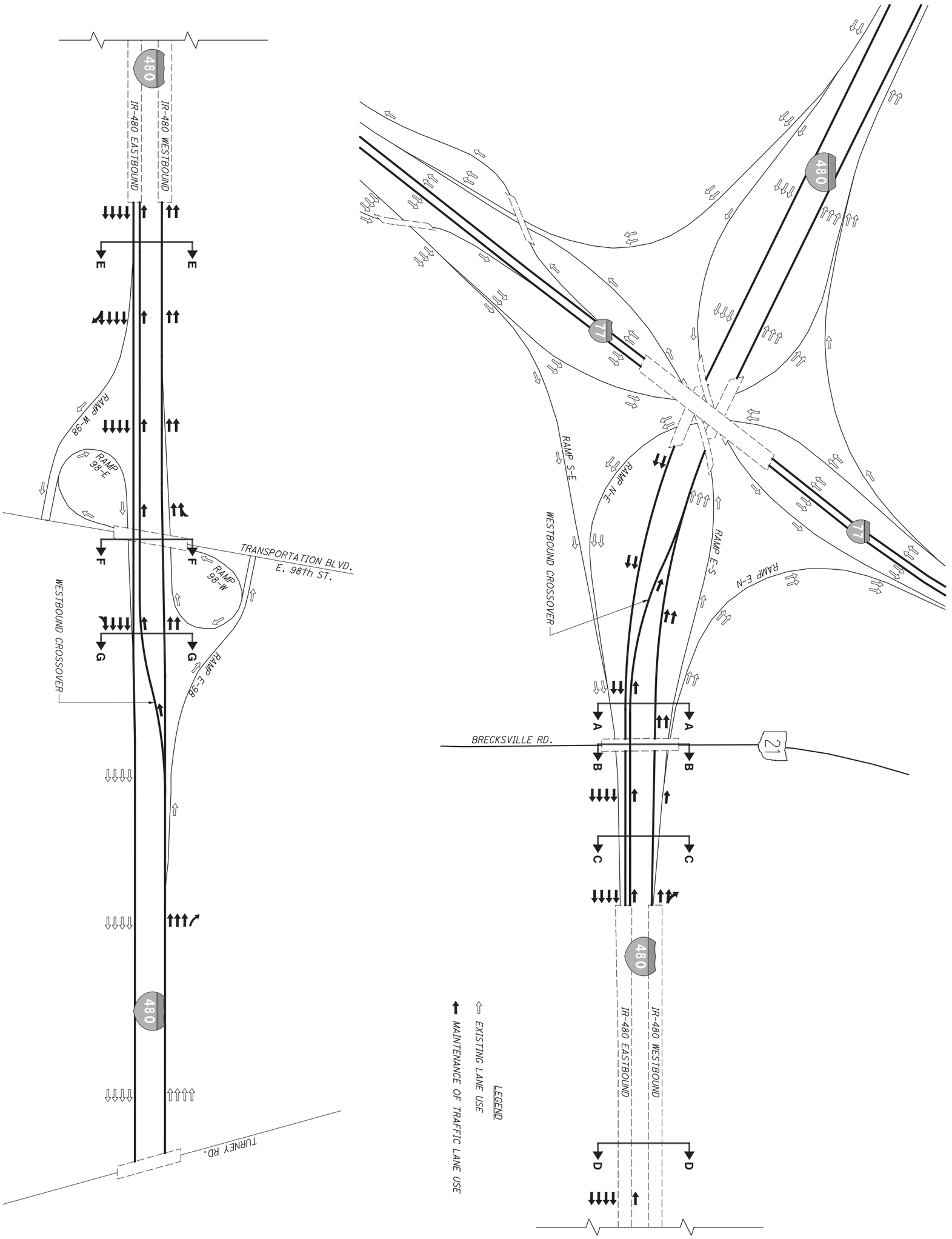
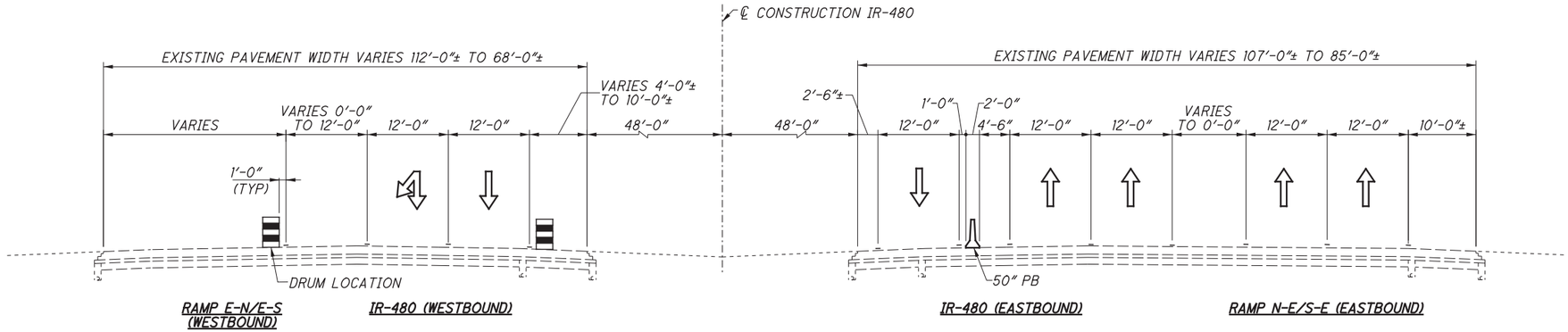


	CUY-480-1842	MAINTENANCE OF TRAFFIC ALTERNATIVE 1 - PHASES 3 & 4

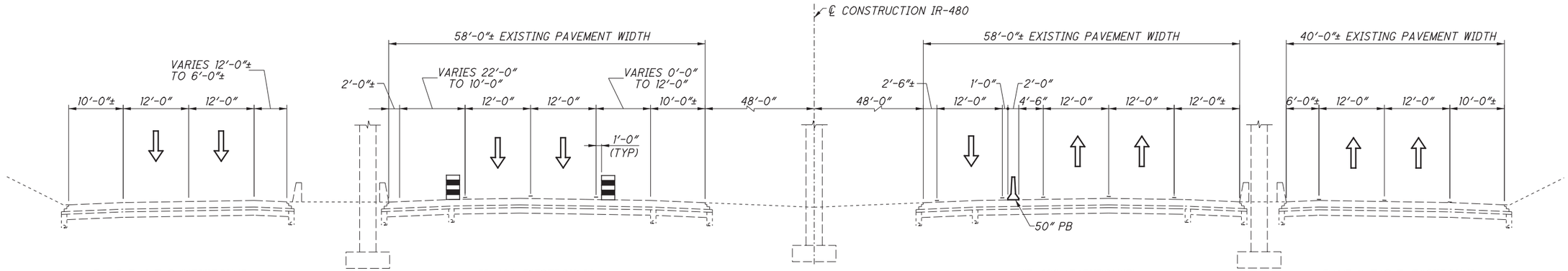
0 250
125 500
HORIZONTAL SCALE IN FEET

N



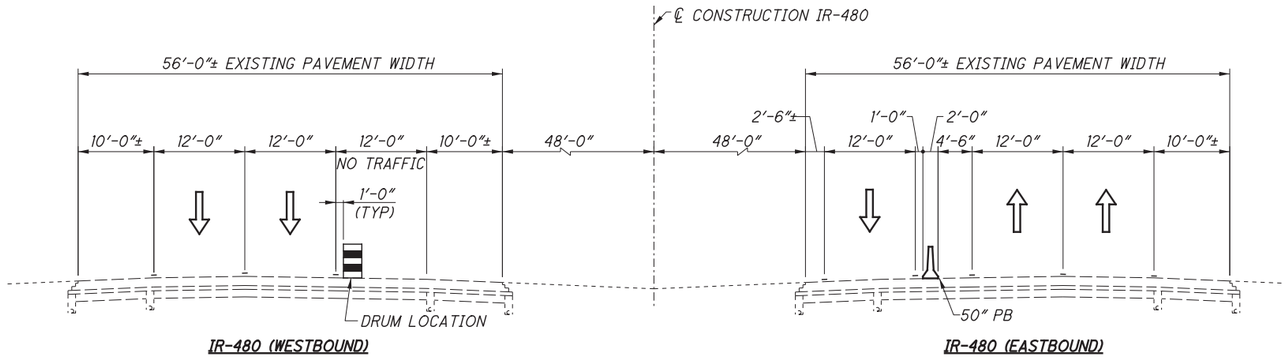
EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 1 - PHASE 3
SECTION C-C



EXISTING TYPICAL SECTION
UNDER BRECKSVILLE ROAD BRIDGE

MAINTENANCE OF TRAFFIC ALTERNATIVE 1 - PHASE 3
SECTION B-B



EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 1 - PHASE 3
SECTION A-A

MAINTENANCE OF TRAFFIC
ALTERNATIVE 1 TYPICAL SECTIONS - PHASE 3

CUY-480-18.42

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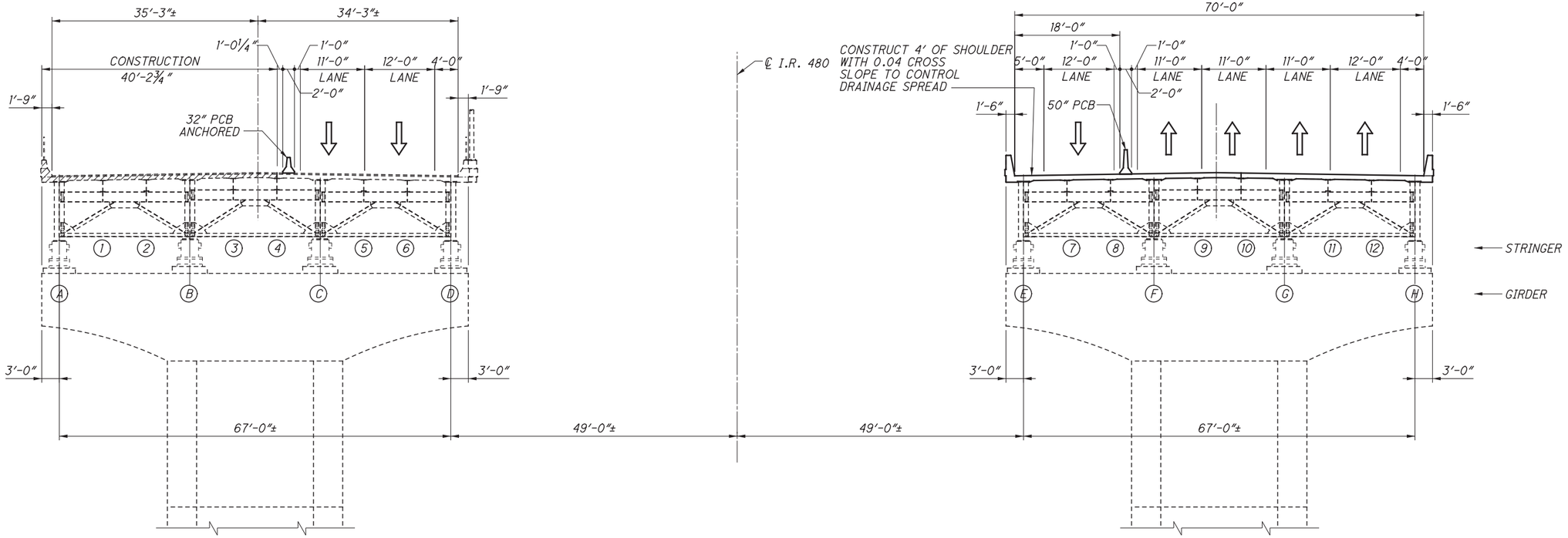

TRANSVERSE SECTION
SECTION D-D

MAINTENANCE OF TRAFFIC ALTERNATIVE 1 - PHASE 3

MAINTENANCE OF TRAFFIC
ALTERNATIVE 1 BRIDGE TRANSVERSE SECTION - PHASE 3

CUY-480-18.42

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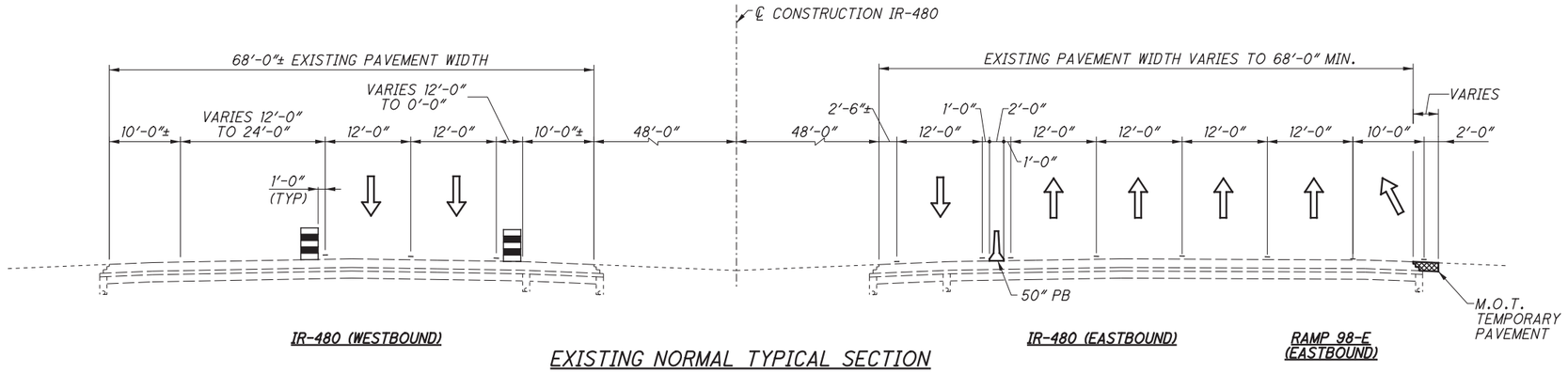
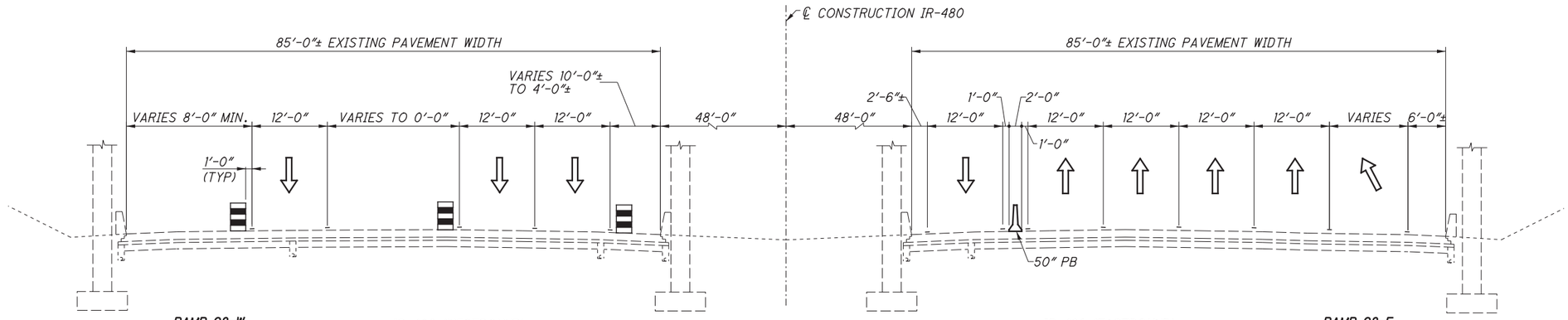


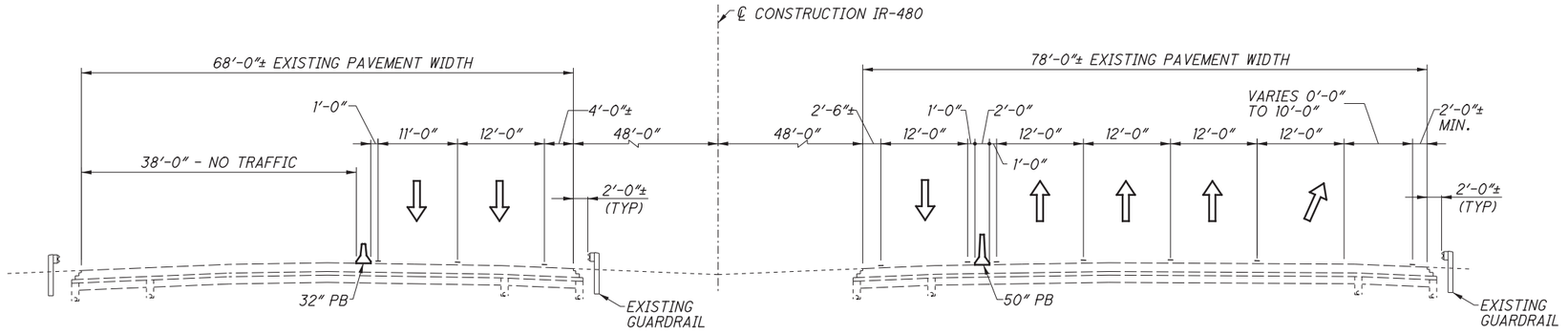
EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 1 - PHASE 3
SECTION G-G



EXISTING TYPICAL SECTION
UNDER E. 98TH STREET BRIDGE

MAINTENANCE OF TRAFFIC ALTERNATIVE 1 - PHASE 3
SECTION F-F

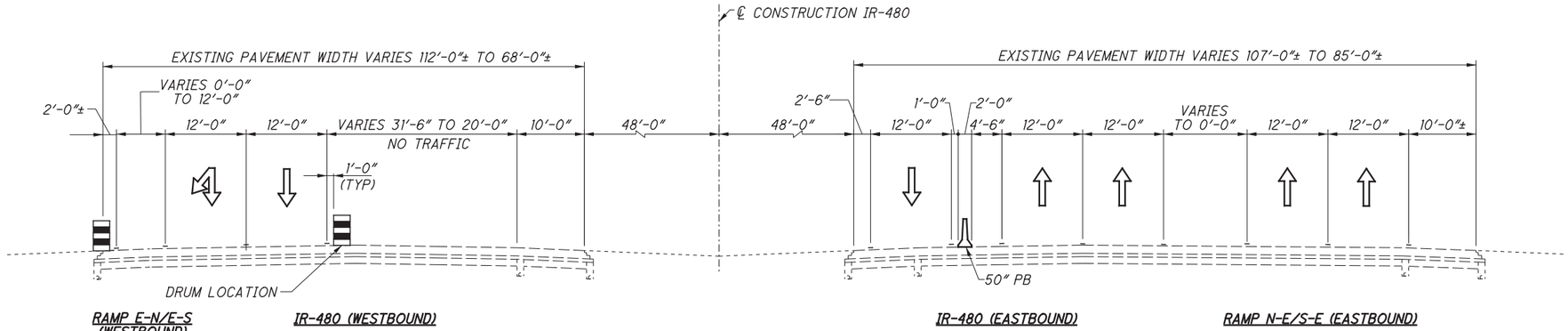


EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 1 - PHASE 3
SECTION E-E

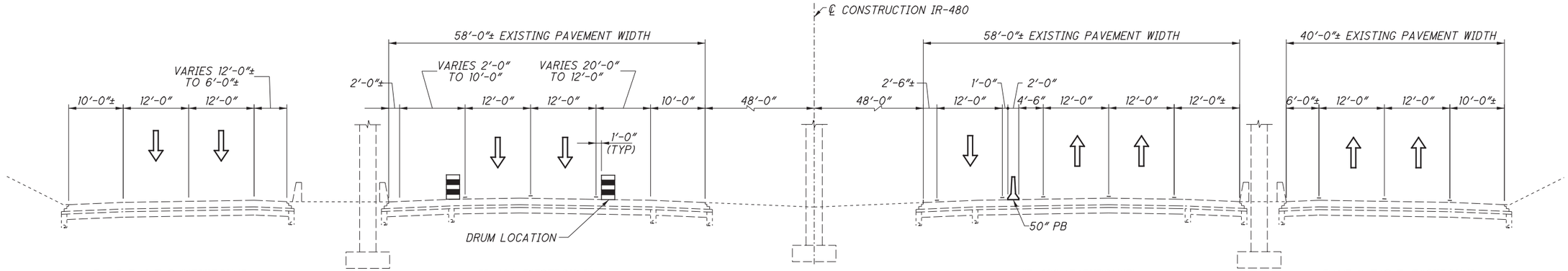
MAINTENANCE OF TRAFFIC
ALTERNATIVE 1 TYPICAL SECTIONS - PHASE 3

CUY-480-18.42



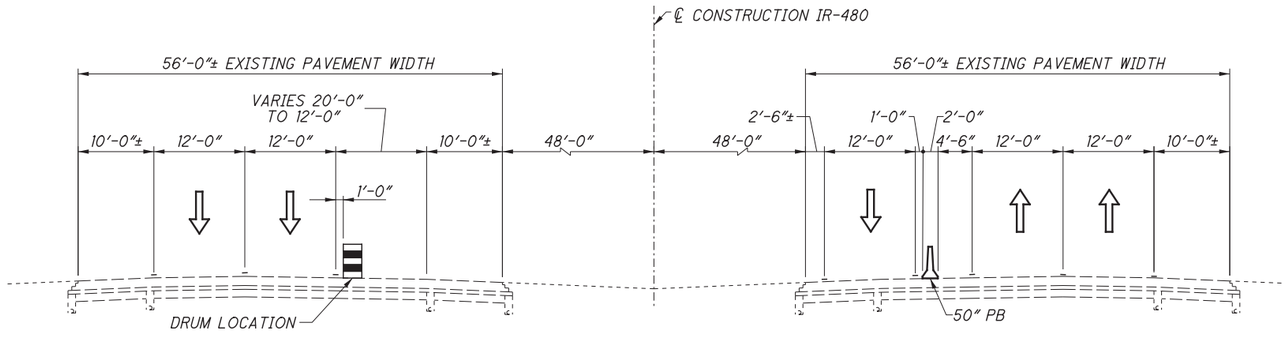
EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 1 - PHASE 4
SECTION C-C



EXISTING TYPICAL SECTION
UNDER BRECKSVILLE ROAD BRIDGE

MAINTENANCE OF TRAFFIC ALTERNATIVE 1 - PHASE 4
SECTION B-B

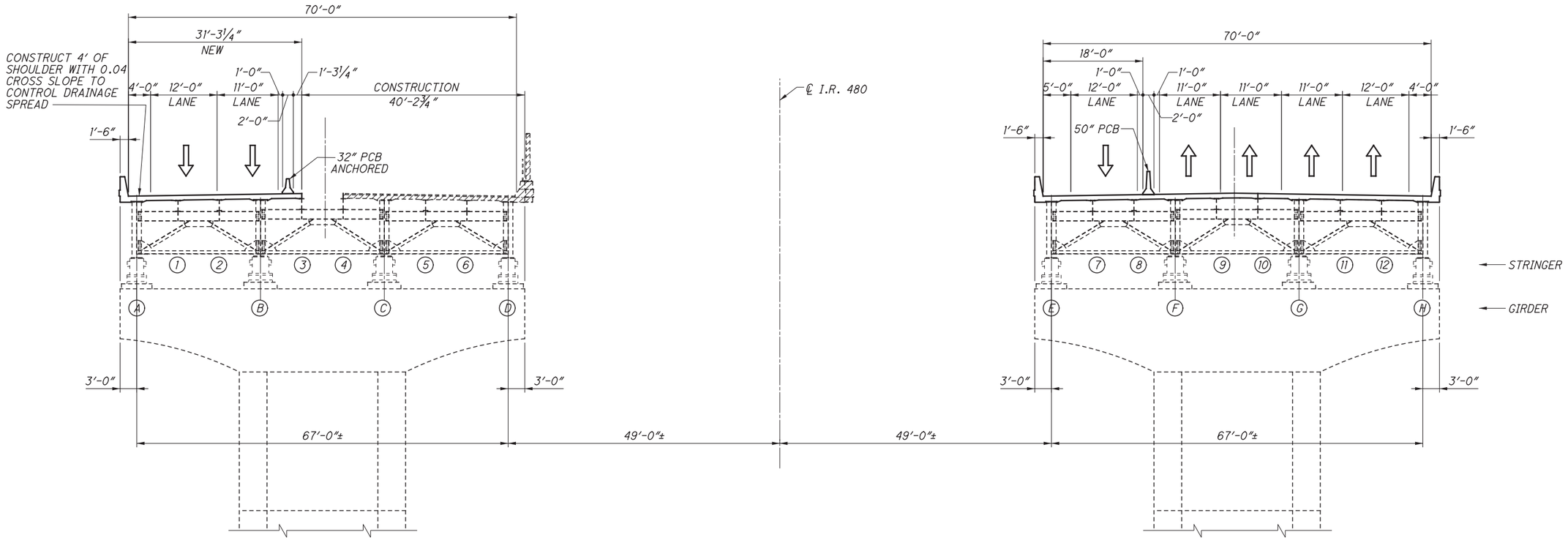


EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 1 - PHASE 4
SECTION A-A

MAINTENANCE OF TRAFFIC
ALTERNATIVE 1 TYPICAL SECTIONS - PHASE 4

CUY-480-18.42



TRANSVERSE SECTION

SECTION D-D

MAINTENANCE OF TRAFFIC ALTERNATIVE 1 - PHASE 4

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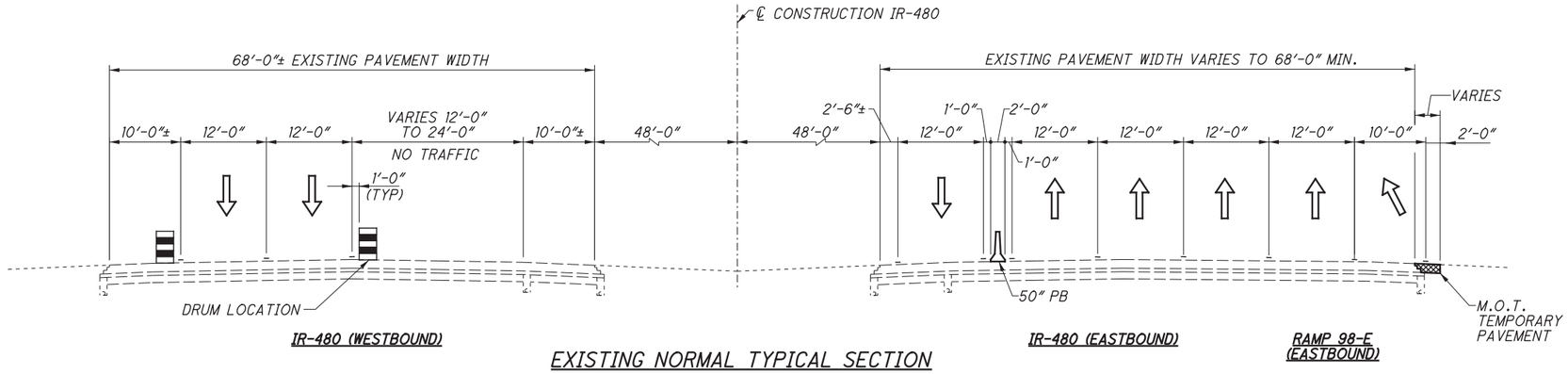
MAINTENANCE OF TRAFFIC
ALTERNATIVE 1 BRIDGE TRANSVERSE SECTION - PHASE 4

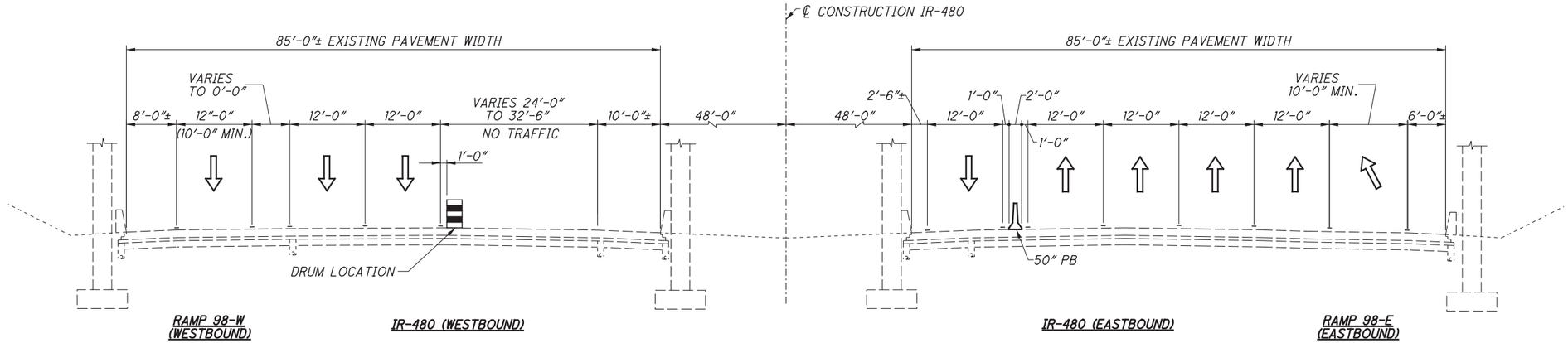
CUY-480-18.42

1



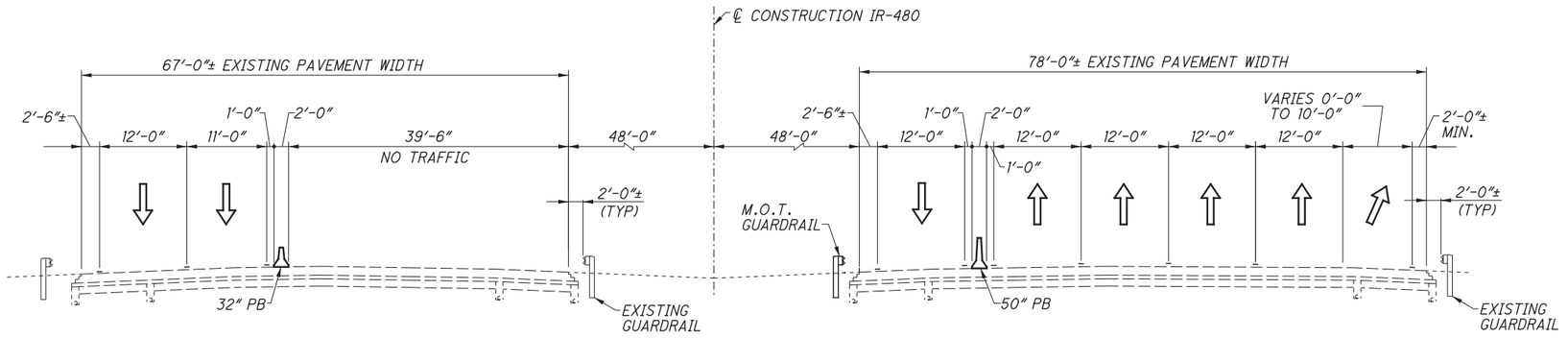
EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 1 - PHASE 4
SECTION G-G



EXISTING TYPICAL SECTION
UNDER E. 98TH STREET BRIDGE

MAINTENANCE OF TRAFFIC ALTERNATIVE 1 - PHASE 4
SECTION F-F

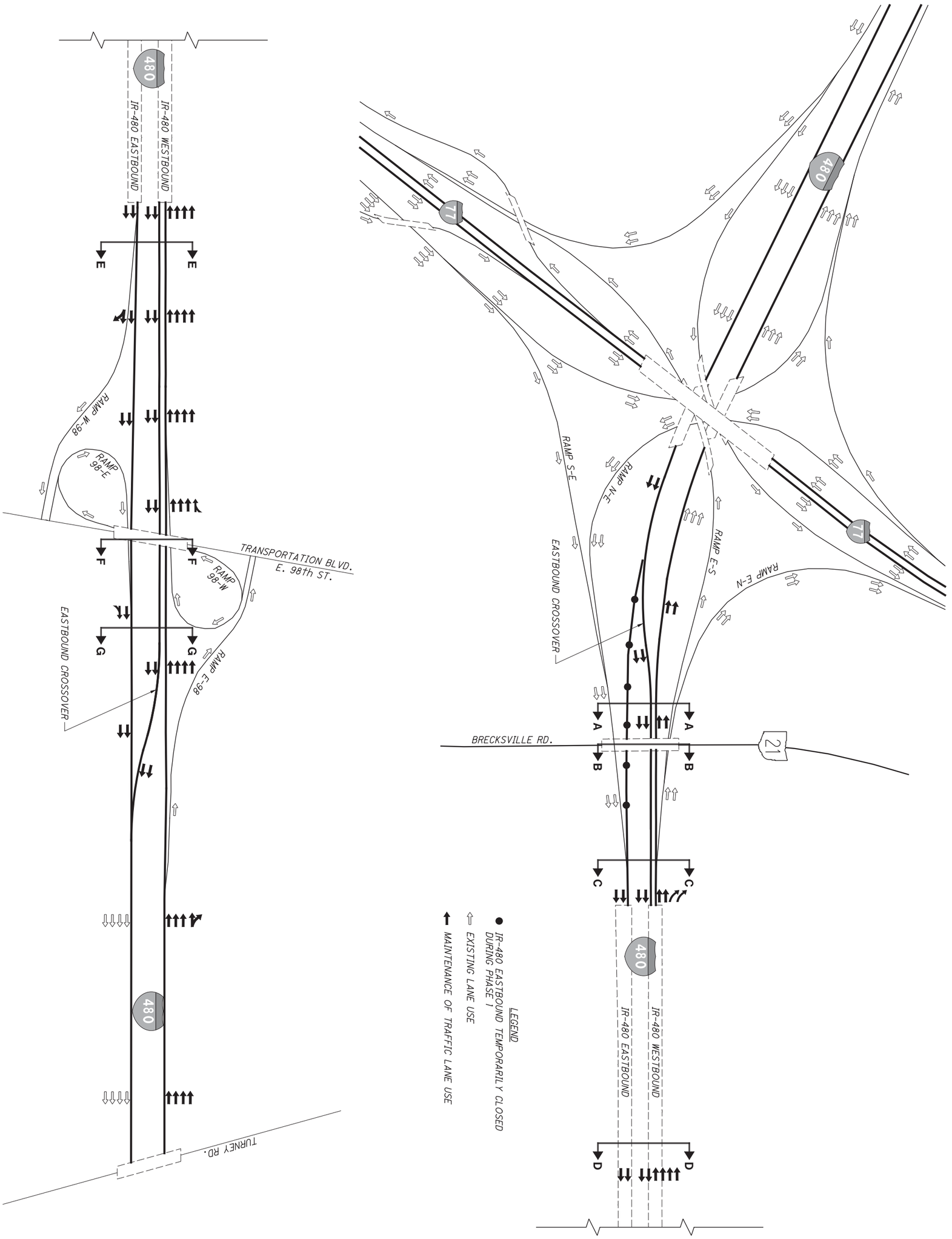


EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 1 - PHASE 4
SECTION E-E

MAINTENANCE OF TRAFFIC
ALTERNATIVE 1 TYPICAL SECTIONS - PHASE 4

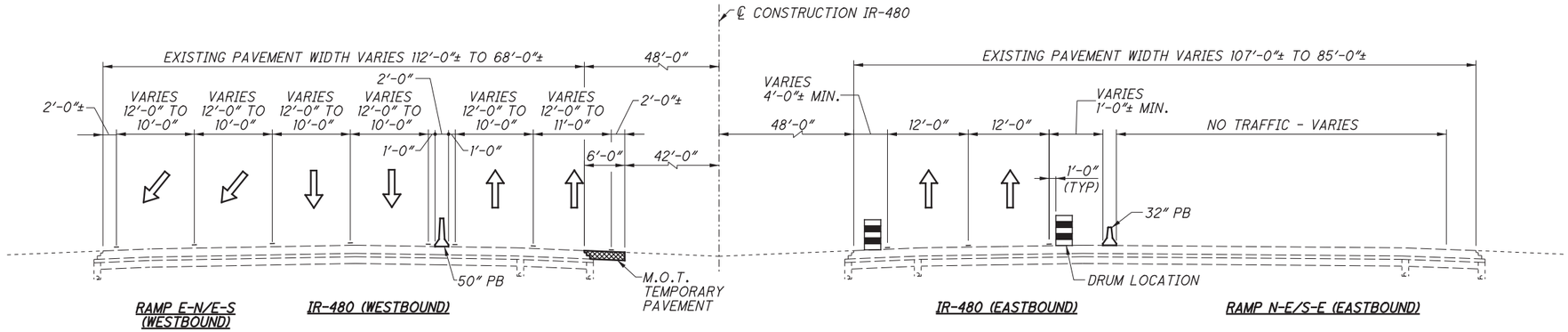
CUY-480-18.42



	CUY-480-1842	MAINTENANCE OF TRAFFIC ALTERNATIVE 3.a (72) - PHASES 1 & 2

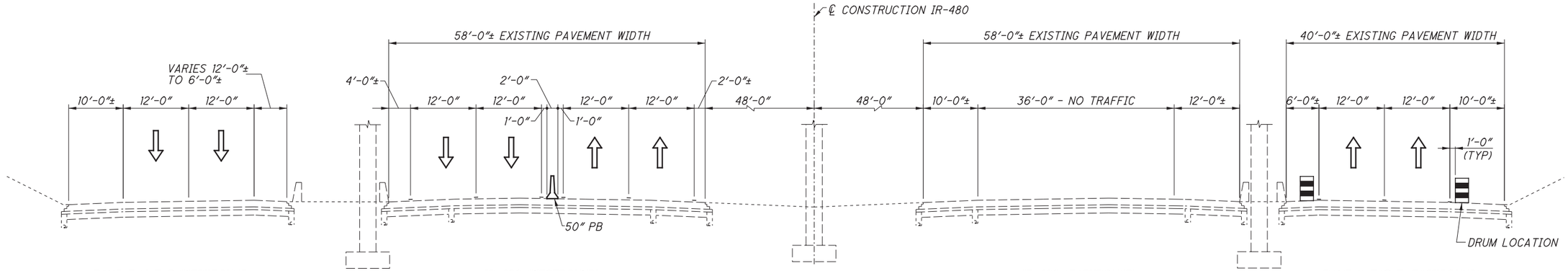
0 250
125 500
HORIZONTAL SCALE IN FEET

N



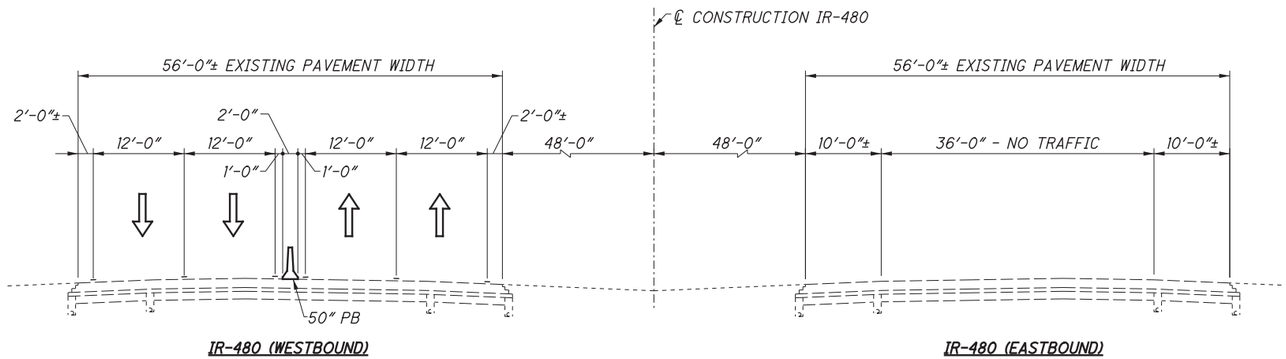
EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.a (72) - PHASE 1
SECTION C-C



EXISTING TYPICAL SECTION
UNDER BRECKSVILLE ROAD BRIDGE

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.a (72) - PHASE 1
SECTION B-B



EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.a (72) - PHASE 1
SECTION A-A

MAINTENANCE OF TRAFFIC
ALTERNATIVE 3.a (72) TYPICAL SECTIONS - PHASE 1

CUY-480-18.42

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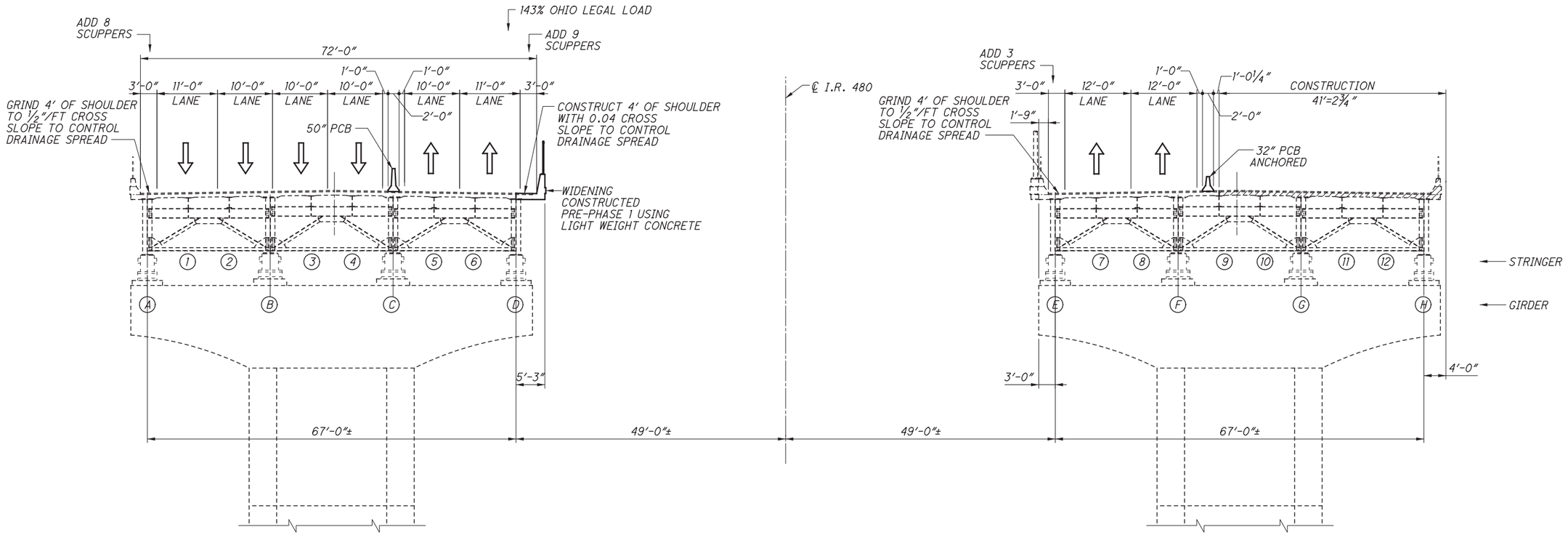

TRANSVERSE SECTION
SECTION D-D

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.a (72) - PHASE 1

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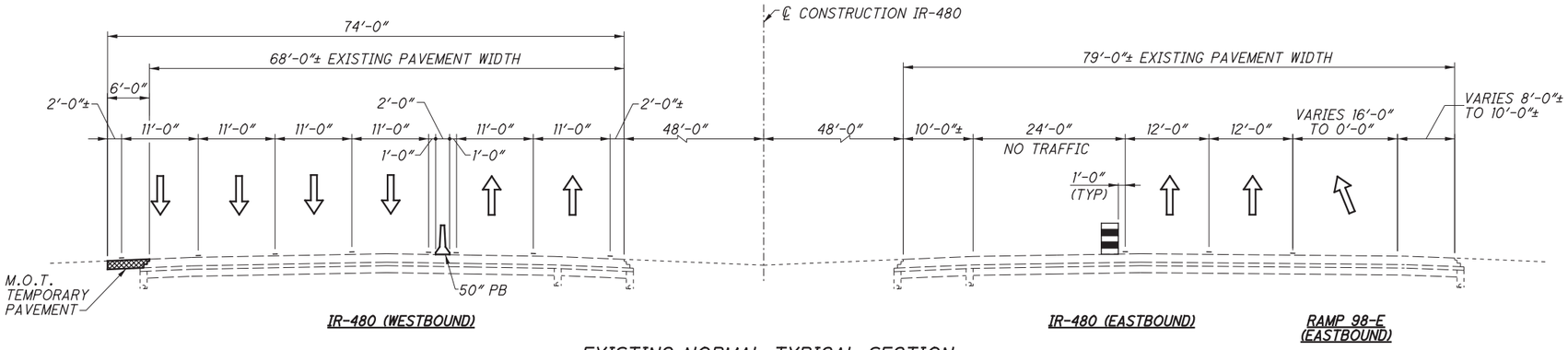
MAINTENANCE OF TRAFFIC
ALTERNATIVE 3.a (72) BRIDGE TRANSVERSE SECTION - PHASE 1

CUY-480-18.42

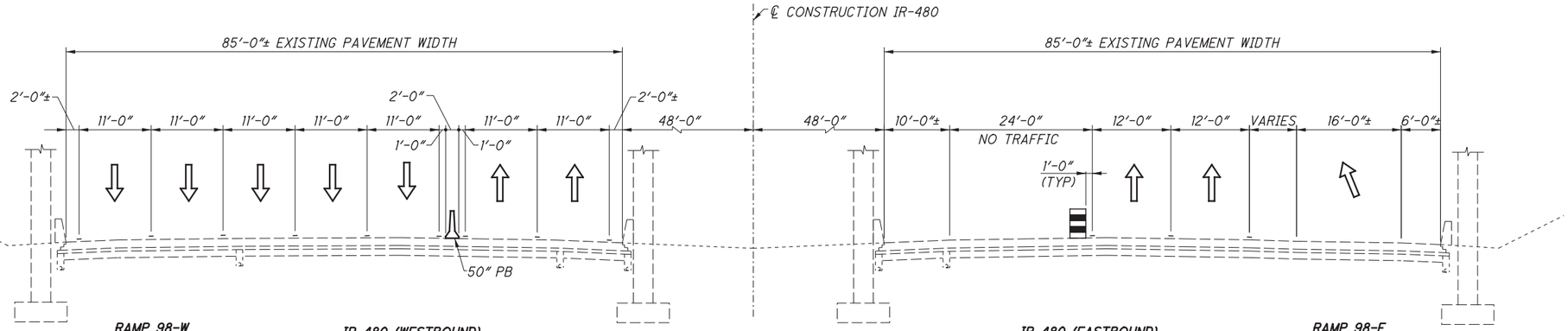
1 / 4



EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.a (72) - PHASE 1

SECTION G-G

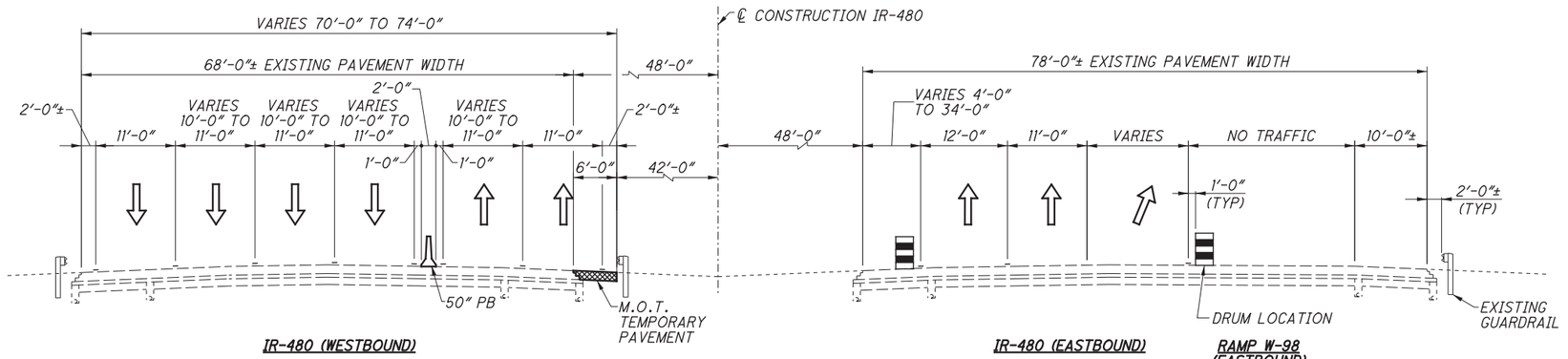


EXISTING TYPICAL SECTION

UNDER E. 98TH STREET BRIDGE

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.a (72) - PHASE 1

SECTION F-F



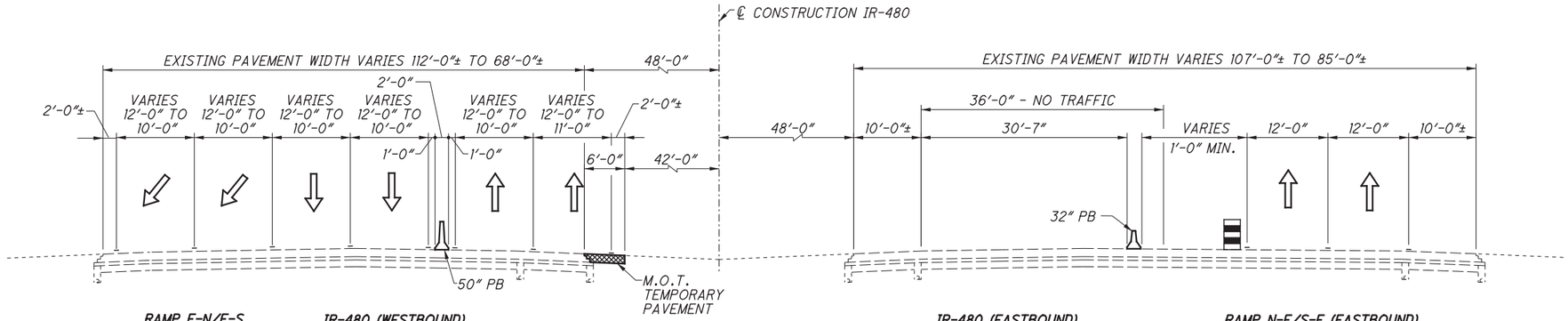
EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.a (72) - PHASE 1

SECTION E-E

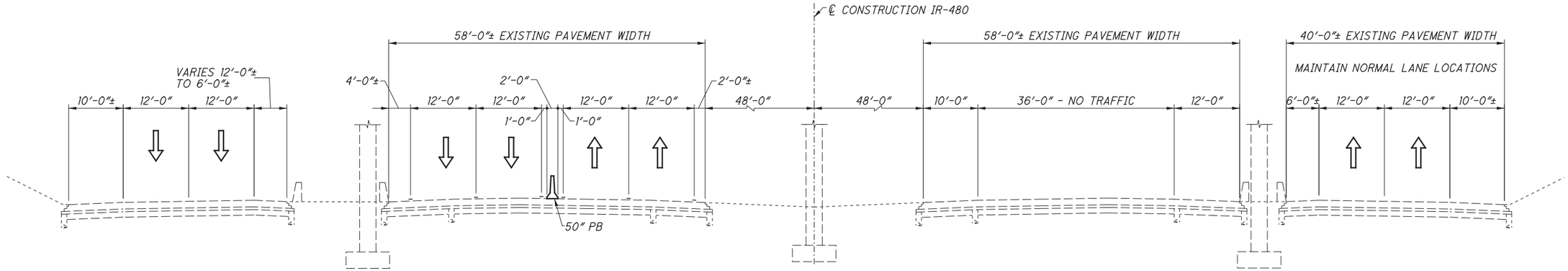
MAINTENANCE OF TRAFFIC
ALTERNATIVE 3.a (72) TYPICAL SECTIONS - PHASE 1

CUY-480-18.42

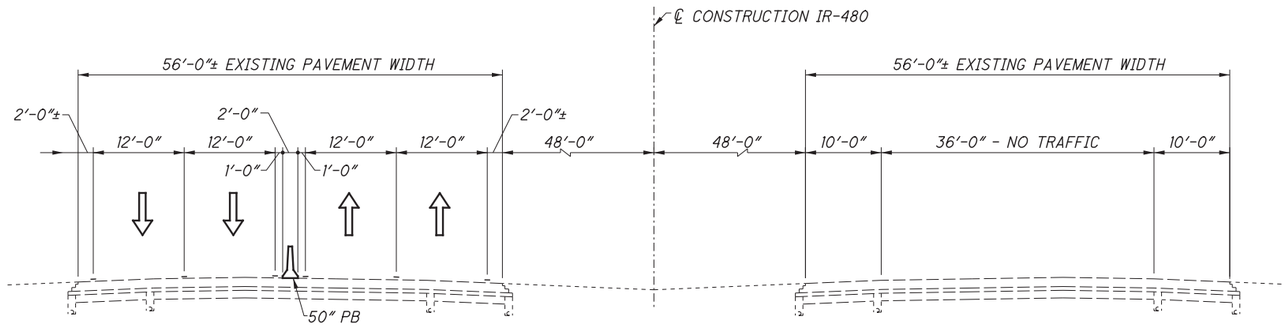


EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.a (72) - PHASE 2
SECTION C-C



EXISTING TYPICAL SECTION
UNDER BRECKSVILLE ROAD BRIDGE
MAINTENANCE OF TRAFFIC ALTERNATIVE 3.a (72) - PHASE 2
SECTION B-B



EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.a (72) - PHASE 2
SECTION A-A

MAINTENANCE OF TRAFFIC
ALTERNATIVE 3.a (72) TYPICAL SECTIONS - PHASE 2

CUY-480-18.42

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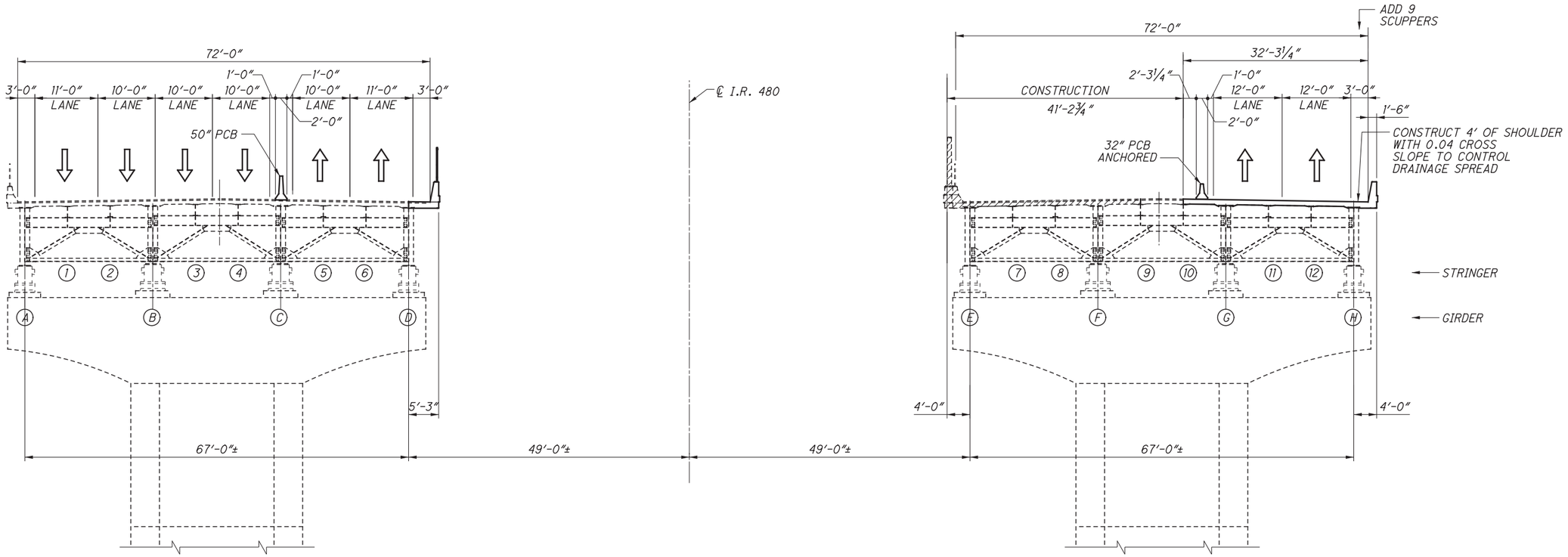


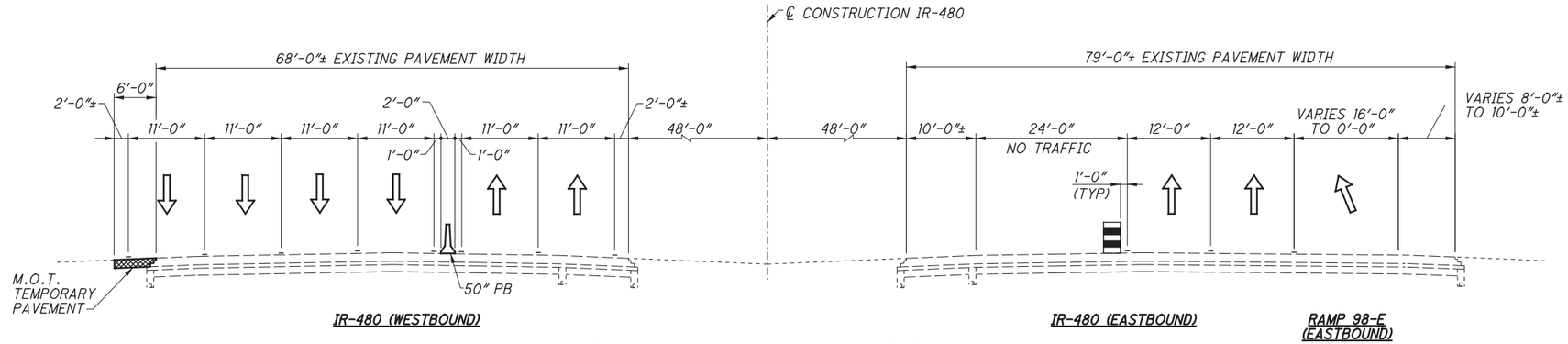
TRANSVERSE SECTION
SECTION D-D

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.a (72) - PHASE 2

MAINTENANCE OF TRAFFIC
ALTERNATIVE 3.a (72) BRIDGE TRANSVERSE SECTION - PHASE 2

CUY-480-18.42

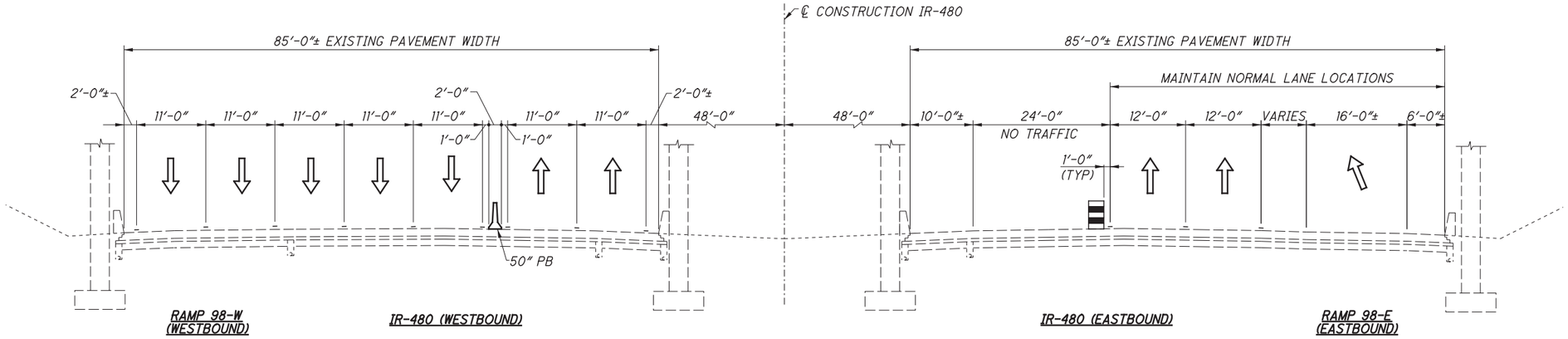
2 / 4



EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.a (72) - PHASE 2

SECTION G-G

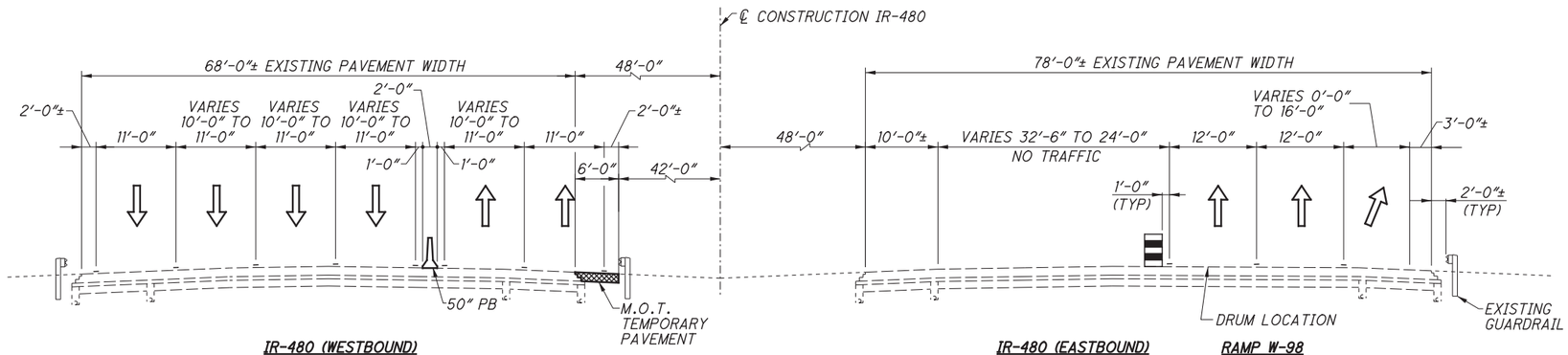


EXISTING TYPICAL SECTION

UNDER E. 98TH STREET BRIDGE

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.a (72) - PHASE 2

SECTION F-F



EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.a (72) - PHASE 2

SECTION E-E

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.a (72) TYPICAL SECTIONS - PHASE 2

CUY-480-18.42

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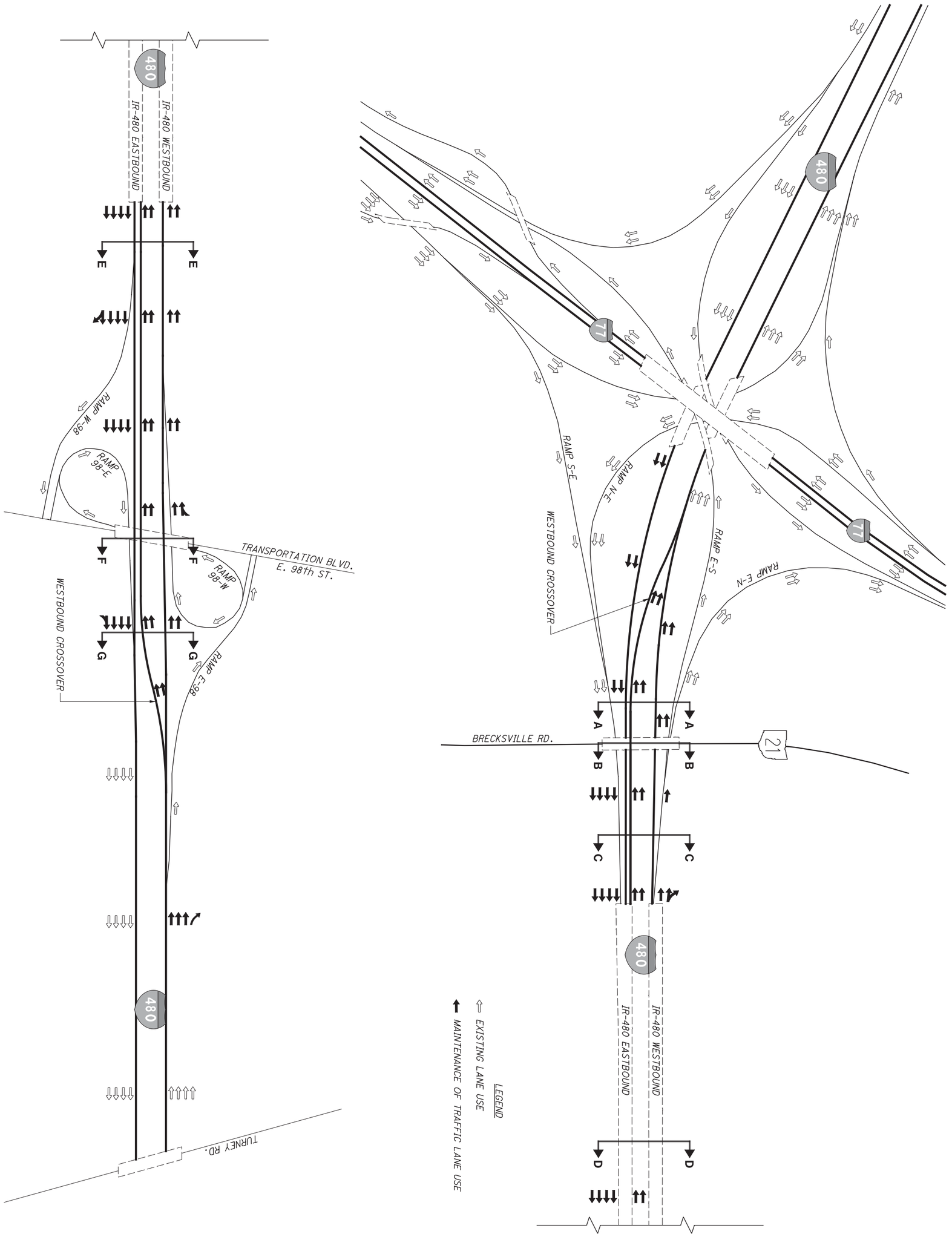
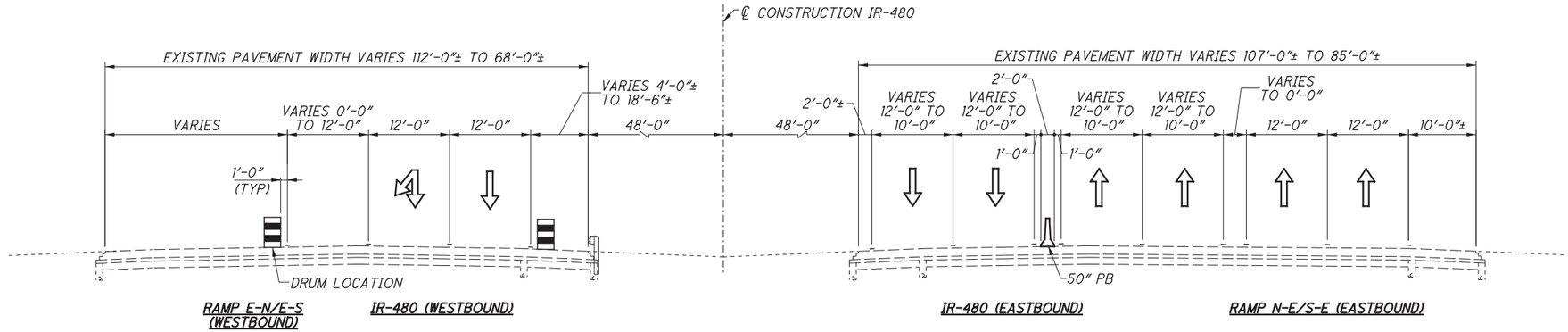


	CUY-480-1842	MAINTENANCE OF TRAFFIC ALTERNATIVE 3.a (72) - PHASES 3 & 4

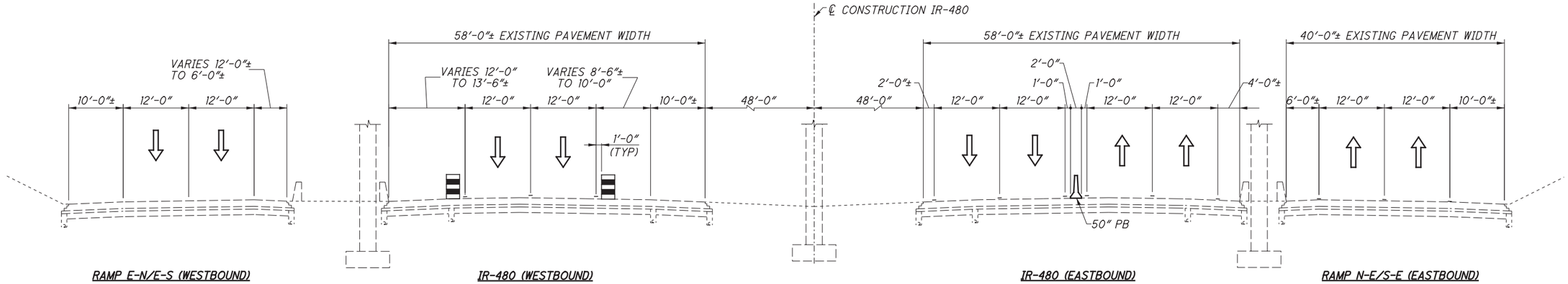
0 250
125 500
HORIZONTAL SCALE IN FEET

N



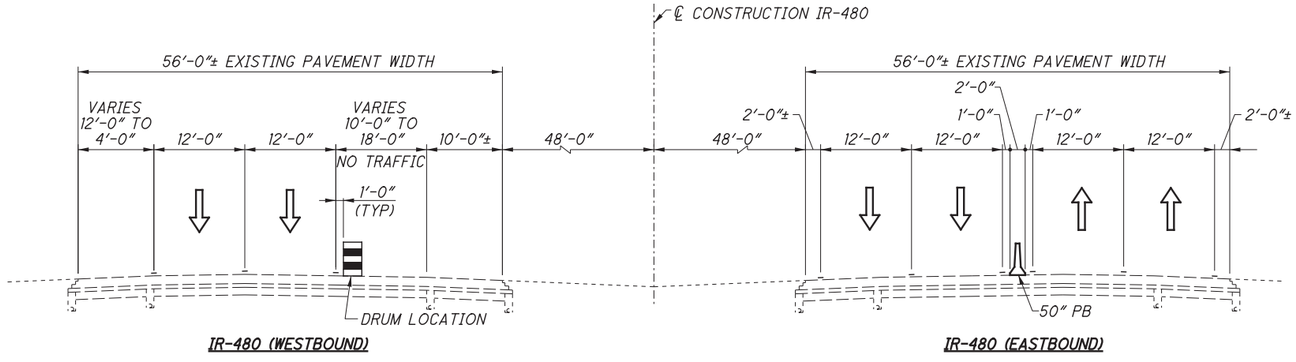
EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.a (72) - PHASE 3
SECTION C-C



EXISTING TYPICAL SECTION
UNDER BRECKSVILLE ROAD BRIDGE

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.a (72) - PHASE 3
SECTION B-B

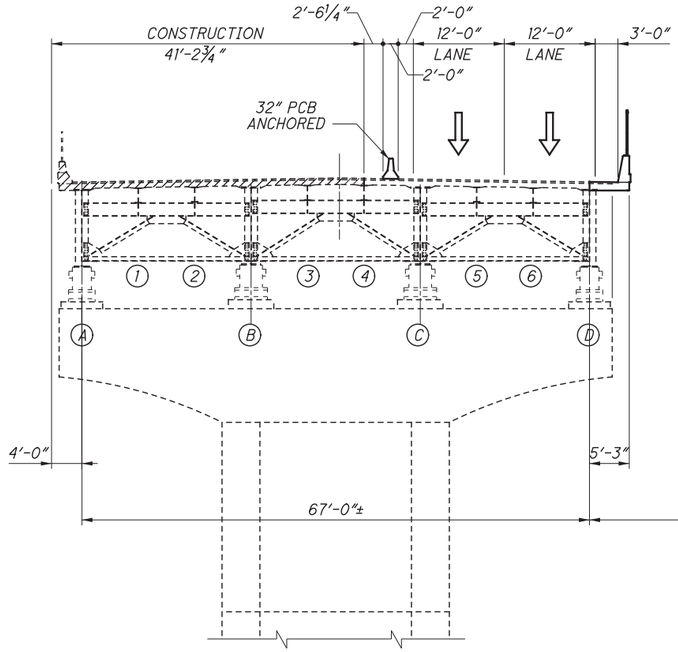


EXISTING NORMAL TYPICAL SECTION

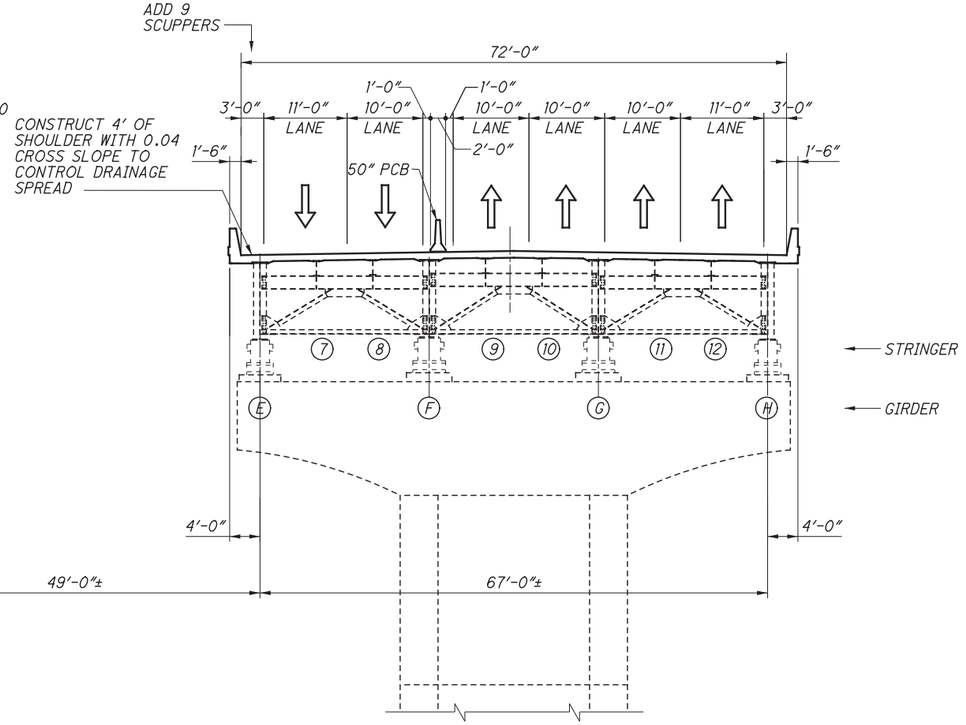
MAINTENANCE OF TRAFFIC ALTERNATIVE 3.a (72) - PHASE 3
SECTION A-A

MAINTENANCE OF TRAFFIC
ALTERNATIVE 3.a (72) TYPICAL SECTIONS - PHASE 3

CUY-480-18.42



IR-480 (WESTBOUND)

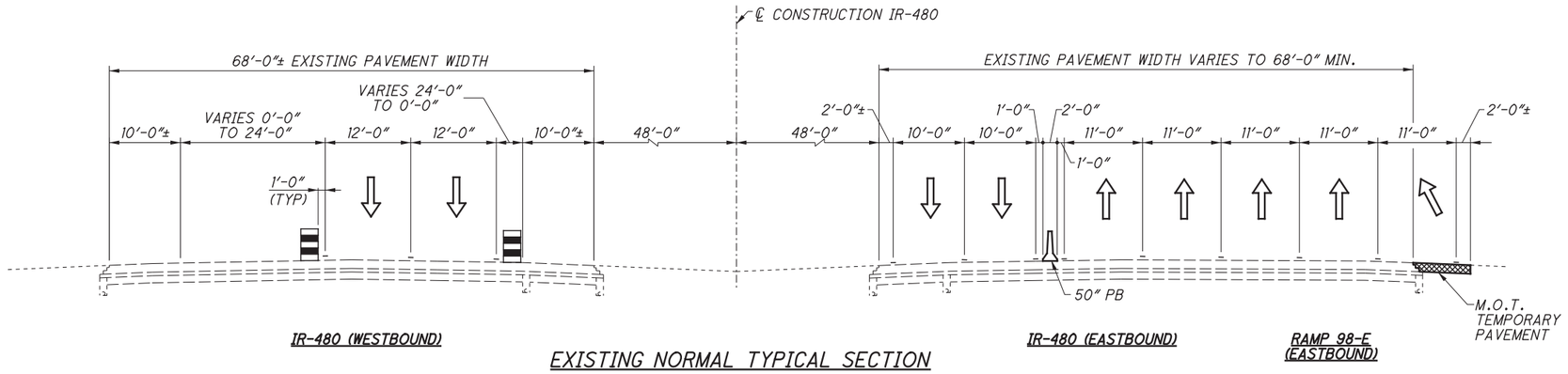


IR-480 (EASTBOUND)

TRANSVERSE SECTION
SECTION D-D

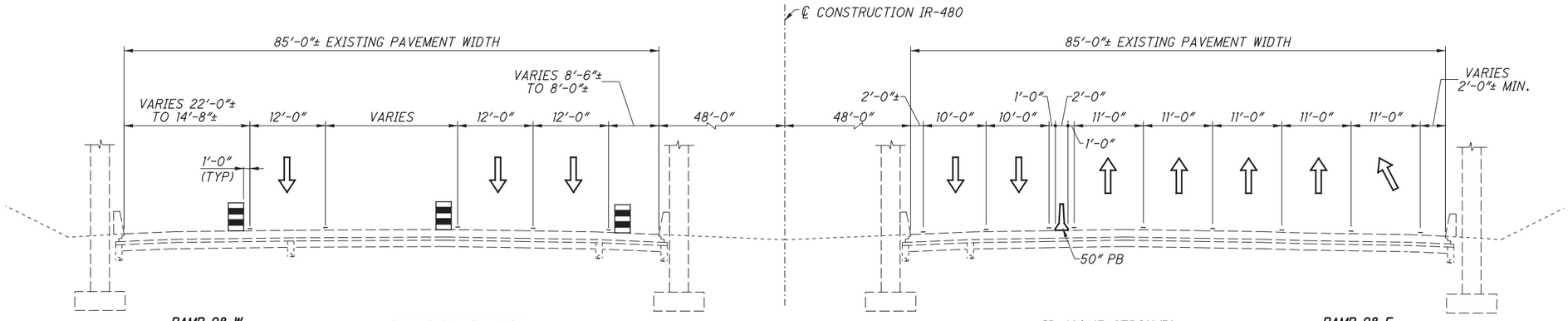
MAINTENANCE OF TRAFFIC ALTERNATIVE 3.a (72) - PHASE 3

MAINTENANCE OF TRAFFIC
(72) BRIDGE TRANSVERSE SECTION - PHASE 3
ALTERNATIVE 3.a
CUY-480-18.42
3 / 4



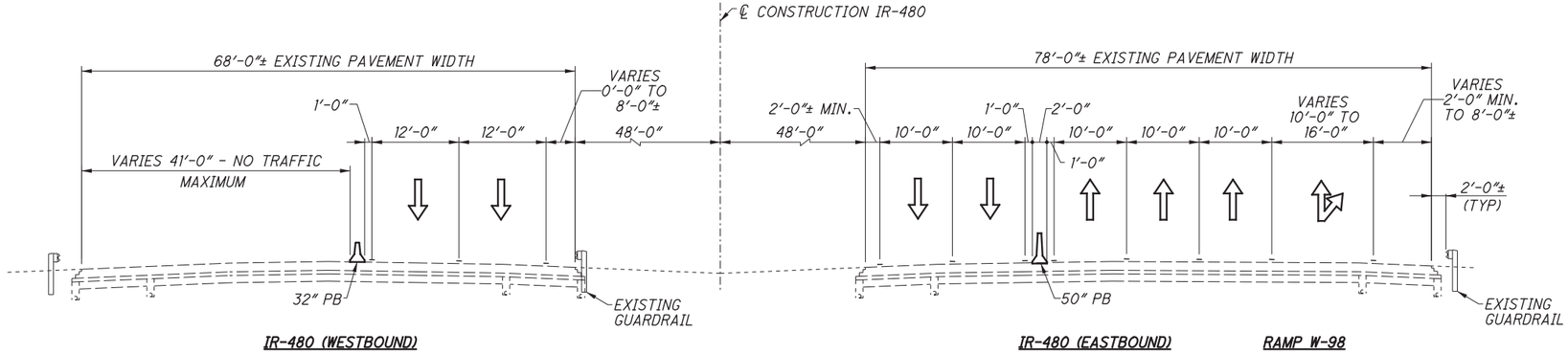
EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.a (72) - PHASE 3
SECTION G-G



EXISTING TYPICAL SECTION
UNDER E. 98TH STREET BRIDGE

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.a (72) - PHASE 3
SECTION F-F

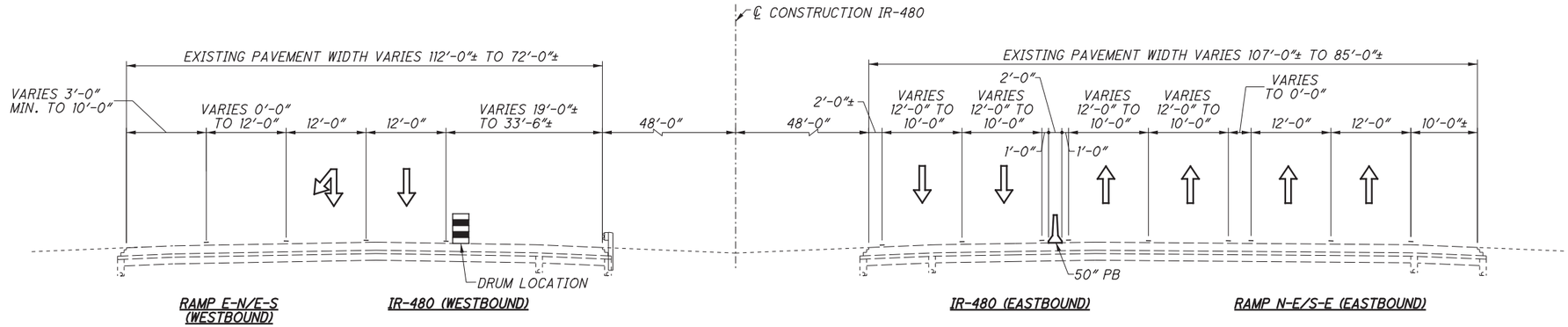


EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.a (72) - PHASE 3
SECTION E-E

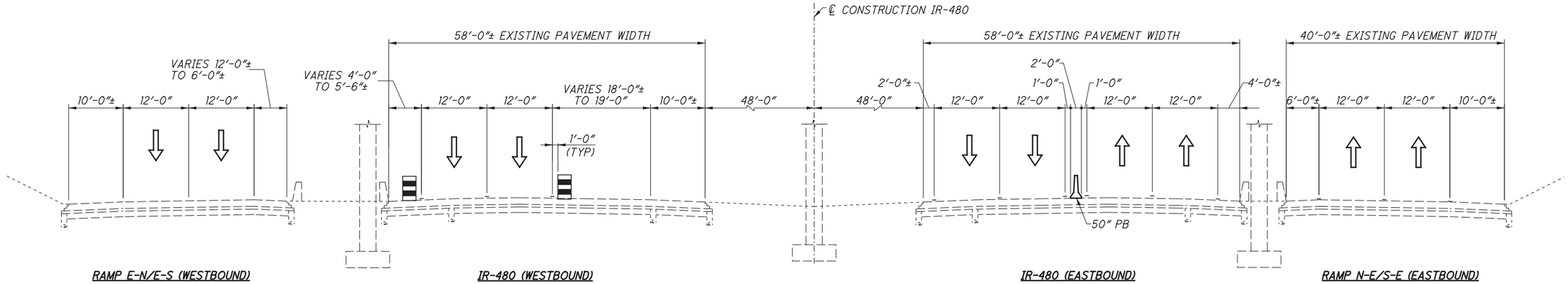
MAINTENANCE OF TRAFFIC
ALTERNATIVE 3.a (72) TYPICAL SECTIONS - PHASE 3

CUY-480-18.42



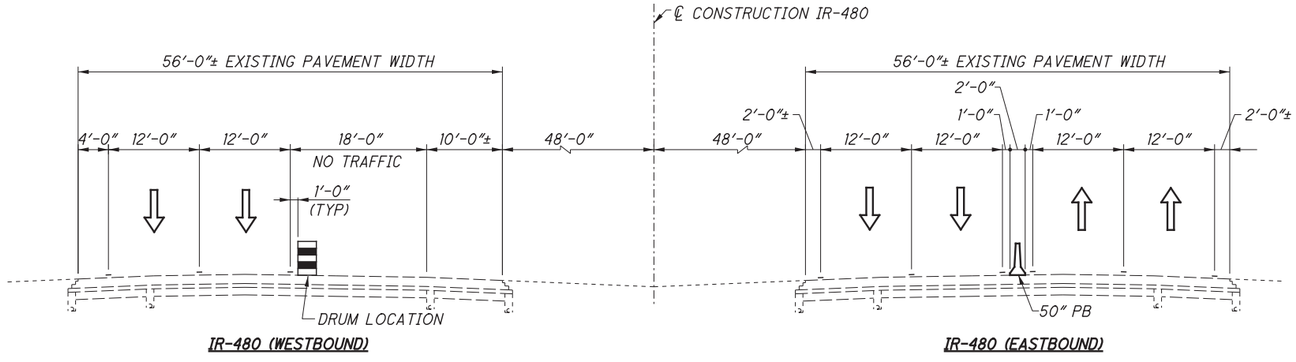
EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.a (72) - PHASE 4
SECTION C-C



EXISTING TYPICAL SECTION
UNDER BRECKSVILLE ROAD BRIDGE

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.a (72) - PHASE 4
SECTION B-B

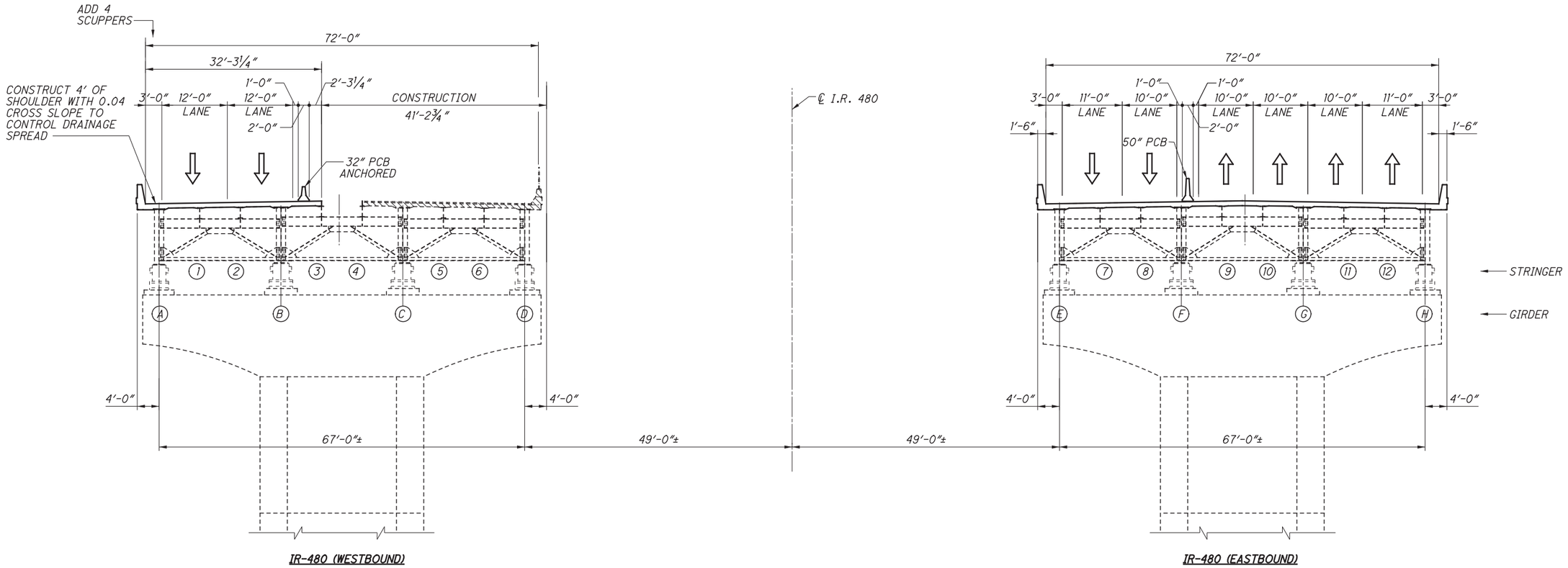


EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.a (72) - PHASE 4
SECTION A-A

MAINTENANCE OF TRAFFIC
ALTERNATIVE 3.a (72) TYPICAL SECTIONS - PHASE 4

CUY-480-18.42



TRANSVERSE SECTION
SECTION D-D

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.a (72) - PHASE 4

ALTERNATIVE 3.a (72)
(72) BRIDGE TRANSVERSE SECTION - PHASE 4

CUY-480-18.42

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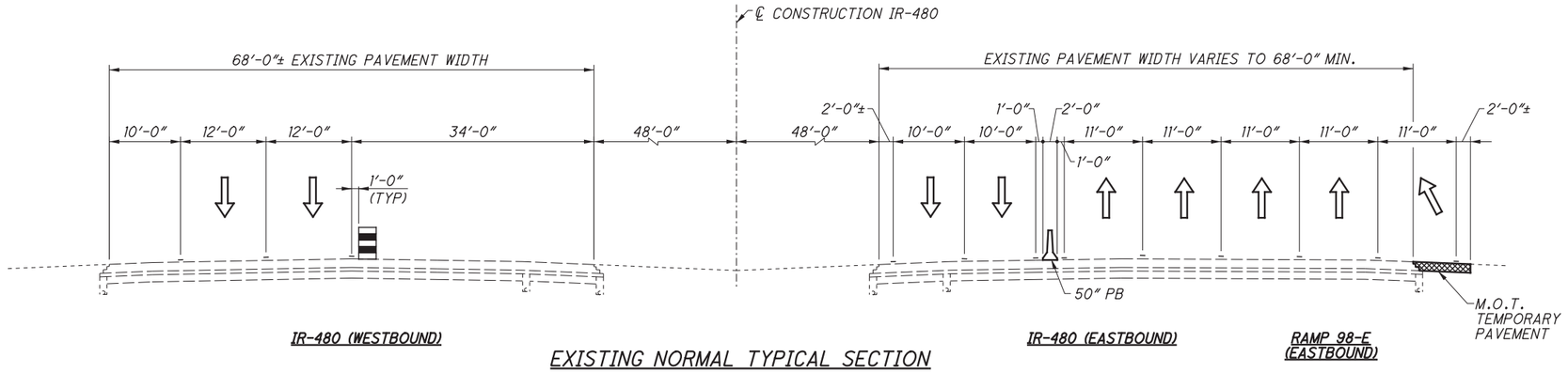
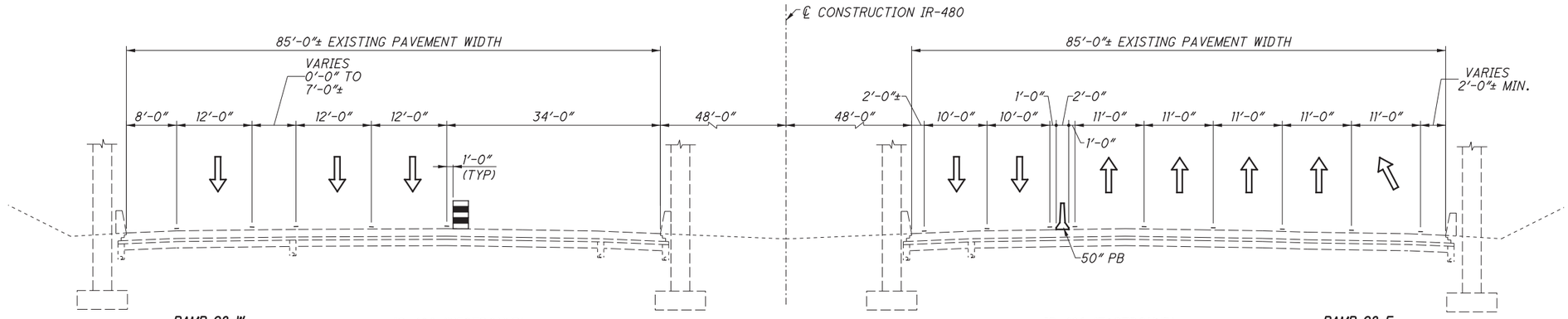


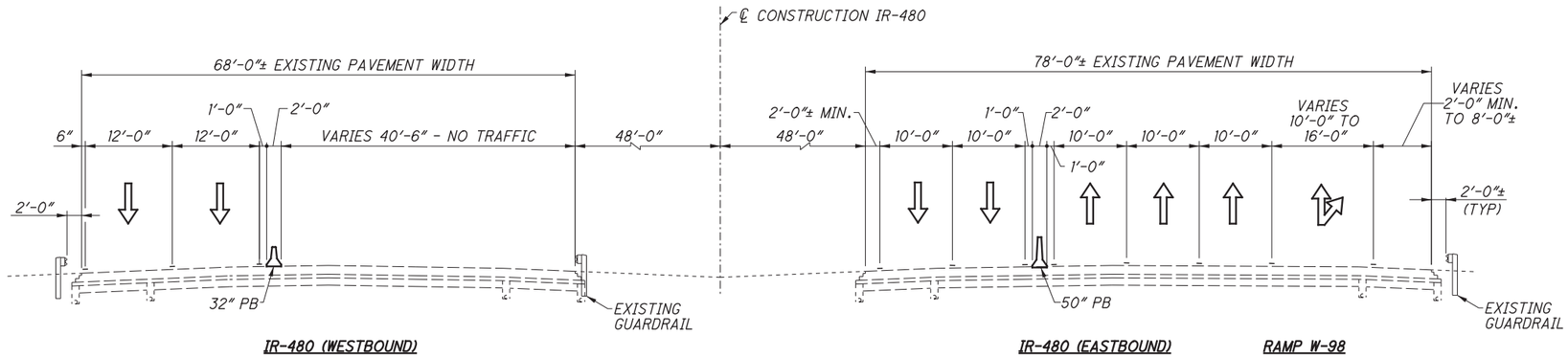
EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.a (72) - PHASE 4
SECTION G-G



EXISTING TYPICAL SECTION
UNDER E. 98TH STREET BRIDGE

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.a (72) - PHASE 4
SECTION F-F

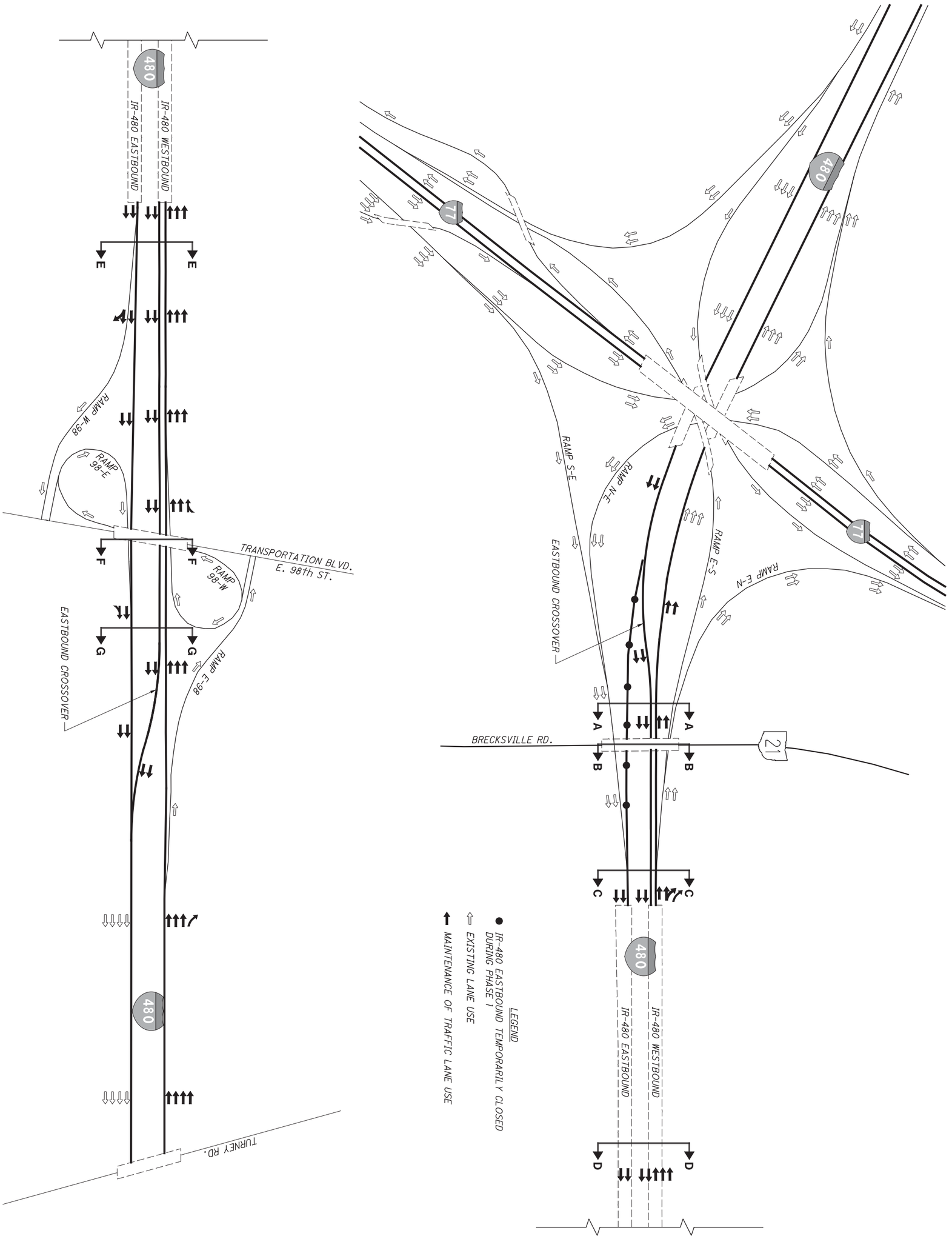


EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.a (72) - PHASE 4
SECTION E-E

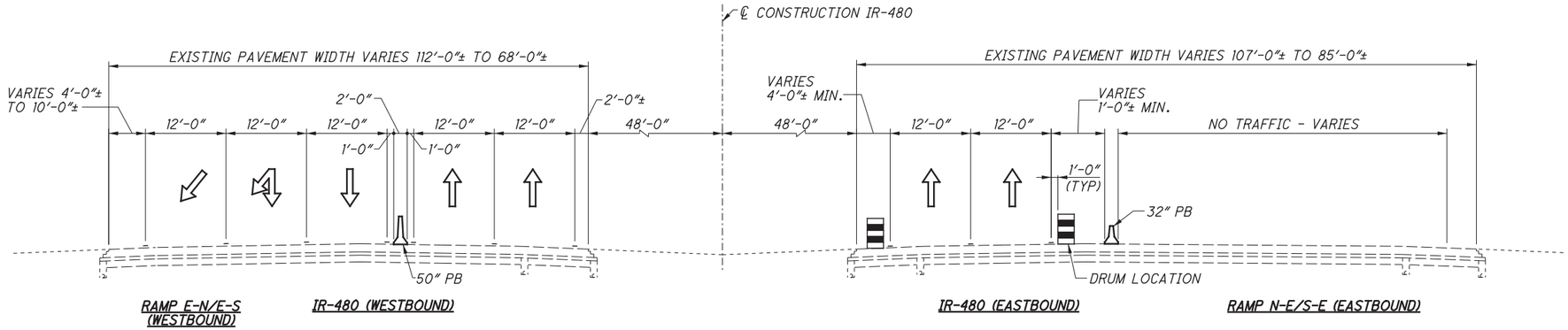
MAINTENANCE OF TRAFFIC
ALTERNATIVE 3.a (72) TYPICAL SECTIONS - PHASE 4

CUY-480-18.42



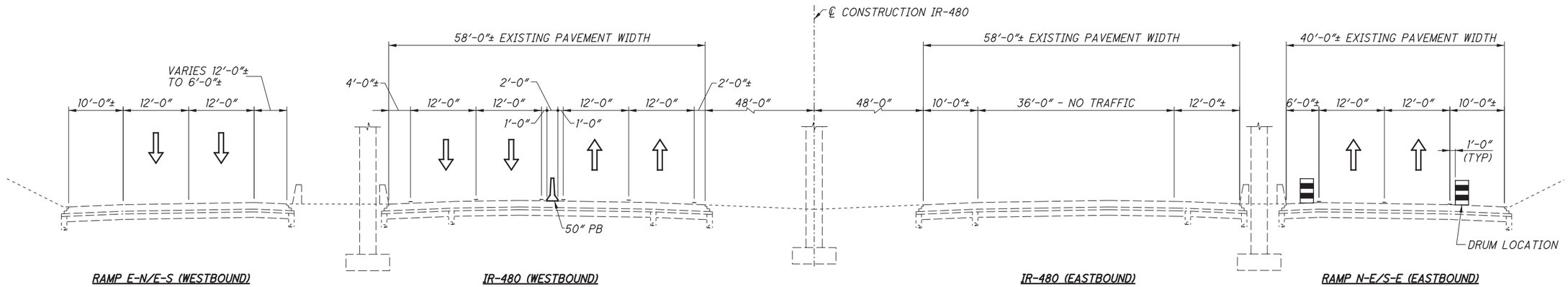
	CUY-480-1842	MAINTENANCE OF TRAFFIC ALTERNATIVE 3.b (72) - PHASES 1 & 2

0 125 250 500
HORIZONTAL SCALE IN FEET



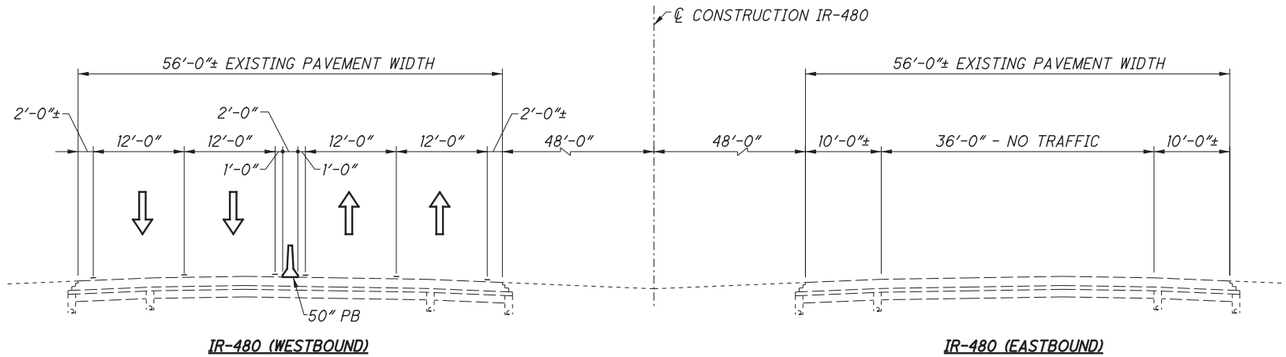
EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.b (72) - PHASE 1
SECTION C-C



EXISTING TYPICAL SECTION
UNDER BRECKSVILLE ROAD BRIDGE

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.b (72) - PHASE 1
SECTION B-B



EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.b (72) - PHASE 1
SECTION A-A

MAINTENANCE OF TRAFFIC
ALTERNATIVE 3.b (72) TYPICAL SECTIONS - PHASE 1

CUY-480-18.42

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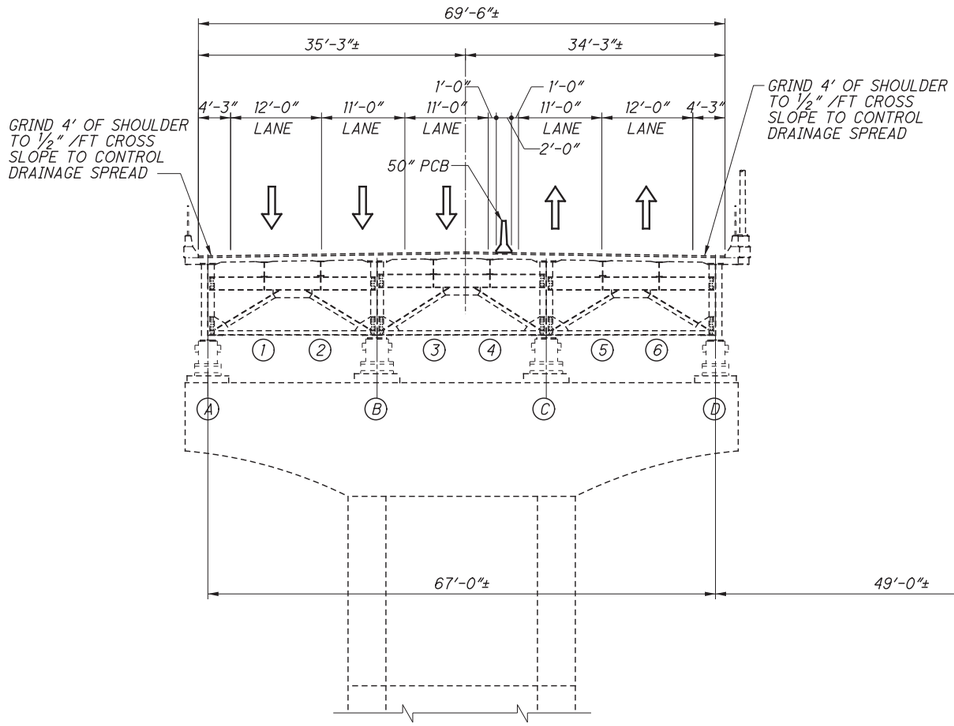
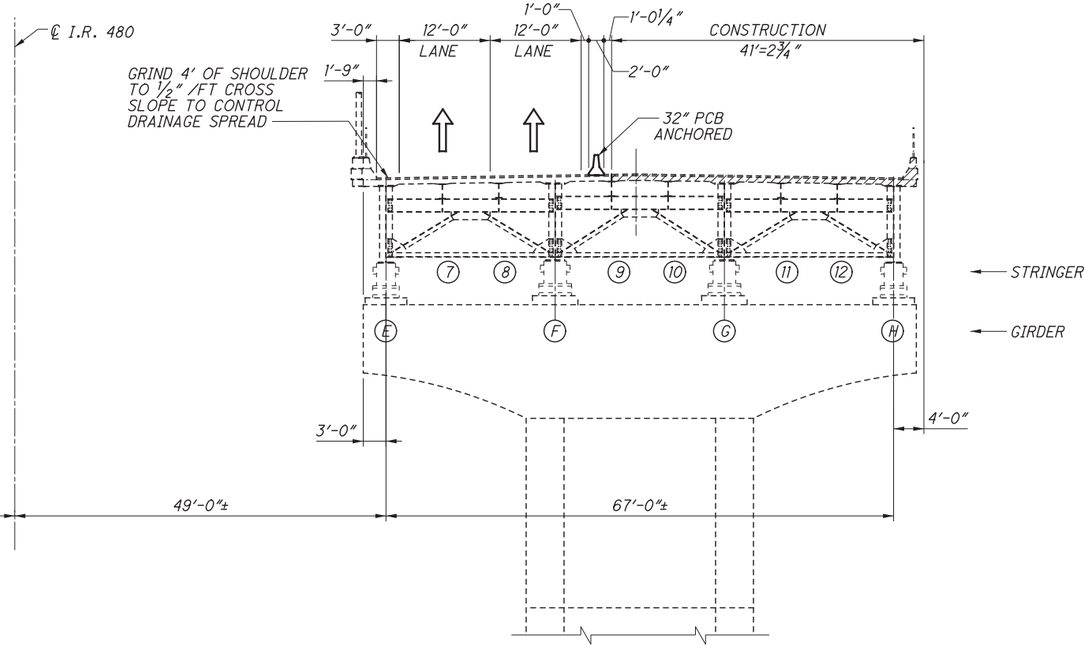


IR-480 (WESTBOUND)



IR-480 (EASTBOUND)

TRANSVERSE SECTION
SECTION D-D

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.b (72) - PHASE 1

MAINTENANCE OF TRAFFIC
ALTERNATIVE 3.b (72) BRIDGE TRANSVERSE SECTION - PHASE 1

CUY-480-18.42

1

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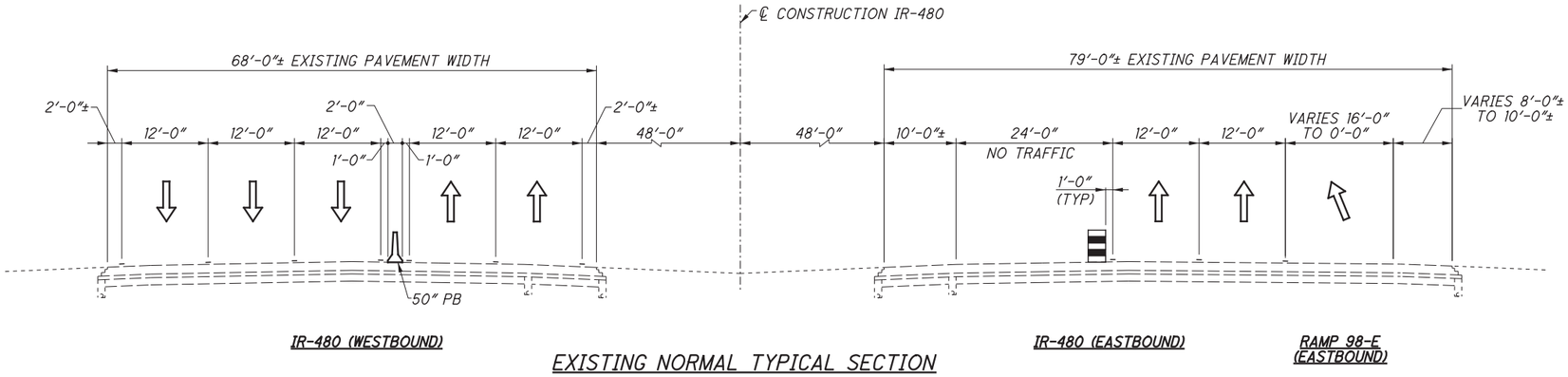
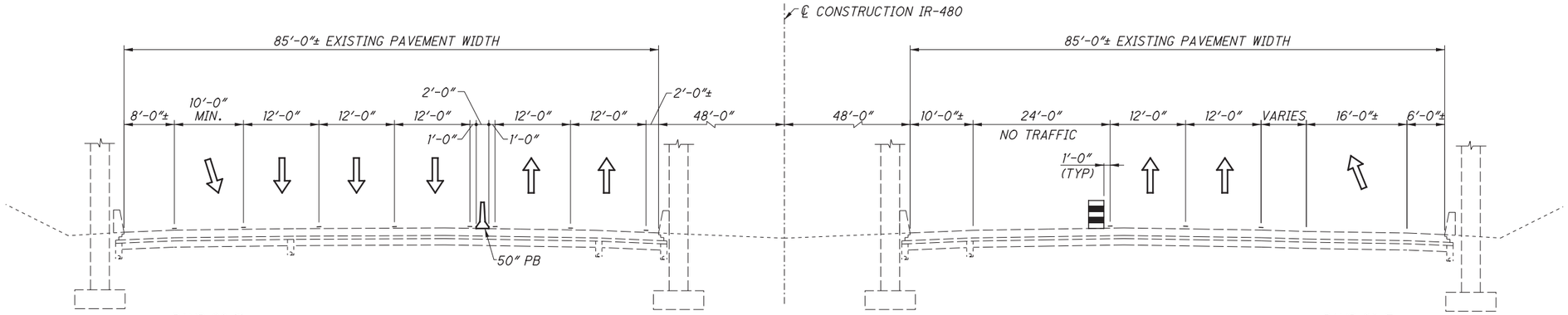


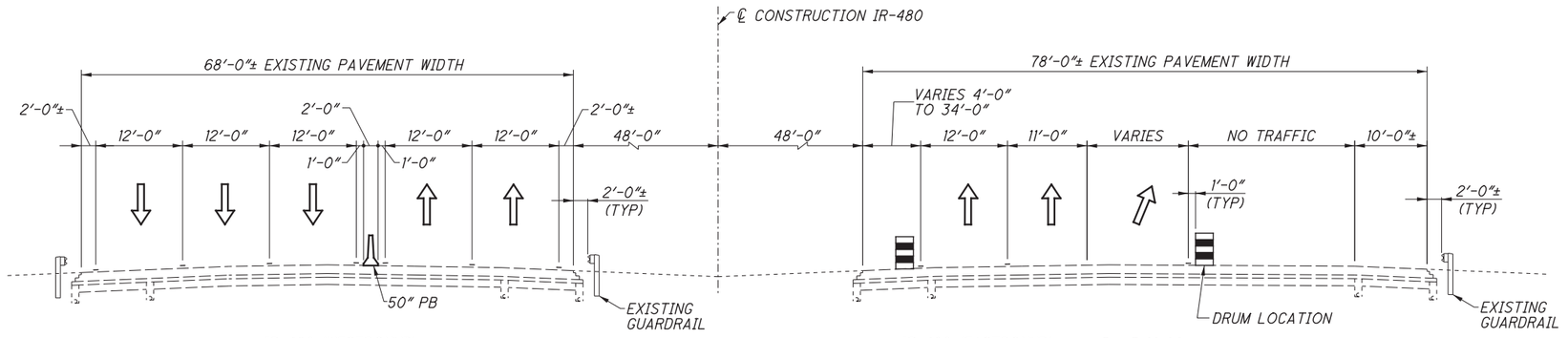
EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.b (72) - PHASE 1
SECTION G-G



EXISTING TYPICAL SECTION
UNDER E. 98TH STREET BRIDGE

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.b (72) - PHASE 1
SECTION F-F



EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.b (72) - PHASE 1
SECTION E-E

MAINTENANCE OF TRAFFIC
ALTERNATIVE 3.b (72) TYPICAL SECTIONS - PHASE 1

CUY-480-18.42

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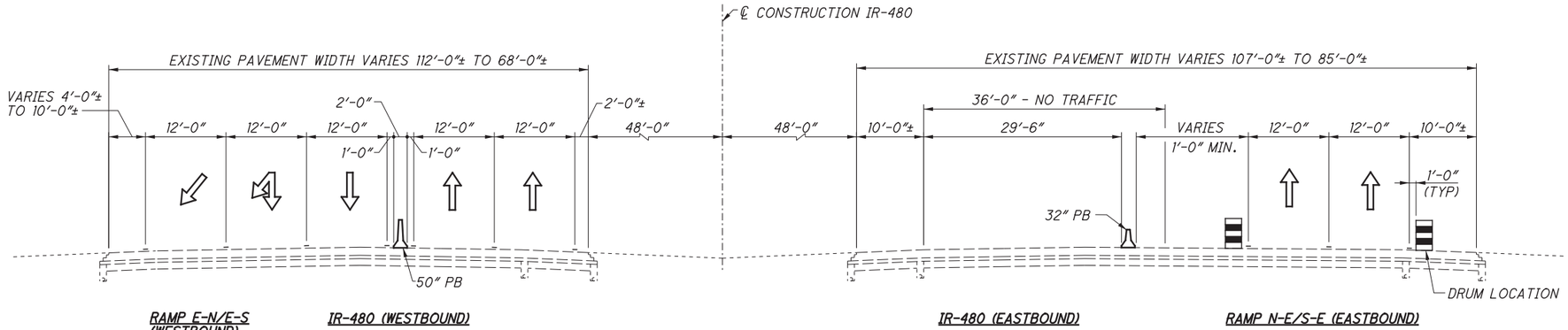
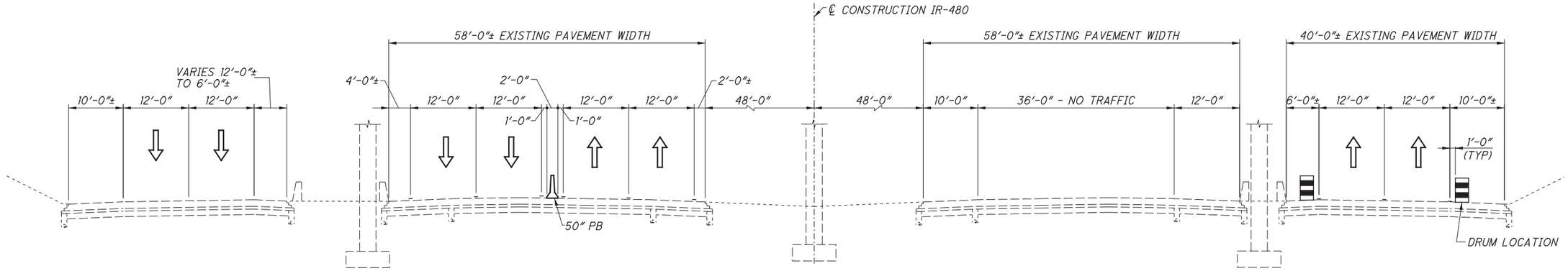
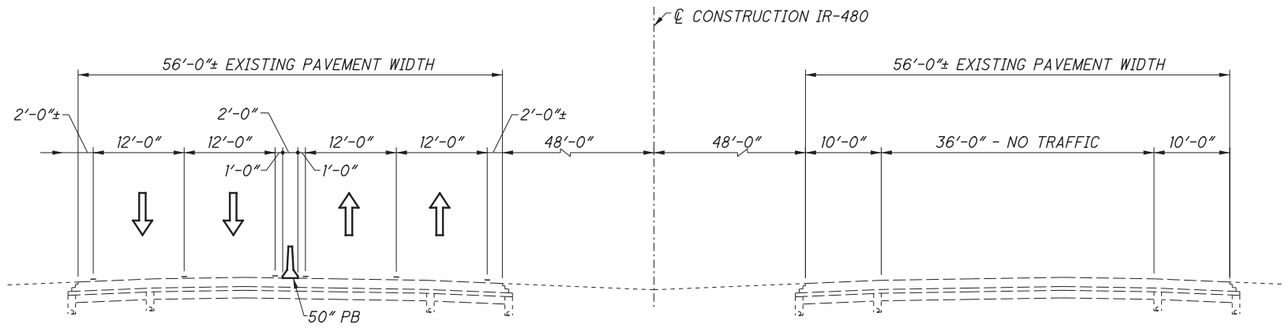


EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.b (72) - PHASE 2
SECTION C-C



EXISTING TYPICAL SECTION
UNDER BRECKSVILLE ROAD BRIDGE
MAINTENANCE OF TRAFFIC ALTERNATIVE 3.b (72) - PHASE 2
SECTION B-B

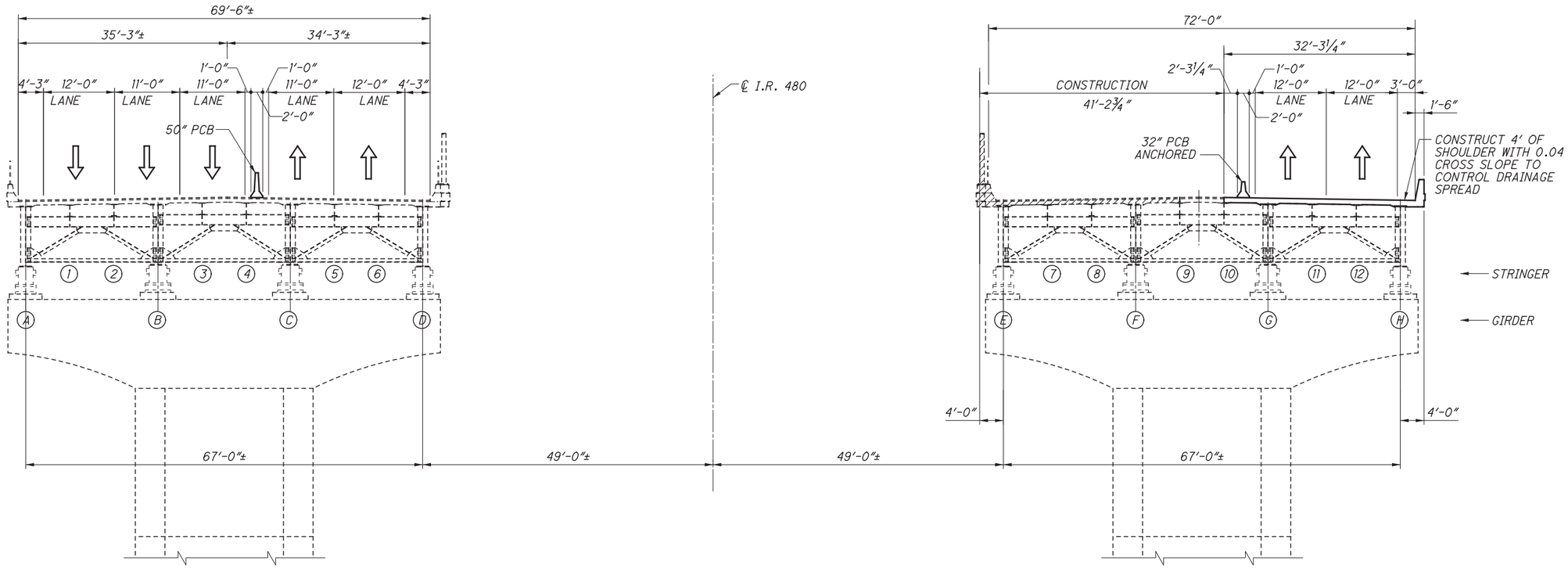


EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.b (72) - PHASE 2
SECTION A-A

MAINTENANCE OF TRAFFIC
ALTERNATIVE 3.b (72) TYPICAL SECTIONS - PHASE 2

CUY-480-18.42



IR-480 (WESTBOUND)

IR-480 (EASTBOUND)

TRANSVERSE SECTION
SECTION D-D

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.b (72) - PHASE 2

MAINTENANCE OF TRAFFIC
ALTERNATIVE 3.b (72) BRIDGE TRANSVERSE SECTION - PHASE 2

CUY-480-18.42

1

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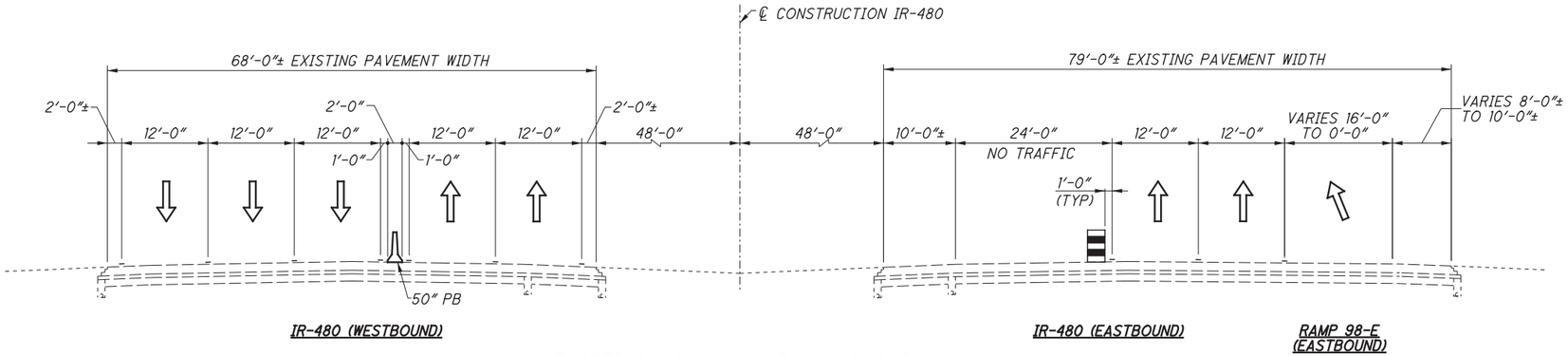
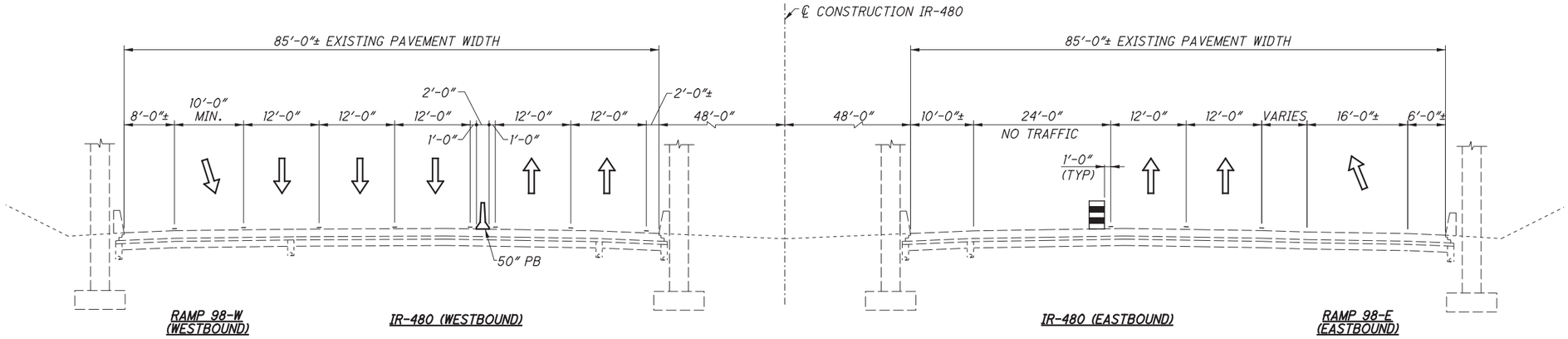


EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.b (72) - PHASE 2

SECTION G-G

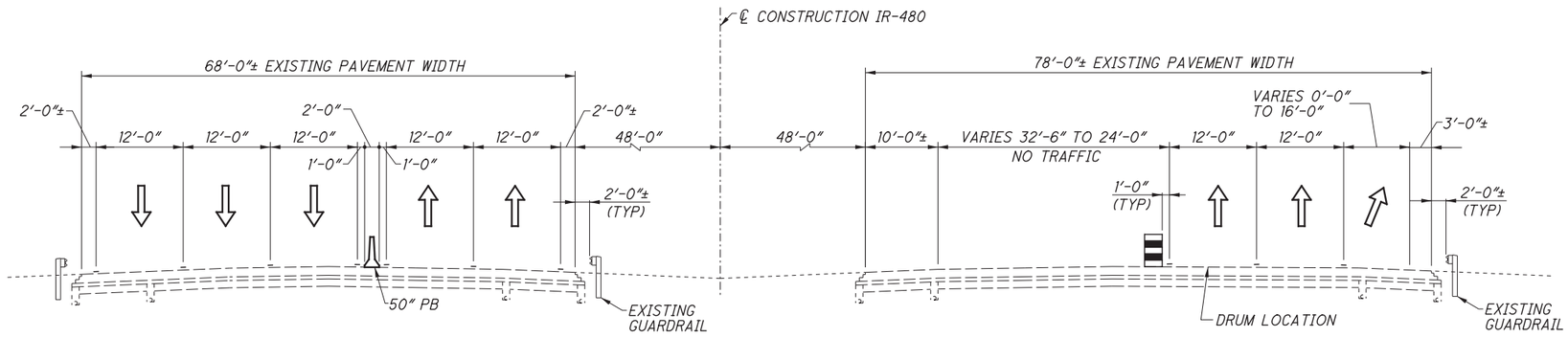


EXISTING TYPICAL SECTION

UNDER E. 98TH STREET BRIDGE

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.b (72) - PHASE 2

SECTION F-F



EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.b (72) - PHASE 2

SECTION E-E

MAINTENANCE OF TRAFFIC
ALTERNATIVE 3.b (72) TYPICAL SECTIONS - PHASE 2

CUY-480-18.42

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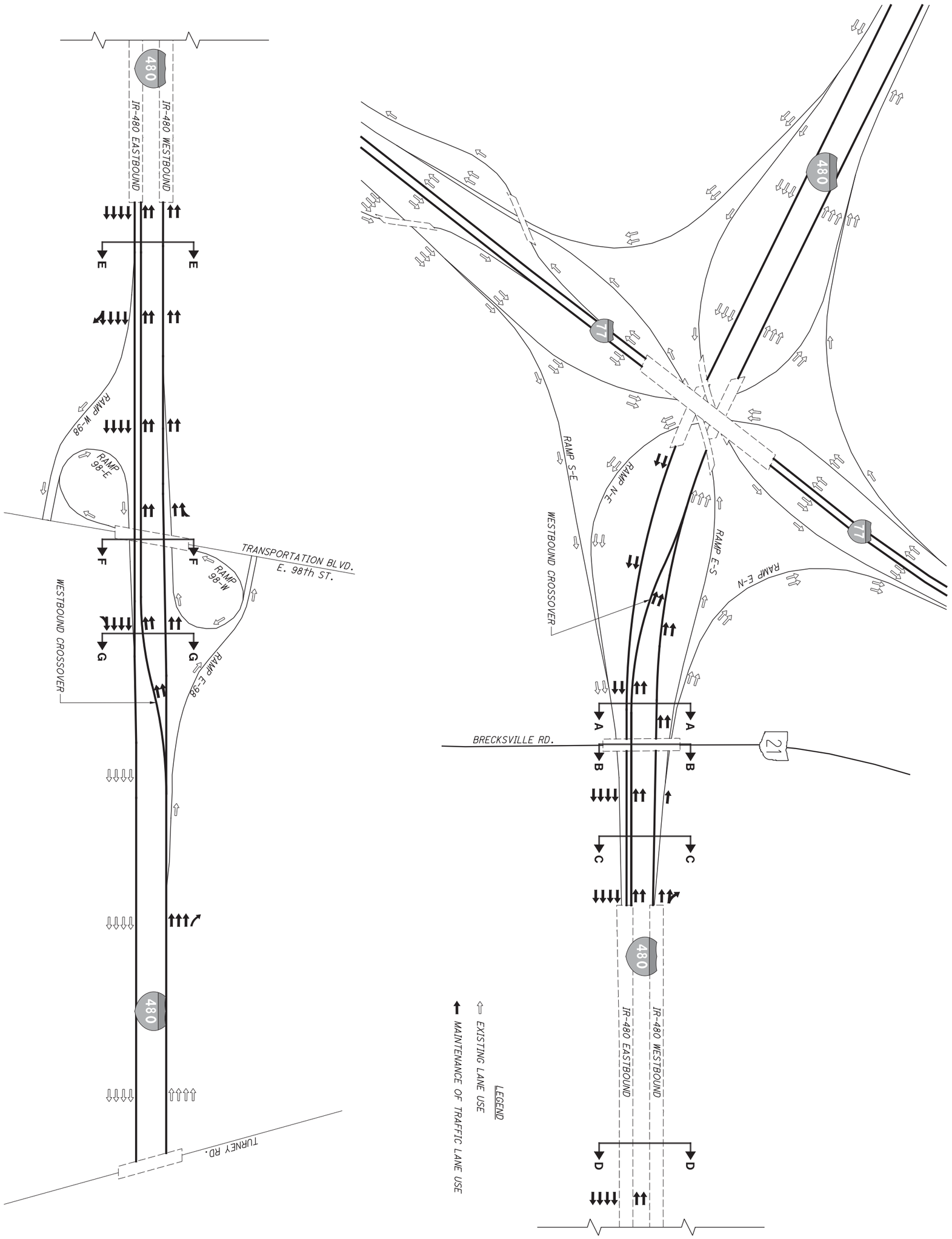
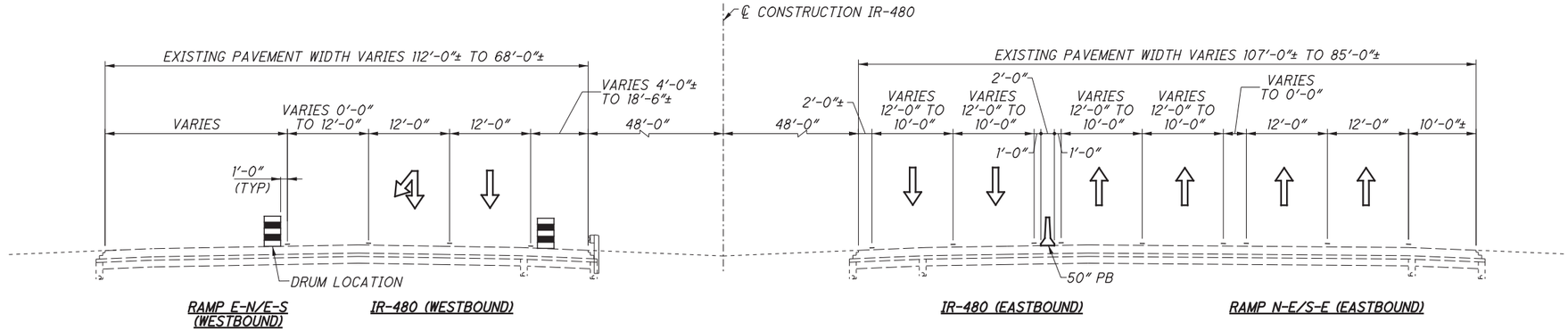


	CUY-480-1842	MAINTENANCE OF TRAFFIC ALTERNATIVE 3.b (72) - PHASES 3 & 4

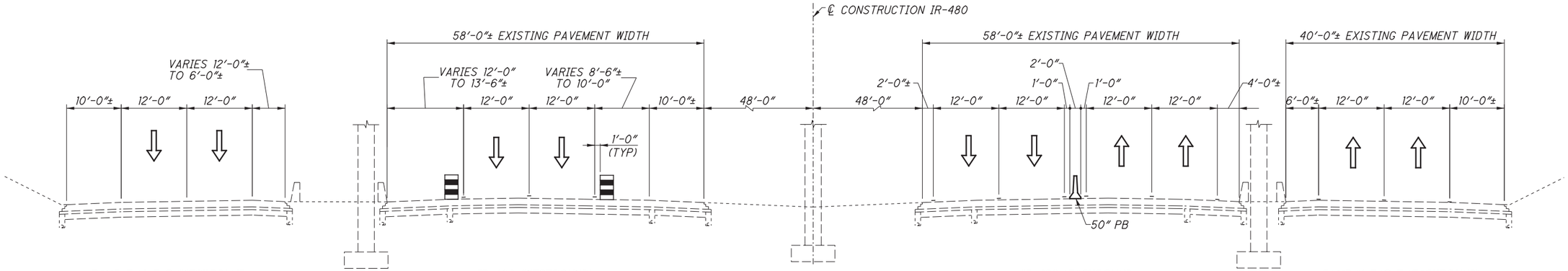
0 250
125 500
HORIZONTAL SCALE IN FEET

N



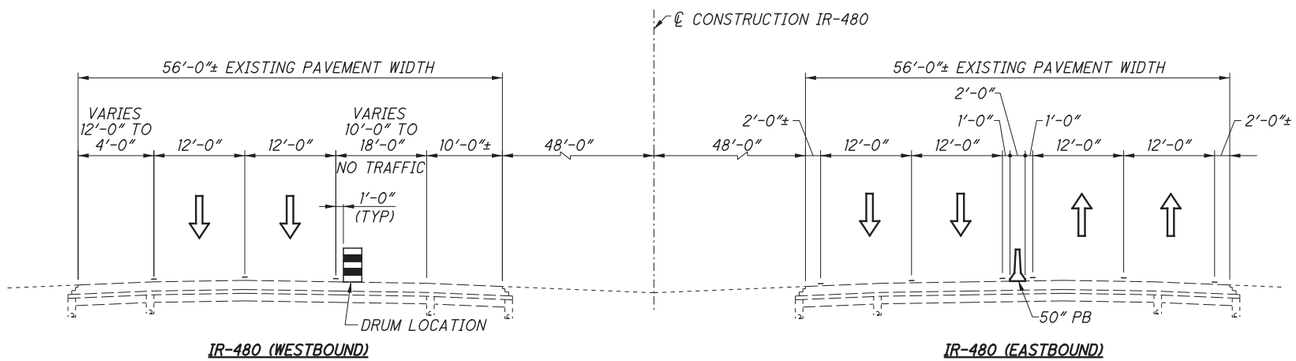
EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.b (72) - PHASE 3
SECTION C-C



EXISTING TYPICAL SECTION
UNDER BRECKSVILLE ROAD BRIDGE

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.b (72) - PHASE 3
SECTION B-B

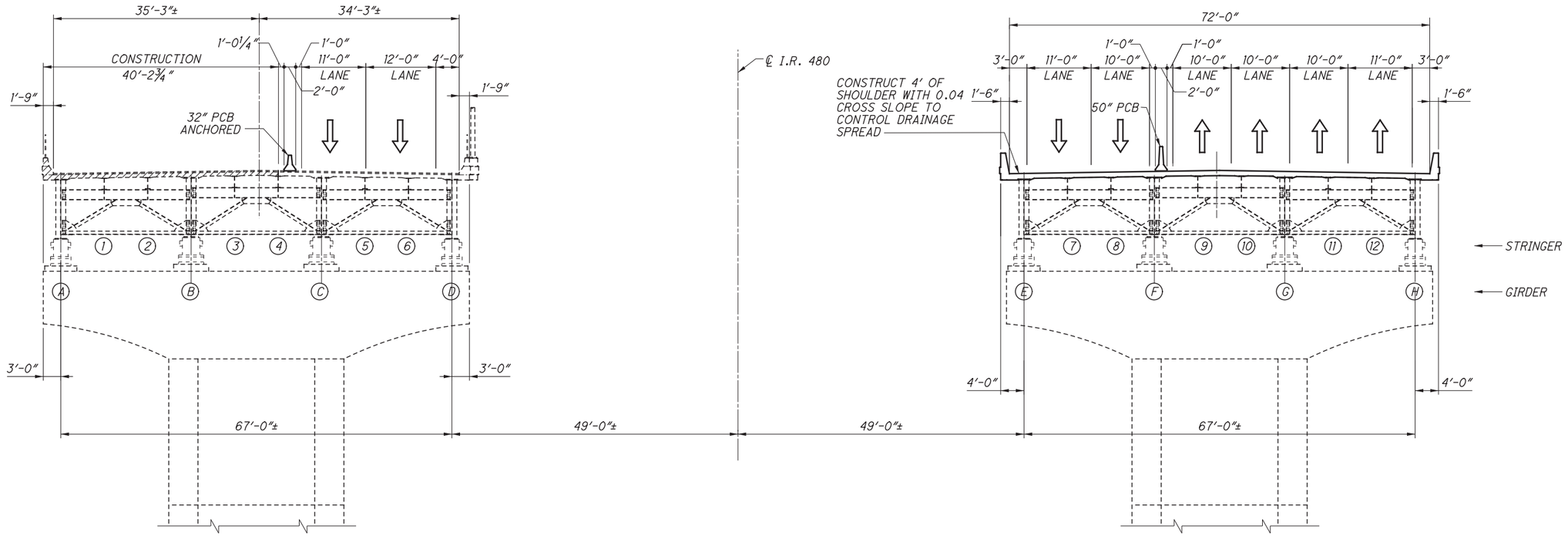


EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.b (72) - PHASE 3
SECTION A-A

MAINTENANCE OF TRAFFIC
ALTERNATIVE 3.b (72) TYPICAL SECTIONS - PHASE 3

CUY-480-18.42



TRANSVERSE SECTION
SECTION D-D

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.b (72) - PHASE 3

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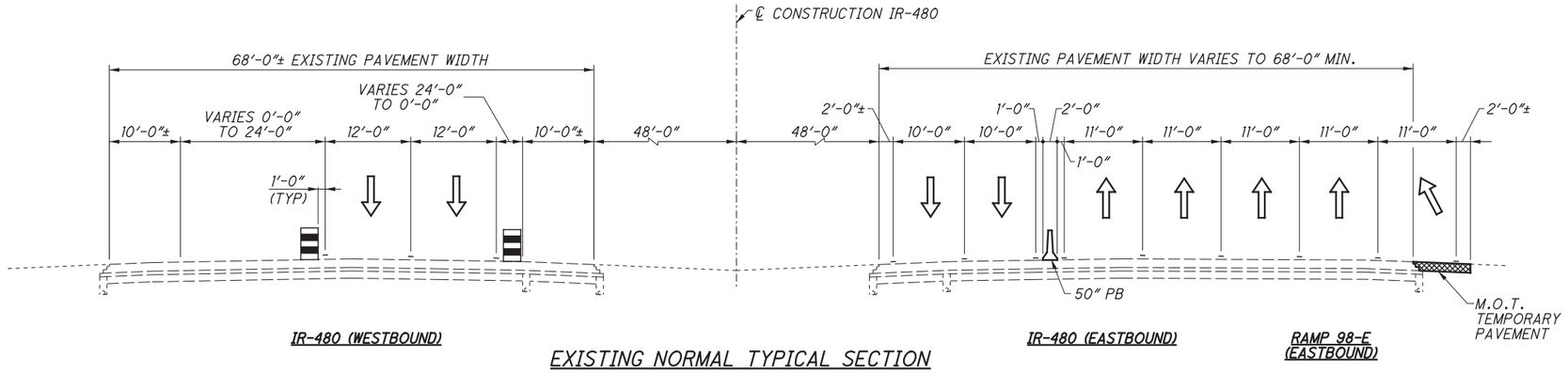
MAINTENANCE OF TRAFFIC
ALTERNATIVE 3.b (72) BRIDGE TRANSVERSE SECTION - PHASE 3

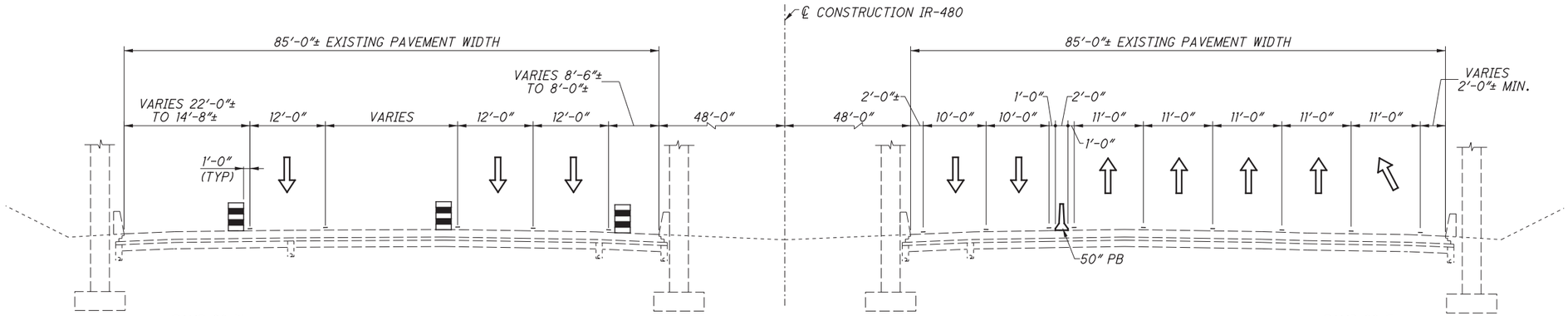
CUY-480-18.42

3 / 4



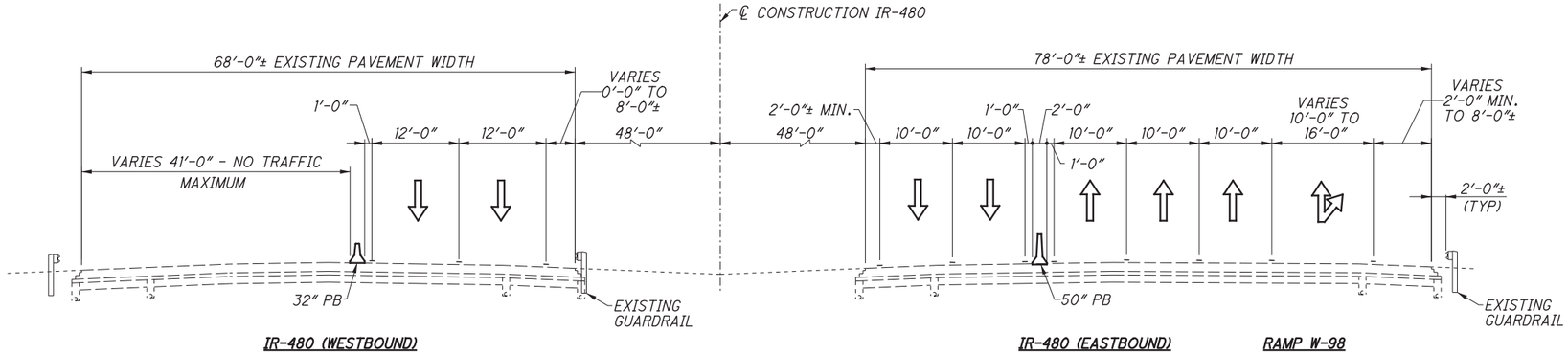
EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.b (72) - PHASE 3
SECTION G-G



EXISTING TYPICAL SECTION
UNDER E. 98TH STREET BRIDGE

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.b (72) - PHASE 3
SECTION F-F

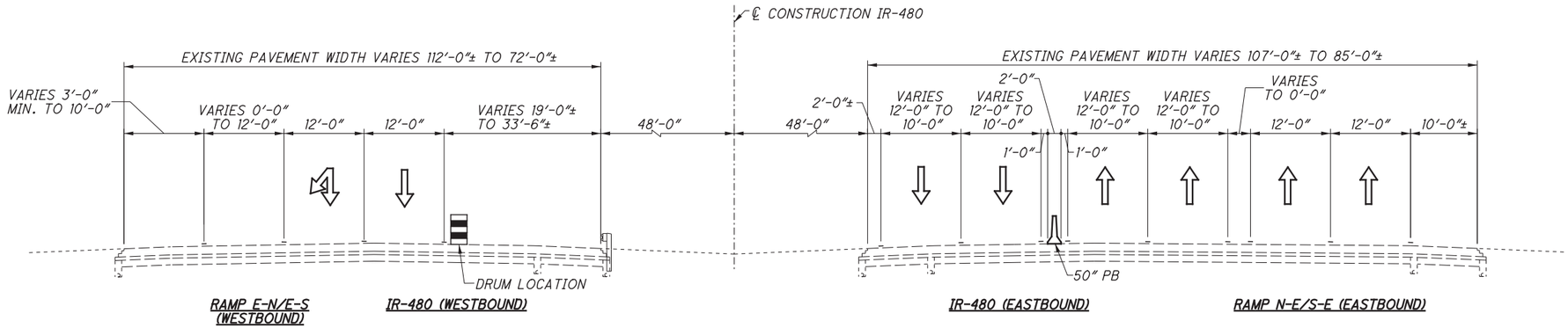


EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.b (72) - PHASE 3
SECTION E-E

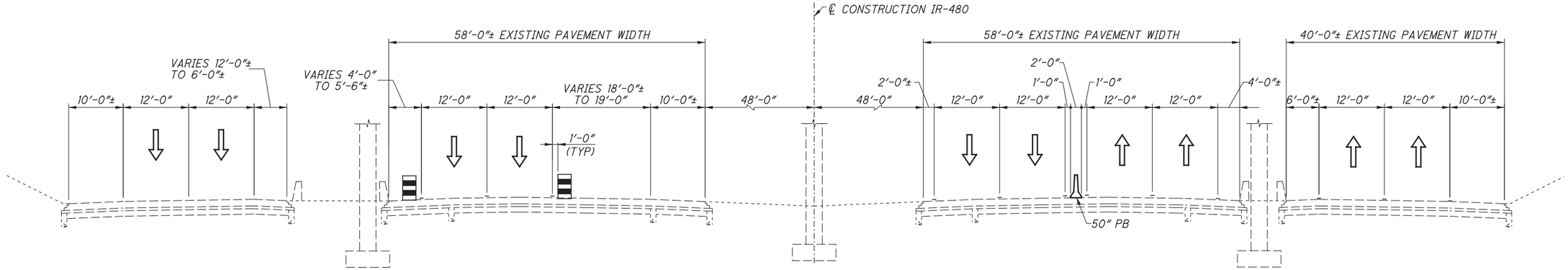
MAINTENANCE OF TRAFFIC
ALTERNATIVE 3.b (72) TYPICAL SECTIONS - PHASE 3

CUY-480-18.42



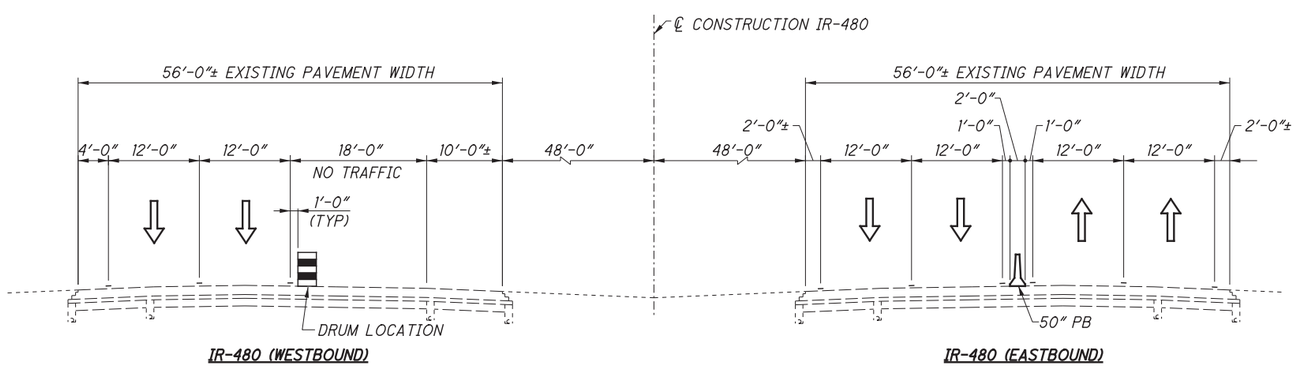
EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.b (72) - PHASE 4
SECTION C-C



EXISTING TYPICAL SECTION
UNDER BRECKSVILLE ROAD BRIDGE

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.b (72) - PHASE 4
SECTION B-B

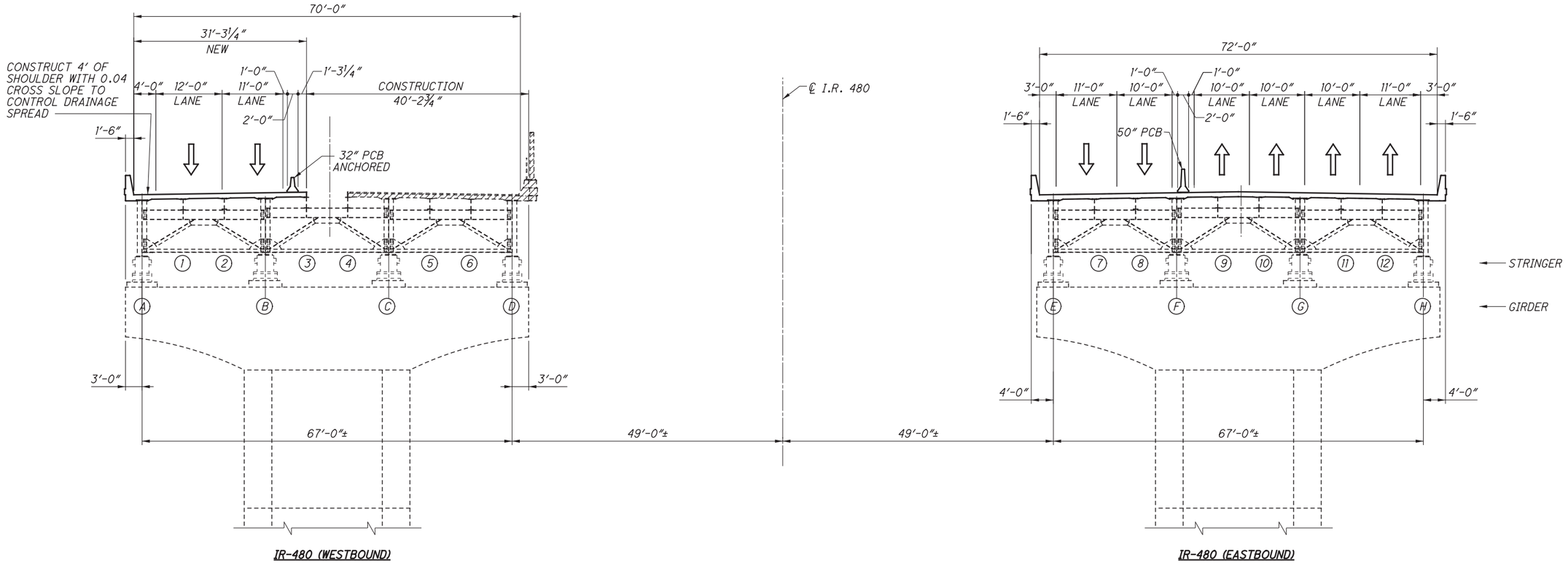


EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.b (72) - PHASE 4
SECTION A-A

MAINTENANCE OF TRAFFIC
ALTERNATIVE 3.b (72) TYPICAL SECTIONS - PHASE 4

CUY-480-18.42



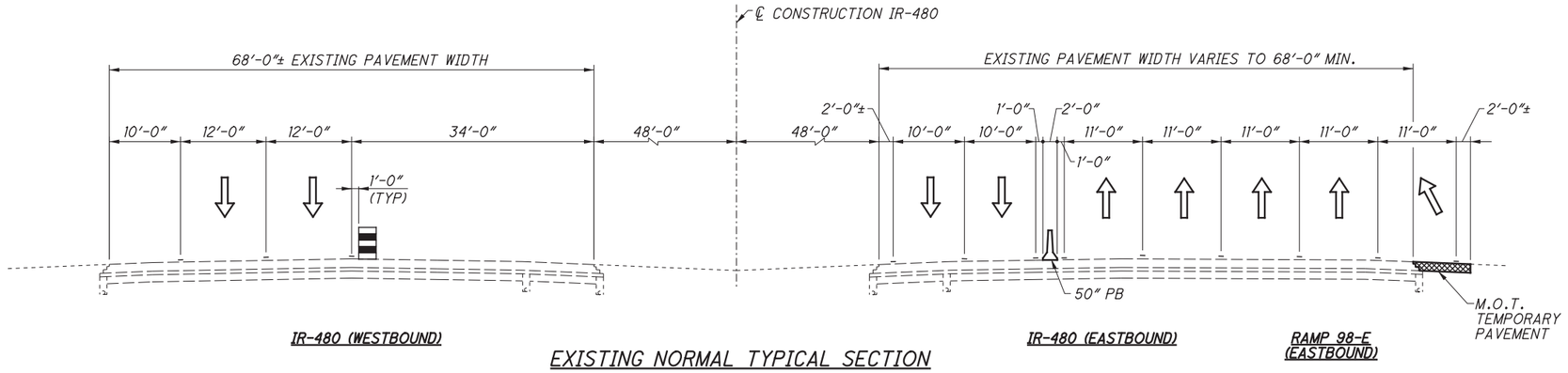
TRANSVERSE SECTION
SECTION D-D

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.b (72) - PHASE 4

ALTERNATIVE 3.b (72)
(72) BRIDGE TRANSVERSE SECTION - PHASE 4

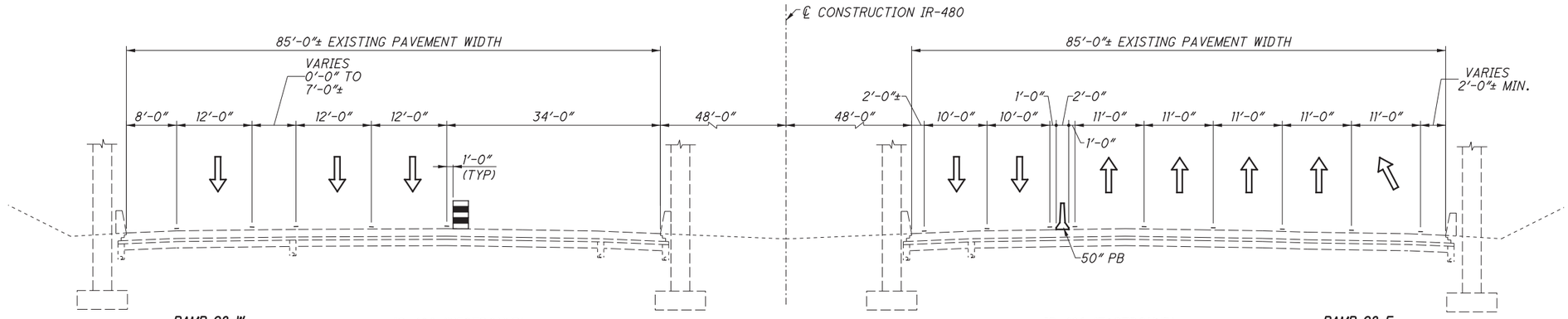
CUY-480-18.42

4 / 4



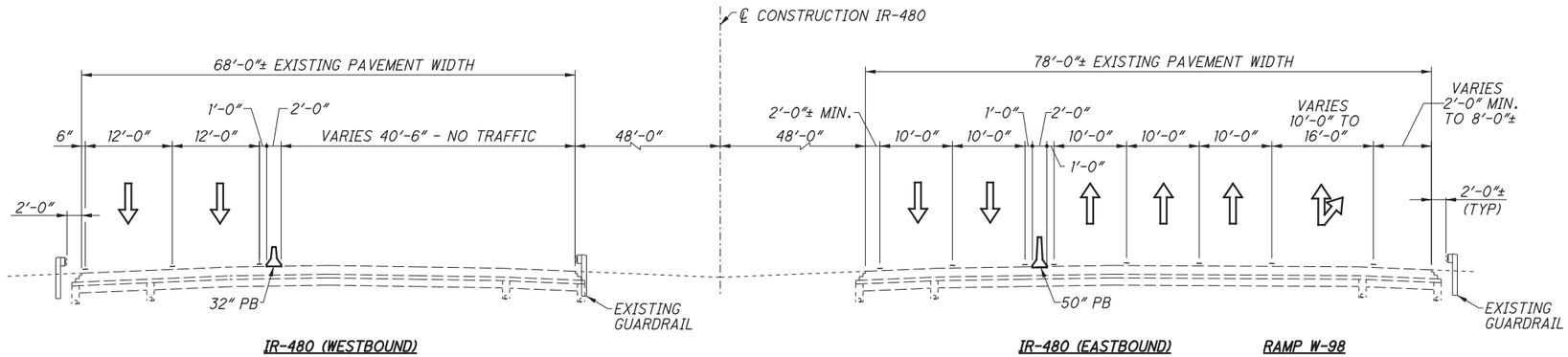
EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.b (72) - PHASE 4
SECTION G-G



EXISTING TYPICAL SECTION
UNDER E. 98TH STREET BRIDGE

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.b (72) - PHASE 4
SECTION F-F



EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.b (72) - PHASE 4
SECTION E-E

MAINTENANCE OF TRAFFIC
ALTERNATIVE 3.b (72) TYPICAL SECTIONS - PHASE 4

CUY-480-18.42

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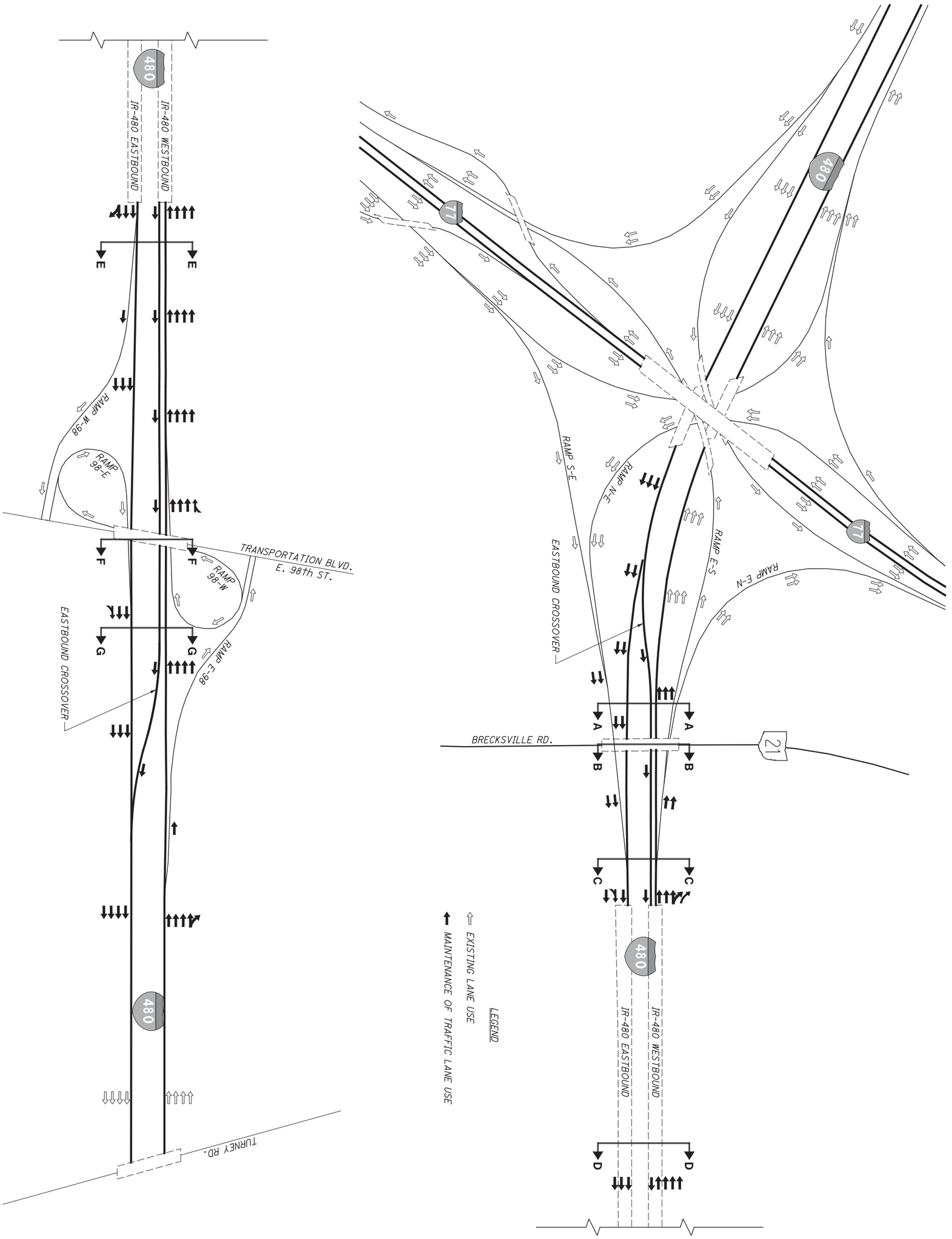
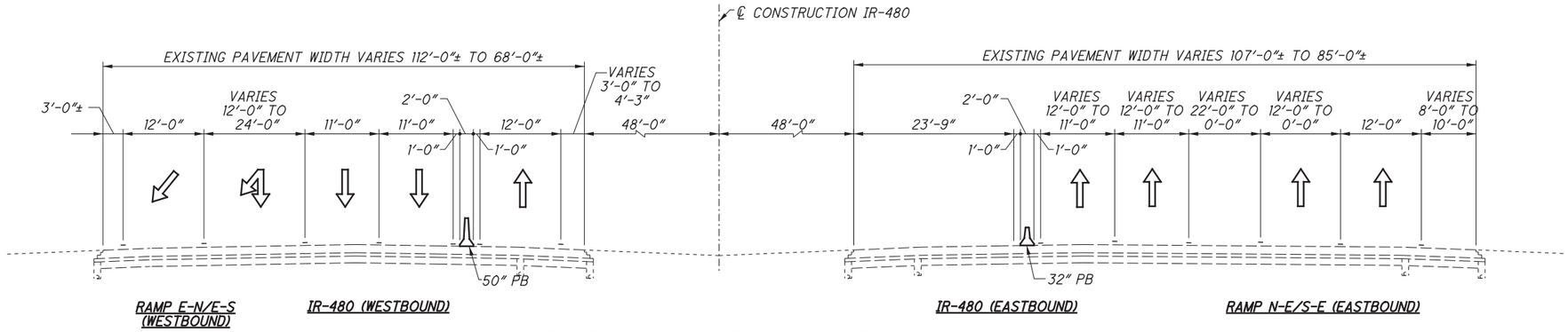


	CUY-480-1842	MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 1

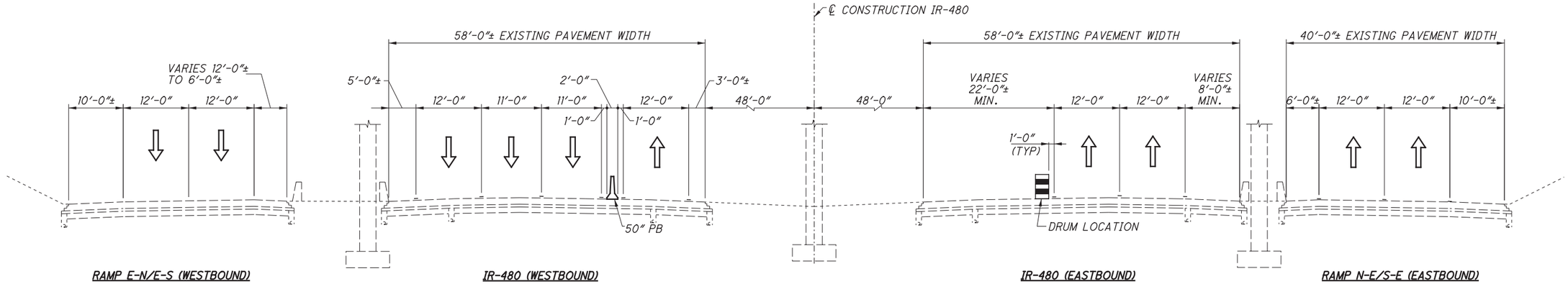
0 125 250 500
HORIZONTAL SCALE IN FEET

N



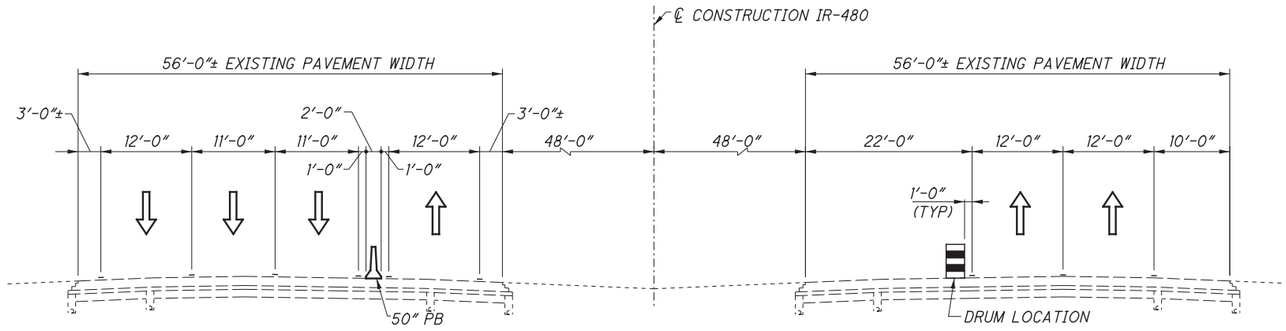
EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 1
SECTION C-C



EXISTING TYPICAL SECTION
UNDER BRECKSVILLE ROAD BRIDGE

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 1
SECTION B-B

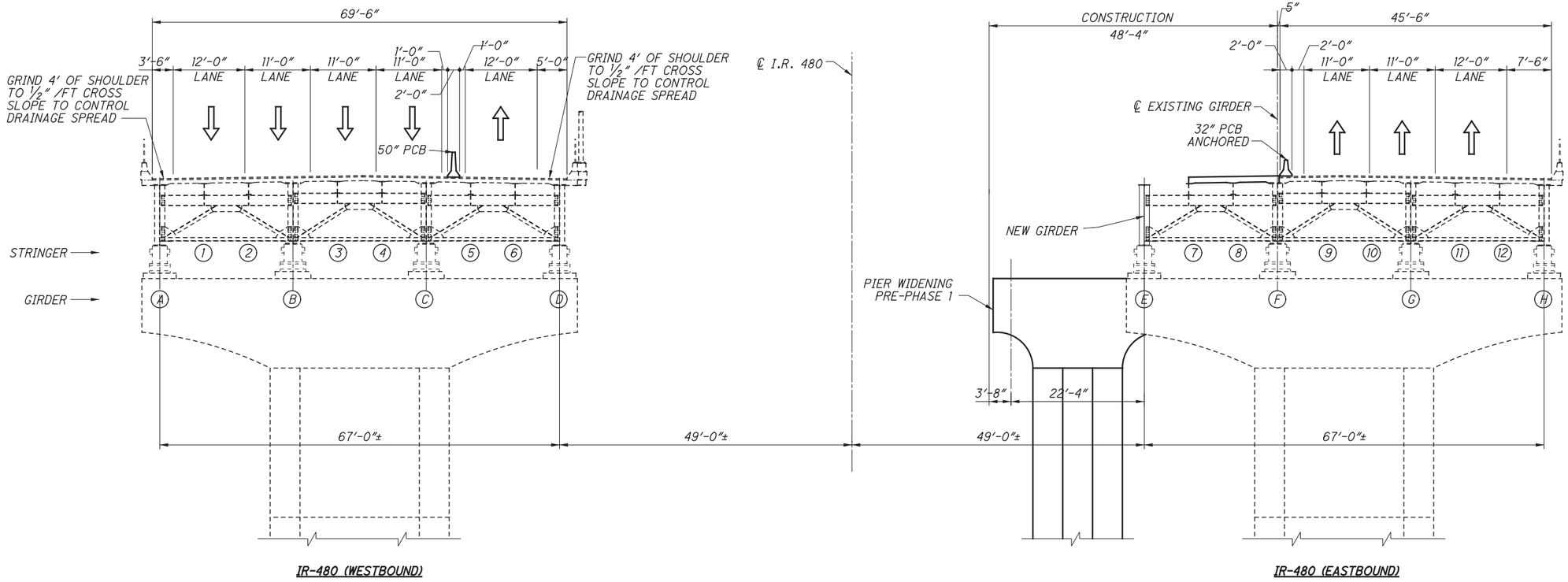


EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 1
SECTION A-A

MAINTENANCE OF TRAFFIC
ALTERNATIVE 3.c TYPICAL SECTIONS - PHASE 1

CUY-480-18.42



IR-480 (WESTBOUND)

IR-480 (EASTBOUND)

TRANSVERSE SECTION

SECTION D-D

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 1

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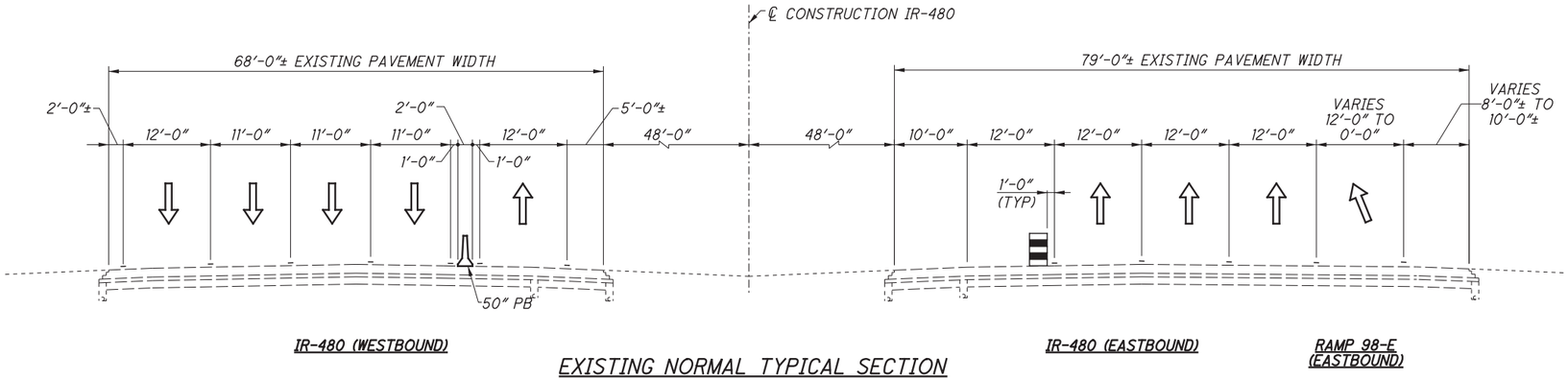
MAINTENANCE OF TRAFFIC
ALTERNATIVE 3.c BRIDGE TRANSVERSE SECTION - PHASE 1

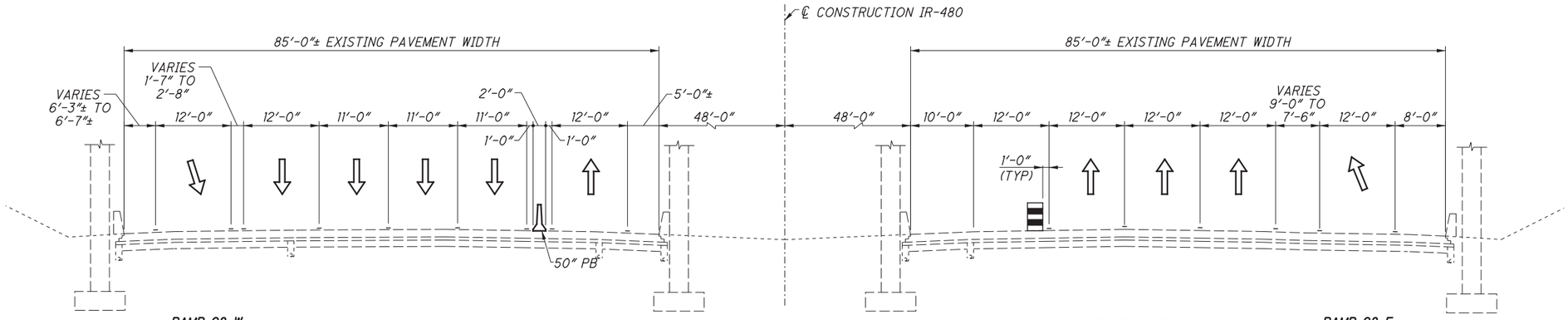
CUY-480-18.42

1 / 5



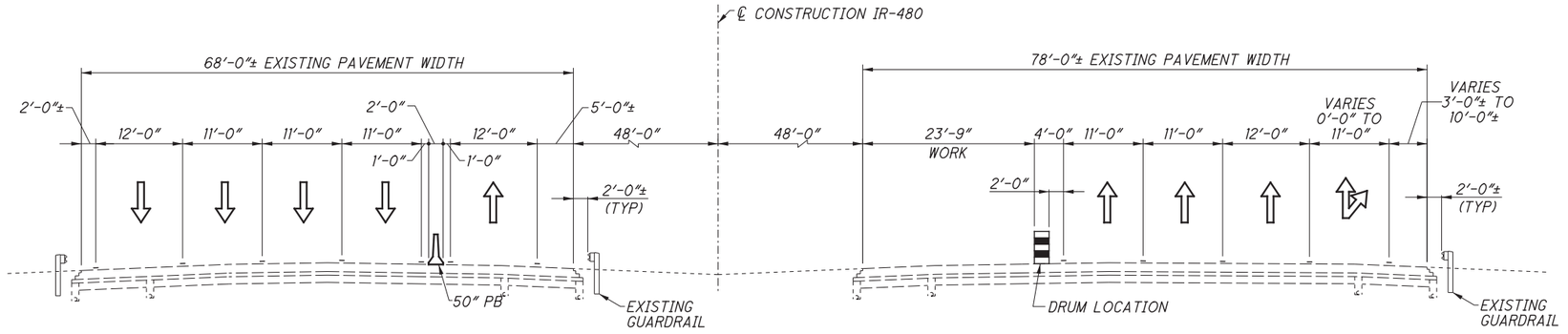
EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 1
SECTION G-G



EXISTING TYPICAL SECTION
UNDER E. 98TH STREET BRIDGE

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 1
SECTION F-F



EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 1
SECTION E-E

MAINTENANCE OF TRAFFIC
ALTERNATIVE 3.c TYPICAL SECTIONS - PHASE 1

CUY-480-18.42

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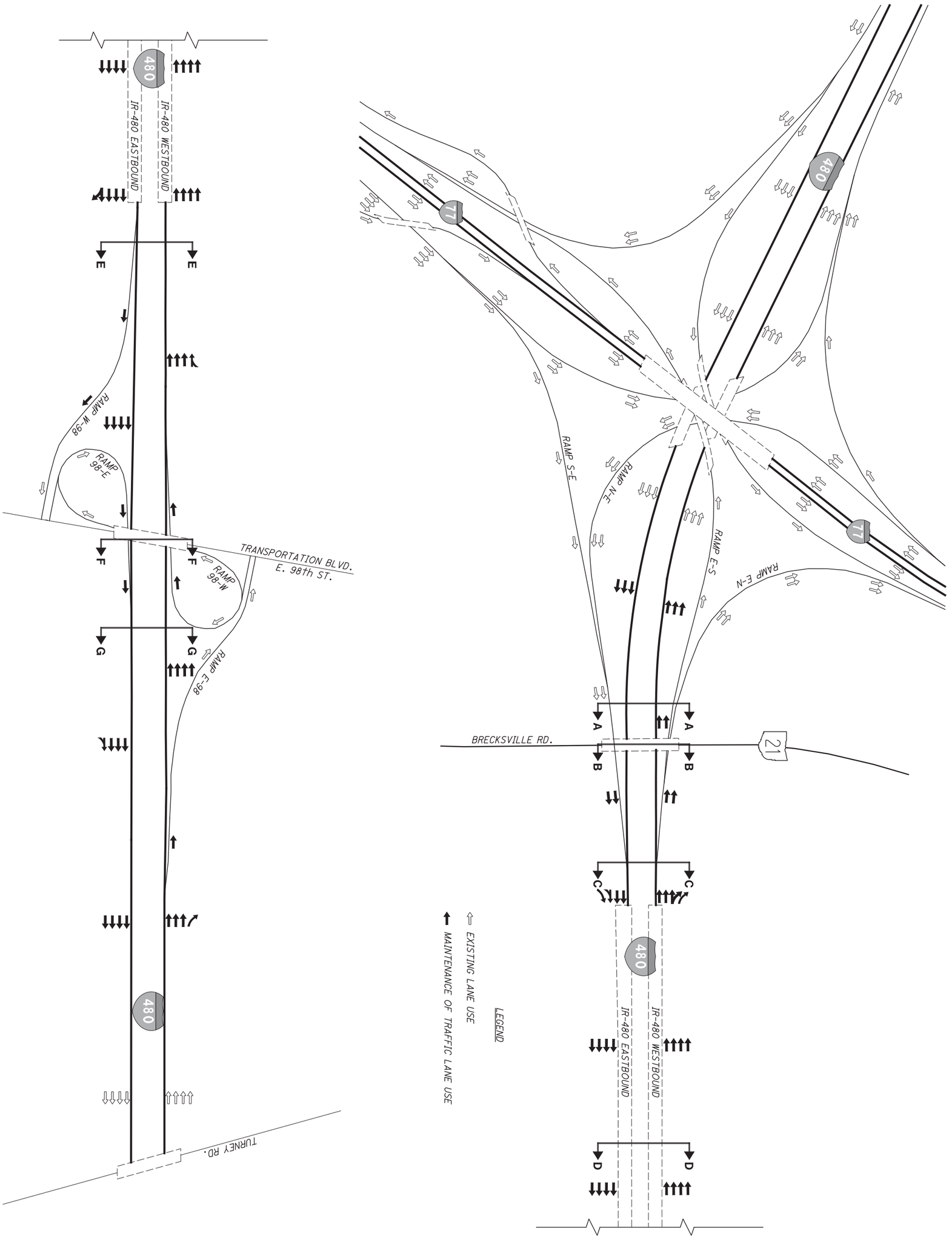
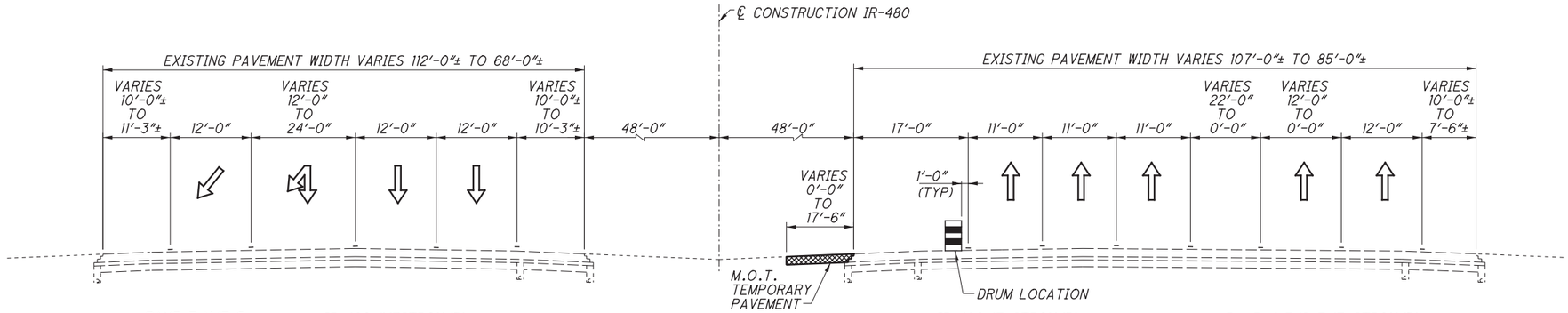


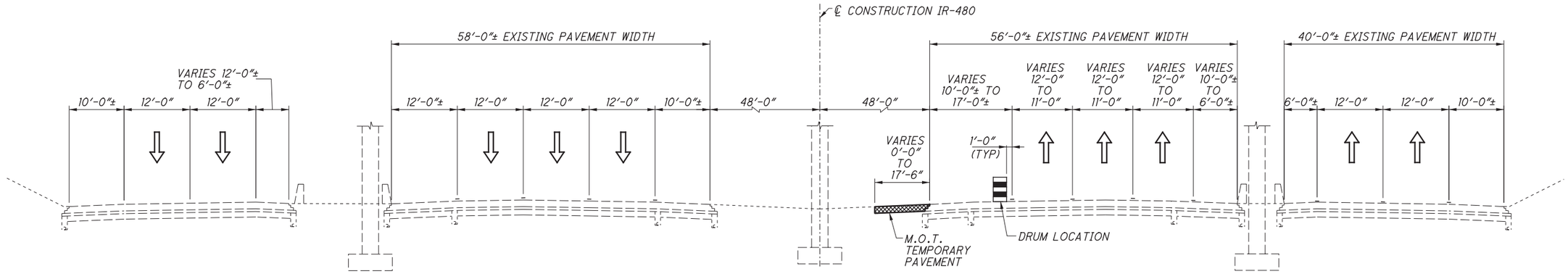
	CUY-480-1842	MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 2

0 250
125 500
HORIZONTAL SCALE IN FEET

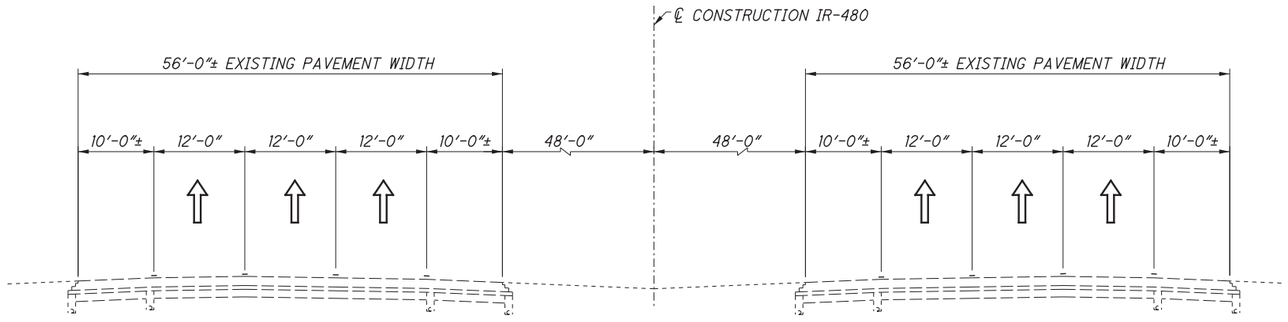
N



EXISTING NORMAL TYPICAL SECTION
MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 2
SECTION C-C



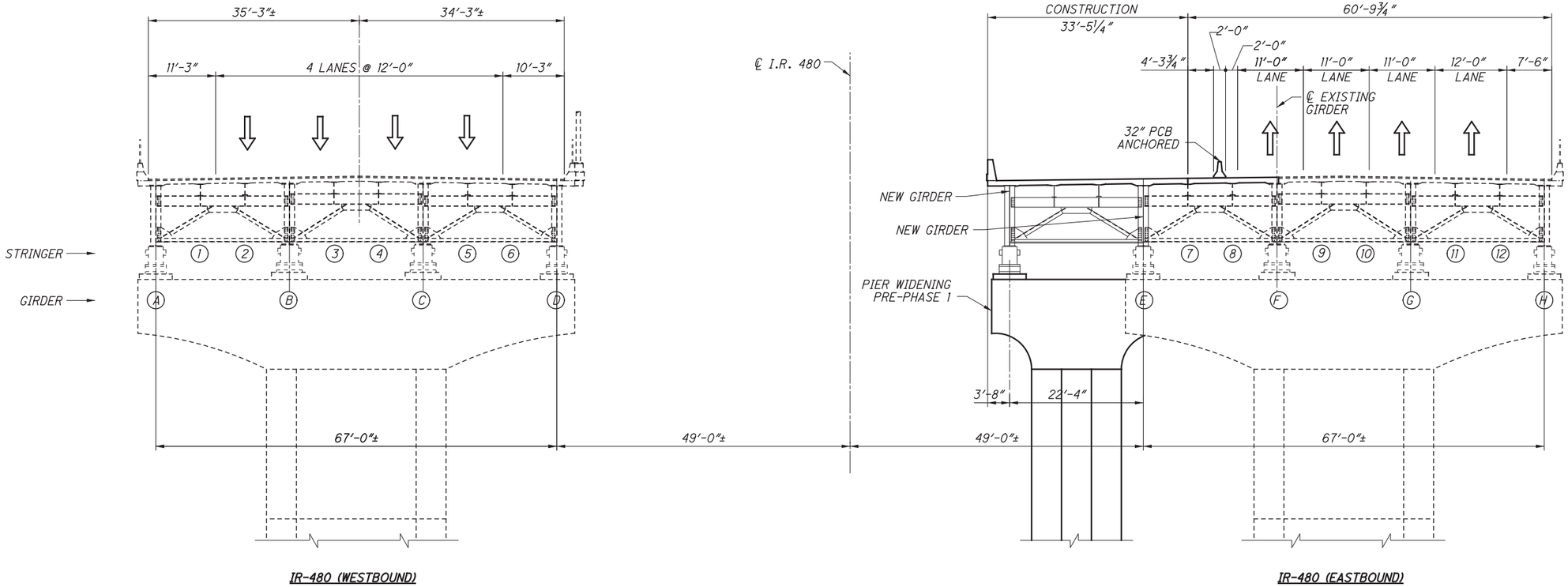
EXISTING TYPICAL SECTION
UNDER BRECKSVILLE ROAD BRIDGE
MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 2
SECTION B-B



EXISTING NORMAL TYPICAL SECTION
MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 2
SECTION A-A

MAINTENANCE OF TRAFFIC
ALTERNATIVE 3.c TYPICAL SECTIONS - PHASE 2

CUY-480-18.42



TRANSVERSE SECTION

SECTION D-D

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 2

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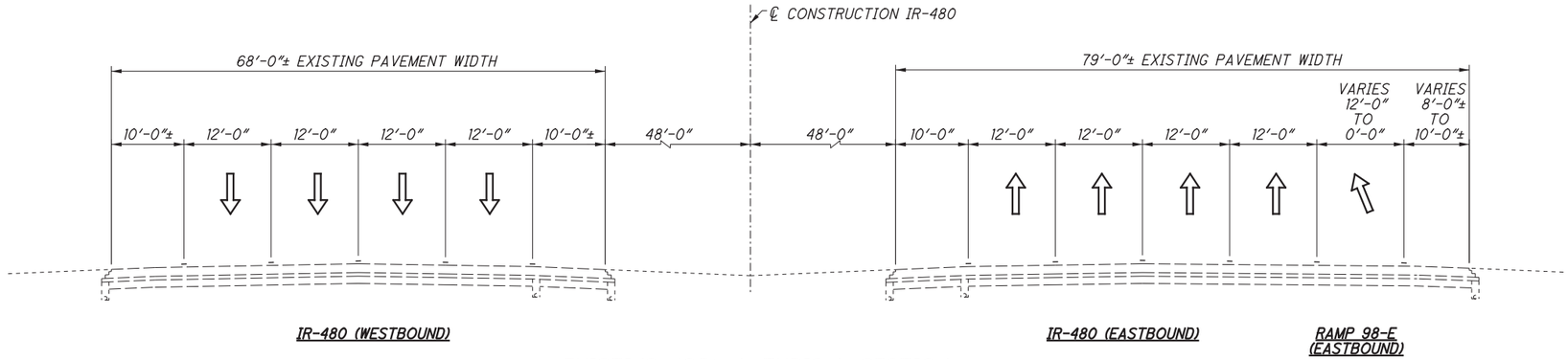
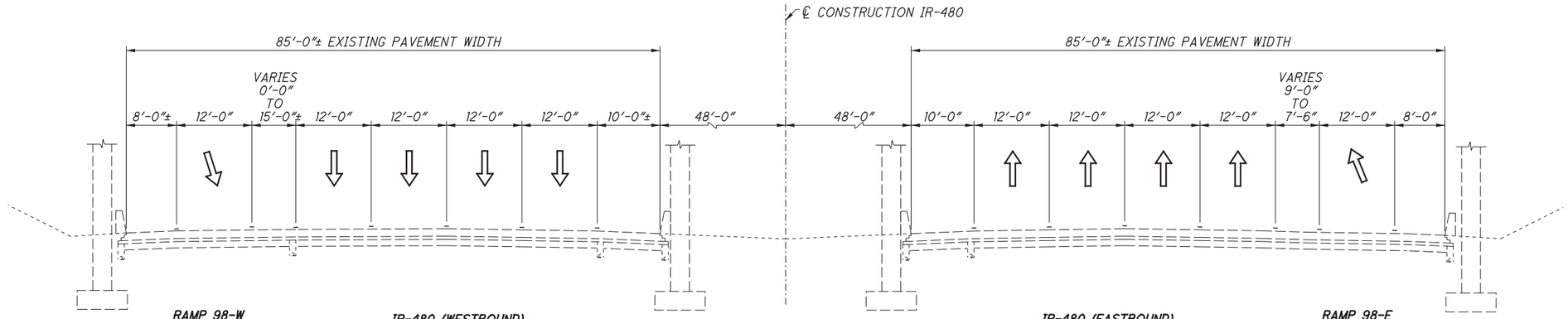
MAINTENANCE OF TRAFFIC
ALTERNATIVE 3.c BRIDGE TRANSVERSE SECTION - PHASE 2

CUY-480-18.42

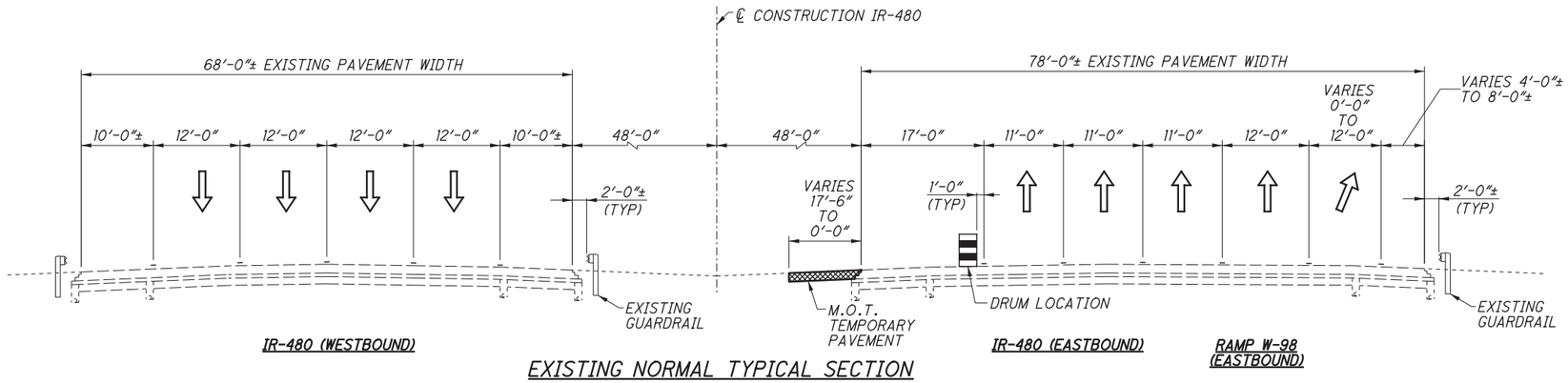
2 / 5



EXISTING NORMAL TYPICAL SECTION
MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 2
SECTION G-G



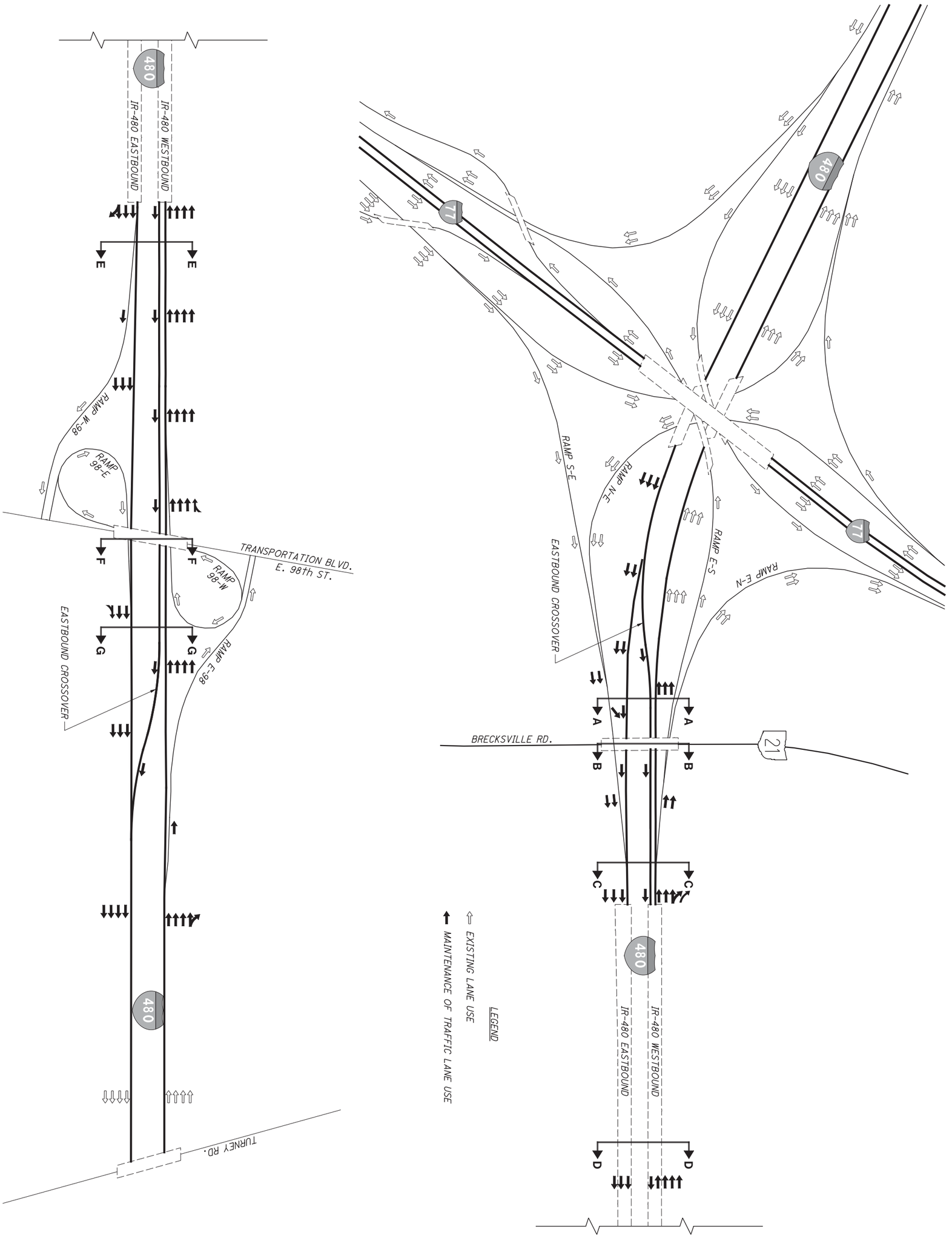
EXISTING TYPICAL SECTION
UNDER E. 98TH STREET BRIDGE
MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 2
SECTION F-F



EXISTING NORMAL TYPICAL SECTION
MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 2
SECTION E-E

MAINTENANCE OF TRAFFIC
ALTERNATIVE 3.c TYPICAL SECTIONS - PHASE 2

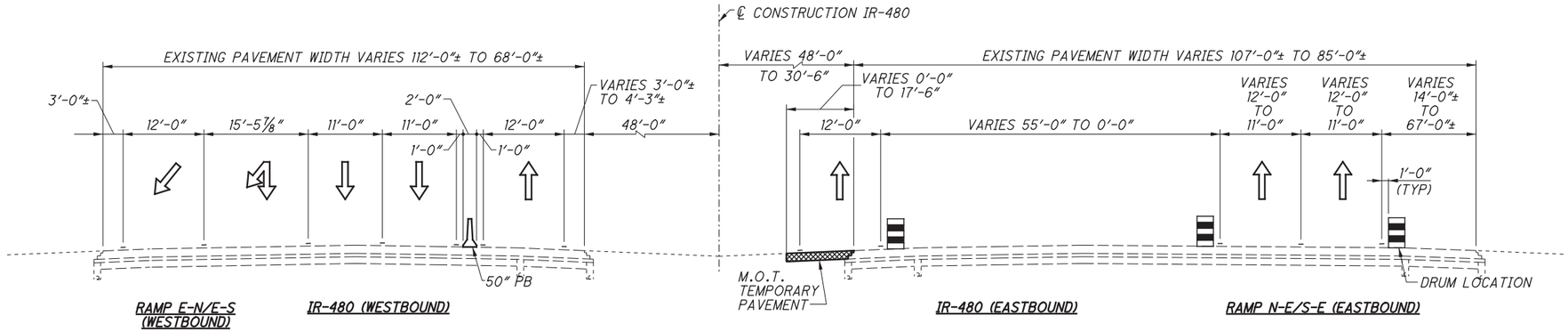
CUY-480-18.42



	CUY-480-1842	MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 3

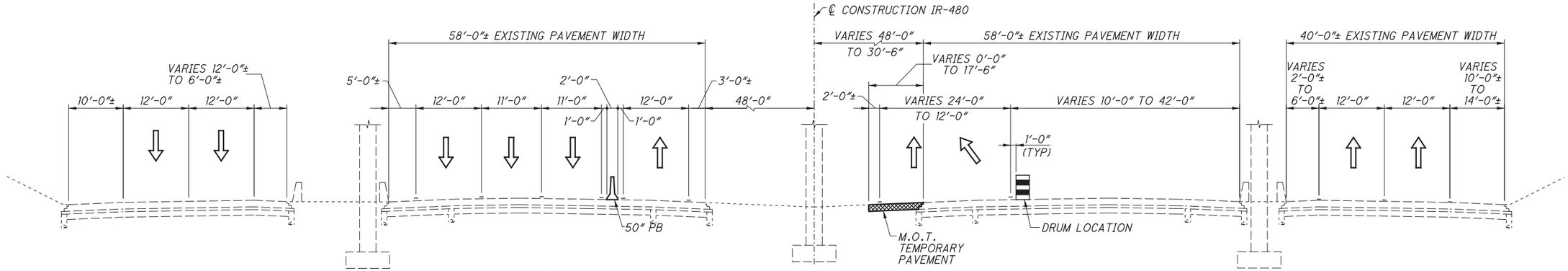
0 250
125 500
HORIZONTAL SCALE IN FEET

N

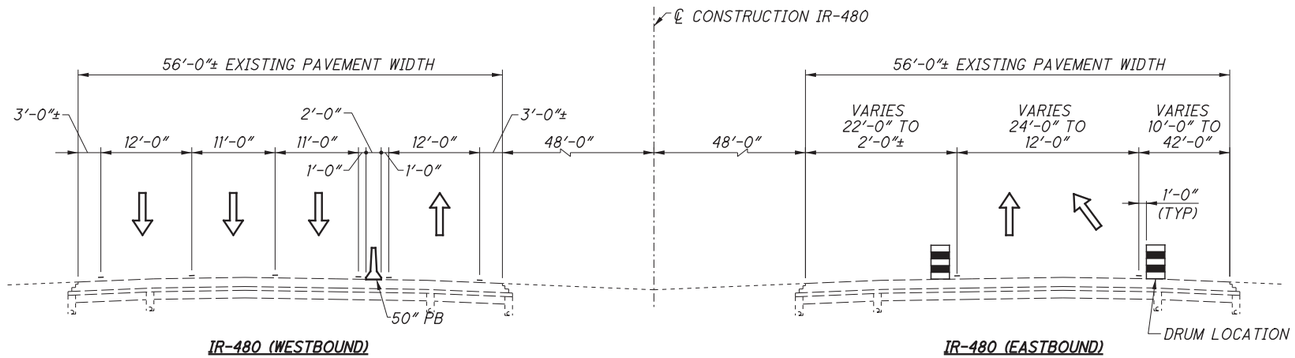


EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 3
SECTION C-C



EXISTING TYPICAL SECTION
UNDER BRECKSVILLE ROAD BRIDGE
MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 3
SECTION B-B



EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 3
SECTION A-A

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c TYPICAL SECTIONS - PHASE 3

CUY-480-18.42

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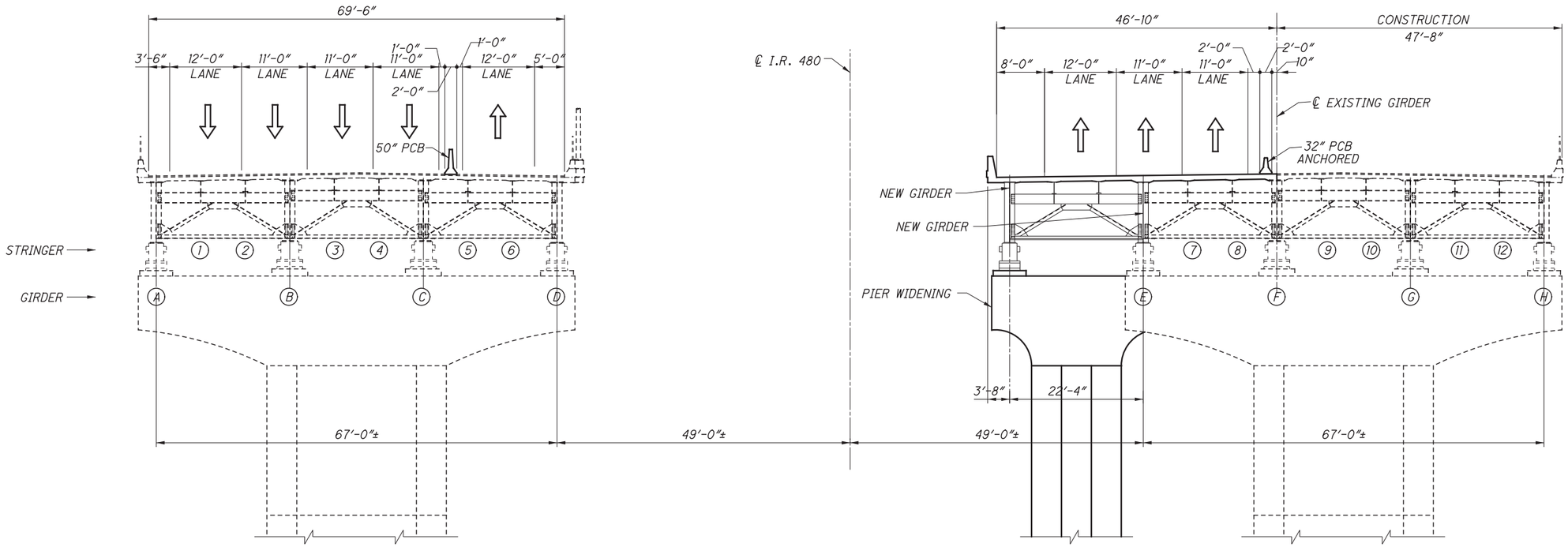

TRANSVERSE SECTION

SECTION D-D

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 3

MAINTENANCE OF TRAFFIC
ALTERNATIVE 3.c BRIDGE TRANSVERSE SECTION - PHASE 3

CUY-480-18.42

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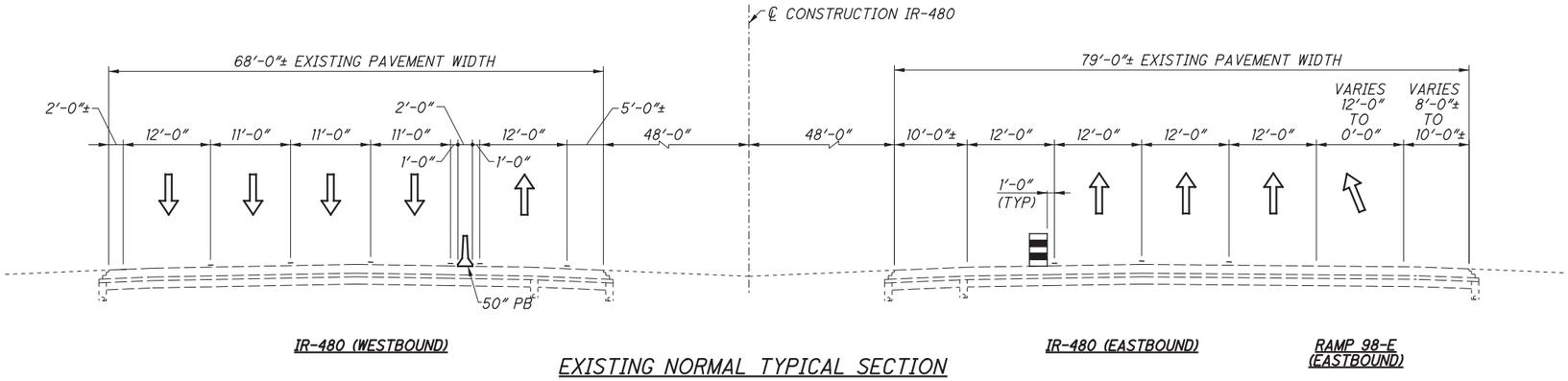
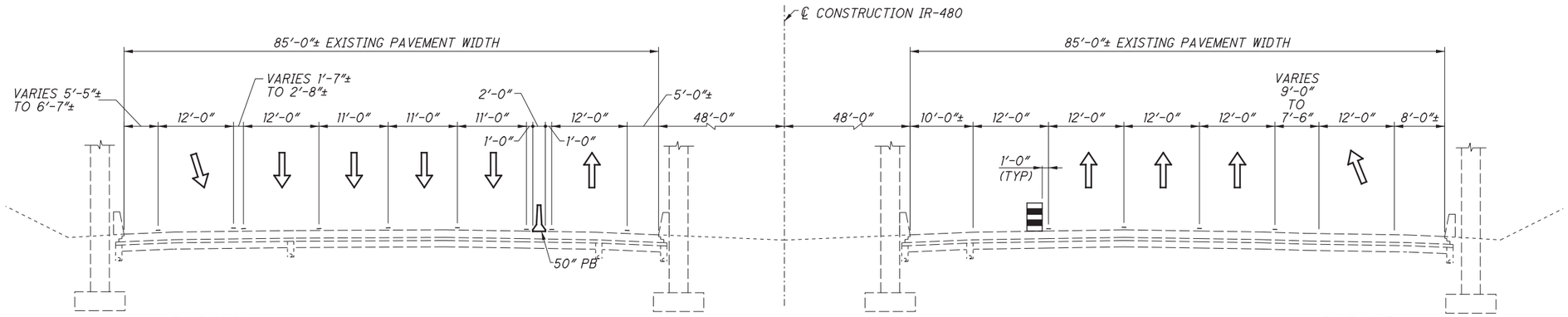


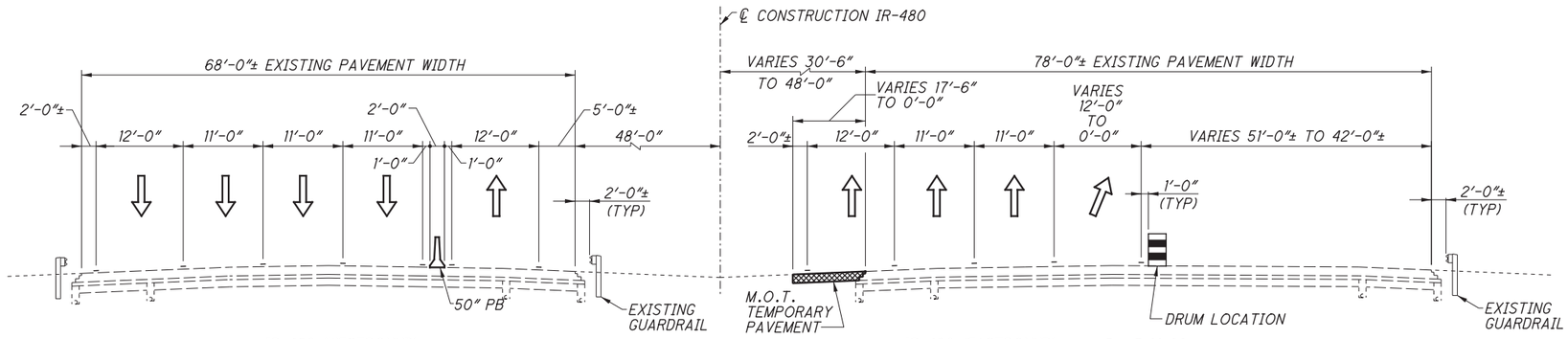
EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 3
SECTION G-G



EXISTING TYPICAL SECTION
UNDER E. 98TH STREET BRIDGE

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 3
SECTION F-F



EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 3
SECTION E-E

MAINTENANCE OF TRAFFIC
ALTERNATIVE 3.c TYPICAL SECTIONS - PHASE 3

CUY-480-18.42

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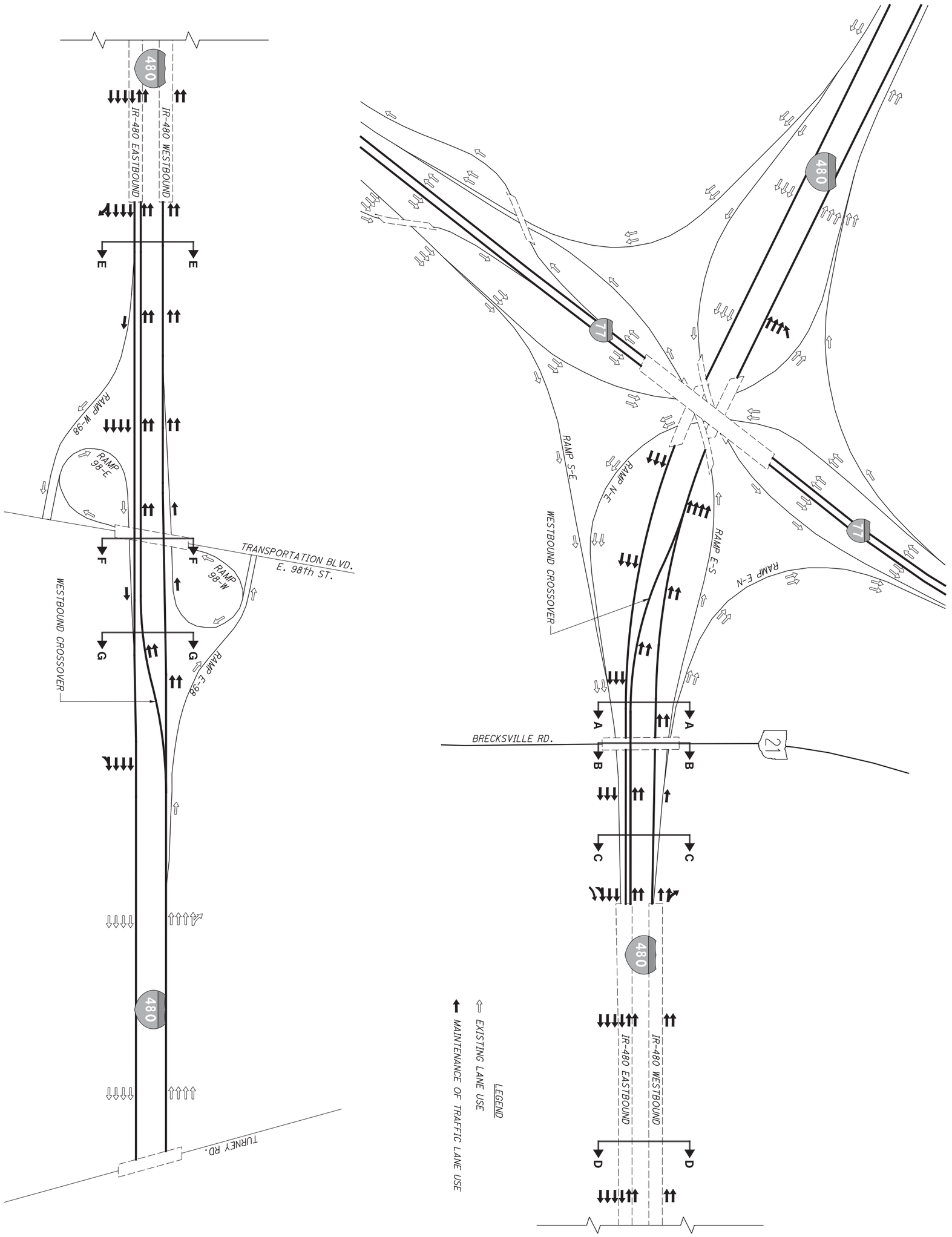
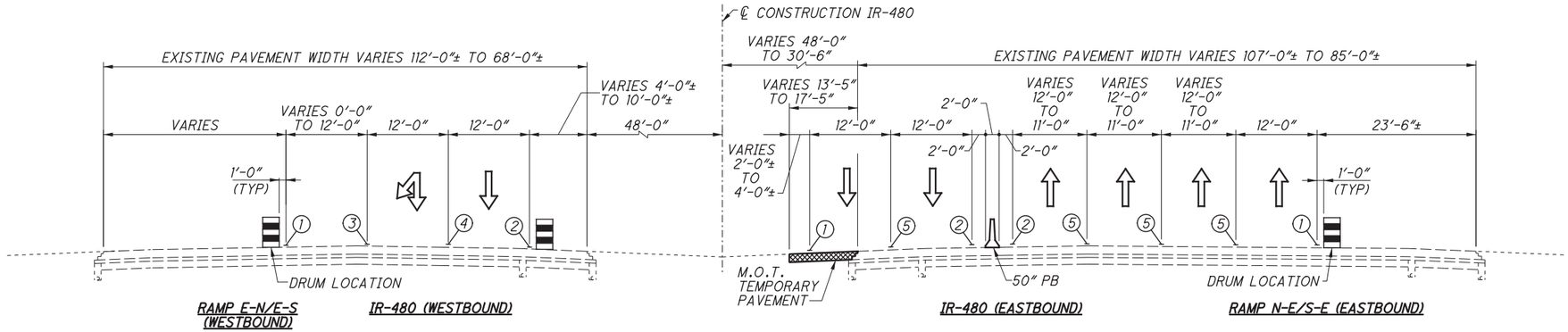


	CUY-480-1842	MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASES 4 & 5

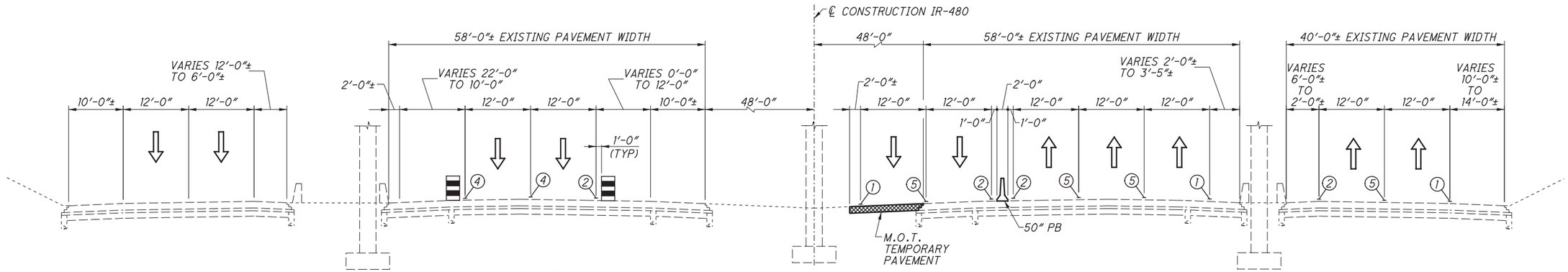
0 250
125 500
HORIZONTAL SCALE IN FEET

N



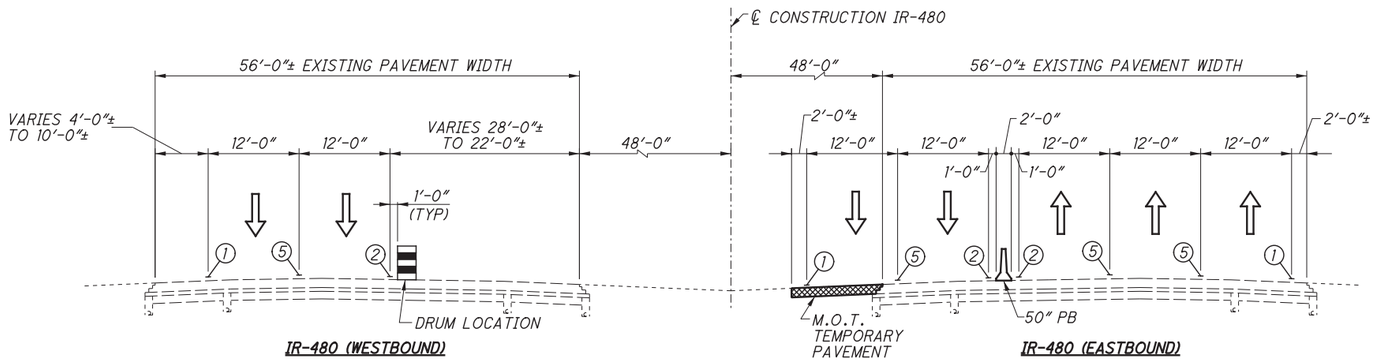
EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 4
SECTION C-C



EXISTING TYPICAL SECTION
UNDER BRECKSVILLE ROAD BRIDGE

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 4
SECTION B-B



EXISTING NORMAL TYPICAL SECTION

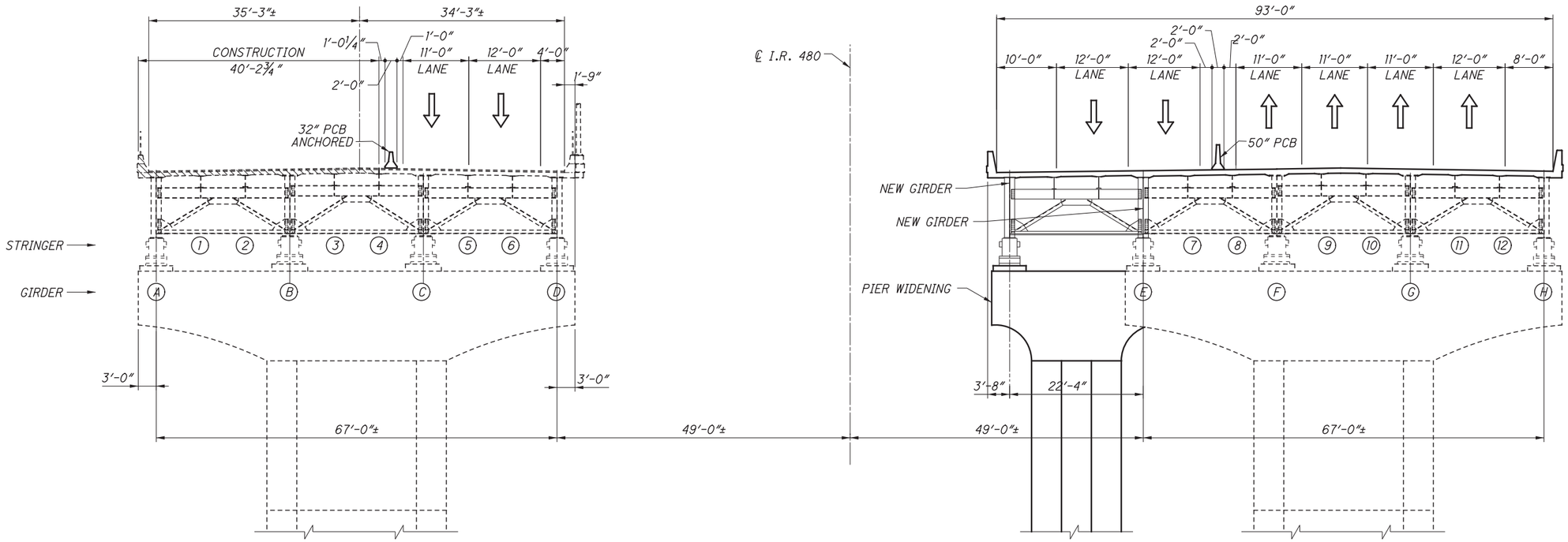
MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 4
SECTION A-A

WORK ZONE MARKING LEGEND

1. WORK ZONE EDGE LINE, CLASS 1, AS PER PLAN
2. WORK ZONE EDGE LINE, CLASS 1, AS PER PLAN (YELLOW)
3. WORK ZONE DOTTED LINE, CLASS 1, AS PER PLAN
4. WORK ZONE CHANNELIZING LINE, CLASS 1, AS PER PLAN
5. WORK ZONE LANE LINE, CLASS 1, AS PER PLAN

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c TYPICAL SECTIONS - PHASE 4

CUY-480-18.42



IR-480 (WESTBOUND)

IR-480 (EASTBOUND)

TRANSVERSE SECTION

SECTION D-D

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 4

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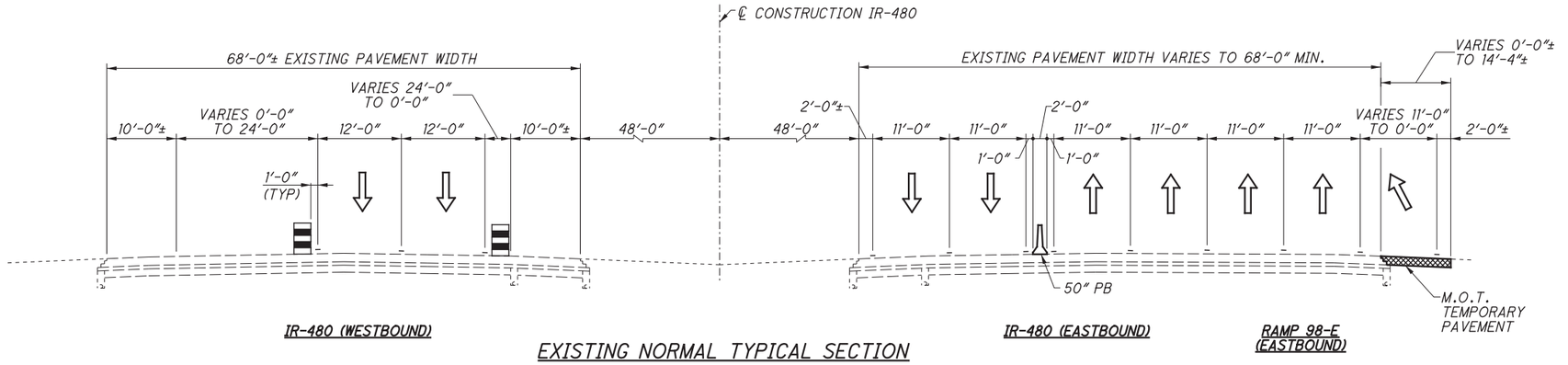
MAINTENANCE OF TRAFFIC
ALTERNATIVE 3.c BRIDGE TRANSVERSE SECTION - PHASE 4

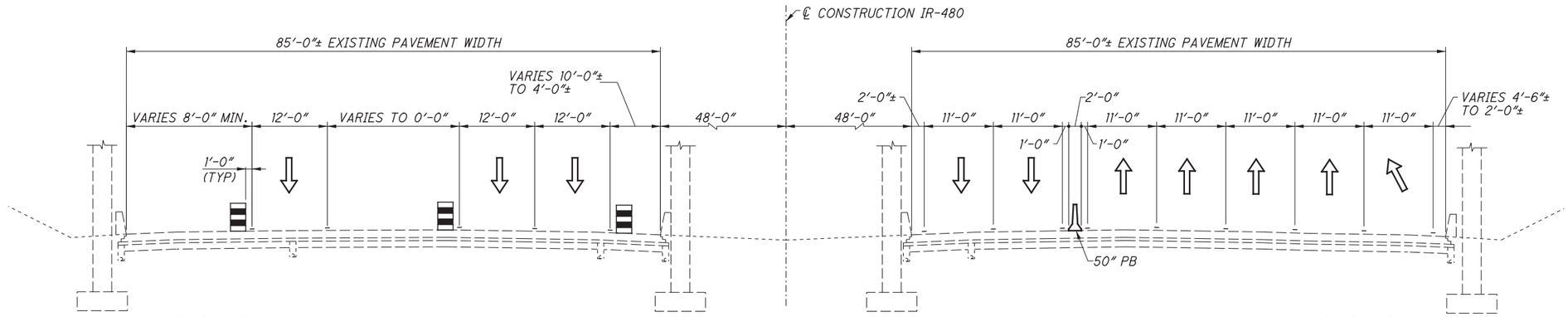
CUY-480-18.42

4 / 5



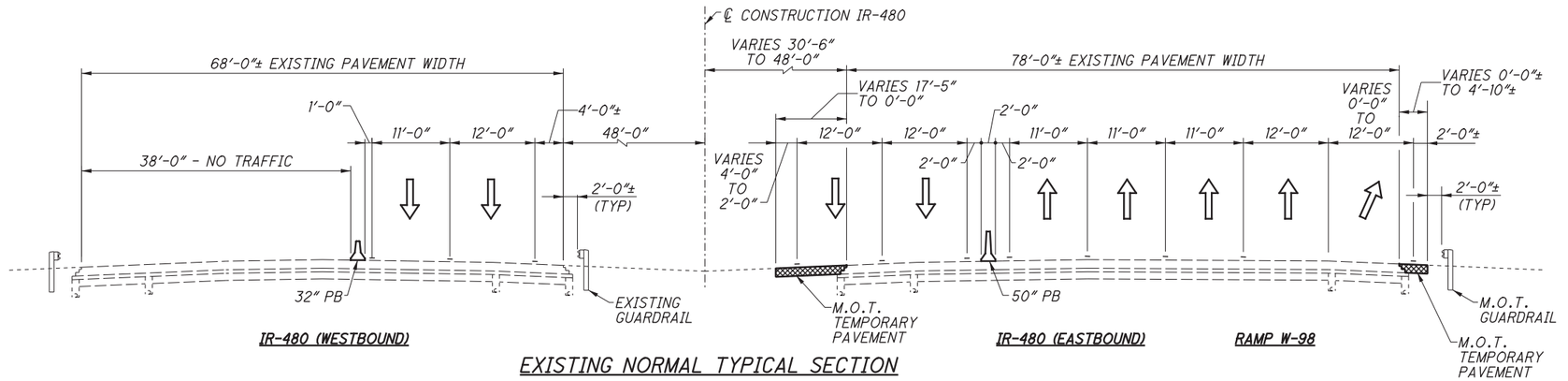
EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 4
SECTION G-G



EXISTING TYPICAL SECTION
UNDER E. 98TH STREET BRIDGE

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 4
SECTION F-F

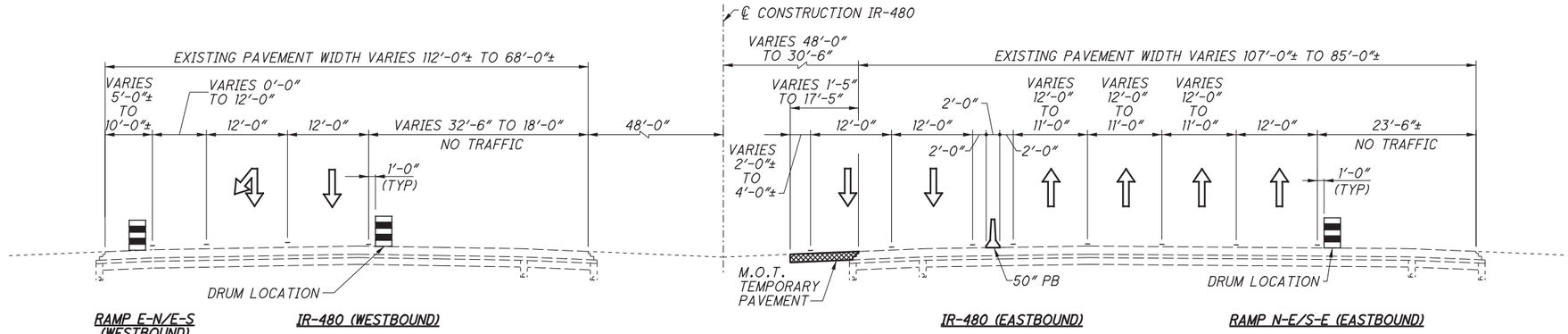


EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 4
SECTION E-E

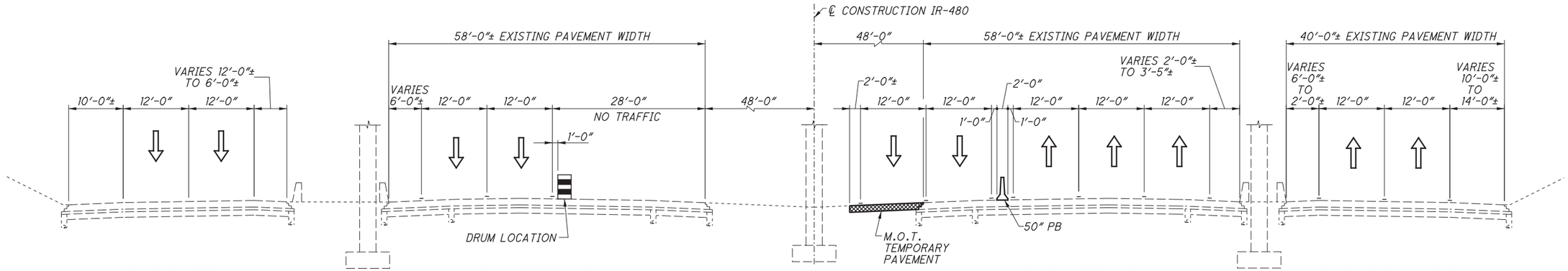
MAINTENANCE OF TRAFFIC
ALTERNATIVE 3.c TYPICAL SECTIONS - PHASE 4

CUY-480-18.42



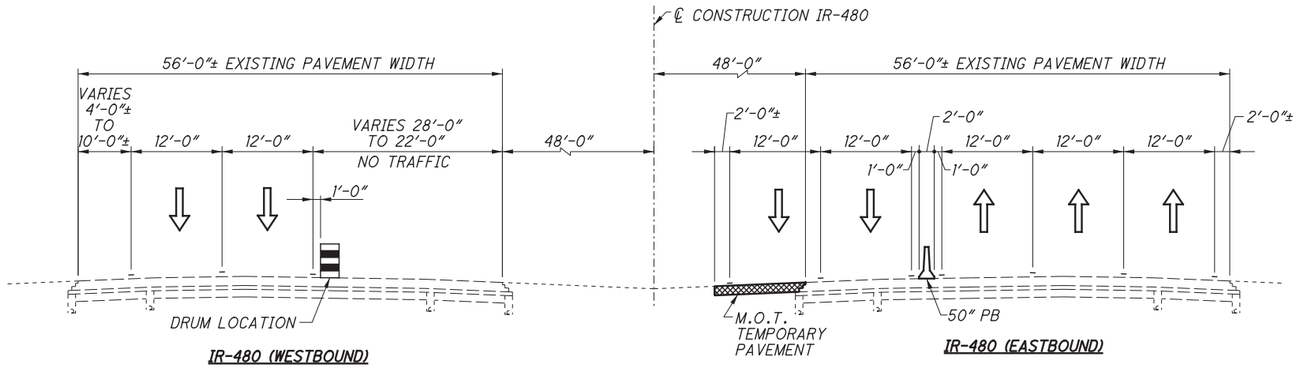
EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 5
SECTION C-C



EXISTING TYPICAL SECTION
UNDER BRECKSVILLE ROAD BRIDGE

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 5
SECTION B-B



EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 5
SECTION A-A

MAINTENANCE OF TRAFFIC
ALTERNATIVE 3.c TYPICAL SECTIONS - PHASE 5

CUY-480-18.42

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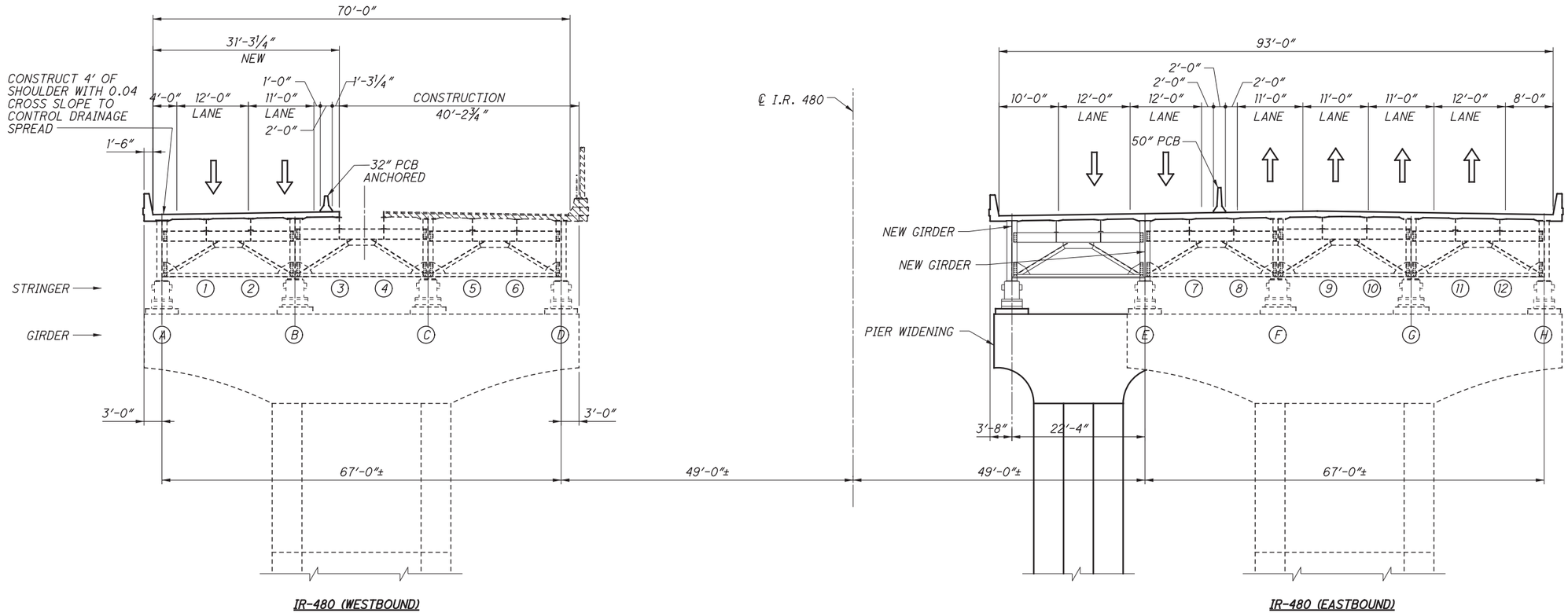

TRANSVERSE SECTION

SECTION D-D

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 5

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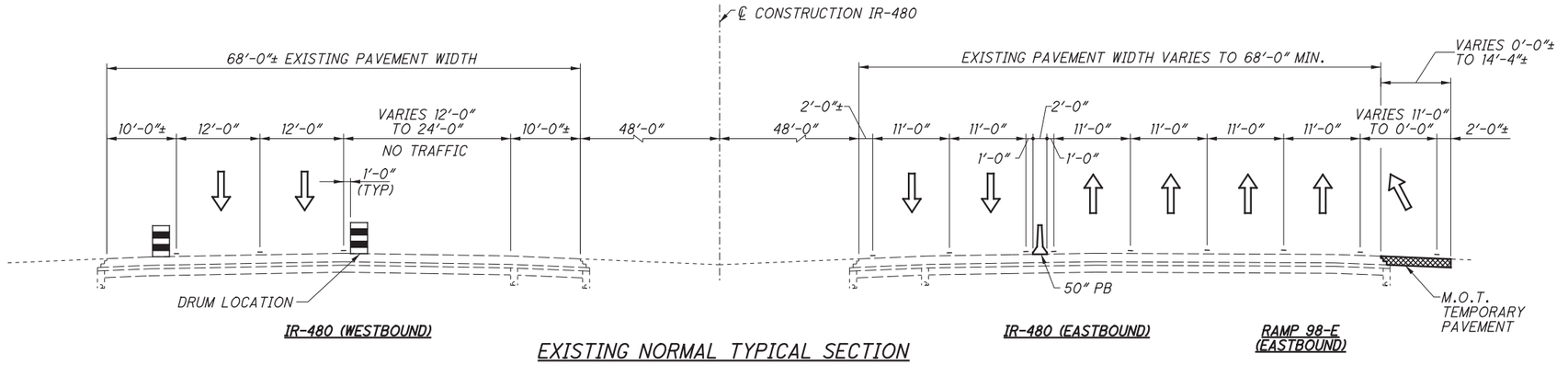
MAINTENANCE OF TRAFFIC
3.c BRIDGE TRANSVERSE SECTION - PHASE 5
ALTERNATIVE 3.c

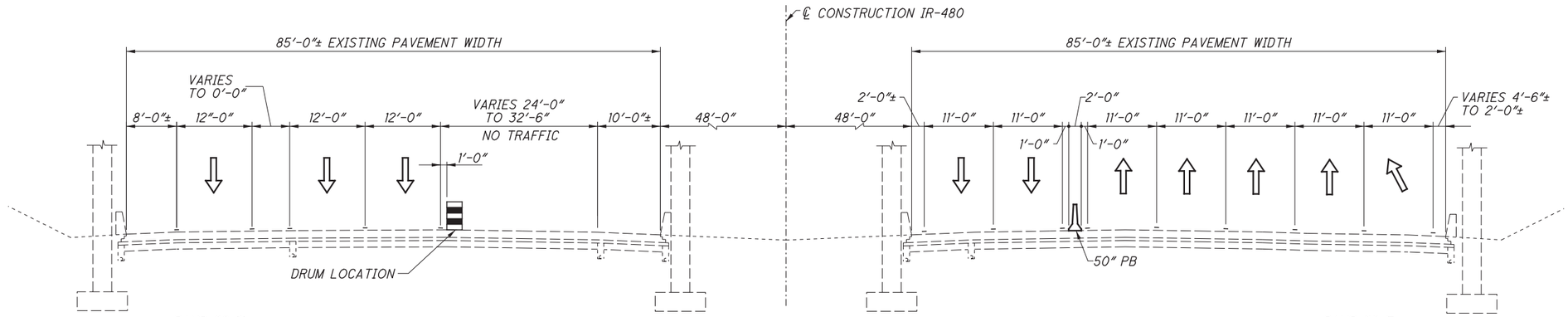
CUY-480-18.42

5 / 5



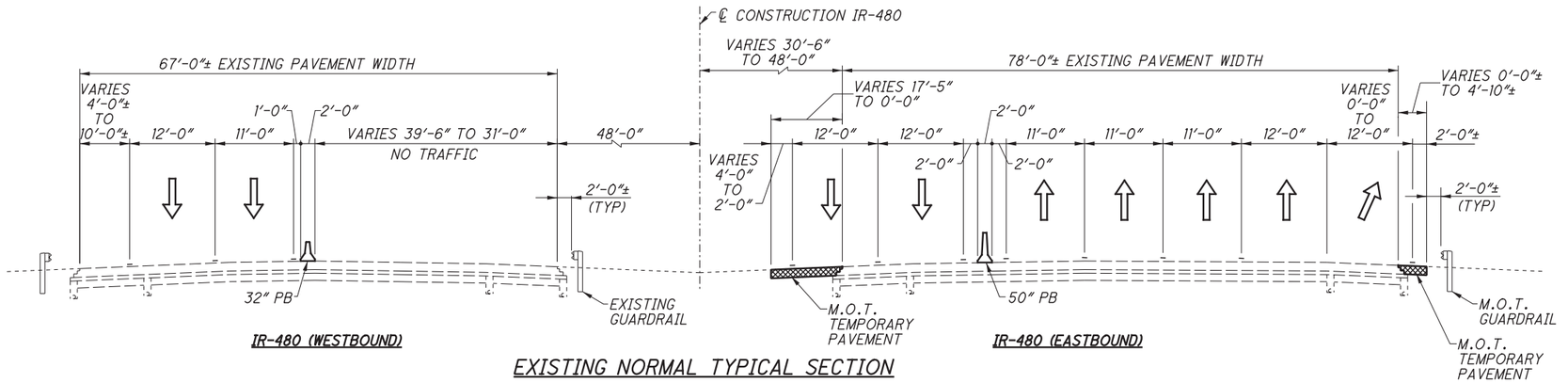
EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 5
SECTION G-G



EXISTING TYPICAL SECTION
UNDER E. 98TH STREET BRIDGE

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 5
SECTION F-F



EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 3.c - PHASE 5
SECTION E-E

ALTERNATIVE 3.c TYPICAL SECTIONS - PHASE 5

CUY-480-18.42

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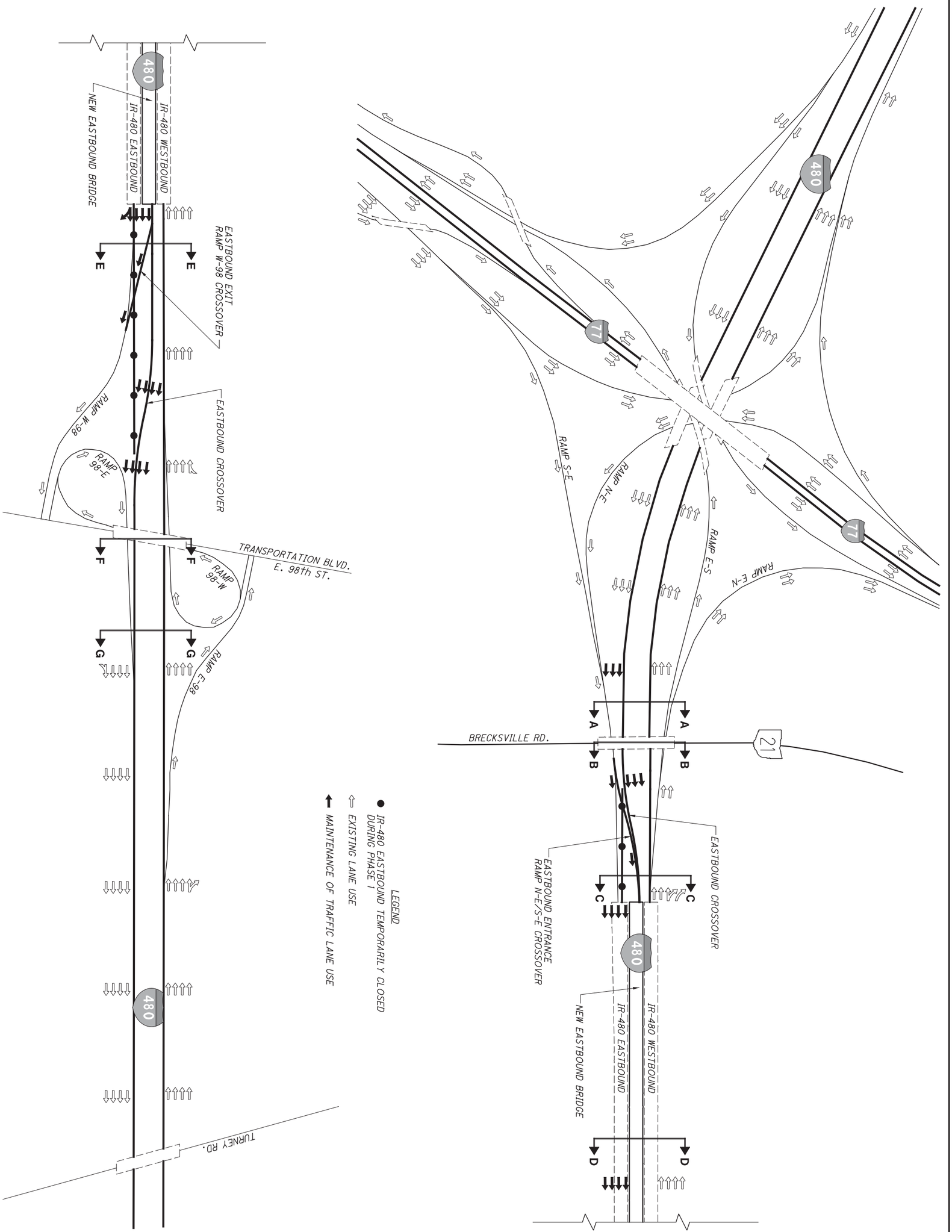
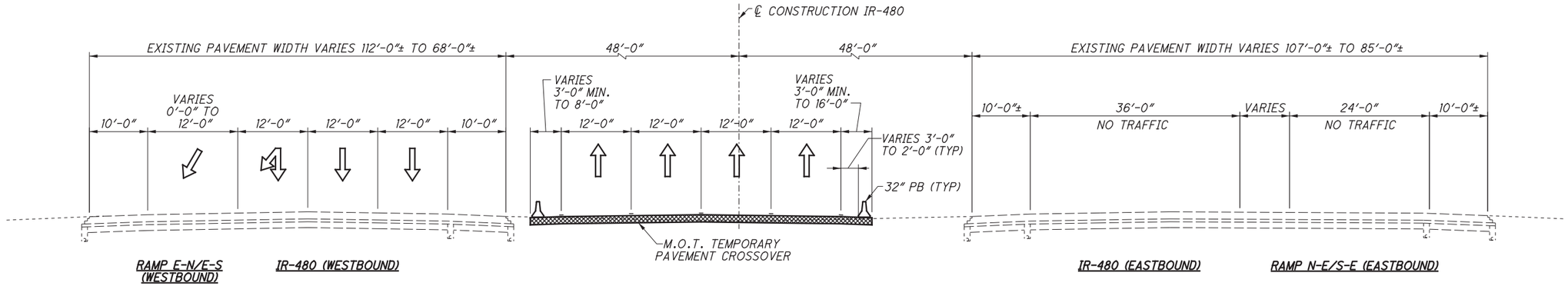


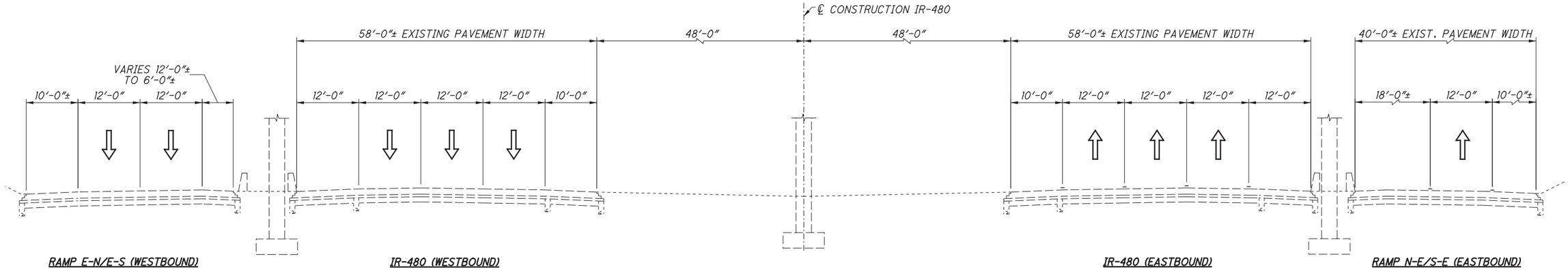
	CUY-480-1842 L/R	MAINTENANCE OF TRAFFIC ALTERNATIVE 5 - PHASE 1

0 125 250 500
HORIZONTAL SCALE IN FEET

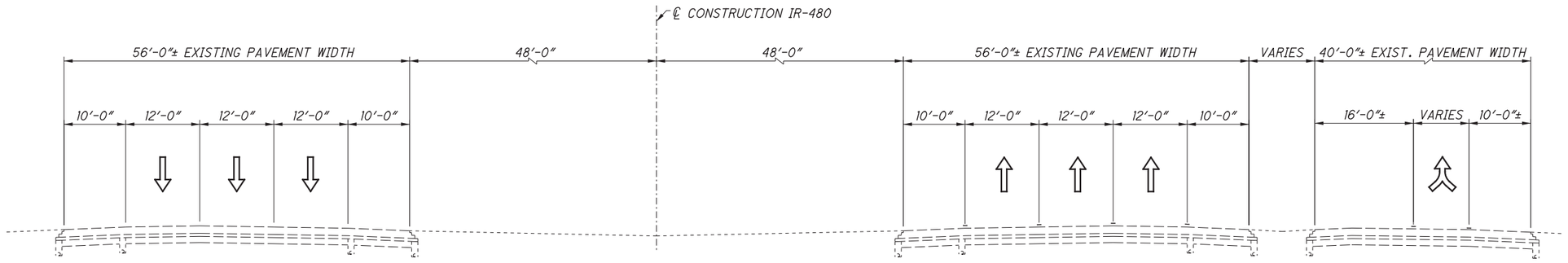
N



EXISTING NORMAL TYPICAL SECTION
MAINTENANCE OF TRAFFIC ALTERNATIVE 5 - PHASE 1
SECTION C-C



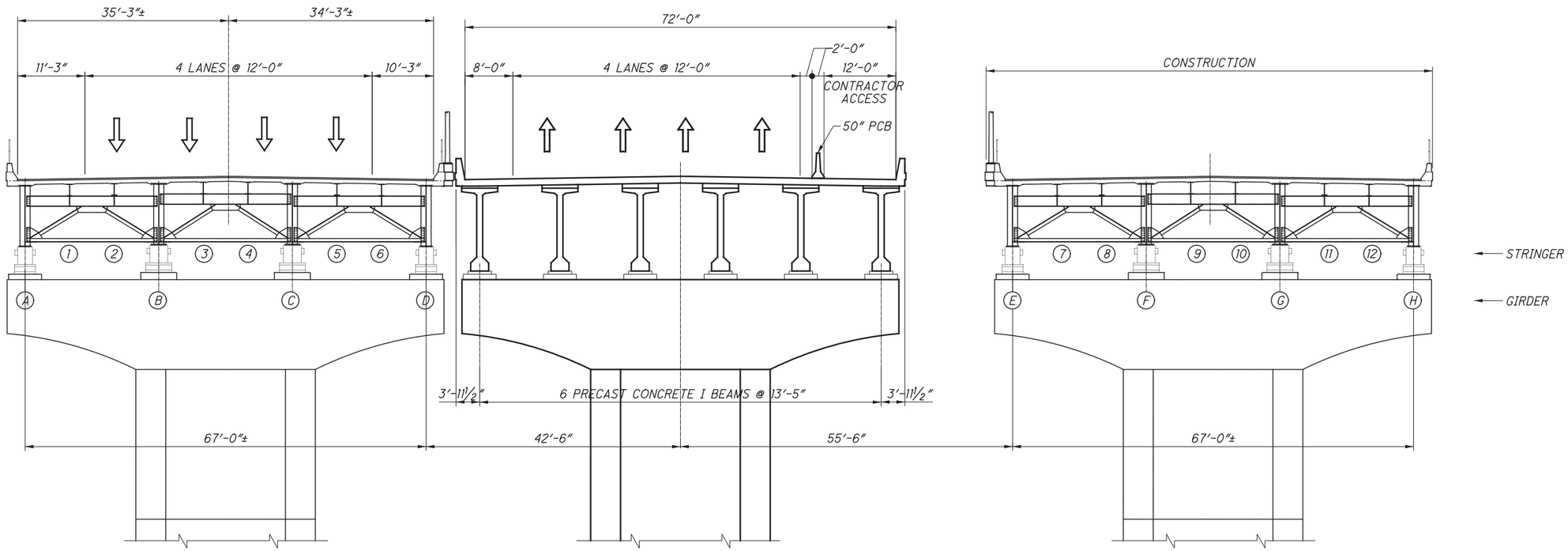
EXISTING TYPICAL SECTION
UNDER BRECKSVILLE ROAD BRIDGE
MAINTENANCE OF TRAFFIC ALTERNATIVE 5 - PHASE 1
SECTION B-B



EXISTING NORMAL TYPICAL SECTION
MAINTENANCE OF TRAFFIC ALTERNATIVE 5 - PHASE 1
SECTION A-A

MAINTENANCE OF TRAFFIC
ALTERNATIVE 5 TYPICAL SECTIONS - PHASE 1

CUY-480-18.42



IR-480 (WESTBOUND)

IR-480 (EASTBOUND)

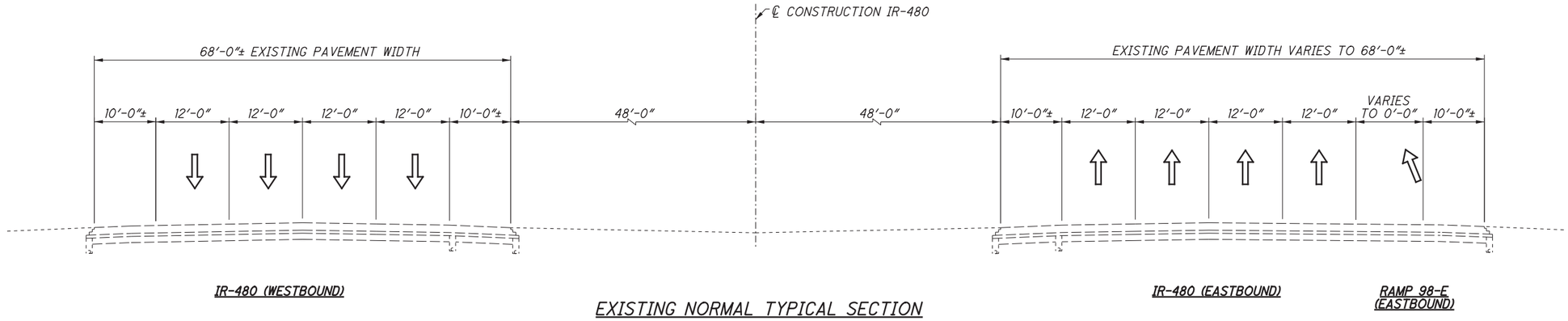
TRANSVERSE SECTION
SECTION D-D

MAINTENANCE OF TRAFFIC ALTERNATIVE 5 - PHASE 1

MAINTENANCE OF TRAFFIC
ALTERNATIVE 5 BRIDGE TRANSVERSE SECTION - PHASE 1

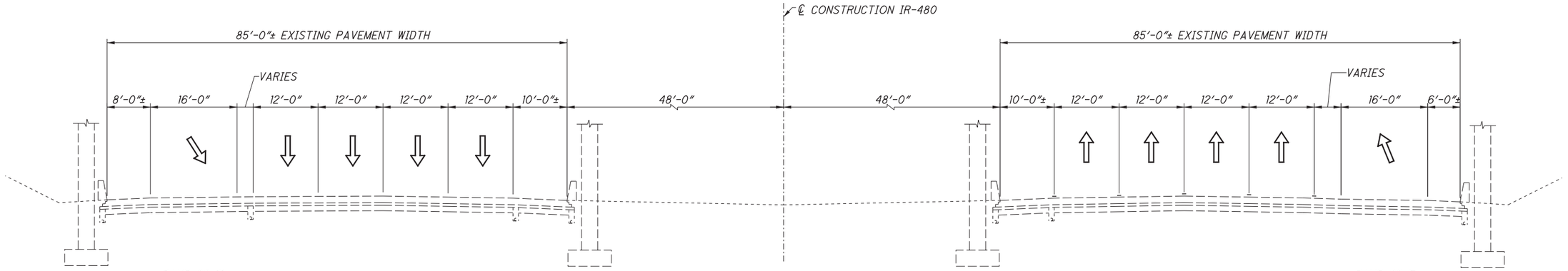
CUY-480-18.42

1



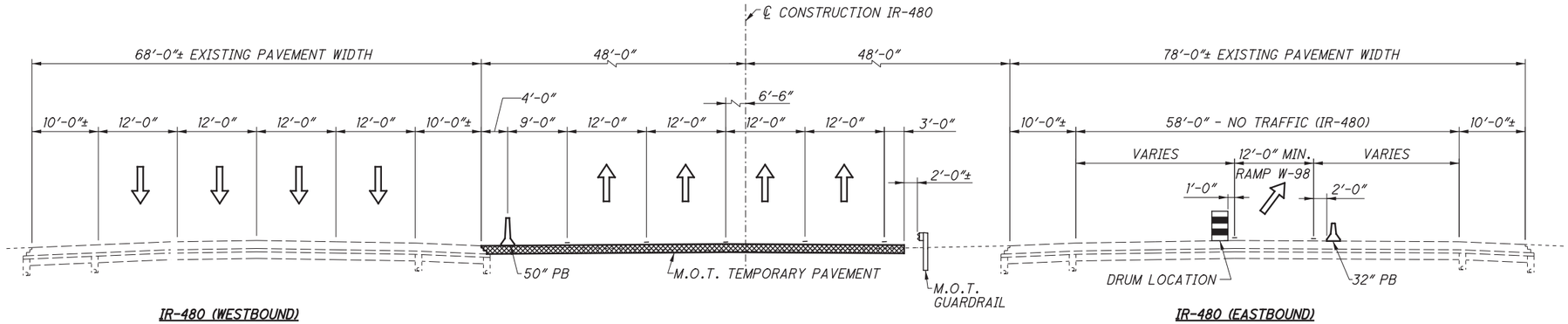
EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 5 - PHASE 1
SECTION G-G



EXISTING TYPICAL SECTION
UNDER E. 98TH STREET BRIDGE

MAINTENANCE OF TRAFFIC ALTERNATIVE 5 - PHASE 1
SECTION F-F

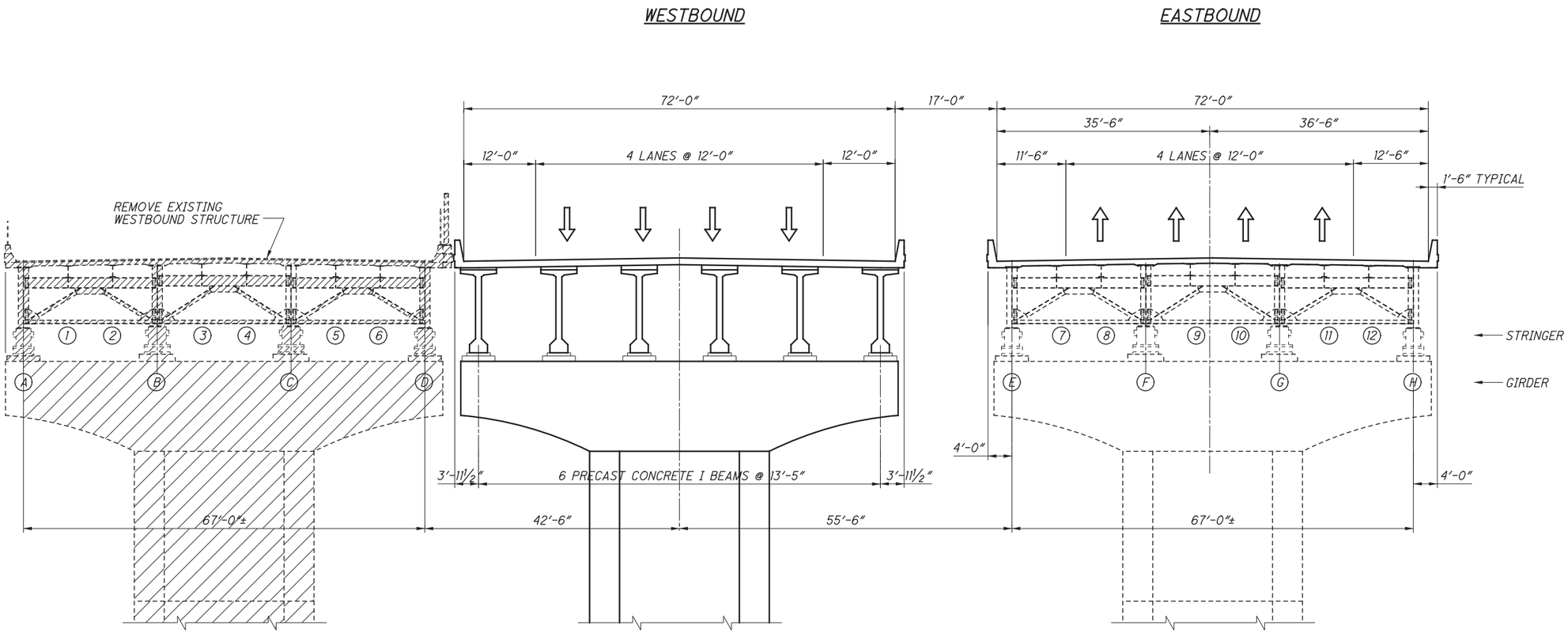


EXISTING NORMAL TYPICAL SECTION

MAINTENANCE OF TRAFFIC ALTERNATIVE 5 - PHASE 1
SECTION E-E

MAINTENANCE OF TRAFFIC
ALTERNATIVE 5 TYPICAL SECTIONS - PHASE 1

CUY-480-18.42



TRANSVERSE SECTION

UNIT 2 TO 5

ALTERNATIVE 5, FINAL CONDITION
10'-0" DRAINAGE SPREAD
(4+4) 4 WB, 4 EB

ALTERNATIVE 5
TRANSVERSE SECTION - UNIT 2 TO 5

CUY-480-18.42

1/2

Work Zone Constraints

CUY-480-18.42 L/R, PID No. 90591

Constraint	Work Zone Alternatives				
	Alternative 1.a (70) - Same Width Deck Replacement - Maintain 3 Lanes WB (on bridge only) & 4 Lanes EB (5 + 2) Modify existing & proposed shoulder cross slope	**Alternative 3.a (72) - Widen Existing and New Bridge - Maintain 4 Lanes WB & EB (6 + 2) Modify existing & proposed shoulder cross slope**	**Alternative 3.b (72) - Widen New Bridge - Phases 1 & 2 Maintain 3 Lanes WB & 4 Lanes EB (5 + 2); Phases 3 & 4 Maintain 4 Lanes WB & EB (6 + 2) Modify existing & proposed shoulder cross slope**	**Alternative 3.c - Widen EB Substructure & Superstructure - New EB Bridge (93)- Maintain 4 Lanes All Phases - Phase 1 & 3 (5 + 3); Phase 2 (4 + 4); Phases 4 & 5 (6 + 2)**	**Alternative 5 - New WB Bridge in Median - Maintain 4 Lanes WB & EB**
Ability to meet Work Zone Policy	**Impact: High** No, eastbound direction Phase 1 and 2 maintains 4 total lanes however two lanes (reduced from 3) are crossed over through traffic and two lanes are IR 77 ramp traffic. Eastbound Phases 3 and 4 provides 4 lanes at all times. No in the westbound direction (a minimum 3 lanes maintained).	**Impact: Medium** No, eastbound direction Phase 1 and 2 maintains 4 total lanes however two lanes (reduced from 3) are crossed over through traffic and two lanes are IR 77 ramp traffic. Eastbound Phases 3 and 4 provides 4 lanes at all times. Westbound provides 4 lanes in all phases at all times.	**Impact: High** No, eastbound direction Phase 1 and 2 maintains 4 total lanes however two lanes (reduced from 3) are crossed over through traffic and two lanes are IR 77 ramp traffic. Eastbound Phases 3 and 4 provides 4 lanes at all times. No in the westbound direction, a minimum of 3 lanes maintained in Phases 1 and 2.	**Impact: Low** No. Phase 3 eastbound through traffic is reduced from 3 lanes to 2 lanes west of the bridge to eliminate merge with 77 ramps.	**Impact: Low** Yes for both directions, four lanes can be maintained at all times. Minor overnight lane closures possible off the bridge ends to construct pavement tie-in's for the temporary alignments. Minor Overnight lane closures and a Complete closure of IR 480 WB over a weekend will be required in order construct pavement tie-in's for WB IR 480. A two week closure of westbound IR 480 ramps to 77 NB and 77 SB will be required in order to construct new ramp alignment tie-ins.
Ability to Maintain All Accesses	**Impact: Low** 480 EB traffic approaching the bridge will be crossed over to the left bridge and will not have access to the E 98th St. (Transportation Bvld.) Exit ramp during phases 1 and 2 (the first two construction seasons).	**Impact: Low** 480 EB traffic approaching the bridge will be crossed over to the left bridge and will not have access to the E 98th St. (Transportation Bvld.) Exit ramp during phases 1 and 2 (the first two construction seasons).	**Impact: Low** 480 EB traffic approaching the bridge will be crossed over to the left bridge and will not have access to the E 98th St. (Transportation Bvld.) Exit ramp during phases 1 and 2 (the first two construction seasons).	**Impact: None** Access to the same degree as the exisitng condition can be maintained in all Phases.	**Impact: Low** All access can be maintained. Temporary ramp pavement will need to be provided and a reduction of the ramp speed is likely due to the temporary sharper ramp curves required to match into the existing ramp alignments. A 2 week closure of westbound IR 480 ramps to 77 NB and 77 SB ramps will be required in order to construct new ramp alignment tie-ins. A 2 week closure of E 98th St. ramp to WB IR 480 will be required in order to construct new ramp alignment tie-ins.
Ability to Provide Required On-Ramp Merge Decision Sight Distance	**Impact: Low** Reconstructed shoulders and temporary pavement will be required to provide the necessary 1135' of DSD and 600' taper distance for both the E 98th St EB and WB entrance ramps.	**Impact: Low** Reconstructed shoulders and temporary pavement will be required to provide the necessary 1135' of DSD and 600' taper distance for both the E 98th St EB and WB entrance ramps.	**Impact: Low** Reconstructed shoulders and temporary pavement will be required to provide the necessary 1135' of DSD and 600' taper distance for both the E 98th St EB and WB entrance ramps.	**Impact: Low** Reconstructed shoulders and temporary pavement will be required to provide the necessary 1135' of DSD and 600' taper distance for the E 98th St EB entrance ramp.	**Impact: None** There will be no entrance ramp merge tapers within an MOT zone.
Right-of-Way Impacts	**Impact: Very Low** Lease agreements with the adjoining property owners may need to be coordinated.	**Impact: Very Low** Lease agreements with the adjoining property owners may need to be coordinated.	**Impact: Very Low** Lease agreements with the adjoining property owners may need to be coordinated.	**Impact: Low** Lease agreements with the adjoining property owners may need to be coordinated.	**Impact: Low** Lease agreements with the adjoining property owners may need to be coordinated.
Environmental Impacts	**Impact: Low** Impact to Metroparks area beneath bridge for loss of use during construction. Peregrin falcons nesting on bridge may be disturbed.	**Impact: Low** Impact to Metroparks area beneath bridge for loss of use during construction. MOT drainage will require construction of an enclosed storm sewer system at the base of pier 5 to convey water from the temporary bridge scuppers. The enclosed storm sewer system for the MOT drainage has been arranged to minimize impacts to the MetroParks parking area under the bridge. Peregrin falcons nesting on bridge may be disturbed.	**Impact: Low** Impact to Metroparks area beneath bridge for loss of use during construction. MOT drainage will require construction of an enclosed storm sewer system at the base of pier 5 to convey water from the temporary bridge scuppers. The enclosed storm sewer system for the MOT drainage has been arranged to minimize impacts to the MetroParks parking area under the bridge. Peregrin falcons nesting on bridge may be disturbed.	**Impact: Low** Impact to Metroparks area beneath bridge for loss of use during construction. The widening of the eastbound bridge will require the widening of the substructure at the existing piers. Pier 5 is within an area leased to MetroParks between Canal Road and the Cuyahoga River and includes the Brickworks Ovrlook and a smalll parking area. The construction of the substructure widening of pier 5 will impact these facilities. Peregrin falcons nesting on bridge may be disturbed.	**Impact: Low** Impact to Metroparks area beneath bridge for loss of use during construction. The construction of a new bridge in the median, bewteen the two existing bridges will require the construction of new pier footings and piers. The new structure type will be of a different bridge design which will allow for different pier locations and may limit the impact to the area leased to MetroParks between Canal Road and the Cuyahoga River, including the Brickworks Ovrlook and the small parking area. Peregrin falcons nesting on bridge may be disturbed.
Bridge Widths	**Impact: Low** Same as existing bridge widths. **Cost: No additional cost.**	**Impact: Low** Widening of the existing westbound bridge roadway to 72 feet in Pre-Phase 1. Construction of the proposed bridge deck widths to 72 feet on both the eastbound and the westbound bridges. **Cost: $12,050,000**	**Impact: Low** Construction of the proposed eastbound bridge roadway width to 72 feet. **Cost: $4,400,000**	**Impact: Medium** Widening of the existing eastbound bridge roadway to 93 feet in the first three construction phases. The widening of the bridge deck requires the widening of the substructure and the superstructure. **Cost: $40,530,000**	**Impact: High** A new bridge constructed in the median between the two existing bridges. New bridge roadway width to meet current standards (72 feet) **Cost: $71,610,000**
Significant Impacts for Construction Duration and/or Construction Costs	**Impact: Medium** Construct 1/2 of a bridge deck in a construction season. 2 years for new eastbound bridge deck, 2 years for new westbound bridge deck, 4 year total, bridge construction project with IR 480 traffic restricted. Additional duration required prior to the first year for the construction of crossovers and parallel route improvements. Additional duration required after the final phase to remove crossover pavement, plane, resurface, final markings within the area required for MOT. **5 year total duration.**	**Impact: Medium** Widen the existing westbound bridge deck in the first construction season along with the construction of crossovers and parallel route improvements. Construct 1/2 of a bridge deck in a construction season. 2 years for new eastbound bridge deck, 2 years for new westbound bridge deck, 4 year total, bridge construction project with IR 480 traffic restrictions. Additional duration required after the final phase to remove crossover pavement, plane, resurface, final markings within the area required for MOT. **5 1/2 year total duration.**	**Impact: Medium** Construct 1/2 of a bridge deck in a construction season. 2 years for new eastbound bridge deck, 2 years for new westbound bridge deck, 4 year total, bridge construction project with IR 480 traffic restricted. Additional duration required prior to the first year for the construction of crossovers and parallel route improvements. Additional duration required after the final phase to remove crossover pavement, plane, resurface, final markings within the area required for MOT. **5 year total duration.**	**Impact: Medium** Widen the existing eastbound bridge substructure in a pre-phase year with no impact on the IR 480 traffic. The first construction season would modify the existing superstructure and provide a portion of the new eastbound bridge deck. The second construction season will complete the widening of the eastbound bridge deck toward the median. Construct 1/2 of the westbound bridge deck in a construction season. 2 years for new westbound bridge deck, 5 year total, bridge construction project, four years with IR 480 traffic constrictions. Additional duration required after the final phase to remove crossover pavement, plane, resurface, final markings for the area within the required MOT limits. **6 year total duration.**	**Impact: High** Three construction seasons to build the new bridge in the median between the existing bridges. Construct 1/2 of the westbound bridge deck in a construction season. 2 years for new westbound bridge deck, 5 year total, bridge construction project, 2 years with minor IR 480 traffic constrictions. Additional duration required after the final phase to remove pavement, plane, resurface, final markings for the area within the required MOT limits. **5 year total duration.** **Cost:**
Significant Impacts to Earthwork, Retaining Walls, Pier Clearances, Profile Differences, etc.	**Impact: Very Low** Minor earthwork required to construct crossovers and temporary pavement to maintain E 98th St. ramps.	**Impact: Very Low** Minor earthwork required to construct crossovers and temporary pavement to maintain E 98th St. ramps. Temporary pavement to shift traffic and utilize the widened bridge deck.	**Impact: Very Low** Minor earthwork required to construct crossovers and temporary pavement to maintain E 98th St. ramps. Temporary pavement to shift traffic and utilize the widened bridge deck.	**Impact: Low** Minor earthwork required to construct crossovers and temporary pavement to maintain E 98th St. ramps. Temporary pavement to shift traffic and utilize the widened bridge deck. Temporary pavement to accommodate shifts and tapers.	**Impact: Low** Additional earthwork required to construct temporary/new alignments at both bridge ends of the new bridge along with additional earthwork for new bridge abutments.
Ability to Maintain Existing Drainage Systems - Bridge Deck, Storm Sewer Collection, Storm Sewer Trunk line	**Impact: Low** Grind the existing bridge deck shoulders to 1/4"/ft. prior to Phase 1 MOT to avoid adding additional scuppers. The existing drainage at piers 3, 6, 9 and 12 needs reconstructed to provide adequate positive drainage to the trunk sewer. The existing drainage trunk sewer needs minor repairs. **Cost: $70,000**	**Impact: Medium** Grind the existing bridge deck shoulders to 1/4"/ft. prior to Phase 1 MOT to minimize adding additional scuppers. In addition to trunk sewer repairs and the reconstruction of bridge pier drainage at piers 3, 6, 9 and 12, additional bridge deck scuppers will be required to minimize spread into the MOT travel lanes and provide a 10 feet dry lane for the 2 yr. storm frequency. These additional scuppers will be conducted to the ground and additional catch basins will be required at pier legs 4, 5, 7, 8, 10 and 11 to collect bridge drainage. Additional connections into the existing storm sewer trunk line will be required, including new junction structures on the existing storm sewer. This additional drainage will be required for both the MOT on the existing WB bridge and the new deck on the EB bridge to accommodate traffic in MOT Phases 1, 2, 3 & 4. **Cost: $1,542,000**	**Impact: Medium** Grind the existing bridge deck shoulders to 1/4"/ft. prior to Phase 1 MOT to avoid adding additional scuppers in the existing bridge deck. In addition to trunk sewer repairs and the reconstruction of bridge pier drainage at piers 3, 6, 9 and 12, additional bridge deck scuppers will be required in the new eastbound bridge deck to minimize spread into the MOT travel lanes and provide a 10 feet dry lane for the 2 yr. storm frequency. These additional scuppers will be conducted to the ground and additional catch basins will be required at pier legs 4, 5, 7, 8, 10 and 11 to collect bridge drainage. Additional connections into the existing storm sewer trunk line will be required, including new junction structures on the existing storm sewer. This additional drainage will be required for the MOT on the new deck on the EB bridge to accommodate traffic in MOT Phases 3 & 4. **Cost: $1,013,000**	**Impact: Low** Grind the existing bridge deck shoulders to 1/4"/ft. prior to Phase 1 MOT to avoid adding additional scuppers in the existing bridge deck. The existing drainage trunk sewer needs minor repairs. The drainage at piers 3, 6, 9 and 12 needs reconstructed to provide adequate positive drainage to the trunk sewer. **Cost: $56,000**	**Impact: Medium** The existing drainage trunk sewer needs minor repairs. The drainage at piers 3, 6, 9 and 12 for the existing eastbound bridge needs reconstructed to provide adequate positive drainage to the trunk sewer. The new bridge deck drainage may require additional drainage at piers to provide adequate positive drainage to the trunk sewer. **Cost: No Additional Cost**

Work Zone Constraints

CUY-480-18.42 L/R, PID No. 90591

Constraint	Work Zone Alternatives				
	Alternative 1.a (70) - Same Width Deck Replacement - Maintain 3 Lanes WB (on bridge only) & 4 Lanes EB (5 + 2) Modify existing & proposed shoulder cross slope	**Alternative 3.a (72) - Widen Existing and New Bridge - Maintain 4 Lanes WB & EB (6 + 2) Modify existing & proposed shoulder cross slope**	**Alternative 3.b (72) - Widen New Bridge - Phases 1 & 2 Maintain 3 Lanes WB & 4 Lanes EB (5 + 2); Phases 3 & 4 Maintain 4 Lanes WB & EB (6 + 2) Modify existing & proposed shoulder cross slope**	**Alternative 3.c - Widen EB Substructure & Superstructure - New EB Bridge (93)- Maintain 4 Lanes All Phases - Phase 1 & 3 (5 + 3); Phase 2 (4 + 4); Phases 4 & 5 (6 + 2)**	**Alternative 5 - New WB Bridge in Median - Maintain 4 Lanes WB & EB**
Ability to Maintain Existing Lighting Systems	**Impact: Medium** The lighting on the bridge decks under construction will be near 50% during all phases when the existing parapet and lighting is removed for part width construction. To provide temporary lighting free standing trailer lights on the bridge deck sections beyond the PB or temporary poles mounted to the bridge framing through the bridge deck are options. **Cost: $ 300,000**	**Impact: Medium** Pre-phase 1 will remove and replace the existing westbound inside parapet and lighting. The widened westbound bridge deck in pre-phase 1 willl require temporary lighting erected for MOT phases 1 & 2. The lighting on the bridge decks under construction will be near 50% during all phases when the existing parapet and lighting is removed for part width construction. To provide temporary lighting in phases 1 & 3 free standing trailer lights on the bridge deck sections beyond the PB or temporary poles mounted to the bridge framing through the bridge deck are options. **Cost: $ 400,000**	**Impact: Medium** The lighting on the bridge decks under construction will be near 50% during all phases when the existing parapet and lighting is removed for part width construction. To provide temporary lighting in phases 1 & 3 free standing trailer lights on the bridge deck sections beyond the PB or temporary poles mounted to the bridge framing through the bridge deck are options. **Cost: $ 300,000**	**Impact: Medium** The lighting on the eastbound bridge deck in Phase 1 & 2 will be near 50% when the existing parapet and lighting is removed for the superstructure widening. To provide temporary lighting in phases 1 & 2 free standing trailer lights on the bridge deck sections beyond the PB or temporary poles mounted to the bridge framing are options. The lighting on the bridge decks under construction in Phases 3 through 5 will be near 50% when the existing parapet and lighting is removed for part width construction. To provide temporary lighting free standing trailer lights on the bridge deck sections beyond the PB or temporary poles mounted to the bridge framing through the bridge deck are options. **Cost: $ 300,000**	**Impact: Low** Lighting will need to be provided on the new bridge. Lighting will be maintained on the existing bridge carrying the MOT traffic. Temporary lighting along the temporary alignments east of the Bridge will be needed during Phase 1. **Cost: $ 25,000**
Constructability; and Construction Equipment Access	**Impact: Low** All proposed work on and below the bridges is within the existing L/A right of way. Access under the bridge is required to construct new bridge deck drainage to the ground. At piers 3, 6, 9 & 12 closed storm sewer systems are required to be constructed from the piers to the existing trunk sewer. Several trunk sewer repairs are necessary under the bridges. All bridge piers will require some degree of patching. Multiple work agreements to cross private property and gain access to the necessary areas under the bridge will be required.	**Impact: Low** All proposed work on and below the bridges is within the existing L/A right of way. Access under the bridge is required to construct new bridge deck drainage to the ground. At piers 3, 6, 9 & 12 closed storm sewer systems are required to be constructed from the piers to the existing trunk sewer. At piers 4, 5, 7, 8, 10 & 11 MOT storm drainage systems are required to be constructed from the piers to the existing trunk sewer. Several trunk sewer repairs are necessary under the bridges. All bridge piers will require some degree of patching. Multiple work agreements to cross private property and gain access to the necessary areas under the bridge will be required.	**Impact: Low** All proposed work on and below the bridges is within the existing L/A right of way. Access under the bridge is required to construct new bridge deck drainage to the ground. At piers 3, 6, 9 & 12 closed storm sewer systems are required to be constructed from the piers to the existing trunk sewer. At piers 4, 5, 7, 8, 10 & 11 MOT storm drainage systems are required to be constructed from the piers to the existing trunk sewer. Several trunk sewer repairs are necessary under the bridges. All bridge piers will require some degree of patching. Multiple work agreements to cross private property and gain access to the necessary areas under the bridge will be required.	**Impact: Low** All proposed work on and below the bridges is within the existing L/A right of way. Access under the bridge is required to construct new bridge widening substructure and piers. At piers 3, 6, 9 & 12 closed storm sewer systems are required to be constructed from the piers to the existing trunk sewer. Several trunk sewer repairs are necessary under the bridges. All bridge piers will require some degree of patching. Multiple work agreements to cross private property and gain access to the necessary areas under the bridge will be required.	**Impact: Low** All proposed work on and below the bridges is within the existing L/A right of way. Access under the bridges is required to construct new bridge footings, piers, drainage appurtenances. Several trunk sewer repairs are necessary under the bridge. The remaining eastbound bridge piers will require some degree of patching. Demolition of the existing westbound bridge after the completion of the new bridge construction and the eastbound bridge deck widening. Multiple work agreements to cross private property and gain access to the necessary areas under the bridge will be required.
Location of Crossovers (e.g., Can crossovers be located near the project?)	**Impact: Low** Locations for the crossovers can be provided that will allow for access to and from the ramps at E 98th Street. The crossover locations for IR 480 eastbound to the west of the project will not allow for IR 480 eastbound traffic to access the East 98th Street exit on the east side of the bridge in Phases 1 and 2 (the first two construction seasons). The crossover locations will minimize the resulting queues on the adjoining interchanges and provide a measure of lane continuity through the construction of the project.	**Impact: Low** Locations for the crossovers can be provided that will allow for access to and from the ramps at E 98th Street. The crossover locations for IR 480 eastbound to the west of the project will not allow for IR 480 eastbound traffic to access the East 98th Street exit on the east side of the bridge in Phases 1 and 2 (the first two construction seasons). The crossover locations will minimize the resulting queues on the adjoining interchanges and provide a measure of lane continuity through the construction of the project.	**Impact: Low** Locations for the crossovers can be provided that will allow for access to and from the ramps at E 98th Street. The crossover locations for IR 480 eastbound to the west of the project will not allow for IR 480 eastbound traffic to access the East 98th Street exit on the east side of the bridge in Phases 1 and 2 (the first two construction seasons). The crossover locations will minimize the resulting queues on the adjoining interchanges and provide a measure of lane continuity through the construction of the project.	**Impact: Low** Locations for the crossovers can be provided that will allow for access to and from the ramps at E 98th Street and IR 77. The crossover locations will minimize the resulting queues on the adjoining interchanges and provide a measure of lane continuity through the construction of the project.	**Impact: None** Crossovers not required. Temporary eastbound alignments in MOT Phase. New alignment for westbound final condition.
What are the Access Impacts to Important Traffic Generators such as Hospitals, Fire Departments, Industries, Sports Arenas, etc.	**Impact: Low** The crossover locations for IR 480 eastbound to the west of the project will not allow for IR 480 eastbound traffic to access the East 98th Street exit on the east side of the bridge in Phases 1 and 2 (the first two construction seasons). ODOT District 12 personnel and business along Transportation Boulevard will be impacted. Access for the IR 480 eastbound through traffic to Transportation Boulevard will be provided via IR 77 southbound to Rockside Road eastbound to IR 77 northbound to IR 480 eastbound.	**Impact: Low** The crossover locations for IR 480 eastbound to the west of the project will not allow for IR 480 eastbound traffic to access the East 98th Street exit on the east side of the bridge in Phases 1 and 2 (the first two construction seasons). ODOT District 12 personnel and business along Transportation Boulevard will be impacted. Access for the IR 480 eastbound through traffic to Transportation Boulevard will be provided via IR 77 southbound to Rockside Road eastbound to IR 77 northbound to IR 480 eastbound.	**Impact: Low** The crossover locations for IR 480 eastbound to the west of the project will not allow for IR 480 eastbound traffic to access the East 98th Street exit on the east side of the bridge in Phases 1 and 2 (the first two construction seasons). ODOT District 12 personnel and business along Transportation Boulevard will be impacted. Access for the IR 480 eastbound through traffic to Transportation Boulevard will be provided via IR 77 southbound to Rockside Road eastbound to IR 77 northbound to IR 480 eastbound.	**Impact: Very Low** No ramp closures or restrictions.	**Impact: Very Low** No ramp closures or restrictions. Temporary eastbound alignments in MOT Phase will merge the IR 77 ramps into one lane prior to the entrance onto the bridge. New alignments for westbound final condition.
Parallel Route Improvements	**Impact: Medium** Upgrade intersections along Granger Road and Rockside Road to mitigate level of service degradation from IR 480 traffic diversion. **Cost: $19,419,900**	**Impact: Low** Minor intersection improvements along Granger Road and Rockside Road to provide acceptable level of service for the existing traffic conditions. **Cost: $5,516,300**	**Impact: Medium** Upgrade intersections along Granger Road and Rockside Road to mitigate level of service degradation from IR 480 traffic diversion. **Cost: $19,419,900**	**Impact: Low** Minor intersection improvements along Granger Road and Rockside Road to provide acceptable level of service for the existing traffic conditions. **Cost: $5,516,300**	**Impact: None** No Intersection improvements along Granger Road and Rockside Road. Level of service for the existing intersections will remain. **Cost: $0**
Exit Ramps - Can the existing number of ramp lanes be maintained?	**Impact: Medium** All existing exit ramps are maintained. 480 EB traffic approaching the bridge will be crossed over to the left bridge and will not have access to the E 98th St. (Transportation Bvld.) Exit ramp during phases 1 and 2 (the first two construction seasons). During phases 3 & 4 exit Ramp EN/ES (IR 480 WB to IR 77 North and IR 77 South Exit ramps) will be reduced from 2 lanes to 1.	**Impact: Low** All existing exit ramps are maintained. 480 EB traffic approaching the bridge will be crossed over to the left bridge and will not have access to the E 98th St. (Transportation Bvld.) Exit ramp during phases 1 and 2 (the first two construction seasons). During phases 3 & 4 exit Ramp EN/ES (IR 480 WB to IR 77 North and IR 77 South Exit ramps) will be reduced from 2 lanes to 1.	**Impact: Low** All existing exit ramps are maintained. 480 EB traffic approaching the bridge will be crossed over to the left bridge and will not have access to the E 98th St. (Transportation Bvld.) Exit ramp during phases 1 and 2 (the first two construction seasons). During phases 3 & 4 exit Ramp EN/ES (IR 480 WB to IR 77 North and IR 77 South Exit ramps) will be reduced from 2 lanes to 1.	**Impact: Low** All existing exit ramps are maintained. During phases 4 & 5 exit Ramp EN/ES (IR 480 WB to IR 77 North and IR 77 South Exit ramps) will be reduced from 2 lanes to 1.	**Impact: Low** Yes, all existing number of exit ramp lanes are maintained. Ramps fromIR 480 WB to IR 77 NB & SB closed in Phase 2 for pavement tie-in work. Short term (approximately 7-day) closure of westbound IR 480 ramps to 77 NB and 77 SB will be required in order to construct new ramp alignment tie-ins.
Estimated Maintenance of Traffic Cost	**Impact:** Maintain existing bridge widths (70 feet toe to toe) **Cost: $2,267,321**	**Impact:** Pre-Phase 1 will widen existing bridge deck width. New eastbound and westbound bridge decks will be constructed to 72 feet width. **Cost: $ 23,637,859**	**Impact:** No widening of the existing westbound bridge deck. Widen the new eastbound bridge deck to 72 feet. Allow for 4 MOT lanes in Phases 3 & 4. **Cost: $10,648,868**	**Impact:** Widen the eastbound bridge substructure and superstructure to allow for a 93 feet toe to toe bridge deck. **Cost: $ 65,563,081**	**Impact:** Construct a new westbound bridge substructure, superstructure and 72 feet toe to toe bridge deck width. **Cost: $ 111,996,569**

Bridge Information
CUY-480-18.42 L/R, PID No. 90591

Bridge Description

BRIDGE NAME	EXTENT OF WORK	TYPE OF BRIDGE	LENGTH OF BRIDGE (Feet)	EXISTING PIER SPACING (Feet)	EXISTING BRIDGE WIDTH (Feet)	FUTURE BRIDGE WIDTH (Feet)
CUY-480-1842L SFN 1812521 Westbound	DECK REPLACEMENT	CONTINUOUS STEEL GIRDER	4,155	220; 11 @ 300; 2 @ 225; 180	69.5	70 (minimum)
CUY-480-1842R SFN 1812548 Eastbound	DECK REPLACEMENT	CONTINUOUS STEEL GIRDER	4,155	220; 11 @ 300; 2 @ 225; 180	69.5	70 (minimum)

Alternative 1.a(70) - Same Width Deck Replacement - Maintain 3 Lanes WB & 4 Lanes EB (5 + 2)

BRIDGE NAME	BRIDGE WIDTH NEEDED (Feet)	COST OF 32" PCB BRIDGE MOUNTED (4 Phases)	COST OF 50" PCB BRIDGE MOUNTED (4 Phases)	COST OF ADDITIONAL BRIDGE DECK DRAINAGE	COST OF ADDITIONAL BRIDGE WIDENING
CUY-480-1842L SFN 1812521 Westbound	70	$477,751	$615,226	$108,000	NA
CUY-480-1842R SFN 1812548 Eastbound	70				NA

Alternative 3.a (72) - Widen Existing and New Bridge - Maintain 4 Lanes WB & EB (6 + 2)

BRIDGE NAME	BRIDGE WIDTH NEEDED (Feet)	COST OF 32" PCB BRIDGE MOUNTED (4 Phases)	COST OF 50" PCB BRIDGE MOUNTED (4 Phases)	COST OF ADDITIONAL BRIDGE DECK DRAINAGE	COST OF ADDITIONAL NEW BRIDGE WIDENING
CUY-480-1842L SFN 1812521 Westbound	72	$536,650	$606,188	$2,393,000	$11,870,000
CUY-480-1842R SFN 1812548 Eastbound	72				$6,827,000

Alternative 3.b (72) - Widen New Bridge - Phases 1 & 2 Maintain 3 Lanes WB & 4 Lanes EB; Phases 3 & 4 Maintain 4 Lanes WB & EB (5 + 2) & (6 + 2)

BRIDGE NAME	BRIDGE WIDTH NEEDED (Feet)	COST OF 32" PCB BRIDGE MOUNTED (4 Phases)	COST OF 50" PCB BRIDGE MOUNTED (4 Phases)	COST OF ADDITIONAL BRIDGE DECK DRAINAGE	COST OF ADDITIONAL NEW BRIDGE WIDENING
CUY-480-1842L SFN 1812521 Westbound	70	$476,232	$615,208	$1,572,000	NA
CUY-480-1842R SFN 1812548 Eastbound	72				$6,827,000

Alternative 3.c - Widen EB Substructure & Superstructure - New EB Bridge (93)- Maintain 4 Lanes All Phases - Phase 1 & 3 (5 + 3); Phase 2 (4 + 4); Phases 4 & 5 (6 + 2)

BRIDGE NAME	BRIDGE WIDTH NEEDED (Feet)	COST OF 32" PCB BRIDGE MOUNTED (4 Phases)	COST OF 50" PCB BRIDGE MOUNTED (4 Phases)	COST OF ADDITIONAL BRIDGE DECK DRAINAGE	COST OF ADDITIONAL NEW BRIDGE WIDENING
CUY-480-1842L SFN 1812521 Westbound	70	$564,508	$604,646	$87,000	NA
CUY-480-1842R SFN 1812548 Eastbound	93				$62,919,000

Alternative 5 - New Bridge in Median - Maintain 4 Lanes WB & EB

BRIDGE NAME	BRIDGE WIDTH NEEDED (Feet)	COST OF 32" PCB BRIDGE MOUNTED (4 Phases)	COST OF 50" PCB BRIDGE MOUNTED (4 Phases)	COST OF ADDITIONAL BRIDGE DECK DRAINAGE	ADDITIONAL COST OF NEW BRIDGE
CUY-480-1842L SFN 1812521 Westbound	72	$154,812	$32,115	$0	$104,347,000
CUY-480-1842R SFN 1812548 Eastbound	72				

Ramp Information

CUY-480-18.42 L/R, PID No. 90591

RAMP DESIGNATION (LOCATION)	ODOT Short Term Traffic Volume count (c)	RAMP NAME	NUMBER OF LANES (a)	RAMP VOLUME (% TRUCKS)	RAMP CLOSURES (c)																					DETOUR
					Alternative 1.a (70) - Same Width Deck Replacement - Maintain 3 Lanes WB (on bridge only) & 4 Lanes EB (5 + 2) Modify existing & proposed shoulder cross slope					Alternative 3.a (72) - Widen Existing and New Bridge - Maintain 4 Lanes WB & EB (6 + 2) Modify existing & proposed shoulder cross slope					Alternative 3.b (72) - Widen New Bridge - Phases 1 & 2 Maintain 3 Lanes WB & 4 Lanes EB (5 + 2); Phases 3 & 4 Maintain 4 Lanes WB & EB (6 + 2) Modify existing & proposed shoulder cross slope					Alternative 3.c - Widen EB Substructure & Superstructure - New EB Bridge (93)- Maintain 4 Lanes All Phases - Phase 1 & 3 (5 + 3); Phase 2 (4 + 4); Phases 4 & 5 (6 + 2)						Alternative 5 - New WB Bridge in Median / Remove Existing WB Bridge - Maintain 4 Lanes WB & EB			
					PHASE 1	PHASE 2	PHASE 3	PHASE 4	DURATION OF IMPACT (DAYS) (h)	PHASE 1	PHASE 2	PHASE 3	PHASE 4	DURATION OF IMPACT (DAYS) (h)	PHASE 1	PHASE 2	PHASE 3	PHASE 4	DURATION OF IMPACT (DAYS) (h)	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5	DURATION OF IMPACT (DAYS) (h)	PHASE 1	PHASE 2	DURATION OF IMPACT (b) OR CLOSURE	
IR 77 NB to IR 480 EB	78618	S-E	1	14965(6%)	1 (h)	1 (h)	1	1		1 (h)	1 (h)	1	1		1 (h)	1 (h)	1	1		1	1	1	1 (h)	1 (h)		1 (i,k)	1	480	480WB to Granger, Left on Granger at Exit ramp signal, through the Granger/Tuxedo signalized intersection, to 480EB entrance ramp.
IR 77 SB to IR 480 EB	78218	N-E	2	24015(10%)	2 (h)	2 (h)	2	2		2 (h)	2 (h)	2	2		2 (h)	2 (h)	2	2		2	2	2	2 (h)	2 (h)		1 (l,k)	2	480	480WB to Granger, Left on Granger at Exit ramp signal, through the Granger/Tuxedo signalized intersection, to 480EB entrance ramp.
IR 480 WB to IR 77 NB	77918	E-N	2	10280(12%)	2	2	2 (f)	2 (f)	480	2	2	2 (e)	2 (e)	480	2	2	2 (e)	2 (e)	480	2	2	2	2 (f)	2 (f)	480	2	2 (l)	7 (p)	480WB to Granger, Left on Granger at Exit ramp signal, through the Granger/Tuxedo signalized intersection, to 480EB entrance ramp, 480EB to 77NB.
IR 480 WB to IR 77 SB	78418	E-S	1	400(14%)	1	1	1 (f)	1 (f)	480	1	1	1 (e)	1 (e)	480	1	1	1 (e)	1 (e)	480	1	1	1	1 (f)	1 (f)	480	1	1 (l)	7 (p)	480WB to Granger, Left on Granger at Exit ramp signal, through the Granger/Tuxedo signalized intersection, to 480EB entrance ramp, 480EB to 77SB.
IR 480 EB to East 98th St.	74818	W-98	1	10955(3%)	1 (d)	1 (d)	1	1	480	1 (d)	1 (d)	1	1	480	1 (d)	1 (d)	1	1	480	1	1	1	1	1		1	1		480EB to 77SB, to Rockside Rd., left at the signal to Rockside EB, immediate right to 77NB, to 480EB
East 98th St. to IR 480 EB	74918	98-E	1	7945(8%)	1	1	1 (g)	1 (g)		1	1	1	1		1	1	1	1		1	1	1	1	1		1	1		
East 98th St. to IR 480 WB	75118	98-W	1	11005(5%)	1	1	1 (g)	1 (g)	480	1	1	1 (g)	1 (g)	480	1	1	1 (g)	1 (g)	480	1	1	1	1 (g)	1 (g)	480	1	1 (l)	7 (p)	Alternate access to 480WB is provided by: 480EB at Transportation Blvd. to Granger Rd., Left at signal onto Granger, right from Granger to 480EB entrance ramp.
IR 480 WB to East 98th St.	75018	E-98	1	7910(6%)	1 (o)	1 (o)	1 (o)	1 (o)		1 (o)	1 (o)	1 (o)	1 (o)		1 (o)	1 (o)	1 (o)	1 (o)		1	1	1	1	1		1	1		

240 DAYS = 1 Construction season

(a) The number of lanes indicated reflects the 'normal' number of ramp lanes along the ramp. Turn lanes at intersections and merge lanes with adjoining ramps are not included.
(b) Duration of Impact refers to the number of days that a ramp will have a major operational change such as a lane reduction or the ramp traffic will be entering an MOT zone with a reduced number of mainline lanes thereby reducing the amount of merge gaps.
(c) The number indicates the lanes to be maintained in the construction phase. An "X" indicates closure of the ramp.
(d) Access to the ramp exit is only provided to the 480EB traffic entering the bridge from the 77 ramps at the west end of the bridge. 480EB traffic on 480EB @ 77 will be crossed-over and will not have access to the E98th St. exit ramp.
(e) Access to the ramp exit is only provided to the 480WB traffic staying in the right two lanes on the left bridge under construction. 480WB crossed-over traffic will not have access to the ramp.
(f) Access to the ramp exit is only provided to the 480WB traffic staying in the right lane of the two lanes on the left bridge under construction. 480WB crossed-over traffic will not have access to the ramp.
(g) One lane will be maintained however, MOT condition is a merge into a reduced number of through lanes and may be restrictive. Temporary pavement will be required to achieve DSD and Minimum MOT Ramp lane and shoulder widths.
(h) The entrance ramp will function as an "add" lane and no merge of ramp traffic into 480EB traffic is required. The efficiency of the entrance ramp will be enhanced during this MOT phase.
(i) Single lane from each ramp would be merged together prior to the bridge and a single "add" lane would be carried onto the bridge.
(j) Both exit ramps will share the right lane which functions as an IR 480 through/exit Ramp Decision lane.
(k) Temporary pavement on temporary alignment required.
(l) New ramp alignment and new ramp pavement required.
(m) Temporary Exit Ramp requires Speed Reduction and Advisory Signing.
(n) Temporary pavement on temporary alignment required. Temporary Alignment will pass beneath existing Overpass Structure
(o) Exit ramp operation changes from a diverging taper exit to a drop lane exit
(p) The Ramps will require a closure in order to perform tie in work between new ramp alignment and the existing ramp alignment

Cost Comparision

CUY-480-18.42 L/R, PID No. 90591

	Alternative 1.a (70) - Same Width Deck Replacement - Maintain 3 Lanes WB (on bridge only) & 4 Lanes EB (5 + 2)	Alternative 3.a(72) - Widen Existing and New Bridge - Maintain 4 Lanes WB & EB (6 + 2)	Alternative 3.b(72) - Widen New Bridge - Phases 1 & 2 Maintain 3 Lanes WB & 4 Lanes EB; Phases 3 & 4 Maintain 4 Lanes WB & EB (6 + 2)	Alternative 3.c - Widen Existing EB Substructure and Superstructure - Maintain 4 Lanes WB & EB All Phases (5 + 3), (4 + 4) & (6 + 2)	Alternative 5 - New Bridge in Median - Maintain 4 Lanes WB & EB
	Cost	Cost	Cost	Cost	Cost
Additional Bridge Structure	$0	$12,042,649.00	$4,397,123.00	$40,527,575.00	$71,609,284.00
Lighting	$304,215	$429,215.00	$304,215.00	$329,215	$25,000
Temporay Drainage	$69,700	$1,541,255	$1,012,410	$55,750	$0
Temporary Pavement	$211,718	$300,844	$263,576	$359,628	$353,680
Temporary Pavement Marking	$150,774	$155,038	$158,844	$184,680	$27,996
Portable Concrete Barrier	$724,025	$756,674	$723,007	$773,800	$123,537
Subtotal:	$1,460,432	$15,225,674	$6,859,174	$42,230,648	$72,139,497
15% Contingency	$219,065	$2,283,851	$1,028,876	$6,334,597	$10,820,925
Subtotal:	$1,679,497	$17,509,525	$7,888,051	$48,565,246	$82,960,421
35% Inflation	$587,824	$6,128,334	$2,760,818	$16,997,836	$29,036,147
Parallel Route Improvements	$19,419,900	$5,516,300	$19,419,900	$5,516,300	$0
MOT RELATED COST	**$21,687,221**	**$29,154,159**	**$30,068,768**	**$71,079,381**	**$111,996,569**
Additional User Costs due to Delays and Queues/per day	$746,500 4 years with additional costs	$479,500 4 years with additional costs	$531,500 4 years with additional costs	$467,000 5 years with additional costs	$279,000 1 years with additional costs
Project Duration	5 years	5 1/2 Years	5 Years	6 Years	5 Years

Work Zone Alternatives - Operational Comparison
CUY-480-18.42 L/R, PID No. 90591

Alternative - Phase - Direction		Number of Lanes Maintained	Description	ODOT Queue Spreadsheet Results					QUEWZ Software		HCS Computer Software			ODOT PLCM Chart Information		
				AM Peak hour/Max AM Queue	Number of AM hours w/queue	PM Peak hour/Max PM Queue	Number of PM hours w/queue	Number of occurrences of 1/4 mile queue in non-peak hours	Capacity in Vehicles/Lane/ Hour	Additional User Costs/Day from QUEWZ	AM/PM Capacity in Vehicles/Lane/ Hour	LOS/MPH based upon AM Peak volume	LOS/MPH based upon PM Peak volume	Capacity: Vehicles/ Lane/Hour	AM Closure Restrictions	PM Closure Restrictions
Existing Condition 4 Lanes EB and 4 Lanes WB																
	Eastbound	4 Lanes		7:00/0 Miles	0 Hours	5:00/0 Miles	0 Hours	0	1800	$0	1882/1670	D/61	D/64			
	Westbound	4 Lanes		7:00/0 Miles	0 Hours	4:00/0 Miles	0 Hours	0	1800	$0	1829/1907	D/62	D/61			
Existing Condition 4 Lanes EB and 4 Lanes WB with Work Zone Introduced																
	Eastbound	4 Lanes		7:00/1.8 Miles	2 Hours	5:00/2.0 Miles	3 Hours	0	1488	$126,000				1490	6 Thru 10	12 Thru 7
	Westbound	4 Lanes		7:00/1.3 Miles	2 Hours	4:00/7.0 Miles	5 Hours	1	1560	$153,000				1490	7 Thru 10	12 Thru 7
Alternative 1.a (70) - Same Width Deck Replacement - Maintain 3 Lanes WB (on bridge only) & 4 Lanes EB (5 + 2)																
Phases 1 & 2	Eastbound	2 Lanes	(IR 480 Thru)	7:00/12.2 Miles	6 Hours	3:00/9.8 Miles	8 Hours	6 Hours	1413	$188,000	2245/1964	E/52	D/57			
		2 Lanes	(From IR 77 Ramps)	7:00/0.0 Miles	0 Hours	4:00/3.6 Miles	3 Hours	0	1413	$63,000	1504/1899	C/60	D/58			
	Westbound	3 Lanes		7:00/11.2 Miles	6 Hours	4:00/47.4 Miles	12 Hours	12 Hours	1482	$341,000	2439/2616	F/47	F/41			
Phases 3 & 4	Eastbound	4 Lanes		7:00/2.5 Miles	2 Hours	4:00/4.1 Miles	4 Hours	0	1413	$175,000	1882/1783	D/58	D/59			
	Westbound	1 Lane	(IR 480 Thru)	7:00/11.9 Miles	5 Hours	4:00/48.9 Miles	11 Hours	* 9 Hours	1482	$331,000	2439/2616	F/47	F/41			
		2 Lanes	(To IR 77 Ramps + 480 Thru)	7:00/11.9 Miles	8 Hours	4:00/48.9 Miles	12 Hours	* 13 Hours	1482	$395,000	2439/2616	F/47	F/41			
Alternative 3.a (72) - Widen Existing and New Bridge - Deck Replacement - Maintain 4 (10') Lanes WB & EB (6 + 2) - Modify Shoulder Cross Slopes																
Phases 1 & 2	Eastbound	2 Lanes	(IR 480 Thru)	7:00/14.3 Miles	7 Hours	3:00/18.1 Miles	8 Hours	7 Hours	1339	$220,000	2245/1964	E/52	D/57			
		2 Lanes	(From IR 77 Ramps)	7:00/0.0 Miles	0 Hours	4:00/2.2 Miles	3 Hours	0	1488	$40,000	1504/1899	C/60	D/58			
	Westbound	4 Lanes		7:00/3.2 Miles	3 Hours	4:00/12.7 Miles	7 Hours	3 Hours	1404	$228,000	1829/1962	D/59	D/58			
Phases 3 & 4	Eastbound	4 Lanes		7:00/4.5 Miles	5 Hours	4:00/6.2 Miles	5 Hours	0	1339	$212,000	1882/1783	D/58	D/59			
	Westbound	2 Lane	(IR 480 Thru)	7:00/3.2 Miles	3 Hours	4:00/12.7 Miles	7 Hours	3 Hours	1404	$159,000	1829/1962	D/59	D/58			
		2 Lanes	(To IR 77 Ramps + 480 Thru)	7:00/1.1 Miles	2 Hours	4:00/6.2 Miles	5 Hours	1 Hours	1560	$100,000	1829/1962	D/59	D/58			
Alternative 3.b (72) - Widen New Bridge - Deck Replacement - Phases 1 &2 Maintain 3 Lanes WB & 4 Lanes EB (5 + 2); Phases 3 & 4 Maintain 4 (10') Lanes WB & EB (6 + 2) - Modify Shoulder Cross Slopes																
Phases 1 & 2	Eastbound	2 Lanes	(IR 480 Thru)	7:00/12.2 Miles	6 Hours	3:00/9.8 Miles	8 Hours	6 Hours	1413	$188,000	2245/1964	E/52	D/57			
		2 Lanes	(From IR 77 Ramps)	7:00/0.0 Miles	0 Hours	4:00/3.6 Miles	3 Hours	0	1413	$63,000	1504/1899	C/60	D/58			
	Westbound	3 Lanes		7:00/11.2 Miles	6 Hours	4:00/47.4 Miles	12 Hours	12 Hours	1482	$341,000	2439/2616	F/47	F/41			
Phases 3 & 4	Eastbound	4 Lanes		7:00/4.5 Miles	5 Hours	4:00/6.2 Miles	5 Hours	0	1339	$212,000	1882/1783	D/58	D/59			
	Westbound	2 Lane	(IR 480 Thru)	7:00/3.2 Miles	3 Hours	4:00/12.7 Miles	7 Hours	3 Hours	1404	$159,000	1829/1962	D/59	D/58			
		2 Lanes	(To IR 77 Ramps + 480 Thru)	7:00/1.1 Miles	2 Hours	4:00/6.2 Miles	5 Hours	1 Hours	1560	$100,000	1829/1962	D/59	D/58			
Alternative 3.c - Widen Eastbound Substructure and Superstructure - Deck Replacement - Maintain 4 Lanes WB & EB all Phases; Phases 1 & 3 (5 + 3); Phase 2 (4 + 4); Phases 4 & 5 (6 + 2)																
Phases 1 & 3	Eastbound	1 Lanes	(IR 480 Thru)	7:00/2.5 Miles	4 Hours	3:00/0.4 Miles	1 Hour	0	1488	$46,000	1835/1883	D/59	D/59			
		3 Lanes	(480 & IR 77 Ramps)	7:00/3.2 Miles	2 Hours	4:00/8.1 Miles	4 Hours	0	1413	$129,000	1835/1883	D/59	D/59			
	Westbound	4 Lanes		7:00/1.8 Miles	2 Hours	4:00/9.1 Miles	5 Hours	1 Hour	1482	$191,000	1829/1962	D/59	D/58			
Phase 2	Eastbound	4 Lanes		7:00/2.5 Miles	2 Hours	4:00/4.1 Miles	4 Hours	0	1413	$16,000	1882/1783	D/58	D/59			
	Westbound	4 Lanes		7:00/1.3 Miles	2 Hours	4:00/7.0 Miles	5 Hours	1	1560	$153,000	1829/1907	D/62	D/61			
Phases 4 & 5	Eastbound	4 Lanes		7:00/2.5 Miles	2 Hours	4:00/4.1 Miles	4 Hours	0	1413	$129,000	1882/1783	D/58	D/59			
	Westbound	2 Lane	(To IR 77 Ramps + 480 Thru)	7:00/1.8 Miles	2 Hours	4:00/9.1 Miles	5 Hours	1 Hours	1482	$122,000	1829/1962	D/59	D/58			
		2 Lanes	(IR 480 Thru)	7:00/1.1 Miles	2 Hours	4:00/6.2 Miles	5 hours	1 hour	1560	$100,000	1829/1962	D/59	D/58			
Alternative 5 - New Westbound Bridge in Median - Maintain 4 Lanes WB & EB																
All Phases	Eastbound	4 Lanes		7:00/1.8 Miles	2 Hours	5:00/2.0 Miles	3 Hours	0	1488	$126,000	1882/1670	D/61	D/64			
	Westbound	4 Lanes		7:00/1.3 Miles	2 Hours	4:00/7.0 Miles	5 Hours	1	1560	$153,000	1829/1907	D/62	D/61			

Notes

Traffic volumes used were from the peak Friday in August 2012. This day had the peak daily traffic for 2012. 4 months (March to June) in 2013 have been reviewed. There are 6 days in 2013 in the 4 months review above the peak day in 2013.

Peak hour/Max AM Queue The peak hour and the maximum queue length are not always coincidential. Queue length accumulates as traffic continues to exceed Quewz work zone volumes.

* Although the traffic distribution shown in the ODOT spreadsheet results in different queue lengths in the non-peak hours traffic flow will distribute equally and the result for 1/4 mile queues in non-peak hours will be similar to Alternative 1.a (70) Phases 1 & 2 (12 Hours)

\# Flow rate beyond limits for which HCS provides results

Alternative 1.a(70)

QUEWZ-98

Phase 1 & 2 – 3 (11’) lanes WB
2 (11’) lanes EB from IR 77 Ramps
2 (11’) lanes EB crossover

Phase 3 & 4 - 1 (12’) lane WB crossover
4 (11’) lanes EB
2 (11’) lanes WB

QUEWZ-98 Alternative 1.a(70) – Phase 1 & 2 – 3 lanes WB and 2 lanes EB from IR 77 Ramps

INPUT DATA SUMMARY: ROAD USER COST OUTPUT
ALT 1 Phase 1 & 2 WB & 77 ramps EB

LANE CLOSURE CONFIGURATION:

TOTAL NUMBER OF LANES		
INBOUND	4	
OUTBOUND	4	
NUMBER OF OPEN LANES		
INBOUND	3	WB
OUTBOUND	2	(2 LANES FROM THE IR 77 RAMPS)
LENGTH OF WORK ZONE	2.00 MILES	
INBOUND CAPACITY (WESTBOUND)	E=1.5	
NORMAL	8000.	(VPH)
RESTRICTED	5400.	(VPH)
WORKING HOURS	4446.	(VPH)/3= 1482 VEH/HR/LN
OUTBOUND CAPACITY (IR 77 RAMPS)	E=2.5	
NORMAL	8000.	(VPH)
RESTRICTED	3600.	(VPH)
WORKING HOURS	2826.	(VPH)/2= 1413 VEH/HR/LN

TRAFFIC PARAMETERS:

PERCENTAGE TRUCK	5.

SCHEDULE OF WORK ACTIVITY:

HOURS OF RESTRICTED CAPACITY	
BEGINNING	0
ENDING	24
HOURS OF WORK ZONE ACTIVITY	
BEGINNING	0
ENDING	24

IDLE HC CAR	34.9 (g/hr)	IDLE HC TRUCK	12.6 (g/hr)
IDLE CO CAR	218.5 (g/hr)	IDLE CO TRUCK	94.6 (g/hr)
IDLE NOX CAR	4.7 (g/hr)	IDLE NOX TRUCK	53.1 (g/hr)

♀ SUMMARY OF ADDITIONAL ROAD USER COSTS
ALT 1 phase 1&2 WB & 77 ramps

HOUR	ADDITIONAL ROAD USER COSTS ($) INBOUND (WB)	OUTBOUND (77 Ramps)	TOTAL
0- 1	17.	5.	22.
1- 2	8.	2.	10.
2- 3	6.	2.	9.
3- 4	7.	2.	9.
4- 5	14.	5.	19.
5- 6	96.	24.	120.
6- 7	2727.	377.	3103.
7- 8	19468.	1144.	20613.
8- 9	30896.	477.	31373.
9-10	25537.	412.	25950.
10-11	20553.	274.	20827.
11-12	15019.	348.	15367.
12-13	16468.	396.	16864.
13-14	22979.	472.	23452.

14-15	30815.	657.	31471.
15-16	34065.	3490.	37555.
16-17	35653.	11861.	47514.
17-18	34918.	20867.	55785.
18-19	33809.	18560.	52369.
19-20	15991.	2564.	18554.
20-21	562.	90.	652.
21-22	327.	76.	402.
22-23	222.	32.	255.
23-24	100.	16.	116.
TOTAL	340257.	62154.	402412.

♀ SUMMARY OF TRAFFIC CONDITIONS -- INBOUND DIRECTION
ALT 1 phase 1&2 WB & 77 ramps

HOUR	APPROACH VOLUME (VPH)	CAPACITY (VPH)	APPROACH SPEED (MPH)	WORK ZONE SPEED (MPH)	QUEUE LENGTH (MILES)
0- 1	770.	4446.	59.	57.	0.0
1- 2	486.	4446.	59.	58.	0.0
2- 3	418.	4446.	59.	59.	0.0
3- 4	441.	4446.	59.	58.	0.0
4- 5	688.	4446.	59.	58.	0.0
5- 6	1763.	4446.	57.	54.	0.0
6- 7	4397.	4446.	52.	38.	0.0
7- 8	6709.	4446.	47.	30.	0.8
8- 9	5923.	4446.	49.	30.	1.5
9-10	4566.	4446.	51.	30.	1.5
10-11	4121.	4446.	52.	30.	1.2
11-12	4309.	4446.	52.	30.	0.8
12-13	4664.	4446.	51.	30.	0.8
13-14	4879.	4446.	51.	30.	1.3
14-15	5902.	4446.	49.	30.	1.5
15-16	6763.	4446.	47.	30.	1.5
16-17	7197.	4446.	46.	30.	1.5
17-18	6995.	4446.	47.	30.	1.5
18-19	6694.	4446.	47.	30.	1.5
19-20	3789.	4446.	53.	30.	0.9
20-21	2717.	4446.	55.	49.	0.1
21-22	2741.	4446.	55.	51.	0.0
22-23	2403.	4446.	55.	52.	0.0
23-24	1787.	4446.	57.	54.	0.0

NOTE: TRAFFIC DIVERSION IS PREDICTED, SEE SUMMARY OF TRAFFIC VOLUMES

SUMMARY OF TRAFFIC CONDITIONS -- OUTBOUND DIRECTION
ALT 1 phase 1&2 WB & 77 ramps

HOUR	APPROACH VOLUME (VPH)	CAPACITY (VPH)	APPROACH SPEED (MPH)	WORK ZONE SPEED (MPH)	QUEUE LENGTH (MILES)
0- 1	288.	2826.	59.	58.	0.0
1- 2	170.	2826.	60.	59.	0.0
2- 3	162.	2826.	60.	59.	0.0
3- 4	164.	2826.	60.	59.	0.0
4- 5	285.	2826.	59.	58.	0.0
5- 6	695.	2826.	59.	56.	0.0
6- 7	2017.	2826.	56.	49.	0.0

7- 8	2719.	2826.	55.	44.	0.0
8- 9	2174.	2826.	56.	48.	0.0
9-10	2076.	2826.	56.	49.	0.0
10-11	1818.	2826.	57.	50.	0.0
11-12	1967.	2826.	56.	49.	0.0
12-13	2049.	2826.	56.	49.	0.0
13-14	2167.	2826.	56.	48.	0.0
14-15	2397.	2826.	55.	47.	0.0
15-16	2834.	2826.	55.	30.	0.0
16-17	3432.	2826.	54.	30.	0.6
17-18	2990.	2826.	54.	30.	1.3
18-19	2529.	2826.	55.	30.	1.2
19-20	1497.	2826.	57.	44.	0.5
20-21	1224.	2826.	58.	53.	0.0
21-22	1143.	2826.	58.	54.	0.0
22-23	801.	2826.	58.	56.	0.0
23-24	575.	2826.	59.	57.	0.0

NOTE: TRAFFIC DIVERSION IS PREDICTED, SEE SUMMARY OF TRAFFIC VOLUMES

♀ SUMMARY OF TRAFFIC VOLUMES -- INBOUND DIRECTION PAGE 5 OF 6
ALT 1 phase 1&2 WB & 77 ramps QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	VOLUME REMAINING ON FREEWAY (VPH)	VOLUME DIVERTING FROM FREEWAY (VPH)
0- 1	770.	770.	0.
1- 2	486.	486.	0.
2- 3	418.	418.	0.
3- 4	441.	441.	0.
4- 5	688.	688.	0.
5- 6	1763.	1763.	0.
6- 7	4397.	4397.	0.
7- 8	6709.	5238.	1471.
8- 9	5923.	4446.	1477.
9-10	4566.	4446.	120.
10-11	4121.	4121.	0.
11-12	4309.	4309.	0.
12-13	4664.	4664.	0.
13-14	4879.	4690.	189.
14-15	5902.	4446.	1456.
15-16	6763.	4446.	2317.
16-17	7197.	4446.	2751.
17-18	6995.	4446.	2549.
18-19	6694.	4446.	2248.
19-20	3789.	3789.	0.
20-21	2717.	2717.	0.
21-22	2741.	2741.	0.
22-23	2403.	2403.	0.
23-24	1787.	1787.	0.

NOTE: THESE ESTIMATES ASSUME THAT TRAFFIC WILL DIVERT SUCH THAT
QUEUE LENGTHS NEVER EXCEED 1.50 MILES.

♀ SUMMARY OF TRAFFIC VOLUMES -- OUTBOUND DIRECTION PAGE 6 OF 6
ALT 1 phase 1&2 WB & 77 ramps QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	VOLUME REMAINING ON FREEWAY (VPH)	VOLUME DIVERTING FROM FREEWAY (VPH)
0- 1	288.	288.	0.

1- 2	170.	170.	0.
2- 3	162.	162.	0.
3- 4	164.	164.	0.
4- 5	285.	285.	0.
5- 6	695.	695.	0.
6- 7	2017.	2017.	0.
7- 8	2719.	2719.	0.
8- 9	2174.	2174.	0.
9-10	2076.	2076.	0.
10-11	1818.	1818.	0.
11-12	1967.	1967.	0.
12-13	2049.	2049.	0.
13-14	2167.	2167.	0.
14-15	2397.	2397.	0.
15-16	2834.	2834.	0.
16-17	3432.	3432.	0.
17-18	2990.	2990.	0.
18-19	2529.	2529.	0.
19-20	1497.	1497.	0.
20-21	1224.	1224.	0.
21-22	1143.	1143.	0.
22-23	801.	801.	0.
23-24	575.	575.	0.

NOTE: THESE ESTIMATES ASSUME THAT TRAFFIC WILL DIVERT SUCH THAT
QUEUE LENGTHS NEVER EXCEED 1.50 MILES.

EXCESS EMISSIONS (DIFFERENCE)

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	215.9	1561.8	-137.2
Outbound	56.1	344.7	-50.1

BASE EMISSIONS

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	291.1	1688.9	488.2
Outbound	99.6	624.1	194.7

CONSTRUCTION RELATED EMISSIONS

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	510.0	3269.5	351.7
Outbound	174.6	1087.7	148.7

QUEWZ-98 Alternative 1.a(70) – Phase 1 & 2 – 3 lanes WB and 2 lanes EB on crossover

INPUT DATA SUMMARY: ROAD USER COST OUTPUT
ALT 1 Phase 1 & 2 WB & IR 480 EB thru

LANE CLOSURE CONFIGURATION:

TOTAL NUMBER OF LANES	
INBOUND	4
OUTBOUND	4
NUMBER OF OPEN LANES	
INBOUND	3 WB
OUTBOUND	2 EB IR 480 Crossover - Thru
LENGTH OF WORK ZONE	2.00 MILES
INBOUND CAPACITY (WESTBOUND)	E= 1.5
NORMAL	8000. (VPH)
RESTRICTED	5400. (VPH)
WORKING HOURS	4446. (VPH)/3= 1482 VEH/HR/LN
OUTBOUND CAPACITY (EASTBOUND CROSSOVER - THRU)	E= 2.5
NORMAL	8000. (VPH)
RESTRICTED	3600. (VPH)
WORKING HOURS	2826. (VPH)/2= 1413 VEH/HR/LN

TRAFFIC PARAMETERS:

PERCENTAGE TRUCK	5.

SCHEDULE OF WORK ACTIVITY:

HOURS OF RESTRICTED CAPACITY	
BEGINNING	0
ENDING	24
HOURS OF WORK ZONE ACTIVITY	
BEGINNING	0
ENDING	24

IDLE HC CAR	34.9 (g/hr)	IDLE HC TRUCK	12.6 (g/hr)
IDLE CO CAR	218.5 (g/hr)	IDLE CO TRUCK	94.6 (g/hr)
IDLE NOX CAR	4.7 (g/hr)	IDLE NOX TRUCK	53.1 (g/hr)

♀ SUMMARY OF ADDITIONAL ROAD USER COSTS
ALT 1 phase 1&2 WB & 480 thru

HOUR	ADDITIONAL ROAD USER COSTS ($) INBOUND	OUTBOUND	TOTAL
0- 1	17.	12.	29.
1- 2	8.	6.	14.
2- 3	6.	5.	11.
3- 4	7.	6.	12.
4- 5	14.	14.	28.
5- 6	96.	186.	282.
6- 7	2727.	14288.	17015.
7- 8	19468.	31057.	50526.
8- 9	30896.	27327.	58222.
9-10	25537.	17476.	43014.
10-11	20553.	9044.	29597.
11-12	15019.	1168.	16187.
12-13	16468.	720.	17188.
13-14	22979.	1048.	24027.

14-15	30815.	5513.	36328.
15-16	34065.	16242.	50308.
16-17	35653.	23880.	59533.
17-18	34918.	24132.	59050.
18-19	33809.	13608.	47418.
19-20	15991.	524.	16515.
20-21	562.	100.	662.
21-22	327.	183.	509.
22-23	222.	520.	742.
23-24	100.	610.	709.
TOTAL	340257.	187668.	527925.

♀ SUMMARY OF TRAFFIC CONDITIONS -- INBOUND DIRECTION
ALT 1 phase 1&2 WB & 480 thru

HOUR	APPROACH VOLUME (VPH)	CAPACITY (VPH)	APPROACH SPEED (MPH)	WORK ZONE SPEED (MPH)	QUEUE LENGTH (MILES)
0- 1	770.	4446.	59.	57.	0.0
1- 2	486.	4446.	59.	58.	0.0
2- 3	418.	4446.	59.	59.	0.0
3- 4	441.	4446.	59.	58.	0.0
4- 5	688.	4446.	59.	58.	0.0
5- 6	1763.	4446.	57.	54.	0.0
6- 7	4397.	4446.	52.	38.	0.0
7- 8	6709.	4446.	47.	30.	0.8
8- 9	5923.	4446.	49.	30.	1.5
9-10	4566.	4446.	51.	30.	1.5
10-11	4121.	4446.	52.	30.	1.2
11-12	4309.	4446.	52.	30.	0.8
12-13	4664.	4446.	51.	30.	0.8
13-14	4879.	4446.	51.	30.	1.3
14-15	5902.	4446.	49.	30.	1.5
15-16	6763.	4446.	47.	30.	1.5
16-17	7197.	4446.	46.	30.	1.5
17-18	6995.	4446.	47.	30.	1.5
18-19	6694.	4446.	47.	30.	1.5
19-20	3789.	4446.	53.	30.	0.9
20-21	2717.	4446.	55.	49.	0.1
21-22	2741.	4446.	55.	51.	0.0
22-23	2403.	4446.	55.	52.	0.0
23-24	1787.	4446.	57.	54.	0.0

NOTE: TRAFFIC DIVERSION IS PREDICTED, SEE SUMMARY OF TRAFFIC VOLUMES

SUMMARY OF TRAFFIC CONDITIONS -- OUTBOUND DIRECTION
ALT 1 phase 1&2 WB & 480 thru

HOUR	APPROACH VOLUME (VPH)	CAPACITY (VPH)	APPROACH SPEED (MPH)	WORK ZONE SPEED (MPH)	QUEUE LENGTH (MILES)
0- 1	495.	2826.	59.	57.	0.0
1- 2	312.	2826.	59.	58.	0.0
2- 3	270.	2826.	59.	59.	0.0
3- 4	306.	2826.	59.	58.	0.0
4- 5	534.	2826.	59.	57.	0.0
5- 6	1593.	2826.	57.	51.	0.0
6- 7	3633.	2826.	53.	30.	0.8

7- 8	4019.	2826.	52.	30.	1.5
8- 9	3463.	2826.	53.	30.	1.5
9-10	2425.	2826.	55.	30.	1.1
10-11	2531.	2826.	55.	30.	0.5
11-12	2359.	2826.	56.	44.	0.1
12-13	2464.	2826.	55.	47.	0.0
13-14	2696.	2826.	55.	45.	0.0
14-15	2983.	2826.	54.	30.	0.1
15-16	3517.	2826.	53.	30.	0.9
16-17	2954.	2826.	54.	30.	1.5
17-18	2991.	2826.	54.	30.	1.5
18-19	2142.	2826.	56.	30.	0.9
19-20	1821.	2826.	57.	48.	0.1
20-21	1274.	2826.	58.	53.	0.0
21-22	1583.	2826.	57.	52.	0.0
22-23	2232.	2826.	56.	48.	0.0
23-24	2344.	2826.	56.	47.	0.0

NOTE: TRAFFIC DIVERSION IS PREDICTED, SEE SUMMARY OF TRAFFIC VOLUMES

♀ SUMMARY OF TRAFFIC VOLUMES -- INBOUND DIRECTION PAGE 5 OF 6
ALT 1 phase 1&2 WB & 480 thru QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	VOLUME REMAINING ON FREEWAY (VPH)	VOLUME DIVERTING FROM FREEWAY (VPH)
0- 1	770.	770.	0.
1- 2	486.	486.	0.
2- 3	418.	418.	0.
3- 4	441.	441.	0.
4- 5	688.	688.	0.
5- 6	1763.	1763.	0.
6- 7	4397.	4397.	0.
7- 8	6709.	5238.	1471.
8- 9	5923.	4446.	1477.
9-10	4566.	4446.	120.
10-11	4121.	4121.	0.
11-12	4309.	4309.	0.
12-13	4664.	4664.	0.
13-14	4879.	4690.	189.
14-15	5902.	4446.	1456.
15-16	6763.	4446.	2317.
16-17	7197.	4446.	2751.
17-18	6995.	4446.	2549.
18-19	6694.	4446.	2248.
19-20	3789.	3789.	0.
20-21	2717.	2717.	0.
21-22	2741.	2741.	0.
22-23	2403.	2403.	0.
23-24	1787.	1787.	0.

NOTE: THESE ESTIMATES ASSUME THAT TRAFFIC WILL DIVERT SUCH THAT
QUEUE LENGTHS NEVER EXCEED 1.50 MILES.

♀ SUMMARY OF TRAFFIC VOLUMES -- OUTBOUND DIRECTION PAGE 6 OF 6
ALT 1 phase 1&2 WB & 480 thru QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	VOLUME REMAINING ON FREEWAY (VPH)	VOLUME DIVERTING FROM FREEWAY (VPH)
0- 1	495.	495.	0.

1- 2	312.	312.	0.
2- 3	270.	270.	0.
3- 4	306.	306.	0.
4- 5	534.	534.	0.
5- 6	1593.	1593.	0.
6- 7	3633.	3618.	15.
7- 8	4019.	2826.	1193.
8- 9	3463.	2826.	637.
9-10	2425.	2425.	0.
10-11	2531.	2531.	0.
11-12	2359.	2359.	0.
12-13	2464.	2464.	0.
13-14	2696.	2696.	0.
14-15	2983.	2983.	0.
15-16	3517.	3461.	56.
16-17	2954.	2826.	128.
17-18	2991.	2826.	165.
18-19	2142.	2142.	0.
19-20	1821.	1821.	0.
20-21	1274.	1274.	0.
21-22	1583.	1583.	0.
22-23	2232.	2232.	0.
23-24	2344.	2344.	0.

NOTE: THESE ESTIMATES ASSUME THAT TRAFFIC WILL DIVERT SUCH THAT
QUEUE LENGTHS NEVER EXCEED 1.50 MILES.

EXCESS EMISSIONS (DIFFERENCE)

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	215.9	1561.8	-137.2
Outbound	163.7	1081.7	-87.2

BASE EMISSIONS

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	291.1	1688.9	488.2
Outbound	162.2	981.8	311.6

CONSTRUCTION RELATED EMISSIONS

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	510.0	3269.5	351.7
Outbound	334.4	2117.4	226.2

QUEWZ-98 Alternative 1.a(70) – Phase 3 & 4 – 1 lane WB crossover and 4 lanes EB

INPUT DATA SUMMARY: ROAD USER COST OUTPUT PAGE 1 OF 6
ALT 1 phase 3 & 4 4 EB/1 WB QUEWZ-98

LANE CLOSURE CONFIGURATION:

TOTAL NUMBER OF LANES	
INBOUND	4
OUTBOUND	5
NUMBER OF OPEN LANES	
INBOUND	1 WB
OUTBOUND	4 EB
LENGTH OF WORK ZONE	2.00 MILES
INBOUND CAPACITY (WESTBOUND) E=1.5	
NORMAL	8000. (VPH)
RESTRICTED	1800. (VPH)
WORKING HOURS	1482. (VPH)/1= 1482 VEH/HR/LN
OUTBOUND CAPACITY (EASTBOUND) E=2.5	
NORMAL	10000. (VPH)
RESTRICTED	7200. (VPH)
WORKING HOURS	5652. (VPH)/4= 1413 VEH/HR/LN

TRAFFIC PARAMETERS:

PERCENTAGE TRUCK	5.

SCHEDULE OF WORK ACTIVITY:

HOURS OF RESTRICTED CAPACITY	
BEGINNING	0
ENDING	24
HOURS OF WORK ZONE ACTIVITY	
BEGINNING	0
ENDING	24

IDLE HC CAR	34.9 (g/hr)	IDLE HC TRUCK	12.6 (g/hr)
IDLE CO CAR	218.5 (g/hr)	IDLE CO TRUCK	94.6 (g/hr)
IDLE NOX CAR	4.7 (g/hr)	IDLE NOX TRUCK	53.1 (g/hr)

♀ SUMMARY OF ADDITIONAL ROAD USER COSTS PAGE 2 OF 6
ALT 1 phase 3&4 4 EB/1 WB QUEWZ-98

HOUR	ADDITIONAL ROAD USER COSTS ($) INBOUND	OUTBOUND	TOTAL
0- 1	0.	14.	14.
1- 2	0.	7.	7.
2- 3	0.	6.	6.
3- 4	0.	7.	7.
4- 5	0.	16.	16.
5- 6	0.	128.	128.
6- 7	1797.	5786.	7583.
7- 8	12024.	20410.	32435.
8- 9	26547.	31214.	57761.
9-10	21613.	14073.	35686.
10-11	21087.	824.	21912.
11-12	21087.	810.	21898.
12-13	22047.	931.	22978.
13-14	22992.	1199.	24191.
14-15	27464.	1823.	29287.
15-16	31221.	16167.	47388.
16-17	33103.	29692.	62795.
17-18	32227.	32725.	64952.
18-19	30920.	17915.	48835.
19-20	21087.	363.	21451.
20-21	5014.	161.	5175.
21-22	0.	204.	204.
22-23	0.	274.	274.
23-24	0.	246.	246.
TOTAL	330231.	174997.	505227.

♀ SUMMARY OF TRAFFIC CONDITIONS -- INBOUND DIRECTION PAGE 3 OF 6
ALT 1 phase 3&4 4 EB/1 WB QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	CAPACITY (VPH)	APPROACH SPEED (MPH)	WORK ZONE SPEED (MPH)	QUEUE LENGTH (MILES)
0- 1	0.	1482.	60.	60.	0.0
1- 2	0.	1482.	60.	60.	0.0
2- 3	0.	1482.	60.	60.	0.0
3- 4	0.	1482.	60.	60.	0.0
4- 5	0.	1482.	60.	60.	0.0
5- 6	0.	1482.	60.	60.	0.0
6- 7	1482.	1482.	57.	30.	0.0
7- 8	2237.	1482.	56.	30.	0.7
8- 9	1975.	1482.	56.	30.	1.5
9-10	1522.	1482.	57.	30.	1.5
10-11	1482.	1482.	57.	30.	1.5
11-12	1482.	1482.	57.	30.	1.5
12-13	1555.	1482.	57.	30.	1.5
13-14	1627.	1482.	57.	30.	1.5
14-15	1968.	1482.	56.	30.	1.5
15-16	2255.	1482.	56.	30.	1.5
16-17	2399.	1482.	55.	30.	1.5
17-18	2332.	1482.	56.	30.	1.5
18-19	2232.	1482.	56.	30.	1.5
19-20	1482.	1482.	57.	30.	1.5
20-21	0.	1482.	60.	44.	0.8
21-22	0.	1482.	60.	60.	0.0
22-23	0.	1482.	60.	60.	0.0
23-24	0.	1482.	60.	60.	0.0

NOTE: TRAFFIC DIVERSION IS PREDICTED, SEE SUMMARY OF TRAFFIC VOLUMES

SUMMARY OF TRAFFIC CONDITIONS -- OUTBOUND DIRECTION PAGE 4 OF 6
ALT 1 phase 3&4 4 EB/1 WB QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	CAPACITY (VPH)	APPROACH SPEED (MPH)	WORK ZONE SPEED (MPH)	QUEUE LENGTH (MILES)
0- 1	783.	5652.	59.	58.	0.0
1- 2	482.	5652.	59.	59.	0.0
2- 3	432.	5652.	59.	59.	0.0
3- 4	470.	5652.	59.	59.	0.0
4- 5	819.	5652.	59.	58.	0.0
5- 6	2288.	5652.	57.	54.	0.0
6- 7	5650.	5652.	51.	32.	0.0

7- 8	6738.	5652.	50.	30.	0.8
8- 9	5637.	5652.	51.	30.	1.5
9-10	4501.	5652.	53.	33.	0.7
10-11	4349.	5652.	53.	48.	0.0
11-12	4326.	5652.	53.	48.	0.0
12-13	4513.	5652.	53.	48.	0.0
13-14	4863.	5652.	53.	47.	0.0
14-15	5380.	5652.	52.	45.	0.0
15-16	6351.	5652.	50.	30.	0.5
16-17	6386.	5652.	50.	30.	1.3
17-18	5981.	5652.	51.	30.	1.5
18-19	4671.	5652.	53.	30.	0.8
19-20	3318.	5652.	55.	51.	0.0
20-21	2498.	5652.	56.	53.	0.0
21-22	2726.	5652.	56.	53.	0.0
22-23	3033.	5652.	55.	52.	0.0
23-24	2919.	5652.	56.	52.	0.0

NOTE: TRAFFIC DIVERSION IS PREDICTED, SEE SUMMARY OF TRAFFIC VOLUMES

SUMMARY OF TRAFFIC VOLUMES -- INBOUND DIRECTION PAGE 5 OF 6
ALT 1 phase 3&4 4 EB/1 WB QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	VOLUME REMAINING ON FREEWAY (VPH)	VOLUME DIVERTING FROM FREEWAY (VPH)
0- 1	0.	0.	0.
1- 2	0.	0.	0.
2- 3	0.	0.	0.
3- 4	0.	0.	0.
4- 5	0.	0.	0.
5- 6	0.	0.	0.
6- 7	1482.	1482.	0.
7- 8	2237.	2237.	0.
8- 9	1975.	1519.	456.
9-10	1522.	1482.	40.
10-11	1482.	1482.	0.
11-12	1482.	1482.	0.
12-13	1555.	1482.	73.
13-14	1627.	1482.	145.
14-15	1968.	1482.	486.
15-16	2255.	1482.	773.
16-17	2399.	1482.	917.
17-18	2332.	1482.	850.
18-19	2232.	1482.	750.
19-20	1482.	1482.	0.
20-21	0.	0.	0.
21-22	0.	0.	0.
22-23	0.	0.	0.
23-24	0.	0.	0.

NOTE: THESE ESTIMATES ASSUME THAT TRAFFIC WILL DIVERT SUCH THAT
QUEUE LENGTHS NEVER EXCEED 1.50 MILES.

SUMMARY OF TRAFFIC VOLUMES -- OUTBOUND DIRECTION PAGE 6 OF 6
ALT 1 phase 3&4 4 EB/1 WB QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	VOLUME REMAINING ON FREEWAY (VPH)	VOLUME DIVERTING FROM FREEWAY (VPH)
0- 1	783.	783.	0.

1- 2	482.	482.	0.
2- 3	432.	432.	0.
3- 4	470.	470.	0.
4- 5	819.	819.	0.
5- 6	2288.	2288.	0.
6- 7	5650.	5650.	0.
7- 8	6738.	6642.	96.
8- 9	5637.	5637.	0.
9-10	4501.	4501.	0.
10-11	4349.	4349.	0.
11-12	4326.	4326.	0.
12-13	4513.	4513.	0.
13-14	4863.	4863.	0.
14-15	5380.	5380.	0.
15-16	6351.	6351.	0.
16-17	6386.	5943.	443.
17-18	5981.	5652.	329.
18-19	4671.	4671.	0.
19-20	3318.	3318.	0.
20-21	2498.	2498.	0.
21-22	2726.	2726.	0.
22-23	3033.	3033.	0.
23-24	2919.	2919.	0.

NOTE: THESE ESTIMATES ASSUME THAT TRAFFIC WILL DIVERT SUCH THAT
QUEUE LENGTHS NEVER EXCEED 1.50 MILES.

EXCESS EMISSIONS (DIFFERENCE)

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	313.2	1943.9	-35.6
Outbound	127.8	928.3	-117.6

BASE EMISSIONS

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	100.2	680.5	198.2
Outbound	262.0	1532.7	468.3

CONSTRUCTION RELATED EMISSIONS

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	413.4	2624.5	162.6
Outbound	542.0	3417.6	383.0

QUEWZ-98 Alternative 1.a(70) – Phase 3 & 4 – 2 lanes WB and 4 lanes EB

INPUT DATA SUMMARY: ROAD USER COST OUTPUT PAGE 1 OF 6
ALT 1 phase 3 & 4 4 EB/2 WB QUEWZ-98

LANE CLOSURE CONFIGURATION:

TOTAL NUMBER OF LANES	
INBOUND	4
OUTBOUND	5
NUMBER OF OPEN LANES	
INBOUND	2 WB
OUTBOUND	4 EB
LENGTH OF WORK ZONE	2.00 MILES
INBOUND CAPACITY (WESTBOUND)	E=1.5
NORMAL	8000. (VPH)
RESTRICTED	3600. (VPH)
WORKING HOURS	2964. (VPH)/2= 1482 VEH/HR/LN
OUTBOUND CAPACITY (EASTBOUND)	E=2.5
NORMAL	10000. (VPH)
RESTRICTED	7200. (VPH)
WORKING HOURS	5652. (VPH)/4= 1413 VEH/HR/LN

TRAFFIC PARAMETERS:

PERCENTAGE TRUCK	5.

SCHEDULE OF WORK ACTIVITY:

HOURS OF RESTRICTED CAPACITY	
BEGINNING	0
ENDING	24
HOURS OF WORK ZONE ACTIVITY	
BEGINNING	0
ENDING	24

IDLE HC CAR	34.9 (g/hr)	IDLE HC TRUCK	12.6 (g/hr)
IDLE CO CAR	218.5 (g/hr)	IDLE CO TRUCK	94.6 (g/hr)
IDLE NOX CAR	4.7 (g/hr)	IDLE NOX TRUCK	53.1 (g/hr)

♀ SUMMARY OF ADDITIONAL ROAD USER COSTS PAGE 2 OF 6
ALT 1 phase 3&4 4EB/2 WB QUEWZ-98

HOUR	ADDITIONAL ROAD USER COSTS ($) INBOUND	OUTBOUND	TOTAL
0- 1	28.	14.	42.
1- 2	11.	7.	18.
2- 3	9.	6.	15.
3- 4	10.	7.	16.
4- 5	22.	16.	37.
5- 6	225.	128.	353.
6- 7	3540.	5786.	9326.
7- 8	17021.	20410.	37431.
8- 9	29519.	31214.	60733.
9-10	23713.	14073.	37786.
10-11	23196.	824.	24020.
11-12	23196.	810.	24006.
12-13	24140.	931.	25071.
13-14	25062.	1199.	26261.

14-15	29429.	1823.	31252.
15-16	33061.	16167.	49229.
16-17	34874.	29692.	64566.
17-18	34035.	32725.	66760.
18-19	32772.	17915.	50687.
19-20	23196.	363.	23559.
20-21	19778.	161.	19939.
21-22	14002.	204.	14205.
22-23	3814.	274.	4088.
23-24	234.	246.	481.
TOTAL	394885.	174997.	569882.

♀ SUMMARY OF TRAFFIC CONDITIONS -- INBOUND DIRECTION PAGE 3 OF 6
ALT 1 phase 3&4 4EB/2 WB QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	CAPACITY (VPH)	APPROACH SPEED (MPH)	WORK ZONE SPEED (MPH)	QUEUE LENGTH (MILES)
0- 1	770.	2964.	59.	56.	0.0
1- 2	486.	2964.	59.	58.	0.0
2- 3	418.	2964.	59.	58.	0.0
3- 4	441.	2964.	59.	58.	0.0
4- 5	688.	2964.	59.	56.	0.0
5- 6	1763.	2964.	57.	51.	0.0
6- 7	2964.	2964.	54.	30.	0.0
7- 8	4473.	2964.	52.	30.	0.8
8- 9	3949.	2964.	53.	30.	1.5
9-10	3044.	2964.	54.	30.	1.5
10-11	2964.	2964.	54.	30.	1.5
11-12	2964.	2964.	54.	30.	1.5
12-13	3110.	2964.	54.	30.	1.5
13-14	3253.	2964.	54.	30.	1.5
14-15	3935.	2964.	53.	30.	1.5
15-16	4509.	2964.	51.	30.	1.5
16-17	4798.	2964.	51.	30.	1.5
17-18	4664.	2964.	51.	30.	1.5
18-19	4463.	2964.	52.	30.	1.5
19-20	2964.	2964.	54.	30.	1.5
20-21	2717.	2964.	55.	30.	1.3
21-22	2741.	2964.	55.	30.	0.8
22-23	2403.	2964.	55.	38.	0.3
23-24	1787.	2964.	57.	51.	0.0

NOTE: TRAFFIC DIVERSION IS PREDICTED, SEE SUMMARY OF TRAFFIC VOLUMES

SUMMARY OF TRAFFIC CONDITIONS -- OUTBOUND DIRECTION PAGE 4 OF 6
ALT 1 phase 3&4 4EB/2 WB QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	CAPACITY (VPH)	APPROACH SPEED (MPH)	WORK ZONE SPEED (MPH)	QUEUE LENGTH (MILES)
0- 1	783.	5652.	59.	58.	0.0
1- 2	482.	5652.	59.	59.	0.0
2- 3	432.	5652.	59.	59.	0.0
3- 4	470.	5652.	59.	59.	0.0
4- 5	819.	5652.	59.	58.	0.0
5- 6	2288.	5652.	57.	54.	0.0
6- 7	5650.	5652.	51.	32.	0.0

7- 8	6738.	5652.	50.	30.	0.8
8- 9	5637.	5652.	51.	30.	1.5
9-10	4501.	5652.	53.	33.	0.7
10-11	4349.	5652.	53.	48.	0.0
11-12	4326.	5652.	53.	48.	0.0
12-13	4513.	5652.	53.	48.	0.0
13-14	4863.	5652.	53.	47.	0.0
14-15	5380.	5652.	52.	45.	0.0
15-16	6351.	5652.	50.	30.	0.5
16-17	6386.	5652.	50.	30.	1.3
17-18	5981.	5652.	51.	30.	1.5
18-19	4671.	5652.	53.	30.	0.8
19-20	3318.	5652.	55.	51.	0.0
20-21	2498.	5652.	56.	53.	0.0
21-22	2726.	5652.	56.	53.	0.0
22-23	3033.	5652.	55.	52.	0.0
23-24	2919.	5652.	56.	52.	0.0

NOTE: TRAFFIC DIVERSION IS PREDICTED, SEE SUMMARY OF TRAFFIC VOLUMES

♀ SUMMARY OF TRAFFIC VOLUMES -- INBOUND DIRECTION PAGE 5 OF 6
ALT 1 phase 3&4 4EB/2 WB QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	VOLUME REMAINING ON FREEWAY (VPH)	VOLUME DIVERTING FROM FREEWAY (VPH)
0- 1	770.	770.	0.
1- 2	486.	486.	0.
2- 3	418.	418.	0.
3- 4	441.	441.	0.
4- 5	688.	688.	0.
5- 6	1763.	1763.	0.
6- 7	2964.	2964.	0.
7- 8	4473.	3756.	717.
8- 9	3949.	2964.	985.
9-10	3044.	2964.	80.
10-11	2964.	2964.	0.
11-12	2964.	2964.	0.
12-13	3110.	2964.	146.
13-14	3253.	2964.	289.
14-15	3935.	2964.	971.
15-16	4509.	2964.	1545.
16-17	4798.	2964.	1834.
17-18	4664.	2964.	1700.
18-19	4463.	2964.	1499.
19-20	2964.	2964.	0.
20-21	2717.	2717.	0.
21-22	2741.	2741.	0.
22-23	2403.	2403.	0.
23-24	1787.	1787.	0.

NOTE: THESE ESTIMATES ASSUME THAT TRAFFIC WILL DIVERT SUCH THAT
QUEUE LENGTHS NEVER EXCEED 1.50 MILES.

♀ SUMMARY OF TRAFFIC VOLUMES -- OUTBOUND DIRECTION PAGE 6 OF 6
ALT 1 phase 3&4 4EB/2 WB QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	VOLUME REMAINING ON FREEWAY (VPH)	VOLUME DIVERTING FROM FREEWAY (VPH)
0- 1	783.	783.	0.

1- 2	482.	482.	0.
2- 3	432.	432.	0.
3- 4	470.	470.	0.
4- 5	819.	819.	0.
5- 6	2288.	2288.	0.
6- 7	5650.	5650.	0.
7- 8	6738.	6642.	96.
8- 9	5637.	5637.	0.
9-10	4501.	4501.	0.
10-11	4349.	4349.	0.
11-12	4326.	4326.	0.
12-13	4513.	4513.	0.
13-14	4863.	4863.	0.
14-15	5380.	5380.	0.
15-16	6351.	6351.	0.
16-17	6386.	5943.	443.
17-18	5981.	5652.	329.
18-19	4671.	4671.	0.
19-20	3318.	3318.	0.
20-21	2498.	2498.	0.
21-22	2726.	2726.	0.
22-23	3033.	3033.	0.
23-24	2919.	2919.	0.

NOTE: THESE ESTIMATES ASSUME THAT TRAFFIC WILL DIVERT SUCH THAT
QUEUE LENGTHS NEVER EXCEED 1.50 MILES.

EXCESS EMISSIONS (DIFFERENCE)

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	316.8	2139.8	-126.6
Outbound	127.8	928.3	-117.6

BASE EMISSIONS

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	229.6	1350.6	427.1
Outbound	262.0	1532.7	468.3

CONSTRUCTION RELATED EMISSIONS

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	549.4	3509.1	301.2
Outbound	465.4	2936.3	366.8

Alternative 1.a(70)

ODOT Queue Spreadsheets

Phase 1 & 2 –	3 (11’) lanes WB 2 (11’) lanes EB from IR 77 Ramps 2 (11’) lanes EB crossover
Phase 3 & 4 -	1 (12’) lane WB crossover 4 (11’) lanes EB 2 (11’) lanes WB

Alternative 1.a(70) – Phase 1 & 2 – 3 (11') lanes WB

Queue Calc. Worksheet for Freeway Work Zones

Alternative 1, Phase 1 & 2

CUY 480 Westbound (total volume)

Friday in August	
Free Flow Work Zone Capacity (veh/ln/hr)	1482
Queued Work Zone Capacity (veh/ln/hr)	1482
One Way AADT (veh)	91122
Percent of Peak Period (>1000 vph) Traffic Diverted (%)	0
Number of Lanes for Queued Vehicles(lanes)	3
Number of vehicles in Queue per Lane Mile (veh)	108

Time Begining	Estimated or Actual Volume	Reduced Volume	Queue (Veh)	Queue (miles)
0:00	770	770	2901	9.0
1:00	486	486	0	0.0
2:00	418	418	0	0.0
3:00	441	441	0	0.0
4:00	688	688	0	0.0
5:00	1763	1763	0	0.0
6:00	4397	4397	0	0.0
7:00	6709	6709	2263	7.0
8:00	5923	5923	3740	11.5
9:00	4566	4566	3860	11.9
10:00	4121	4121	3535	10.9
11:00	4309	4309	3398	10.5
12:00	4664	4664	3616	11.2
13:00	4879	4879	4049	12.5
14:00	5902	5902	5505	17.0
15:00	6763	6763	7822	24.1
16:00	7197	7197	10573	32.6
17:00	6995	6995	13122	40.5
18:00	6694	6694	15370	47.4
19:00	3789	3789	14713	45.4
20:00	2717	2717	12984	40.1
21:00	2741	2741	11279	34.8
22:00	2403	2403	9236	28.5
23:00	1787	1787	6577	20.3

Alternative 1.a(70) – Phase 1 & 2 – 2 (11') lanes EB from IR 77 Ramps

Queue Calc. Worksheet for Freeway Work Zones

Alternative 1, phase 1 & 2

CUY 480 Eastbound (from 77 Ramps)	2.62%
Tuesday in June	
Free Flow Work Zone Capacity (veh/ln/hr)	1413
Queued Work Zone Capacity (veh/ln/hr)	1413
One Way AADT (veh)	38173
Percent of Peak Period (>1000 vph) Traffic Diverted (%)	0
Number of Lanes for Queued Vehicles(lanes)	2
Number of vehicles in Queue per Lane Mile (veh)	108

Time Begining	Estimated or Actual Volume	Reduced Volume	Queue (Veh)	Queue (miles)
0:00	288	288	0	0.0
1:00	170	170	0	0.0
2:00	162	162	0	0.0
3:00	164	164	0	0.0
4:00	285	285	0	0.0
5:00	695	695	0	0.0
6:00	2017	2017	0	0.0
7:00	2719	2719	0	0.0
8:00	2174	2174	0	0.0
9:00	2076	2076	0	0.0
10:00	1818	1818	0	0.0
11:00	1967	1967	0	0.0
12:00	2049	2049	0	0.0
13:00	2167	2167	0	0.0
14:00	2397	2397	0	0.0
15:00	2834	2834	8	0.0
16:00	3432	3432	614	2.8
17:00	2990	2990	778	3.6
18:00	2529	2529	481	2.2
19:00	1497	1497	0	0.0
20:00	1224	1224	0	0.0
21:00	1143	1143	0	0.0
22:00	801	801	0	0.0
23:00	575	575	0	0.0

Alternative 1.a(70) – Phase 1 & 2 – 2 (11') lanes EB on crossover

Queue Calc. Worksheet for Freeway Work Zones

Alternative 1, phase 1 & 2

CUY 480 Eastbound Through (Total - Ramps)	2.62%
Friday in August-Tuesday in June	
Free Flow Work Zone Capacity (veh/ln/hr)	1413
Queued Work Zone Capacity (veh/ln/hr)	1413
One Way AADT (veh)	50941
Percent of Peak Period (>1000 vph) Traffic Diverted (%)	0
Number of Lanes for Queued Vehicles(lanes)	2
Number of vehicles in Queue per Lane Mile (veh)	108

Time Begining	Estimated or Actual Volume	Reduced Volume	Queue (Veh)	Queue (miles)
0:00	495	495	0	0.0
1:00	312	312	0	0.0
2:00	270	270	0	0.0
3:00	306	306	0	0.0
4:00	534	534	0	0.0
5:00	1593	1593	0	0.0
6:00	3633	3633	807	3.7
7:00	4019	4019	2000	9.3
8:00	3463	3463	2637	12.2
9:00	2425	2425	2236	10.4
10:00	2531	2531	1941	9.0
11:00	2359	2359	1474	6.8
12:00	2464	2464	1112	5.1
13:00	2696	2696	982	4.5
14:00	2983	2983	1139	5.3
15:00	3517	3517	1830	8.5
16:00	2954	2954	1958	9.1
17:00	2991	2991	2123	9.8
18:00	2142	2142	1439	6.7
19:00	1821	1821	434	2.0
20:00	1274	1274	0	0.0
21:00	1583	1583	0	0.0
22:00	2232	2232	0	0.0
23:00	2344	2344	0	0.0

Alternative 1.a(70) – Phase 3 & 4 – 4 (11’) lanes EB

Queue Calc. Worksheet for Freeway Work Zones

Alternative 1, phase 3 & 4

CUY 480 Eastbound	2.62%
Friday in August	
Free Flow Work Zone Capacity (veh/ln/hr)	1413
Queued Work Zone Capacity (veh/ln/hr)	1413
One Way AADT (veh)	89114
Percent of Peak Period (>1000 vph) Traffic Diverted (%)	0
Number of Lanes for Queued Vehicles(lanes)	4
Number of vehicles in Queue per Lane Mile (veh)	108

Time Begining	Estimated or Actual Volume	Reduced Volume	Queue (Veh)	Queue (miles)
0:00	783	783	0	0.0
1:00	482	482	0	0.0
2:00	432	432	0	0.0
3:00	470	470	0	0.0
4:00	819	819	0	0.0
5:00	2288	2288	0	0.0
6:00	5650	5650	0	0.0
7:00	6738	6738	1086	2.5
8:00	5637	5637	1071	2.5
9:00	4501	4501	0	0.0
10:00	4349	4349	0	0.0
11:00	4326	4326	0	0.0
12:00	4513	4513	0	0.0
13:00	4863	4863	0	0.0
14:00	5380	5380	0	0.0
15:00	6351	6351	699	1.6
16:00	6386	6386	1433	3.3
17:00	5981	5981	1762	4.1
18:00	4671	4671	781	1.8
19:00	3318	3318	0	0.0
20:00	2498	2498	0	0.0
21:00	2726	2726	0	0.0
22:00	3033	3033	0	0.0
23:00	2919	2919	0	0.0

Alternative 1.a(70) – Phase 3 & 4 – 1 (12’) lane WB crossover

Queue Calc. Worksheet for Freeway Work Zones

Alternative 1, Phase 3 & 4

Add 1/3rd to the max volume of the 1 left lane

Wednesday in May for NB and Thursday in July for SB	
Free Flow Work Zone Capacity (veh/ln/hr)	1482
Queued Work Zone Capacity (veh/ln/hr)	1482
One Way AADT (veh)	26030
Percent of Peak Period (>1000 vph) Traffic Diverted (%)	0
Number of Lanes for Queued Vehicles(lanes)	1
Number of vehicles in Queue per Lane Mile (veh)	108

Time Begining	Estimated or Actual Volume	Reduced Volume	Queue (Veh)	Queue (miles)
0:00	0	0	0	0.0
1:00	0	0	0	0.0
2:00	0	0	0	0.0
3:00	0	0	0	0.0
4:00	0	0	0	0.0
5:00	0	0	0	0.0
6:00	1482	1482	0	0.0
7:00	2237	2237	755	7.0
8:00	1975	1975	1248	11.6
9:00	1522	1522	1288	11.9
10:00	1482	1482	1288	11.9
11:00	1482	1482	1288	11.9
12:00	1555	1555	1361	12.6
13:00	1627	1627	1506	13.9
14:00	1968	1968	1992	18.4
15:00	2255	2255	2765	25.6
16:00	2399	2399	3682	34.1
17:00	2332	2332	4532	42.0
18:00	2232	2232	5282	48.9
19:00	1482	1482	5282	48.9
20:00	0	0	3800	35.2
21:00	0	0	2318	21.5
22:00	0	0	836	7.7
23:00	0	0	0	0.0

Alternative 1.a(70) – Phase 3 & 4 – 2 (11’) lanes WB

Queue Calc. Worksheet for Freeway Work Zones

Alternative 1, Phase 3 & 4

Add 2/3rds to the max volume of the 2 right lanes

Wednesday in May for NB and Thursday in July for SB	
Free Flow Work Zone Capacity (veh/ln/hr)	1482
Queued Work Zone Capacity (veh/ln/hr)	1482
One Way AADT (veh)	66268
Percent of Peak Period (>1000 vph) Traffic Diverted (%)	0
Number of Lanes for Queued Vehicles(lanes)	2
Number of vehicles in Queue per Lane Mile (veh)	108

Time Begining	Estimated or Actual Volume	Reduced Volume	Queue (Veh)	Queue (miles)
0:00	770	770	5818	26.9
1:00	486	486	3340	15.5
2:00	418	418	794	3.7
3:00	441	441	0	0.0
4:00	688	688	0	0.0
5:00	1763	1763	0	0.0
6:00	2964	2964	0	0.0
7:00	4473	4473	1509	7.0
8:00	3949	3949	2494	11.5
9:00	3044	3044	2574	11.9
10:00	2964	2964	2574	11.9
11:00	2964	2964	2574	11.9
12:00	3110	3110	2720	12.6
13:00	3253	3253	3009	13.9
14:00	3935	3935	3980	18.4
15:00	4509	4509	5525	25.6
16:00	4798	4798	7359	34.1
17:00	4664	4664	9059	41.9
18:00	4463	4463	10558	48.9
19:00	2964	2964	10558	48.9
20:00	2717	2717	10311	47.7
21:00	2741	2741	10088	46.7
22:00	2403	2403	9527	44.1
23:00	1787	1787	8350	38.7

Alternative 3.a(72)

QUEWZ-98

Phase 1 & 2 –	4 (10’) lanes WB 2 (10’) lanes EB crossover 2 (12’) lanes EB from IR 77 Ramps
Phase 3 & 4 -	4 (10’) lanes EB 2 (10’) lanes WB crossover 2 (12’) lanes WB

QUEWZ-98 Alternative 3.a(72) – Phase 1 & 2 – 4 lanes WB and 2 lanes EB crossover

INPUT DATA SUMMARY: ROAD USER COST OUTPUT
ALT3a72 phase 1&2 WB & 480 thru

LANE CLOSURE CONFIGURATION:

TOTAL NUMBER OF LANES	
INBOUND	5
OUTBOUND	4
NUMBER OF OPEN LANES	
INBOUND	4 WB
OUTBOUND	2 EB
LENGTH OF WORK ZONE	2.00 MILES
INBOUND CAPACITY (WESTBOUND)	E= 1.5
NORMAL	10000. (VPH)
RESTRICTED	7200. (VPH)
WORKING HOURS	5616. (VPH)/4= 1404 VEH/HR/LN
OUTBOUND CAPACITY (EASTBOUND)	E= 2.5
NORMAL	8000. (VPH)
RESTRICTED	3600. (VPH)
WORKING HOURS	2678. (VPH)/2= 1339 VEH/HR/LN

TRAFFIC PARAMETERS:

PERCENTAGE TRUCK	5.

SCHEDULE OF WORK ACTIVITY:

HOURS OF RESTRICTED CAPACITY	
BEGINNING	0
ENDING	24
HOURS OF WORK ZONE ACTIVITY	
BEGINNING	0
ENDING	24

IDLE HC CAR	34.9 (g/hr)	IDLE HC TRUCK	12.6 (g/hr)
IDLE CO CAR	218.5 (g/hr)	IDLE CO TRUCK	94.6 (g/hr)
IDLE NOX CAR	4.7 (g/hr)	IDLE NOX TRUCK	53.1 (g/hr)

♀ SUMMARY OF ADDITIONAL ROAD USER COSTS
ALT3a72 phase 1&2 WB & 480 thru

HOUR	ADDITIONAL ROAD USER COSTS ($) INBOUND	OUTBOUND	TOTAL
0- 1	14.	13.	27.
1- 2	7.	6.	13.
2- 3	6.	5.	11.
3- 4	6.	6.	12.
4- 5	12.	15.	27.
5- 6	69.	208.	277.
6- 7	870.	14714.	15584.
7- 8	20391.	32378.	52769.
8- 9	32607.	28434.	61041.
9-10	15972.	19311.	35284.
10-11	705.	14528.	15233.
11-12	814.	8559.	9373.
12-13	1059.	1694.	2753.
13-14	1235.	3454.	4689.

14-15	10460.	7803.	18263.
15-16	24677.	19631.	44307.
16-17	37577.	24793.	62370.
17-18	36802.	25059.	61861.
18-19	35638.	15431.	51069.
19-20	8477.	1566.	10043.
20-21	205.	111.	316.
21-22	210.	205.	414.
22-23	147.	593.	740.
23-24	71.	698.	769.
TOTAL	228031.	219214.	447245.

♀ SUMMARY OF TRAFFIC CONDITIONS -- INBOUND DIRECTION
ALT3a72 phase 1&2 WB & 480 thru

HOUR	APPROACH VOLUME (VPH)	CAPACITY (VPH)	APPROACH SPEED (MPH)	WORK ZONE SPEED (MPH)	QUEUE LENGTH (MILES)
0- 1	770.	5616.	59.	58.	0.0
1- 2	486.	5616.	59.	59.	0.0
2- 3	418.	5616.	59.	59.	0.0
3- 4	441.	5616.	59.	59.	0.0
4- 5	688.	5616.	59.	58.	0.0
5- 6	1763.	5616.	57.	55.	0.0
6- 7	4397.	5616.	53.	48.	0.0
7- 8	6709.	5616.	50.	30.	0.8
8- 9	5923.	5616.	51.	30.	1.5
9-10	4566.	5616.	53.	31.	0.8
10-11	4121.	5616.	54.	49.	0.0
11-12	4309.	5616.	53.	48.	0.0
12-13	4664.	5616.	53.	47.	0.0
13-14	4879.	5616.	53.	47.	0.0
14-15	5902.	5616.	51.	30.	0.2
15-16	6763.	5616.	50.	30.	1.0
16-17	7197.	5616.	49.	30.	1.5
17-18	6995.	5616.	49.	30.	1.5
18-19	6694.	5616.	50.	30.	1.5
19-20	3789.	5616.	54.	39.	0.8
20-21	2717.	5616.	56.	53.	0.0
21-22	2741.	5616.	56.	53.	0.0
22-23	2403.	5616.	56.	54.	0.0
23-24	1787.	5616.	57.	55.	0.0

NOTE: TRAFFIC DIVERSION IS PREDICTED, SEE SUMMARY OF TRAFFIC VOLUMES

SUMMARY OF TRAFFIC CONDITIONS -- OUTBOUND DIRECTION
ALT3a72 phase 1&2 WB & 480 thru

HOUR	APPROACH VOLUME (VPH)	CAPACITY (VPH)	APPROACH SPEED (MPH)	WORK ZONE SPEED (MPH)	QUEUE LENGTH (MILES)
0- 1	495.	2678.	59.	57.	0.0
1- 2	312.	2678.	59.	58.	0.0
2- 3	270.	2678.	59.	58.	0.0
3- 4	306.	2678.	59.	58.	0.0
4- 5	534.	2678.	59.	57.	0.0
5- 6	1593.	2678.	57.	51.	0.0
6- 7	3633.	2678.	53.	30.	0.8

7- 8	4019.	2678.	52.	30.	1.5
8- 9	3463.	2678.	53.	30.	1.5
9-10	2425.	2678.	55.	30.	1.3
10-11	2531.	2678.	55.	30.	0.9
11-12	2359.	2678.	56.	30.	0.4
12-13	2464.	2678.	55.	41.	0.1
13-14	2696.	2678.	55.	30.	0.0
14-15	2983.	2678.	54.	30.	0.3
15-16	3517.	2678.	53.	30.	1.1
16-17	2954.	2678.	54.	30.	1.5
17-18	2991.	2678.	54.	30.	1.5
18-19	2142.	2678.	56.	30.	1.0
19-20	1821.	2678.	57.	44.	0.2
20-21	1274.	2678.	58.	53.	0.0
21-22	1583.	2678.	57.	51.	0.0
22-23	2232.	2678.	56.	47.	0.0
23-24	2344.	2678.	56.	47.	0.0

NOTE: TRAFFIC DIVERSION IS PREDICTED, SEE SUMMARY OF TRAFFIC VOLUMES

SUMMARY OF TRAFFIC VOLUMES -- INBOUND DIRECTION PAGE 5 OF 6
ALT3a72 phase 1&2 WB & 480 thru QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	VOLUME REMAINING ON FREEWAY (VPH)	VOLUME DIVERTING FROM FREEWAY (VPH)
0- 1	770.	770.	0.
1- 2	486.	486.	0.
2- 3	418.	418.	0.
3- 4	441.	441.	0.
4- 5	688.	688.	0.
5- 6	1763.	1763.	0.
6- 7	4397.	4397.	0.
7- 8	6709.	6606.	103.
8- 9	5923.	5616.	307.
9-10	4566.	4566.	0.
10-11	4121.	4121.	0.
11-12	4309.	4309.	0.
12-13	4664.	4664.	0.
13-14	4879.	4879.	0.
14-15	5902.	5902.	0.
15-16	6763.	6320.	443.
16-17	7197.	5616.	1581.
17-18	6995.	5616.	1379.
18-19	6694.	5616.	1078.
19-20	3789.	3789.	0.
20-21	2717.	2717.	0.
21-22	2741.	2741.	0.
22-23	2403.	2403.	0.
23-24	1787.	1787.	0.

NOTE: THESE ESTIMATES ASSUME THAT TRAFFIC WILL DIVERT SUCH THAT
QUEUE LENGTHS NEVER EXCEED 1.50 MILES.

SUMMARY OF TRAFFIC VOLUMES -- OUTBOUND DIRECTION PAGE 6 OF 6
ALT3a72 phase 1&2 WB & 480 thru QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	VOLUME REMAINING ON FREEWAY (VPH)	VOLUME DIVERTING FROM FREEWAY (VPH)
0- 1	495.	495.	0.

1- 2	312.	312.	0.
2- 3	270.	270.	0.
3- 4	306.	306.	0.
4- 5	534.	534.	0.
5- 6	1593.	1593.	0.
6- 7	3633.	3470.	163.
7- 8	4019.	2678.	1341.
8- 9	3463.	2678.	785.
9-10	2425.	2425.	0.
10-11	2531.	2531.	0.
11-12	2359.	2359.	0.
12-13	2464.	2464.	0.
13-14	2696.	2696.	0.
14-15	2983.	2983.	0.
15-16	3517.	3147.	370.
16-17	2954.	2678.	276.
17-18	2991.	2678.	313.
18-19	2142.	2142.	0.
19-20	1821.	1821.	0.
20-21	1274.	1274.	0.
21-22	1583.	1583.	0.
22-23	2232.	2232.	0.
23-24	2344.	2344.	0.

NOTE: THESE ESTIMATES ASSUME THAT TRAFFIC WILL DIVERT SUCH THAT
QUEUE LENGTHS NEVER EXCEED 1.50 MILES.

EXCESS EMISSIONS (DIFFERENCE)

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	157.8	1134.4	-126.1
Outbound	191.8	1269.0	-89.3

BASE EMISSIONS

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	272.1	1588.9	476.2
Outbound	165.6	1004.5	318.6

CONSTRUCTION RELATED EMISSIONS

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	498.9	3157.2	364.8
Outbound	377.1	2397.8	233.5

QUEWZ-98 Alternative 3.a(72) – Phase 1 & 2 – 4 lanes WB and 2 lanes EB from IR 77 Ramps

INPUT DATA SUMMARY: ROAD USER COST OUTPUT
ALT 3a72 phase 1&2 WB & 77 ramps

LANE CLOSURE CONFIGURATION:

TOTAL NUMBER OF LANES	
INBOUND	5
OUTBOUND	4
NUMBER OF OPEN LANES	
INBOUND	4 WB
OUTBOUND	2 EB (77 RAMPS)
LENGTH OF WORK ZONE	2.00 MILES
INBOUND CAPACITY (WESTBOUND)	E= 1.5
NORMAL	10000. (VPH)
RESTRICTED	7200. (VPH)
WORKING HOURS	5616. (VPH)/4 = 1404 VEH/HR/LN
OUTBOUND CAPACITY (EASTBOUND)	77 RAMPS E= 2.5
NORMAL	8000. (VPH)
RESTRICTED	3600. (VPH)
WORKING HOURS	2976. (VPH)/2= 1488 VEH/HR/LN

TRAFFIC PARAMETERS:

PERCENTAGE TRUCK	5.

SCHEDULE OF WORK ACTIVITY:

HOURS OF RESTRICTED CAPACITY	
BEGINNING	0
ENDING	24
HOURS OF WORK ZONE ACTIVITY	
BEGINNING	0
ENDING	24

IDLE HC CAR	34.9 (g/hr)	IDLE HC TRUCK	12.6 (g/hr)
IDLE CO CAR	218.5 (g/hr)	IDLE CO TRUCK	94.6 (g/hr)
IDLE NOX CAR	4.7 (g/hr)	IDLE NOX TRUCK	53.1 (g/hr)

♀ SUMMARY OF ADDITIONAL ROAD USER COSTS
ALT 3a72 phase 1&2 WB & 77 ramps

HOUR	ADDITIONAL ROAD USER COSTS ($) INBOUND	OUTBOUND	TOTAL
0- 1	14.	5.	19.
1- 2	7.	2.	10.
2- 3	6.	2.	8.
3- 4	6.	2.	9.
4- 5	12.	5.	17.
5- 6	69.	22.	91.
6- 7	870.	334.	1204.
7- 8	20391.	880.	21271.
8- 9	32607.	422.	33029.
9-10	15972.	365.	16337.
10-11	705.	244.	949.
11-12	814.	310.	1123.
12-13	1059.	351.	1410.
13-14	1235.	418.	1653.

14-15	10460.	577.	11037.
15-16	24677.	1076.	25753.
16-17	37577.	9776.	47353.
17-18	36802.	15065.	51867.
18-19	35638.	9110.	44748.
19-20	8477.	156.	8633.
20-21	205.	82.	287.
21-22	210.	69.	279.
22-23	147.	30.	177.
23-24	71.	15.	86.
TOTAL	228031.	39319.	267350.

♀ SUMMARY OF TRAFFIC CONDITIONS -- INBOUND DIRECTION
ALT 3a72 phase 1&2 WB & 77 ramps

HOUR	APPROACH VOLUME (VPH)	CAPACITY (VPH)	APPROACH SPEED (MPH)	WORK ZONE SPEED (MPH)	QUEUE LENGTH (MILES)
0- 1	770.	5616.	59.	58.	0.0
1- 2	486.	5616.	59.	59.	0.0
2- 3	418.	5616.	59.	59.	0.0
3- 4	441.	5616.	59.	59.	0.0
4- 5	688.	5616.	59.	58.	0.0
5- 6	1763.	5616.	57.	55.	0.0
6- 7	4397.	5616.	53.	48.	0.0
7- 8	6709.	5616.	50.	30.	0.8
8- 9	5923.	5616.	51.	30.	1.5
9-10	4566.	5616.	53.	31.	0.8
10-11	4121.	5616.	54.	49.	0.0
11-12	4309.	5616.	53.	48.	0.0
12-13	4664.	5616.	53.	47.	0.0
13-14	4879.	5616.	53.	47.	0.0
14-15	5902.	5616.	51.	30.	0.2
15-16	6763.	5616.	50.	30.	1.0
16-17	7197.	5616.	49.	30.	1.5
17-18	6995.	5616.	49.	30.	1.5
18-19	6694.	5616.	50.	30.	1.5
19-20	3789.	5616.	54.	39.	0.8
20-21	2717.	5616.	56.	53.	0.0
21-22	2741.	5616.	56.	53.	0.0
22-23	2403.	5616.	56.	54.	0.0
23-24	1787.	5616.	57.	55.	0.0

NOTE: TRAFFIC DIVERSION IS PREDICTED, SEE SUMMARY OF TRAFFIC VOLUMES

SUMMARY OF TRAFFIC CONDITIONS -- OUTBOUND DIRECTION
ALT 3a72 phase 1&2 WB & 77 ramps

HOUR	APPROACH VOLUME (VPH)	CAPACITY (VPH)	APPROACH SPEED (MPH)	WORK ZONE SPEED (MPH)	QUEUE LENGTH (MILES)
0- 1	288.	2976.	59.	59.	0.0
1- 2	170.	2976.	60.	59.	0.0
2- 3	162.	2976.	60.	59.	0.0
3- 4	164.	2976.	60.	59.	0.0
4- 5	285.	2976.	59.	59.	0.0
5- 6	695.	2976.	59.	56.	0.0
6- 7	2017.	2976.	56.	50.	0.0

7- 8	2719.	2976.	55.	46.	0.0
8- 9	2174.	2976.	56.	49.	0.0
9-10	2076.	2976.	56.	49.	0.0
10-11	1818.	2976.	57.	51.	0.0
11-12	1967.	2976.	56.	50.	0.0
12-13	2049.	2976.	56.	50.	0.0
13-14	2167.	2976.	56.	49.	0.0
14-15	2397.	2976.	55.	48.	0.0
15-16	2834.	2976.	55.	45.	0.0
16-17	3432.	2976.	54.	30.	0.4
17-18	2990.	2976.	54.	30.	0.9
18-19	2529.	2976.	55.	30.	0.5
19-20	1497.	2976.	57.	52.	0.0
20-21	1224.	2976.	58.	54.	0.0
21-22	1143.	2976.	58.	54.	0.0
22-23	801.	2976.	58.	56.	0.0
23-24	575.	2976.	59.	57.	0.0

NOTE: TRAFFIC DIVERSION IS PREDICTED, SEE SUMMARY OF TRAFFIC VOLUMES

♀ SUMMARY OF TRAFFIC VOLUMES -- INBOUND DIRECTION
ALT 3a72 phase 1&2 WB & 77 ramps

HOUR	APPROACH VOLUME (VPH)	VOLUME REMAINING ON FREEWAY (VPH)	VOLUME DIVERTING FROM FREEWAY (VPH)
0- 1	770.	770.	0.
1- 2	486.	486.	0.
2- 3	418.	418.	0.
3- 4	441.	441.	0.
4- 5	688.	688.	0.
5- 6	1763.	1763.	0.
6- 7	4397.	4397.	0.
7- 8	6709.	6606.	103.
8- 9	5923.	5616.	307.
9-10	4566.	4566.	0.
10-11	4121.	4121.	0.
11-12	4309.	4309.	0.
12-13	4664.	4664.	0.
13-14	4879.	4879.	0.
14-15	5902.	5902.	0.
15-16	6763.	6320.	443.
16-17	7197.	5616.	1581.
17-18	6995.	5616.	1379.
18-19	6694.	5616.	1078.
19-20	3789.	3789.	0.
20-21	2717.	2717.	0.
21-22	2741.	2741.	0.
22-23	2403.	2403.	0.
23-24	1787.	1787.	0.

NOTE: THESE ESTIMATES ASSUME THAT TRAFFIC WILL DIVERT SUCH THAT
QUEUE LENGTHS NEVER EXCEED 1.50 MILES.

♀ SUMMARY OF TRAFFIC VOLUMES -- OUTBOUND DIRECTION
ALT 3a72 phase 1&2 WB & 77 ramps

HOUR	APPROACH VOLUME (VPH)	VOLUME REMAINING ON FREEWAY (VPH)	VOLUME DIVERTING FROM FREEWAY (VPH)
0- 1	288.	288.	0.

1- 2	170.	170.	0.
2- 3	162.	162.	0.
3- 4	164.	164.	0.
4- 5	285.	285.	0.
5- 6	695.	695.	0.
6- 7	2017.	2017.	0.
7- 8	2719.	2719.	0.
8- 9	2174.	2174.	0.
9-10	2076.	2076.	0.
10-11	1818.	1818.	0.
11-12	1967.	1967.	0.
12-13	2049.	2049.	0.
13-14	2167.	2167.	0.
14-15	2397.	2397.	0.
15-16	2834.	2834.	0.
16-17	3432.	3432.	0.
17-18	2990.	2990.	0.
18-19	2529.	2529.	0.
19-20	1497.	1497.	0.
20-21	1224.	1224.	0.
21-22	1143.	1143.	0.
22-23	801.	801.	0.
23-24	575.	575.	0.

NOTE: THESE ESTIMATES ASSUME THAT TRAFFIC WILL DIVERT SUCH THAT
QUEUE LENGTHS NEVER EXCEED 1.50 MILES.

EXCESS EMISSIONS (DIFFERENCE)

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	157.8	1134.4	-126.1
Outbound	31.5	183.5	-42.5

BASE EMISSIONS

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	272.1	1588.9	476.2
Outbound	91.2	571.9	178.5

CONSTRUCTION RELATED EMISSIONS

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	498.9	3157.2	364.8
Outbound	183.0	1134.8	148.8

QUEWZ-98 Alternative 3.a(72) – Phase 3 & 4 – 4 lanes EB and 2 lanes WB crossover

INPUT DATA SUMMARY: ROAD USER COST OUTPUT
ALT 3a72 phase 3 & 4 4 EB & 2 WB crossover
QUEWZ-98

LANE CLOSURE CONFIGURATION:

TOTAL NUMBER OF LANES	
INBOUND	4
OUTBOUND	5
NUMBER OF OPEN LANES	
INBOUND	2 WB CROSSOVER
OUTBOUND	4 EB
LENGTH OF WORK ZONE	2.00 MILES
INBOUND CAPACITY (WESTBOUND)	CROSSOVER E= 1.5
NORMAL	8000. (VPH)
RESTRICTED	3600. (VPH)
WORKING HOURS	2808. (VPH)/2= 1404 VEH/HR/LN
OUTBOUND CAPACITY (EASTBOUND)	E= 2.5
NORMAL	10000. (VPH)
RESTRICTED	7200. (VPH)
WORKING HOURS	5356. (VPH)/4= 1339 VEH/HR/LN

TRAFFIC PARAMETERS:

PERCENTAGE TRUCK	5.

SCHEDULE OF WORK ACTIVITY:

HOURS OF RESTRICTED CAPACITY	
BEGINNING	0
ENDING	24
HOURS OF WORK ZONE ACTIVITY	
BEGINNING	0
ENDING	24

IDLE HC CAR	34.9 (g/hr)	IDLE HC TRUCK	12.6 (g/hr)
IDLE CO CAR	218.5 (g/hr)	IDLE CO TRUCK	94.6 (g/hr)
IDLE NOX CAR	4.7 (g/hr)	IDLE NOX TRUCK	53.1 (g/hr)

♀ SUMMARY OF ADDITIONAL ROAD USER COSTS
ALT 3a72 phase 3&4 4 EB & 2 WB

HOUR	ADDITIONAL ROAD USER COSTS ($) INBOUND	OUTBOUND	TOTAL
0- 1	8.	15.	23.
1- 2	4.	7.	11.
2- 3	3.	6.	10.
3- 4	3.	7.	11.
4- 5	7.	16.	23.
5- 6	41.	143.	184.
6- 7	502.	10289.	10791.
7- 8	10813.	25288.	36101.
8- 9	19001.	32270.	51271.
9-10	13470.	19289.	32758.
10-11	1191.	1540.	2731.
11-12	471.	939.	1409.
12-13	609.	1082.	1691.
13-14	707.	1401.	2108.

14-15	5301.	6603.	11904.
15-16	14762.	20221.	34983.
16-17	26820.	35403.	62224.
17-18	27685.	33717.	61401.
18-19	26666.	21619.	48284.
19-20	9869.	1240.	11109.
20-21	121.	181.	301.
21-22	123.	230.	353.
22-23	87.	311.	398.
23-24	42.	279.	321.
TOTAL	158305.	212097.	370402.

♀ SUMMARY OF TRAFFIC CONDITIONS -- INBOUND DIRECTION
ALT 3a72 phase 3&4 4 EB & 2 WB

HOUR	APPROACH VOLUME (VPH)	CAPACITY (VPH)	APPROACH SPEED (MPH)	WORK ZONE SPEED (MPH)	QUEUE LENGTH (MILES)
0- 1	385.	2808.	59.	58.	0.0
1- 2	243.	2808.	60.	59.	0.0
2- 3	209.	2808.	60.	59.	0.0
3- 4	220.	2808.	60.	59.	0.0
4- 5	344.	2808.	59.	58.	0.0
5- 6	881.	2808.	58.	55.	0.0
6- 7	2198.	2808.	56.	48.	0.0
7- 8	3354.	2808.	54.	30.	0.5
8- 9	2961.	2808.	54.	30.	1.2
9-10	2283.	2808.	56.	30.	0.8
10-11	2060.	2808.	56.	45.	0.2
11-12	2154.	2808.	56.	48.	0.0
12-13	2332.	2808.	56.	47.	0.0
13-14	2439.	2808.	55.	47.	0.0
14-15	2951.	2808.	54.	30.	0.1
15-16	3381.	2808.	54.	30.	0.8
16-17	3598.	2808.	53.	30.	1.4
17-18	3497.	2808.	53.	30.	1.5
18-19	3347.	2808.	54.	30.	1.5
19-20	1894.	2808.	56.	33.	0.8
20-21	1358.	2808.	57.	53.	0.0
21-22	1370.	2808.	57.	53.	0.0
22-23	1201.	2808.	58.	54.	0.0
23-24	893.	2808.	58.	55.	0.0

NOTE: TRAFFIC DIVERSION IS PREDICTED, SEE SUMMARY OF TRAFFIC VOLUMES

SUMMARY OF TRAFFIC CONDITIONS -- OUTBOUND DIRECTION
ALT 3a72 phase 3&4 4 EB & 2 WB

HOUR	APPROACH VOLUME (VPH)	CAPACITY (VPH)	APPROACH SPEED (MPH)	WORK ZONE SPEED (MPH)	QUEUE LENGTH (MILES)
0- 1	783.	5356.	59.	58.	0.0
1- 2	482.	5356.	59.	59.	0.0
2- 3	432.	5356.	59.	59.	0.0
3- 4	470.	5356.	59.	59.	0.0
4- 5	819.	5356.	59.	58.	0.0
5- 6	2288.	5356.	57.	54.	0.0
6- 7	5650.	5356.	51.	30.	0.2

7- 8	6738.	5356.	50.	30.	1.0
8- 9	5637.	5356.	51.	30.	1.5
9-10	4501.	5356.	53.	30.	0.9
10-11	4349.	5356.	53.	45.	0.1
11-12	4326.	5356.	53.	48.	0.0
12-13	4513.	5356.	53.	47.	0.0
13-14	4863.	5356.	53.	46.	0.0
14-15	5380.	5356.	52.	30.	0.0
15-16	6351.	5356.	50.	30.	0.8
16-17	6386.	5356.	50.	30.	1.5
17-18	5981.	5356.	51.	30.	1.5
18-19	4671.	5356.	53.	30.	1.0
19-20	3318.	5356.	55.	48.	0.2
20-21	2498.	5356.	56.	53.	0.0
21-22	2726.	5356.	56.	52.	0.0
22-23	3033.	5356.	55.	51.	0.0
23-24	2919.	5356.	56.	52.	0.0

NOTE: TRAFFIC DIVERSION IS PREDICTED, SEE SUMMARY OF TRAFFIC VOLUMES

♀ SUMMARY OF TRAFFIC VOLUMES -- INBOUND DIRECTION PAGE 5 OF 6
ALT 3a72 phase 3&4 4 EB & 2 WB QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	VOLUME REMAINING ON FREEWAY (VPH)	VOLUME DIVERTING FROM FREEWAY (VPH)
0- 1	385.	385.	0.
1- 2	243.	243.	0.
2- 3	209.	209.	0.
3- 4	220.	220.	0.
4- 5	344.	344.	0.
5- 6	881.	881.	0.
6- 7	2198.	2198.	0.
7- 8	3354.	3354.	0.
8- 9	2961.	2961.	0.
9-10	2283.	2283.	0.
10-11	2060.	2060.	0.
11-12	2154.	2154.	0.
12-13	2332.	2332.	0.
13-14	2439.	2439.	0.
14-15	2951.	2951.	0.
15-16	3381.	3381.	0.
16-17	3598.	2884.	714.
17-18	3497.	2808.	689.
18-19	3347.	2808.	539.
19-20	1894.	1894.	0.
20-21	1358.	1358.	0.
21-22	1370.	1370.	0.
22-23	1201.	1201.	0.
23-24	893.	893.	0.

NOTE: THESE ESTIMATES ASSUME THAT TRAFFIC WILL DIVERT SUCH THAT
QUEUE LENGTHS NEVER EXCEED 1.50 MILES.

♀ SUMMARY OF TRAFFIC VOLUMES -- OUTBOUND DIRECTION PAGE 6 OF 6
ALT 3a72 phase 3&4 4 EB & 2 WB QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	VOLUME REMAINING ON FREEWAY (VPH)	VOLUME DIVERTING FROM FREEWAY (VPH)
0- 1	783.	783.	0.

1- 2	482.	482.	0.
2- 3	432.	432.	0.
3- 4	470.	470.	0.
4- 5	819.	819.	0.
5- 6	2288.	2288.	0.
6- 7	5650.	5650.	0.
7- 8	6738.	6052.	686.
8- 9	5637.	5356.	281.
9-10	4501.	4501.	0.
10-11	4349.	4349.	0.
11-12	4326.	4326.	0.
12-13	4513.	4513.	0.
13-14	4863.	4863.	0.
14-15	5380.	5380.	0.
15-16	6351.	6322.	29.
16-17	6386.	5356.	1030.
17-18	5981.	5356.	625.
18-19	4671.	4671.	0.
19-20	3318.	3318.	0.
20-21	2498.	2498.	0.
21-22	2726.	2726.	0.
22-23	3033.	3033.	0.
23-24	2919.	2919.	0.

NOTE: THESE ESTIMATES ASSUME THAT TRAFFIC WILL DIVERT SUCH THAT
QUEUE LENGTHS NEVER EXCEED 1.50 MILES.

EXCESS EMISSIONS (DIFFERENCE)

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	137.9	903.9	-73.5
Outbound	157.6	1135.2	-127.7

BASE EMISSIONS

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	137.9	843.0	265.1
Outbound	271.2	1587.2	485.7

CONSTRUCTION RELATED EMISSIONS

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	303.4	1920.1	197.4
Outbound	465.8	2954.8	365.9

QUEWZ-98 Alternative 3.a(72) – Phase 3 & 4 – 4 lanes EB and 2 lanes WB

INPUT DATA SUMMARY: ROAD USER COST OUTPUT
ALT 3a72 phase 3 & 4 4 EB & 2 WB (12' lanes)

LANE CLOSURE CONFIGURATION:

TOTAL NUMBER OF LANES	
INBOUND	4
OUTBOUND	5
NUMBER OF OPEN LANES	
INBOUND	2 WB
OUTBOUND	4 EB
LENGTH OF WORK ZONE	2.00 MILES
INBOUND CAPACITY (WESTBOUND)	E= 1.5
NORMAL	8000. (VPH)
RESTRICTED	3600. (VPH)
WORKING HOURS	3120. (VPH)/2= 1560 VEH/HR/LN
OUTBOUND CAPACITY (EASTBOUND)	E= 2.5
NORMAL	10000. (VPH)
RESTRICTED	7200. (VPH)
WORKING HOURS	5356. (VPH)/4= 1339 VEH/HR/LN

TRAFFIC PARAMETERS:

PERCENTAGE TRUCK	5.

SCHEDULE OF WORK ACTIVITY:

HOURS OF RESTRICTED CAPACITY	
BEGINNING	0
ENDING	24
HOURS OF WORK ZONE ACTIVITY	
BEGINNING	0
ENDING	24

IDLE HC CAR	34.9 (g/hr)	IDLE HC TRUCK	12.6 (g/hr)
IDLE CO CAR	218.5 (g/hr)	IDLE CO TRUCK	94.6 (g/hr)
IDLE NOX CAR	4.7 (g/hr)	IDLE NOX TRUCK	53.1 (g/hr)

♀ SUMMARY OF ADDITIONAL ROAD USER COSTS
ALT 3a72 phase 3&4 4 EB & 2 WB (12' lanes)

HOUR	ADDITIONAL ROAD USER COSTS ($) INBOUND	OUTBOUND	TOTAL
0- 1	7.	15.	23.
1- 2	4.	7.	11.
2- 3	3.	6.	9.
3- 4	3.	7.	10.
4- 5	6.	16.	23.
5- 6	35.	143.	178.
6- 7	390.	10289.	10679.
7- 8	6905.	25288.	32193.
8- 9	7367.	32270.	39637.
9-10	640.	19289.	19928.
10-11	320.	1540.	1860.
11-12	367.	939.	1305.
12-13	470.	1082.	1552.
13-14	543.	1401.	1944.
14-15	1059.	6603.	7662.
15-16	7274.	20221.	27494.
16-17	16785.	35403.	52189.
17-18	24744.	33717.	58461.
18-19	24791.	21619.	46410.
19-20	7266.	1240.	8506.
20-21	98.	181.	279.
21-22	101.	230.	330.
22-23	72.	311.	383.
23-24	36.	279.	314.
TOTAL	99285.	212097.	311381.

♀ SUMMARY OF TRAFFIC CONDITIONS -- INBOUND DIRECTION
ALT 3a72 phase 3&4 4 EB & 2 WB (12' lanes)

HOUR	APPROACH VOLUME (VPH)	CAPACITY (VPH)	APPROACH SPEED (MPH)	WORK ZONE SPEED (MPH)	QUEUE LENGTH (MILES)
0- 1	385.	3120.	59.	58.	0.0
1- 2	243.	3120.	60.	59.	0.0
2- 3	209.	3120.	60.	59.	0.0
3- 4	220.	3120.	60.	59.	0.0
4- 5	344.	3120.	59.	58.	0.0
5- 6	881.	3120.	58.	56.	0.0
6- 7	2198.	3120.	56.	49.	0.0
7- 8	3354.	3120.	54.	30.	0.2
8- 9	2961.	3120.	54.	30.	0.3
9-10	2283.	3120.	56.	47.	0.1
10-11	2060.	3120.	56.	50.	0.0
11-12	2154.	3120.	56.	50.	0.0
12-13	2332.	3120.	56.	49.	0.0
13-14	2439.	3120.	55.	48.	0.0
14-15	2951.	3120.	54.	45.	0.0
15-16	3381.	3120.	54.	30.	0.2
16-17	3598.	3120.	53.	30.	0.9
17-18	3497.	3120.	53.	30.	1.4
18-19	3347.	3120.	54.	30.	1.5
19-20	1894.	3120.	56.	37.	0.8
20-21	1358.	3120.	57.	53.	0.0
21-22	1370.	3120.	57.	53.	0.0
22-23	1201.	3120.	58.	54.	0.0
23-24	893.	3120.	58.	56.	0.0

NOTE: TRAFFIC DIVERSION IS PREDICTED, SEE SUMMARY OF TRAFFIC VOLUMES

SUMMARY OF TRAFFIC CONDITIONS -- OUTBOUND DIRECTION
ALT 3a72 phase 3&4 4 EB & 2 WB (12' lanes)

HOUR	APPROACH VOLUME (VPH)	CAPACITY (VPH)	APPROACH SPEED (MPH)	WORK ZONE SPEED (MPH)	QUEUE LENGTH (MILES)
0- 1	783.	5356.	59.	58.	0.0
1- 2	482.	5356.	59.	59.	0.0
2- 3	432.	5356.	59.	59.	0.0
3- 4	470.	5356.	59.	59.	0.0
4- 5	819.	5356.	59.	58.	0.0
5- 6	2288.	5356.	57.	54.	0.0
6- 7	5650.	5356.	51.	30.	0.2

7- 8	6738.	5356.	50.	30.	1.0
8- 9	5637.	5356.	51.	30.	1.5
9-10	4501.	5356.	53.	30.	0.9
10-11	4349.	5356.	53.	45.	0.1
11-12	4326.	5356.	53.	48.	0.0
12-13	4513.	5356.	53.	47.	0.0
13-14	4863.	5356.	53.	46.	0.0
14-15	5380.	5356.	52.	30.	0.0
15-16	6351.	5356.	50.	30.	0.8
16-17	6386.	5356.	50.	30.	1.5
17-18	5981.	5356.	51.	30.	1.5
18-19	4671.	5356.	53.	30.	1.0
19-20	3318.	5356.	55.	48.	0.2
20-21	2498.	5356.	56.	53.	0.0
21-22	2726.	5356.	56.	52.	0.0
22-23	3033.	5356.	55.	51.	0.0
23-24	2919.	5356.	56.	52.	0.0

NOTE: TRAFFIC DIVERSION IS PREDICTED, SEE SUMMARY OF TRAFFIC VOLUMES

♀ SUMMARY OF TRAFFIC VOLUMES -- INBOUND DIRECTION PAGE 5 OF 6
ALT 3a72 phase 3&4 4 EB & 2 WB (12' lanes) QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	VOLUME REMAINING ON FREEWAY (VPH)	VOLUME DIVERTING FROM FREEWAY (VPH)
0- 1	385.	385.	0.
1- 2	243.	243.	0.
2- 3	209.	209.	0.
3- 4	220.	220.	0.
4- 5	344.	344.	0.
5- 6	881.	881.	0.
6- 7	2198.	2198.	0.
7- 8	3354.	3354.	0.
8- 9	2961.	2961.	0.
9-10	2283.	2283.	0.
10-11	2060.	2060.	0.
11-12	2154.	2154.	0.
12-13	2332.	2332.	0.
13-14	2439.	2439.	0.
14-15	2951.	2951.	0.
15-16	3381.	3381.	0.
16-17	3598.	3598.	0.
17-18	3497.	3173.	324.
18-19	3347.	3120.	227.
19-20	1894.	1894.	0.
20-21	1358.	1358.	0.
21-22	1370.	1370.	0.
22-23	1201.	1201.	0.
23-24	893.	893.	0.

NOTE: THESE ESTIMATES ASSUME THAT TRAFFIC WILL DIVERT SUCH THAT
QUEUE LENGTHS NEVER EXCEED 1.50 MILES.

♀ SUMMARY OF TRAFFIC VOLUMES -- OUTBOUND DIRECTION PAGE 6 OF 6
ALT 3a72 phase 3&4 4 EB & 2 WB (12' lanes) QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	VOLUME REMAINING ON FREEWAY (VPH)	VOLUME DIVERTING FROM FREEWAY (VPH)
0- 1	783.	783.	0.

1- 2	482.	482.	0.
2- 3	432.	432.	0.
3- 4	470.	470.	0.
4- 5	819.	819.	0.
5- 6	2288.	2288.	0.
6- 7	5650.	5650.	0.
7- 8	6738.	6052.	686.
8- 9	5637.	5356.	281.
9-10	4501.	4501.	0.
10-11	4349.	4349.	0.
11-12	4326.	4326.	0.
12-13	4513.	4513.	0.
13-14	4863.	4863.	0.
14-15	5380.	5380.	0.
15-16	6351.	6322.	29.
16-17	6386.	5356.	1030.
17-18	5981.	5356.	625.
18-19	4671.	4671.	0.
19-20	3318.	3318.	0.
20-21	2498.	2498.	0.
21-22	2726.	2726.	0.
22-23	3033.	3033.	0.
23-24	2919.	2919.	0.

NOTE: THESE ESTIMATES ASSUME THAT TRAFFIC WILL DIVERT SUCH THAT
QUEUE LENGTHS NEVER EXCEED 1.50 MILES.

EXCESS EMISSIONS (DIFFERENCE)

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	86.5	570.8	-64.2
Outbound	157.6	1135.2	-127.7

BASE EMISSIONS

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	126.5	771.3	242.8
Outbound	271.2	1587.2	485.7

CONSTRUCTION RELATED EMISSIONS

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	236.0	1486.3	183.5
Outbound	463.3	2938.6	365.3

Alternative 3.a(72)

ODOT Queue Spreadsheets

Phase 1 & 2 – 4 (10’) lanes WB
2 (10’) lanes EB crossover
2 (12’) lanes EB from IR 77 Ramps

Phase 3 & 4 - 4 (10’) lanes EB
2 (10’) lanes WB crossover
2 (12’) lanes WB

Alternative 3.a(72) – Phase 1 & 2 – 4 (10') lanes WB

Queue Calc. Worksheet for Freeway Work Zones

Alternative 3.a(72), Phase 1 & 2

CUY 480 Westbound (total volume)

Friday in August	
Free Flow Work Zone Capacity (veh/ln/hr)	1404
Queued Work Zone Capacity (veh/ln/hr)	1404
One Way AADT (veh)	91122
Percent of Peak Period (>1000 vph) Traffic Diverted (%)	0
Number of Lanes for Queued Vehicles(lanes)	4
Number of vehicles in Queue per Lane Mile (veh)	108

Time Begining	Estimated or Actual Volume	Reduced Volume	Queue (Veh)	Queue (miles)
0:00	770	770	0	0.0
1:00	486	486	0	0.0
2:00	418	418	0	0.0
3:00	441	441	0	0.0
4:00	688	688	0	0.0
5:00	1763	1763	0	0.0
6:00	4397	4397	0	0.0
7:00	6709	6709	1093	2.5
8:00	5923	5923	1400	3.2
9:00	4566	4566	350	0.8
10:00	4121	4121	0	0.0
11:00	4309	4309	0	0.0
12:00	4664	4664	0	0.0
13:00	4879	4879	0	0.0
14:00	5902	5902	286	0.7
15:00	6763	6763	1433	3.3
16:00	7197	7197	3014	7.0
17:00	6995	6995	4393	10.2
18:00	6694	6694	5471	12.7
19:00	3789	3789	3644	8.4
20:00	2717	2717	745	1.7
21:00	2741	2741	0	0.0
22:00	2403	2403	0	0.0
23:00	1787	1787	0	0.0

Alternative 3.a(72) – Phase 1 & 2 - 2 (10') lanes EB crossover

Queue Calc. Worksheet for Freeway Work Zones

Alternative 3.a(72), Phase 1 & 2

CUY 480 Eastbound Through (Total - Ramps)	2.62%
Friday in August-Tuesday in June	
Free Flow Work Zone Capacity (veh/ln/hr)	1339
Queued Work Zone Capacity (veh/ln/hr)	1339
One Way AADT (veh)	50941
Percent of Peak Period (>1000 vph) Traffic Diverted (%)	0
Number of Lanes for Queued Vehicles(lanes)	2
Number of vehicles in Queue per Lane Mile (veh)	108

Time Begining	Estimated or Actual Volume	Reduced Volume	Queue (Veh)	Queue (miles)
0:00	495	495	0	0.0
1:00	312	312	0	0.0
2:00	270	270	0	0.0
3:00	306	306	0	0.0
4:00	534	534	0	0.0
5:00	1593	1593	0	0.0
6:00	3633	3633	955	4.4
7:00	4019	4019	2296	10.6
8:00	3463	3463	3081	14.3
9:00	2425	2425	2828	13.1
10:00	2531	2531	2681	12.4
11:00	2359	2359	2362	10.9
12:00	2464	2464	2148	9.9
13:00	2696	2696	2166	10.0
14:00	2983	2983	2471	11.4
15:00	3517	3517	3310	15.3
16:00	2954	2954	3586	16.6
17:00	2991	2991	3899	18.1
18:00	2142	2142	3363	15.6
19:00	1821	1821	2506	11.6
20:00	1274	1274	1102	5.1
21:00	1583	1583	7	0.0
22:00	2232	2232	0	0.0
23:00	2344	2344	0	0.0

Alternative 3.a(72) – Phase 1 & 2 –
2 (12') lanes EB from IR 77 Ramps

Queue Calc. Worksheet for Freeway Work Zones

Alternative 3.a(72), Phase 1 & 2

CUY 480 Eastbound (from 77 Ramps)	2.62%
Tuesday in June	
Free Flow Work Zone Capacity (veh/ln/hr)	1488
Queued Work Zone Capacity (veh/ln/hr)	1488
One Way AADT (veh)	38173
Percent of Peak Period (>1000 vph) Traffic Diverted (%)	0
Number of Lanes for Queued Vehicles(lanes)	2
Number of vehicles in Queue per Lane Mile (veh)	108

Time Begining	Estimated or Actual Volume	Reduced Volume	Queue (Veh)	Queue (miles)
0:00	288	288	0	0.0
1:00	170	170	0	0.0
2:00	162	162	0	0.0
3:00	164	164	0	0.0
4:00	285	285	0	0.0
5:00	695	695	0	0.0
6:00	2017	2017	0	0.0
7:00	2719	2719	0	0.0
8:00	2174	2174	0	0.0
9:00	2076	2076	0	0.0
10:00	1818	1818	0	0.0
11:00	1967	1967	0	0.0
12:00	2049	2049	0	0.0
13:00	2167	2167	0	0.0
14:00	2397	2397	0	0.0
15:00	2834	2834	0	0.0
16:00	3432	3432	456	2.1
17:00	2990	2990	470	2.2
18:00	2529	2529	23	0.1
19:00	1497	1497	0	0.0
20:00	1224	1224	0	0.0
21:00	1143	1143	0	0.0
22:00	801	801	0	0.0
23:00	575	575	0	0.0

Alternative 3.a(72) – Phase 3 & 4 – 4 (10') lanes EB

Queue Calc. Worksheet for Freeway Work Zones

Alternative 3.a(72), Phase 3 & 4

CUY 480 Eastbound	2.62%
Friday in August	
Free Flow Work Zone Capacity (veh/ln/hr)	1339
Queued Work Zone Capacity (veh/ln/hr)	1339
One Way AADT (veh)	89114
Percent of Peak Period (>1000 vph) Traffic Diverted (%)	0
Number of Lanes for Queued Vehicles(lanes)	4
Number of vehicles in Queue per Lane Mile (veh)	108

Time Begining	Estimated or Actual Volume	Reduced Volume	Queue (Veh)	Queue (miles)
0:00	783	783	0	0.0
1:00	482	482	0	0.0
2:00	432	432	0	0.0
3:00	470	470	0	0.0
4:00	819	819	0	0.0
5:00	2288	2288	0	0.0
6:00	5650	5650	294	0.7
7:00	6738	6738	1676	3.9
8:00	5637	5637	1957	4.5
9:00	4501	4501	1102	2.6
10:00	4349	4349	95	0.2
11:00	4326	4326	0	0.0
12:00	4513	4513	0	0.0
13:00	4863	4863	0	0.0
14:00	5380	5380	24	0.1
15:00	6351	6351	1019	2.4
16:00	6386	6386	2049	4.7
17:00	5981	5981	2674	6.2
18:00	4671	4671	1989	4.6
19:00	3318	3318	0	0.0
20:00	2498	2498	0	0.0
21:00	2726	2726	0	0.0
22:00	3033	3033	0	0.0
23:00	2919	2919	0	0.0

Alternative 3.a(72) – Phase 3 & 4 - 2 (10') lanes WB crossover

Queue Calc. Worksheet for Freeway Work Zones

Alternative 3.a(72), Phase 3 & 4

CUY 480 Westbound (2 lanes on crossover)	
1/2 the total through volume	
Wednesday in May for NB and Thursday in July for SB	
Free Flow Work Zone Capacity (veh/ln/hr)	1404
Queued Work Zone Capacity (veh/ln/hr)	1404
One Way AADT (veh)	45553
Percent of Peak Period (>1000 vph) Traffic Diverted (%)	0
Number of Lanes for Queued Vehicles(lanes)	2
Number of vehicles in Queue per Lane Mile (veh)	108

Time Begining	Estimated or Actual Volume	Reduced Volume	Queue (Veh)	Queue (miles)
0:00	385	385	0	0.0
1:00	243	243	0	0.0
2:00	209	209	0	0.0
3:00	220	220	0	0.0
4:00	344	344	0	0.0
5:00	881	881	0	0.0
6:00	2198	2198	0	0.0
7:00	3354	3354	546	2.5
8:00	2961	2961	699	3.2
9:00	2283	2283	174	0.8
10:00	2060	2060	0	0.0
11:00	2154	2154	0	0.0
12:00	2332	2332	0	0.0
13:00	2439	2439	0	0.0
14:00	2951	2951	143	0.7
15:00	3381	3381	716	3.3
16:00	3598	3598	1506	7.0
17:00	3497	3497	2195	10.2
18:00	3347	3347	2734	12.7
19:00	1894	1894	1820	8.4
20:00	1358	1358	370	1.7
21:00	1370	1370	0	0.0
22:00	1201	1201	0	0.0
23:00	893	893	0	0.0

Alternative 3.a(72) – Phase 3 & 4 – 2 (12') lanes WB

Queue Calc. Worksheet for Freeway Work Zones

Alternative 3.a(72), Phase 3 & 4

CUY 480 Westbound Through (2 lanes on	
WB bridge in work zone)	
Friday in August minus Ramps	
Free Flow Work Zone Capacity (veh/ln/hr)	1560
Queued Work Zone Capacity (veh/ln/hr)	1560
One Way AADT (veh)	45569
Percent of Peak Period (>1000 vph) Traffic Diverted (%)	0
Number of Lanes for Queued Vehicles(lanes)	2
Number of vehicles in Queue per Lane Mile (veh)	108

Time Begining	Estimated or Actual Volume	Reduced Volume	Queue (Veh)	Queue (miles)
0:00	385	385	0	0.0
1:00	243	243	0	0.0
2:00	209	209	0	0.0
3:00	221	221	0	0.0
4:00	344	344	0	0.0
5:00	882	882	0	0.0
6:00	2199	2199	0	0.0
7:00	3355	3355	235	1.1
8:00	2962	2962	77	0.4
9:00	2283	2283	0	0.0
10:00	2061	2061	0	0.0
11:00	2155	2155	0	0.0
12:00	2332	2332	0	0.0
13:00	2440	2440	0	0.0
14:00	2951	2951	0	0.0
15:00	3382	3382	262	1.2
16:00	3599	3599	741	3.4
17:00	3498	3498	1119	5.2
18:00	3347	3347	1346	6.2
19:00	1895	1895	121	0.6
20:00	1359	1359	0	0.0
21:00	1371	1371	0	0.0
22:00	1202	1202	0	0.0
23:00	894	894	0	0.0

Alternative 3.b(72)

QUEWZ-98

Phase 1 & 2 – 3 (11') lanes WB
2 (11') lanes EB from IR 77 Ramps
2 (11') lanes EB crossover

The Phase 1 and 2 MOT lane configurations and lane widths for Alternative 3.b(72) are the same as for Alternative 1.a(70), Phase 1 and 2. No separate QUEWZ-98 output files were generated for these Phases. See Alternative 1.a(70), QUEWZ-98, Phase 1 and 2 for results.

Phase 3 & 4 - 4 (10') lanes EB
2 (10') lanes WB crossover
2 (12') lanes WB

The Phase 3 and 4 MOT lane configurations and lane widths for Alternative 3.b(72) are the same as for Alternative 3.a(72), Phase 3 and 4. No separate QUEWZ-98 output files were generated for these Phases. See Alternative 3.a(72), QUEWZ-98, Phase 3 and 4 for results.

Alternative 3.b(72)

ODOT Queue Spreadsheets

Phase 1 & 2 – 3 (11') lanes WB
2 (11') lanes EB from IR 77 Ramps
2 (11') lanes EB crossover

The Phase 1 and 2 MOT lane configurations and lane widths for Alternative 3.b(72) are the same as for Alternative 1.a(70), Phase 1 and 2. No separate ODOT Queue spreadsheet files were generated for these Phases. See Alternative 1.a(70), ODOT Queue spreadsheet, Phase 1 and 2 for results.

Phase 3 & 4 - 4 (10') lanes EB
2 (10') lanes WB crossover
2 (12') lanes WB

The Phase 3 and 4 MOT lane configurations and lane widths for Alternative 3.b(72) are the same as for Alternative 3.a(72), Phase 3 and 4. No separate ODOT Queue spreadsheet files were generated for these Phases. See Alternative 3.a(72), ODOT Queue spreadsheet, Phase 3 and 4 for results.

Alternative 3.c

QUEWZ-98

Phase 1 & 3 – 4 (11’) lanes WB
1 (12’) lane EB crossover
3 (11’) lanes EB

Phase 2 - 4 (12’) lanes WB
4 (11’) lanes EB

The Phase 2 MOT lane configuration and lane widths for Alternative 3.c are the same as the existing condition for westbound traffic and are the same as Alternative 1.a(70), Phase 3 and 4 for the eastbound traffic. No separate QUEWZ-98 output files were generated for this Phase. See Alternative 1.a(70), QUEWZ-98, Phase 3 and 4 for results.

Phase 4 & 5 – 4 (11’) lanes EB
2 (12’) lanes WB crossover
2 (11’) lanes WB

The Phase 4 and 5 MOT lane configuration and lane widths for Alternative 3.c are the same as Alternative 1.a(70), Phase 3 and 4 for the eastbound traffic. No separate QUEWZ-98 output files were generated for this Phase. See Alternative 1.a(70), QUEWZ-98, Phase 3 and 4 for results.

QUEWZ-98 Alternative 3.c – Phase 1 & 3 – 4 lanes WB and 3 lanes EB

LANE CLOSURE CONFIGURATION:

TOTAL NUMBER OF LANES	
INBOUND	5
OUTBOUND	4
NUMBER OF OPEN LANES	
INBOUND	4 WB
OUTBOUND	3 EB
LENGTH OF WORK ZONE	2.00 MILES
INBOUND CAPACITY (WESTBOUND)	E= 1.5
NORMAL	10000. (VPH)
RESTRICTED	7200. (VPH)
WORKING HOURS	5928. (VPH)/4= 1482 VEH//HR/LN
OUTBOUND CAPACITY (EASTBOUND)	E=2.5
NORMAL	8000. (VPH)
RESTRICTED	5400. (VPH)
WORKING HOURS	4239. (VPH)/3= 1413 VEH/HR/LN

TRAFFIC PARAMETERS:

PERCENTAGE TRUCK	5.

SCHEDULE OF WORK ACTIVITY:

HOURS OF RESTRICTED CAPACITY	
BEGINNING	0
ENDING	24
HOURS OF WORK ZONE ACTIVITY	
BEGINNING	0
ENDING	24

IDLE HC CAR	34.9 (g/hr)	IDLE HC TRUCK	12.6 (g/hr)
IDLE CO CAR	218.5 (g/hr)	IDLE CO TRUCK	94.6 (g/hr)
IDLE NOX CAR	4.7 (g/hr)	IDLE NOX TRUCK	53.1 (g/hr)

♀ SUMMARY OF ADDITIONAL ROAD USER COSTS PAGE 2 OF 6
ALT 3c Phase 1&2 WB & 3 lanes EB QUEWZ-98

HOUR	ADDITIONAL ROAD USER COSTS ($) INBOUND	OUTBOUND	TOTAL
0- 1	13.	10.	24.
1- 2	7.	5.	12.
2- 3	6.	4.	10.
3- 4	6.	5.	11.
4- 5	11.	11.	22.
5- 6	63.	79.	142.
6- 7	750.	1340.	2090.
7- 8	17586.	14436.	32022.
8- 9	26421.	20040.	46461.
9-10	8129.	6494.	14623.
10-11	610.	604.	1213.
11-12	702.	638.	1340.
12-13	909.	732.	1641.
13-14	1057.	926.	1983.

14-15	4549.	1409.	5959.
15-16	18330.	12215.	30545.
16-17	33819.	23908.	57728.
17-18	35656.	26506.	62162.
18-19	34563.	17460.	52024.
19-20	7188.	956.	8144.
20-21	181.	134.	315.
21-22	186.	151.	337.
22-23	131.	154.	286.
23-24	65.	123.	187.
TOTAL	190938.	128342.	319280.

♀ SUMMARY OF TRAFFIC CONDITIONS -- INBOUND DIRECTION PAGE 3 OF 6
ALT 3c Phase 1&2 WB & 3 lanes EB QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	CAPACITY (VPH)	APPROACH SPEED (MPH)	WORK ZONE SPEED (MPH)	QUEUE LENGTH (MILES)
0- 1	770.	5928.	59.	58.	0.0
1- 2	486.	5928.	59.	59.	0.0
2- 3	418.	5928.	59.	59.	0.0
3- 4	441.	5928.	59.	59.	0.0
4- 5	688.	5928.	59.	58.	0.0
5- 6	1763.	5928.	57.	55.	0.0
6- 7	4397.	5928.	53.	49.	0.0
7- 8	6709.	5928.	50.	30.	0.6
8- 9	5923.	5928.	51.	30.	1.2
9-10	4566.	5928.	53.	38.	0.6
10-11	4121.	5928.	54.	49.	0.0
11-12	4309.	5928.	53.	49.	0.0
12-13	4664.	5928.	53.	48.	0.0
13-14	4879.	5928.	53.	48.	0.0
14-15	5902.	5928.	51.	35.	0.0
15-16	6763.	5928.	50.	30.	0.6
16-17	7197.	5928.	49.	30.	1.4
17-18	6995.	5928.	49.	30.	1.5
18-19	6694.	5928.	50.	30.	1.5
19-20	3789.	5928.	54.	41.	0.7
20-21	2717.	5928.	56.	53.	0.0
21-22	2741.	5928.	56.	53.	0.0
22-23	2403.	5928.	56.	54.	0.0
23-24	1787.	5928.	57.	55.	0.0

NOTE: TRAFFIC DIVERSION IS PREDICTED, SEE SUMMARY OF TRAFFIC VOLUMES

SUMMARY OF TRAFFIC CONDITIONS -- OUTBOUND DIRECTION PAGE 4 OF 6
ALT 3c Phase 1&2 WB & 3 lanes EB QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	CAPACITY (VPH)	APPROACH SPEED (MPH)	WORK ZONE SPEED (MPH)	QUEUE LENGTH (MILES)
0- 1	560.	4239.	59.	58.	0.0
1- 2	342.	4239.	59.	59.	0.0
2- 3	311.	4239.	59.	59.	0.0
3- 4	332.	4239.	59.	59.	0.0
4- 5	579.	4239.	59.	58.	0.0
5- 6	1571.	4239.	57.	54.	0.0
6- 7	4015.	4239.	52.	45.	0.0

7- 8	4929.	4239.	51.	30.	0.7
8- 9	4079.	4239.	52.	30.	1.2
9-10	3410.	4239.	54.	36.	0.5
10-11	3210.	4239.	54.	49.	0.0
11-12	3264.	4239.	54.	48.	0.0
12-13	3404.	4239.	54.	48.	0.0
13-14	3650.	4239.	53.	47.	0.0
14-15	4038.	4239.	52.	45.	0.0
15-16	4768.	4239.	51.	30.	0.5
16-17	5057.	4239.	50.	30.	1.3
17-18	4635.	4239.	51.	30.	1.5
18-19	3707.	4239.	53.	30.	1.0
19-20	2499.	4239.	55.	48.	0.2
20-21	1925.	4239.	56.	53.	0.0
21-22	2014.	4239.	56.	53.	0.0
22-23	2029.	4239.	56.	53.	0.0
23-24	1864.	4239.	56.	53.	0.0

NOTE: TRAFFIC DIVERSION IS PREDICTED, SEE SUMMARY OF TRAFFIC VOLUMES

♀ SUMMARY OF TRAFFIC VOLUMES -- INBOUND DIRECTION PAGE 5 OF 6
ALT 3c Phase 1&2 WB & 3 lanes EB QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	VOLUME REMAINING ON FREEWAY (VPH)	VOLUME DIVERTING FROM FREEWAY (VPH)
0- 1	770.	770.	0.
1- 2	486.	486.	0.
2- 3	418.	418.	0.
3- 4	441.	441.	0.
4- 5	688.	688.	0.
5- 6	1763.	1763.	0.
6- 7	4397.	4397.	0.
7- 8	6709.	6709.	0.
8- 9	5923.	5923.	0.
9-10	4566.	4566.	0.
10-11	4121.	4121.	0.
11-12	4309.	4309.	0.
12-13	4664.	4664.	0.
13-14	4879.	4879.	0.
14-15	5902.	5902.	0.
15-16	6763.	6763.	0.
16-17	7197.	6083.	1114.
17-18	6995.	5928.	1067.
18-19	6694.	5928.	766.
19-20	3789.	3789.	0.
20-21	2717.	2717.	0.
21-22	2741.	2741.	0.
22-23	2403.	2403.	0.
23-24	1787.	1787.	0.

NOTE: THESE ESTIMATES ASSUME THAT TRAFFIC WILL DIVERT SUCH THAT
QUEUE LENGTHS NEVER EXCEED 1.50 MILES.

♀ SUMMARY OF TRAFFIC VOLUMES -- OUTBOUND DIRECTION PAGE 6 OF 6
ALT 3c Phase 1&2 WB & 3 lanes EB QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	VOLUME REMAINING ON FREEWAY (VPH)	VOLUME DIVERTING FROM FREEWAY (VPH)
0- 1	560.	560.	0.

1- 2	342.	342.	0.
2- 3	311.	311.	0.
3- 4	332.	332.	0.
4- 5	579.	579.	0.
5- 6	1571.	1571.	0.
6- 7	4015.	4015.	0.
7- 8	4929.	4929.	0.
8- 9	4079.	4079.	0.
9-10	3410.	3410.	0.
10-11	3210.	3210.	0.
11-12	3264.	3264.	0.
12-13	3404.	3404.	0.
13-14	3650.	3650.	0.
14-15	4038.	4038.	0.
15-16	4768.	4768.	0.
16-17	5057.	4502.	555.
17-18	4635.	4239.	396.
18-19	3707.	3707.	0.
19-20	2499.	2499.	0.
20-21	1925.	1925.	0.
21-22	2014.	2014.	0.
22-23	2029.	2029.	0.
23-24	1864.	1864.	0.

NOTE: THESE ESTIMATES ASSUME THAT TRAFFIC WILL DIVERT SUCH THAT
QUEUE LENGTHS NEVER EXCEED 1.50 MILES.

EXCESS EMISSIONS (DIFFERENCE)

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	133.3	970.0	-119.3
Outbound	97.0	684.7	-88.5

BASE EMISSIONS

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	266.7	1557.1	466.0
Outbound	192.0	1129.2	347.9

CONSTRUCTION RELATED EMISSIONS

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	466.2	2943.0	360.8
Outbound	345.4	2168.8	271.4

QUEWZ-98 Alternative 3. c – Phase 1 & 3 – 4 lanes WB and 1 lane EB crossover

INPUT DATA SUMMARY: ROAD USER COST OUTPUT PAGE 1 OF 6
ALT 3c Phase 1 & 3 4 WB & 1 lane EB crossover QUEWZ-98

LANE CLOSURE CONFIGURATION:

TOTAL NUMBER OF LANES	
INBOUND	5
OUTBOUND	4
NUMBER OF OPEN LANES	
INBOUND	4 WB
OUTBOUND	1 EB crossover
LENGTH OF WORK ZONE	2.00 MILES
INBOUND CAPACITY (WESTBOUND)	E=1.5
NORMAL	10000. (VPH)
RESTRICTED	7200. (VPH)
WORKING HOURS	5928. (VPH)/4= 1482 VEH/HR/LN
OUTBOUND CAPACITY (EASTBOUND)	E=2.5
NORMAL	8000. (VPH)
RESTRICTED	1800. (VPH)
WORKING HOURS	1488. (VPH)/1= 1488 VEH/HR/LN

TRAFFIC PARAMETERS:

PERCENTAGE TRUCK	5.

SCHEDULE OF WORK ACTIVITY:

HOURS OF RESTRICTED CAPACITY	
BEGINNING	0
ENDING	24
HOURS OF WORK ZONE ACTIVITY	
BEGINNING	0
ENDING	24

IDLE HC CAR	34.9 (g/hr)	IDLE HC TRUCK	12.6 (g/hr)
IDLE CO CAR	218.5 (g/hr)	IDLE CO TRUCK	94.6 (g/hr)
IDLE NOX CAR	4.7 (g/hr)	IDLE NOX TRUCK	53.1 (g/hr)

♀ SUMMARY OF ADDITIONAL ROAD USER COSTS PAGE 2 OF 6
ALT 3c Phase 1&2 WB & 1 lane EB QUEWZ-98

HOUR	ADDITIONAL ROAD USER COSTS ($) INBOUND	OUTBOUND	TOTAL
0- 1	13.	5.	19.
1- 2	7.	3.	10.
2- 3	6.	2.	8.
3- 4	6.	2.	9.
4- 5	11.	6.	18.
5- 6	63.	70.	133.
6- 7	750.	3776.	4525.
7- 8	17586.	9724.	27310.
8- 9	26421.	14157.	40578.
9-10	8129.	9534.	17664.
10-11	610.	1249.	1859.
11-12	702.	217.	919.
12-13	909.	248.	1157.
13-14	1057.	329.	1386.

14-15	4549.	458.	5008.
15-16	18330.	3077.	21407.
16-17	33819.	1687.	35506.
17-18	35656.	463.	36119.
18-19	34563.	162.	34725.
19-20	7188.	101.	7289.
20-21	181.	39.	220.
21-22	186.	69.	254.
22-23	131.	183.	314.
23-24	65.	212.	277.
TOTAL	190938.	45774.	236713.

♀ SUMMARY OF TRAFFIC CONDITIONS -- INBOUND DIRECTION PAGE 3 OF 6
ALT 3c Phase 1&2 WB & 1 lane EB QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	CAPACITY (VPH)	APPROACH SPEED (MPH)	WORK ZONE SPEED (MPH)	QUEUE LENGTH (MILES)
0- 1	770.	5928.	59.	58.	0.0
1- 2	486.	5928.	59.	59.	0.0
2- 3	418.	5928.	59.	59.	0.0
3- 4	441.	5928.	59.	59.	0.0
4- 5	688.	5928.	59.	58.	0.0
5- 6	1763.	5928.	57.	55.	0.0
6- 7	4397.	5928.	53.	49.	0.0
7- 8	6709.	5928.	50.	30.	0.6
8- 9	5923.	5928.	51.	30.	1.2
9-10	4566.	5928.	53.	38.	0.6
10-11	4121.	5928.	54.	49.	0.0
11-12	4309.	5928.	53.	49.	0.0
12-13	4664.	5928.	53.	48.	0.0
13-14	4879.	5928.	53.	48.	0.0
14-15	5902.	5928.	51.	35.	0.0
15-16	6763.	5928.	50.	30.	0.6
16-17	7197.	5928.	49.	30.	1.4
17-18	6995.	5928.	49.	30.	1.5
18-19	6694.	5928.	50.	30.	1.5
19-20	3789.	5928.	54.	41.	0.7
20-21	2717.	5928.	56.	53.	0.0
21-22	2741.	5928.	56.	53.	0.0
22-23	2403.	5928.	56.	54.	0.0
23-24	1787.	5928.	57.	55.	0.0

NOTE: TRAFFIC DIVERSION IS PREDICTED, SEE SUMMARY OF TRAFFIC VOLUMES

SUMMARY OF TRAFFIC CONDITIONS -- OUTBOUND DIRECTION PAGE 4 OF 6
ALT 3c Phase 1&2 WB & 1 lane EB QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	CAPACITY (VPH)	APPROACH SPEED (MPH)	WORK ZONE SPEED (MPH)	QUEUE LENGTH (MILES)
0- 1	223.	1488.	60.	58.	0.0
1- 2	140.	1488.	60.	59.	0.0
2- 3	122.	1488.	60.	59.	0.0
3- 4	138.	1488.	60.	59.	0.0
4- 5	240.	1488.	60.	58.	0.0
5- 6	717.	1488.	59.	53.	0.0
6- 7	1635.	1488.	57.	30.	0.1

7- 8	1809.	1488.	57.	30.	0.6
8- 9	1558.	1488.	57.	30.	1.0
9-10	1091.	1488.	58.	30.	0.6
10-11	1139.	1488.	58.	41.	0.1
11-12	1062.	1488.	58.	49.	0.0
12-13	1109.	1488.	58.	49.	0.0
13-14	1213.	1488.	58.	48.	0.0
14-15	1342.	1488.	57.	46.	0.0
15-16	1583.	1488.	57.	30.	0.1
16-17	1329.	1488.	57.	37.	0.1
17-18	1346.	1488.	57.	46.	0.0
18-19	964.	1488.	58.	50.	0.0
19-20	819.	1488.	58.	52.	0.0
20-21	573.	1488.	59.	54.	0.0
21-22	712.	1488.	59.	53.	0.0
22-23	1004.	1488.	58.	50.	0.0
23-24	1055.	1488.	58.	49.	0.0

NOTE: TRAFFIC DIVERSION IS PREDICTED, SEE SUMMARY OF TRAFFIC VOLUMES

♀ SUMMARY OF TRAFFIC VOLUMES -- INBOUND DIRECTION PAGE 5 OF 6
ALT 3c Phase 1&2 WB & 1 lane EB QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	VOLUME REMAINING ON FREEWAY (VPH)	VOLUME DIVERTING FROM FREEWAY (VPH)
0- 1	770.	770.	0.
1- 2	486.	486.	0.
2- 3	418.	418.	0.
3- 4	441.	441.	0.
4- 5	688.	688.	0.
5- 6	1763.	1763.	0.
6- 7	4397.	4397.	0.
7- 8	6709.	6709.	0.
8- 9	5923.	5923.	0.
9-10	4566.	4566.	0.
10-11	4121.	4121.	0.
11-12	4309.	4309.	0.
12-13	4664.	4664.	0.
13-14	4879.	4879.	0.
14-15	5902.	5902.	0.
15-16	6763.	6763.	0.
16-17	7197.	6083.	1114.
17-18	6995.	5928.	1067.
18-19	6694.	5928.	766.
19-20	3789.	3789.	0.
20-21	2717.	2717.	0.
21-22	2741.	2741.	0.
22-23	2403.	2403.	0.
23-24	1787.	1787.	0.

NOTE: THESE ESTIMATES ASSUME THAT TRAFFIC WILL DIVERT SUCH THAT
QUEUE LENGTHS NEVER EXCEED 1.50 MILES.

♀ SUMMARY OF TRAFFIC VOLUMES -- OUTBOUND DIRECTION PAGE 6 OF 6
ALT 3c Phase 1&2 WB & 1 lane EB QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	VOLUME REMAINING ON FREEWAY (VPH)	VOLUME DIVERTING FROM FREEWAY (VPH)
0- 1	223.	223.	0.

1- 2	140.	140.	0.
2- 3	122.	122.	0.
3- 4	138.	138.	0.
4- 5	240.	240.	0.
5- 6	717.	717.	0.
6- 7	1635.	1635.	0.
7- 8	1809.	1809.	0.
8- 9	1558.	1558.	0.
9-10	1091.	1091.	0.
10-11	1139.	1139.	0.
11-12	1062.	1062.	0.
12-13	1109.	1109.	0.
13-14	1213.	1213.	0.
14-15	1342.	1342.	0.
15-16	1583.	1583.	0.
16-17	1329.	1329.	0.
17-18	1346.	1346.	0.
18-19	964.	964.	0.
19-20	819.	819.	0.
20-21	573.	573.	0.
21-22	712.	712.	0.
22-23	1004.	1004.	0.
23-24	1055.	1055.	0.

NOTE: THESE ESTIMATES ASSUME THAT TRAFFIC WILL DIVERT SUCH THAT
QUEUE LENGTHS NEVER EXCEED 1.50 MILES.

EXCESS EMISSIONS (DIFFERENCE)

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	133.3	970.0	-119.3
Outbound	46.2	214.7	-32.5

BASE EMISSIONS

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	266.7	1557.1	466.0
Outbound	62.5	463.6	125.1

CONSTRUCTION RELATED EMISSIONS

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	466.2	2943.0	360.8
Outbound	126.3	789.2	96.4

QUEWZ-98 Alternative 3. c – Phase 4 & 5 – 4 lanes EB and 2 lanes WB

LANE CLOSURE CONFIGURATION:

TOTAL NUMBER OF LANES	
INBOUND	4
OUTBOUND	5
NUMBER OF OPEN LANES	
INBOUND	2 WB I=80 (11' LANES)
OUTBOUND	4 EB I=80 (11' LANES)
LENGTH OF WORK ZONE	2.00 MILES R=0
INBOUND CAPACITY (WESTBOUND)	E=1.5
NORMAL	8000. (VPH)
RESTRICTED	3600. (VPH)
WORKING HOURS	2964. (VPH)/2= 1482 VEH/HR/LN
OUTBOUND CAPACITY (EASTBOUND)	E=2.5
NORMAL	10000. (VPH)
RESTRICTED	7200. (VPH)
WORKING HOURS	5652. (VPH)/4= 1413 VEH/HR/LN

TRAFFIC PARAMETERS:

PERCENTAGE TRUCK	5.

SCHEDULE OF WORK ACTIVITY:

HOURS OF RESTRICTED CAPACITY	
BEGINNING	0
ENDING	24
HOURS OF WORK ZONE ACTIVITY	
BEGINNING	0
ENDING	24

IDLE HC CAR	34.9 (g/hr)	IDLE HC TRUCK	12.6 (g/hr)
IDLE CO CAR	218.5 (g/hr)	IDLE CO TRUCK	94.6 (g/hr)
IDLE NOX CAR	4.7 (g/hr)	IDLE NOX TRUCK	53.1 (g/hr)

♀ SUMMARY OF ADDITIONAL ROAD USER COSTS PAGE 2 OF 6
ALT 3c Phase 4 & 5 EB & 2 (11' lanes)EB QUEWZ-98

HOUR	ADDITIONAL ROAD USER COSTS ($) INBOUND	OUTBOUND	TOTAL
0- 1	8.	14.	22.
1- 2	4.	7.	11.
2- 3	3.	6.	9.
3- 4	3.	7.	10.
4- 5	6.	16.	22.
5- 6	37.	128.	165.
6- 7	442.	5786.	6227.
7- 8	8870.	20410.	29281.
8- 9	13216.	31214.	44431.
9-10	4111.	14073.	18184.
10-11	360.	824.	1185.
11-12	414.	810.	1224.
12-13	533.	931.	1464.
13-14	618.	1199.	1817.

14-15	2398.	1823.	4221.
15-16	9241.	16167.	25408.
16-17	20419.	29692.	50111.
17-18	26637.	32725.	59362.
18-19	25667.	17915.	43582.
19-20	8381.	363.	8744.
20-21	109.	161.	270.
21-22	111.	204.	315.
22-23	79.	274.	353.
23-24	39.	246.	285.
TOTAL	121707.	174997.	296704.

♀ SUMMARY OF TRAFFIC CONDITIONS -- INBOUND DIRECTION PAGE 3 OF 6
ALT 3c Phase 4 & 5 EB & 2 (11' lanes)EB QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	CAPACITY (VPH)	APPROACH SPEED (MPH)	WORK ZONE SPEED (MPH)	QUEUE LENGTH (MILES)
0- 1	385.	2964.	59.	58.	0.0
1- 2	243.	2964.	60.	59.	0.0
2- 3	209.	2964.	60.	59.	0.0
3- 4	221.	2964.	60.	59.	0.0
4- 5	344.	2964.	59.	58.	0.0
5- 6	882.	2964.	58.	55.	0.0
6- 7	2199.	2964.	56.	49.	0.0
7- 8	3355.	2964.	54.	30.	0.4
8- 9	2962.	2964.	54.	30.	0.7
9-10	2283.	2964.	56.	38.	0.4
10-11	2061.	2964.	56.	49.	0.0
11-12	2155.	2964.	56.	49.	0.0
12-13	2332.	2964.	56.	48.	0.0
13-14	2440.	2964.	55.	48.	0.0
14-15	2951.	2964.	54.	35.	0.0
15-16	3382.	2964.	54.	30.	0.4
16-17	3599.	2964.	53.	30.	1.1
17-18	3498.	2964.	53.	30.	1.5
18-19	3347.	2964.	54.	30.	1.5
19-20	1895.	2964.	56.	35.	0.8
20-21	1359.	2964.	57.	53.	0.0
21-22	1371.	2964.	57.	53.	0.0
22-23	1202.	2964.	58.	54.	0.0
23-24	894.	2964.	58.	55.	0.0

NOTE: TRAFFIC DIVERSION IS PREDICTED, SEE SUMMARY OF TRAFFIC VOLUMES

SUMMARY OF TRAFFIC CONDITIONS -- OUTBOUND DIRECTION PAGE 4 OF 6
ALT 3c Phase 4 & 5 EB & 2 (11' lanes)EB QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	CAPACITY (VPH)	APPROACH SPEED (MPH)	WORK ZONE SPEED (MPH)	QUEUE LENGTH (MILES)
0- 1	783.	5652.	59.	58.	0.0
1- 2	482.	5652.	59.	59.	0.0
2- 3	432.	5652.	59.	59.	0.0
3- 4	470.	5652.	59.	59.	0.0
4- 5	819.	5652.	59.	58.	0.0
5- 6	2288.	5652.	57.	54.	0.0
6- 7	5650.	5652.	51.	32.	0.0

7- 8	6738.	5652.	50.	30.	0.8
8- 9	5637.	5652.	51.	30.	1.5
9-10	4501.	5652.	53.	33.	0.7
10-11	4349.	5652.	53.	48.	0.0
11-12	4326.	5652.	53.	48.	0.0
12-13	4513.	5652.	53.	48.	0.0
13-14	4863.	5652.	53.	47.	0.0
14-15	5380.	5652.	52.	45.	0.0
15-16	6351.	5652.	50.	30.	0.5
16-17	6386.	5652.	50.	30.	1.3
17-18	5981.	5652.	51.	30.	1.5
18-19	4671.	5652.	53.	30.	0.8
19-20	3318.	5652.	55.	51.	0.0
20-21	2498.	5652.	56.	53.	0.0
21-22	2726.	5652.	56.	53.	0.0
22-23	3033.	5652.	55.	52.	0.0
23-24	2919.	5652.	56.	52.	0.0

NOTE: TRAFFIC DIVERSION IS PREDICTED, SEE SUMMARY OF TRAFFIC VOLUMES

SUMMARY OF TRAFFIC VOLUMES -- INBOUND DIRECTION PAGE 5 OF 6
ALT 3c Phase 4 & 5 EB & 2 (11' lanes)EB QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	VOLUME REMAINING ON FREEWAY (VPH)	VOLUME DIVERTING FROM FREEWAY (VPH)
0- 1	385.	385.	0.
1- 2	243.	243.	0.
2- 3	209.	209.	0.
3- 4	221.	221.	0.
4- 5	344.	344.	0.
5- 6	882.	882.	0.
6- 7	2199.	2199.	0.
7- 8	3355.	3355.	0.
8- 9	2962.	2962.	0.
9-10	2283.	2283.	0.
10-11	2061.	2061.	0.
11-12	2155.	2155.	0.
12-13	2332.	2332.	0.
13-14	2440.	2440.	0.
14-15	2951.	2951.	0.
15-16	3382.	3382.	0.
16-17	3599.	3338.	261.
17-18	3498.	2964.	534.
18-19	3347.	2964.	383.
19-20	1895.	1895.	0.
20-21	1359.	1359.	0.
21-22	1371.	1371.	0.
22-23	1202.	1202.	0.
23-24	894.	894.	0.

NOTE: THESE ESTIMATES ASSUME THAT TRAFFIC WILL DIVERT SUCH THAT
QUEUE LENGTHS NEVER EXCEED 1.50 MILES.

SUMMARY OF TRAFFIC VOLUMES -- OUTBOUND DIRECTION PAGE 6 OF 6
ALT 3c Phase 4 & 5 EB & 2 (11' lanes)EB QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	VOLUME REMAINING ON FREEWAY (VPH)	VOLUME DIVERTING FROM FREEWAY (VPH)
0- 1	783.	783.	0.

1- 2	482.	482.	0.
2- 3	432.	432.	0.
3- 4	470.	470.	0.
4- 5	819.	819.	0.
5- 6	2288.	2288.	0.
6- 7	5650.	5650.	0.
7- 8	6738.	6642.	96.
8- 9	5637.	5637.	0.
9-10	4501.	4501.	0.
10-11	4349.	4349.	0.
11-12	4326.	4326.	0.
12-13	4513.	4513.	0.
13-14	4863.	4863.	0.
14-15	5380.	5380.	0.
15-16	6351.	6351.	0.
16-17	6386.	5943.	443.
17-18	5981.	5652.	329.
18-19	4671.	4671.	0.
19-20	3318.	3318.	0.
20-21	2498.	2498.	0.
21-22	2726.	2726.	0.
22-23	3033.	3033.	0.
23-24	2919.	2919.	0.

NOTE: THESE ESTIMATES ASSUME THAT TRAFFIC WILL DIVERT SUCH THAT
QUEUE LENGTHS NEVER EXCEED 1.50 MILES.

EXCESS EMISSIONS (DIFFERENCE)

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	106.5	700.1	-68.2
Outbound	127.8	928.3	-117.6

BASE EMISSIONS

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	130.9	799.2	251.5
Outbound	262.0	1532.7	468.3

CONSTRUCTION RELATED EMISSIONS

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	281.1	1773.8	192.6
Outbound	491.9	3102.8	372.4

QUEWZ-98 Alternative 3. c – Phase 4 & 5 – 4 lanes EB and 2 lanes WB crossover

INPUT DATA SUMMARY: ROAD USER COST OUTPUT — PAGE 1 OF 6
ALT 3c Phase 4 & 5 EB & 2 (12' lanes) WB crossover — QUEWZ-98

LANE CLOSURE CONFIGURATION:

TOTAL NUMBER OF LANES	
INBOUND	4
OUTBOUND	5
NUMBER OF OPEN LANES	
INBOUND	2 WB I=0 (12' lanes)
OUTBOUND	4 EB I=80 (11' lanes)
LENGTH OF WORK ZONE	2.00 MILES R=0
INBOUND CAPACITY (WESTBOUND)	E=1.5
NORMAL	8000. (VPH)
RESTRICTED	3600. (VPH)
WORKING HOURS	3120. (VPH)/2= 1560 VEH/HR/LN
OUTBOUND CAPACITY (EASTBOUND)	E=2.5
NORMAL	10000. (VPH)
RESTRICTED	7200. (VPH)
WORKING HOURS	5652. (VPH)/4= 1413 VEH/HR/LN

TRAFFIC PARAMETERS:

PERCENTAGE TRUCK	5.

SCHEDULE OF WORK ACTIVITY:

HOURS OF RESTRICTED CAPACITY	
BEGINNING	0
ENDING	24
HOURS OF WORK ZONE ACTIVITY	
BEGINNING	0
ENDING	24

IDLE HC CAR	34.9 (g/hr)	IDLE HC TRUCK	12.6 (g/hr)
IDLE CO CAR	218.5 (g/hr)	IDLE CO TRUCK	94.6 (g/hr)
IDLE NOX CAR	4.7 (g/hr)	IDLE NOX TRUCK	53.1 (g/hr)

♀ SUMMARY OF ADDITIONAL ROAD USER COSTS — PAGE 2 OF 6
ALT 3c Phase 4 & 5 EB & 2 (12' lanes) WB — QUEWZ-98

HOUR	ADDITIONAL ROAD USER COSTS ($) INBOUND	OUTBOUND	TOTAL
0- 1	7.	14.	22.
1- 2	4.	7.	11.
2- 3	3.	6.	9.
3- 4	3.	7.	10.
4- 5	6.	16.	22.
5- 6	35.	128.	163.
6- 7	391.	5786.	6176.
7- 8	6919.	20410.	27329.
8- 9	7405.	31214.	38620.
9-10	647.	14073.	14720.
10-11	320.	824.	1145.
11-12	367.	810.	1177.
12-13	470.	931.	1402.
13-14	544.	1199.	1743.

14-15	1059.	1823.	2882.
15-16	7287.	16167.	23455.
16-17	16824.	29692.	46516.
17-18	24786.	32725.	57511.
18-19	24791.	17915.	42706.
19-20	7273.	363.	7636.
20-21	98.	161.	259.
21-22	101.	204.	304.
22-23	72.	274.	346.
23-24	36.	246.	282.
TOTAL	99449.	174997.	274445.

♀ SUMMARY OF TRAFFIC CONDITIONS -- INBOUND DIRECTION — PAGE 3 OF 6
ALT 3c Phase 4 & 5 EB & 2 (12' lanes) WB — QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	CAPACITY (VPH)	APPROACH SPEED (MPH)	WORK ZONE SPEED (MPH)	QUEUE LENGTH (MILES)
0- 1	385.	3120.	59.	58.	0.0
1- 2	243.	3120.	60.	59.	0.0
2- 3	209.	3120.	60.	59.	0.0
3- 4	221.	3120.	60.	59.	0.0
4- 5	344.	3120.	59.	58.	0.0
5- 6	882.	3120.	58.	56.	0.0
6- 7	2199.	3120.	56.	49.	0.0
7- 8	3355.	3120.	54.	30.	0.2
8- 9	2962.	3120.	54.	30.	0.3
9-10	2283.	3120.	56.	47.	0.1
10-11	2061.	3120.	56.	50.	0.0
11-12	2155.	3120.	56.	50.	0.0
12-13	2332.	3120.	56.	49.	0.0
13-14	2440.	3120.	55.	48.	0.0
14-15	2951.	3120.	54.	45.	0.0
15-16	3382.	3120.	54.	30.	0.2
16-17	3599.	3120.	53.	30.	0.9
17-18	3498.	3120.	53.	30.	1.5
18-19	3347.	3120.	54.	30.	1.5
19-20	1895.	3120.	56.	37.	0.8
20-21	1359.	3120.	57.	53.	0.0
21-22	1371.	3120.	57.	53.	0.0
22-23	1202.	3120.	58.	54.	0.0
23-24	894.	3120.	58.	56.	0.0

NOTE: TRAFFIC DIVERSION IS PREDICTED, SEE SUMMARY OF TRAFFIC VOLUMES

SUMMARY OF TRAFFIC CONDITIONS -- OUTBOUND DIRECTION — PAGE 4 OF 6
ALT 3c Phase 4 & 5 EB & 2 (12' lanes) WB — QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	CAPACITY (VPH)	APPROACH SPEED (MPH)	WORK ZONE SPEED (MPH)	QUEUE LENGTH (MILES)
0- 1	783.	5652.	59.	58.	0.0
1- 2	482.	5652.	59.	59.	0.0
2- 3	432.	5652.	59.	59.	0.0
3- 4	470.	5652.	59.	59.	0.0
4- 5	819.	5652.	59.	58.	0.0
5- 6	2288.	5652.	57.	54.	0.0
6- 7	5650.	5652.	51.	32.	0.0

7- 8	6738.	5652.	50.	30.	0.8
8- 9	5637.	5652.	51.	30.	1.5
9-10	4501.	5652.	53.	33.	0.7
10-11	4349.	5652.	53.	48.	0.0
11-12	4326.	5652.	53.	48.	0.0
12-13	4513.	5652.	53.	48.	0.0
13-14	4863.	5652.	53.	47.	0.0
14-15	5380.	5652.	52.	45.	0.0
15-16	6351.	5652.	50.	30.	0.5
16-17	6386.	5652.	50.	30.	1.3
17-18	5981.	5652.	51.	30.	1.5
18-19	4671.	5652.	53.	30.	0.8
19-20	3318.	5652.	55.	51.	0.0
20-21	2498.	5652.	56.	53.	0.0
21-22	2726.	5652.	56.	53.	0.0
22-23	3033.	5652.	55.	52.	0.0
23-24	2919.	5652.	56.	52.	0.0

NOTE: TRAFFIC DIVERSION IS PREDICTED, SEE SUMMARY OF TRAFFIC VOLUMES

SUMMARY OF TRAFFIC VOLUMES -- INBOUND DIRECTION PAGE 5 OF 6
ALT 3c Phase 4 & 5 EB & 2 (12' lanes) WB QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	VOLUME REMAINING ON FREEWAY (VPH)	VOLUME DIVERTING FROM FREEWAY (VPH)
0- 1	385.	385.	0.
1- 2	243.	243.	0.
2- 3	209.	209.	0.
3- 4	221.	221.	0.
4- 5	344.	344.	0.
5- 6	882.	882.	0.
6- 7	2199.	2199.	0.
7- 8	3355.	3355.	0.
8- 9	2962.	2962.	0.
9-10	2283.	2283.	0.
10-11	2061.	2061.	0.
11-12	2155.	2155.	0.
12-13	2332.	2332.	0.
13-14	2440.	2440.	0.
14-15	2951.	2951.	0.
15-16	3382.	3382.	0.
16-17	3599.	3599.	0.
17-18	3498.	3171.	327.
18-19	3347.	3120.	227.
19-20	1895.	1895.	0.
20-21	1359.	1359.	0.
21-22	1371.	1371.	0.
22-23	1202.	1202.	0.
23-24	894.	894.	0.

NOTE: THESE ESTIMATES ASSUME THAT TRAFFIC WILL DIVERT SUCH THAT
QUEUE LENGTHS NEVER EXCEED 1.50 MILES.

SUMMARY OF TRAFFIC VOLUMES -- OUTBOUND DIRECTION PAGE 6 OF 6
ALT 3c Phase 4 & 5 EB & 2 (12' lanes) WB QUEWZ-98

HOUR	APPROACH VOLUME (VPH)	VOLUME REMAINING ON FREEWAY (VPH)	VOLUME DIVERTING FROM FREEWAY (VPH)
0- 1	783.	783.	0.

1- 2	482.	482.	0.
2- 3	432.	432.	0.
3- 4	470.	470.	0.
4- 5	819.	819.	0.
5- 6	2288.	2288.	0.
6- 7	5650.	5650.	0.
7- 8	6738.	6642.	96.
8- 9	5637.	5637.	0.
9-10	4501.	4501.	0.
10-11	4349.	4349.	0.
11-12	4326.	4326.	0.
12-13	4513.	4513.	0.
13-14	4863.	4863.	0.
14-15	5380.	5380.	0.
15-16	6351.	6351.	0.
16-17	6386.	5943.	443.
17-18	5981.	5652.	329.
18-19	4671.	4671.	0.
19-20	3318.	3318.	0.
20-21	2498.	2498.	0.
21-22	2726.	2726.	0.
22-23	3033.	3033.	0.
23-24	2919.	2919.	0.

NOTE: THESE ESTIMATES ASSUME THAT TRAFFIC WILL DIVERT SUCH THAT
QUEUE LENGTHS NEVER EXCEED 1.50 MILES.

EXCESS EMISSIONS (DIFFERENCE)

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	86.7	571.8	-64.3
Outbound	127.8	928.3	-117.6

BASE EMISSIONS

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	126.6	771.7	243.0
Outbound	262.0	1532.7	468.3

CONSTRUCTION RELATED EMISSIONS

	HC (Kgs)	CO (Kgs)	NOx (Kgs)
Inbound	236.4	1488.6	183.6
Outbound	489.4	3086.9	371.9

Alternative 3.c

ODOT Queue Spreadsheets

Phase 1 & 3 – 4 (11') lanes WB
1 (12') lane EB crossover
3 (11') lanes EB

Phase 2 - 4 (12') lanes WB
4 (11') lanes EB

The Phase 2 MOT lane configuration and lane widths for Alternative 3.c are the same as the existing condition for westbound traffic and are the same as Alternative 1.a(70), Phase 3 and 4 for the eastbound traffic. No separate ODOT Queue spreadsheet files were generated for these Phases. See Alternative 1.a(70), ODOT Queue spreadsheet, Phase 3 and 4 for results.

Phase 4 & 5 – 4 (11') lanes EB
2 (12') lanes WB crossover
2 (11') lanes WB

The Phase 4 and 5 MOT lane configuration and lane widths for Alternative 3.c are the same as Alternative 1.a(70), Phase 3 and 4 for the eastbound traffic. No separate ODOT Queue spreadsheet files were generated for this Phase. See Alternative 1.a(70), ODOT Queue spreadsheet, Phase 3 and 4 for results.

Alternative 3.c – Phase 1 & 3 – 4 (11') lanes WB

Queue Calc. Worksheet for Freeway Work Zones

Alternative 3c, Phase 1 & 3

CUY 480 Westbound (total volume)

Friday in August

Free Flow Work Zone Capacity (veh/ln/hr)	1482
Queued Work Zone Capacity (veh/ln/hr)	1482
One Way AADT (veh)	91122
Percent of Peak Period (>1000 vph) Traffic Diverted (%)	0
Number of Lanes for Queued Vehicles(lanes)	4
Number of vehicles in Queue per Lane Mile (veh)	108

Time Begining	Estimated or Actual Volume	Reduced Volume	Queue (Veh)	Queue (miles)
0:00	770	770	0	0.0
1:00	486	486	0	0.0
2:00	418	418	0	0.0
3:00	441	441	0	0.0
4:00	688	688	0	0.0
5:00	1763	1763	0	0.0
6:00	4397	4397	0	0.0
7:00	6709	6709	781	1.8
8:00	5923	5923	776	1.8
9:00	4566	4566	0	0.0
10:00	4121	4121	0	0.0
11:00	4309	4309	0	0.0
12:00	4664	4664	0	0.0
13:00	4879	4879	0	0.0
14:00	5902	5902	0	0.0
15:00	6763	6763	835	1.9
16:00	7197	7197	2104	4.9
17:00	6995	6995	3171	7.3
18:00	6694	6694	3937	9.1
19:00	3789	3789	1798	4.2
20:00	2717	2717	0	0.0
21:00	2741	2741	0	0.0
22:00	2403	2403	0	0.0
23:00	1787	1787	0	0.0

Alternative 3.c – Phase 1 & 3 – 3 (11') lanes EB

Queue Calc. Worksheet for Freeway Work Zones

Alternative 3c, phase 1 & 3 (3 lanes Eastbound)

CUY 480 Eastbound Through (55% thru + Ramps)	2.62%

Friday in August-Tuesday in June

Free Flow Work Zone Capacity (veh/ln/hr)	1413
Queued Work Zone Capacity (veh/ln/hr)	1413
One Way AADT (veh)	66191
Percent of Peak Period (>1000 vph) Traffic Diverted (%)	0
Number of Lanes for Queued Vehicles(lanes)	3
Number of vehicles in Queue per Lane Mile (veh)	108

Time Begining	Estimated or Actual Volume	Reduced Volume	Queue (Veh)	Queue (miles)
0:00	560	560	0	0.0
1:00	342	342	0	0.0
2:00	311	311	0	0.0
3:00	332	332	0	0.0
4:00	579	579	0	0.0
5:00	1571	1571	0	0.0
6:00	4015	4015	0	0.0
7:00	4929	4929	690	3.2
8:00	4079	4079	530	2.5
9:00	3410	3410	0	0.0
10:00	3210	3210	0	0.0
11:00	3264	3264	0	0.0
12:00	3404	3404	0	0.0
13:00	3650	3650	0	0.0
14:00	4038	4038	0	0.0
15:00	4768	4768	529	2.5
16:00	5057	5057	1347	6.2
17:00	4635	4635	1743	8.1
18:00	3707	3707	1211	5.6
19:00	2499	2499	0	0.0
20:00	1925	1925	0	0.0
21:00	2014	2014	0	0.0
22:00	2029	2029	0	0.0
23:00	1864	1864	0	0.0

Alternative 3.c – Phase 1 & 3 – 1 (12') lane EB crossover

Queue Calc. Worksheet for Freeway Work Zones

Alternative 3c, phase 1 & 3 (1 lane Eastbound)

CUY 480 Eastbound Through (45% thru)	2.62%

Friday in August-Tuesday in June

Free Flow Work Zone Capacity (veh/ln/hr)	1488
Queued Work Zone Capacity (veh/ln/hr)	1488
One Way AADT (veh)	22923
Percent of Peak Period (>1000 vph) Traffic Diverted (%)	0
Number of Lanes for Queued Vehicles(lanes)	1
Number of vehicles in Queue per Lane Mile (veh)	108

Time Begining	Estimated or Actual Volume	Reduced Volume	Queue (Veh)	Queue (miles)
0:00	223	223	0	0.0
1:00	140	140	0	0.0
2:00	122	122	0	0.0
3:00	138	138	0	0.0
4:00	240	240	0	0.0
5:00	717	717	0	0.0
6:00	1635	1635	147	0.7
7:00	1809	1809	467	2.2
8:00	1558	1558	538	2.5
9:00	1091	1091	141	0.7
10:00	1139	1139	0	0.0
11:00	1062	1062	0	0.0
12:00	1109	1109	0	0.0
13:00	1213	1213	0	0.0
14:00	1342	1342	0	0.0
15:00	1583	1583	95	0.4
16:00	1329	1329	0	0.0
17:00	1346	1346	0	0.0
18:00	964	964	0	0.0
19:00	819	819	0	0.0
20:00	573	573	0	0.0
21:00	712	712	0	0.0
22:00	1004	1004	0	0.0
23:00	1055	1055	0	0.0

Alternative 3.c – Phase 4 & 5 – 2 (11’) lanes WB

Queue Calc. Worksheet for Freeway Work Zones

Alternative 3c, Phase 3 & 4 (To IR 77 ramps + IR 480 thru)

CUY 480 Westbound

Friday in August

Free Flow Work Zone Capacity (veh/ln/hr)	1482
Queued Work Zone Capacity (veh/ln/hr)	1482
One Way AADT (veh)	45561
Percent of Peak Period (>1000 vph) Traffic Diverted (%)	0
Number of Lanes for Queued Vehicles(lanes)	2
Number of vehicles in Queue per Lane Mile (veh)	108

Time Begining	Estimated or Actual Volume	Reduced Volume	Queue (Veh)	Queue (miles)
0:00	385	385	0	0.0
1:00	243	243	0	0.0
2:00	209	209	0	0.0
3:00	221	221	0	0.0
4:00	344	344	0	0.0
5:00	882	882	0	0.0
6:00	2199	2199	0	0.0
7:00	3355	3355	391	1.8
8:00	2962	2962	388	1.8
9:00	2283	2283	0	0.0
10:00	2061	2061	0	0.0
11:00	2155	2155	0	0.0
12:00	2332	2332	0	0.0
13:00	2440	2440	0	0.0
14:00	2951	2951	0	0.0
15:00	3382	3382	418	1.9
16:00	3599	3599	1052	4.9
17:00	3498	3498	1586	7.3
18:00	3347	3347	1969	9.1
19:00	1895	1895	899	4.2
20:00	1359	1359	0	0.0
21:00	1371	1371	0	0.0
22:00	1202	1202	0	0.0
23:00	894	894	0	0.0

Alternative 3.c – Phase 4 & 5 – 2 (12’) lanes WB crossover

Queue Calc. Worksheet for Freeway Work Zones

Alternative 3c, Phase 3 & 4 (To IR 77 ramps + IR 480 thru)

CUY 480 Westbound

Friday in August

Free Flow Work Zone Capacity (veh/ln/hr)	1482
Queued Work Zone Capacity (veh/ln/hr)	1482
One Way AADT (veh)	45561
Percent of Peak Period (>1000 vph) Traffic Diverted (%)	0
Number of Lanes for Queued Vehicles(lanes)	2
Number of vehicles in Queue per Lane Mile (veh)	108

Time Begining	Estimated or Actual Volume	Reduced Volume	Queue (Veh)	Queue (miles)
0:00	385	385	0	0.0
1:00	243	243	0	0.0
2:00	209	209	0	0.0
3:00	221	221	0	0.0
4:00	344	344	0	0.0
5:00	882	882	0	0.0
6:00	2199	2199	0	0.0
7:00	3355	3355	391	1.8
8:00	2962	2962	388	1.8
9:00	2283	2283	0	0.0
10:00	2061	2061	0	0.0
11:00	2155	2155	0	0.0
12:00	2332	2332	0	0.0
13:00	2440	2440	0	0.0
14:00	2951	2951	0	0.0
15:00	3382	3382	418	1.9
16:00	3599	3599	1052	4.9
17:00	3498	3498	1586	7.3
18:00	3347	3347	1969	9.1
19:00	1895	1895	899	4.2
20:00	1359	1359	0	0.0
21:00	1371	1371	0	0.0
22:00	1202	1202	0	0.0
23:00	894	894	0	0.0

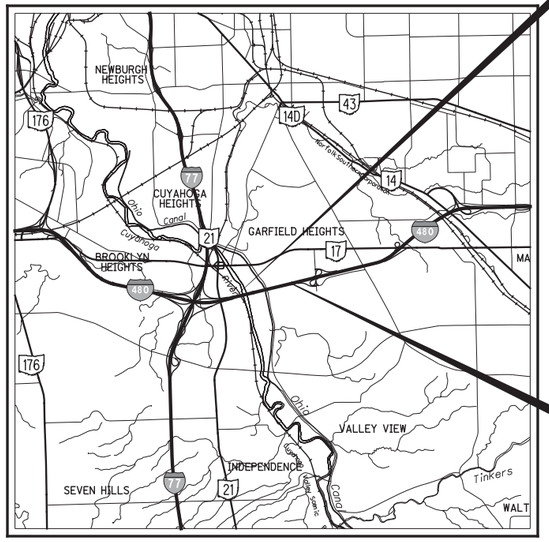
MAINTENANCE OF TRAFFIC ALTERNATIVE ANALYSIS

CUY-480-18.42 L/R, PID No. 90591

ATTACHED DRAWINGS

INDEX OF SHEETS

RICHLAND ENGINEERING LIMITED



BEGIN PROJECT
STA. 995+47.25

END PROJECT
STA. 1038+52.75

LOCATION MAP

LATITUDE: 41° 24′ 35″ N LONGITUDE: 81° 37′ 45″ W

SCALE IN MILES

0 1 2 3 4

N

PORTION TO BE IMPROVED
INTERSTATE & DIVIDED HIGHWAY
UNDIVIDED STATE & FEDERAL ROUTES
OTHER ROADS

DESIGN DESIGNATION

	IR 480
CURRENT ADT (2018)	146,190
DESIGN YEAR ADT (2038)	147,320
DESIGN HOURLY VOLUME (2038)	13,700
DIRECTIONAL DISTRIBUTION	50%
TRUCKS (24 HOUR B&C)	8%
DESIGN SPEED	60 MPH
LEGAL SPEED	60 MPH
DESIGN FUNCTIONAL CLASSIFICATION: URBAN INTERSTATE	
NHS PROJECT	YES

DESIGN EXCEPTIONS

UNDERGROUND UTILITIES

CONTACT BOTH SERVICES
CALL TWO WORKING DAYS
BEFORE YOU DIG

CALL
1-800-362-2764
(TOLL FREE)
OHIO UTILITIES PROTECTION SERVICE
NON-MEMBERS
MUST BE CALLED DIRECTLY

OIL & GAS PRODUCERS PROTECTIVE
SERVICE CALL: **1-800-925-0988**

PLAN PREPARED BY:

RICHLAND ENGINEERING LIMITED
29 NORTH PARK STREET
MANSFIELD OHIO 44902
PHONE: (419) 524-0074 FAX: (419) 524-1812

ENGINEERS SEAL:

SIGNED:
DATE:

STATE OF OHIO

DEPARTMENT OF TRANSPORTATION

CUY-480-18.42

CITY OF INDEPENDENCE
CITY OF VALLEY VIEW
CITY OF GARFIELD HEIGHTS
CUYAHOGA COUNTY

INDEX OF SHEETS:

STANDARD CONSTRUCTION DRAWINGS						SUPPLEMENTAL SPECIFICATIONS
						SPECIAL PROVISIONS

PROJECT DESCRIPTION

THE PROJECT CONSISTS OF THE REPLACEMENT OF THE DECKS ON THE BRIDGES CARRYING EB & WB IR-480 OVER THE CUYAHOGA RIVER, CANAL RD., TOWPATH TRAIL, CSX RAILROAD AND OHIO AND ERIE CANAL RESERVATION. ALSO INCLUDED IN THE PROJECT ARE SUBSTRUCTURE REPAIRS, BACK WALL REPAIRS, EXPANSION JOINT REHABILITATION/REPLACEMENTS, BRIDGE DRAINAGE REHABILITATION, AND APPROACH SLAB REPLACEMENTS.
PROJECT LENGTH = 2.5 MILES.

THIS IS A MAINTENANCE PROJECT

PROJECT EARTH DISTURBED AREA:	XXX ACRES
ESTIMATED CONTRACTOR EARTH DISTRUBED AREA:	XXX ACRES
NOTICE OF INTENT EARTH DISTURBED AREA:	N/A (NOT REQUIRED)

LIMITED ACCESS

THIS IMPROVEMENT IS ESPECIALLY DESIGNED FOR THROUGH TRAFFIC AND HAS BEEN DECLARED A LIMITED ACCESS HIGHWAY OR FREEWAY BY ACTION OF THE DIRECTOR IN ACCORDANCE WITH THE PROVISIONS OF SECTION 5511.02 OF THE OHIO REVISED CODE.

2013 SPECIFICATIONS

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

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

UNDER AUTHORITY OF SECTION 4511.21, DIVISION (H) OF THE OHIO REVISED CODE, THE REVISED PRIMA FACIE SPEED LIMITS AS INDICATED HEREIN ARE DETERMINED TO BE REASONABLE AND SAFE, AND ARE HEREBY ESTABLISHED FOR THE DURATION OF THIS PROJECT. THE PRIMA FACIE SPEED LIMIT OR LIMITS HEREBY ESTABLISHED SHALL BECOME EFFECTIVE WHEN APPROPRIATE SIGNS GIVING NOTICE THEREOF ARE ERECTED.

APPROVED _____
DATE _____ DISTRICT DEPUTY DIRECTOR

APPROVED _____
DATE _____ DIRECTOR, DEPARTMENT OF TRANSPORTATION

FEDERAL PROJECT NO.

PID NO. 90591

CONSTRUCTION PROJECT NO.

RAILROAD INVOLVEMENT
CSX RAILROAD

CUY-480-18.42

1

CITY OF CUYAHOGA HEIGHTS

VILLAGE OF BROOKLYN HEIGHTS

CITY OF GARFIELD HEIGHTS

CITY OF INDEPENDENCE

CITY OF VALLEY VIEW

LEGEND

CORPORATION LIMITS

HORIZONTAL SCALE IN FEET
0 250 500 1000

SCHEMATIC PLAN

CUY-480-18.42

2

RAMP N-W
RAMP W-N
RAMP W-S
RAMP S-W
RAMP S-E
RAMP E-S
RAMP N-E
RAMP E-N
RAMP F-1
RAMP F-2
RAMP F-3
RAMP F-4
RAMP F-5
RAMP F-6
RAMP F-7
RAMP W-98
RAMP 98-E
RAMP 98-W
RAMP E-98

PC Sta. 967+67.57
PT Sta. 985+57.45
S 77° 19' 43" E
N 76° 25' 11" E
N 76° 25' 11" E

BRECKSVILLE ROAD
CSX RAILROAD
CUYAHOGA RIVER
WEST CANAL ROAD
OHIO AND ERIE TOWPATH TRAIL
CANAL ROAD
OHIO AND ERIE CANAL
ELECTRIC TRANSMISSION TOWER
ELECTRIC TRANSMISSION TOWER
HIGH TENSION POWER LINE
HIGH TENSION POWER POLE
CELLULAR TOWER
EXCHANGE ST.
ROCKSIDE RD.
ANTENUCCI BLVD.
TRANSPORTATION BLVD. (E. 98TH ST.)
℄ CONST. IR-480
I.R. 77

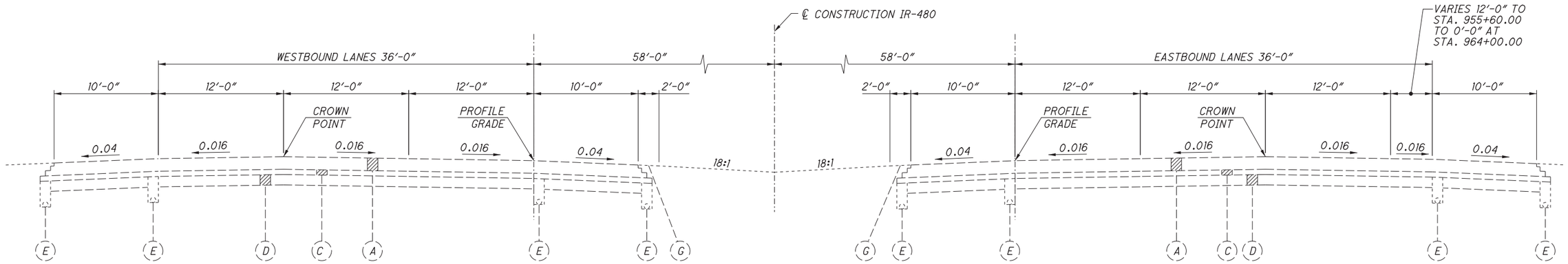
EQUATION:
Sta 1040+50.00 BK =
Sta 1040+26.85 AH

℄ IR-480 CURVE DATA

P.I.= Sta. 976+78.50
D = 26° 15' 06" (LT)
Dc = 1° 28' 00"
R = 3,906.53'
T = 910.93'
L = 1,789.88'
E = 104.80'
C = 1,774.26'
C.B. = N 89° 32' 44" E

BRIDGE NO. CUY-480-1842 L/R
SFN:

F:\2013\113012 IR 480\90591\roadway\sheets\90591GB001.dgn 11/20/2013 3:09:35 PM CraigBanghart



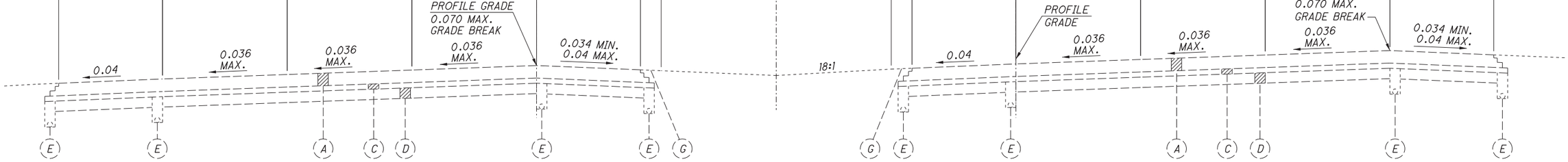
IR-480 (WESTBOUND)

STA. 951+64.74 TO STA. 964+48.00 = 1283.26 FT.

EXISTING NORMAL TYPICAL SECTION

IR-480 (EASTBOUND)

STA. 947+29.68 TO STA. 964+48.00 = 1718.32 FT.



IR-480 (WESTBOUND)

STA. 964+48.00 TO STA. 966+35.18 = 187.18 FT.
STA. 970+54.18 TO STA. 988+80.00 = 1826.00 FT.
TOTAL = 2013.18 FT.

EXISTING SUPERELEVATED TYPICAL SECTION

IR-480 (EASTBOUND)

STA. 964+48.00 TO STA. 967+27.50 = 279.50 FT.
STA. 971+32.77 TO STA. 988+80.00 = 2026.73 FT.
TOTAL = 2306.23 FT.

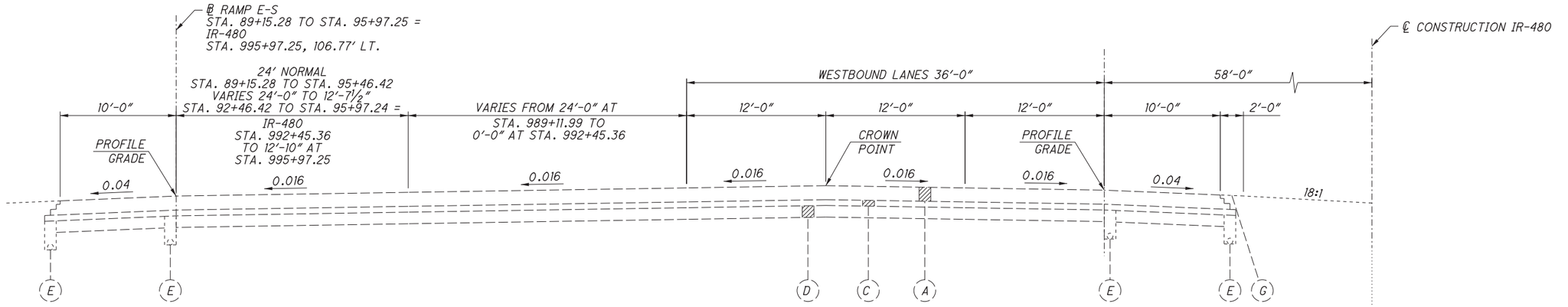
EXISTING LEGEND

- (A) ASPHALT CONCRETE, 14.5″
- (B) REINFORCED CONCRETE PAVEMENT, 10″, 9″ ON RAMPS
- (C) 6″ AGGREGATE BASE
- (D) 24″ GRANULAR MATERIAL, TYPE B
- (E) UNDERDRAIN
- (F) GUARDRAIL
- (G) VARIABLE DEPTH SUBBASE
- (H) 3″ BITUMINOUS AGGREGATE BASE
- (I) 10″ CONCRETE BASE
- (J) CONCRETE APPROACH SLAB, 13″
- (K) ASPHALT OVERLAY, 5″ ON MAINLINE, 3″ ON RAMPS, 2½″ ON APPROACH SLABS
- (L) WINGWALL PARAPET
- (M) CURB
- (N) 3″ ASPHALT UNDER GUARDRAIL
- (O) 3″ ASPHALT CONCRETE

EXISTING TYPICAL SECTIONS - IR-480

CUY-480-18.42

3

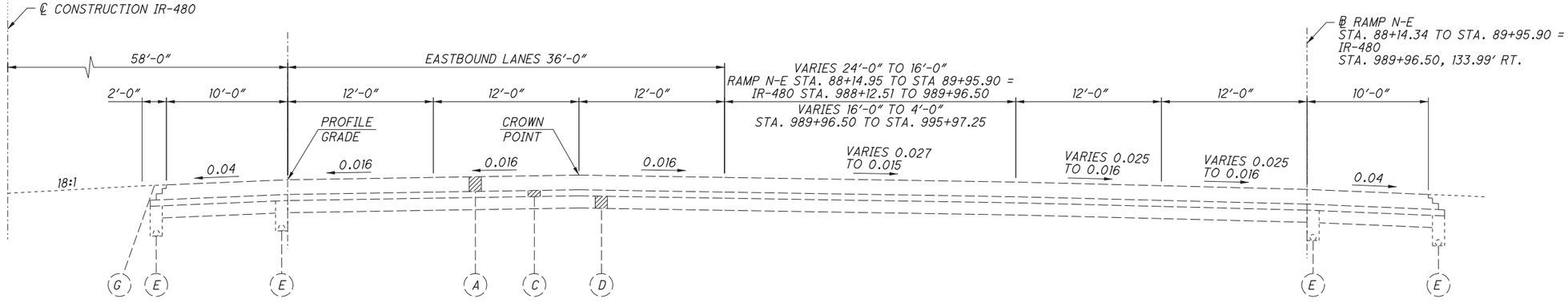


TERMINAL SECTION IR-480 & RAMP E-S

IR-480 STA. 989+11.99 TO STA. 995+97.25 = 685.26 FT.
RAMP E-S STA. 89+15.28 TO STA. 95+97.25 = 681.97 FT.

NORMAL SECTION IR-480 (WESTBOUND)

IR-480 STA. 988+80.00 TO STA. 995+97.25 = 717.25 FT.



NORMAL SECTION IR-480 (EASTBOUND)

IR-480 STA. 988+80.00 TO STA. 995+97.25 = 717.25 FT.

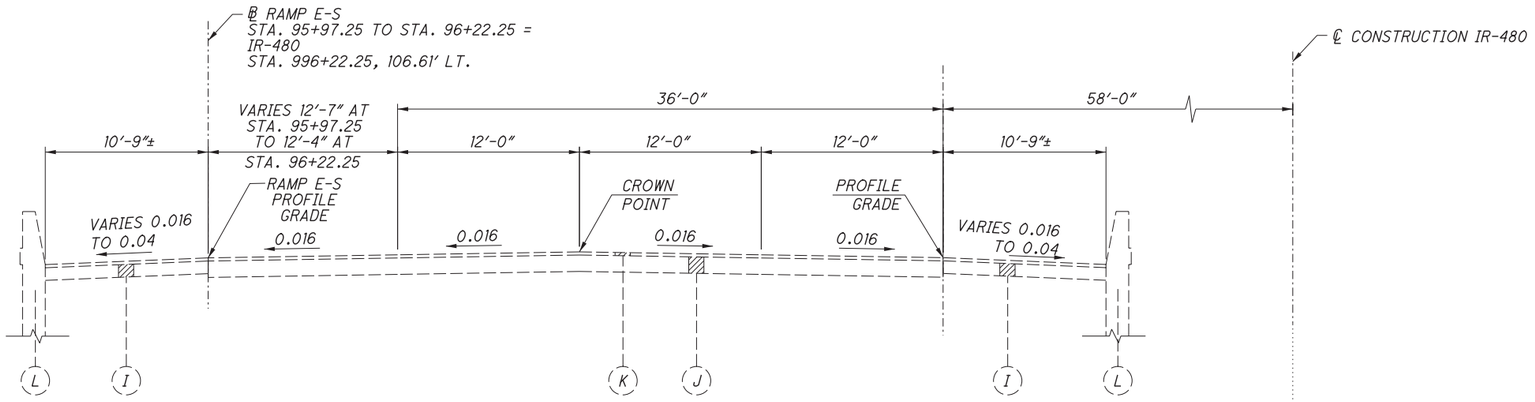
TERMINAL SECTION IR-480 & RAMP N-E

IR-480 STA. 988+12.51 TO STA. 995+97.25 = 784.74 FT.
RAMP N-E STA. 88+14.95 TO STA. 89+95.90 = 180.95 FT.
RAMP N-E STA. 89+95.90 = STA. 989+96.50 IR-480
IR-480 STA. 989+96.50 TO STA. 995+97.25

FOR THE EXISTING ITEM LEGEND SEE SHEET 3 .

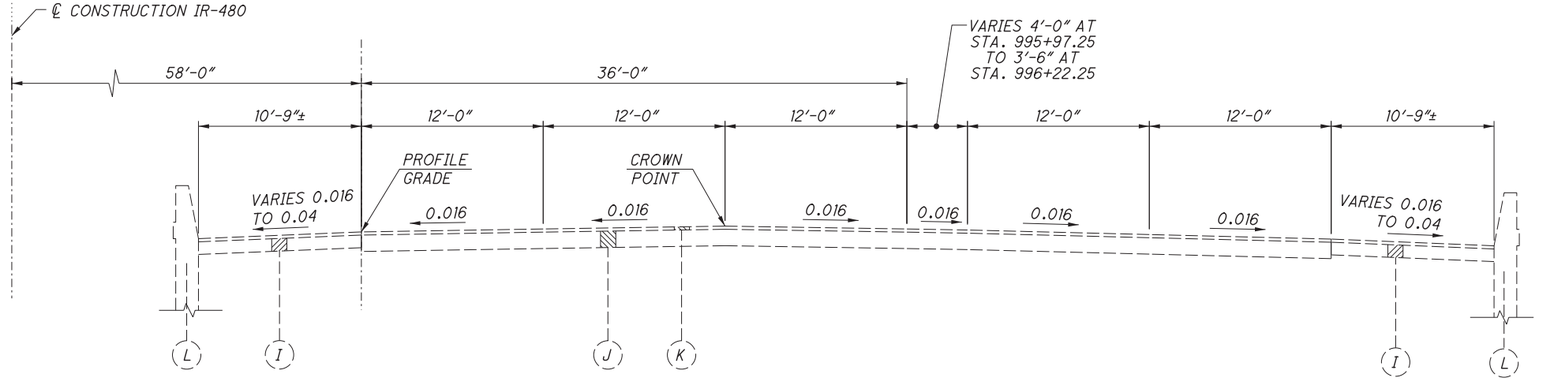
EXISTING TYPICAL SECTIONS - IR-480

CUY-480-18.42



APPROACH SLAB TYPICAL SECTION IR-480 (WESTBOUND)

STA. 995+97.25 TO STA. 996+22.25 = 25.00 FT.



APPROACH SLAB TYPICAL SECTION IR-480 (EASTBOUND)

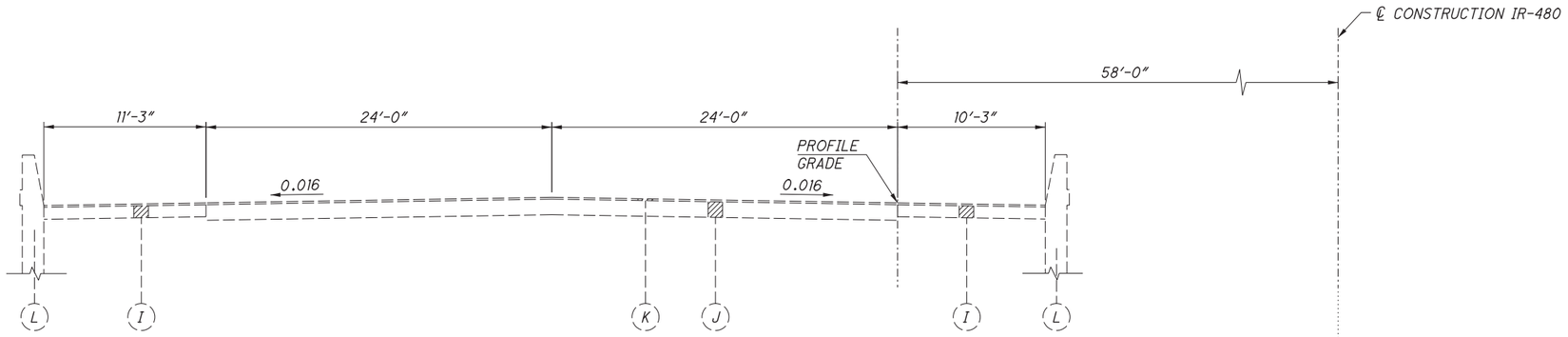
STA. 995+97.25 TO STA. 996+22.25 = 25.00 FT.

FOR THE EXISTING ITEM LEGEND SEE SHEET 3 .

EXISTING REAR APPROACH SLAB TYPICAL SECTIONS - IR-480

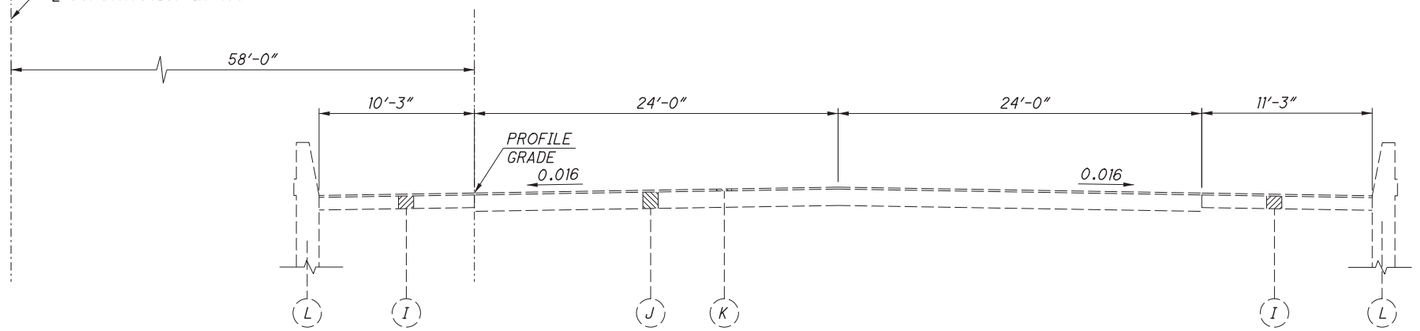
CUY-480-18.42

5



APPROACH SLAB TYPICAL SECTION IR-480 (WESTBOUND)

STA. 1037+77.75 TO STA. 1038+02.75 = 25.00 FT.



APPROACH SLAB TYPICAL SECTION IR-480 (EASTBOUND)

STA. 1037+77.75 TO STA. 1038+02.75 = 25.00 FT.

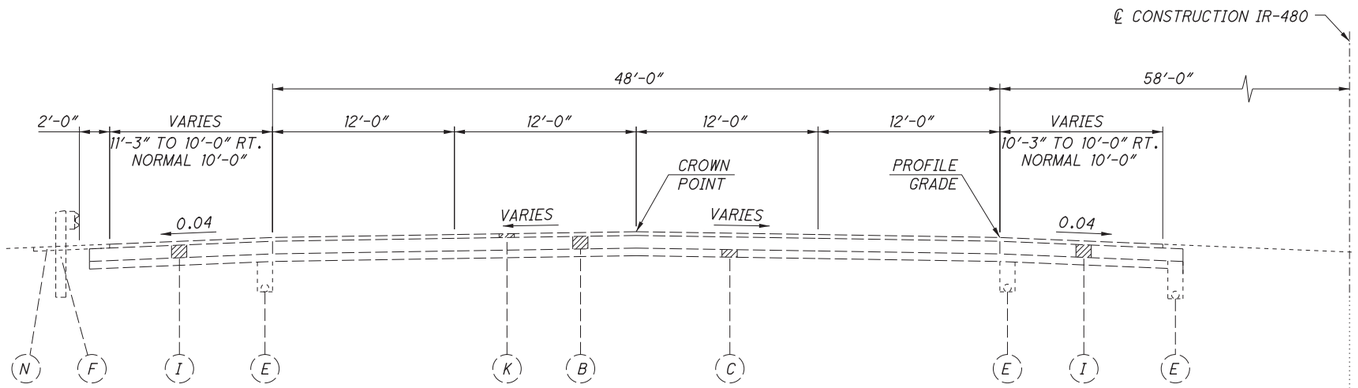
FOR THE EXISTING ITEM LEGEND SEE SHEET 3 .

APPROACH SLAB TYPICAL SECTIONS - IR-480

EXISTING FORWARD APPROACH SLAB TYPICAL SECTIONS - IR-480

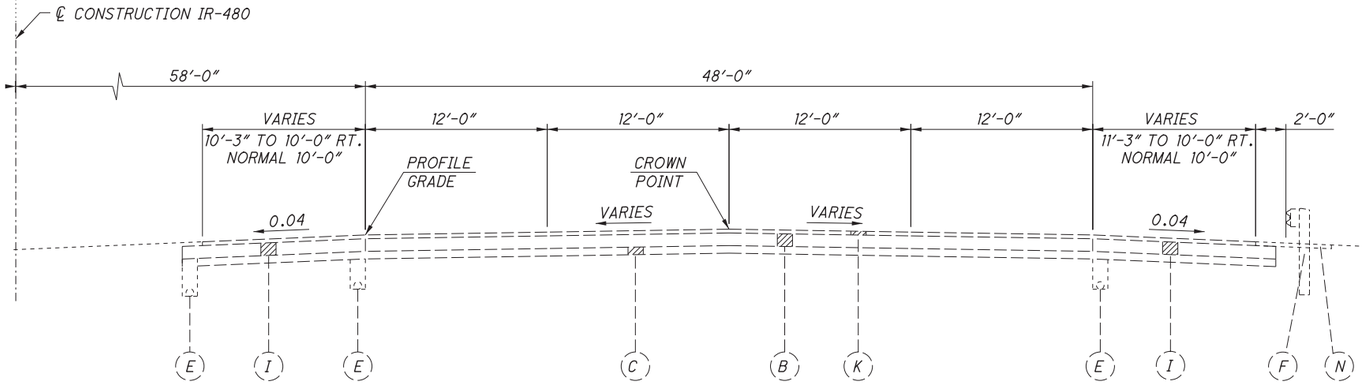
CUY-480-18.42

6



TYPICAL SECTION IR-480 (4-LANE WESTBOUND)

STA. 1038+02.75 TO STA. 1040+50.00 BK. = 247.25 FT.
STA. 1040+25.85 AHD. TO STA. 1096+73.58 = 5647.73 FT.



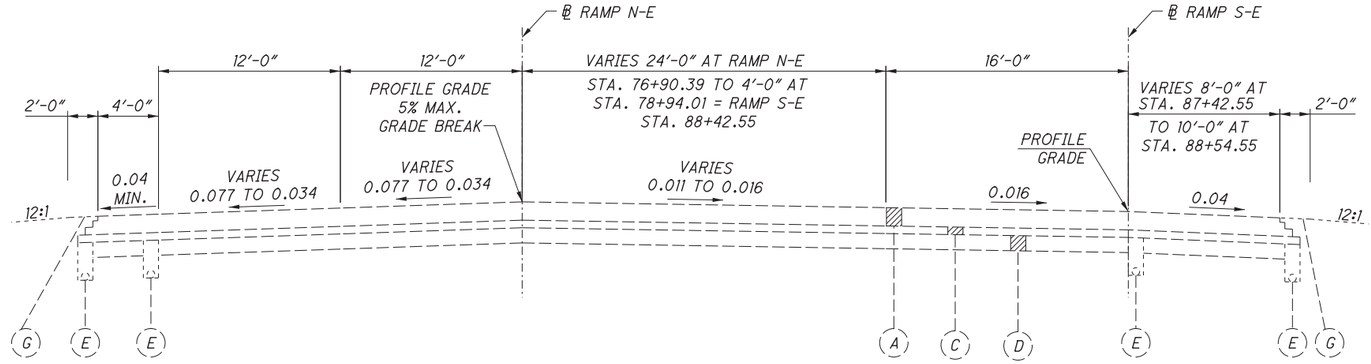
TYPICAL SECTION IR-480 (4-LANE EASTBOUND)

STA. 1038+02.75 TO STA. 1040+50.00 BK. = 247.25 FT.
STA. 1040+25.85 AHD. TO STA. 1096+73.58 = 5647.73 FT.

FOR THE EXISTING ITEM LEGEND SEE SHEET 3 .

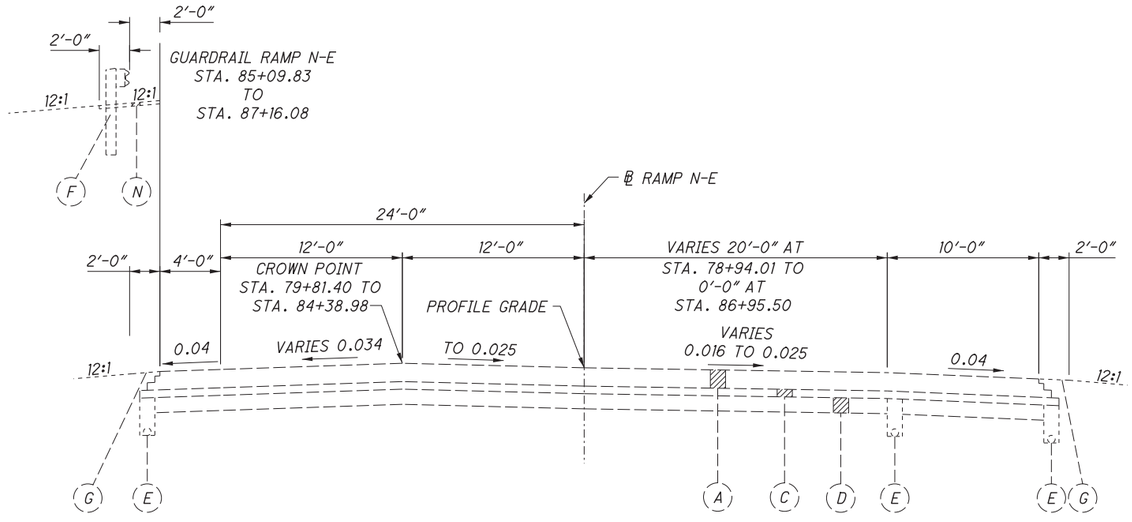
EXISTING TYPICAL SECTIONS - IR-480/IR-77 RAMPS

CUY-480-18.42



MERGE SECTION RAMP N-E & RAMP S-E

RAMP N-E STA. 76+90.39 TO STA. 78+94.01 = 203.62 FT.
RAMP S-E STA. 86+35.66 TO STA. 88+42.54 = 206.88 FT.



MERGE SECTION RAMP N-E (& RAMP S-E)

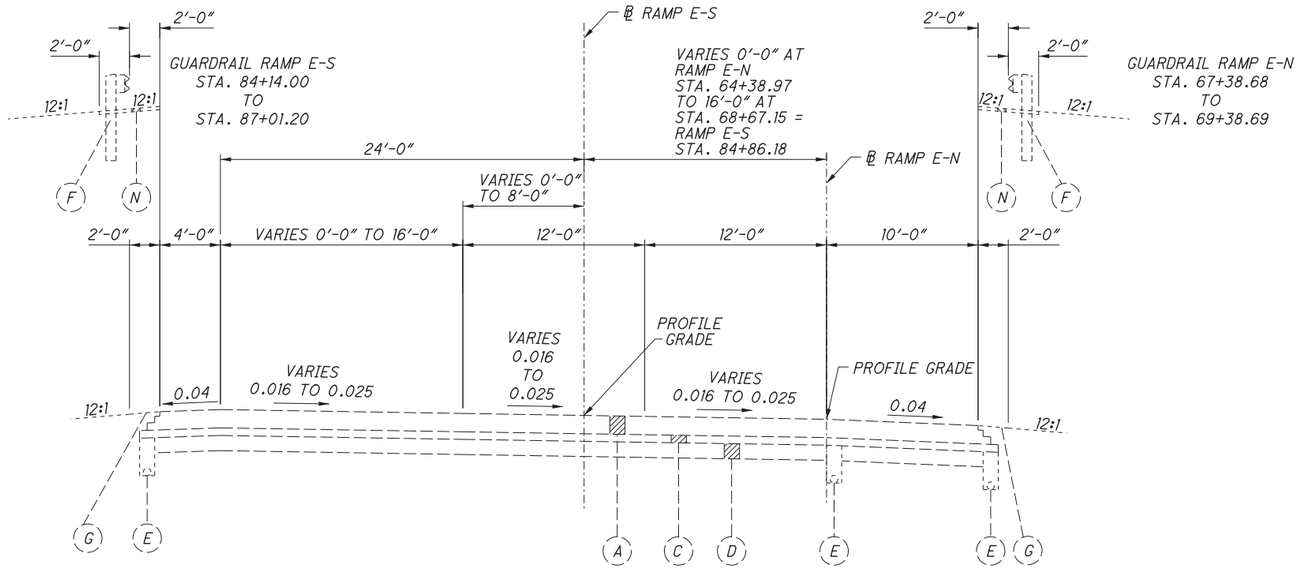
RAMP N-E STA. 78+94.01 TO STA. 88+14.95 = 920.94 FT.

FOR THE EXISTING ITEM LEGEND SEE SHEET 3 .

EXISTING TYPICAL TERMINAL SECTIONS RAMPS N-E & S-E

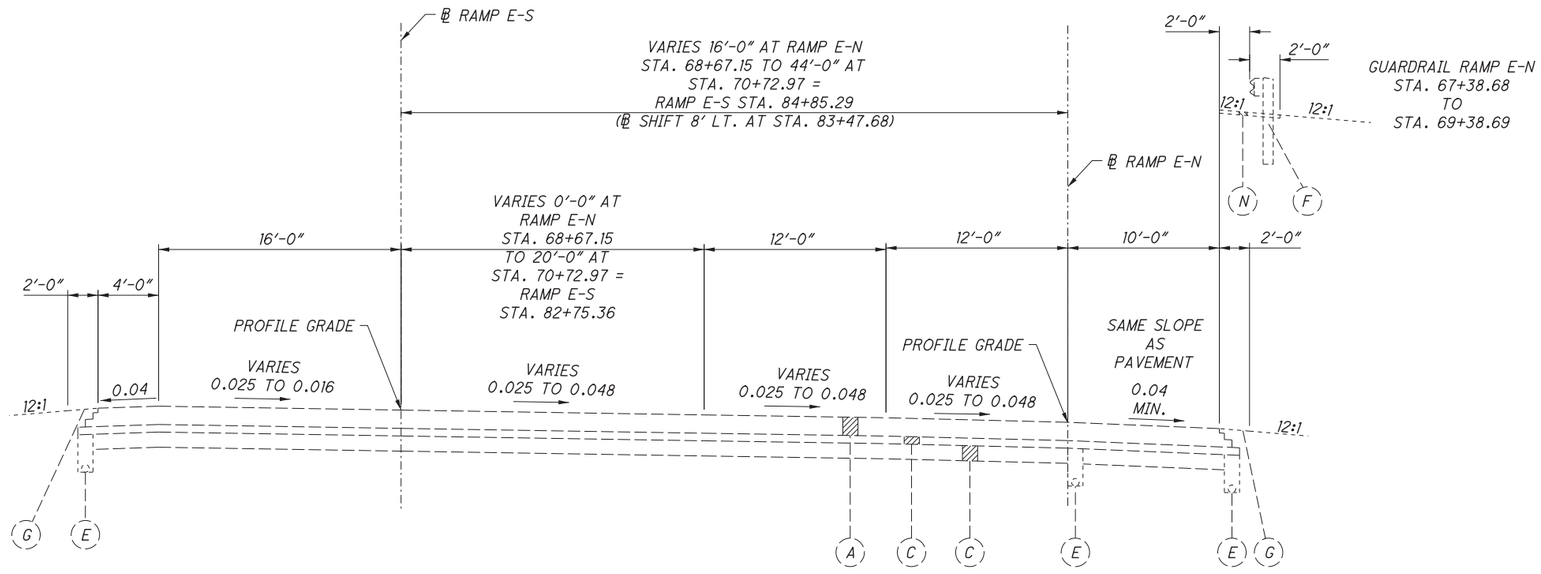
CUY-480-18.42

8



DIVERGE SECTION RAMP E-N & RAMP E-S

RAMP E-N STA. 64+38.79 TO STA. 68+67.15 = 428.36 FT.
RAMP E-S STA. 84+86.18 TO STA. 89+15.28 = 429.10 FT. (STATIONING IN OPPOSITE DIRECTION)



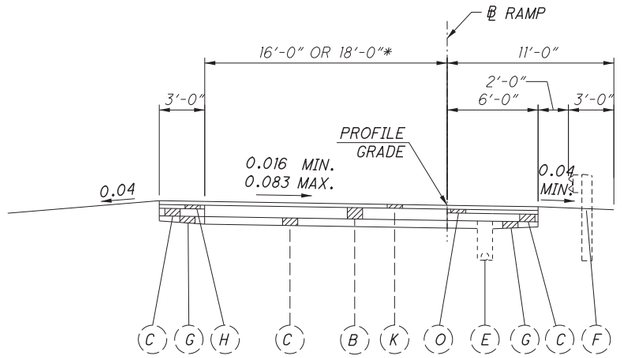
DIVERGE SECTION RAMP E-N & RAMP E-S

RAMP E-N STA. 68+67.15 TO STA. 70+72.97 = 205.82 FT.
RAMP E-S STA. 82+74.92 TO STA. 84+86.18 = 211.26 FT. (STATIONING IN OPPOSITE DIRECTION)

FOR THE EXISTING ITEM LEGEND SEE SHEET 3 .

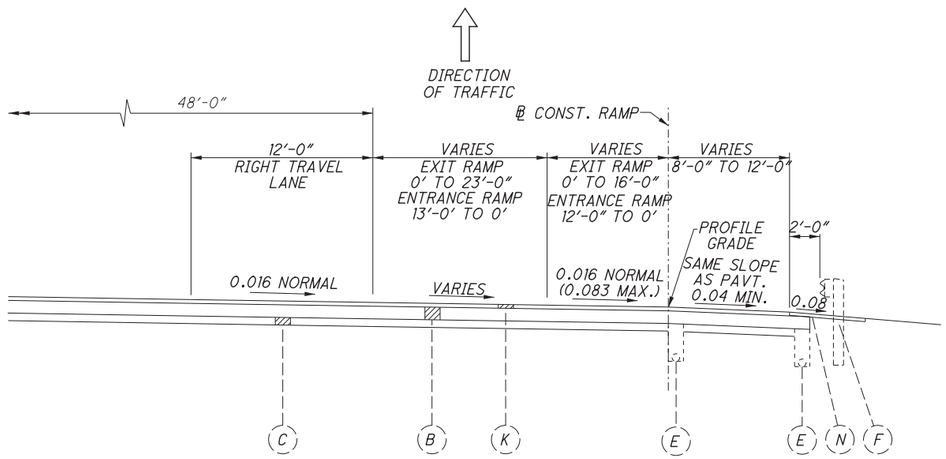
EXISTING TYPICAL SECTIONS RAMPS E-N & E-S

CUY-480-18.42



RAMP TYPICAL SECTION

RAMP W-98 STA. 44+87.30 TO STA. 49+42.54 = 455.24 FT.
RAMP E-98 STA. 60+88.71 TO STA. 66+99.34 = 610.63 FT.
RAMP 98-E STA. 49+36.25 TO STA. 53+71.27 = 435.02 FT.*
RAMP 98-W STA. 59+88.37 TO STA. 62+23.75 = 235.38 FT.*



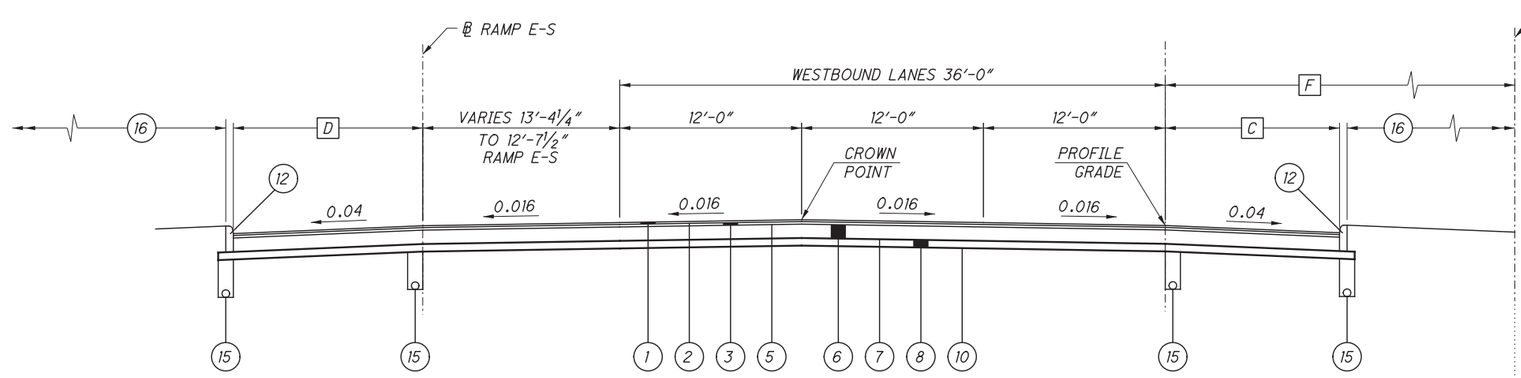
SPEED CHANGE LANE TYPICAL SECTION

W-98 STA. 1039+12.80 RT. TO STA. 1044+88.65 RT. = 575.85 FT.
98-W STA. 1047+88.73 LT. TO STA. 1057+88.73 LT. = 1000.00 FT.
98-E STA. 1053+71.27 RT. TO STA. 1063+71.27 RT. = 1000.00 FT.
E-98 STA. 1066+98.51 LT. TO STA. 1074+98.51 LT. = 800.00 FT.

FOR THE EXISTING ITEM LEGEND SEE SHEET 3 .

EXISTING TYPICAL SECTIONS - IR-480/E. 98TH ST. RAMPS

CUY-480-18.42

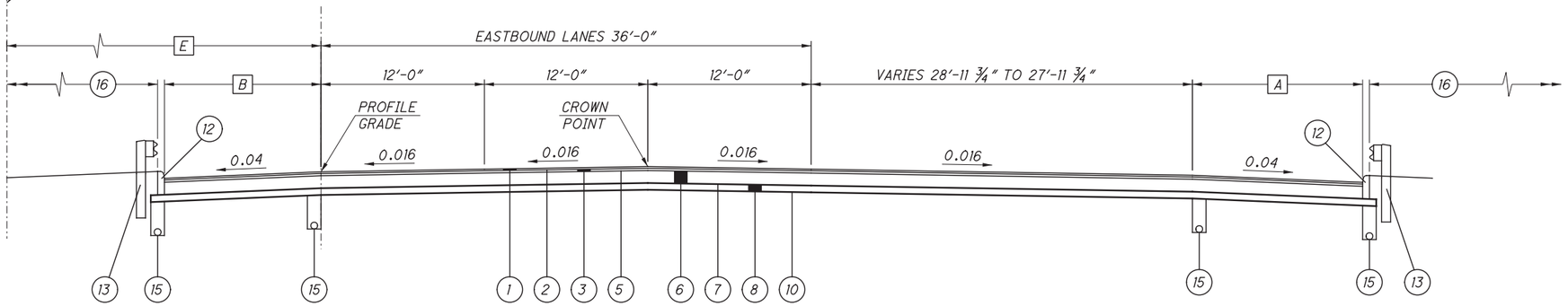


TERMINAL SECTION IR-480 & RAMP E-S

IR-480 STA. 995+47.24 TO STA. 995+97.25 = 50.00 FT.
RAMP E-S STA. 95+47.24 TO STA. 95+97.24 = 50.00 FT.

NORMAL SECTION IR-480 (WESTBOUND)

IR-480 STA. 995+47.25 TO STA. 995+97.25 = 50.00 FT.



NORMAL SECTION IR-480 (EASTBOUND)

IR-480 STA. 995+47.25 TO STA. 995+97.25 = 50.00 FT.

PROPOSED VARIABLE DIMENSION TABLE						
	A	B	C	D	E	F
ALTERNATIVE 1	11'-6"	10'-6"	10'-6"	11'-6"	58'-0"	58'-0"
ALTERNATIVE 3.a	12'-6"	11'-6"	11'-6"	12'-6"	58'-0"	58'-0"
ALTERNATIVE 3.b	12'-6"	11'-6"	10'-6"	11'-6"	58'-0"	58'-0"
ALTERNATIVE 3.c	11'-6"	21'-6"	10'-6"	11'-6"	46'-0"	58'-0"
ALTERNATIVE 5	12'-6"	11'-6"	12'-0"	12'-0"	58'-0"	*17'-6"

*RIGHT OF ℄ CONST. IR 480

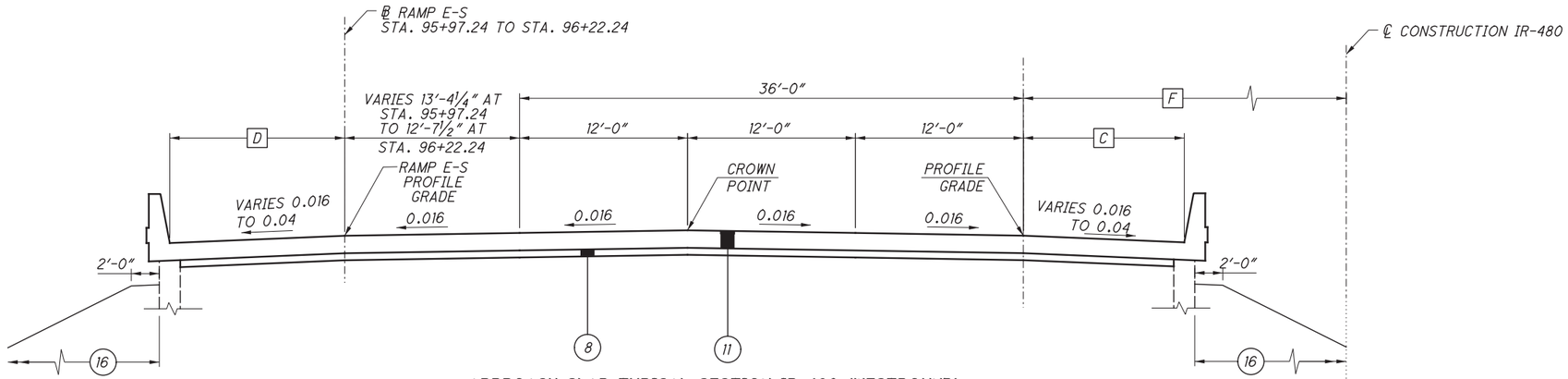
PROPOSED LEGEND

1. ITEM 442 - 1½" ASPHALT CONCRETE SURFACE COURSE, 12.5mm, TYPE B (446)
2. ITEM 407 - TACK COAT FOR INTERMEDIATE COURSE (0.04 GAL./S.Y. APP. RATE)
3. ITEM 442 - 2" ASPHALT CONCRETE INTERMEDIATE COURSE, 19mm, TYPE B (446)
4. ITEM 442 - 3" ASPHALT CONCRETE INTERMEDIATE COURSE, 19mm, TYPE B (446)
5. ITEM 407 - TACK COAT FOR INTERMEDIATE COURSE (0.04 GAL./S.Y. APP. RATE)
6. ITEM 302 - 11" ASPHALT CONCRETE BASE, PG64-22
7. ITEM 408 - PRIME COAT (0.4 GAL./S.Y. APP. RATE)
8. ITEM 304 - 6" AGGREGATE BASE
9. ITEM 305 - 10" CONCRETE BASE
10. ITEM 204 - SUBGRADE COMPACTION
11. ITEM 526 - REINFORCED CONCRETE APPROACH SLAB (T="15"), AS PER PLAN
12. ITEM 609 - CURB, TYPE 6
13. ITEM 606 - GUARDRAIL, TYPE 5
14. ITEM 448 - 3" ASPHALT CONCRETE INTERMEDIATE COURSE, TYPE 1 PG64-22 (UNDER GUARDRAIL)
15. ITEM 605 - 6" SHALLOW PIPE UNDERDRAIN WITH FABRIC WRAP
16. ITEM 659 - SEEDING AND MULCHING

PROPOSED TYPICAL SECTIONS - IR-480

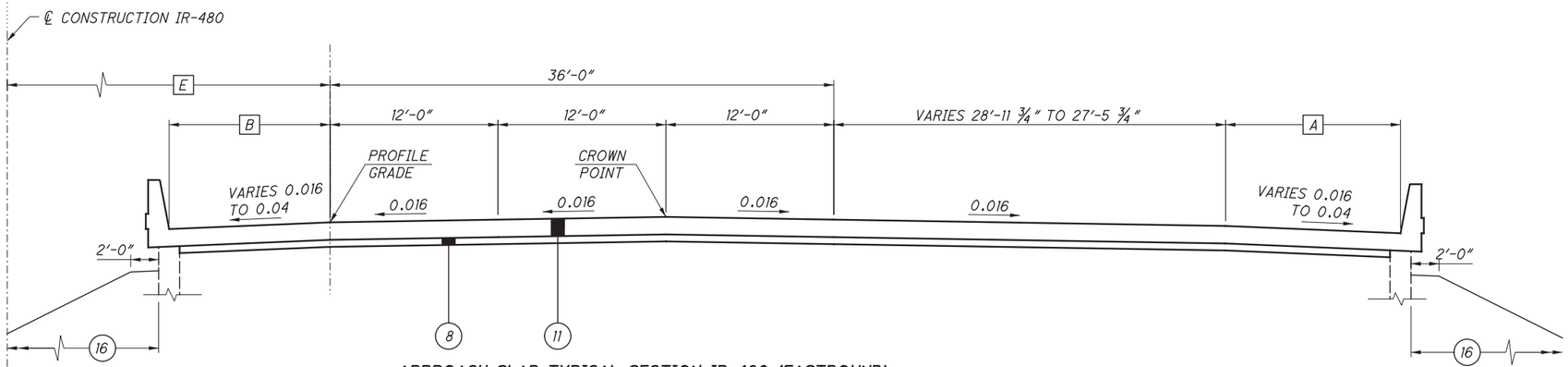
CUY-480-18.42

11



APPROACH SLAB TYPICAL SECTION IR-480 (WESTBOUND)

STA. 995+97.25 TO STA. 996+22.25 = 25.00 FT.



APPROACH SLAB TYPICAL SECTION IR-480 (EASTBOUND)

STA. 995+97.25 TO STA. 996+22.25 = 25.00 FT.

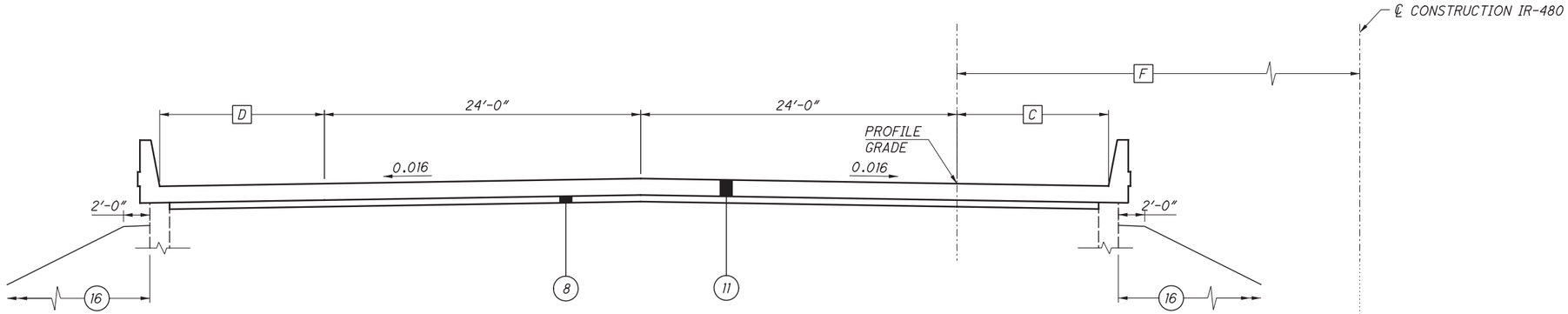
FOR THE PROPOSED ITEM LEGEND SEE SHEET 11 .

FOR THE PROPOSED VARIABLE DIMENSION TABLE SEE SHEET 11 .

PROPOSED REAR APPROACH SLAB TYPICAL SECTIONS - IR-480

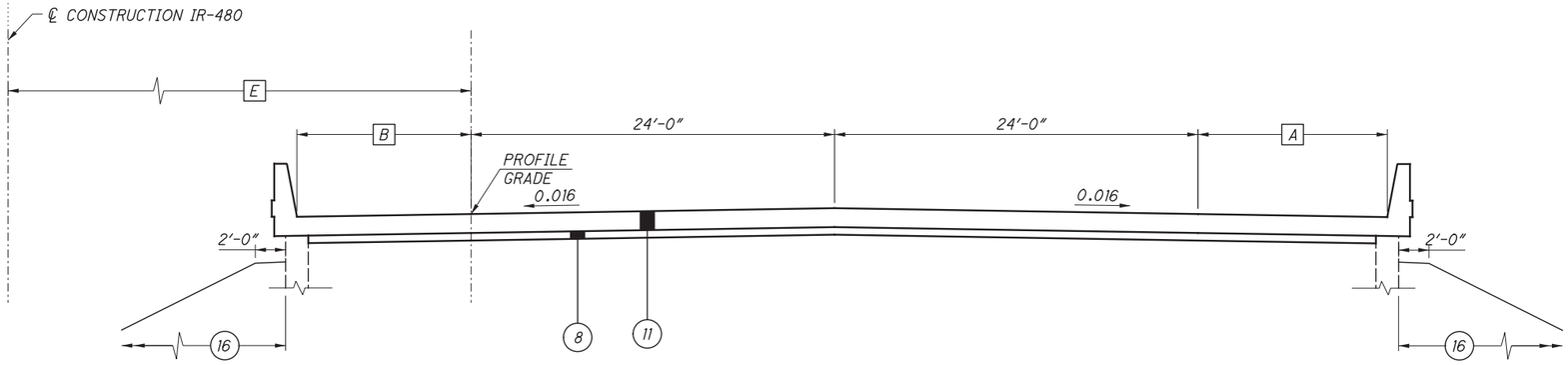
CUY-480-18.42

12



APPROACH SLAB TYPICAL SECTION IR-480 (WESTBOUND)

STA. 1037+77.75 TO STA. 1038+02.75 = 25.00 FT.



APPROACH SLAB TYPICAL SECTION IR-480 (EASTBOUND)

STA. 1037+77.75 TO STA. 1038+02.75 = 25.00 FT.

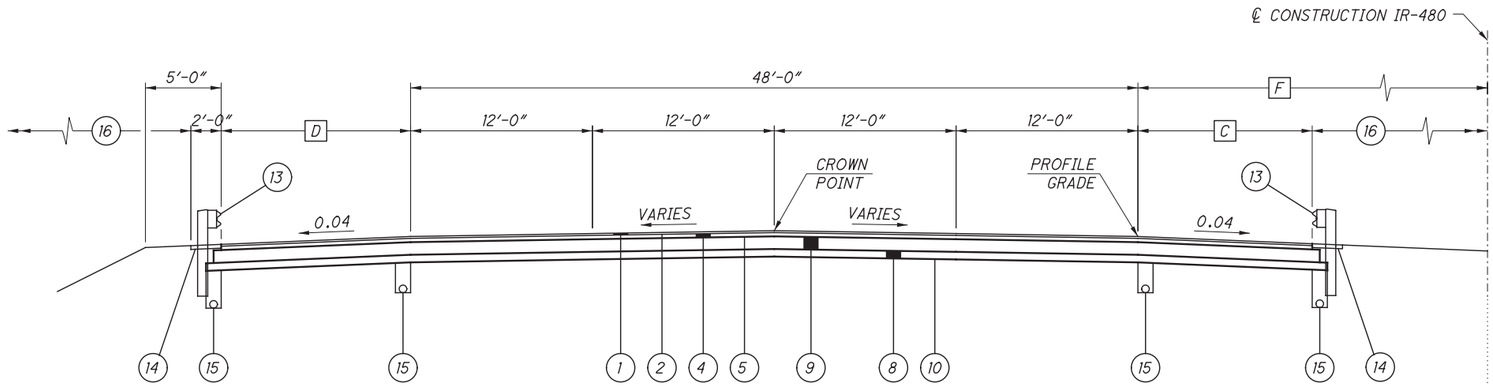
FOR THE PROPOSED ITEM LEGEND SEE SHEET 11 .

FOR THE PROPOSED VARIABLE DIMENSION TABLE SEE SHEET 11 .

PROPOSED FORWARD AND APPROACH SLAB TYPICAL SECTIONS - IR-480

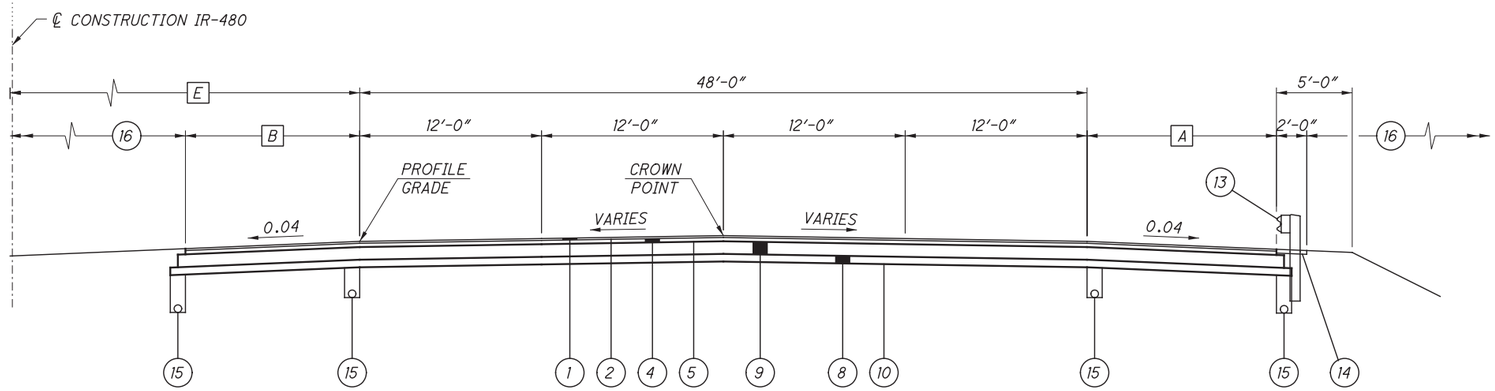
CUY-480-18.42

13



TYPICAL SECTION IR-480 (4-LANE WESTBOUND)

STA. 1038+02.75 TO STA. 1038+52.75 = 50.00 FT.



TYPICAL SECTION IR-480 (4-LANE EASTBOUND)

STA. 1038+02.75 TO STA. 1038+52.75 = 50.00 FT.

FOR THE PROPOSED ITEM LEGEND SEE SHEET 11 .

FOR THE PROPOSED VARIABLE DIMENSION TABLE SEE SHEET 11 .

PROPOSED TYPICAL SECTIONS - IR-480/IR-77 RAMPS

CUY-480-18.42

14

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UTILITIES

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

ELECTRIC:

THE ILLUMINATION CO.
6896 MILLER ROAD
BRECKSVILLE, OHIO 44141
(440)-717-6845
ATTN: MARK ROBINSON

GAS:

DOMINION EAST OHIO
320 SPRINGSIDE DR.
AKRON, OHIO 44333
(330)-664-2643
ATTN: CORY ADKINS

WATER LINES & SEWERS:

VILLAGE OF VALLEY VIEW
DGB & ASSOCIATES
7979 HUB PARKWAY
VALLEY VIEW, OH 44123
(216)-642-1130 EXT. 104
ATTN: PAUL DEY

COMMUNICATIONS

MCI
OSP NATIONAL SUPPORT/INVESTIGATION
2400 NORTH GLENVILLE
RICHARDSON, TX 75082
(972)-729-6322
ATTN: JOHN BACHELDER

LEVEL 3 COMMUNICATIONS
1025 EL DORADO BLVD.
BROOMFIELD, CO. 80021
(720)-888-2639
ATTN: MATT PINK

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

SURVEYING PARAMETERS

USE THE FOLLOWING VERTICAL POSITIONING AND HORIZONTAL POSITIONING PARAMETERS FOR ALL SURVEYING:

VERTICAL POSITIONING

ORTHOMETRIC HEIGHT DATUM: NAVD 88

GEOID: 2011

ORIGINAL PLAN DATUM WAS BASED ON NGVD 29.

HORIZONTAL POSITIONING

REFERENCE FRAME: NAD 83 (2011)

ELLIPSOID: GRS 80

MAP PROJECTION: LAMBERT CONFORMAL CONIC

COORDINATE SYSTEM: OHIO STATE PLANE, NORTH ZONE

COMBINED SCALE FACTOR: 1.0000764278960

UNITS ARE IN U.S. SURVEY FEET. USE THE FOLLOWING CONVERSION FACTOR:
1 METER = 3.280833333 U.S. SURVEY FEET.

CALCULATED | CHECKED

GENERAL NOTES

CUY-480-14.82

15

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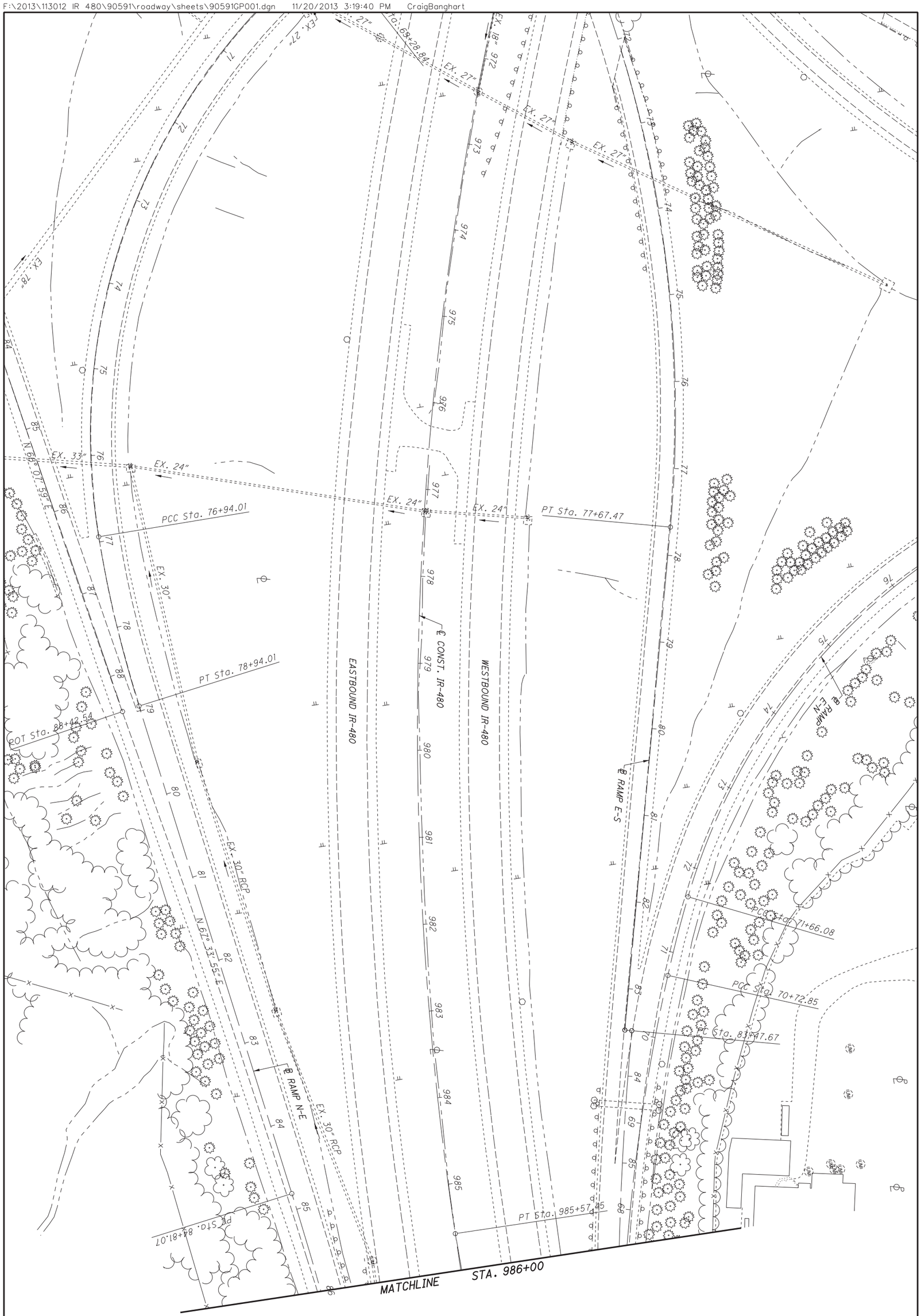


16	CUY-480-18.42	PLAN STA. 972+00 TO STA. 986+00	CALCULATED CHECKED	0 50 25 100 HORIZONTAL SCALE IN FEET

DRAINAGE LEGEND

- DRAINAGE PIPE TO BE CLEANED
- DRAINAGE PIPE TO BE REPLACED
- PROP. 12" PROPOSED MOT DRAINAGE
- PROP. 12" PROPOSED DRAINAGE

EXIST. CONTROL CENTER

SR 21 (BRECKSVILLE RD.)

PC Sta. 64+38.79

PCC Sta. 89+14.75

℄ RAMP E-N

℄ RAMP E-S

℄ CONST. IR-480

N 76° 25' 11" E

WESTBOUND IR-480

EASTBOUND IR-480

EX. 18" RCP

EX. 24" RCP

EX. 27" RCP

EX. 2' COMP

PROP. 18"

EX. 18"

RIPRAP

WOODS

5' CHAINLINK FENCE

Ex LA

PT Sta. 97+00.00

PT Sta. 89+95.90

PIER 1

℄ RAMP N-E

KLEBER CT.

STA. 986+00

STA. 998+50

MATCHLINE

HORIZONTAL SCALE IN FEET

0 25 50 100

CALCULATED

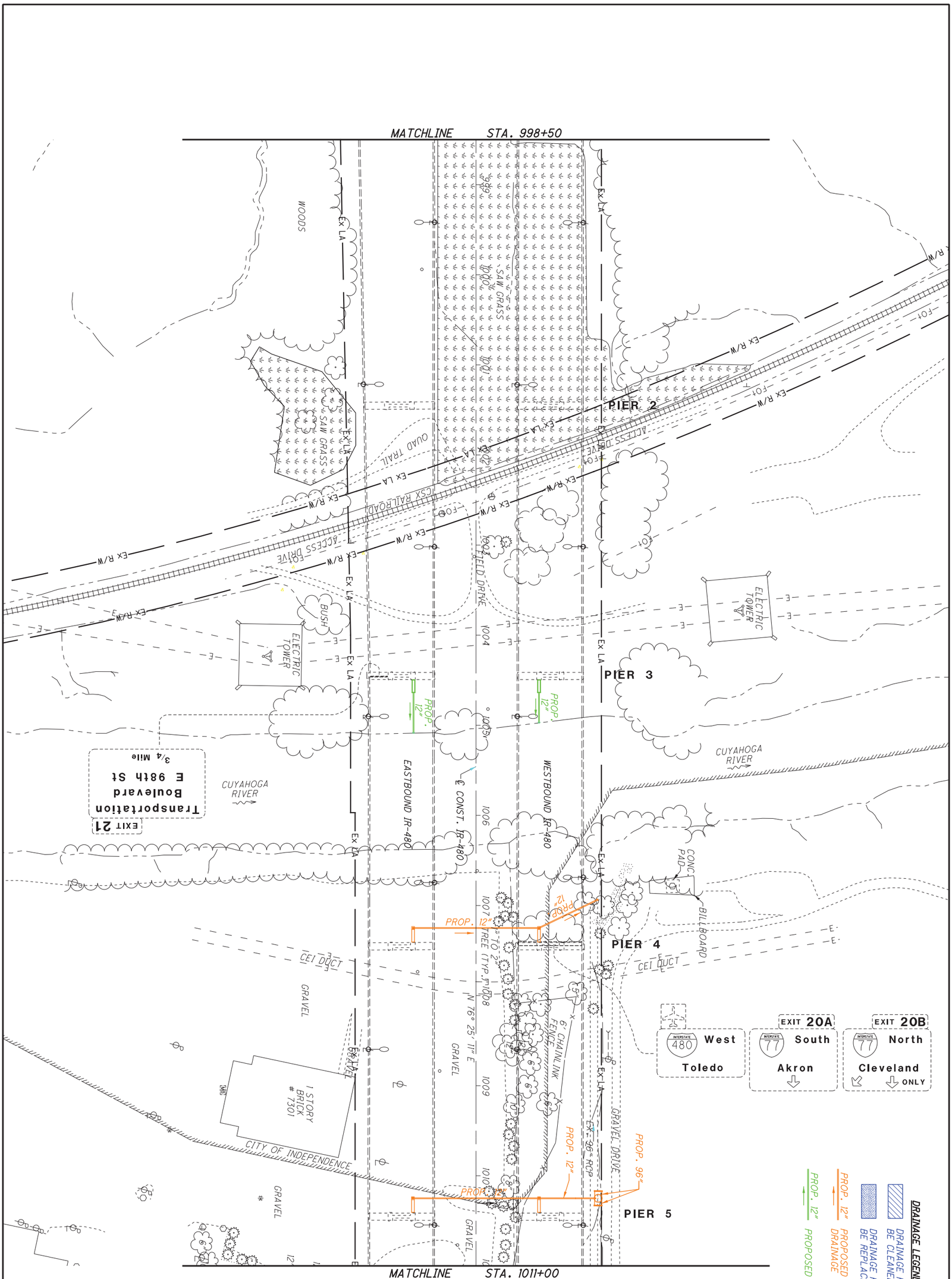
CHECKED

PLAN

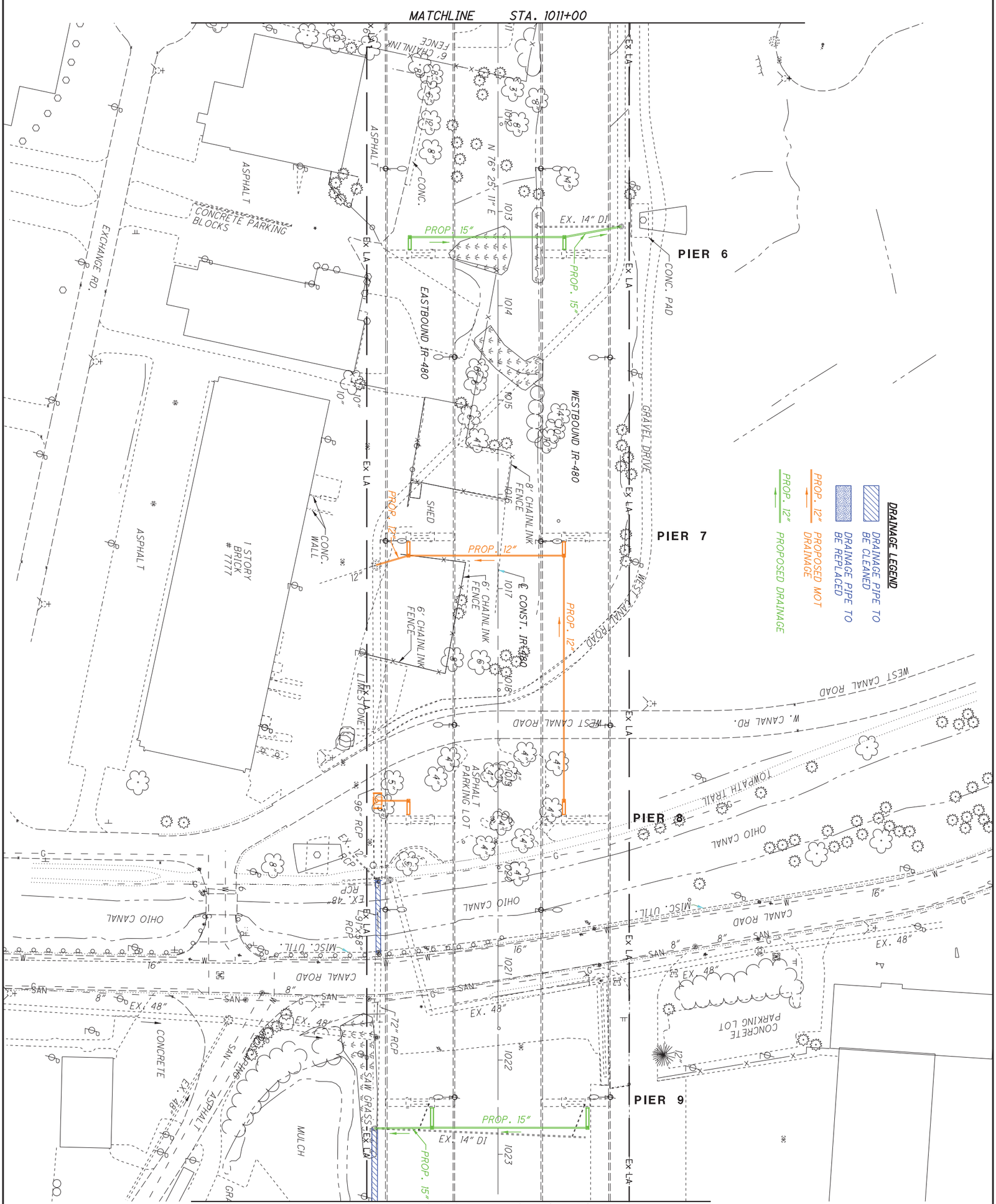
STA. 986+00 TO STA. 998+50

CUY-480-18.42

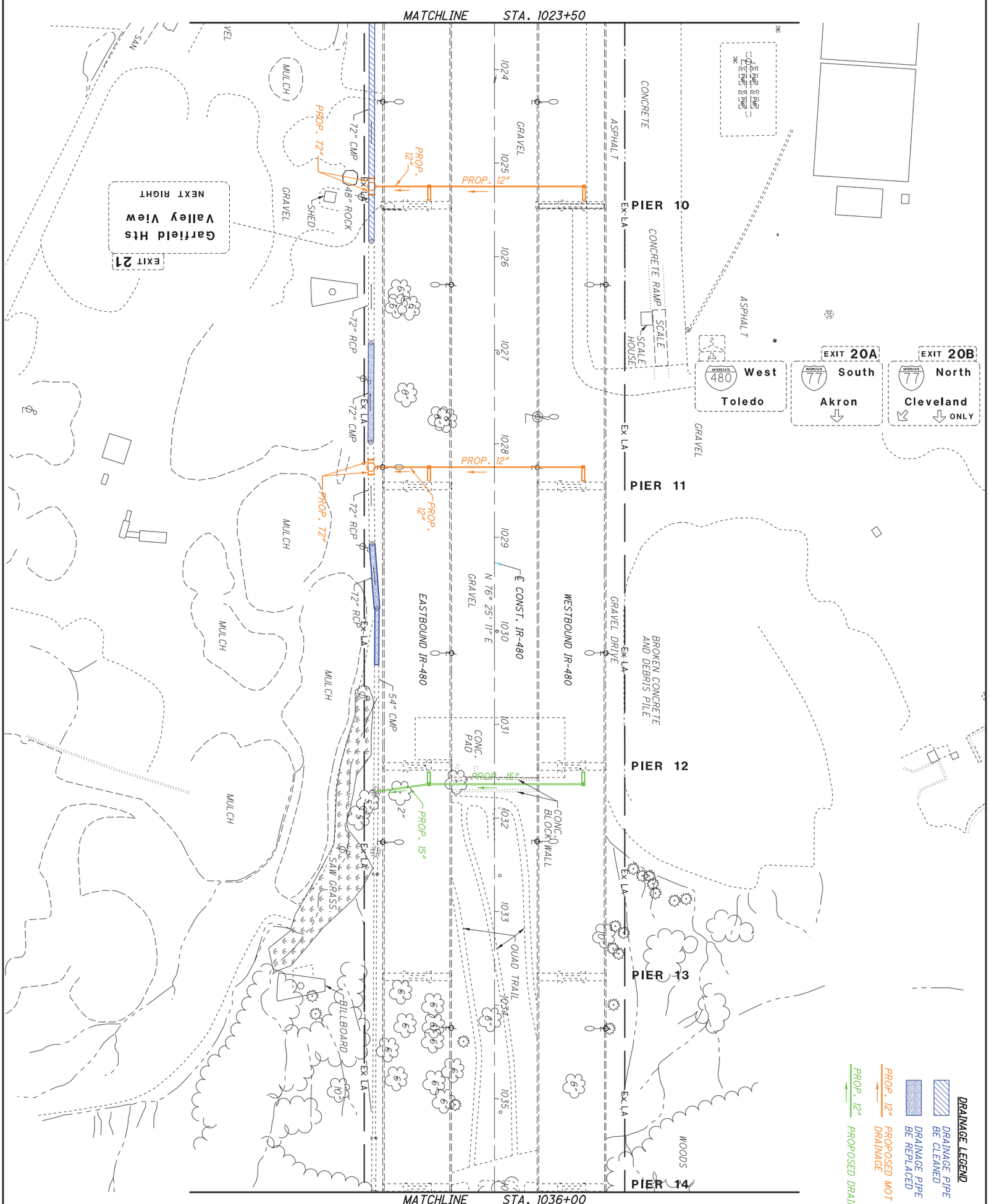
17



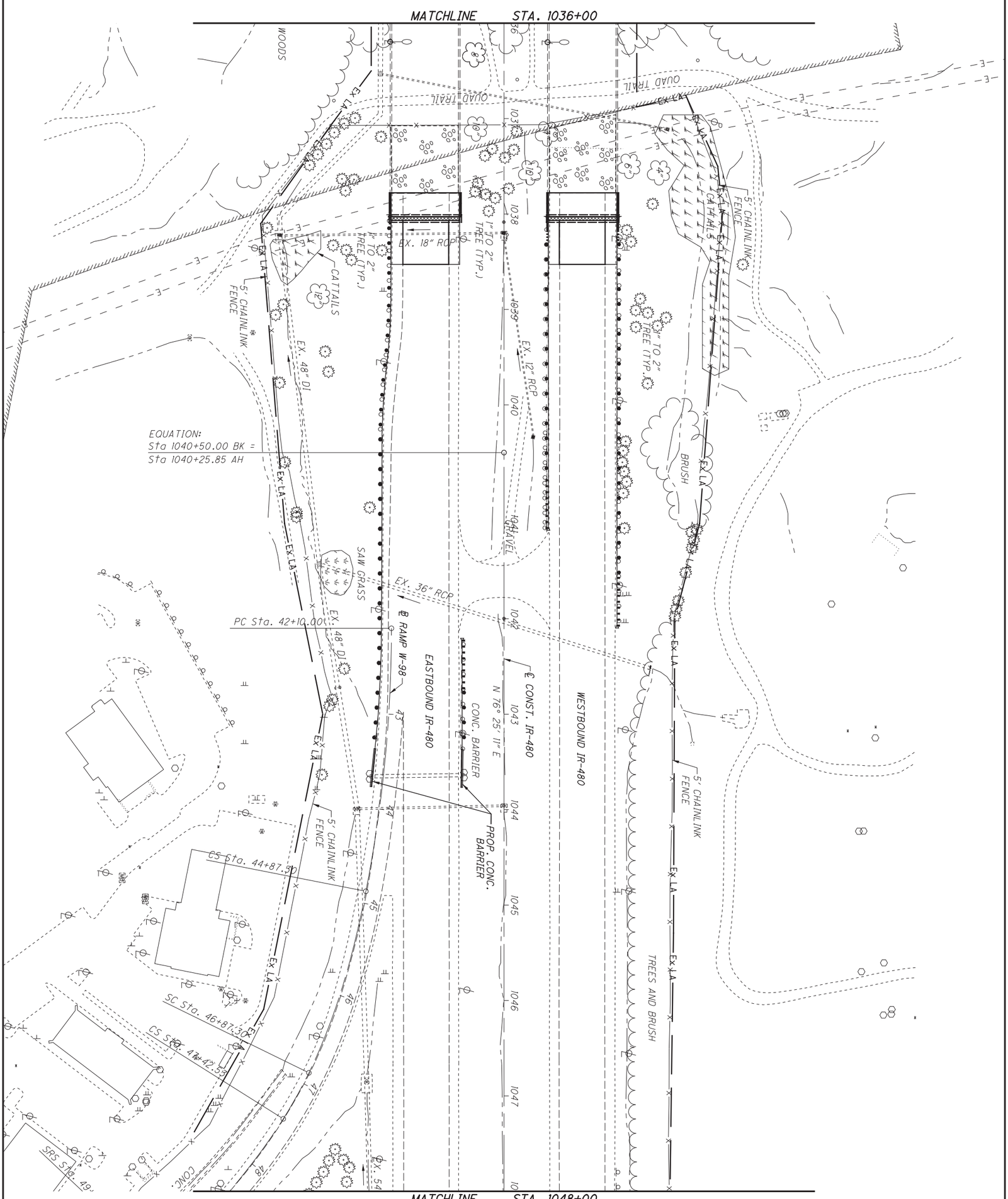
18	CUY-480-18.42	PLAN STA. 998+50 TO STA. 1011+00	CALCULATED CHECKED	0 50 25 100 HORIZONTAL SCALE IN FEET



19	CUY-480-18.42	PLAN STA. 1011+00 TO STA. 1023+50	CALCULATED CHECKED	0 50 25 100 HORIZONTAL SCALE IN FEET



20	CUY-480-18.42	PLAN STA. 1023+50 TO STA. 1036+00	CALCULATED CHECKED	0 50 25 100 HORIZONTAL SCALE IN FEET



21	CUY-480-18.42	PLAN STA. 1036+00 TO STA. 1048+00	CALCULATED CHECKED	0 50 25 100 HORIZONTAL SCALE IN FEET

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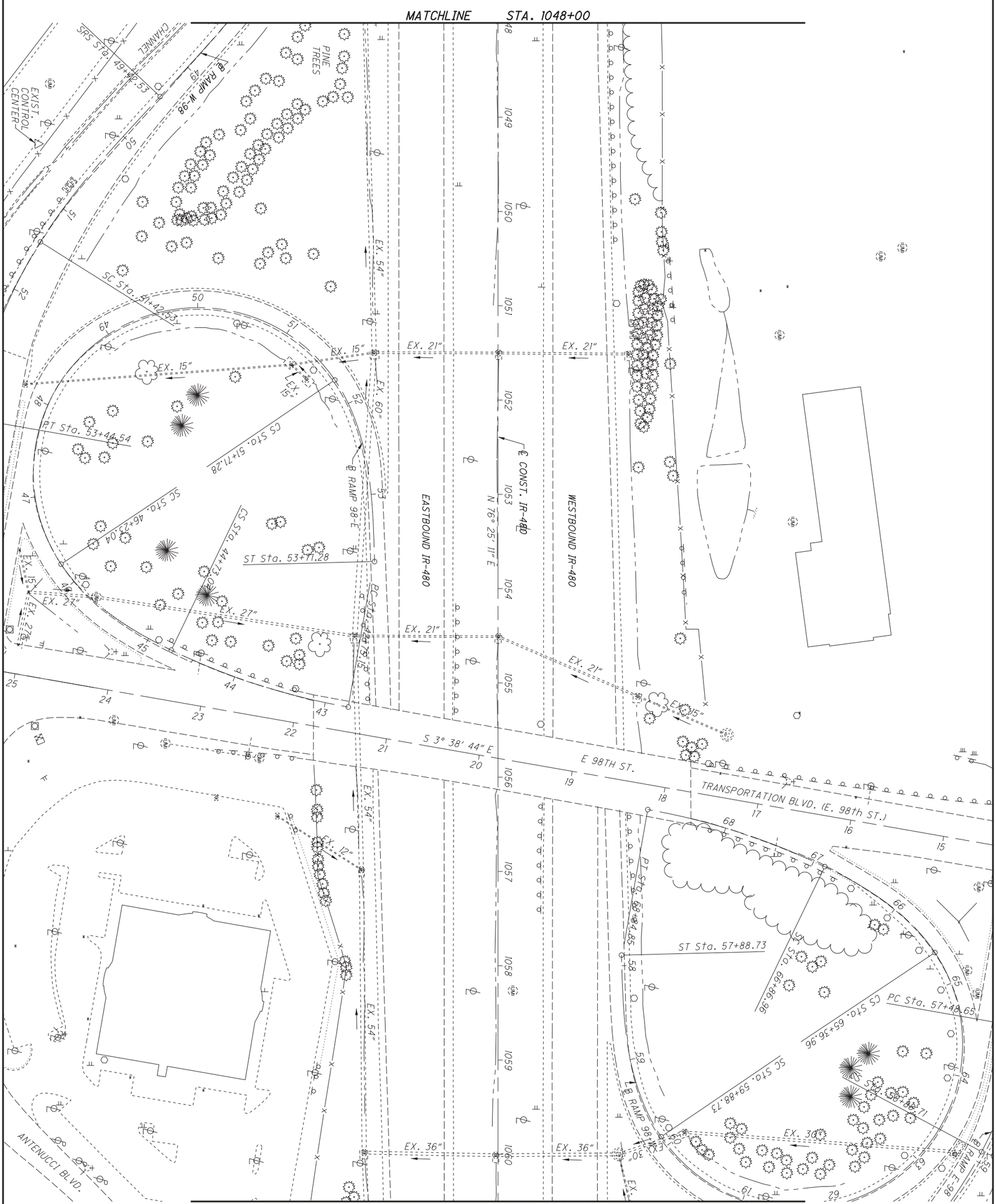
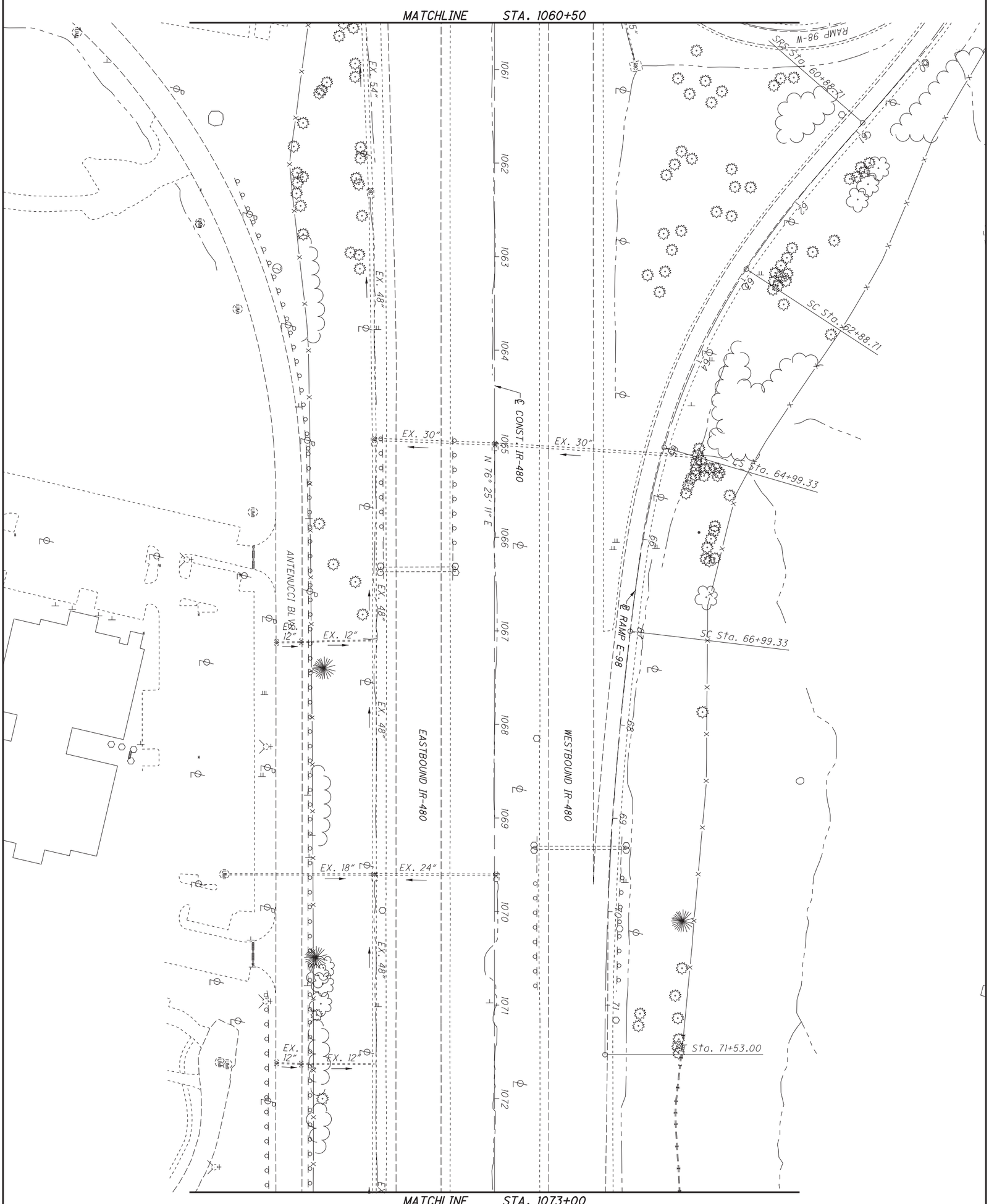
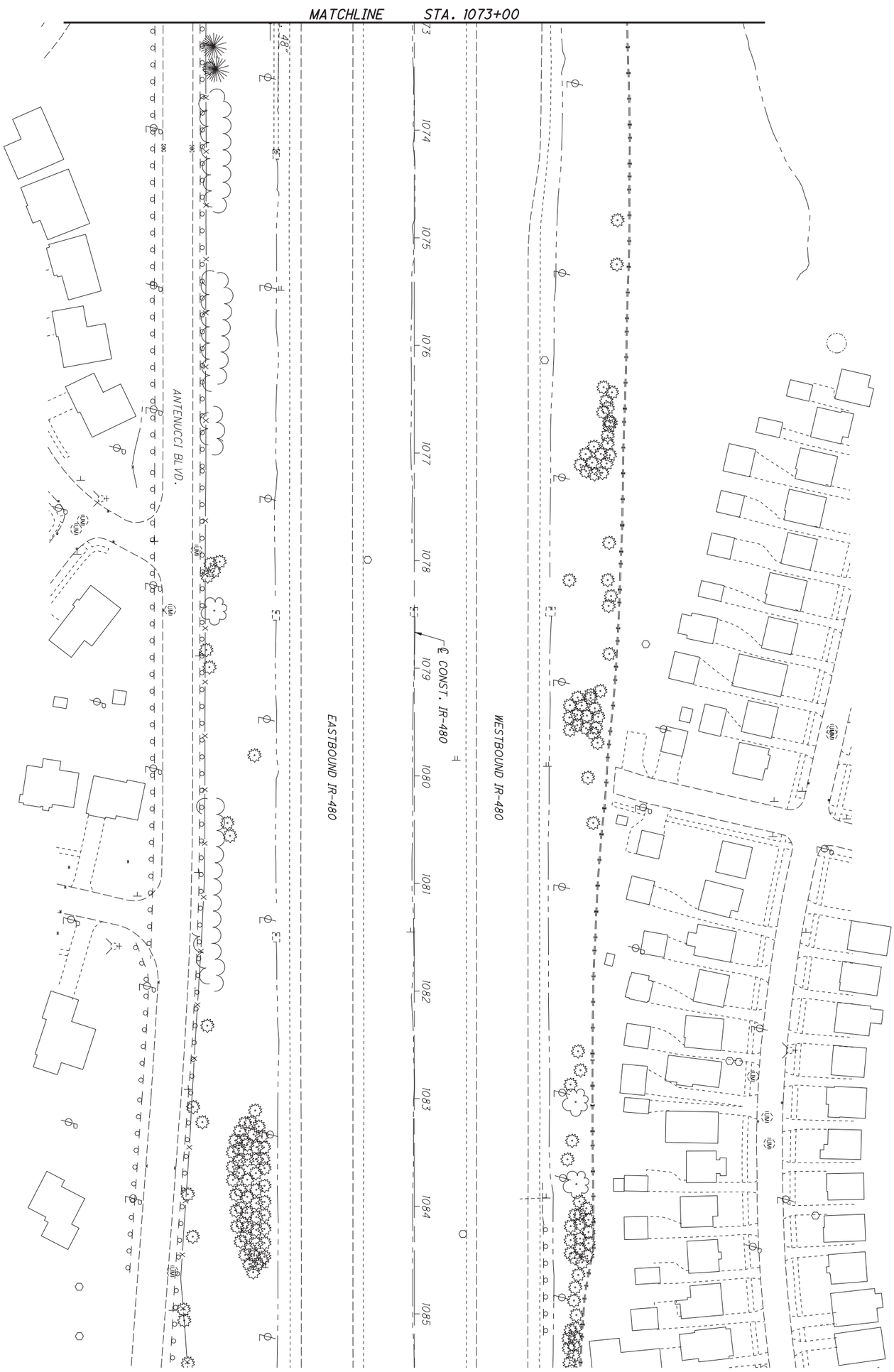


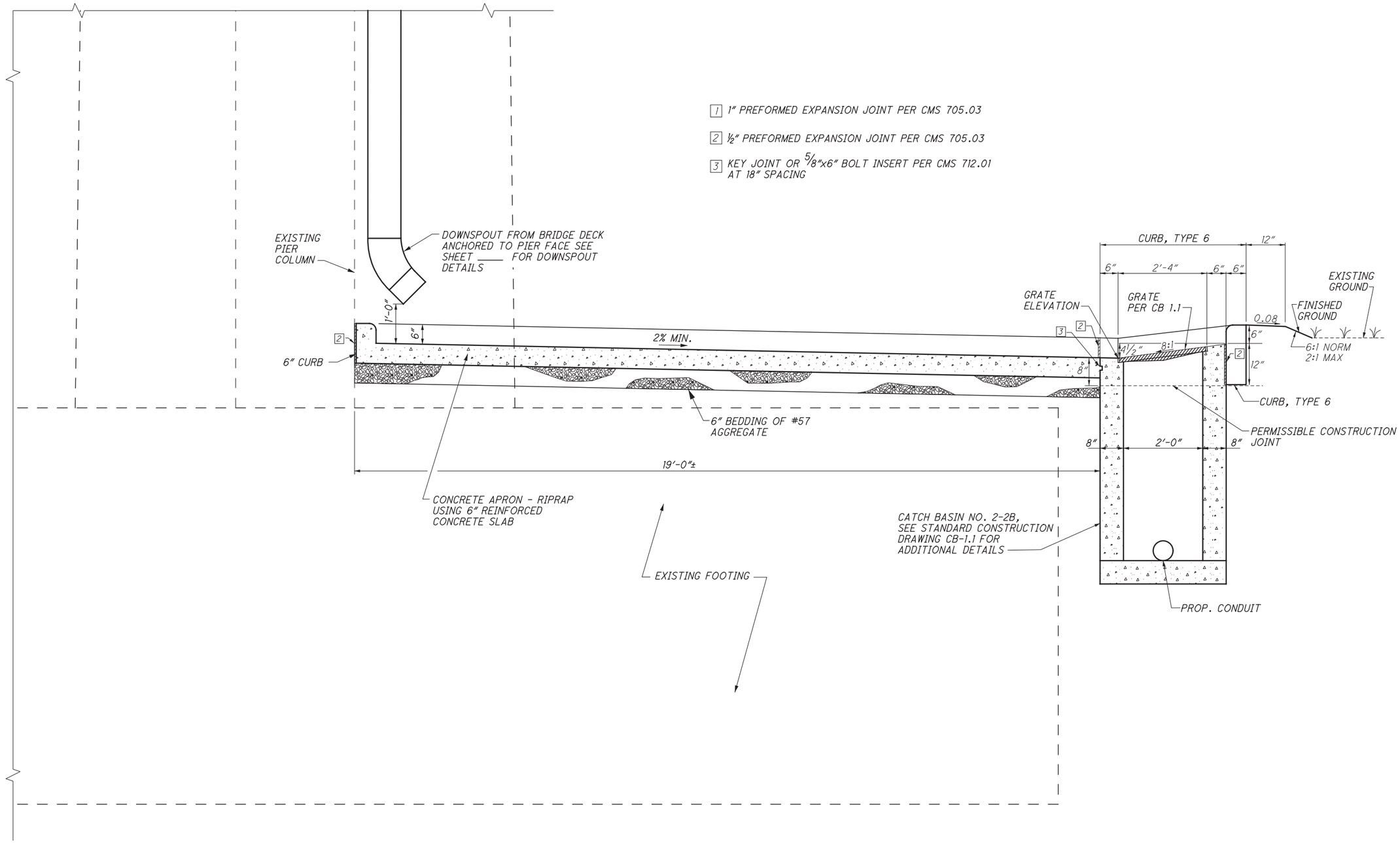
22	CUY-480-18.42	PLAN STA. 1048+00 TO STA. 1060+50	CALCULATED CHECKED	0 50 25 100 HORIZONTAL SCALE IN FEET



23	CUY-480-18.42	PLAN STA. 1060+50 TO STA. 1073+00	CALCULATED CHECKED	0 50 25 100 HORIZONTAL SCALE IN FEET



24	CUY-480-18.42	PLAN STA. 1073+00 TO STA. 1085+50	CALCULATED CHECKED	0 50 25 100 HORIZONTAL SCALE IN FEET



CATCH BASIN NO. 2-2B, AS PER PLAN-2

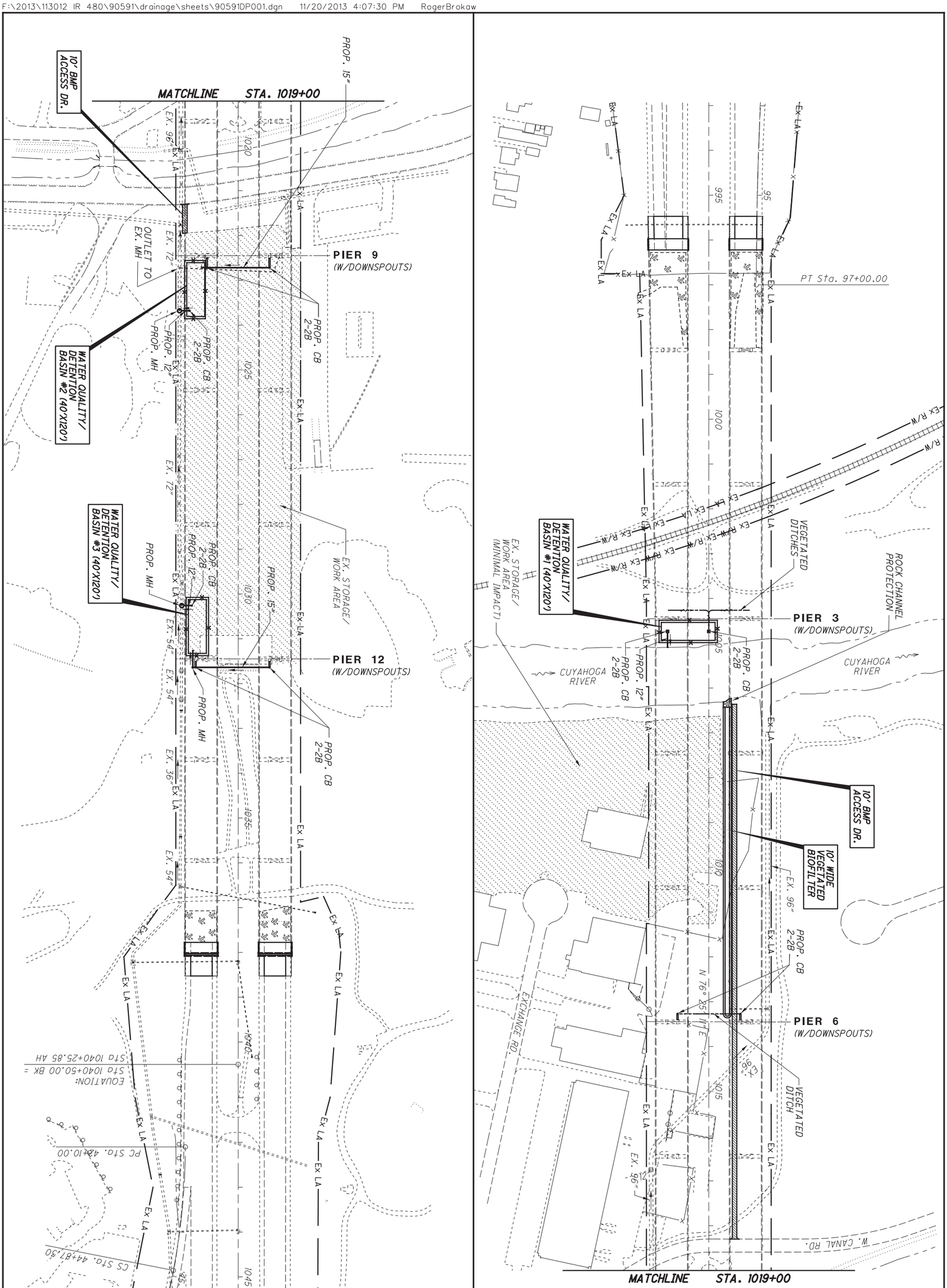
CATCH BASIN, CURB, CONCRETE APRON WITH BEDDING, EXPANSION JOINT MATERIAL AND MINOR GRADING TO ADJUST EXISTING GROUND TO CONFORM TO DETAIL SHALL BE INCLUDED FOR PAYMENT IN ITEM 604 - CATCH BASIN, NO. 2-2B, AS PER PLAN-2.

CALCULATED | CHECKED

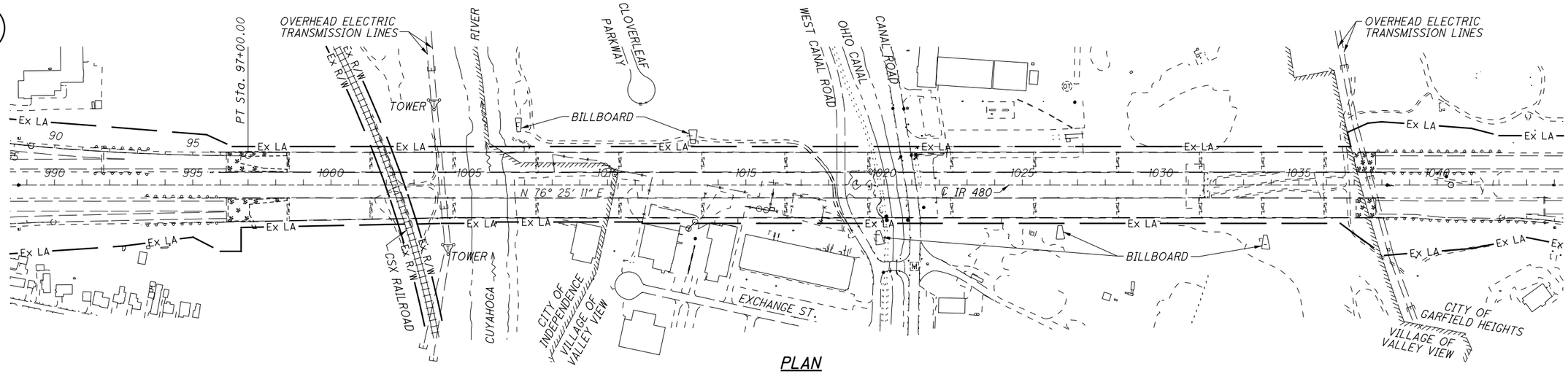
PROPOSED AND MOT BRIDGE PIER SCUPPER DRAINAGE COLLECTION DETAIL

CUY-480-18.42

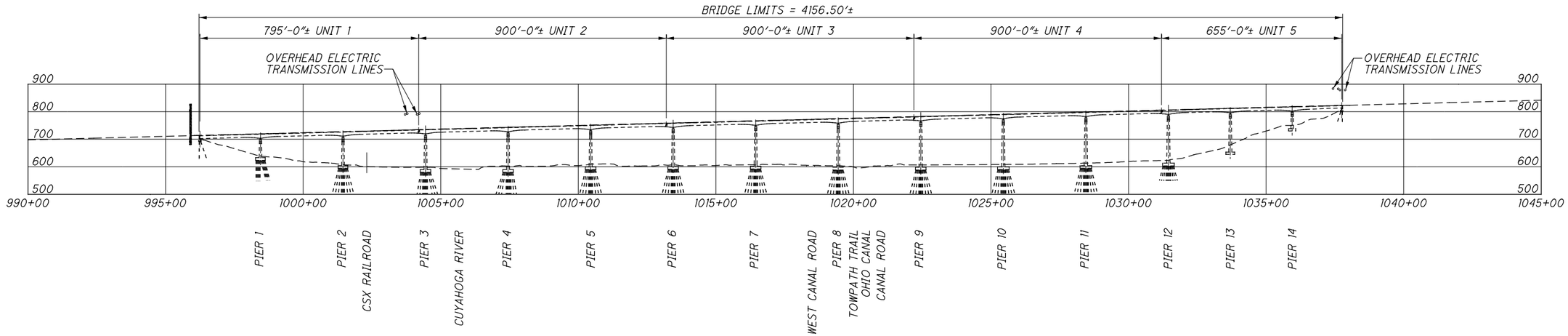
25



26	CUY-480-18.42	CONCEPTUAL LAYOUT POST CONSTRUCTION STORM WATER MANAGEMENT	CALCULATED / CHECKED	0 50 100 200 HORIZONTAL SCALE IN FEET



PLAN



ELEVATION

NOTES

DESIGN TRAFFIC:
ADT ADTT

EXISTING STRUCTURE

TYPE: CONTINUOUS WELDED STEEL GIRDERS WITH FLOOR SYSTEM AND REINFORCED CONCRETE DECK AND SUBSTRUCTURE.

SPANS: UNIT 1 - 220'±, 300'±, AND 275'±
UNIT 2, 3 AND 4 - 25'± CANTILEVER, 2 @ 300'± AND 275'±
UNIT 5 - 25'± CANTILEVER, 2 @ 225'± AND 180'±

ROADWAY: UNIT 1 L - VARIES 69'-6"±" TO 69'-10"± FACE TO FACE OF PARAPETS
UNIT 1 R - VARIES 69'-6"± TO 85'-0"± FACE TO FACE OF PARAPETS
UNITS 2, 3, 4 AND 5 - 69'-6"± FACE TO FACE OF PARAPETS

LOADING: HS 20-44 AND INTERSTATE ALTERNATE LOADING
SKEW: NONE
WEARING SURFACE: 2½"± SUPERPLASTICIZED DENSED CONCRETE (1990)
APPROACH SLABS: AS-1-67 (25' LONG)
ALIGNMENT: TANGENT
CROWN: 0.188±
DATE BUILT: 1975
DISPOSITION:

PROPOSED STRUCTURE

TYPE: NEW COMPOSITE REINFORCED CONCRETE DECK ON EXISTING STEEL SUPERSTRUCTURE.

SPANS: SAME AS EXISTING

ROADWAY: SEE ALTERNATIVES
LOADING: HS20-44 AND INTERSTATE ALTERNATE LOADING
SKEW: SAME AS EXISTING
WEARING SURFACE: MONOLITHIC CONCRETE
APPROACH SLABS: 25'-0" LONG (AS-1-81)
ALIGNMENT: TANGENT
CROWN: 0.0156
COORDINATES: LATITUDE 41° 24' 33" N
LONGITUDE 81° 77' 47" W

RICHLAND ENGINEERING LIMITED
29 NORTH PARK STREET
MANSFIELD, OHIO 44902

DESIGNED	DRAWN	REVIEWED	DATE
KAK	RB		
CHECKED	REVISED	STRUCTURE FILE NUMBER 1825571 (L) 1812548 (R)	

CUYAHOGA COUNTY
STA. 995+00.00
STA. 1000+00.00

KEY PLAN
BRIDGE NO. CUY-480-1842 L&R
OVER CUYAHOGA RIVER VALLEY

CUY-480-18.42
PID No. 90591

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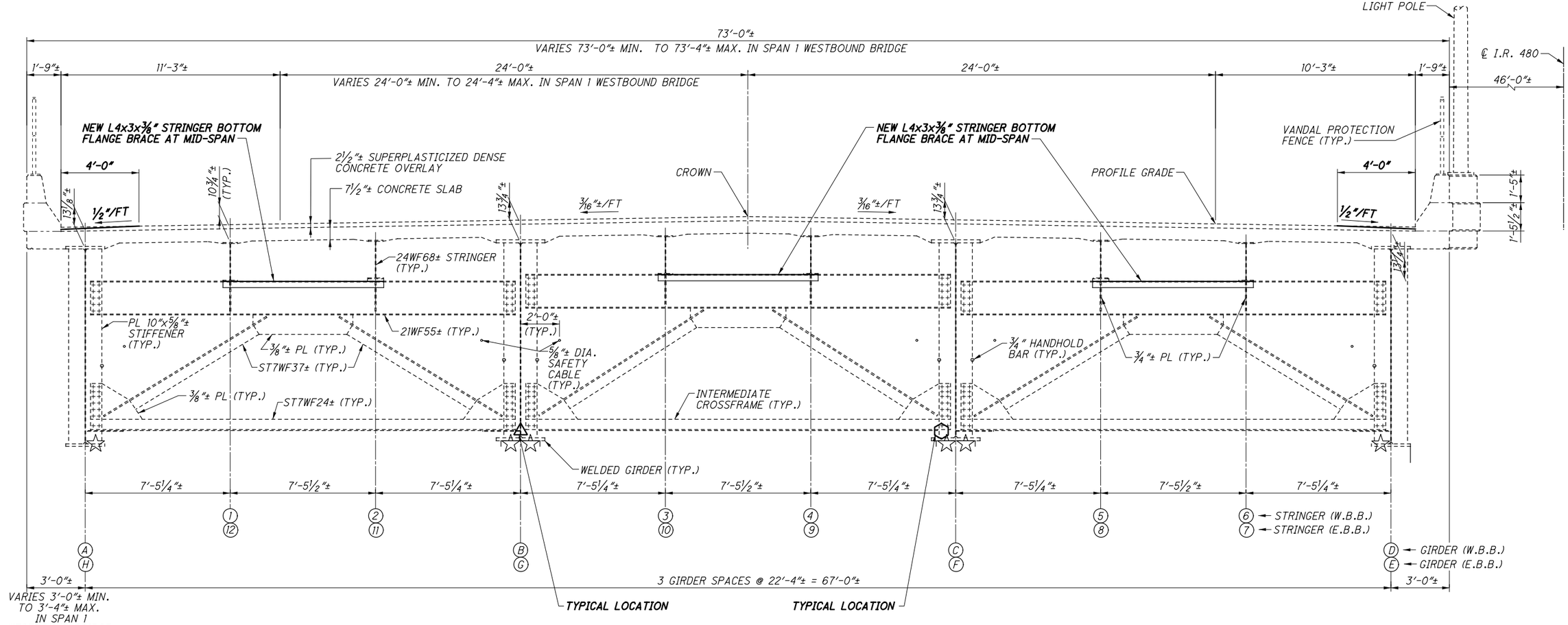


EXISTING TRANSVERSE SECTION

WESTBOUND BRIDGE - AS SHOWN
EASTBOUND BRIDGE EXCEPT UNIT 1 - OPPOSITE HAND

LEGEND

△ DOGBONE OVERCUT HOLES IN GIRDER WEB

⬡ CRACKED FLOORBEAM LOWER CHORD COPES

☆ GIRDER CONNECTION PLATE TO BOTTOM FLANGE RETROFIT

NOTES

MATERIALS SHOWN ARE EXISTING UNLESS NOTED OTHERWISE.

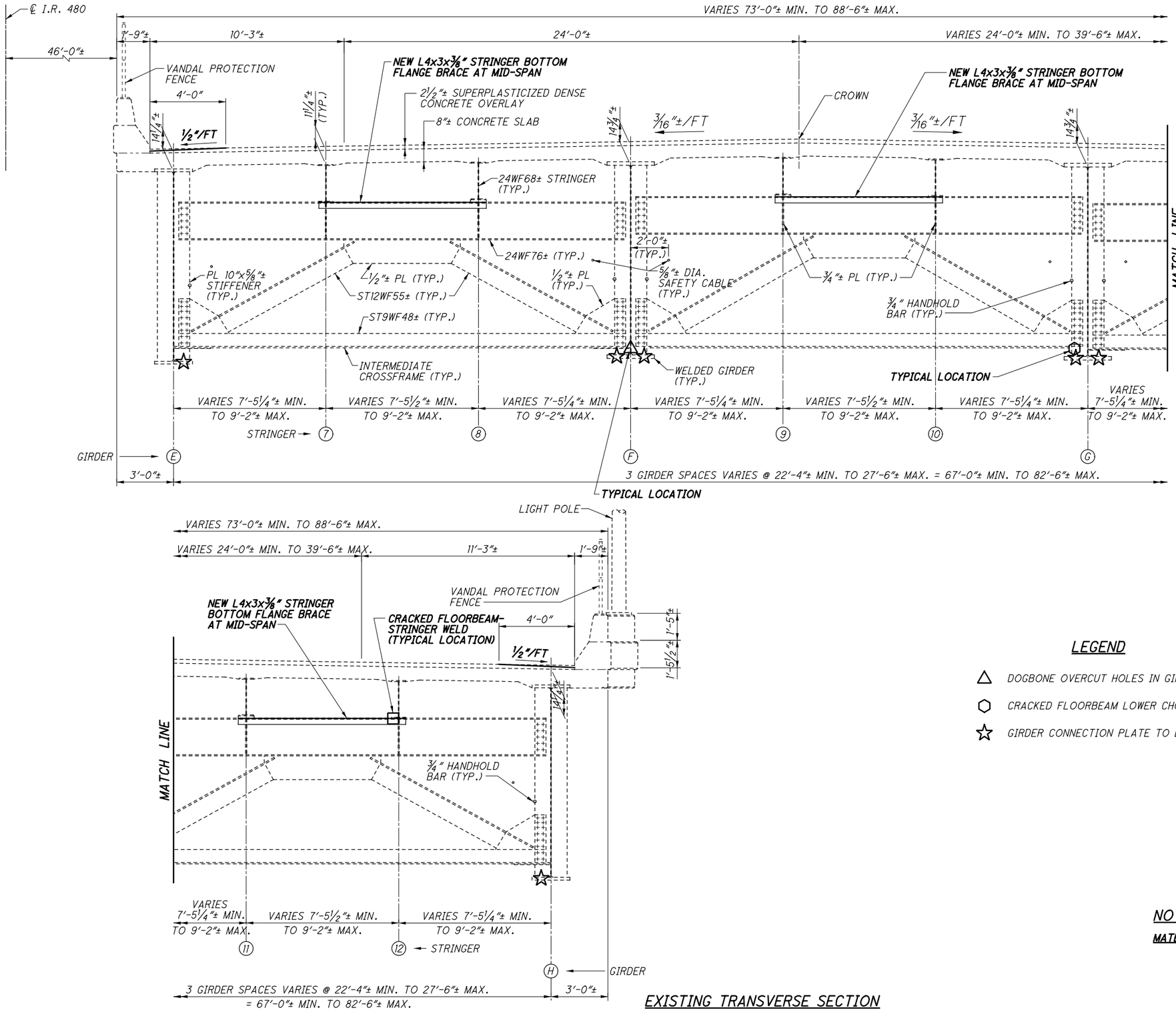
NOTATION: W.B.B. - WESTBOUND BRIDGE
E.B.B. - EASTBOUND BRIDGE

RICHLAND ENGINEERING LIMITED
29 NORTH PARK STREET
MANSFIELD, OHIO 44902

DESIGNED	DRAWN	REVIEWED	DATE
KAK	KH		
CHECKED	REVISED	STRUCTURE FILE NUMBER	
ALP		1812521 (L) 1812548 (R)	

EXISTING TRANSVERSE SECTION - 1
BRIDGE NO. CUY-480-1842 L&R
OVER CUYAQHOGA RIVER VALLEY

CUY-480-18.42
PID No. 90591



EXISTING TRANSVERSE SECTION

EASTBOUND BRIDGE - UNIT 1

LEGEND

- △ DOGBONE OVERCUT HOLES IN GIRDER WEB
- ⬡ CRACKED FLOORBEAM LOWER CHORD COPES
- ☆ GIRDER CONNECTION PLATE TO BOTTOM FLANGE RETROFIT

NOTES

MATERIALS SHOWN ARE EXISTING UNLESS NOTED OTHERWISE.

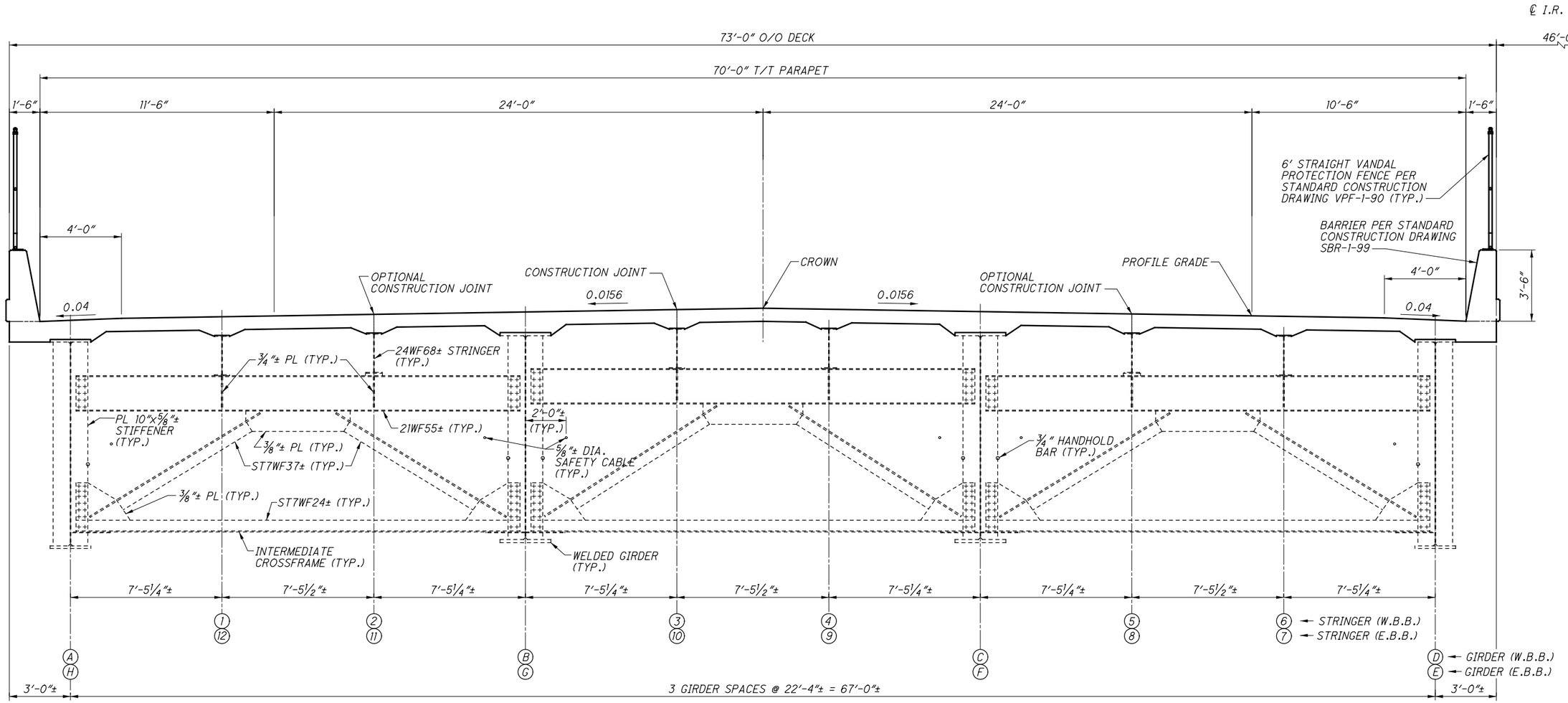
RICHLAND ENGINEERING LIMITED
29 NORTH PARK STREET
MANSFIELD, OHIO 44902

DESIGNED	DRAWN	REVIEWED	DATE
KAK	KH		
CHECKED	REVISED	STRUCTURE FILE NUMBER	
ALP		18512571 (L) 18512548 (R)	

EXISTING TRANSVERSE SECTION - 2

BRIDGE NO. CUY-480-1842 R
OVER CUYAOHOGA RIVER VALLEY

CUY-480-18.42
PID No. 90591



PROPOSED TRANSVERSE SECTION - UNITS 2 TO 5

WESTBOUND BRIDGE - AS SHOWN
EASTBOUND BRIDGE - OPPOSITE HAND

NOTES

MATERIALS SHOWN ARE EXISTING UNLESS NOTED OTHERWISE.

NOTATION: W.B.B. - WESTBOUND BRIDGE
E.B.B. - EASTBOUND BRIDGE

NEW DECK 70' ROADWAY

RICHLAND ENGINEERING LIMITED
29 NORTH PARK STREET
MANSFIELD, OHIO 44902

DESIGNED	DRAWN	REVIEWED	DATE
KAK	KH		
CHECKED	REVISED	STRUCTURE FILE NUMBER 1812521 (L) 1812548 (R)	

PROPOSED TRANSVERSE SECTION - 3
BRIDGE NO. CUY-480-1842 L&R
OVER CUYAQHOGA RIVER VALLEY

CUY-480-18.42
PID No. 90591

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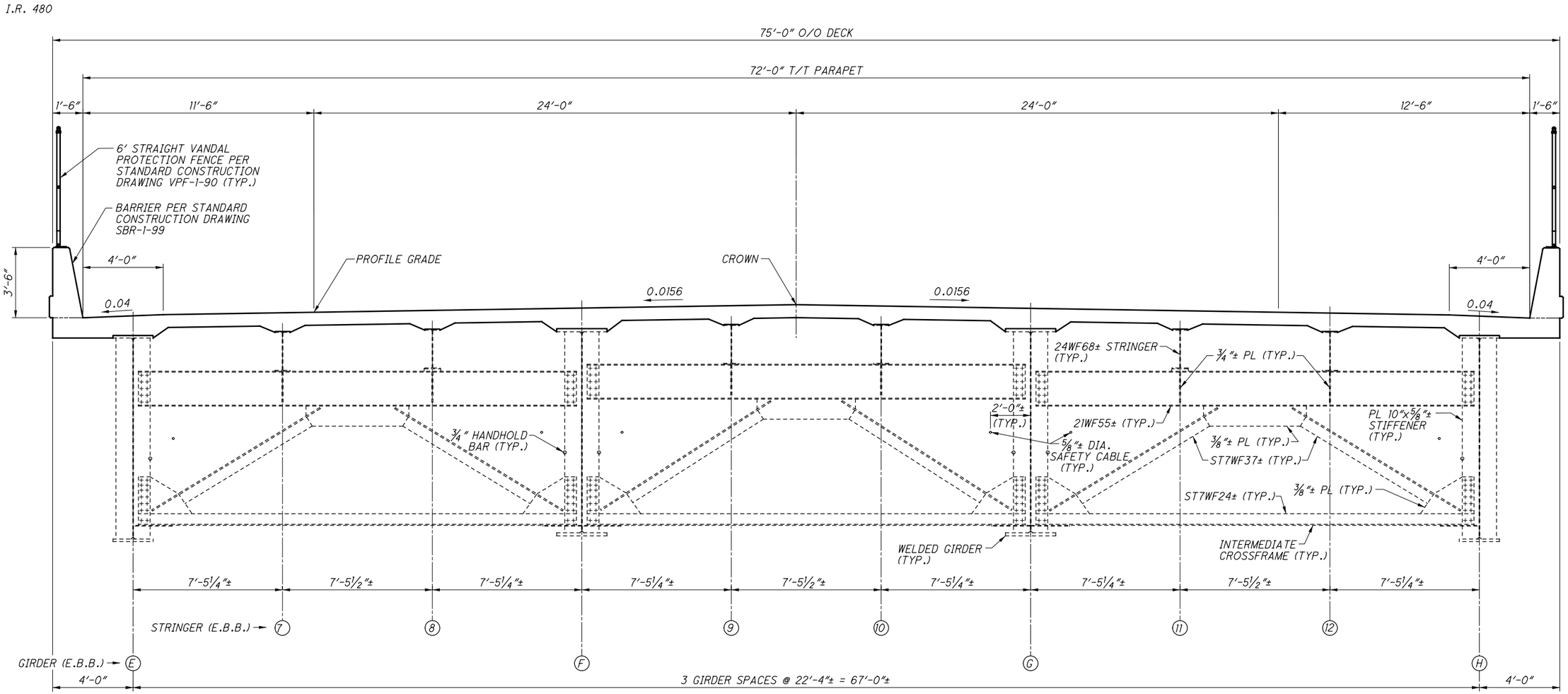

PROPOSED EASTBOUND TRANSVERSE SECTION - UNITS 2 TO 5

NOTES

MATERIALS SHOWN ARE EXISTING UNLESS NOTED OTHERWISE.

NOTATION: W.B.B. - WESTBOUND BRIDGE
E.B.B. - EASTBOUND BRIDGE

WIDEN NEW EASTBOUND BRIDGE
NEW DECK 72' ROADWAY

RICHLAND ENGINEERING LIMITED
29 NORTH PARK STREET
MANSFIELD, OHIO 44902

DESIGNED	DRAWN	REVIEWED	DATE
KAK	KH		
CHECKED	REVISED	STRUCTURE FILE NUMBER 1812521 (L) 1812548 (R)	

PROPOSED TRANSVERSE SECTION - 4
BRIDGE NO. CUY-480-1842 L&R
OVER CUYAQHOGA RIVER VALLEY

CUY-480-18.42
PID No. 90591

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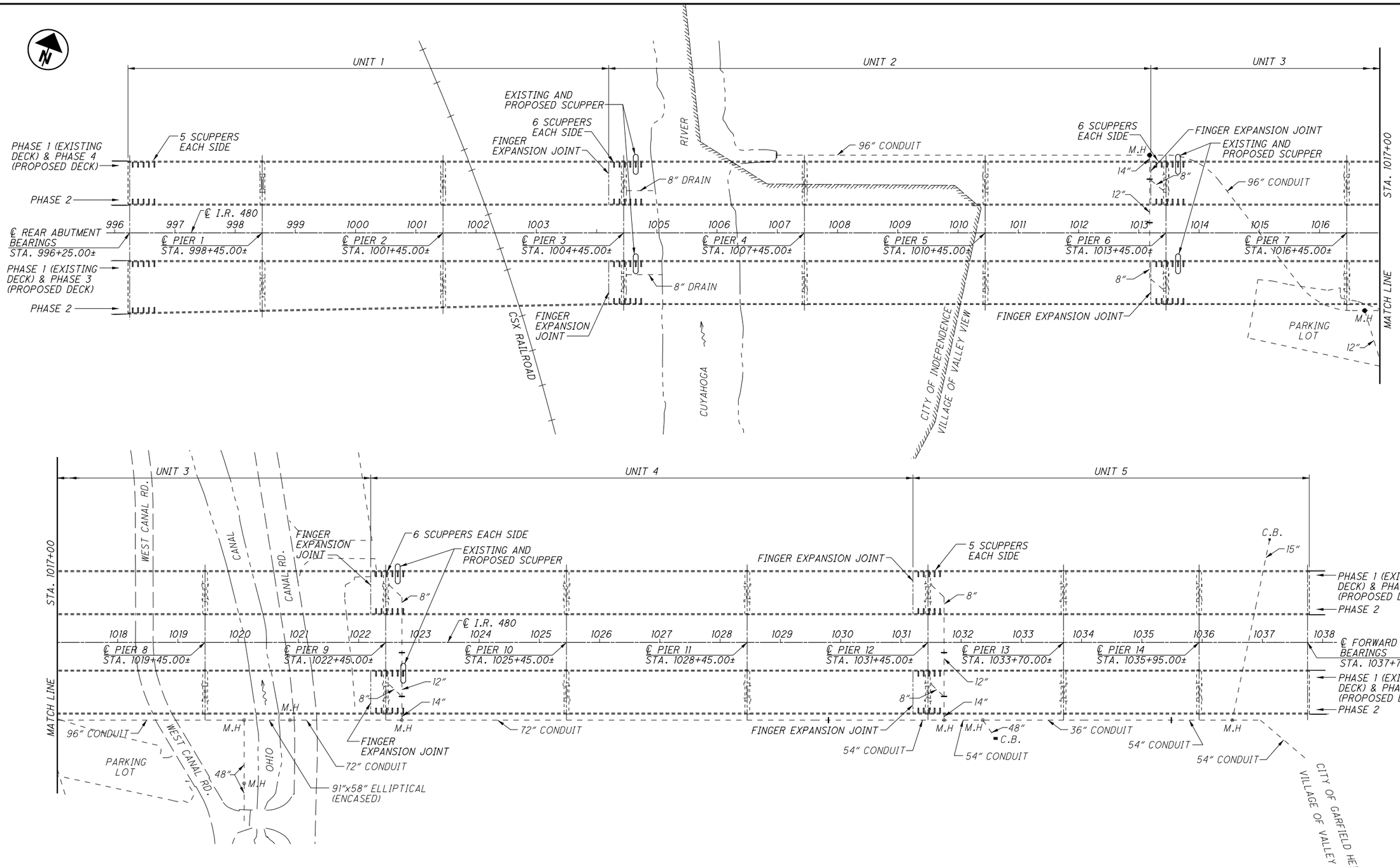

NOTES

MATERIALS *SHOWN ARE EXISTING UNLESS NOTED OTHERWISE.*

RICHLAND ENGINEERING LIMITED
29 NORTH PARK STREET
MANSFIELD, OHIO 44902

DESIGNED ALP | DRAWN JLS | REVIEWED | DATE | CHECKED | REVISED

STRUCTURE FILE NUMBER 1812521
1812548 (R)

EXISTING DRAINAGE PLAN - 1
BRIDGE NO. CUY-480-1843 L&R
OVER CUYAHOGA RIVER VALLEY

CUY-480-18.43
PID No. 90591

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