

SOUTH STAMFORD ACCESSIBILITY & MNRR BRIDGE REPLACEMENT FEASIBILITY STUDY

State Project No. 135-301
Stamford, Connecticut

PRELIMINARY ENGINEERING REPORT

Volume 6 of 7

U.S. ROUTE 1 (EAST MAIN STREET)

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1. INTRODUCTION

1.1. Project Location and Description

This Metro-North Railroad (MNRR) undergrade¹ bridge is located at mile post 34.17 on the New Haven Line and carries five tracks; one track is for the New Canaan Branch and the other four are for the New Haven Line. The underpass is located 1.17 miles east of the Stamford Intermodal Transportation Center (SITC) and crosses over East Main Street, a section of U.S. Route 1 located in Stamford, Connecticut. The East Main Street bridge is the only bridge in this study that has a north-south orientation. U.S. Route 1 is a designated north-south route, but at this location U.S. Route 1 has an east-west orientation. For the purposes of this study the directions of travel on East Main Street will follow the U.S. Route 1 designations (i.e. northbound & southbound). Please refer to Figure 2.1- Project Area, located in Appendix G, for plan view of the project area.

To the west of the bridge, Crystal Street intersects East Main Street at a T-intersection from the north and North State Street intersects East Main Street at a T-intersection from the south. To the east of the bridge, Myrtle Street intersects East Main Street at a T-intersection from the south. Myrtle Street and a section of East Main Street (East Main Street located east of the underpass) are part of the proposed Stamford Urban Transitway (SUT) that is currently under design by the City. The intersection of North State Street, East Main Street and Myrtle Street is state assigned intersection number 135-263.

1.2. Site Features

The existing East Main Street underpass is marked as an undivided two-lane road with one 21-foot lane in each direction. During times of heavy traffic, motorists use the wide lanes as two, informal lanes in each direction. Bridge columns separate the roadway from the 8-foot sidewalks located on both sides on the road. The MNRR undergrade bridge is skewed approximately 45-degrees over East Main Street.

The roadway alignment of East Main Street, traveling east (northbound US Route 1) from the bridge, follows a slight curve. The vertical geometry is relatively flat.

The Crystal Street intersection is stop sign controlled on Crystal Street only. Crystal Street carries only two 15-foot lanes, one in each direction, with no shoulders. A crosswalk is provided. Left turns to go northbound on East Main Street from Crystal Street are not permitted due to sight restrictions imposed by the existing abutment.

North State Street travels southwest from East Main Street approximately 165 feet west of Crystal Street. This is a signalized, T-intersection. A crosswalk is provided to cross North State Street. North State Street carries two 16-foot lanes with no shoulders in

¹ An “Undergrade Bridge,” in rail terms, refers to a road going under the grade of the railroad or under the track. In this case, the bridge acts to carry the tracks over East Main Street resulting in an undergrade bridge.

one direction, one traveling in each direction. The existing intersection sight distance for the North State Street to East Main Street approach is approximately 240 feet which corresponds to a design speed of 20+/- mph for a passenger car design vehicle.

The Myrtle Street intersection, just east of the bridge, is a signalized T-intersection with a crosswalk on the south side of East Main Street. Myrtle Street intersects East Main Street from the south and carries two 18-foot lanes with no shoulders, one in each direction.

Catenary towers are located approximately 120 feet west and 90 feet east from the west and east abutments, respectively.

1.3 Purpose of Project

The widening of East Main Street will allow for the addition of two travel lanes and two bike lanes. These travel lanes will provide the additional capacity needed to permit movements of cars northbound and southbound along U.S. Route 1. The bike lanes will improve the safety of those on bicycle and encourage the use of bicycles as an alternative means of transportation. Additional improvements include two-foot shoulders and a median to divide opposing traffic. The reconstruction of the MNRR undergrade bridge will support the roadway widening and will provide an increased vertical clearance to permit the passing of all legal height vehicles. The largest vehicles owned and operated by the City of Stamford are a HazMat truck and the Police Department's command vehicle, both of which have a height of 12'-6". Please refer to Figure 2.4A located in Appendix G for a cross section of the proposed two-span East Main Street bridge.

Proposed improvements to the undergrade bridge include total reconstruction of the superstructure and substructure. The type of deck proposed for the bridge is the MNRR preferred ballasted deck rather than an open deck which is currently in place. Proposed improvements to East Main Street include the addition of two lanes which will provide a total of two 11-foot lanes in each direction. The addition of 5-foot bike lanes in both directions, two-foot shoulders, and a median to divide opposing traffic are also proposed improvements.

2. HIGHWAY

2.1. Horizontal Alignments and Lane Arrangements

The proposed roadway cross section of the U.S. Route 1 (East Main Street) underpass is based on discussions with the Connecticut Department of Transportation (CTDOT) and the City of Stamford. U.S. Route 1 is a designated north-south route. At this location along East Main Street the roadway has an east-west orientation. For the purposes of this study the directions of travel on East Main Street will follow the U.S. Route 1 designations. Please refer to Figure 2.4a in Appendix G, for the proposed East Main Street, two-span, cross section. The proposed lane arrangements include:

- two 11-foot lanes in the northbound direction
- two 11-foot lanes in the southbound direction
- 2-foot shoulders, inside only
- an 8-foot median which will also accommodate a bridge pier
- 8-foot sidewalks
- two 5-foot bike lanes, one in each direction

The total curb-to-curb width of East Main Street at the underpass will be 76 feet.

The horizontal alignment for the roadway is proposed to match the existing conditions for East Main Street on its west side, and the proposed SUT layout on its east side. The proposed horizontal alignment for the East Main Street underpass will match the existing layout with a 675 feet radii at the inside edge of the southbound traveled way on the west side of the bridge, and a radii of 1000 feet along the roadway centerline on the east side of the bridge. Left turns to East Main Street from North State Street provide a proposed intersection sight distance (ISD) of 270 feet which does not meet the required ISD for a posted speed of 30 miles per hour (mph). Designing the intersection to provide for the required ISD will significantly impact the urban roadway and abutting properties, therefore a design exception will be required. Please refer to Figure 2.2a for the two-span roadway plan, located in Appendix G.

2.2. Vertical Profiles

The proposed vertical alignment for East Main Street is a sag curve controlled by the bridge structure and the minimum clearance required of 14'-6". To provide the required minimum clearance for a two-span bridge, the profile for East Main Street has to be lowered by approximately 2.6 feet, creating a 150-foot sag vertical curve and a maximum grade of 4.2%. The stopping sight distance (SSD) provided is based on an illuminated highway and exceeds 500 feet which provides for a design speed greater than 50 mph. The K value for the sag curve corresponds to a design speed of 20 mph. Please refer to Figure 2.3a for the two-span roadway profile, located in Appendix G.

2.3. Rights-of-Way

The parking lot and driveways to the plaza located west of Crystal Street and to the east of Myrtle Street will be impacted. A partial take of the building (876 E. Main Street) on the west side of Crystal Street will be required.

The plans for the Stamford Urban Transitway include the proposed improvements on the south side of East Main Street between Myrtle Street and Maple Avenue.

2.4. Exceptions to Geometric Design Criteria

The ISD for the intersection of North State Street and East Main Street does not meet the criteria for a design speed of 30 mph and will require a design exception.

2.5. Enhancements to Pedestrian, Bus, Taxi, and Transit Operations

The addition of a 5-foot bike lane in each direction will provide safer riding conditions for cyclists. The widening of East Main Street will provide additional capacity for bus service allowing for more frequent and more reliable service to be implemented.

3. RAIL OPERATIONS

3.1. Rail Staging and Sequence Requirements

The East Main Street bridge is an undergrade structure on the New Haven Line at mile post (MP) 34.17 in Stamford. The East Main Street bridge is located approximately 1.17 miles east of the SITC. The bridge carries five tracks: the New Canaan Branch (Track 5) and the 4 New Haven Line tracks (numbered 3, 1, 2, and 4) over East Main Street. The bridge is situated between CP234 and CP235. CP234 and CP235 are interlockings². The “CP” signifies “Control Point” while the “2” indicates that the interlockings are located on the New Haven Line. The last two digits indicate approximate mile posts.

Replacement of the bridge will be done one track at a time. The replacement work will require that each track be taken out of service while the reconstruction work on the portion of the bridge under that track is performed. The bridge replacement work can be done either working in the north to south, or the south to north direction.

The construction staging plans for East Main Street bridge show the reconstruction of the bridge being progressed in a north to south direction (Track 5 to Track 4). Please refer to Appendix C for the construction schedule. The bridge reconstruction work is shown being done in five main stages. Each of these stages will require a continuous track outage for the track being replaced on the portion of the bridge being reconstructed. It is estimated that the duration of the continuous track outages required for each track reconstruction will be 150 calendar days.

The continuous track outages will not impact the use of the SITC passenger platforms. During these outages however, the normal routing of westbound trains into the station area will have to be adjusted to accommodate the out-of-service tracks on the East Main Street bridge.

The installation of a temporary track cut-and-throw between Tracks 5 and 3 will be required during Stage 1 of the project work. This track cut-and-throw will allow the continuous operation of the New Canaan Branch trains during the replacement of Track 5 on the East Main Street bridge. Please refer to Figure 3.1a located in Appendix G. Two additional short track outage periods will be required during this stage for the

² Interlockings are switches and/or crossovers that allow trains to travel from one track to another governed by signal indications. On the New Haven line, these points are remotely controlled by the MNRR Operations Control Center.

installation and removal of the temporary track throw. Please refer to Figures 3.1b-c, located in Appendix G.

During Stage 1 and Stage 5 of the project work, bridge plates at the Noroton Heights, Darien, and Rowayton Stations will be required. Bridge plates will be required as the Track 3 continuous outage in Stage 1 and the Track 4 continuous outage in Stage 5, extend east through these three stations.

With the mobilization period, the 150 calendar days required for each continuous track outage, and the approximate five month period to complete the roadway work under the bridge, the total project duration time for the replacement of the East Main Street bridge is approximated at 2 years, 11 months.

3.2. Impact and Operational Issues of Proposed Construction

At the East Main Street bridge, as outlined below, there will be a critical impact to Metro-North train operations during reconstruction of the Track 5 portion of the bridge.

When Track 5 is removed during the replacement of that portion of the East Main Street bridge, the New Canaan Branch will be out of service at the bridge. Normal train service on the Branch cannot be run. Busing service for the New Canaan Branch commuters was considered and deemed not practical. After review by CTDOT and Metro-North, it was determined that a temporary Track 3-5 cut-and-throw be installed between Tracks 5 and 3, just east of the East Main Street bridge.

This temporary track realignment will allow the New Canaan Branch trains to operate during the Track 5 bridge reconstruction at East Main Street. Minor track outages and limited weekend busing may be required during the installation and the removal of the track cut-and-throw.

Replacement of Track 5 (New Canaan Branch) - When Track 5 at the East Main Street bridge is taken out of service, the installation of a temporary cut-and-throw between Tracks 5 and 3 will be required. This temporary track realignment will allow operation of the New Canaan Branch train service during the Track 5 reconstruction work. Please refer to Figure 3.1c.

During this stage of the work, bridge plates will be required at the Noroton Heights, Darien, and Rowayton passenger stations.

When Track 5 at the East Main Street bridge is taken out of service, eastbound trains on Track 5 will use the 5-3 crossover in CP234 to divert to Track 3, and the Track 3-5 cut-and-throw to divert to Track 5 and up the New Canaan Branch.

Westbound trains on Track 5 (New Canaan Branch) will use the Track 3-5 cut-and-throw to divert to Track 3, and the 5-3 crossover in CP234 to divert to the Track 5 passenger platform track.

The Track 3-5 cut-and-throw will be removed, and the normal alignment of Tracks 5 and 3 restored when the Track 5 bridge work is completed on the East Main Street bridge.

Replacement of Track 3 - When Track 3 at the East Main Street bridge is taken out of service eastbound trains on Track 3 will use the crossovers in CP234 and CP235 to run around the Track 3 outage at the East Main Street bridge. Please refer to Figure 3.1d, located in Appendix G.

Westbound trains on Track 3 will use the 5-3 crossover in CP235 and the crossovers in CP234 to run around the bridge work on Track 3.

Replacement of Track 1 - When Track 1 at the East Main Street bridge is taken out of service, eastbound trains on Track 1 will use the crossovers in CP234 and CP235 to run around the bridge work on Track 1. Please refer to Figure 3.1e, located in Appendix G.

Westbound trains on Track 1 will be able to use the 3-1 crossover in CP235 and the crossovers in CP234 to run around the Track 1 outage at the East Main Street bridge.

Replacement of Track 2 - When Track 2 at the East Main Street bridge is taken out of service, east bound trains on Track 2 will use the crossovers in CP234 to divert to one of the adjacent in-service tracks to run around the bridge work on Track 2. Please refer to Figure 3.1f, located in Appendix G.

Westbound trains on Track 2 will use the crossovers in CP240 and CP241 to divert from Track 2 to an adjacent in-service track to run around the Track 2 outage at the East Main Street bridge.

Replacement of Track 4 - When Track 4 is taken out of service at the East Main Street bridge, bridge plates will be required at the Noroton Heights, Darien, and Rowayton passenger stations. Please refer to Figure 3.1g, located in Appendix G.

Eastbound trains on Track 4 will use the crossovers in CP234 to divert to one of the adjacent in-service tracks to run around the bridge work on Track 4.

Westbound trains on Track 4 will use the crossovers in CP240 and CP241 to divert from Track 4 to an adjacent in-service track to run around the Track 4 outage at the East Main Street bridge.

3.3. Summary and Conclusions

Construction of the East Main Street bridge will impact train operations on the New Canaan Branch and in CP234. The bridge reconstruction will also require the installation of a temporary Track 3-5 cut-and-throw for continued operation of the New Canaan Branch train service.

Bridge construction will not substantially impact train operations on the SITC tracks. Bridge plates will be required at the Noroton Heights, Darien, and Rowayton passenger stations during different stages of the work.

It is recommended that this bridge be reconstructed in the same time frame as the Elm Street bridge. Both of these bridges have the same train operation issues for the New Canaan Branch service when Track 5 is taken out of service on these bridges. Any rail sequencing and train operation inconveniences could be shared between both bridges in a single construction stage period, rather than having to implement them twice in different construction timeframe periods.

This bridge could also be considered for concurrent reconstruction with the Canal Street, Atlantic Street, or Greenwich Avenue bridges. Metro-North should be consulted for its concurrence regarding these recommendations, and to determine any other train operation impacts.

4. BRIDGE 02237R – MNRR OVER U.S. ROUTE 1 (EAST MAIN ST)

4.1. Existing Bridge

The existing Metro-North Railroad (MNRR) bridge is identified as Bridge No. 02237R at mile post (MP) 34.17. The bridge carries four mainline tracks and one New Canaan Branch track over U.S. Route 1. The bridge was originally constructed in 1896 and then rehabilitated in 1931. The length of the bridge is 105 feet overall with a center-span length of 71 feet, and an out-to-out deck dimension of 65 feet. There is a posted vertical clearance of 13'-1"; however, the measured vertical clearance is 13'-3". Please refer to Figure 4.2 located in Appendix G for an existing section of the bridge superstructure.

The bridge has an open deck with three simple spans. The superstructure is steel-framed with riveted through-girders and a floor beam and stringer system comprising the center span. The end spans bridge the sidewalks and are the continued stringers from the center span. The superstructure is in poor condition with numerous cracks in repair welds.

The superstructure is supported by brownstone masonry abutments and steel-framed intermediate piers. The existing abutments and wingwalls are a gravity type made of stacked stone masonry. The wingwalls are typically parallel to East Main Street as they taper down with the embankment grading. The exception is the northeast wingwall

which is flared back away from the roadway. The abutments are in fair condition. However, the stone backwalls have moved and they are contacting the end span superstructure. The steel-framed piers are constructed of riveted cap beams with built-up columns supported by concrete pedestals. The piers are in poor condition with laminated rust and knife edging of the flanges of the cap beams.

In a Railroad Bridge Inspection report, dated October of 2008, it was noted that the East Main Street bridge is in “serious condition” with an overall rating of “3”. The report identified varying degrees of section loss throughout the super- and substructure steel. In addition to steel deterioration, support settlement at the abutments was also noted. The bridge has been rated for a Cooper E48 loading as its Normal Load Rating. The load rating is controlled by girders under Tracks 1, 2, 3, and 4.

4.2. Proposed Improvements

Proposed improvements include:

1. Increasing the bridge span length to accommodate the wider curb-to-curb width of East Main Street.
2. Increasing the vertical clearance to accommodate all legal height vehicles.

4.2.1. Critical Controls

4.2.1.1. Clearance Envelope

Please refer to Appendix B – Bridge Design Criteria, for the American Rail Engineering and Maintenance-of-way Association’s (AREMA) defined track clearance envelope for railway bridges. All proposed structure types for the reconstruction of the U.S. Route 1 bridge will not encroach upon this clearance envelope. The only structure type affected by this criterion is the through-girder which is restricted vertically by the bottom of the clearance envelope or the top of rail elevation.

4.2.1.2. Depth of Structure

In order to accommodate the proposed roadway widening, it is necessary to increase the bridge’s span length. With the addition of two travel lanes, bike lanes, shoulders, and a median, the curb-to-curb width will increase from 42 feet to 66 feet. However, it is the 48-degree skew of the bridge over East Main Street that increases the abutment face to abutment face width to 99’-4”. The proposed bridge configuration will require at least two spans in order to keep the structure depth within reasonable limits.

The profile of East Main Street will need to be lowered approximately 2.6 feet, contingent upon the final depth of proposed structure as measured from top of rail to bottom of superstructure.

The depth of structure is critical to minimize impacts to adjacent properties and also to the construction sequencing for maintenance and protection of traffic. U.S. Route 1 (East Main Street) serves the region as an emergency route and a major truck route and must maintain traffic during construction. Several options have been explored in an attempt to keep the depth which U.S. Route 1 is to be lowered to a minimum, while also considering the costs and benefits.

For the purposes of evaluating the options presented, each is compared to a benchmark design defined as a two-span, multi concrete-encased steel beam type superstructure with a design span of 74 feet and a structure depth of 5'-5".

1. Conventional Abutment

One option to reduce the structure depth involves reducing the span length. This would be accomplished by using a conventional abutment construction method instead of a top-down construction method, reducing the overall length of the bridge. This construction method will reduce the design span length from 74 feet to 65.5 feet, reducing the structural depth by about five inches.

A cost analysis indicated an increase in total cost (depending upon the structure type) to be between one and two million dollars. This increase in cost is mainly due to the fact that:

- a conventional abutment method requires a deeper excavation, down to four feet below the street grade
- a more substantial support of excavation system is needed
- the complete demolition of the existing abutment is required before reconstruction

Because the earth excavation will occur adjacent to operating tracks, increasing the depth of excavation will add to the complexity of the construction. In addition to being more costly, the construction of conventional abutments would require a longer construction period than the top-down construction method.

2. Four-Span Option

A four-span option was considered in addition to a two-span option. The four-span option would reduce the design span length from 74 feet to 52'-3". The shortened span length would reduce the structure depth by at least one foot, depending upon the structure type selected. (Specific structure depths are presented in section 4.2.2. for each structure type considered for both two-span and four-span, top-down and conventional abutment construction options).

A four-span option provides the benefit of a reduced superstructure depth, resulting in the bottom of the proposed superstructure being at a higher elevation than that of the existing through girders. For the two-span option, the opposite is true where the increased superstructure depth results in the bottom of the proposed superstructure being set at an elevation lower than the existing through girders. The two-span option creates an adverse condition of a reduction in vertical clearance. To mitigate this, construction sequencing for a two-span option will require that a portion of the roadway to be lowered prior to the reconstruction of the bridge in order to maintain existing vertical clearances. The result is that the road lowering work would be performed prior to any bridge reconstruction, which requires additional phases of construction staging in the project.

The four-span option also presents a drawback. The CTDOT Highway Design Manual requires that for an undivided roadway, such as East Main Street, all approaches to a structure are considered to be leading ends and therefore all approaches must be protected in case of vehicle impact. These details are further explained in Section 6.4, where the pier's impact attenuator, located on East Main Street's southbound curb line, eliminates right turns onto Crystal Street.

The proposed bridge will consist of at least two spans. The piers will also serve to provide a barrier between opposing traffic and, for the four-span option, to separate the sidewalk from the roadway. The proposed pier layouts will conform to the proposed horizontal roadway alignments. The proposed structure layout was defined by holding the face of the north abutment and offsetting lane delineations, curb locations, centerlines of piers, and centerlines of bearing from there.

4.2.1.3. MNRR Track Alignment

A requirement of Metro-North is that the elevation and horizontal alignment of the MNRR tracks remain unchanged. Since the tracks cannot be raised, the required minimum vertical clearance of 14'-6" in conjunction with the depth of proposed structure will control the elevation and vertical geometry of East Main Street. The final vertical profile of East Main Street will determine the extent that East Main Street will need to be lowered and the degree to which this will impact adjacent intersections, roadways and adjacent properties.

4.2.1.4. Limited Headroom

Overhead catenary wires will be de-energized but will be maintained in their current location during construction, restricting headroom. This constraint will limit the use of overhead equipment, e.g. cranes. This is of particular importance during construction of the foundations and erection of the superstructure.

4.2.2. Superstructure Types

Several bridge types were considered for the preliminary engineering study including:

- ballasted deck, through-girders
- 2-girder ballasted concrete deck
- multi-steel girder ballasted steel plate deck
- precast multi concrete-encased beams
- prestressed butted box beams

Two bridge configurations were considered: a two-span option and a four-span option. The two-span option has two simple spans, with a controlling span length of 74'-0" (considering the 48-degree skew). A four-span option has a shorter span length consequently reducing the depth of structure, minimizing impacts to the existing East Main Street profile. The four-span option has a controlling span length of 52'-3" (considering the 48-degree skew). Please refer to Figure 4.1A for a proposed general plan and elevation of the two-span alternative and Figure 4.1B for the four-span alternative, located in Appendix G.

For consistency, each structure type is compared based on its structure depth. The structure depth is measured from the top of rail to the bottom of the girder. The girder depth takes into account only the total depth of the girder. Dimensions common to all structure types include: $7\frac{5}{16}$ -inch rail height, 8½-inch concrete ties, 8½-inch minimum ballast thickness, and a 1-inch ballast mat. Dimensions for specific structure types include: a 13-inch concrete deck with haunch for the two-girder option, 1½-inch steel deck plate for the through-girder option, and 2-inch thick steel deck plate for the multi-steel girder option.

Through-Girders: This structure type allows the top of the girder to be elevated above the deck but limited by the railroad clearance envelope (please see Page 32 in Appendix B for details pertaining to the clearance envelope). The through-girder permits a reduction in the superstructure depth because the track structure sits on the stringer and floor beam system situated within a pair of through-girders. This allows the top flange of the through-girders to be elevated alongside the tracks. However, this may not benefit short spans where the geometric configuration of the deck framing system would require a larger superstructure depth than is structurally required. Through-girders would provide a 6'-2" structure depth for a two-span, top-down abutment construction method. For a four-span top down construction method, the through-girders would require a 4'-8" structure depth.

Considering East Main Street, the through-girder option would require a different construction and rail operation sequence than the sequences proposed for the other structure types. The existing bridge uses common through-girders where each girder supports two adjacent tracks rather than each track being independently supported by a pair of girders. Because the common girder supports two adjacent

tracks and only one track can be taken out of service at a time, a temporary support system will need to be installed between the girders to support the tracks as the existing structure is removed. The temporary support will be completed under all tracks prior to the installation of the new permanent girders and the reconstruction of the substructure. This operation will require more track outages than those proposed for the other structure types. Selection of this structure type will increase the construction duration at East Main Street and will further reduce vertical clearance for East Main Street. The reduced vertical clearance will need to be addressed for maintenance and protection of traffic. If coordinated properly, this is still considered a viable option. Another drawback of this structure type is that all girders are fracture critical.

Two-Girder Ballasted Concrete Deck: This superstructure type consists of two girders below a ballasted concrete deck. This is generally more economical compared to other superstructure types because it is the simplest to fabricate and to erect. A major drawback is that it usually requires the greatest superstructure depth, adding to the amount East Main Street would have to be lowered in order to attain the required minimum vertical clearance. This structure type has the deepest superstructure depth. Since the depth of structure is a critical criterion for the East Main Street bridge, this structure type is not considered a viable option.

Multi-Steel Girder Ballasted Steel Plate Deck: This framing system requires a shallower superstructure than a two-girder framing system. It is more economical to fabricate and to erect compared to a through-girder system, but requires more maintenance throughout its design life. This steel superstructure requires a higher life-cycle cost than the precast multi concrete-encased beam alternative. Considering a two-span, top-down abutment construction method, this structure type option requires a 5'-10" superstructure depth at East Main Street. For a four-span, top-down abutment construction method, the multi-steel girder ballasted steel plate deck structure type would require a 4'-8" structure depth.

Precast Multi Concrete-Encased Beams: This superstructure type is economical and requires low maintenance. The butted beam construction allows for a ballasted track without the need to provide for an additional deck system. This structure type offers the shallowest superstructure depth among the alternatives considered, but usually requires significantly more steel than the other alternatives. This system is appropriate for short to moderate span lengths. Considering a two-span, top-down abutment construction method, this structure-type alternate would require a 5'-5" superstructure depth at East Main Street. For the four-span, top-down abutment construction method, the precast multi concrete-encased beam structure-type would require a structure depth of 4'-6".

Prestressed Butted Box Beams: Butted box beams are generally economical, easy to erect, and require low maintenance. Similar to the precast multi concrete-encased beams, they allow for a ballasted deck without the need to provide for an

additional deck system. However, precast butted box beams offer limited superstructure depth options, generally requiring larger superstructure depths than the precast multi concrete-encased beams. For this reason, this alternative will not be considered in this study.

Summary: After consideration of the advantages and disadvantages of each superstructure type, the multi-steel girder, the precast multi concrete-encased beam, and the through-girders are all structurally viable alternatives for this application and will be considered in this report. Please refer to Figure 4.2 for the typical bridge sections of these two bridge types.

4.2.3. *Abutments*

Because the bridge is being built in stages, it is proposed that the new abutments be constructed using a top-down construction technique. The top-down technique allows for short stub abutments supported on mini-piles. Because this type of abutment and methodology requires less excavation and materials, it greatly reduces the support of excavation requirements within close proximity to the adjacent operating tracks. Drilled mini-piles are the recommended foundation type for the abutments since they will allow ease of installation under low overhead conditions. The abutment seat will be constructed with cast-in-place concrete and the abutment wall will be built using a tie-back wall with steel walers, concrete lagging, and a concrete fascia aesthetically treated with concrete formliner. For the Abutment 1 and 2 plan and elevation, please refer to Figures 4.6A and 4.6B located in Appendix G.

Alternatively, conventional abutments may be used, which would reduce the span length and subsequently reduce the superstructure depth by approximately five to seven inches. However, construction of conventional type abutments would require a significant amount of structural excavation adjacent to live tracks and an extensive temporary earth retaining system. Because of this, this type of abutment would result in a longer construction duration. Roadway construction cost savings from the reduction of the superstructure depth is estimated to be minimal, and is not considered to be commensurate to the significant additional costs associated with this substructure construction.

4.2.4. *Pier*

Due to the increased length of the bridge and the need to provide a shallow superstructure, a two-span and a four-span bridge option have been considered. The multiple spans will be supported by the new abutments and new proposed piers. The pier(s) will also act as a divider between directional traffic and, for the four-span option, a divider between the sidewalks and bike lanes.

The proposed pier(s) will be comprised of a footing, pier cap and circular columns. The pier cap width is estimated to be 5.5 feet in order to accommodate two rows of

bearings. The circular columns are estimated to be 4-foot in diameter and will be supported by an 8-foot wide pile cap founded on mini-piles. Two-foot wide vertical traffic barriers will be placed on either side of the pier columns to protect the columns from vehicular collisions. Please refer to Figure 4.7 for the pier plan, located in Appendix G.

East Main Street will remain open to traffic maintaining two travel lanes during construction. The space available for maintenance of traffic and a work zone is very limited, and therefore a narrow pile cap will be utilized. For this reason, a spread footing is not a viable option at this location because it will require a wider footing which will increase the width of the work zone. A narrower pile-cap foundation will be supported on drilled mini-piles.

4.2.5. Retaining Walls

4.2.5.1. Roadway Retaining Walls

The impact from lowering East Main Street reaches beyond the immediate vicinity of the underpass to the surrounding streets and intersections. Crystal Street on the northwest corner of the bridge will need to be lowered to meet the East Main Street profile. A new retaining wall will need to be constructed at the northwest corner of the Crystal Street intersection to maintain the current grade at the building face on the property located behind it. Because of the addition of this retaining wall, the existing stairs and wheelchair ramp located there will need to be reconfigured.

4.2.5.2. Railroad Retaining Walls

Railroad retaining walls will exist as the bridge's wingwalls and are therefore considered to be part of the bridge's substructure.

4.3. Phased Construction Requirements

Since only one MNRR track can be taken out of service at a time, the construction of a new bridge must be done in phases. The tracks can be taken out of service in a north to south or a south to north order. As previously discussed in the rail operations section of this report, the tracks are shown as being taken out of service from north to south.

As a track is taken out of service, work will immediately begin to stabilize the foundation of the adjacent tracks to permit excavation under the track that is out. Once the support of excavation has been installed, construction of the new abutments will begin in a top-down method, or a conventional method, to support the new structure. Simultaneously, the existing pier will be demolished under the track that is out and the new pier will be constructed in its proposed location. The new superstructure will be fully supported by new substructure with existing structure that remains functioning independently one track away. Once the new structure is completed, the next adjacent track will be taken out of service. Again, care will be taken not to disturb the existing

foundations and the new foundations. Construction phasing will differ if a through-girder structure-type is selected. Please refer to section 4.2.2. *Superstructure Types*, “Through-Girders” for more details. Please also refer to Figures 4.3A-4.3C and Figures 4.4A-4.4B for construction staging and sequence. These figures are located in Appendix G.

4.3.1 Suggested Superstructure Erection Method

The conditions around the track present challenges for the erection procedure. Particular challenges include:

- obtaining the required vertical clearance
- horizontal clearances limited by adjacent live tracks
- maintenance of traffic
- overhead wires

A method of erection that is suited to these constraints is launching the girders on the out of service track. This involves the building of a beam erection frame on both the abutment and the pier at track level. These frames will support an erection beam that will span from pier to abutment and be capable of supporting at least one half the weight of a bridge beam. The bridge beam will be delivered to the site via rail car on the track that is out of service. One end of the bridge beam will be supported by rollers on the bottom flange of the erection beam while the other beam will be supported on land by another rolling mechanism. The bridge beam will be launched across the span and lowered to its permanent location. These steps will be repeated for all beams to complete the superstructure.

4.4. Aesthetic Treatments

The face of the concrete abutments will be aesthetically treated with concrete formliner to simulate a stone appearance and can be made to mimic the appearance of the original brownstone masonry.

4.5. Summary and Conclusions

4.5.1. Structure Summary

It is proposed that the existing three-span plate girder bridge be replaced with one of the several proposed bridge types in either a two-span or a four-span bridge configuration. The longer spans will require the addition of piers in order to minimize structure depth.

Five structure types were considered and non-viable types were eliminated. The remaining options (multi-steel girder, precast multi concrete-encased beam, and through-girders) were considered for their impact to East Main Street’s profile, constructability and cost.

One track will be taken out of service at a time in order to mitigate impact to the rail operations. As a result, construction will progress in phases. Each phase will require a track outage where the existing bridge will be removed and reconstructed without disturbing the adjacent tracks which are to remain in operation. Because of the constraints presented, a top-down construction method is recommended to construct the abutments. For the purposes of this report, the tracks were replaced from north to south.

4.5.2. *Construction Duration*

With the mobilization period, the 150 calendar days required for each of the five continuous track outages, and the approximate five month period to complete the roadway work under the bridge, the total project duration time for the replacement of the East Main Street bridge is approximated at 2 years, 11 months.

4.5.3. *Estimated Construction Costs*

Construction cost estimates have been developed based on the weighted unit prices listed in the Connecticut Department of Transportation’s Item Master File (December 2010) and the CTDOT’s Preliminary Cost Estimating Guidelines (January 2011). The cost estimates do not include costs associated with environmental studies, environmental remediation, rights-of-way acquisitions, or professional services for survey, design, or construction engineering and inspection. The construction costs for the East Main Street site are summarized as follows:

Structure-type: Concrete-Encased Steel Beams

		Two-Span	Four-Span
Roadway, Drainage, Traffic, Structures and Railroad Operations	\$	30,495,000	38,284,000
Utilities	\$	1,585,000	1,585,000
Railroad	\$	13,502,000	16,284,000
Incidentals & Contingencies	\$	8,538,000	10,720,000
Totals	\$	54,120,000	66,873,000

Structure-type: Through-Girder

		Two-Span	Four-Span
Roadway, Drainage, Traffic, Structures and Railroad Operations	\$	31,037,000	38,453,000
Utilities	\$	1,585,000	1,585,000

Railroad	\$	13,696,000	16,344,000
Incidentals & Contingencies	\$	8,690,000	10,767,000
Totals	\$	55,008,000	67,149,000

5. OTHER STRUCTURES

No other structures are proposed for East Main Street.

6. TRAFFIC

6.1. Traffic Operational Requirements

East Main Street is a two-lane road that is designated U. S. Route 1, and is classified as a Principal Urban Arterial. It provides two wide lanes with shoulders as it passes under the MNRR bridge, with a single lane designated for each direction. An unsignalized intersection with Crystal Street is located immediately west of the bridge at the north, and a signalized intersection with Myrtle Street is located immediately east of the bridge to the south. An additional unsignalized intersection is provided with Maple Street, approximately 250 feet east of Myrtle Street, and a signalized intersection is provided with North State Street approximately 120 feet west of Crystal Street. All of these intersecting streets provide a single lane in each direction. Left turns are prohibited from Crystal Street onto East Main Street due to the restricted sight distances at this location.

The effect of these closely spaced intersections is a condition where traffic flows are heavily impacted by both upstream and downstream operations. Queuing between these intersections can lead to congestion at adjoining locations even though the basic intersection capacity may theoretically be sufficient. Intersection signal timings, phasing and system coordination influence the operation and level of service within the entire corridor.

Capacity analyses show that the intersections along U.S. Route 1 are generally operating below capacity, although the existing queuing interferes with operation at adjacent intersections. As traffic grows through the 2029 design year, queuing is anticipated to get worse, operations will continue to suffer, and several turning movements may be blocked by queues from adjoining intersections.

Discussions with CTDOT and the City of Stamford led to the adoption of a cross section under the bridge that will provide increased capacity for the corridor, adding a second lane and shoulders in each direction. In addition, a bike lane in each direction is also proposed. These lane arrangements are designed to match the SUT improvements that are proposed for the corridor, including the reconstruction of the Maple Street intersection and signalization as part of that project. These additional lanes will provide overall better levels of service, increased safety, multi-modal capability, reduced queuing, and reduce congestion levels in the corridor.

The substantial revision to the East Main Street curb line under the MNRR bridge and the modifications to the lane arrangements will require new signal head locations at the North State Street intersection and the Myrtle Street (SUT) intersection, including the removal and re-installation of impacted span poles. Because of the difficulties associated with the relocation of signal heads and wiring on an existing span wire assembly, it is likely that new signal poles, signals, and wiring will be necessary. The new signal poles would likely follow Stamford's preference of using mast arm installations instead of span poles and wire. In addition, new vehicle detectors will be needed to accommodate the revised alignments and lane usage. It is potentially possible that the existing traffic signal controllers could be maintained. A final determination of the viability of this alternate will be made during final design.

6.2. M&PT Requirements

In order to match the proposed cross-section of the SUT, East Main Street will be widened to include two 11-foot lanes with a 5-foot wide bike lane in each direction. A median of 8 feet in width will accommodate a bridge pier and divide each direction of traffic on East Main Street. An 8-foot wide sidewalk will also be provided on both sides of the roadway.

The horizontal alignment for East Main Street under the bridge follows the existing alignment, and matches the existing roadway to the west and the proposed SUT layout to the east. The vertical alignment will be a sag curve providing a minimum clearance of 14'-6" under the bridge. In order to maintain this clearance, East Main Street will be lowered an estimated 2.6 feet.

The lowering of the profile for East Main Street will impact a number of intersecting roadways, including Crystal Street and Myrtle Street, and, potentially North State Street. Grading within the parking lot and driveways to the plaza located west of Crystal Street and to the north of East Main Street will be required. The lowering of the road will also impact several utilities, which have been identified to date to include:

- Low Pressure Gas
- Sanitary Sewer (2 – 1 possibly abandoned)
- Underground Electric
- Water (2)
- Telephone (Fiberoptics) (2)

Although the precise depth of these utilities is not known at this time, it is assumed that the utilities will have to be relocated to accommodate the proposed profile.

The reconstruction of the bridge is anticipated to lower the bottom of the superstructure by as much as 1 foot, which will further compromise the sub-standard vertical clearance available at this location. In order to avoid detouring truck and emergency vehicle traffic to other routes during the reconstruction process, it will be necessary to

lower East Main Street prior to the start of the superstructure construction. In order to accomplish this work in the proper sequence, the utility relocations will have to be completed at an early stage. This can then be followed by the removal of the concrete roadway pavement and the placement of a temporary wearing surface at the proposed grade on the northbound side of the proposed center pier. This work will require temporary lane closures to complete the utility work, and maintenance of traffic on processed gravel during the regrading process. Two lanes of traffic can then be maintained on temporary pavement on the north side of the center pier at the proposed grade throughout the construction. Reconstruction work on the side streets and at the adjacent intersections can be accomplished through the use of temporary lane closures and flaggers.

It is anticipated that the construction will be completed in four stages. The first stage will involve relocating the utilities and lowering the roadway to accommodate minimum vertical clearance. During the first stage, one 10-foot lane of traffic will be maintained in each direction with a 1-foot shoulder on both sides. In the second stage, one 11-foot lane of traffic will be maintained with 1-foot shoulders on both sides in the northbound direction and a single 10-foot lane with 1-foot shoulders on both sides in the southbound direction. The third stage will maintain one 10-foot lane of traffic in each direction with 1 foot shoulders on both sides while demolishing the south abutment and pier and constructing the proposed roadway. In the fourth and final stage, the north abutment and pier will be demolished and the proposed roadway will be constructed maintaining 11-foot lanes of traffic in each direction with 1-foot shoulders one either side. Please refer to Figures 6.1a through 6.1d for the maintenance and protection of traffic staging, located in Appendix G.

Pedestrian detours will need to be developed whenever a sidewalk under a bridge is closed. Pedestrians should be directed to cross at the nearest signalized intersection on either side of the bridge. These detours will be developed during the final design stages.

6.3. Other Design Alternatives Considered

6.3.1. Four-Span Bridge

A four-span bridge alternative was developed to reduce the structural depth. Please refer to Figures 2.2b for the four-span roadway plan, 2.3b for the four-span roadway profile, and 2.4b for the four-span roadway cross section, all located in Appendix G. This alternate would allow for the bridge to be reconstructed while maintaining traffic on existing pavement with the existing 13'-3" vertical clearance. This alternative would introduce piers along the curblines that are within the roadway clearzones. The roadway would be undivided on the approaches to the bridge and both ends of each curbside pier would require protection with an impact attenuator. At the intersection of East Main Street with Crystal Street, the necessary impact attenuator would project past the existing curb return and into the Crystal Street roadway, eliminating right turns onto Crystal Street traveling southbound on East

Main Street. The curbside piers would reduce the intersection sight distances (ISD) at all the impacted intersections and significantly impact the ISD for Crystal Street.

6.3.2. Relocate Crystal Street

A plan was developed to study potential mitigation of impacts to the Crystal Street intersection. The plan involved relocating the southern portion of Crystal Street to the west, and aligning it with the intersection of East Main Street and North State Street. This would eliminate the existing non-signalized intersection with the restricted ISD and operational inefficiencies. Please refer for Figure 2.2c for the proposed roadway plan with Crystal Street relocated, located in Appendix G.

7. DRAINAGE

7.1. Existing System Conditions

The East Main Street profile has a low point beneath the existing MNRR bridge crossing. It appears that the drainage inlets in the vicinity of the bridge are all conveyed to an existing 24-inch RCP that runs west to east following the roadway alignment. This 24-inch RCP eventually ties into a 72-inch RCP that runs north to south and eventually ties into a pump station on Harborview Avenue, approximately one mile to the southwest. The pump station discharges to the East Branch Canal. Crystal Street and Quintard Terrace also tie into the 72-inch RCP through the 24-inch RCP on East Main Street. To the east of the bridge (upstation from 107+00), it appears that inlets on East Main Street and Maple Avenue are connected to the 72-inch pipe with an 18-inch trunkline. Drainage from the northern end of Phase II of the Stamford Urban Transitway (SUT - currently Myrtle Street) has a planned direct connection to the 72-inch RCP. It is noted that the 72-inch pipe, as shown on the survey for this study, is shown as a 60-inch pipe on the Phase II SUT plans currently being designed by the City. There are also discrepancies between the inverts shown on the survey and those design plans. Further investigation will be needed to verify location, size and inverts. For this study, the survey information was used where shown and the City design used as supplemental information. In this area it is understood that the storm and sanitary systems have been separated. In summary, it appears that active drainage systems within this portion of East Main Street (east and west) are conveyed to the 72-inch pipe by a 24-inch trunkline from the west and the 18-inch trunkline from the east. Please refer to Figure 7.1, located in Appendix G, for the drainage plan. All drainage calculations are provided in Appendix E.

7.2. System Constraints and Concepts Considered

Due to the lowering and widening of East Main Street by about 2.6 feet, it appears that all drainage inlets within the work limits will have to be abandoned or relocated as shown on figure 7.1. To replace the inlets within the limits of re-grading, a catch basin is proposed on either side of the road at the sag point (station 105+25) with flanker basins on either side set at +0.5 feet or at the anticipated low point of adjacent intersections. The northern segment of the proposed drainage system will tie into the

72-inch RCP through the existing 24-inch trunkline in East Main Street. The southern segment of the proposed system will tie to the 72-inch RCP further down the flow line (exact location TBD).

The most noteworthy constraint to the system presented is the potential for the proposed profile cut of East Main Street to expose the 72-inch RCP as it is shown on the base mapping. In this stage of the planning process, it is recommended to gather additional information on the 72-inch pipe and the system as a whole. Based on information provided to date, the 72-inch pipe will need to be relocated.

From the design plans for the second phase of the SUT, this 72-inch pipe is labeled as a 60-inch “POSSIBLE CONCRETE CULVERT, LOCATION NOT DETERMINED”. This profile, in conjunction with a plan developed for the same project, indicates that this pipe is laid flat with no flow line slope. On the profile for the SUT design, this pipe is placed with an invert of 8.7 feet (datum NGVD '29). Similarly on the associated plan, a located manhole indicates a flow line of 8.7 feet (datum NGVD '29). This leads to the assumption of a horizontal pipe.

Based on a review of the survey information and City design plans, the adjustment for datums (NGVD '29 vs. NAVD '88) between the two sets of plans was -1.1 feet. It was found an additional -0.44 feet adjustment was needed to tie the two together.

In summary, the discrepancies that were found will need to be resolved. Differences in elevation (such as those reported here) can have a great impact to the drainage design for East Main Street. For the remainder of this study, a horizontal pipe will be assumed, this pipe will be 72-inch as per the project survey, and the flow line will be 6.6 feet (datum NAVD '88). Figure 7.1 shows a possible pipe relocation based on the assumptions stated here. However, tie-ins to this relocated pipe have not been addressed due to the absence of verified as-built information.

7.3. Design Criteria

The City of Stamford requires that the storm sewer design accommodate a 25-year event. All other requirements for storm sewer design will adhere to the Connecticut Department of Transportation Drainage Manual. Specifically:

- low points will be analyzed for a 25-year event
- on-grade gutter flow spread will be one half of the travel lane at maximum
- sag condition gutter flow spread will be all but one lane width at maximum
- storm sewer design will address full flow (non-pressure) conditions

7.4. Design Documentation

The proposed drainage for East Main Street includes providing a catch basin at the sag points with flanker basins on either side of the sag or at the corners of intersections as shown on Figure 7.1. The portion of the system to the north will tie into the existing

24-inch trunkline which flows from west to east along the roadway. This trunkline in turn conveys to the 72-inch pipe running from north to south. The portion of the system to the south will tie into the existing 72-inch directly (exact location TBD).

Due to the required lowering of East Main Street, an investigation to potential impacts on the existing 24-inch trunkline was conducted. Each of the manholes connecting the flow lines were located on the base mapping for this project, however many of the inverts were inaccessible. To account for the pipe elevations, the SUT plans were consulted.

The limit of roadway work is based on the proposed profile of East Main Street and is between station 103+27 and station 107+72. Three manhole structures fall within these limits. Of the three structures, one presented accessible inverts for field locations while the other structure inverts were inaccessible. To start this investigation, the manhole at baseline station 102+59, 7.5 feet LT was compared to the same located manhole on the City plans. The top of frame for this manhole as surveyed for this project was 16.55 feet (datum NAVD '88). As shown on the City base mapping, this top of frame is 18.08 feet (datum NGVD '29). Converting the City plans elevation to NAVD '88 datum gives an elevation of 16.98 feet, a difference of 0.43 feet. The same was done for the remainder of the manholes within the project limits:

Baseline Station	DTC elevation (NGVD '29)	Conversion of - 1.1 feet	DTC elevation (NAVD '88)	URS elevation (NAVD '88)	Difference
104+52, 16' LT	16.17	→	15.07	14.63	0.44
105+15 18' RT	15.66	→	14.56	14.11	0.45
106+00 19 LT	16.41	→	15.31	14.86	0.45

Table 1 – Manhole top of frame elevation investigation (to aid in assigning inverts to inaccessible pipes from project survey).

The difference between the converted elevations from the City plans and the surveyed elevations for this project showed a correlation, lending confidence to the approach of averaging the difference to -0.44 feet from the converted SUT elevations. Flow lines (inverts) for the inaccessible pipes were then determined by converting the elevations recorded on the SUT plans to NAVD '88 datum, and subtracting 0.44 feet. At station 104+52, 16' LT, the 24-inch pipe inverts were accessible and checked against the computed inverts and found to be within 0.05', verifying this approach. Once the inverts were determined, minimum cover in relation to the proposed roadway lowering was calculated to be 0.8 feet.

The manhole at station 106+00, 19' LT could not be opened for either of the surveys, and an assumption was made that the slope would be constant from 105+15, 18' LT to 106+00, 19' LT and carry on to the 72-inch cross culvert.

The proposed catch basins and 15-inch pipes were set based on 2 feet of minimum cover at the low point and the flow lines carried at 0.5% accordingly.

7.4.1. Gutter Flow

Gutter flow to the low points has been calculated from best available information. Drainage areas which were delineated are preliminary and subject to final grading based on the vertical profile. The area contributing to the sag point at 105+25 LT is approximately 1.7 acres and includes portions of Crystal Street, adjacent properties, the railway embankment and portions of East Main Street. Assuming a minimum time of concentration of 10 minutes due to the amount of pervious contributing surface, returns a 25-year rainfall event of 5.5 inches per hour. This, along with an assumed combined runoff coefficient of 0.5, yields 4.7 cfs being contributed to this point. Computed spread and depth to this point is 24 feet and 0.4 feet, respectively. Due to the depth, the flanker basin will be functioning at this design flow, intercepting some of the gutter flow and reducing the total spread. It is anticipated that one lane will remain open.

The area contributing to the sag point at 105+25 RT is approximately 0.7 acres and includes portions of the SUT (presently Myrtle Street), adjacent properties, the railway embankment, and portions of East Main Street. Assuming a minimum time of concentration of 10 minutes due to the amount of pervious contributing surface, returns a 25-year rainfall event of 5.5 inches per hour. This, along with an assumed combined runoff coefficient of 0.5, yields 1.9 cfs being contributed to this point. Computed spread and depth to this point is 13 feet and 0.3 feet respectively. This provides for one lane to remain open.

7.4.2. Pipe Flow

Using Manning's equation for flow in pipes and the runoff calculated for the contributing area (4.7-cfs), the required pipe size for the northern leg of the proposed system is 15-inch. For the southern leg, with a design flow of 1.9-cfs, the required pipe size would be 12-inch.

7.4.3. Hydraulic Grade Line

Though it is known that the 72-inch pipe, which receives all of the computed flow from the proposed system, is on a pumped line, it is not known at this time what the design hydraulic grade line is within this pipe. For this reason, the pipe will conservatively be considered to be flowing full. Following the assumptions on pipe size and invert elevation as previously documented, the flow line for this pipe is assumed at 12.6 feet. The starting water surface elevation is greater than the low point of the roadway, at 12.22 feet (datum NAVD '88), by 0.38 feet. With the

information available at this time, it appears that the depth of lowering will put the travel way at risk of flooding for the design event.

7.5. Summary of Impacts and Proposed Improvements

Although assumptions were made because of the discrepancies noted, the results will likely not change due to the proposed 2+ foot lowering of East Main Street.

The grade change will unearth the 72-inch culvert beneath the existing roadway surface and the hydraulic grade line will extend into the low point under the bridge.

If it is determined that the headwater remains higher than the proposed low point, an alternate configuration could be pursued. One alternate configuration could be a wholly independent drainage system consisting of a pump and elevated outlet adjacent to the site. Additional information on the surrounding area will be required to select an advantageous outlet location.

Finally, if the 72-inch RCP is found to be a 60-inch pipe, relocation may not be required, though cover will be minimal.

8. UTILITIES

It is anticipated that the roadway will require an estimated 2.6 feet of lowering at the underpass. At the East Main Street bridge, the impacted utilities identified are a low pressure gas main, sanitary sewer, an underground electric duct bank, two water mains, and telephone duct bank (fiberoptics go up Myrtle Street in two ducts). The City of Stamford also has underground copper communication cable in telephone duct for their traffic operations system. This would also be impacted if the telephone duct is affected. The limits of work and utilities in the project area are shown on Figure 8.1, located in Appendix G. The depth of these utilities is not known at this time and it is assumed that these utilities will have to be lowered to accommodate the roadway lowering. Vertical depth information is required to determine the limits of the actual relocation needs.

9. GEOTECHNICAL

9.1. Summary of Subsurface Data

9.1.1 Regional Geology

Published geologic mapping indicates that the predominant natural surficial deposits within the project area are sands overlying fines. The sand is of variable thickness, commonly found in inclined forest beds and overlies thinly bedded fines of variable thickness. The underlying bedrock within the project site is mapped as principally Pumpkin Ground Member of Harrison Gneiss, which is a gray to spotted, medium to coarse grained, foliated gneiss.

9.1.2 Pilot Borings

Three geotechnical borings were performed to preliminarily explore the subsurface conditions at the site. The approximate as-drilled pilot boring locations are shown on Figure 9.1, East Main Street Pilot Boring Program. Each geotechnical boring was located in the field by taping from existing site features, then observed and logged during drilling. Boring logs are located in Appendix F.

The geotechnical boring depths ranged from about 10 to 30 feet below the existing ground surface at their respective locations. Representative soil samples were obtained continuously to a depth of at least 10 feet and at about 5-foot intervals thereafter. Samples were collected by split-barrel sampling procedures in general accordance with ASTM D 1586 and bedrock was cored in one location to confirm its depth, nature, and quality. An observation well was installed within one of the geotechnical borings to observe longer term groundwater levels.

9.1.3 Subsurface Conditions

The subsurface conditions as interpreted from the geotechnical borings generally consisted of asphalt over subbase or asphalt over fill over natural sand and gravel over bedrock, which is consistent with published geologic data. A detailed description of the subsurface conditions encountered in each of the test borings is contained on the logs.

The asphalt encountered was less than 6 inches thick. Where encountered, the subbase was approximately 18 inches thick. The fill encountered in geotechnical borings B-1 and B-2 was less than 2 feet thick. The fill material was generally classified as loose to dense fine to coarse sand with varying fractions of silt and gravel and trace wood and brick.

9.1.4 Soil

Sand and gravel immediately underlies the surficial materials described above and where it was fully penetrated was approximately 21 feet thick. The sand and gravel was generally classified as medium dense to very dense, fine to coarse sand with varying fractions of silt and gravel or fine to coarse gravel with varying fractions of sand and silt.

Bedrock was observed below the sand and gravel at a depth of approximately 24 feet below the existing ground surface at geotechnical boring B-1. At this location the bedrock generally consisted of very poor quality, medium hard, moderately weathered, gray, medium grained gneiss.

9.1.5 Groundwater

Groundwater was observed between approximately 8 and 11 feet below the existing ground surface. Fluctuations in the observed groundwater level occur due to

variation in precipitation, temperature, and other factors differing from those existing at the time the measurements were made.

9.2. Geotechnical Construction Issues

Based on the bridge rehabilitation concepts, the primary geotechnical issues that are anticipated will be the following:

- Protection of active railroad operations and of the existing tracks is required.
- Protection of existing structures during construction. These structures include railroad catenary structures, overhead and underground utilities, buildings and retaining walls.
- Management and disposal of excavated materials. Since both abutments are being removed and replaced, mini-piles will be drilled and significant excavation of the embankment soils will be required. Drill spoils will have to be disposed of in accordance with State and Local requirements. Excavated soils may be able to be reused elsewhere on the project depending on the nature and quality of the materials. If not, they will have to be disposed of in accordance with State and Local requirements.

9.3. Foundation Recommendations

Based on the information available, drilled mini-piles are recommended for the support of the proposed abutments and pier. The drilled mini-piles will have a permanent casing installed to the top of bedrock and will develop their capacity in the underlying bedrock. A continuous reinforcing bar will be installed from the bottom of the rock socket to the top of the pile. The rock socket and casing will be filled with tremie placed grout.

The mini-piles will be designed to carry the required design loads in the rock socket and will be sized and reinforced appropriately to resist any other imposed loads (e.g. uplift, lateral, etc.). Based on preliminary design loads and subsurface conditions, it is estimated that rock socket lengths will be approximately 10 to 15 feet and overall mini-pile lengths will be approximately 40 to 55 feet for the center pier and abutments, respectively.

10. ENVIRONMENTAL

10.1. Required Environmental Permits

Work activities proposed for East Main Street fall outside of any FEMA regulated Floodplain and Floodway. Therefore, no Flood Management Certification is anticipated for the project. Please refer to Figure 10.1 in Appendix G for the 10-year FEMA floodplain map.

The project site does not fall within the Coastal Boundary indicating that a DEEP administered Coastal Area Management Permit (CAM) will not be required.

Wetland impacts are not expected for this highly urban setting, consequently local or tidal wetland permits are not anticipated.

The total project footprint is expected to be greater than 1 acre which will trigger the requirements for a DEEP administered General Permit for *Stormwater and Dewatering Wastewaters from Construction Activities*.

11. SUMMARY AND CONCLUSIONS

In order to accommodate the rising traffic demands within the City of Stamford and to open up east-west access along U.S. Route 1, it is necessary to address the bottlenecks that occur at the Metro-North undergrade bridge. Additional travel lanes will be added upon the reconstruction of the undergrade bridge. The proposed new underpass will provide two 8-foot sidewalks, two-foot shoulders, 5-foot bike lanes in both directions, two 11-foot lanes traveling in the northbound direction and two 11-foot lanes traveling in the southbound direction.

After careful consideration of several structure types for the study, two were eliminated as not being viable. Three structure types remain as possible options: the precast multi concrete-encased beams, the multi-steel girder ballasted steel plate deck, and the through-girders. The structure-type that is selected will determine the construction sequence.

There are several options that must be considered before the design-span length and structure depth are known. The design-span length will depend upon the abutment construction methodology and the span configuration. The depth of structure is dependent upon the design-span length and the structure type. The depth of which the East Main Street profile will be lowered to obtain the minimum vertical clearance of 14'-6" will determine the extent of the impacts upon nearby intersections, roadways and properties. There are several combinations that have been evaluated and can be considered to optimize the benefits and costs for the reconstruction of the East Main Street undergrade bridge.

Impacts to rail operations will be minimized by only taking one Metro-North railroad track out of service at a time. Throughout the construction process, East Main Street will remain open to traffic. Two travel lanes will be maintained, one in each direction.

APPENDIX A – HIGHWAY DESIGN CRITERIA

East Main Street is located in built-up areas with a design speed of 30 mph. East Main Street is classified as a Principal Urban Arterial according to the Connecticut Department of Transportation’s criterion for roadway design based on roadway classification.

Key design criteria are outlined in the table below.

East Main Street - Principal Urban Arterial			
Design Element		Recommended Design Value	Proposed Design Value
Design Speed		30 - 45 mph	30 mph
Travel Lane Width		11’-12’	11’
Shoulder Width	Right	4’ – 8’	N.A.
	Left	2’ – 4’	2’
Cross Slope		1.5 – 2.0%	2.0%
Turn Lane Width		11’ – 12’	N.A.
Turn Lane Shoulder Width		2’ – 4’	N.A.
Sidewalk Width		5’ Minimum	8’
Bicycle Lane	Width	5’	5’
	Cross Slope	2.0%	2.0%
Roadside Clearzones		14’	13’
Stopping Sight Distance		200’	> 500’ ⁽²⁾
Intersection Sight Distance		355’	270’
Minimum radius (e=4.0%)		230’	675’
Superelevation Maximum		4.0%	None
Maximum Grade		9.0%	4.95%
Minimum Grade		0.5%	1.12%
Vertical Curvature (K-Value)	Crest	19	15
	Sag	37	18
Minimum Vertical Clearance Under New Bridge		16’-3’’ ⁽¹⁾	14’-8’’

Source: Figure 5B, Connecticut Department of Transportation Highway Design Manual, 2003 Edition
 (1) 14’-6’’ minimum vertical clearance used.
 (2) Stopping Sight Distance is based on illuminated highway.

APPENDIX B – BRIDGE DESIGN CRITERIA

- Structure Layout
 - Bridge will span over the proposed roadway cross section conforming to the City of Stamford requirements
 - Abutments will be located outside of proposed sidewalks
 - Pier is located between the northbound and southbound lanes
 - Substructure units will be parallel or tangent to the roadway baseline and parallel to each other

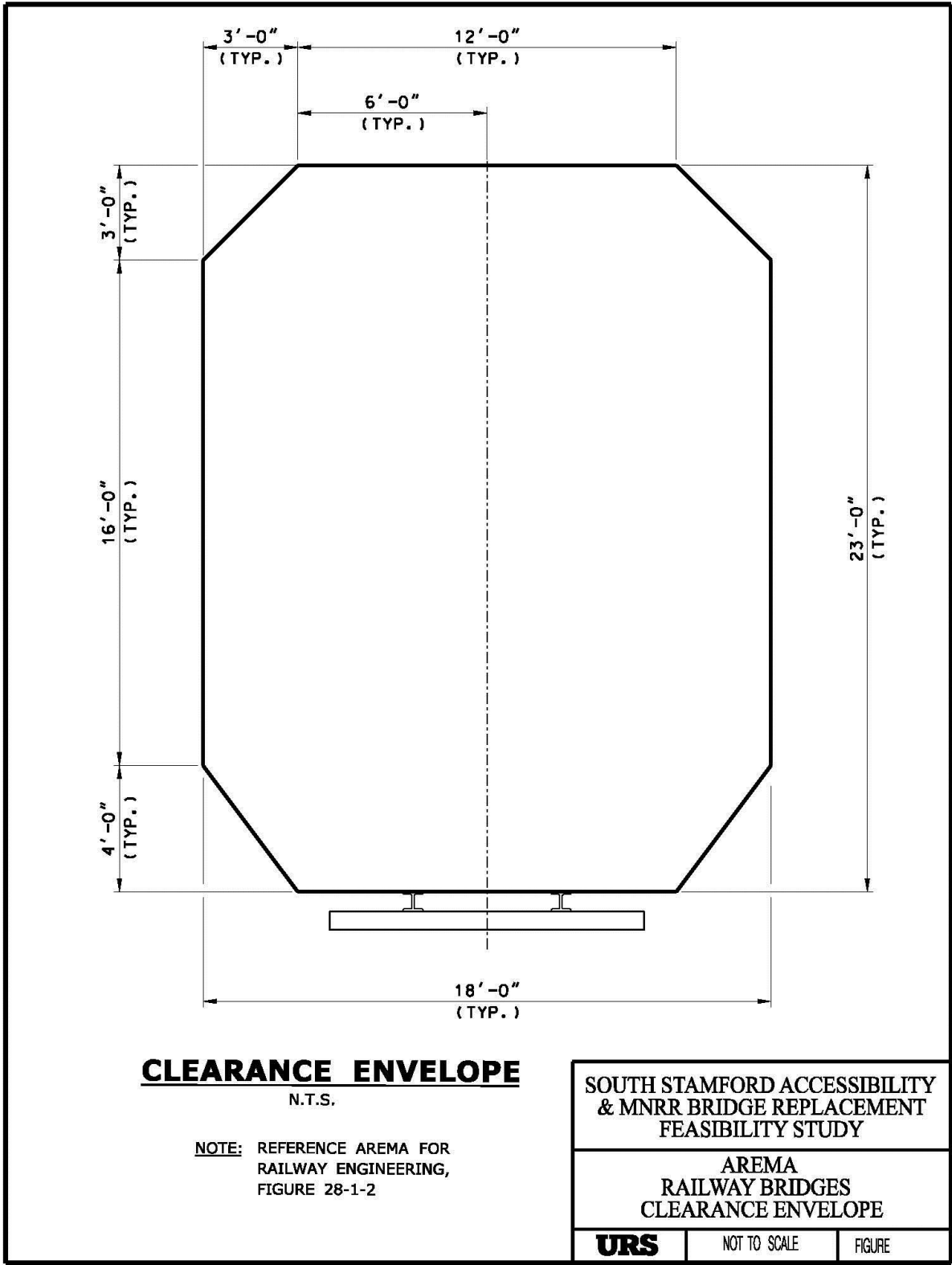
- Bridge Type
 - Superstructure
 - Bridge will consist of two simple spans supported on abutments and a pier
 - Primary replacement bridge choice will be Metro-North’s preferred ballasted deck
 - Structure types considered:
 - Through-Plate Girders
 - Two-Girder Ballasted Concrete Deck
 - Four-Girder Ballasted Steel Plate Deck
 - Multi-Concrete Encased Beams
 - Pre-stressed Butted Box Beams
 - Design considerations:
 - Girders are designed for strength
 - Girders also have a service criteria
 - Maximum deflection is equal to $L/640$
 - Structure type used for the purposes of this report is the multi concrete-encased beams
 - Access walkways will be provided for the purposes of servicing the tracks
 - Substructure
 - The abutments and the pier proposed are to be constructed using cast-in-place concrete. Precast concrete modules will be considered for an accelerated construction schedule.
 - Foundation
 - The footing of the abutment will be founded on mini-piles

- Consideration will be given to using a spread footing at the center pier if a work area of sufficient width can be obtained given the constraints posed by M&PT. If a spread footing is not attainable, mini-piles will be used.

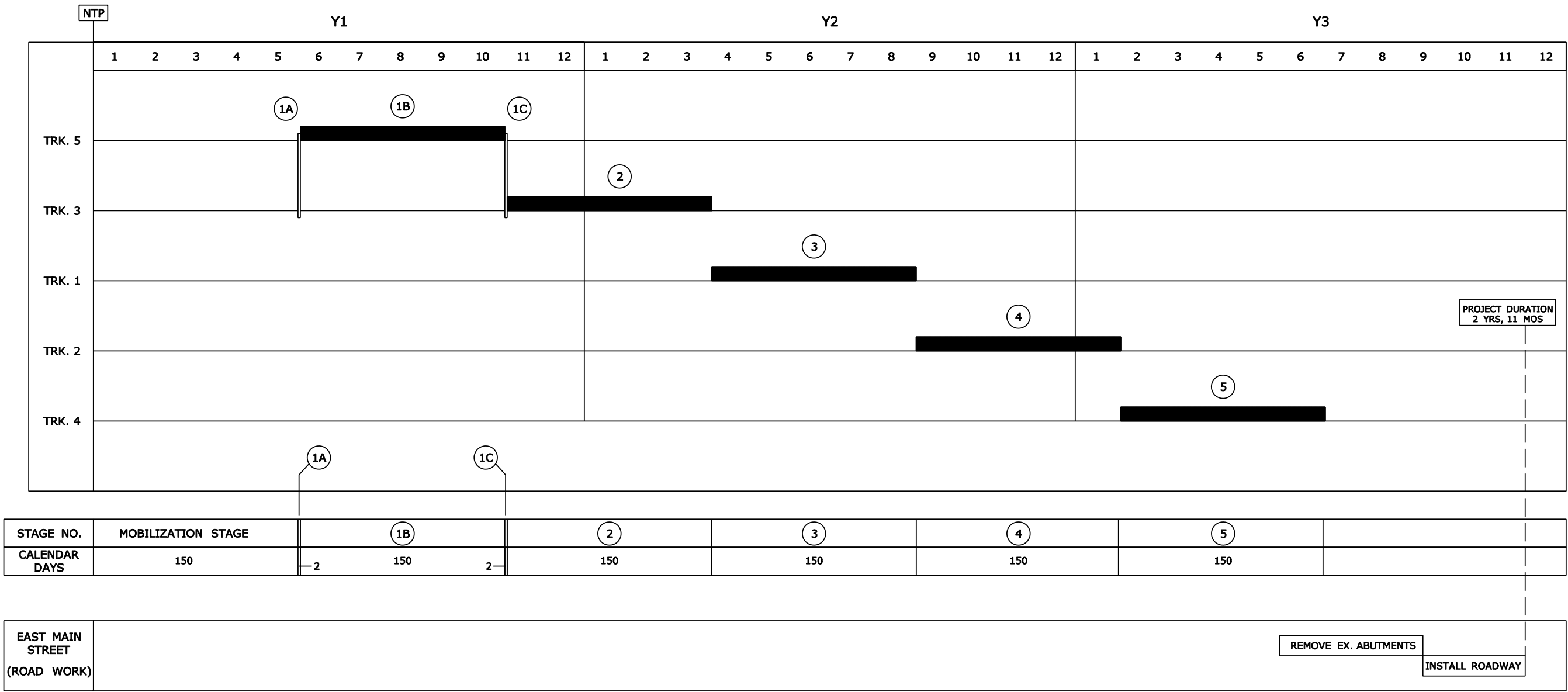
- Structure Depth
 - Structure depth is based on a top of rail elevation to bottom of beam depth and is based on the following assumptions:
 - Rail height – 7 5/8” (typ.)
 - Depth of Concrete Tie – 8.5” (typ.)
 - Depth of Ballast below railroad tie – 8.5” (typ.) bridge was designed for an additional 3.5” to be added in the future
 - Ballast Mat – 1” (typ.)
 - Concrete Deck with Haunch – 13” (specific to the 2-girder ballasted concrete deck structure type)
 - Steel Plate – 1.5” (specific to the 4-girder ballasted steel plate deck structure type)
 - Depth of Beam (this dimension is in addition to the previously mentioned items with the exception of the through-girder option. For the through-girder option, the structure depth is equivalent to the beam depth as the top flange is at the top of rail elevation.)

- Construction
 - Stage construction is based on single track outages
 - For the purposes of this report, tracks are taken out of service from north to south
 - Construction of the abutments will use a top-down methodology
 - Catenary wires will remain in place during construction and will be maintained and protected

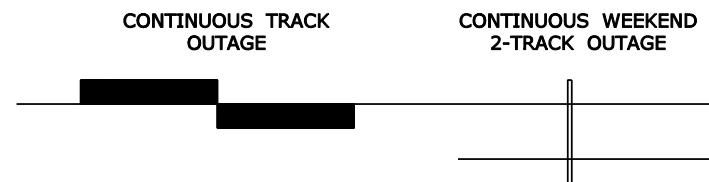
- Rail Geometry
 - Existing horizontal and vertical alignment will be maintained



APPENDIX C – CONSTRUCTION SCHEDULE



LEGEND:



SOUTH STAMFORD ACCESSIBILITY & MNRR BRIDGE REPLACEMENT FEASIBILITY STUDY

EAST MAIN STREET TRACK OUTAGE SCHEDULE

URS	SCALE: N.T.S.
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APPENDIX D – CONSTRUCTION COST ESTIMATES



South Stamford Accessibility and MNRR Bridge Replacement Feasibility Study

Stamford, Connecticut
State Project No. 135-301

**PRELIMINARY ENGINEERING CONSTRUCTION COST ESTIMATE
U.S. ROUTE 1 (EAST MAIN STREET)**

Item No.	Description	Unit	Unit Price	Alternative 1					
				Two Span Top Down Concrete-Encased Steel Beams		Two Span Conventional Concrete-Encased Steel Beams		Four Span Top Down Concrete-Encased Steel Beams	
				Quant.	Price	Quant.	Price	Quant.	Price
Highway & Traffic Items									
1.	Earth Excavation	CY	\$26.00	3,348	\$87,056.67	3,348	\$87,056.67	2,784	\$72,374.47
2.	Rock Excavation	CY	\$50.00	372	\$18,601.85	372	\$18,601.85	309	\$15,464.63
3.	Drainage; Pipe (12")	LF	\$55.00	96	\$5,280.00	96	\$5,280.00	96	\$5,280.00
4.	Drainage; Pipe (15")	LF	\$60.00	104	\$6,240.00	104	\$6,240.00	104	\$6,240.00
5.	Drainage; Pipe (72")	LF	\$165.00	204	\$33,660.00	204	\$33,660.00	204	\$33,660.00
6.	Drainage; Catch Basins	EA	\$2,800.00	7	\$19,600.00	7	\$19,600.00	7	\$19,600.00
7.	Manhole	EA	\$3,500.00	3	\$10,500.00	3	\$10,500.00	3	\$10,500.00
8.	Milling of Bituminous Concrete 0"-4"	SY	\$8.00	719	\$5,755.56	719	\$5,755.56	628	\$5,022.22
9.	HMA - Superpave	T	\$105.00	1,051	\$110,336.80	1,051	\$110,336.80	1,020	\$107,057.44
10.	Processed Aggregate Base	T	\$45.00	1,051	\$47,287.20	1,051	\$47,287.20	1,020	\$45,881.76
11.	Subbase	T	\$35.00	1,196	\$41,870.37	1,196	\$41,870.37	1,161	\$40,625.93
12.	Temporary PCBC	LF	\$42.00	600	\$25,200.00	600	\$25,200.00	600	\$25,200.00
13.	Relocate TPCBC	LF	\$17.00	600	\$10,200.00	600	\$10,200.00	600	\$10,200.00
14.	PCBC (Vertical and "F" Shape)	LF	\$100.00	270	\$27,000.00	270	\$27,000.00	800	\$80,000.00
15.	Impact Attenuators	EA.	\$25,000.00	2	\$50,000.00	2	\$50,000.00	2	\$50,000.00
16.	Curbing; Concrete	LF	\$30.00	1,100	\$33,000.00	1,100	\$33,000.00	1,050	\$31,500.00
17.	Concrete Sidewalk	SF	\$15.00	8,800	\$132,000.00	8,800	\$132,000.00	8,400	\$126,000.00
18.	Trafficperson (City/State Police)	HR	\$75.00	1,100	\$82,500.00	1,100	\$82,500.00	1,100	\$82,500.00
19.	Roadway Lighting	LF	\$40.00	450	\$18,000.00	450	\$18,000.00	450	\$18,000.00
20.	Traffic Signals; Minor Modification	EA	\$30,000.00	2	\$60,000.00	2	\$60,000.00	2	\$60,000.00
21.	Retaining Walls	SF	\$70.00	450	\$31,500.00	450	\$31,500.00	450	\$31,500.00
Section Sub-Total					\$855,588.44		\$855,588.44		\$876,606.44

Structures Items - Undergrade Bridge									
22.	Structure Excavation - Earth	CY	\$90.00	7,000	\$630,000.00	10,900	\$981,000.00	7,700	\$693,000.00
23.	Ballast	CY	\$175.00	750	\$131,250.00	650	\$113,750.00	810	\$141,750.00
24.	Ballast Mat	SF	\$15.00	10,800	\$162,000.00	10,800	\$162,000.00	10,800	\$162,000.00
25.	Pervious Structure Backfill	CY	\$105.00	800	\$84,000.00	9,900	\$1,039,500.00	900	\$94,500.00
26.	Removal of Superstructure	LS	\$250,000.00	1	\$250,000.00	1	\$250,000.00	1	\$250,000.00
27.	Removal of Substructure (Two Span LS		\$530,000.00	1	\$530,000.00	1	\$530,000.00	0	\$0.00
28.	Removal of Substructure (Four Spar LS		\$750,000.00	0	\$0.00	0	\$0.00	1	\$750,000.00
29.	Temporary Support	LS	\$250,000.00	0	\$0.00	0	\$0.00	0	\$0.00
30.	Tie-Back Wall	SF	\$400.00	6,550	\$2,620,000.00	0	\$0.00	9,240	\$3,696,000.00
31.	Steel-Laminated Elastomeric Brgs.	CI	\$3.00	37,000	\$111,000.00	37,000	\$111,000.00	74,000	\$222,000.00
32.	Class "A" Concrete	CY	\$850.00	1,200	\$1,020,000.00	2,300	\$1,955,000.00	2,200	\$1,870,000.00
33.	Class "F" Concrete	CY	\$1,250.00	200	\$250,000.00	200	\$250,000.00	500	\$625,000.00
34.	Architectural Formliner	SY	\$400.00	250	\$100,000.00	350	\$140,000.00	350	\$140,000.00
35.	Deformed Steel Bars	LBS	\$1.60	140,000	\$224,000.00	250,000	\$400,000.00	270,000	\$432,000.00
36.	Structural Steel	LBS	\$3.25	0	\$0.00	0	\$0.00	0	\$0.00
37.	P/C Conc. Enc. Steel Grdrs (34"D)	LF	\$1,570.00	0	\$0.00	5,700	\$8,949,000.00	0	\$0.00
38.	P/C Conc. Enc. Steel Grdrs (39"D)	LF	\$1,620.00	6,400	\$10,368,000.00	0	\$0.00	0	\$0.00
39.	P/C Conc. Enc. Steel Grdrs (28"D)	LF	\$1,510.00	0	\$0.00	0	\$0.00	7,100	\$10,721,000.00
40.	Drilled Mini-Piles	EA	\$10,000.00	340	\$3,400,000.00	340	\$3,400,000.00	545	\$5,450,000.00
41.	Repointed Masonry	SY	\$80.00	85	\$6,800.00	0	\$0.00	0	\$0.00
42.	Temp. Earth Retaining System	SF	\$50.00	2,030	\$101,500.00	2,030	\$101,500.00	6,090	\$304,500.00
43.	Temp. Earth Retaining System (RR)	SF	\$160.00	4,130	\$660,800.00	18,000	\$2,880,000.00	4,130	\$660,800.00
44.	Lead Health Protection Program	LS	\$100,000.00	1	\$100,000.00	1	\$100,000.00	1	\$100,000.00
Section Sub-Total					\$20,749,350.00		\$21,362,750.00		\$26,312,550.00

Rail Operations									
48.	Bridge Plates	EA	\$9,000.00	25	\$225,000.00	25	\$225,000.00	25	\$225,000.00
49.	Removal & Erection - Bridge Plates	EA	\$1,200.00	25	\$30,000.00	25	\$30,000.00	25	\$30,000.00
Section Sub-Total					\$255,000.00		\$255,000.00		\$255,000.00



South Stamford Accessibility and MNRR Bridge Replacement Feasibility Study

Stamford, Connecticut
State Project No. 135-301

**PRELIMINARY ENGINEERING CONSTRUCTION COST ESTIMATE
U.S. ROUTE 1 (EAST MAIN STREET)**

Item No.	Description	Unit	Unit Price	Alternative 1					
				Two Span Top Down Concrete-Encased Steel Beams		Two Span Conventional Concrete-Encased Steel Beams		Four Span Top Down Concrete-Encased Steel Beams	
				Quant.	Price	Quant.	Price	Quant.	Price

Project Sub-Total									
Highway & Traffic + Structure + Rail Operations				\$21,859,938.44		\$22,473,338.44		\$27,444,156.44	

Percentage Based Items (applied to Project Sub-Total)									
1.	Clearing and Grubbing Roadway	@	2%	\$437,198.77	2%	\$449,466.77	2%	\$548,883.13	
2.	M & P of Traffic	@	4%	\$874,397.54	4%	\$898,933.54	4%	\$1,097,766.26	
3.	Mobilization	@	7.5%	\$1,639,495.38	7.5%	\$1,685,500.38	7.5%	\$2,058,311.73	
4.	Construction Staking	@	1%	\$218,599.38	1%	\$224,733.38	1%	\$274,441.56	
5.	Minor Items	@	25%	\$5,464,984.61	25%	\$5,618,334.61	25%	\$6,861,039.11	
Section Sub-Total				\$8,634,675.69		\$8,876,968.69		\$10,840,441.80	

Project Total									
Project Sub-Total + Percentage Based Items				\$30,494,614.13		\$31,350,307.13		\$38,284,598.24	

Utility Relocation Costs									
1.	Utility Relocation	Est.	\$1,585,500.00	1	\$1,585,500.00	1	\$1,585,500.00	1	\$1,585,500.00
Section Sub-Total				\$1,585,500.00		\$1,585,500.00		\$1,585,500.00	

Railroad Costs									
1.	RR Force Account Work ^{1&2}	@	40%	\$10,502,175.00	40%	\$10,808,875.00	40%	\$13,283,775.00	
2.	Temporary Cut and Throw	Est.	\$3,000,000.00	1	\$3,000,000.00	1	\$3,000,000.00	1	\$3,000,000.00
Section Sub-Total				\$13,502,175.00		\$13,808,875.00		\$16,283,775.00	

Incidentals and Contingencies (applied to Project Total)									
1.	Incidentals	@	18%	\$5,489,030.54	18%	\$5,643,055.28	18%	\$6,891,227.68	
2.	Contingencies	@	10%	\$3,049,461.41	10%	\$3,135,030.71	10%	\$3,828,459.82	
Section Sub-Total				\$8,538,491.96		\$8,778,086.00		\$10,719,687.51	

Cost of Bridge Replacement (2011)	\$54,120,781.09	\$55,522,768.13	\$66,873,560.75
SAY	\$54,100,000.00	\$55,500,000.00	\$66,900,000.00

Inflation to Mid-Point of Construction									
Price Adjustment (adj. to 2016)	5 years	@	5%	\$14,952,573.96	5%	\$15,339,917.13	5%	\$18,475,931.85	
Cost of Bridge Replacement (2016)	\$69,073,355.05	\$70,862,685.26	\$85,349,492.60						
SAY	\$69,100,000.00	\$70,900,000.00	\$85,300,000.00						

Project Cost Escalation Footnotes:

- Estimated construction cost shown above is based on 2011 prices.
- Rate of construction cost escalation is estimated at 5% per year, per CTDOT Estimating Guidelines, calculated to the mid-point of construction, which is anticipated to be 2016 based on an anticipated 2014 start of construction. Accordingly, the cost escalation factor is 1.28.

NOTES:

- MNRR Force Account value is based on 40% of the sum of the total structure and rail operations work for the Undergrade Bridge + 25% minor items applied to the total structure work.
- MNRR Force Account includes the cost of Metro North personnel and railroad work associated with the removal of the existing bridge and construction of the proposed bridge, including removal & replacement of railroad tracks, communications & signals, and catenary pole relocation where applicable.
- Items NOT included in this estimate:
 - Building Demolition / ROW acquisitions
 - Environmental Remediation
 - Environmental Studies (20% of Environmental Remediation Costs)



South Stamford Accessibility and MNRR Bridge Replacement Feasibility Study

Stamford, Connecticut
State Project No. 135-301

**PRELIMINARY ENGINEERING CONSTRUCTION COST ESTIMATE
U.S. ROUTE 1 (EAST MAIN STREET)**

				Alternative 2					
				Two Span Top Down Half-Through Girders		Two Span Conventional Half-Through Girders		Four Span Top Down Half-Through Girders	
Item No.	Description	Unit	Unit Price	Quant.	Price	Quant.	Price	Quant.	Price
Highway & Traffic Items									
1.	Earth Excavation	CY	\$26.00	3,348	\$87,056.67	3,348	\$87,056.67	2,784	\$72,374.47
2.	Rock Excavation	CY	\$50.00	372	\$18,601.85	372	\$18,601.85	309	\$15,464.63
3.	Drainage; Pipe (12")	LF	\$55.00	96	\$5,280.00	96	\$5,280.00	96	\$5,280.00
4.	Drainage; Pipe (15")	LF	\$60.00	104	\$6,240.00	104	\$6,240.00	104	\$6,240.00
5.	Drainage; Pipe (72")	LF	\$165.00	204	\$33,660.00	204	\$33,660.00	204	\$33,660.00
6.	Drainage; Catch Basins	EA	\$2,800.00	7	\$19,600.00	7	\$19,600.00	7	\$19,600.00
7.	Manhole	EA	\$3,500.00	3	\$10,500.00	3	\$10,500.00	3	\$10,500.00
8.	Milling of Bituminous Concrete 0"-4"	SY	\$8.00	719	\$5,755.56	719	\$5,755.56	628	\$5,022.22
9.	HMA - Superpave	T	\$105.00	1,051	\$110,336.80	1,051	\$110,336.80	1,020	\$107,057.44
10.	Processed Aggregate Base	T	\$45.00	1,051	\$47,287.20	1,051	\$47,287.20	1,020	\$45,881.76
11.	Subbase	T	\$35.00	1,196	\$41,870.37	1,196	\$41,870.37	1,161	\$40,625.93
12.	Temporary PCBC	LF	\$42.00	600	\$25,200.00	600	\$25,200.00	600	\$25,200.00
13.	Relocate TPCBC	LF	\$17.00	600	\$10,200.00	600	\$10,200.00	600	\$10,200.00
14.	PCBC (Vertical and "F" Shape)	LF	\$100.00	270	\$27,000.00	270	\$27,000.00	800	\$80,000.00
15.	Impact Attenuators	EA.	\$25,000.00	2	\$50,000.00	2	\$50,000.00	2	\$50,000.00
16.	Curbing; Concrete	LF	\$30.00	1,100	\$33,000.00	1,100	\$33,000.00	1,050	\$31,500.00
17.	Concrete Sidewalk	SF	\$15.00	8,800	\$132,000.00	8,800	\$132,000.00	8,400	\$126,000.00
18.	Trafficperson (City/State Police)	HR	\$75.00	1,100	\$82,500.00	1,100	\$82,500.00	1,100	\$82,500.00
19.	Roadway Lighting	LF	\$40.00	450	\$18,000.00	450	\$18,000.00	450	\$18,000.00
20.	Traffic Signals; Minor Modification	EA	\$30,000.00	2	\$60,000.00	2	\$60,000.00	2	\$60,000.00
21.	Retaining Walls	SF	\$70.00	450	\$31,500.00	450	\$31,500.00	450	\$31,500.00
Section Sub-Total					\$855,588.44	\$855,588.44	\$855,588.44	\$876,606.44	

Structures Items - Undergrade Bridge									
22.	Structure Excavation - Earth	CY	\$90.00	7,000	\$630,000.00	10,900	\$981,000.00	7,700	\$693,000.00
23.	Ballast	CY	\$175.00	750	\$131,250.00	650	\$113,750.00	810	\$141,750.00
24.	Ballast Mat	SF	\$15.00	10,800	\$162,000.00	10,800	\$162,000.00	10,800	\$162,000.00
25.	Pervious Structure Backfill	CY	\$105.00	800	\$84,000.00	9,900	\$1,039,500.00	900	\$94,500.00
26.	Removal of Superstructure	LS	\$250,000.00	1	\$250,000.00	1	\$250,000.00	1	\$250,000.00
27.	Removal of Substructure (Two Span LS		\$530,000.00	1	\$530,000.00	1	\$530,000.00	0	\$0.00
28.	Removal of Substructure (Four Spar LS		\$750,000.00	0	\$0.00	0	\$0.00	1	\$750,000.00
29.	Temporary Support	LS	\$200,000.00	1	\$200,000.00	1	\$200,000.00	1	\$200,000.00
30.	Tie-Back Wall	SF	\$400.00	6,550	\$2,620,000.00	0	\$0.00	9,240	\$3,696,000.00
31.	Steel-Laminated Elastomeric Brgs.	CI	\$3.00	21,300	\$63,900.00	21,300	\$63,900.00	21,300	\$63,900.00
32.	Class "A" Concrete	CY	\$850.00	1,200	\$1,020,000.00	2,300	\$1,955,000.00	2,200	\$1,870,000.00
33.	Class "F" Concrete	CY	\$1,250.00	200	\$250,000.00	200	\$250,000.00	500	\$625,000.00
34.	Architectural Formliner	SY	\$400.00	250	\$100,000.00	350	\$140,000.00	350	\$140,000.00
35.	Deformed Steel Bars	LBS	\$1.60	140,000	\$224,000.00	250,000	\$400,000.00	270,000	\$432,000.00
36.	Structural Steel	LBS	\$3.25	3,262,700	\$10,603,775.00	3,009,700	\$9,781,525.00	3,323,000	\$10,799,750.00
37.	P/C Conc. Enc. Steel Grdrs (34"D)	LF	\$1,570.00	0	\$0.00	0	\$0.00	0	\$0.00
38.	P/C Conc. Enc. Steel Grdrs (39"D)	LF	\$1,620.00	0	\$0.00	0	\$0.00	0	\$0.00
39.	P/C Conc. Enc. Steel Grdrs (28"D)	LF	\$1,510.00	0	\$0.00	0	\$0.00	0	\$0.00
40.	Drilled Mini-Piles	EA	\$10,000.00	340	\$3,400,000.00	340	\$3,400,000.00	545	\$5,450,000.00
41.	Repointed Masonry	SY	\$80.00	85	\$6,800.00	0	\$0.00	0	\$0.00
42.	Temp. Earth Retaining System	SF	\$50.00	2,030	\$101,500.00	2,030	\$101,500.00	6,090	\$304,500.00
43.	Temp. Earth Retaining System (RR)	SF	\$160.00	4,130	\$660,800.00	18,000	\$2,880,000.00	4,130	\$660,800.00
44.	Lead Health Protection Program	LS	\$100,000.00	1	\$100,000.00	1	\$100,000.00	1	\$100,000.00
Section Sub-Total					\$21,138,025.00	\$22,348,175.00	\$22,348,175.00	\$26,433,200.00	

Rail Operations									
48.	Bridge Plates	EA	\$9,000.00	25	\$225,000.00	25	\$225,000.00	25	\$225,000.00
49.	Removal & Erection - Bridge Plates	EA	\$1,200.00	25	\$30,000.00	25	\$30,000.00	25	\$30,000.00
Section Sub-Total					\$255,000.00	\$255,000.00	\$255,000.00	\$255,000.00	



South Stamford Accessibility and MNRR Bridge Replacement Feasibility Study

Stamford, Connecticut
State Project No. 135-301

**PRELIMINARY ENGINEERING CONSTRUCTION COST ESTIMATE
U.S. ROUTE 1 (EAST MAIN STREET)**

				Alternative 2					
				Two Span Top Down Half-Through Girders		Two Span Conventional Half-Through Girders		Four Span Top Down Half-Through Girders	
Item No.	Description	Unit	Unit Price	Quant.	Price	Quant.	Price	Quant.	Price
Project Sub-Total									
Highway & Traffic + Structure + Rail Operations					\$22,248,613.44		\$23,458,763.44		\$27,564,806.44
Percentage Based Items (applied to Project Sub-Total)									
1.	Clearing and Grubbing Roadway	@	2%		\$444,972.27	2%	\$469,175.27	2%	\$551,296.13
2.	M & P of Traffic	@	4%		\$889,944.54	4%	\$938,350.54	4%	\$1,102,592.26
3.	Mobilization	@	7.5%		\$1,668,646.01	7.5%	\$1,759,407.26	7.5%	\$2,067,360.48
4.	Construction Staking	@	1%		\$222,486.13	1%	\$234,587.63	1%	\$275,648.06
5.	Minor Items	@	25%		\$5,562,153.36	25%	\$5,864,690.86	25%	\$6,891,201.61
Section Sub-Total					\$8,788,202.31		\$9,266,211.56		\$10,888,098.55
Project Total									
Project Sub-Total + Percentage Based Items					\$31,036,815.76		\$32,724,975.01		\$38,452,904.99
Utility Relocation Costs									
1.	Utility Relocation	Est.	\$1,585,500.00	1	\$1,585,500.00	1	\$1,585,500.00	1	\$1,585,500.00
Section Sub-Total					\$1,585,500.00		\$1,585,500.00		\$1,585,500.00
Railroad Costs									
1.	RR Force Account Work ^{1&2}	@	40%		\$10,696,512.50	40%	\$11,301,587.50	40%	\$13,344,100.00
2.	Temporary Cut and Throw	Est.	\$3,000,000.00	1	\$3,000,000.00	1	\$3,000,000.00	1	\$3,000,000.00
Section Sub-Total					\$13,696,512.50		\$14,301,587.50		\$16,344,100.00
Incidentals and Contingencies (applied to Project Total)									
1.	Incidentals	@	18%		\$5,586,626.84	18%	\$5,890,495.50	18%	\$6,921,522.90
2.	Contingencies	@	10%		\$3,103,681.58	10%	\$3,272,497.50	10%	\$3,845,290.50
Section Sub-Total					\$8,690,308.41		\$9,162,993.00		\$10,766,813.40
Cost of Bridge Replacement (2011)					\$55,009,136.67		\$57,775,055.51		\$67,149,318.39
SAY					\$55,000,000.00		\$57,800,000.00		\$67,100,000.00
Inflation to Mid-Point of Construction									
Price Adjustment (adj. to 2016)		5 years @	5%		\$15,198,010.23	5%	\$15,962,182.61	5%	\$18,552,118.60
Cost of Bridge Replacement (2016)					\$70,207,146.90		\$73,737,238.12		\$85,701,436.99
SAY					\$70,200,000.00		\$73,700,000.00		\$85,700,000.00

Project Cost Escalation Footnotes:

1. Estimated construction cost shown above is based on 2011 prices.
2. Rate of construction cost escalation is estimated at 5% per year, per CTDOT Estimating Guidelines, calculated to the mid-point of construction, which is anticipated to be 2016 based on an anticipated 2014 start of construction. Accordingly, the cost escalation factor is 1.28.

NOTES:

1. MNRR Force Account value is based on 40% of the sum of the total structure and rail operations work for the Undergrade Bridge + 25% minor items applied to the total structure work.
2. MNRR Force Account includes the cost of Metro North personnel and railroad work associated with the removal of the existing bridge and construction of the proposed bridge, including removal & replacement of railroad tracks, communications & signals, and catenary pole relocation where applicable.
3. Items NOT included in this estimate:
 - Building Demolition / ROW acquisitions
 - Environmental Remediation
 - Environmental Studies (20% of Environmental Remediation Costs)



South Stamford Accessibility and MNRR Bridge Replacement Feasibility Study

Stamford, Connecticut
State Project No. 135-301

**PRELIMINARY ENGINEERING CONSTRUCTION COST ESTIMATE
PHASE I CONSTRUCTION**

Description	Phase 1 Construction	Phase 1 Construction
	Combined Construction Cost Totals	Individual Bridge Cost Totals
	Price	Price
Project Total		
Atlantic Street - Alternate 2	\$36,282,032.59	\$36,282,032.59
Elm Street	\$27,877,155.21	\$27,877,155.21
East Main Street	\$30,494,614.13	\$30,494,614.13
Net Savings in Rail Operation Costs (between Elm and East Main)	-\$255,000.00	\$0.00
Section Sub-Total	\$94,398,801.93	\$94,653,801.93
Utility Relocation Costs		
Atlantic Street - Alternate 2	\$3,157,500.00	\$3,157,500.00
Elm Street	\$1,563,500.00	\$1,563,500.00
East Main Street	\$1,585,500.00	\$1,585,500.00
Section Sub-Total	\$6,306,500.00	\$6,306,500.00
Railroad Costs (incl. Force Account)		
Atlantic Street - Alternate 2	\$8,598,150.00	\$8,598,150.00
Elm Street	\$10,574,980.00	\$10,574,980.00
East Main Street	\$13,502,175.00	\$13,502,175.00
Net Savings by constructing 3 bridges at once	-\$7,000,000.00	\$0.00
Section Sub-Total	\$25,675,305.00	\$32,675,305.00
Incidentals and Contingencies (applied to Project Total)		
1. Incidentals @	15% \$14,159,820.29	18% \$17,037,684.35
2. Contingencies @	10% \$9,439,880.19	10% \$9,465,380.19
Section Sub-Total	\$23,599,700.48	\$26,503,064.54
Cost of Bridge Rehabilitation (2011)	\$149,980,307.42	\$160,138,671.48
SAY	\$150,000,000.00	\$160,100,000.00
Inflation to Mid-Point of Construction		
Price Adjustment (adjust to 2016) 5 years @	5% \$41,436,793.68	5% \$44,243,362.37
Cost of Bridge Replacement (2016)	\$191,417,101.10	\$204,382,033.85
SAY	\$191,400,000.00	\$204,400,000.00

Project Cost Escalation Footnotes:

1. Estimated construction cost shown above is based on 2011 prices.
2. Rate of construction cost escalation is estimated at 5% per year, per CTDOT Estimating Guidelines, calculated to the mid-point of construction, which is anticipated to be 2016 based on an anticipated 2014 start of construction. Accordingly, the cost escalation factor is 1.28.

APPENDIX E – DRAINAGE CALCULATIONS

--- SIZE DETERMINATION FOR SOUTHERN LEG ⇒ 12" PIPE
 --- SIZE DETERMINATION FOR NORTHERN LEG ⇒ 15" PIPE

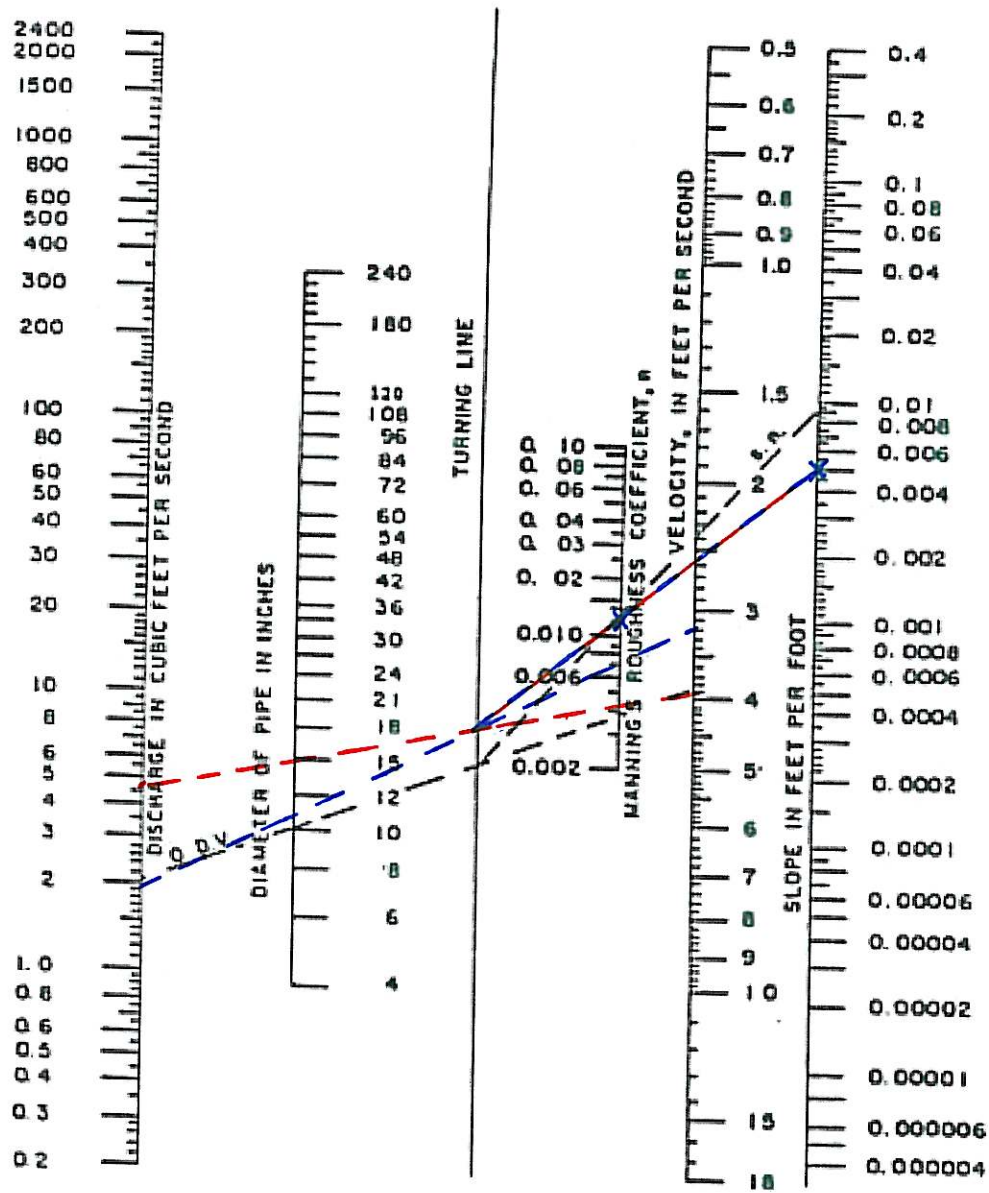


Figure 11-9.1 Manning's Formula For Flow In Storm Drains – English units

Hydraulic Analysis Report

Project Data

Project Title: Gutter Flow East Main Street

Designer: Eric Buckley

Project Date: Friday, September 17, 2010

Project Units: U.S. Customary Units

Notes:

Curb and Gutter Analysis: Northern Leg East Main Street

Notes:

Parameters

Longitudinal Slope of Road: 0.0400 (ft/ft)
Cross-Slope of Pavement: 0.0200 (ft/ft)
Cross-Slope of Gutter: 0.0200 (ft/ft)
Mannings: 0.0150
Gutter Width: 2.0000 (ft)
Design Flow: 4.7000 (cfs)
Width of Spread: 9.6933 (ft)
Gutter Depression: 0.0000 (in)
Area of Flow: 0.9396 (ft²)
Eo (Gutter Flow to Total Flow): 0.4604
Gutter Depth at Curb: 2.3264 (in)
Inlet Location: Inlet in Sag
Percent Clogging: 0.0000 %
Inlet Type: Grate
Grate Type: P - 1-7/8
Grate Width: 1.3500 (ft)
Grate Length: 2.3100 (ft)
Local Depression: 0.0000 (in)
Perimeter: 5.0100 (ft)
Effective Perimeter: 5.0100 (ft)
Area: 2.8067 (ft²)
Effective Area: 2.8067 (ft²)
Depth at center of grate: 0.4607 (ft)
Computed Width of Spread at Sag: 24.0354 (ft)
Flow type: Weir Flow
Efficiency: 1.0000

Curb and Gutter Analysis: Southern Leg East Main Street

Notes:

Parameters

Longitudinal Slope of Road: 0.0400 (ft/ft)
Cross-Slope of Pavement: 0.0200 (ft/ft)
Cross-Slope of Gutter: 0.0200 (ft/ft)
Mannings: 0.0150
Gutter Width: 2.0000 (ft)
Design Flow: 1.9000 (cfs)
Width of Spread: 6.9019 (ft)
Gutter Depression: 0.0000 (in)
Area of Flow: 0.4764 (ft²)
Eo (Gutter Flow to Total Flow): 0.5989
Gutter Depth at Curb: 1.6564 (in)
Inlet Location: Inlet in Sag
Percent Clogging: 0.0000 %
Inlet Type: Grate
Grate Type: P - 1-7/8
Grate Width: 1.3500 (ft)
Grate Length: 2.3100 (ft)
Local Depression: 0.0000 (in)
Perimeter: 5.0100 (ft)
Effective Perimeter: 5.0100 (ft)
Area: 2.8067 (ft²)
Effective Area: 2.8067 (ft²)
Depth at center of grate: 0.2519 (ft)
Computed Width of Spread at Sag: 13.5941 (ft)
Flow type: Weir Flow
Efficiency: 1.0000

APPENDIX F – BORING LOGS

		Connecticut DOT Boring Report				Hole No.: B-1		
Inspector: R. Janeiro		Town: Stamford		Stat./Offset:				
Engineer: J. Kidd		Project No.: 0101-025.00		Northing:				
Start Date: 8-31-10		Route No.:		Easting:				
Finish Date: 8-31-10		Bridge No.:		Surface Elevation:				
Project Description: East Main Street, Pilot Boring Program								
Casing Size/Type: 3"/NW		Sampler Type/Size: SS/1-3/8"			Core Barrel Type: NX			
Hammer Wt.: 300 lb. Fall: 24in.		Hammer Wt.: 140 lb. Fall: 30 in.						
Groundwater Observations: @11 ft. after 0 hours								
Depth (ft)	SAMPLES					Generalized Strata Description	Material Description and Notes	Elevation (ft)
	Sample Type/No.	Blows on Sampler per 6 inches						
0							Asphalt Fill	
	S-1	5	1	3	3	24	5	S-1: Loose, brown fine to coarse SAND, little Silt, trace fine Gravel
	S-2	8	9	13	18	24	21	S-2: Medium dense, Top 5", brown fine to coarse SAND, some Silt, trace Brick Bot 16": reddish brown fine to medium SAND, trace Silt
5	S-3	13	27	24	21	24	18	S-3: Very dense, brown fine to coarse SAND, little Silt, trace fine Gravel, 4" of fractured Rock mid-sample
	S-4	16	24	31	30	24	12	S-4: Very dense, brown fine to coarse SAND, and fine to coarse Gravel, little Silt
	S-5	29 100/5"				11	7	S-5: Very dense, brown fine to coarse SAND, and fine to coarse Gravel, little Silt
10								
	S-6	34	38	82	61	24	10	S-6: Very dense, grayish brown fine to coarse GRAVEL, and fine to coarse Sand, trace Silt, broken Gravel pieces within sample
15								
20								
Sample Type: S = Split Spoon C = Core UP = Undisturbed Piston V = Vane Shear Test Proportions Used: Trace = 1 - 10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%								
Total Penetration in		NOTES:						Sheet 1 of 2
Earth: 24ft Rock: 5.5ft								
No. of Soil Samples: 7		No. of Core Runs: 1						SM-001-M REV. 1/02

		Connecticut DOT Boring Report		Hole No.: B-1
Inspector: R. Janeiro	Town: Stamford	Project No.: 0101-025.00		Stat./Offset:
Engineer: J. Kidd	Route No.:	Bridge No.:		Northing:
Start Date: 8-31-10			Easting:	
Finish Date: 8-31-10			Surface Elevation:	

Project Description: East Main Street, Pilot Boring Program

Casing Size/Type: 3"/NW	Sampler Type/Size: SS/1-3/8"	Core Barrel Type: NX
Hammer Wt.: 300 lb. Fall: 24in.	Hammer Wt.: 140 lb. Fall: 30 in.	

Groundwater Observations: @11 ft. after 0 hours

Depth (ft)	SAMPLES					Generalized Strata Description	Material Description and Notes	Elevation (ft)		
	Sample Type/No.	Blows on Sampler per 6 inches							Pen. (in.)	Rec. (in.)
20	S-7	26	42	34	27	24	11		Sand & Gravel (cont)	S-7: Very dense, brown fine to coarse SAND and fine to coarse GRAVEL, little Silt, (broken coarse Gravel pieces mid-sample)
25	C-1					66	55	20		
30										END OF BORING 29.5ft
35										
40										

Sample Type: S = Split Spoon C = Core UP = Undisturbed Piston V = Vane Shear Test
Proportions Used: Trace = 1 - 10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 24ft Rock: 5.5ft	NOTES:	Sheet 2 of 2
No. of Soil Samples: 7 No. of Core Runs: 1		

		Connecticut DOT Boring Report		Hole No.: B-2
Inspector: R. Janeiro	Town: Stamford	Project No.: 0101-025.00		Stat./Offset:
Engineer: J. Kidd	Route No.:	Bridge No.:		Northing:
Start Date: 9-8-10			Easting:	
Finish Date: 9-8-10			Surface Elevation:	

Project Description: East Main Street, Pilot Boring Program

Casing Size/Type: 3"/NW	Sampler Type/Size: SS/1-3/8"	Core Barrel Type: NX
Hammer Wt.: 300 lb. Fall: 24in.	Hammer Wt.: 140 lb. Fall: 30 in.	

Groundwater Observations: @8 ft. after 0 hours

Depth (ft)	SAMPLES					Generalized Strata Description	Material Description and Notes	Elevation (ft)	
	Sample Type/No.	Blows on Sampler per 6 inches							Pen. (in.)
0						Asphalt	S-1: Dense, Top 10": brown fine to coarse SAND, some fine to coarse Gravel, little Silt, trace Wood Bottom 4": brownish gray fine SAND, and Silt S-2: Very dense, Top 3": brownish gray fine to coarse SAND, and Silt Bottom 6": brown fine to coarse SAND, and fine to coarse Gravel, little Silt S-3: Dense, brown fine to coarse GRAVEL and fine to coarse SAND, little Silt, (jammed pieces of coarse Gravel throughout sample) S-4: Very dense, light brownish gray fine to coarse SAND and fine to coarse GRAVEL, little Silt, (jammed/broken pieces of coarse Gravel throughout sample)		
	S-1	26	19	14	14	24			14
	S-2	16	26	31	31	24			9
5	S-3	15	20	29	29	24			14
	S-4	70	83	100/5"		17	9		
10							END OF BORING 10ft		
15									
20									

Sample Type: S = Split Spoon C = Core UP = Undisturbed Piston V = Vane Shear Test
 Proportions Used: Trace = 1 - 10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 10ft Rock: 0ft	NOTES:	Sheet 1 of 1
No. of Soil Samples: 4 No. of Core Runs: 0		SM-001-M REV. 1/02

		Connecticut DOT Boring Report		Hole No.: B-3 (OW)
Inspector: R. Janeiro	Town: Stamford	Project No.: 0101-025.00		Stat./Offset:
Engineer: J. Kidd	Route No.:	Bridge No.:		Northing:
Start Date: 9-1-10			Easting:	
Finish Date: 9-1-10			Surface Elevation:	

Project Description: East Main Street, Pilot Boring Program

Casing Size/Type: 3"/NW	Sampler Type/Size: SS/1-3/8"	Core Barrel Type: NX
Hammer Wt.: 300 lb. Fall: 24in.	Hammer Wt.: 140 lb. Fall: 30 in.	

Groundwater Observations: @10 ft. after 0 hours

Depth (ft)	SAMPLES					Generalized Strata Description	Material Description and Notes	Well Construction	Elevation (ft)
	Sample Type/No.	Blows on Sampler per 6 inches							
0						Asphalt			
	S-1	4	2	2	3	24	8		
	S-2	9	15	9	17	24	8		
5	S-3	13	12	10	18	24	18		
	S-4	23	21	20	23	24	12		
10	S-5	20	25	25	29	24	10		
15	S-6	22	34	44	36	24	14		
20									

Sample Type: S = Split Spoon C = Core UP = Undisturbed Piston V = Vane Shear Test
 Proportions Used: Trace = 1 - 10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 24ft Rock: 0ft	NOTES:	Sheet 1 of 2
No. of Soil Samples: 8 No. of Core Runs: 0		SM-001-M REV. 1/02

		Connecticut DOT Boring Report		Hole No.: B-3 (OW)
Inspector: R. Janeiro	Town: Stamford	Project No.: 0101-025.00		Stat./Offset:
Engineer: J. Kidd	Route No.:	Bridge No.:		Northing:
Start Date: 9-1-10			Easting:	
Finish Date: 9-1-10			Surface Elevation:	

Project Description: East Main Street, Pilot Boring Program

Casing Size/Type: 3"/NW	Sampler Type/Size: SS/1-3/8"	Core Barrel Type: NX
Hammer Wt.: 300 lb. Fall: 24in.	Hammer Wt.: 140 lb. Fall: 30 in.	

Groundwater Observations: @10 ft. after 0 hours

Depth (ft)	SAMPLES					Generalized Strata Description	Material Description and Notes	Well Construction	Elevation (ft)	
	Sample Type/No.	Blows on Sampler per 6 inches								Pen. (in.)
20	S-7	22	20	16	23	24	0		Sand & Gravel (cont)	S-7: No recovery
	S-8	11	32	26	28	24	11			S-8: Very dense, brown fine to coarse SAND and fine to coarse GRAVEL, trace Silt
25										END OF BORING 24ft
30										
35										
40										

Sample Type: S = Split Spoon C = Core UP = Undisturbed Piston V = Vane Shear Test
 Proportions Used: Trace = 1 - 10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 24ft Rock: 0ft	NOTES:	Sheet 2 of 2
No. of Soil Samples: 8 No. of Core Runs: 0		

APPENDIX G - FIGURES

Highway

- Figure 2.1 – Project Area
- Figure 2.2a – Roadway Plan (2-span)
- Figure 2.2b – Roadway Plan (4-span)
- Figure 2.2c – Roadway Plan (with Crystal Street Relocated)
- Figure 2.3a – East Main Street Roadway Profile (2-span)
- Figure 2.3b – East Main Street Roadway Profile (4-span)
- Figure 2.4a – Roadway Cross Section (2-span)
- Figure 2.4b – Roadway Cross Section (4-span)

Rail Operations

- Figure 3.1a-g– Rail Staging and Sequencing Plans for Bridge 02237R

Bridge 02237R

- Figure 4.1a – General Plan & Elevation
- Figure 4.1b – General Plan & Elevation
- Figure 4.2 – Bridge Typical Sections
- Figure 4.3a-c – Construction Staging Sections
- Figure 4.4a – Phased Construction Sequence (2-span)
- Figure 4.4b – Phased Construction Sequence (4-span)
- Figure 4.5 – Girder Details
- Figure 4.6a-b – Abutments
- Figure 4.7 – Piers

Traffic

- Figure 6.1a-d – Maintenance and Protection of Traffic

Drainage

- Figure 7.1 – Drainage Plan

Utilities

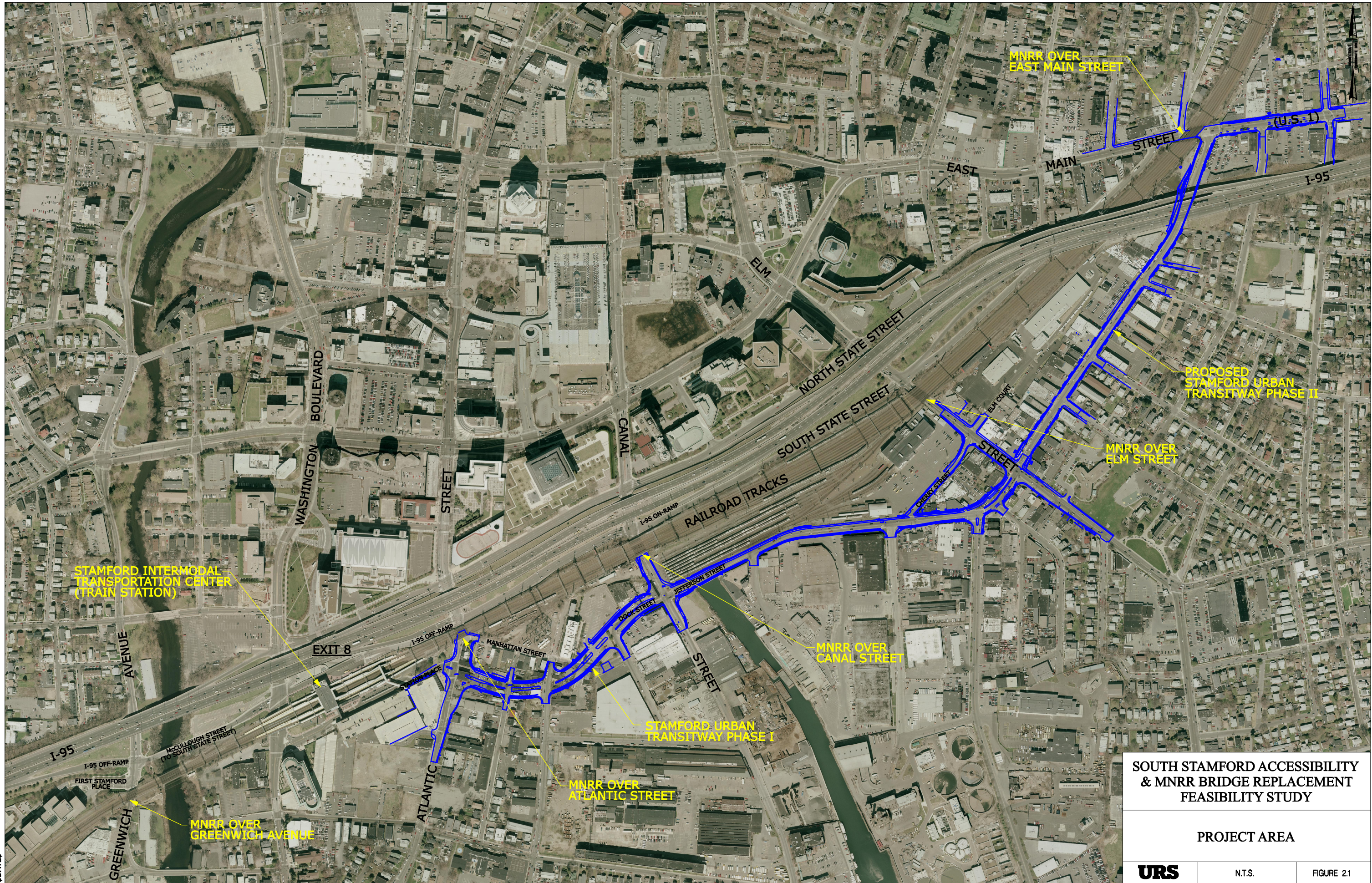
- Figure 8.1 – Utility Plan

Geotechnical

- Figure 9.1 – Boring Plan

Environmental

- Figure 10.1 – 100 Year FEMA Floodplain



SOUTH STAMFORD ACCESSIBILITY & MNRR BRIDGE REPLACEMENT FEASIBILITY STUDY

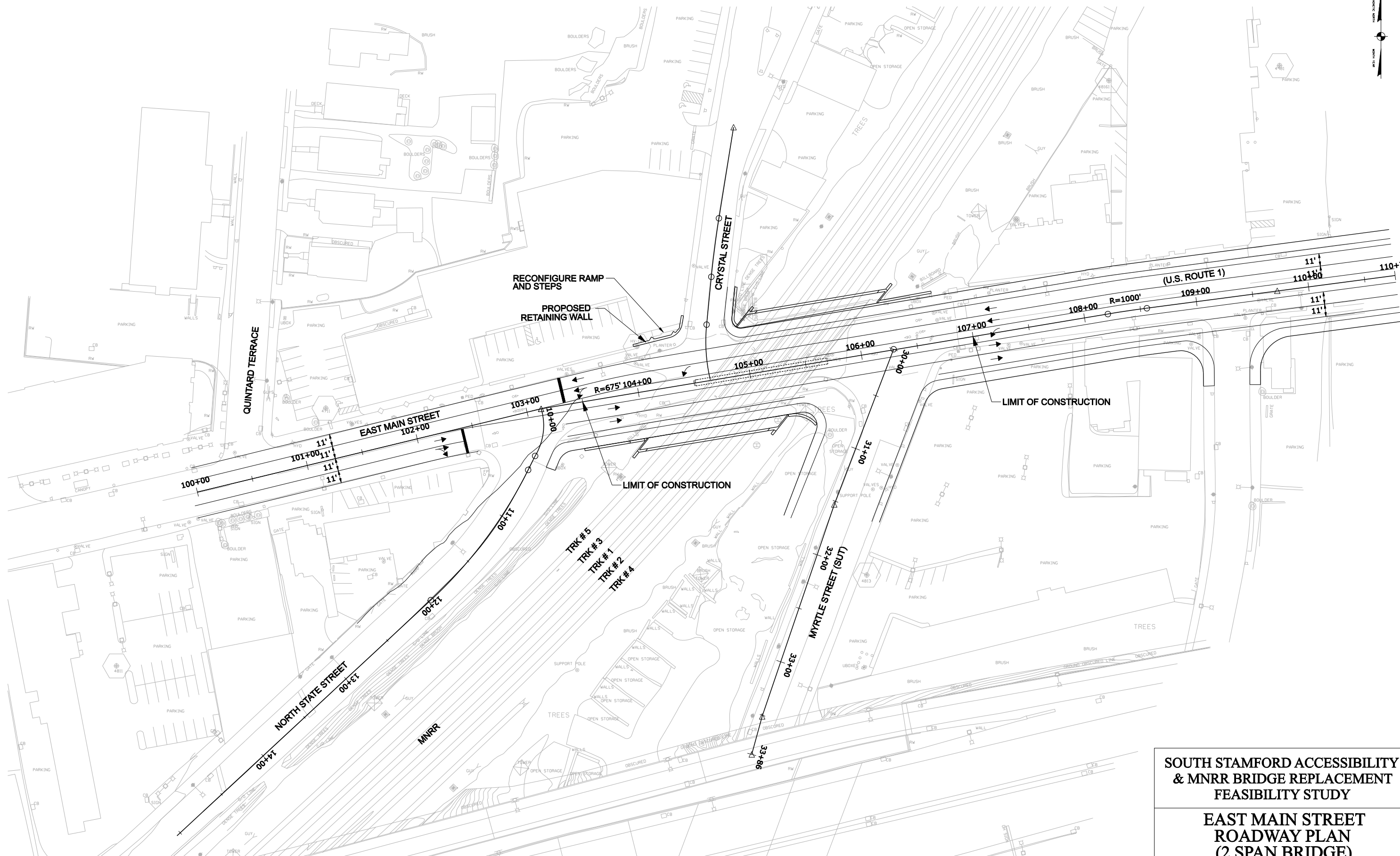
PROJECT AREA

URS

N.T.S.

FIGURE 2.1

FILES
DATES



**SOUTH STAMFORD ACCESSIBILITY
& MNRR BRIDGE REPLACEMENT
FEASIBILITY STUDY**

**EAST MAIN STREET
ROADWAY PLAN
(2 SPAN BRIDGE)**

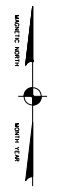
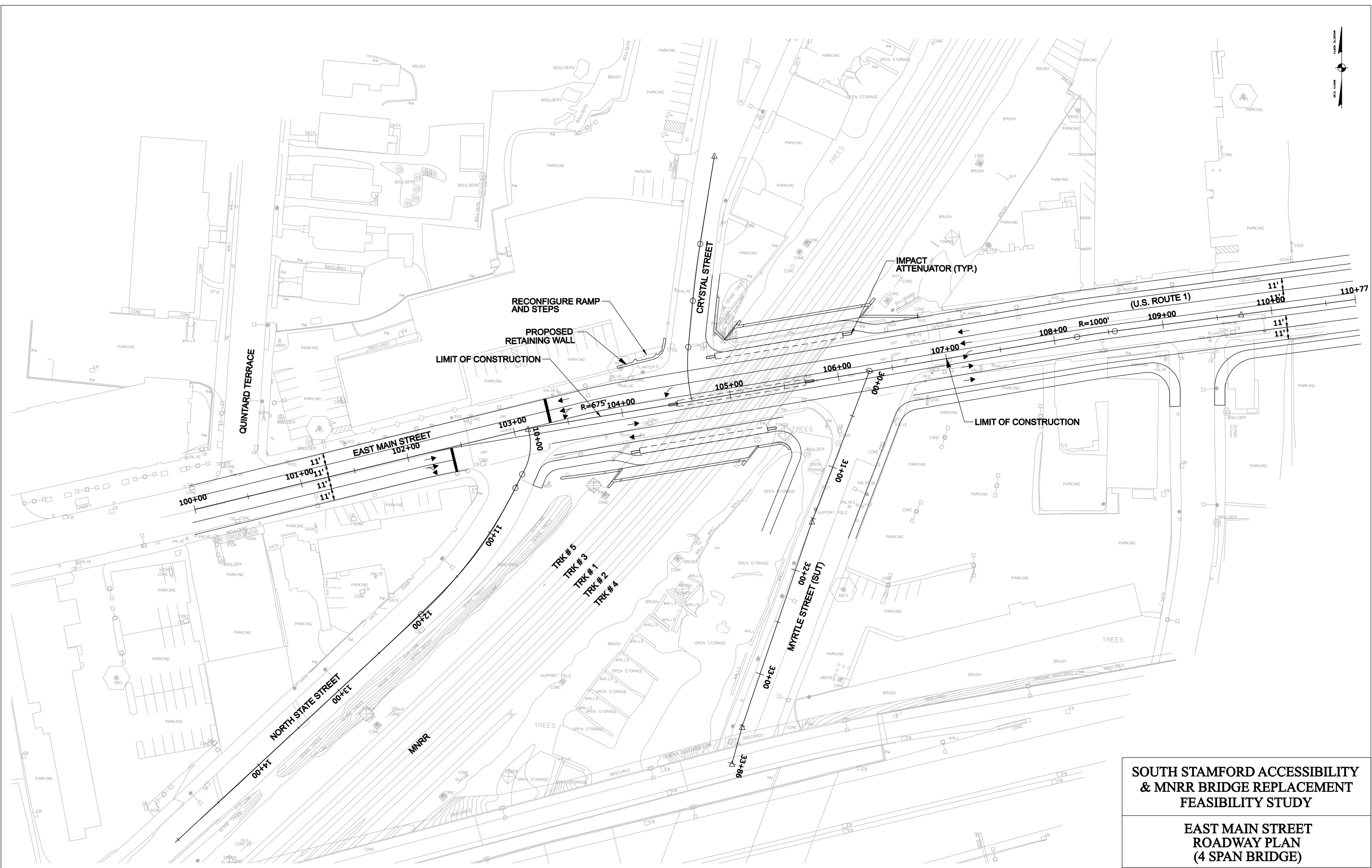
URS

SCALE 1" = 80'

FIGURE 2.2a

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P:\CTDOT_projects\135-301 Highways\Phase-2\East_Main\MSta_Contract_Sheet_Files\HW_MSH_135-301_Plan_EastMain(4Span).dgn
3/1/2011



**SOUTH STAMFORD ACCESSIBILITY
& MNRR BRIDGE REPLACEMENT
FEASIBILITY STUDY**

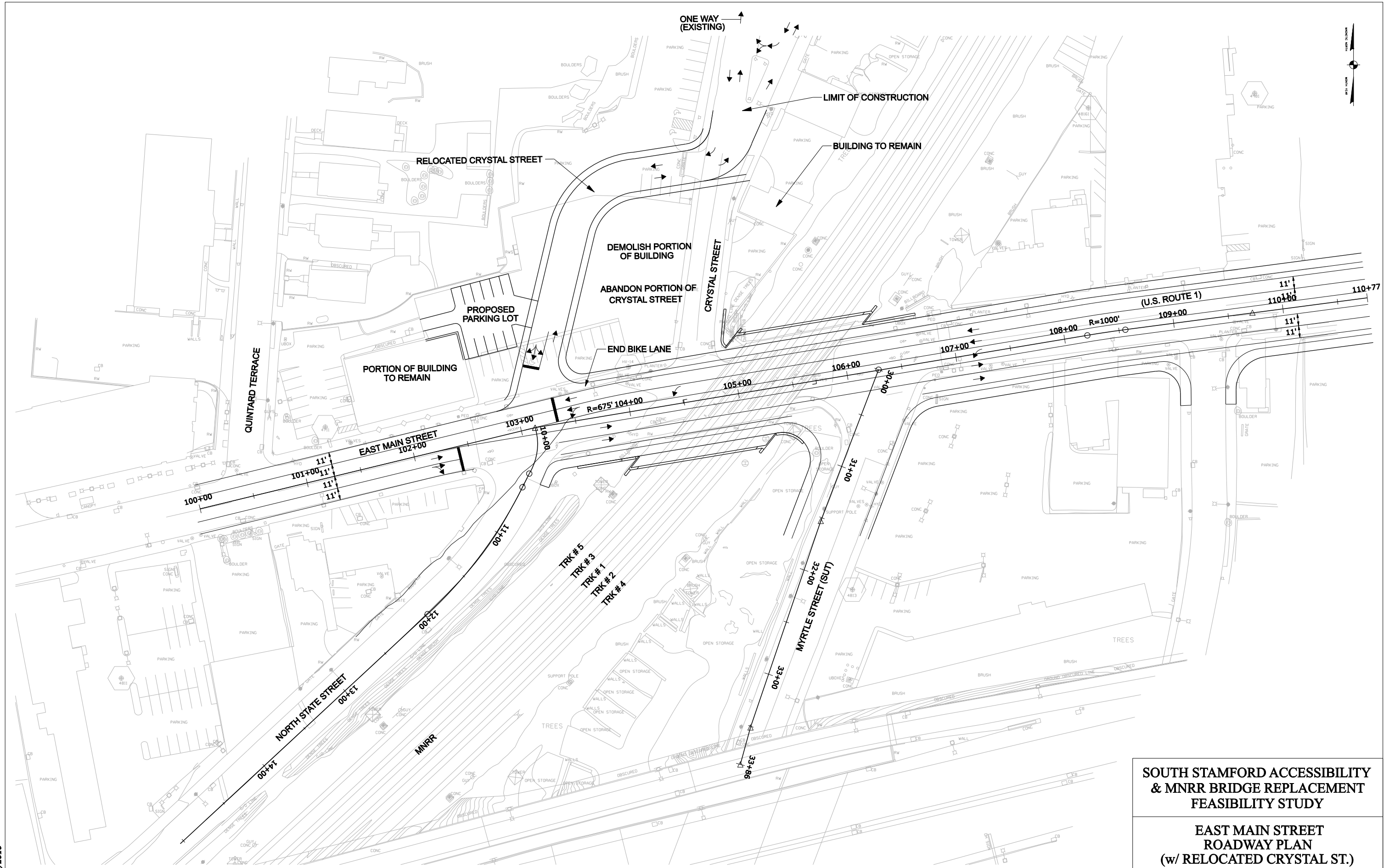
**EAST MAIN STREET
ROADWAY PLAN
(4 SPAN BRIDGE)**

URS

SCALE 1" = 80'

FIGURE 2.2b

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10/20/2010



**SOUTH STAMFORD ACCESSIBILITY
& MNRR BRIDGE REPLACEMENT
FEASIBILITY STUDY**

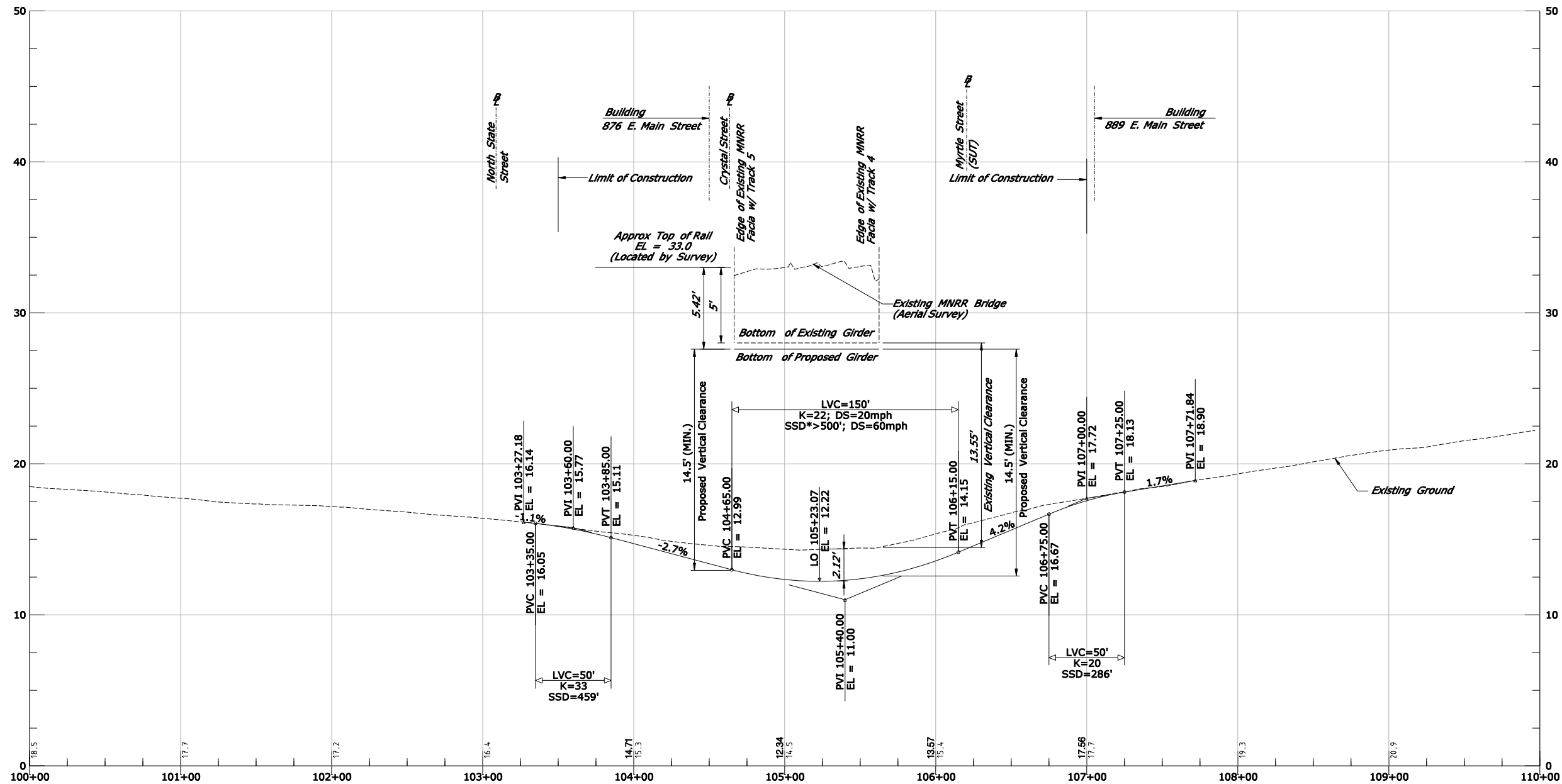
**EAST MAIN STREET
ROADWAY PLAN
(w/ RELOCATED CRYSTAL ST.)**

URS

SCALE 1" = 80'

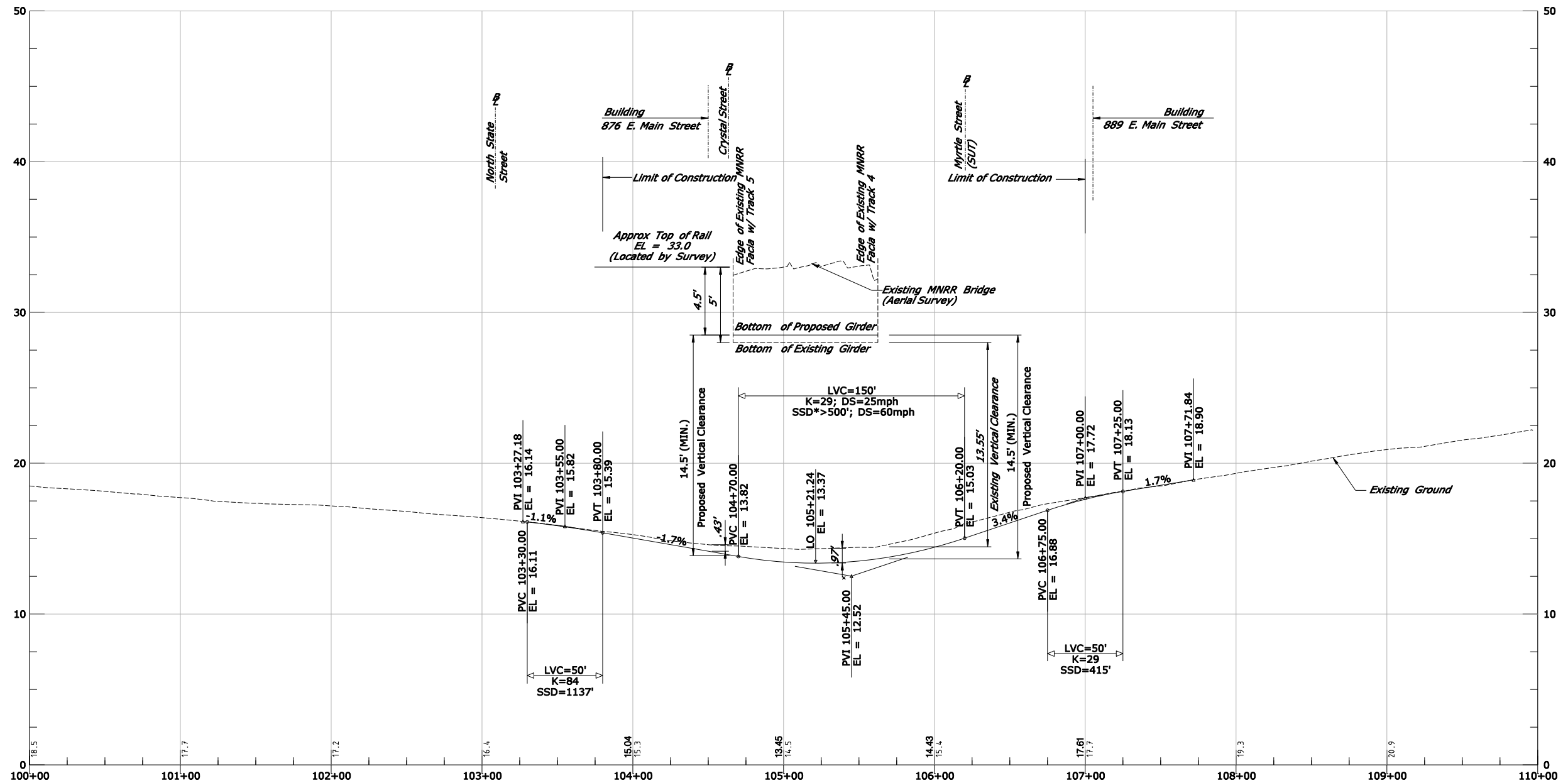
FIGURE 2.2c

P:\CTDOT_projects\135-301\Highways\Phase-2\East_Main\MSA-Contract-Sheet_Files\HW_MSH_135-301_PRO_EastMain(2Span).dgn
10/20/2010



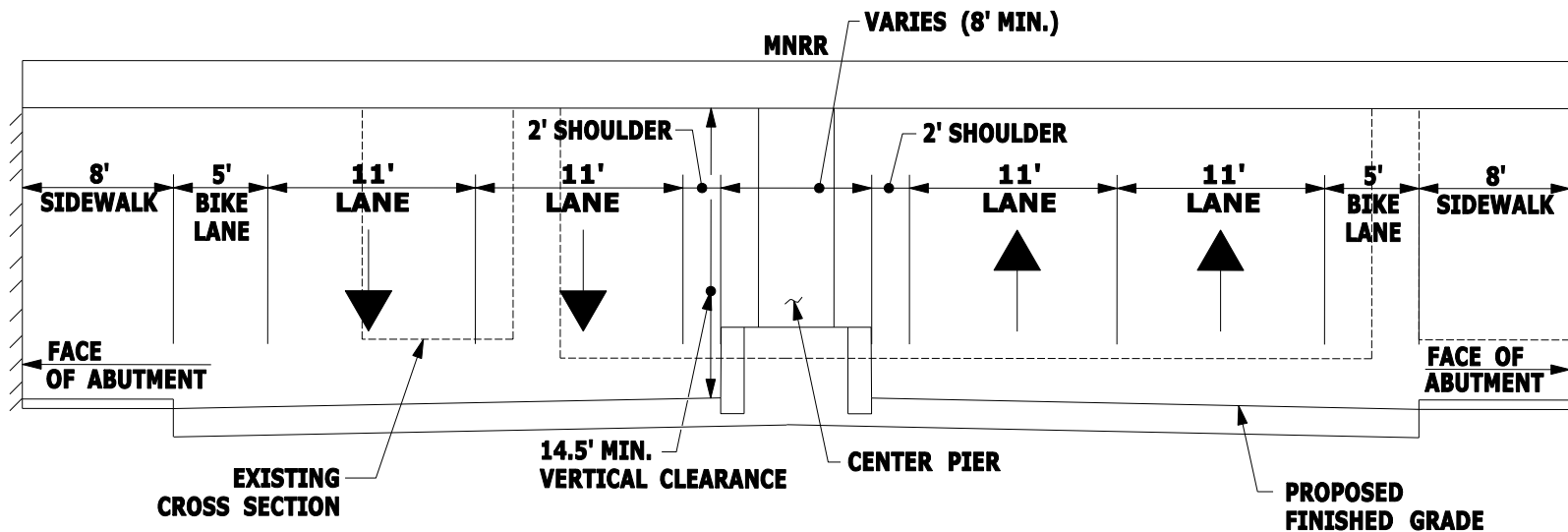
*SSD BASED ON ILLUMINATED HIGHWAY.

SOUTH STAMFORD ACCESSIBILITY & MNRR BRIDGE REPLACEMENT FEASIBILITY STUDY		
EAST MAIN STREET ROADWAY PROFILE (2 SPAN BRIDGE)		
URS	SCALE 1"=80'	FIGURE 2.3a



*SSD BASED ON ILLUMINATED HIGHWAY.

SOUTH STAMFORD ACCESSIBILITY & MNRR BRIDGE REPLACEMENT FEASIBILITY STUDY		
EAST MAIN STREET ROADWAY PROFILE (4 SPAN BRIDGE)		
URS	SCALE 1"=80'	FIGURE 2.3b



EAST MAIN STREET LOOKING NORTHBOUND

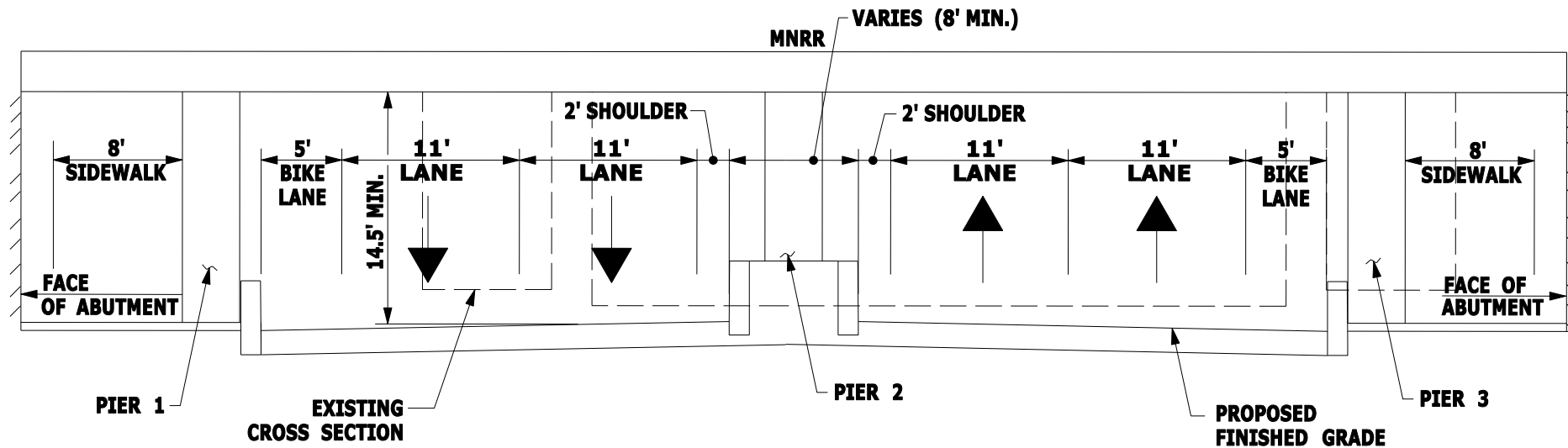
SOUTH STAMFORD ACCESSIBILITY
& MNRR BRIDGE REPLACEMENT
FEASIBILITY STUDY

EAST MAIN STREET
ROADWAY CROSS SECTION
(2 SPAN BRIDGE)

URS

SCALE: 1"=10'

FIGURE 2.4a



EAST MAIN STREET LOOKING NORTHBOUND

SOUTH STAMFORD ACCESSIBILITY
& MNRR BRIDGE REPLACEMENT
FEASIBILITY STUDY

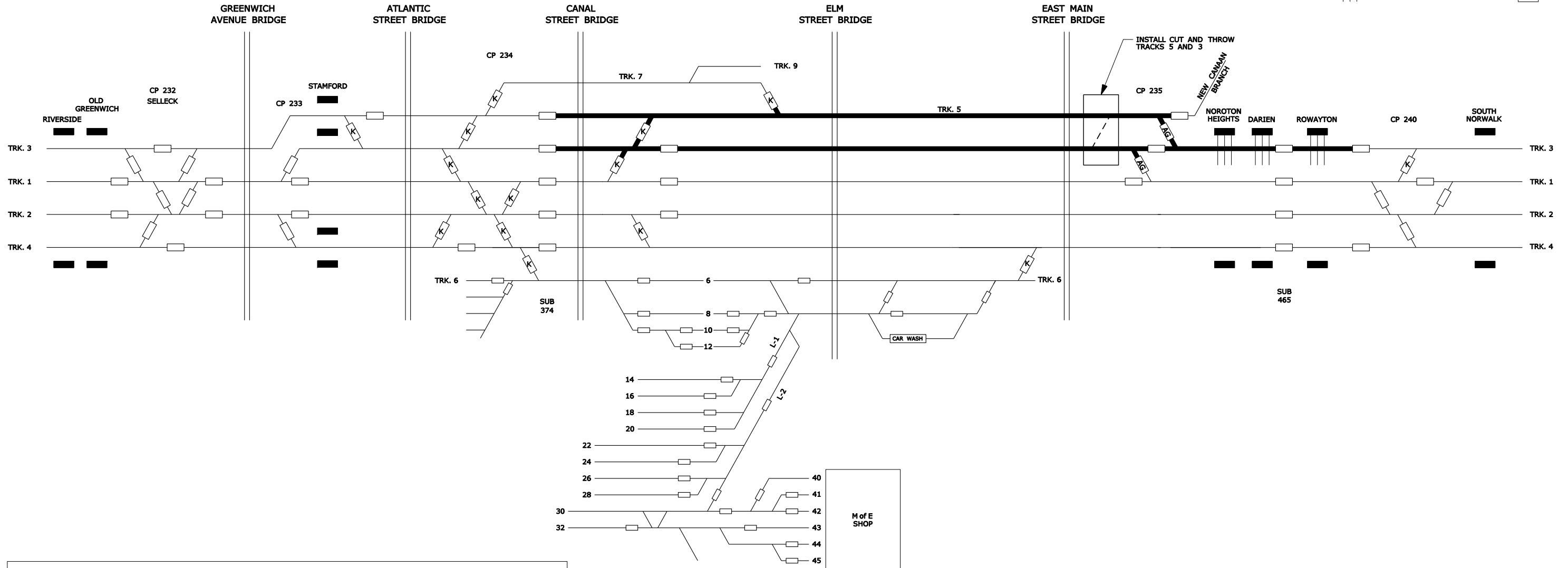
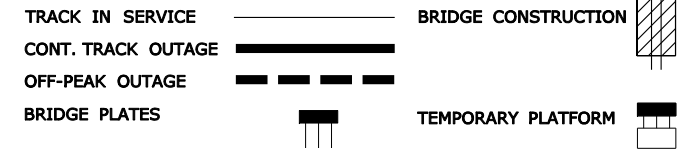
EAST MAIN STREET
ROADWAY CROSS SECTION
(4 SPAN BRIDGE)

URS

SCALE: 1"=10'

FIGURE 2.4b

LEGEND:



STAGE	TASK	TRACK	TRACK OUTAGE
1A	1) INSTALL BRIDGE PLATES AT NORTON HEIGHTS, DARIEN, AND ROWAYTON.	3	OFF PEAK WEEKEND NIGHT OUTAGE
	2) INSTALL CUT AND THROW TRACKS 5 AND 3		5,3 CONTINUOUS TRACK OUTAGE (ONE WEEKEND ONLY)

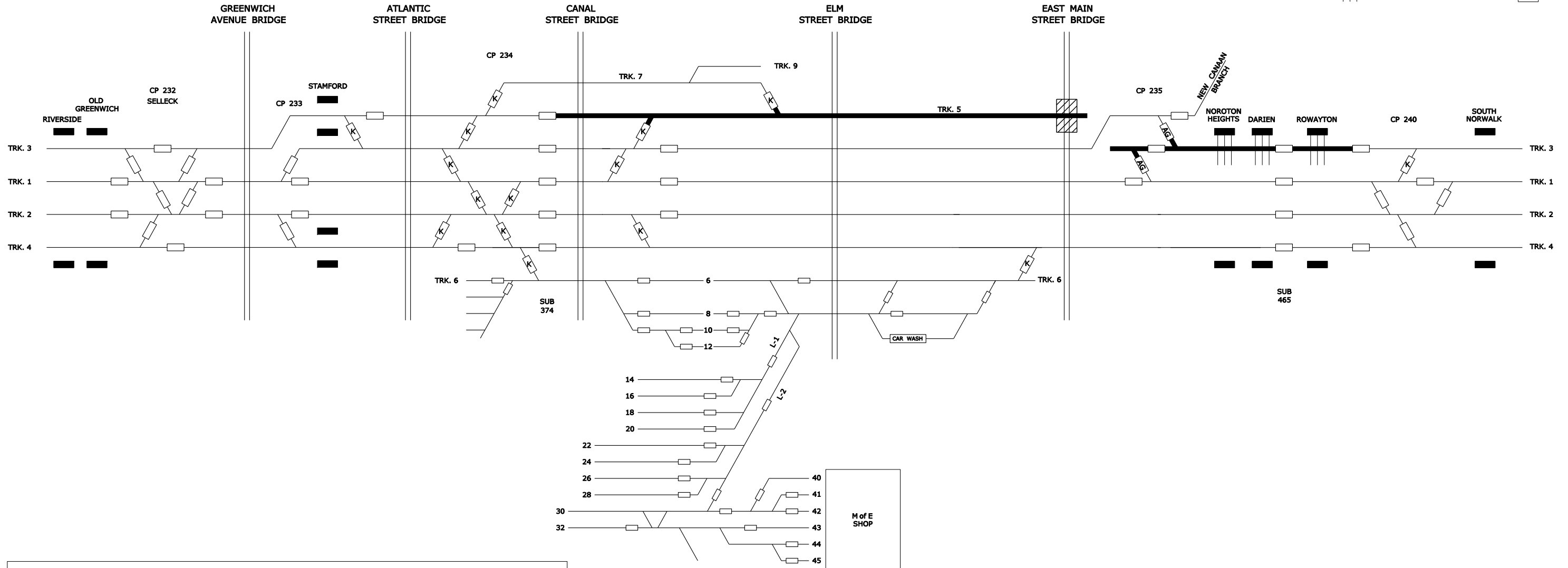
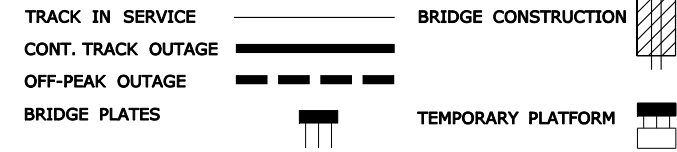
**SOUTH STAMFORD ACCESSIBILITY
& MNRR BRIDGE REPLACEMENT
FEASIBILITY STUDY**

**EAST MAIN STREET
CONSTRUCTION STAGING**

STAGE 1A

URS	SCALE: N.T.S.	FIGURE 3.1a
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LEGEND:



STAGE	TASK	TRACK	TRACK OUTAGE
1B	1) REMOVE TRACK 5 AT EAST MAIN ST. 2) REMOVE EXISTING STEEL SUPERSTRUCTURE 3) INSTALL NEW ABUTMENTS 4) INSTALL NEW CENTER PIER 5) CUT BACK TOPS OF EXISTING ABUTMENTS 6) INSTALL NEW SUPERSTRUCTURE 7) INSTALL NEW TRACK 5 AT EAST MAIN ST.	5,3	CONTINUOUS TRACK OUTAGE

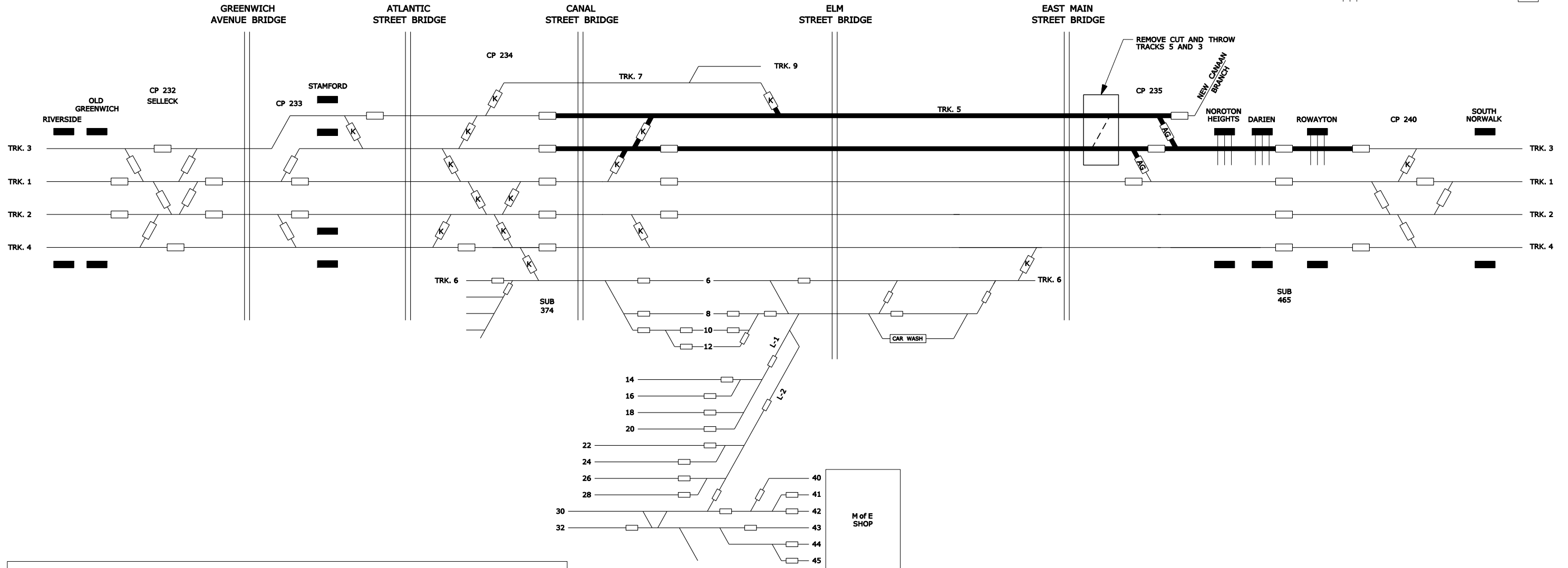
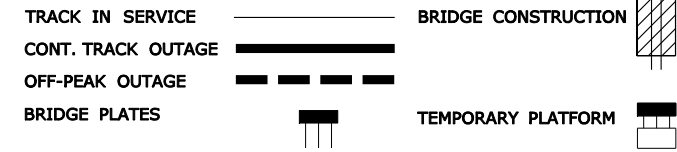
**SOUTH STAMFORD ACCESSIBILITY
& MNRR BRIDGE REPLACEMENT
FEASIBILITY STUDY**

**EAST MAIN STREET
CONSTRUCTION STAGING**

STAGE 1B

URS	SCALE: N.T.S.	FIGURE 3.1b
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LEGEND:



STAGE	TASK	TRACK	TRACK OUTAGE
1C	1) REMOVE CUT AND THROW TRACKS 5 AND 3	3	OFF PEAK WEEKEND NIGHT OUTAGE
	2) REMOVE BRIDGE PLATES AT NORTON HEIGHTS, DARIEN, AND ROWAYTON.	5,3	CONTINUOUS TRACK OUTAGE (ONE WEEKEND ONLY)

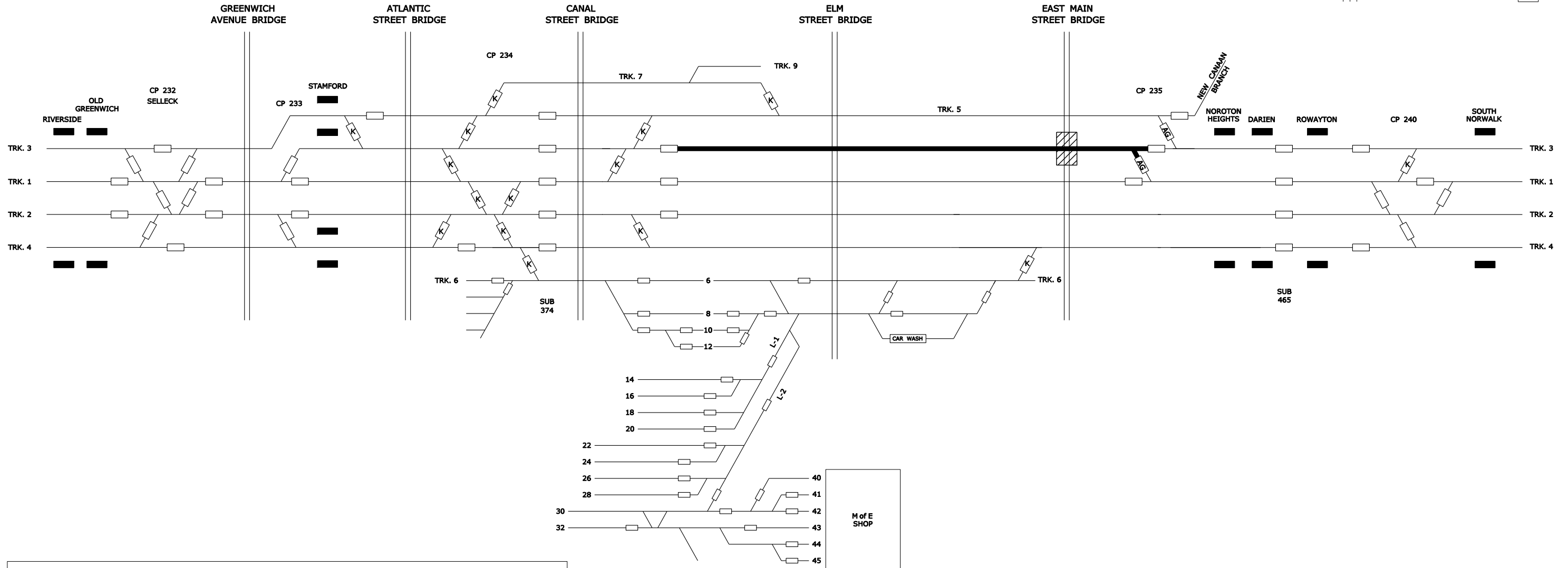
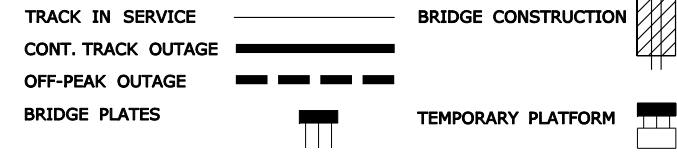
**SOUTH STAMFORD ACCESSIBILITY
& MNRR BRIDGE REPLACEMENT
FEASIBILITY STUDY**

**EAST MAIN STREET
CONSTRUCTION STAGING**

STAGE 1C

URS	SCALE: N.T.S.	FIGURE 3.1c
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LEGEND:



STAGE	TASK	TRACK	TRACK OUTAGE
2	1) REMOVE TRACK 3 AT EAST MAIN ST. 2) REMOVE EXISTING STEEL SUPERSTRUCTURE 3) INSTALL NEW ABUTMENTS 4) INSTALL NEW CENTER PIER 5) CUT BACK TOPS OF EXISTING ABUTMENTS 6) INSTALL NEW SUPERSTRUCTURE 7) INSTALL NEW TRACK 3 AT EAST MAIN ST.	3	CONTINUOUS TRACK OUTAGE

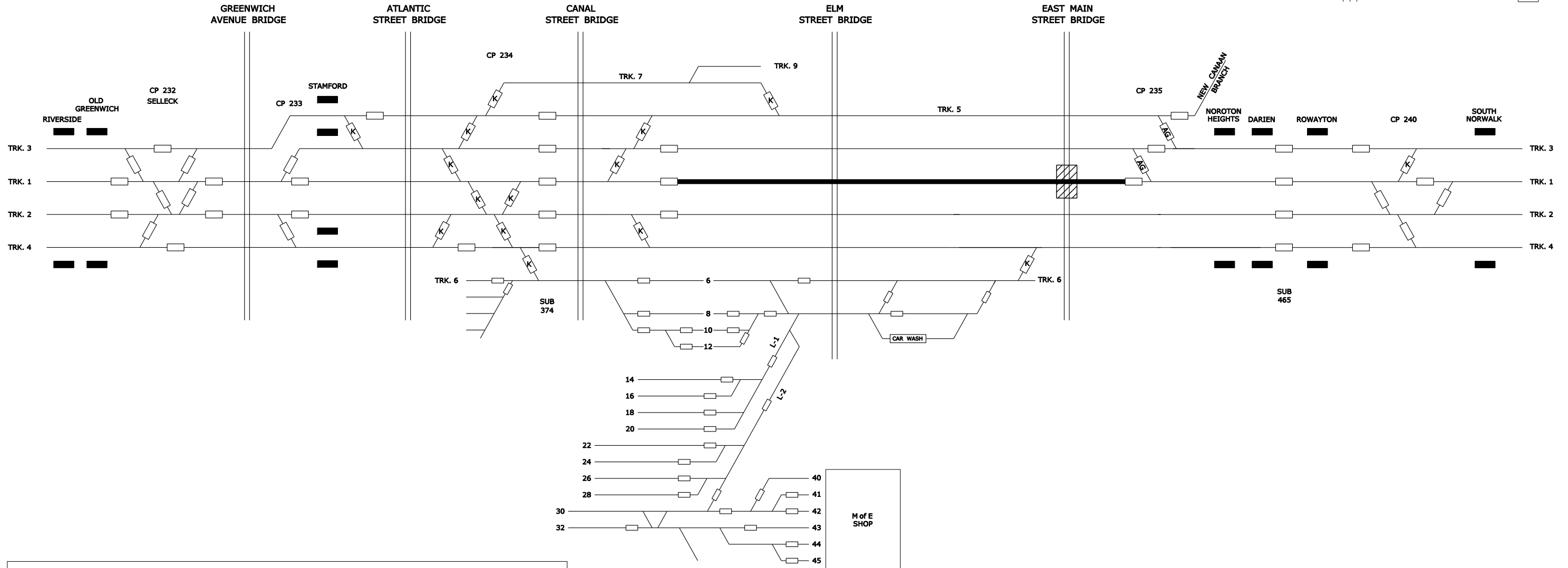
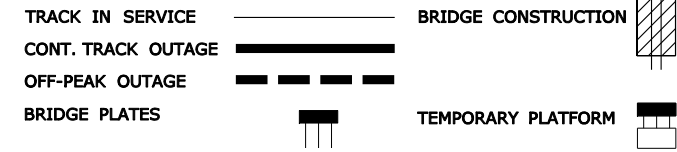
**SOUTH STAMFORD ACCESSIBILITY
& MNRR BRIDGE REPLACEMENT
FEASIBILITY STUDY**

**EAST MAIN STREET
CONSTRUCTION STAGING**

STAGE 2

URS	SCALE: N.T.S.	FIGURE 3.1d
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LEGEND:



STAGE	TASK	TRACK	TRACK OUTAGE
3	1) REMOVE TRACK 1 AT EAST MAIN ST. 2) REMOVE EXISTING STEEL SUPERSTRUCTURE 3) INSTALL NEW ABUTMENTS 4) INSTALL NEW CENTER PIER 5) CUT BACK TOPS OF EXISTING ABUTMENTS 6) INSTALL NEW SUPERSTRUCTURE 7) INSTALL NEW TRACK 1 AT EAST MAIN ST.	1	CONTINUOUS TRACK OUTAGE

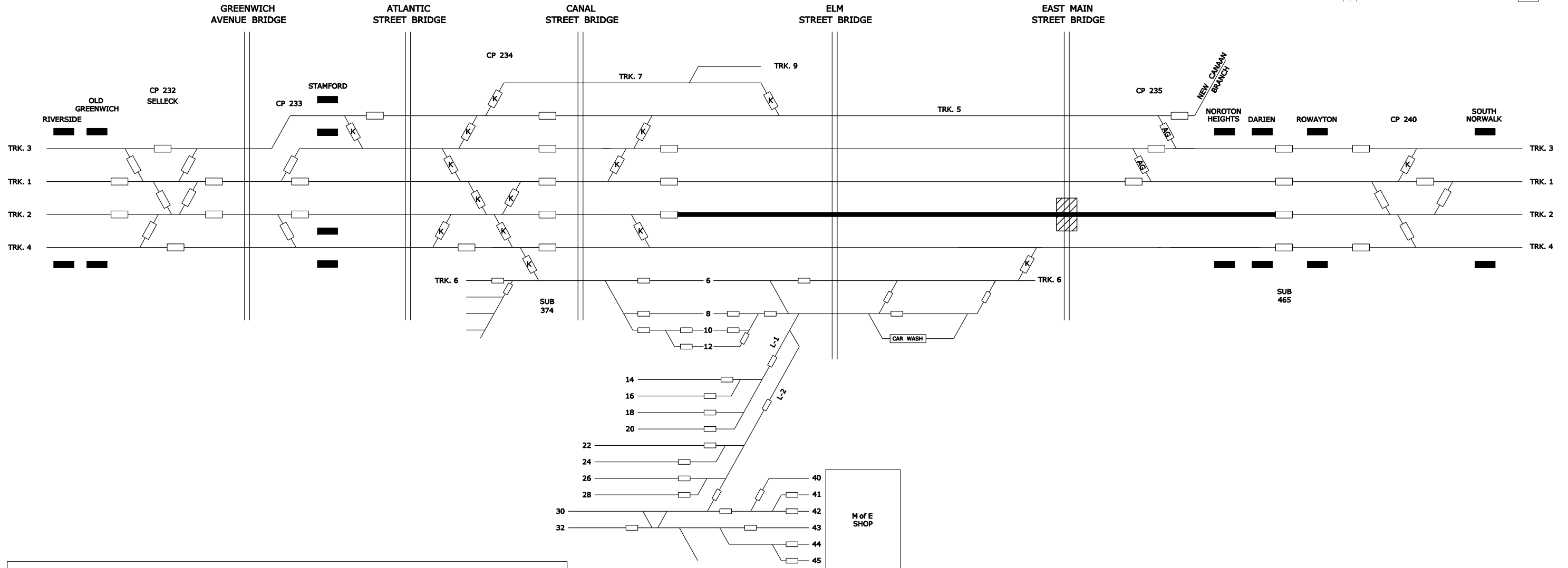
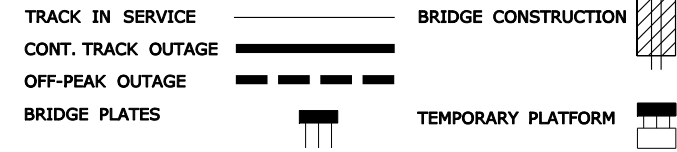
**SOUTH STAMFORD ACCESSIBILITY
& MNRR BRIDGE REPLACEMENT
FEASIBILITY STUDY**

**EAST MAIN STREET
CONSTRUCTION STAGING**

STAGE 3

URS	SCALE: N.T.S.	FIGURE 3.1e
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LEGEND:



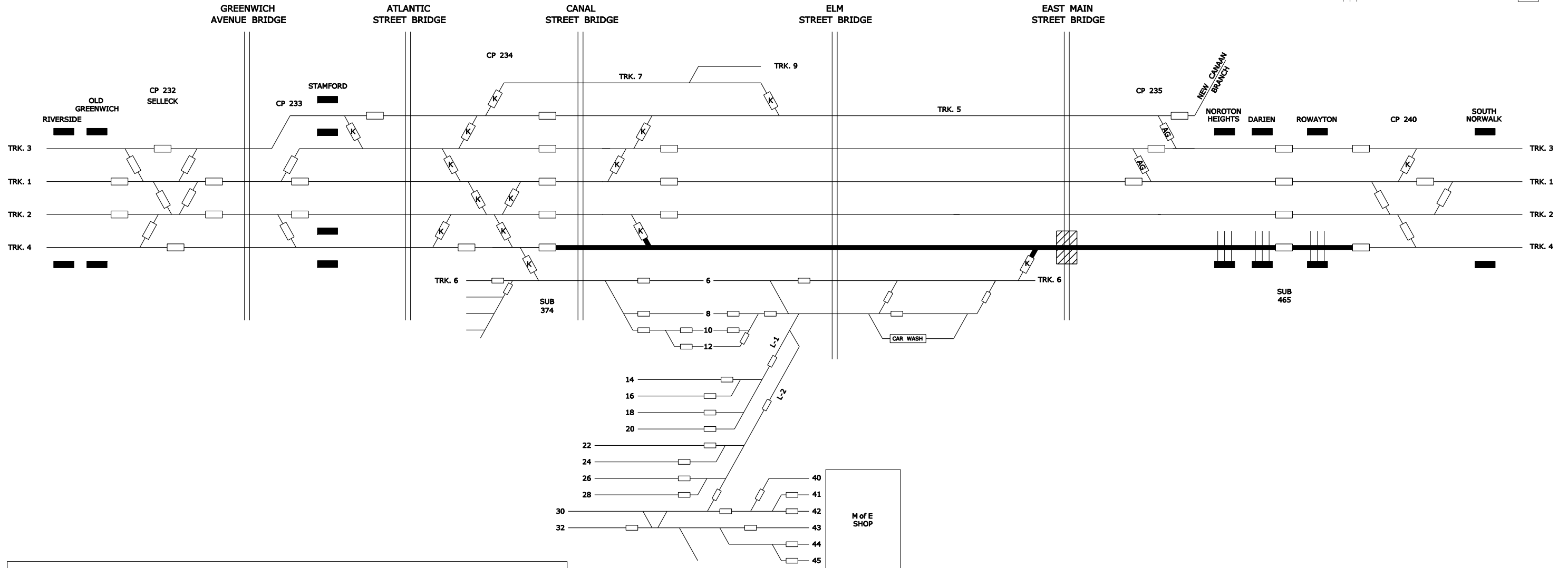
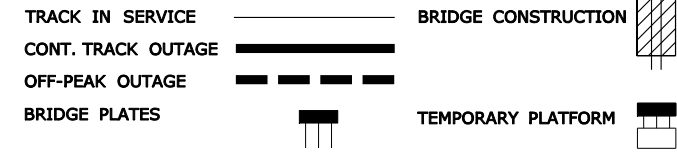
STAGE	TASK	TRACK	TRACK OUTAGE
4	1) REMOVE TRACK 2 AT EAST MAIN ST. 2) REMOVE EXISTING STEEL SUPERSTRUCTURE 3) INSTALL NEW ABUTMENTS 4) INSTALL NEW CENTER PIER 5) CUT BACK TOPS OF EXISTING ABUTMENTS 6) INSTALL NEW SUPERSTRUCTURE 7) INSTALL NEW TRACK 2 AT EAST MAIN ST.	2	CONTINUOUS TRACK OUTAGE

SOUTH STAMFORD ACCESSIBILITY & MNRR BRIDGE REPLACEMENT FEASIBILITY STUDY

EAST MAIN STREET CONSTRUCTION STAGING

STAGE 4

LEGEND:



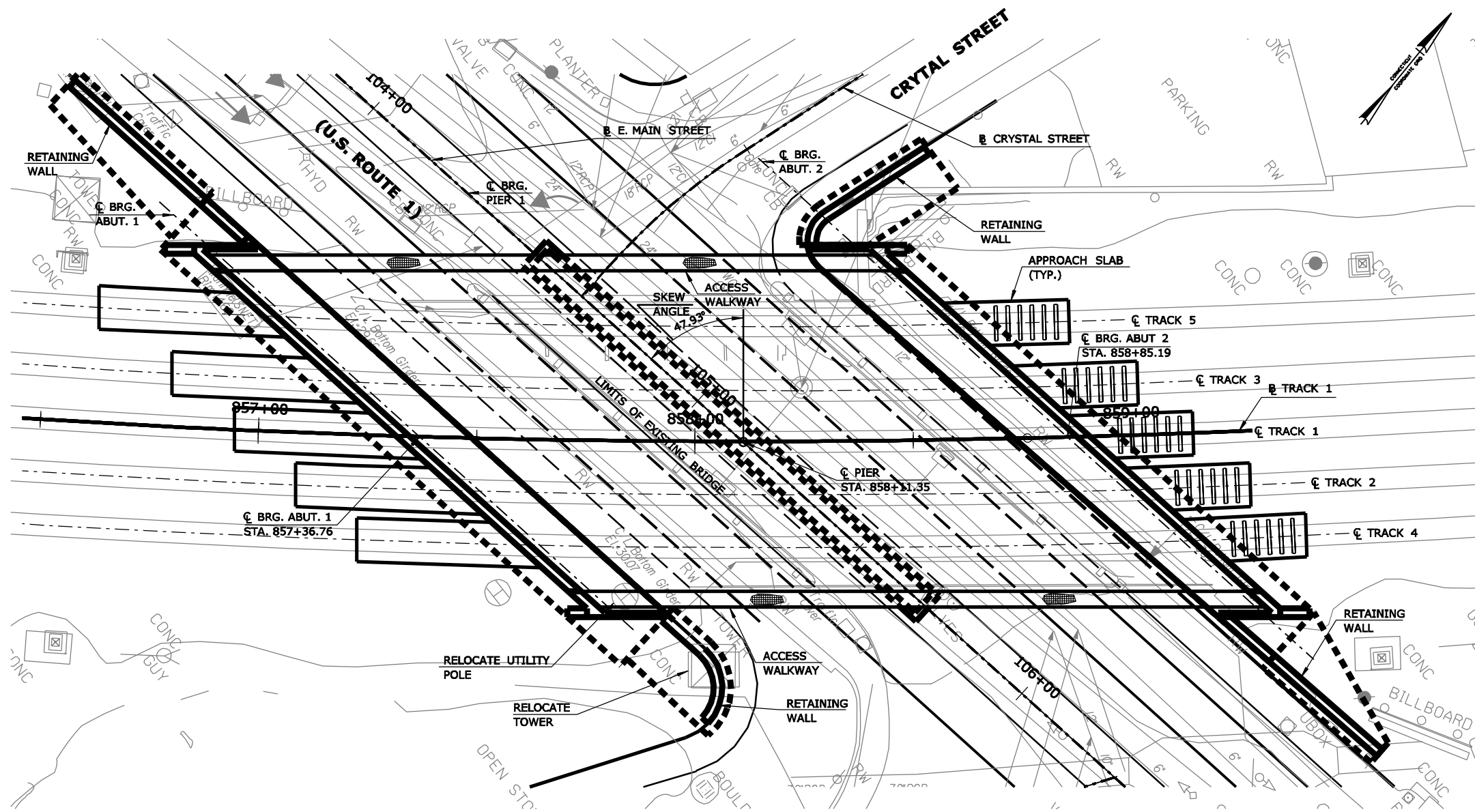
STAGE	TASK	TRACK	TRACK OUTAGE
5	1) INSTALL BRIDGE PLATES AT NORTON HEIGHTS, DARIEN, AND ROWAYTON	4	OFF PEAK WEEKEND NIGHT OUTAGE
	2) REMOVE TRACK 4 AT EAST MAIN ST.	4	CONTINUOUS TRACK OUTAGE
	3) REMOVE EXISTING STEEL SUPERSTRUCTURE		
	4) INSTALL NEW ABUTMENTS		
	5) INSTALL NEW CENTER PIER		
	6) CUT BACK TOPS OF EXISTING ABUTMENTS		
	7) INSTALL NEW SUPERSTRUCTURE		
	8) INSTALL NEW TRACK 4 AT EAST MAIN ST.		
	9) REMOVE ALL BRIDGE PLATES	4	OFF PEAK WEEKEND NIGHT OUTAGE

**SOUTH STAMFORD ACCESSIBILITY
& MNRR BRIDGE REPLACEMENT
FEASIBILITY STUDY**

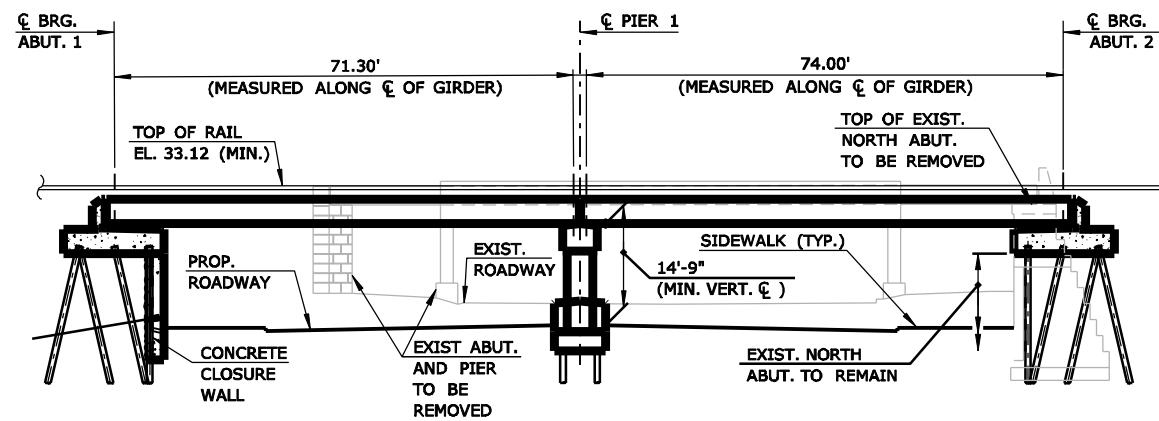
**EAST MAIN STREET
CONSTRUCTION STAGING**

STAGE 5

URS	SCALE: N.T.S.	FIGURE 3.1g
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PROPOSED PLAN
SCALE: 1" = 30'



ELEVATION
SCALE: 1" = 30'

**SOUTH STAMFORD ACCESSIBILITY
& MNRR BRIDGE REPLACEMENT
FEASIBILITY STUDY**

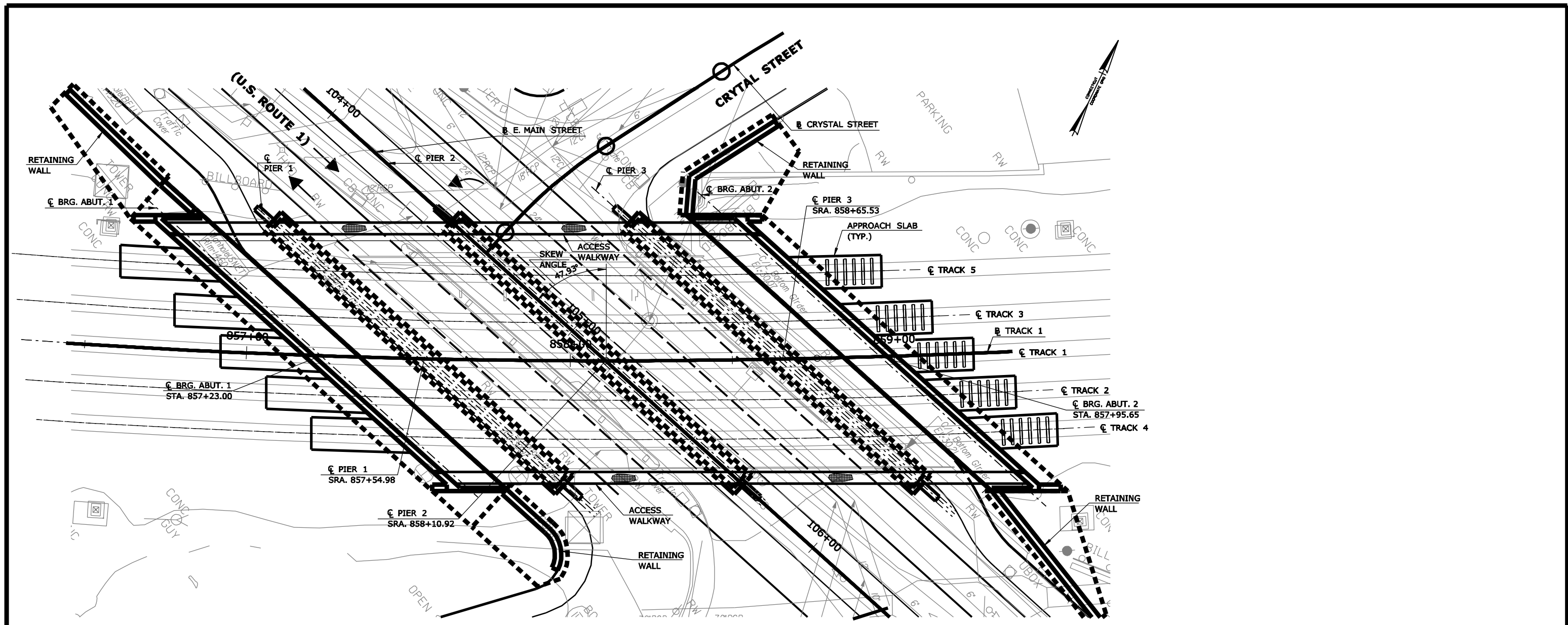
**EAST MAIN STREET
GENERAL PLAN AND ELEVATION
(2-SPAN ALTERNATIVE)**

URS

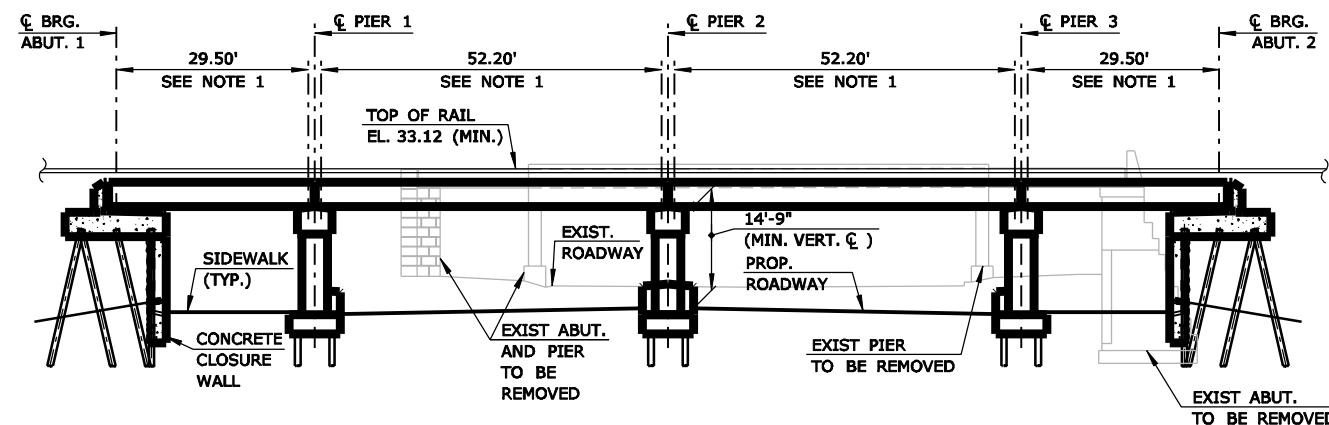
SCALE AS NOTED

FIGURE 4.1A

URS



PROPOSED PLAN
SCALE: 1" = 30'



ELEVATION
SCALE: 1" = 30'

NOTE:
(MEASURED ALONG ϕ OF GIRDER)

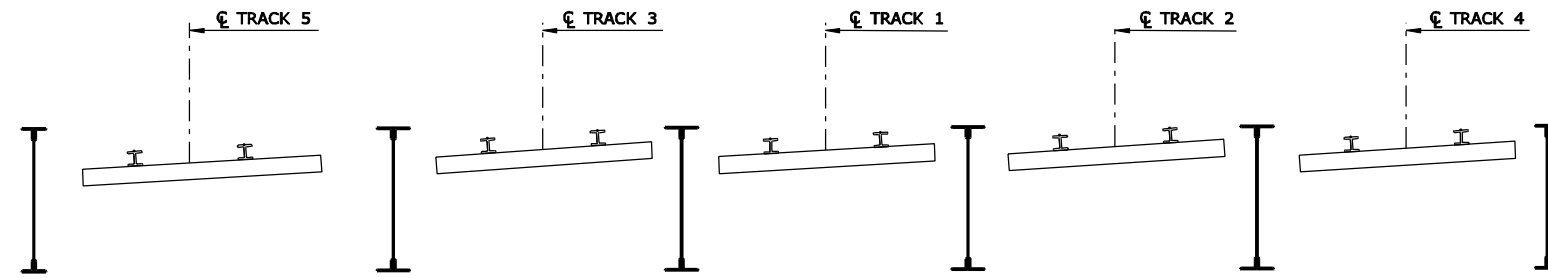
**SOUTH STAMFORD ACCESSIBILITY
& MNRR BRIDGE REPLACEMENT
FEASIBILITY STUDY**

**EAST MAIN STREET
GENERAL PLAN AND ELEVATION
(4-SPAN ALTERNATIVE)**

URS

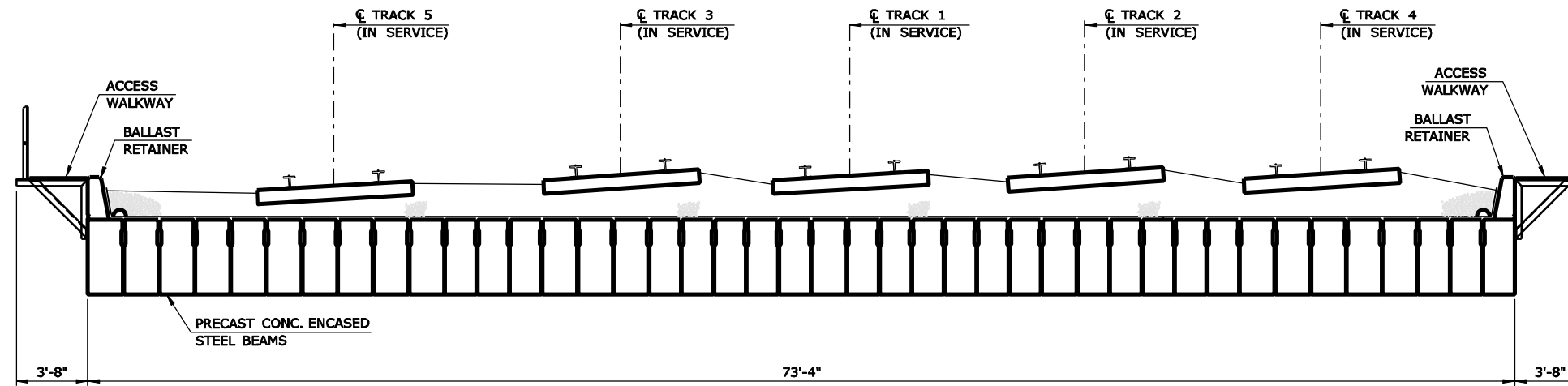
SCALE AS NOTED

FIGURE 4.1B



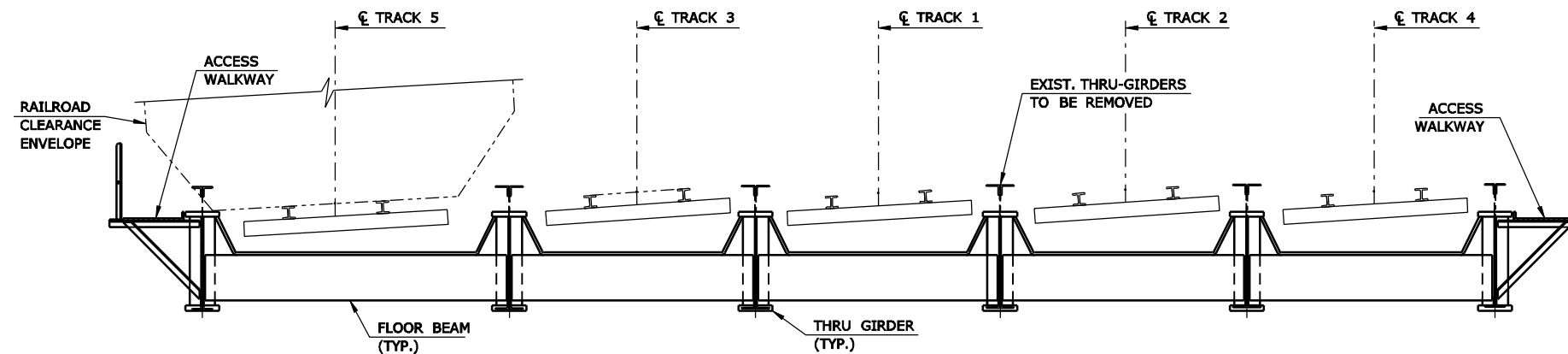
EXISTING SECTION - EAST MAIN STREET

SCALE: 1/8" = 1'-0"



PRECAST MULTIPLE CONCRETE ENCASED STEEL GIRDERS

SCALE: 1/8" = 1'-0"



THRU-GIRDERS

SCALE: 1/8" = 1'-0"

SOUTH STAMFORD ACCESSIBILITY
& MNRR BRIDGE REPLACEMENT
FEASIBILITY STUDY

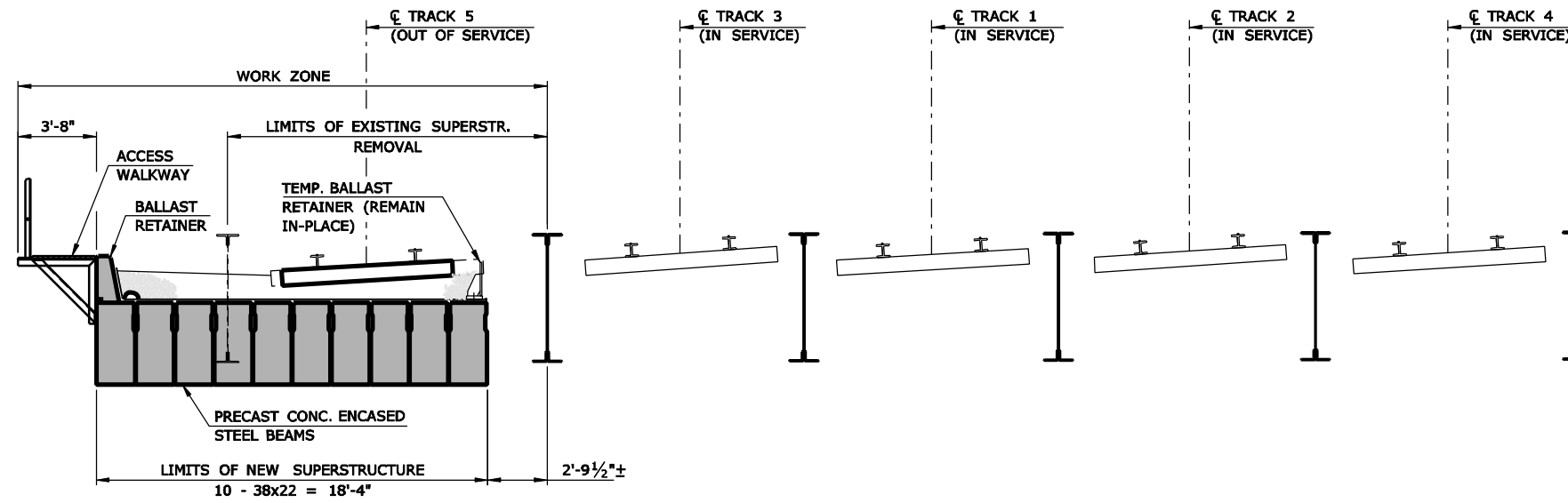
EAST MAIN STREET
BRIDGE TYPICAL SECTIONS

URS

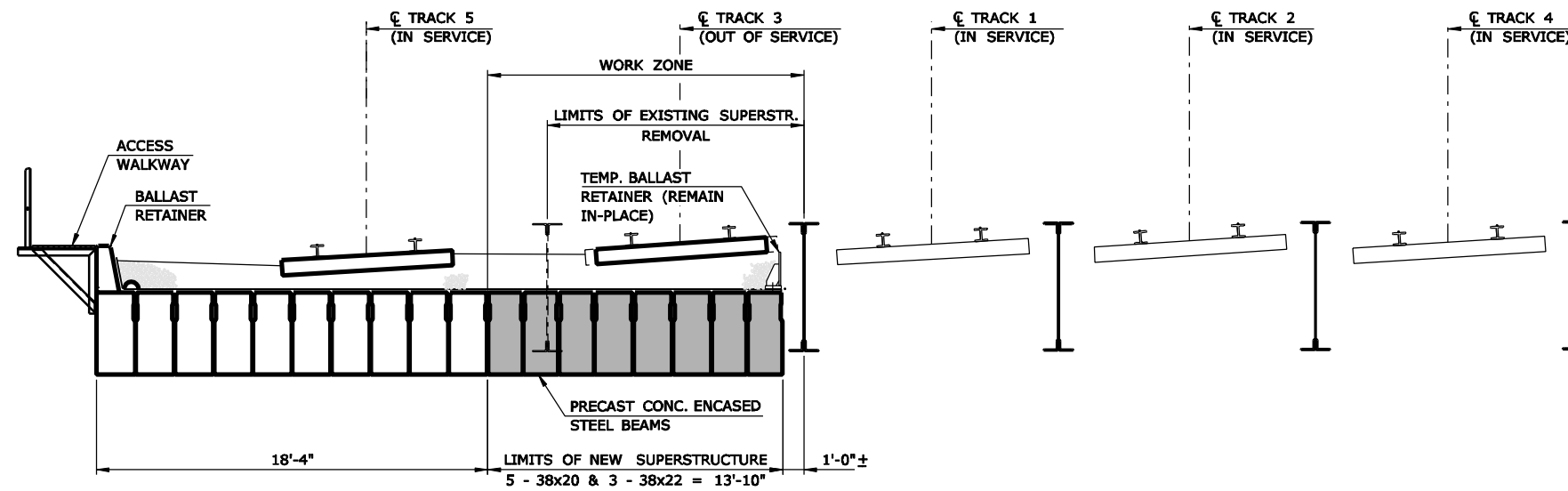
SCALE AS NOTED

FIGURE 4.2

07/15/15



STAGE 1



STAGE 2

STAGE CONSTRUCTION - PRECAST MULTIPLE CONCRETE ENCASED STEEL GIRDERS

SCALE: 1/8" = 1'-0"

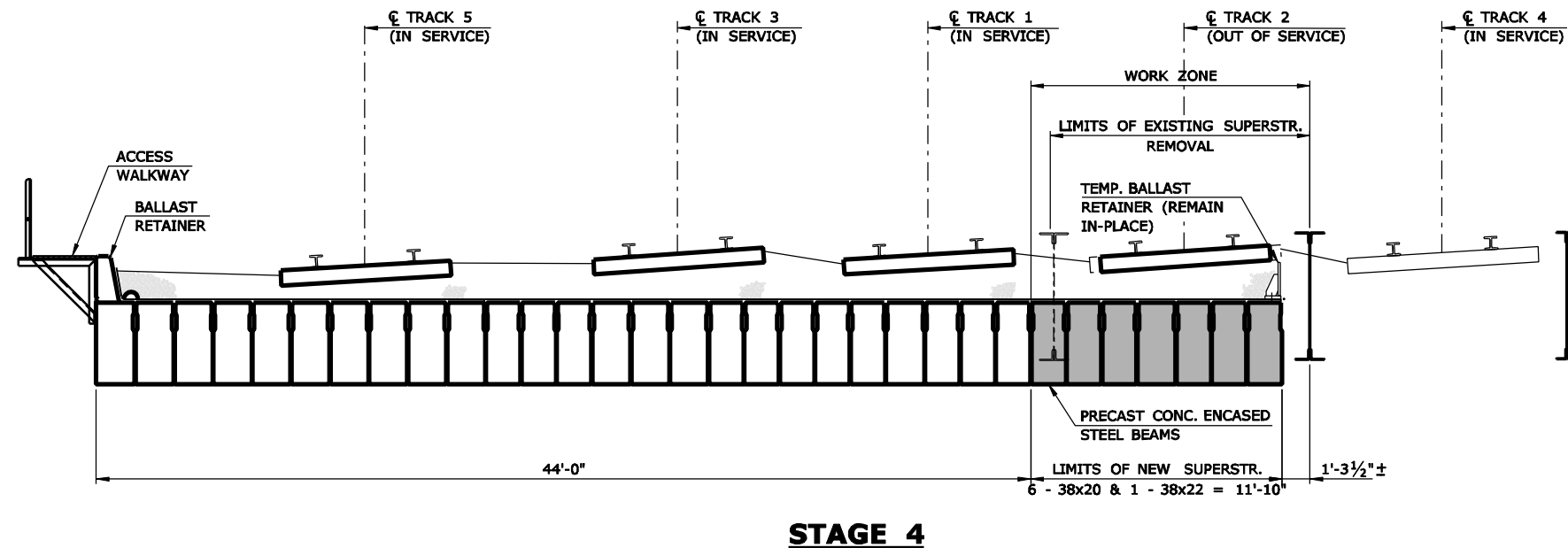
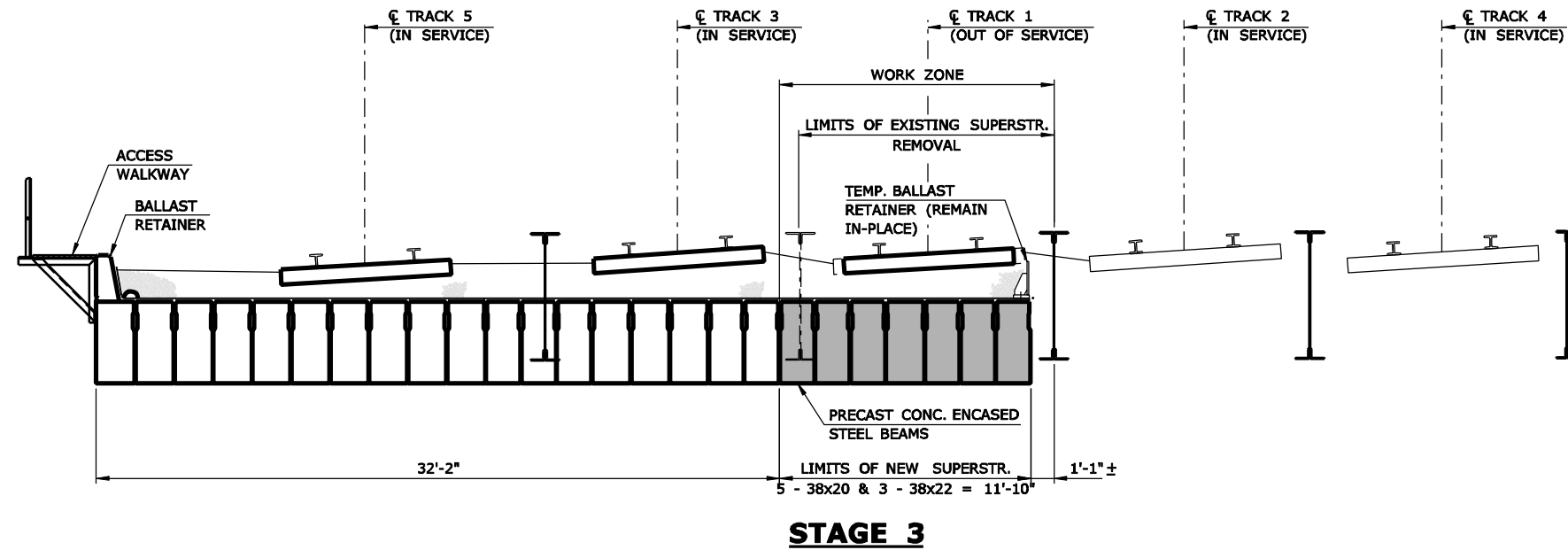
SOUTH STAMFORD ACCESSIBILITY
& MNRR BRIDGE REPLACEMENT
FEASIBILITY STUDY

EAST MAIN STREET
CONSTRUCTION STAGE 1 & 2

URS

SCALE AS NOTED

FIGURE 4.3A



STAGE CONSTRUCTION - PRECAST MULTIPLE CONCRETE ENCASED STEEL GIRDERS

SCALE: 1/8" = 1'-0"

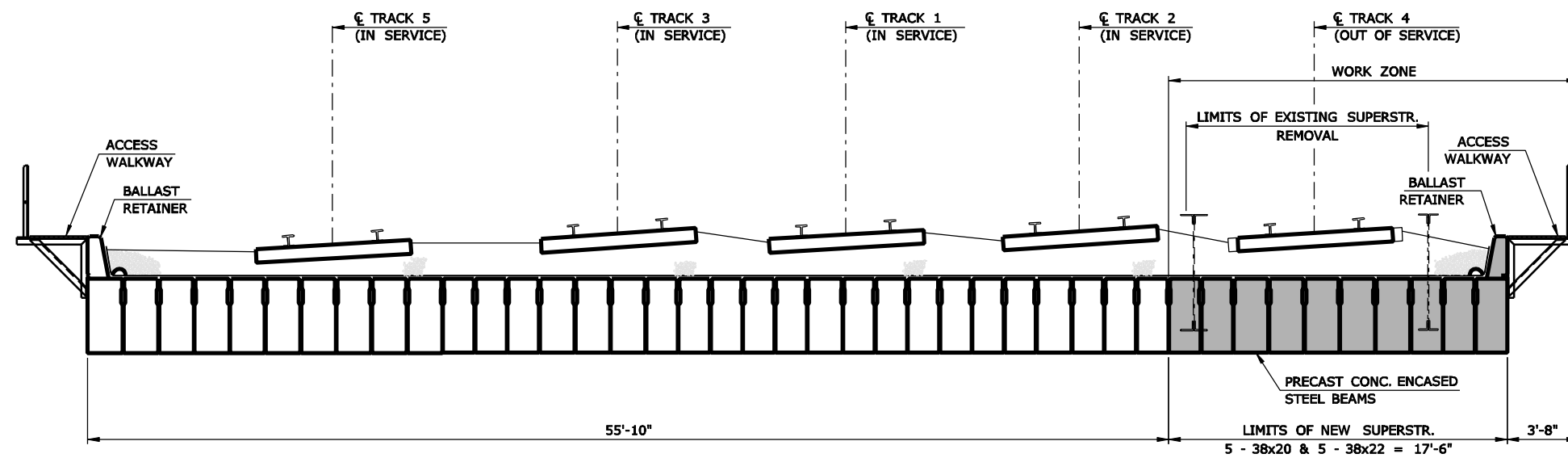
SOUTH STAMFORD ACCESSIBILITY
& MNRR BRIDGE REPLACEMENT
FEASIBILITY STUDY

EAST MAIN STREET
CONSTRUCTION STAGE 3 & 4

URS

SCALE AS NOTED

FIGURE 4.3B



STAGE 5

STAGE CONSTRUCTION - PRECAST MULTIPLE CONCRETE ENCASED STEEL GIRDERS

SCALE: 1/8" = 1'-0"

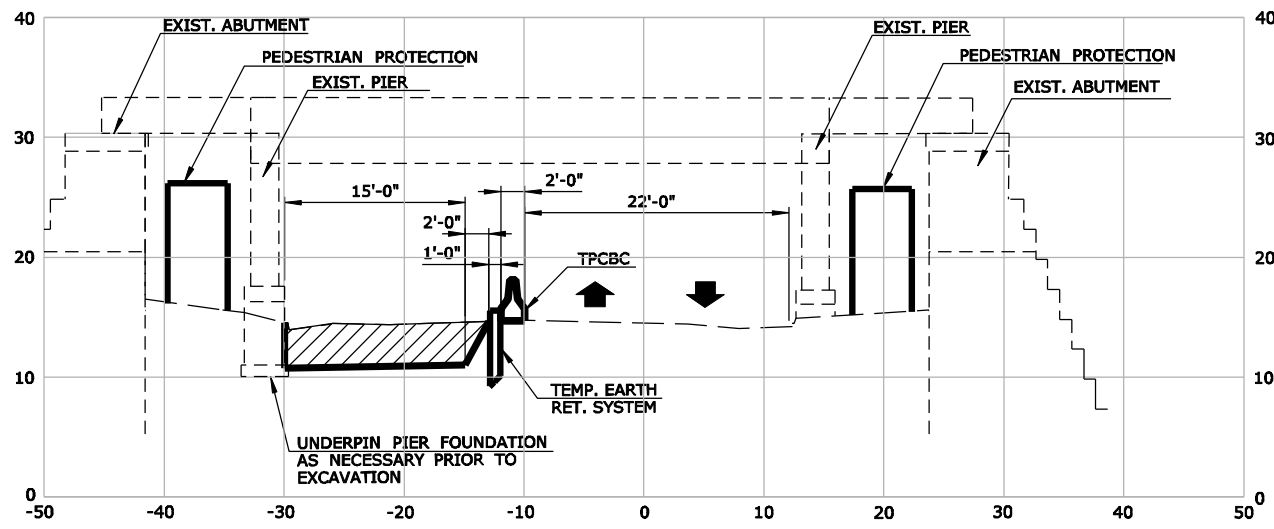
SOUTH STAMFORD ACCESSIBILITY
& MNRR BRIDGE REPLACEMENT
FEASIBILITY STUDY

EAST MAIN STREET
CONSTRUCTION STAGE 5

URS

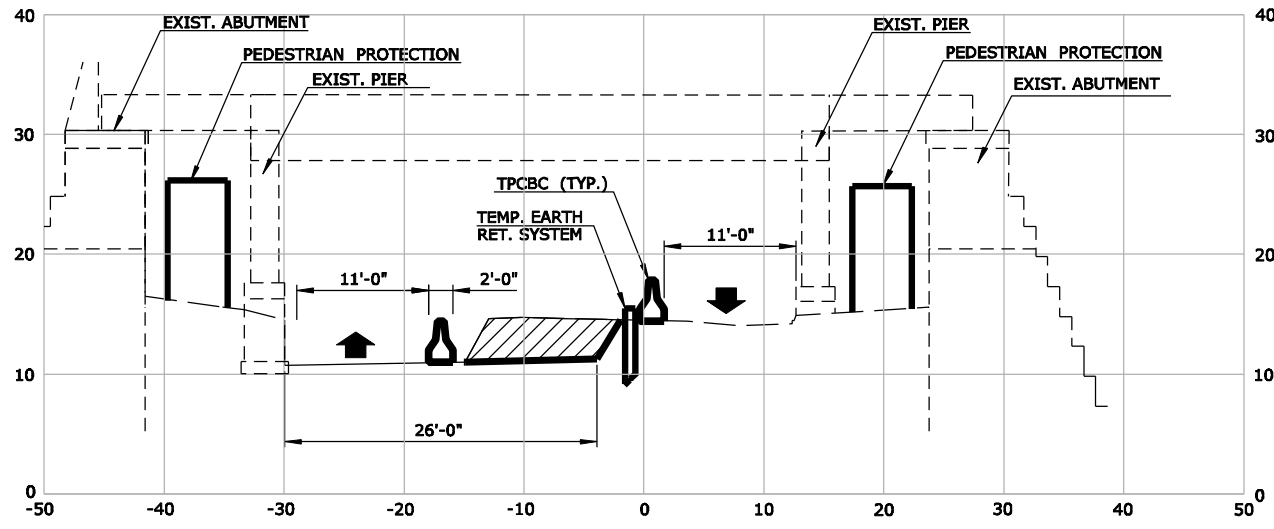
SCALE AS NOTED

FIGURE 4.3C



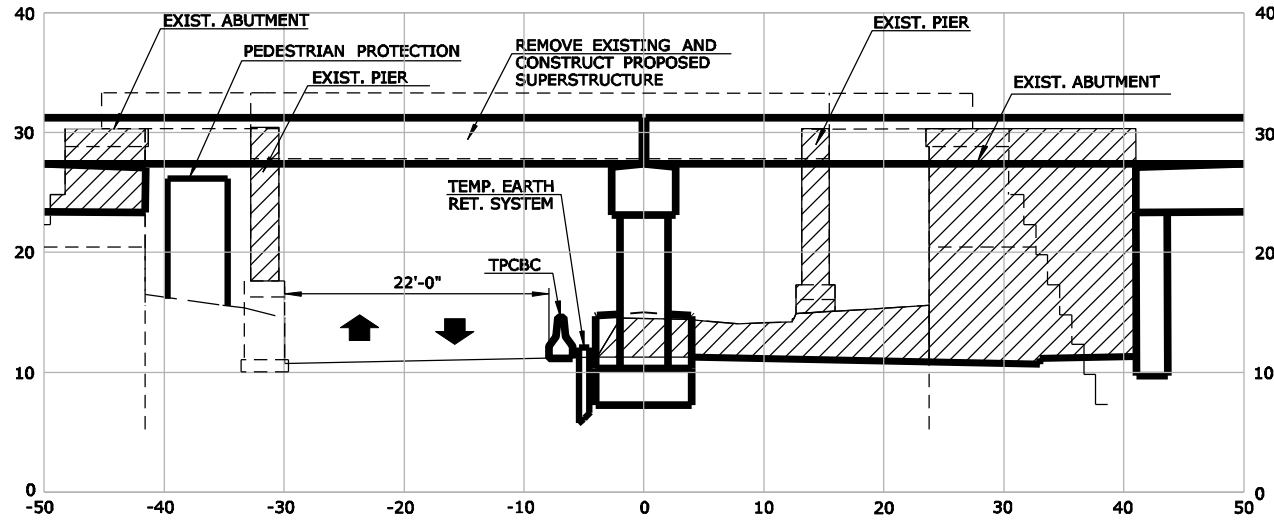
PHASE 1

NOTE: 4-SPAN ALTERNATIVE SIMILAR.

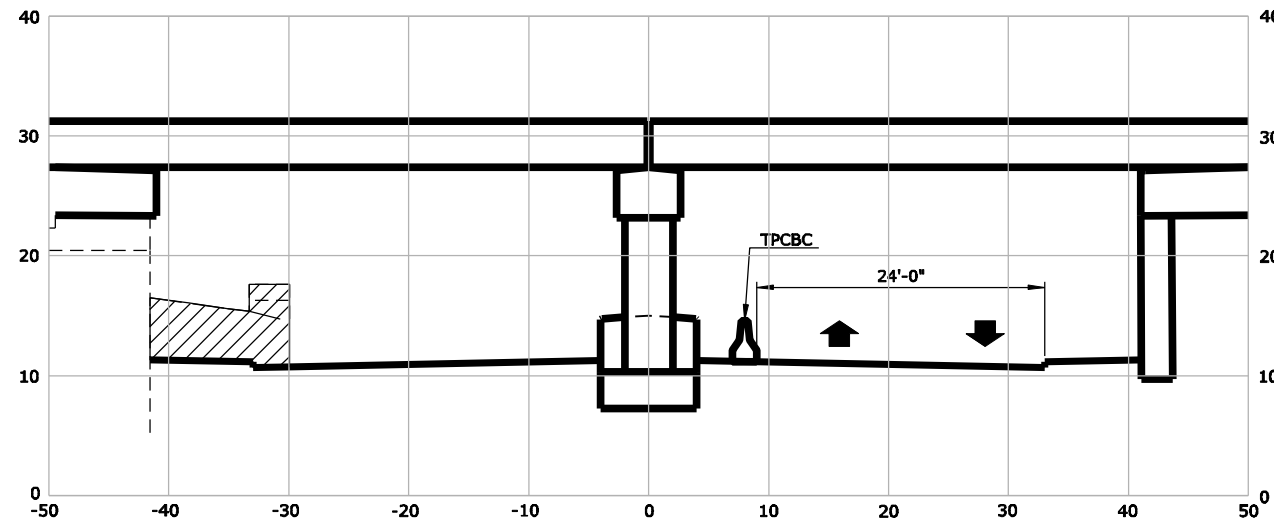


PHASE 2

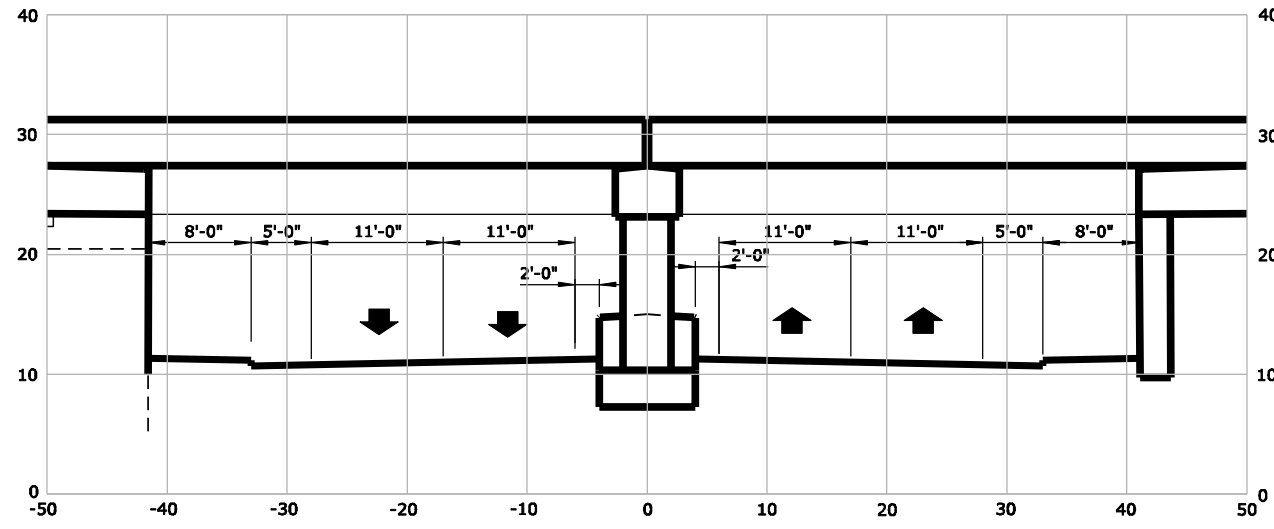
NOTE: 4-SPAN ALTERNATIVE SIMILAR.



PHASE 3



PHASE 4



FINAL

SOUTH STAMFORD ACCESSIBILITY & MNRR BRIDGE REPLACEMENT FEASIBILITY STUDY

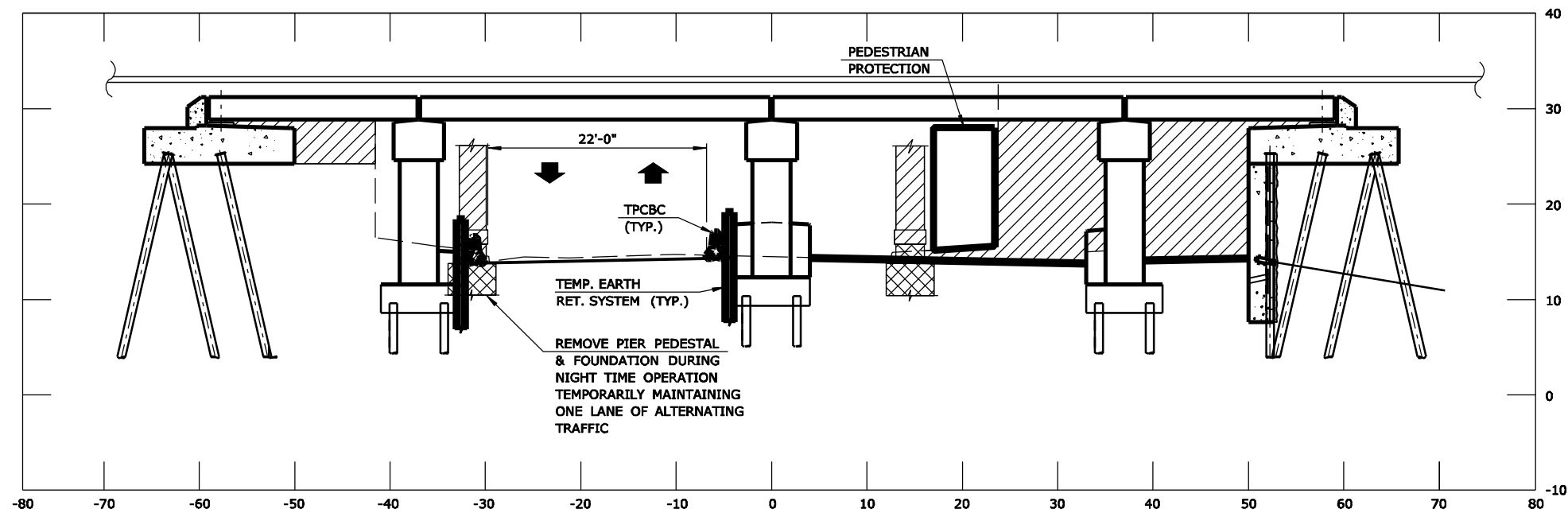
EAST MAIN STREET PHASED CONSTRUCTION SEQUENCE (2-SPAN ALTERNATIVE)

URS

SCALE: 1/16" = 1'-0"

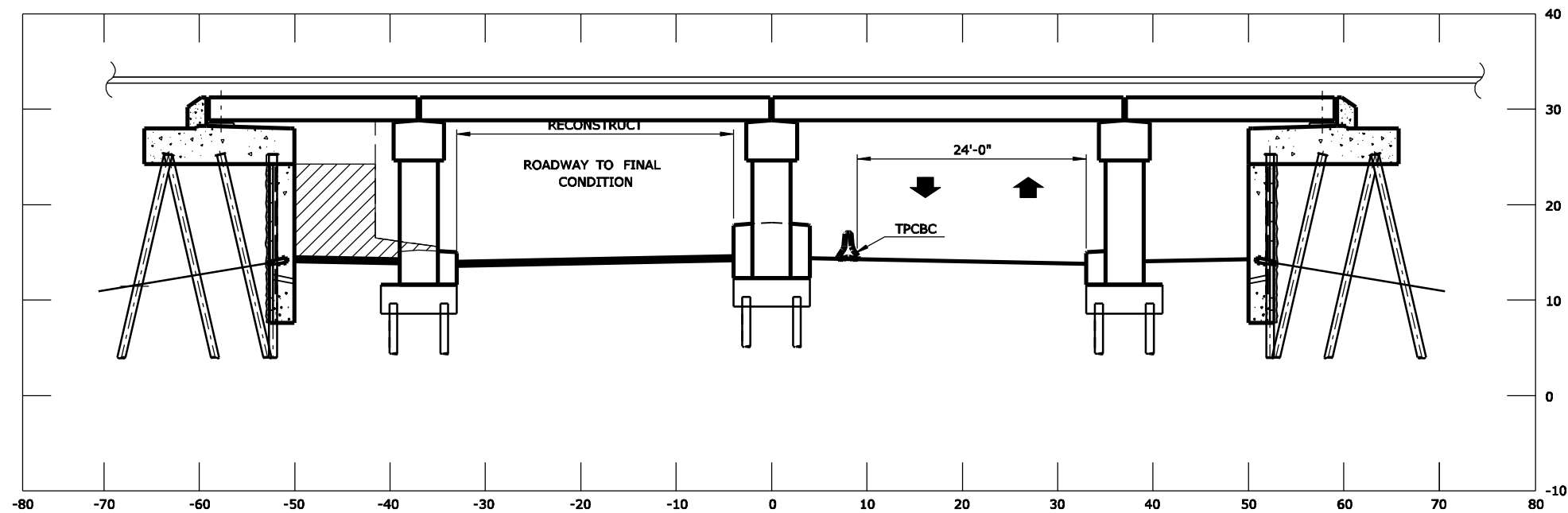
FIGURE 4.4A

FILE: \$
DATE: \$



PHASE 3
SCALE: 1/16" = 1'-0"

NOTE:
FOR CONSTRUCTION PHASES 1 & 2, SEE TWO-SPAN ALT.
CONSTRUCTION STAGES (SIM.)



PHASE 4
SCALE: 1/16" = 1'-0"

NOTE:
FOR CONSTRUCTION PHASES 1 & 2, SEE TWO-SPAN ALT.
CONSTRUCTION STAGES (SIM.)

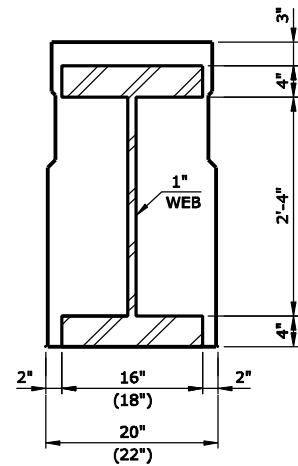
SOUTH STAMFORD ACCESSIBILITY
& MNRR BRIDGE REPLACEMENT
FEASIBILITY STUDY

EAST MAIN STREET
PHASED CONSTRUCTION SEQUENCE
(4-SPAN ALTERNATIVE)

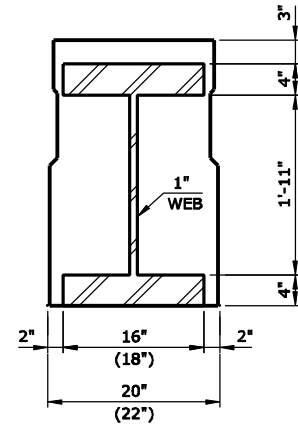
URS

SCALE AS NOTED

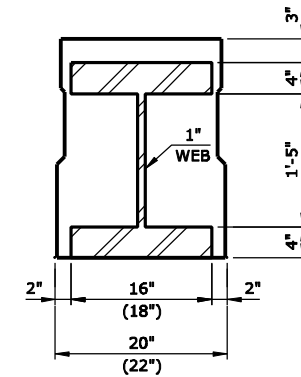
FIGURE 4.4B



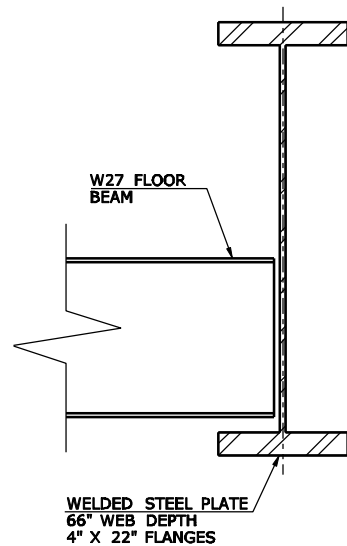
CONCRETE-ENCASED BEAM



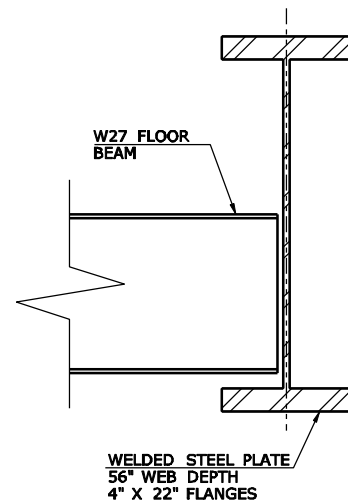
CONCRETE-ENCASED BEAM



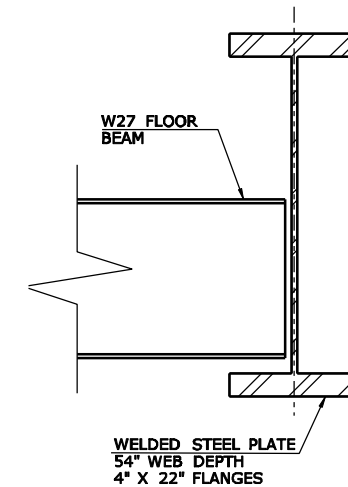
CONCRETE-ENCASED BEAM



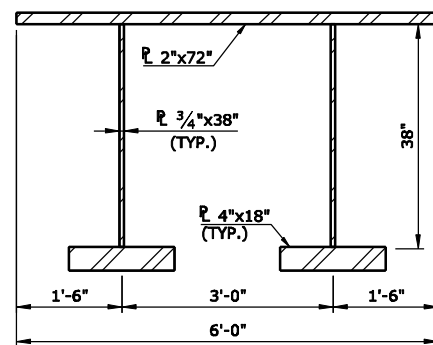
MULTI-STEEL GIRDER



MULTI-STEEL GIRDER



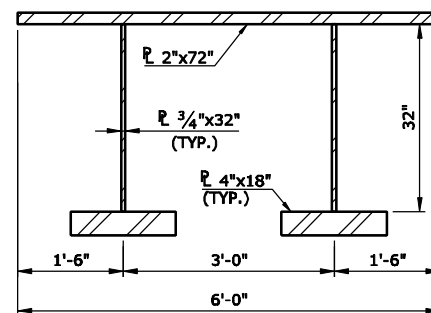
MULTI-STEEL GIRDER



THRU-GIRDER

**TWO-SPAN ALTERNATIVE
TOP-DOWN CONSTRUCTION**

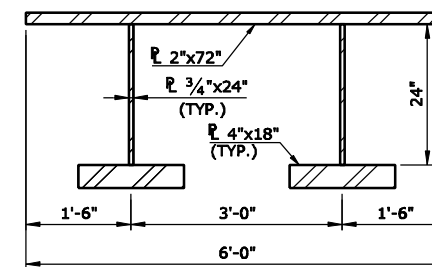
N.T.S.



THRU-GIRDER

**TWO-SPAN ALTERNATIVE
CONVENTIONAL ABUTMENT**

N.T.S.



THRU-GIRDER

**FOUR-SPAN ALTERNATIVE
TOP-DOWN CONSTRUCTION**

N.T.S.

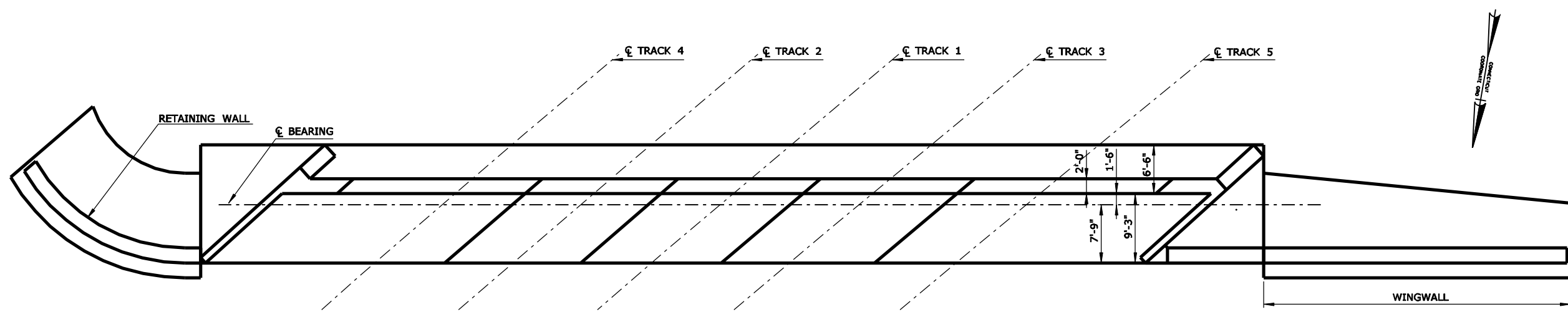
**SOUTH STAMFORD ACCESSIBILITY
& MNRR BRIDGE REPLACEMENT
FEASIBILITY STUDY**

**EAST MAIN STREET
GIRDER DETAILS**

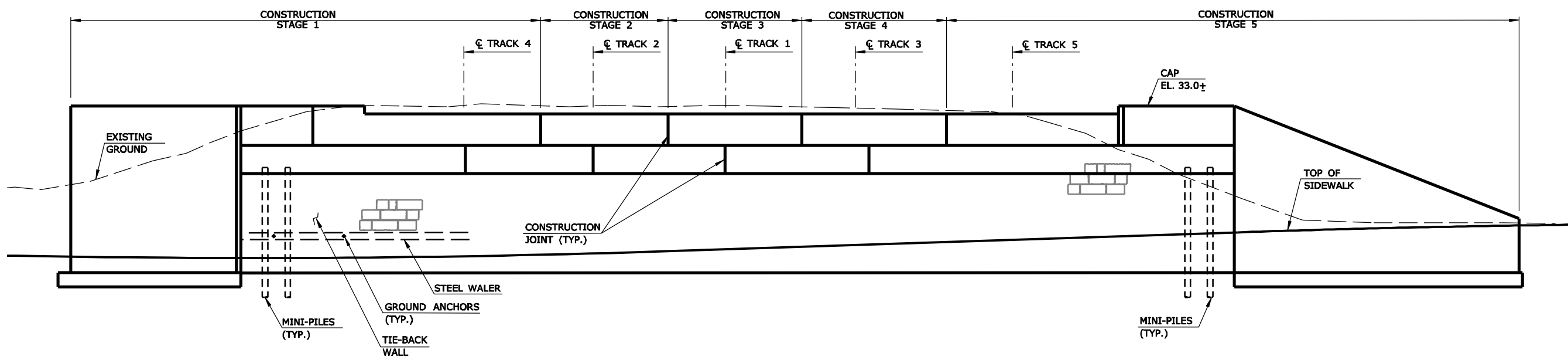
URS

SCALE AS NOTED

FIGURE 4.5



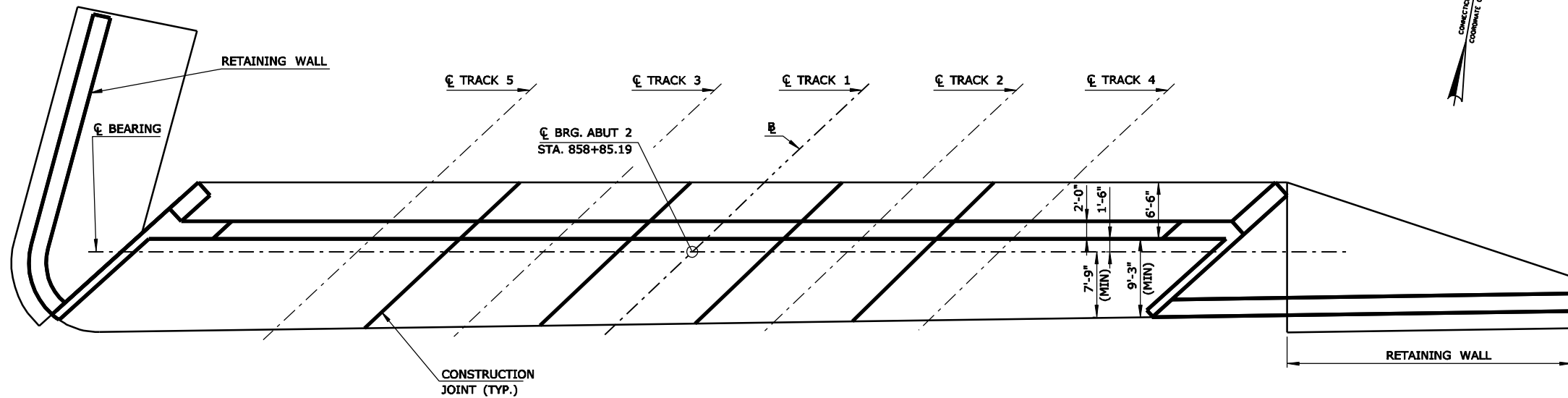
ABUTMENT 1 PLAN
SCALE: 1/16" = 1'-0"



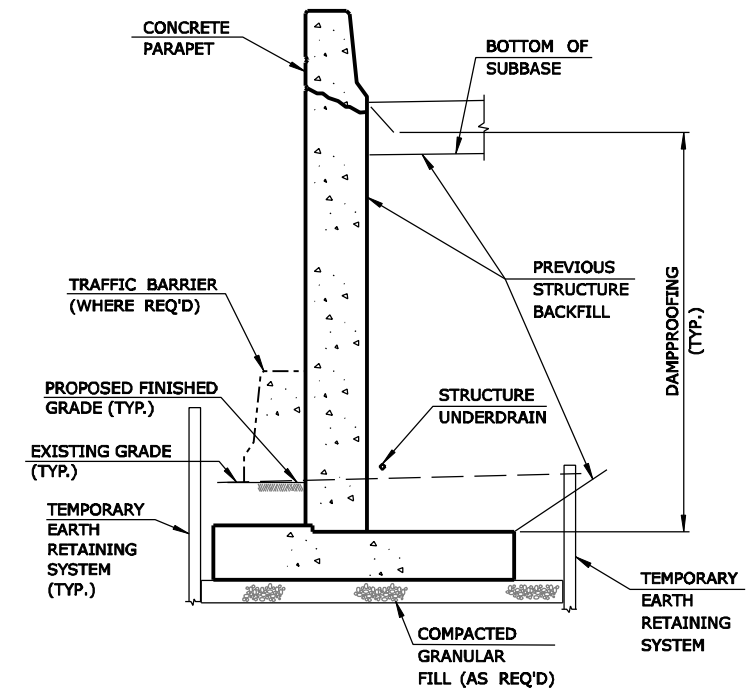
ABUTMENT 1 ELEVATION
SCALE: 1/16" = 1'-0"

SOUTH STAMFORD ACCESSIBILITY & MNRR BRIDGE REPLACEMENT FEASIBILITY STUDY		
EAST MAIN STREET ABUTMENT 1 (2-SPAN ALT.; 4-SPAN SIMILAR)		
URS	SCALE AS NOTED	FIGURE 4.6A

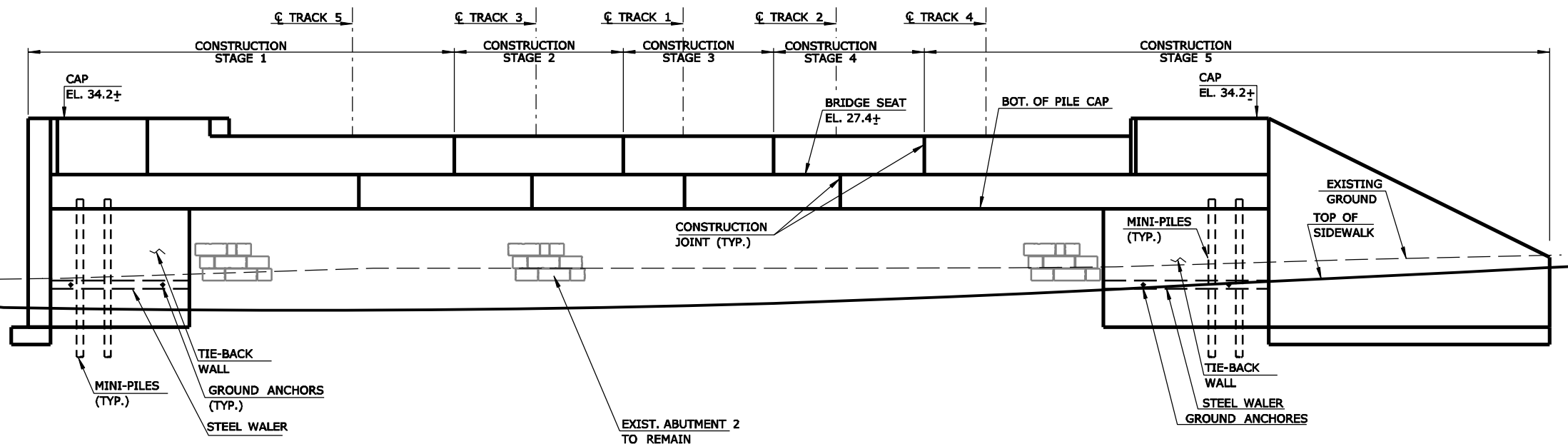
FILES
DATES



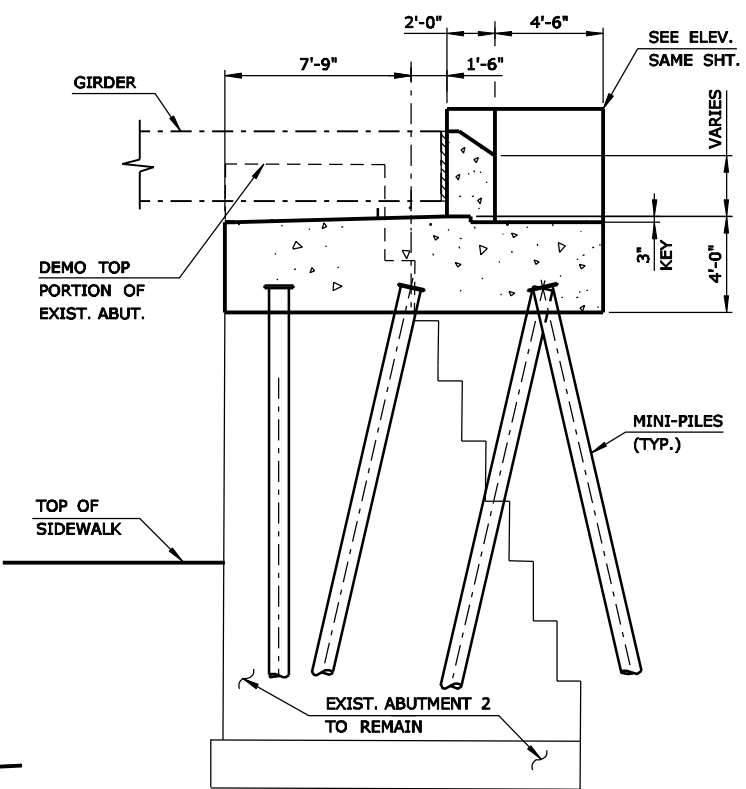
ABUTMENT 2 PLAN
SCALE: 1/16" = 1'-0"



WINGWALL SECTION
SCALE: 1/8" = 1'-0"



ABUTMENT 2 ELEVATION
SCALE: 1/16" = 1'-0"



ABUTMENT SECTION
SCALE: 1/8" = 1'-0"

**SOUTH STAMFORD ACCESSIBILITY
& MNRR BRIDGE REPLACEMENT
FEASIBILITY STUDY**

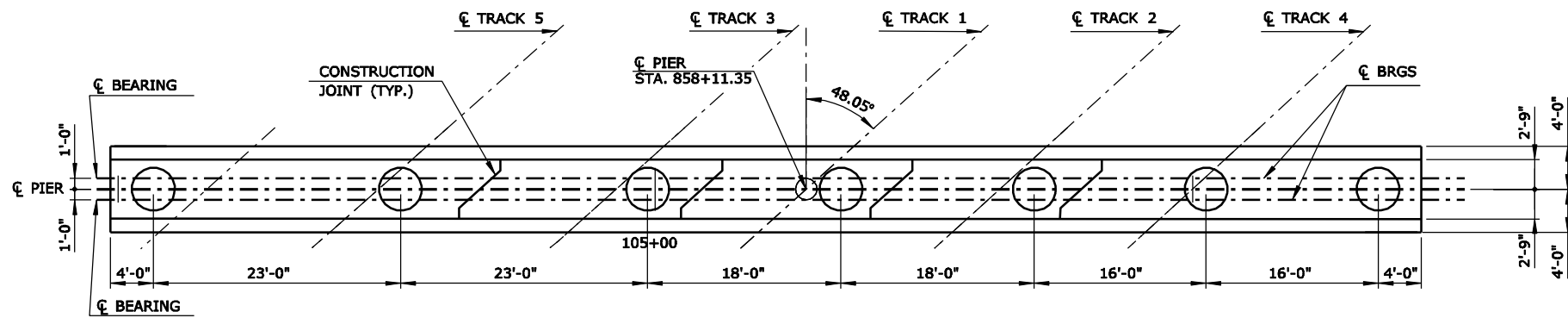
**EAST MAIN STREET
ABUTMENT 2
(2-SPAN ALTERNATIVE)**

URS

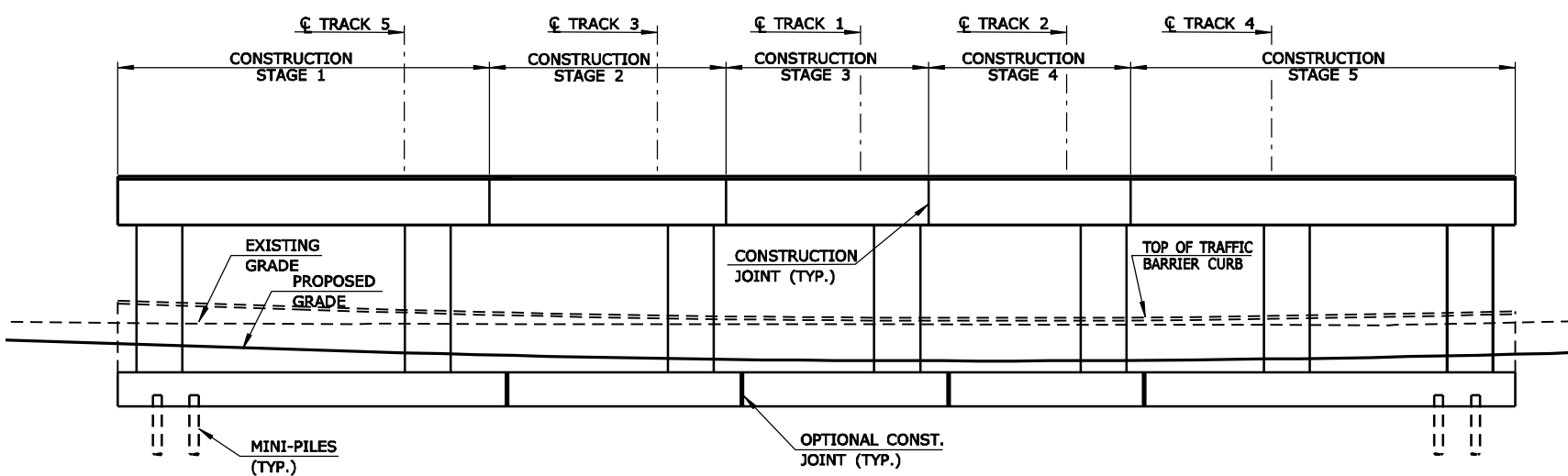
SCALE AS NOTED

FIGURE 4.6B

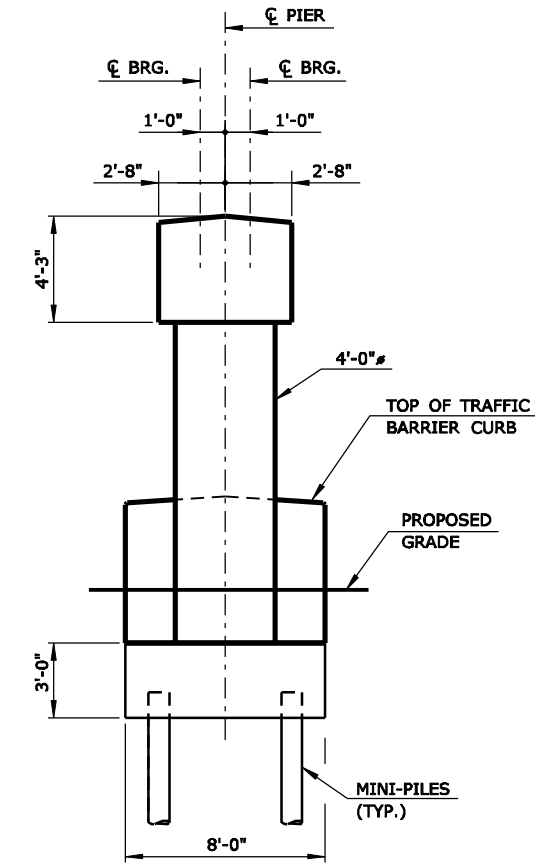
FILES
DATES



PIER PLAN
SCALE: 1/16" = 1'-0"



PIER ELEVATION
SCALE: 1/16" = 1'-0"



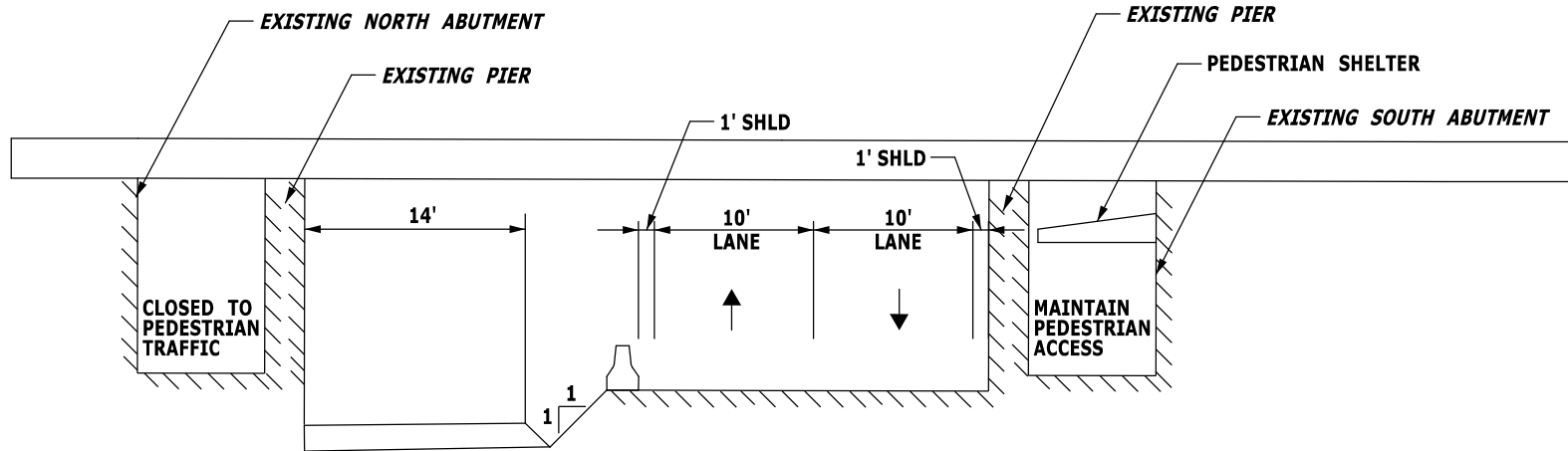
PIER SECTION
SCALE: 1/8" = 1'-0"

SOUTH STAMFORD ACCESSIBILITY & MNRR BRIDGE REPLACEMENT FEASIBILITY STUDY		
EAST MAIN STREET PIER PLAN		
URS	SCALE AS NOTED	FIGURE 4.7

\$FILES\$
\$DATES\$

MAINTENANCE AND PROTECTION OF TRAFFIC

- MAINTAIN ONE LANE OF TRAFFIC IN EACH DIRECTION.
- MAINTAIN PEDESTRIAN ACCESS ON SIDEWALK ALONG SOUTH ABUTMENT AND CLOSE SIDEWALK ALONG NORTH ABUTMENT TO PEDESTRIAN TRAFFIC.



EAST MAIN STREET LOOKING EAST (NORTHBOUND)

CONSTRUCTION STAGING

1. INSTALL PEDESTRIAN SHELTER.
2. RELOCATE UTILITIES AS REQUIRED.
3. REMOVE EXISTING PAVEMENT AND LOWER ROADWAY.

SOUTH STAMFORD ACCESSIBILITY
& MNRR BRIDGE REPLACEMENT
FEASIBILITY STUDY

EAST MAIN STREET
ROADWAY MPT - STAGE 1A

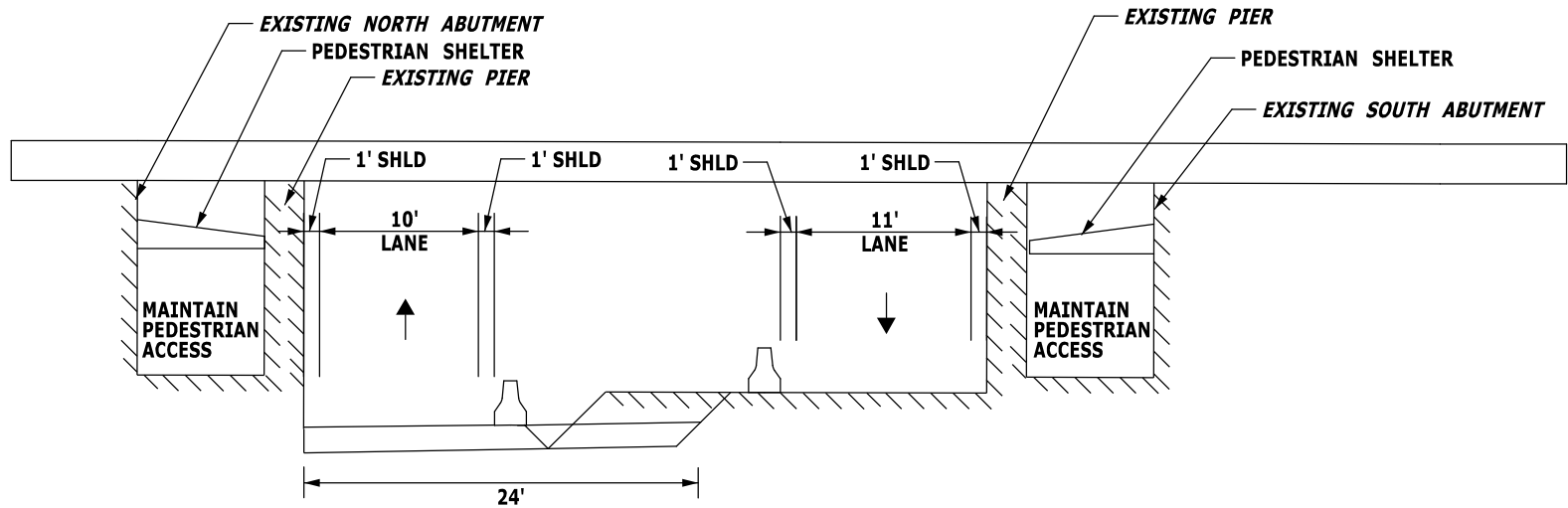
URS

SCALE: 1"=12'

FIGURE 6.1a

MAINTENANCE AND PROTECTION OF TRAFFIC

- MAINTAIN ONE LANE OF TRAFFIC IN EACH DIRECTION.
- MAINTAIN PEDESTRIAN ACCESS ON SIDEWALK ALONG NORTH AND SOUTH ABUTMENTS.



**EAST MAIN STREET
LOOKING EAST (NORTHBOUND)**

CONSTRUCTION STAGING

1. INSTALL PEDESTRIAN SHELTER.
2. RELOCATE UTILITIES AS REQUIRED.

SOUTH STAMFORD ACCESSIBILITY
& MNRR BRIDGE REPLACEMENT
FEASIBILITY STUDY

EAST MAIN STREET
ROADWAY MPT - STAGE 1B

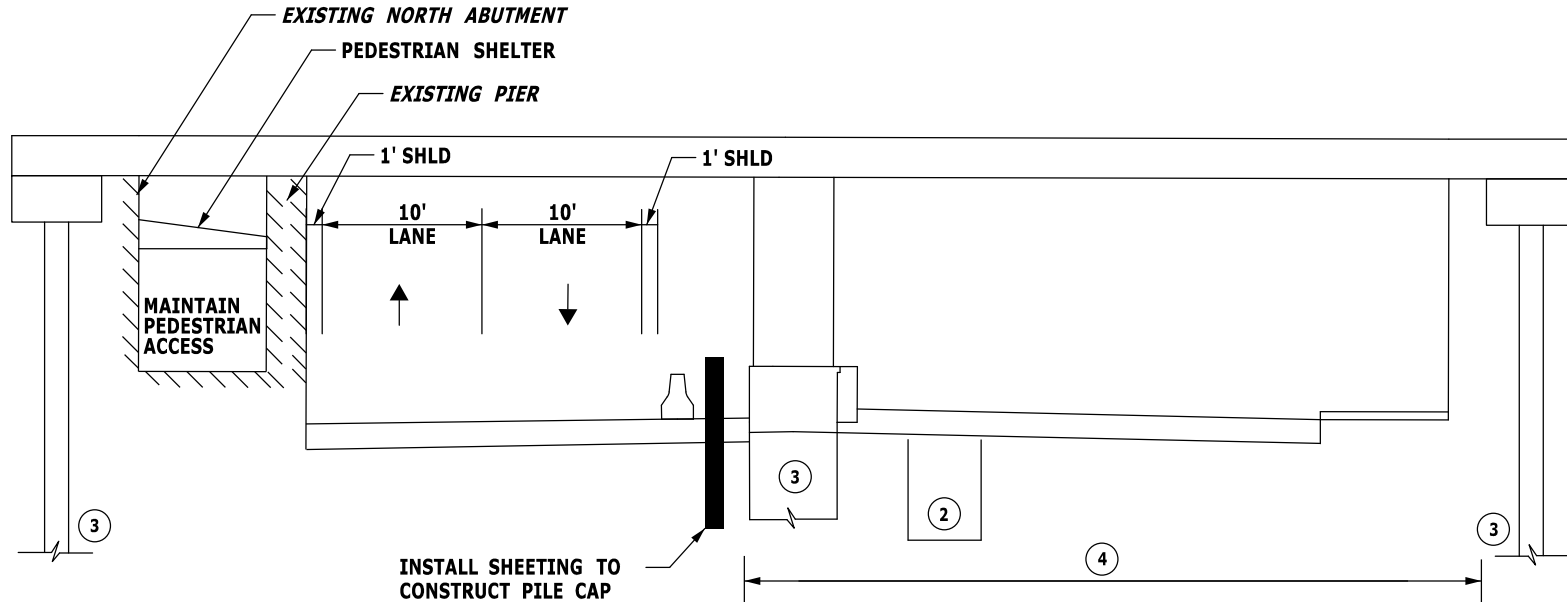
URS

SCALE: 1"=12'

FIGURE 6.1b

MAINTENANCE AND PROTECTION OF TRAFFIC

- MAINTAIN ONE LANE OF TRAFFIC IN EACH DIRECTION DURING CONSTRUCTION OF ABUTMENTS AND PIERS.
- MAINTAIN PEDESTRIAN ACCESS ON SIDEWALK ALONG NORTH ABUTMENT AND CLOSE SIDEWALK ALONG SOUTH ABUTMENT TO PEDESTRIAN TRAFFIC.
- CLOSE ROADWAY TO TRAFFIC TO INSTALL GIRDERS DURING WEEKEND PERIODS.



EAST MAIN STREET LOOKING EAST (NORTHBOUND)

CONSTRUCTION STAGING

1. INSTALL PEDESTRIAN SHELTER.
2. RELOCATE UTILITIES AS REQUIRED.
3. CONSTRUCT ABUTMENTS AND PIERS.
4. DEMOLISH EXISTING SOUTH ABUTMENT AND RECONSTRUCT ROADWAY AND SIDEWALK BETWEEN NORTH ABUTMENT AND PIER.

SOUTH STAMFORD ACCESSIBILITY
& MNRR BRIDGE REPLACEMENT
FEASIBILITY STUDY

EAST MAIN STREET
ROADWAY MPT - STAGE 1C

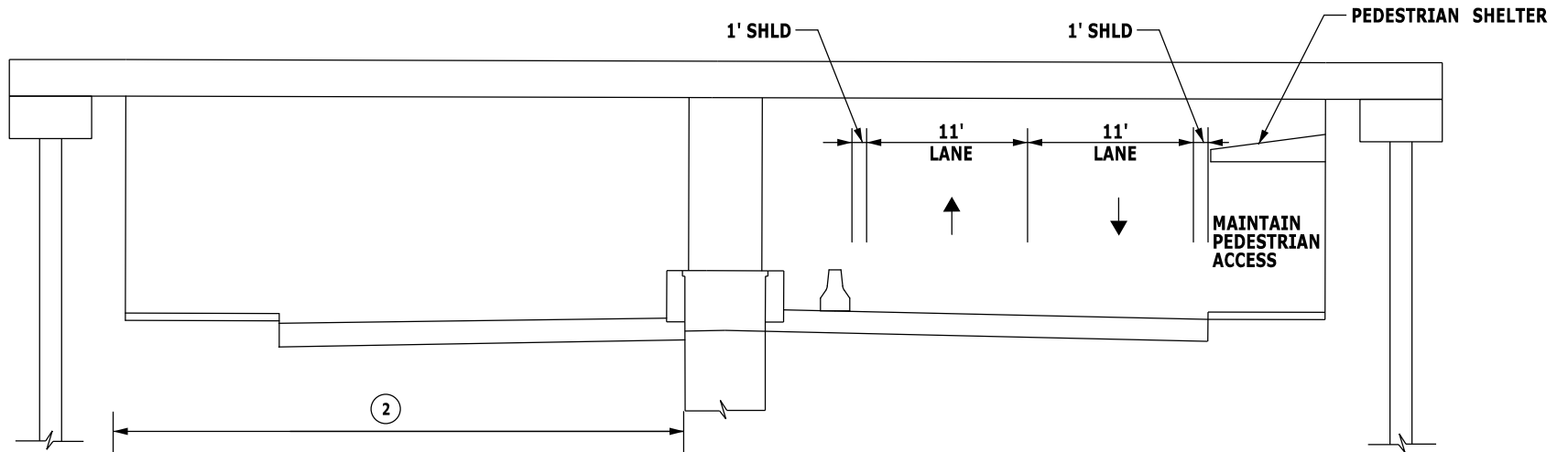
URS

SCALE: 1"=12'

FIGURE 6.1c

MAINTENANCE AND PROTECTION OF TRAFFIC

- MAINTAIN ONE LANE OF TRAFFIC IN EACH DIRECTION DURING CONSTRUCTION OF ABUTMENTS AND PIERS.
- MAINTAIN PEDESTRIAN ACCESS ON SIDEWALK ALONG SOUTH ABUTMENT AND CLOSE SIDEWALK ALONG NORTH ABUTMENT TO PEDESTRIAN TRAFFIC.
- CLOSE ROADWAY TO TRAFFIC TO INSTALL GIRDERS DURING WEEKEND PERIODS.



EAST MAIN STREET LOOKING EAST (NORTHBOUND)

CONSTRUCTION STAGING

1. INSTALL PEDESTRIAN SHELTER.
2. DEMOLISH EXISTING NORTH ABUTMENT AND RECONSTRUCT ROADWAY AND SIDEWALK BETWEEN NORTH ABUTMENT AND PIER.

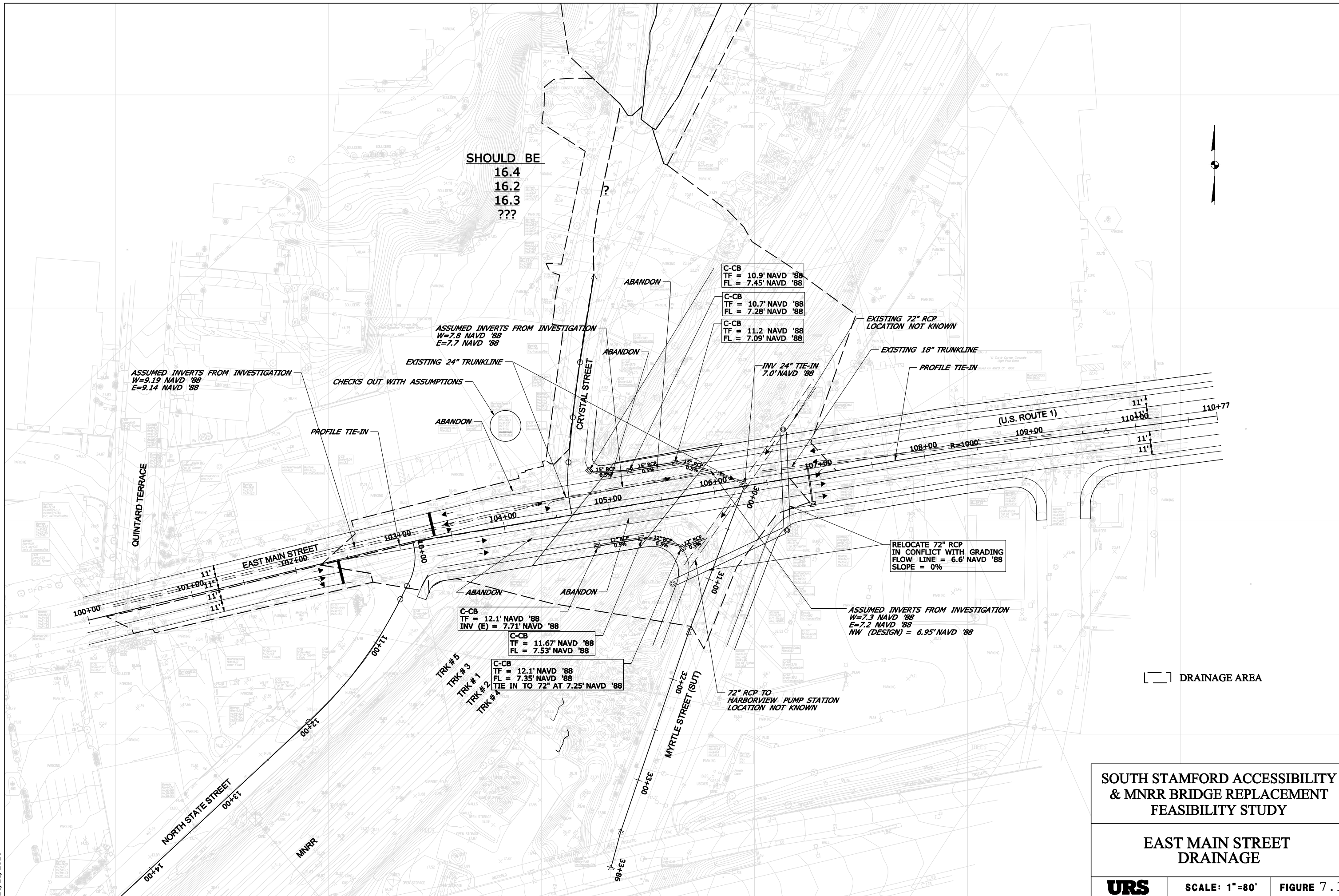
SOUTH STAMFORD ACCESSIBILITY
& MNRB BRIDGE REPLACEMENT
FEASIBILITY STUDY

EAST MAIN STREET
ROADWAY MPT - STAGE 2

URS

SCALE: 1"=12'

FIGURE 6.1d



SHOULD BE
16.4
16.2
16.3
???

C-CB
TF = 10.9' NAVD '88
FL = 7.45' NAVD '88

C-CB
TF = 10.7' NAVD '88
FL = 7.28' NAVD '88

C-CB
TF = 11.2' NAVD '88
FL = 7.09' NAVD '88

ASSUMED INVERTS FROM INVESTIGATION
W=9.19 NAVD '88
E=9.14 NAVD '88

ASSUMED INVERTS FROM INVESTIGATION
W=7.8 NAVD '88
E=7.7 NAVD '88

EXISTING 24" TRUNKLINE

CHECKS OUT WITH ASSUMPTIONS

EXISTING 72" RCP
LOCATION NOT KNOWN

EXISTING 18" TRUNKLINE

PROFILE TIE-IN

INV 24" TIE-IN
7.0' NAVD '88

RELOCATE 72" RCP
IN CONFLICT WITH GRADING
FLOW LINE = 6.6' NAVD '88
SLOPE = 0%

ASSUMED INVERTS FROM INVESTIGATION
W=7.3 NAVD '88
E=7.2 NAVD '88
NW (DESIGN) = 6.95' NAVD '88

C-CB
TF = 12.1' NAVD '88
INV (E) = 7.71' NAVD '88

C-CB
TF = 11.67' NAVD '88
FL = 7.53' NAVD '88

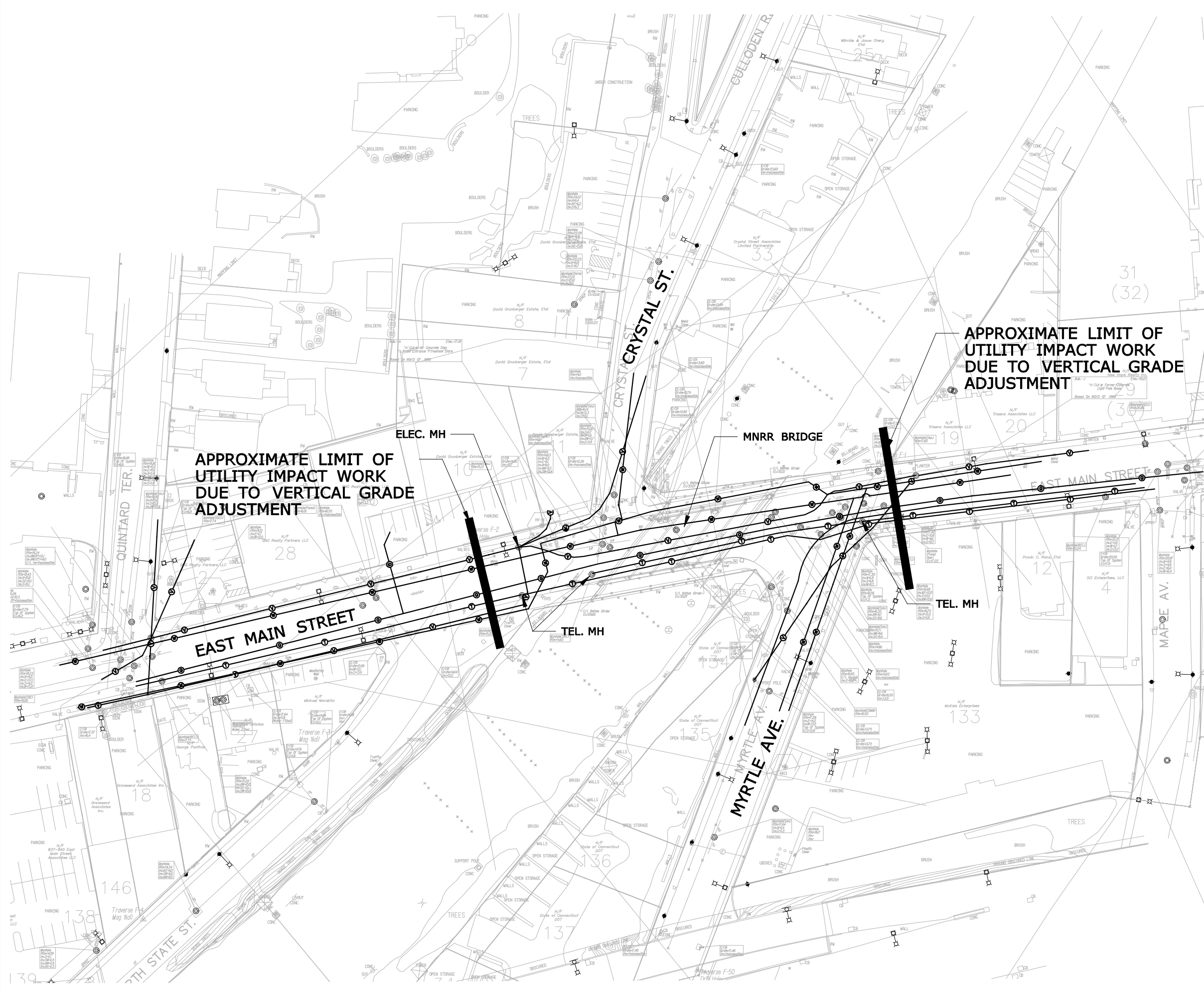
C-CB
TF = 12.1' NAVD '88
FL = 7.35' NAVD '88
TIE IN TO 72" AT 7.25' NAVD '88

72" RCP TO
HARBORVIEW PUMP STATION
LOCATION NOT KNOWN

☐ DRAINAGE AREA

SOUTH STAMFORD ACCESSIBILITY
& MNRR BRIDGE REPLACEMENT
FEASIBILITY STUDY

EAST MAIN STREET
DRAINAGE



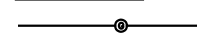
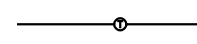
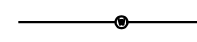
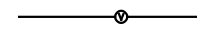
APPROXIMATE LIMIT OF UTILITY IMPACT WORK DUE TO VERTICAL GRADE ADJUSTMENT

APPROXIMATE LIMIT OF UTILITY IMPACT WORK DUE TO VERTICAL GRADE ADJUSTMENT

UTILITY IMPACT

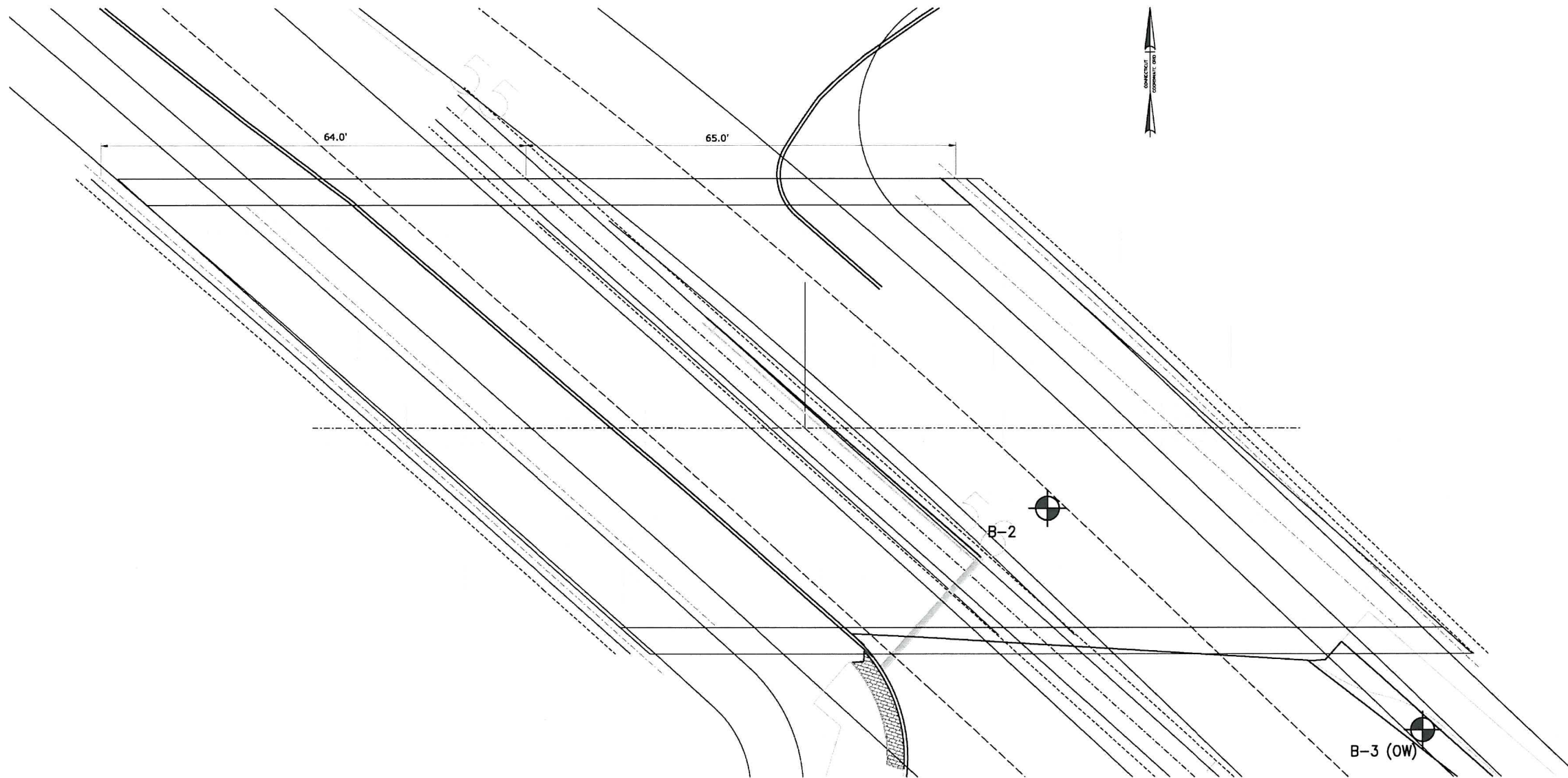
- ELECTRIC:
 - MH - 1
 - DUCT - 480'
- TELEPHONE:
 - MH - 2
 - DUCT - 610'
- GAS - 350'
- WATER - 620'
- UTILITY POLES - 0
- LIGHT POLES - 0
- CITY ITS - UNDERGROUND AT&T DUCT

LEGEND

-  GAS LINE
-  TELEPHONE LINE
-  WATER MAIN
-  ELECTRIC UTILITY LINE

METRO NORTH RAILROAD BRIDGE REPLACEMENT FEASIBILITY STUDY		
EAST MAIN STREET UTILITY PLAN		
GM2 Associates	SCALE: 1"=80'	FIGURE 8.1

B-1



EAST MAIN STREET PLAN

LEGEND

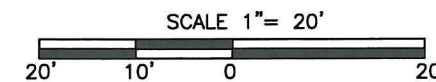
B-1 PROPOSED PILOT BORING

NOTES:

- 1) BASE MAP DEVELOPED FROM AN ELECTRONIC FILE PROVIDED BY URS ENTITLED 'METRO NORTH BRIDGE REPLACEMENT FEASIBILITY STUDY - EAST MAIN STREET PLAN' DATED 1/11/2010. ORIGINAL SCALE 1/8" = 1'-0".
- 2) THE LOCATIONS OF THE BORINGS WERE DETERMINED BY TAPING AND VISUAL ESTIMATES FROM EXISTING SITE FEATURES.

**METRO NORTH RAILROAD
BRIDGE REPLACEMENT
FEASIBILITY STUDY**

**EAST MAIN STREET
PILOT BORING PROGRAM**

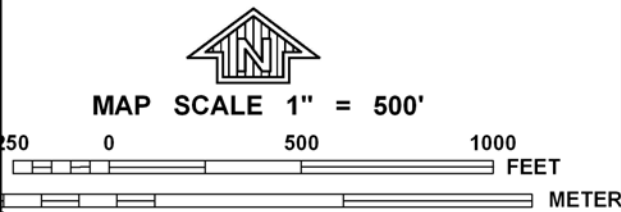


URS

SCALE: 1"=20'

FIGURE 9.1

M:\C\1\0101\25\PHASE 1\CADD\EAST_MAIN_ST.dwg



NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0517F

FIRM
FLOOD INSURANCE RATE MAP

FAIRFIELD COUNTY,
CONNECTICUT
(ALL JURISDICTIONS)

PANEL 517 OF 626
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
DARIEN, TOWN OF	090005	0517	F
STAMFORD, CITY OF	090015	0517	F

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.



MAP NUMBER
09001C0517F
EFFECTIVE DATE
JUNE 18, 2010

Federal Emergency Management Agency

METRO NORTH RAILROAD
BRIDGE REPLACEMENT
FEASIBILITY STUDY

EAST MAIN STREET
100-YEAR FEMA FLOODPLAIN

URS

FIGURE 10.1

Note: This area is shown as being protected from the 1-percent annual-chance or greater flood hazard.

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

580000 FT

S PANEL 0516