SHRP 2 Renewal Project R04

ABC Standard Concepts: The Lateral Slide

Addendum Report

SHRP 2
STRATEGIC HIGHWAY RESEARCH PROGRAM
Accelerating solutions for highway safety, renewal, reliability, and capacity

TRANSPORTATION RESEARCH BOARD
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ABC Standard Concepts: The Lateral Slide Addendum Report

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Introduction

The lateral slide is an accelerated bridge construction (ABC) technique in which a new bridge superstructure is constructed and then moved laterally into its final position. The lateral slide is an option typically used for the replacement of a bridge structure on a heavily trafficked roadway and/or primary roadway where extended closures are not practical and in some cases simply not possible.

The first phase of a lateral slide project involves constructing new substructure elements under the existing bridge and new superstructure elements on temporary supports adjacent to the existing bridge. Once the new substructure is constructed under the bridge and temporary structures are built outside the bridge, the new bridge superstructure is assembled on the temporary supports and the tracks and rollers/slide bearings for the slide are installed. Once complete, the second phase requires closing and detouring traffic, removing the old bridge quickly, either by demolishing or sliding out, sliding the new bridge spans onto the support structures, and performing the final bridge and pavement connections and paving.

The lateral slide is executed by moving structures on low-friction bearing pads or rollers using hydraulic jacks to either push or pull the structure or using strand jacks or winches to pull the structure.

The time required to complete a lateral slide-in varies depending on the size and complexity of the bridge. Typical replacement of single and multiple spans has been completed during night or weekend closures. The primary benefit of the lateral slide is a reduced length of disruption to the traveling public during construction activities; however, there are many secondary benefits including a safer driving environment with shorter detour periods and a higher quality product with construction off-line in a more controlled location.

As with all ABC techniques, the upfront costs of the lateral slide can exceed those of more conventional construction techniques; however, the hidden cost savings related to shorter closure periods make the lateral slide a viable option in many situations.

This addendum to the SHRP 2 ABC Toolkit was prepared to include the lateral slide technology used in the second demonstration project—Replacement of I-84 over Dingle Ridge Road in New York State. It is not a comprehensive guide to the slide-in construction method. It provides an introduction to this ABC technology, along with a sample set of drawings to illustrate its application on a real project.

Applicability of Lateral Slide Construction

One of the most important processes in the project planning is making the decision to use ABC on a particular project. There are two major steps in the project planning and scoping process that apply to ABC. First, the agency needs to determine if ABC is appropriate at a site. This decision- making process needs to include a study of several factors including but not limited to average daily traffic (ADT), potential detours, emergency routes, and road user costs. The ABC Toolkit (page 39) includes references to publications that provide a framework for ABC decision making. Many agencies have modified this decision-making framework to account for their specific practices and needs. The second step involves a decision as to what ABC technology is appropriate for a site once a decision has been made to use an ABC technology.

When considering the use of the lateral slide, a number of factors must be reviewed:

1) Societal Cost of Long-Term Traffic Delays and Disruption
    a. Would traffic delays and disruptions negatively impact a large number of people over a long duration?
    b. Is there a convenient detour around proposed construction activities?
    c. Do road closures compromise public safety by limiting access to or delaying response times for emergency vehicles?
    d. What are the length and impact of traditional construction activities?
    e. If public inconvenience and societal costs of traditional construction are high, the project may be a good candidate for lateral slide construction techniques.

2) Construction Site Setting
    Is there available space adjacent to the bridge under consideration for replacement?
    a. If the construction site is located in an open setting with access to a staging yard or other areas for the new bridge to be constructed, the lateral slide could be a viable option.
    b. If the bridge is located in a dense urban area or otherwise closely confined setting where open space near the bridge is not available, the use of the lateral slide may not be practical.

3) Bridge Geometry and Overall Design Configuration
    Is the bridge geometry and overall bridge configuration suitable for lateral slide construction?
    a. Will the new structure have parallel piers?
    b. What is the skew angle of the piers?
    c. What does the new bridge span?
        i. Span another road?
        ii. Span a body of water?
        iii. Span a deep valley?
    d. What is the roadway geometry? Is the bridge in a horizontal curve?

4) Willingness of Parties to Utilize Innovative Construction Techniques
    The success of ABC lateral slide is dependent upon all involved parties.
    a. Is the owner willing to sponsor a nontraditional project?
    b. Is the design engineer willing to consider a construction technique that is outside the scope of normal bridge design?

c. Is the bridge-contracting community willing to consider, and more importantly, engage in innovative construction techniques to provide a competitive bidding environment?
d. In the early stages of the project, the duties and scope of work for each party should be identified.

Design Considerations

The engineer of record on a lateral slide project is responsible for the design of the permanent structure. Superstructure design of ABC bridges is generally the same as that used for conventional construction. The major difference occurs at the abutment or piers where the lateral slide surfaces and slide bearings are located. In the conventional bridge design, the girder loads pass directly into the abutment. When the bridge is rolled or slid, either the end diaphragms of the bridge have to be designed to support the bridge on the sliding shoes or rollers or the girders must be designed to accommodate both the sliding or rolling bearings and the permanent bearings. Integral end diaphragms and shoes should provide a robust section to transfer loads and minimize differential deflection between girder lines.

The key to a successful project using slide-in or roll-in construction is to carefully plan every step: designing the falsework to handle movement and transfer loads and accounting for stresses during moving, lifting, and setting the beams into their permanent place. Design elements need to be coordinated at every stage with the construction means and methods. To ensure success, the contractor's engineer, the contractor, and the heavy-lifting subcontractor must work through every contingency and create a plan that anticipates each possibility that could possibly arise. It is critical for engineers and contractors to define each member's duties, requirements, and who will be responsible for all the means and methods. Design of temporary structures and the slide system are usually performed by the contractor working with the contractor's engineer and the heavy-lifting subcontractor. It is important that the design of these systems be accomplished by a registered professional engineer with experience in the design of such systems. Typically, the means and methods will derive from the contractor's preference, based on the method with which the contractor is most comfortable.

At every step of the process, engineers must account for the numerous stresses and how they vary during the moving process. Likewise, the contractor should be diligent about the quality of construction and building the bridge accurately and according to the plans and specifications. Small field changes can alter the load path of the entire structure because of the complexities of the movements being handled. Each part, starting with the skid shoes or roller troughs, should be precisely aligned to ensure that the bridge movement can proceed easily once it starts and that the system does not bind up. Design details that in other forms of construction are insignificant or can be dealt with in the field become critical when moving a bridge into place. Wind-speed limitations, for instance, need to be established in advance such that an allowable maximum wind speed is set beyond which the construction will not go forward. This typically is set at about 30 mph, but it will be up to the contractor to determine what can be tolerated by the equipment and to comply with this limit.

During the slide, transitioning from the temporary support condition to the final support condition can cause differential deflections between the supports. Consideration should be given to the possibility that abutments will deflect when the bridge weight is moved into place. This typically is not noticed in a more traditional method of construction, using cranes or launchers, because that weight is added incrementally and any deflections can be accommodated in the haunch or deck thickness. When sliding the bridge into place, all of the significant weight is placed on the abutments at about the same time, so deflections of the permanent support from the partial and complete loading process need to be considered.

The curve and skew of a bridge does have an impact on the use of ABC; however, it does not preclude the use of the slide-in method. All of the construction issues can be overcome with sound engineering judgment and careful planning. Attention to detailing and geometry are critical to the success of any curved or skewed bridge design regardless of whether or not ABC methods are employed. For difficult geometries, the superstructure may need to be moved into place above the adjacent roadway and jacked vertically down to the bridge seats after they are positioned in the horizontal position. This is especially true for curved bridges with nonparallel substructures.

Key Components of Lateral Slide Construction

Success of the lateral slide is dependent upon the effectiveness of the total slide package. Coordination of all components from the conceptual design, through final design and field implementation, is critical to achieving proper bridge position. Lateral slides are typically performed during specific time durations, usually predetermined to minimize public inconvenience. As such, the total slide package must perform without issue from the start to finish. Usually a trial slide is performed prior to the actual slide to verify static and dynamic friction values and jacking force requirements and to iron out any issues with the slide system.

The following are key components of the lateral slide:

1) Permanent Bridge Design

The design of the permanent bridge must consider anticipated construction activities. This often requires consideration of how the new bridge will be slid into place. Strengthening or modifying components of the superstructure and the substructure generally is required including the local areas where the push/pull system will be attached, where the sliding plates and/or rollers will support the structure, and where the sliding track will be installed.

Bridge components requiring special design consideration include the following:

Steel Girders

- Local web effects (web yielding, crippling, and web buckling) at temporary support locations
- Local stress effects at areas near the connection to the push/pull system
- End diaphragm or end cross-frame connections that may resist temporary force effects due to sliding friction
- Composite deck potentially acting as a diaphragm during lateral slide

Concrete Girders

- End diaphragms and end diaphragm connections that support the bridge during the lateral slide
- Composite deck potentially acting as a diaphragm during lateral slide

Concrete Piers

- Geometric constraints for staged construction – verify that the pier can be constructed with the existing bridge and the temporary sliding system in place
- Capbeam flexural and shear effects caused by moving vertical loads due to bearings progressing over supporting capbeam during lateral slide
- Column/frame design resisting transverse force effects that develop during lateral slide due to friction (if temporary track system is anchored to capbeam, external loads can be minimized)
- Local detail design for support of sliding track on top surface of capbeam

2) Temporary Support System

The temporary support system (falsework) will support the new bridge structure while being erected adjacent to the existing bridge (Figure 1). Design of the temporary support system must consider all applicable load effects including the self-weight of the new bridge, environmental loads (wind, stream flow, ice, and earthquake, as may be applicable) as well as the anticipated load effects applied by the sliding system. Construction live loads also need to be evaluated. These include items like form work, deck finishing machines, and overhang systems. The falsework needs to be able to provide the same level of interim stability during construction as the permanent structure.

Components of the temporary support system include substructure foundations (typically driven piles, drilled shafts, micro-piles or spread footings), superstructure components including primary column/frame/tower members, bracing members, and the sliding track system supports.

The sliding track provides a guided path for the structures (Figure 1). The track system must be continuously supported along its length by temporary beams or some other means. The track system may or may not be included as part of the push/pull system and may have “teeth” or pintle holes that provide resistance to the push/pull system.

Design considerations should be made for the effects of relative stiffness of permanent support structures (likely relatively stiff) versus stiffness of temporary support structures (likely relatively flexible).

As-built dimensions are essential, and connection details must be built to tight tolerances to ensure that the substructure and superstructure fit together during the slide. Design of the temporary support system must consider significant lateral forces during the slide and shall anticipate field imperfections to yield a robust temporary system. Anticipated deflection of the temporary system must not increase the stress of the permanent superstructure beyond design parameters.

3) Push/Pull System

Whether pushing or pulling actions are selected for use, the detail design of the system applying the load must be considered even if final design is to be performed by the contractor.

Developing adequate force application to overcome frictional force effects can be achieved through a variety of systems. Factors that may be considered in the selection of the push/pull system details include the availability or ownership of push/pull equipment, challenge of the site conditions, and familiarity with complex construction techniques. Regardless of the system selected for use, the details of the push/pull system must be designed and implemented in the field for successful lateral slide (Figure 2).

The primary push/pull system may consist of hydraulic jacks, strand jacks, or winches. Frictional resistance forces must be considered in the design of the lateral load system including contact friction between the moving components as well as side or racking friction generated when the slide rubs against the longitudinal guides.

Consideration of the directionality of the lateral slide should be considered. Will the slide be designed for one direction only or will it be designed to stop and reverse the movement for more functionality? Hydraulic jacks offer the opportunity to either push or pull the system. Strand jacks and winches typically are used for “pull only” conditions; however, pairs of opposing strand jacks and winches can be used to develop a push/pull system. If using a “pull only” system, consideration for braking should be reviewed.

Design of the push/pull system should include a method for making fine adjustments in the field that may be required because of unanticipated support settlements or miscellaneous misalignment/geometry issues (within tolerance). Consideration should also be made for removal of system components following the lateral slide operation including temporary jacking locations, additional rigging points for temporary works located directly under the new structure, and possibly bolted splices in the temporary works for more controlled removal.

Regardless of which system is selected, system controls and monitoring for the lateral slide should be planned. System controls vary in sophistication depending on project requirements and contractor options. The control system shall ensure that all components of the push/pull system work together to move the new bridge uniformly and to achieve proper alignment/geometry of the structure. Displacement control during the slide is important to ensure that the ends of the superstructure move at the same rate and thus avoid any racking or binding.

4) Sliding Bearings

Consideration of the sliding system is dependent on the structure type and the decision to leave or remove the sliding system. Rollers and slide plates require removal whereas a built-in slide shoe could be designed to remain as part of the permanent structure.

Rollers are generally more costly than pads and are often used on bridge projects with larger load requirements. When properly sized, the slide resistance is more predictable and requires less force to overcome friction. Rollers are almost always guided with restrainers or channels that align the rollers during the move. Roller-guide surfaces can be flush or approximately 2 to 3 inches wider than the rollers to allow room as the jacks push or pull the bridge.

Rollers are effective for the lateral slide of steel structures and depending on availability generally require a significant initial investment (Figure 3). Rollers also require additional coordination with the permanent and temporary structures as the rollers generally have higher concentrated forces. Removal of the rollers will require vertical jacks that also have to be considered in the design of the permanent and temporary structures.

Slide shoes are typically used on concrete structures or steel structures with integral type end diaphragms (Figure 4). Slide shoes are designed for the dual purpose of the slide as well as to provide permanent support for the new bridge. One advantage of the slide shoe is that there can be a direct attachment of the push/pull system.

Slide plates are an economical temporary bearing type and depending on the owner may or may not be left behind to support the permanent structure. The use of slide plates prevents the need for building in a permanent slide shoe or acquiring significant quantities of rollers. If the slide plates are to be removed, consideration for vertical jacks will be required in the design of the permanent and temporary structures.

Typically Teflon (PTFE) and stainless steel are used as interfacing materials when using slide plates or slide shoes (Figure 5). Friction has also been reduced using lubricants between the interfacing materials (including common dishwashing soap). PTFE pads are a simple, low-cost alternative that offers significant directional flexibility, as the direction of movement is not tied to the orientation of the pads. Pads also allow the use of an unguided system that will not bind if ends of the bridge move at different rates. Continuous lubrication of the pads is critical during the slide. Normally, the sliding surface of the shoe consists of polished stainless steel. Often, slide pads are reused in a slide as the bridge transitions over them. For the final move into the bridge's permanent position, new pads are placed and left in place. Monitoring is especially important on bridges moved without guides. Without guides, the structure will move unrestrained transversely as the jacking system will most likely be hydraulically connected and not using a displacement-based control. The initial movement creates the largest horizontal force demand.

5) Sliding Forces

The required force to move the bridge is a function of the weight of the superstructure and the coefficient of friction between the interfacing elements of the sliding/rolling system. Coefficients of friction for PTFE bearings are given in the *AASHTO LRFD Bridge Design Specifications*, Section 14. Data are also available from product manufacturers. Based on recent project experience, static coefficients in the range of 0.09 to 0.12 and dynamic coefficients in the range of 0.05 to 0.06 are reasonable values to consider for lubricated PTFE bearings sliding against polished stainless steel skid shoes. The pushing or pulling mechanisms should have a capacity in excess of the calculated pushing or pulling force in anticipation of higher frictional effects. Some designers recommend that the entire moving system be designed for the full capacity of the hydraulic system so the connections cannot be overloaded by the jacking system.

Conclusion

The lateral slide is an accelerated bridge construction (ABC) technique that significantly reduces societal disruption and public inconvenience associated with bridge construction by rapidly replacing an existing structure with a new structure during a short-duration closure. Successful execution of a lateral slide project requires upfront planning and communications to coordinate all project stakeholders. The design engineer and bridge construction contractor must work together to consider all applicable design limit states for the bridge structure and temporary support system, including consideration of all conditions during construction and final in-service conditions.

Because of the level of deterioration of the infrastructure system and the societal demands for minimizing traffic disruptions, the demand for rapid bridge replacement will likely continue to increase. Continued accumulation of project experience by the overall bridge engineering and construction communities as well as future technological advances will continue to make lateral slide projects more prevalent and viable options for bridge replacement.

Figure 1. Temporary supports and slide tracks—I-84 bridge lateral slide, New York.

Figure 2. Slide track and push/pull jacks—I-84 bridge lateral slide, New York.

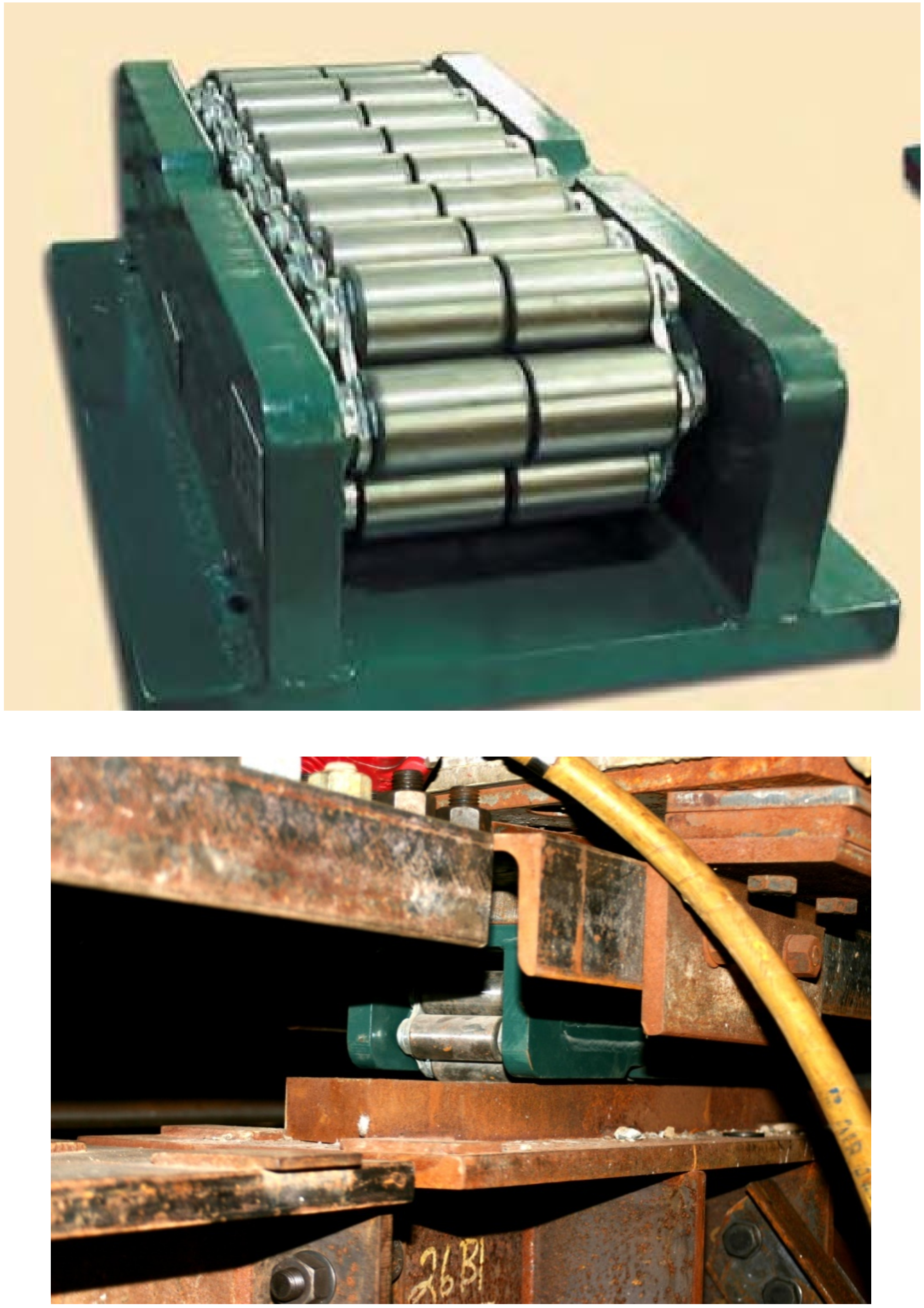

Figure 3. Roller bearing–Hillside Avenue bridge roll-in, New York.

Figure 4. End diaphragm with slide shoes—I-84 bridge lateral slide, New York.

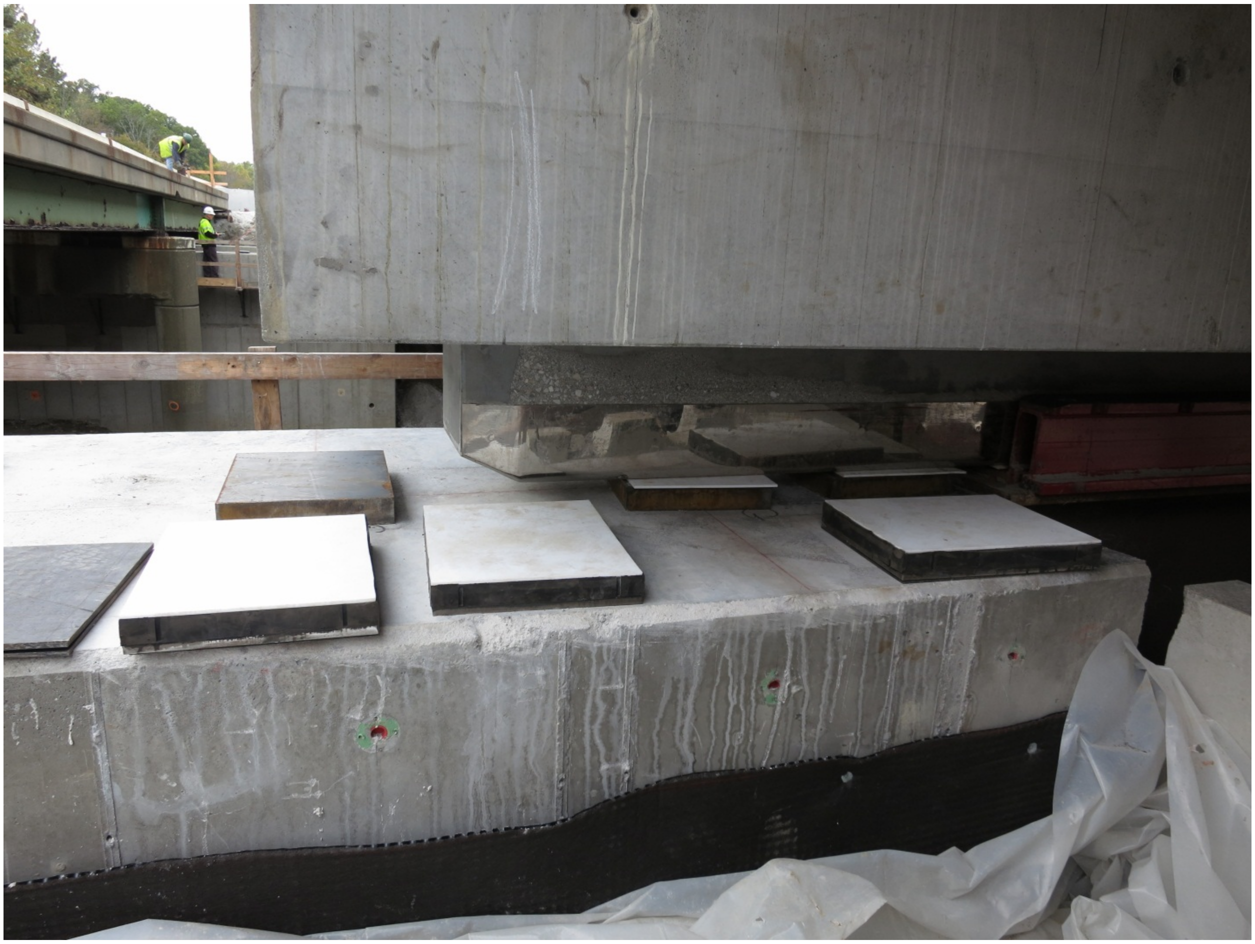

Figure 5. PTFE slide pads on elastomeric bearings—I-84 bridge lateral slide, New York.

Sample Construction Specifications: Horizontal Slide and Temporary Shoring

Description

A. General

The work shall consist of furnishing and removing all horizontal slide equipment (mechanical devices, jacks, tracks, and other components), performing lateral slide, monitoring of bridge movement, removal of lateral slide equipment, and performing of post-slide inspections and any necessary remedial actions. The work shall include furnishing, installing, and demolishing all temporary shoring structures.

Work shall include preparation and submittal of calculations and Working Drawings by a registered Professional Engineer (with working load capacities) for horizontal slide equipment and temporary shoring.

B. Prequalification of Bidders

The Contractor or the Specialty Subcontractor executing the horizontal slide shall have documented previous experience in performing horizontal slides on similar projects. Contractor shall also submit qualifications and prior experience in the use of the horizontal slide system and controls proposed for this project to the Owner for review.

C. Definitions

Horizontal Slide shall refer to all components [including but not exclusive of the jacks, tracks, pumps, programmable logic controller (PLC) equipment] and processes (including but not exclusive of submittal preparation, execution of the bridge movement, monitoring of bridge movement, post-event inspections, and remedial action) related to moving the newly erected superstructure from the temporary falsework onto the permanent substructure units.

Temporary Shoring shall refer to all components of the structure erected adjacent to the current bridge locations supporting all the construction activities to erect the complete superstructure including but not exclusive of the bents, lateral bracing, foundations, work platforms, and all personnel safety systems.

D. Submittals

1. Working Drawings, Calculations, and Procedures

    i. The Contractor shall design all elements of the temporary falsework and horizontal slide system. Design shall be done in conformance with the current edition of the *AASHTO LRFD Bridge Construction Specifications*. Alternatively, the design shall be in conformance with the current edition of the *AASHTO Standard Specifications for Highway Bridges, Division II*.

    ii. Submit detailed Working Drawings, calculations, and procedures of all equipment, materials, and processes required for the horizontal slide and temporary shoring in accordance with the New York State Department of Transportation (NYDOT) *Steel Construction Manual*.

    iii. Working Drawings for the horizontal slide shall be submitted to the Owner for review at least 60 days prior to performing the horizontal slide.

iv. Working Drawings for the temporary falsework shall be submitted to the Owner for review at least 30 days prior to the beginning of falsework erection.

v. The Deputy Chief Engineer (Structures) comments shall be indicated on the returned copies. Should the proposed system not be approved, the reasons shall be indicated with the return of the material. The Contractor shall then submit revised drawings for approval, subject to the same terms as the first submission. Resubmission shall not be considered a legitimate reason to request an extension of time.

vi. Do not order materials or begin work until written approval or authorization is granted by the Owner. The Contractor shall bear all costs and/or damages that may result from the ordering of any materials or equipment; or the use of any preparatory labor prior to the approval of the Working Drawings.

vii. Do not deviate from the approved Working Drawings and procedures unless authorized in writing. All work shall be done in accordance with the approved Working Drawings. The Contractor must have approved Working Drawings prior to the erection of the temporary falsework.

viii. Review and approval of the Working Drawings by the Owner shall not relieve the Contractor of the responsibility for the adequacy and design of temporary falsework and horizontal slide systems.

ix. Contractor is solely responsible for the adequacy of the design and performance of the falsework system and Lateral Slide Plan and will be responsible for repair, replacement, redesign, or modifications to the falsework or Lateral Slide Plan to ensure a system capable of carrying out the intent of the Plans and Specifications.

Materials

A. Use qualified suppliers for all jacking products. Qualified suppliers shall have a minimum of 10 years' experience in manufacturing and/or programming equipment used in the proposed horizontal slide. Contractor shall submit experience and qualifications for review. Proprietary systems may be used in lieu of constructing a new system specific to this project provided all components of the proprietary system have certifications and current calibrations indicating the equipment is sufficient for the needs of this project.

B. Steel and hardware for temporary shoring shall be in accordance with §564. Used materials will be allowed, as approved by the Owner, except that materials that are permanently attached to the structure shall be in conformance with the current NYDOT Standard Specifications.

If the Contractor proposes to construct with used materials, the Contractor's Professional Engineer shall submit with the plans the method for documenting that all primary member material meets the physical properties required by the design. In the absence of record plans or other valid documentation for the used materials, physical testing shall be performed. Excluded from this provision are proprietary structures.

All welding required for the fabrication of temporary steel structures shall be performed in accordance with the provisions of the NYDOT *Steel Construction Manual*. Complete penetration groove welds in primary members shall be radiographed as described therein.

The Owner reserves the right to perform in-process fabrication inspection. The Contractor shall notify the Owner of the fabrication schedule 7 calendar days prior to commencement of fabrication.

C. Concrete for temporary shoring shall meet the requirements of §555.

Construction Details

A. General Requirements

1. Use methods and procedures to provide adequate safety to the general public from all construction activities and superstructure delivery and erection.
2. If the Contractor chooses to deviate from use of previously approved materials, components, Working Drawings, or procedures, the Contractor shall resubmit revised Working Drawings and procedures to the Owner for approval.
3. All fabrication shall conform to the *AASHTO Standard Specifications for Highway Bridges, Division II*, or *AASHTO LRFD Bridge Construction Specifications*, except as modified herein. Fabrication shall be performed by an AISC Category III-Certified Fabricator.
4. Construction requirements for the Temporary Shoring shall meet the requirements of §555-3, §564-3, and the NYDOT *Steel Construction Manual*.
5. Construction requirements for the Horizontal Slide System shall meet the requirements of §564-3 and the NYDOT *Steel Construction Manual*.

B. Horizontal Slide and Temporary Shoring—Submittal Process

1. Submittal Requirements and Process

    i. Provide details necessary to move the new bridge into its final position using horizontal slide methods. Key information required is summarized below.

        1. The Contractor shall design any modifications to the permanent bridge details and/or bridge materials indicated on the Contract Plans as may be needed. Include calculations prepared by the Bridge Contractors' Specialty Engineer, the Heavy Lift Engineer, or the Contractor's Geotechnical Engineer.

        2. Provide details of the horizontal slide components (including but not exclusive of the jacks, tracks, pumps, PLC equipment) and processes (including but not exclusive of submittal preparation, execution of the bridge movement, monitoring of bridge movement, post-event inspections, and remedial action).

        3. Provide details of the temporary falsework components (including but not exclusive of the bents, lateral bracing, foundations, work platforms, and all personnel safety systems).

2. Professional Requirements

    i. Provide Working Drawings for the horizontal slide system, the temporary shoring structure, and all modifications to the permanent bridge superstructure. Working Drawings shall be sealed by a Professional Engineer, with appropriate, demonstrated knowledge and experience in the design, use, and operation of these types of systems and structures.

    ii. Working Drawings, calculations, and procedures for the horizontal slide system and the temporary falsework structure shall be prepared and sealed by a Professional Engineer.

    iii. Working Drawings and calculations for all Geotechnical Engineering work necessary for the temporary falsework shall be prepared and sealed by a Professional Engineer, with appropriate, demonstrated knowledge and experience in the design, use, and operation of these types of systems and structures.

C. Design Criteria and Standards

1. General

It is the intention that all design necessary for the horizontal slide and temporary falsework shall be carried out to the latest industry criteria and standards applicable to the particular item and work involved.

2. Design Criteria and Standards

   i. Meet the requirements of *AASHTO LRFD Bridge Design Specifications* (current edition) for modifications to the permanent bridge superstructure necessitated by the Contractor's elected horizontal slide system.

   ii. Meet the requirements of *AASHTO LRFD Bridge Construction Specifications* (current edition).

   iii. In the absence of any other stated referenced national code based criteria, for the design and use of the horizontal slide system and temporary shoring structure, use as a minimum the requirements of *AASHTO Guide Design Specifications for Bridge Temporary Works* (2008 Interim).

   iv. For items not addressed by the above documents or for any other circumstances, submit a proposal and seek the guidance and approval of the Owner prior to proceeding.

D. Horizontal Slide and Temporary Works (Working Drawings)

1. General

   i. It is the overall responsibility of the Prime Contractor to coordinate all planned activities and submittals.

   ii. In general, specify all materials, details, and procedures related to the construction and implementation of the proposed horizontal slide system and temporary falsework structure.

   iii. Use materials for the project that are of satisfactory quality, from sources approved by the Owner, and that must be capable of sustaining the loads and stresses required. The Owner reserves the right to reject any material considered unsuitable or unsatisfactory. The Contractor is required to provide satisfactory material at no additional expense to the State.

2. Bridge Staging Area Layout:

   Show site plans and details of the Bridge Staging Area including but exclusive of the location and general layout of the site with existing, temporary, and permanent structures indicated. Provide proposed locations of benchmarks or other reference locations for geometry control and survey purposes.

3. Bridge Staging Area Geotechnical Requirements:

    i. The Contractor’s Geotechnical Engineer shall verify that the Bridge Staging Area is suitable for all proposed construction operations and shall develop/design methods to stabilize all excavations and to support the temporary falsework.

        1. Provide design and details for all temporary foundation systems.

        2. Provide calculations demonstrating the temporary foundations’ anticipated settlements and details for adjusting for differential settlements between the temporary and permanent foundations.

4. Temporary Shoring

    Provide calculations for all falsework elements and Working Drawings showing the location and details of temporary bents used to support the construction activities for permanent superstructure. Include bents, bracing, foundations, work platforms, personnel safety details, and support of sliding track. Indicate the type and grade for all materials.

    Provide calculations and details for methods used to stabilize excavations.

    Take responsibility for the overall design, engineering, and construction of temporary support structures. The Contractor’s Specialty Engineer shall sign, seal, and take responsibility of all Working Drawings and calculations for the design of the temporary falsework.

    If attachment of the temporary falsework to the permanent bridge substructure is required for any reason (i.e., strength or stability of frames or moving systems), the Contractor shall submit calculations and details for any proposed attachments/modifications to the Owner for approval.

5. Horizontal Slide

    Show details of proposed jacking system including but not exclusive of the jacks, tracks, pumps, PLC equipment, and schematic hydraulic layout, used to move the bridge superstructure from the temporary structure onto the permanent bridge substructure. Indicate the distance that the superstructure is to be moved.

    Provide type and grade for all materials.

    Clearly show on the Working Drawings and in the calculations the push/pull capacity of the horizontal slide system and limitations during all jacking operations. Provide jacking/pulling locations.

Provide a detailed slide procedure, including but not limited to execution of the bridge movement, monitoring of the bridge movement, post-event inspections, and remedial action. Procedures shall include checklists to support the activities prior to, during, and after the bridge superstructure has been moved to its final location.

Provide checking [quality control/quality assurance (QC/QA)] procedures prior to the horizontal movement of the superstructure in order to ensure its completion.

Provide contingency plans in the event of a major breakdown or equipment malfunction.

Provide operational details for the control of the movement, including any system of check-off items for the Operators and for safety purposes.

The Contractor's Specialty Engineer shall sign, seal, and take responsibility of all Working Drawings, calculations, and procedures for the design and execution of the horizontal slide.

If attachment of the horizontal slide system to the permanent bridge substructure is required for any reason, the Contractor shall submit detailed calculations and Working Drawings for any proposed attachments/modifications to the permanent bridge details and/or materials to the Owner for approval.

6. Permanent Superstructure

    i. The Contractor's Specialty Engineer is responsible for all modifications made to the details for the construction of the permanent bridge superstructure. The Contractor's Specialty Engineer shall sign, seal, and take responsibility of all Working Drawings and calculations for modifications to the permanent superstructure. All Working Drawings and calculations shall be submitted to the Owner for approval.

    ii. Details for modifications of details related to the permanent superstructure include, but are not necessarily limited to the following:

        1. Details of and supporting calculations for any modifications to reinforcement at anchorages, diaphragms, deck-slabs, block-outs, and the like made that may be necessary for accommodating the proposed horizontal slide system.

        2. The Contractors' Specialty Engineer will provide repair procedures for any damage or cracking to the permanent bridge components

(substructure and/or superstructure) resulting from the sliding operation of the bridge superstructure.

7. Geometry Control

Prior to commencing construction of the superstructure in the Bridge Staging Area, submit proposed method of geometry control to the Owner for approval. The submittal is to contain actual details of the proposed temporary falsework structure and horizontal slide system, and shall be in the form of Working Drawings and should include, but is not necessarily limited to items such as

i. Measuring equipment, procedures, and locations of geometry control reference points on the superstructure, in the Bridge Staging Area, and at the bridge site.

ii. The location and values of permanent benchmarks and reference points in the staging area and at the bridge site.

iii. During erection and casting of wearing surface, as a minimum, establish and maintain a record of key vertical elevations along the main longitudinal elements (i.e., centerline of beams or precast approach panels) and along the proposed horizontal slide track supports. Submit all records to the Engineer.

iv. Establish lateral and longitudinal location reference points on the erected superstructure that correspond to, or can be referenced to, appropriate lateral and longitudinal reference points at the erection site.

E. Preparation for Movement of Superstructure

1. General

i. The Bridge Contractor has overall responsibility for the construction of temporary falsework structure and horizontal slide system in accordance with the approved Working Drawings and procedures.

ii. Accurately calculate slide forces, including an accurate weight take off of the total weight of superstructure to be moved and the anticipated maximum coefficient of friction between sliding points.

iii. Follow established QA/QC procedures and prepare a Pre-Operations Check-List as appropriate and necessary for information and coordination purposes.

2. Horizontal Slide System

   i. Follow approved Working Drawings for details and sequences of procedures for positioning the jacks and track.

   ii. Carefully jack superstructure horizontally in an incremental fashion. Maintain even push strokes between all jacking points. Jacks shall be able to be controlled as a group and/or as individual units. Provide controls to reset jacks as a group and/or as individual units.

   iii. Operate horizontal slide system with care and within anticipated limitations (stroke limits) of the jacking systems. Follow limitations on Working Drawings for all incremental and differential jacking with due regard to assuring minimal differential movement between all slide locations.

   iv. Implement checking (QC/QA) procedures prior to a transportation operation in order to ensure satisfactory completion.

   v. Implement contingency plans in the event of a major breakdown or Equipment malfunction.

   vi. Operational details for the control of the movement shall be provided in an "Operations Manual" that shall also include a system of check-off items for the Operators and for safety purposes. Treat such an "Operations Manual" as a Working Drawing for submittal and approval.

F. Trial Horizontal Slide

The Contractor is required to perform a trial horizontal slide for each structure, following approved horizontal slide procedures in the Working Drawings. This trial slide shall occur a minimum of 5 days prior to the slide of the bridge into its final position. The trial slide should move the structure a few feet to test the performance of the slide system.

G. Movement of Superstructure

1. General

   i. The intent during movement is to ensure that the structure is delivered to the Owner, in its final location, with no damage or adverse loss of strength, loss of performance, or loss of long-term durability. To this end, it is necessary to place certain limitations upon characteristics that can be quantified and observed or checked by careful observations or by using suitable detection methods during these operations. Any damages to the permanent structure caused by the move after the bridge is in its final position shall be repaired at no cost to the State.

ii. The Bridge Contractor takes responsibility for establishing geometric alignment and elevation reference controls at the Bridge Staging Area and Bridge Site. Establish survey control points and benchmarks as necessary. Establish transverse and longitudinal reference lines - e.g., centerlines of bearings, offsets from fixed surfaces - for setting superstructure span or spans on bearings, as necessary.

iii. Keep records of observations and operations. Submit all records to the Engineer. Notify Engineer in event of errors and submit proposals for corrective adjustments or modifications to any of the permanent structure or components to the Engineer for approval prior to their implementation.

2. Tolerances

   i. Plan Alignment, Location, Clearances

   ii. For the final condition of the span after placement in the bridge:

      1. Do not exceed ¼ inch maximum deviation at each end of span from overall longitudinal alignment of an individual span after setting.

      2. Do not exceed ¼ inch maximum deviation from overall transverse location (i.e., longitudinal position) at each line of bearings.

      3. Maximum deviation from alignment in both primary plan directions (yaw) at each end of the span or spans being set shall not exceed ¼ inch or that required for the accommodation of manufactured expansion joint components or bearings, whichever is the less.

      4. In the absence of other constraints, keep individual elements or surfaces within ¼ inch of location with respect to similar matching surfaces at expansion joints (i.e., plane of web or parapet) of adjacent spans, pier, or abutment features.

   iii. During Movement

   The Contractor shall ensure that the superstructure itself remains as free as possible from harmful effects of differential movements at all sliding surfaces.

3. Movement of Superstructure—Step-by-Step Procedures

   Follow procedures approved by the Owner in the sliding procedures on the Working Drawings for the step-by-step sequence of operations for movement of the superstructure span.

Method of Measurement

This work will be measured for payment on a lump sum basis.

Basis of Payment

The unit price bid for the horizontal slides shall include the cost of all labor, materials, equipment, and adjustment necessary to complete the work. All labor, materials, and equipment required for the trial slide shall be included in the price bid for this item. All temporary falsework necessary to support the structure prior to and during the horizontal slide and their removal upon completion of the horizontal slide shall be included in the price bid for this item.

A. GENERAL INFORMATION

THIS SET OF SAMPLE DRAWINGS ILLUSTRATES THE SLIDE-IN METHOD OF REPLACING BRIDGES. THE DRAWINGS HAVE BEEN EXTRACTED FROM THE CONTRACT PLANS DEVELOPED FOR THE RAPID REPLACEMENT OF THE TWIN I-84 BRIDGES OVER DINGLE RIDGE ROAD IN NEW YORK. THIS PROJECT WAS COMPLETED IN 2013 AS THE SECOND ABC DEMONSTRATION PROJECT UNDER SHRP2 PROJECT R04.

THE EXISTING STRUCTURE CONSISTED OF A 3-SPAN STEEL GIRDER SUPERSTRUCTURE WITH A TOTAL LENGTH OF 135'-0". THE NEW SRUCTURE UTILIZES AN 80'-0" SINGLE-SPAN CONCRETE NEXT BEAM SUPERSTRUCTURE WITH PRECAST APPROACH SLABS DESIGNED TO SERVE AS TEMPORARY SPANS AND CARRY LIVE LOADS AFTER THE SLIDE-IN AND BEFORE THE ABUTMENT BACKFILL IS COMPLETED. NEXT BEAMS AND APPROACH SLABS WERE MADE COMPOSITE WITH ONE ANOTHER THROUGH LONGITUDINAL ULTRA HIGH PERFORMANCE CONCRETE (UHPC) CLOSURE POURS FOR GREATER DURABILITY. THE SUPERSTRUCTURE AND APPROACH DETAILS WERE ADAPTED FROM THE SHRP2 R04 "ABC TOOLKIT" PUBLISHED BY TRB.

CLOSURE OF THE ROADWAY WAS FROM 5 PM SATURDAY TO 1 PM SUNDAY DURING TWO WEEKENDS IN SEPTEMBER AND OCTOBER 2013 TO ALLOW FOR THE RAPID DEMOLITION OF THE EXISTING BRIDGE AND SLIDE-IN OF THE NEW SUPERSTRUCTURE. CONVENTIONAL BRIDGE REPLACEMENT WOULD HAVE EXTENDED OVER TWO YEARS AND WOULD HAVE REQUIRED A TEMPORARY BRIDGE IN THE MEDIAN. USE OF ABC METHODS ELIMINATED THE NEED FOR A TEMPORARY BRIDGE AND SIGNIFICANTLY REDUCED MOBILITY IMPACTS.

IN ADDITION TO THE DESIGN DRAWINGS, GUIDELINE DRAWINGS HAVE ALSO BEEN INCLUDED FOR TEMPORARY SUPPORT STRUCTURES, LATERAL SLIDE SYSTEM DETAILS AND RAPID DEMOLITION STAGING. THE CONCEPTS AND DETAILS PRESENTED IN THESE DRAWINGS ARE INTENDED TO ASSIST THE DESIGNER, OWNER AND CONTRACTOR IN COMPLETING THE ABC DESIGN AND CONSTRUCTION USING THE SLIDE-IN METHOD.

B. GENERAL NOTES

DESIGN SPECIFICATIONS: NYSDOT LRFD BRIDGE DESIGN SPECIFICATIONS WITH ALL PROVISIONS IN EFFECT AS OF JULY, 2012. FOR DESIGN PURPOSES, COMPRESSIVE STRENGTH OF CONCRETE AT 28 DAYS SHALL BE FOLLOWS:

f'c = 3,000 psi FOR ABUTMENT WALLS, CHEEKWALLS AND BARRIERS

f'c = 5,000 psi FOR ABUTMENT COLUMNS AND CAP BEAMS, DRILLED SHAFTS, SLEEPER SLABS, APPROACH SLABS, AND END DIAPHRAGMS.

f'c = 10,000 psi FOR PRECAST PRESTRESSED BEAMS

THE COST OF ALL JOINT MATERIAL SHALL BE INCLUDED IN THE UNIT PRICES BID FOR THE VARIOUS ITEMS OF THE CONTRACT, UNLESS OTHERWISE SPECIFIED ON THE PLANS.

LIVE LOAD: AASHTO HL-93 AND NYSDOT DESIGN PERMIT VEHICLE.

ALL SHOP DRAWINGS SUBMITTED FOR THIS PROJECT SHALL BE IN US CUSTOMARY UNITS.

THE LOAD RATINGS ARE IN ACCORDANCE WITH THE AASHTO MANUAL FOR BRIDGE EVALUATION, 2ND EDITION WITH 2011 INTERIM REVISIONS.

ONE DIRECTION OF I-84 WILL BE CLOSED TO ALL TRAFFIC DURING EACH ABC PERIOD. DINGLE RIDGE ROAD WILL BE PERMITTED TO BE CLOSED FOR A FIVE (5) DAY WINDOW, INCLUDING THE ABC PERIOD, FOR EACH BRIDGE REPLACEMENT. SEE WORKZONE TRAFFIC CONTROL PLANS FOR DETOURS.

UTILITY COMPANIES WHOSE FACILITIES ARE SHOWN ON THE PLANS OR KNOWN TO BE WITHIN THE CONSTRUCTION LIMITS SHALL BE NOTIFIED BY THE BRIDGE CONTRACTOR OF THE STARTING DATE.

ALL DIMENSIONS AND DETAILS SHOWN IN THESE PLANS PERTINENT TO NEW CONSTRUCTION IN RELATION TO EXISTING PORTIONS OF THE STRUCTURE SHALL BE VERIFIED IN THE FIELD BY THE BRIDGE CONTRACTOR BEFORE STARTING CONSTRUCTION.

THIS BRIDGE SHALL BE MAINTAINED IN ACCORDANCE WITH THE GUIDELINES CONTAINED IN THE CURRENT EDITION OF THE AASHTO MAINTENANCE MANUAL: THE MAINTENANCE AND MANAGEMENT OF ROADWAYS AND BRIDGES.

THE CONTRACTOR IS CAUTIONED THAT MATERIALS CONTAINING ASBESTOS ARE BELIEVED TO EXIST AT VARIOUS LOCATIONS ON OR IN CERTAIN STRUCTURES OF THIS CONTRACT. THESE MATERIALS WERE NOTED ON THE ORIGINAL CONTRACT PLANS OF THE STRUCTURES AND/OR DURING FIELD INSPECTIONS.

HIGH VOLTAGE ELECTRICAL LINES ARE IN PROXIMITY TO THIS BRIDGE. REFER TO SUBSECTION 107-05 OF THE STANDARD SPECIFICATIONS FOR CONTRACTOR SAFETY REQUIREMENTS.

C. FOUNDATIONS

DRILLED SHAFTS 1 AND 2 AT THE EASTBOUND BEGIN ABUTMENT WILL SUPPORT A MAXIMUM SERVICE LIMIT STATE AXIAL LOAD OF 751 AND 740 KIPS PER SHAFT, RESPECTIVELY, AND A MAXIMUM STRENGTH LIMIT STATE AXIAL LOAD OF 1016 AND 1001 KIPS, RESPECTIVELY. INSTALL THESE SHAFTS TO ACHIEVE A NOMINAL RESISTANCE OF 1870 KIPS PER SHAFT.

DRILLED SHAFTS 1 AND 2 AT THE EASTBOUND END ABUTMENT WILL SUPPORT A MAXIMUM SERVICE LIMIT STATE AXIAL LOAD OF 766 AND 772 KIPS PER SHAFT, RESPECTIVELY, AND A MAXIMUM STRENGTH LIMIT STATE AXIAL LOAD OF 1034 AND 1042 KIPS, RESPECTIVELY. INSTALL THESE SHAFTS TO ACHIEVE A NOMINAL RESISTANCE OF 1910 KIPS PER SHAFT.

DRILLED SHAFTS 1 AND 2 AT THE WESTBOUND BEGIN ABUTMENT WILL SUPPORT A MAXIMUM SERVICE LIMIT STATE AXIAL LOAD OF 748 AND 735 KIPS PER SHAFT, RESPECTIVELY, AND A MAXIMUM STRENGTH LIMIT STATE AXIAL LOAD OF 1012 AND 995 KIPS, RESPECTIVELY. INSTALL THESE SHAFTS TO ACHIEVE A NOMINAL RESISTANCE OF 1860 KIPS PER SHAFT.

DRILLED SHAFTS 1 AND 2 AT THE WESTBOUND END ABUTMENT WILL SUPPORT A MAXIMUM SERVICE LIMIT STATE AXIAL LOAD OF 759 AND 762 KIPS PER SHAFT, RESPECTIVELY, AND A MAXIMUM STRENGTH LIMIT STATE AXIAL LOAD OF 1025 AND 1029 KIPS, RESPECTIVELY. INSTALL THESE SHAFTS TO ACHIEVE A NOMINAL RESISTANCE OF 1890 KIPS PER SHAFT.

FACTORED BEARING RESISTANCE OF SOIL FOR TEMPORARY STRUCTURES IS 3 KSF. THE CONTRACTOR SHALL DESIGN TEMPORARY STRUCTURES AND TEMPORARY STRUCTURE FOUNDATIONS TO ACCOUNT FOR THE EFFECTS OF FOUNDATION SETTLEMENT ON THE SLIDE TRACK ALIGNMENT AND TO CORRECT FOR SUCH SETTLEMENTS IF NECESSARY.

D. SUBSTRUCTURE NOTES

ALL EXPOSED EDGES OF CONCRETE SHALL BE CHAMFERED 1 INCH UNLESS OTHERWISE NOTED ON THE PLANS.

ALL PLACEMENTS OF SELECT STRUCTURE FILL, ITEM 203.21, SHALL BE COMPACTED TO 95 PERCENT OF STANDARD PROCTOR MAXIMUM DENSITY.

THE COST OF WATER USED FOR COMPACTION OF SELECT FILL ITEMS SHALL BE INCLUDED IN THE UNIT PRICE BID FOR ITEM 203.21 SELECT STRUCTURE FILL.

HIGHWAY EMBANKMENT MATERIAL (HIGHWAY ESTIMATE) AND SELECT STRUCTURE FILL, ITEM 203.21, SHALL BE PLACED SIMULTANEOUSLY, IN CONTACT, ON BOTH SIDES OF THE VERTICAL PAYMENT LINE.

THE COST OF ALL JOINT MATERIAL SHALL BE INCLUDED IN THE UNIT PRICES BID FOR THE VARIOUS ITEMS OF THE CONTRACT, UNLESS OTHERWISE SPECIFIED ON THE PLANS.

TOP OF BACKWALLS AND SLEEPER SLABS SHALL BE STEEL TROWEL FINISHED. SHEET GASKET (TREATED BOTH SIDES), 728-06, SHALL BE PLACED ON THE TOP OF THE SLEEPER SLABS AND BACKWALLS OF FIXED AND EXPANSION ABUTMENTS. TWO SHEETS SHALL BE USED; PAYMENT SHALL BE INCLUDED IN THE UNIT PRICE BID FOR THE APPROACH SLAB ITEM.

ALL PLACEMENT OF CONTROLLED LOW STRENGTH MATERIAL (CLSM), ITEM 204.01, SHALL BE LIMITED TO 12 INCH MAXIMUM LIFTS WITH NO LESS THAN 24 HOURS BETWEEN LIFTS.

CLSM SHALL HAVE A MAXIMUM DENSITY OF 125 PCF.

E. SUPERSTRUCTURE NOTES

THE DETAILS FOR THE BARRIER REINFORCEMENT ARE FOR THE SLIP-FORMED OR CAST-IN-PLACE OPTION ONLY. COST OF BARRIER AND ANCHORAGE REINFORCEMENT ORIGINATING IN THE SLAB SHALL BE INCLUDED IN THE UNIT PRICE BID FOR THE BARRIER ITEM. COST OF BARRIER ANCHORAGE REINFORCEMENT ORIGINATING IN THE PRESTRESSED UNIT SHALL BE INCLUDED IN THE UNIT PRICE BID FOR THE PRESTRESSED UNIT ITEM.

THE CONTRACTOR'S ATTENTION IS DIRECTED TO THE PROVISIONS OF THE CURRENT SPECIFICATIONS FOR PERMANENT CONCRETE TRAFFIC BARRIER FOR STRUCTURES, WHICH ALLOWS THE OPTION OF THREE CONSTRUCTION METHODS: CAST-IN-PLACE, SLIP FORMED, OR PRECAST. HOWEVER, ON THIS BRIDGE, ONLY CAST-IN-PLACE AND SLIP FORMING ARE ALLOWED.

CONSTRUCTION EQUIPMENT SHALL NOT BE PERMITTED ON THE LIFTED SPAN UNITS UNTIL SHIMS, CRIBBING, BOLSTERS OR OTHER SUITABLE SUPPORTS ARE IN THEIR REQUIRED POSITION.

PRIOR TO PRECAST BEAM CONCRETE PLACEMENT DURING FABRICATION, THOROUGHLY COAT THE BEVELED FACES OF THE FORMWORK AT ALL CLOSURE JOINTS WITH AN APPROVED CONCRETE RETARDING ADMIXTURE.

AFTER FORMS ARE STRIPPED FROM PRECAST BEAMS DURING FABRICATION, USE A HIGH-PRESSURE STREAM OF WATER TO ROUGHEN THE BEVELED FACES AT ALL CLOSURE JOINTS TO AN AMPLITUDE OF 1*4 INCH WITHOUT DISPLACING COARSE AGGREGATE.

EDGES OF CLOSURE POUR SHALL BE SATURATED SURFACE DRY PRIOR TO PLACING UHPC. ALL CONCRETE FACES TO BE IN CONTACT WITH UHPC SHALL BE CLEANED AND COATED WITH AN APPROVED EPOXY BONDING AGENT PRIOR TO PLACING UHPC.

MOCKUPS OF EACH UHPC POUR SHALL BE PERFORMED PRIOR TO ACTUAL UHPC CONSTRUCTION.

USE CONTINUOUS TOP AND BOTTOM FORMS FOR UHPC JOINTS.

TWO PORTABLE BATCHING UNITS SHOULD BE USED FOR MIXING OF THE UHPC.

EACH UHPC PLACEMENT SHALL BE CAST USING ONE CONTINUOUS POUR. COLD JOINTS ARE PERMITTED ONLY AS APPROVED BY THE ENGINEER. UHPC SHALL BE PRODUCED TO FILL ANY ONE CONNECTION AREA WITHIN 30 MINUTES.

INDEX OF SHEETS

THE STRATEGIC HIGHWAY RESEARCH PROGRAM 2
PROJECT R04
INNOVATIVE BRIDGE DESIGNS FOR RAPID RENEWAL

ACCELERATED BRIDGE CONSTRUCTION
SAMPLE LATERAL SLIDE SYSTEM DETAILS

GENERAL NOTES

HNTB
SEA / ISU / GENESIS SEPTEMBER 2013

DESIGN TEAM

A. GENERAL INSTALLATION PROCEDURE:

A1. DO NOT SLIDE SUPERSTRUCTURE ONTO SUBSTRUCTURE UNTIL THE COMPRESSIVE TEST RESULTS DEMONSTRATE THE SUBSTRUCTURE CONCRETE HAS REACHED THE SPECIFIED MINIMUM VALUES.

A2. SURVEY THE TOP ELEVATION OF THE SUBSTRUCTURES. ESTABLISH WORKING POINTS, WORKING LINES, AND BENCHMARK ELEVATIONS PRIOR TO PERFORMING LATERAL SLIDE.

A3. LIFT AND ERECT MODULES USING LIFTING DEVICES AS SHOWN ON THE SHOP DRAWINGS IN CONFORMANCE WITH THE ASSEMBLY PLANS.

A4. SET MODULE IN THE PROPER LOCATION. SURVEY THE TOP ELEVATION OF THE MODULES. VERIFY PROPER LINE AND GRADE WITHIN SPECIFIED TOLERANCES.

A5. TEMPORARILY SUPPORT, ANCHOR, AND BRACE ALL ERECTED MODULES AS NECESSARY FOR STABILITY AND TO RESIST WIND OR OTHER LOADS UNTIL THEY ARE PERMANENTLY SECURED TO THE STRUCTURE. SUPPORT, ANCHOR, AND BRACE ALL MODULES AS DETAILED IN THE ASSEMBLY PLAN.

A6. DIFFERENCES IN CAMBER BETWEEN ADJACENT MODULES SHIPPED TO THE SITE SHALL NOT EXCEED THE PRESCRIBED LIMITS.

A7. FORM, CAST AND CURE UHPC CLOSURE POURS AS DETAILED IN THE PLANS AND SPECIFICATION.

B. GENERAL CONSTRUCTION SEQUENCE

B1. FOLLOWING IS THE ANTICIPATED CONSTRUCTION SEQUENCE FOR PRE ABC, ABC, AND POST ABC ACTIVITIES. STAGING IS DESCRIBED FOR ONE BRIDGE. REPLACEMENT OF THE OTHER BRIDGE WILL BE DONE USING A SIMILAR APPROACH. PRE ABC ACTIVITIES MAY PROCEED SIMULTANEOUSLY FOR BOTH BRIDGES. THE ABC WINDOW FOR EACH BRIDGE SHALL OCCUR ON SEPARATE WEEKENDS.

B2. EACH CLOSURE OF THE ROADWAY CROSSING IS EXPECTED TO LAST ONE NIGHT (16 HOURS) TO ALLOW FOR THE RAPID DEMOLITION OF THE EXISTING BRIDGE AND SLIDE-IN OF THE NEW SUPERSTRUCTURE.

B3. CONTRACTOR SHALL PROVIDE A CRITICAL PATH METHOD (CPM) SCHEDULE FOR ALL PRE ABC, ABC, AND POST ABC ACTIVITIES SHOWING HOW THE ACTIVITIES WILL BE MANAGED ON THE TIGHT CONSTRUCTION SITE. IT IS NOTED THAT MANY OF THE PRE ABC STAGING ACTIVITIES CAN RUN CONCURRENTLY TO OTHER ACTIVITIES. CONTRACTOR IS ALERTED THAT MANY ABC STAGING ACTIVITIES REQUIRE OVERLAPPING ACCESS (IN PARTICULAR DEMOLITION OF STRUCTURE AND INSTALLATION OF PRECAST SLEEPER SLAB AND ABUTMENT BACKWALL).

B4. PRE ABC STAGING:

REMOVE ASBESTOS CONTAINING BOND BREAKER AT ABUTMENTS BACKWALLS.

CONSTRUCT ABUTMENT DRILLED SHAFT FOUNDATIONS, COLUMNS, AND CAP BEAMS TO THE SLIDE ELEVATION.

WIDEN THE APPROACHES FROM TWO LANES TO THREE LANES, MATCHING THE ELEVATION OF THE EXISTING ROADWAY.

PLACE PRECAST SLEEPER SLABS ON WIDENED SECTIONS.

ERECT TEMPORARY FALSEWORK WITH SLIDING TRACKS TO THE NORTH OF EACH EXISTING BRIDGE.

CONSTRUCT ABUTMENT BREASTWALLS.

INSTALL FILL TYPE RETAINING WALLS. CONSTRUCT ADJACENT WINGWALLS AT EACH ABUTMENT SIMULTANEOUSLY. BACKFILL ABUTMENTS WITH COMPACTED STRUCTURAL FILL AS WINGWALL CONSTRUCTION PROGRESSES, MAINTAINING BACKFILL TO THE TOP OF THE MOST RECENTLY COMPLETED MODULAR WALL ROW.

ERECT END DIAPHRAGM MODULES WITH SLIDING SHOES.

ERECT NEXT BEAMS AND PRECAST APPROACH SLAB MODULES ON TEMPORARY FALSEWORK.

CAST UHPC LONGITUDINAL CLOSURE POURS.

CAST END DIAPHRAGM CLOSURE POUR.

SETUP DETOUR SIGNS.

B5. ABC STAGING (ABC PERIOD):

CLOSE I-84 AND DIVERT TRAFFIC FROM STRUCTURE ONTO ROUTE 6.

DEMOLISH EXISTING BRIDGE AND REMOVE EXISTING APPROACH SLABS AS SHOWN.

PLACE PRECAST SLEEPER SLABS (CENTER SECTIONS).

RAISE EXISTING TWO LANES OF EXISTING APPROACH ROADWAYS TO THE NEW PROFILE. INSTALL TEMPORARY APPROACH BARRIERS.

SLIDE SUPERSTRUCTURE AND APPROACH SLABS INTO PLACE.

INSTALL EXPANSION JOINTS.

RE-ROUTE TRAFFIC ONTO THE NEW STRUCTURE. (APPROACH SLABS WILL TEMPORARILY CARRY TRAFFIC LOADS, SPANNING IN THE LONGITUDINAL DIRECTION).

B5. POST ABC STAGING:

DEMOLISH TEMPORARY FALSEWORK.

INSTALL WINGWALL CAP SEGMENTS.

BACKFILL BENEATH THE APPROACH SLABS WITH CONTROLLED LOW-STRENGTH FLOWABLE FILL TO CREATE POSITIVE CONTACT BETWEEN THE APPROACH SLABS AND UNDERLYING SUBGRADE.

RAISE THE WIDENED ROADWAY TO THE SAME ELEVATION AS THE RAISED SECTION CARRYING TWO LANES.

APPLY FINAL 2" ASPHALT COURSE ACROSS THE NEW APPROACH ROADWAYS AND BRIDGE TO MEET THE FINAL PROFILE.

INSTALL APPROACH RAILING.

REMOVE TEMPORARY BARRIER.

COMPLETE OTHER APPROACH WORK.

C. APPROXIMATE ABC TIMEFRAME

C1. THERE SHALL BE TWO EQUAL ABC TIME FRAMES, ONE FOR THE REPLACEMENT OF THE EASTBOUND BRIDGE AND ONE FOR THE REPLACEMENT OF THE WESTBOUND BRIDGE. THESE ABC WINDOWS SHALL OCCUR ON SEPARATE WEEKENDS, AS APPROVED BY THE ENGINEER, COMMENCING ON SATURDAY NIGHT AND EXTENDING THROUGH SUNDAY MORNING. THEY COULD BE DONE ON SUCCESSIVE WEEKENDS AS APPROVED BY NYSDOT.

C2. EACH ABC TIME FRAME IS CONSIDERED TO BEGIN WITH THE CLOSURE OF THE EXISTING CROSSING AND TO END WHEN TRAFFIC IS REROUTED OVER THE NEW BRIDGE.

C3. FOLLOWING IS THE PROPOSED SCHEDULE OF THE ANTICIPATED ABC TIME FRAME FOR THE REPLACEMENT OF ONE OF THE I-84 BRIDGES OVER DINGLE RIDGE ROAD.

TIME	BRIDGE ACTIVITY	MAXIMUM ANTICIPATED DURATION
8:00 PM SATURDAY	REROUTE TRAFFIC TO ROUTE 6	-
8:00 PM SATURDAY	REMOVE DECK FROM EXISTING BRIDGE	8 HRS
10:00 PM SATURDAY	PLACE SLEEPER SLABS AND COMMENCE APPROACH WORK	2 HRS
2:00 AM SUNDAY	REMOVE STEEL GIRDERS FROM EXISTING BRIDGE	2 HRS
4:00 AM SUNDAY	REMOVE SUBSTRUCTURE TO ELEVATION BELOW ELEVATION OF SLIDE	4 HRS
8:00 AM SUNDAY	SLIDE IN NEW BRIDGE	4 HRS
12:00 PM SUNDAY	OPEN BRIDGE TO TRAFFIC	-
8:00 PM SATURDAY TO 12:00 PM SUNDAY	ABC TIMEFRAME	18 HRS

TIME DURATION FOR INDIVIDUAL ACTIVITIES MAY VARY. HOWEVER, TOTAL ABC DURATION SHALL NOT EXCEED 18 HOURS.

NOTES:

1. FOR SUGGESTED CONSTRUCTION SEQUENCE STAGES, SHEET NO. S02.

THE STRATEGIC HIGHWAY RESEARCH PROGRAM 2
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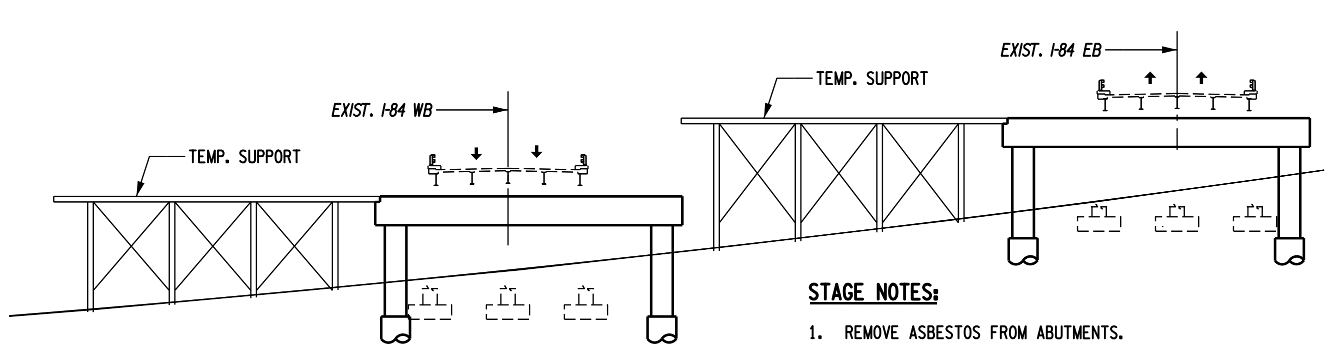
SAMPLE LATERAL SLIDE SYSTEM DETAILS

SUGGESTED CONSTRUCTION SEQUENCE
1 OF 2

HNTB
SEA / ISU / GENESIS SEPTEMBER 2013

DESIGN TEAM

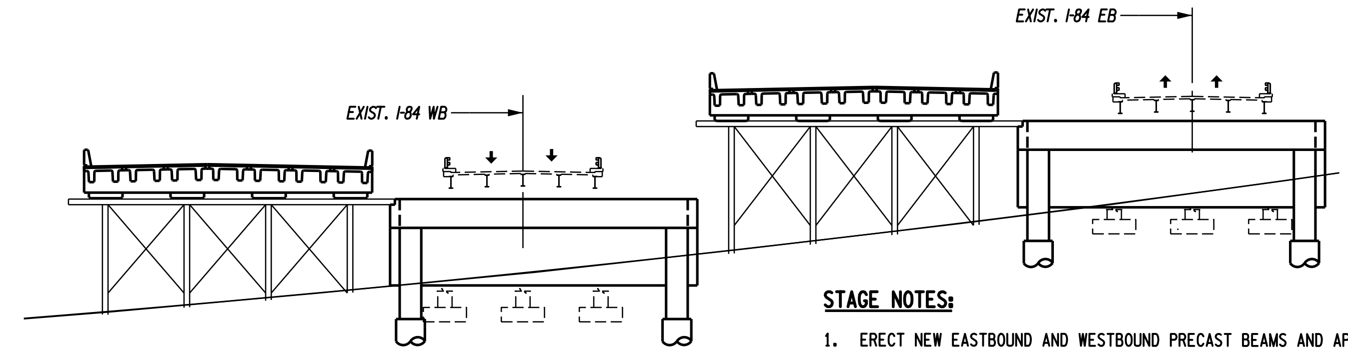
SHEET NUMBER S02



STAGE 1 (PRE-ABC)

STAGE NOTES:

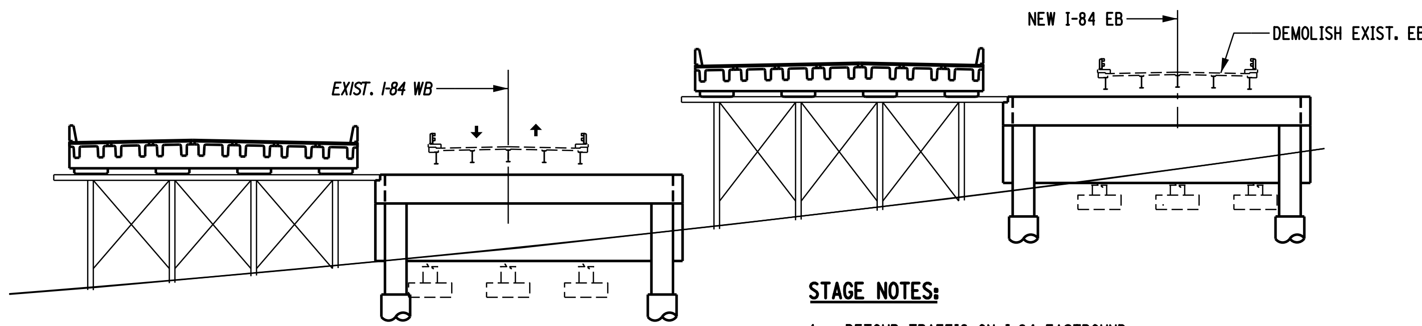
1. REMOVE ASBESTOS FROM ABUTMENTS.
2. INSTALL NEW ABUTMENT DRILLED SHAFTS, COLUMNS AND CAP BEAMS TO SLIDE ELEVATION.
3. WIDEN APPROACHES.
4. INSTALL EASTBOUND TEMPORARY SUPPORTS FOR SUPERSTRUCTURE AND APPROACHES.
5. INSTALL WESTBOUND TEMPORARY SUPPORTS FOR SUPERSTRUCTURE AND APPROACHES.



STAGE 2 (PRE-ABC)

STAGE NOTES:

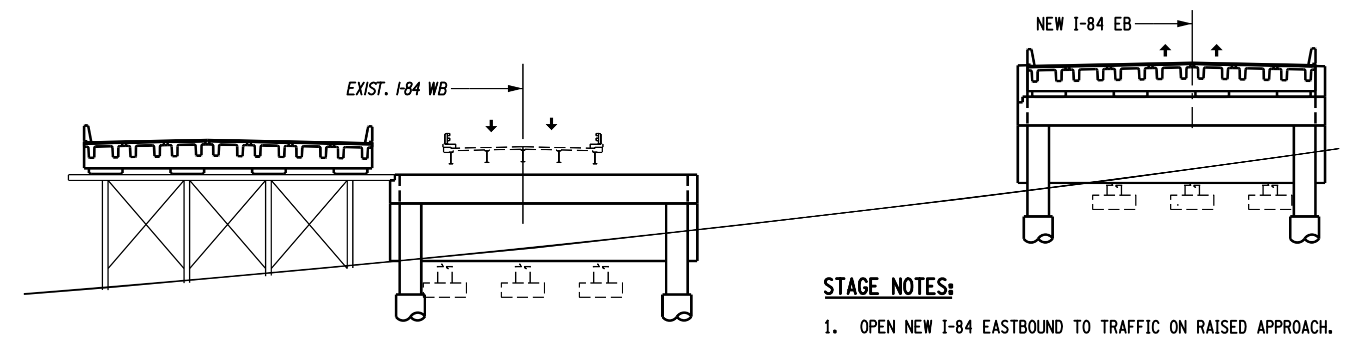
1. ERECT NEW EASTBOUND AND WESTBOUND PRECAST BEAMS AND APPROACH SLABS ON TEMPORARY SUPPORTS.
2. INSTALL ABUTMENT BREAST WALLS AND WINGWALLS, BACKFILL TO SLIDE ELEVATION.



STAGE 3 (ABC PERIOD)
EASTBOUND BRIDGE

STAGE NOTES:

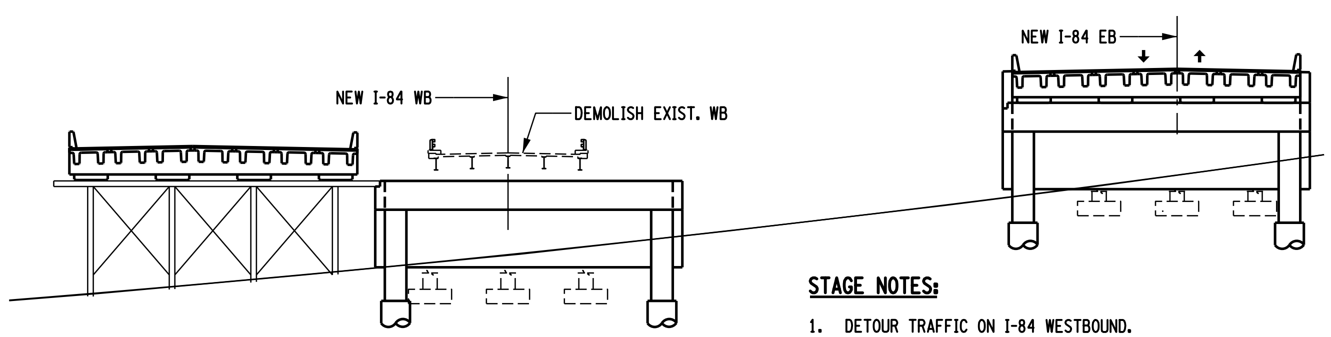
1. DETOUR TRAFFIC ON I-84 EASTBOUND.
2. DEMOLISH EXISTING I-84 EASTBOUND BRIDGE.
3. RAISE EXISTING TWO LANES ON I-84 EASTBOUND APPROACHES.
4. SLIDE-IN NEW I-84 EASTBOUND SUPERSTRUCTURE.



STAGE 4 (POST ABC PERIOD)
EASTBOUND BRIDGE

STAGE NOTES:

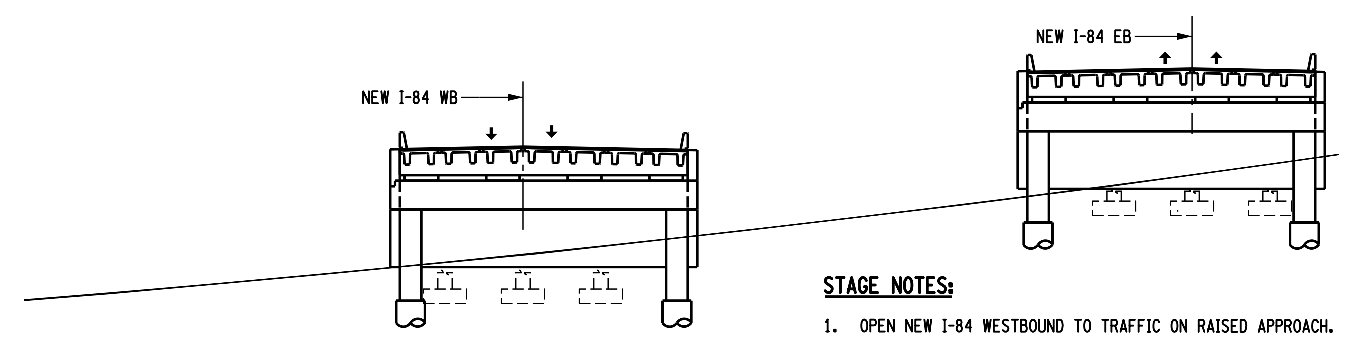
1. OPEN NEW I-84 EASTBOUND TO TRAFFIC ON RAISED APPROACH.
2. DEMOLISH TEMPORARY SUPPORTS.
3. FINISH WINGWALL INSTALLATION ABOVE SLIDE ELEVATION.
4. PUMP FLOWABLE BACKFILL AT EASTBOUND ABUTMENTS.
5. COMPLETE APPROACH WIDENING.



STAGE 5 (ABC PERIOD)
WESTBOUND BRIDGE

STAGE NOTES:

1. DETOUR TRAFFIC ON I-84 WESTBOUND.
2. DEMOLISH EXISTING I-84 WESTBOUND BRIDGE.
3. RAISE EXISTING TWO LANES ON I-84 WESTBOUND APPROACHES.
4. SLIDE-IN NEW I-84 WESTBOUND SUPERSTRUCTURE.



STAGE 6 (POST ABC PERIOD)
WESTBOUND BRIDGE

STAGE NOTES:

1. OPEN NEW I-84 WESTBOUND TO TRAFFIC ON RAISED APPROACH.
2. DEMOLISH TEMPORARY SUPPORTS.
3. FINISH WINGWALL INSTALLATION ABOVE SLIDE ELEVATION.
4. PUMP FLOWABLE BACKFILL AT WESTBOUND ABUTMENTS.
5. COMPLETE APPROACH WIDENING.

NOTES:

1. ALL SECTIONS ARE LOOKING UP STATION TO THE EAST.
2. SEE SHEET NO. S01 FOR GENERAL CONSTRUCTION SEQUENCE.
3. STAGE 3 AND STAGE 5 OCCUR ON SEPARATE WEEKENDS.

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SAMPLE LATERAL SLIDE SYSTEM DETAILS

SUGGESTED CONSTRUCTION SEQUENCE
2 OF 2

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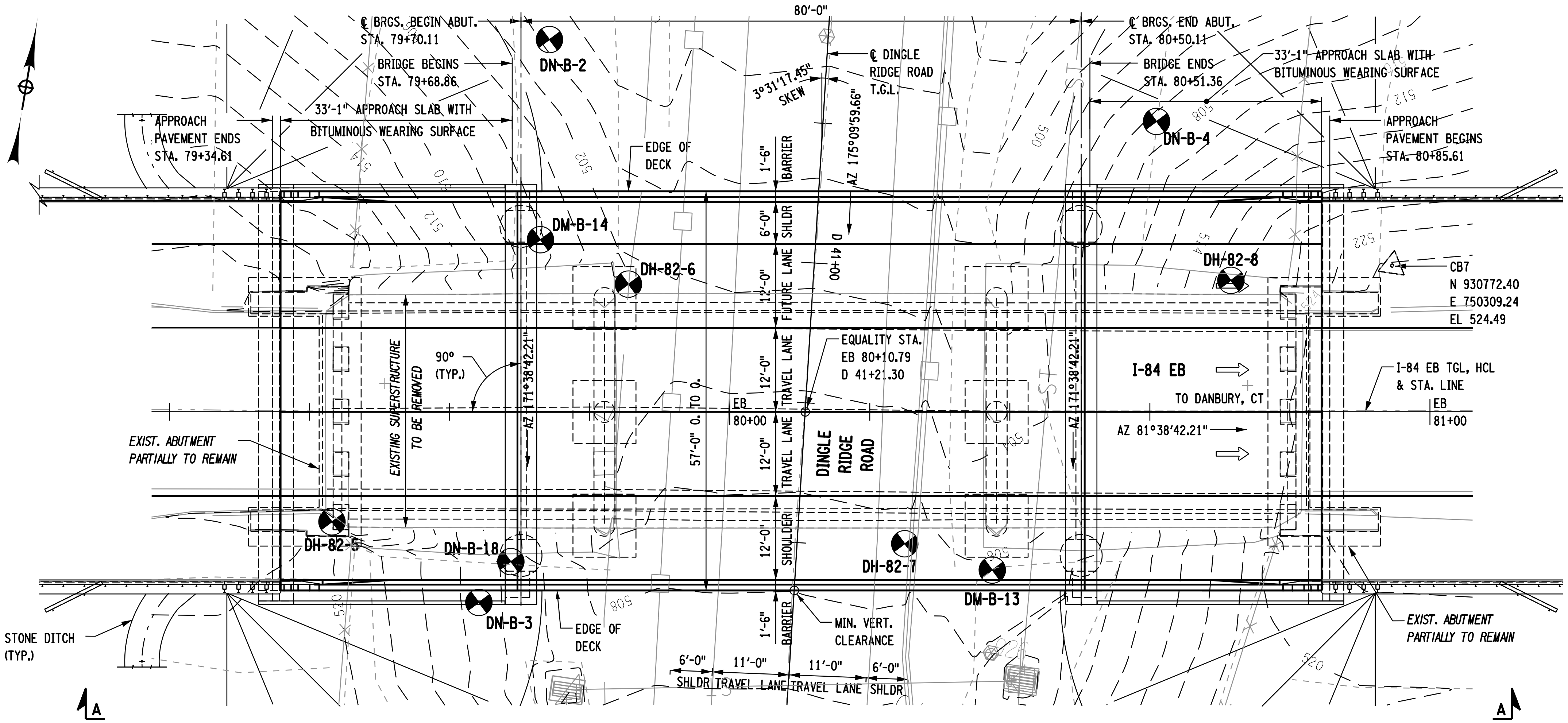
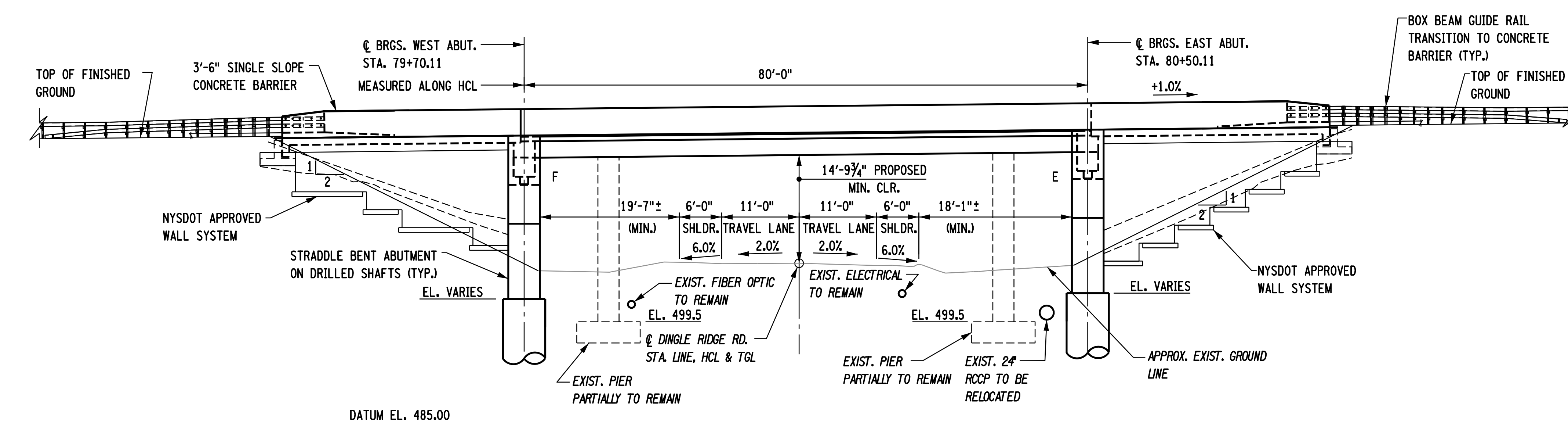


PLAN



ELEVATION A-A

NOTES:

1. FOR GENERAL NOTES, SEE SHEET NO. S01.
2. FOR TYPICAL CROSS SECTIONS, SEE SHEET NOS. S05 AND S06.
3. I-84 WESTBOUND NOT SHOWN. PLAN AND ELEVATION DETAILS FOR BOTH BRIDGES ARE SIMILAR.

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GENERAL PLAN AND ELEVATION

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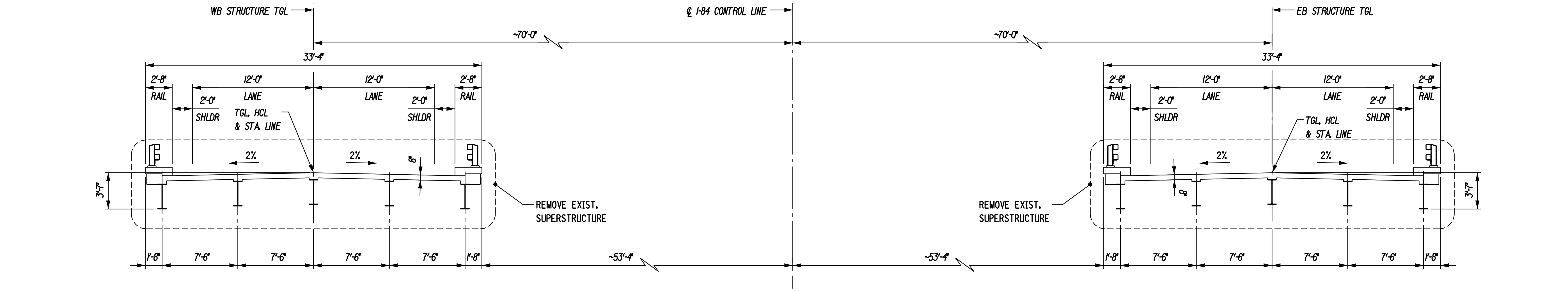
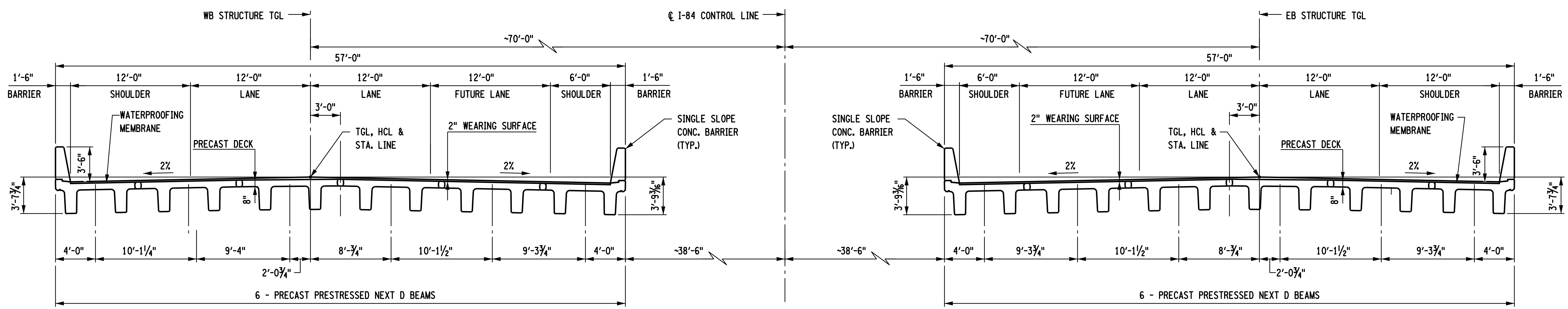
DESIGN TEAM   BIN 1032622   SHEET NUMBER S04



EXISTING STRUCTURES SECTION



PROPOSED STRUCTURES SECTION

NOTES:

1. FOR TYPICAL SECTIONS THROUGH APPROACH SLABS, SEE SHEET NO. S06.
2. FOR EASTBOUND STRUCTURE GENERAL PLAN AND ELEVATION, SEE SHEET NO. S04.

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TYPICAL BRIDGE SECTIONS

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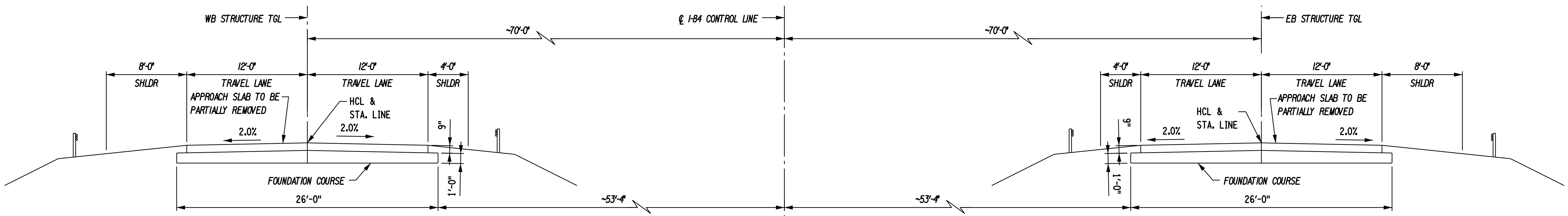
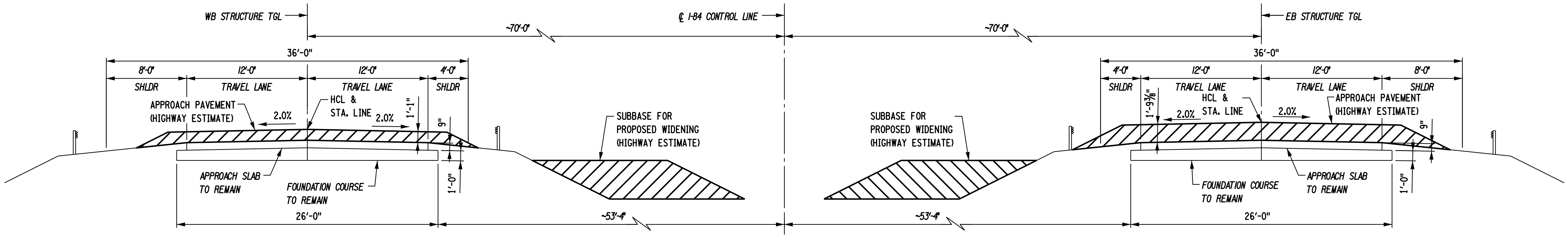
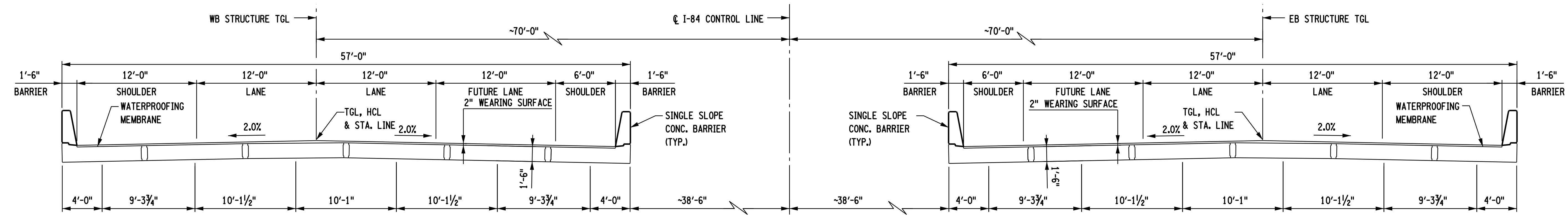
DESIGN TEAM
BIN 1032622
SHEET NUMBER S05



EXISTING APPROACH SLABS SECTION



PROPOSED HIGHWAY SECTION AT EXISTING APPROACH SLAB AT END OF ABC CLOSURE



PROPOSED APPROACH SLABS SECTION

NOTES:

1. FOR TYPICAL SECTIONS THROUGH SUPERSTRUCTURE, SEE SHEET NO. S05.
2. FOR EASTBOUND STRUCTURE GENERAL PLAN AND ELEVATION, SEE SHEET NO. S04.

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TYPICAL APPROACH SLAB SECTIONS

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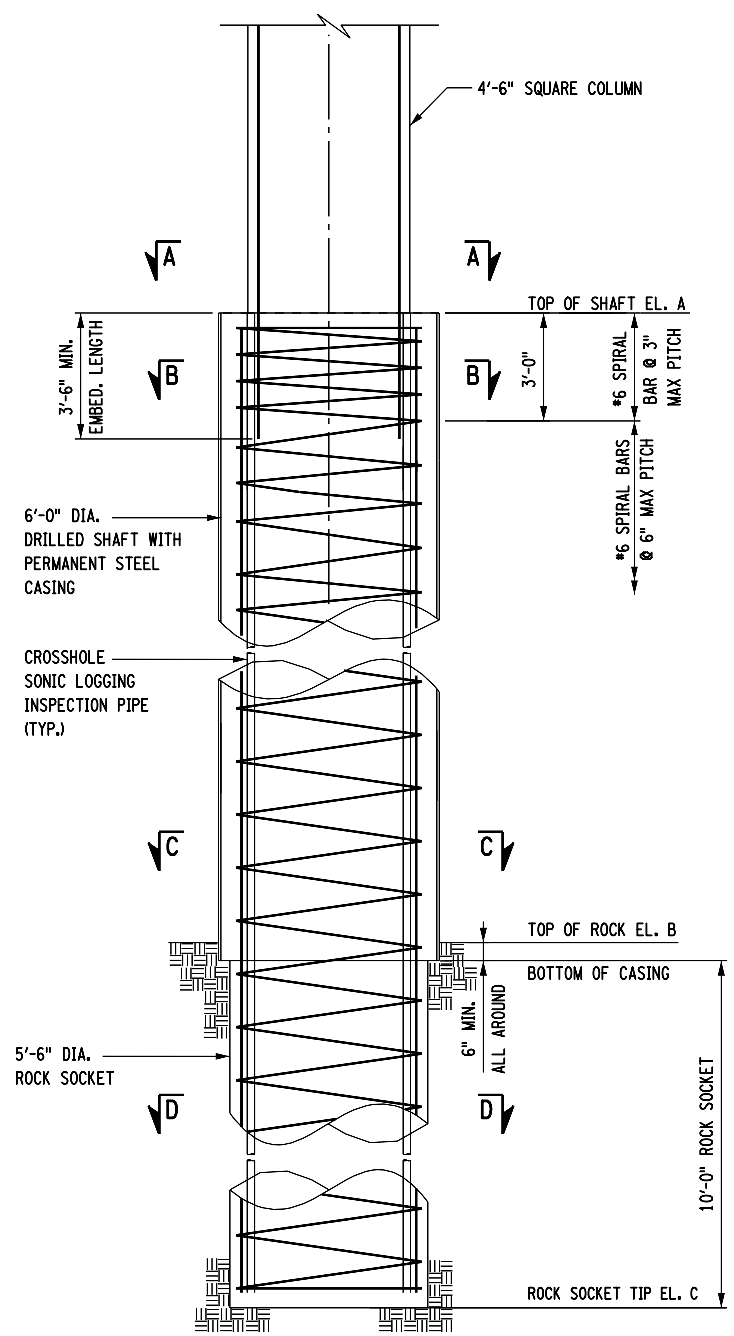
DESIGN TEAM

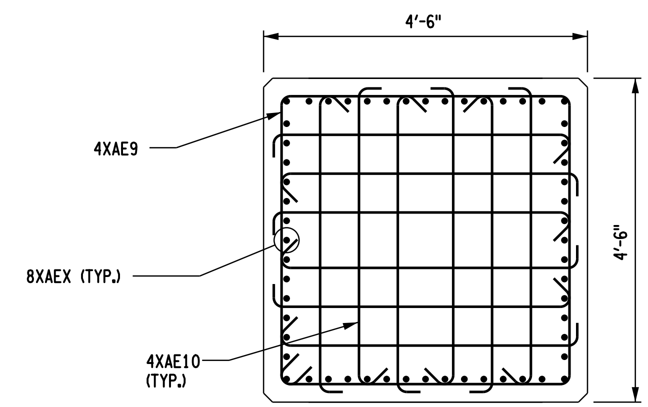
SHEET NUMBER S06

DGN$SYTIME0123456 pella \\nyw00\dept\cadd\45737 TRB\Phase 4 Dingle Ridge Road\S06_sec_typ_EB_appr_slab.dgn



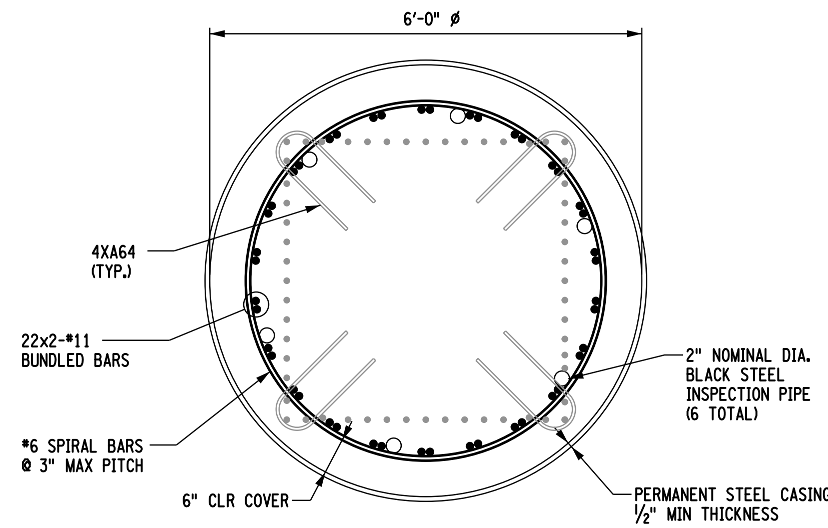
DRILLED SHAFT ELEVATION

3/16" = 1'-0"



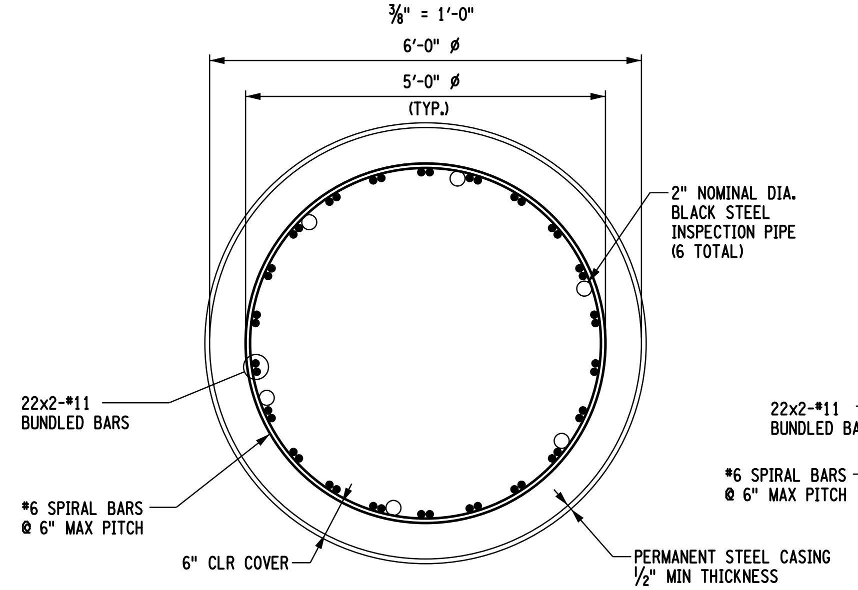
SECTION A-A

3/8" = 1'-0"



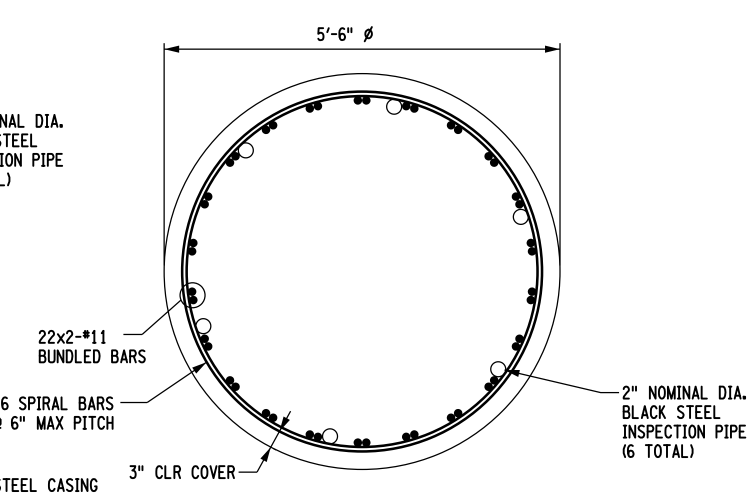
SECTION B-B 6'-0" DRILLED SHAFT

3/8" = 1'-0"



SECTION C-C 6'-0" DRILLED SHAFT

3/8" = 1'-0"



SECTION D-D 5'-6" ROCK SOCKET

3/8" = 1'-0"

DRILLED SHAFT TABLE

	6'-0" DIA. DRILLED SHAFT NO.	REQUIRED GEOTECHNICAL NOMINAL RESISTANCE		TOP OF DRILLED SHAFT EL. A	APPROX. GROUND SURFACE EL.	APPROX. TOP OF SOUND ROCK EL. B	APPROX. ROCK SOCKET TIP EL. C	ACTUAL DRILLED SHAFT LENGTH (FT)
		COMPRESSION (KIPS)	TENSION (KIPS)					
BEGIN ABUTMENT	1	1870	0	503.00	507.03	475.60	465.10	
	2	1840	0	507.00	510.22	496.40	485.90	
END ABUTMENT	1	1900	0	505.00	507.39	472.20	461.70	
	2	1910	0	501.00	505.58	489.20	478.70	

NOTES:

1. ALL DRILLED SHAFT STEEL CASING SHALL MEET THE REQUIREMENTS OF ASTM A252 GRADE 2.
2. A TRIAL SHAFT WILL NOT BE REQUIRED.
3. PERMANENT STEEL CASING, UNCOATED BAR REINFORCEMENT, AND CONCRETE IN DRILLED SHAFTS SHALL BE INCLUDED IN THE UNIT PRICE BID FOR DRILLED SHAFTS.
4. INSPECTION (ACCESS) PIPE AND GROUTING SHALL BE INCLUDED IN THE UNIT PRICE BID FOR CROSSHOLE SONIC LOGGING (CSL) OF DRILLED SHAFTS.
5. ESTIMATED TOP OF ROCK IS PROVIDED IN THE DRILLED SHAFT TABLE ABOVE.
6. AN ENGINEERING GEOLOGIST FROM THE NYSDOT GEOTECHNICAL ENGINEERING BUREAU WILL BE PRESENT ON SITE TO ASCERTAIN THE TOP OF SOUND ROCK DURING DRILLING.
7. ALL SHAFTS WILL BE TESTED TO VERIFY CONCRETE INTEGRITY IN ACCORDANCE WITH CROSSHOLE SONIC LOGGING (CSL) OF DRILLED SHAFTS. DETAIL 6 - 2" NOMINAL DIAMETER SCHEDULE 40 STEEL PIPES FOR CSL TESTING, ATTACHED TO THE INSIDE OF THE REINFORCEMENT CAGE WITH THE BOTTOM OF THE PIPES LOCATED A MAXIMUM OF 4" ABOVE THE BOTTOM OF THE CAGE. SHOW ACCESS PIPES AT 60° INTERVALS, OR AS CLOSE TO 60° AS POSSIBLE.
8. CONDUCT CROSSHOLE SONIC LOGGING (CSL) OF DRILLED SHAFTS ON ALL DRILLED SHAFTS.
9. CONDUCT CSL TESTING WITHIN 3 TO 45 DAYS AFTER CONCRETING EACH SHAFT.
10. AFTER COMPLETION OF THE DRILLED SHAFT INSTALLATION, THE ENGINEER WILL COMPLETE THE "ACTUAL DRILLED SHAFT LENGTH" TABLE FOR INCLUSION IN THE AS BUILT PLANS.
11. ALL ROCK SOCKETS SHALL BE INSPECTED AND APPROVED BY THE ENGINEER PRIOR TO PLACEMENT OF THE REINFORCING CAGE.
12. EQUIPMENT REQUIRED TO INSTALL THE SHAFTS SHALL BE MOBILIZED UNDER FURNISHING EQUIPMENT FOR INSTALLING DRILLED SHAFTS.
13. FINAL BAR LENGTHS TO BE COORDINATED WITH ACTUAL TOP OF SOUND ROCK ELEVATION.
14. PERMANENT CASING SHALL BE ROTATED INTO POSITION AHEAD OF DRILLING. VIBRATING OR OSCILLATING OF CASING SHALL NOT BE PERMITTED.
15. ROCK SOCKET LENGTH SHALL BE MEASURED FROM THE BOTTOM OF PERMANENT CASING. CASED PORTION OF DRILLED SHAFT IN ROCK SHALL NOT BE INCLUDED IN MEASUREMENT OF ROCK SOCKET.

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DRILLED SHAFT DETAILS

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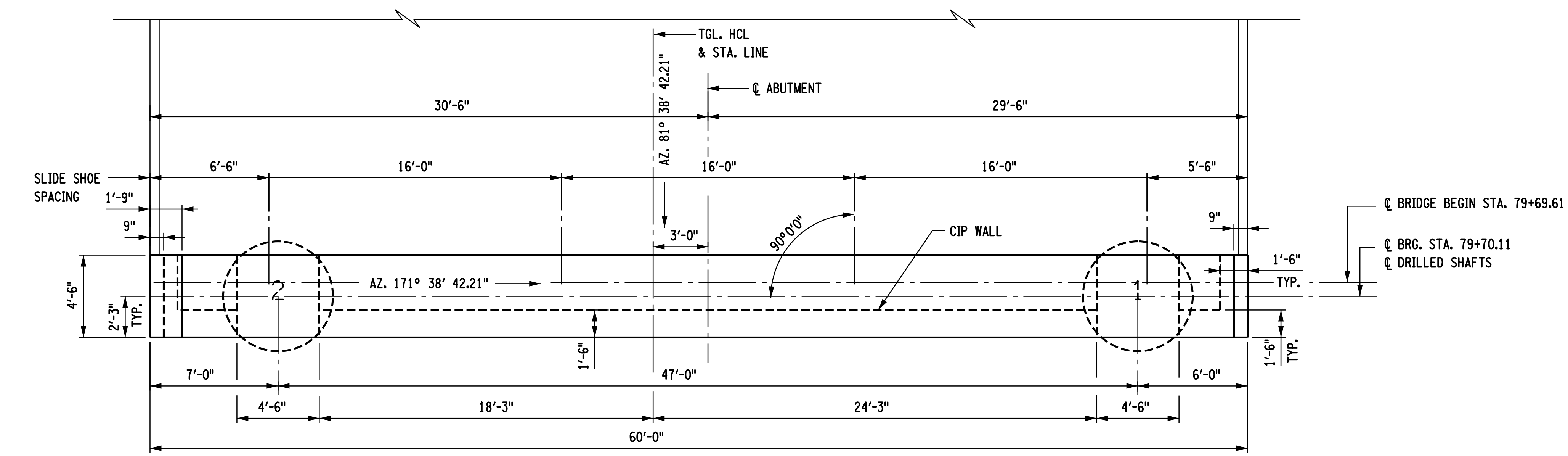
DESIGN TEAM

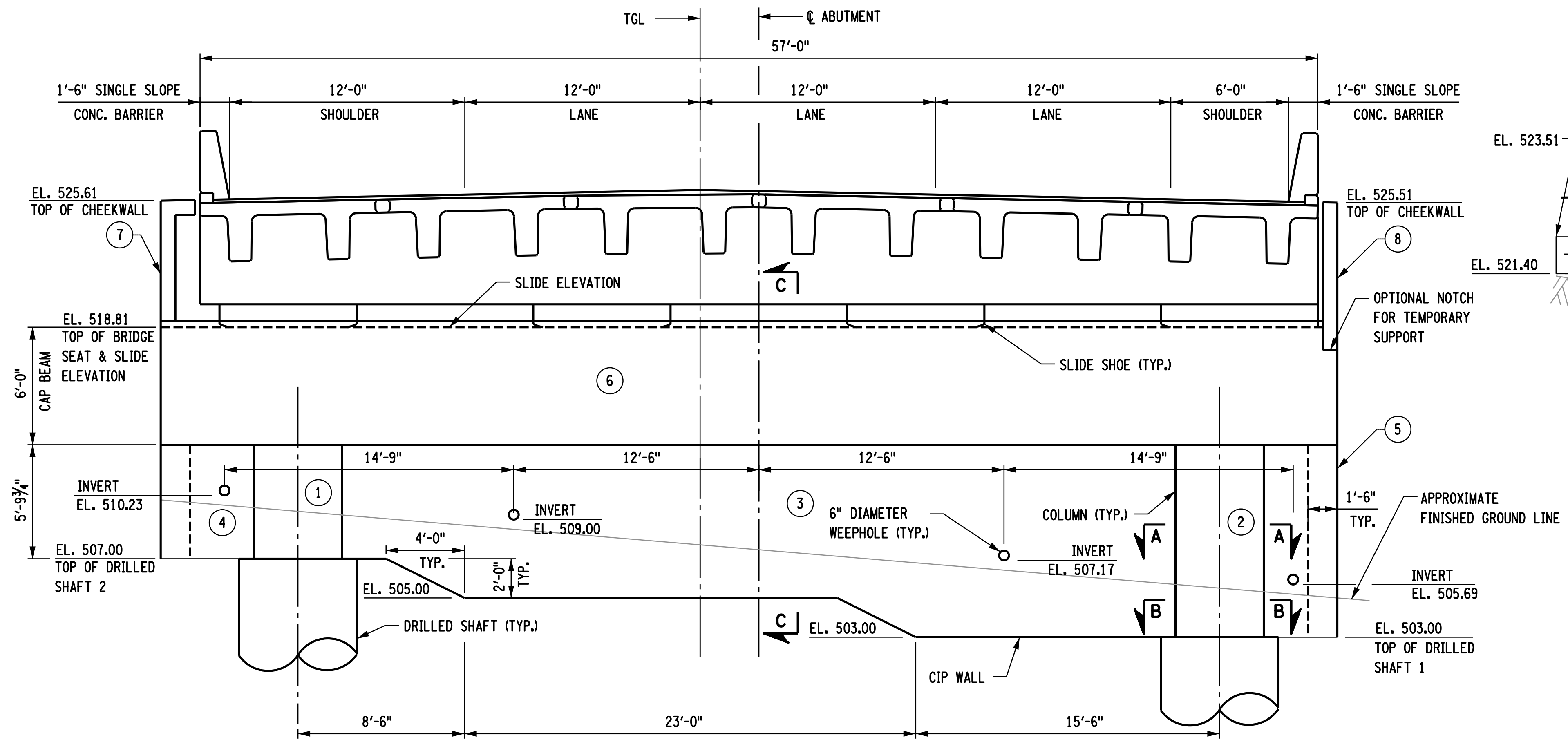
SHEET NUMBER S07



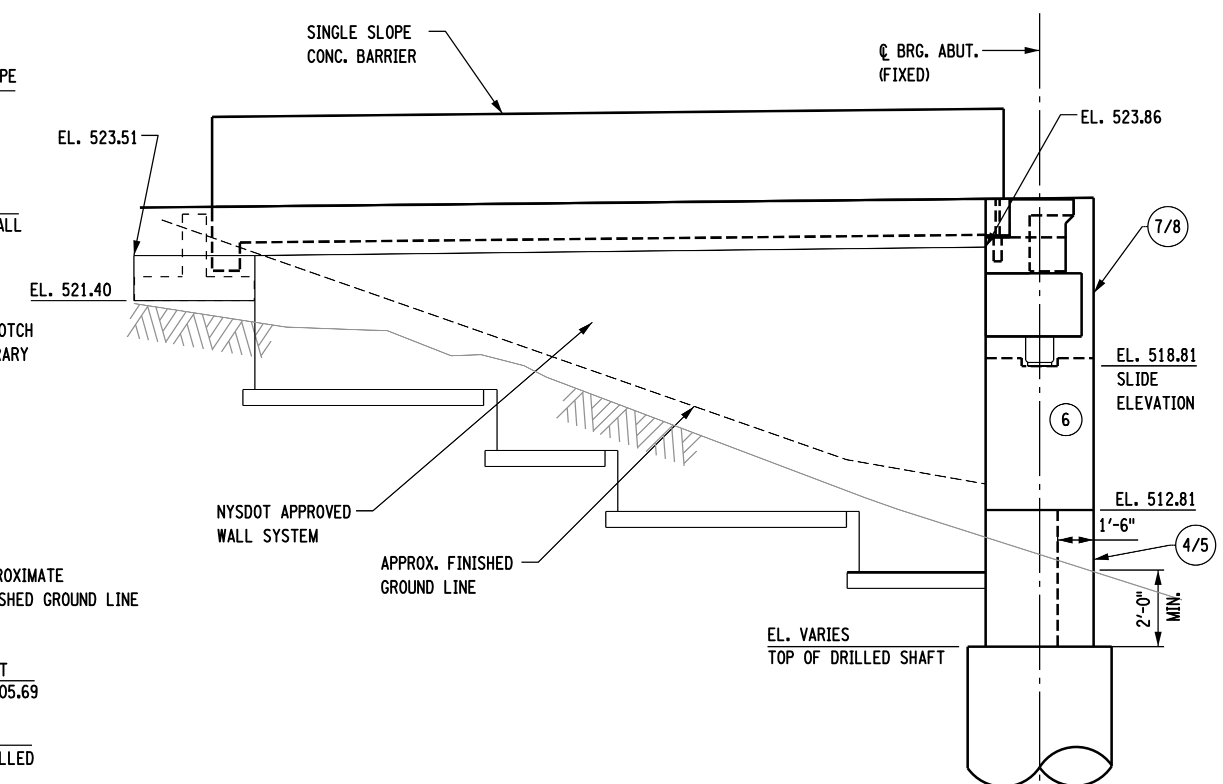
PLAN

NOTES:

1. FOR SECTIONS A-A, B-B AND C-C, SEE SHEET NO. S09.



ELEVATION - LOOKING WEST



SIDE VIEW

LEGEND:

(NO.) INDICATES PLACEMENT NUMBER

N INDICATES DRILLED SHAFT NUMBER

THE STRATEGIC HIGHWAY RESEARCH PROGRAM 2
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BEGIN ABUTMENT
PLAN AND ELEVATION

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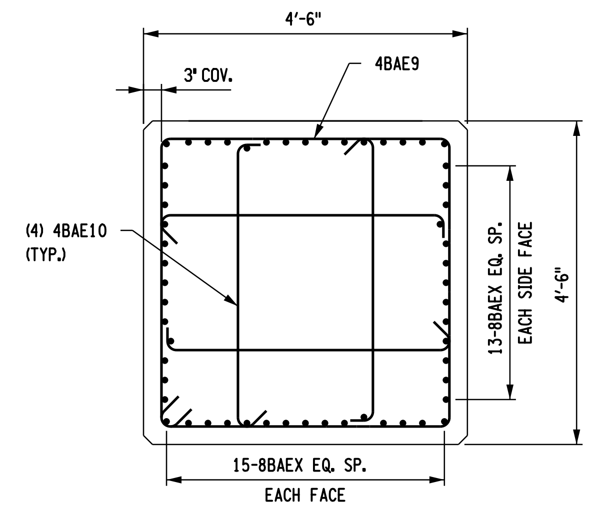
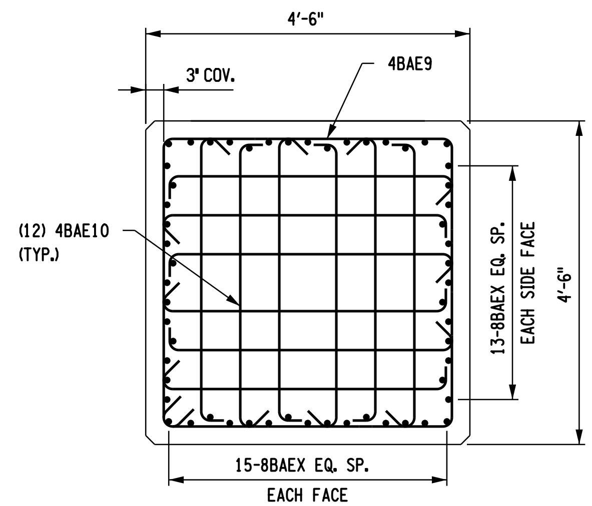
DESIGN TEAM

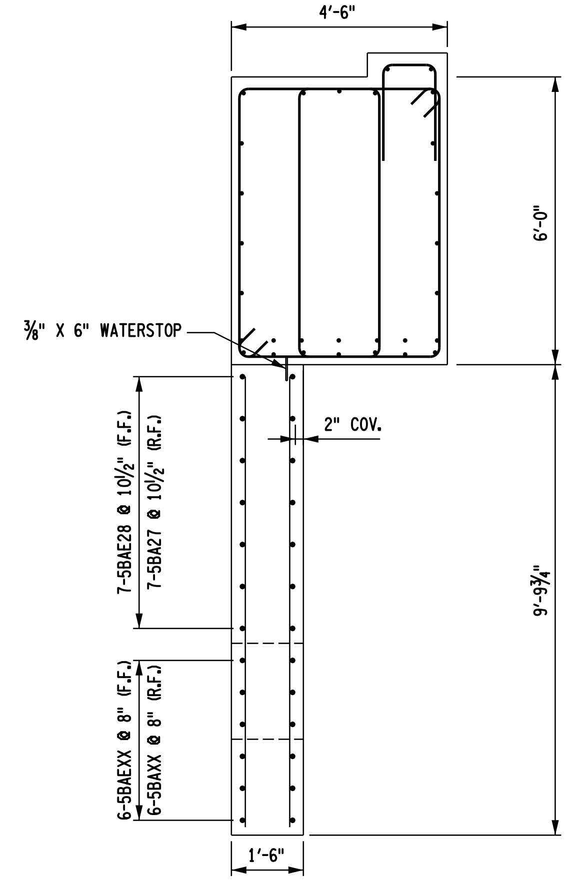
SHEET NUMBER S08



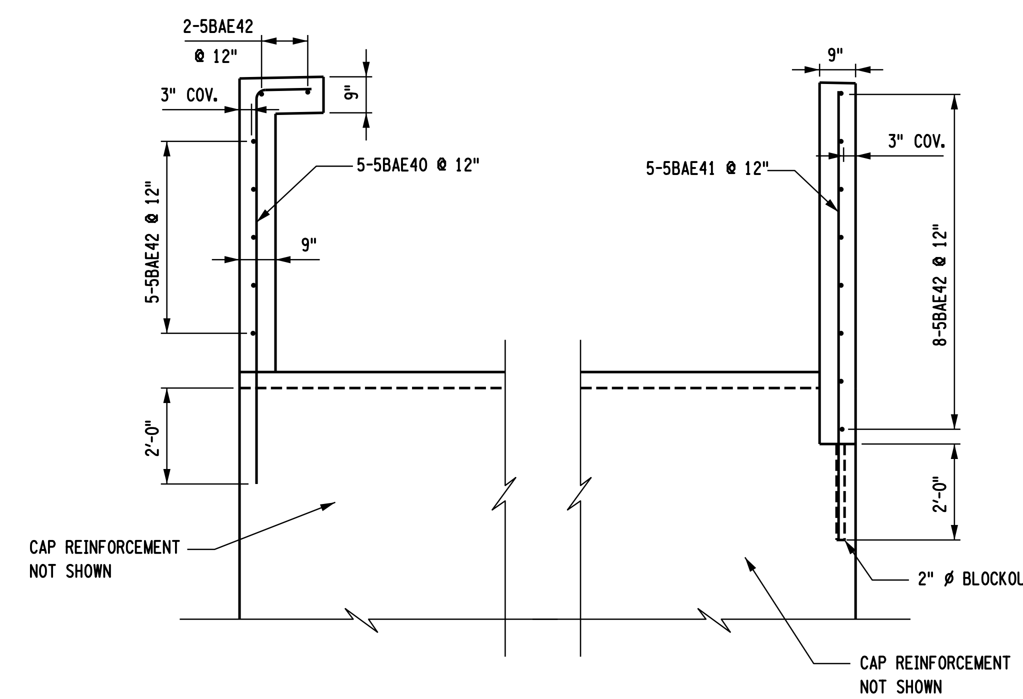
SECTION A-A
3/8" = 1'-0"



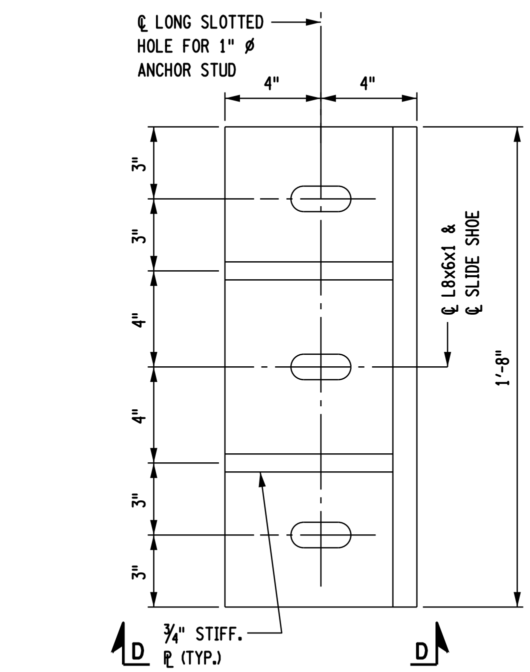
SECTION B-B
3/8" = 1'-0"



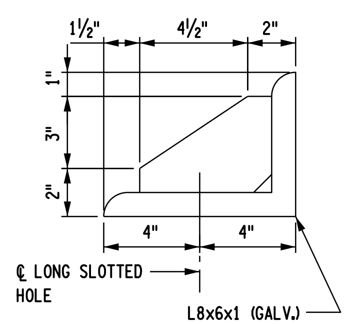
SECTION C-C
1/4" = 1'-0"



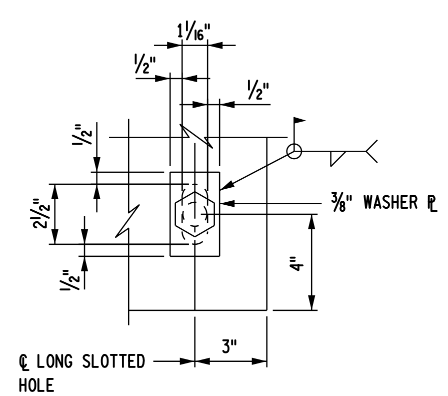
CHEEKWALL DETAILS
1/4" = 1'-0"



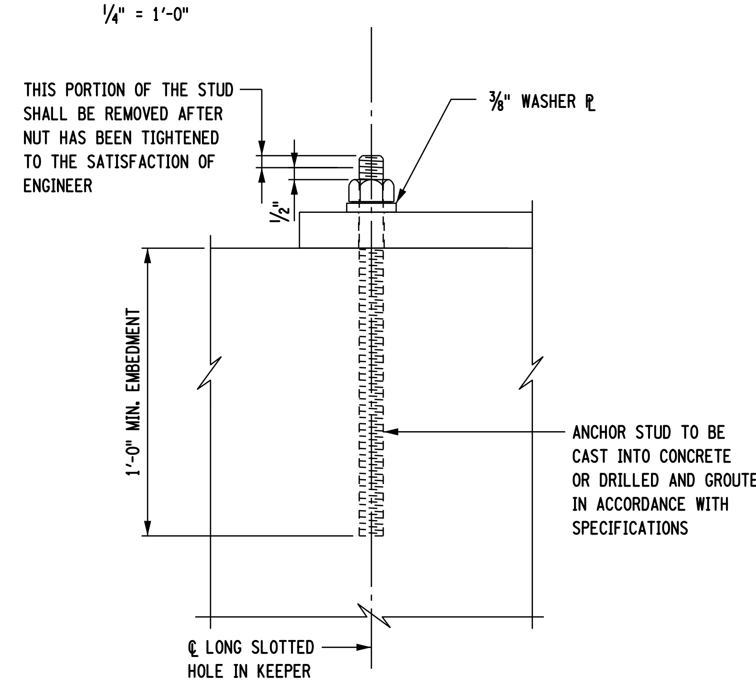
KEEPER ANGLE DETAIL
1 1/2" = 1'-0"



VIEW D-D
1 1/2" = 1'-0"



TYPICAL SLOTTED HOLE DETAIL
FOR 1" Ø ANCHOR
1 1/2" = 1'-0"



ANCHOR STUD
1 1/2" = 1'-0"

NOTES:

1. ANCHOR STUDS SHALL BE ASTM F1554, GRADE 105.
2. ALL STEEL SHALL CONFORM TO ASTM A709, GRADE 50.
3. FOR LOCATION OF SECTIONS A-A, B-B AND C-C, SEE SHEET NO. S08.

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BEGIN ABUTMENT DETAILS

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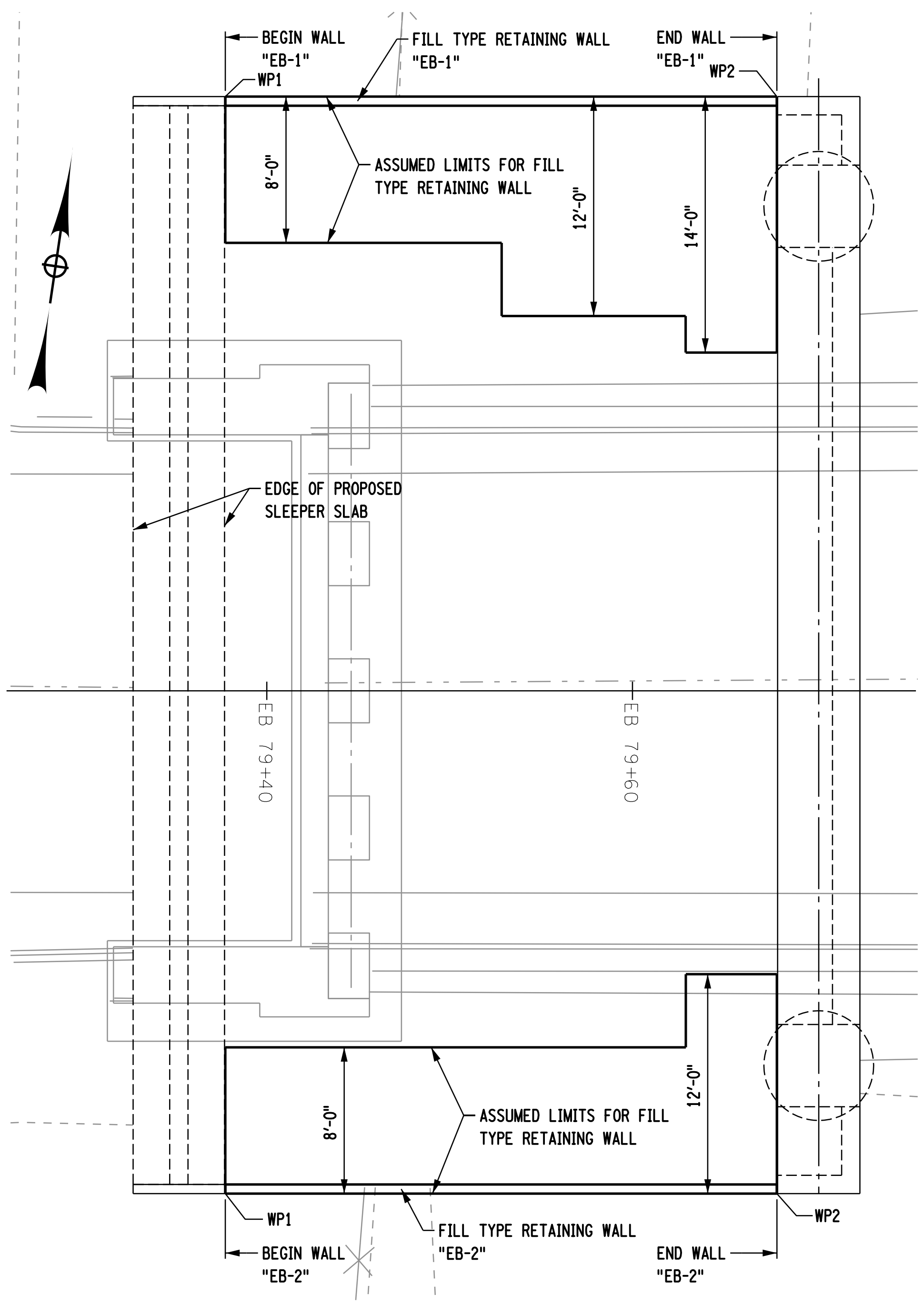
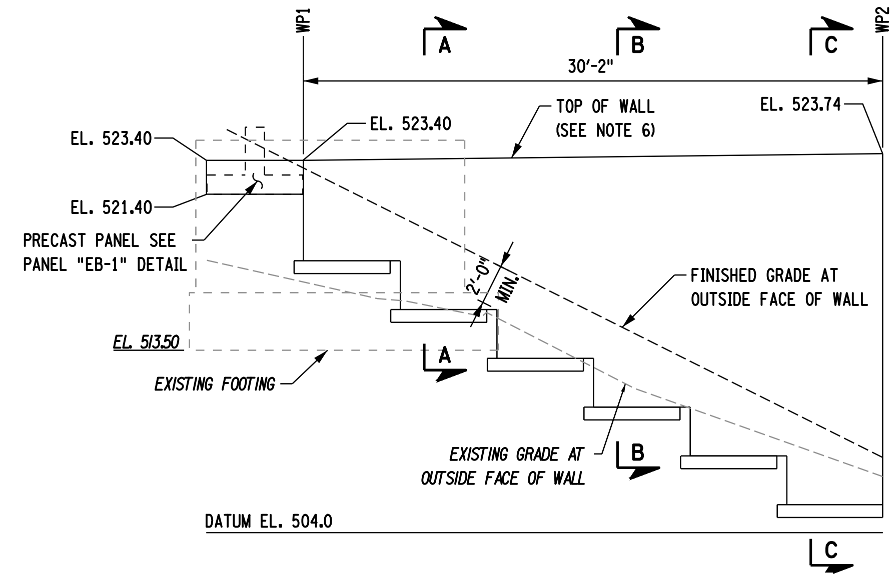
DESIGN TEAM

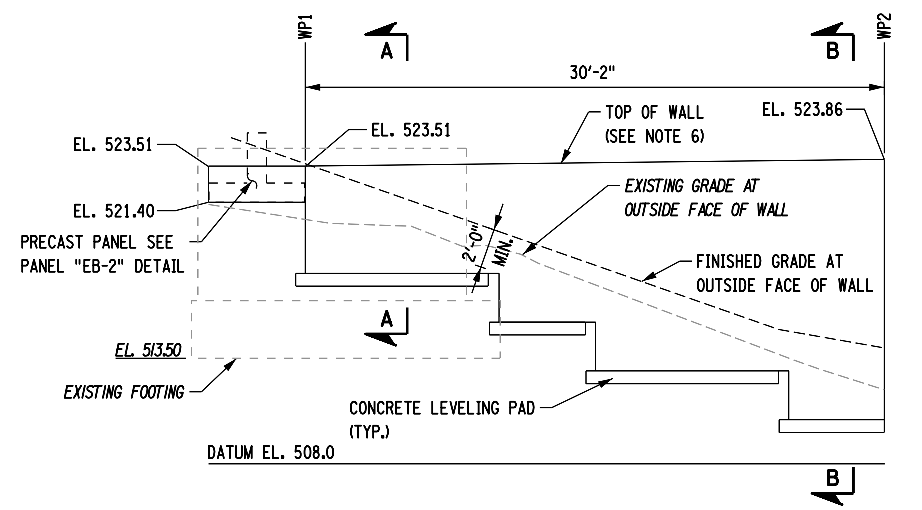
SHEET NUMBER S09



FILL TYPE RETAINING WALL "EB-1" & "EB-2" - PLAN
1" = 10'-0"



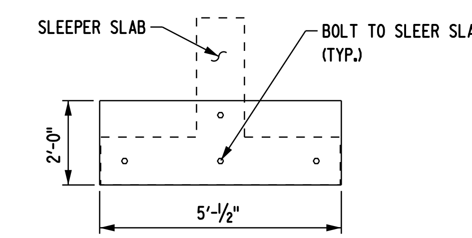
WALL "EB-1" - ELEVATION
1" = 10'-0"



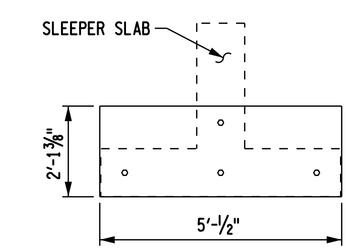
WALL "EB-2" - ELEVATION
1" = 10'-0"

NOTES:

1. WORKPOINTS ARE GIVEN AT OUTSIDE FACE OF RETAINING WALL.
2. LEVELING PAD AND BOTTOM OF FILL TYPE RETAINING WALL ARE SHOWN FOR ILLUSTRATIVE PURPOSES ONLY. CONTRACTOR SHALL VERIFY TOP OF LEVELING PAD/BOTTOM OF WALL ELEVATION AND LEVELING PAD DIMENSIONS BASED ON WALL SYSTEM CHOSEN.
3. BOTTOM OF FILL TYPE RETAINING WALL SHALL BE EMBEDDED A MINIMUM OF TWO (2) FEET BELOW FINISHED GRADE AT OUTSIDE FACE OF WALL, AND NO MORE THAN FIVE (5) FEET BELOW THE ORIGINAL GROUND SURFACE.
4. WHERE THE WINGWALL IS TO INTERSECT WITH THE SLEEPER SLAB, A PRECAST CONCRETE PANEL SHALL BE BOLTED TO THE END OF THE SLEEPER SLAB IN PLACE OF A MODULAR WALL UNIT. THE PANELS SHALL BE INSTALLED FOLLOWING THE BRIDGE SLIDE. THE FINISH AT THE FACE OF THE PANELS SHALL MATCH THAT OF THE ADJACENT WALL UNITS.
5. PROVIDE MINIMUM 3 INCH CLEARANCE BETWEEN THE TOP OF WALL AND BOTTOM OF APPROACH SLAB TO ACCOMMODATE THE SLIDE.



PANEL "EB-1" DETAIL
¼" = 1'-0"



PANEL "EB-2" DETAIL
¼" = 1'-0"

WORKPOINT TABLE - WALL "EB-1"

WORKPOINT	STATION	OFFSET	NORTHING	EASTING
WP1	EB 79+37.71	32.5 L	930761.1037	750152.2887
WP2	EB 79+67.90	32.5 L	930765.4870	750182.1352

WORKPOINT TABLE - WALL "EB-2"

WORKPOINT	STATION	OFFSET	NORTHING	EASTING
WP1	EB 79+37.74	27.5 R	930701.7404	750161.0070
WP2	EB 79+67.90	27.5 R	930706.1238	750190.8535

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BEGIN ABUTMENT
WINGWALL PLAN AND ELEVATION

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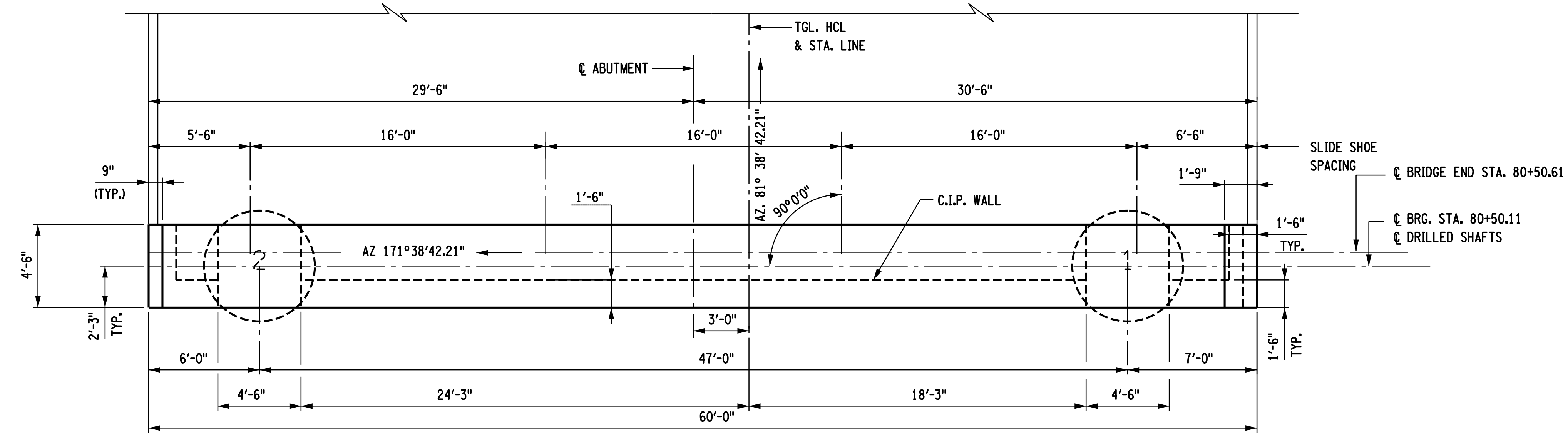
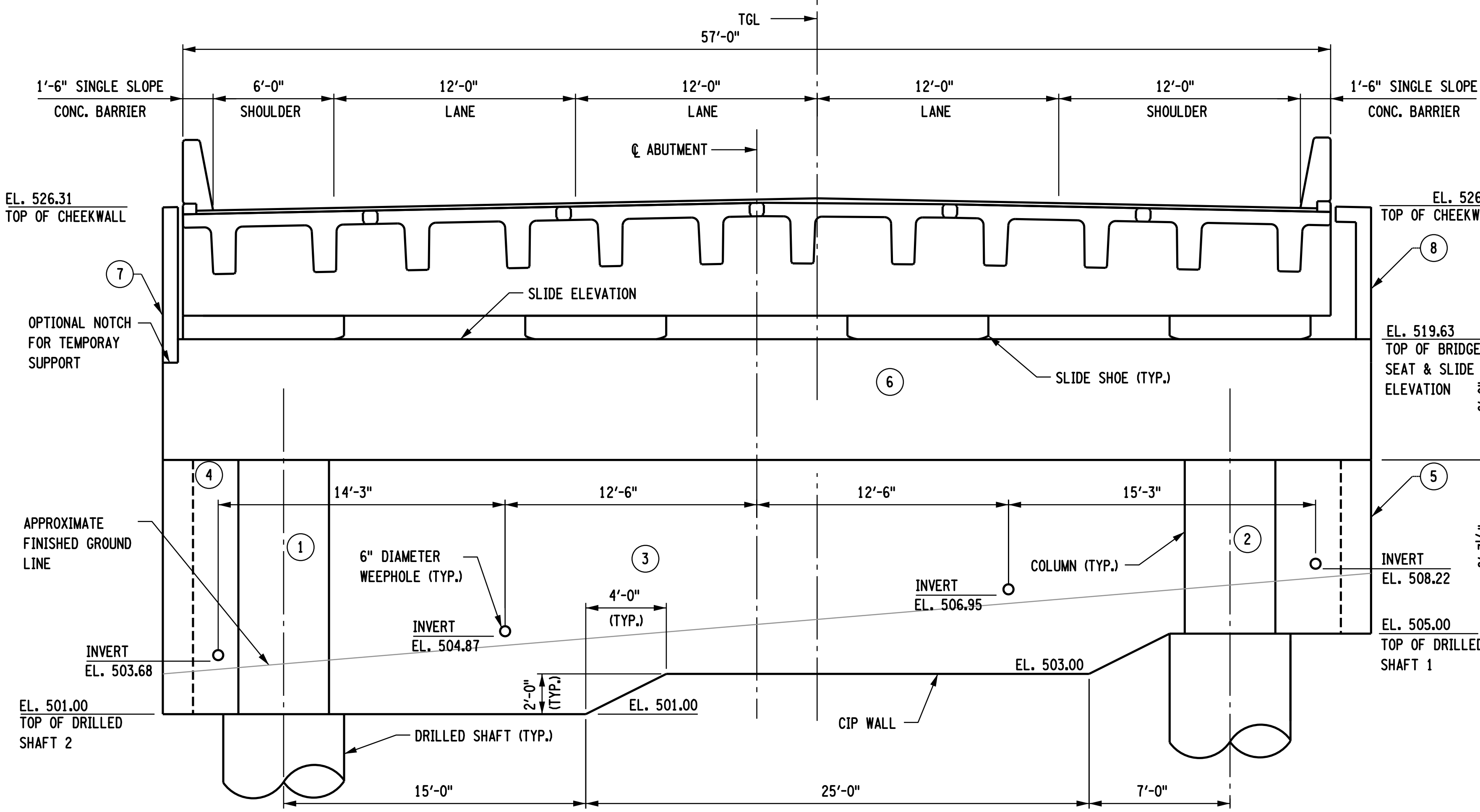
DESIGN TEAM

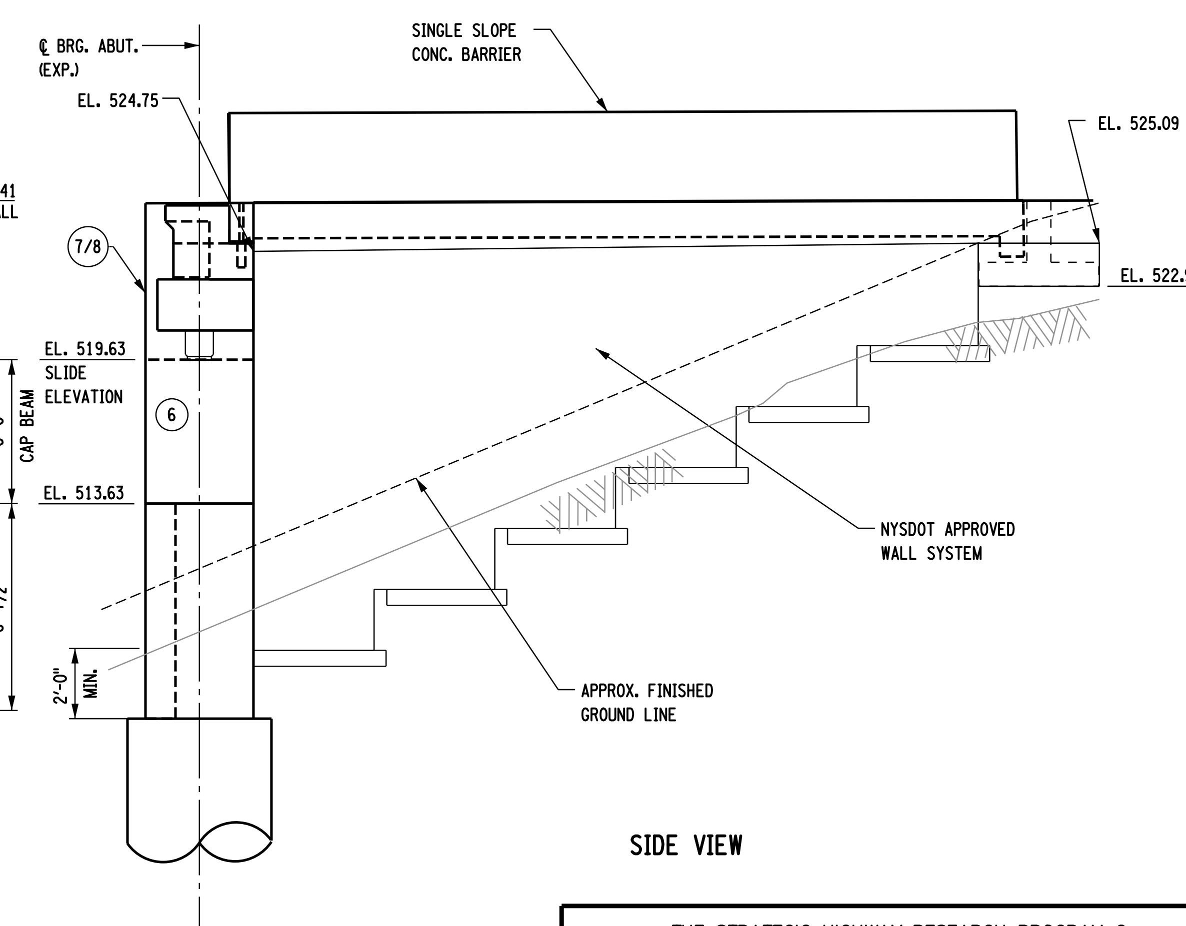
SHEET NUMBER S10



PLAN



ELEVATION - LOOKING EAST



SIDE VIEW

LEGEND:

(NO.) INDICATES PLACEMENT NUMBER

N INDICATES DRILLED SHAFT NUMBER

THE STRATEGIC HIGHWAY RESEARCH PROGRAM 2
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END ABUTMENT
PLAN AND ELEVATION

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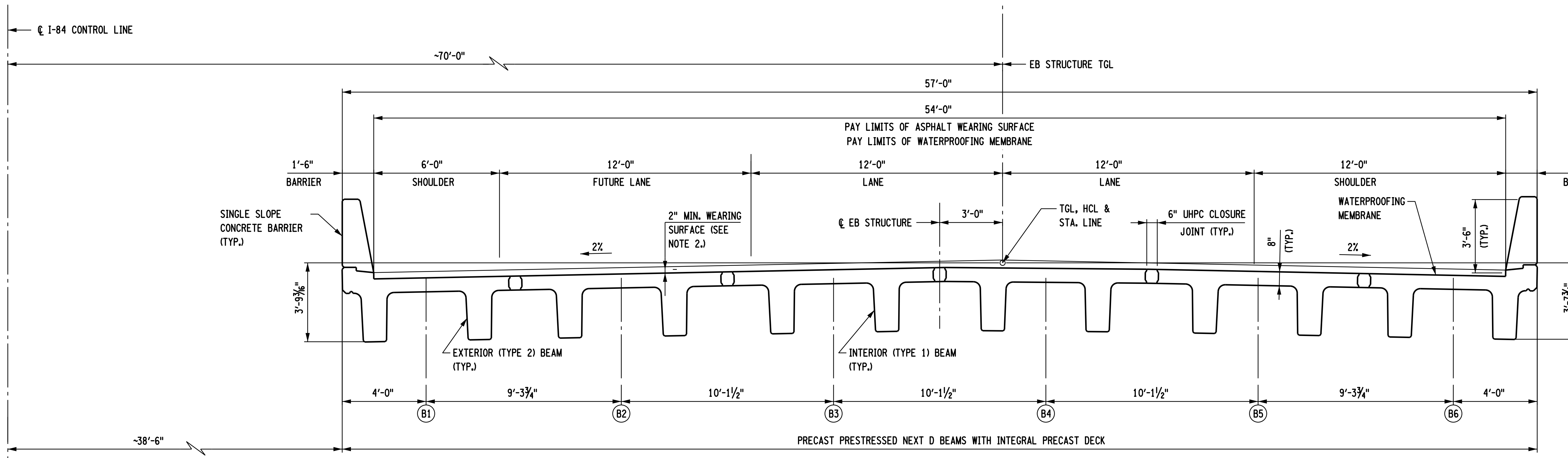
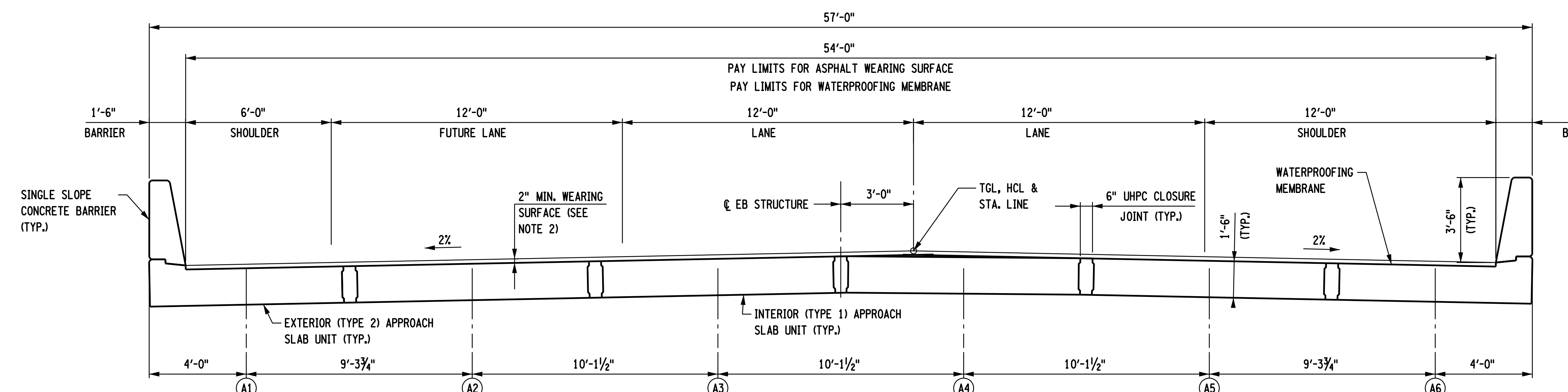
DESIGN TEAM

SHEET NUMBER S11



STRUCTURE TYPICAL SECTION

3/16" = 1'-0"



APPROACH TYPICAL SECTION

(BEGIN APPROACH SLAB SHOWN; END APPROACH SLAB SIMILAR)

3/16" = 1'-0"

NOTES:

1. PRECAST PRESTRESSED BEAMS ARE BASED ON PCINE NEXT "D" BEAM DETAILS.
2. WEARING SURFACE THICKNESS VARIES FROM 2" MINIMUM THICKNESS AT THE TGL TO PROVIDE CONSTANT CROSS-SLOPE IN THE FINAL CONDITION.
3. FOR UHPC CLOSURE JOINT DETAILS, SEE SHEET NO. S13.

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SUPERSTRUCTURE
TYPICAL CROSS SECTIONS

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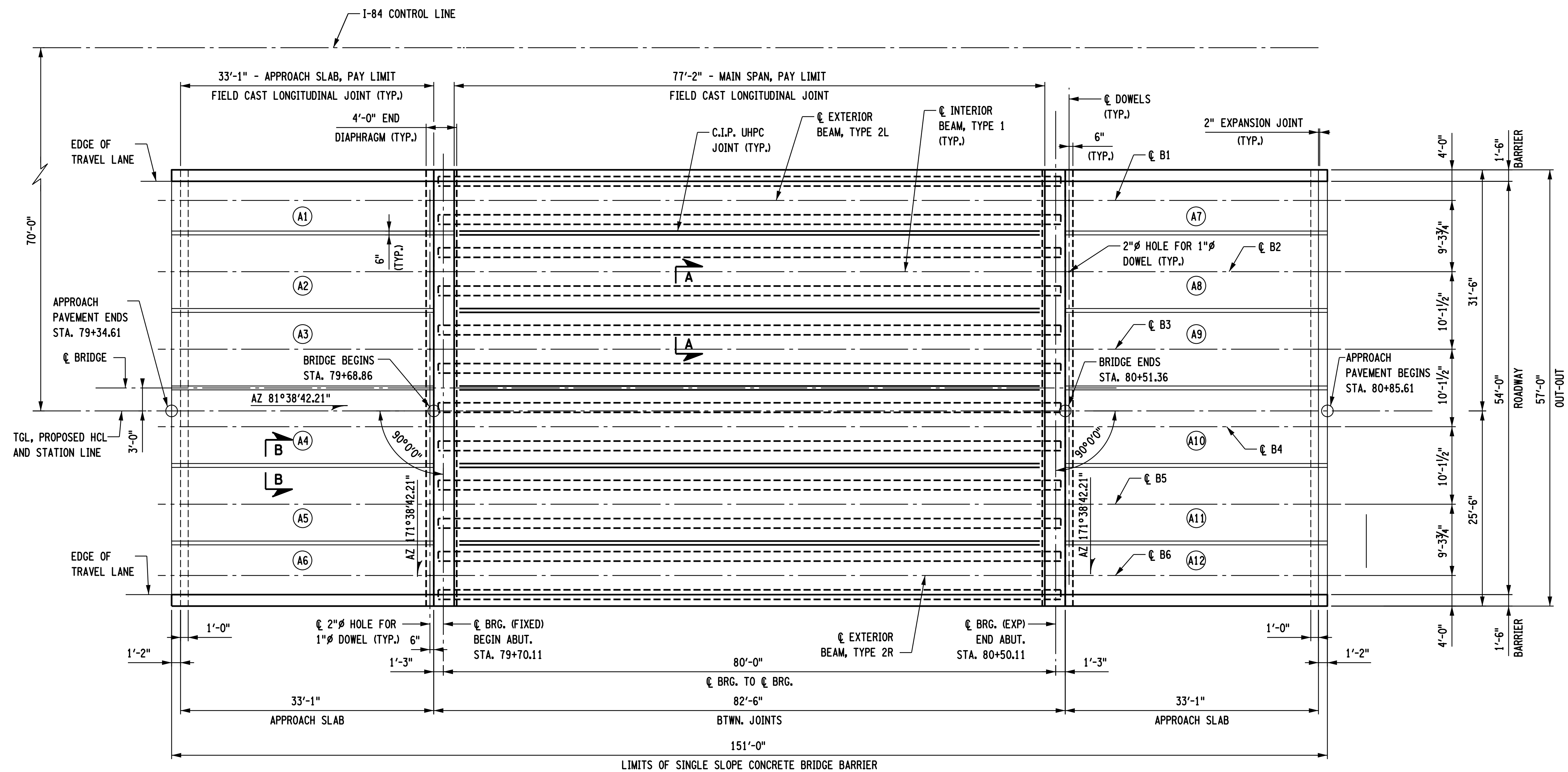
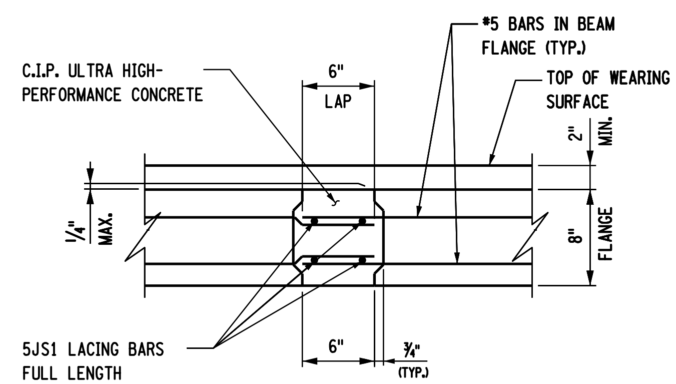
DESIGN TEAM

SHEET NUMBER S12

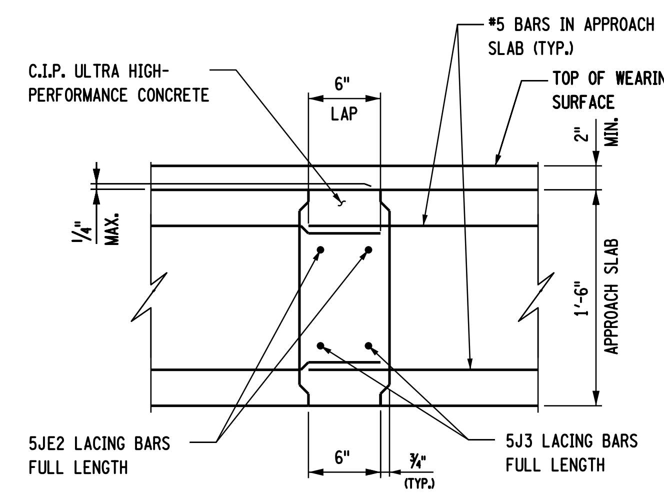
DGN$SYTIME0123456 pella \\nyw00\dept\cadd\45737 TRB\Phase 4 Dingle Ridge Road\S12_sec_trn_EB_sup_sect.dgn



SUPERSTRUCTURE PLAN
$\frac{1}{16}$" = 1'-0"



SECTION A-A
¾" = 1'-0"



SECTION B-B
¾" = 1'-0"

NOTES:

1. FOR PRECAST BEAM DETAILS, SEE SHEET NOS. S15 AND S16.
2. FOR END DIAPHRAGM DETAILS, SEE SHEET NO. S17.
3. FOR APPROACH SLAB DETAILS, SEE SHEET NO. S20.
4. MAXIMUM DIFFERENTIAL ELEVATION BETWEEN FLANGE TIPS OF ADJACENT BEAMS AT ANY POINT ALONG THE LENGTH OF A LONGITUDINAL CLOSURE JOINT IS ¼".
5. CORRECTIONS SHALL BE MADE BY ADJUSTING THE BEARING ELEVATIONS AT ONE OR BOTH ENDS OF THE BEAMS USING STAINLESS STEEL SHIMS TO SATISFY THIS REQUIREMENT. SHIMS USED FOR THIS PURPOSE ARE CONSIDERED INCIDENTAL TO BEAM ERECTION.
6. REDUCING EXCESSIVE DIFFERENTIAL ELEVATION BY OTHER METHODS, SUCH AS GRINDING, JACKING, AND BALLASTING, SHALL NOT BE USED WITHOUT APPROVAL OF THE OWNER OR OWNER'S REPRESENTATIVE. IF APPROVED, THE ALTERNATE METHOD(S) SHALL BE EXECUTED AT NO ADDITIONAL COST TO THE OWNER.

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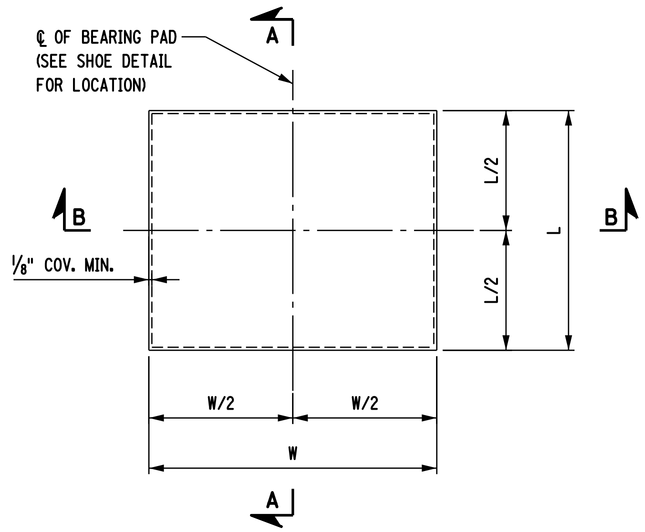
ACCELERATED BRIDGE CONSTRUCTION
SAMPLE LATERAL SLIDE SYSTEM DETAILS

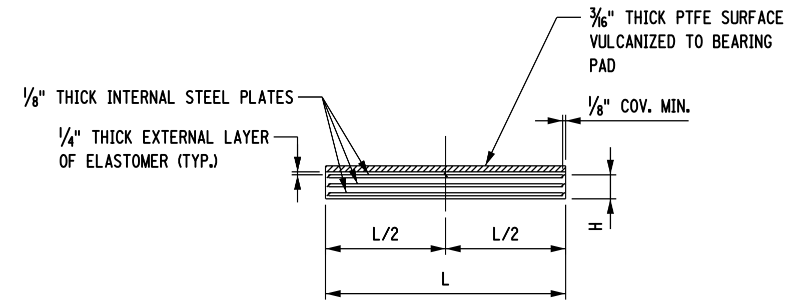
SUPERSTRUCTURE
BEAM AND SLAB LAYOUT

HNTB
SEA / ISU / GENESIS SEPTEMBER 2013

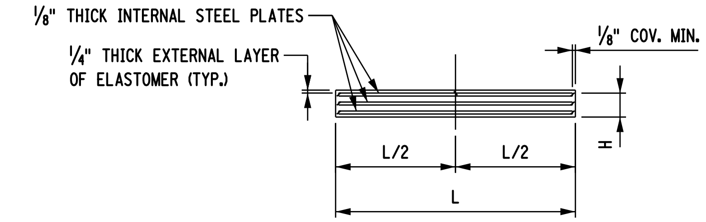
DESIGN TEAM



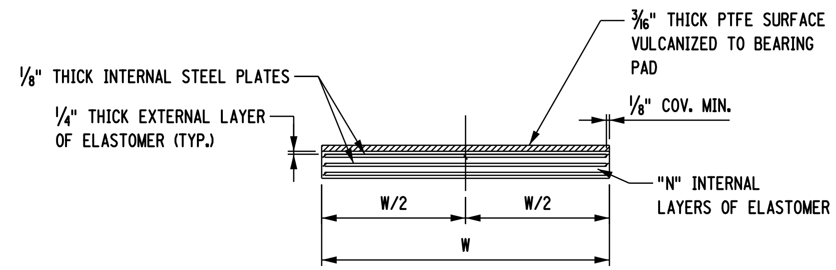
PLAN
STEEL LAMINATED ELASTOMERIC BEARING



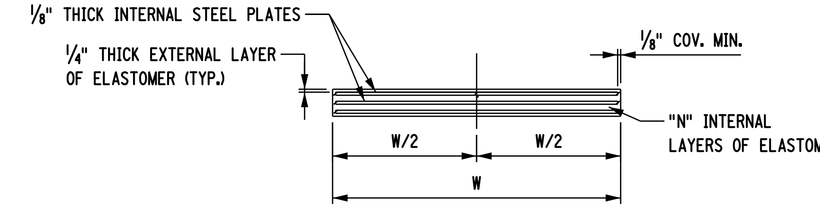
SECTION A-A
(PTFE SLIDING)



SECTION A-A
(E.L. BEARING)



SECTION B-B
(PTFE SLIDING)



SECTION B-B
(E.L. BEARING)

STEEL LAMINATED ELASTOMERIC BEARING TABLE (BEAM BEARINGS)

LOCATION	ITEM NO.	QUANTITY REQUIRED	D.L. + S.D.L. (KIPS)	L.L. WITHOUT IMPACT (KIPS)	TOTAL DESIGN REACTION (KIPS)	SHAPE FACTOR	INTERNAL ELASTOMER LAYER (IN.)				HRT (IN.)	COMP. AREA (SQ. IN.)	SHEAR. AREA (SQ. IN.)	BRG. H (IN.)	ANCHOR DOWEL DIAMETER (IN.)
							THK/LAYER	NO. LAYERS	L	W					
BEG. ABUTMENT E.B.	---	12	44.0	42.7	86.7	6.2	1/2	2	16	10	1 1/2	153.6	160.0	1 7/8	---
END. ABUTMENT E.B.	---	12	44.0	42.7	86.7	6.2	1/2	2	16	10	1 1/2	153.6	160.0	1 7/8	---
BEG. ABUTMENT W.B.	---	12	44.0	42.7	86.7	6.2	1/2	2	16	10	1 1/2	153.6	160.0	1 7/8	---
END. ABUTMENT W.B.	---	12	44.0	42.7	86.7	6.2	1/2	2	16	10	1 1/2	153.6	160.0	1 7/8	---

PTFE SLIDING, STEEL LAMINATED ELASTOMERIC BEARING TABLE (SLIDE SHOE BEARINGS)

LOCATION	ITEM NO.	QUANTITY REQUIRED	D.L. + S.D.L. (KIPS)	L.L. WITHOUT IMPACT (KIPS)	TOTAL DESIGN REACTION (KIPS)	SHAPE FACTOR	INTERNAL ELASTOMER LAYER (IN.)				HRT (IN.)	COMP. AREA (SQ. IN.)	SHEAR. AREA (SQ. IN.)	BRG. H (IN.)	FRICTION COEFFICIENT	ANCHOR DOWEL DIAMETER (IN.)
							THK/LAYER	NO. LAYERS	L	W						
BEG. ABUTMENT E.B.	---	12	75.3	38.5	113.8	6.7	1/2	2	12	15	1 1/2	173.3	180.0	1 7/8	7%	---
END. ABUTMENT E.B.	---	12	75.3	38.5	113.8	6.7	1/2	2	12	15	1 1/2	173.3	180.0	1 7/8	7%	---
BEG. ABUTMENT W.B.	---	12	75.3	38.5	113.8	6.7	1/2	2	12	15	1 1/2	173.3	180.0	1 7/8	7%	---
END. ABUTMENT W.B.	---	12	75.3	38.5	113.8	6.7	1/2	2	12	15	1 1/2	173.3	180.0	1 7/8	7%	---

NOTES:

1. ALL ELASTOMER SHALL BE 50 DUROMETER HARDNESS ON THE SHORE A SCALE.
2. THE MAXIMUM VARIATION FROM PERFECT ALIGNMENT UNDER FULL DEAD LOAD SHALL NOT EXCEED 3/16". THIS VARIATION SHALL BE MEASURED AS THE HORIZONTAL DISTANCE BETWEEN THE CENTERLINE OF THE HIGHEST ELASTOMER SURFACE AND THE CENTERLINE OF THE LOWEST ELASTOMER SURFACE.
3. ALL EXTERNAL ELASTOMER LAYERS ARE ONE-HALF THE THICKNESS OF THE INTERNAL ELASTOMER LAYERS.

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BEARING PAD DETAILS

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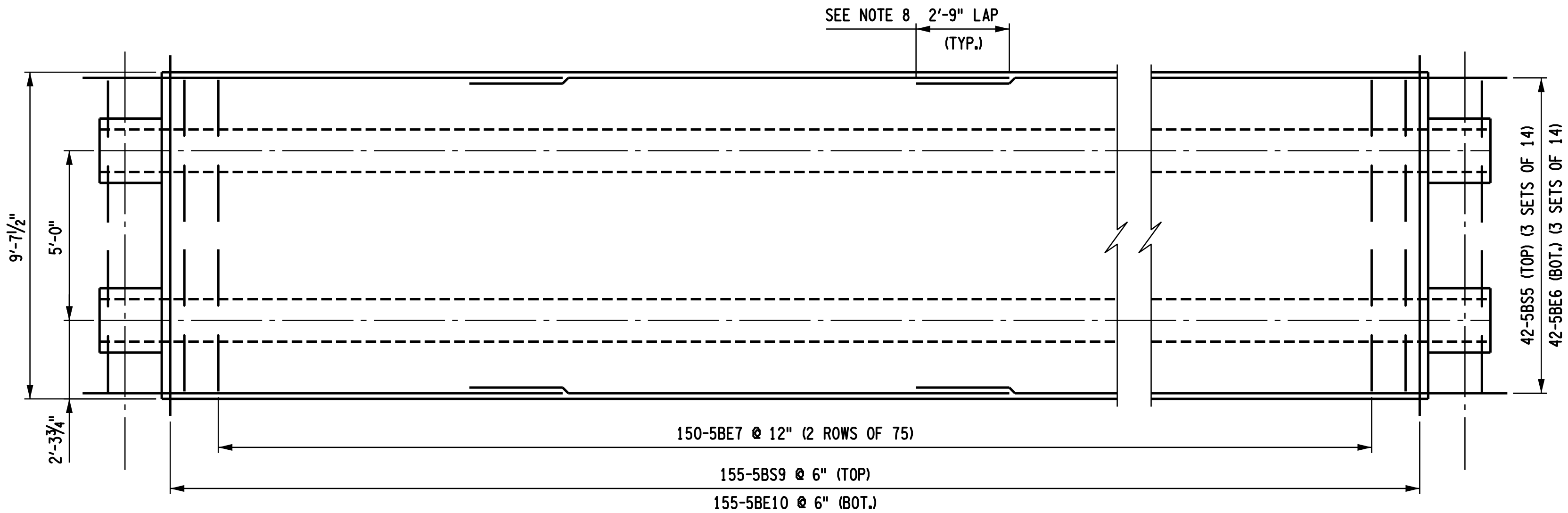
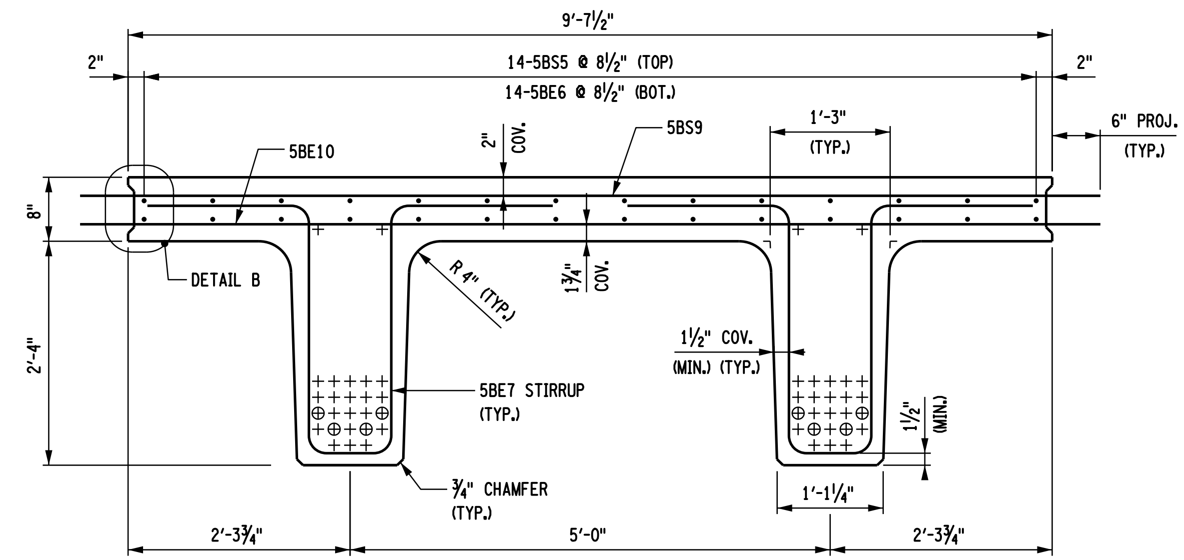
DESIGN TEAM

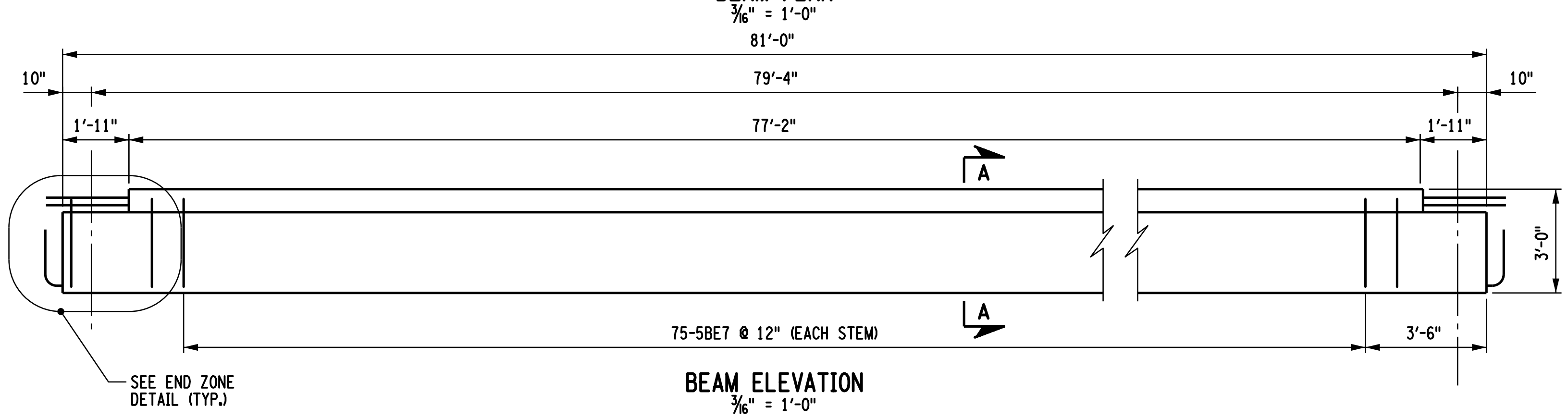
SHEET NUMBER S14



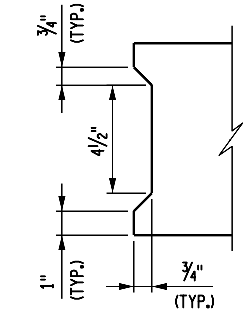
BEAM PLAN
3/16" = 1'-0"



SECTION A-A
(BEAMS B2 TO B5)
½" = 1'-0"



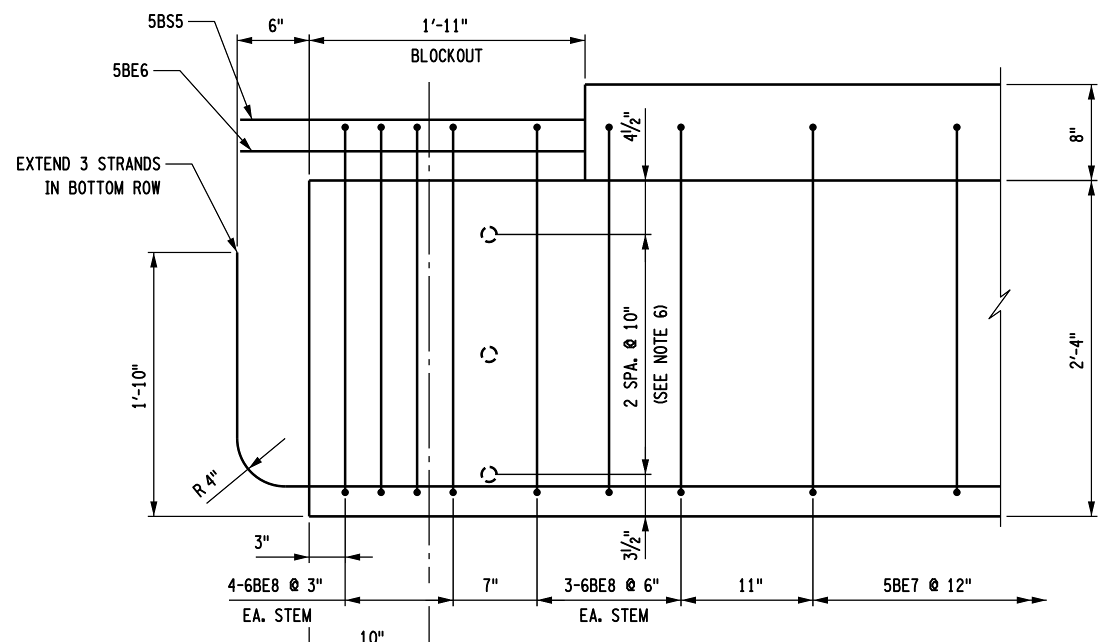
BEAM ELEVATION
3/16" = 1'-0"



DETAIL B
1½" = 1'-0"

NOTES:

1. PRECAST PRESTRESSED BEAMS ARE BASED ON PCINE NEXT "D" BEAM DETAILS.
2. ALL EXPOSED CORNERS, EXCEPT TOP FLANGE CORNERS, SHALL BE CHAMFERED ¾".
3. EPOXY COATED BAR REINFORCEMENT SHALL BE ASTM A615, GRADE 60. STAINLESS STEEL BAR REINFORCEMENT SHALL BE ASTM 955, GRADE 60.
4. 1" HOLES FORMED WITH NON-RIGID TUBING. FOR REINFORCEMENT GOING THROUGH.
5. ALL TEMPORARY INSERTS SHALL BE APPROVED BY THE DEPUTY CHIEF ENGINEER (STRUCTURES) AND DETAILED ON THE PRESTRESSED CONCRETE "WORKING DRAWINGS".
6. SPLICES IN ADJACENT BARS 5BS4 AND 5BE5 SHALL BE STAGGERED 5'-0" LONGITUDINALLY.
7. TOP FLANGE REINFORCEMENT IN BEAMS AND CLOSURE POURS SHALL BE STAINLESS STEEL. ALL OTHER REINFORCEMENT IN BEAMS AND CLOSURE POURS SHALL BE EPOXY COATED.
8. 28 DAY COMPRESSIVE STRENGTH OF CONCRETE SHALL BE F'C = 10,000 PSI.



END ZONE DETAIL
¾" = 1'-0"

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INTERIOR BEAM DETAILS

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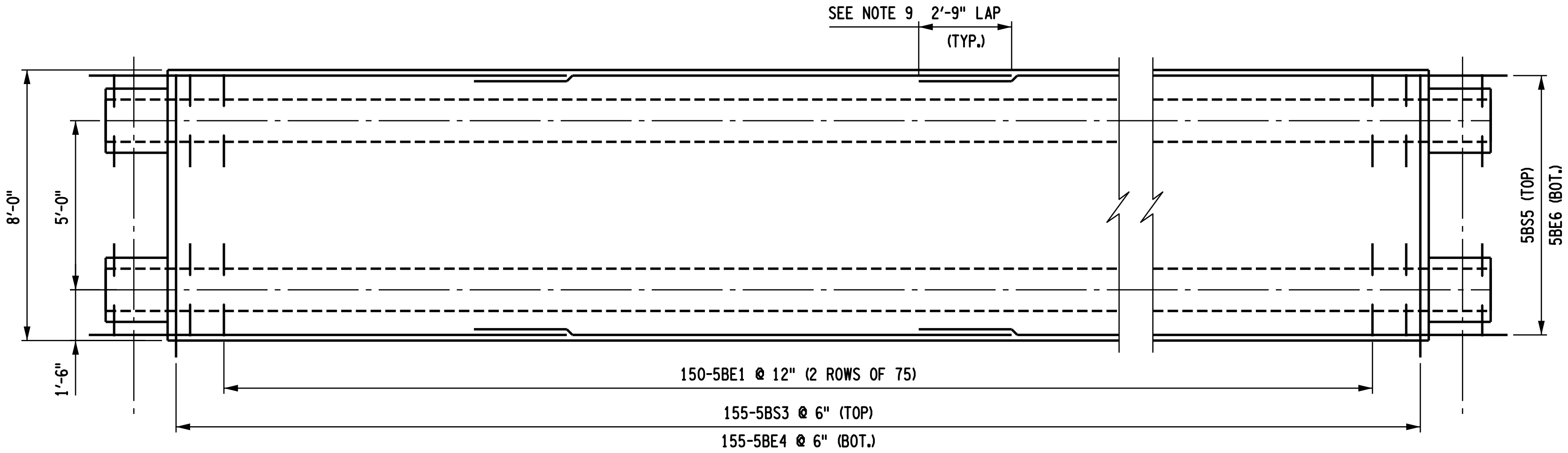
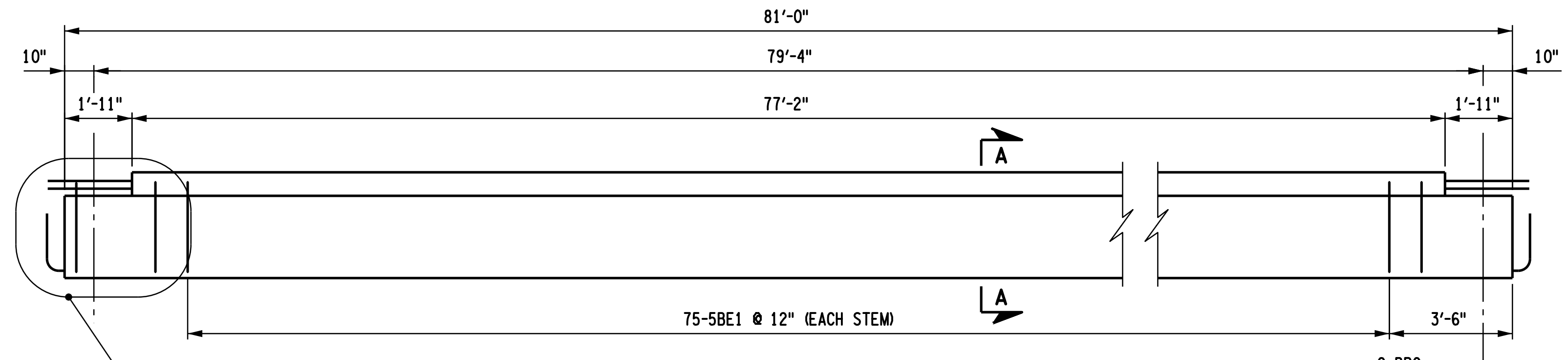
DESIGN TEAM

SHEET NUMBER S15

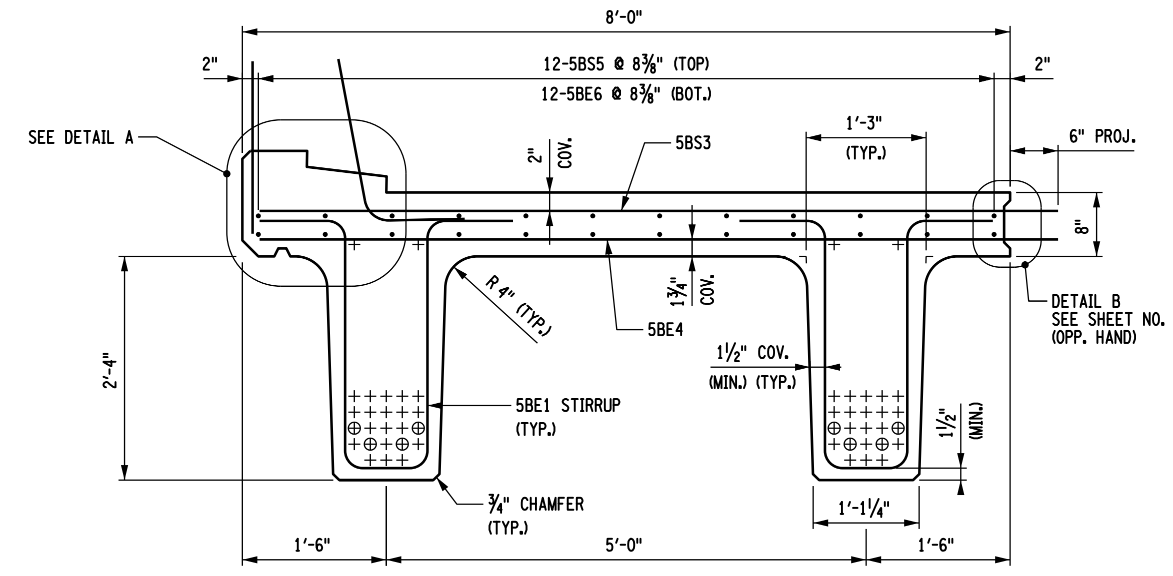
DGN$SYTIME0123456   pella   \\nyw00\dept\cadd\45737 TRB\Phase 4 Dingle Ridge Road\S15_dtl_elv_NEXT_dtls.dgn



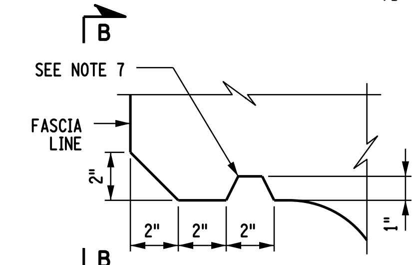
PLAN
3/16" = 1'-0"



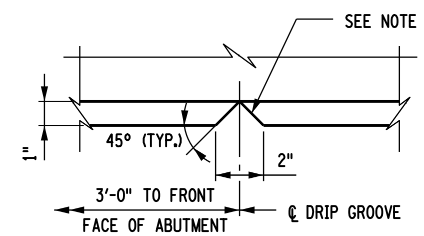
ELEVATION
3/16" = 1'-0"



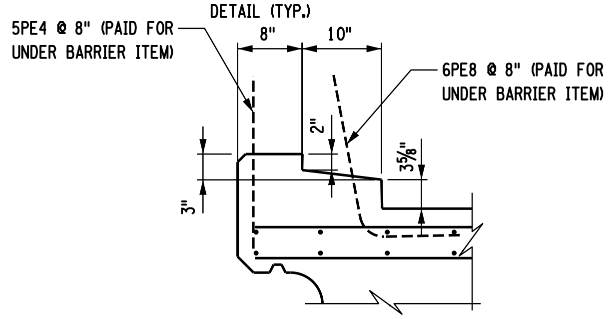
SECTION A-A
(BEAM B1 SHOWN, BEAM B6 OPPOSITE HAND)
1/2" = 1'-0"



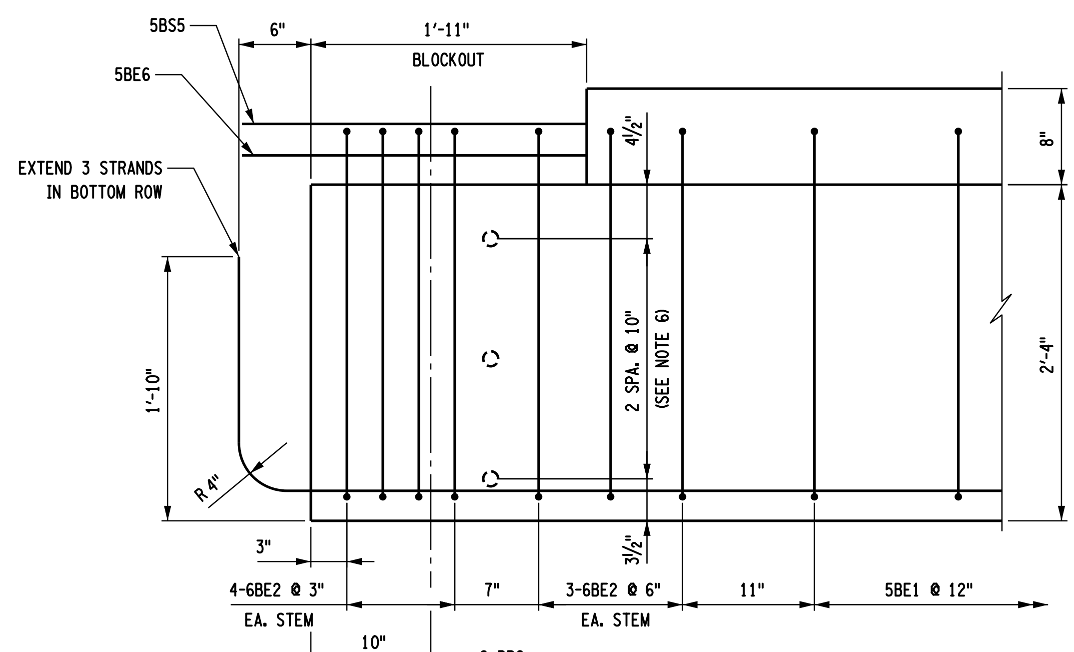
DRIP GROOVE DETAIL
1 1/2" = 1'-0"



SECTION B-B
1 1/2" = 1'-0"



DETAIL A
1/2" = 1'-0"



END ZONE DETAIL
3/4" = 1'-0"

NOTES:

1. PRECAST PRESTRESSED BEAMS ARE BASED ON PCINE NEXT "D" BEAM DETAILS.
2. ALL EXPOSED CORNERS SHALL BE CHAMFERED 3/4".
3. EPOXY COATED BAR REINFORCEMENT SHALL BE ASTM A615, GRADE 60. STAINLESS STEEL BAR REINFORCEMENT SHALL BE ASTM A955, GRADE 60.
4. 1" HOLES FORMED WITH NON-RIGID TUBING. FOR REINFORCEMENT GOING THROUGH.
5. DRIP GROOVE TO END 3'-0" FROM FACES OF ABUTMENTS WITH A 90° TURN TOWARD FASCIA. GROOVE CONTINUES TO INTERSECTION WITH THE CHAMFER.
6. SPLICES IN ADJACENT BARS 5BS4 AND 5BE5 SHALL BE STAGGERED 5'-0" LONGITUDINALLY.
7. TOP FLANGE REINFORCEMENT IN BEAMS AND CLOSURE POURS SHALL BE STAINLESS STEEL. ALL OTHER REINFORCEMENT IN BEAMS AND CLOSURE POURS SHALL BE EPOXY COATED.
8. ALL TEMPORARY INSERTS SHALL BE APPROVED BY THE DEPUTY CHIEF ENGINEER (STRUCTURES) AND DETAILED ON THE PRESTRESSED CONCRETE "WORKING DRAWINGS".
9. 28 DAY COMPRESSIVE STRENGTH OF CONCRETE SHALL BE F'C = 10,000 PSI.

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EXTERIOR BEAM DETAILS

HNTB
SEA / ISU / GENESIS   SEPTEMBER 2013

DESIGN TEAM

SHEET NUMBER S16

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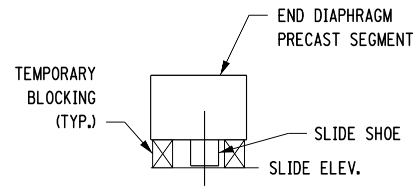
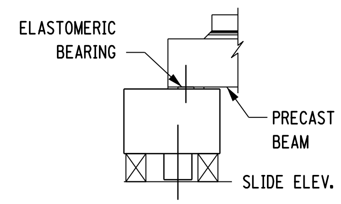
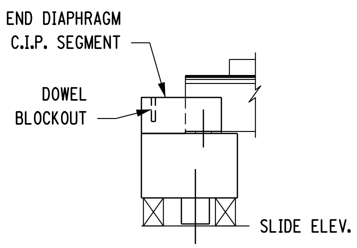


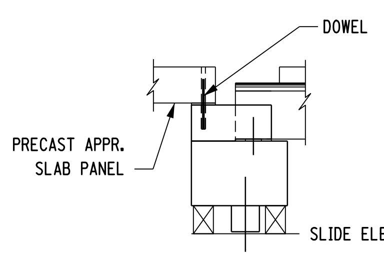
STAGE A - SECTION



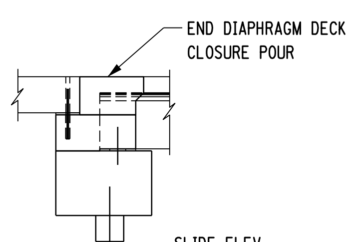
STAGE B - SECTION



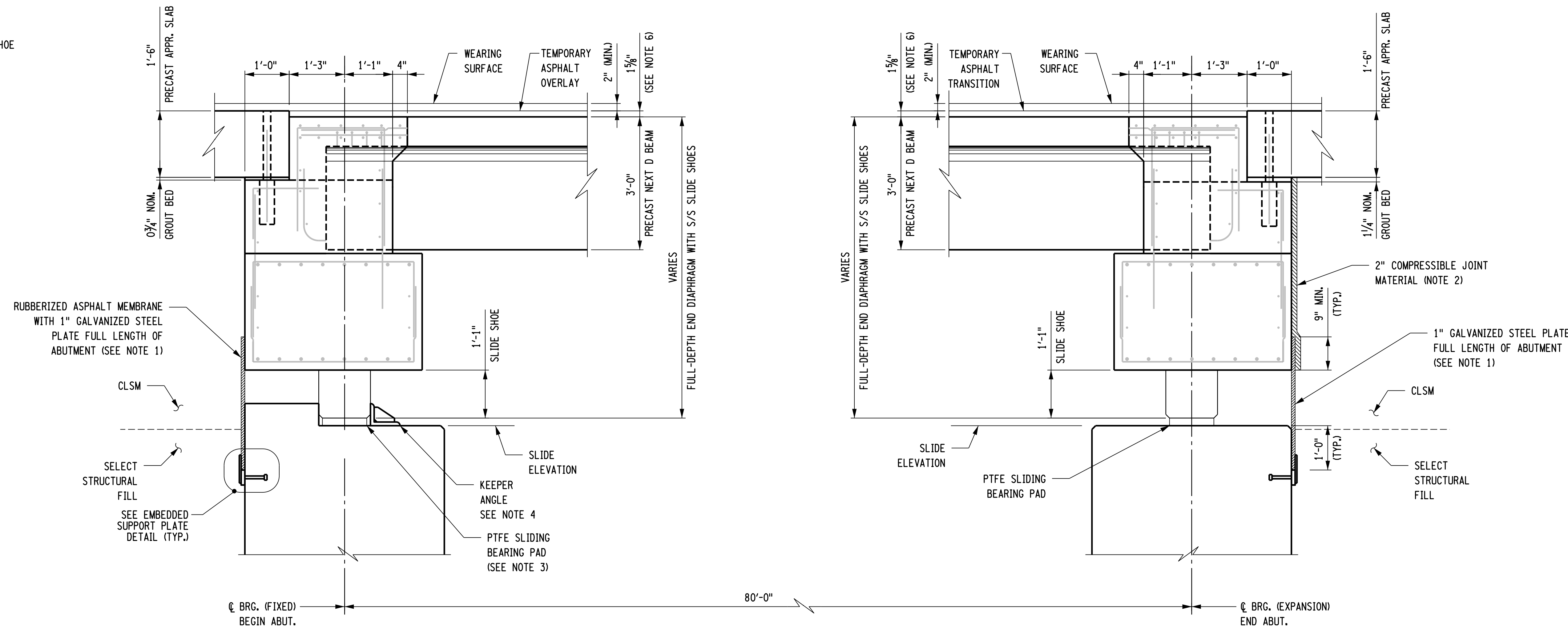
STAGE C - SECTION



STAGE D - SECTION

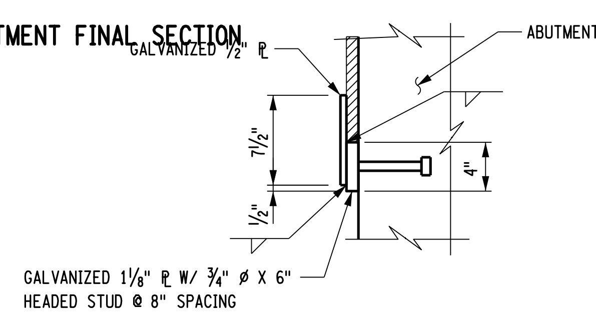


STAGE E - SECTION



BEGIN ABUTMENT FINAL SECTION

END ABUTMENT FINAL SECTION



EMBEDDED SUPPORT PLATE DETAIL

1½" = 1'-0"

END DIAPHRAGM ERECTION SEQUENCE:

STAGE A. ERECT PRECAST (LOWER) SEGMENT OF END DIAPHRAGM WITH SLIDE SHOES ON THE TEMPORARY BENTS AT EACH END OF THE BRIDGE.

STAGE B. PLACE ELASTOMERIC BEARING PADS ON PRECAST END DIAPHRAGMS AND SET PRECAST BEAMS. ADJUST BEAM ELEVATIONS AT EACH END USING STAINLESS STEEL OR NEOPRENE SHIMS TO MINIMZE DIFFERENTIAL ELEVATION BETWEEN FLANGE TIPS OF ADJACENT BEAMS DURING THE PLACING SEQUENCE.

STAGE C. INSTALL END DIAPHRAGM REINFORCING AND APPROACH SLAB DOWEL BLOCKOUTS. CAST END DIAPHRAGM AND APPROACH SLAB SEAT TO ELEVATION OF BEAM FLANGES.

STAGE D. PLACE PRECAST APPROACH SLAB. INSERT AND GROUT DOWELS INTO END DIAPHRAGM.

STAGE E. INSTALL REMAINING DECK REINFORCING BETWEEN THE APPROACH SLAB AND BEAM FLANGES, CAST LONGITUDINAL DECK AND SLAB JOINTS, AND CAST END DIAPHRAGM DECK CLOSURE.

NOTES:

1. GALVANIZED STEEL PLATE AND MEMBRANE SHALL BE PAID FOR UNDER CONTROLLED LOW-STRENGTH MATERIAL.
2. ALL ELEMENTS DESIGNATED GALVANIZED SHALL BE HOT-DIP GALVANIZED AND IN ACCORDANCE WITH ASTM A123.
3. COMPRESSIVE JOINT MATERIAL AGAINST FILL TO BE PAID FOR UNDER CONTROLLED LOW-STRENGTH MATERIAL.
4. FOR KEEPER ANGLE DETAILS, SEE ABUTMENT DRAWINGS.
5. TEMPORARY TRANSITION DEPTH SHOWN IS BASED ON DESIGN BEAM CAMBER. ACTUAL DEPTH MAY VARY BASED AS-BUILT CAMBER AT TIME OF BEAM PLACEMENT.
6. TEMPORARY ASPHALT TRANSITION SHALL BE CONSTRUCTED IN ACCORDANCE WITH STD. SPEC. 619-03 AND SHALL BE REMOVED PRIOR TO PLACING FINAL WEARING SURFACE.

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END DIAPHRAGM DETAILS

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SEA / ISU / GENESIS SEPTEMBER 2013

DESIGN TEAM

SHEET NUMBER S17

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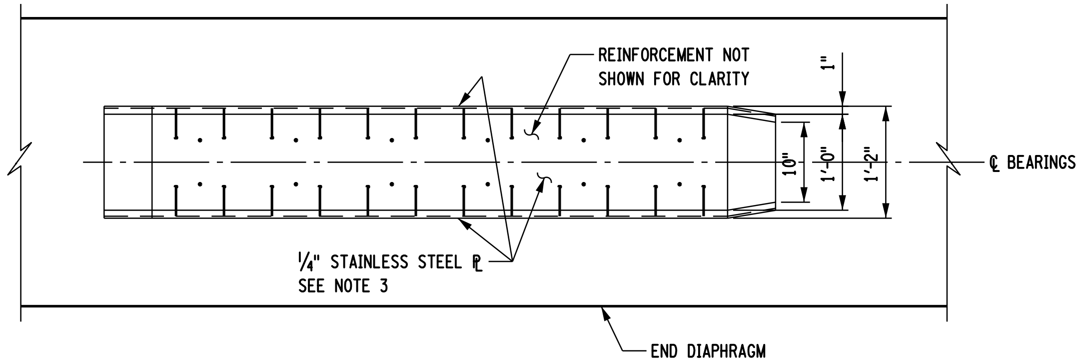
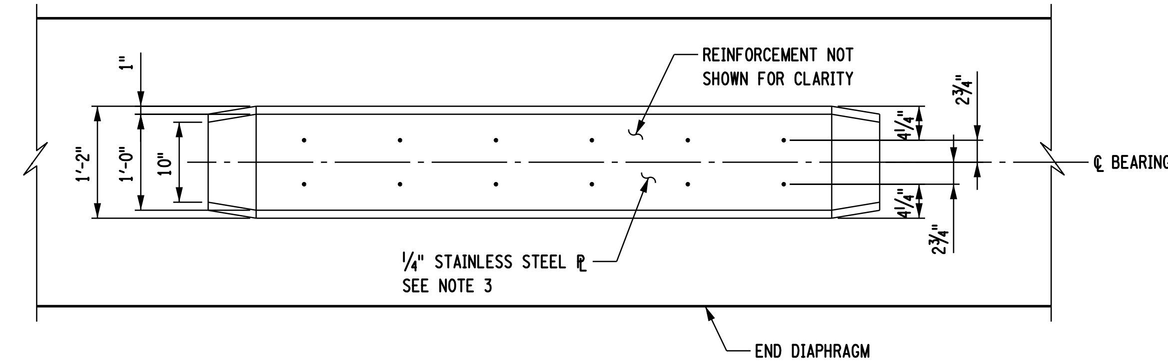
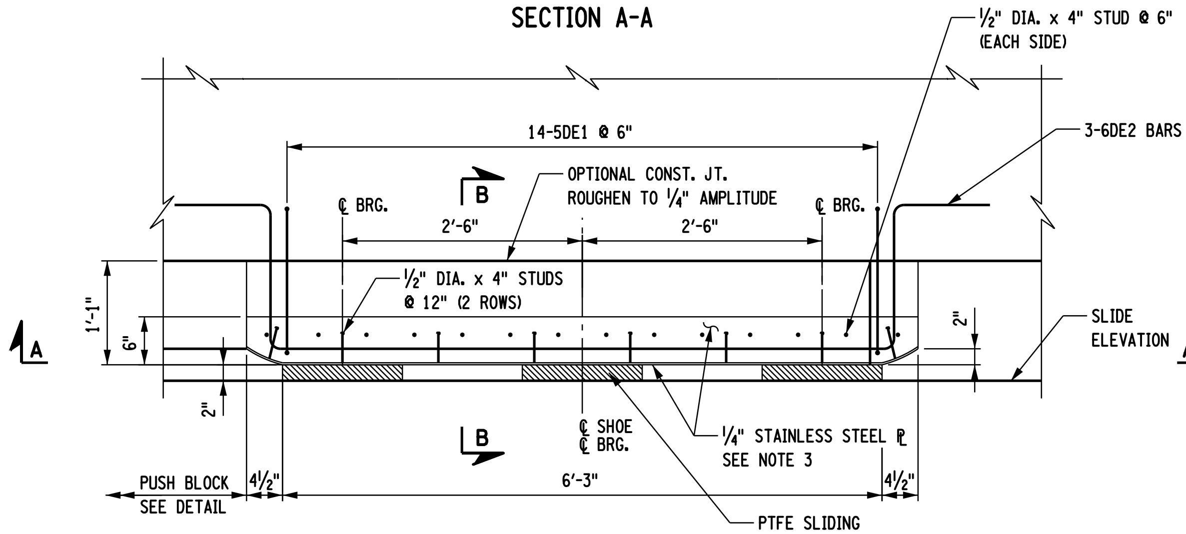


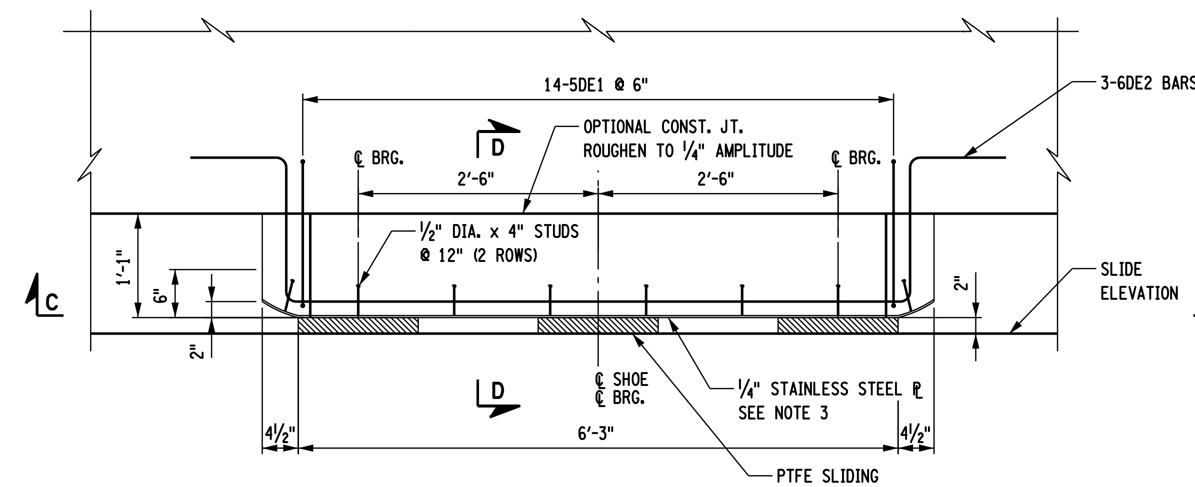
SECTION A-A



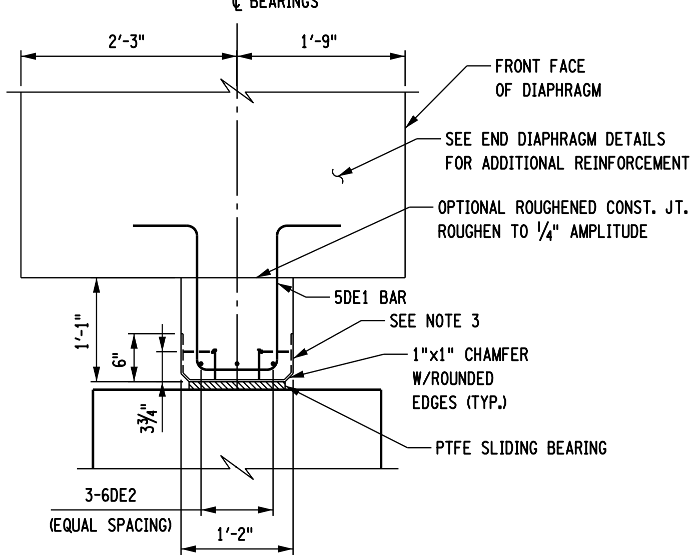
SECTION C-C



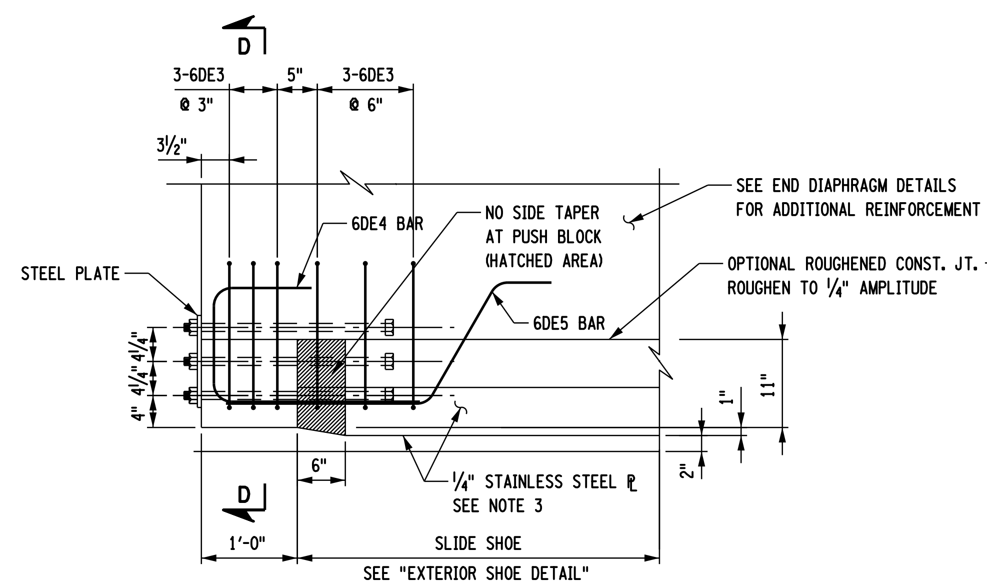
EXTERIOR SHOE DETAIL



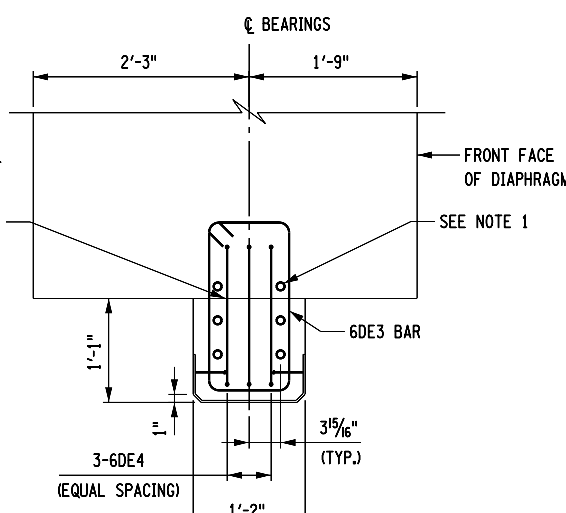
INTERIOR SHOE DETAIL



SECTION B-B



PUSH BLOCK DETAIL (EXTERIOR SHOE)



SECTION D-D

NOTES:

1. 1" DIA. ANCHOR BOLT (2'-0" EMBEDMENT) WITH WASHER AND HEAVY HEX NUT (ALL GALVANIZED). VERIFY DIMENSIONS PRIOR TO PLACEMENT. CUT BOLTS FLUSH AND PATCH AFTER SLIDING OPERATION IS COMPLETE.
2. USE STAINLESS STEEL ¼" PLATE AND STUDS AT BOTTOM AND BOTH SIDES OF SHOE AT EXTERIOR SHOES AND ONLY USE STAINLESS STEEL ¼" PLATE AND STUDS AT BOTTOM OF SHOES AT ALL INTERIOR SHOES.
3. FOR BEARING PAD DETAILS, SEE SHEET NO. S14.

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SLIDE SHOE DETAILS

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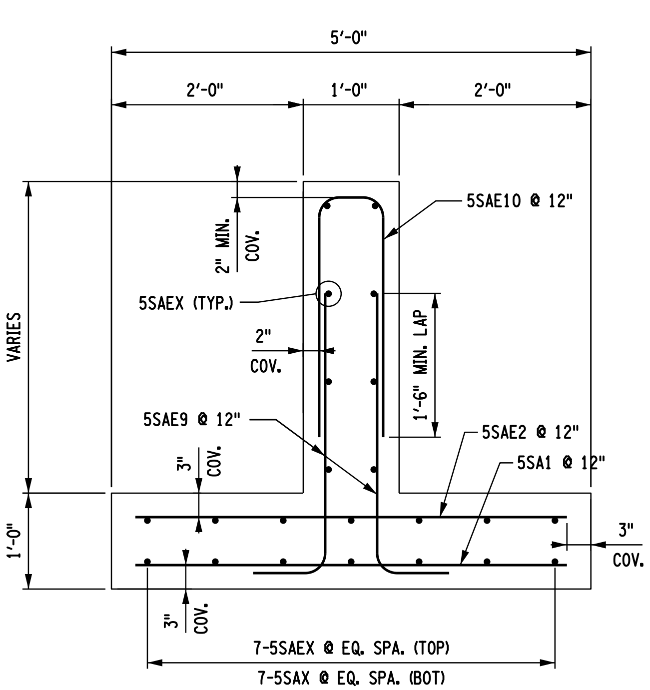
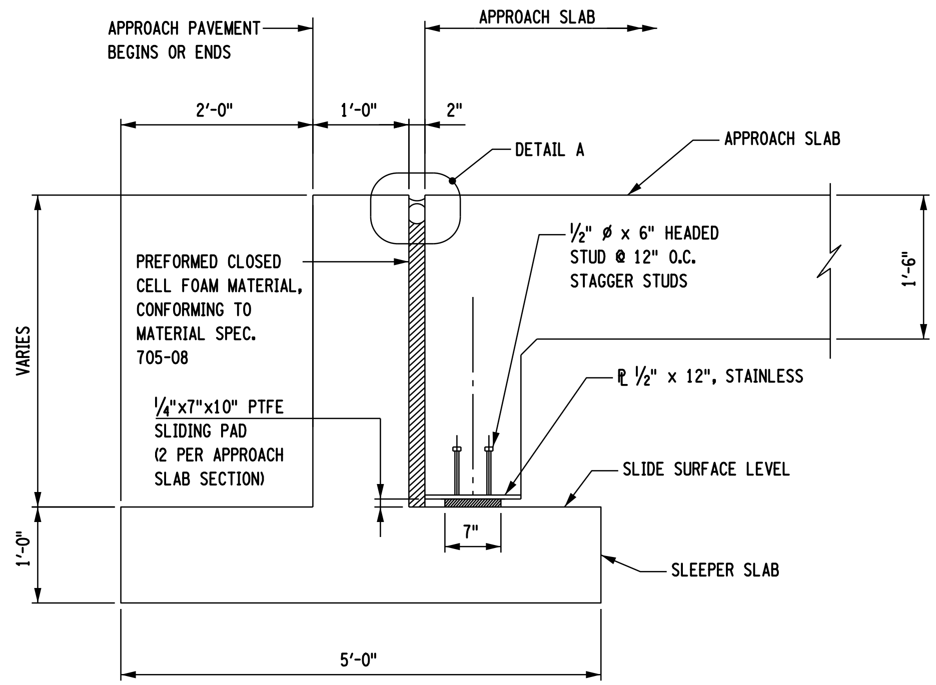
DESIGN TEAM

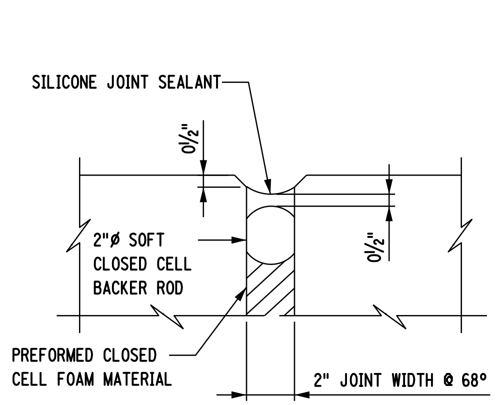
SHEET NUMBER S18



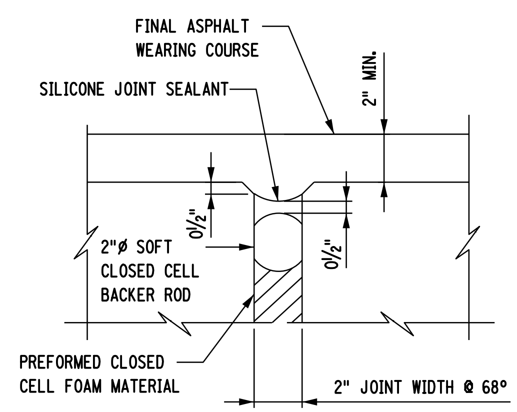
TYPICAL SLEEPER SLAB REINFORCEMENT
½" = 1'-0"



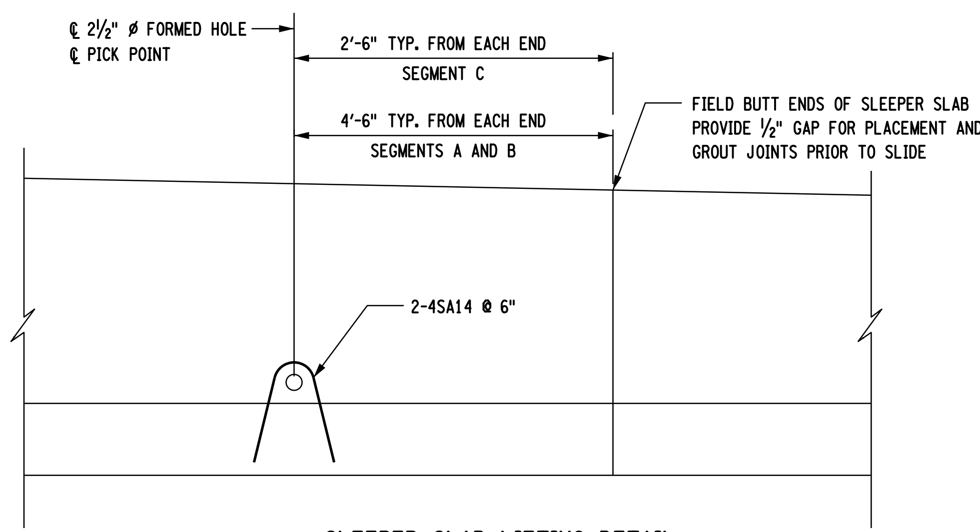
TYPICAL SLEEPER SLAB SECTION
½" = 1'-0"



DETAIL A
(AT END OF ABC PERIOD)
1½" = 1'-0"



DETAIL A
(FINAL CONDITION)
1½" = 1'-0"



SLEEPER SLAB LIFTING DETAIL
N.T.S.

NOTES:

1. FILL THE RECESS WITH A STRUCTURAL JOINT MATERIAL, LIQUID SEALANT, FROM THE DEPARTMENT'S APPROVED LIST. THE MANUFACTURER'S RECOMMENDATIONS SHALL BE FOLLOWED FOR THOSE SEALANTS THAT REQUIRES A PRIMER. THE CONCRETE SHALL CURE FOR MINIMUM OF 7 DAYS BEFORE JOINT IS SEALED. SEALING SHALL ONLY BE PERFORMED WHEN THE CONCRETE TEMPERATURE IS 40 °F OR ABOVE. BOTH JOINT FACES SHALL BE SAND BLASTED TO ROUGHEN THE SURFACE AND TO REMOVE ALL SURFACE MOISTURE AND ANY OTHER MATERIAL THAT MAY INTERFERE WITH BOND.

2. STAINLESS STEEL PLATE SHALL BE 8'-2¾" LONG AT EXTERIOR SLAB UNITS AND SHALL BE CAST FLUSH WITH FASCIA. STAINLESS STEEL PLATE SHALL BE 10'-1" LONG AT INTERIOR SLAB UNITS AND SHALL BE CAST CENTERED ON UNIT.

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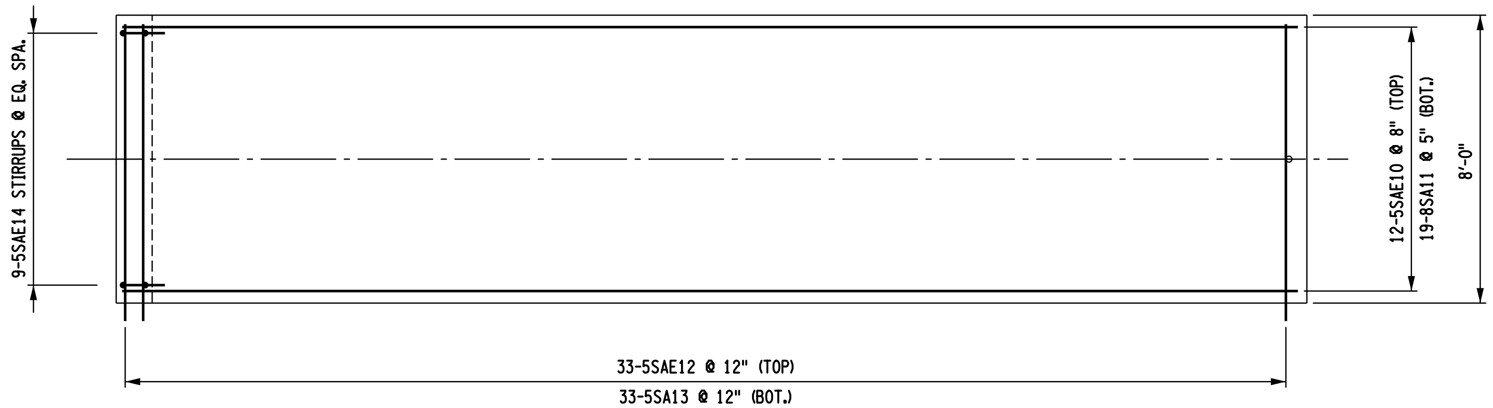
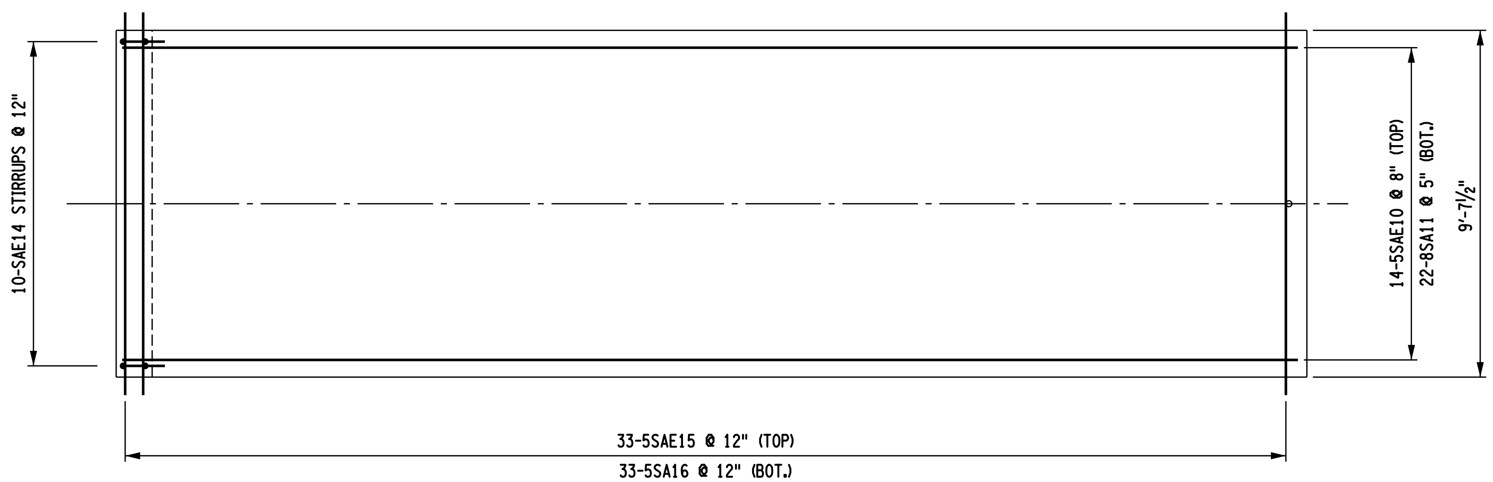
SLEEPER SLAB DETAILS

HNTB
SEA / ISU / GENESIS   SEPTEMBER 2013

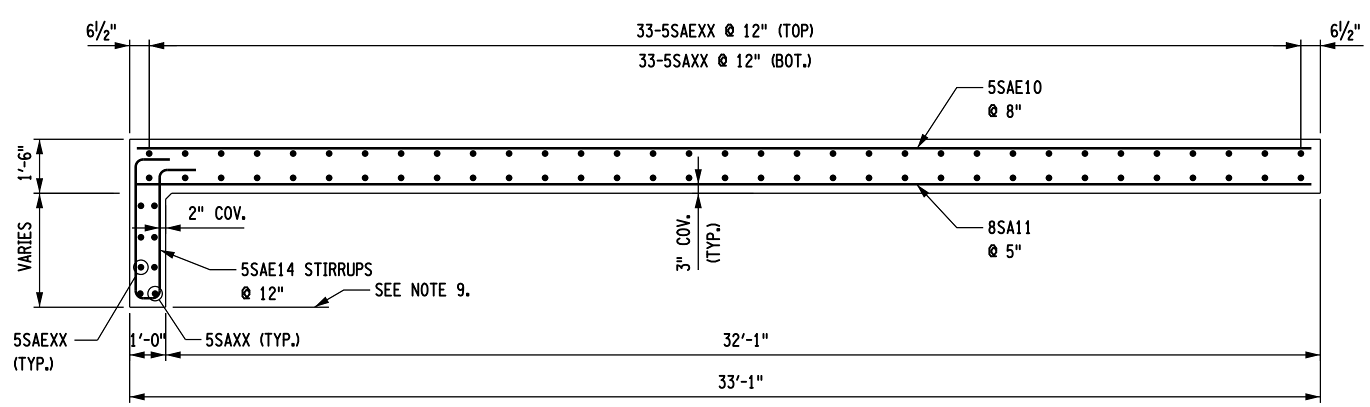
DESIGN TEAM   SHEET NUMBER S19



EXTERIOR SLAB UNIT PLAN
3/16" = 1'-0"



INTERIOR SLAB UNIT PLAN
3/16" = 1'-0"



APPROACH SLAB UNIT ELEVATION
3/16" = 1'-0"

NOTES:

1. FOR END DIAPHRAGM DETAILS, SEE SHEET NO. S17.
2. FOR SLEEPER SLAB DETAILS, SEE SHEET NO. S19.
3. ALL APPROACH SLAB REINFORCEMENT SHALL HAVE A MINIMUM 3 INCH COVER UNLESS OTHERWISE NOTED.
4. TO PERMIT UNHINDERED LONGITUDINAL MOVEMENT OF SLAB IN THE FINAL CONDITION, POLYETHYLENE CURING COVERS (WHITE OPAQUE) IN ACCORDANCE WITH MATERIAL SPECIFICATION SUBSECTION 711-04 SHALL BE ATTACHED TO THE UNDERSIDE OF THE APPROACH SLAB. THE CURING COVERS SHALL BE .004 IN. THICK, AND LAPS SHALL BE 2 FT. MINIMUM.
5. APPROACH SLABS HAVE BEEN DESIGNED TO CARRY TRAFFIC LIVE LOAD PRIOR TO PLACEMENT OF BACKFILL.
6. SURFACE SHALL BE BEVELED TO PRODUCE A LEVEL SLIDING SURFACE.

THE STRATEGIC HIGHWAY RESEARCH PROGRAM 2
PROJECT R04
INNOVATIVE BRIDGE DESIGNS FOR RAPID RENEWAL

ACCELERATED BRIDGE CONSTRUCTION
SAMPLE LATERAL SLIDE SYSTEM DETAILS

APPROACH SLAB DETAILS

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DESIGN TEAM | SHEET NUMBER S20