New Hampshire Department of Transportation

TYPE, SIZE AND LOCATION STUDY FOR THE NEW CASTLE-RYE BRIDGE OVER LITTLE HARBOR

Bridge 066/071
Project 16127

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1. Introduction

The New Hampshire Department of Transportation (NHDOT) retained a Design Team lead by HDR Engineering Inc. (HDR), in conjunction with Hoyle, Tanner & Associates (HTA) and Fitzgerald & Halliday Inc. (FHI) to provide preliminary design services for the New Castle-Rye Bridge. The bridge, which carries Wentworth Road/NH Route 1B, is functionally obsolete, and in poor condition. This project will rehabilitate or replace the bridge, so that the future structure can satisfy modern statutory requirements of the American Association of State Highway Transportation Officials (AASHSTO) Load and Resistance Factor Design (LRFD) Bridge Design Specifications (6th Edition), and the AASHTO LRFD Movable Highway Bridge Design Specifications (2nd Edition). Per these specifications, the bridge will be designed to sustain HL-93 vehicular loading. As part of the preliminary design the Design Team has performed this Type, Size and Location (TS&L) Study to review whether Rehabilitation of the existing structure, or Replacement of the structure is the best course of action. As part of the study, the Design Team will consider possible impacts that this project will have, including:

- Impacts on the community
- Environmental Impacts
- Impacts to Historic Resources
- Capital costs and life-cycle costs
- Constructability
- Impacts to vehicular, pedestrian and marine traffic

2. Bridge Description

The New Castle-Rye Bridge, constructed in 1942, carries Wentworth Road/NH Route 1B over Little Harbor in the towns of New Castle and Rye, New Hampshire. Wentworth/NH Route 1B is comprised of two-way traffic, with a sidewalk located to the west at the bridge. The town of New Castle is an archipelago with only two entry routes. This bridge carries one of these two routes, making it a vital piece of infrastructure for the local community.

The structure is located in a tidal area where water elevation has an eight to nine foot variation between high and low tides. Correspondence with the United States Coast Guard (USCG) has indicated that Little Harbor is likely considered a Navigable Channel and under the jurisdiction of the USCG, as Little Harbor does carry a small volume of marine traffic which requires the structure to lift; according to the bridge's lift logs, the structure was been lifted nine times for vessels between March of 2010 and July of 2013, six times for buoy maintenance by the USCG and three times for private vessels. Lifts for marine traffic require four-hour notice to the New Hampshire Department of Transportation (NHDOT) Transportation Maintenance Center (TMC), and personnel travel from the NHDOT Bridge Maintenance Office at 10 Ranger Way in Portsmouth, NH to the bridge to operate the lift.

This bridge is considered a historic resource, as it is eligible for the National Register of Historic Places. Details regarding its eligibility and historic significance can be found in the Individual Inventory Form, completed in July 2013.

2.1. Structure Description

The bridge is comprised of two south approach spans, three north approach spans and one bascule lift span. The approach spans consist of seven 24"WF74# stringer lines and the main bascule lift span consists of nine 18"WF47# floorbeams supported by two 36"WF150# girders. The bridge deck consists of an open grid with serrated edges. The sidewalk is also supported by an open grid deck, with a composite wearing surface overlaid on the grid. The superstructure is supported by one reinforced

counterfort abutment at the south end, one reinforced concrete pile supported abutment at the north end and five steel multi-pile pier bents. The bridge's operator house is located at the southwest corner of the bascule span. Refer to Appendix E for plans of the existing structure.

The bridge was designed for the American Association of State Highway Officials (AASHO) H20 Truck Loading, a truck with a weight of 20 tons. AASHO is the predecessor to the American Association of State Highway Transportation Officials (AASHTO), the federal organization which governs highway bridge design.

2.2. Mechanical and Electrical Systems

The moveable span is raised and lowered using two 5 HP, 850 RPM, 220/440V, 3 phase, 60 cycle, wound rotor type motors with Stern motor brakes. Each motor is connected to the load side of a General Electric NEMA Size 1 full voltage reversing starter (model number CR109C0), which is then connected to the load side of a 40A circuit breaker. These motors are controlled by the pendant control station located on the north wall inside the operator's house.

At each end of the bridge, there are traffic signals and electronically operated traffic gates. There is a manually operated structural steel swing gate located at the north approach to the bridge and manually operated span locks, controlled by a lever at the northeast corner of the bascule span. The electronic gates, traffic signals and moveable span are all operated from the Control House. There are no interlocks to prevent the bridge from being lifted while the electronically or manually controlled gates are open.

The bridge motors are powered by one utility feeder supplying the 220V three phase power to the bridge. This power is fed from a utility pole located at the west side of the bridge at the south end (NET&T Pole 13527143). The service is then run along the railing of the bridge to a meter located outside the operator's house. From the meter the utility feeder enters the operator house which encloses the main service disconnect, motor starters and pendant control stations. The electronic gates and traffic signals at the south end of the bridge are fed from the same pole as the primary bridge motor. The north approach is fed from a utility pole adjacent to the traffic light.

The motors and machinery are housed in a wooden case that sits on the machinery platform of the bascule pier.

2.3. Roadway Approaches

Wentworth Road/NH Route 1B is an urban minor arterial that connects the island of New Castle with Portsmouth to the north and Rye to south. The roadway, which carries approximately 4,200 vehicles per day (vpd) at the bridge across Little Harbor, has a posted speed limit of 25 mph. The existing approaches on either side of the bridge consist of reclaimed land with 1.5(H):1(V) stone fill side slopes. The north and south approaches to the structure are supported by a stone fill causeway. There is stone rip rap and vegetation stabilizing the soil slope above the stone fill causeways. The roadway cross section is made up of two 11' travel lanes with approximately 1' shoulders on either side. A narrow 4' wide asphalt sidewalk is provided on the west side of the roadway, however, a roadway crossing is required on the north side of the bridge to connect to the rest of the sidewalk network. An existing concrete retaining wall is located on the northwest quadrant of the bridge.

The horizontal alignment of the existing roadway consists on a 1450' radius right hand curve leading to a 700 linear foot tangent across the bridge. A 1000' radius left hand curve exits the project area. Superelelevation is provided on the existing horizontal curves. The existing profile begins on a 1.86% downgrade which leads to a low point sag curve on the south side of the bridge. The existing bridge is located on a 1.0% upgrade leading to a second sag curve and crest curve exiting the project area.

The existing guardrail on the project is a mix of steel and wood post w-beam with sub-standard flared and buried end sections. Existing closed drainage systems are provided on the north side of the bridge which collect curb line flow in catch basins. One of these systems outlets at the base of the 1.5(H):1(V) slopes while a second system directs water towards Campbell's Lane where it discharges into a rip-rap slope prior to entering a wetland adjacent to the harbor. Runoff on the south side of the bridge generally sheet flows off the roadway and down the adjacent embankments.

3. Condition Evaluation of Existing Bridge

The New Castle-Rye Bridge was inspected by HDR and Hoyle, Tanner & Associates in January 2011. This inspection of the structural, mechanical and electrical components of the bridge found the bridge to be in overall Serious Condition, per National Bridge Inspection Standards (NBIS). NBIS assign condition ratings to every publicly-owned bridge in the country, ranging from 0 (Failed Condition) to 9 (Excellent Condition). A rating of "Serious" rates as a 3 on this scale, and indicates that the structure has deterioration to such an extent that it has seriously affected structural components.

The bridge superstructure was found to have significant section loss. Seven of the nine bascule span floorbeams and eighteen of thirty-five approach span stringers had corrosion holes, and those members without corrosion holes had significant section loss. In several locations, welded repair plates were found to have pack rust, with prying and cracking. The bascule span girders had significant section loss, up to ¼" deep, on the flanges and web. The bridge deck was found to have broken bars throughout the bridge deck and impact damage at the bridge abutments.

The bridge substructure was found to have section loss, cracks, buckled piles and corrosion holes. Significant section loss was found on the steel bent caps, with cracks found on the stitch welds connecting the caps to piles. Buckled piles were found on four bents. Section loss was found on the majority piles from deterioration, and from gouging. Lateral bracing on the bents was previously removed and replaced during the 2000 pier rehabilitation, causing a number of gouges on the pile flanges. The work platform on the bascule span has spalling and delamination, and is in poor condition. Cross beams supporting the bascule trunnions had multiple corrosion holes in the webs, up to 5"x9" in size. One of the bascule piles has a corrosion hole measuring 4 ½"x6" in size.

The bridge railings are not sufficient for crash loads, and numerous rail posts were found to have pack rust, broken bars and broken welds.

Based upon these findings, HDR and Hoyle, Tanner & Associates performed a load rating of the structure in 2011. The load rating was performed using the Load Factor Rating (LFR) method, using the HS20 Truck as the statutory load. Upon conclusion of this load rating, it was determined that several repairs were required, and that the bridge must be posted at 15 tons.

HDR also reviewed the existing structural, mechanical and electrical systems for the modern AASHTO requirements and found that all systems were insufficient.

HDR performed a structural analysis of the bridge members using the Load and Resistance Factor Design (LRFD) method in accordance with the American Association of Highway and Transportation Officials (AASHTO) LRFD Bridge Design Specifications (5th Ed.), with HL-93 Loading being the statutory live

loading. The review checked members that controlled the 2011 LFR Load Rating in their as-inspected condition, the members that had the highest rating factor in the 2011 LFR Load Rating in their as-inspected condition, and as-built conditions of each member. Additionally, a structural analysis of the steel piles at the piers and abutments was performed.

The review found that the vast majority of the bridge's primary members are not sufficient for HL-93 Loading. Only one member of the entire bridge, the west girder, was sufficient for HL-93 Loading. The west girder was found to have a sufficient load rating due to the fact that it only supports a small portion of the roadway width and the bridge sidewalk, which does not carry vehicular loads.

See Appendix A, Drawings 15 to 17 for plans showing insufficient structural members for AASHTO HL-93 Loading.

It should be noted that this structure was designed in 1942 for an "H20" Truck, a truck weighing 20 tons, and that modern standards and codes require that the structure carry "HL-93" loading, which is comprised of a 36 ton truck plus additional loads. Even in a state of perfect condition, all of the approach stringers, the east bascule girder and bascule span floorbeams would be structurally insufficient because it was designed for a much lighter truck than required by modern standards. Additionally, the pier piles would be insufficient because they would not support current AASHTO loading requirements, nor would they meet modern requirements for slenderness without significant modifications to the pier bracing system. Given that this bridge carries one of only two ways onto New Castle Island and that the US Coast Guard has a station in New Castle, it is necessary for this structure to carry AASHTO loading requirements. This is a major concern for rehabilitating of this structure – a number of piles have already shown signs of being overloaded, which over the long-term would be a significant safety concern for the structure.

The mechanical and electrical systems do not meet a number of requirements of AASHTO LRFD Movable Highway Bridge Design Specifications (2nd Edition). The bridge has no interlocks and doesn't have any fail safes in place. The bridge also does not have an auxiliary system to support operation in the event of a failure. It is recommended that an entire rehab of the electrical system be considered to bring the bridge up to current standards. If not, at a minimum, more limit switches should be installed for indication, stopping, and a backups should one limit switch fail. It is also recommended that the system be interlocked to ensure that the bridge operates in a safe manner.

In addition to not meeting modern codes, the electrical system was found to have significant corrosion and wear throughout. The primary casing of the primary conduit was found to have rusting and corrosion. Paint loss and corrosion were found on the bridge motors. Span and seat limit switches, which signal to the moveable system that the bridge is closed and open, were found to have significant corrosion. The traffic gates also exhibited signs of deterioration, with rusting on the gate itself and capacitor, exposed electrical terminals and oil leakage. The traffic signal was found to have a broken foundation.

Significant deterioration was also found in the mechanical systems. Wearing, scoring, pitting and minor surface corrosion were found on the gears and trunnions of the moveable span. Fasteners connecting

components also show significant signs of deterioration which will allow for the misalignment to occur causing premature wear. Span lock machinery, which prevents the span from inadvertently opening, is in poor condition with paint loss and corrosion. Additionally, lock bars, which engage supports on the approach, were found to have excessive gaps allowing the span to rotate about the trunnions and lift off the live load supports. The reducers, which convert the power at high speeds to a lower speed with higher torque, have leakage.

Rehabilitation and repairs have been frequently performed on the New Castle-Rye Bridge over its life. Major rehabilitations of stringers and floorbeams were performed in 1975 and 1978. In 1994, a Memorandum of Agreement was signed by former NHDOT Commissioner Charles O'Leary with the New Hampshire Division of Historical Resources (NHDHR). The Memorandum was created in response to the required demolition of the Scammel Bridge, another bascule structure located in Dover, New Hampshire, which was eligible for the National Register of Historic Places. This memorandum states that FHWA and NHDOT committed to the long-term maintenance and preservation of the New Castle-Rye Bridge and that the bridge would only be replaced under exceptional circumstances, including a natural disaster creating a severe safety hazard or other unforeseen circumstance.

In order to meet the requirements of this memorandum, NHDOT made an extensive effort at maintaining this structure. Most notably, there have been two major rehabilitations of the bridge piers, a complete cleaning and re-painting of the structure, a major repair to mechanical components, multiple upgrades to the electrical systems and numerous structural repairs to the deck and beams since 1994. Despite the extensive work performed on this bridge, it was still found to have significant deterioration during the 2011 inspection. This is primarily due to the harsh marine environment in which this bridge is located. Complicated steel detailing with welded and bolted plates creates many seams between steel plates that can trap moisture and cause deterioration over time. Additionally, the open grid decking allows moisture to pool on top of the beams, increasing rates of deterioration at these locations.

The following is a summary of significant rehabilitation and repair work performed on the New Castle-Rye Bridge since 1994:

- First Major Rehabilitation of bridge piers (June 1999-June 2000)
    - Remove deteriorated pile casings and replacement of casings. Place anti-spalling coatings on concrete.
    - Repairs to pile casings with only limited deterioration.
    - Remove and replace cross bracing at piers.
    - Structural repairs to piles.
    - Clean and repaint piles and bracing.
- Second Major Rehabilitation of bridge piers (Winter 2010/2011)
    - Remove and replace all pile casings.
    - Repaint steel as required.
- Complete cleaning and re-painting of entire bridge structure (Summer 2000)
- Updates to lift span components and serviceability of operator house (October 2000)
    - Install new windows in operator house.

    - Install security screens in operator house.
    - Replace bridge bearings for lift span girders.
- Repaving of approaches (August 2002)
- Major repairs to mechanical components and reconstruction of machinery housing (March/April 2007)
    - Replace failed shaft supports.
    - Replace bent pinions.
    - Reinforce machinery platform, re-build machinery housing.
- Repairs to the grid decking have been performed numerous times:
    - July 2002
    - March 2003
    - August 2005
    - June 2006
    - September 2007
    - January 2008
    - April 2008
    - October 2008
    - January 2009
- Repairs to beams have also been performed multiple times:
    - Beam adjacent to north abutment (July 2002)
    - Welded repairs to beams, with painting as required (October 2008)
    - Emergency repairs to beams (March 2011)
- Upgrades to the electrical systems of the bridge have been performed multiple times:
    - Replace doors to traffic gate signal (January 1999)
    - Construct new platform for electrical service meters (November 1999)
    - Replace wiring and conduits from lift house to motors (July 2002)
    - Repair seating limit switch (October 2005)
    - Upgrade electrical system to separate traffic gates from lift system – install new wiring and controls (May-July 2006)
    - Adjustment limit switch (August 2007)
- Other miscellaneous repairs:
    - Repair traffic barrier gates (July 2003)
    - Repair bridge rail (October 2004)

The following is a summary of typical maintenance performed on the bridge that was reflected in the maintenance logs. This maintenance occurred at frequent and regular intervals:

- Clean and lubricate mechanical components of bridge (annually)
- Electrical systems inspection (twice per year)
- Clean or replace tide gauge. (as required – approximately every four years)
- Inspection of structure (biannually)

Additionally, the aforementioned in-depth inspection and structural analysis (Load Rating) of the bridge structure was performed in 2011. See Appendix F for the NHDOT Maintenance Logs, showing work performed on the bridge.

4. Project Background

The Bridge was inspected by HDR and Hoyle Tanner in 2011, and the aforementioned significant deficiencies were identified. At that time, the NHDOT hired the Design Team to review various rehabilitation and replacement alternatives and their impacts, recommend a course of action, and design the bridge rehabilitation or replacement alternative selected.

As part of this review process, NHDOT and the Design Team have made extensive efforts to garner input from the public. A Public Advisory Committee (PAC), comprised of a NH state Senator and NH state Representatives, abutters, local business owners and New Castle's Historical Society, amongst others, was established at the outset of the project. The Design Team also created a Public Involvement Plan, to gather input via Public Meetings from local residents.

In January 2013, a meeting with the PAC was held, in which the Design Team provided an overview of the bridge's condition, and known historic and environmental elements of the bridge and surrounding area. The Design Team took input from the PAC and produced initial conceptual sketches of roadway alignments, and of bridge rehabilitation and replacement options.

Input received from the PAC has driven decisions made by the Design Team in the development of alternatives. Some key suggestions and concerns given during the Public Involvement process include:

- During construction, minimizing closure time of the bridge is critical to the community of New Castle. This town is an archipelago, a series of islands, with only two routes to the town. This bridge carries one of them. Closure of this bridge causes large disturbances to businesses, to public safety organizations such as the police and fire department, and to the commutes of residents. One critical example of a disturbance to local business and public safety is fire ladder protection of the Wentworth by the Sea Hotel. This five story tall structure is eligible for the National Register and receives fire ladder protection across the New Castle-Rye Bridge.
- Moving the sidewalk from the west side of the bridge to the east side of the bridge would create a much safer route for pedestrians. Currently, pedestrians must cross the street to use the bridge's sidewalk, which is a potential safety hazard due to the short sight distances on Wentworth Road.
- Providing a solid surface deck, instead of the grid decking currently on the structure, is imperative. This grid decking is a hazard to bicyclists, and is noisy when vehicular traffic crosses over it, creating a nuisance for abutters.
- Impacts to abutter's properties should be avoided or minimized. Property takings, or impacts to private property, should be avoided regardless of alternative selected.

In July and August of 2013, the Design Team held a meeting with the PAC, as well as a Public Meeting. In these meetings, preliminary information was provided with regards to the impacts and project challenges of four different alternatives. These Alternatives were:

- Alternative 1 - Rehabilitation Alternative
- Alternative 2 – Raised Profile Alternative - Raised roadway, replacement with fixed bridge
- Alternative 3 – Widened Roadway Alternative - Widened roadway, replacement with moveable bridge
- Alternative 4 – Off-Line Alternative - Offline roadway, replacement with moveable bridge using phased construction

Input gathered from the public was largely similar to that received from the PAC in January of 2013, and at the end of the public meeting, an attendee requested that the audience be asked what their preferred Alternative would be. In response, those attending gave overwhelming support for Alternative 3 (Widened roadway, replacement with moveable bridge). This was primarily driven by the fact that this alternative would mitigate all of the key concerns stated at the PAC and Public Meetings, including minimizing bridge closure, moving the sidewalk, and providing a solid bridge deck.

In fall of 2013, the Design team submitted the Engineering Report, reviewing the various alignments, project constraints and requirements. In this Report, the Design Team recommended that Alternatives 2 and 4 (Raised Profile Alternative and Off-Line Alternative) be eliminated from the review process, because of substantial impacts to the abutters and the environment, and due to the prolonged construction times required. See Appendix A, Drawings 45 to 52 for plans showing the roadway alignment for these eliminated alternatives.

The Design Team has moved forward with Alternatives 1 and 3, which are referred to herein as the Rehabilitation Alternative and the Replacement Alternative.

5. Overview of Alternatives

The Rehabilitation Alternative strives to update the structure to sustain modern loading requirements and meet minimum requirements for shoulder width, while maintaining as much of the original fabric as possible, and in compliance with the Secretary of the Interior's standards for rehabilitation. After the engineering review of the existing structure, it was found that the vast majority of the bridge components require replacement, resulting in much of the structure to be replaced in-kind. The pier piles and bridge abutments are the only original components to remain on the bridge. The Rehabilitation Alternative will match the aesthetic of the original bridge as much as possible, but will require higher railings, larger floorbeams, new pier caps, new mechanical and electrical systems, a larger operator house, and nearly double the original number of steel piles driven alongside the existing piles. The Rehabilitation Alternative will provide 2' wide shoulders and a 5' wide sidewalk, minimizing changes to the existing cross section while meeting modern requirements.

Based on the effort required for rehabilitation, with vast majority of the structure being replaced, the Rehabilitation Alternative is effectively a replica of the existing structure, and not a rehabilitation.

The Replacement Alternative will construct a new bridge structure that will match the massing and scale of the existing structure as much as practical, while focusing on an efficient design that minimizes construction and maintenance cost, and construction durations. The bridge will be along the same alignment as the existing bridge, with a solid riding surface and widened shoulders (4' wide) for increased safety of bicyclists and motorists, as well as sidewalk widened to 5'.

Both Alternatives widen the roadway westward. This is necessary because of limitations provided by the existing right-of-way limits eastward widening. Additionally, there are two natural resources, eel grass and a wetland mitigation area, located in the Harbor east of the approaches, which should not be impacted if possible. See Section 8 for further discussion on impacts to resources.

The two Alternatives provide roadways of differing widths, so the capital cost comparisons will not be truly "apples to apples", as the volume of required materials will differ. In order to provide further insight into the costs associated with the construction of each alternative, a Rehabilitation Alternative with 4' shoulders and a Replacement Alternative with 2' shoulders will be estimated for cost comparison purposes.

6. Major Bridge Rehabilitation Alternative

6.1. Roadway Geometry and Considerations

This alternative will match the horizontal and vertical geometry of the existing roadway to facilitate bridge rehabilitation in the existing location and at the existing grade. The horizontal alignment and curve superelevation will retain the existing condition and will meet the requirements for the desired 30 mph design speed. The vertical profile will generally retain the existing profile; however, the sag curve on the south side of the bridge will be improved to meet the 30 mph design speed.

Minor improvements are proposed for the roadway typical section which include 2 foot paved shoulders and a 5 foot sidewalk. This alternative limits the impacts to the existing steep side slopes and has the smallest footprint of construction impacts. It does not, however, provide sufficient bike shoulders and does not align the bridge sidewalk with the sidewalk approaching the bridge from the north. The proposed roadway structural section consists of 4.5" of pavement with 8" of gravel, crushed gravel, and sand. The limits of proposed guardrail have not been designed at this point, but are expected to be similar to the existing condition for this alternative. The required guardrail system for this design will be investigated during the Slope and Drain Submission. The proposed side slopes vary from 4(H):1(V) to 1.5(H):1(V). Slopes 2(H):1(V) or steeper have been assumed to require Class B stone fill which matches the existing banks.

As discussed in Section 5, it is feasible to provide 4-foot shoulders on the roadway section to provide sufficient bike shoulders on the approaches. Costs associated with this will be provided for comparison purposes, but Major Rehabilitation with 4' shoulders will not be fully investigated, as this will not match the existing bridge's aesthetic as much as possible. This would require roadway geometry and retaining walls as discussed in the Replacement Alternative later in the document.

The proposed stormwater design on the northern approach to the bridge is expected to retain the existing condition while requiring a few catch basin relocations. On the southbound side of the bridge, runoff from the northbound lane will not change the existing condition. Runoff from the south bound lane will now be channelized by the curbing along the proposed sidewalk and may need to be collected by some form of closed system. The southwest quadrant of the bridge provides a location for a potential stormwater treatment area.

6.2. Bridge Considerations and Approach

The rehabilitated bridge would maintain the existing layout and aesthetic of the bridge as much as possible, but with the structure widened to increase roadway shoulders from 1-foot to 2-feet and widening of the sidewalk to 5-feet from 3-feet.

Rehabilitation of the individual existing members, utilizing welded or bolted plates as reinforcement, is not recommended for a number of reasons. Firstly, steel components of the bridge exhibit extensive section loss, with uneven surfaces and corrosion holes. It will be extremely expensive and time-consuming to attempt to weld or bolt repair plates that properly fit additional repair plates to the existing members without there being gaps between the existing and new plates. Secondly, welded and bolted plate repairs create small seams between plates, where salt water from ocean spray or roadway deicing can enter and cause pack rust. This is a common type of corrosion in built-up steel bridges which can dramatically shorten the lifespan of a bridge. Lastly, the majority of stringers and floorbeams have already been rehabilitated with welded plates which exhibit pack rust, prying and cracking. In order to fit a new flange plate over the existing would require cleaning pack rust between existing plates and straightening plates already welded to a beam. This is costly, and not recommended.

On the approach spans, the open grid bridge deck would be replaced with a partially-filled grid deck to provide a solid surface for most of the bridge structure, which was a key concern expressed during the Public Involvement Process. However, the bascule span deck will be an open grid deck, so that the counterweight can remain similar in size to the existing. The bridge rails will be replaced with a TL4 type bridge rails. The sidewalk railing will also be replaced. The bridge rails on the existing and on the rehabilitated structure terminate at the end of the bridge. This poses a hazard to vehicles as it is an obstruction along the roadway. Because the approaches to the bridge are narrow, the railing and sidewalk cannot be transitioned away from the road to mitigate this hazard. The two possible outcomes for termination of the railing are installing a crash attenuation system at the ends of the railing, or simply terminating the railing and receiving a design exception from NHDOT. Neither of these options is recommended, though the latter would adhere to the Secretary of the Interior's Standards for Rehabilitation.

Rehabilitation calls for replacement of all approach span stringers with W24x131 stringers. The approach span stringer spacing will largely match that of the existing seven stringers, except that an eighth stringer would be added to the west side of the bridge, to account for the widened roadway. These stringers would be fixed at the piers, with expansion joints at the abutments and rest pier. This will minimize the number of bridge joints required, and allow the piers to work together. Cover plates will be required on top of the stringers in order to allow for a 1% cross slope on the deck.

The pier caps exhibit extensive section loss, and will require replacement. Approach pier and rest pier caps will be replaced with two MC18x53 channel, with new stiffeners between the channels at stringer locations. The existing 24"WF shape supporting stringers at the bascule pier will be replaced with a W24x131 stringer.

Existing bascule floorbeams will be replaced with either W18x60 floorbeams with shims to account for a 1% cross slope or with a built-up member of varying depth, and the existing bascule girders will be replaced with W36x150 girders. It should be noted that although the west bascule girder rates above statutory in its existing layout, it would not rate above statutory when the roadway is widened to accommodate 2' shoulders. Additionally, maintaining even weight between the girders is essential on a bascule bridge, and the existing west girder has been modified with cover plates, which would require unnecessary cover plates be welded to the new east girder.

The existing pier piles were found to be insufficient for a number of reasons: Firstly, there is extensive corrosion found along the mudline. Secondly numerous piles exhibit section loss and buckling above the water line. Thirdly, the piles do not meet the minimum AASHTO requirements for slenderness. Because of their inadequacy, all approach and rest pier piles require sistering, with new piles being driven outside and between existing.

Piles were analyzed utilizing conservative estimates of soil properties that are based on information taken from the 1942 borings. Further investigation into subsurface conditions is recommended during final design.

New bracing would be required for the piles as well. Existing bracing is welded to the piles, and will require removal prior to driving new piles. Additionally, the lower cross brace will require a substantial increase in size. In order to create a situation where the existing piles meet AASHTO slenderness requirements, a fixed moment-connection will be required at the lower bracing location, making it a primary member, as it will be critical to the capacity of the piles. This will create a situation where a primary member and primary connections are located close to the high water mark in a salt-water environment, which will be a long-term maintenance concern.

The existing bascule pier would require complete removal and reconstruction. Because of the close spacing of the existing piles, new piles cannot be installed between the existing piles. Significantly changing the location of the existing bascule pier would 1) change the original layout of the bridge and 2) would require a much larger counterweight, potentially requiring the counterweight lower into water during lifts. This is not an acceptable condition. The existing work and machinery platforms are in poor condition and require replacement. The existing piles require replacement, as does the bracing.

In order to sustain braking and seismic loads, new batter piles must be installed at Pier Bents A and E (see Appendix E, page E-2 for bridge layout). The addition of these piles restricts the navigable width between approach spans, but does not affect the width of the navigable channel at the bascule pier.

The existing bridge abutments would be widened on the west side to accommodate the new roadway width. Two piles would be driven on the west side of each abutment. Because the south abutment is a counterfort abutment, there is clearance on the west side to drive new piles without interfering with the existing footings. New approach slabs would also be constructed on the existing abutments, requiring modifications to them.

See Drawings 1-14 for details on the Major Rehabilitation Alternative.

6.3. Mechanical and Electrical Systems

New mechanical and electrical systems are proposed for the rehabilitated bridge. This need is due to the fact that the existing systems are both obsolete and in poor condition. The new machinery would be laid out in a similar manner to the existing. It will utilize two 15 horsepower motors, one as the primary mover and the other as a backup emergency drive, coupled to a single two stage reducer with a 50 to 1 reduction. The reducer will output to a new set of open gearing. All open gearing will be replaced and although it will utilize the same gear ratio, it will be sized appropriately to the new machinery. The rack portion of the open gearing will be connected to the main pinion shaft. As the pinions rotate, force is applied to the racks and turn the bridge about the trunnions.

The braking system will include four drum type motor brakes with brake wheel couplings to connect all the machinery to the reducer. A motor brakes will be placed between each motor and reducer. The larger machinery brakes will be just after the reducer and will connect the reducer to the open gearing and rack and pinion shaft. The machinery brake must be larger as it must be able to withstand the greater of either the motor full load torque after the reducer or wind loading normal to the deck.

The span locks will be two self contained units in the approach span and will engage a receiver socket in the movable span. A new lock platform will be required capable of handling the weight of the span lock units as well as any uplift forces the span locks may see. The locks will be sized appropriately to not allow the bridge to move should the operator try to lift the bridge before pulling the locks, as well as to

keep the bridge from bouncing on the live load shoes under traffic. This not only prevents damage to the bridge but also helps prevent premature wear to the machinery.

A rehabilitated control house is required to be larger than the existing 10'-3" x 7'-6" house to fit the required electrical equipment. A control house matching the aesthetic of the existing will be constructed in the same location. The new control house will be 16'-0" by 12'-4" in size. All of the electrical distribution and controls will be placed in the proposed control house. The room will have a transformer, motor control center (MCC), two motor drive cabinets, a programmable logic controller (PLC) cabinet, control console, and a lighting panel. The control console will be located in the operator room/control house located on the roadway level above the electrical room.

The power distribution will include a MCC which will contain all starters for the motors located in a compact single location. A lighting transformer will be provided for control and lighting. Onsite back-up power is not feasible due to space restrictions. Should back-up power be required a generator plug can be placed outside of the control house to connect to a portable generator. The back-up power may be selected automatically via an automatic transfer switch (ATS) or manual transfers switch (MTS).

The control system, aside from required hardwired safety logic, will be entirely PLC based. All field devices can be monitored by the PLC. Examples of hardwired safety logic are traffic gates with traffic signals and emergency push buttons. Other control features such as interlocking of span raise function with span locks and span speed features will be internal to the PLC program. The PLC will also enable the operation of the bridge remotely should it be desired.

As a part of the Major Rehabilitation Alternative, the bridge additional components/machinery would be installed. The main drive system will consist of vector duty motors and a drive to control the motors. The drive will enable speed control of the motors without the addition of bulky resistors and relay logic to control speed. Span locks would be placed at the rest pier. Electronic barrier gates will be placed on the north and approach spans of the bridge, with electronic warning gates placed approximately 100' north and south of the barrier gates. Span locks will be placed at the rest pier, preventing the girders from uplifting. All devices required for safety interlocking and monitoring would also be installed; such devices would be limit switches for brakes, span locks, span position, and brakes.

For the rehabilitation, the lighting would also be upgraded to include work area lighting, roadway lighting, and navigational lighting.

Electrical service and fiber optic communication cable will be required on the north side of the bascule span, for purposes of communication with gates and lights, as well as providing a power supply. There are three options for supplying this power:

1) Run fiber optic cables over the existing utility poles, and extend power supply from the north approach onto the bridge.
2) Run fiber optic cables and power lines over the existing utility poles from the south side of the bridge to the north.
3) Place a submarine cable underneath the navigable channel, connecting the north gates and lights to the operator house south of the bascule span.

At this time, the first option is recommended. Submarine cables are expensive, and complicate any future dredging that may be done in Little Harbor. The power line required to power the north gates and lights will be larger in diameter than lines that are typically run on utility lines, and would pose additional expense and maintenance concerns. There is also an additional potential hazard, if the cable were to fall off the line. This is potentially a concern because there have been previous instances where utility lines have fallen off the poles at the bridge site. Since roadwork will already require excavation on

the existing roadway, no additional staging or closures would be required to extend underground electrical service to the bridge. Final determination for the layout of power and fiber optic cables will be determined during preliminary design, as it will require coordination with utility companies for permissions to use existing utility poles and coordination with the US Coast Guard to maintain navigable clearances.

Because of the limited space available on the machinery platform for the Major Rehabilitation Alternative, a backup generator cannot be implemented for the Major Rehabilitation Alternative.

6.4. Construction Staging and Techniques

Construction staging, allowing for one-way alternating traffic, is not feasible for this alternative. There are a number of reasons causing this:

- The bascule span has only two girders, and the roadway cannot be maintained with only one girder in service.
- Installation of new piles requires that pier caps be removed. These caps are continuous across the span, and cutting the cap would only gain the installation of one pile, making it impractical to stage construction for such a small gain.
- The bascule pier requires that piles be removed and replaced. This cannot be done with the bridge in service.

Because of the detailed nature of the Major Rehabilitation Alternative, accelerated construction techniques can only be implemented in a limited manner. Key techniques that would be implemented are:

- Two pile-driving crews will work simultaneously
- Install entire pre-constructed approach spans with partially-filled grid deck pre-cast
- Precast counterweight, pre-construct bascule span and install
- Seven day work weeks

Much of the detailed work on the piers requires that steel caps and bracing be bolted directly to driven piles. This is detailed and time-consuming work, which can be accelerated by utilizing more than one work crew, but not through technique.

This alternative requires that large volumes of concrete be cast in the winter at the abutments and at the bascule pier (for the machinery platforms). This can be performed, but will require additional funds for tenting and heating for concrete pours in winter.

7. Bridge Replacement Alternative

7.1. Roadway Geometry and Considerations

This alternative will retain the existing roadway's vertical profile and shift the horizontal alignment to allow for wider shoulders while limiting impacts to the western side of the roadway. The horizontal tangent across the bridge will be shifted approx. 6'-9" to the west. This new tangent will be connected to the existing roadway alignment utilizing curve radii which match the current curves. Utilizing appropriate superelevation, this alignment will meet the requirements for a 30 mph design speed. The vertical profile will generally retain the existing profile; however, the sag curve on the south side of the bridge will be improved to meet the 30 mph design speed.

The roadway typical section will be widened to accommodate 4' shoulders on both sides for bicycle use while maintaining 11' travel lanes for vehicles. The sidewalk will be widened to 5' and relocated to the

east side of the roadway so that it lines up with the existing sidewalk to the north of the project. Similar to the rehab alternative, the proposed roadway structural section consists of 4.5” of pavement with 8” of gravel, crushed gravel, and sand. Also similar to the rehab alternative, this alternative will require the guardrail panel to be reduced to 1 foot or 1'-6" in some areas. The required guardrail system and limits will also be investigated for future Submissions. The shift in horizontal alignment will require additional lengths of retaining wall on the northwest and southwest quadrants of the bridge to avoid impacts to the harbor. Slopes 2:1 or steeper will also require Class B stone fill which matches the existing banks.

As discussed in Section 5, the costs of Replacement with 2’ shoulders will be calculated for comparison purposes. A Replacement with 2’ shoulders is eliminated from full consideration because it does not provide the same level of safety for bicycle and vehicle traffic as 4’ shoulders do. A replacement with 2’ shoulders would require shorter retaining walls and re-grading similar to that discussed under the Major Rehabilitation Alternative.

The proposed stormwater design on the northern approach to the bridge is also expected to retain the existing condition while requiring a few catch basin relocations. On the southbound side of the bridge, runoff from the northbound lane will need to be collected by a closed system due to the relocation of the sidewalk and installation of granite curbing. Similar to the rehab alternative, runoff from the southbound lane will be channelized by the curbing and may also need to be collected by some form of closed system. The southwest quadrant of the bridge provides a location for a potential stormwater treatment area in this alternative as well.

Please see Appendix A, Drawings 18-24 for roadway plans, profiles and sections of the Replacement Alternative.

7.2. Bridge Considerations and Approach

The Replacement Alternative will construct a new bridge focusing on an efficient design that minimizes costs, construction durations and a 75-year design life. Design decisions for this alternative are driven by input from the Public Involvement Process, as well as minimizing environmental, economic and right-of-way impacts.

When considering structure types, the NHDOT and the Design Team decided to utilize a steel bascule-type moveable span for the following reasons:

- A bascule span would maintain two bascule bridges in the State of New Hampshire.
- A bascule span would maintain the aesthetic of the original structure as much as practical, realizing it is a new structure and design.
- A bascule span would minimize impacts to the navigable channel.
- A bascule span is an efficient choice for a moveable span, requiring a smaller footprint than structures such as a swing bridge, and allowing for vertical underclearance that would accommodate all vessel heights anticipated to use the channel, which cannot be achieved using vertical lift bridges.

The Design Team has initially reviewed three options for the approach span structure types:

- Northeast Extreme Tee Beams, or “NEXT” Beams
- Concrete Spread Box Beams
- Steel Girders

After comparing the superstructure options, the Design Team recommends Northeast Extreme Tee Beams (NEXT Beams). Precast concrete box beams were eliminated because NEXT Beams offer comparable structure depth, have a less expensive capital cost, and will similarly minimize maintenance costs. Additionally, it is impossible to inspect and repair the inside faces of the open-cell concrete box beams, which is especially detrimental in the harsh marine environment that this bridge is located in. NEXT beams eliminate this maintenance concern. Steel I-beams were eliminated because of the higher captital and maintenance costs.

The span arrangement proposed is driven by constructability. The proposed Bascule Pier is located behind the existing, allowing construction to commence prior to closing the existing bridge. A four span configuration will be utilized, one 55'-8" approach span south of the bascule pier, a 64'-9"bascule span and two 65'-0½" approach spans north of the bascule span. A single 130' approach span was considered on the north side, but was eliminated because the structure depth would be over 6'-6", dramatically reducing the underclearance at the bridge. A 130' span would also eliminate the possible use of NEXT beams, an option that significantly reduces the long-term maintenance costs.

During initial review, a roadway with both 2' wide and 4' wide shoulders were considered for this Alternative. After reviewing potential environmental and right-of-way impacts, it was determined that there would be minimal environmental and no right-of-way impacts, a Replacement Alternative with 4' wide shoulders was further investigated. A geotechnical review of the existing stone fill causeway was performed. This causeway supports the approach roadway on both ends of the bridge. After checking capacity and global stability based on a conservative estimate of the soil's geotechnical capacity, it was determined that MSE walls supporting a widened roadway with 4' shoulders could be constructed.

An 8" thick reinforced concrete deck will be utilized for the approach spans regardless of the selected approach superstructure. The bascule span will utilize a partially-filled grid deck. Deck joints will be required at the bascule pier and at the abutments. The deck will be supported by four 32F NEXT beams.

The approach and rest piers of the Replacement Alternative are comprised of two 5' diameter drilled shafts and a precast concrete cap. The drilled shafts will be drilled outside the limits of the existing bridge, prior to closure of the existing bridge. Ten, 5' diameter drilled shafts are required to support the bascule pier, six of which will be drilled outside the limits of the existing bridge, prior to its closure. The abutments will be comprised of a precast concrete cap supported by three drilled shafts, to be drilled in parallel with construction of the bascule piers. Drilled shafts were analyzed utilizing using conservative estimates of soil properties that are based on information taken from the 1942 borings. Further investigation into subsurface conditions is recommended during final design.

A Scenic Overlook is proposed at the east end of the Fixed Pier. This was requested by the Public Advisory Committee, and will provide a place for pedestrians to enjoy the views of Little Harbor. The proposed overlook is a bumpout that is 5' wide, eight feet long, with a 2:1 flare transition. The 2:1 flare transitions is less than that required in the AASHTO Roadside Design Guide, but since the roadway is classified as an urban arterial, a design exception may not be required by NHDOT.

Please see Appendix A, Drawings 25 to 34 for structural details of the Replacement Alternative.

7.3. Mechanical and Electrical Systems

The mechanical system for the Replacement Alternative will consist of an entirely new machinery design. It will utilize two 40 horsepower motors, one as the primary mover and the other as a backup emergency drive, coupled to a single four stage reducer with a 400 to 1 reduction. A single reducer requires less space than a smaller reducer with open gearing and will be more efficient than the existing system. The reducer will output on each side to long float shafts connecting the reducer to the main

pinion shaft. As the pinions rotate, force is applied on the racks and turn the movable span about the trunnions.

The braking system will include two drum type motor brakes with brake wheel couplings to connect the motors to the reducer. The system will also include a set of disc type machinery brakes on the pinion shaft with two brakes on opposite ends of a single brake rotor. These are much larger brakes as they have to be able to take full load motor torque after the reducer or wind loading normal to the deck.

The span locks will be two self contained units placed at the heal of the movable span and will utilize a front and rear guide on the approach and a receiver on the movable span. The locks will be sized appropriately to not allow the bridge to move should the operator try to lift the bridge before pulling the locks as well as to keep the bridge from bouncing on the live load shoes under traffic. This not only prevents damage to the bridge but also helps prevent premature wear to the machinery.

The electrical system for the Replacement Alternative will consist of entirely new mechanical and electrical system. All of the electrical distribution and controls will be placed on the pier directly below the proposed control house in an electrical room. The electrical room will have a transformer, motor control center (MCC), two motor drive cabinets, a programmable logic controller (PLC) cabinet, and a lighting panel. The control console will be located in the operator room/control house located on the roadway level above the electrical room.

The power distribution will include MCC which will contain all starters for the motors located in a compact single location. A lighting transformer will be provided for control and lighting. Should onsite emergency power be required a generator can be placed on the pier on same side of the electrical room opposite the machinery room. Should onsite back up power not be required, a generator plug can be placed at roadway level to connect to a portable generator. The back up power may be selected automatically via an automatic transfer switch (ATS) or manual transfers switch (MTS).

The control system, aside from required hardwired safety logic, will be entirely PLC based. All field devices can be monitored by the PLC. Examples of hardwired safety logic are traffic gates with traffic signals and emergency push buttons. Other control features such as interlocking of span raise function with span locks and span speed features will be internal to the PLC program. The PLC will also enable the operation of the bridge remotely should it be desired.

Similar to the Major Rehabilitation Alternative, there are three options for providing fiber optic communication lines and power to the barrier and traffic gates, as well as traffic lights, to the north approach:

1) Run fiber optic cables over the existing utility poles, and extend power supply from the north approach onto the bridge.
2) Run fiber optic cables and power lines over the existing utility poles from the south side of the bridge to the north.
3) Place a submarine cable underneath the navigable channel, connecting the north gates and lights to the operator house south of the bascule span.

As with the Major Rehabilitation Alternative, the first option is recommended at this time due to costs and complications associated with marine cables, and due to maintenance issues associated with running a large diameter power cable over existing utility lines.

Additional machinery to be installed includes the main drive system, consisting of vector duty motors and a drive to control the motors. The drive will enable speed control of the motors without the addition of bulky resistors and relay logic to control speed. Span locks will be placed at the heel of the bridge. In addition machinery and motor brakes would also be installed. In addition traffic gates and

barrier gates will also be installed as required. All devices required for safety interlocking and monitoring will also be installed; such devices will be limit switches for brakes, span locks, span position, and brakes.

For the Replacement Alternative the lighting would also be upgraded to include work area lighting, roadway lighting, and navigational lighting. Electronic barrier gates will be placed on the north and south approach spans of the bridge, with electronic warning gates placed approximately 100' north and south of the respective barrier gates. Span locks will be placed at the south end of the girders, inside the bascule pier, preventing the girders from uplifting.

The new control house is required to be larger than that of the existing, and will be 16'-0" by 12'-4" in size, with the control desk installed inside and a stairwell leading down inside the bascule pier, where the control systems are stored.

Please see Appendix A, Drawings 34 to 38 for details of the electrical and mechanical systems for the Replacement Alternative.

7.4. Construction Staging and Techniques

The Replacement Alternative will minimize bridge closures by maximizing the construction that can be performed prior to closing the existing bridge and allow for closures during low volume winter months. The Design Team proposes a sequence in which ten of the drilled shafts, the Fixed and Rest Pier caps and the Bascule Pier be constructed prior to demolition of the existing bridge. This will require drilling shafts outside the limits of the existing structure, and floating in precast substructure elements for installation onto new drilled shafts under the existing superstructure.

Other accelerated construction techniques and practices that can be implemented are:

- Expedited construction of approach spans:
    - NEXT Beam approaches allow for expedited construction, as the entire span is comprised of only four beams.
- Precasting counterweight, pre-constructing bascule span and installing as an entire unit after demolition of the existing bridge will minimize closures and construction time for the bascule span.
- Utilize precast abutment stems
- Seven day work weeks
- Prefabricating the operator house

Constructing cast-in-place concrete is expensive during winter months, as cover and heating is often required. Utilizing precast members where possible also expedites construction.

Similar to the Major Rehabilitation Alternative, staging construction to allow for one-way alternating traffic is not feasible for this alternative. There are a number of reasons causing this:

- The bascule span has only two girders, and the roadway cannot be maintained with only one girder in service.
- There is no pile support at the centerline of roadway, so new piles would need to be driven in order to support one lane. Additionally, a bridge closure would be required to drive the temporary pile support, making the requirements of staging impractical for a small gain.
- Complete removal of the bridge allows for an accelerated construction, and for entire spans to be pre-constructed and placed, expediting the closure period.

The construction sequence will consist of the following:

1. Construct MSE walls and widen approach during fall months. This will require one-way alternating traffic for a period of approximately 5 weeks. Construct drilled shafts located outside of the existing bridge's footprint. Place Rest Pier and Fixed Pier caps. No closure is required during substructure work.
2. Demolish existing superstructure and install precast bascule pier.
3. Demolish existing substructure and construct new abutments behind existing.
4. Construct new superstructure off-site and float-in.

See Appendix A, Drawings 42 and 43 for details on the construction staging.

8. Considerations for Impacts to Resources

As part of the TS&L Study process, the impacts of each Alternative are being investigated. Impacts to environmental resources, right-of-way, affects on the community and historical resources are being considered under the alternative analysis of this project. The primary environmental resources of concern identified in, or proximate to, the project area include: tidal wetlands, navigable waters, listed aquatic species, essential fish habitat, and eelgrass beds.

Regardless of the Alternative selected, all will require in-water work, which will require water resource permitting and mitigation of potential siltation. The Replacement Alternative will accomplish mitigation of potential siltation by precasting all piers, to avoid cofferdams, and by placing sleeves around augers during drilling of the substructure shafts. Additionally, noise levels will be monitored during construction of the drilled shafts, to keep it below acceptable volumes for sensitive receptors, such as property abutters. The Major Rehabilitation Alternative will vibrate piles into the sediment, and may require cofferdams or other mitigation measures to prevent disturbances in the river bed and excessive siltation. In addition, the Major Rehabilitation Alternative will require more piles to be installed than the pier installation option for the Replacement Alternative.

Construction windows for work in water will be determined in the National Environmental Policy Act (NEPA) documents for this project, to be completed in early 2014, but it is initially anticipated that in-water work will likely be allowed from November 1-April 1. This construction window estimate is based on those allowed for the Memorial Bridge, constructed in Portsmouth Harbor (2012-2013). Additionally, bridge closures will be limited as much as possible, in response to input received from the Public Involvement Process. Based on input from the community, the design team reviewed the possibility of limiting construction between the months of January and March. This was found to be feasible for the Replacement Alternative only.

The wetlands study performed as part of this project has shown that there is a former wetland mitigation area associated with a separate project northeast of the bridge, adjacent to the approach in the intertidal zone. Eelgrass was found southeast of the bridge site in the subtidal zone. To avoid and minimize potential impacts to these resources, and to Little Harbor in general, temporary silt fencing or other appropriate erosion control measures will be installed outside the limits of construction on the approaches.

If a marine cable is used to provide fiber optic communications and power from the control house to the north approach, it will require open-trench installation in sediments under the bridge. Open cut

trenching is undertaken for cable placement, environmental mitigation and best management practices (BMP's) will be required to minimize siltation in the water column. Potential future dredging should also be considered when determining the depth at which the cable will be placed. At this time, a marine cable is not recommended for communication lines and power supply due to the potential for environmental impacts.

After review of available right-of-way information , it was found that neither the Major Rehabilitation Alternative nor the Replacement Alternative would directly impact private property on either the New Castle or Rye sides of the bridge. Wentworth road was previously situated to the west of where the existing bridge is, so the right-of-way limits are located up to 53' west of the existing roadway. The right-of-way on the east side of the roadway is located less than 10' from the edge of roadway. See Appendix A, Drawings 40 and 41 for the limits of work of each Alternative.

The current clearances of the navigable channel will be maintained with the Major Rehabilitation Alternative. The maximum vertical clearance of the Replacement Alternative will be increased by 1'-2" to approximately 14'-2" at mean high water, as the bascule span depth is being reduced. The width of the navigable channel will increased from the existing 28'-9" to approximately 44'-6".

The existing bridge is eligible for the National Register of Historic Places, as described in the Individual Inventory Form, completed in July 2013. It is therefore considered a historic resource. Unfortunately, for the numerous reasons laid out in the Bridge Condition section of this study, the bridge is nearing the end of its functional life and the vast majority of the bridge's components cannot be rehabilitated. Because the Major Rehabilitation Alternative effectively constructs what is a replica of the existing bridge, both alternatives will substantially change the existing bridge structure, and therefore both would constitute an "Adverse Effect" under Section 106 of the National Historic Preservation Act. An adverse effect occurs when an undertaking may directly or indirectly alter characteristics of a historic property that qualify it for inclusion in the National Register of Historic Places.

9. Construction Schedule

The Design Team reviewed potential construction staging for the alternatives. Schedules are based on staging and construction sequences previously discussed. Both alternatives will require that the MSE walls retaining the approach, as well as the widening of the roadway, will require construction in the fall, prior to the ground freezing. This construction will require one-lane alternating traffic for a period of about 5 weeks. It is not anticipated that there will be substantive differences in the duration of roadway construction between the two alternatives even though the Replacement Alternative provides for 4-foot shoulders while the Major Rehabilitation Alternative provides 2-foot shoulders.

Construction windows for work in water will be determined in the National Environmental Policy Act (NEPA) documents for this project, to be completed in early 2014, but it is initially anticipated that in-water work will likely be allowed from November 1-April 1. This construction window estimate is based on those allowed for the Memorial Bridge, constructed in Portsmouth Harbor (2012-2013). Additionally, bridge closures will be limited as much as possible especially during the busy tourist months of June

through September, in response to input received from the Public Involvement Process. The PAC's desired closure timeframe was the months of January through March.

Mobilization and staging by barge or work platform is anticipated to be constructed in November and December for either alternative. No bridge closures will be required for this work.

Review of bridge construction for the Major Rehabilitation Alternative found that staging is not feasible, and that the construction sequence will require demolition of the deck, superstructure, pier caps, the entirety of the bascule pier, control house and mechanical systems prior to construction of new bridge components bridge. The total construction duration for the Major Rehabilitation Alternative is anticipated to be 7 months, with a bridge closure of 5 months. Because of the expected requirements for in-water work, the bridge closure would occur from January to June.

Review of bridge construction for the Replacement Alternative also found that construction staging (alternating one-way traffic) is not feasible, but that several components of the new bridge structure can be constructed prior to closure of the existing bridge. The total construction duration for the Replacement Alternative is anticipated to be 5 months, with a bridge closure of 3 months. It is anticipated that the bridge closure will occur from January through March.

Refer to Appendix B – Construction Schedule for details on the preliminary schedules proposed for each Alternative.

10. Life Cycle Cost Analysis

Preliminary cost estimates for the Major Rehabilitation Alternative and Replacement Alternatives were developed. These estimated the capital costs of each alternative, as well as life-cycle maintenance costs associated with each alternative over a 75-year design life. A 75 year period is recommended by AASHTO, and serves as the basis for a bridge's life cycle.

Capital costs were calculated for each Alternative. A previously discussed, the two Alternatives have different roadway widths. To provide an "apples to apples" comparison, capital costs for a Major Rehabilitation with 4' shoulders and a Replacement with 2' shoulders was calculated to provide alternative comparisons under similar roadway geometries. See the following tables, which compares the capital costs of the Alternatives with similar shoulder widths:

Alternatives with Two Foot Shoulders

Alternative	Roadway Cost	Retaining Wall Cost	Bridge Cost	Engineering	Total
Major Rehabilitation	$296,000	$24,500	$13,860,000	$1,140,000	**$15,321,000**
Replacement	$296,000	$24,500	$13,900,000	$880,000	**$15,101,000**

Alternatives with Four Foot Shoulders

Alternative	Roadway Cost	Retaining Wall Cost	Bridge Cost	Engineering	Total
Major Rehabilitation	$482,317	$280,000	$14,590,000	$1,230,000	**$16,583,000**
Replacement	$482,317	$280,000	$14,140,000	$920,000	**$15,823,000**

When comparing capital costs of the Alternatives with similar roadway geometry, the Major Rehabilitation Alternative was found to have higher capital costs regardless of shoulder width, showing that the construction type for the Major Rehabilitation Alternative when providing similar roadway geometries. Because a goal of the Major Rehabilitation Alternative match the existing bridge layout and aesthetics as much as possible, the design team moved forward with a Major Rehabilitation Alternative with 2' shoulders, to maintain as much of original structure's historic fabric as possible. The Design Team also moved forward with the Replacement Alternative using 4' shoulders, as it provides increased safety to bicycle and vehicular traffic.

A life-cycle cost analysis was performed on the Alternatives to determine which is most cost-effective over the 75-year design life. Life-cycle cost analyses determine the cost of constructing a bridge and maintaining it over its year design life in present day dollars. In order to account for the time-reduction value of the dollar, and to make an "apples-to-apples" comparison of Alternatives given that future expenditures are valued less than present-day expenditures, dollars are discounted at 4% per year in this analysis. This 4% discount is per guidelines of the Federal Highway Administration (FHWA).

The dollars are discounted over time because dollars spent in the future are valued less than dollars spent in the present. In other words, even with zero inflation, the value attached to $1 received one year from now is less than the value attached to $1 received today. The same principle applies to the world of investing, where $100 today is worth more than $100 ten years from now as one could invest the $100 and earn interest on it to be worth more in the future.

The need for discounting is not related to inflation, it is in addition to that. There are two types of discount rates. One is used for future consumption and is expressed in "nominal" terms (in inflated dollars). The second is used for cash flows, and is expressed in "real" terms (in dollars of constant purchasing power relative to a base year; that is, after the effects of inflation have been removed).

A "real" discount rate should be used to discount future values measured in constant dollar terms, and a nominal discount rate should be used to discount future values measured in inflated dollars. Given that Life-Cycle Cost Analysis uses costs in today's dollars applied to future expenditures, a "real" discount rate is used in this analysis to bring the future costs back to the present value.

The Major Rehabilitation Alternative provides a bridge that has a large number of bolted steel connections to existing steel. Additionally, it provides an open grid deck on the bascule span. This type of construction, especially when utilizing exiting steel has a dramatically reduced life span. The previous structure required a major rehabilitation only 33 years after its initial construction. A capital cost for a major rehabilitation is included in the Life-Cycle Cost Analysis in 2055 for the Major Rehabilitation Alternative.

Other costs included in the Rehabilitation Alternative include efforts to paint and repair the structural steel, pier rehabilitations, cleaning and painting structural steel and work on the deck and deck joints.

The Replacement Alternative was initially reviewed with three options for Approach Span structure types: steel stringers, precast spread box beams and precast NEXT beams. NEXT Beams provided the lowest capital costs and life-cycle costs between the three options, and is the recommended superstructure type. The differences in capital cost between the NEXT Beam and steel stringer options are approximately $400,000, or about 2.4% of the construction cost. A Replacement Alternative with approach superstructures comprised of steel superstructures was found to have a higher capital cost, and higher life-cycle maintenance costs than a Replacement Alternative with approach spans using NEXT beams.

The following table summarizes costs associated with each Alternative. The first column, Capital Cost, presents the cost of construction in today's dollars. The second column, Life Cycle Cost (Present Day Expenditure) provides the sum of all costs associated with constructing and maintaining each alternative over a 75-year period. This column presents the dollar value as if all money was being spent in the present. The third column, Life Cycle Cost (2013 Dollars), also provides cost associated with the bridge over its 75-year life, but accounts for all costs associated with constructing and maintaining each alternative over a 75-year service life, but discounts dollars.

Alternative	**Capital Cost**	**Life Cycle Cost (Present Day Expenditure)**	**Life Cycle Cost (2013 Dollars)**
Major Rehabilitation Alternative	$15.32 million	$41.555 Million	$19.532 Million
Replacement Alternative with NEXT Beam Approaches	$15.82 million	$24.298 Million	$16.286 Million

The Major Rehabilitation Alternative was found to have a slightly lower capital cost, but significantly higher life-cycle costs than the Replacement Alternative. Based upon this analysis, it was determined that the Replacement Alternative with NEXT Beams is the most cost-effective alternative for the New Castle-Rye Bridge Project.

Refer to Appendices C and D for construction and life-cycle cost estimates.

11. Evaluation Matrix

There are large number of factors that must be considered when selecting and alternative for the New Castle-Rye Bridge. The following Evaluation Matrix summarizes and tabulates the critical factors:

Alternative	Life Cycle Cost (2013 Dollars)	Life Cycle Cost (Present Day Expenditure)	Capital Cost	Expected Life of Structure	Bridge Closure	Changes to Navigable Channel	ROW Impacts	Design Exceptions Required	Public Support
Major Rehabilitation	$19.532 Million	$41.555 Million	$15.32 million	35-40 Years	5 Months	None	None	Guard Rail Transition	No
Replacement with NEXT Beam Approaches	$16.286 Million	$24.298 Million	$15.82 million	75 Years	3 Months	Increased Vertical and Horizontal	None	Scenic Bumpout may require an exception	Yes

Alternative	Design Load	Roadway Shoulders	Sidewalk Width	Bascule Bridge Deck	Approach Span Deck	Approach Retaining Walls	Bridge Railing	Backup Power
Major Rehabilitation	HL-93	2 feet	5 feet	Open Grid	Partially Filled Grid	50 Linear Feet	TL4 with termination at bridge end	None or off-bridge
Replacement with NEXT Beam Approaches	HL-93	4 feet	5 feet	Partially Filled Grid	Reinforced Concrete	375 Linear Feet	TL4	Inside bascule pier

12. Recommendation

After careful review of the Alternatives, the Design Team recommends that the Replacement Alternative, with NEXT beam approaches, be selected for the New Castle-Rye Bridge project. NEXT Beams were selected for the approach spans over a steel stringer superstructure because the use of NEXT Beams reduces the long-term maintenance efforts and allows for easier construction.

The Replacement Alternative with NEXT beam approach spans provides a number of benefits:

- Shorter closure times are required, allowing construction to take place in the winter with closures from January to March. Based on information gathered from the Public Involvement Process, constructing the bridge within this period will minimize impacts to the general public.
- Lowest life-cycle costs ($24.3 Million with Present-Day Expenditure, $16.3 Million in 2013 Dollars).
- Longer service life (75 Years).
- Roadway shoulders are 4' wide, providing benefit to bicyclists.
- A closed deck system for both approach spans and the bascule span will provide a safer riding surface for bicyclists, and provide a quieter roadway that will not be a nuisance to abutters. A closed deck system will not expose the girders and floorbeams to roadway salts.
- Moving the sidewalk to the east side of the bridge aligns the bridge's sidewalk with that of the north approach, and aligns it with the wider shoulders on the east side of the south approach. This is a safer condition for pedestrians, as they do not need to cross the road to use the bridge.
- Utilizing drilled shafts and precast substructure elements minimizes impacts on marine life, since noise levels will be kept to a minimum and silting in the water can also be minimized. It also removes the need for cofferdams.
- Increases clearances of the navigable channel.
- Preferred by the public based on input received during the Public Involvement Process.

There were a great number of detractors found when considering the Rehabilitation Alternative. A primary reason that the Design Team does not recommend the Rehabilitation Alternative is due to its condition. Only a limited number of bridge components could be salvaged, and the piles require extensive sistering, or removal and replacement. Typically sistering or replacing the piles in the manner proposed is an inefficient means of constructing a bridge, but because this structure was the subject of agreement under the Scammel MOA, extraordinary efforts and designs were investigated. Despite these efforts, it was found that this alternative has a reduced effective life because of the nature of its construction. Open grid decking, as well as structures with large numbers of steel connections are more prone to deterioration than modern rolled steel structures, and especially more than modern concrete structures. Additionally, machinery that is exposed to the elements, as it will be in the Rehabilitation Alternative, are far more prone to deterioration. As discussed in Section 3, Condition Evaluation of Existing Bridge, this structure has already had numerous repairs and extensive rehabilitations performed largely due to the nature of its construction, and has now reached the end of its service life.

Other significant reasons why the Rehabilitation Alternative is not recommended are as follows:

- Longer closure times are required
- Highest life-cycle costs ($41.6 Million with Present-Day Expenditure, $19.5 Million in 2013 Dollars).
- Significantly shorter service life (35-40 years)
- Roadway shoulders are only 2' wide, which reduce safety for bicyclists and drivers

- The roadway railing that terminates at the end of the bridge is a crash hazard to drivers
- The open grid deck at the bascule span will pose a long-term maintenance concern to the bascule, exposing the girders and floorbeams to roadway salts. It is also a hazard to bicyclists
- The sidewalk remains on the west side of the bridge, posing a hazard to pedestrians by requiring that they cross the road in order to use the bridge
- Potentially increased disturbances to marine resources, since a large number of piles will require driving, a noise nuisance to marine resources
- Since the vast majority of bridge components require replacement, this alternative does not preserve a large majority of the historic fabric of the existing bridge.
- Not preferred by the public based on input received during the Public Involvement Process.

The Design Team respectfully submits the recommendation, and will seek additional input from the New Hampshire Department of Transportation, the public through the Public Involvement Process and appropriate authorities and agencies before moving forward with preliminary design of the Replacement Alternative with NEXT beam approach spans.

Appendix A

Drawings

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Bridge Replacement

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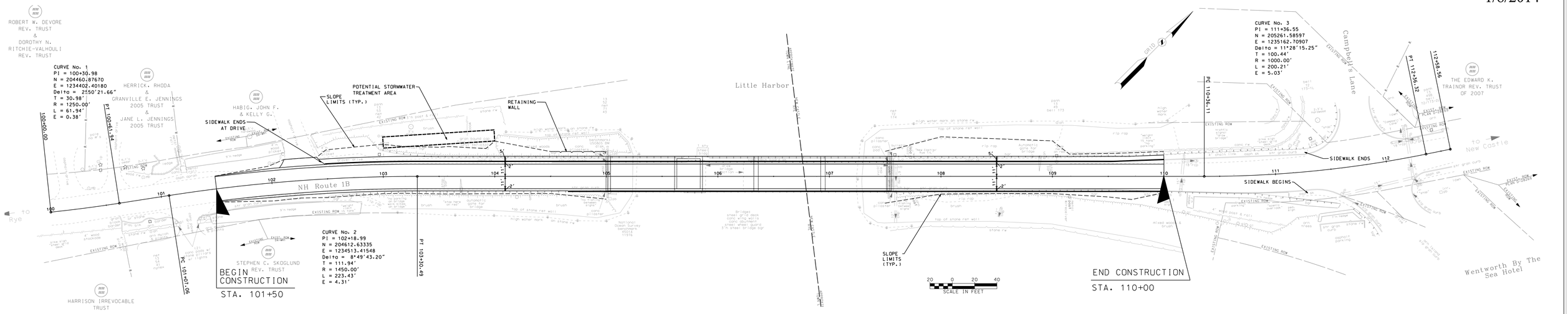
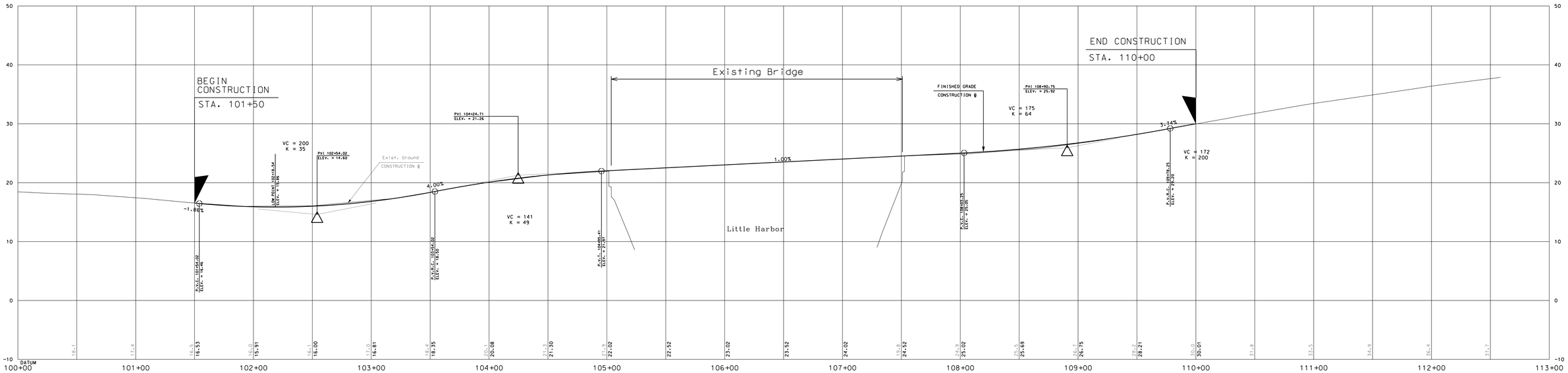
1/8/2014





SCALE:
1"= 20' HORIZ.
1"= 4' VERT.

NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE, & LOCATION STUDY

BRIDGE MAJOR REHABILITATION ALTERNATIVE

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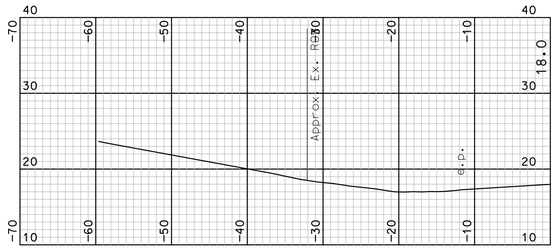

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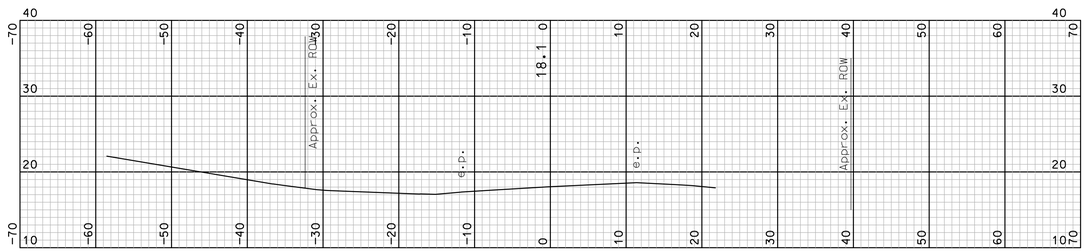

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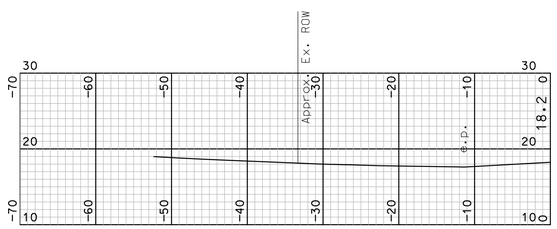

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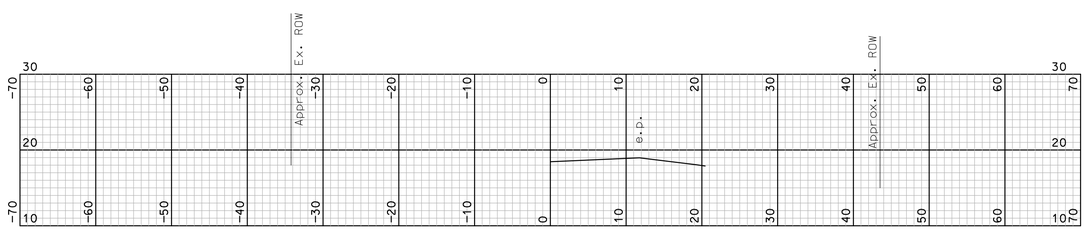

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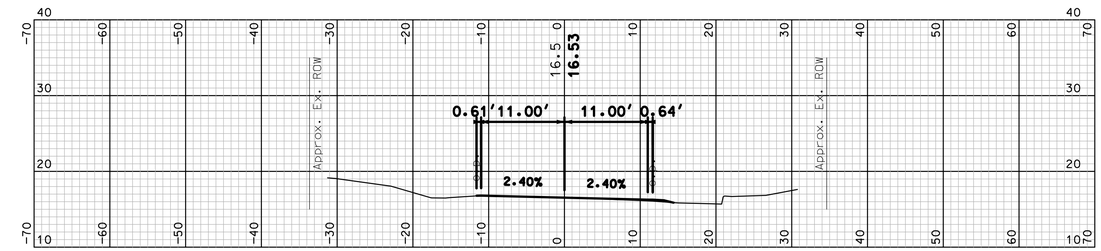

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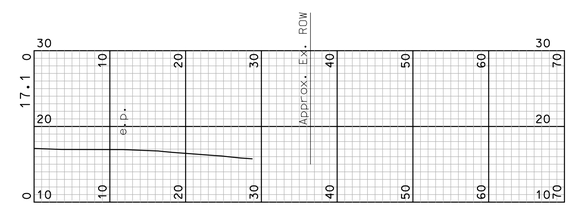

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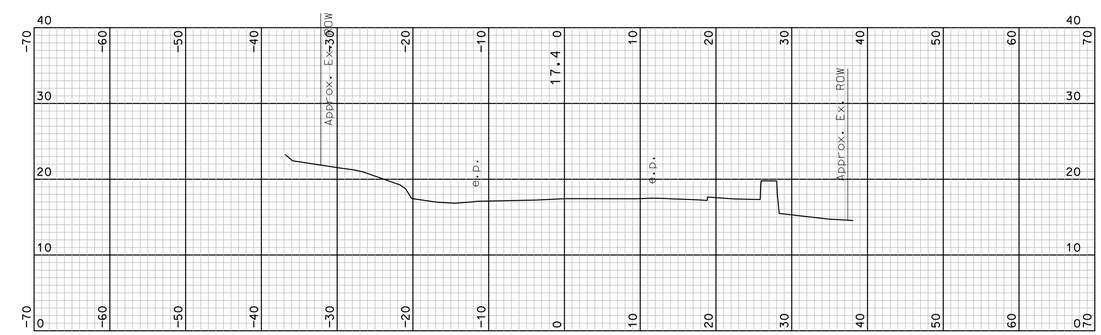

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NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

BRIDGE MAJOR REHABILITATION ALTERNATIVE - ROADWAY CROSS SECTIONS

SCALE: 1" = 10'-0"

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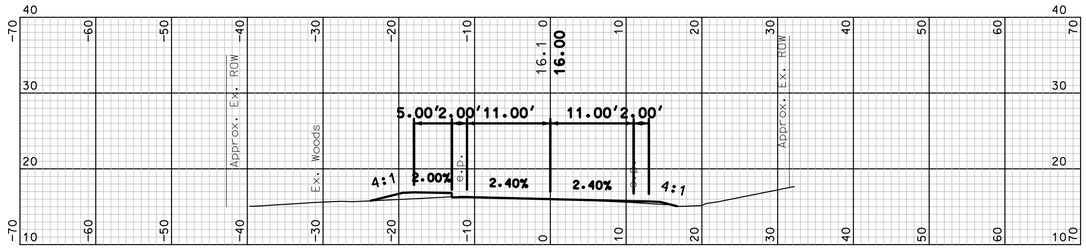

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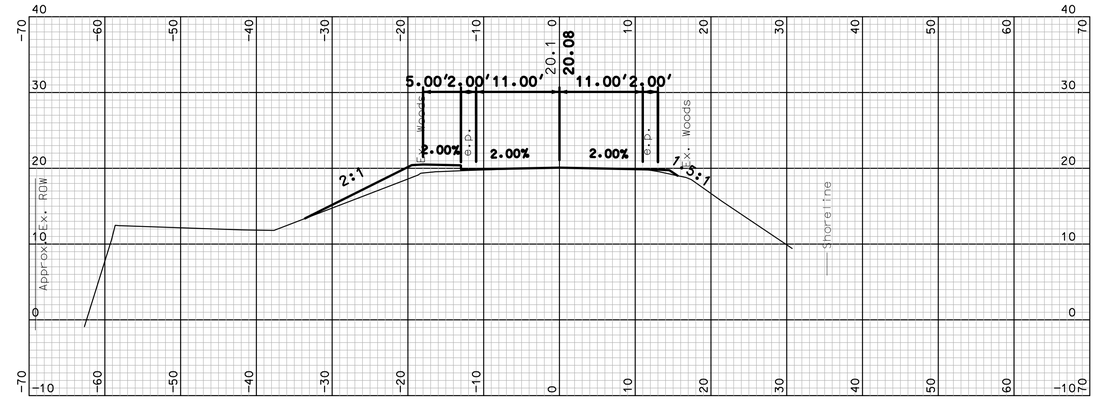

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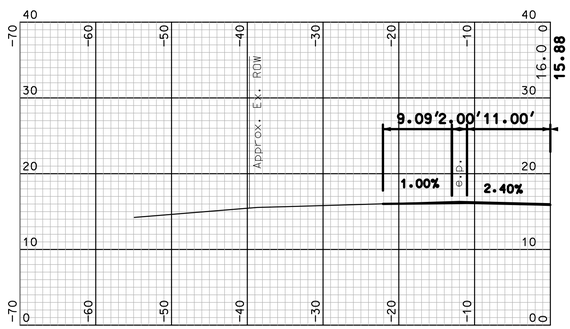

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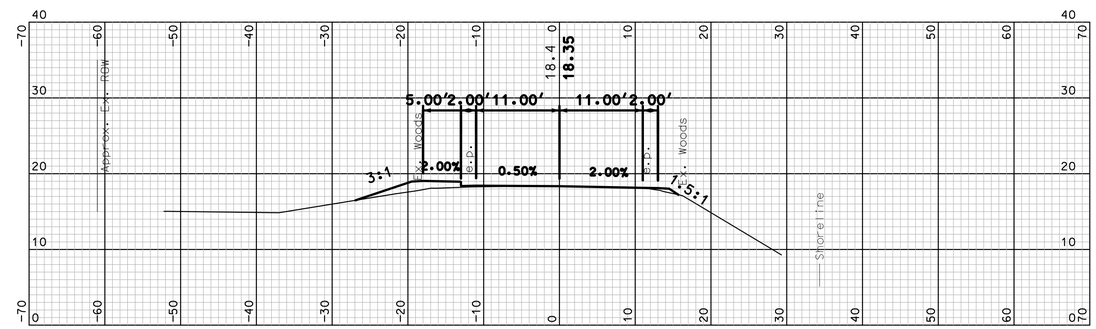

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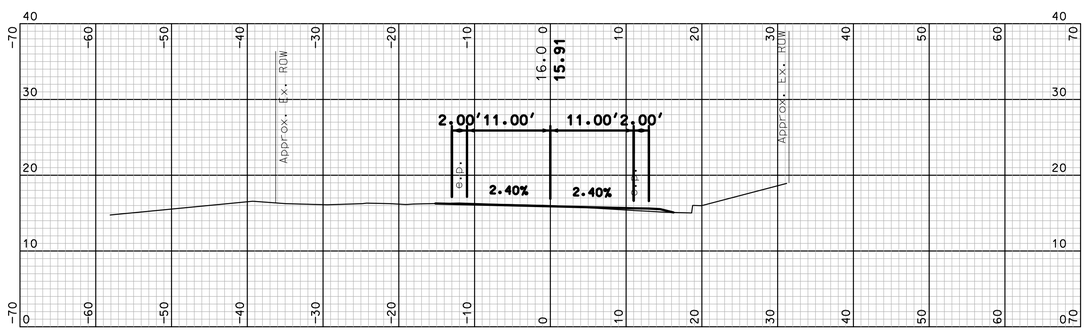

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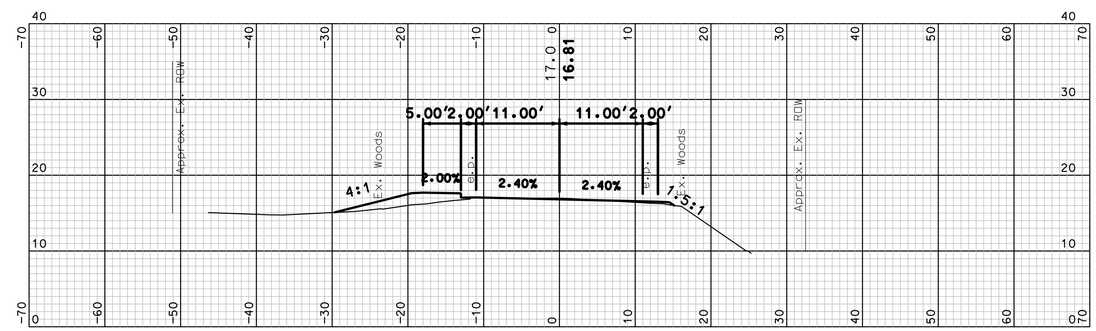

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NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

BRIDGE MAJOR REHABILITATION ALTERNATIVE - ROADWAY CROSS SECTIONS

SCALE: 1" = 10'-0"

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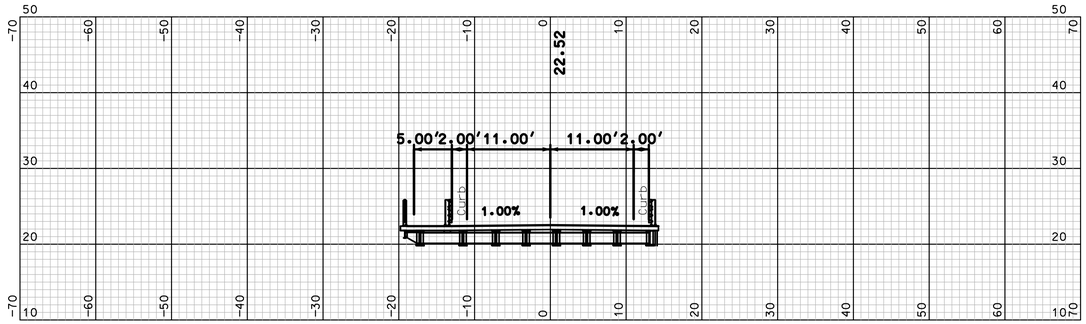

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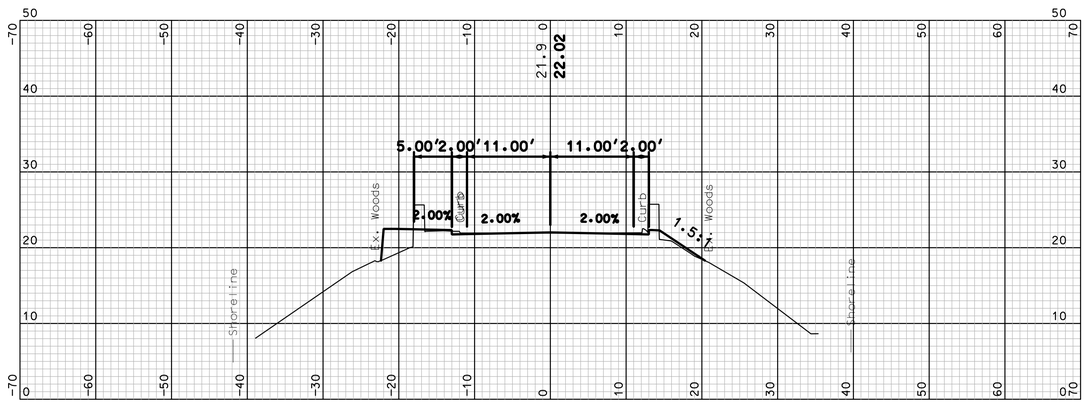

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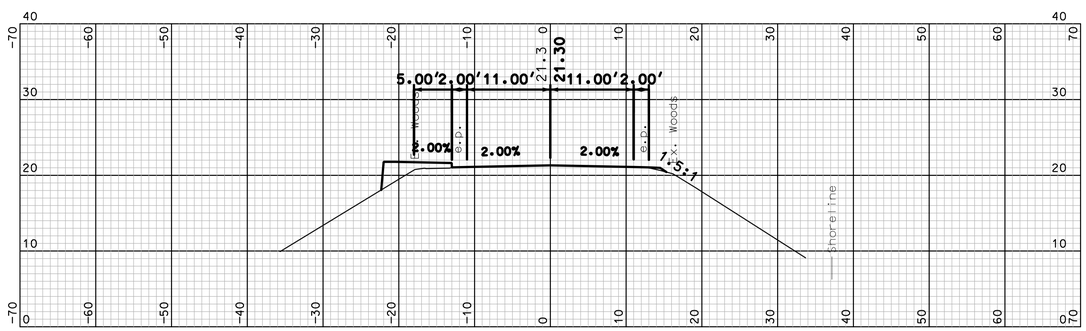

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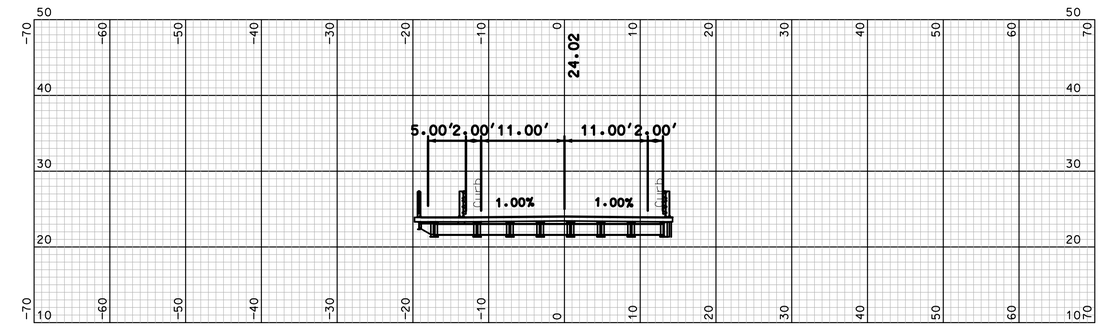

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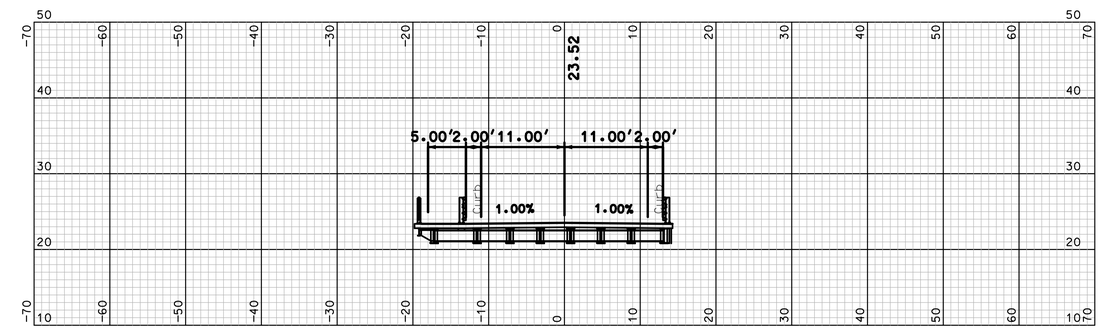

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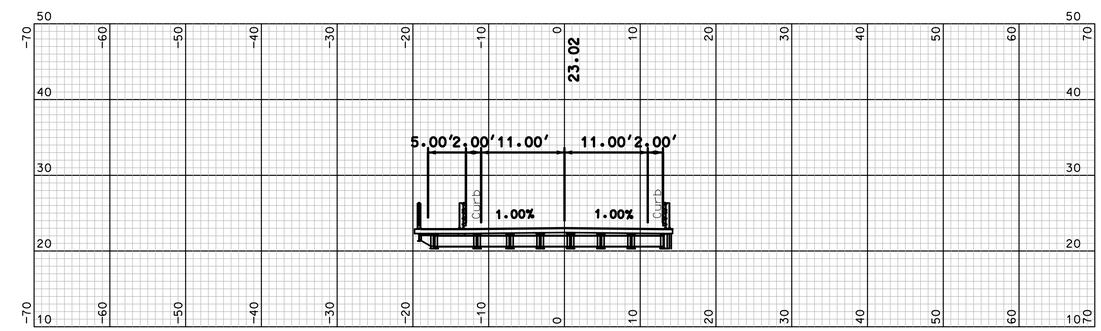

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NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

BRIDGE MAJOR REHABILITATION ALTERNATIVE - ROADWAY CROSS SECTIONS

SCALE: 1" = 10'-0"

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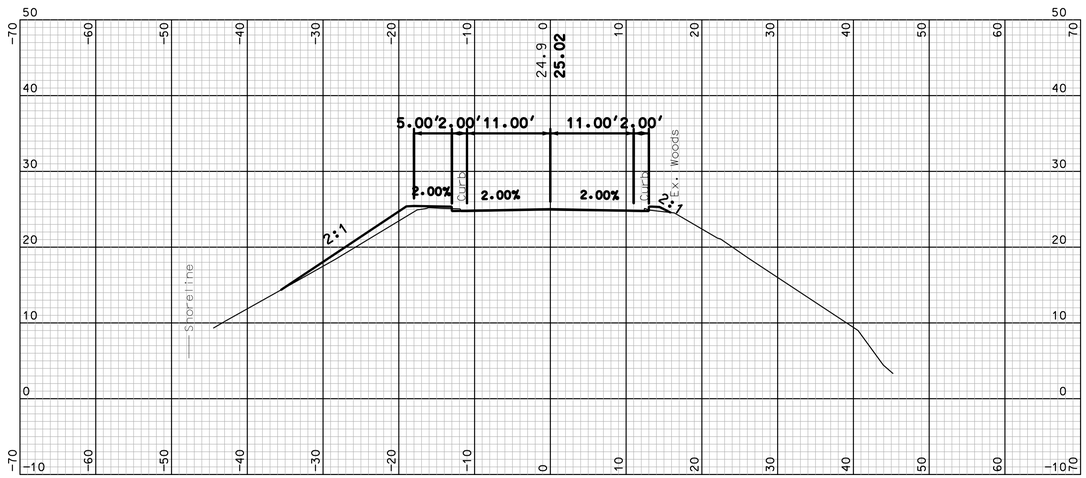

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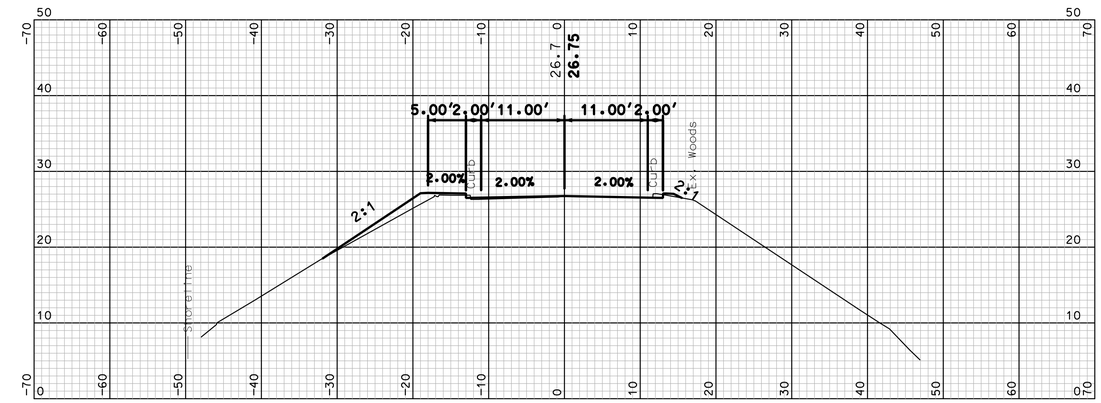

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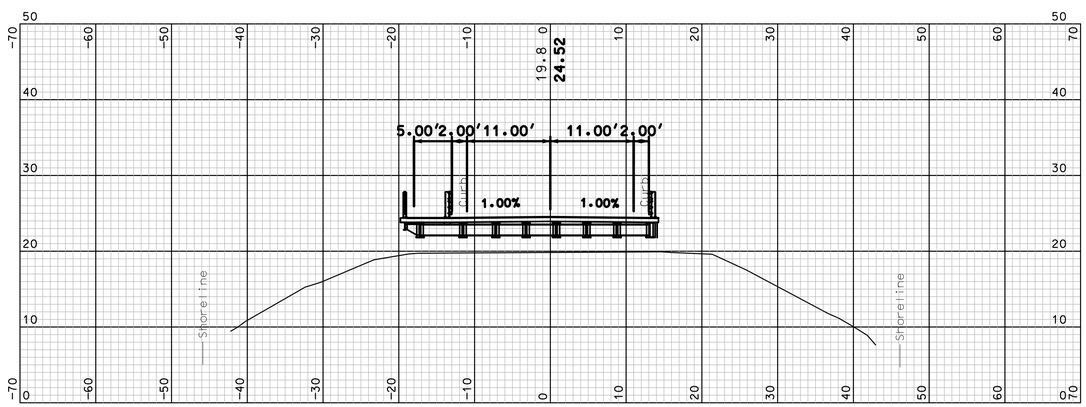

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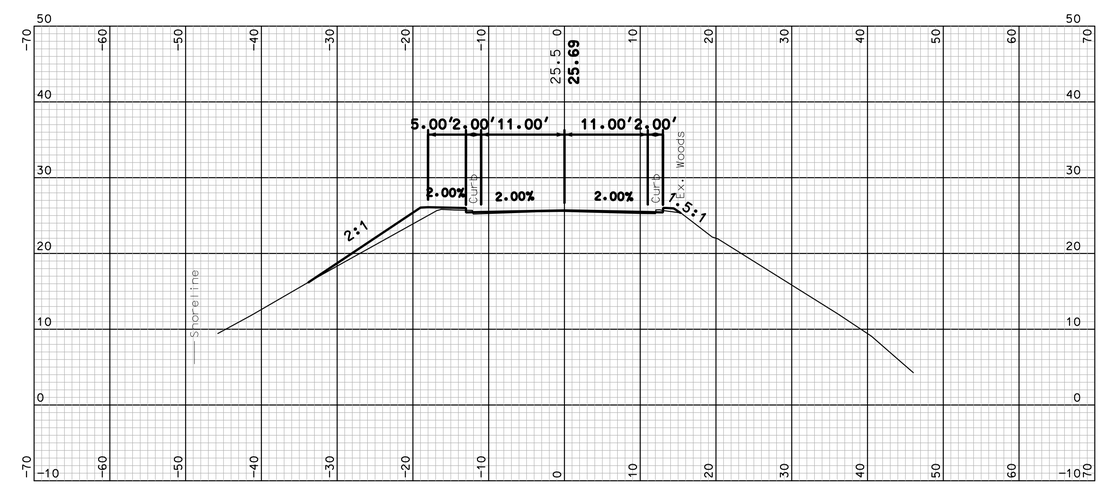

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NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

BRIDGE MAJOR REHABILITATION ALTERNATIVE - ROADWAY CROSS SECTIONS

SCALE: 1" = 10'-0"

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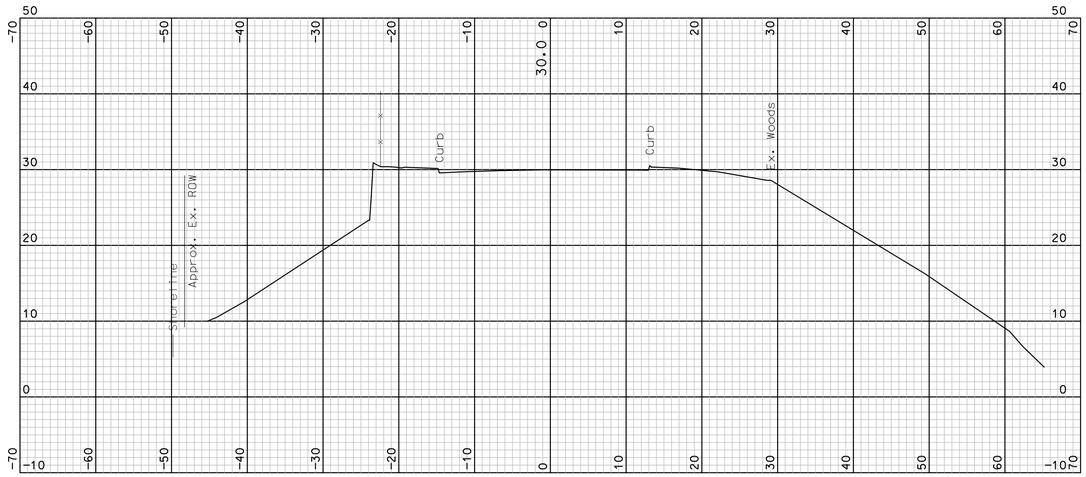

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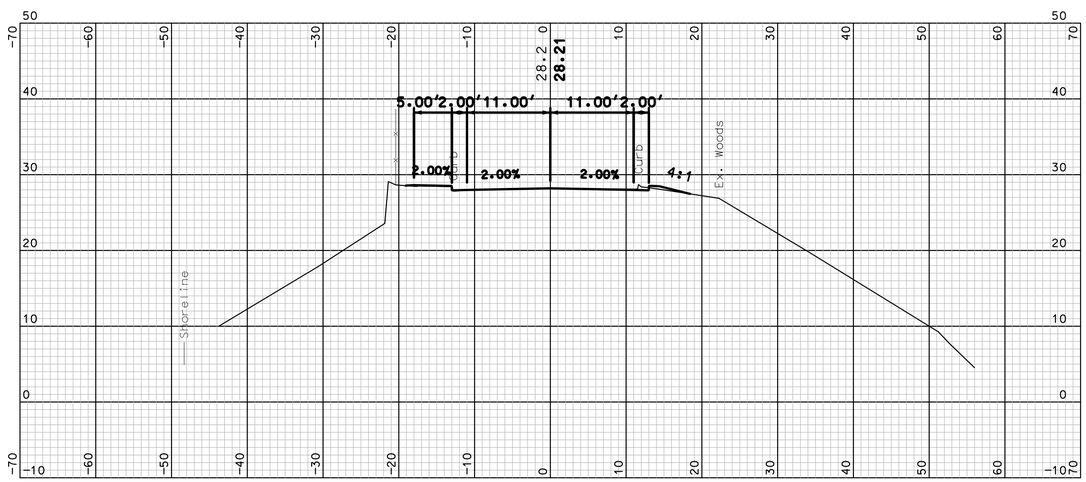

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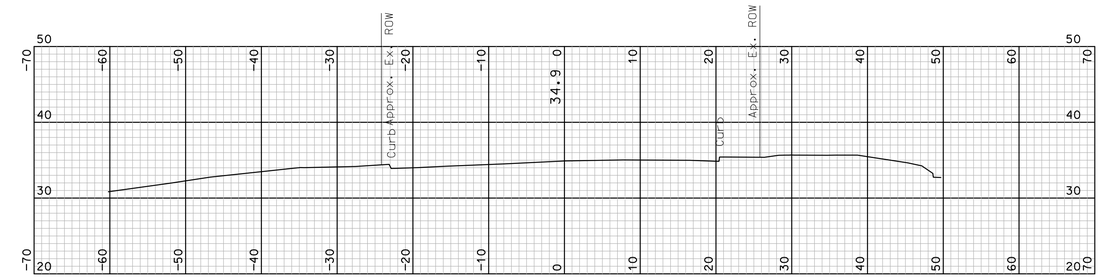

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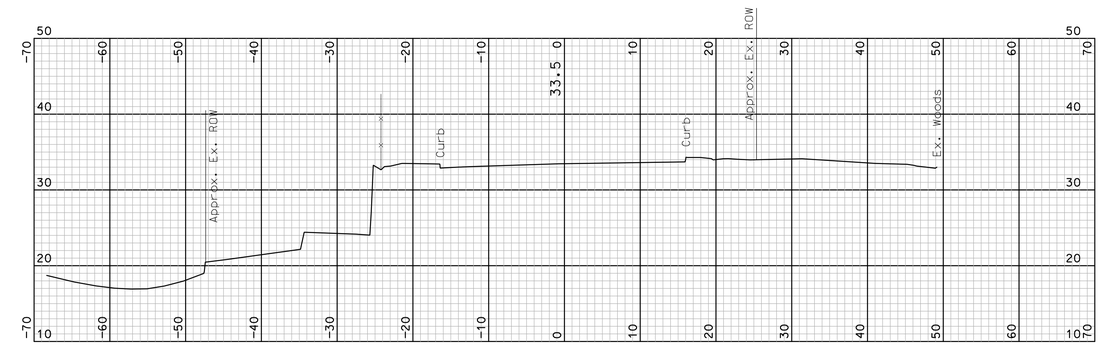

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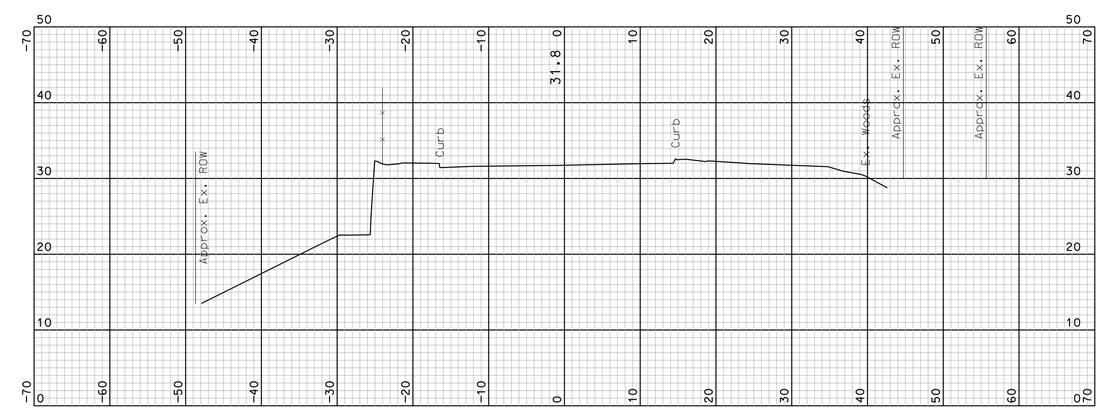

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NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

BRIDGE MAJOR REHABILITATION ALTERNATIVE - ROADWAY CROSS SECTIONS

SCALE: 1" = 10'-0"

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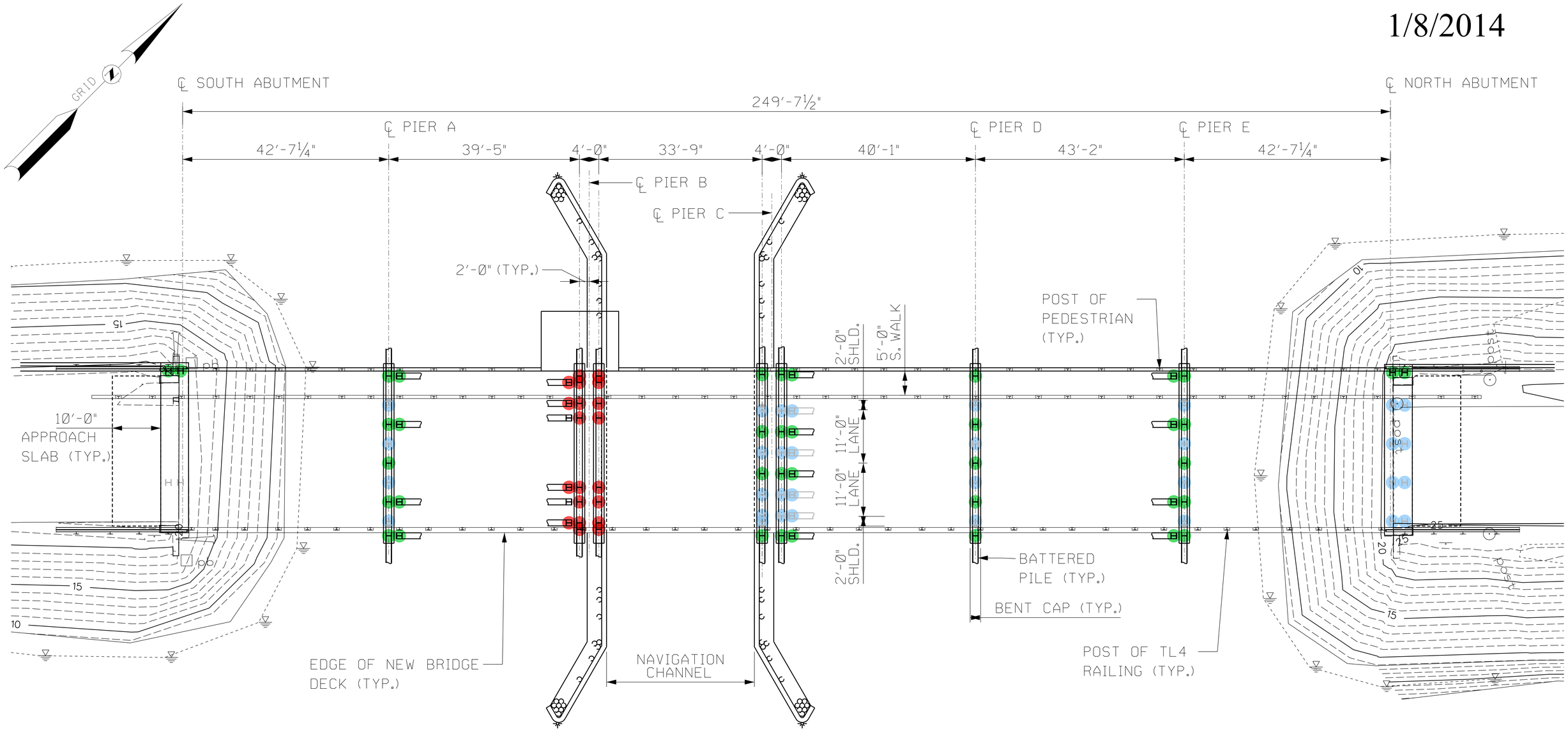

LEGEND

- NEW PILE
- PILE REMOVED AND REPLACED
- EXISTING PILE

NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

MAJOR REHABILITATION ALT. - GENERAL PLAN

SCALE: 1" = 20'-0"

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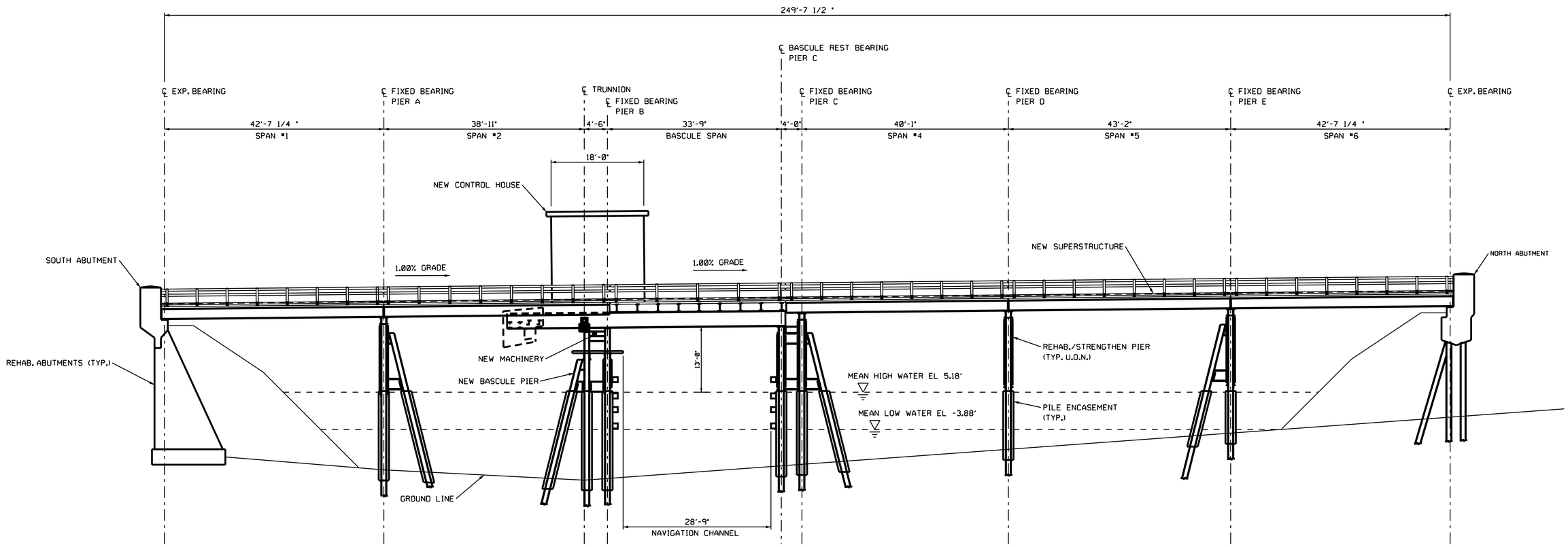
1/8/2014



NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

MAJOR BRIDGE REHABILITATION - ELEVATION

SCALE: 1" = 20'-0"

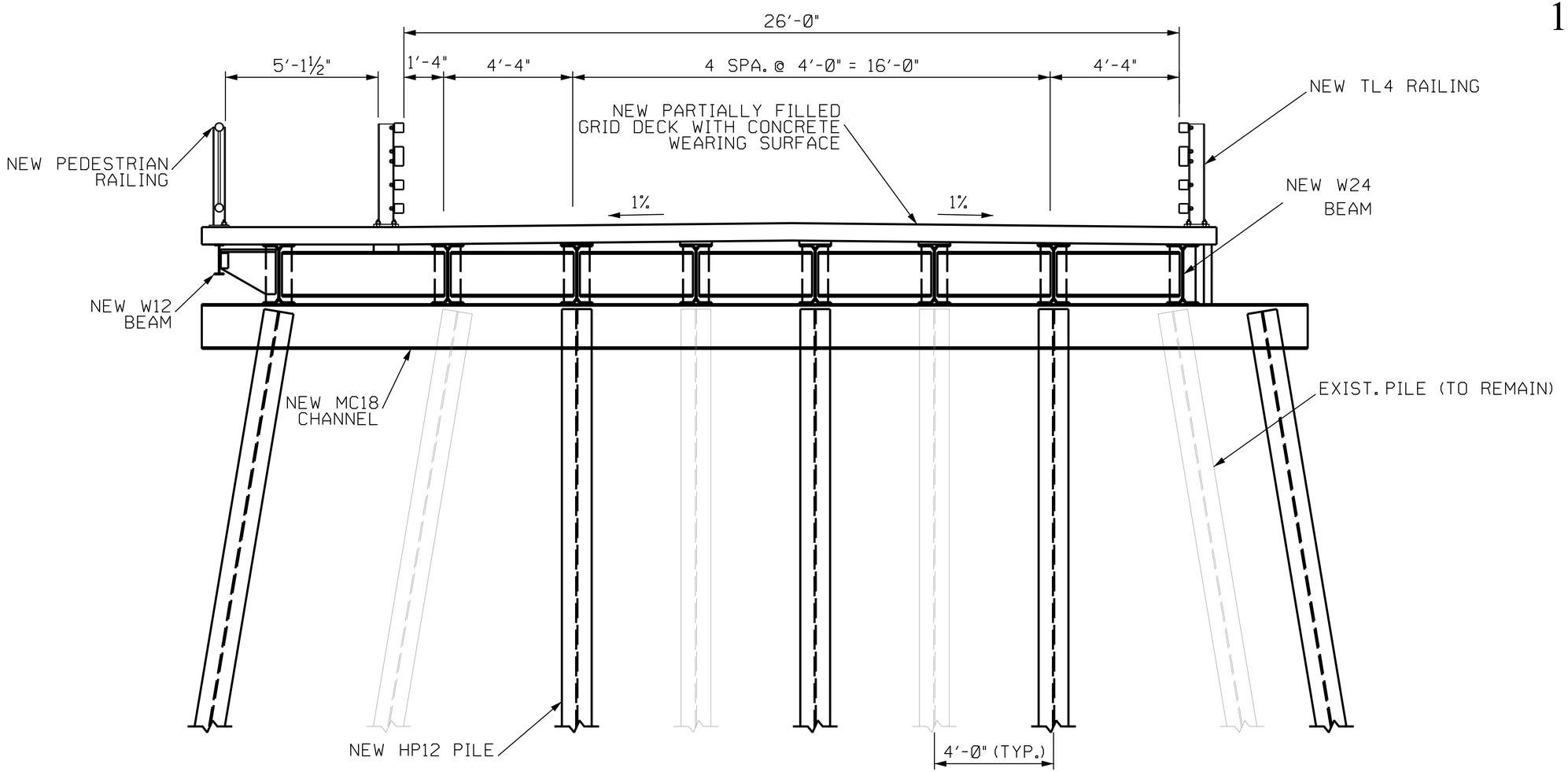
Hoyle, Tanner & Associates, Inc.

HDR

THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE					
DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN					
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	KCK	DATE:	12/05/2013	SHEET NO.	TOTAL SHEETS
CHECK BY:	JFM	DATE:	12/05/2013	8	52
APPROVED BY:	JFM	DATE:	12/05/2013		

1/8/2014



EXISTING PIER TO BE REHABILITATED AND STRENGTHENED

NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

MAJOR REHABILITATION ALT. - APPROACH PIER SECTION

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

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THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE					
DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN					
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
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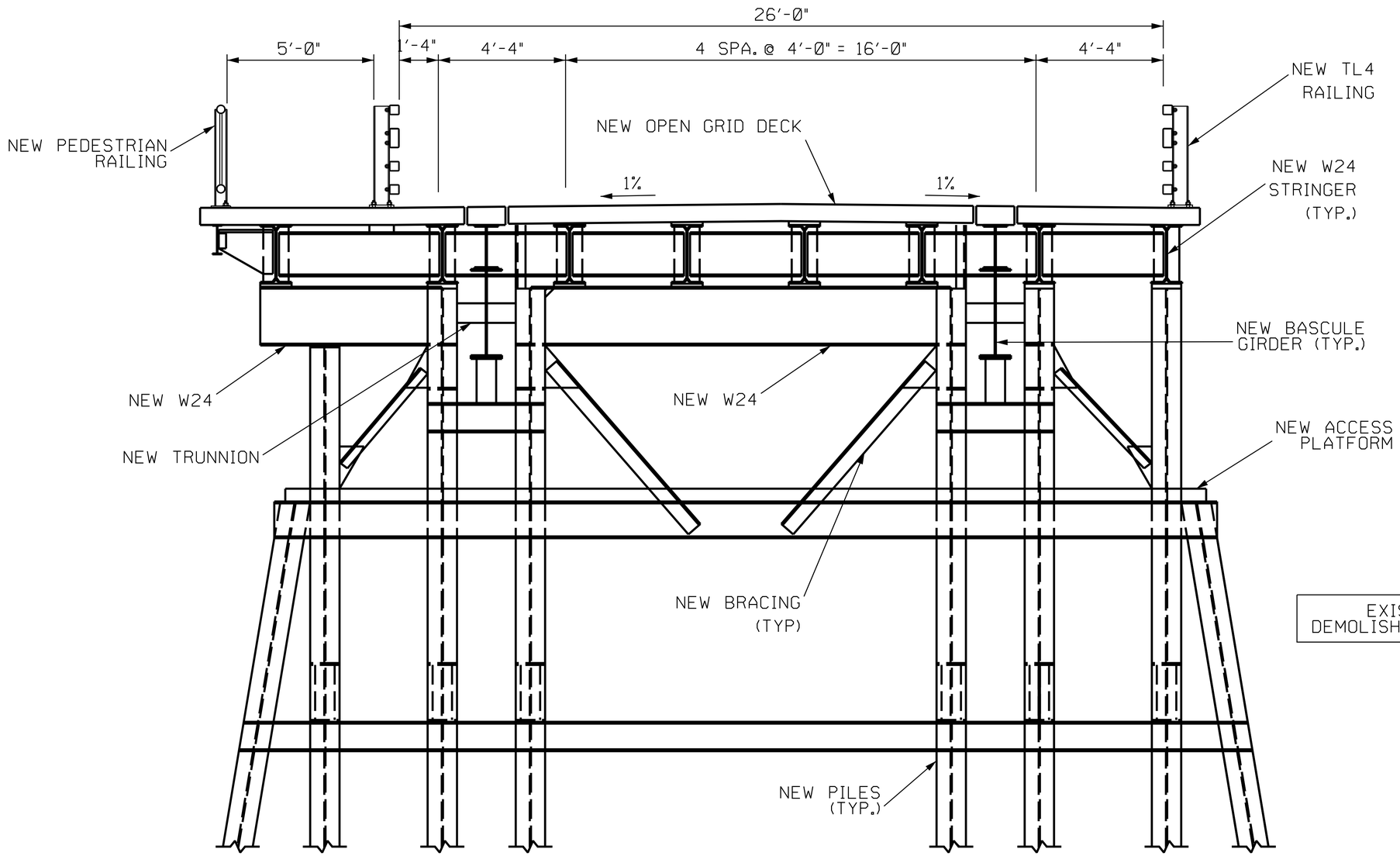
1/8/2014



EXISTING PIER TO BE DEMOLISHED AND REPLACED

NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

MAJOR REHABILITATION ALT. - BASCULE PIER SECTION

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

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THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

NOTE: BASCULE MACHINERY NOT SHOWN FOR CLARITY

STATE OF NEW HAMPSHIRE					
DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN					
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	MCC	DATE:	12/13/2013	SHEET NO.	TOTAL SHEETS
CHECK BY:	JFM	DATE:	12/13/2013	10	52
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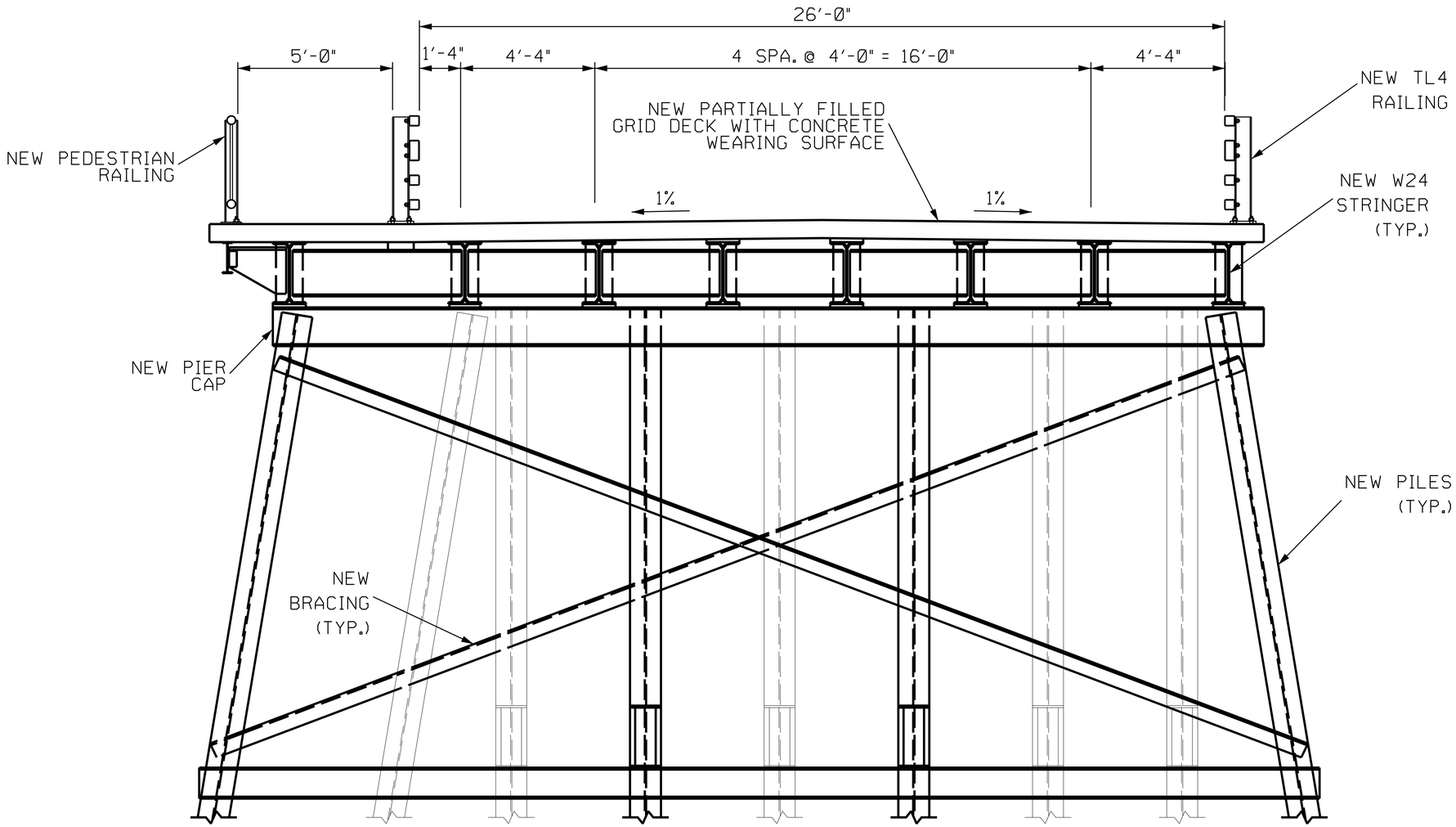
1/8/2014



EXISTING PIER TO BE REHABILITATED AND STRENGTHENED

NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

MAJOR REHAB. ALT. - REST PIER SECTION - APPROACH

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

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THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE					
DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN					
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	MCC	DATE:	12/13/2013	SHEET NO.	TOTAL SHEETS
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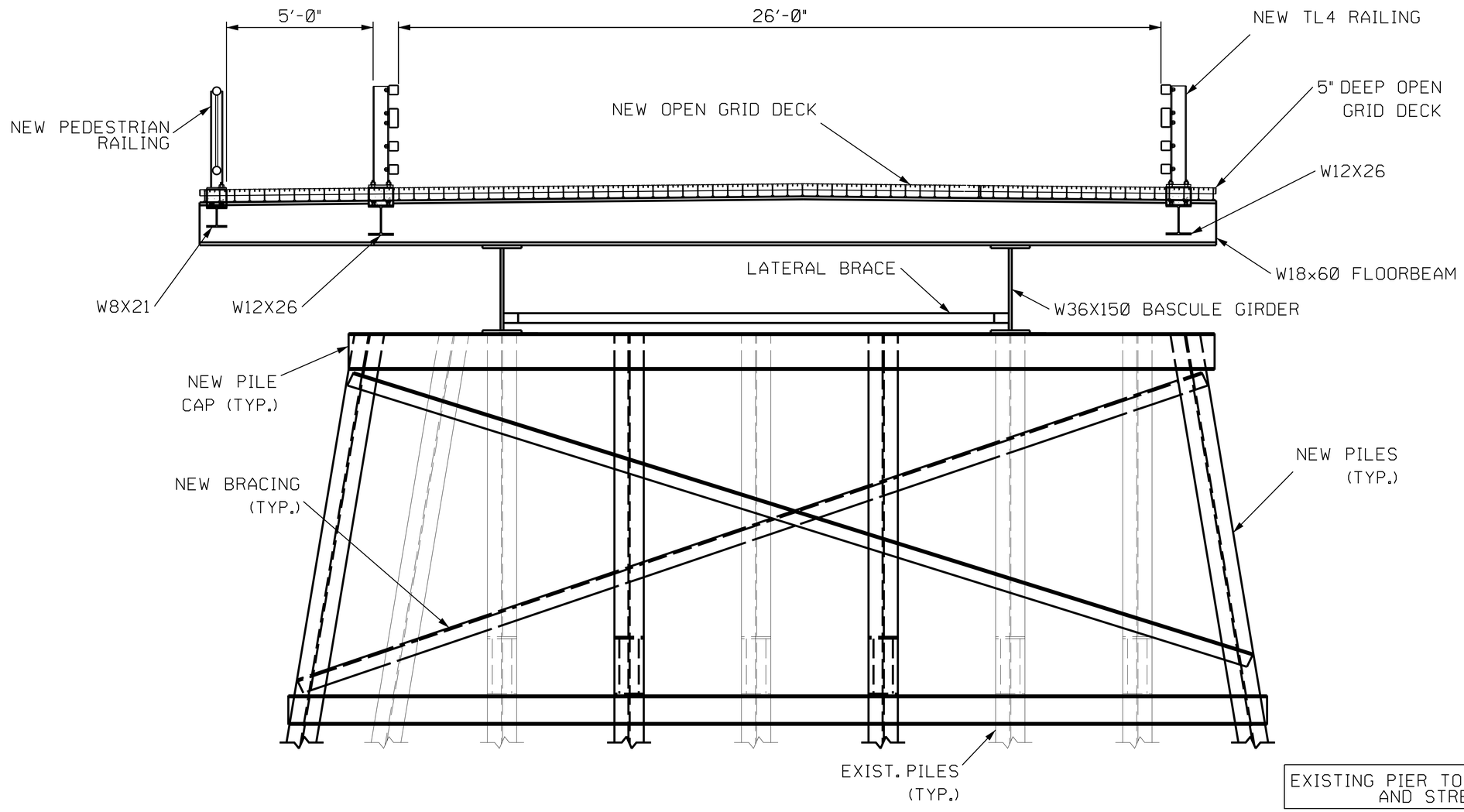
1/8/2014



EXISTING PIER TO BE REHABILITATED AND STRENGTHENED

NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

MAJOR REHAB. ALT. - REST PIER SECTION - BASCULE

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

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THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE					
DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN					
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	MCC	DATE:	12/13/2013	SHEET NO.	TOTAL SHEETS
CHECK BY:	JFM	DATE:	12/13/2013	11B	52
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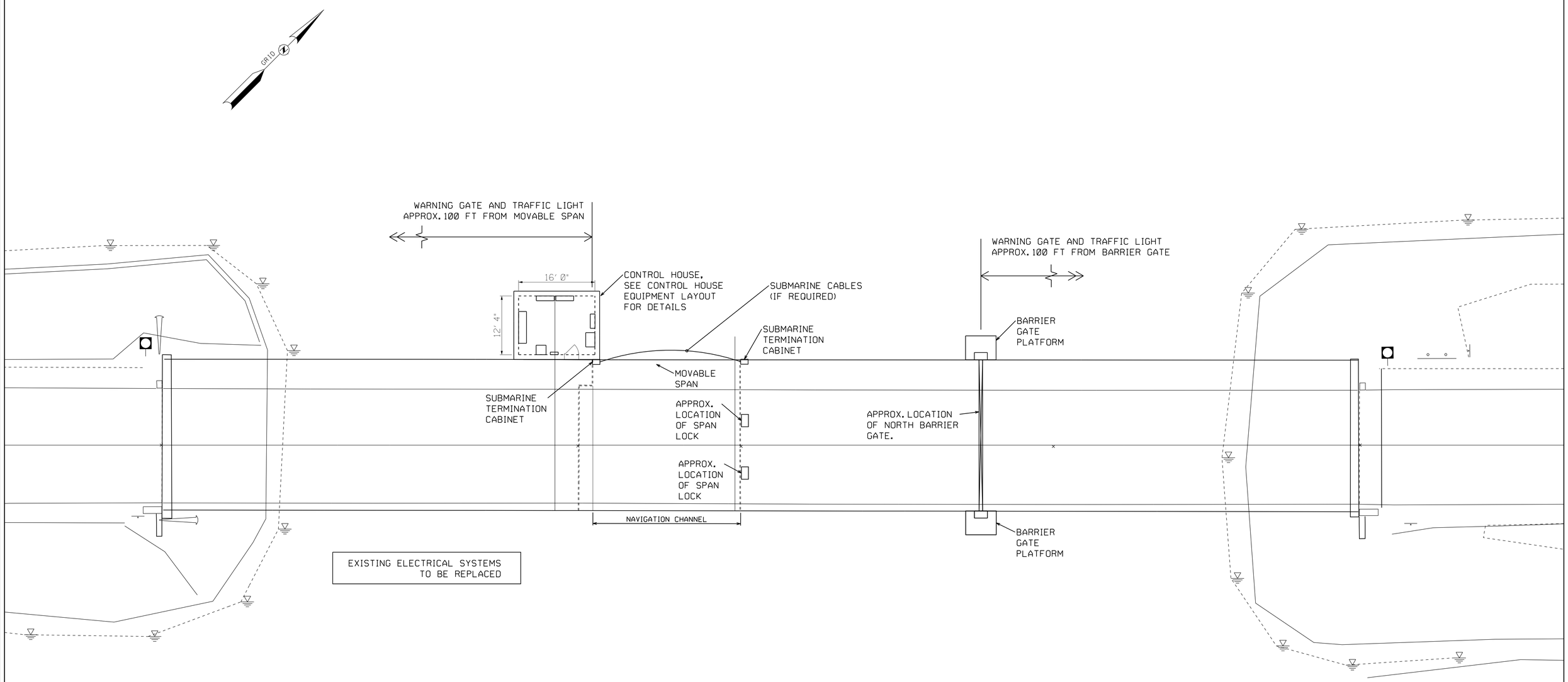
1/8/2014



NEW CASTLE-RYE BRIDGE - 16127

MAJOR REHABILITATION ALTERNATIVE
ELECTRICAL SYSTEMS PLAN
SCALE: 1" = 20'-0"

Hoyle, Tanner & Associates, Inc.

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THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE					
DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN					
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	XXX	DATE:	XX/XX/2013	SHEET NO.	TOTAL SHEETS
CHECK BY:	XXX	DATE:	XX/XX/2013	12	52
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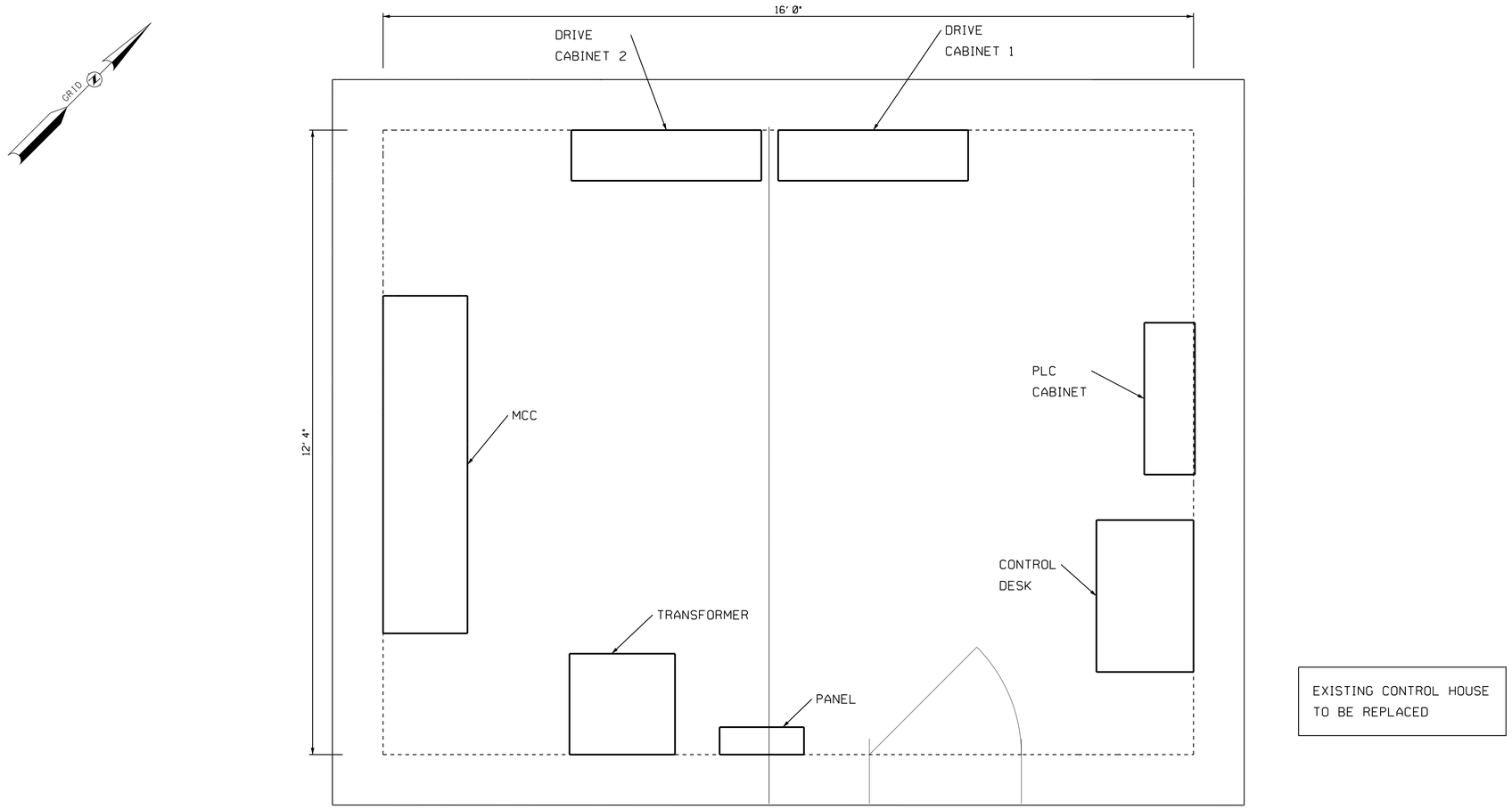
1/8/2014



NEW CASTLE-RYE BRIDGE - 16127

MAJOR REHABILITATION ALTERNATIVE
CONTROL HOUSE EQUIPMENT LAYOUT

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

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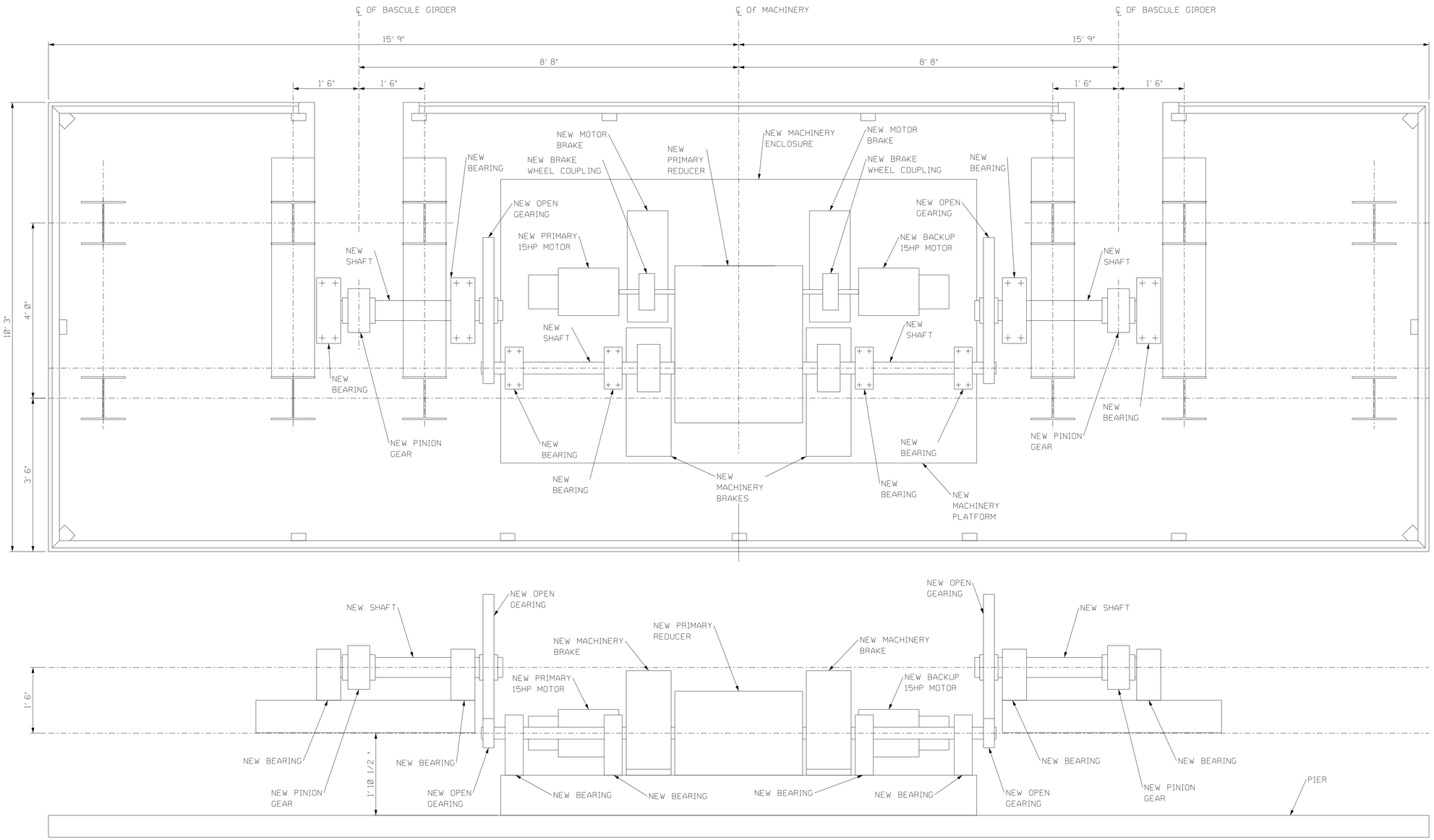
THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE					
DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN					
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	XXX	DATE:	XX/XX/2013	SHEET NO.	TOTAL SHEETS
CHECK BY:	XXX	DATE:	XX/XX/2013	13	52
APPROVED BY:	XXX	DATE:	XX/XX/2013		

1/8/2014



NEW CASTLE-RYE BRIDGE - 16127

BASCULE MACHINERY MAJOR REHABILITATION ALT.

GENERAL PLAN AND ELEVATION

SCALE: 1" = 20'-0"

EXISTING MACHINERY TO BE REPLACED

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THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE					
DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN					
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	SSG	DATE:	12/13/2013	SHEET NO.	TOTAL SHEETS
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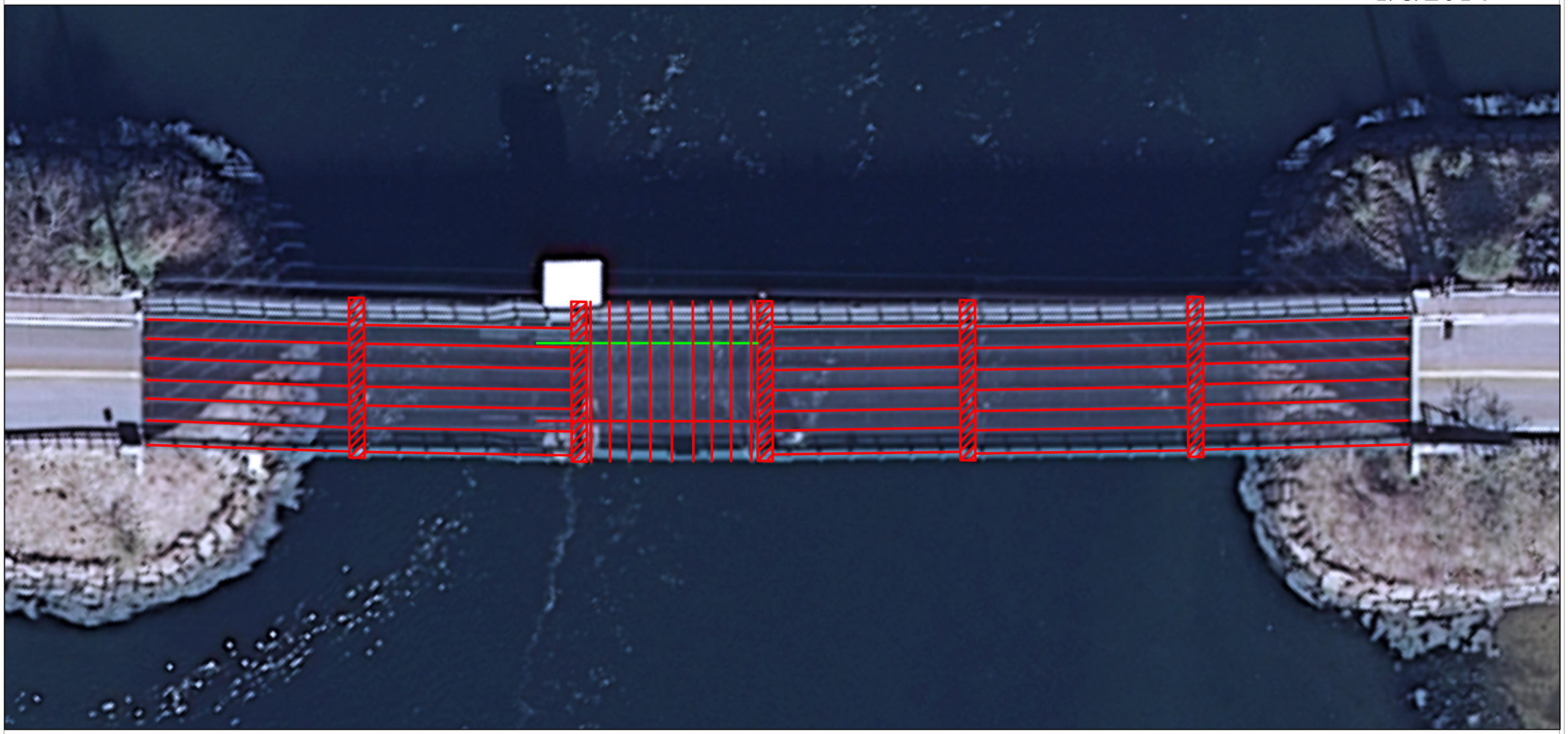
APPROVED BY:	HFP	DATE:	12/13/2013		

1/8/2014



NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY
EXISTING BRIDGE - FRAMING PLAN

SCALE: 1" = 20'-0"

LEGEND:

MEMBER STRENGTH IS SUFFICIENT

MEMBER STRENGTH IS INSUFFICIENT

Hoyle, Tanner & Associates, Inc.

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THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE

DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN

PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	MCC	DATE:	11/01/2013	SHEET NO.	TOTAL SHEETS
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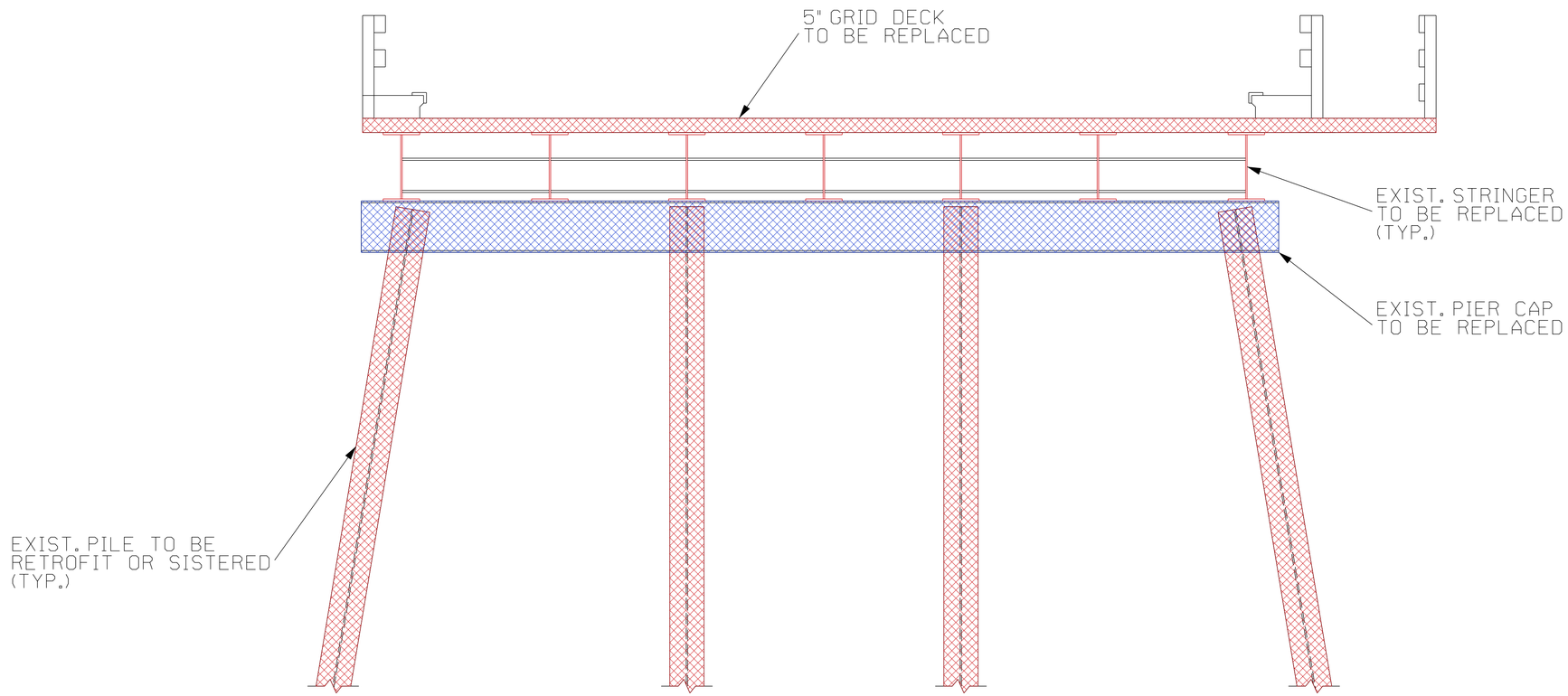
1/8/2014



NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY
EXISTING BRIDGE - APPROACH PIER SECTION
SCALE: 1/4" = 1'-0"

LEGEND:

MEMBER STRENGTH IS INSUFFICIENT

MEMBER INSUFFICIENT DUE TO DETERIORATION

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THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE					
DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN					
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	MCC	DATE:	11/01/2013	SHEET NO.	TOTAL SHEETS
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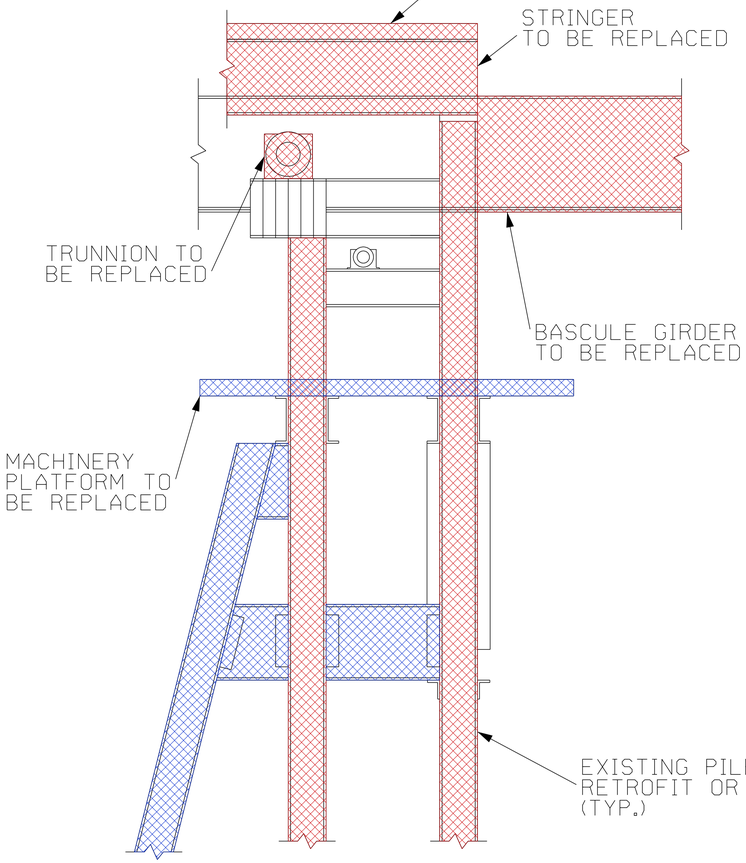
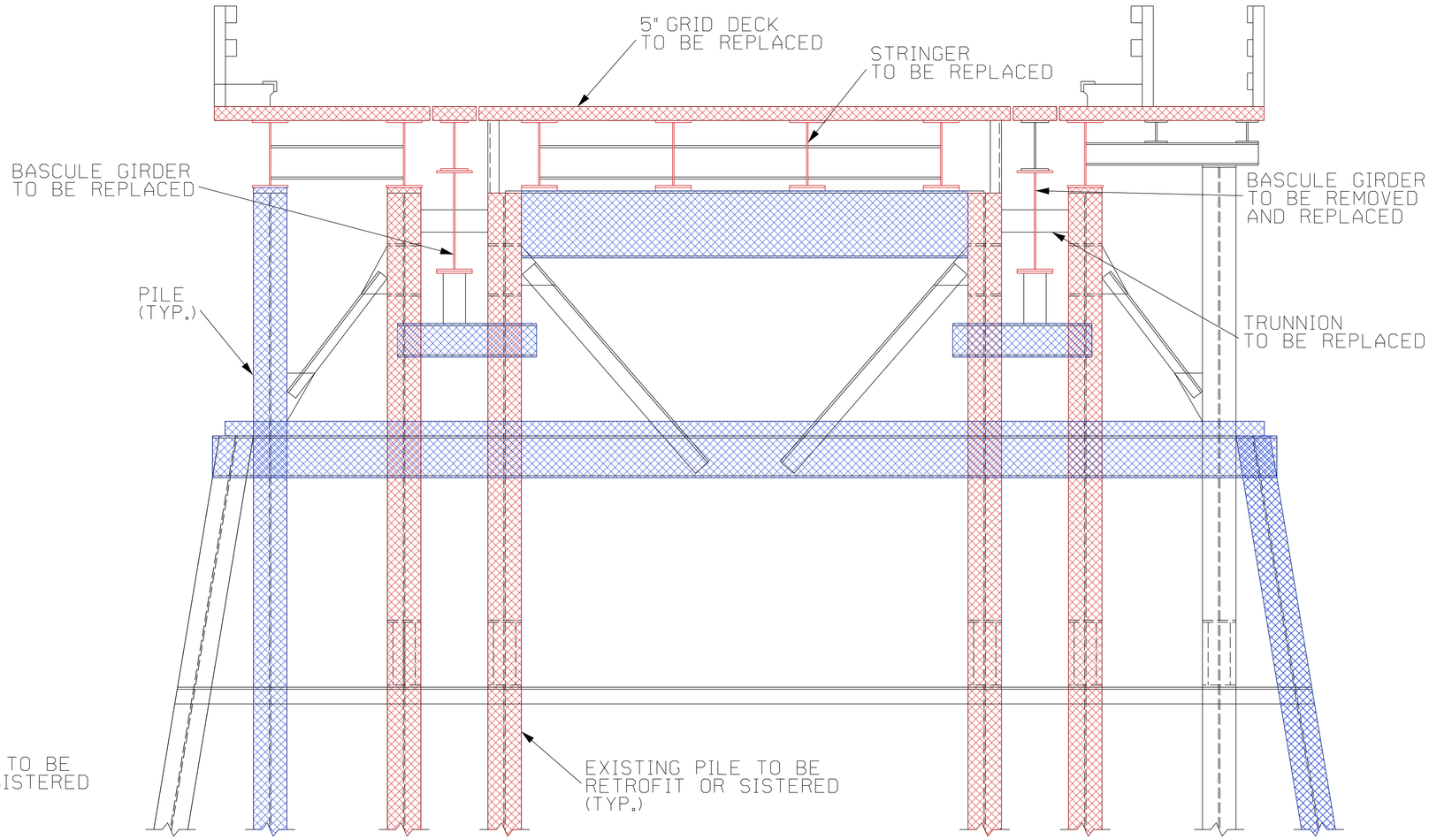
APPROVED BY:	JFM	DATE:	11/01/2013		

1/8/2014





NOTE: BASCULE MACHINERY NOT SHOWN FOR CLARITY

NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

EXISTING BASCULE PIER - ELEVATION AND SECTION

SCALE: 1/2" = 1'-0"

LEGEND:

- MEMBER STRENGTH IS INSUFFICIENT
- MEMBER INSUFFICIENT DUE TO DETERIORATION

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THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE					
DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN					
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	MCC	DATE:	11/01/2013	SHEET NO.	TOTAL SHEETS
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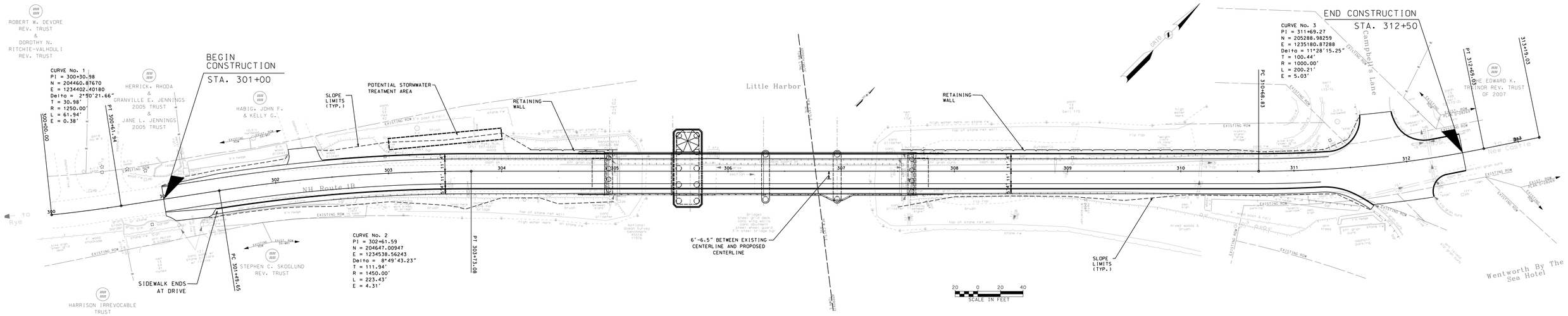

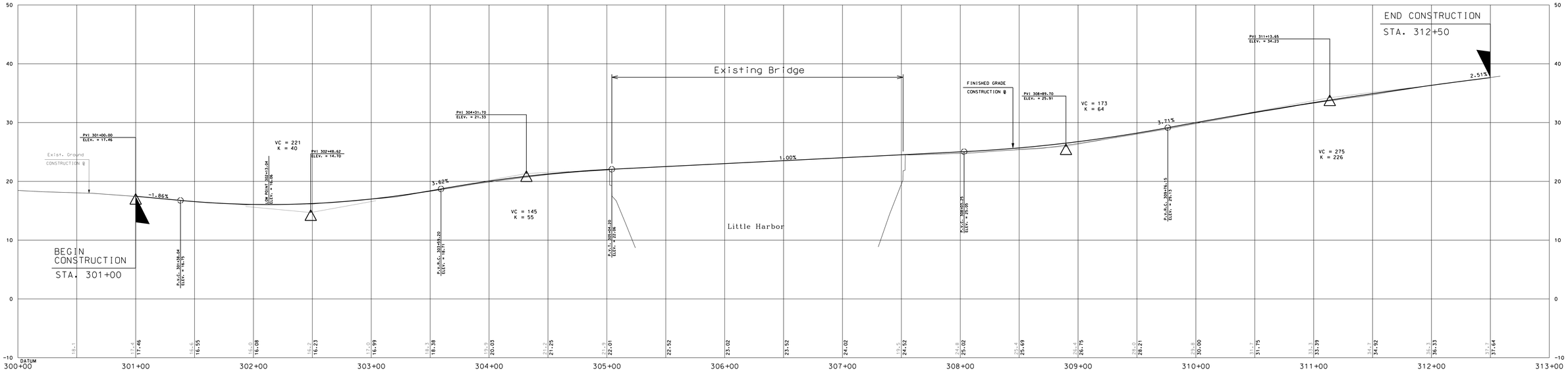

NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE, & LOCATION STUDY

BRIDGE REPLACEMENT ALTERNATIVE

SCALE:
1"= 20' HORIZ.
1"= 4' VERT.

Hoyle, Tanner & Associates, Inc.

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STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN

PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	SCS	DATE:	12/13/2013	SHEET NO.	TOTAL SHEETS
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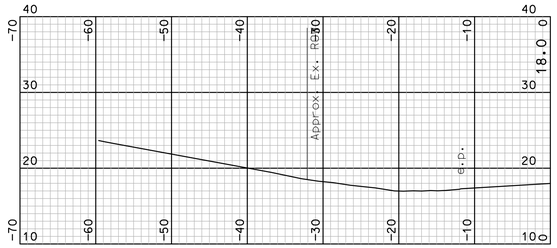

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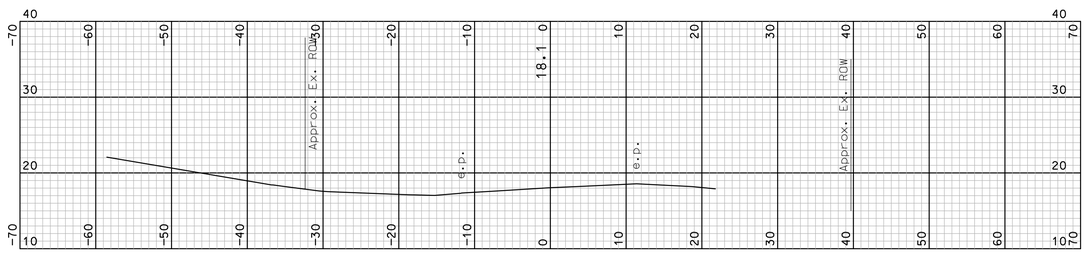
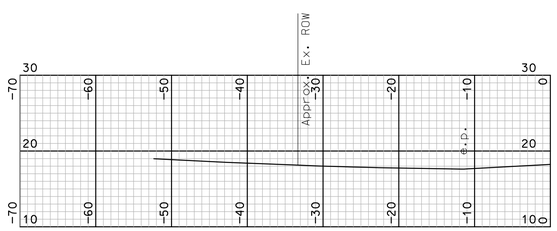
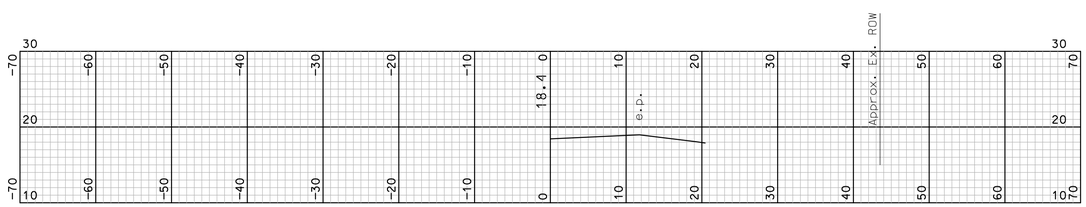


300+50



300+21 DRIVE LEFT



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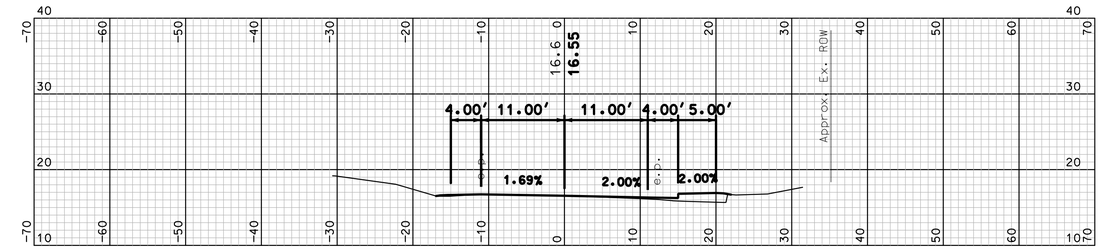
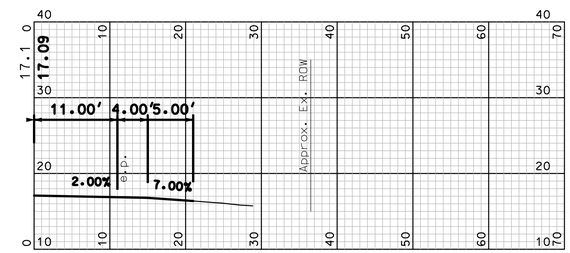


301+50



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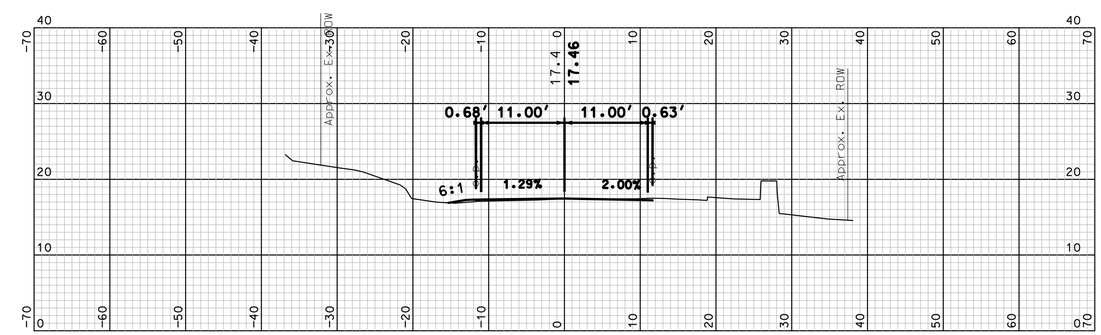

301+00

NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

BRIDGE REPLACEMENT ALTERNATIVE - ROADWAY CROSS SECTIONS

SCALE: 1" = 10'-0"

Hoyle, Tanner & Associates, Inc.

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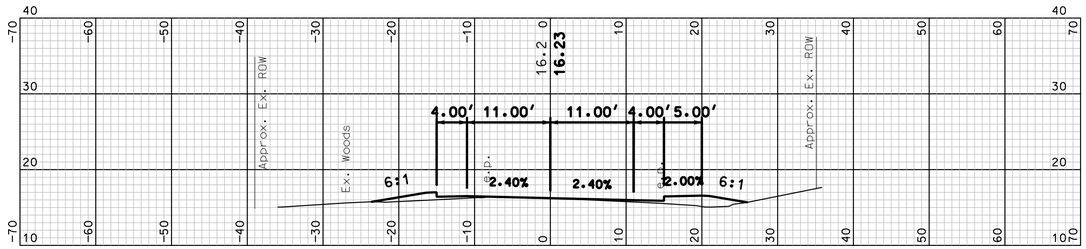
STATE OF NEW HAMPSHIRE

DEPARTMENT OF TRANSPORTATION - BUREAU BRIDGE DESIGN

PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	XXX	DATE:	12/13/2013	SHEET NO.	TOTAL SHEETS
CHECK BY:	XXX	DATE:	12/13/2013	19	52
APPROVED BY:	XXX	DATE:	12/13/2013		



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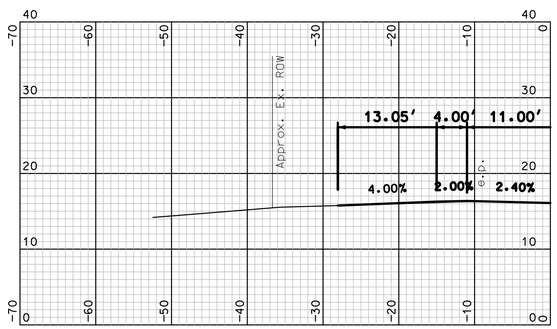

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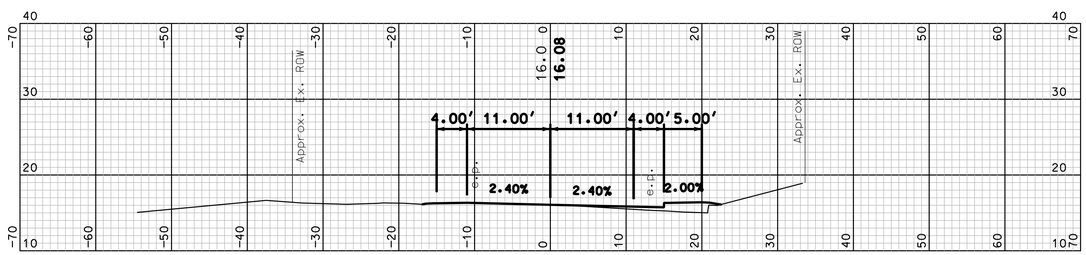

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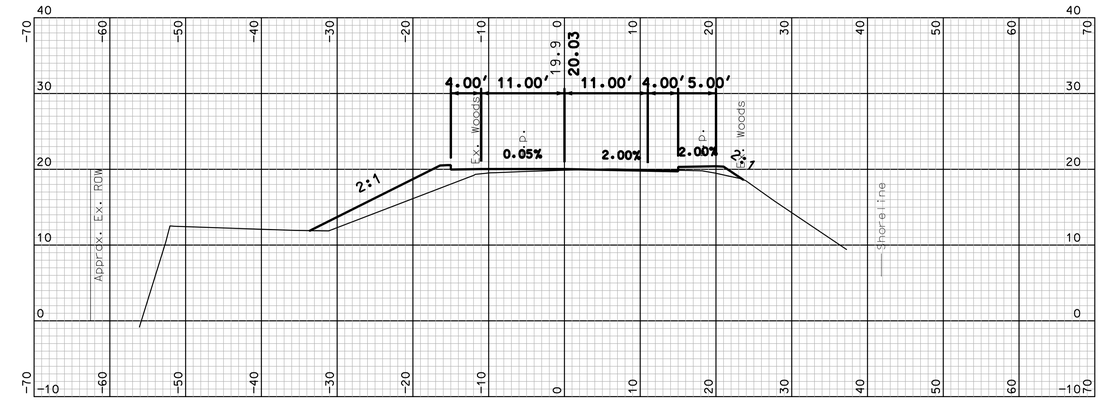

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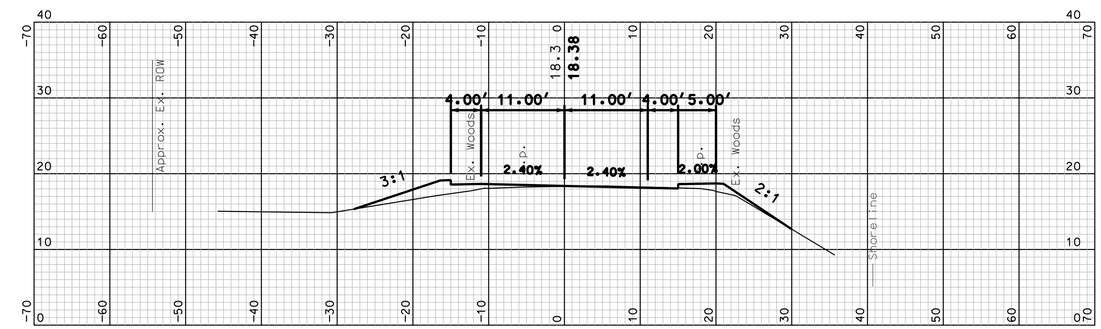

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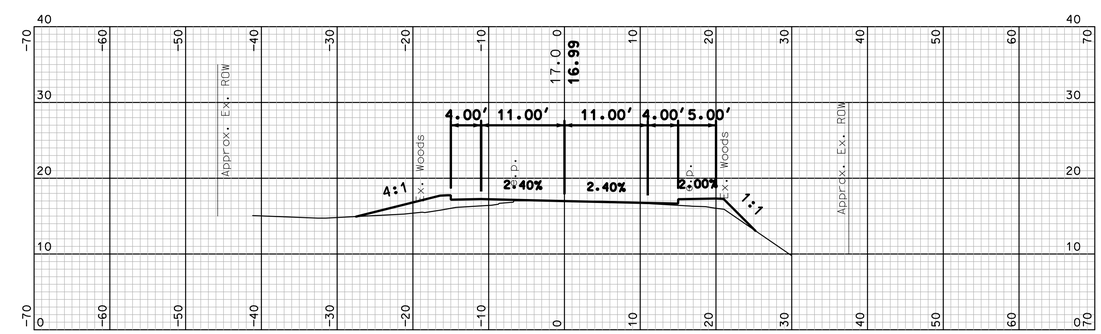


303+00

NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

BRIDGE REPLACEMENT ALTERNATIVE - ROADWAY CROSS SECTIONS

SCALE: 1" = 10'-0"

Hoyle, Tanner & Associates, Inc.

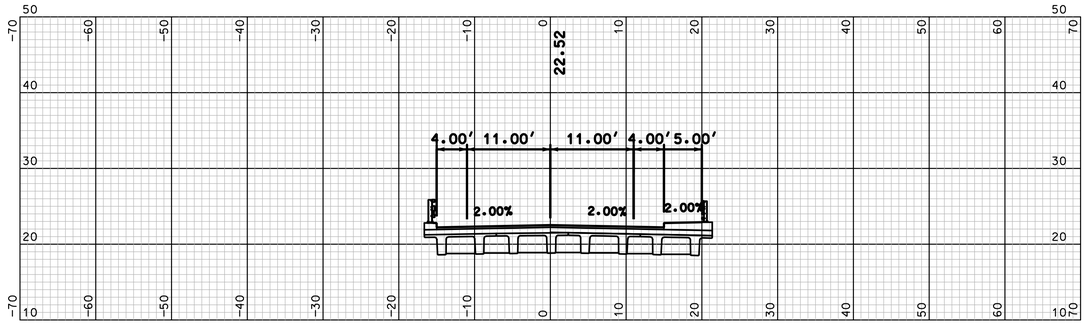
HDR

THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

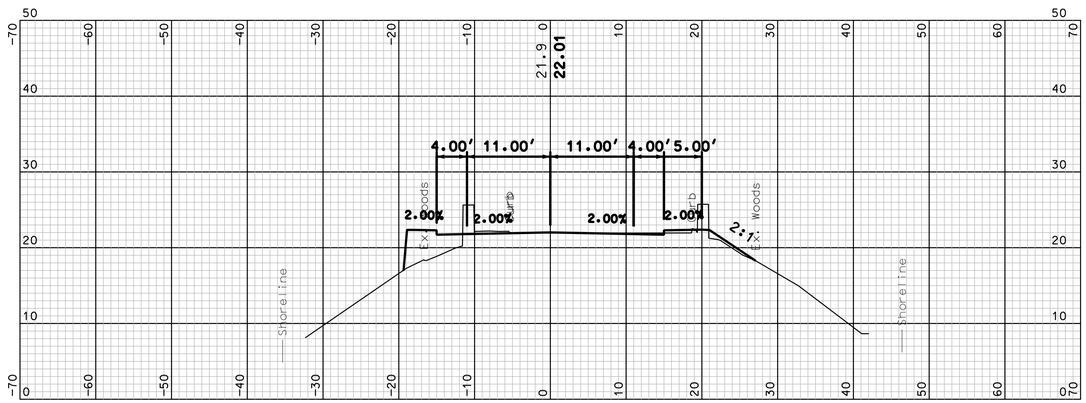
STATE OF NEW HAMPSHIRE

DEPARTMENT OF TRANSPORTATION - BUREAU BRIDGE DESIGN

PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	SCS	DATE:	12/13/2013	SHEET NO.	TOTAL SHEETS
CHECK BY:	CED	DATE:	12/13/2013	20	52
APPROVED BY:	SBH	DATE:	12/13/2013		



305+50



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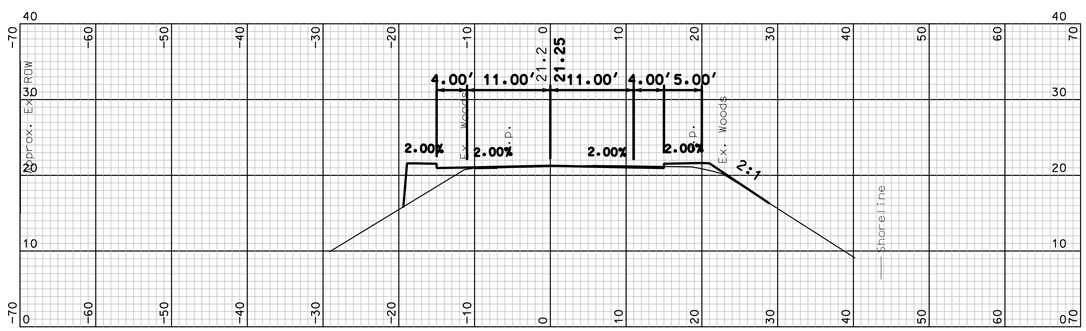

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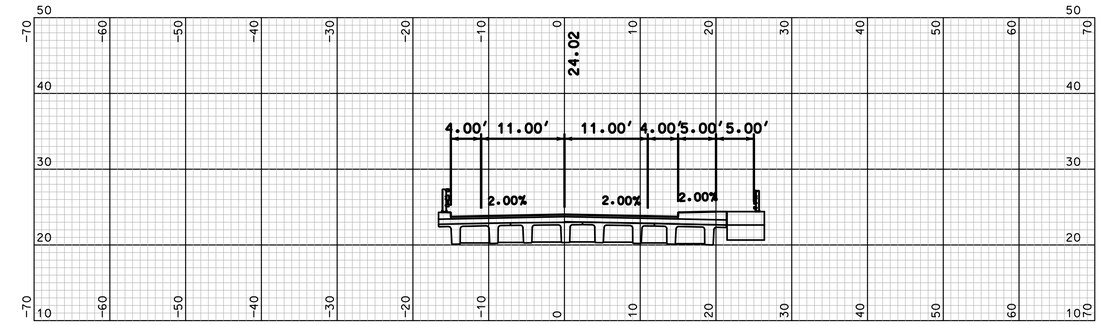

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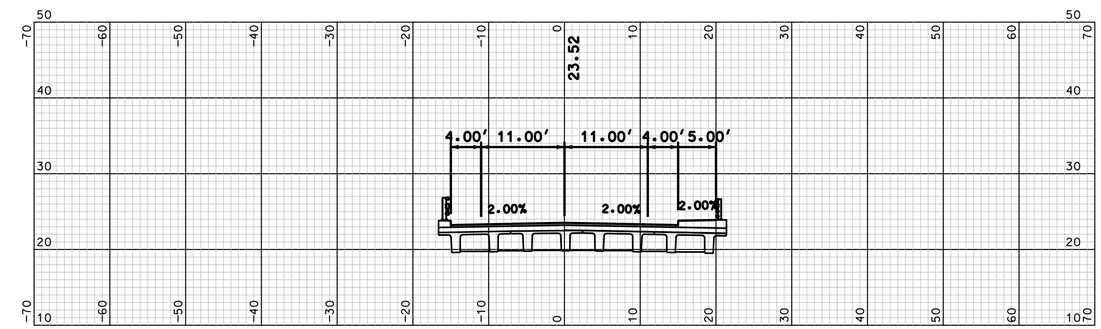

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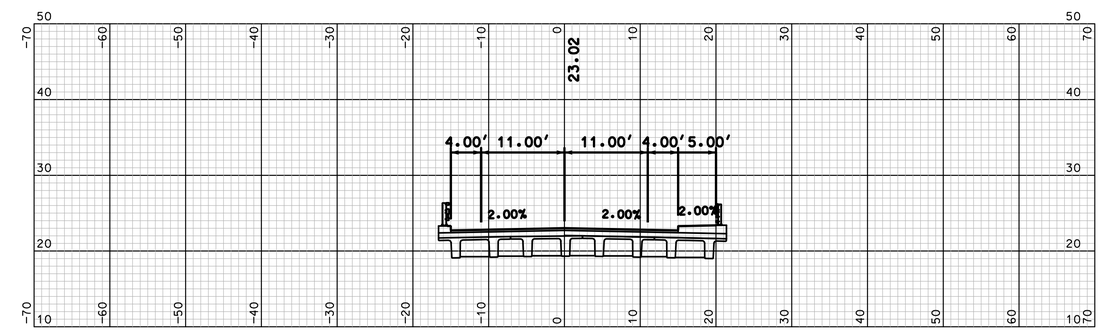


306+00

NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

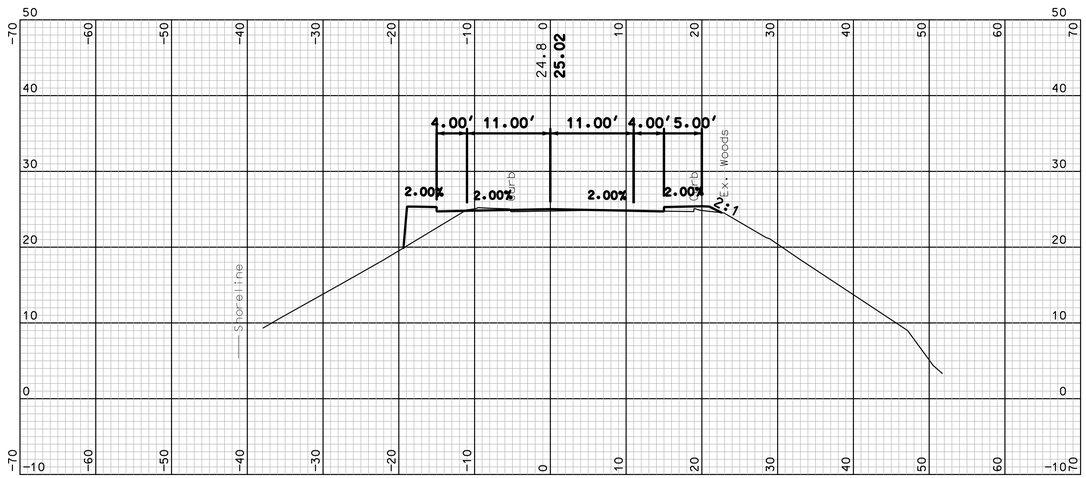
BRIDGE REPLACEMENT ALTERNATIVE - ROADWAY CROSS SECTIONS

SCALE: 1" = 10'-0"

Hoyle, Tanner & Associates, Inc.

HDR

STATE OF NEW HAMPSHIRE					
DEPARTMENT OF TRANSPORTATION - BUREAU BRIDGE DESIGN					
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	SCS	DATE:	12/13/2013	SHEET NO.	TOTAL SHEETS
CHECK BY:	CED	DATE:	12/13/2013	21	52
APPROVED BY:	SBH	DATE:	12/13/2013		



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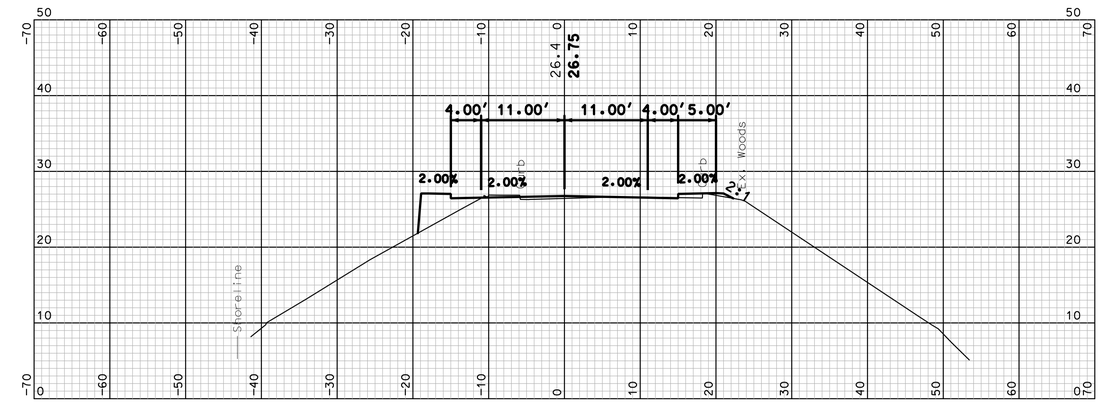

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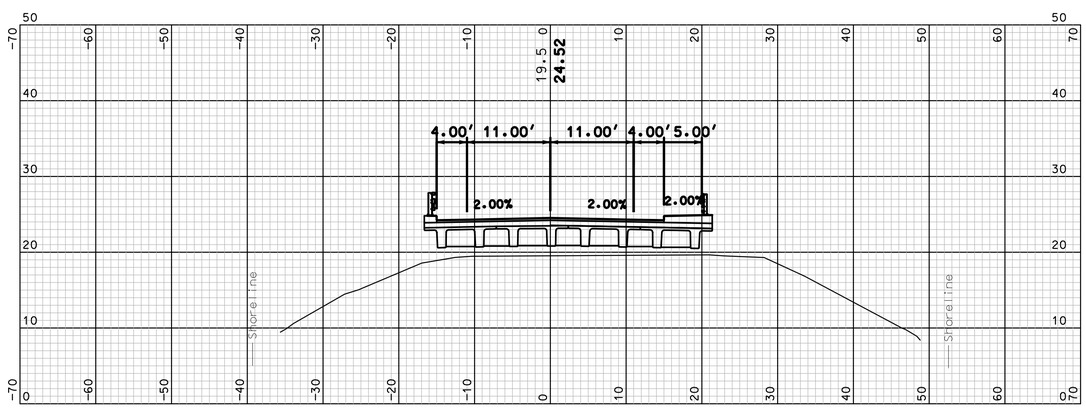

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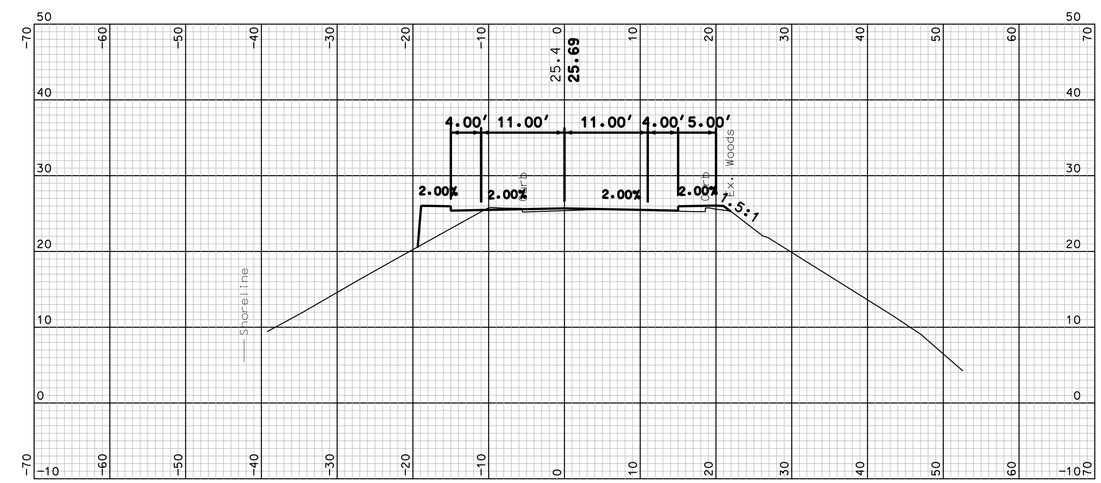

308+50

NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

BRIDGE REPLACEMENT ALTERNATIVE - ROADWAY CROSS SECTIONS

SCALE: 1" = 10'-0"

Hoyle, Tanner & Associates, Inc.

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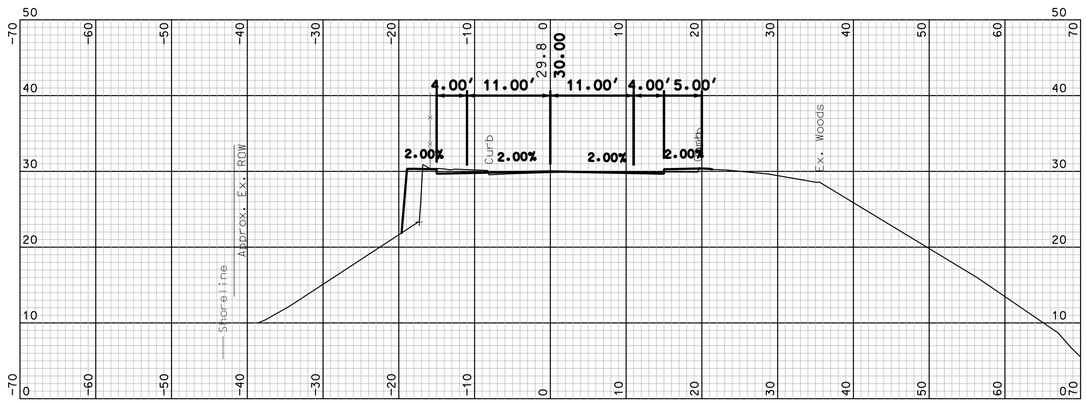
THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE

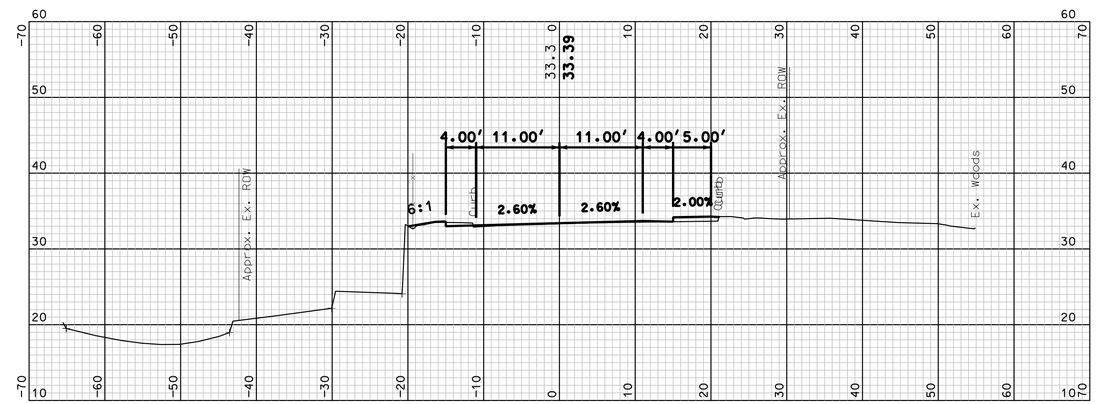
DEPARTMENT OF TRANSPORTATION - BUREAU BRIDGE DESIGN

PROJECT: 16127 - NEW CASTLE - RYE BRIDGE

DRAWN BY:	SCS	DATE:	12/13/2013	SHEET NO.	TOTAL SHEETS
CHECK BY:	CED	DATE:	12/13/2013	22	52
APPROVED BY:	SBH	DATE:	12/13/2013		



310+00



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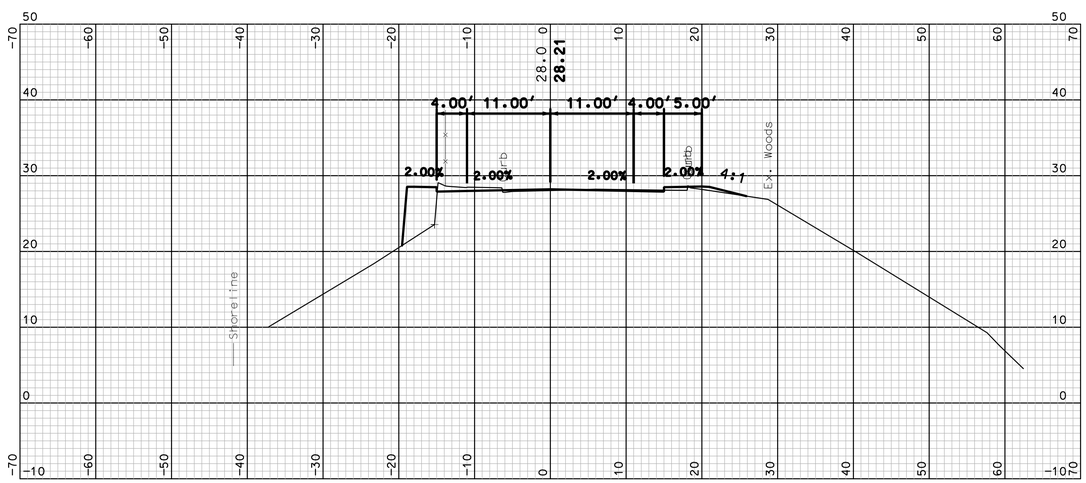

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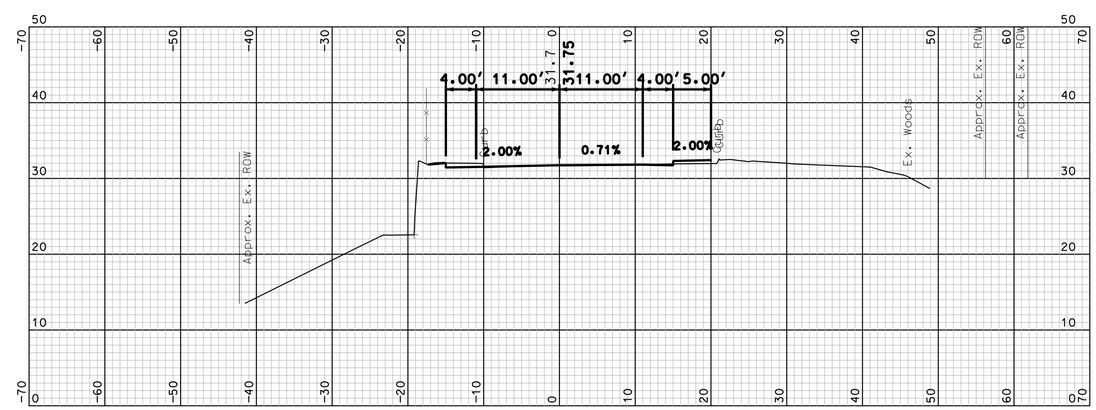

310+50

NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

BRIDGE REPLACEMENT ALTERNATIVE - ROADWAY CROSS SECTIONS

SCALE: 1" = 10'-0"

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THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE

DEPARTMENT OF TRANSPORTATION - BUREAU BRIDGE DESIGN

PROJECT: 16127 - NEW CASTLE - RYE BRIDGE

DRAWN BY:	SCS	DATE:	12/13/2013	SHEET NO.	TOTAL SHEETS
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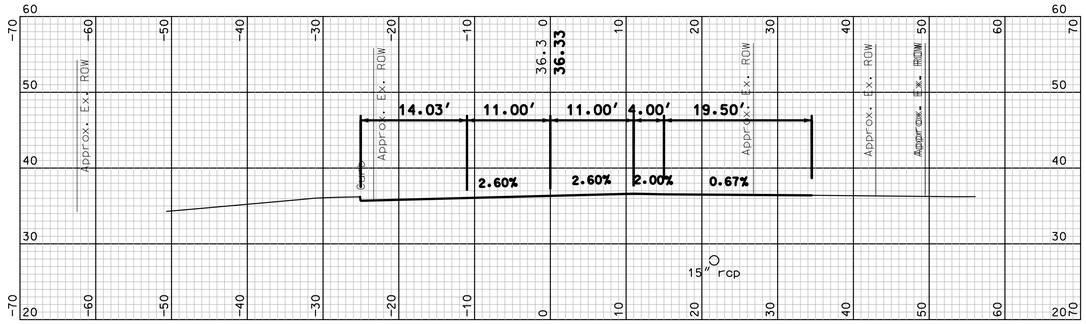
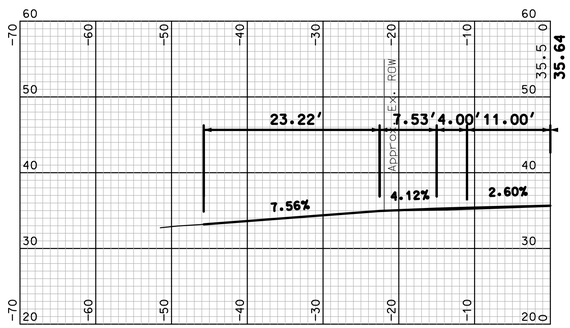
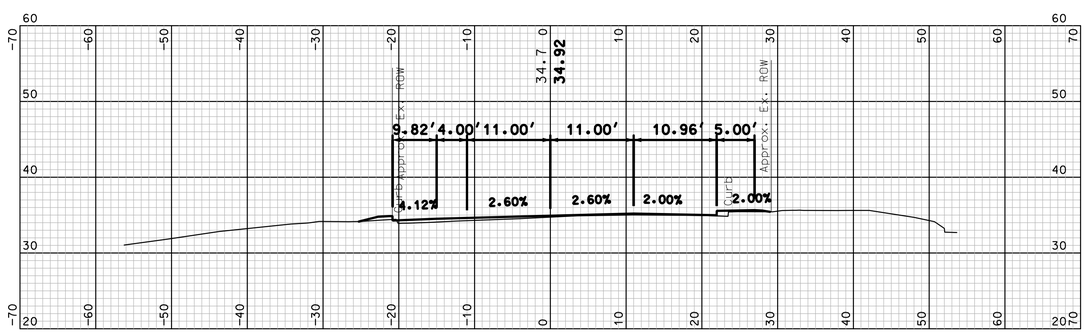


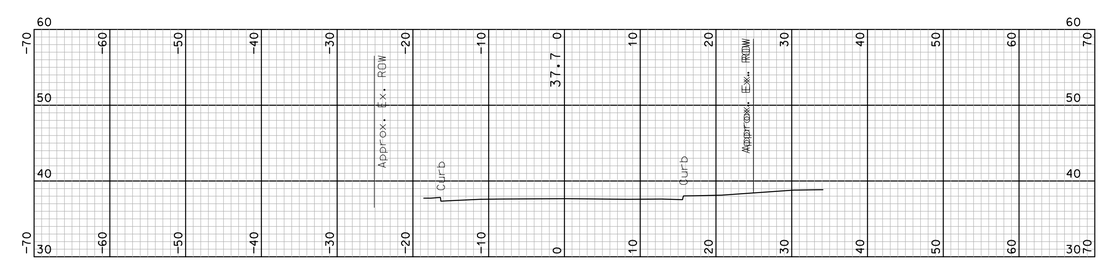
312+00 DRIVE RIGHT



311+75 CAMPBELL'S LANE LEFT



311+50



312+50

NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

BRIDGE REPLACEMENT ALTERNATIVE - ROADWAY CROSS SECTIONS

SCALE: 1" = 10'-0"

Hoyle, Tanner & Associates, Inc.

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STATE OF NEW HAMPSHIRE

DEPARTMENT OF TRANSPORTATION - BUREAU BRIDGE DESIGN

PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	SCS	DATE:	12/13/2013	SHEET NO.	TOTAL SHEETS
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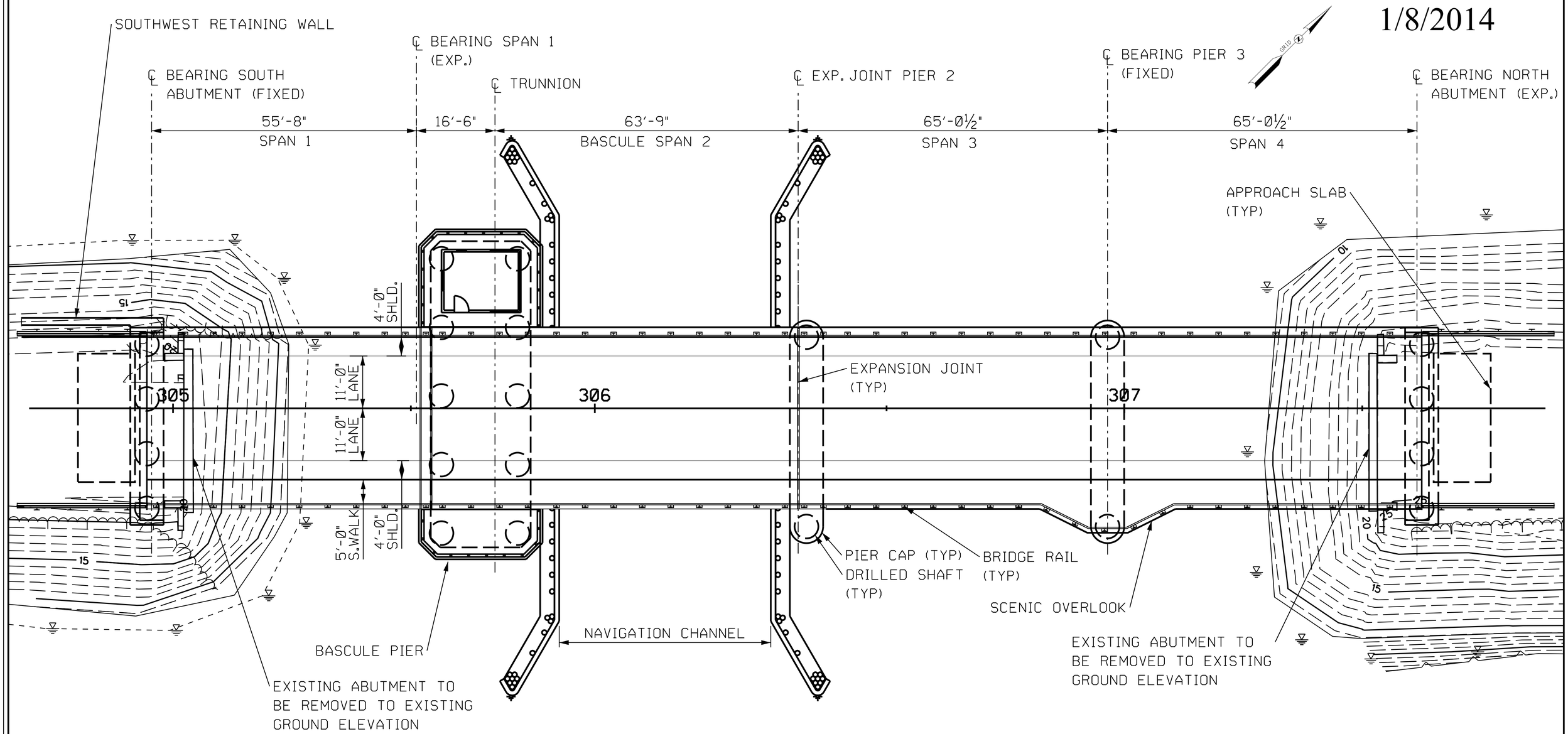
1/8/2014



NEW CASTLE-RYE BRIDGE - 16127

CONCEPTUAL BRIDGE REPLACEMENT
GENERAL PLAN
SCALE: 1" = 20'-0"

Hoyle, Tanner & Associates, Inc.

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THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE					
DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN					
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	CAD	DATE:	XX/XX/2013	SHEET NO.	TOTAL SHEETS
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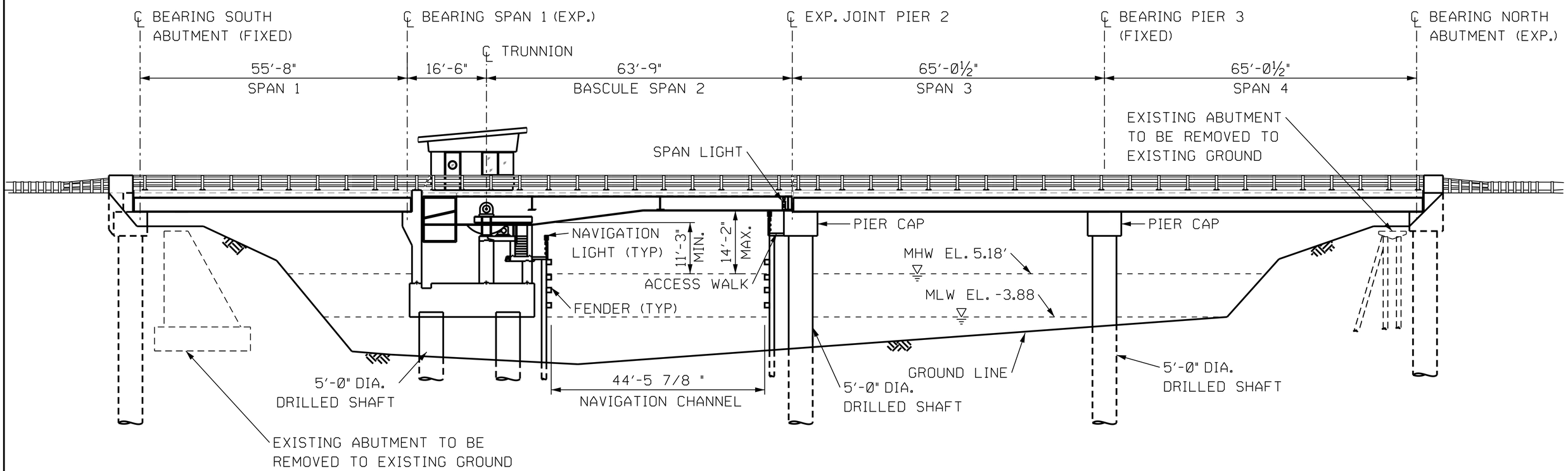
1/8/2014



NEW CASTLE-RYE BRIDGE - 16127

CONCEPTUAL BRIDGE REPLACEMENT
PIER VIEW OF ELEVATION
SCALE: 1" = 20'-0"

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THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE					
DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN					
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	CAD	DATE:	XX/XX/2013	SHEET NO.	TOTAL SHEETS
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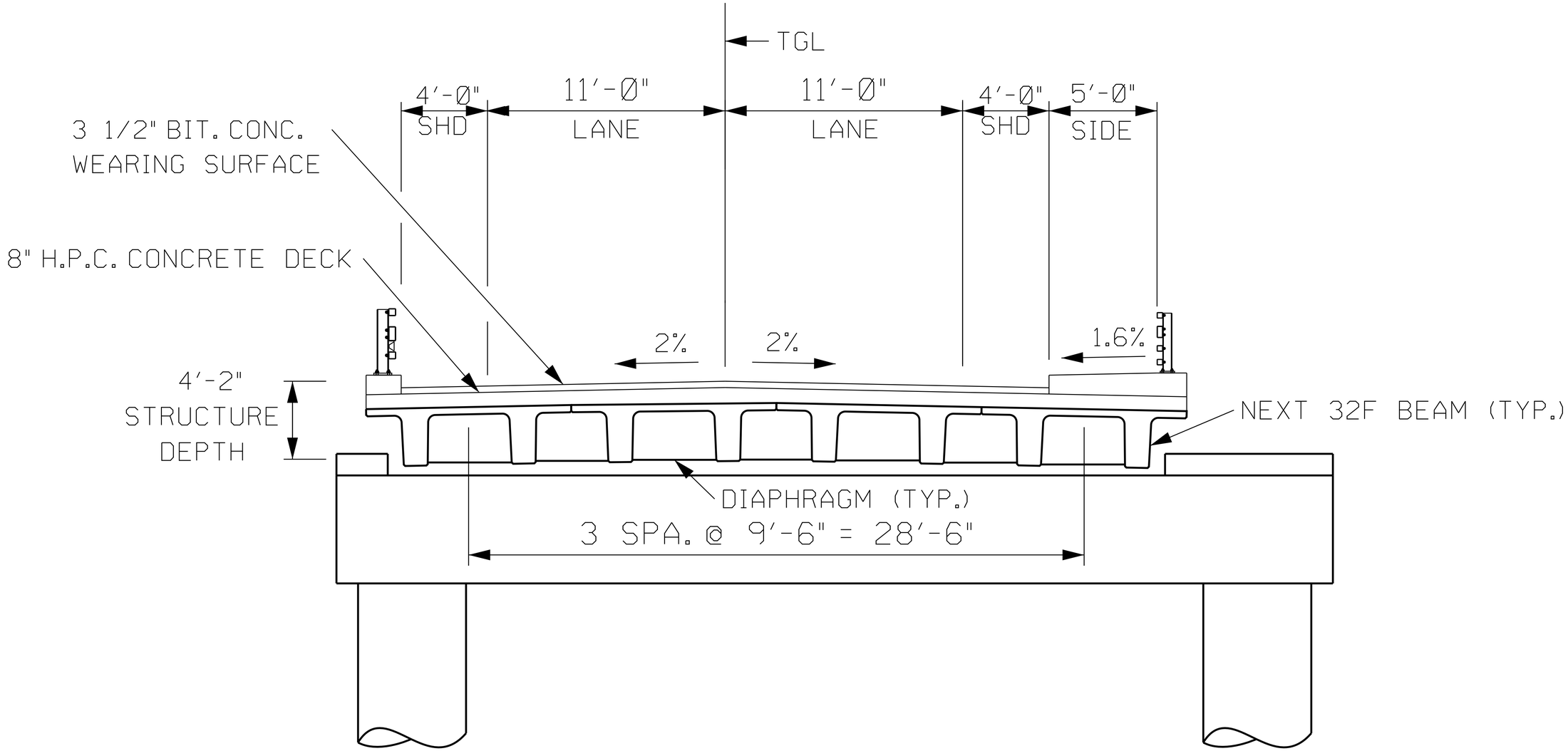
1/8/2014



NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

REPLACEMENT ALTERNATIVE - CROSS SECTION AT PIER 2

NEXT BEAM OPTION

SCALE: 1" = 5'-0"

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THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE					
DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN					
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	KCK	DATE:	11/01/2013	SHEET NO.	TOTAL SHEETS
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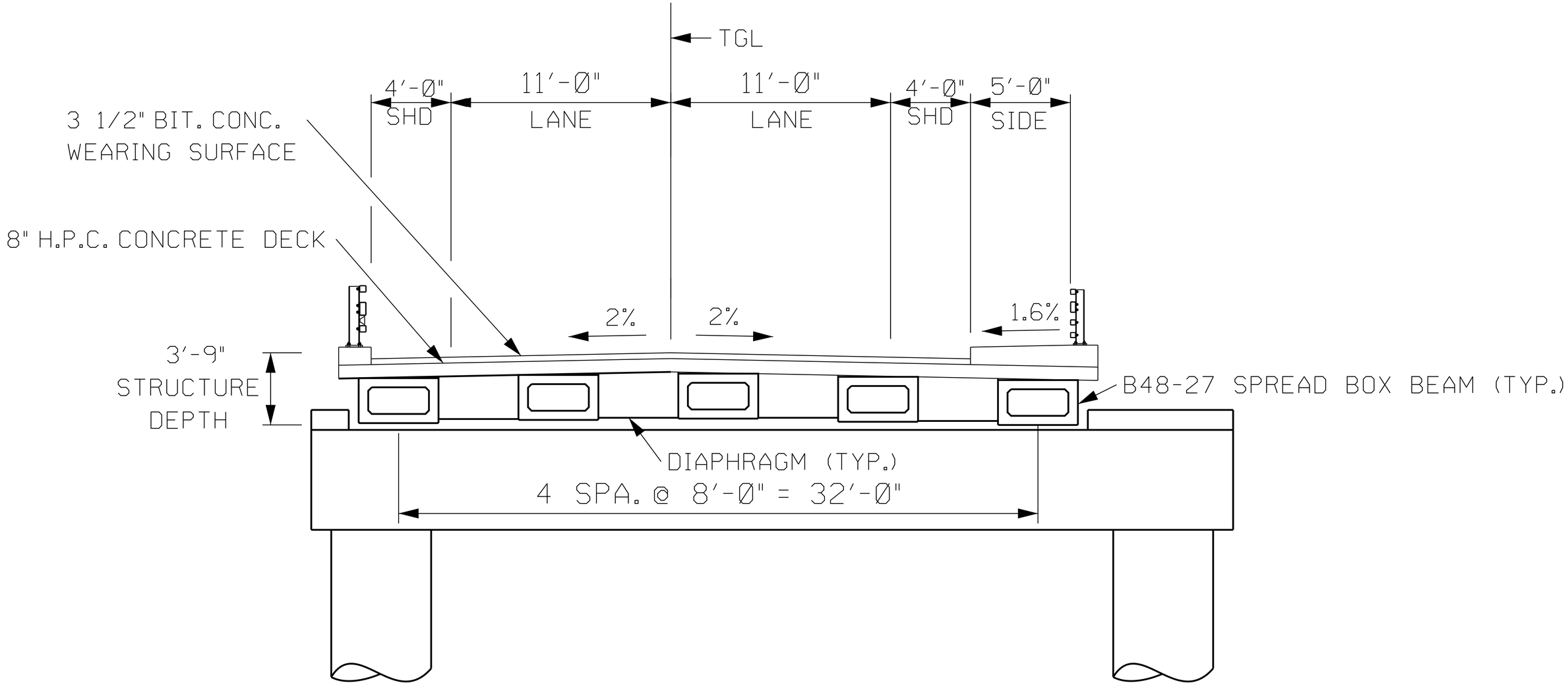
1/8/2014



NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

REPLACEMENT ALTERNATIVE - CROSS SECTION AT PIER 2

SPREAD BOX BEAM OPTION

SCALE: 1" = 5'-0"

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THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE					
DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN					
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	KCK	DATE:	11/01/2013	SHEET NO.	TOTAL SHEETS
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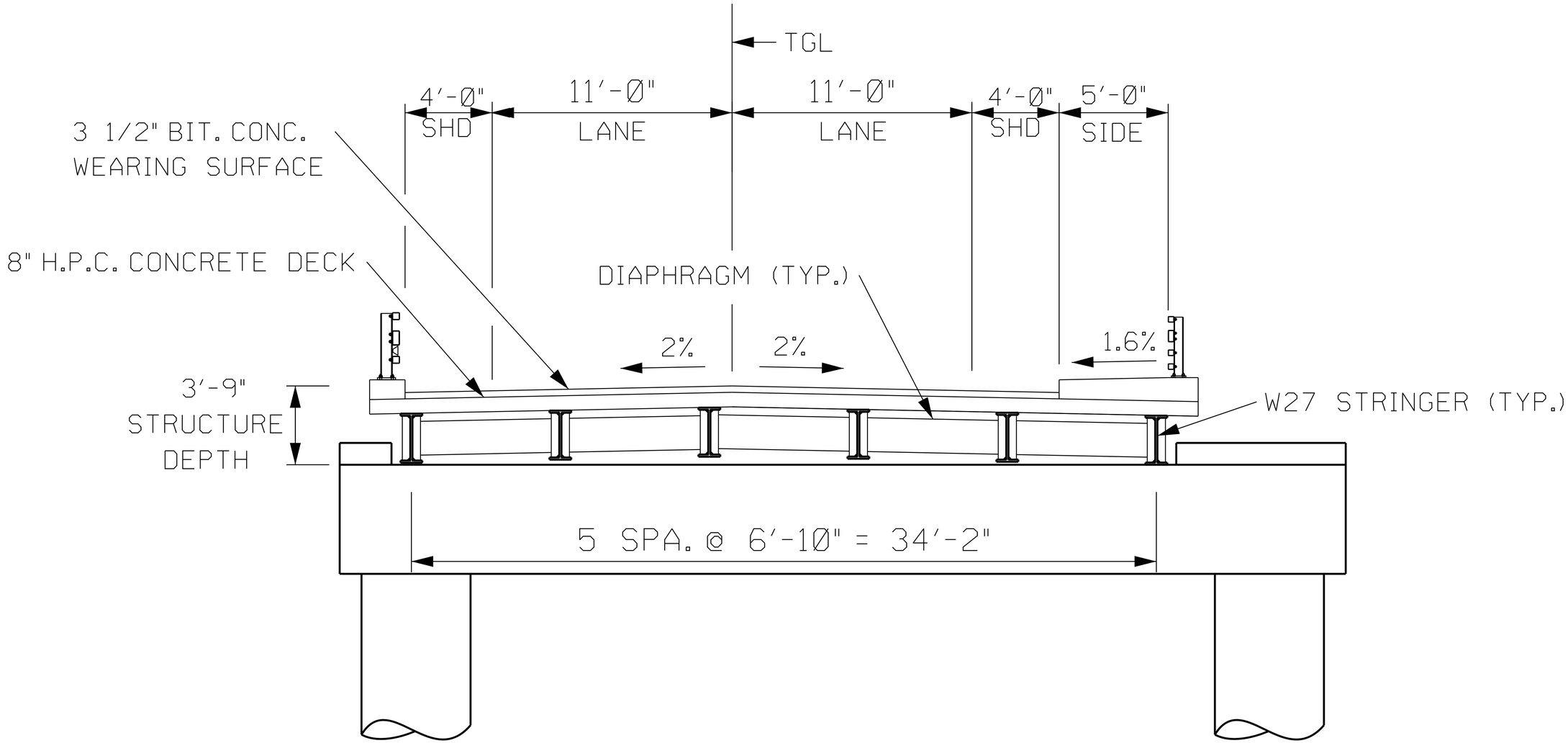
1/8/2014



NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

REPLACEMENT ALTERNATIVE - CROSS SECTION AT PIER 2

STEEL STRINGER OPTION

SCALE: 1" = 5'-0"

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THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE					
DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN					
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
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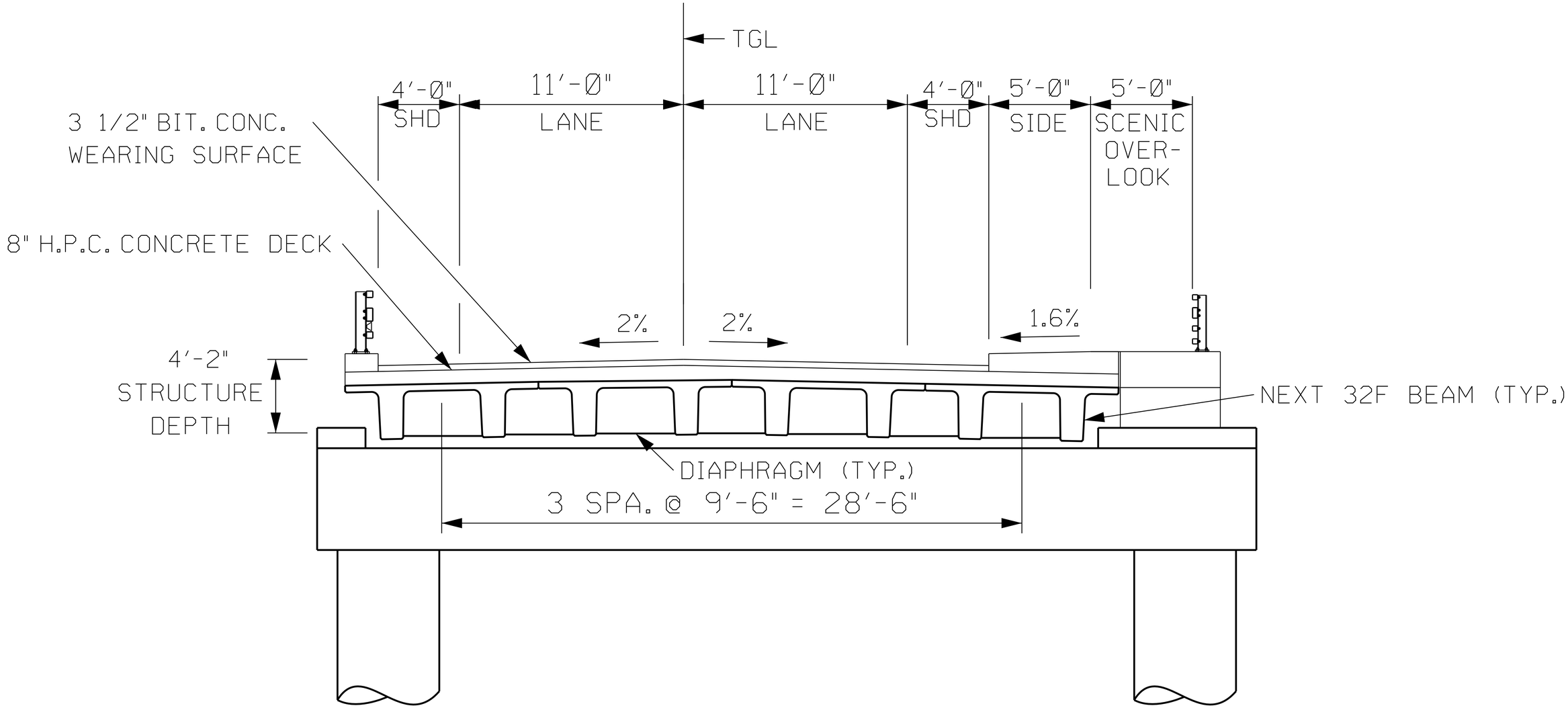
1/8/2014



NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

REPLACEMENT ALTERNATIVE - CROSS SECTION AT PIER 3

NEXT BEAM OPTION

SCALE: 1" = 5'-0"

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THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE					
DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN					
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	KCK	DATE:	11/01/2013	SHEET NO.	TOTAL SHEETS
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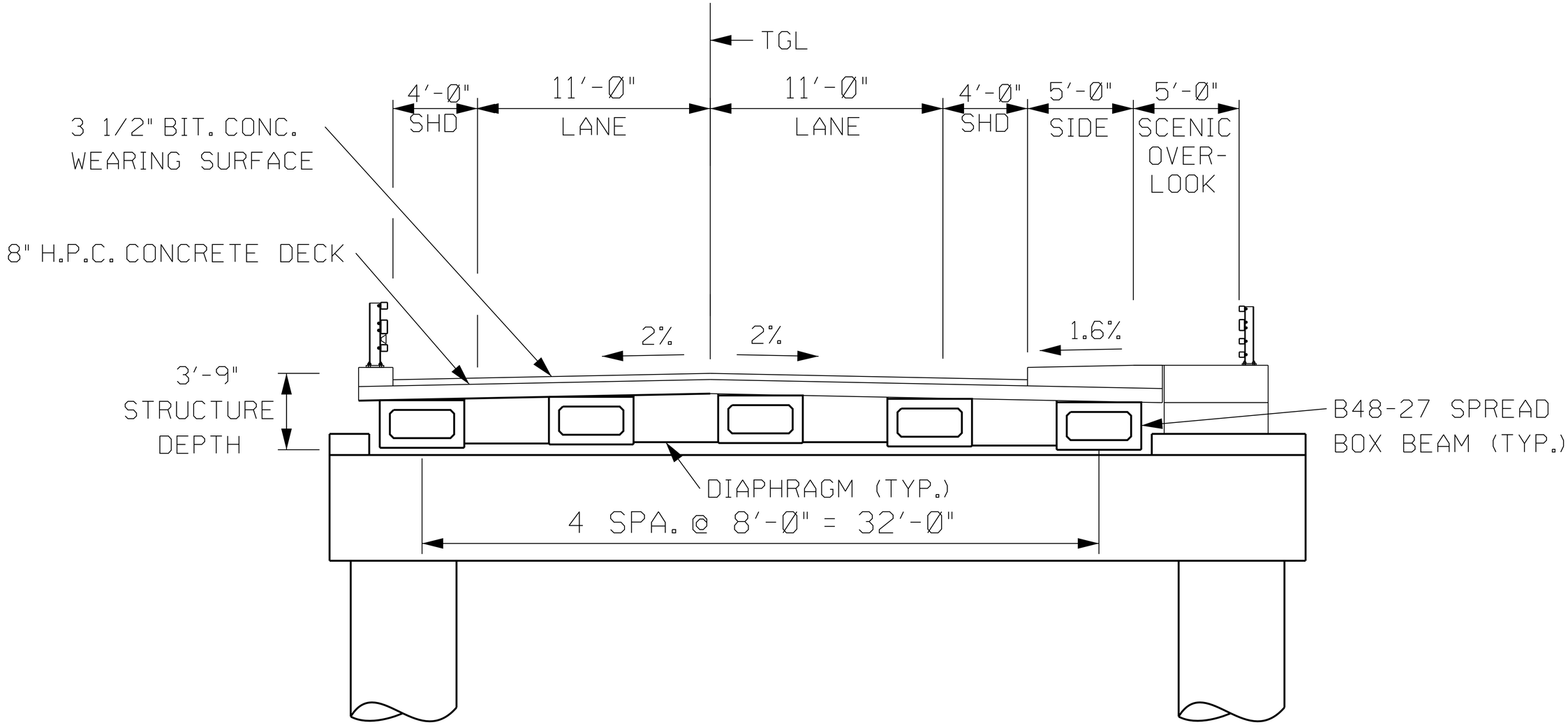
1/8/2014



NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

REPLACEMENT ALTERNATIVE - CROSS SECTION AT PIER 3

SPREAD BOX BEAM OPTION

SCALE: 1" = 5'-0"

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THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE					
DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN					
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	KCK	DATE:	11/01/2013	SHEET NO.	TOTAL SHEETS
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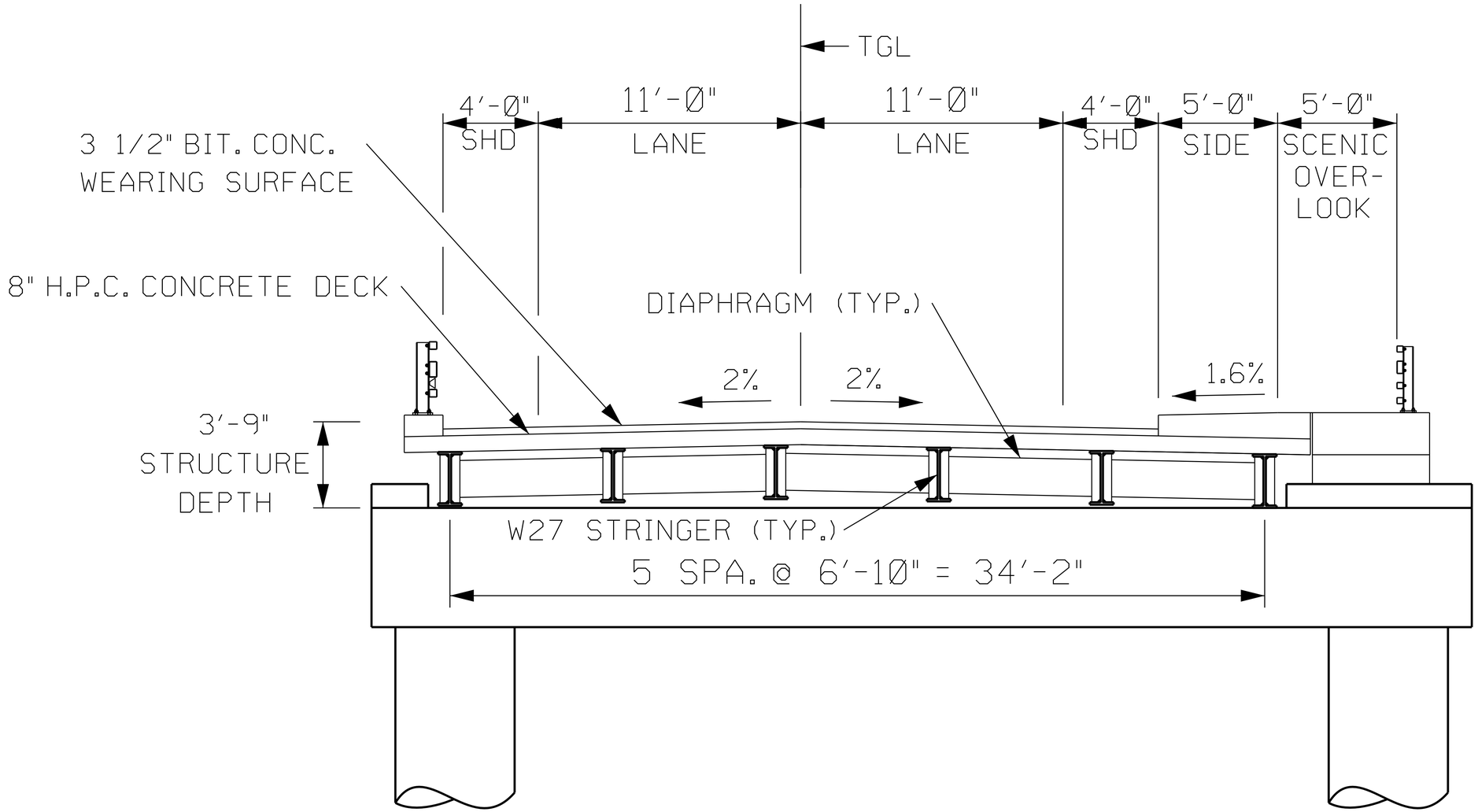
1/8/2014



NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

REPLACEMENT ALTERNATIVE - CROSS SECTION AT PIER 3

STEEL STRINGER OPTION

SCALE: 1" = 5'-0"

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THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE					
DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN					
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
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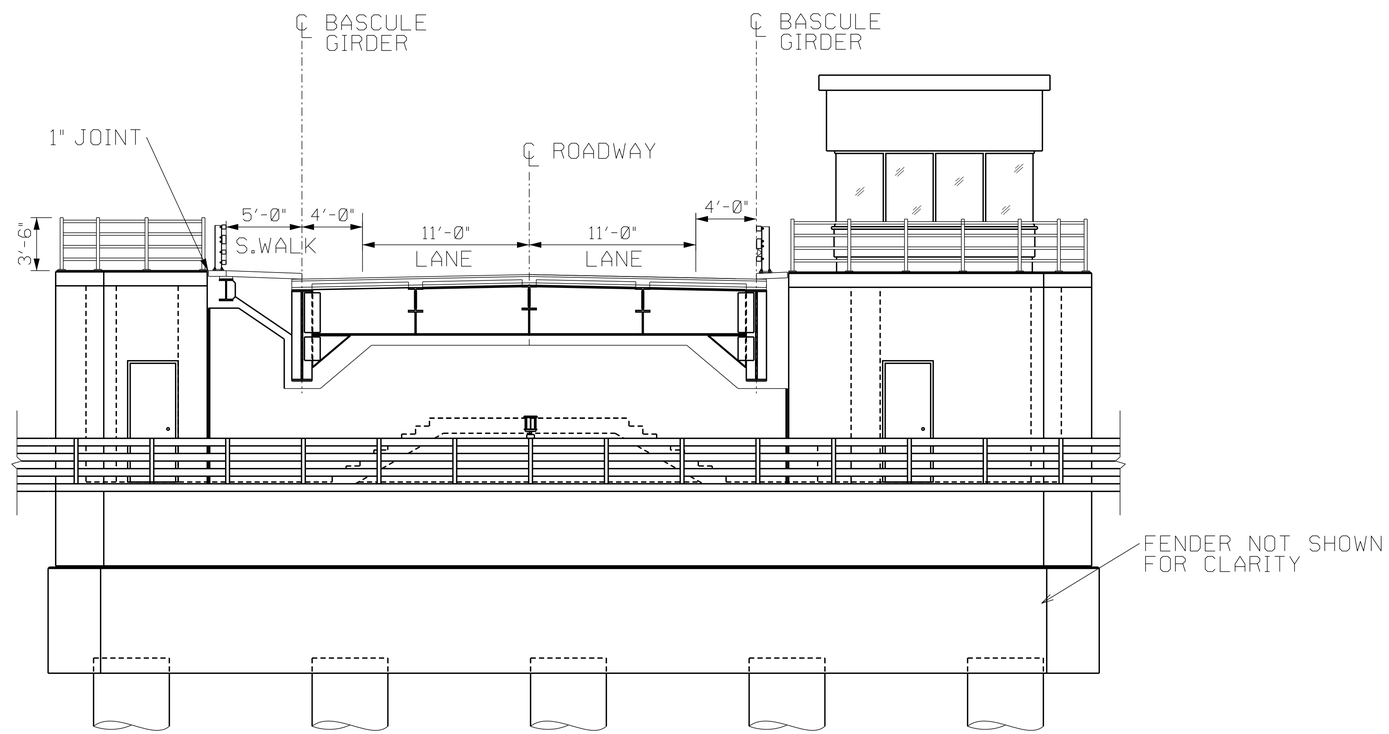
1/8/2014



NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

CONCEPTUAL BRIDGE REPLACEMENT - BASCULE SECTION

SCALE: 1" = 10'-0"

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THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE					
DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN					
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
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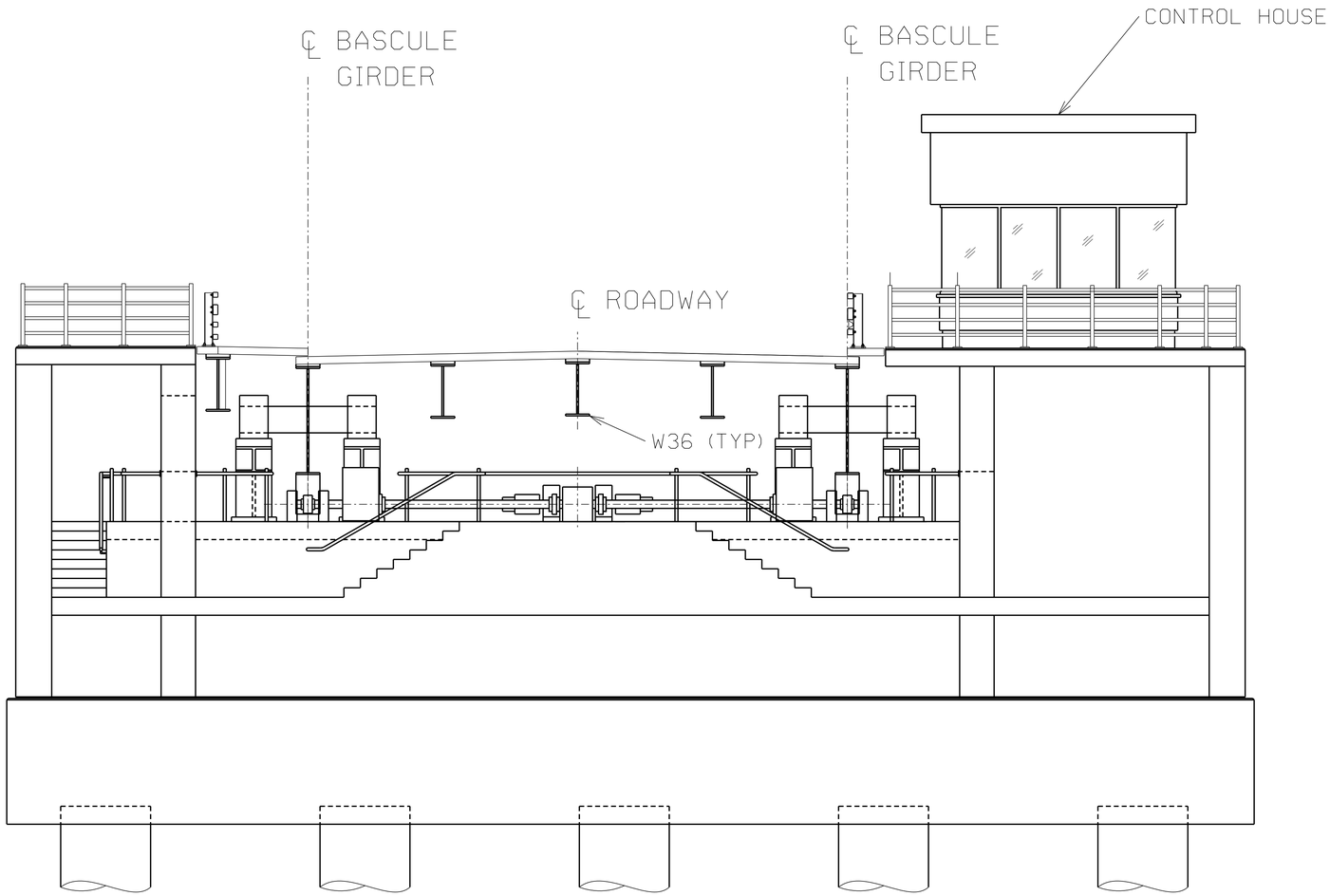
1/8/2014



NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY
CONCEPTUAL BRIDGE REPLACEMENT
BASCULE PIER SECTION

Hoyle, Tanner & Associates, Inc.

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THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE					
DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN					
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	CAD	DATE:	XX/XX/2013	SHEET NO.	TOTAL SHEETS
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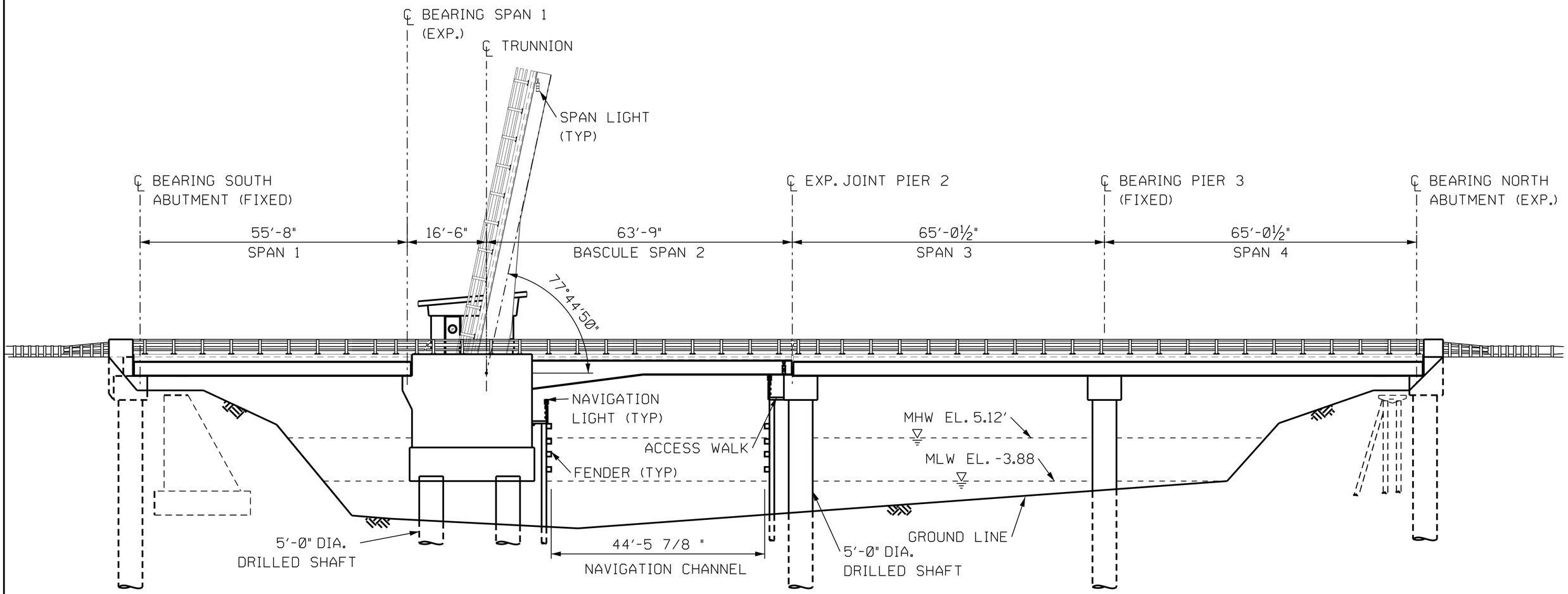
1/8/2014



NEW CASTLE-RYE BRIDGE - 16127

CONCEPTUAL BRIDGE REPLACEMENT
BASCULE SPAN - SPAN RAISED
SCALE: 1" = 20'-0"

Hoyle, Tanner & Associates, Inc.

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THE STATE OF NEW HAMPSHIRE ★ DEPARTMENT OF TRANSPORTATION ★

STATE OF NEW HAMPSHIRE					
DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN					
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	CAD	DATE:	XX/XX/2013	SHEET NO.	TOTAL SHEETS
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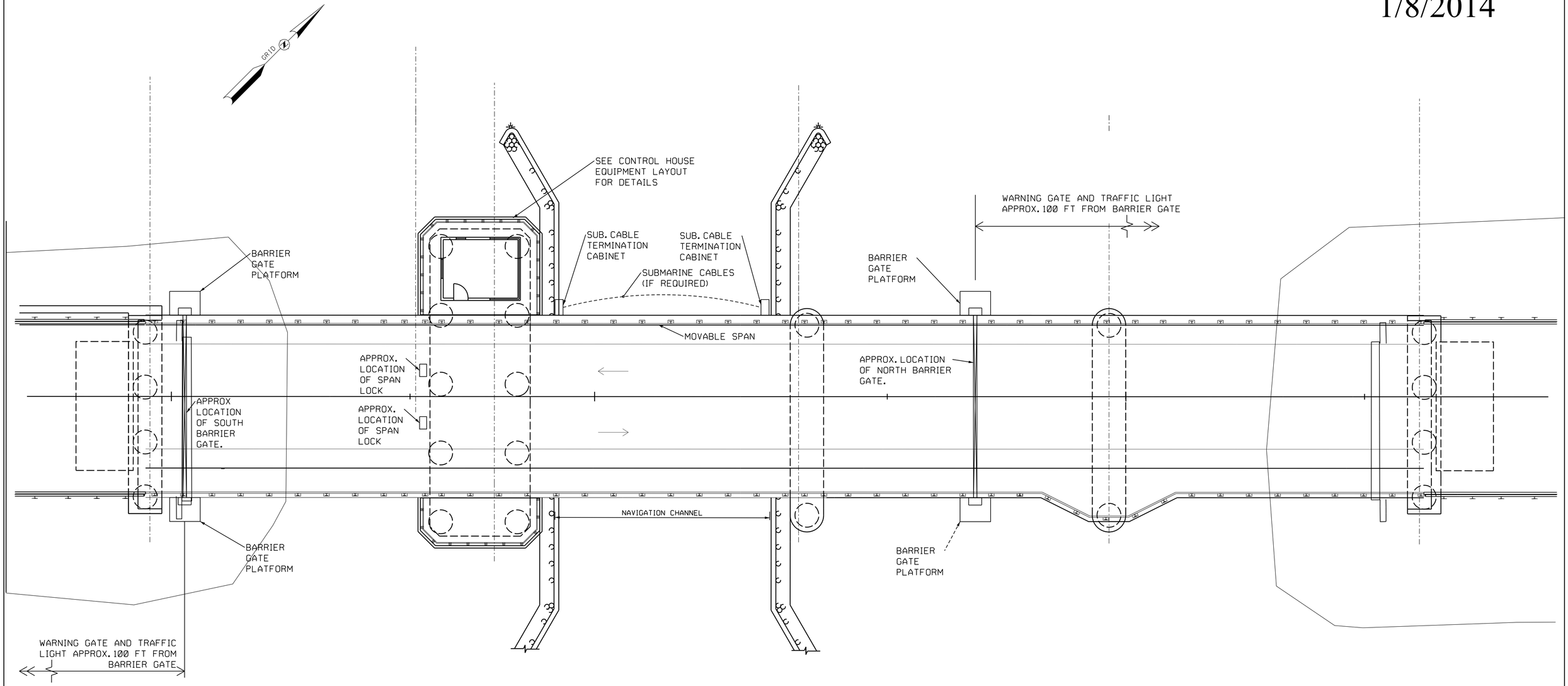
1/8/2014



NEW CASTLE-RYE BRIDGE - 16127

CONCEPTUAL BRIDGE REPLACEMENT
ELECTRICAL SYSTEMS PLAN

SCALE: 1" = 20'-0"

Hoyle, Tanner & Associates, Inc.

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THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE					
DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN					
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	XXX	DATE:	XX/XX/2013	SHEET NO.	TOTAL SHEETS
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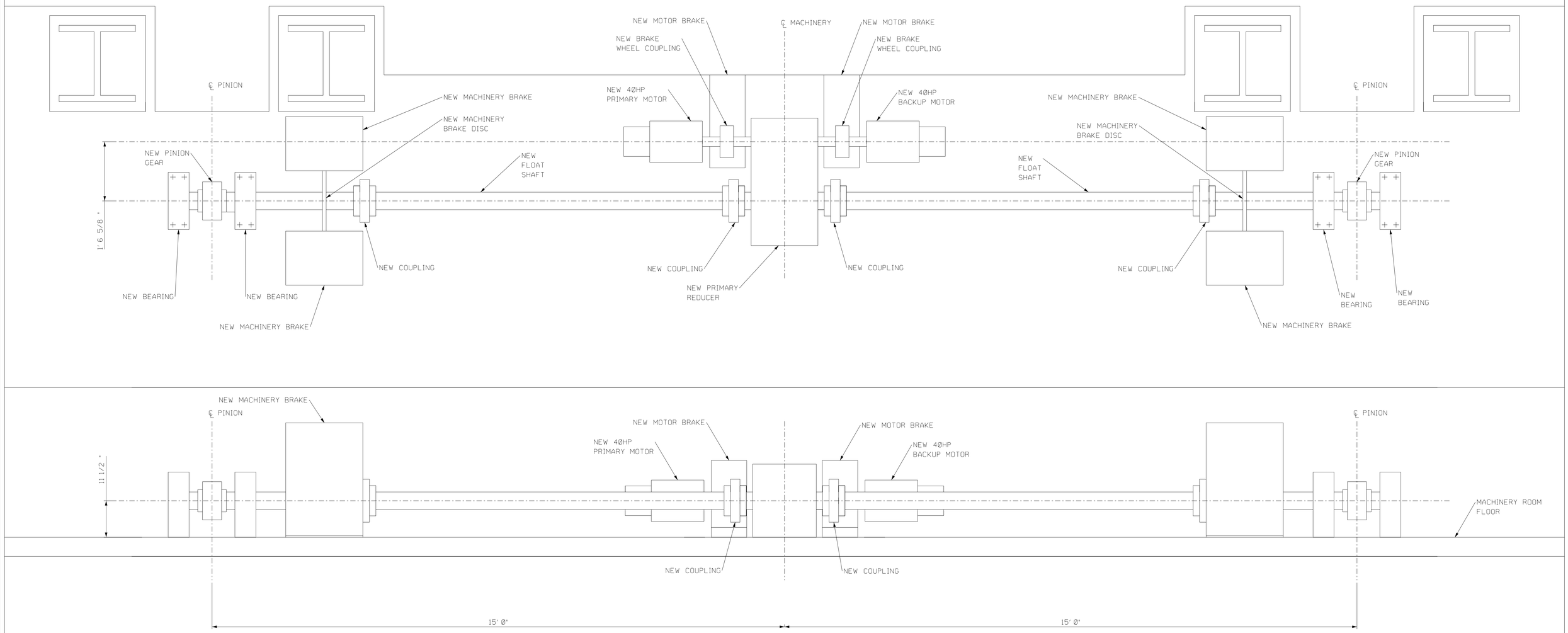
1/8/2014



NEW CASTLE-RYE BRIDGE - 16127

BASCULE MACHINERY REPLACEMENT
GENERAL PLAN AND ELEVATION
SCALE: 1" = 20'-0"

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THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE					
DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN					
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	SSG	DATE:	12/13/2013	SHEET NO.	TOTAL SHEETS
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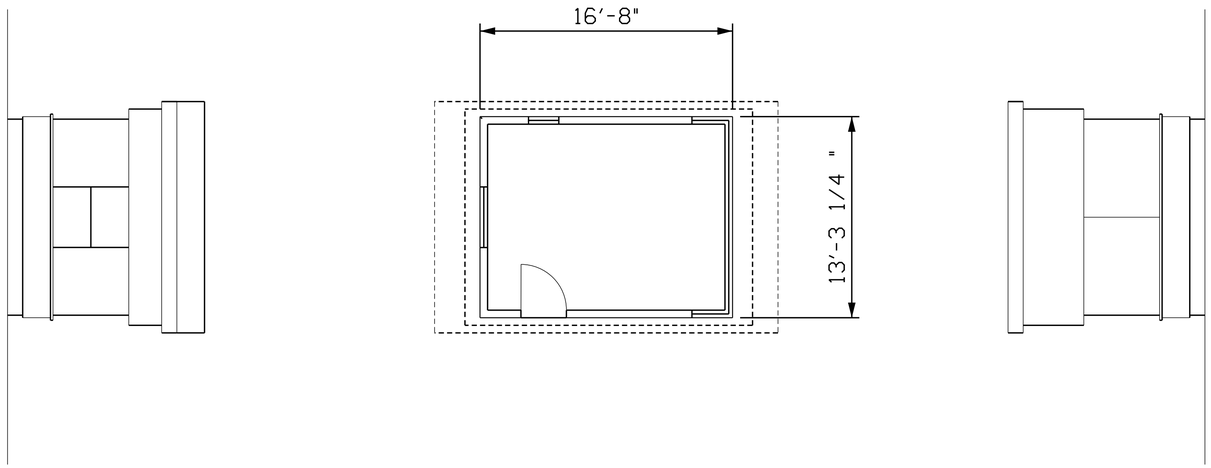
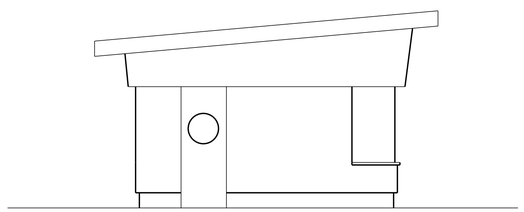
1/8/2014





NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY
CONTROL HOUSE PLAN AND ELEVATIONS
SCALE: 1" = 10'-0"

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THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE					
DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN					
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	XXX	DATE:	XX/XX/2013	SHEET NO.	TOTAL SHEETS
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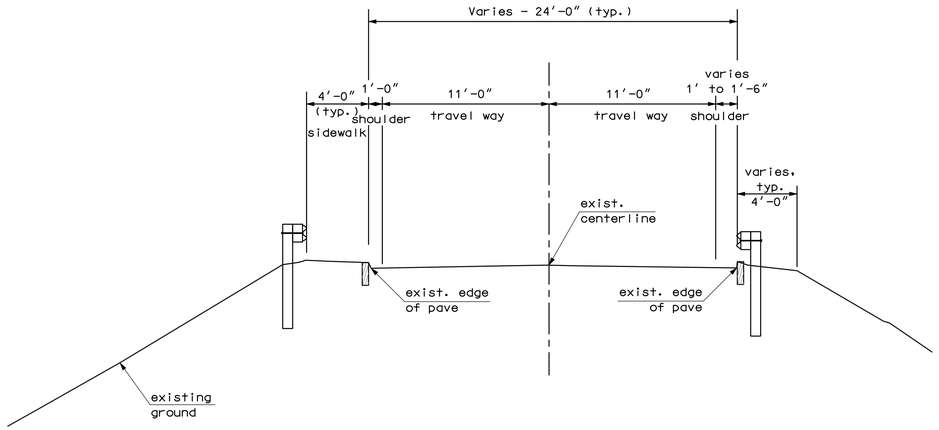
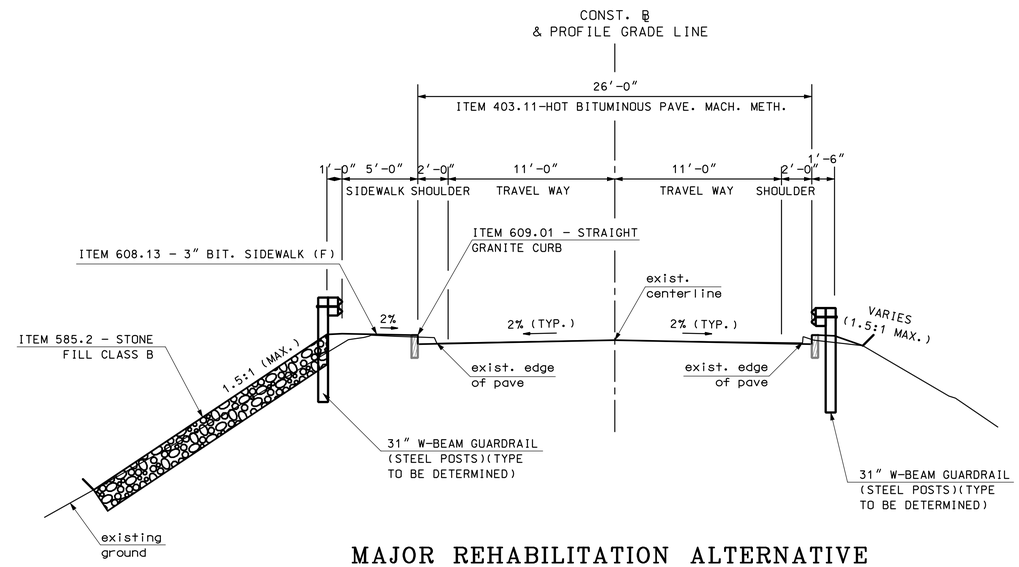
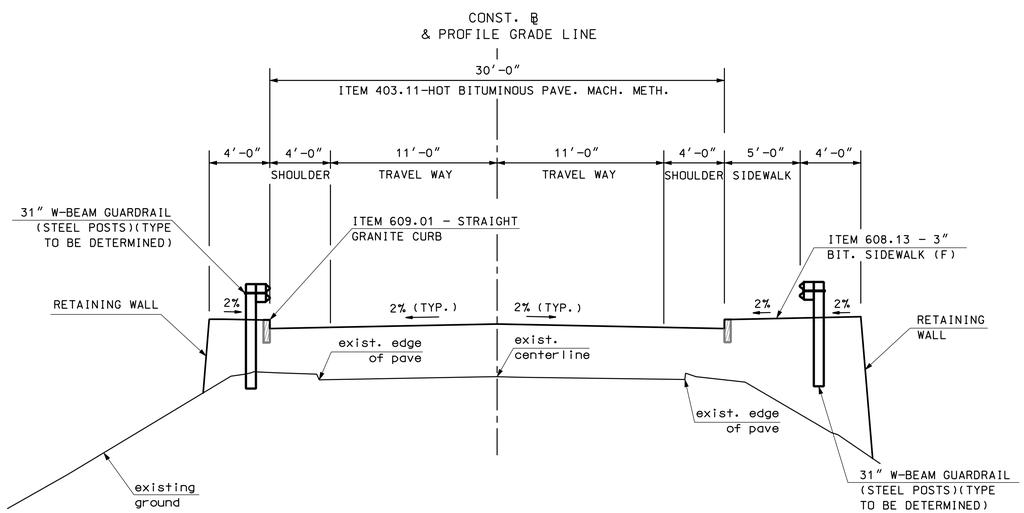
1/8/2014



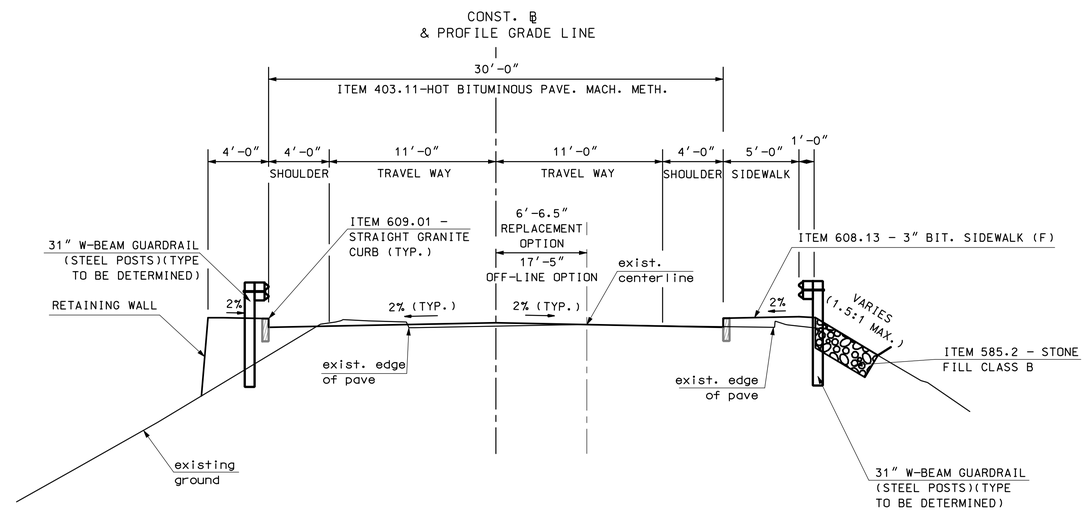
EXISTING ROADWAY



MAJOR REHABILITATION ALTERNATIVE



RAISED PROFILE ALTERNATIVE



REPLACEMENT ALTERNATIVE / OFF-LINE ALTERNATIVE

NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY
ROADWAY TYPICALS
SCALE: 1" = 5'-0"

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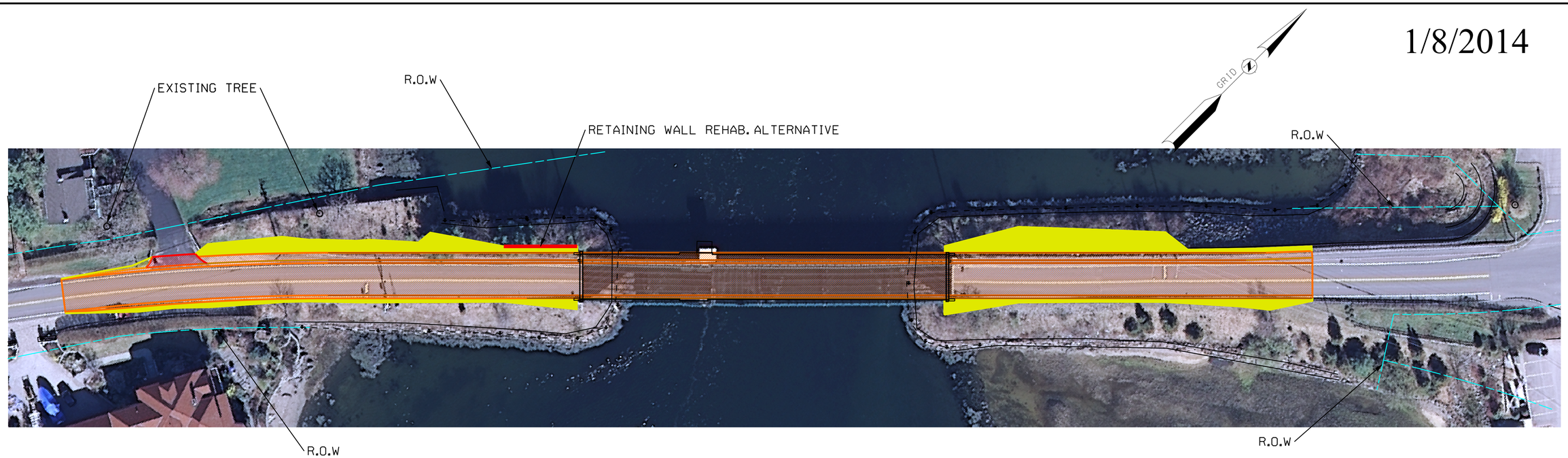
THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE

DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN

PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	SCS	DATE:	12/13/2013	SHEET NO.	TOTAL SHEETS
CHECK BY:	SBH	DATE:	12/13/2013	39	52
APPROVED BY:	CED	DATE:	12/13/2013		

1/8/2014



NOTE: THE AERIAL IMAGE SHOWN IN THIS DRAWING IS FROM GRANITVIEW, NEW HAMPSHIRE'S GIS SYSTEM. THERE IS MINOR DISTORTION IN THE IMAGE PROVIDED, AND IT SHOULD BE USED FOR PURPOSES OF GENERAL REFERENCE ONLY. REFER TO LINEWORK DRAWN FOR SURVEYED AND ENGINEERED LIMITS OF RIGHT-OF-WAY, GRADING, ROADWAY, AND STRUCTURES.

NEW CASTLE-RYE BRIDGE - 16127

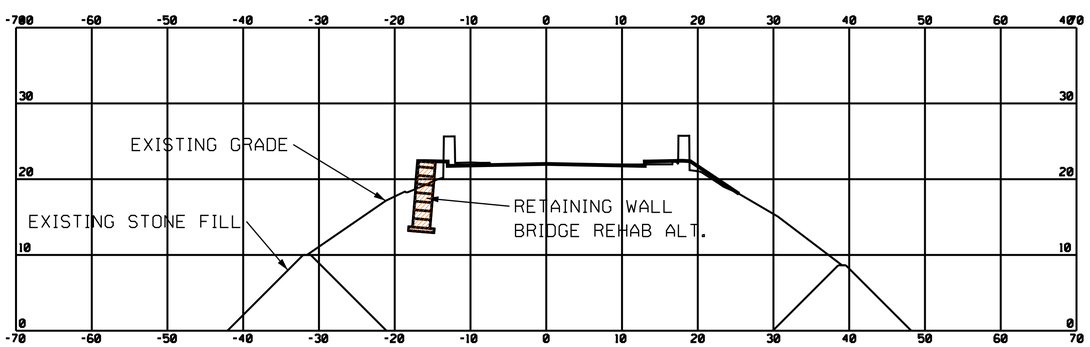
TYPE, SIZE & LOCATION STUDY

MAJOR REHABILITATION ALTERNATIVE - IMPACT PLAN

SCALE: 1" = 70'-0"

LEGEND

- BRIDGE REHAB. - ROADWAY IMPACTS
- BRIDGE REHAB. - GRADING IMPACTS
- BRIDGE REHAB. - DRIVEWAY IMPACTS



SECTION AT SOUTHWEST RETAINING WALL
STATION 305+00
1" = 20'-0"

Hoyle, Tanner & Associates, Inc.

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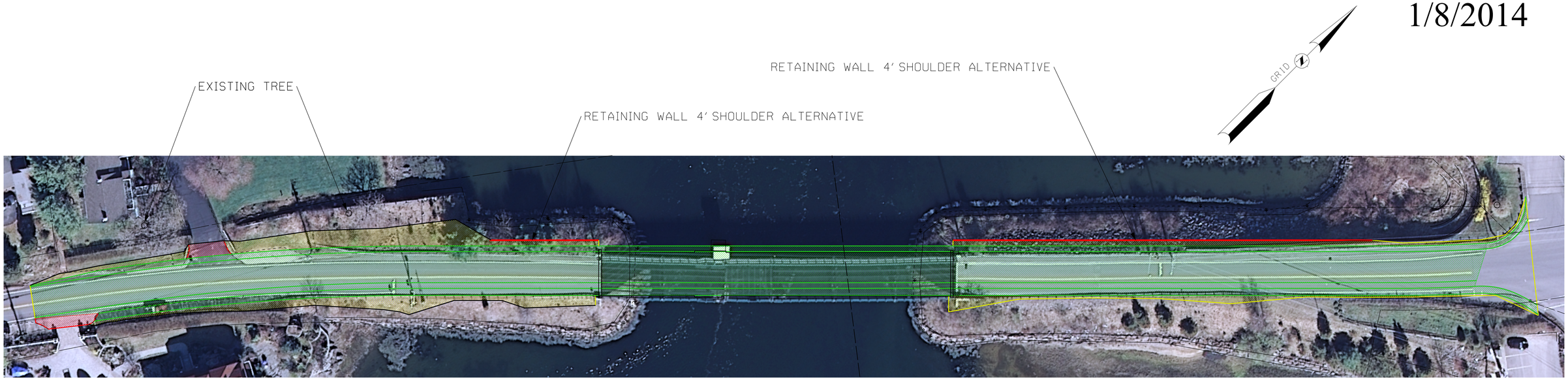
STATE OF NEW HAMPSHIRE

DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN

PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	KCK	DATE:	11/01/2013	SHEET NO.	TOTAL SHEETS
CHECK BY:	JFM	DATE:	11/01/2013	40	52
APPROVED BY:	JFM	DATE:	11/01/2013		

1/8/2014



NOTE: THE AERIAL IMAGE SHOWN IN THIS DRAWING IS FROM GRANITVIEW, NEW HAMPSHIRE'S GIS SYSTEM. THERE IS MINOR DISTORTION IN THE IMAGE PROVIDED, AND IT SHOULD BE USED FOR PURPOSES OF GENERAL REFERENCE ONLY. REFER TO LINEWORK DRAWN FOR SURVEYED AND ENGINEERED LIMITS OF RIGHT-OF-WAY, GRADING, ROADWAY, AND STRUCTURES

NEW CASTLE-RYE BRIDGE - 16127

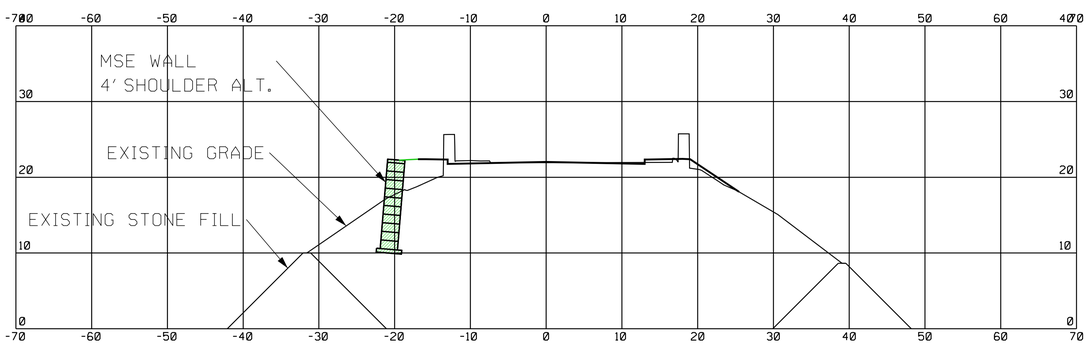
TYPE, SIZE & LOCATION STUDY

BRIDGE REPLACEMENT OPTION - IMPACT PLAN

SCALE: 1" = 70'-0"

LEGEND

- 4' SHOULDER - ROADWAY IMPACTS
- 4' SHOULDER - GRADING IMPACTS
- 4' SHOULDER - DRIVEWAY IMPACTS



SECTION AT SOUTHWEST RETAINING WALL
STATION 305+00
1" = 20'-0"

Hoyle, Tanner & Associates, Inc.

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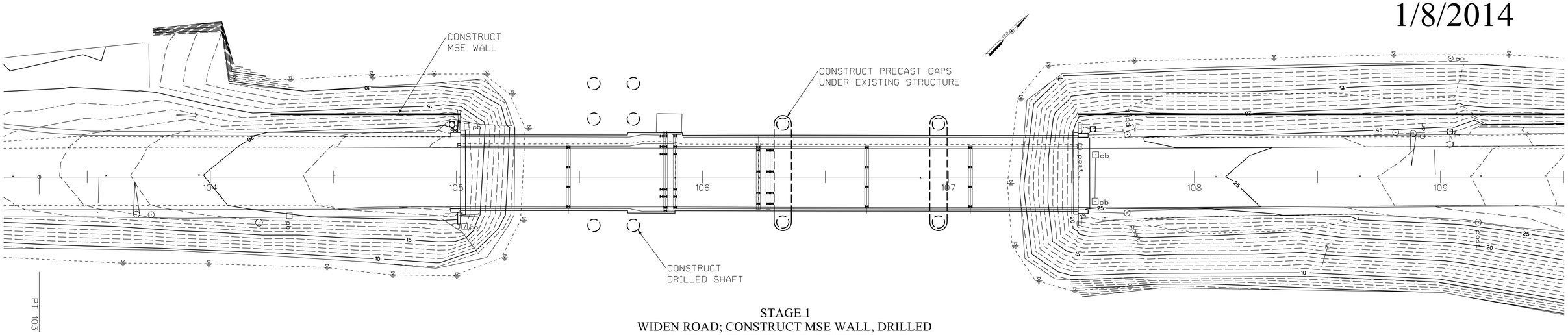
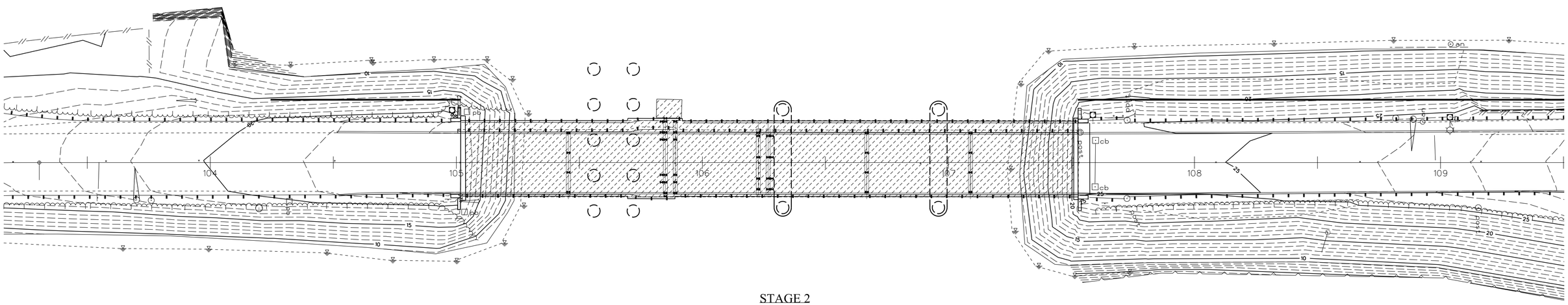
THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE					
DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN					
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	KCK	DATE:	11/01/2013	SHEET NO.	TOTAL SHEETS
CHECK BY:	JFM	DATE:	11/01/2013	41	52
APPROVED BY:	JFM	DATE:	11/01/2013		

1/8/2014



STAGE 1
WIDEN ROAD; CONSTRUCT MSE WALL, DRILLED SHAFTS, AND FIXED AND REST PIER CAPS



STAGE 2
DEMOLISH EXISTING STRUCTURE,
CONSTRUCT REMAINING DRILLED SHAFTS

NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY
BRIDGE REPLACEMENT - CONSTRUCTION PHASING
SCALE: 1" = 40'-0"

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THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

STRUCTURE TO BE DEMOLISHED

STATE OF NEW HAMPSHIRE					
DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN					
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	MCC	DATE:	12/16/2013	SHEET NO.	TOTAL SHEETS
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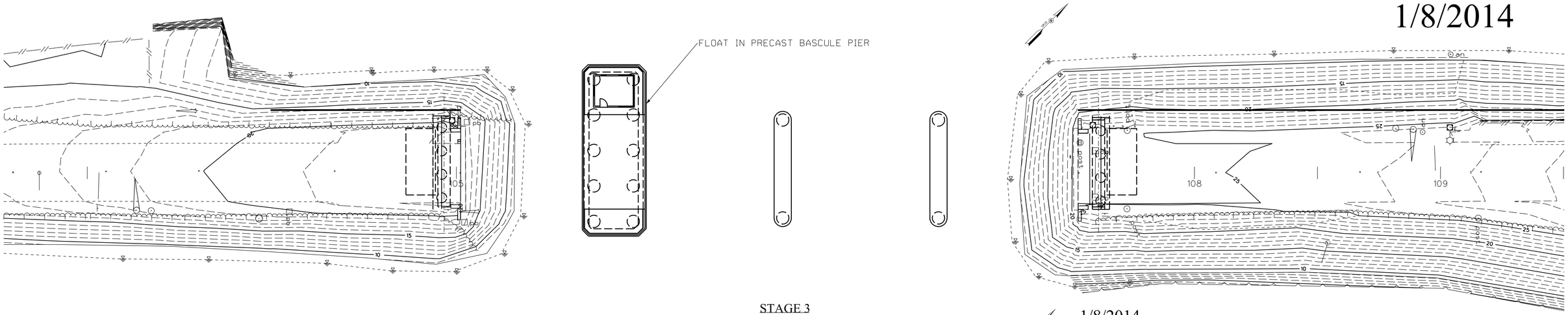
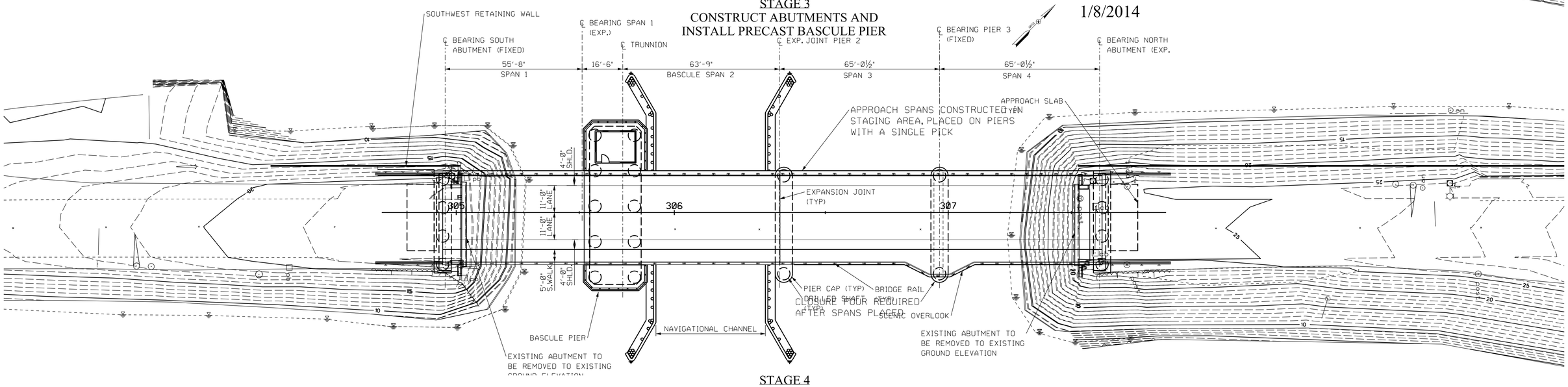
APPROVED BY:	JFM	DATE:	12/16/2013		

1/8/2014



STAGE 3
CONSTRUCT ABUTMENTS AND
INSTALL PRECAST BASCULE PIER

1/8/2014



STAGE 4
CONSTRUCT MECHANICAL AND ELECTRICAL
SYSTEMS AND SUPERSTRUCTURE

NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

BRIDGE REPLACEMENT - CONSTRUCTION PHASING

SCALE: 1" = 40'-0"

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THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE					
DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN					
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	MCC	DATE:	12/16/2013	SHEET NO.	TOTAL SHEETS
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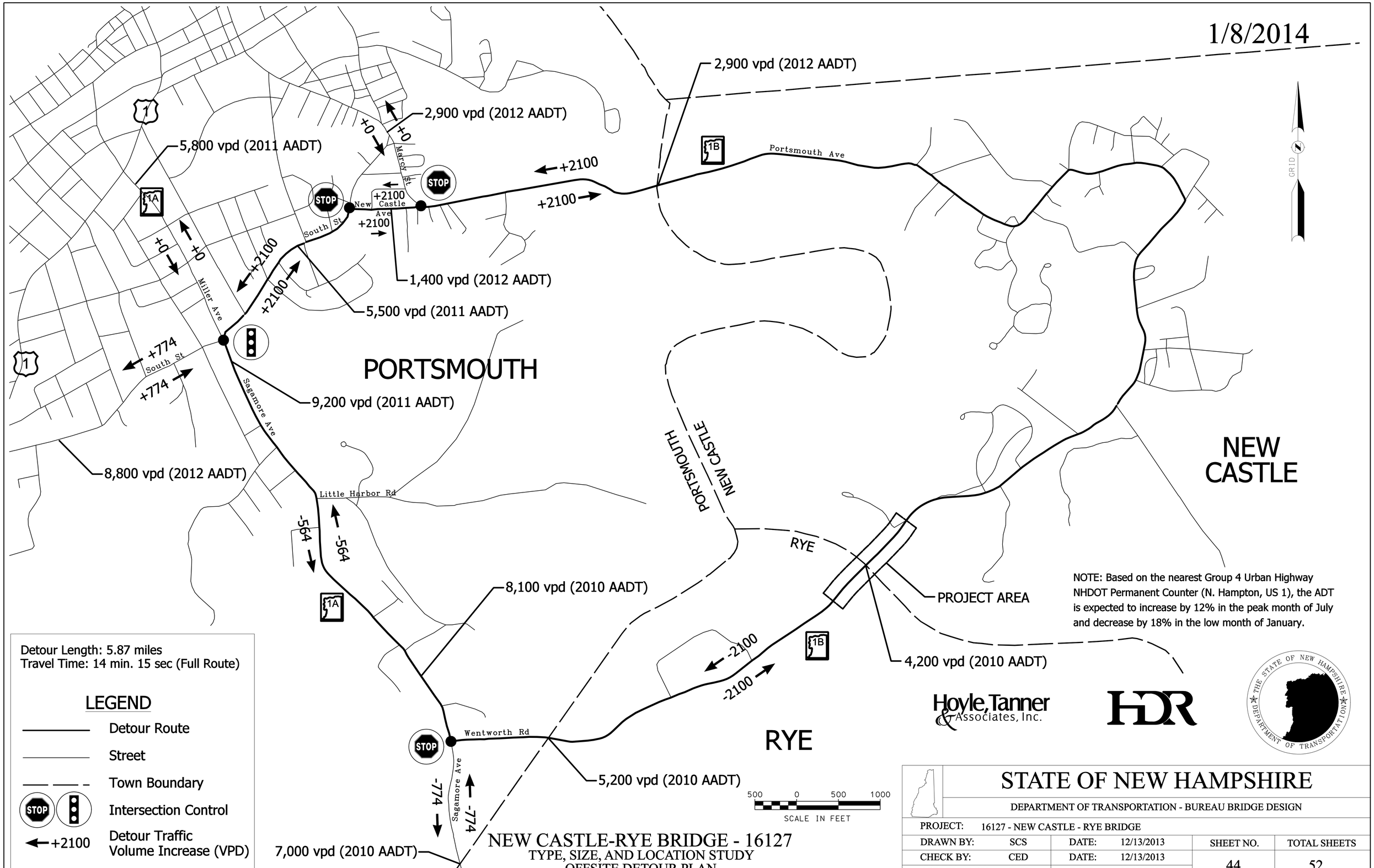
APPROVED BY:	JFM	DATE:	12/16/2013		

1/8/2014



NOTE: Based on the nearest Group 4 Urban Highway NHDOT Permanent Counter (N. Hampton, US 1), the ADT is expected to increase by 12% in the peak month of July and decrease by 18% in the low month of January.

Detour Length: 5.87 miles
Travel Time: 14 min. 15 sec (Full Route)

LEGEND

- Detour Route
- Street
- Town Boundary
- Intersection Control
- +2100 Detour Traffic Volume Increase (VPD)

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THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

NEW CASTLE-RYE BRIDGE - 16127

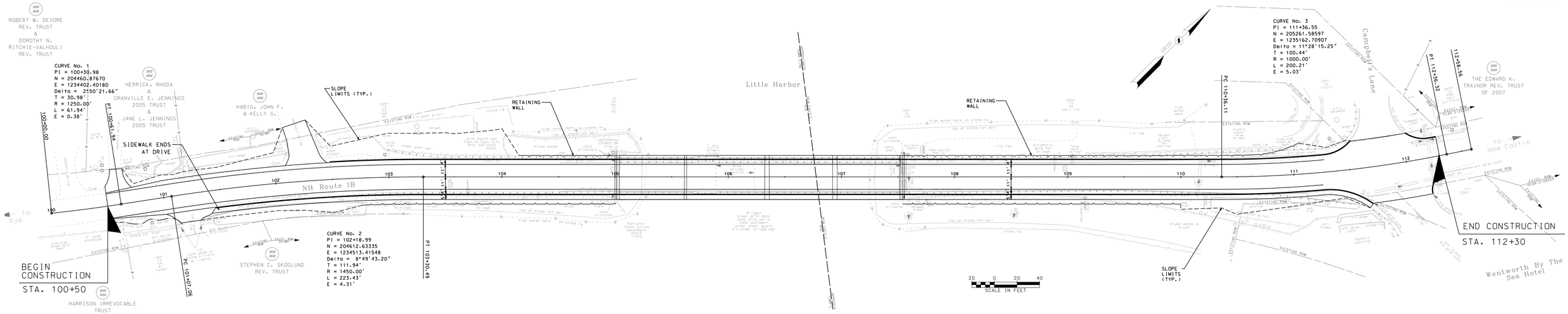
TYPE, SIZE, AND LOCATION STUDY
OFFSITE DETOUR PLAN

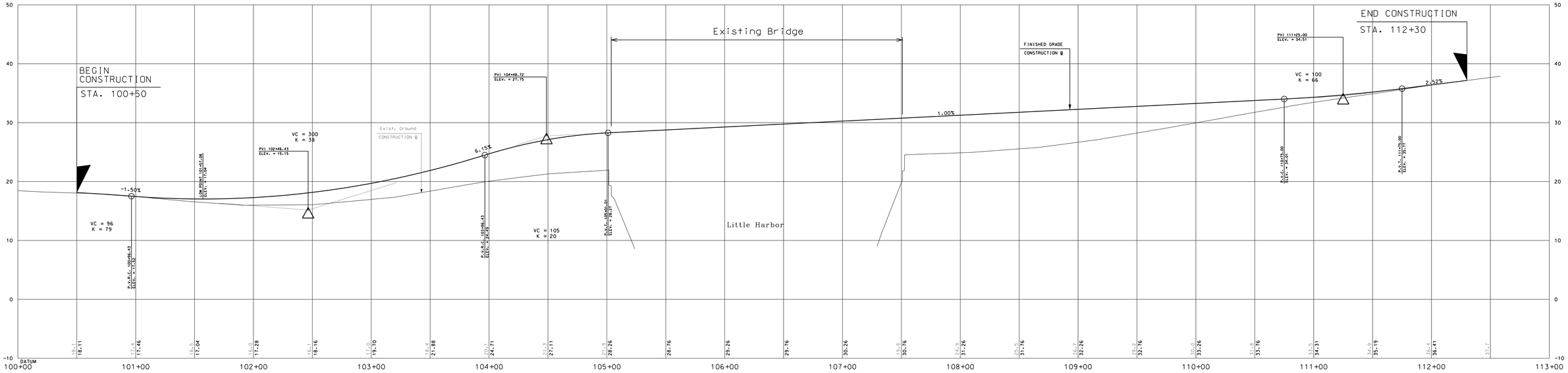
STATE OF NEW HAMPSHIRE

DEPARTMENT OF TRANSPORTATION - BUREAU BRIDGE DESIGN

PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	SCS	DATE:	12/13/2013	SHEET NO.	TOTAL SHEETS
CHECK BY:	CED	DATE:	12/13/2013	44	52
APPROVED BY:	SBH	DATE:	12/13/2013		

1/8/2014





NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE, & LOCATION STUDY
RAISED PROFILE ALTERNATIVE

SCALE:
1"= 20' HORIZ.
1"= 4' VERT.

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STATE OF NEW HAMPSHIRE					
DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN					
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	SCS	DATE:	12/13/2013	SHEET NO.	TOTAL SHEETS
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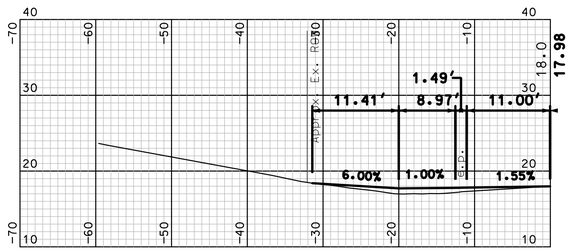
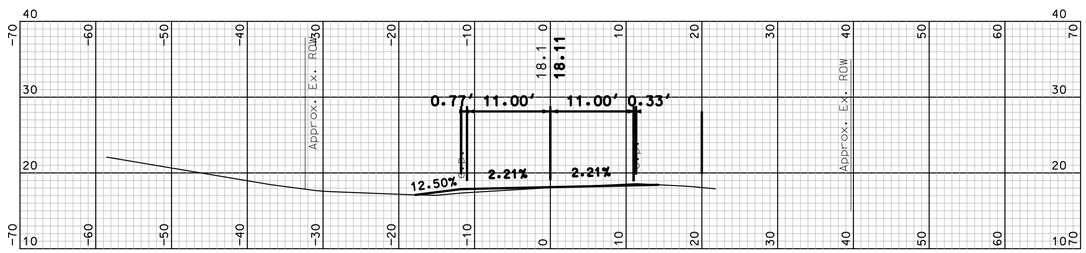
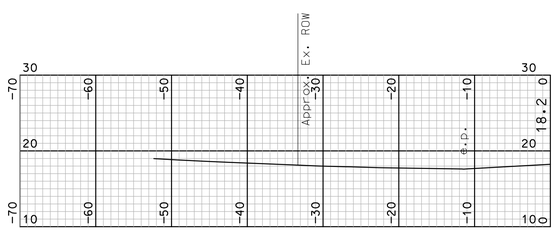
APPROVED BY:	SBH	DATE:	12/13/2013		



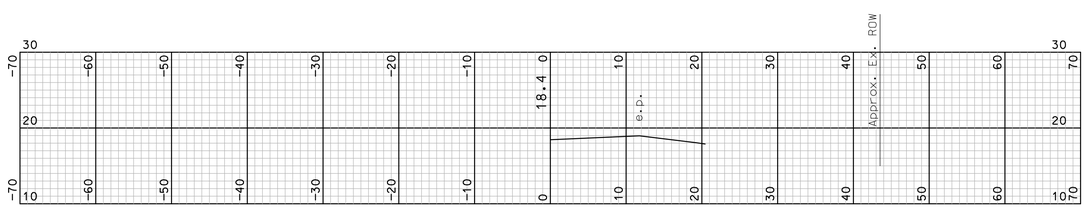
100+61 DRIVE LEFT



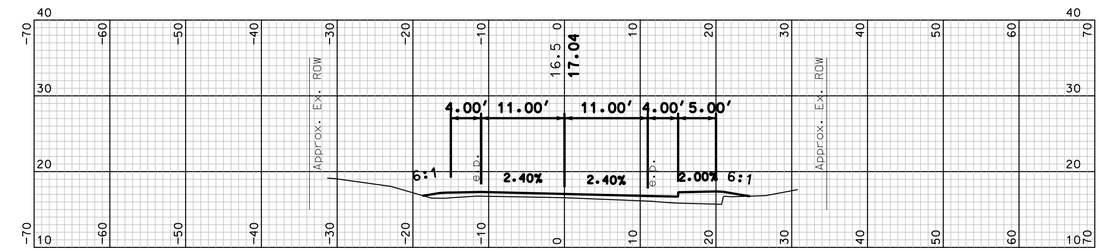
100+50



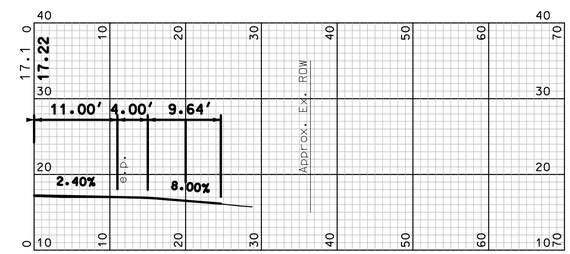
100+21 DRIVE LEFT



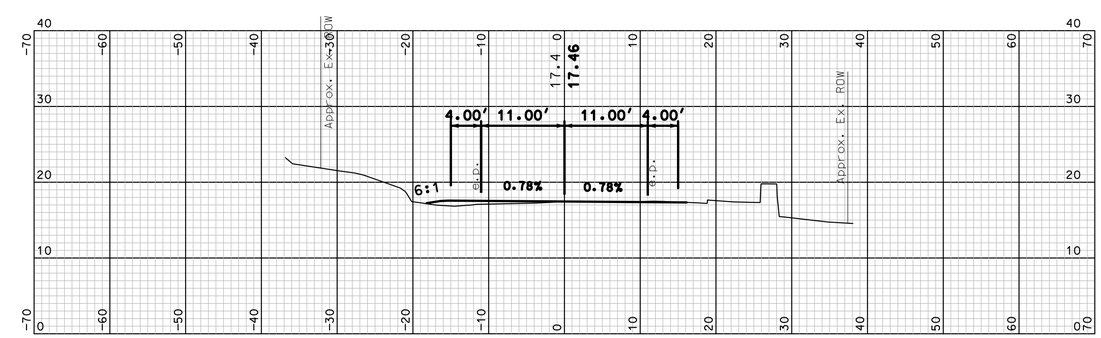
100+00



101+50



101+20 DRIVE RIGHT



101+00

NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

RAISED PROFILE ALTERNATIVE - ROADWAY CROSS SECTIONS

SCALE: 1" = 10'-0"

Hoyle, Tanner & Associates, Inc.

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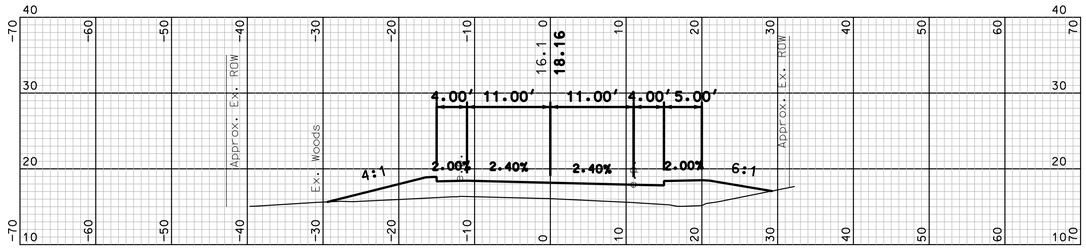
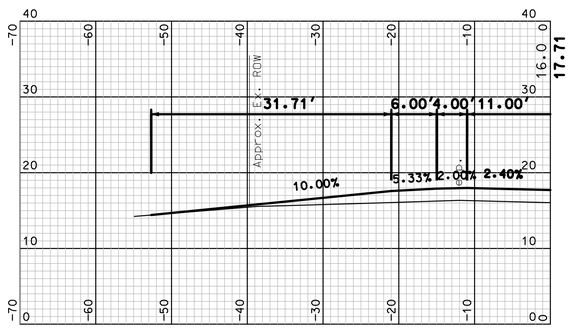
STATE OF NEW HAMPSHIRE

DEPARTMENT OF TRANSPORTATION - BUREAU BRIDGE DESIGN

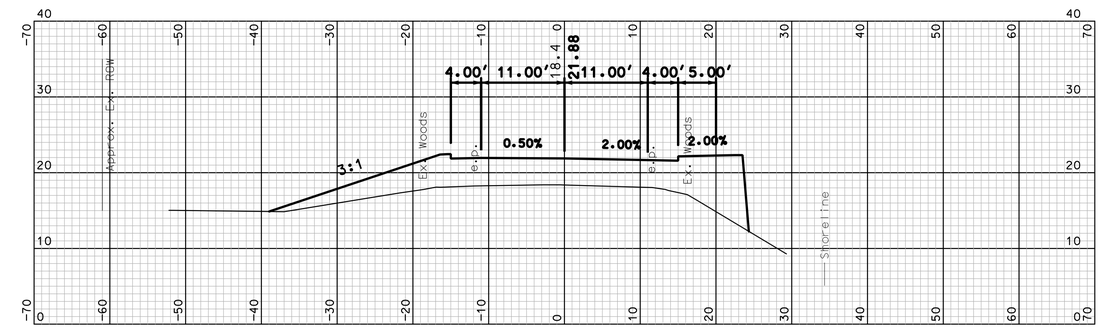
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	SCS	DATE:	12/13/2013	SHEET NO.	TOTAL SHEETS
CHECK BY:	CED	DATE:	12/13/2013	46	52
APPROVED BY:	SBH	DATE:	12/13/2013		



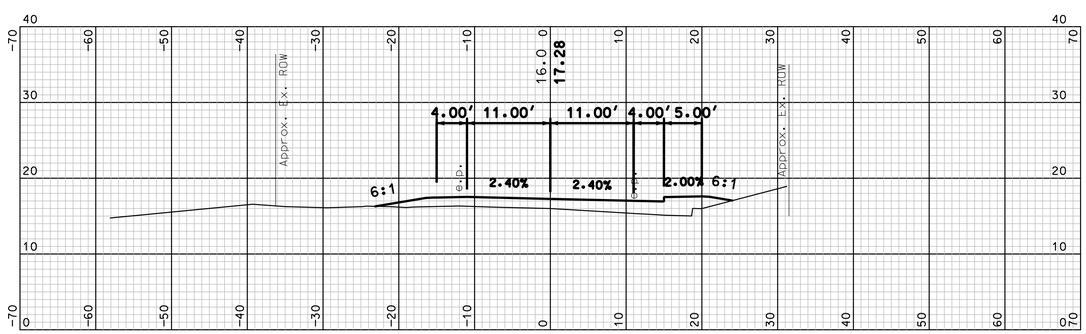
102+50



102+28 DRIVE LEFT



103+50



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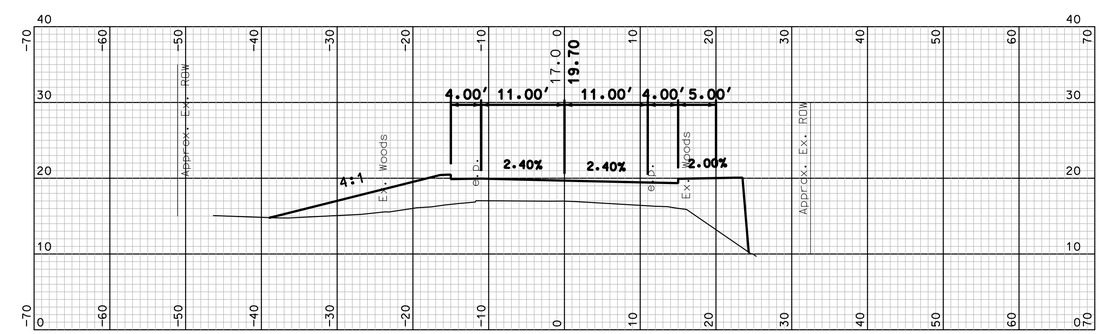

103+00

NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

RAISED PROFILE ALTERNATIVE - ROADWAY CROSS SECTIONS

SCALE: 1" = 10'-0"

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THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE

DEPARTMENT OF TRANSPORTATION - BUREAU BRIDGE DESIGN

PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	SCS	DATE:	12/13/2013	SHEET NO.	TOTAL SHEETS
CHECK BY:	CED	DATE:	12/13/2013	47	52
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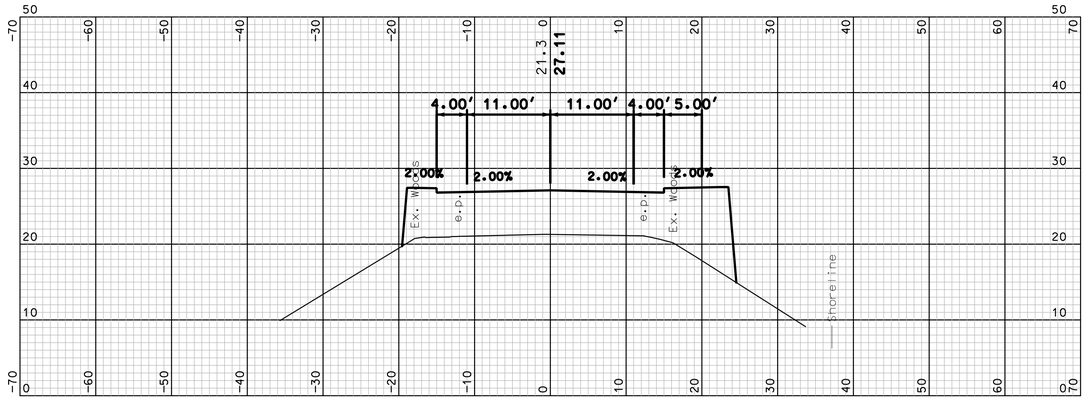
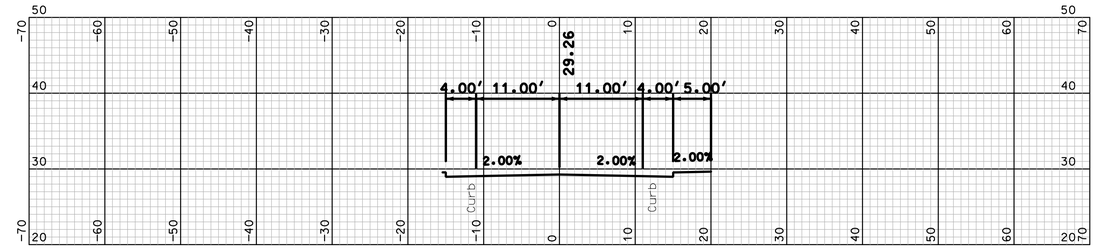
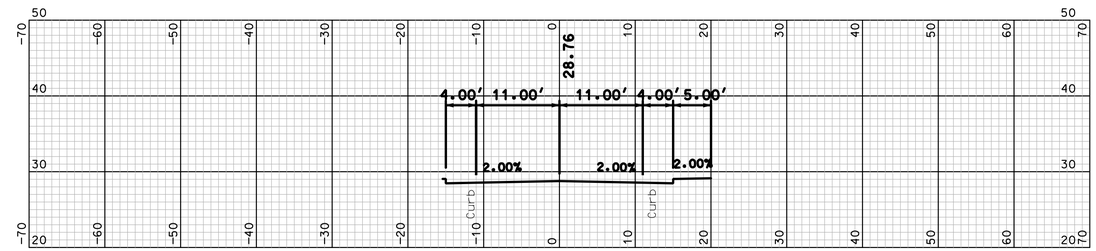


104+50



106+00



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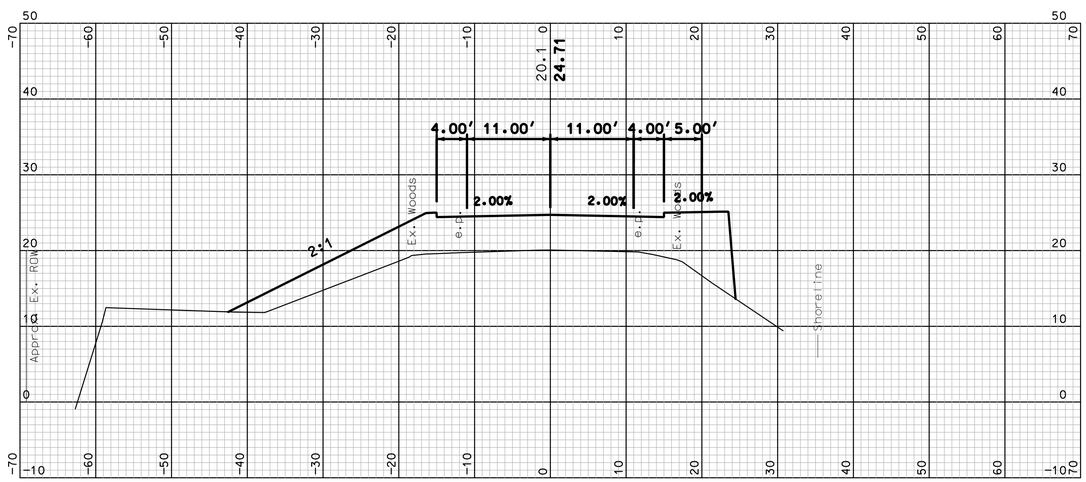

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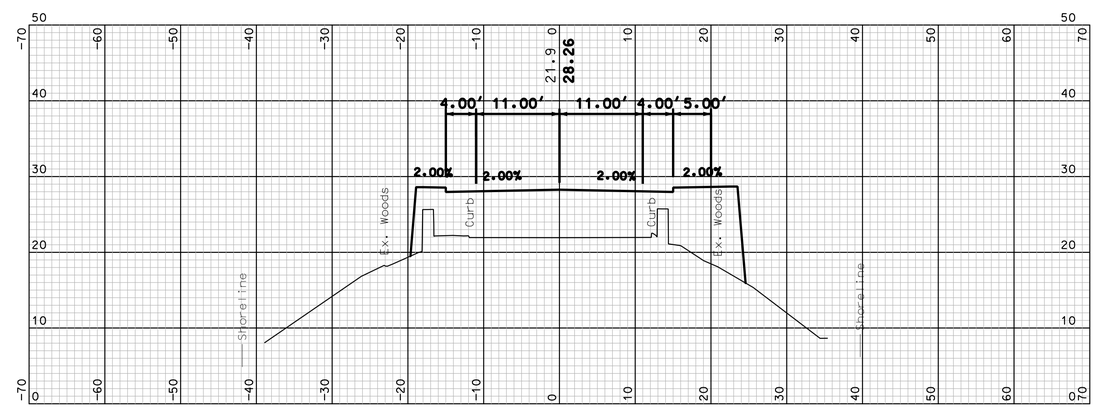

105+00

NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

RAISED PROFILE ALTERNATIVE - ROADWAY CROSS SECTIONS

SCALE: 1" = 10'-0"

Hoyle, Tanner & Associates, Inc.

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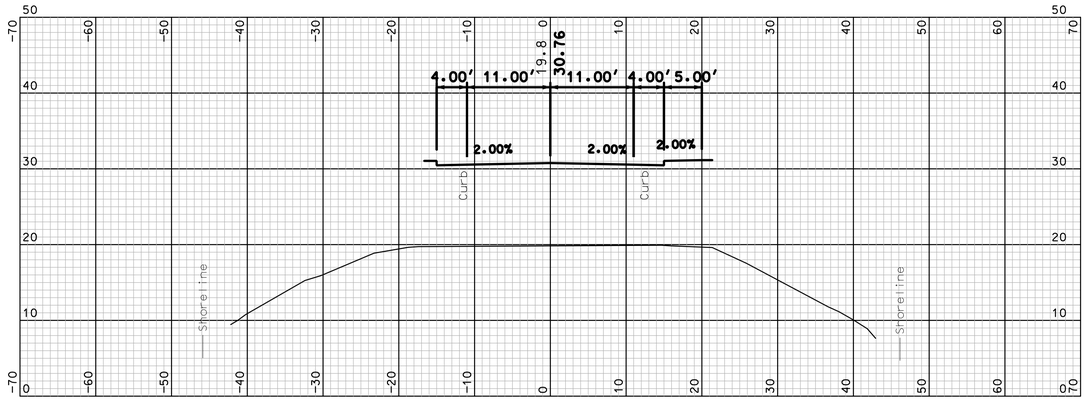
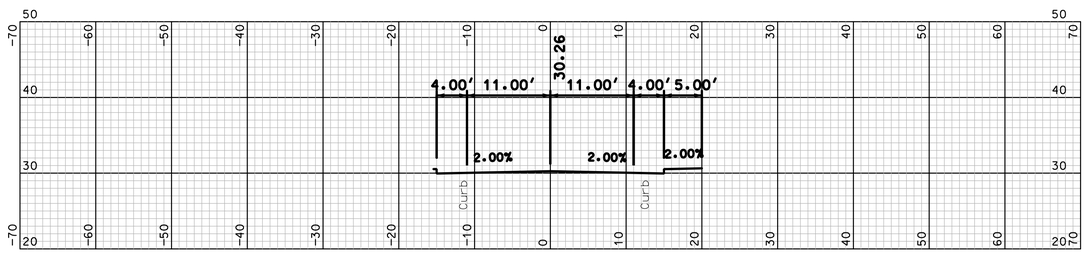
STATE OF NEW HAMPSHIRE					
DEPARTMENT OF TRANSPORTATION - BUREAU BRIDGE DESIGN					
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	SCS	DATE:	12/13/2013	SHEET NO.	TOTAL SHEETS
CHECK BY:	CED	DATE:	12/13/2013	48	52
APPROVED BY:	SBH	DATE:	12/13/2013		



107+50



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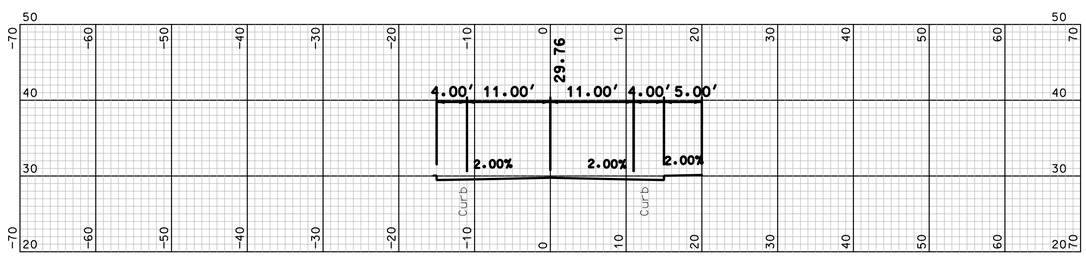

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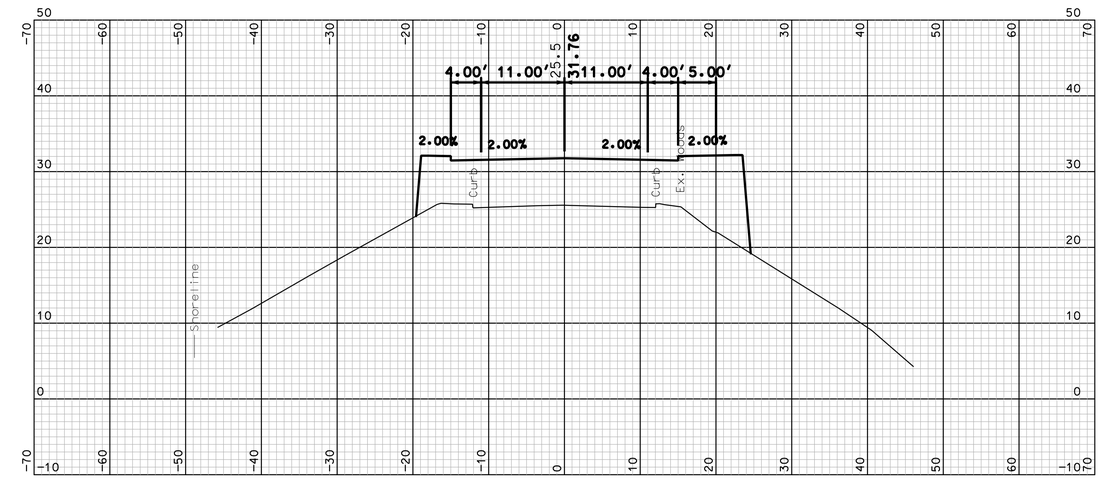

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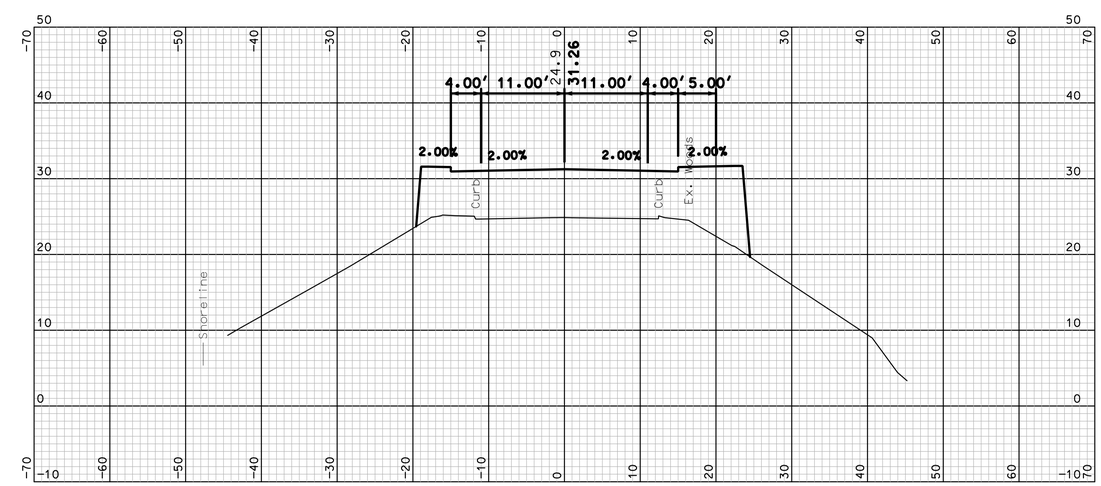

108+00

NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

RAISED PROFILE ALTERNATIVE - ROADWAY CROSS SECTIONS

SCALE: 1" = 10'-0"

Hoyle, Tanner & Associates, Inc.

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THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE

DEPARTMENT OF TRANSPORTATION - BUREAU BRIDGE DESIGN

PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	SCS	DATE:	12/13/2013	SHEET NO.	TOTAL SHEETS
CHECK BY:	CED	DATE:	12/13/2013	49	52
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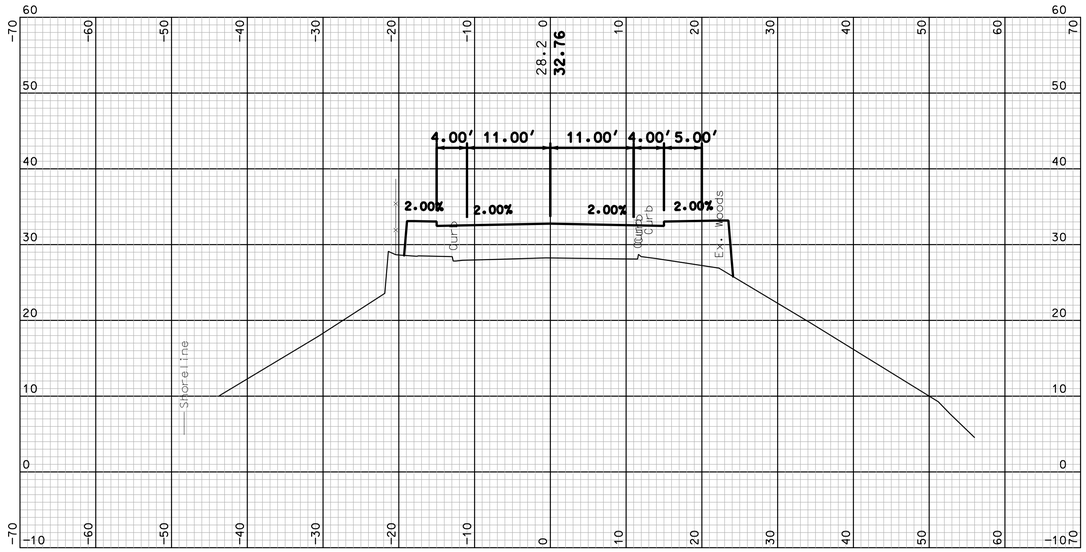

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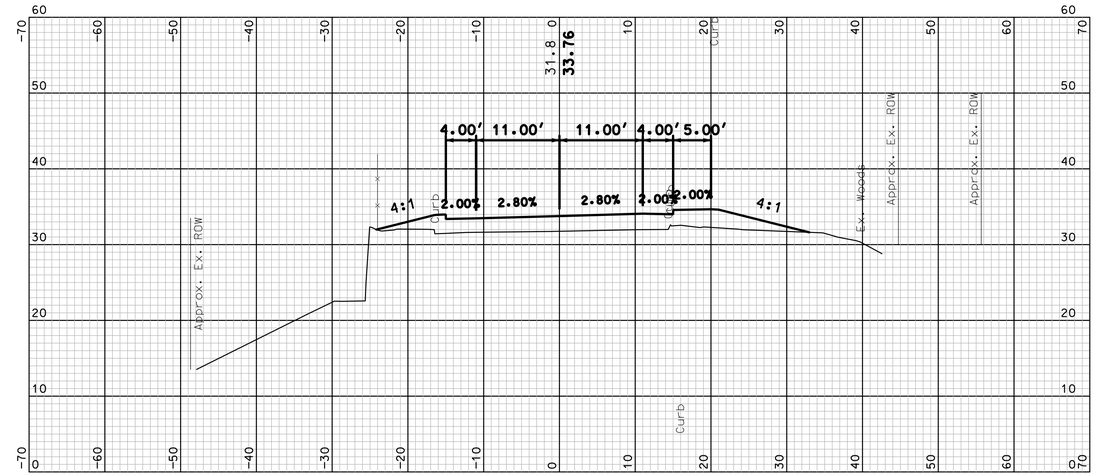

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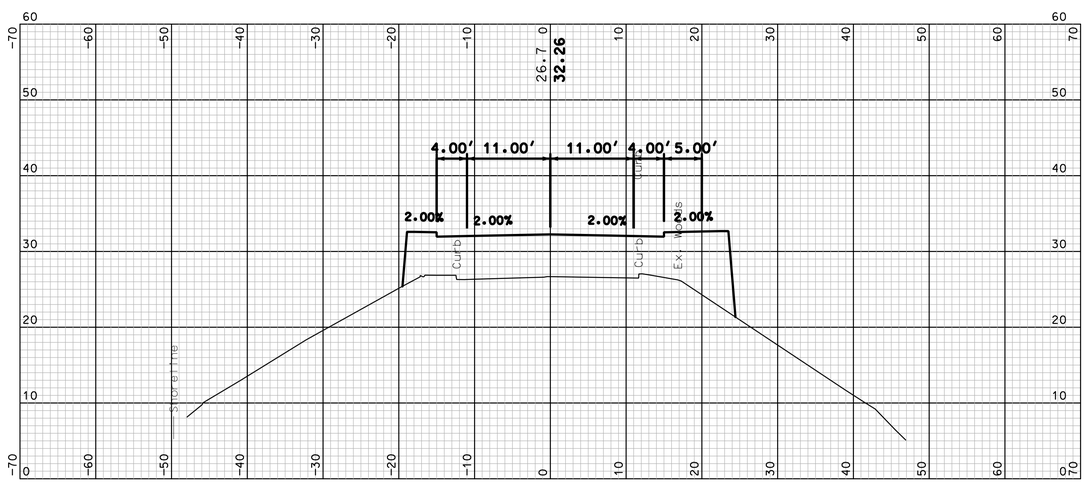
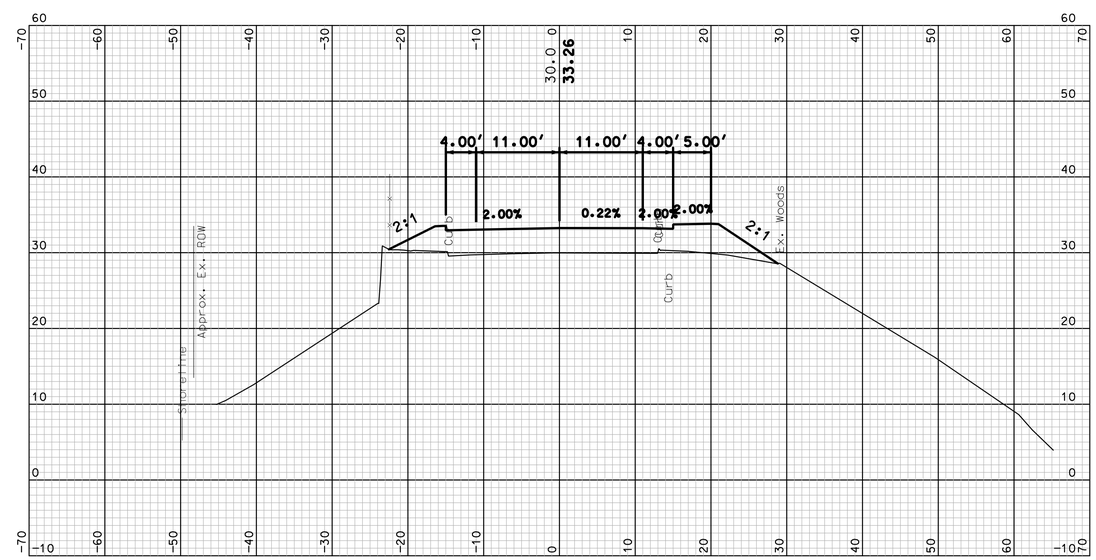


109+00



110+00

NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

RAISED PROFILE ALTERNATIVE - ROADWAY CROSS SECTIONS

SCALE: 1" = 10'-0"

Hoyle, Tanner & Associates, Inc.

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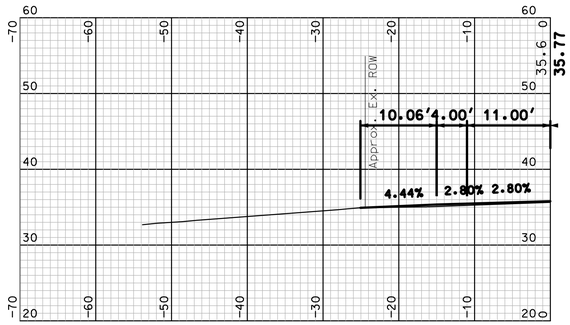
THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

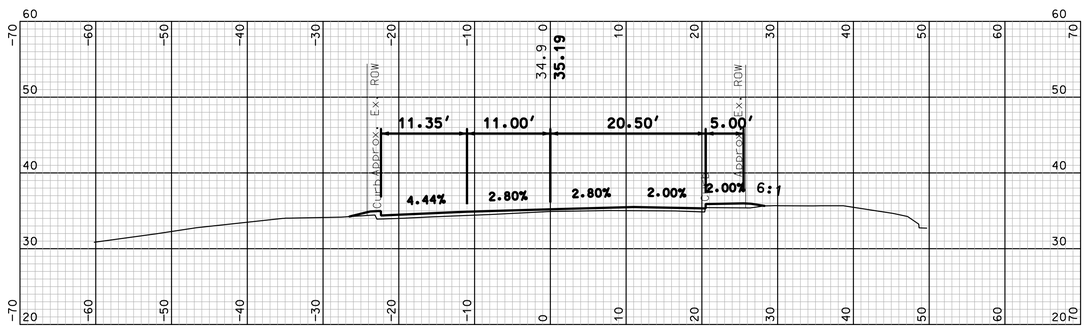
STATE OF NEW HAMPSHIRE

DEPARTMENT OF TRANSPORTATION - BUREAU BRIDGE DESIGN

PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	SCS	DATE:	12/13/2013	SHEET NO.	TOTAL SHEETS
CHECK BY:	CED	DATE:	12/13/2013	50	52
APPROVED BY:	SBH	DATE:	12/13/2013		



111+75 CAMPBELL'S LANE LEFT



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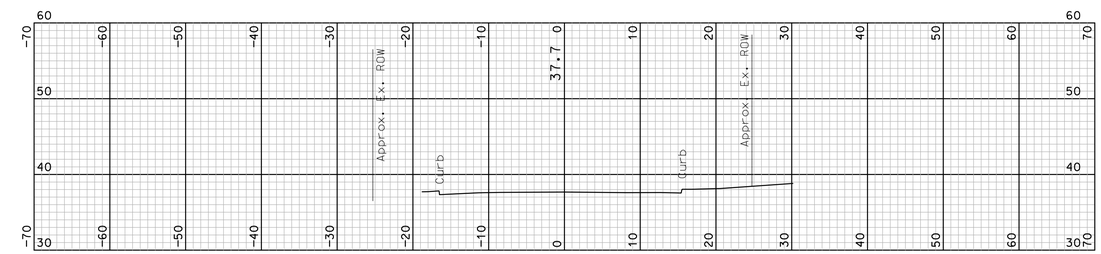
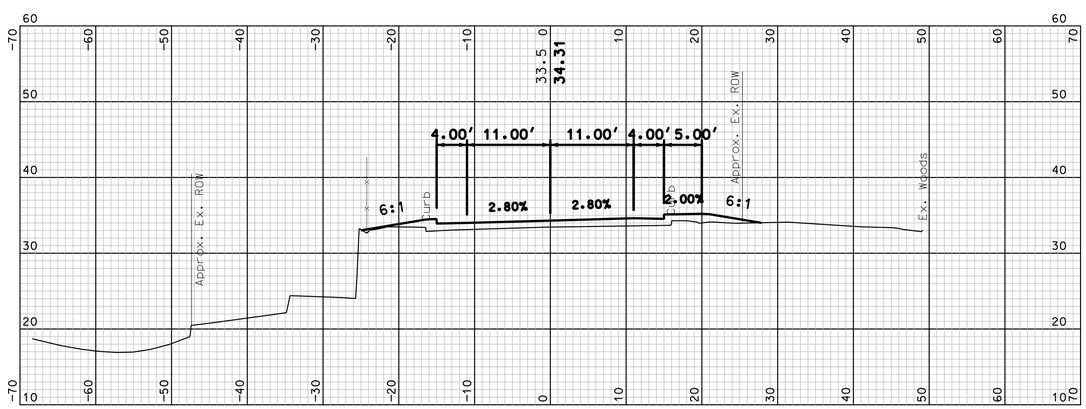


112+50



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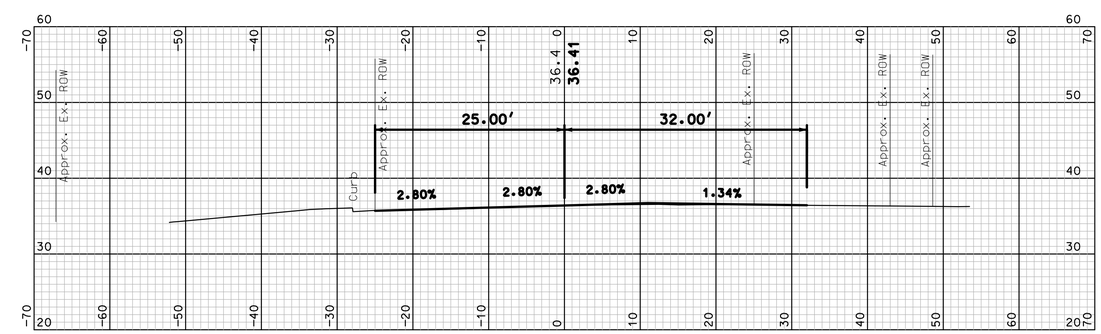


112+00 DRIVE RIGHT

NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE & LOCATION STUDY

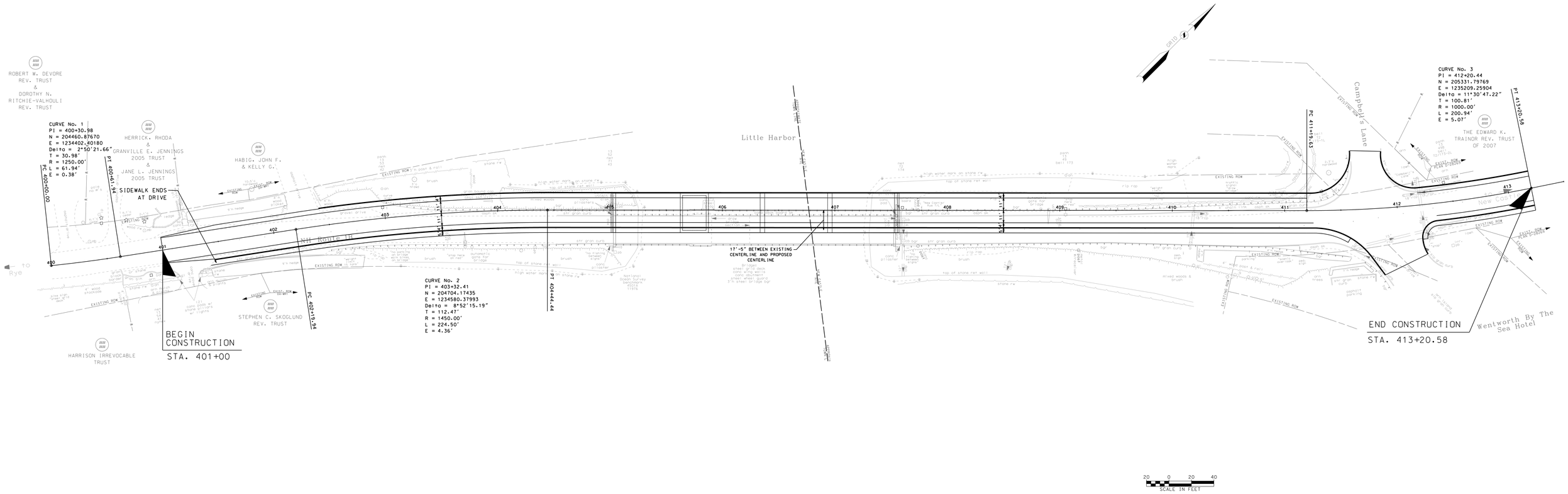
RAISED PROFILE ALTERNATIVE - ROADWAY CROSS SECTIONS

SCALE: 1" = 10'-0"

Hoyle, Tanner & Associates, Inc.

HDR

STATE OF NEW HAMPSHIRE					
DEPARTMENT OF TRANSPORTATION - BUREAU BRIDGE DESIGN					
PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	SCS	DATE:	12/13/2013	SHEET NO.	TOTAL SHEETS
CHECK BY:	CED	DATE:	12/13/2013	51	52
APPROVED BY:	SBH	DATE:	12/13/2013		



NEW CASTLE-RYE BRIDGE - 16127

TYPE, SIZE, & LOCATION STUDY
OFF-LINE ALTERNATIVE

Hoyle, Tanner & Associates, Inc.

HDR

STATE OF NEW HAMPSHIRE

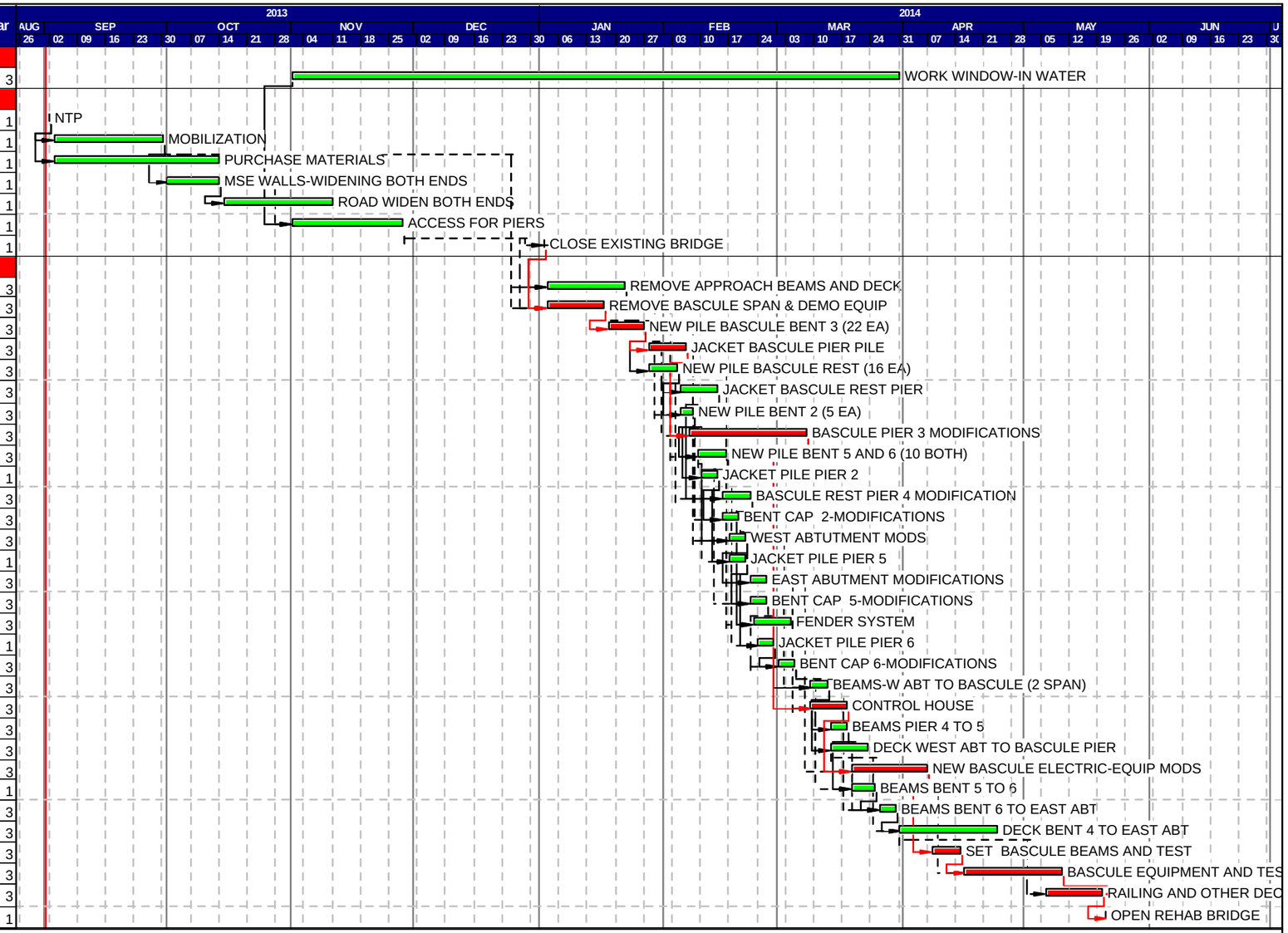
DEPARTMENT OF TRANSPORTATION - BUREAU OF BRIDGE DESIGN

PROJECT:	16127 - NEW CASTLE - RYE BRIDGE				
DRAWN BY:	SCS	DATE:	12/13/2013	SHEET NO.	TOTAL SHEETS
CHECK BY:	CED	DATE:	12/13/2013	52	52
APPROVED BY:	SBH	DATE:	12/13/2013		

Appendix B

Construction Schedule

Act ID	Description	Orig Dur	Early Start	Early Finish	Phase	Calendar
WORK WINDOWS						
100	WORK WINDOW-IN WATER	151d	01NOV13 *	31MAR14	4	3
COMMON ITEMS						
1000	NTP	1d	02SEP13 *	02SEP13	3	1
1010	MOBILIZATION	20d	03SEP13	30SEP13	3	1
1020	PURCHASE MATERIALS	30d	03SEP13	14OCT13	3	1
1120	MSE WALLS-WIDENING BOTH ENDS	10d	01OCT13	14OCT13	3	1
1130	ROAD WIDEN BOTH ENDS	20d	15OCT13	11NOV13	3	1
1100	ACCESS FOR PIERS	20d	01NOV13	28NOV13	3	1
1110	CLOSE EXISTING BRIDGE	1d	02JAN14 *	02JAN14	3	1
REHABILITATE EXISTING						
4000	REMOVE APPROACH BEAMS AND DECK	20d	03JAN14	22JAN14	2	3
4010	REMOVE BASCULE SPAN & DEMO EQUIP	15d	03JAN14	17JAN14	2	3
4150	NEW PILE BASCULE BENT 3 (22 EA)	10d	18JAN14	27JAN14	2	3
4100	JACKET BASCULE PIER PILE	10d	28JAN14	06FEB14	2	3
4160	NEW PILE BASCULE REST (16 EA)	8d	28JAN14	04FEB14	2	3
4110	JACKET BASCULE REST PIER	10d	05FEB14	14FEB14	2	3
4120	NEW PILE BENT 2 (5 EA)	4d	05FEB14	08FEB14	2	3
4170	BASCULE PIER 3 MODIFICATIONS	30d	07FEB14	08MAR14	2	3
4130	NEW PILE BENT 5 AND 6 (10 BOTH)	8d	09FEB14	16FEB14	2	3
4230	JACKET PILE PIER 2	5d	10FEB14	14FEB14	2	1
4180	BASCULE REST PIER 4 MODIFICATION	8d	15FEB14	22FEB14	2	3
4200	BENT CAP 2-MODIFICATIONS	5d	15FEB14	19FEB14	2	3
4140	WEST ABTUTMENT MODS	5d	17FEB14	21FEB14	2	3
4240	JACKET PILE PIER 5	5d	17FEB14	21FEB14	2	1
4190	EAST ABUTMENT MODIFICATIONS	5d	22FEB14	26FEB14	2	3
4210	BENT CAP 5-MODIFICATIONS	5d	22FEB14	26FEB14	2	3
5400	FENDER SYSTEM	10d	23FEB14	04MAR14	2	3
4250	JACKET PILE PIER 6	5d	24FEB14	28FEB14	2	1
4220	BENT CAP 6-MODIFICATIONS	5d	01MAR14	05MAR14	2	3
5210	BEAMS-W ABT TO BASCULE (2 SPAN)	5d	09MAR14	13MAR14	2	3
5420	CONTROL HOUSE	10d	09MAR14	18MAR14	2	3
5220	BEAMS PIER 4 TO 5	5d	14MAR14	18MAR14	2	3
5300	DECK WEST ABT TO BASCULE PIER	10d	14MAR14	23MAR14	2	3
4300	NEW BASCULE ELECTRIC-EQUIP MODS	20d	19MAR14	07APR14	2	3
5240	BEAMS BENT 5 TO 6	5d	19MAR14	25MAR14	2	1
5230	BEAMS BENT 6 TO EAST ABT	5d	26MAR14	30MAR14	2	3
5310	DECK BENT 4 TO EAST ABT	25d	31MAR14	24APR14	2	3
4310	SET BASCULE BEAMS AND TEST	8d	08APR14	15APR14	2	3
5320	BASCULE EQUIPMENT AND TEST	25d	16APR14	10MAY14	2	3
5410	RAILING AND OTHER DECK	15d	06MAY14	20MAY14	2	3
5430	OPEN REHAB BRIDGE	1d	21MAY14	21MAY14	2	1



Start date	01SEP13
Finish date	21MAY14
Data date	01SEP13
Run date	09JAN14
Page number	1A

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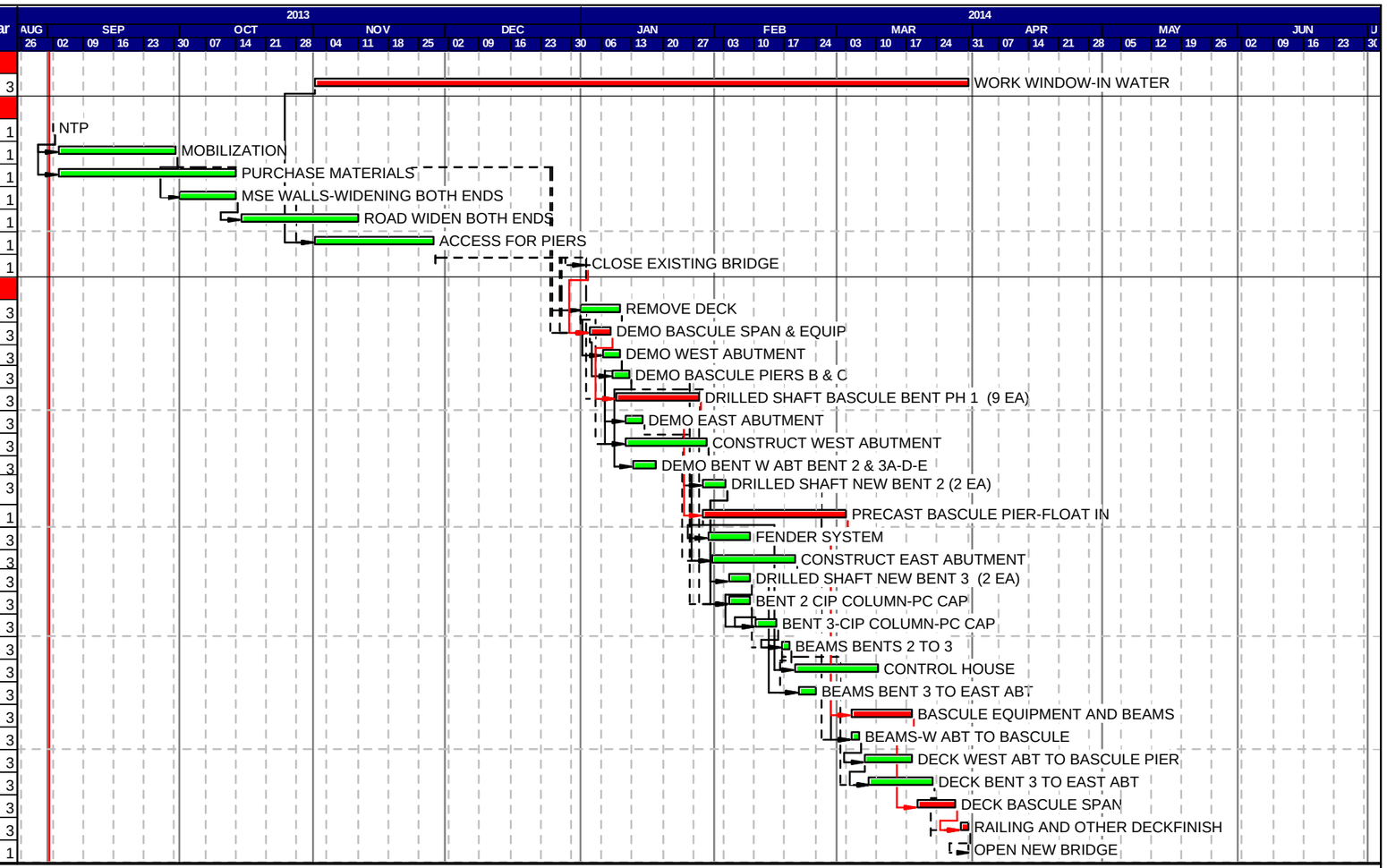
BASED ON CONCEPTUAL DESIGN DRAWINGS
DECEMBER 2013

HDR
New Castle-Rye 16127
Major Rehabilitation Alternate

- Early bar
- Progress bar
- Critical bar
- Summary bar
- Start milestone point
- Finish milestone point

Act ID	Description	Orig Dur	Early Start	Early Finish	Phase	Calendar
WORK WINDOWS						
100	WORK WINDOW-IN WATER	151d	01NOV13 *	31MAR14	4	3
COMMON ITEMS						
1000	NTP	1d	02SEP13 *	02SEP13	3	1
1010	MOBILIZATION	20d	03SEP13	30SEP13	3	1
1020	PURCHASE MATERIALS	30d	03SEP13	14OCT13	3	1
1120	MSE WALLS-WIDENING BOTH ENDS	10d	01OCT13	14OCT13	3	1
1130	ROAD WIDEN BOTH ENDS	20d	15OCT13	11NOV13	3	1
1100	ACCESS FOR PIERS	20d	01NOV13	28NOV13	3	1
1110	CLOSE EXISTING BRIDGE	1d	02JAN14 *	02JAN14	3	1
DEMOLISH AND RECONSTRUCT						
2000	REMOVE DECK	10d	01JAN14 *	10JAN14	1	3
2010	DEMO BASCULE SPAN & EQUIP	6d	03JAN14	08JAN14	1	3
2020	DEMO WEST ABUTMENT	5d	06JAN14	10JAN14	1	3
2040	DEMO BASCULE PIERS B & C	5d	08JAN14	12JAN14	1	3
3000	DRILLED SHAFT BASCULE BENT PH 1 (9	20d	09JAN14	28JAN14	1	3
2050	DEMO EAST ABUTMENT	5d	11JAN14	15JAN14	1	3
3040	CONSTRUCT WEST ABUTMENT	20d	11JAN14	30JAN14	1	3
2030	DEMO BENT W ABT BENT 2 & 3A-D-E	6d	13JAN14	18JAN14	1	3
3010	DRILLED SHAFT NEW BENT 2 (2 EA)	6d	29JAN14	03FEB14	1	3
3030	PRECAST BASCULE PIER-FLOAT IN	24d	29JAN14	03MAR14	1	1
3400	FENDER SYSTEM	10d	30JAN14	09FEB14	1	3
3140	CONSTRUCT EAST ABUTMENT	20d	31JAN14	19FEB14	1	3
3020	DRILLED SHAFT NEW BENT 3 (2 EA)	6d	04FEB14	09FEB14	1	3
3120	BENT 2 CIP COLUMN-PC CAP	6d	04FEB14	09FEB14	1	3
3130	BENT 3-CIP COLUMN-PC CAP	6d	10FEB14	15FEB14	1	3
3220	BEAMS BENTS 2 TO 3	3d	16FEB14	18FEB14	1	3
3520	CONTROL HOUSE	20d	19FEB14	10MAR14	1	3
3230	BEAMS BENT 3 TO EAST ABT	5d	20FEB14	24FEB14	1	3
3200	BASCULE EQUIPMENT AND BEAMS	15d	04MAR14	18MAR14	1	3
3210	BEAMS-W ABT TO BASCULE	3d	04MAR14	06MAR14	1	3
3300	DECK WEST ABT TO BASCULE PIER	12d	07MAR14	18MAR14	1	3
3310	DECK BENT 3 TO EAST ABT	15d	08MAR14	23MAR14	1	3
3320	DECK BASCULE SPAN	10d	19MAR14	28MAR14	1	3
3410	RAILING AND OTHER DECKFINISH	3d	29MAR14	31MAR14	1	3
3420	OPEN NEW BRIDGE	1d	31MAR14 *	31MAR14	1	1



Start date	01SEP13
Finish date	31MAR14
Data date	01SEP13
Run date	09JAN14
Page number	1A

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BASED ON CONCEPTUAL DESIGN DRAWINGS
DECEMBER 2013

HDR
New Castle-Rye 16127
Replacement Alternative

- Early bar
- Progress bar
- Critical bar
- Summary bar
- Start milestone point
- Finish milestone point

Appendix C

Cost Estimate

Cost Estimate Summary

Major Rehabilitation Alternative

HDR Computation

Project:	New Castle-Rye	Date	MCC	Date	12/12/2013
Subject:	Bridge Rehabilitation	Date	KCK	Date	12/16/2013
Task:	TSL Cost Estimate		1	Of	17
Job No.					

SUMMARY

Item	Cost
Bridge Structure:	$ 13,860,000
Highway Construction	$ 296,000
Retaining Wall Construction	$ 24,500
Engineering	$ 1,140,000
	$ 15,320,500
Say =	$ 15,321,000

Structural Cost Estimate

Major Rehabilitation Alternative

HDR Computation

Project:	New Castle-Rye	Date	MCC	Date	12/12/2013
Subject:	Bridge Rehabilitation	Date	KCK	Date	12/16/2013
Task:	TSL Cost Estimate	Page	2	Of	17
Job No.					

COMPONENT REPLACEMENT SUMMARY

Item	Quantity	Units	Unit Cost	Cost
DEMOLITION	1	LS	$ 741,686.27	$ 741,686
SOIL EXCAVATION	18	CY	$ 23.50	$ 430
REINFORCED CONCRETE EXCAVATION	6	CY	$ 1,400.00	$ 8,031
APPROACH SPAN DECK REPLACEMENT	1	LS	$ 736,250.00	$ 736,250
BASCULE DECK REPLACEMENT	1	LS	$ 99,000.00	$ 99,000
SIDEWALK REPLACEMENT	1	LS	$ 148,750.00	$ 148,750
APPROACH BRIDGE STRINGER REPLACEMENT	244,738	LB	$ 3.00	$ 734,214
BASCULE SPAN SUPERSTRUCTURE REPL	44,788	LB	$ 3.00	$ 134,364
BARRIER REPLACEMENT	1	LS	$ 132,720.00	$ 132,720
APPROACH SLAB	680	SF	$ 70.00	$ 47,600
COUNTERWEIGHT REPLACEMENT	1	LS	$ 168,678.52	$ 168,679
PILE CAP REPLACEMENT	1	LS	$ 180,000.00	$ 180,000
MACHINERY AND ACCESS PLATFORMS	1	LS	$ 54,000.00	$ 54,000
PIER PILE CONSTRUCTION AND RETROFIT	1	LS	$3,335,515.22	$ 3,335,515
ABUTMENT MODIFICATION (WINTER PLACEMENT)	18	CY	$ 670.00	$ 12,252
ELECTRICAL SYSTEM	1	LS	$2,168,420.00	$ 2,168,420
MECHANICAL SYSTEM	1	LS	$1,284,000.00	$ 1,284,000
OPERATOR HOUSE REPLACEMENT	1	LS	$ 100,000.00	$ 100,000
FENDER SYSTEM	1	LS	$1,000,000.00	$ 1,000,000

Sub Total =	$	11,085,910
25% Contingency =	$	2,771,477
Total =	$	13,857,387
Say =	**$**	**13,860,000**

Mechanical Cost Estimate

Major Rehabilitation Alternative

HDR Computation

Project:	New Castle-Rye	Date	LWN	Date	11/10/13
Subject:	Bridge Rehabilitation Cost Estimate	Date		Date	
Task:	Rehabilitation Mechanical Cost Summary		1	Of	16
Job No.	194643, Dept. 114				

MECHANICAL REHABILITATION

ITEM	DESCRIPTION	Approx. Quantity	Unit	Unit Cost	Total Cost
1	Main Reducer	1	L.S.	$136,747	$136,747
2	Drive Motor	1	L.S.	$73,374	$73,374
3	Motor Brake	1	L.S.	$49,052	$49,052
4	Machinery Brakes	1	L.S.	$71,621	$71,621
5	Couplings	1	L.S.	$34,946	$34,946
6	Line Shafts	1	L.S.	$16,928	$16,928
7	Instrument Drives	1	L.S.	$28,182	$28,182
8	Open Gearing	1	L.S.	$109,539	$109,539
9	Pedestal Bearings	1	L.S.	$119,122	$119,122
10	Trunnions	1	L.S.	$118,417	$118,417
11	Tail Lock Bushing	1	L.S.	$17,546	$17,546
12	Tail Locks	1	L.S.	$176,260	$176,260
13	Fully-Seated/Over Travel LS	1	L.S.	$4,698	$4,698
14	Span Balance	1	L.S.	$117,303	$117,303
				Subtotal	**$1,073,735**

Roadway Cost Estimate

Major Rehabilitation Alternative

Hoyle, Tanner & Associates, Inc.

Date Printed: 6/17/2013

NHDOT **Alternative 1 - Existing Horizontal Alignment/Existing Profile**

NHDOT Project No. 16127
HTA Project No. 916904

Conceptual
New Castle - Rye
OPINION OF COST
QUANTITIES RELATED TO ROADWAY CONSTRUCTION

Date of Estimate: 6/21/2013

Calc'd By: AGB Date: 6/13/2013
Checked By: SCS Date: 6/13/2013

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST	COST
201.1	CLEARING AND GRUBBING (F)	A	0.05	$10,000.00	$500.00
203.1	COMMON EXCAVATION	CY	1,700.00	$10.00	$17,000.00
203.6	EMBANKMENT-IN-PLACE (F)	CY	50	$6.00	$300.00
214	FINE GRADING	U	1	$3,350.00	$3,350.00
304.1	SAND (F)	CY	590	$15.00	$8,850.00
304.2	GRAVEL (F)	CY	580	$20.00	$11,600.00
304.3	CRUSHED GRAVEL (F)	CY	575	$25.00	$14,375.00
304.35	CRUSHED GRAVEL FOR DRIVES	CY	5	$25.00	$125.00
403.11	HOT BITUMINOUS PAVEMENT, MACHINE METHOD	TON	470	$80.00	$37,600.00
403.12	HOT BITUMINOUS PAVEMENT, HAND METHOD	TON	22	$110.00	$2,420.00
417	COLD PLANING BITUMINOUS SURFACES	SY	150	$3.00	$450.00
585.2	STONE FILL, CLASS B	CY	175	$40.00	$7,000.00
593.411	GEOTEXTILE; PERM. CONTROL CL. 1, NON-WOVEN	SY	365	$5.00	$1,825.00
606.18001	31" W-BEAM GR W/8" BLOCKOUTS (STEEL POSTS)	LF	1,375.0	$17.00	$23,375.00
606.1455	BEAM GUARDRAIL (TERM. UNIT EAGRT 25 FT.)	U	4	$1,600.00	$6,400.00
608.13	3" BITUMINOUS SIDEWALK (F)	SY	295	$15.00	$4,425.00
609.01	STRAIGHT GRANITE CURB	LF	830	$20.00	$16,600.00
	SUBTOTAL A				**$156,195.00**
	MISC. ITEMS (MARKINGS, LOAM, SEED, SIGNS) (15% SUB A)	15%			$23,429.25
	SUBTOTAL B				**$179,624.25**
	DRAINAGE ITEMS (20% SUB B)	20%			$35,924.85
	SUBTOTAL C				**$215,549.10**
618.61	UNIFORMED OFFICERS WITH VEHICLE	$	1	$5,000.00	$5,000.00
619.1	MAINTENANCE OF TRAFFIC	U	1	$13,000.00	$13,000.00
606.417	PORTABLE CONCRETE BARRIER FOR TRAFFIC CONTROL	LF	60	$25.00	$1,500.00
	MISC. TRAFFIC CONTROL (VMS, IMPACT ATTEN) (55% of 619.1)	U	1	$7,150.00	$7,150.00
	EROSION, SEDIMENT, AND POLLUTION CONTROL (10% DRAINAGE (HAY BALES, SILT FENCE, SWPPP, TEMP. WATER POLL. CONTROL)	U	1	$4,000.00	$4,000.00
	SUBTOTAL D				**$246,199.10**
	ROADWAY MOBILIZATION	5%			$12,309.96
	ROADWAY CONTINGENCIES	10%			$24,619.91
	MISCELLANEOUS (LANDSCAPING, FUEL ADJUST., ALTERATIONS)	5%			$12,309.96
				Item Total:	**$295,438.92**

Project Length (LF) 600
Cost Per Linear Foot: $492.40

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Cost Estimate Summary

Replacement Alternative

HDR Computation

Project:	New Castle-Rye	Date	MCC	Date	12/12/2013
Subject:	Bridge Replacement	Date	KCK	Date	12/16/2013
Task:	TSL Cost Estimate	Page	1	Of	16
Job No.	Alternative 3 - Shifted Alignment				

Item	Cost
Highway Construction	$ 482,317
Retaining Wall Construction	$ 280,000
Bridge Construction (Steel Approach Superstructure)	$ 14,540,000
Bridge Construction (Concrete Approach Superstructure)	$ 14,140,000
Engineering	$ 920,000

Total Cost (Steel Approach Superstructure): $ 16,222,317

Say: **$ 16,223,000.00**

Total Cost (Concrete Approach Superstructure): $ 15,822,317

Say:

$ 15,823,000.00

Structural Cost Estimate

Replacement Alternative

HDR Computation

Project:	New Castle-Rye	Date	MCC	Date	12/12/2013
Subject:	Bridge Replacement	Date	KCK	Date	12/16/2013
Task:	TSL Cost Estimate	Page	2	Of	16
Job No.	Alternative 3 - Shifted Alignment Steel Approach Superstructure				

Item	Quantity	Units	Unit Cost	Cost
DEMO OF BRIDGE	1	LS	$ 782,849.80	$ 782,850
SOIL EXCAVATION	141	CY	$ 23.50	$ 3,316
REINFORCED CONCRETE EXCAVATION	64	CY	$ 1,400.00	$ 89,863
SUBSTRUCTURE AND APP SLABS	1	LS	$ 1,974,480.52	$ 1,974,481
APPROACH BRIDGE DECK	1	LS	$ 459,499.94	$ 459,500
APPROACH BRIDGE SUPERSTRUCTURE (Steel)	1	**LS**	$ 734,593.80	$ 734,594
FENDER SYSTEM	1	**LS**	$ 1,000,000.00	$ 1,000,000
ELECTRICAL SYSTEMS	1	**LS**	$ 2,819,000.00	$ 2,819,000
MECHANICAL SYSTEM	1	**LS**	$ 1,647,000.00	$ 1,647,000
BASCULE BRIDGE STRUCTURE AND OPERATOR HOUSE	1	LS	$ 2,119,591.33	$ 2,119,591

Sub Total =	$	11,630,195
25% Contingency =	$	2,907,549
Total =	$	14,537,744
Say =	**$**	**14,540,000**

HDR Computation

Project:	New Castle-Rye	Date	MCC	Date	12/12/2013
Subject:	Bridge Replacement	Date	KCK	Date	12/16/2013
Task:	TSL Cost Estimate	Page	3	Of	16
Job No.	Alternative 3 - Shifted Alignment Concrete Approach Superstructure				

Item	Quantity	Units	Unit Cost	Cost
DEMO OF BRIDGE	1	LS	$ 782,849.80	$ 782,850
SOIL EXCAVATION	141	CY	$ 23.50	$ 3,316
REINFORCED CONCRETE EXCAVATION	64	CY	$ 1,400.00	$ 89,863
SUBSTRUCTURE AND APP SLABS	1	LS	$ 1,974,480.52	$ 1,974,481
APPROACH BRIDGE DECK	1	LS	$ 459,499.94	$ 459,500
APPROACH BRIDGE SUPERSTRUCTURE (NEXT Beams)	1	**LS**	$ 414,200.00	$ 414,200
FENDER SYSTEM	1	**LS**	$ 1,000,000.00	$ 1,000,000
ELECTRICAL SYSTEMS	1	**LS**	$ 2,819,000.00	$ 2,819,000
MECHANICAL SYSTEM	1	**LS**	$ 1,647,000.00	$ 1,647,000
BASCULE BRIDGE STRUCTURE AND OPERATOR HOUSE	1	LS	$ 2,119,591.33	$ 2,119,591

Sub Total =	$	11,309,801
25% Contingency =	$	2,827,450
Total =	$	14,137,251
Say =	**$**	**14,140,000**

Mechanical Cost Estimate

Replacement Alternative

HDR Computation

Project:	New Castle-Rye	Date	LWN	Date	11/10/13
Subject:	Bridge Replacement Cost Estimate	Date		Date	
Task:	New Bridge Mechanical Cost Summary		1	Of	16
Job No.	194643, Dept. 114				

MECHANICAL REPLACEMENT

ITEM	DESCRIPTION	Approx. Quantity	Unit	Unit Cost	Total Cost
1	Main Reducer	1	L.S.	$194,236	$194,236
2	Drive Motor	1	L.S.	$94,249	$94,249
3	Motor Brake	1	L.S.	$48,840	$48,840
4	Machinery Brakes	1	L.S.	$136,412	$136,412
5	Couplings	1	L.S.	$43,643	$43,643
6	Line Shafts	1	L.S.	$42,865	$42,865
7	Instrument Drives	1	L.S.	$31,719	$31,719
8	Open Gearing	1	L.S.	$65,271	$65,271
9	Pedestal Bearings	1	L.S.	$53,061	$53,061
10	Trunions	1	L.S.	$142,573	$142,573
11	Tail Lock Bushings	1	L.S.	$17,546	$17,546
12	Tail Locks	1	L.S.	$176,260	$176,260
13	Fully-Seated/Over Travel LS	1	L.S.	$4,971	$4,971
14	Span Balance	1	L.S.	$798,078	$798,078
				Subtotal	**$1,849,725**

Roadway Cost Estimate

Replacement Alternative

Hoyle, Tanner & Associates, Inc.

Date Printed: 6/17/2013

NHDOT **Alternative 3 - Shifted Horizontal Alignment**

NHDOT Project No. 16127
HTA Project No. 916904

Conceptual
New Castle - Rye
OPINION OF COST
QUANTITIES RELATED TO ROADWAY CONSTRUCTION

Date of Estimate: 6/21/2013

Calc'd By: AGB Date: 6/13/2013
Checked By: SCS Date: 6/14/2013

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST	COST
201.1	CLEARING AND GRUBBING (F)	A	0.1	$10,000.00	$1,000.00
203.1	COMMON EXCAVATION	CY	3,630.00	$10.00	$36,300.00
203.6	EMBANKMENT-IN-PLACE (F)	CY	400	$6.00	$2,400.00
214	FINE GRADING	U	1	$6,000.00	$6,000.00
304.1	SAND (F)	CY	1075	$15.00	$16,125.00
304.2	GRAVEL (F)	CY	1050	$20.00	$21,000.00
304.3	CRUSHED GRAVEL (F)	CY	1050	$25.00	$26,250.00
304.35	CRUSHED GRAVEL FOR DRIVES	CY	12	$25.00	$300.00
403.11	HOT BITUMINOUS PAVEMENT, MACHINE METHOD	TON	885	$80.00	$70,800.00
403.12	HOT BITUMINOUS PAVEMENT, HAND METHOD	TON	42	$110.00	$4,620.00
417	COLD PLANING BITUMINOUS SURFACES	SY	450	$3.00	$1,350.00
585.2	STONE FILL, CLASS B	CY	260	$40.00	$10,400.00
593.411	GEOTEXTILE; PERM. CONTROL CL. 1, NON-WOVEN	SY	560	$5.00	$2,800.00
606.18001	31" W-BEAM GR W/8" BLOCKOUTS (STEEL POSTS)	LF	1,375.0	$17.00	$23,375.00
606.1455	BEAM GUARDRAIL (TERM. UNIT EAGRT 25 FT.)	U	4	$1,600.00	$6,400.00
608.13	3" BITUMINOUS SIDEWALK (F)	SY	450	$15.00	$6,750.00
609.01	STRAIGHT GRANITE CURB	LF	1,550	$20.00	$31,000.00
	SUBTOTAL A				**$266,870.00**
	MISC. ITEMS (MARKINGS, LOAM, SEED, SIGNS) (15% SUB A)	15%			$40,030.50
	SUBTOTAL B				**$306,900.50**
	DRAINAGE ITEMS (20% SUB B)	20%			$61,380.10
	SUBTOTAL C				**$368,280.60**
618.61	UNIFORMED OFFICERS WITH VEHICLE	$	1	$5,000.00	$5,000.00
619.1	MAINTENANCE OF TRAFFIC	U	1	$13,000.00	$13,000.00
606.417	PORTABLE CONCRETE BARRIER FOR TRAFFIC CONTROL	LF	60	$25.00	$1,500.00
	MISC. TRAFFIC CONTROL (VMS, IMPACT ATTEN) (55% of 619.1)	U	1	$7,150.00	$7,150.00
	EROSION, SEDIMENT, AND POLLUTION CONTROL (10% DRAINAGE (HAY BALES, SILT FENCE, SWPPP, TEMP. WATER POLL. CONTROL)	U	1	$7,000.00	$7,000.00
	SUBTOTAL D				**$401,930.60**
	ROADWAY MOBILIZATION	5%			$20,096.53
	ROADWAY CONTINGENCIES	10%			$40,193.06
	MISCELLANEOUS (LANDSCAPING, FUEL ADJUST., ALTERATIONS)	5%			$20,096.53
				Item Total:	**$482,316.72**

Project Length (LF) 900
Cost Per Linear Foot: $535.91

Cost Estimates of
Major Rehabilitation Alternative with 4' shoulders
and
Replacement Alternative with 2' shoulders

HDR Computation

Project:	New Castle-Rye	Date	MCC	Date	1/3/2014
Subject:	Bridge Rehabilitation	Date	JFM	Date	1/7/2014
Task:	TSL Cost Estimate - Major Rehab w/ 4' Shoulders		1	Of	17
Job No.					

SUMMARY

Item	Cost
Retaining Wall Construction*	$ 280,000
Highway Construction*	$ 482,317
Bridge Structure:	$ 14,590,000
Engineering	$ 1,230,000
	$ 16,582,317
Say =	$ 16,583,000

* Similar to Replacement Alternative, which has 4' shoulders. Refer to Replacement Alternative estimate for more information.

HDR Computation

Project:	New Castle-Rye	Date	MCC	Date	1/3/2014
Subject:	Bridge Rehabilitation	Date	JFM	Date	1/7/2014
Task:	TSL Cost Estimate - Major Rehab w/ 4' Shoulders	Page	2	Of	17
Job No.					

COMPONENT REPLACEMENT SUMMARY

Item	Quantity	Units	Unit Cost	Cost
DEMOLITION	1	LS	$ 741,686.27	$ 741,686
SOIL EXCAVATION	27	CY	$ 23.50	$ 639
REINFORCED CONCRETE EXCAVATION	6	CY	$ 1,400.00	$ 8,031
APPROACH SPAN DECK REPLACEMENT	1	LS	$ 837,500.00	$ 837,500
BASCULE DECK REPLACEMENT	1	LS	$ 112,000.00	$ 112,000
SIDEWALK REPLACEMENT	1	LS	$ 148,750.00	$ 148,750
APPROACH BRIDGE STRINGER REPLACEMENT	274,738	LB	$ 3.00	$ 824,214
BASCULE SPAN SUPERSTRUCTURE REPL	47,164	LB	$ 3.00	$ 141,492
BARRIER REPLACEMENT	1	LS	$ 132,720.00	$ 132,720
APPROACH SLAB	760	SF	$ 70.00	$ 53,200
COUNTERWEIGHT REPLACEMENT	1	LS	$ 189,573.33	$ 189,573
PILE CAP REPLACEMENT	1	LS	$ 210,000.00	$ 210,000
MACHINERY AND ACCESS PLATFORMS	1	LS	$ 54,000.00	$ 54,000
PIER PILE CONSTRUCTION AND RETROFIT	1	LS	$ 3,641,179.03	$ 3,641,179
ABUTMENT MODIFICATION (WINTER PLACEMENT)	27	CY	$ 670.00	$ 18,225
ELECTRICAL SYSTEM	1	LS	$ 2,168,420.00	$ 2,168,420
MECHANICAL SYSTEM	1	LS	$ 1,284,000.00	$ 1,284,000
OPERATOR HOUSE REPLACEMENT	1	LS	$ 100,000.00	$ 100,000
FENDER SYSTEM	1	LS	$ 1,000,000.00	$ 1,000,000

Sub Total =	$	11,665,630
25% Contingency =	$	2,916,407
Total =	$	14,582,037
Say =	**$**	**14,590,000**

HDR Computation

Project:	New Castle-Rye	Date	MCC	Date	1/3/2014
Subject:	Bridge Replacement	Date	JFM	Date	1/7/2014
Task:	TSL Cost Estimate - Replacement w/ 2' Shoulders	Page	1	Of	
Job No.					

Item	Cost
Highway Construction*	$ 296,000
Retaining Wall Construction*	$ 24,500
Bridge Construction (with NEXT beam Approaches)	$ 13,900,000
Engineering	$ 880,000

Total Cost (with NEXT beam Approaches): $ 15,100,500

Say: **$ 15,101,000.00**

* Similar to Major Rehabilitation Alternative, which has 4' shoulders. Refer to Major Rehabilitation Alternative estimate for more information.

HDR Computation

Project:	New Castle-Rye	Date	MCC	Date	1/3/2014
Subject:	Bridge Replacement	Date	JFM	Date	1/7/2014
Task:	TSL Cost Estimate - Replacement w/ 2' Shoulders	Page	3	Of	
Job No.	Concrete Approach Superstructure				

Item	Quantity	Units	Unit Cost	Cost
DEMO OF BRIDGE	1	LS	$ 782,849.80	$ 782,850
SOIL EXCAVATION	141	CY	$ 23.50	$ 3,316
REINFORCED CONCRETE EXCAVATION	64	CY	$ 1,400.00	$ 89,863
SUBSTRUCTURE AND APP SLABS	1	LS	$ 1,974,480.52	$ 1,974,481
APPROACH BRIDGE DECK	1	LS	$ 424,397.48	$ 424,397
APPROACH BRIDGE SUPERSTRUCTURE (NEXT Beams)	1	**LS**	$ 398,760.00	$ 398,760
FENDER SYSTEM	1	**LS**	$ 1,000,000.00	$ 1,000,000
ELECTRICAL SYSTEMS	1	**LS**	$ 2,819,000.00	$ 2,819,000
MECHANICAL SYSTEM	1	**LS**	$ 1,647,000.00	$ 1,647,000
BASCULE BRIDGE STRUCTURE AND OPERATOR HOUSE	1	LS	$ 1,977,517.60	$ 1,977,518

Sub Total =	$	11,117,185
25% Contingency =	$	2,779,296
Total =	$	13,896,481
Say =	**$**	**13,900,000**

Appendix D

Life Cycle Cost Estimate

HDR Computation

Project: Bridge Rehabilitation

Subject: New Castle-Rye

Task: Life-Cycle Costs - Summary

2013 Base Year Calculations	Concrete Replacement	Rehabilitation
Initial Capital Costs	$15,823,000	$15,321,000
Maintenance Costs for State of Good Repair	$4,728,174	$22,076,000
Maintenance Costs for Mechanical & Electrical	$3,135,000	$3,005,750
Operator & Monthly Maintenance	$612,000	$1,152,000
Total	**$24,298,174**	**$41,554,750**

Present Value Calculations	Concrete Replacement	Rehabilitation
Initial Capital Costs	$14,629,253	$14,165,126
Maintenance Costs for State of Good Repair	$935,718	$4,516,017
Maintenance Costs for Mechanical & Electrical	$542,620	$514,809
Operator & Monthly Maintenance	$178,654	$336,290
Total	**$16,286,245**	**$19,532,241**

HDR Computation

Project:	Bridge Rehabilitation	Date	JFM	Date	11/11/2013
Subject:	New Castle-Rye	Date	KCK	Date	12/19/2013
Task:	Rehabilitation Alternative Life-Cycle Costs	Of		Of	
Job No.					

Item	Interval (Years)	Cost with 25% contingency	Occurences	Cost	Year of Occurrence 1
Capital Expenditure	**75**	$ 15,321,000	1	$15,321,000	2015
DECK REPLACEMENT - ALL SPANS	25	$ 1,842,750	2	$3,685,500	2040
CLEAN AND PAINT STRUCTURAL STEEL	25	$ 725,000	2	$1,450,000	2040
TOUCH UP OVERCOAT PAINTING AT JOINTS AND BASCULE	25	$ 67,875	3	$203,625	2028
BEARING REHAB	25	$ 307,500	2	$615,000	2040
PIER REHABILITATION	25	$ 2,598,750	2	$5,197,500	2040
DECK JOINT REHAB	15	$ 109,688	4	$438,750	2030
TYPICAL MAINTENANCE	5	$ 32,375	15	$485,625	2020
MAJOR REHABILITATION	**40**	$ 10,000,000	1	$10,000,000	2055

**Note that the intermediate maintenance intervals will start over after the major rehabilitation

Sub Total = $ 37,397,000

HDR Computation

Project:	Bridge Replacement	Date	JFM	Date	11/13/2013
Subject:	New Castle-Rye	Date	KCK	Date	12/19/2013
Task:	Replacement Alternative Life-Cycle Costs - NEXT Beam Approach Spans	Of		Of	
Job No.					

Item	Interval (Years)	Cost with 25% contingency	Occurences	Cost	Year of Occurrence 1
Capital Expenditure	**75**	$ 15,823,000	1	$15,823,000	2015
DECK REPLACEMENT - APPROACH	50	$ 1,115,111	1	$1,115,111	2065
DECK GRIND AND PAVE	25	$ 235,219	2	$470,438	2040
DECK REPLACEMENT - BASCULE	20	$ 541,125	3	$1,623,375	2035
NEXT BEAM MAINTENANCE	50	$ 38,500	2	$77,000	2040
NEXT BEAM REPAIRS	50	$ 115,500	1	$115,500	2065
BEARING REHAB	50	$ 45,000	1	$45,000	2065
SUBSTRUCTURE REPAIRS	50	$ 59,625	2	$119,250	2040
SUBSTRUCTURE REHABILITATION	50	$ 238,125	1	$238,125	2065
DECK JOINT REHAB	15	$ 87,750	5	$438,750	2030
TYPICAL MAINTENANCE	5	$ 32,375	15	$485,625	2020

Sub Total = $ 20,551,174

HDR Computation

Project: Bridge Rehabilitation

Subject: New Castle-Rye

Task: Life-Cycle Costs - Mechanical and Electrical Systems

Note: The "First Cost" in each alternative is accounted for in the overall capital cost of that alternative

Bridge Rehabilitation									
Year	Operating Machy	Span Locks	Trunnion Bearings	Sub Cable	Bridge Elect	Control System	Operator Costs	Monthly Maintenance	Other
First Cost	$854,000	$220,000	$210,000	$720,750	$1,020,870	$426,800			
5							$40,000	$40,000	$50,000
10						$50,000	$40,000	$40,000	$50,000
15							$40,000	$40,000	$50,000
20		$110,000					$40,000	$40,000	$50,000
25					$250,000	$100,000	$40,000	$40,000	$50,000
30							$40,000	$40,000	$50,000
35	$225,000						$40,000	$40,000	$50,000
40		$110,000				$100,000	$40,000	$40,000	$50,000
45					$150,000		$40,000	$40,000	$50,000
50			$105,000	$720,750			$40,000	$40,000	$50,000
55							$40,000	$40,000	$50,000
60	$425,000	$110,000			$350,000	$100,000	$40,000	$40,000	$50,000
65							$40,000	$40,000	$50,000
70							$40,000	$40,000	$50,000
75						$100,000	$40,000	$40,000	$50,000
80	$225,000	$110,000			$150,000		$40,000	$40,000	$50,000
85							$40,000	$40,000	$50,000
90						$50,000	$40,000	$40,000	$50,000
95							$40,000	$40,000	$50,000
100				$720,750			$40,000	$40,000	$50,000

Note: Costs after Year 75 not included in analysis.

Operator Costs
24 openings per year at 4 hours each at $80/hr = $ 7680/year

Monthly Maintenance
Lube/ minor repairs/etc
assume 8 hours per month at $80/hr = $ 7680/year

Other
Materials such as lubricants gate arms, etc.

HDR Computation

Project: Bridge Rehabilitation

Subject: New Castle-Rye

Task: Life-Cycle Costs - Mechanical and Electrical Systems

Note: The "First Cost" in each alternative is accounted for in the overall capital cost of that alternative

Bridge Replacement

Year	Operating Machy	Span Locks	Trunnion Bearings	Sub Cable	Bridge Elect	Control System	Operator Costs	Monthly Maintenance	Other
First Cost	$1,217,000	$220,000	$210,000	$936,975	$1,327,131	$554,840			
5							$2,400	$40,000	$50,000
10						$50,000	$2,400	$40,000	$50,000
15							$2,400	$40,000	$50,000
20		$110,000					$2,400	$40,000	$50,000
25					$300,000	$100,000	$2,400	$40,000	$50,000
30							$2,400	$40,000	$50,000
35	$350,000						$2,400	$40,000	$50,000
40		$110,000				$100,000	$2,400	$40,000	$50,000
45					$150,000		$2,400	$40,000	$50,000
50			$105,000	$500,000			$2,400	$40,000	$50,000
55							$2,400	$40,000	$50,000
60	$600,000	$110,000				$100,000	$2,400	$40,000	$50,000
65					$350,000		$2,400	$40,000	$50,000
70							$2,400	$40,000	$50,000
75						$100,000	$2,400	$40,000	$50,000
80	$350,000	$110,000					$2,400	$40,000	$50,000
85					$200,000		$2,400	$40,000	$50,000
90						$50,000	$2,400	$40,000	$50,000
95									
100									

Note: Costs after Year 75 not included in analysis.

Operator Costs

Remote operation 24 openings per year at 0.25 hours each at $80/hr = $ 480/year

Note: Maintenance and other cost similar between new and rehabilitation

HDR Computation

Project:	Bridge Rehabilitation
Subject:	New Castle-Rye
Task:	Life-Cycle Costs - Assumptions

Life-Cycle Assumptions			Notes
Real Discount Rate	4%		FHWA prefers to use a rate between 3 and 5% for LCCA. The office of management & Budget prefers a discount rate of 7%
Bridge Useful Life	75	years	
Cost for Operator			
Replacement	$480	per year	Remote operation 24 openings per year at 0.25 hours each at $80/hr = $ 480/year
Rehabilitation	$7,680	per year	24 openings per year at 4 hours each at $80/hr = $ 7680/year
Monthly Maintenance Costs			
Replacement	$7,680	per year	Lube/ minor repairs/etc; assume 8 hours per month at $80/hr = $ 7680/year
Rehabilitation	$7,680	per year	Lube/ minor repairs/etc; assume 8 hours per month at $80/hr = $ 7680/year

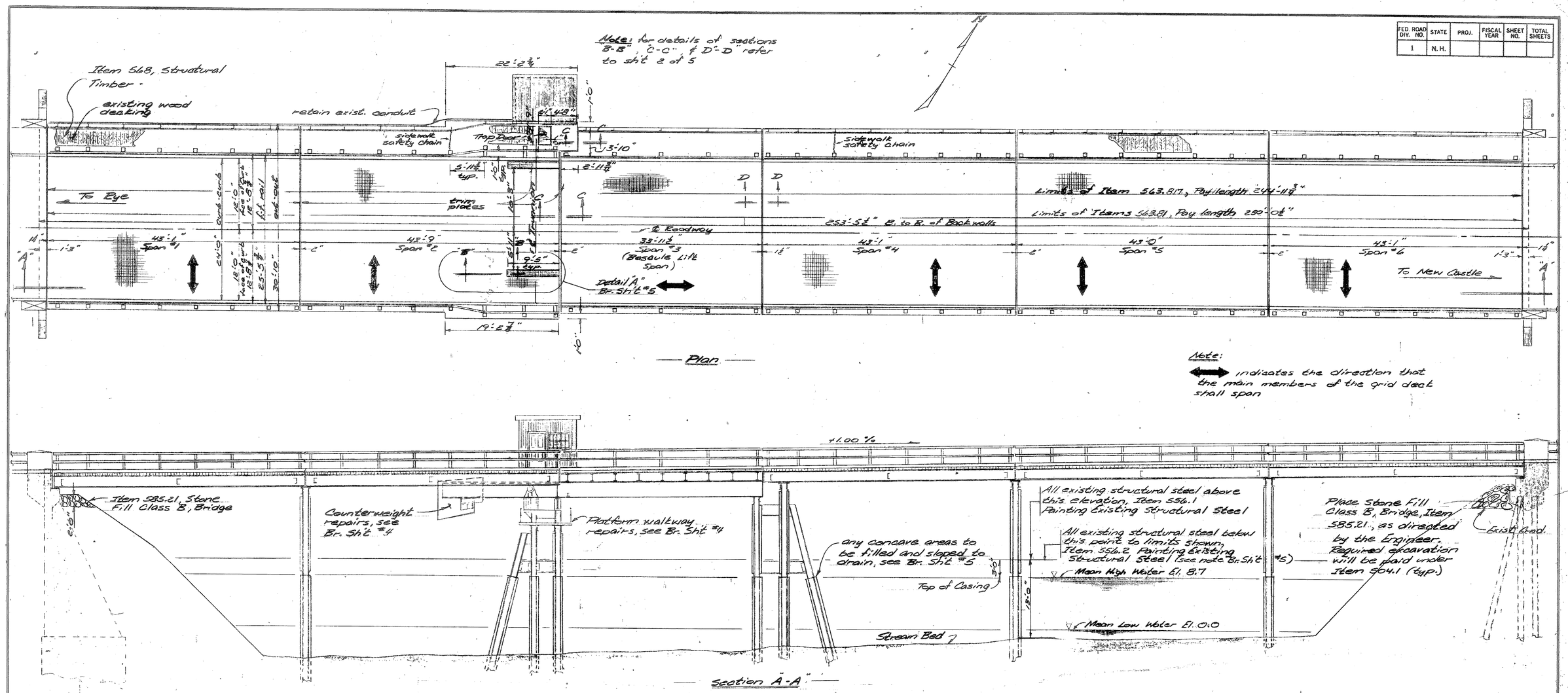
Appendix E

Select Existing Bridge Plans

Table of Contents

General Plan and Elevation	Page E-1
Framing Plan and Pile Elevation	Page E-2
Approach Pier Section	Page E-3
Bascule Span Plan and Section	Page E-4
Bascule Pier Section	Page E-5
Rest Pier Section	Page E-6
Bascule Machinery Plan and Elevation	Page E-7

FED. ROAD DIV. NO.	STATE	PROJ.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1	N.H.				



SUMMARY of PROJECT NO. P.2054 QUANTITIES

Item No.	Item	Quant.
403.1	Hot Bituminous Pavement	10 tons
502	Removal of Existing Bridge Structure	1 unit
504.1	Common Bridge Excavation	35 c.y.
512.01	Preparation for Concrete Repairs	1 unit
512.02	Preparation for Concrete Repairs	1 unit
512.03	Preparation for Concrete Repairs	1 unit
520.02	Concrete Class P for Patching	.8 c.y.
520.11	Concrete Class A, Footings	3.1 c.y.
520.12	Concrete Class A, Above footings	4.7 c.y.
525.11	Epoxy Mortar for Patching Hor. Conc. Surf.	6.0 c.f. △ C.F.
525.12	Epoxy Mortar for Patching Vert. Conc. Surf.	2.8 c.f. △ C.F.
526.1	Crew and Equipment Injecting Epoxy	3 days
526.2	Epoxy for Epoxy Injection	10 gal.
536.1	Epoxy Coating for Concrete	37 gal.
544	Reinforcing Steel	1077 lbs.
550.1	Structural Steel	1 unit
555.1	Steel Grid Floor (open)	1748 s.f.
563.81	Rehabilitation of Bridge Railing	500.1 l.f.
563.817	Rehab. of Bridge Sidewalk Railing	245.0 l.f.
568	Structural Timber	3.40 MFBM
585.21	Stone Fill Class B (Bridge)	46 c.y.
603.14012	12" B.C.C. Steel Pipe, .064", inc. spec. exc.	12 l.f.
618	Uniformed Officers and Flagmen	700 Hrs.
619.1	Maintenance of Traffic incl. dust laying	1 unit
619.2	Construction Signs & Warning Devices	1 unit
692	Mobilization	1 unit
698.3	Field Office (Modified)	1 unit
1002	Repairs or Replacements as Needed	*

SUMMARY of PROJECT NO. P.2054-A QUANTITIES

Item No.	Item	Quant.
556.1	Painting Existing Structural Steel	1 unit
556.2	Painting Existing Structural Steel	1 unit
1002.1	Repairs or Replacements as Needed	*

General Notes

1. Design Loading; H20-44 for Existing Bridge.
2. Specifications: N.H.D.P.W. & H. 1974 & AASHTO 1974 ammended to date.
3. A minimum of a one line 10 ft. wide traffic lane shall be maintained at all times during deck installation.

Subsidiary Items

		Br. Sht.
1.	⅝"x4"x4" neoprene pad	2
2.	⅝"x3"x3" neoprene pad " "	3
3.	⅝"Ø x 6" std. bolts & nuts " "	4
4.	hard pressed asbestos in bridge shoes " "	5
5.	asphaltic material " "	5

scale: ⅛" = 1'-0"

* Not Bid Items
Item 1002 $5,000.00
Item 1002.1 $5,000.00

Plans of the existing bridge are on file at the John O. Morton Building, Concord, New Hampshire.

△	Change unit from C.Y. to C.F.	SEW	11/6/76
△	DESCRIPTION	BY	DATE
	REVISIONS		

STATE OF NEW HAMPSHIRE
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
BRIDGE DESIGN DIVISION

TOWN Rye - New Castle
FEDERAL PROJECT S 245(1)
LOCATION N.H. 1-B over Little Harbor
BRIDGE NO. 064/071 P-2054
STATE PROJECT P-2054-A

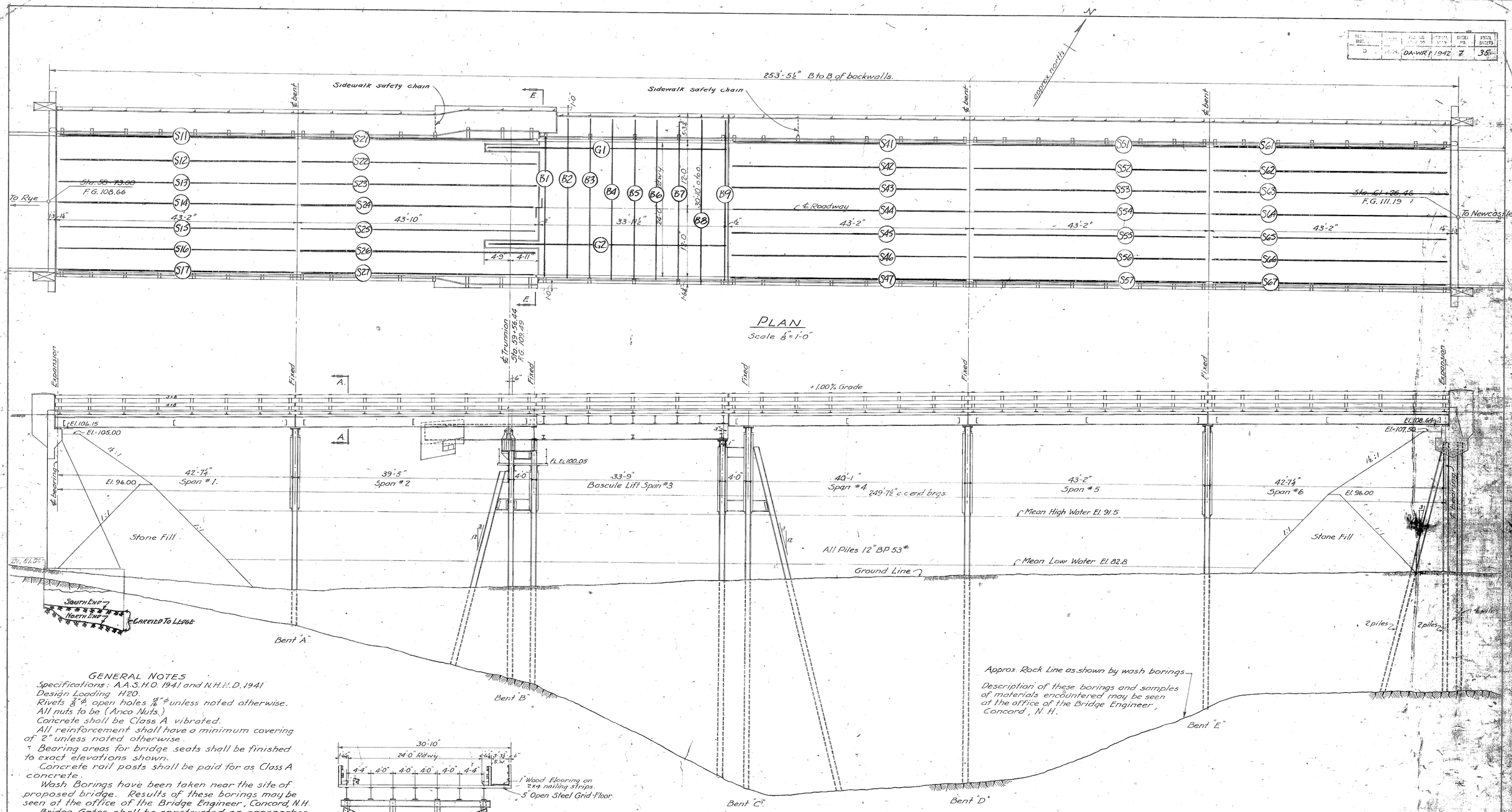
General Plan and Elevation

	BY	DATE		BY	DATE	BRIDGE SHEET NO.
DESIGNED	SEW	11/72	CHECKED	JDB	4/73	1 OF 5
DRAWN	SEW	11/72	CHECKED	JDB	4/73	FILE NUMBER
TRACED	SEW	11/72	CHECKED	JDB	4/73	2-8-2-2
QUANTITIES	SEW	11/72	CHECKED	JDB	4/73	

REVIEWED BY	PROJ. NO.	SHEET NO.	TOTAL SHEETS
	S-245(1)	2	6

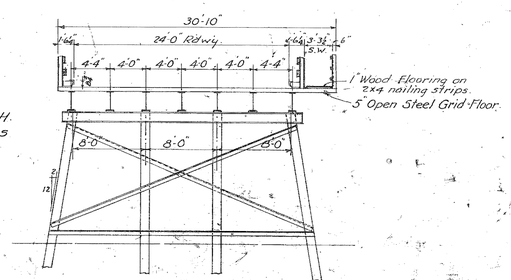
The Draftboard, Inc.

NO.				SHEET NO.	TOTAL SHEETS
DIST.					
D			DA-WR-1	1942	7	35



GENERAL NOTES

Specifications: A.A.S.H.O. 1941 and N.H.H.D. 1941
Design Loading H20.
Rivets ⅞" ϕ open holes 15/16" ϕ unless noted otherwise.
All nuts to be (Anco Nuts.)
Concrete shall be Class A vibrated.
All reinforcement shall have a minimum covering of 2" unless noted otherwise.
Bearing areas for bridge seats shall be finished to exact elevations shown.
Concrete rail posts shall be paid for as Class A concrete.
Wash Borings have been taken near the site of proposed bridge. Results of these borings may be seen at the office of the Bridge Engineer, Concord, N.H.
Bridge Gates shall be constructed on approaches as shown on Sheet No. 6
Material from present Superstructure shall be salvaged as directed by the Engineer.
Lumber for board walk + railing shall be No 1 Spruce or equivalent.



SECTION A-A

SECTIONAL ELEVATION ON CENTER LINE
Scale ⅛"=1'-0"

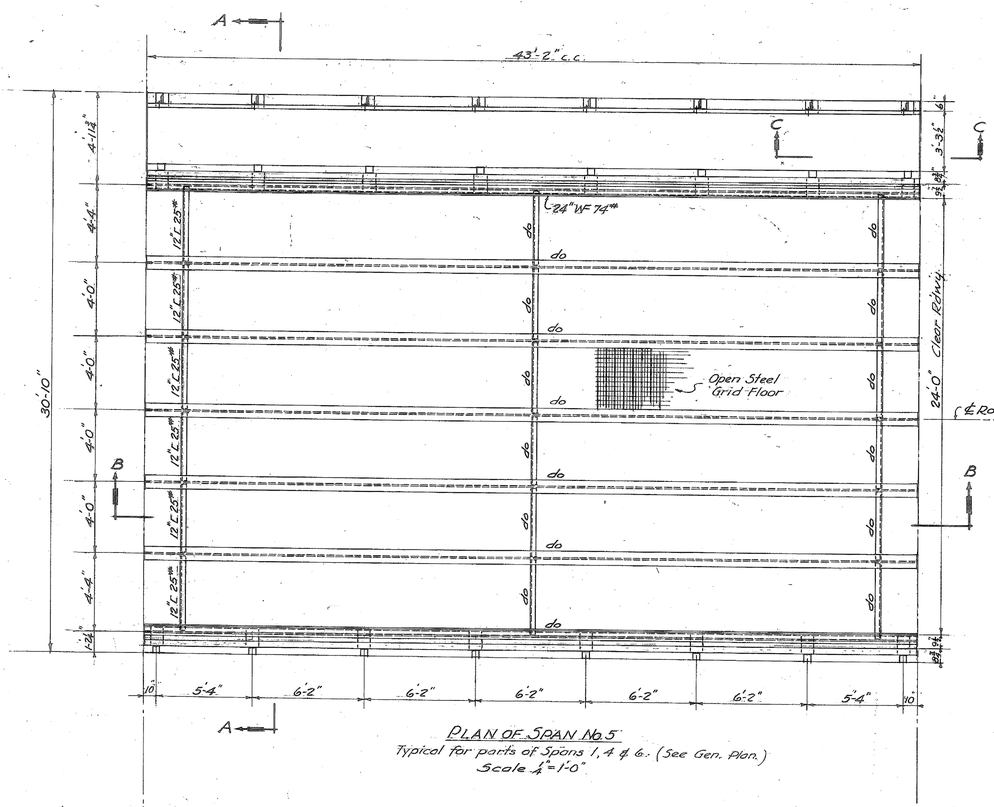
REVISIONS		
DESCRIPTION	BY	DATE
Find Costs & Notes	[illegible]	1-9-42
Sidewalk changed from steel to wood	W.H.P.	2-16-42
Road Rail changed to wood	W.H.P.	3/1/42

N.H. Project No. P-623

STATE OF NEW HAMPSHIRE
HIGHWAY DEPARTMENT
TOWN PROJECT: RYE-NEWCASTLE D.A. WR-1
OVER: LITTLE HARBOR
LOCATION: WENTWORTH BY THE SEA
ROUTE: NEWCASTLE (ROUTE 1-B) PRIMARY NO. 066/01
GENERAL PLAN, ELEVATION & SECTION
DESIGNED BY W.H.P. 9-41 DRAWN BY W.H.P. 9-41
CHECKED BY R.J.P. DATE 10/27/41

Traced by W.H.P. DA-WR-1
SHEET 1 of 2

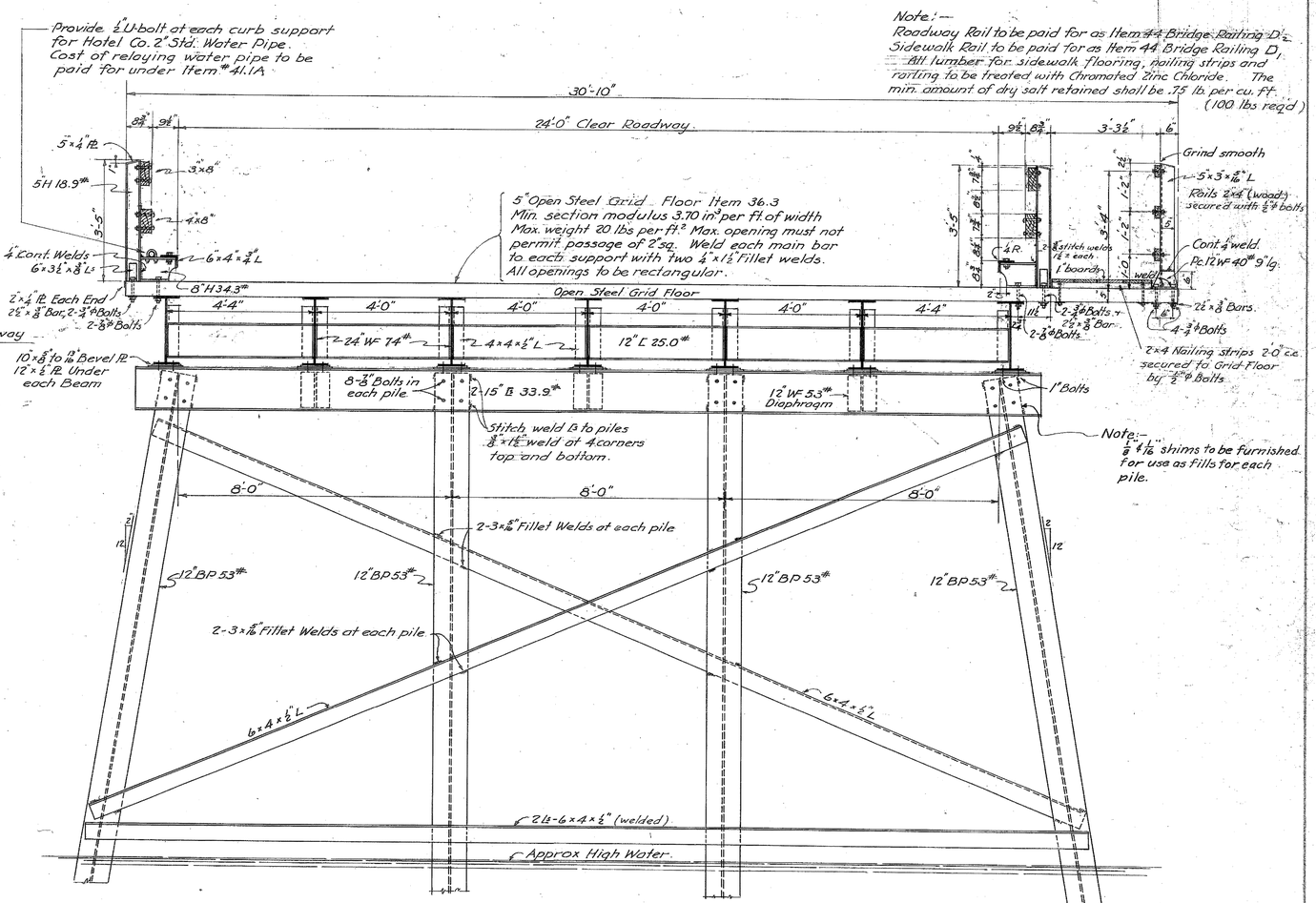
FED. ROAD DIST. NO.	STATE	ROAD NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1	N.H.	DA-WR1	1942	8	35



PLAN OF SPAN No. 5

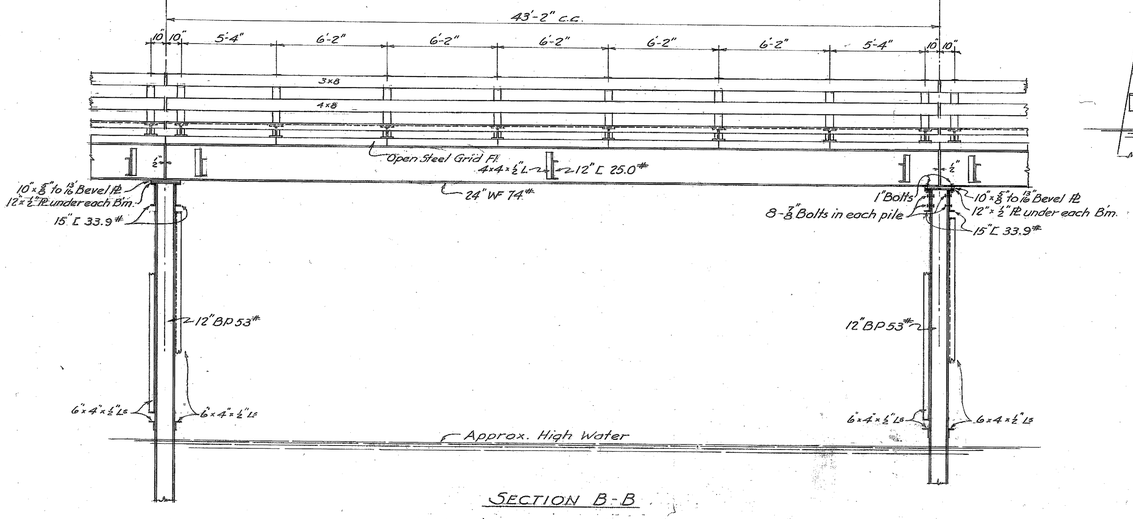
Typical for parts of Spans 1, 4 & 6. (See Gen. Plan.)

Scale 1/4" = 1'-0"



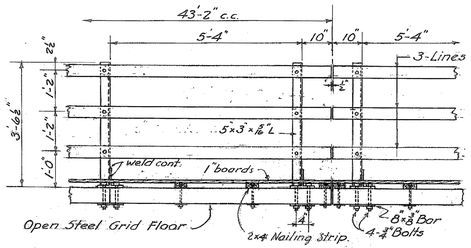
SECTION A-A

Scale 1/2" = 1'-0".



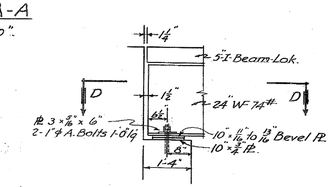
SECTION B-B

Scale 1/4" = 1'-0".



SECTION C-C

Scale 1/2" = 1'-0".



ELEVATION OF ABUTMENT END OF SPAN No. 1.

Scale 1/2" = 1'-0".

SECTION D-D

Note:— Abutment end of Span #6 the same opposite hand.

REVISIONS		
DESCRIPTION	BY	DATE
Notes	CRS	1-14-42
Change Sidewalk Rail to Floor to wood	W.H.P.	2-18-42
Stitch welds added rail posts to curb	"	3-31-42
Change Road Rail to wood	"	4-7-42

N. H. PROJECT No. P-623

STATE OF NEW HAMPSHIRE

HIGHWAY DEPARTMENT BRIDGE DIVISION

TOWN PROJECT: RYE-NEWCASTLE DA-WR1

OVER: LITTLE HARBOR

LOCATION: WENTWORTH-BY-THE-SEA

TO: NEWCASTLE (ROUTE 1B) BRIDGE No. 066/071

PLAN & SECTIONS SPANS 1, 4, 5 & 6

DESIGNED: A.H.W. 10/41 DRAWN BY: CRS DATE: 10/41

CHECKED: R.J.P. DATE: 12-29-41 FILE No. 2-8-2-2

Traced by W.H.P.

PROJ. NO.	SHEET NO.	TOTAL SHEETS
DA-WR1	8	35

W.H.P. Oct '41

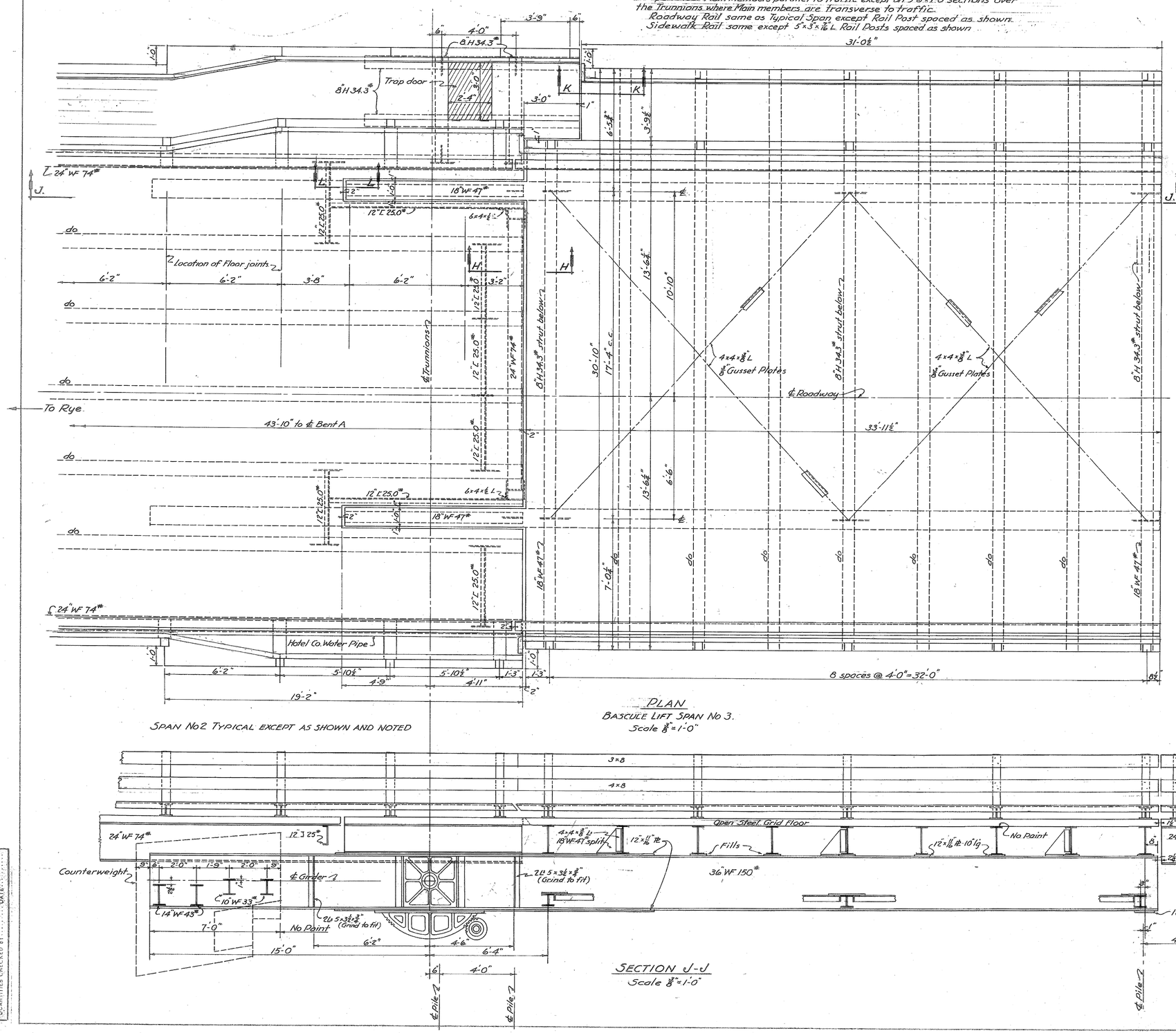
TRACING CHECKED BY ..... DATE .....

QUANTITIES COMPUTED BY ..... DATE .....

QUANTITIES CHECKED BY ..... DATE .....

FOR FINAL PLAN	STATE	FED. AID PROJ. NO.	FISCAL YEARS	SHEET NO.	TOTAL SHEETS
9	N.H.	DA-WR I	1942	9	35

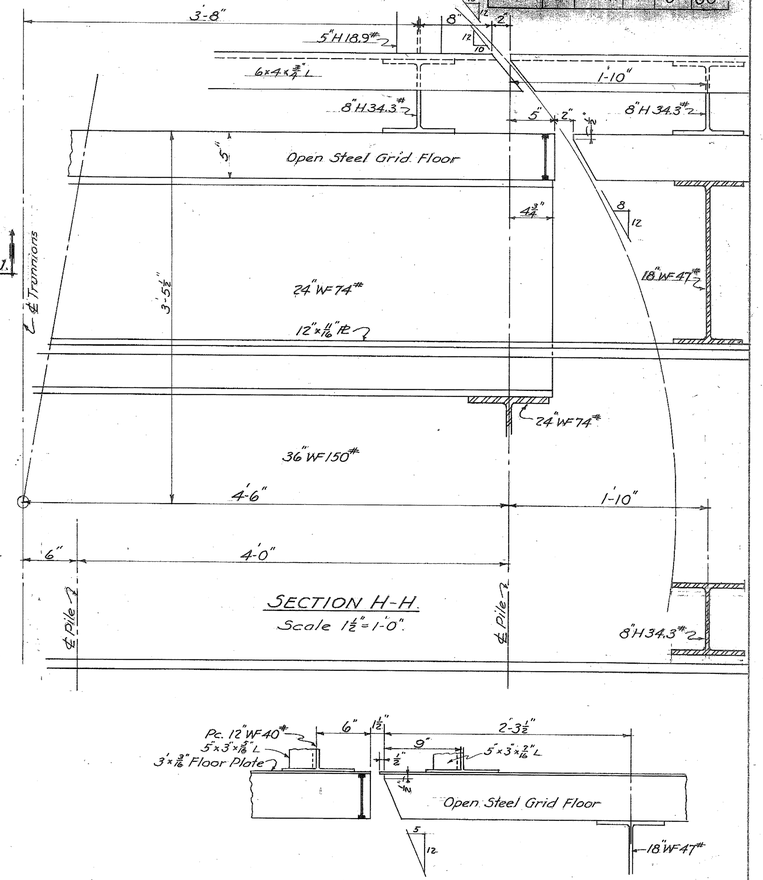
BASCULE LIFT SPAN:
Open Floor Main members parallel to traffic except on 9'-6" x 1'-0" sections over the Trunnions where Main members are transverse to traffic.
Roadway Rail same as Typical Span except Rail Post spaced as shown.
Sidewalk Rail same except 5 x 3 x 7/16 L Rail Posts spaced as shown



SPAN No 2 TYPICAL EXCEPT AS SHOWN AND NOTED

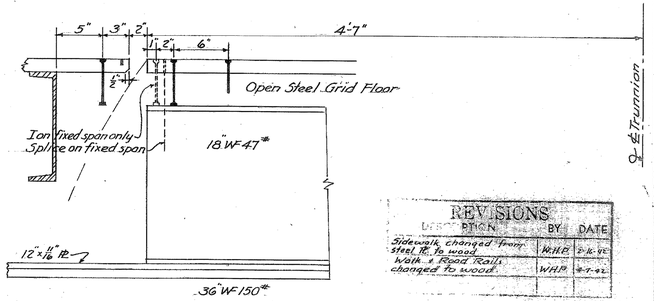
PLAN
BASCULE LIFT SPAN No 3.
Scale ⅜" = 1'-0"

SECTION J-J
Scale ⅜" = 1'-0"



SECTION H-H
Scale 1½" = 1'-0"

SECTION K-K
Scale 1½" = 1'-0"



SECTION L-L.
Scale 1½" = 1'-0"

REVISIONS DESCRIPTION	BY	DATE
Sidewalk changed from steel Pl. to wood	W.H.P.	2-16-42
Walk & Road Rails changed to wood	W.H.P.	2-7-42

N.H. Project No. P-623

STATE OF NEW HAMPSHIRE
HIGHWAY DEPARTMENT BRIDGE DIVISION

TOWN PROJECT RYE-NEWCASTLE DA-WR I
OVER LITTLE HARBOR
LOCATION WENTWORTH-BY-THE-SEA
ROAD NEWCASTLE (ROUTE 1B) BRIDGE No. 060/071
PLAN & SECTIONS - BASCULE LIFT SPAN

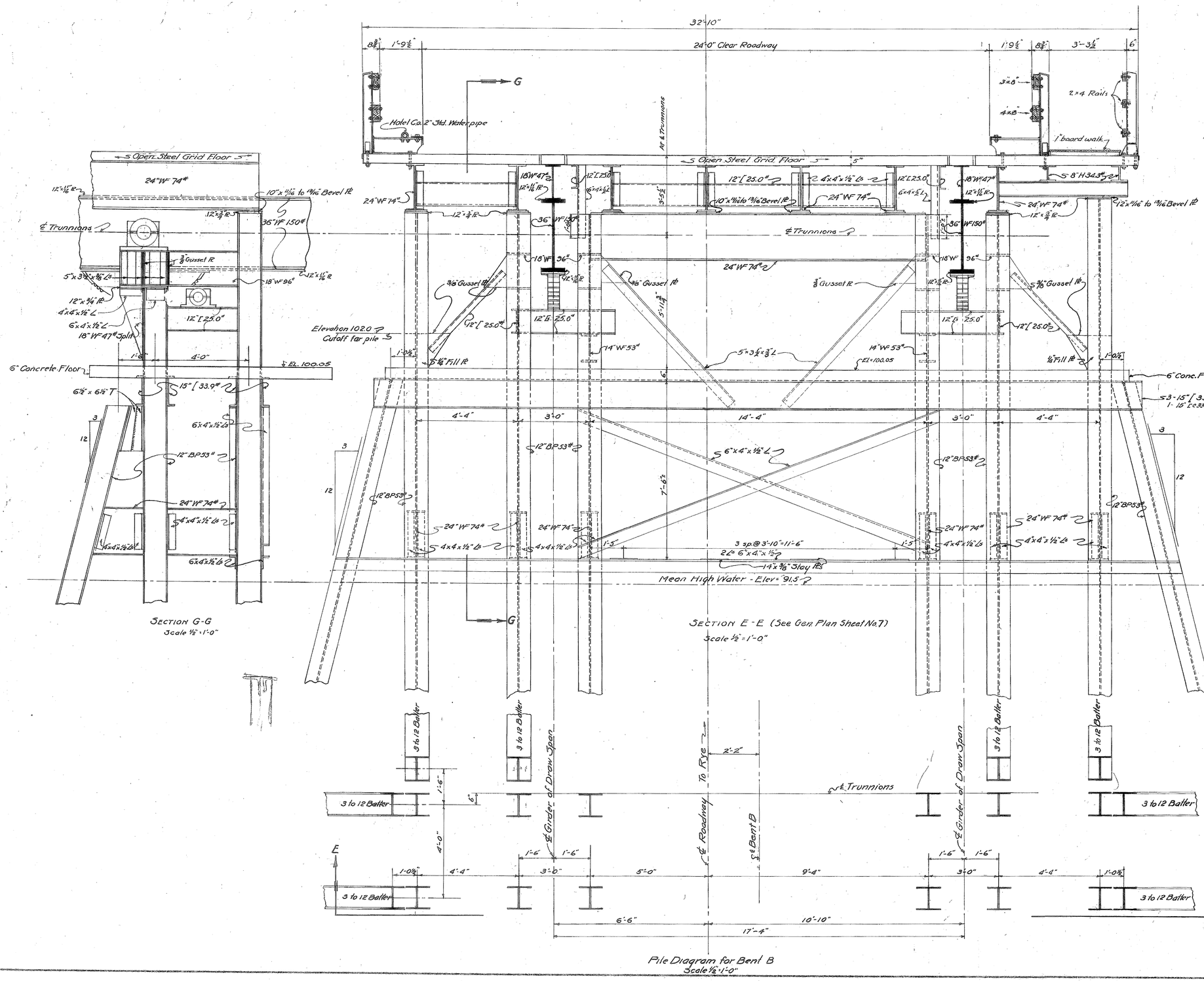
DESIGNED A.M.W. 10-41 DRAWN BY C.R.S. DATE 10-41
CHECKED R.J.P. 12/09/41 2-8-2-2

Traced by W.H.P.

PROJ. NO.	SHEET NO.	TOTAL SHEETS
DA-WR I	9	35

DRAWN CHECKED BY ..... DATE .....
TRACED BY W.H.P. DATE 12-23-41
TRACING CHECKED BY J.T.S.G. DATE 12/29/41
QUANTITIES COMPUTED BY ..... DATE .....
QUANTITIES CHECKED BY ..... DATE .....

FED. ROAD DIST. NO.	STATE	PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
9	N. H.	DA-WR1	1942	10	35

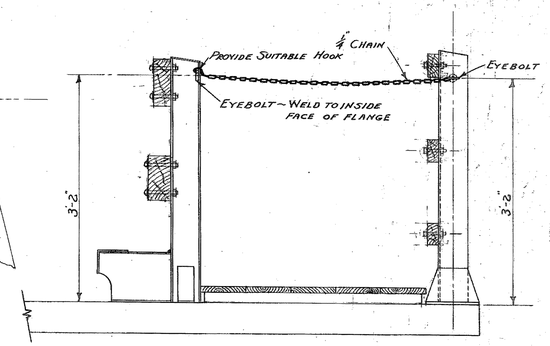


ESTIMATE OF QUANTITIES

ITEM	DESCRIPTION	UNIT	QUANTITY
8.3	Unclassified Structure Excav.	Cu.Yd.	60
8.4	Coffer Dam	Unit	1
31	Removing Superstructure	Unit	1
32.1	Concrete Class A.	Cu.Yd.	172
35	Reinforcing Steel	Lb.	13,170
36.1	Structural Steel	Lb.	230,530
36.3	Steel Grid Floor	Sq.Ft.	7,762
43.3	Steel Bearing Piles	Lb.	133,200
44-A	Bridge Railing D_1 (Sidewalk)	Lin.Ft.	251
79	Maintenance of Traffic	Lin.Ft.	253
303	Machinery for operating Lift Span	Unit	1
37	Structural Timber (treated)	M.B.M.	1,100
44-B	Bridge Railing D_2 (Roadway)	Lin.Ft.	502

REVISIONS

DESCRIPTION	BY	DATE
Changed pipe rails at 1'-6" to 1'-0" to match rest of railing		5-16-41
Lengthened bracket under trunnion	"	5-21-42
Changed road part to wood	"	8-7-42



Sidewalk Safety Chain
Scale 1" = 1'-0"

N.H. Project P623

STATE OF NEW HAMPSHIRE
HIGHWAY DEPARTMENT - BRIDGE DIVISION

Town Project: Rye-Newcastle DA-WR1
Over: Little Harbor
Location: Wentworth by the Sea
Road: Newcastle (Route 1B) Bridge No. 066/071
Plan & Sections - Bent B

Designed by A.H.W. Date ..... Drawn by C.R.S. Date 10/21/41
Checked by R.J.P. Date 12/29/41 File No. 2-8-2-2

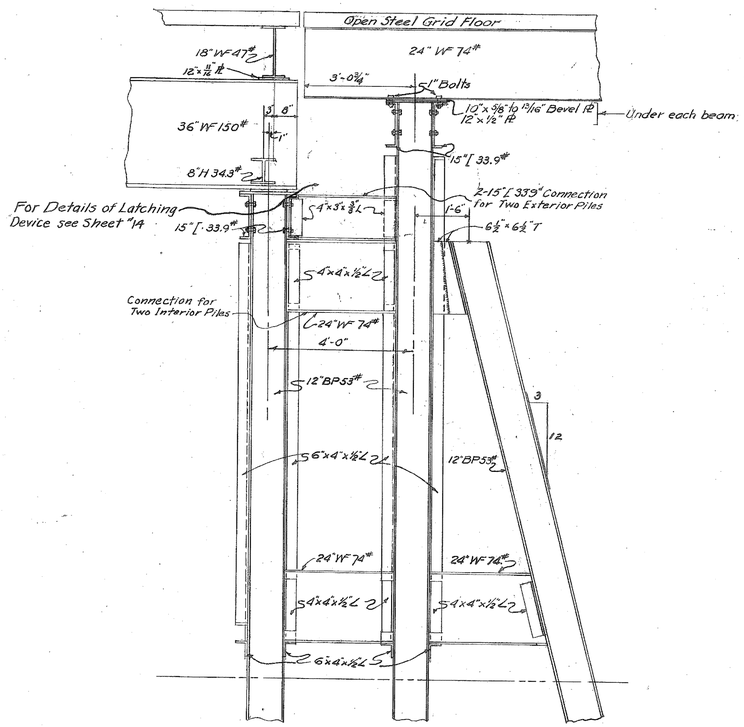
PROJ. NO.	SHEET NO.	TOTAL SHEETS
DA-WR1	10	35

BOOK NO. PAGE NO.

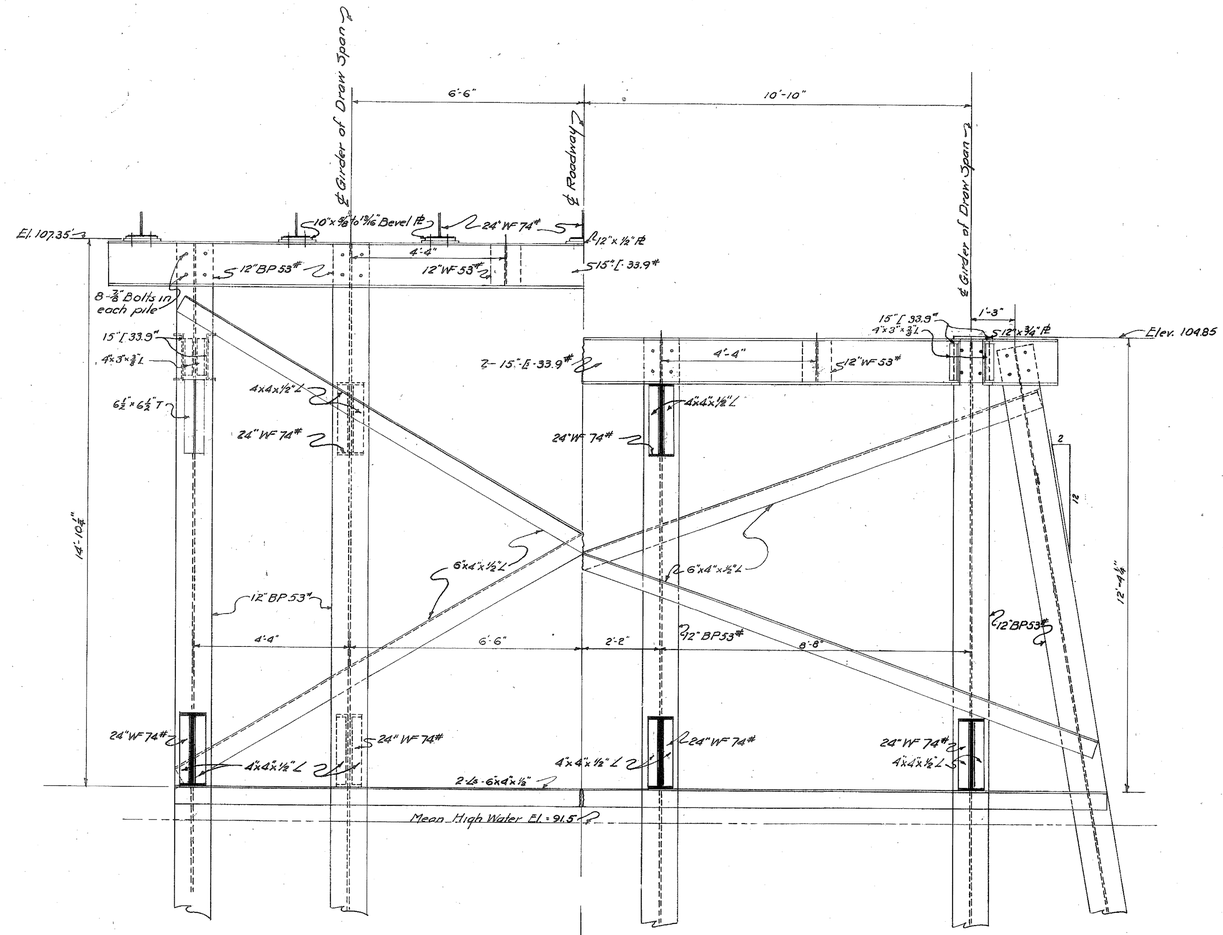
DATE	STA. TO STA.	DESCRIPTION

PLAN TRACED BY
TRACING CHECKED " W.S.G. DATE 12/23/41
PROFILE TRACED BY
CHECKED

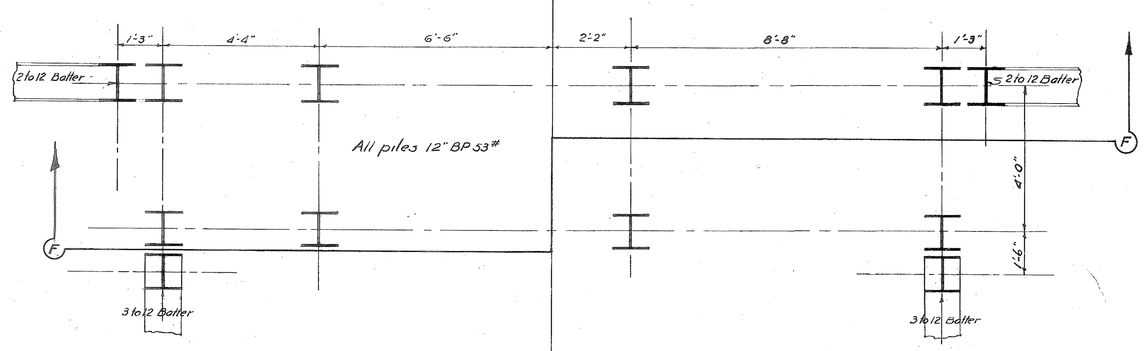
FED. ROAD DIST. NO.	STATE	PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
9	N. H.	DA-WR1	1942	11	35



END VIEW
Scale ½"=1'-0"



SECTION F-F
Scale ½"=1'-0"



PILE DIAGRAM FOR BENT C
Scale ½"=1'-0"

N.H. PROJECT P623

STATE OF NEW HAMPSHIRE
HIGHWAY DEPARTMENT, BRIDGE DIVISION

TOWN PROJECT RYE-NEWCASTLE - DA-WR1
OVER: LITTLE HARBOR
LOCATION: WENTWORTH BY THE SEA
ROAD: NEWCASTLE (ROUTE 1B) BRIDGE NO. 060/071

PILING PLAN & SECTIONS - BENT C

DESIGNED BY A.M.W. DATE 11-41 DRAWN BY G.R.S. DATE 11-41
CHECKED BY R.J.P. DATE 12/29/41 FILE NO. 2-8-2-2

PROJ. NO.	SHEET NO.	TOTAL SHEETS
DA-WR1	11	35

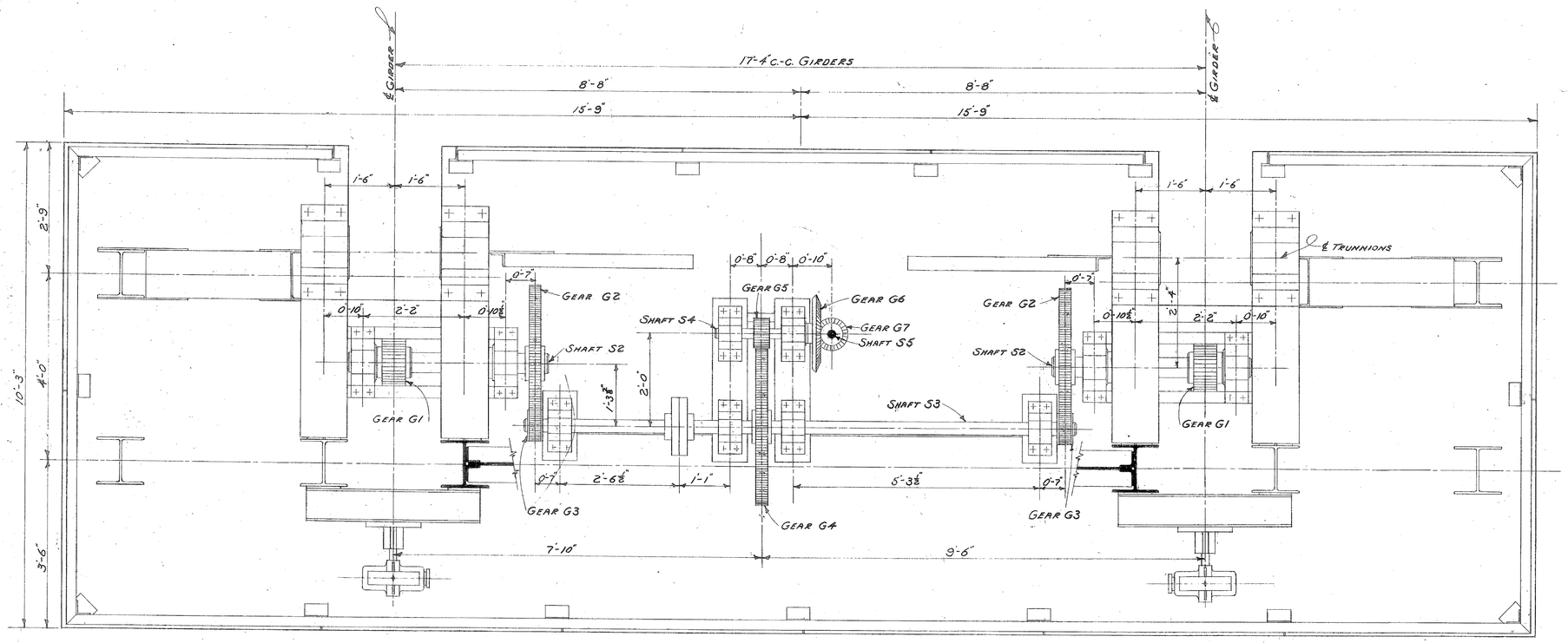
BOOK NO.	PAGE NO.

DATE	STA.	TO	STA.	DESCRIPTION

		DATE
PLAN TRACED BY	K.E.P.	Oct. 14, 41
TRACING CHECKED "	V.S.G.	12/23/41
PROFILE TRACED BY		
CHECKED "		

PRINTED ON ALCO-WEAR TRACING QUALITY IDEAL BLUE PRINT COMPANY 6223-2-73

FED. ROAD DIST. NO.	STATE	PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
9	N.H.	DA-WR-1	1942	12	35



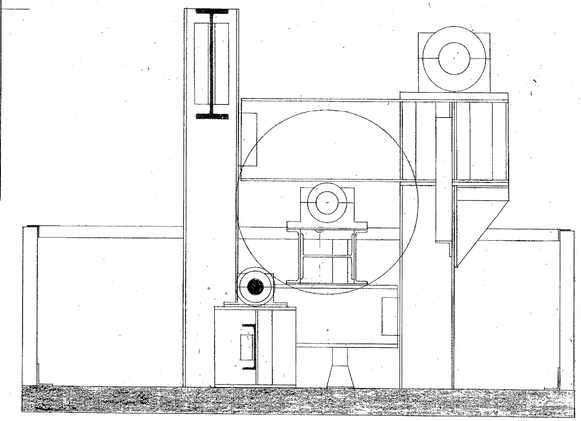
PLAN
SCALE ¾" = 1 FT.

(FOR FURTHER DETAIL OF MACHINERY FLOOR)
(SEE SHEET # 15

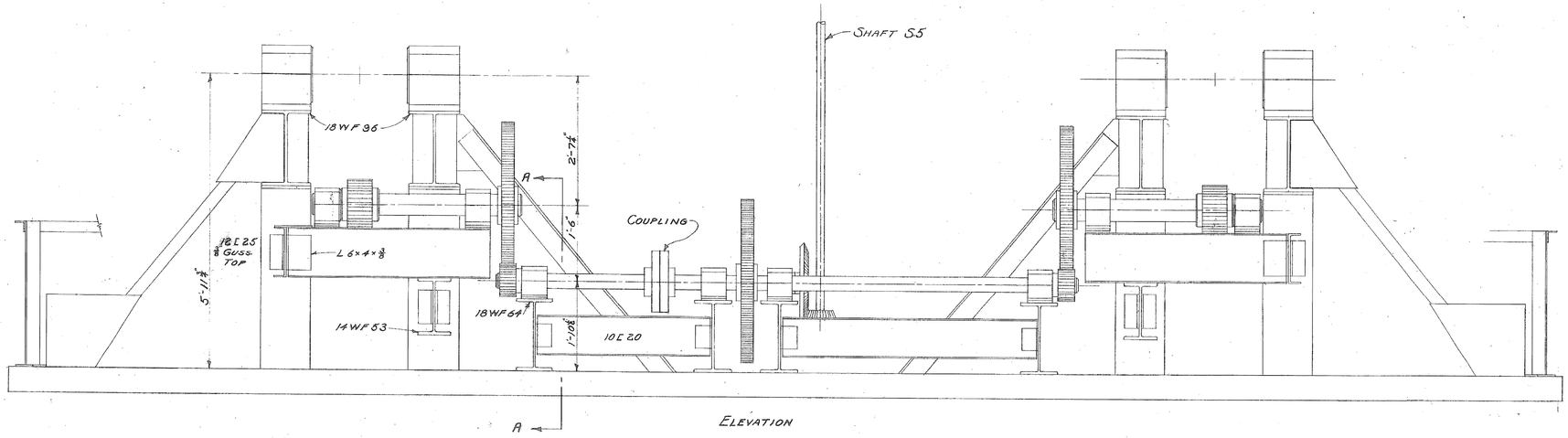
TABLE OF SHAFT SIZES	
SHAFT	DIAM
S1	TRUNNION
S2	5⅞"
S3	3⅝"
S4	2⅝"
S5	2"
S6	2"
S7	2"

TABLE OF GEAR DATA				
GEAR	NO.	DIAM. PITCH	PITCH DIAM.	WIDTH OF FACE
G1	2	1.5	12"	6"
G2	2	2	40"	3"
G3	2	2	8"	4"
G4	1	2	40"	3"
G5	1	2	8"	4"
G6	1	3	20"	2"
G7	1	3	8"	2"
G8	4	3	8"	2"

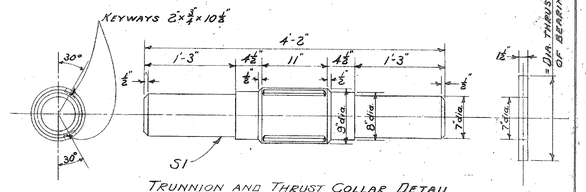
NOTE FOR COUPLING ON SHAFT S3:
DRILL IN FIELD AFTER ALL BACKLASH FROM EACH RACK TO THE COUPLING HAS BEEN ELIMINATED IN THE SAME DIRECTION OF ROTATION.



SECTION A-A
SCALE ¾" = 1 FT.



ELEVATION
FRONT LINE OF PILING AND RAILING REMOVED
SCALE ¾" = 1 FT.



TRUNNION AND THRUST COLLAR DETAIL
SCALE ¾" = 1 FT.

N.H. PROJECT NO. P-623

STATE OF NEW HAMPSHIRE
HIGHWAY DEPARTMENT · BRIDGE DIVISION

TOWN PROJECT: RYE-NEWCASTLE DA-WR1
OVER: LITTLE HARBOR
LOCATION: WENTWORTH BY THE SEA
ROAD: NEWCASTLE (ROUTE 1B) BRIDGE NO. 066/071

OPERATING MACHINERY

DESIGNED BY ..... DATE ..... DRAWN BY L.W.H. DATE 11/18/41
CHECKED BY R.I.P. DATE 12/29/41 FILE NO. 2-8-2-2

TRACED BY ..... DATE .....
TRACING CHECKED BY ..... DATE .....
QUANTITIES COMPUTED BY ..... DATE .....
QUANTITIES CHECKED BY ..... DATE .....

PROJ. NO.	SHEET NO.	TOTAL SHEETS
DA-WR1	12	35

Appendix F

NHDOT Maintenance Logs

BRIDGE 066/071	NEW CASTLE Route NH 1B Over LITTLE HARBOR
6/6/1996	no work description
1/25/1997	Inspect gate problems
2/15/1997	Install informational signing
3/28/1997	Clean and grease lift mechanism on NewCastle Br. #066/071 and Hampton Br.#235/025.
5/17/1997	Removed and replaced tide gauges
10/25/1997	Assisted contractor with fall electrical inspection.
4/4/1998	Electrical contractor performing spring inspection and test lift.
4/18/1998	Inspect and clean tide gauges. Lubricate as needed.
6/1/1998	MISCELLANEOUS PROJECTS
6/6/1998	Troubleshoot and repair traffic gate malfunction, with assistance from Bureau of Traffic.
8/29/1998	Lubricate slides at north end of bridge.
10/3/1998	Perform fall inspection of bridge with electrical contractor.
1/7/1999	Review structure for upcoming repairs. Replace deteriorated traffic gate signal doors.
2/18/1999	Remove deteriorated casings and concrete at pile bents and encase in concrete to elevation above high tide. Clean and prime piles as needed. Completion required prior to contract painting project.
4/1/1999	Lubricate and clean lift span.
5/27/1999	Move equipment and materials to project. Erect advance warning signs. Erect staging and work platform.
6/3/1999	Cut brush as needed at corners of bridge. Move equipment and materials to project. Erect staging at north end of bridge.
6/10/1999	Power tool clean pile casings at south pier. Remove and reset cross braces at same. Remove deteriorated concrete and pile casings at south pier and place re-steel at same.
6/17/1999	Remove deteriorated concrete and pile casings at south pier and place re-steel at same. Relocate staging as needed. Set forms at same.
6/24/1999	Remove existing cross braces and place new members at north pier and apply prime paint coat at same. Place concrete at north pier columns 3 and 4. Place re-steel, set forms, and place concrete at columns 1 and 2.
7/1/1999	Weld and paint cross bracing at Pier 1. Apply anti-spall compound to new concrete surfaces at same. Move staging to Pier 2. Remove existing cross bracing and install new members at Pier 2. Clean pile legs at Pier 2.
7/2/1999	RYE-NEWCASTLE BRIDGE
7/8/1999	Reposition and weld braces on Pier 2. Remove existing pile casings and deteriorated concrete at legs of Pier 2. Remove scale from pier legs at same.
7/15/1999	Remove deteriorated concrete at all Pier 2 columns and place re-steel at same. Clean, paint, and repair deteriorated sections of bridge rail as needed.
7/22/1999	Place re-steel, set forms, and place concrete at Pier 2 casings on inland side. Place re-steel and set forms at ocean side casings. Fabricate and install angle braces at same. Apply prime and finish paint to braces.
7/29/1999	Place concrete at D/R columns, complete installation of cross-bracing, and paint structural steel as needed at Pier 2. Weld loose sections of grid deck as needed. Move staging to Pier 5 and reposition cross-braces at same.
8/5/1999	Relocate, weld, and paint cross-bracing at Pier 5. Remove pile casing and deteriorated concrete and place re-steel at pier columns.
8/12/1999	Remove deteriorated concrete at Pier 5 columns. Place re-steel and set forms at same. Fabricate horizontal bracing replacements and paint upper cross-braces at same. Haul concrete debris from project.

BRIDGE 066/071	NEW CASTLE Route NH 1B Over LITTLE HARBOR
8/19/1999	Place re-steel, set forms, and place concrete at Pier 5 columns. Apply anti-spall compound to same. Fabricate replacement members for horizontal cross-bracing at Pier 5.
8/26/1999	Apply anti-spall compound to concrete surfaces at Pier 5 columns. Attach horizontal cross-braces and paint structural steel areas at same. Move equipment and materials from project. PROJECT SUSPENDED.
11/11/1999	Construct platform for electrical service meters at north and south traffic gates.
3/9/2000	Resume project after winter suspension. Move equipment and materials to project. Erect advance warning signs. Fabricate materials needed for staging.
3/9/2000	Fabricate replacement window screen frames for lift operator's house.
3/16/2000	Remove horizontal bracing at south bent and replace with new member. Cut and remove pile casings at south bent and power tool clean pile members.
3/23/2000	Remove deteriorated pile casings and concrete at SE corner of south bent of lift span. Repair areas of section loss at piles as needed. Weld loose sections of grid deck as needed. Fabricate replacement diaphragm. Place reinforcing steel at casings.
3/30/2000	Repair areas of H-pile section loss at SE corner of south lift span bent as needed. Place reinforcing steel at new casings at same. Erect staging at SW corner of bent and remove deteriorated concrete at pile casings.
4/6/2000	Place reinforcing steel at SE corner of south lift span bent. Remove deteriorated concrete, hand tool clean piles, and place reinforcing steel at SW casings of same. Adjust inland tide gauge brackets to permit work on pile casings.
4/13/2000	Place reinforcing steel at SW corner pile casings at south lift span bent. Repair areas of section loss as needed at diaphragm. Set forms and place concrete at SE corner pile casings at south lift span bent.
4/20/2000	Repair areas of section loss at south bent piles as needed and install new diaphragm. Place reinforcing steel and set forms at pile casings at south lift span bent.
4/27/2000	Place concrete at pile casings at south lift span bent. Place reinforcing steel at next groups of pile casings at same.
5/4/2000	Place reinforcing steel and set forms at pile casings at east and west sides of south lift span bent. Place concrete at east side. Remove and relocate existing cross-braces and clean existing pile members at north lift span bent.
5/11/2000	Place reinforcing steel, set forms, and place concrete at pile casings at east and west sides of south lift span bent. Apply prime paint coat to cross-braces and existing pile members at north lift span bent.
5/18/2000	Place reinforcing steel, set forms, and place concrete at pile casings at east and west sides of south lift span bent. Apply prime paint coat to cross-braces and existing pile members. Weld horizontal braces at north lift span bent.
5/25/2000	Remove work platform from south lift span bent and erect at north bent. Remove horizontal structural steel bracing and top section of casings from piles at north lift span bent.
6/1/2000	Remove scale and deteriorated concrete from piles at north lift span bent. Place reinforcing steel at same.
6/8/2000	Place reinforcing steel, set forms, and place concrete at piles at east side of north lift span bent. Place reinforcing steel at piles at west side of north lift span bent.
6/14/2000	RYE-NEWCASTLE BRIDGE
6/15/2000	Place reinforcing steel, set forms, and place concrete at piles at east and west side of north lift span bent.
6/22/2000	Place reinforcing steel at west side of north lift span bent. Set forms and place concrete at piles at east and west sides of north lift span bent. Clean scale from piles and prime same. Move equipment and materials from project.
6/29/2000	Apply anti-spall compound to concrete at piles on north side of lift span bent. Remove staging and advance warning signs. Move equipment and materials from project.
8/24/2000	Respond to report of inoperative lift span locking mechanism. Made repairs to same as needed.
10/12/2000	Lubricate lift components and perform test lift for completion of painting contract.
10/26/2000	Remove corroded bearing pads at north end of lift span and replace with new. Clean and lubricate span locks.

BRIDGE 066/071	NEW CASTLE Route NH 1B Over LITTLE HARBOR
10/26/2000	Remove existing windows and install new units in operator's building.
11/2/2000	Install security screens on windows of lift operator's building.
11/2/2000	Perform fall inspection of auxiliary lift systems with electrical contractor.
3/29/2001	Clean and lubricate lift span and auxiliary lift system. Perform test lift.
4/12/2001	Assist electrical contractor with lift bridge electrical inspection.
6/14/2001	Replace tide gauge face at east side of bridge. Clean west side tide gauge.
8/30/2001	Clean and lubricate lift system. Replace bearing pads at fixed end.
11/8/2001	Assist Yates Electric in reviewing damage to power lines from over height boat last summer and measuring clearance.
3/14/2002	Clean and lubricate lift span.
3/21/2002	Replace tide gauge.
4/25/2002	Assist Yates Electric with annual electrical inspection.
7/4/2002	Re-weld loose section of decking grate and top flange of stringer at northern backwall.
7/18/2002	Assist Yates Electric replace wiring and conduits from lift house to motors.
8/1/2002	Clean up insulation that was removed from motor housing by contract.
8/22/2002	Insulate motor box. Paint stringer ends on north end of bridge in the deck area repaired 7/4/02.
8/29/2002	Replace inland tide gauges and repave approaches for rideability.
3/20/2003	Weld cracked and loose sections of grid deck.
4/24/2003	Clean and grease lift mechanism. Clean tide gage.
7/3/2003	Repair northern manual traffic barrier gate and checked southern automatic traffic barrier gate.
8/7/2003	Lubricate lift span gates.
3/4/2004	Spring electrical inspection with Yates Electric.
4/1/2004	Spring lubrication and inland tide gauge cleaning and repair.
7/15/2004	Clean and grease lift span motors. Clean tide gauges and replace lower half of eastern gauge (07/09/2004).
10/14/2004	Repair accident damaged bridge rail end post concrete base at northwestern corner.
1/13/2005	Review plow damaged signal pole, controller box and approach rail with patrolman.
3/31/2005	Clean and grease mechanical system. Replace island tide gauge.
4/21/2005	Assist Yates Electric with spring electrical inspection. Southern outer barrier gate problem repair. Traffic controller malfunction.
8/11/2005	Reweld loose section of grid. Repair tide gauge bracket. Repair northeastern barrier gate.
10/6/2005	Assist Yates with the repair of the seating limit switch.
2/23/2006	Rebuild tide gauges.
3/2/2006	Rebuild tide gauges.
3/16/2006	Clean and grease regular and auxiliary lift system and gates.

BRIDGE 066/071	NEW CASTLE Route NH 1B Over LITTLE HARBOR
5/4/2006	Met with Yates Electric and Frank Sullivan (Traffic Bureau) for solution to separate lights from gates. Will determine cost to complete.
6/1/2006	Review with Yates Electric change to gate system to separate traffic gate electrical system from lift system.
6/29/2006	Repair and weld down various areas of grid deck.
7/6/2006	Weld grid decking to stringers at various locations.
7/13/2006	Assist Yates Electric install wires for gate/traffic signal.
7/20/2006	Install separate push button controls for the barrier gates and traffic signals.
8/3/2006	Assist Traffic Bureau with traffic signal installation work.
11/2/2006	Clean and grease for fall shutdown.
3/28/2007	Remove and replace two bent drive shafts and two pillow block bearing pedestals.
3/29/2007	While attempting an annual test lift (3/27) the shaft supports broke and allowed the pinion drive shafts to move and they were bent. Removed shafts with assistance of Cianbro Corp. for replacement. Repair support pedestals.
4/5/2007	Work with Cianbro Corp to replace bent drive shaft. Repairs and test lift complete 4/05.
4/12/2007	Weld steel base plates to channel under concrete platform, tacked nuts on anchor bolts and prime coat paint. Remove work platform staging. Build motor housing enclosure. Move materials and equipment from project.
5/24/2007	Adjust manual span locks and limit switch for seating.
7/5/2007	Assist 610 patrol with temporary repair of north end of lift deck.
8/30/2007	Repair seating switch.
9/6/2007	Weld loose or broken sections of grid decking.
10/4/2007	Clean and grease lift span and remove asphalt spillage off bridge seats.
11/13/2007	Repairs to Rye-Newcastle bridge.
1/24/2008	Re-weld broken sections of grid decking.
3/27/2008	Replace lift notification signs on both side of bridge, sign included new phone number for Concord TMC.
4/3/2008	Reweld various sections of grid decking.
4/10/2008	Clean and grease lift span. Clean bridge seats. Replace tide gauge.
8/28/2008	Re-weld sections of broken grid decking.
10/9/2008	Fish plate weld northern end of deck stringers and repair grid decking at the same.
10/16/2008	Prime coat and finish coat paint the ends of the beams that were fishplated.
11/20/2008	Respond to traffic signal problem, reset and it was fine. Clean and grease.
1/1/2009	Weld cracked and loose sections of grid decking as necessary.
3/31/2011	EMERGENCY REPAIRS OVER LITTLE HARBOR TO STRUCTURE.