Conducting Construction Access Assessments

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State Construction Structures Engineer

Conducting Construction Access Assessments

Acknowledgement:

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Conducting Construction Access Assessments

Presentation Overview

As the designer, what do you need to know to prepare Contract Documents that inform the Contractor of access issues and where needed, that include plans and details that provide effective ways to access the project when access is extremely restricted?

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MAJOR PRESENTATION TOPICS

- **When to perform a construction access assessment**
- **What to consider when performing a construction access assessment**
- **Crane access and selection**
- **Other types of lifting and erection equipment**

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When to perform a construction access assessment

- **Contractor means and methods are restricted because of the following reasons:**
  - **Access is severely limited because of permit requirements, existing utilities, existing underlying structures, wetlands, flood planes or shallow water**
  - **When erection methods other than mobile cranes are necessary and such methods have to be accounted for in the design of the structure**
  - **When cranes have to be placed on existing structures or on top of walls**
- **Scope of the assessment**
  - **A formal assessment should be performed and the results must be kept in the design file**
  - **If the assessment shows that no specific provisions are warranted then the process is complete and no further action is required**
  - **When it is deemed necessary for the designer to provide an access approach, only one feasible construction access approach needs to be provided in the Contract Documents**

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When to perform a construction access assessment

To start with, it will help to know the Contractor's responsibility as detailed in the FDOT "Standard Specifications for Road and Bridge Construction"

5-1.4.7.3 Shop Drawings for Major and Unusual Structures: ….submit information to the Engineer outlining the integration of the Major and Unusual Structure into the overall approach to the project……include…. :

……

(3) The general location of any physical obstacles …. (For example, obstacles might include road, rail and waterway clearances, temporary diversions, transmission lines, utilities, property, and the Contractor's own temporary works, such as haul roads, cofferdams, plant clearances and the like.)

(4) The approximate location of any special lifting equipment in relation to the structure, including clearances required for the operation of the equipment. (For example, crane positions, operating radii and the like.)…..

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When to perform a construction access assessment

STRUCTURAL STEEL:

460-7.1.3 Erection Plan: Submit, for the Engineer's review, an Erection Plan locating all primary members, lifting equipment …..

Locate all pick crane work points….

Provide capacity charts on the drawings for each crane configuration and boom extension utilized...

SEGMENTAL:

452-8.1 Erection Manual: Before commencing erection operations, submit proposals for all segment erection operations to the Engineer for approval…
(1) A detailed step-by-step sequence for the erection of each segment including all intermediate procedures relating to erection equipment…..
(3) Positioning, use and sequencing of erection equipment such as cranes, beam and winch devices, gantries, trusses and the like, including the movement, introduction and/or removal of any supports onto or connections with the structure. Include drawings and calculations for the structural effects of erection equipment on the structure….

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What to consider when performing a construction access assessment

- **Access issues outside of the ROW**
  - **Are local streets and highways that can provide direct access into the project site immediately available for Contractor use?**
  - **If not available, what arrangements or negotiations will be required to provide access and can they be completed before letting?**
  - **Are there restrictions that govern the use of local streets and highways in the vicinity of the project by heavy Contractor vehicles with regard to weight limits, hours of operation or the number of trips per day?**
  - **If there are restrictions, these should be addressed in the contract documents when possible**

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What to consider when performing a construction access assessment

- Access issues within the ROW
  - Utility Obstacles
  - Underlying Drainage Structures
  - Wetlands
  - Flood Planes
  - Shallow Water Limiting the use of Water Borne Vessels
  - Areas of the Completed Project that will Require Access for Future Maintenance Operations

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Access Issues Within the ROW

- Utility Obstacles
  - The placement of heavy mobile equipment loads may be limited by underground utilities which can be damaged by these loads
  - Electric power, telecommunications, water/sewer
  - Cranes or other equipment with high clearance requirements can be limited by overhead utilities such as existing electric power or telecommunication lines suspended from poles
  - Existing traffic control structures such as signs, lights and signals
- Underlying Drainage Structures
  - The placement of heavy mobile equipment loads may be limited by underground drainage pipes or culverts which can be damaged by these loads

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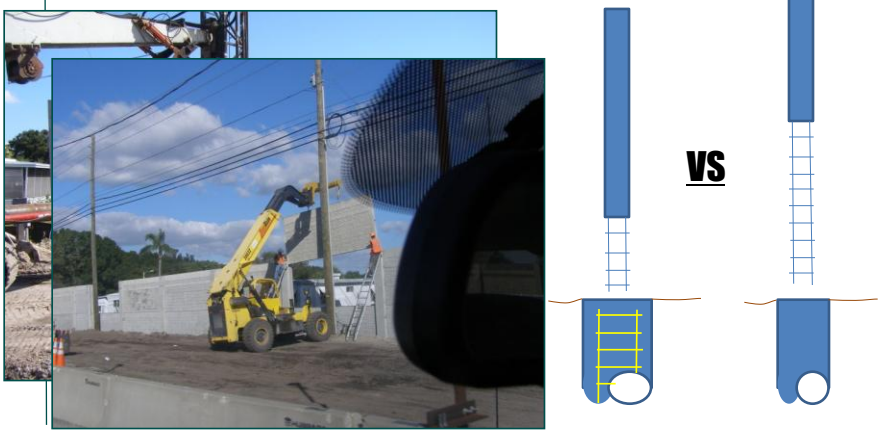
Access Issues Within the ROW

Low Head Room Design Solutions



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Access Issues Within the ROW

- **Wetlands**
  - **The dimensions and alignment of haul roads should be established in the design phase to determine mitigation requirements for the project**
  - **Ensure that the haul road width and layout shown on permit drawings is adequate for bridge component delivery for both the substructure and superstructure construction**
  - **In the plans, provide a subsurface boring at a representative location in the expected alignment of the haul road**

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Access Issues Within the ROW

- **Wetlands**
  - Require a geotextile barrier to be placed prior to the temporary haul road fill to ensure that the fill will be removed completely at the end of construction
  - When a haul road is required in the Plans or Permit Drawings, the Contractor is responsible for designing the haul road

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Access Issues Within the ROW

- **Wetlands**
  - For long bridges that are being widened in the median, top-down construction may minimize wetland impacts
  - Left photo shows a straddle crane with tires supported on the shoulders of parallel existing bridges
  - Right photo shows foundations constructed using sectional barges (10′ x 40′) supporting cranes which were leap-frogged as construction progressed

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Access Issues Within the ROW

- **Flood Planes**
  - Haul roads are not a good option when the new bridge is located in a flood plan
  - Temporary work trestles ensure that Construction equipment and materials will always be above the maximum flood elevation
  - Steel wheel on steel rail straddle cranes are a viable option

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- **Flood Planes**
  - For the case in the photo, the Contractor provided a temporary platform for cranes in order to install permanent drilled shafts and temporary steel piles located outside the bridge superstructure limits on both sides
  - The platforms were leap-frogged as construction progressed
  - The temporary steel piles were spaced so that longitudinal steel beams could bridge between piles to provide support for a straddle crane using steel wheels to move along the entire bridge alignment to supply equipment and materials

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Access Issues Within the ROW

- **Shallow Water Limiting the Use of Water Borne Vessels**
  - **Deepening the water way using dredging is not recommended due to unknown costs associated with maintaining the channel bottom and turbidity concerns**
  - **Temporary sunken pontoons in shallower water may be okay depending on temporary loads but temporary trestles are preferred**
  - **The Contractor is responsible for designing temporary pontoons or trestles for the intended construction Loads**
  - **Specification 103-1.2, Temporary Work Structures, requires the Contractor to assume responsibility for design and coordination with the Coast Guard for navigable water ways**

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Access Issues Within the ROW

- **Shallow Water Limiting the Use of Water Borne Vessels**

- **Use of a temporary work trestle is the preferred method since it minimizes turbidity**
- **If the trestle bridges over sea grass beds then the sea grasses may have to be mitigated since the shade of the trestle can damage the grasses**

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- **Shallow Water Limiting the use of Water Borne Vessels**
  Indian Street Project – Currently Under Construction

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Access Issues Within the ROW

- **Areas of the Completed Project that Will Require Access For Future Maintenance Operations**
  - **FDOT maintenance workers must have easy access to all areas of the project that require mowing and litter pickup**
  - **Clearance between ROW fences and structures such as walls may be very limited unless properly addressed in the design**
  - **Installation of enough gates to facilitate access is critical**
  - **Every effort should be made to provide enough clearance to allow the use of standard riding mowers if possible or push mowers as a minimum**

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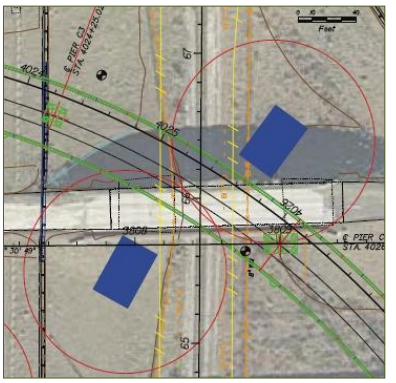
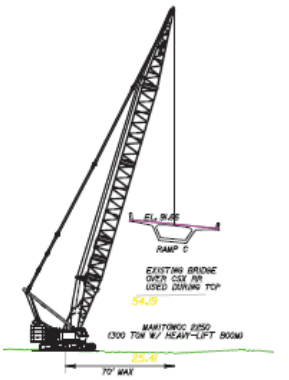
Crane access and selection

- **Land based cranes:**
  A crane access assessment should determine support conditions, position or location (placement footprint), swing radius, maximum load capacity, dimensions, and physical obstructions





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Crane access and selection

- **Potential physical obstructions for land based cranes include:**
  - **Overhead bridges**
  - **Runway glide paths near airports**
  - **ROW boundaries**
  - **High water seasonal flood limits**
  - **Railroad tracks**
  - **Active roadways**
  - **Overhead utilities**
  - **Wetlands**
  - **Bodies of water**

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Crane access and selection

- Land based crane support conditions:
  - Crane support can be affected by weak subsurface soils, underground utilities or drainage structures
  - Cranes are to be located on level ground with load distributed through crane mats or pads
  - Placement of cranes close to walls or on existing bridges should be avoided if at all possible

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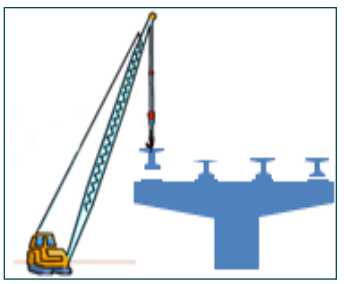
Crane access and selection

- Layout of haul roads on permit sketches for crane effectiveness where wetlands are within the ROW



TYPICAL CRANE LOCATION
FOR BEAM PLACEMENT

- For beam bridges, cranes typically have to be located outside of bridge footprint
- For tall bridges, the set-back of the crane from the bridge coping has to be increased
- Beam placement typically requires two cranes working in tandem

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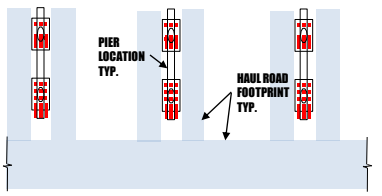
Crane access and selection

- Layout of haul roads on permit sketches for crane effectiveness where wetlands are within the ROW
- Due to crane reach for beam placement and foundation installation, cross ramps at each pier location are typically required



Typical Haul Road Layout
Plan View

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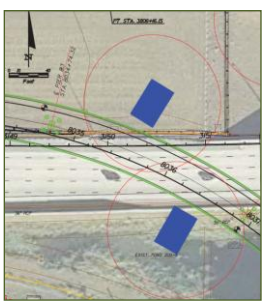
Crane access and selection

Crawler Crane Load Chart
Manitowoc 222



heavy-duty boom load charts

Liftcrane Boom Capacities - Series B
Boom No. 222HD with Open Throat Top

28 710 kg (63,300 lb) Counterweight 6 350 kg (14,000 lb) Crawler Frame Counterweight
6,81 m (22' 4") Crawlers extended
360° Rating kg (lb) x 1 000

Boom m (ft)	12,2 (40)	18,3 (60)	24,4 (80)	30,5 (100)	36,6 (120)	42,7 (140)	45,7 (150)
Radius							
3,0 (10)	90,7 (200.0)						
4,0 (13)	76,8 (171.0)	77,4 (170.7)					
4,5 (15)	68,2 (148.2)	67,5 (145.8)					
6,0 (20)	50,7 (109.2)	47,5 (102.7)	43,8 (94.6)	41,0 (88.5)			
9,0 (30)	27,4 (59.1)	27,1 (58.6)	27,0 (58.1)	25,2 (54.6)	23,9 (51.6)	22,5 (48.6)	22,1 (47.8)
12,0 (40)	16,4 (34.3)	18,0 (38.9)	17,8 (38.5)	17,5 (38.0)	17,4 (38.0)	16,9 (36.1)	16,6 (35.5)
18,0 (60)		8,7 (18.1)	9,8 (21.3)	9,6 (20.8)	9,6 (20.7	9,1 (19.6)	8,9 (19.2)
24,0 (80)			4,9 (10.1)	6,0 (13.0)	6,0 (13.0	5,5 (11.8)	5,4 (11.7)
30,0 (100)				2,6 (5.2)	3,6 (7.6)	3,3 (7.0)	3,3 (7.1)
36,0 (120)						1,7 (3.4)	1,8 (3.7)
38,0 (125)							1,3 (3.0)

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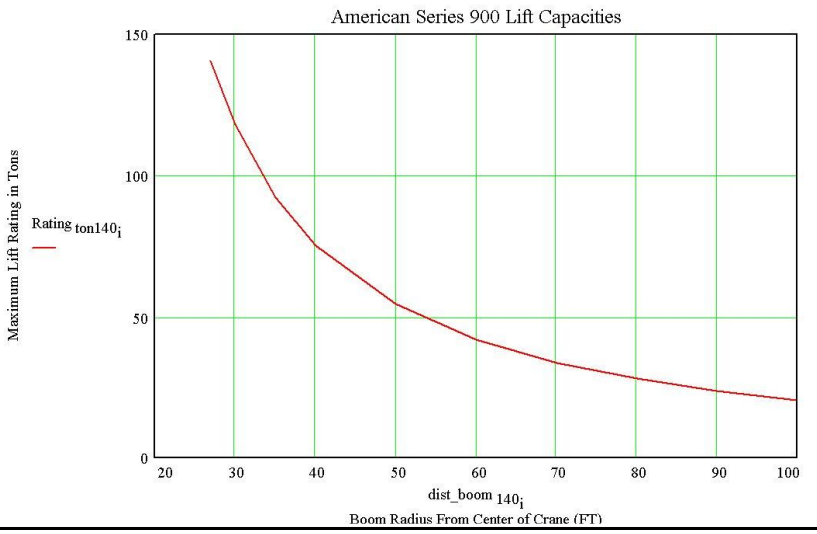
Lifting Capacities: American 9320 (140,000 pound counterweight) 250 Ton Crane

Lifting Curve based on 140 Ft boom (other boom lengths similar)



2012 Design Training Expo

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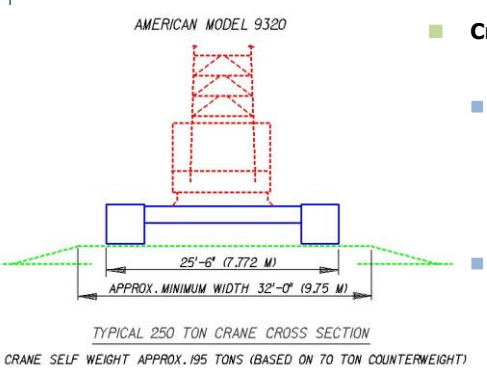
Crane access and selection



- **Crane dimensions and size**
  - **Crane width requirements typically control over trucking material delivery width requirements when determining haul road requirements**
  - **Crane size is dictated by worst case weight and reach requirements**

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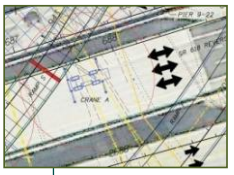
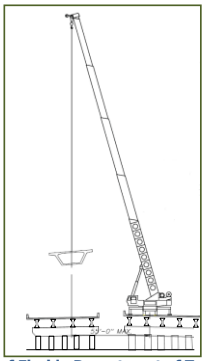
Crane access and selection





- **Crane position or location**
  - **Verify that one method of crane access is feasible during the design stage**
  - **If cranes need to operate from existing structures, then structures need to be checked for anticipated crane loads**
  - **7-7.5 Contractor's Equipment on Bridge Structures, requires that a Contractor's EOR analyzes the effect of imposed loads on bridge structures, within the limits of a construction contract….**

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Crane Access and Selection

- **Crane sizing can be impacted by third party requirements**
  - **CSX Railroad Requirements:**

    Submit crane rating sheets showing cranes to be adequate for 150% of the actual weight of the pick. A complete set of crane charts, including crane, counterweight, maximum boom angle, and boom nomenclature is to be submitted. Safety factors that may have been "built in" to the crane charts are not to be considered when determining the 150% Factor of Safety.
  - **OSHA crane setback requirement from power lines (1926.600)**

    Power Line ≤ 50 kV: any part of the crane or load shall be 10 feet or further away

    Power Line > 50 kV: any part of the crane or load shall be 10 feet plus 0.4 inch for each 1 kV over 50 kV, or twice the length of the line insulator, but never less than 10 feet

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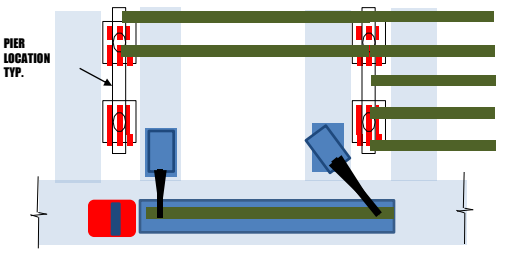
Crane Access and Selection

Typical Positioning of Two Cranes for Beam Placement

CASE 1



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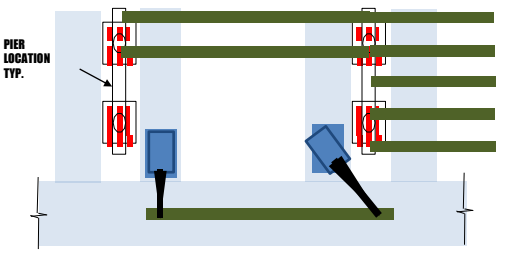

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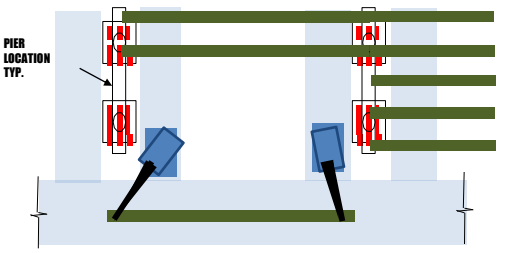

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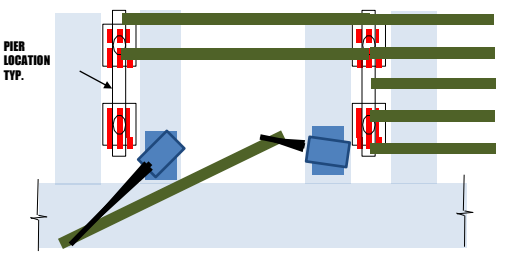

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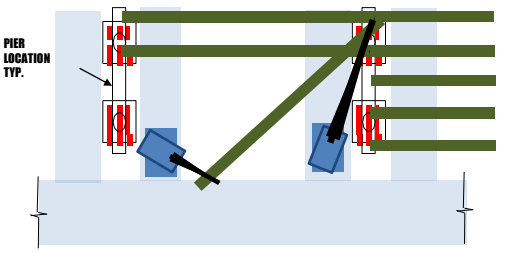

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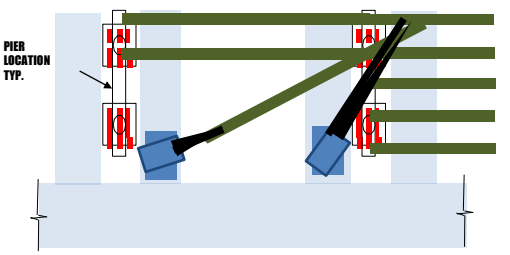

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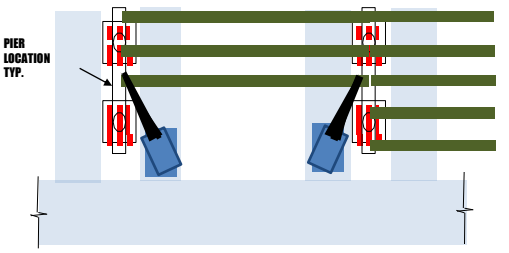

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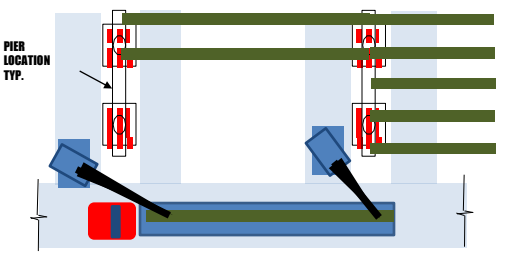
Typical Positioning of Two Cranes for Beam Placement

CASE 2



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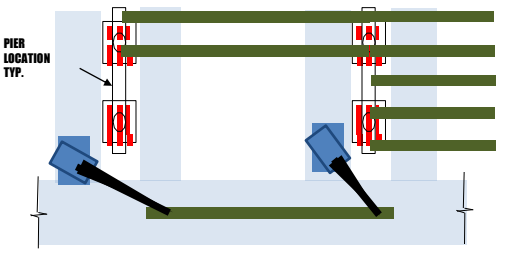

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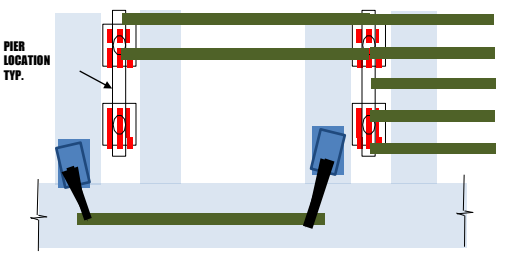

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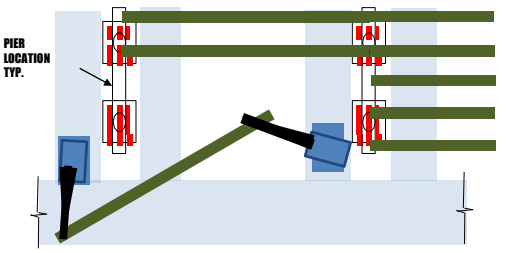

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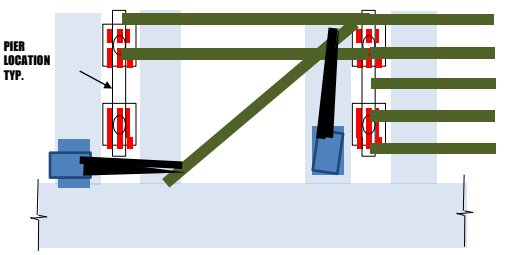

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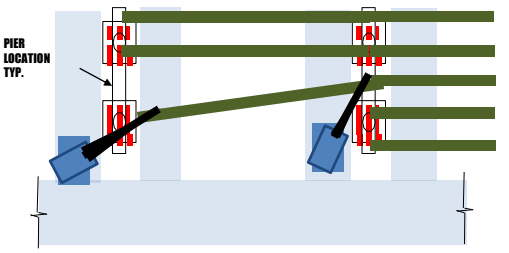

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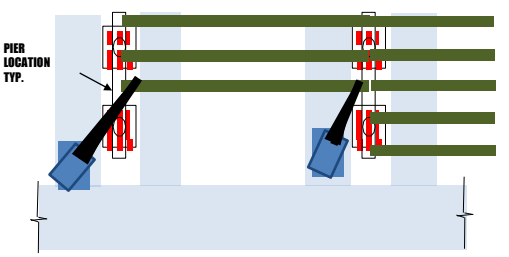

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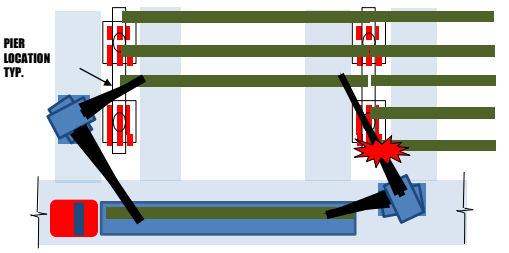
Conducting Construction Access Assessments

Typical Positioning of Two Cranes for Beam Placement

CASE 3



Best crane placement for the last two beam lines

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Other types of lifting and erection equipment

The following question must be asked:

Will the use of this equipment type impact the design of the permanent structure?

Straddle Cranes

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Other types of lifting and erection equipment

Underslung Girders and Trusses

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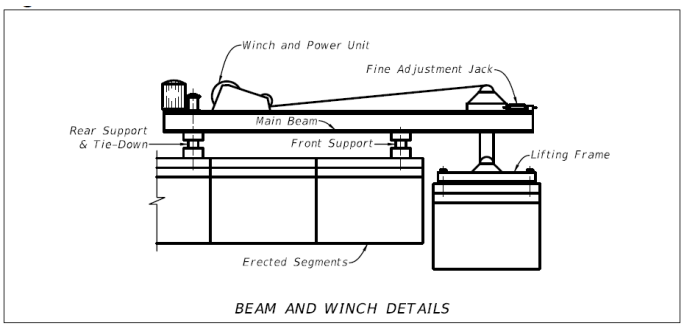
Other types of lifting and erection equipment

Beam And Winch



BEAM AND WINCH DETAILS

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Other types of lifting and erection equipment

Segment Lifters

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Other types of lifting and erection equipment

Overhead Gantries – Top Down Segment Delivery

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Other types of lifting and erection equipment

"The Wiggling Gantry" – Used for Curved Alignments

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Other types of lifting and erection equipment

Stiff Legged Derricks

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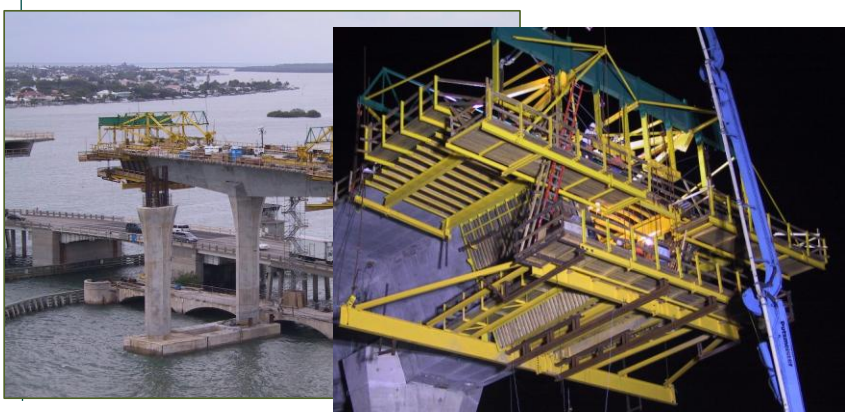
Other types of lifting and erection equipment

Cast-In-Place Options



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Other types of lifting and erection equipment

Beam Launchers

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QUESTIONS ?

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