BRIDGE INSPECTION

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DPW BRIDGE INSPECTION
ALL YOU MIGHT WANT TO KNOW AND MAYBE A LITTLE MORE
JUST WHAT IS A BRIDGE ANYWAY?
BRIDGE COMPONENTS

• Foundation
  • Piles
• Substructure
  • Pile Caps
  • End Bents
  • Piers
• Superstructure
  • Beams
  • Deck
  • Railing
  • All Other Attachments
• Approaches
Рис. 7. Забивная свая-стойка фундамента:
1 — гидроизоляция;
2 — поверхность земли;
3 — железобетонная балка ростверка;
4 — забивная свая прямоугольного сечения;
5 — плотный грунт

Рис. 8. Набивная висячая свая фундамента:
1 — гидроизоляция;
2 — железобетонная балка ростверка;
3 — набивная свая;
4 — наконечник обсадной трубы;
5 — слабые грунты
PILE TYPES

End Bearing Pile

Friction Pile

Weak Soil

Strong Soil or Rock

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End bearing piles are driven to refusal, or to the point where the tip impacts rock.
Friction piles are driven into the soil to a point where the frictional force on the sides of the pile are determined to match the required load capacity. In this method the tip bearing capacity is typically discounted. A subcategory of these piles are compression piles. These are piles that are driven closely together so that the outward pressure from the neighboring piles adds to the bearing capacity of its neighbors.
INSTALLATION

Hammer
• LB double action

Cushion
• Protective cushion for end of pile

Lead
• Railing system used to guide pile and hammer

Pile
• Either hollow core round or H

Template
• Anchor point for where pile is to be driven
• May be only a pre augered hole as a guide
Dynamic Formula  
- Uses the number of blows per foot in comparison to an empirical table to determine the load bearing capacity of a pile. These tables are compiled from data taken from many driven piles and are specific to the type of hammer being used.

Dynamic (Wave) Testing  
- Utilizes strain gauges attached to the pile to ascertain the load bearing capacity of a pile.

A test strike may be required after a proscribed period of time. Typically this is a measure of how far the pile will move with a hammer blow.

Piles typically gain bearing capacity overtime as surrounding soils gain equilibrium.
SUBSTRUCTURE

The portion of a bridge that is referred to as the substructure is really any portion of the bridge that is below the superstructure and is used to transfer the weight of the structure to the pilings. End bents and piers are constructed on the pile cap, a reinforced concrete structure that encapsulates the end of all of the piles for a support. End bents and piers on almost all of the bridges in our area are monolithic reinforced concrete.
BENTS OR PIERS

End bents or piers are designed to take the static and dynamic loading from the bridge superstructure and transfer it to the supporting piles.
SUPERSTRUCTURE

The superstructure portion of the bridge is basically everything that sits on the substructure. Beams and girders, decking railing, and basically anything attached to the upper portion of the bridge is considered superstructure.
Beams and girders typically, unless they are being replaced, are patched (concrete) or painted (Steel). In the case of a widening project, an additional beam may be set as a part of the project.
DECKING

The bridge deck is, obviously, the flat surface on the top of the bridge and includes the driving surface, side walks, and center islands.
RAILING

Railing for each project will likely be different. In most cases railing systems are rather utilitarian, consisting of a raised concrete wall and possibly topped with a metal railing system.
APPROACHES

Approaches are typically reinforced concrete slabs, designed to create a smooth interface between the bridge and the roadway. Typically plans will include dense graded subgrade below the slab to control any settlement issues. In some instances a sleeper slab will be included. This will support the edge of the approach and extend to the edge of the bridge deck. This is covered by a elastic asphalt expansion joint.
OVERALL

General Types of Bridge Repair
- Railing
- Decking
- Substructure Repair
- Superstructure Repair
- Widening
- Complete Replacement
LET'S START FROM THE BEGINNING

Project Specifications:
• Look for what is different from the usual projects
  • DNR restrictions
  • Army Corps restrictions
  • Any other work restriction
• Project specific requirements
  • Historic requirements
  • Railing requirements
  • Aesthetics
LETS START FROM THE BEGINNING

Project Plans

Pay attention to the maintenance of traffic plan. Make sure it is valid and that the contractor understands what is required.

Make sure the erosion control plan will work as it is put in place in the field.

Make sure that the demolition as shown in the plans matches plan to section views.

Attempt to verify that the plan quantities shown are adequate.
PRE CONSTRUCTION MEETING

As with all projects, this is where you will need to go on record to make sure the contractor is aware of everything that you have found in your review of the Project Documents.
MAINTENANCE OF TRAFFIC

All project signage must be in place at the appropriate time prior to the project start. Make sure that detours are adequately marked.

SOME PEOPLE WILL DRIVE AROUND BARRICADES. Make sure that proper measures are taken to protect workers.
EROSION CONTROL

Before any project work can start all erosion control measures must be in place and properly installed.
DEMOLITION

For the most part demolition on a bridge project is the removal of unsound material in order to replace it.

Approaches may be removed in order to replace them.

End bents and piers may be partially removed in order to prepare them to accept an extension.

Decks and to some extent superstructures are “sounded” to locate damaged sections.
DEMOLITION

Substructure can be damaged over time and require repair. This may entail both wet and dry excavation.
Chaining is a common method to sound a deck. The noise made by the chain while being dragged over the concrete will be noticeably different, a ringing sound on good concrete and a flat sound where bad. Paint the area that sound flat for removal.

Hammering is another method, banging on the concrete. The same ringing or flat sounds will be noted. This may help define the edges of areas located by chaining. Time consuming and not practical to sound an entire deck with this method. Can be used on substructure.
DEMOLITION
DEMOLITION

Hydro demolition is becoming more commonly used for deck surface demolition.
DEMO LITION

Hydro demolition uses a high pressure water jet system to remove unsound concrete from the bridge deck. This method will uncover small sections of unsound decking as well as all other areas. It is necessary to calibrate the jet pressure to meet the requirements of the project prior to beginning.

Pros:
• High likelihood that all unsound concrete will be removed from the deck
• All exposed rebar is cleaned and will not require sand blasting before patching.

Cons:
• More material is removed from the deck than the chipping method making overlay material quantities run over.
• Water and concrete debris runoff can be a problem to keep under control.
• Process can send concrete flying over a great distance, care needs to be taken to protect traffic and bystanders.
Patching is another method of demolition. It should be more properly named as chipping as it utilizes an air hammer/chisel to remove unsound material.

Partial depth patching refers to the removal of concrete to just below the first steel mat. Enough material need to be removed to allow the rebar to sand blasted to remove corrosion. * Bid quantities may not match what is sounded on the bridge for removal.

Full depth patching is the removal of concrete to just below the bottom mat of steel. Full depth patches are not common, bid quantities are to assign pricing in the event they occur.

Patching may also be required elsewhere on the sub or superstructure and are usually indicated on the plans and have their own bid quantity.
DEMOLITION
SUBSTRUCTURE REPAIRS

Substructure repairs typically vary in how the concrete is placed. Some locations lend themselves to the use of form work where others require a spray and form method.
SUBSTRUC TURE ADDITIONS

End bents may be extended or hammerheads added to piers to accommodate the bridge widening.
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Decks are typically repaired in a number of ways, each more complex than the next, all requiring some form of demolition:

- **Spot repair with epoxy repair mortar.**
  - **Pro:** Road back in service quicker. Can open to traffic in 45 minutes.
  - **Con:** Material sets up in 15 minutes or faster given ambient temperature, leaving little time to work. Make sure the product meets the current temperature.
DECKING

Decks are typically repaired in a number of ways each more complex than the next all requiring some form of demolition:

• Spot repair with concrete.
  • Pro: Least expensive method of repair.
  • Con: The surface of the patches are not perfect to the original surface and can be uneven when driving at speed. Edges of patched areas can offer and opening for water penetration over time.
Decks are typically repaired in a number of ways each more complex than the next all requiring some form of demolition:

- **Patching with overlay**
  - **Pro:** This method is the best for creating a uniform surface.
  - **Con:** Care must be taken to insure the new height of the bridge deck matches the approaches so as not to create a dip or bump and each end of the bridge.
RAILING

Railing for each project will likely be different. In most cases railing systems are rather utilitarian, consisting of a raised concrete wall and possibly topped with a metal railing system. If your contractor intends to use a slip form, make sure that the railing attachment bolts are installed in while the concrete is sufficiently wet to allow them to bond correctly and they are plum. Certain railing systems may call for cutout openings, Texas rail for example, these we will be covered in the plans and specifications.
RAILING

Thrie beam railing system
RAILING

Limestone railing system. Historic. Detailed specifications. 30th St over White River
RAILING

Texas Railing
Approaches will include subbase, drainage systems, asphalt expansion joints, and occasionally a sleeper slab.
COMPLETE REPLACEMENT

Delaware St over Buffalo Creek Bridge required to be open throughout construction as it was the only egress for about 60 houses.
COMPLETE REplacement
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