Bridge Construction

HIP POCKET GUIDE

Second Edition March 2008

Construction Bureau

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I. Introduction

“HIP POCKET” VERSION
Construction Manual

(A) Purpose Statement

The Hip Pocket version of the Construction Manual and related specifications was prepared for the convenience of project managers (PM) and inspectors. It is specifically intended for field use. The full manuals are too large to use efficiently in the field. However, there are often times when an inspector needs first-hand information about some of the more complex construction procedures. This document was designed to fill that need by being small and easy to handle, and convenient to store in an inspector’s pocket when not in use.

(B) Content of Manual

This manual contains various checklists and construction forms to aide the PM or the inspector during the various stages of construction. Users are reminded that this document DOES NOT CONTAIN ALL OF THE INFORMATION in the Construction Manual and the Current Specifications Manual. Each PM or inspector should be thoroughly familiar with the Construction Manual and the current specifications.

This Hip Pocket version contains the checklists and forms which are most important during the field inspection. If additional information is needed, users are directed to the full Construction Manual and current specifications.

(C) Organization

The Hip Pocket Manual is organized by construction progression and the Construction Manual.

Working Drawings Checklist
Environmental Policy
Bridge Foundation Construction
Pile Driving Inspection Checklist
Drilled Shaft Inspection Checklist
Bridge Substructure Construction
Bridge Superstructure Construction
Anchor Bolt Checklist
High Strength Bolt Checklist
Field Welding Inspection Checklist
Field Painting Inspection Checklist

(D) Limited Use Statement

Users are reminded that the Hip Pocket Manual can not transmit the degree of detail and the volume of material found in the full Construction Manual and the Specifications. This document is intended as a convenient reminder of the most important items. It is not a replacement for the full manual. Users should refer to the full manual whenever there is a question or possible additional instructions not found in the Hip Pocket version of the manual.

(E) Acknowledgments

The editors for the First Edition of this manual were Terry McDuffie, Robert Holmberg, Barry Fagan and Scott Overby ALDOT Construction Bureau.

We would like to thank the following individuals for the assistance: Lesley J. Morrissette-Maintenance Bureau, Lyndi Blackburn-Materials and Test Bureau, and Douglas Sylvester-Bridge Bureau.

Second edition editors include many Division Construction Personnel and a group effort from the Materials and Test Bureau.

(F) Pocket Guide History

	Date	Description
First Edition	July 2007	Initial Publication
Second Edition	March 2008	Updated format General updates Environmental-Policy Tolerances, High Strength Bolting Anchor Bolt Checklist Appendix A Guidance for Testing of Bridge items.

II. Shop & Working Drawings

These are excerpts from the ALDOT Standard Specifications for Highway Construction 2006 Edition and Special Provision 06-0204(2) and 06-0117(4):

105 Control of Work
105.02 Plans and Drawings
105.02(b) Shop Drawings

The Contractor shall supplement the construction plans with drawings for fabrication (Shop Drawings) and construction methods (Working Drawings). Shop drawings and working drawings shall be submitted as a part of the verification that the materials and methods selected by the Contractor for fabrication and construction will be in accordance with the requirements given in the contract and will not be detrimental to the quality of completed roadway facility.

(A) Shop Drawings

1. Preparation of drawings

When shown as a contract requirement, the Contractor shall prepare and submit shop drawings for approval. Shop drawings shall be the proposed fabrication details for structural members and components.

Shop drawings for structural steel members and components shall be prepared on 22 inch {559 mm} x 36 inch {915 mm} size plan sheets.

Shop drawings for structural members other than structural steel shall be prepared on 22 inch {559 mm} x 36 inch {915 mm} size plan sheets or, with prior approval of the Bridge Engineer, on 11 inch {280 mm} by 17 inch {430 mm} sheets.

The Contractor shall carefully verify and shall become fully responsible for the correctness of all dimensions other than the principal controlling dimensions shown on the plans. The Contractor shall immediately advise the Engineer of any errors or discrepancies that are found during the preparation of the drawings.

All drawings shall be clear and complete. The signature of the preparer shall be shown on all drawings.

Any details not sufficiently shown on the plans will be furnished by the Engineer upon request by the Contractor.

2. Submittal

Shop drawings shall be submitted by the Contractor to the ALDOT Bridge Engineer for review and approval. Two copies shall be submitted for an initial review. At the completion of the initial review, one copy will be returned to the Contractor that will be marked "No Exceptions Taken" or marked with corrections to be made. Resubmittal of two copies will be required until the drawings are marked "No Exceptions Taken".

3. Distribution of drawings for Structural Steel

After the Contractor receives the "No Exceptions Taken" copy of the drawings, the original drawings shall be submitted to the Bridge Engineer with one copy. The original drawings will be stamped approved and returned to the Contractor for the production of sets of copies for distribution.

The Contractor shall submit four copies of the approved and stamped drawings for distribution. Additional copies may be submitted for distribution if requested by the Engineer.

Revisions of the shop drawings after approval shall be made on the original drawings. All revisions shall be clearly noted and dated on the drawings. The revised original and one copy shall be submitted to the Bridge Engineer for approval. The approved revised originals will be returned to the Contractor. The Contractor shall submit four copies of the revised original for distribution.

The Contractor shall submit one set of satisfactory reproducibles (Mylar or equal) of the final approved shop drawings. The reproducibles shall be delivered to the Bridge Engineer at the completion of the fabrication work.

4. Distribution of drawings for members other than Structural Steel

After receiving the approved copy of the drawings, the Contractor shall submit ten copies of the approved drawings for distribution by the Department. Additional copies may be submitted for distribution if requested by the Engineer.

5. Time allowed for review

Ten calendar days shall be allowed for each review of each set of drawings containing five sheets or less and two days shall be allowed for each sheet of each set of drawings containing more than five sheets.

If the review is not completed within the number of days allowed, and the delay is not the fault of the Contractor, the delay will be considered for an extension of contract time.

6. Approval

The approval of drawings will not release the Contractor from being solely and fully responsible for the accuracy of the drawings. Extra work that may result from errors in the shop drawings shall be done without additional compensation.

7. Beginning fabrication upon approval

Fabrication shall not begin until the drawings have been approved. There will be no compensation for, or acceptance of structural members and components that are fabricated prior to approval of the drawings.

(B) Working Drawings (105.02(c))

1. Preparation of drawings

The Contractor shall submit working drawings to supplement the plans. Working drawings shall be submitted to provide a complete illustration of the construction methods and materials proposed for use by the Contractor. Design calculations shall be submitted with the drawings.

Working drawings, and design calculations, shall be submitted for the construction of sheeting and shoring, cofferdams, steel erection for continuous spans, falsework, stay-in-place forms and any other construction process where the Engineer determines that working drawings are required.

The drawings and calculations shall be submitted well in advance of the point in time when the work will be performed. The signature, seal, and date of signature shall be placed on all details and design calculations by a Professional Engineer that is licensed in the State of Alabama and not employed by the ALDOT.

2. Submittal

Six copies of working drawings and one copy of design calculations shall be submitted by the Contractor to the ALDOT Construction Engineer.

Working drawings for work on or over the railroad right-of-way must have the approval of the railroad company before the work will be allowed to begin. The Contractor shall submit four extra sets of drawings and one extra set of the design calculations for use by the Construction Engineer in obtaining a review by the railroad company. The Contractor shall make the submittal far enough in advance of the need for the work to begin so that the railroad company will have ample time to review the drawings and design calculations.

3. Distribution

The drawings and design calculations will be checked for completeness. The drawings will be distributed to ALDOT construction personnel for inspection of the work. The distribution of the drawings will not release the Contractor and the Professional Engineer from being solely and fully responsible for the accuracy and adequacy of the drawings. Extra work that may result from errors in the working drawings and design calculations shall be done without additional compensation.

4. Beginning work shown on working drawings

The work shown on the working drawings shall not begin until the drawings have been received by the ALDOT field inspection personnel. There will be no compensation for work that is performed prior to the point in time that ALDOT personnel have the drawings for use in inspecting the construction work.

(C) Compensation for Drawings

There will be no direct payment for the preparation and submittal of shop drawings, working drawings and design calculations. The cost of the drawings and calculations shall be included in the contract unit prices for the items of work.

1. General Information:

Below is a checklist to assist you when the contractor inquires about submittals. The specification is listed to the left side. The number of copies is specified. The Recipient is listed. Included are submittals that relate to notifications, pile driving and drilled shafts. There may be additional required submittals if there are bridges constructed at more than one site.

2. Required submittals that relate to Bridge Construction

PROJECT NUMBER ____________					COUNTY________________				
						SITES			
Spec.	# of Copies	Submitted, days after contract award	FORM	CLASS	DESCRIPTION	A	B	C	D
SHOP DRAWINGS-Submitted to the <u>Bridge Bureau</u> (*The review process is specified in 105.02, basically 2 copies originally, then 2 after review, then final 4 copies)									
105.02(b)	*	30			Girders				
105.02(b)	*	30			Bearings				
511.03	*	30			Elastomeric Bearings				
105.02(b)	*	30			Misc. (Armor Plates, Anchor Bolts, Guard Rail Anchors)				
508.03(d)2e	*	30			Anchor Bolt installation Plan-Engineer				
508.03(b)	1	30	BBF-11		Notification of Structural Steel Fabricator & completed Bridge Form BBF-11				
513.03(d)	1	30			Precast Prestressed Concrete Pile Splicing				
521.03 and 522.03	*	30			Written notification of Paint Coating System & Supplier, to Project Manager with a copy to the Bridge Bureau				
Falsework-Submitted to the <u>Construction Bureau</u> unless noted (6 sets of									

drawings 1 set of calculations except if the RR is involved (Special Provision), 4 additional drawing sets and 1 additional set of calculations will be required). See note 1and note 2									
501.03(j)	6	NS		1	Stay in Place Forms				
501.03(j)	6	NS		1	False work-Caps & Columns(2)				
510.03(c)6c	6	NS		1	Falsework-Overhang to include for screed rail supports for transverse screed(1)				
508.03(d)1	6	NS		2	Structural Steel Erection Plan				
510.03(c)6k	6	NS		1	Placement of Crane on Bridge				
Special	5	30			Navigational Lighting				
521.07	6	NS			Surface Preparation Plan for the Removal of Existing Coatings				
215.03 (c) 503.03(d)1	6	NS		2	Cofferdams or Sheeting & Shoring (Adjacent to the Rail Road)				
501.03(j)	6	NS		2	Class II False Work				
505.03(o)	6	NS			Sheet Pile Walls				
Spec.	**# of Copies**	**Submitted, days after contract award**	**FORM**	**CLASS**	**DESCRIPTION**	**A**	**B**	**C**	**D**
Submittals Directly to the Bureau of Materials and Test									
501.02(c)1	1	NS			Mix Design for Structural Portland Cement Concrete				
504.02	1	14			Mix Design for Pile Encasements				
505.03(d)1	1	30 Prior to driving	C-14		Proposed Pile Driving Equipment Data				
506.10(a)5	1	NS			CSL Testing Results-Engineer				
Submittals to the Engineer (Project Manager) which get routed to the Construction or Bridge or M&T Bureau									
522.03(e)	1	NS			Bridge Joint Seals-Shop Drawings-Engineer				
Plan note, 520.03(b)	1	NS			Raising Existing Bridges-Plans for Falsework and Equipment list-Engineer				
502.03(d)1	1	NS			Reinforcement: Splicing Details				
506.03(a)	2	30 days after NTP			Drilled Shaft Installation Plan				
108.03	1	note 6	C-10		Schedule of Operations				
506.03(c)2	1	note 4			Excavation Log-Engineer				

505.03(h)3a	3	note 5	C-15C		Proposed (Steel) Pile Lengths-Engineer				
505.03(h)3b	3	note 5	C-15C		Proposed (Concrete) Pile Lengths-Engineer				
CM, 2-154	3	note 7,8	C-35 & 35-2		Drilled Shaft Pouring record				
Submittals to the Engineer (Project Manager) which get routed to the Construction or Bridge or M&T Bureau (continued)									
BGN 13	1	Prior to const.			Traffic Protection (Sketches and plan)				
OTHER: Bridge Demolition Plan for structure removals over CSX Railroads									

NOTES	
1. Any Temporary bracing that would provide stability to the girders; require a submittal to the Construction Bureau. (Special Provision).	
2. Formal submittal procedure for Class 1 Falsework always required. Other class 1 falsework that was previously submitted and distributed for use on a project in Alabama shall be signed, sealed and dated again by the professional Engineer that originally sealed the drawings. The Professional Engineer shall clearly indicate on the drawings and calculations that the resubmittal is applicable to the new work. SP-06-204(2)	
3. NS=not specified, "well in advance", but prior to work beginning.	
4. Two copies of the legible, final log shall be furnished to the Engineer within 24 hours after a shaft excavation is completed and accepted.	
5. Upon completion of the load test.	
6. Prior to Preconstruction Conference.	
7. Upon completion of shaft.	
8. Per memo dated April 5, 2007, a signed copy of the excavation log shall be submitted with the C-35 & C-35-2 Drilled shaft pouring record and graph.	
9. CSX RR projects require a bridge demolition plan to be submitted well in advance of the point in time when the work will be performed. The demolition plan requires approval of the railroad company before the work will be allowed to begin. See the railroad agreement for specific submittal requirements.	

III. ALDOT ENVIRONMENTAL POLICY

(A) Statement

It is mandated by law that ALDOT protect the environment as we build our roads and bridges. The ALDOT environmental policy statement reflects this by stating – "It is the policy of ALDOT to conduct all operations, including ALDOT facilities and construction projects, in a manner that is environmentally responsible."

The intent of the policy is promoted in several ALDOT guidelines and contract documents that govern ALDOT construction. Below is a partial listing of documents and specific references that should be reviewed prior to ground disturbance at a bridge site. Many of the documents referenced can be found at the Environmental and Technology page of the ALDOT Construction Bureau website. For additional information and assistance, please contact your division stormwater coordinator or the staff of the Environment and Technology Section of the Construction Bureau.

- Stream, waterbody and wetland encroachments – article 107.21 (special provision 06-0102)
- Protection of endangered species and habitat – plan notes and/or special provisions modifying section 107
- Project specific environmental requirements –plan notes or contract special provisions
- General specification requirements regarding water quality protection – article 108.04 (special provision 06-0352)
- General erosion and sediment control requirements – section 665 (special provision 06-0352)
- Required BMP details – special drawings ESC-100 - ESC-502, additional special project details
- Suggested Dewatering BMPs – special drawings ESC 503 – ESC-503 – ESC-505
- Contractor inspection requirements - article 108.04 (special provision 06-0352)
- ALDOT inspection requirements – ALDOT Stormwater Inspection Guidelines

IV. ALDOT CONSTRUCTION MANUAL 2001 EDITION

(A) Bridge Structures(2:6)

On bridge work, as on other work, the Project Manager has the direct responsibility for the inspection of the construction of the bridge to the lines and grades specified on the plans and in accordance with the Specifications. Any matter that arises that must be decided at a higher level should be handled through the District Engineer to the Division Construction Engineer and then to the Construction Bureau if necessary. The Construction Bureau will contact the Bridge Bureau, Bureau of Materials and Tests, etc., when matters concern them.

The Project Manager, after the structure has been staked out and the layout double-checked by an independent survey party, should examine the site with the bridge plans in hand. If any changes of consequence have occurred since the original location, i.e. any flood conditions, changes in stream channel, improper railroad horizontal clearances, etc., the District Engineer should be contacted and made aware of the changed conditions. A decision can then be made and the plans revised, if necessary. The Project Manager should make sure the Contractor understands the procedures for submitting shop drawings, working drawings, pile driving hammer submittals, drilled shaft installation plans, etc., so that they can be submitted early enough for the required review. Where utilities or railroads are involved, approval is often required from the utility or railroad and ample submittal time should be allowed. The Contractor should be made aware of what materials will be tested and require a test report so that the work will not be delayed due to the lack of adequate material testing. These items can usually be discussed at the pre-construction conference.

(B) Bridge Structures (Substructures) (2:6:A)

The Project Manager needs to be aware of the accuracy required during the substructure construction. Mistakes, whether plan or construction, which are not found and corrected during this stage of construction become extremely difficult and costly to correct during or after the construction of the superstructure.

All work should be carefully inspected during all phases of this construction including excavation, backfill, placement of steel reinforcement, etc., to insure that the substructure is constructed to the correct lines and grades. Line and grade should be checked upon completion of each substructure unit to ensure that they meet specification tolerances. If at any time the Inspector finds a construction mistake or conflict with the plans, then he/she should make the Project Manager and Contractor aware of this and get it resolved before construction continues.

(C) Bridge Foundations (2:6:A:1.1)

1. Description of Work

The foundation of a bridge is the natural rock or other material on which the footing is founded. The plans will show soil information at the bridge site and an approximate elevation to which each footing is to be carried, based on core boring information. Boring information will be located in the plans. The Inspector and Project Manager must watch for any changes in foundation conditions from those shown on the plans or indicated in the borings. If it becomes apparent that satisfactory bearing material is reached above that shown on the plans, or if the material encountered at the depth of footings shown on the plans is apparently still not satisfactory, the Inspector should promptly notify the Project Manager.

The Division Construction Engineer may then make a decision as to what the foundation elevation should be, if needed. If it is determined that the foundation elevation needs to be raised any or lowered more than five feet the Construction Bureau should be contacted to determine if these changes will conflict with the scour prediction or the column design size.

Most bridge foundations can be approved at the Division level. However, for deep river pier foundations and other complicated cases, the Construction Bureau should be contacted through the Division Office to determine whether or not they need to make an inspection before the formwork or concrete placement is started.

The Contractor is also charged with the responsibility of notifying the Engineer of any changes from plan soil data as excavation progresses. The specifications provide for additional investigation by drilling or probing in cases where needed. {See Items 215.03(a) 3 & 215.03(a) 4} Ordinarily, such investigation is ordered only after consulting the District Engineer.

The Contractor must not be permitted to excavate wide, open holes, especially near embankment or footing locations where erosion might be induced. In excavating for a lower pier foundation, precaution must be taken to prevent any ground movement that might disturb foundation conditions at a pier higher up on the stream bank. When direct bearing footings are specified, the foundation material below the bottom of footing elevation shall not be disturbed.

The method of excavation for a foundation will depend on the type of material present and the location of the footing. Because of the different types of equipment available to the Contractor, there are very few excavation problems encountered when excavating on dry land. When excavating in water, which is normally inside a cofferdam, excavation problems are more common.

The primary method for excavating inside cofferdams is with an airlift. The airlifting operation can be an effective operation if it is performed correctly, but it can be totally ineffective if it is not. The effectiveness is primarily based on two things: (1) the depth of the water and (2) the height of the discharge end of the airlift pipe above the surface of the water.

The airlift operates by having compressed air fed into the bottom of the airlift pipe. The air expands and rises upward to the surface of the water through the pipe. This creates suction in the bottom end of the pipe, which pulls the loose material in the excavation up through the pipe (the greater the depth of waters the greater the suction). Once the air reaches the surface of the water it loses its pulling ability; therefore, the airlift operates best when the discharge end of the pipe is near the surface of the water.

When a contractor is using an airlift, the discharge end of the pipe is normally above the top of the cofferdam sheets. The height of the cofferdam above the water is therefore, very important since clear water coming out of the discharge end of the airlift normally indicates that the excavation has been completed and it is ready for the underwater inspection. The contractor should be made aware at the pre-construction conference that if the inspection shows that the excavation is not completed, then he/she will be required to perform whatever work is necessary (employ a diver, cut holes in his/her cofferdam sheets to discharge through, etc.) to complete the excavation. By making him aware of this at this conference he/she should make an extra effort to insure the excavation is completed before the underwater inspection.

2. Footings

Footings are basically of three types; direct bearing footings, pile footings or drilled shafts.

a. Direct Bearing Footings

Direct bearing footings are classified as one of the following three types:

i. Rock footings are reinforced concrete footings, which must be securely keyed into solid rock to prevent sliding of the structure. These footings are the smallest of the direct bearing footings.

ii. Spread footings are reinforced concrete footings and are larger than rock footings. They are placed on stable soils with bearing values that are less than those required for rock footings.

iii. Seal concrete footings are normally the largest direct bearing footings. These are placed on solid rock and other hard materials, such as Selma Chalk, and are poured underwater in cofferdams. These footings are constructed where it is impractical or impossible to de-water a cofferdam and construct a footing in the dry. Since it is usually impossible to inspect the foundation material after excavation, an underwater inspection by the Department's divers must be made and documented on all footings which are to receive seal concrete, except pile footings, unless approved otherwise by the Construction Engineer. After the Contractor notifies the Project Manager that a footing is ready for inspection, the Engineer should immediately contact the Construction Engineer to schedule the divers for the inspection. The inspection requirements are given in our Specifications and by plan notes. There are times when seal concrete is used with rock footings, spread footings, and pile footings for the purpose of sealing a cofferdam. In such cases structural footings would then be constructed on top of the seal concrete in the dry. When a rock or spread footing is to be constructed on top of the seal concrete, these footings should be doweled to the seal concrete. If not provided in the plans, details for this doweling should be obtained from the Construction Bureau since the doweling will be dependent on the type and size footing required.

b. Pile Footings

Pile footings are used in areas where foundation materials will not provide enough support for direct bearing footings or where scour protection is needed. These footings will normally utilize steel H piles or pre-cast/pre-stressed concrete piles for their support.

The following requirements for the installation of piles will also apply to pile bents as well as pile footings.

The goal of the Pile Driving inspector should be to install the piles in their desired location, within allowable tolerances, to minimum penetration (or refusal if required by the plans), which will provide support for the structure without settlement. There are many variables, which should be considered in achieving this goal. Some of the variables are design loading, pile type and size, soil conditions (core borings), estimated and minimum tip requirements, pile driving hammers, pile groupings, and pile stickout length during driving. These and other variables make it impossible for pile driving to be an exact science. Due to this fact, there is no substitute for engineering experience in pile driving. Good, sound engineering judgment must be exercised during driving operations. The Project Manager should always be involved in pile driving operations and should never place an inexperienced inspector in charge of this work.

i. Pile Driving Hammers

All pile driving equipment, including the hammers, must be approved by the Bureau of Materials & Tests prior to use on the project. The contractor should provide, as soon as possible, the information required in Section 505 of the specifications.

Selection of the hammer should be based on the work to be accomplished, not on the equipment owned by the contractor. The contractor may have to rent equipment to suit the size and kind of piles to be driven and the existing soil conditions in order to obtain adequate penetration and bearing.

As a general rule, piles should be driven with the heaviest ram that can be used without damaging the pile. A hammer with a heavy ram and short stroke will do a better job of obtaining penetration while minimizing damage than a hammer with a light ram and long stroke with the same energy rating.

Hammer “kinds” include gravity (drop) hammers, air/steam hammers, diesel hammers and hydraulic hammers. Gravity hammers should not be used except by special permission. Diesel hammers have become most popular with contractors because of economics; however, those with relatively light ram weights may not achieve the desired results in some soil conditions irrespective of their “rated energy” level. They can only be used on concrete piles when the width or diameter of the pile is less than 20 inches.

Hammer “actions” include single acting, double acting and differential acting. Single acting hammers have a power force exerted to assist in raising the ram; the fall of the hammer is by gravity alone. Double acting hammers have a power assist in both directions with spent gases being exhausted with each stroke. Differential acting hammers operate as double acting hammers except that, through valving, a portion of the gases are re-circulated (rather than exhausted) to assist in the powered down stroke. Double acting hammers operate at a faster blow rate than do single acting hammers. Differential acting hammers utilize heavy rams (comparable to single acting hammers) and operate at relatively fast blow rates (comparable to double acting hammers).

Hammer “types” includes open types and closed types. On open type hammers, the top of hammer is open where the ram will be exposed during driving. On these type hammers, the height of fall of the ram will vary depending mainly on the driving resistance of the pile; therefore, the height of fall must be recorded and multiplied by the weight of the ram to determine the driving energy. On closed type hammers, the ram will not be exposed and the length of stroke will be supposedly constant; therefore, the energy delivered to the pile will be a function of bounce chamber pressure. Consequently, bounce chamber pressure must be monitored as described in the specifications.

Some hammers have adjustable fuel pump settings by which the stroke and energy of the hammer can be varied. The purposes of these variable controls are to permit initially setting a pile without risk of damage (i.e., tension cracking in concrete piles) and to permit cutting back the energy of the hammer in hard driving situations to protect the hammer and pile from damage. When wave equation analysis is performed on a driving system with adjustable settings, specific guidance as to the use of these settings will be noted in the information received from the Bureau of Materials and Tests. The inspector must insure that these guidelines are followed.

ii. Protection of Piles

Piling should be carefully handled at all times to prevent damage. Pile Driving Leads must be designed to hold the pile in proper position during driving while at the same time allowing freedom of movement of the pile and hammer during installation. Pile caps (driving heads) must be designed to fit both the hammer and the pile being installed to prevent damaging the pile. Pile cushions should be installed on concrete piles, as shown on the approved Pile and Driving Equipment Data Forms, between the driving head and pile to prevent local damage near the upper end of the pile. The driving force of the hammer must be applied in line with the longitudinal axis of the pile and evenly across the end section to prevent damage. Where piles are being driven through very soft and unstable material, such as muck, care should be taken not to apply hard driving forces until some resistance is obtained at the pile tip. Hard driving which would drive the pile away from the hammer may cause concrete piles to crack and make them unacceptable. Specific guidelines for driving through soft material may be included with the hammer approval and the graph of pile capacity versus blow count, submitted to the Division Construction Engineer by the Bureau of Materials and Tests. The Project Manager should insure that the contractor follows these guidelines during pile installation. Care should be taken not to overdrive steel piles once the tips reach or penetrate a hard stratum. Overdriving may cause the tips to split and/or the upper portion to be unduly damaged.

When concrete piles are driven with pre-stressed strand extending out of the top of the pile, the driving system (pile cap and cushion) must be designed to protect the strands from damage. If these strands are damaged a repair procedure must be submitted to the Construction Engineer for approval.

iii. Penetration of Piles

Piles must be driven to sufficient depth to provide adequate bearing. The pile tips must also be placed to a depth where scour (erosion) will not present a future problem in rivers arid streams. Where minimum tip elevations are shown on the plans, the piles must be driven to that elevation first, and then consideration must be given to bearing capacity. Pile tips should never be left on a thin hard layer of rock or soil underlain by highly compressible soil. Such a situation will lead to long-time settlement of the piles under the design load.

Several aids are available to help with penetration problems. Pile points or shoes will assist in penetrating hard layers and at the same time protect the tips of the pile from damage. Spuds are sometimes used to break through thin rock layers prior to installing the piling. Pre-drilling (pilot holes) may also be used to assist in obtaining penetration. The use of short pile lengths (short stick-out above the ground) will also help in obtaining penetration. By utilizing short lengths, the driving energy will be better transmitted to the pile tips. Jetting will assist pile installation in sandy soils where penetration cannot be obtained by driving alone. If jetting is used, final bearing and penetration (last three to ten feet) should be obtained by driving without the use of jets.

iv. Location of Piles

Piles should be driven within the specification tolerances at the location shown on the plans. Piles driven out of position will cause eccentric loading and will reduce the safety factor of the structure. Also, this may cause some piles to be overstressed. Fixed leads are the best assurance to hold piles in proper position during driving; however, most contractors use swinging leads. Where swinging leads are used, it is necessary that a rigid template (preferably steel members) be used at the ground or water line to guide the piles during driving. The template must be securely anchored in position. Where bearing is reached on a rock stratum, care should be taken to seat the piles on the rock without overdriving the piles. Overdriving will cause the piles to move out of position.

The inspector should check each pile driven to determine if it is within the specification tolerances. The results of these inspections should be recorded in the inspector's daily diary. If any piles do not meet these requirements an accurate drawing indicating the actual location of all out of tolerance piles in a particular structure should be prepared and submitted to the Construction Engineer to determine if corrective procedures are necessary.

Location and alignment tolerance (505.03(e)1)
Pile Trestle Bents and Pile Abutments-maximum deviation of 1.5 inches from exact position designated.
Foundation pile in footings of Piers or Abutments-maximum deviation of 3 inches from exact position designated.
If the location or alignment tolerances are exceeded, the error will be evaluated by the Bridge Engineer by submittal. For required stipulations in the submittal see item 505.03(e)1 in the ALDOT Standard Specifications for Highway Construction, latest edition.

v. Determination of Adequate Bearing

Pilings obtain bearing in one of three ways: (1) End bearing-the entire load of the pile is supported by a firm stratum at the tip of the pile. (2) Skin friction - the load is supported by the friction developed between the surface of the pile and the soil through which it is driven, and (3) A combination of end bearing and skin friction.

Practically all of the piles driven in Alabama are either steel HP sections or pre-cast/pre-stressed concrete piles. Adequate bearing is determined in one of three ways: (1) by static load testing, (2) by dynamic load testing or (3) by driving to refusal on rock.

In general when the intent is to drive piles to refusal on rock, a note to that effect will be included on the plans. (505.03(f)6) Refusal is defined as 240 blows per foot or 20 blows per inch.

Test piles are used to determine the required penetration and bearing of a group of piles in the same general area with generally the same soil conditions. The locations of the test piles and the bents each test pile will represent are normally indicated on the plans. If not, the Construction Engineer should be contacted for guidance on making these determinations.

Driving of all test piles should be monitored by the Engineer or his/her inspector and the results recorded on Form C-15A, "Test Pile Record".

Test piles should be driven to an estimated hammer blow count, which corresponds to the capacity of twice the design load. This blow count will be determined by wave equation analysis. The Bureau of Materials and Tests will run a wave equation analysis on each pile driving hammer (and equipment) submitted by a contractor for approval. For each hammer and equipment approved they will submit a graph of pile capacity versus blow count to the Division Construction Engineer for distribution and use on the project. The required blow count for twice the design load can be obtained from this graph. After a test pile is acceptably driven to the required blow count, a static load test may be applied.

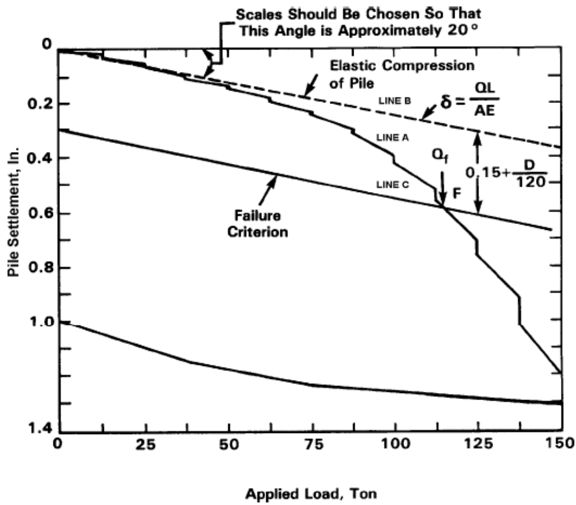
Dynamic load tests, when used, may be correlated to a static load test. The test pile for correlation will be dynamically monitored during driving, statically loaded, and correlated to a dynamic restrike within 48 hours of the quick load static test. When dynamic load tests are to be used, the Geotechnical Engineer in the Bureau of Materials and Tests should be notified at least seven days in advance of driving the test pile which is to be loaded. The Geotechnical Engineer will provide the necessary personnel and equipment for performing this test.

Where static load tests are to be used, the inspector should check the equipment and loading apparatus to assure that the required loads will be transmitted to the test piles. Also, acceptable methods must be used to determine the settlement of the pile under the imposed loads. All hydraulic jacks and gauges should be checked and tested prior to use. Each jack and gauge should be calibrated together and a calibration curve should be developed and used to determine the proper loads to be applied. *(Jacks must be calibrated by M & T within the last 6 months. Once calibrated, it may be used on any project)*. Jacks that are not in good condition should not be used. Anchor piles for jacking frames should have enough penetration so there will be no movement (uplift) of the anchor pile during the test. The frame should be very rigid so there will be minimal deflecting and no bending of the frame.

Upon completion of a static quick load test, the data should be plotted as shown in the following graph, connecting data points with straight line segments (Line A). Calculate and plot QL/AE at the maximum load, then connect this point with a straight line (Line B) to graph origin where load and settlement equals zero. Calculate O.15+D/120, then draw a line (Line C) parallel to Line B offset this distance. The ultimate capacity of the tested pile, Q f is equal to the load that corresponds to the intersection of line A and line C. If the value of Q f equals or exceeds twice the design load the test passes. Otherwise the pile should be re-driven and loaded again in accordance with the specifications.

vi. Variables

Q = Maximum Load (kips) (Note: To convert from tons to kip multiply by 2.)
L = Pile Length (in) from location of settlement instrumentation to bottom of pile.
A = Pile cross-sectional Area (sq. in)
E = Elastic Modulus of Pile Material (ksi)
D = pile Diameter (in) or Width (in



The Elastic Modulus of pile material (E) should be determined as follows:
For Concrete Piling:
If the PDA is used to monitor the pile in question, the Modulus of Elasticity (E) will be provided by the operator of the PDA Otherwise, it should be calculated as follows:

$E = 60{,}000\sqrt{f'c}$

f c = Compressive Strength of pile concrete in psi (5,000 psi unless noted otherwise on bridge plans)

For f c = 5,000 psi:

$E = 60{,}000\sqrt{5000} = 4{,}242{,}640$ psi

E = 4,242.6 ksi

For Steel Piling:

Size	A (sq in)	D (in)	E {ksi)
HP 14x117	34.4	14	29,000
HP 14x102	30.0	14	29,000
HP 14x 89	26.1	14	29,000
HP 14x 73	21.4	14	29,000
HP 13x 73	21.6	13	29,000
HP 12x 74	21.8	12	29,000
HP 12x 53	15.5	12	29,000
HP 10x 57	16.8	10	29,000
HP 10x 42	12.4	10	29,000

Once the test piles are driven and tested, a determination may be made of the proposed pile lengths required for the structure. All piles should be driven to approximately the same penetration and driving resistance as proved to be satisfactory by the test pile. Driving resistance is recorded in" blows per foot" for all pile types.

The results of a static quick load test should be recorded on Form C-15B, "Pile Loading Record-Quick Load Test". As soon as a load test is finished, this form and the attached graph should be completed and submitted through proper channels to the Construction Engineer along with the Test Pile Record. The Bureau of Materials and Tests will use the information obtained from the load test to revise the bearing curves to provide a better estimation of bearing for a specific blow count. These revised curves will be submitted to the Division to be used for estimating the bearing of the production piles on Form C-16, "Driving Record of Piling". This will not require any delay in the driving of production piles. Upon completion of a passing load test, the driving of production piles to the proven blow count of the load test may begin. The estimated bearing for each production pile, as recorded in the last column of Form C-16, may be determined later upon receipt of the revised bearing curves.

vii. Piles Placed in Seal Concrete

If a pile footing is being constructed inside a cofferdam and seal concrete must be poured to seal the cofferdam, then the piling will be cut off to the correct elevation after the seal concrete has been poured and the cofferdam de-watered. No dowels are needed where seal concrete is used with pile footings.

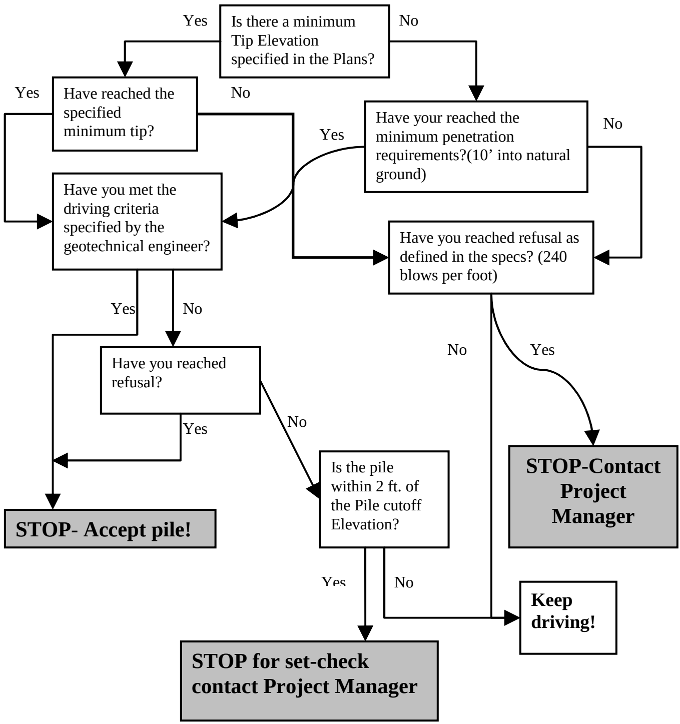
Pile Driving Checklist

All of the following items must be answered yes unless pre-approved by the Geotechnical engineer prior to driving.				
Contractor & Equipment Arrive On-Site		**Yes**	**No**	**NA**
1	Is the Contractor using the same approved hammer system he used during the test pile program? (see Form C-14, 505.03)	Y	N	
2	Do you have the approved pile driving equipment data form (C-14)? [503.03(d)]	Y	N	
3	Do you have the authorized lengths letter? Is it approved? [505.03(h)]	Y	N	
4	Is the contractor following the Plans and the Pile Driving Equipment Data Sheet C-14(right sequence, template at right height, etc.)? [505.03 (d, e, f)]	Y	N	
5	Has the contractor met the requirements for Protection of Existing Structures (vibration and excavation)? [505.04(p)]	Y	N	
6	Has the excavation been completed for the footing in accordance with 505.03(f)?	Y	N	
7	In the abutment, has the fill been completed in accordance with the plans and specifications?	Y	N	
8	Do the pilot holes meet the requirements of 505.03?	Y	N	
9	If a cofferdam is required, has the contractor submitted his design in accordance with the specification?[503.03(d)]	Y	N	
10	Does the pile drive head comply with 505.03(b) 3?	Y	N	
11	Does the cap block (hammer) cushion meet the requirements of 505.03(b) 4 and the approved pile driving equipment data form (C-14)?	Y	N	
12	Does the pile cushion meet the requirements of 505.03(b) 4 and the approved pile driving equipment data form (C-14)?	Y	N	
13	If jetting is required, do the jets and equipment meet the requirements of 505.03(c)?	Y	N	
14	If followers are to be used, were they approved by the engineer or specified in the contract documents? [505.03(c)4]	Y	N	
15	Do you have a reference elevation so that you know where the pile cut-off is and can determine tip elevations and penetration?(Plans)	Y	N	
16	Do you have the required inspection and reporting forms (C-14, C-15, and C-16)?	Y	N	
Piles Arrive On Site				
	Concrete Piles	Y	N	
17	During delivery, are the piles being lifted by the correct number of pickups and at the proper location? Standard Drawing PSCP-1, 834.05, ALDOT 367-89	Y	N	
18	Do the plans have the required information on the pile (QA/stamp, Member number, Pour number, Pour date, ALDOT Cert. Conc. Tech. #)? (ALDOT 367-89)	Y	N	
19	Is the casting date older than 21 days for the normal installation and has the concrete reached its 28 day strength? (Std.drw.PSCP-1)	Y	N	
20	Is the length/cross-section/size/pre-stress configuration correct for your job? (Std.drw.PSCP-1)	Y	N	
21	Did you physically measure the piles? (Pile Tolerances ALDOT 367-89)	Y	N	
22	Are the lifting eyes removed and epoxied? (Std.drw.PSCP-1)	Y	N	
23	Are there spalling/cracks or other damage visually apparent [505.03 (i) and ALDOT367-89]	Y	N	
	Any damage noted should be reported to your supervisor for evaluation.	Y	N	
Piles Arrive On Site (continued)				

	a) If so, explain ____	Y	N	
24	Are the pre-stress strands cut-off flush with end surfaces of pile and painted with an approved epoxy immediately after cutting? (Std.drw.PSCP-1)	Y	N	
25	For storage on job site, is dunnage placed at correct lifting position and is placed so that it won't settle? [501.03 and ALDOT 367-89]	Y	N	
26	Verify other special details that are in the specifications, such as vents, center hole jet pipes, voids or others. Explain? (Std.drw.PSCP-1)	Y	N	
	Steel Piles	Y	N	
27	Are there any defects on the pile?(834.03) If yes please explain ____________________________________	Y	N	
	Piles Arrive On Site (continued)	**Yes**	**No**	**NA**
28	Did the contractor supply you with the mill certification on the piles? (836.01)	Y	N	
29	Are the size and length and type correct for this job? Plans	Y	N	
	a) Pipe	Y	N	
	b) H pile	Y	N	
	c) Concrete filled shell	Y	N	
	d) If painted- thickness verified? Plans, (521)	Y	N	
30	Are the point protectors correct for this job? [Plans, 834.03, 505.03, Special Provision]	Y	N	
31	Did the contractor install the pile points in accordance with the specification? [834.03, 505.03]	Y	N	
32	Did the contractor use the correct procedure for splicing piles?[Std.drw. I-131 and 505.03(j)]	Y	N	
	Begin Pile Driving			
	TEST PILE/PRODUCTION PILE			
33	Has all pre-driving data been entered on the pile driving record? (C-15A &A2, C-15B &B2, B3, C-16)	Y	N	
34	Has the "Minimum Tip Target" mark been determined and entered? Plans (Ref elev.-minimum tip).	Y	N	
35	Has the "stop for spot check" mark been determined and entered? (Best Practices, [Pile length - 2-(cut-off elev.-Ref. elev.)]	Y	N	
36	Are the piles within allowable tolerance?[505.03(e)] (Make sure pile is aligned according to the plans.)	Y	N	
37	Are piles marked in the correct intervals? (Best Practices)	Y	N	
38	Is the hammer warmed up and set on the proper energy setting for starting out?[505.03(f)]	Y	N	
39	Are pilot holes required, has the contractor met the requirements of 505.03(c)?	Y	N	
40	If using jetting to advance the pile, has the contractor removed the jets a minimum of 5 feet above the specified tip elevation and used an impact hammer to drive to the required bearing capacity?[505.03(c) and CM 2-148]	Y	N	
41	If concrete pile requires splicing, is it in accordance with 505.03(j)?	Y	N	
42	If steel piles require splicing has contractor installed the splices in accordance with Std.Drw.I-131?	Y	N	
43	If concrete cast in place piles are the driven shells in satisfactory condition?[505.03(i)]	Y	N	
44	Is it time to check the hammer cushion?[505.03(b)]	Y	N	
45	If using a pile cushion, does it need replacing?[505.03(b)]	Y	N	
46	Did you transfer the heat numbers to cut-offs for splicing purposes?	Y	N	

When to Stop				
47	Is there a Minimum Tip Elevation specified?[505.03(h)]	Y	N	
48	If Yes, has the pile reached Minimum Tip Elevation? Plans	Y	N	
49	If no Minimum Tip Elevation is specified, has the pile achieved Minimum Penetration requirements? Plans, [505.03(f)]	Y	N	
50	Has the pile met the driving criteria specified by the geotechnical engineer? [505.03(f)]	Y	N	
51	Has the Pile reached Practical Refusal? [505.03(f)]	Y	N	
52	Is the top of the pile within 2 feet of Cut-off elevation?	Y	N	
53	Have any of the piles heaved? [505.03(f)]	Y	N	
54	Once the substructure is complete have you sent in the pile driving records? (C-15A &A2, C-15B &B2, B3, C-16)	Y	N	

Decision Chart



c. Drilled Shafts

A drilled shaft is a foundation that is constructed by placing steel reinforcement and fresh concrete in a drilled hole. This type of foundation is being used more frequently due to problems with driving piles to the deeper elevations required by scour projections and the economics involved in replacing a cofferdam with a drilled shaft.

During the excavation of a drilled shaft the contractor is required to maintain an excavation log. The project inspector should work closely with the contractor to insure that this record is kept accurately since it will be used as a basis of measurement for payment for the excavation. Careful attention should be paid to the type of material being excavated at a specific elevation and the type of equipment being used for the excavation process. All of this information will be extremely valuable if questions arise as to the adequacy of the shaft's design.

The inspector must insure that the contractor checks the dimensions and alignment of each shaft excavation. He/she also must insure that the bottom of the shaft is clean. If a shaft is to be poured in the dry, the depth of water on the bottom of the shaft prior to placing concrete must not exceed the allowable maximum depth given in the specifications.

The Contractor will be required to perform some type of exploratory shaft excavation (soil samples, rock cores or drilling or probing) below the bottom elevations shown on the plans unless this requirement is noted on the plans as being deleted. The Contractor shall extend drilled shaft tip elevations when the Engineer determines that the material encountered during this exploratory excavation is unsuitable and/or differs from that anticipated in the design of the drilled shaft. For more explanation see sub article 506.03(f) in the ALDOT Standard Specifications for Highway Construction, latest edition. The contractor may request to alleviate a required exploratory excavation when the shaft beside this one checked out OK. These type questions must be referred through the normal submittal process.

During the placement of the reinforcing cage into a shaft, the inspector should insure that properly sized spacers are used as required in the specifications. If a shaft is constructed at varying diameters, the contractor should be required to use the properly sized spacer for each section of the shaft.

When a shaft is to be poured in the wet, the specifications require that Crosshole Sonic Logging (CSL) tubes be installed "in a regular, symmetric pattern such that each tube is equally spaced from the others around the perimeter of the cage" and that they be "as near to parallel as possible". For acceptable results from the CSL tests it is imperative that these placement patterns be maintained during the installation of the rebar cages into the shafts.

To insure the integrity of test results the inspector should carefully inspect the installation of sonic logging tubes with regards to the following items:

1. To the extent possible given the required placement of longitudinal and transverse steel in a reinforcing cage, sonic logging tubes should be symmetrically placed around the inside perimeter of the cage (plan arrangement) and parallel to the vertical centroid of the cage (profile alignment).

2. Individual logging tubes should be securely tied to the reinforcing cage at not more than five vertical foot intervals to insure correct plan arrangement and profile alignment. Tubes installed in cages less than 35 VF in length should be tied at the 1/5 points of the cage length.

3. Realizing that all completed cages “flex” to some extent as they are raised to the vertical position for insertion into an excavation, correct and secure placement of logging tubes must be checked as the cage is lowered into the excavation. The contractor should be required to retighten and/or add additional tie points as necessary.

4. Insist on the exercise of reasonable care to avoid dislodgment of installed logging tubes during and after concrete placement.

5. Insure that logging tubes are completely filled with clean water and capped prior to concrete placement.

6. Prior to pouring concrete in a slurry filled shaft excavation, the contractor must take slurry samples using a sampling tool similar to that shown in the following diagram.

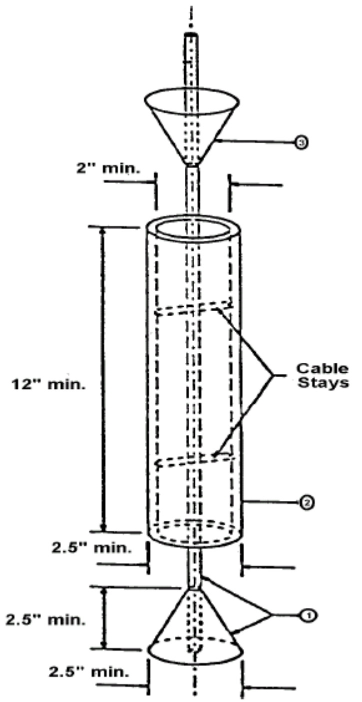
i. Slurry sampler

The sampler consists of three components:

1. Cable with weighted cone-shaped stopper.
2. Cylindrical sampler center-stayed for alignment.
3. Top stopper with hole drilled through the center for slipping onto cable.

Sampling is accomplished by:

1. Lower cable with stopper to desired sampling elevation.
2. Slide cable through aligning guides of sampler.
3. Let sampler drop down the cable and seat onto bottom cone-shaped stopper.
4. Slide cable through hole in top stopper and let drop to seat on top of sample.
5.Withdraw entire assembly from shaft.
6. Sample may be emptied into separate container and used as necessary to perform required testing.



It will be necessary for project inspectors to monitor the concrete volume placed in any trial or production drilled shaft. It is important to confirm that cave-ins of the shaft walls have not occurred during the concrete placement particularly when placing tremie concrete or pumped concrete in slurry filled uncased holes. This can best be accomplished by careful monitoring of the concrete volume placed and the concrete level at frequent intervals so that actual concrete volume placed can be compared with the theoretical volume for the design shaft diameter.

Form C-35, "Drilled Shaft Pouring Record", is provided for this purpose and should be used for recording the necessary data and plotting the required graphs.

The inspector should graph the theoretical volume of excavation prior to the pouring of a shaft.

The theoretical volume per linear foot can be determined from the following table for the appropriate shaft diameter:

Shaft Volumes

Shaft Diameter (in.)	Volume per Linear Foot (cu. yd./L.F.)
24	0.12
30	0.18
36	0.26
42	0.36
48	0.47
54	0.59
60	0.73
66	0.88
72	1.05
78	1.23
84	1.43
90	1.64
96	1.86
108	2.36
120	2.91
132	3.52
144	4.19

During concrete placement the elevation of the top of concrete should be determined after each truck is poured out. This information along with the other required data should be entered on the form at that time and plotted on the graph on the back of the form. Any large variance between the actual concrete volume and the theoretical volume implies possible problems such as necking or enlargement of the shaft and should be investigated to determine the cause.

The bottom of tremie elevation should also be checked and recorded at the same time as the shaft elevations to insure that it is immersed at least five feet in the concrete at all times. Maintaining the five feet (minimum) immersion is critical in preventing formation of an unwanted “cold joint” in the structural part of the shaft.

Immediately after the completion of pouring a shaft the top of shaft and the reinforcing steel should be checked to determine if it is located within the required tolerances given in the specifications. Reference points provided by the contractor’s engineering personnel should be used in making these checks. If the reinforcing steel is found to be out of tolerance, efforts should be made by the contractor to move it within tolerance provided the time limitations for concrete placement have not expired and steel coverage requirements are maintained. If it is necessary to move the reinforcing steel after completing the pour it should be noted on the Drilled Shaft Pouring Record for that particular shaft.

The results of these inspections should be recorded in the inspector’s daily diary. If any shafts or rebar cages do not meet these requirements an accurate drawing indicating the actual location of the shafts and rebar cages should be prepared and submitted to the Construction Engineer to determine if corrective procedures are necessary.

Currently two types of load test devices are being utilized by the Department for load testing drilled shafts; Osterberg Load Cells and Statnamic Load Tests. If load tests are required a special provision will be included in the contract to indicate the type of test and to provide the necessary requirements. When these tests are required personnel from the Bureau of Materials and Tests will aid project personnel in monitoring the tests.

Drilled Shaft Checklist

All of the following items must be answered yes unless pre-approved by the Geotechnical engineer prior to beginning drilling.

	Contractor & Equipment Arrive On-Site	YES	No	NA
1	Has the contractor submitted his drilled shaft installation plan? [506.03(a)2.] Installation Plan	Y	N	
2	Has the drilled shaft installation plan been approved?	Y	N	
3	Does the contractor have an approved mix design? [Special Provision 06-0137 & 506.02(b)]	Y	N	
4	If concreting over 2 hours, has the contractor performed a satisfactory slump test for the extended time period in accordance with 506.08(b)	Y	N	
5	If the Contractor proposes the use of polymer slurry, do they have pre-approval? [506.02(c)]	Y	N	
6	Is the Contractor prepared to take soil samples and/or rock cores on the bottom of the shaft in accordance with 506.03 (f).	Y	N	
7	Is the contractor aware of any potential problems as it relates to existing structures? [506.03(3)]	Y	N	
8	Does the Contractor have all the equipment and tools shown in the drilled shaft installation plan to install the drilled shafts?	Y	N	
9	If casing is to be used, is it the correct size in accordance with 506.02, 506.04, and the DS installation plan?	Y	N	
10	If permanent casing is to be used, has it been coated properly in accordance with 506.05, and the DS installation plan?	Y	N	
11	If the Contractor plans on using slurry, do they have equipment to mix it in?	Y	N	
12	Is a desander required?	Y	N	
13	If a desander is required, does the Contractor have it on site and operational?	Y	N	
14	Does the Contractor's tremie meet the requirements of 506.09 (c), Tremie Requirements?	Y	N	
15	Do you have the required D/S forms that are required to be filled out? (C-35 & C-35-2)	Y	N	
16	Have you reviewed the Contractors Excavation Log and does it meet the requirements of 506.03(c)?	Y	N	
17	Do you understand the forms and log? (If not check with the Project Manager for help)	Y	N	
	Trial Shaft [506.03(h)]			
18	Is the trial shaft positioned away from the production shafts or as specified in the contract documents [506.03(h)]?	Y	N	
19	Has the Contractor performed a successful test in accordance with 506.03 (h)?	Y	N	
20	Did the Contractor cut off the shaft 2 feet below grade in accordance with 506.03 (h)?	Y	N	
21	Has the Contractor revised his technique and equipment (and the revision is approved) to successfully construct a shaft? Revised the DS Installation Plan?	Y	N	
	Shaft Excavation & Cleaning	**Yes**	**No**	**NA**
22	Double check location before excavation, Is the shaft being constructed in the correct location and within tolerances (506.11)?	Y	N	
23	Does the contractor have a bench mark so the shaft can be constructed and inspected to the proper elevations?	Y	N	

24	If a rock core hole is required, has the contractor taken the cores in accordance with 506.03(f)?	Y	N	
25	If a core hole was performed, were the Rock Core samples recorded on the Contractor's log [506.03(f)]?	Y	N	
26	If a core sample was obtained did the contractor properly submit the samples to the Central Laboratory with the field log [506.03(f)]?	Y	N	
27	Unless noted on the plans an exploratory hole is required to 10' below the bottom of each drilled shaft, did contractor drill exploratory holes?[506(f)3.]	Y	N	
28	What type of slurry is the contractor using Mineral? Polymer? Has the Polymer slurry been approved in writing?	Y	N	
29	If the contractor is using slurry, can they perform tests and report the results in accordance with 506.05(e)?	Y	N	
30	Is the slurry level being properly maintained in accordance with [506.03(d)]?	Y	N	
31	Is the proper type and number of tests being run on the slurry in accordance with 506.03(f)?	Y	N	
32	Are you reviewing the Contractor's excavation log [506.03(c)]?	Y	N	
33	After daily review, did you sign the excavation log and note any discrepancies? (memo TM 4/5/2007)	Y	N	
34	If permanent casing is being used, does it meet 506.04?	Y	N	
35	If temporary casing is being used, does it meet 506.04?	Y	N	
Shaft Excavation & Cleaning continued				
36	Is the shaft within allowable vertical alignment tolerances (506.11)?	Y	N	
37	Is the shaft of proper depth?	Y	N	
38	Does the shaft excavation time meet the specified time limit [506.03(c)]?	Y	N	
39	If the shaft required over reaming, was it performed in accordance with 506.03(e)?	Y	N	
40	Does the shaft meet the requirements of 506.06?	Y	N	
Reinforcing Cage (506.07 Reinforcing & 506.11 Tolerances)				
41	Is the rebar the correct size and configuration in accordance with plans?	Y	N	
42	Is the rebar properly tied in accordance with 506.07?	Y	N	
43	Does the Contractor have the proper spacers for the steel cage in accordance with 506.07?	Y	N	
44	If the cage is spliced was it done in accordance with 506.07?	Y	N	
45	Is the steel cage secured from settling and from floating (during concrete placement cages sometimes rise with the concrete) 506.07?	Y	N	
46	Does the contractor have the proper equipment to lift the cage without excessive deformation?	Y	N	
47	If a wet or fully cased pour, does the contractor have the CSL tubes located properly?	Y	N	
48	Is the top of the steel cage at the proper elevation in accordance with 506.11?	Y	N	
Concreting Operations (506.09 Concrete placement Methods)				
49	Prior to the concrete placement, has the slurry been tested in accordance with 506.08(c)?	Y	N	
50	If required was casing removed per 506.04?	Y	N	
51	Was the discharge end of the tremie maintained in the concrete mass with proper concrete head above it 506.09(c)?	Y	N	
52	If free-fall placement (dry shaft only), was concrete placed in accordance with 506.09?	Y	N	

53	Did the placement occur within the time limit specified (506.08)?	Y	N	
54	Are you filling out the concrete placement forms? C-35 & the graph C-35-2.	Y	N	
55	When placing the concrete, did the contractor overflow the shaft until good concrete flowed 506.09(a)?	Y	N	
56	Did the contractor keep the CSL tubes topped off with water (CSL Tubes should be capped before concrete placement) during concrete pour? This is a problem area that can result in debonding and obstructions in the CSL tubes.	Y	N	
	Post Installations			
58	Were concrete acceptance tests performed?	Y	N	
59	Has the shaft reached the required 80% of the 28-day compressive strength and all CSL tests approved and the tubes dewatered and grouted 506.039(a)?	Y	N	
60	Is all casing removed to the proper elevation in accordance with 506.11?	Y	N	
61	Has the contractor complied with the Non-Destructive Testing requirements of 506.10?	Y	N	
62	Is the shaft within the allowable tolerances (506.11)?	Y	N	
63	Has the Drilled Shaft Excavation Log been completed, signed and attached to the C-35 & C-35-2 forms?[506.03(c)]	Y	N	
64	Have you documented the pay items?	Y	N	
65	Have the CSL testing reports been sent directly to the Materials and Tests Engineer, and did you retain a copy? (506.10(a)5)	Y	N	
66	Any problems or any thing that looks strange, anything that doesn't make sense needs to be reported prior to acceptance.	Y	N	
67	Have you sent a copy of the C-35, C-35-2 and the Excavation Log to the Construction Bureau? (CM & Const. Memo)	Y	N	

(D) Bridge Abutments (2:6:A:1.3)

An abutment is located at the beginning and end of each bridge and consists basically of a footing, a cap, two wingwalls and a backwall. Since a large portion of our bridge maintenance problems are located at the abutments, their correct location and construction cannot be overemphasized.

The abutment cap will be stepped, have concrete pedestals under each bearing, or a combination of the two in order for the bearings to be placed to their correct elevations and to help prevent water from collecting around them. These pedestals should always be constructed with a space between the pedestals and the abutment backwall as shown on the plans.

The placement of bearing anchor bolts is covered in our Specifications and the Project Manager and Inspector should be familiar with this. Special attention should be given to anchor bolt wells (holes) cast into the abutment cap. Considerable damage to the cap can result from allowing water to freeze in these wells. The Contractor should cover these wells, fill them with antifreeze, or do whatever is necessary to insure that the cap is protected during the winter months.

Where the backwall is extended from the cap to the roadway finish grade, the bridge expansion is between the backwall and end of the bridge deck. If the backwall is not poured vertical, along the correct skew, or if the forms are allowed to bulge, then the bridge will not have the proper clearance needed for expansion. The Contractor should, therefore, utilize good forms and forming technique and the Project Manager and Inspector should make the Contractor aware of any problems they foresee.

(E) Bridge Bents or Piers (2:6:A:1.3)

A bent is the intermediate support for a bridge and is referred to as a pier when it is constructed in water and, sometimes, even when it is near water.

Bents are usually classified as one of the following three types:

1. Reinforced Concrete Bent

This type bent is constructed in place and consists of reinforced concrete footings, either direct bearing, pile, drilled shaft, or a combination of these, with reinforced concrete columns and caps.

After the footings have been constructed in accordance with the plans and specifications, the columns can be constructed. Metal forms are normally utilized because wood forms have a tendency to bulge when high lifts are poured. Whatever forming method the contractor proposes to use should be acceptable to the Engineer. If the method is not acceptable, the Engineer should require forming details be submitted in accordance with the specifications.

The bent caps are similar to the abutment caps; therefore, the construction requirements for the abutment caps are applicable. The contractor's method of supporting the bent cap forms may vary slightly but they are normally supported by the columns with tie-bolts through the columns or friction collars around the columns. The support for the bent cap is considered as falsework. The contractor should submit working drawings and calculations for distribution in accordance with the specifications.

2. Pile Bent.

This type bent will generally consist of steel H-piles, pre-cast/pre-stressed concrete piles, or drilled shafts. The cap will be either poured in place reinforced concrete or pre-cast concrete.

When steel H-piles are used, the piling will either be encased with reinforced concrete or braced to other piling in the bent by means of sway bracing. The purpose of sway bracing is to give the piling lateral support and will only be required when the bent reaches a certain height. This height is dependent on the size of the H-pile and will, therefore, be shown on the plans or indicated on standard drawings.

The piling should be driven to the tolerances required by the specifications. At no time should the piling be forced into alignment and held there until the sway bracing is connected or the cap poured. This will cause internal stresses that the bent is not designed for and could, cause the bent to fail over a period of time. The piling should be free standing when the sway bracing is connected and when the cap is poured. No pulling on the bent should ever be allowed once the sway bracing or cap is in place.

The pre-cast/pre-stressed concrete pile bents do not require sway bracing or encasements but the piling must be stored and handled with much more care than the steel H-piles in order to keep from cracking them. If a pre-stressed concrete pile is cracked during storing, handling, or driving, a decision must be made whether to accept or reject the piling. The decision should be based on the location and severity of the cracking. The Division Construction Engineer and the Construction Bureau should be involved if this problem arises.

The caps that are normally used for pile bents are cast in place reinforced concrete caps similar to those for the reinforced concrete bents. Pre-cast concrete caps are normally only used with steel H piles. When they are used, steel plates are cast into the caps and the caps are welded to the steel H piles in the field.

3. Pre-cast, Post-tensioned Box Bents.

This type bent normally consists of reinforced concrete footings, either direct bearing, pile, drilled shaft or combination of these, with pre-cast box sections that are post-tensioned together to form the column. The anchorage for the pre-cast box sections is cast in with the footing. The first pre-cast box section is then placed on top of the footing and each remaining section is set into place on top of the previously set section until the column is completed The sections are post-tensioned together as erection continues.

The caps for this type bent can be poured in place reinforced concrete or pre-cast concrete and then post-tensioned to the box sections.

The correct casting of the box sections is critical in order to achieve the required alignment of the bent. The casting will determine whether or not this type bent is successfully constructed and acceptable.

(F) Bridge Structures (Superstructure) (2:6:B)

(G) Bridge Bearings (2:6:B:1.1)

The bearings connect the superstructure to the substructure and provide for the expansion and contraction of the bridge. They must be set correctly in order for the bridge to expand and contract properly. The Contractor should, therefore, be extremely careful when setting the bearings and making the appropriate temperature adjustments.

The main three types of bearings used are Bronze Bearing Assemblies, Rocker Bearings, and Elastomeric Bearings. For sampling information, please refer to the Bureau of Materials and Tests, Testing Manual, ALDOT-368-89 for the sampling procedures for Elastomeric Bridge Bearing Pads.

1. Bronze Bearing Assemblies

This type of bearing assembly is made up of a structural steel top plate, a self-lubricating bronze plate, and a structural steel masonry plate. On grades over 3%, a beveled plate is provided over the top plate to help compensate for the grade.

The uppermost plate (Sole Plate) of the assembly is connected to the girder for both the expansion and fixed assemblies.

The masonry plate is the bottom plate of the assembly and is connected to the cap of the abutment or bent for both the expansion and fixed assemblies.

The self-lubricating bronze plate is between the top plate and the masonry plate. The bronze plate has a series of holes, which are packed with grease just prior to assembly of the bearing. This provides the lubrication requirements needed during the life of the bearing.

The top of the bronze plate is curved to allow for rotation due to loading conditions and the bridge grades. The bottom of the bronze plate slides on the masonry plate as the temperature of the superstructure changes to allow for expansion and contraction. The bronze plate is pinned to the masonry plate on fixed assemblies in order to prevent movement.

Steel straps, which connect the steel plate to the masonry plate, are for shipping and handling purposes only. Just prior to steel or pre-cast concrete girders being placed on the bearings, the straps should be cut and the top plate should be rotated to fit the grade. If the concrete girders are cast-in place, then the straps should not be cut until after the girders have been poured.

Another bearing assembly, often used in lieu of the bronze bearing assembly, utilizes a steel plate with a PTFE (Polytetrafluoroethylene) layer on top and bottom of the plate. This plate replaces the bronze plate with the remainder of the assembly the same as the bronze bearing assembly. The PTFE bearing assembly relies on the self-lubricating ability of the PTFE material for movement during rotation, expansion and contraction.

2. Rocker Bearings.

This type bearing is normally used when the bronze bearing assemblies are too small to carry the load and expansion. However, there are a few small rocker assemblies used on short spans if they are more economical than the bronze bearing assemblies.

The rocker bearing is composed of structural steel and consists of a top assembly, a bottom assembly, and a masonry plate. The top assembly is fixed to the girder and the masonry plate is fixed to the abutment or bent cap.

On expansion bearings the bottom assembly is connected to the top assembly with a stainless steel pin which allows rotation. The bottom of the bottom assembly is curved, also allowing rotation, and sits directly on the masonry plate.

On fixed bearings the bottom assembly is fixed to the masonry plate and the stainless steel pin is fixed to the bottom assemblies in order to prevent any movement during expansion and contraction. The top plate can still rotate to adjust for grades and loading conditions.

3. Elastomeric Bearings.

a. Type 1 and Type 2

These bearings consist of a plain elastomer or a laminated elastomer (having another material such as sheet steel cast integral with the elastomer). Movement during expansion and contraction is provided in the deflection of the elastomer portion of the bearing and is allowed by a properly sized slot in the clip angle that attaches to the girder. A temperature adjustment is required during installation for this type bearing. This adjustment should be made by placing the anchor bolt in the anchor bolt well at the proper location (relative to the slot in the clip angle) based on the temperature of the girder at the time the bolt is installed. The anchor bolt should be installed only after the girders and the bearings have been properly placed.

These bearings are normally used with concrete girders but have also been used on short spans with steel girders.

b. Type 4 and Type 5

These bearings consist of a laminated elastomer vulcanized to a structural steel bearing plate. Movement during expansion and contraction is relative to an anchor bolt and is allowed by a properly sized slot in the bearing plate. A temperature adjustment is required during installation for this type bearing. This adjustment should be made by placing the anchor bolt in the anchor bolt well at the proper location (relative to the slot in the bearing plate) based on the temperature of the girder at the time the bolt is installed. The anchor bolt should be installed only after the girders and the bearings have been properly placed.

4. Temperature Adjustment.

The best time to set or check the position of the bearings is at first light (dawn) while the superstructure is at uniform temperature throughout.

On bronze bearing assemblies or rocker bearings, the bronze plate or pin, whichever the case, should be centered over the masonry plate at 70°F. On Type 1 or 2 elastomeric bearings the anchor bolt should be centered in the slot of the clip angle at 70°F. On Type 4 or 5 elastomeric bearings the anchor bolt should be centered in the slot of the bearing plate at 70°F. At temperatures other than 70°F., the location of the center of the bronze plate or pin relative to the masonry plate (or the location of the center of the anchor bolt relative to the slot for elastomeric bearings) is calculated as follows:

Temperature greater than 70°F.:

D = 0.000006 (T-70) (L)
Move bronze plate or pin away from fixed point (or move anchor bolt away from fixed point relative to the center of slot for elastomeric bearings).

Temperature less than 70°F.:

D = 0.000006 (70-T) (L)
Move bronze plate or pin toward fixed point (or move anchor bolt toward fixed point relative to the center of slot for elastomeric bearings).

D = distance in feet to move center of bronze plate or pin from center of masonry plate (or distance in feet to move anchor bolt from center of slot for elastomeric bearings).
T = temperature of the steel or concrete beam or girder.
L = distance in feet from the bearing being set to the fixed bearing.*

* *Note: On some bridges, the superstructure may be fixed at both main piers. In this case the point of fixity will be half-span between the two fixed bearings.*

Anchor Bolt Checklist

REFERENCES				
See ALDOT Standard Specifications for Highway Construction-latest edition 891.09 , Special Provisions, ALDOT-368				
GENERAL INFORMATION				
In addition to following the sampling and testing procedures, the following is a checklist to assist you in your inspection. In the past, anchor bolts installed in the field have been altered to fit. This is not allowed by the specifications. If you suspect short or altered anchor bolts please contact the Construction Bureau for assistance.				
		Yes	**No**	**NA**
1	Is the type, size and quantity of anchor bolts to be used for the project correct and have samples already been pulled and submitted for testing?(Measure the anchor bolts)	Y	N	
2	If anchor bolt holes are drilled in the concrete or anchor bolt wells been cast in the concrete are the holes free and clear of all debris before the installation of the bolts? (measure the depth of the anchor bolt wells)	Y	N	
3	Prior to installation are temporary caps sealed in place to prevent a debris buildup or prevent water from entering the holes especially during cold weather where temps. are expected to fall to 32F˚ or below?	Y	N	
4	If holes are being drilled in concrete, are these operations being monitored to assure no damage to embedded rebar?	Y	N	
5	Check all anchor bolt locations during the installation and grouting process to assure adequate embedment and accurate vertical stick out.	Y	N	
6	Have the bolts been installed with two nuts and a washer before tightening?	Y	N	

(H) Bridge Beams or Girders (2:6:B:1.2)

The words beams and girders are used interchangeably when referring to bridges. They are designed to carry the different loads applied to the superstructure and transfer these loads through the bearings to the substructure. The beams are usually made of structural steel, pre-tensioned/pre-stressed concrete or cast-in-place reinforced concrete.

There have been some pre-tensioned/pre-stressed concrete beams utilized, which were cast monolithic with the bridge deck. There have also been some pre-cast/post-tensioned reinforced concrete box sections utilized in Segmental Construction. Since both of these are used very little and their design and construction methods are unique to their particular project, they will not be covered in this manual.

1. Structural Steel Beams

These beams are used on both simple and continuous spans and can be wide flange beams, welded plate girders or a combination of the two. A wide flange beam is rolled into its shape by the steel manufacturer. A welded plate girder consists of a top flange plate; a bottom flange plate and center web plate furnished by a manufacturer and then welded together by a fabricator to form a beam. Welded plate girders provide a great flexibility in design because they allow a variety of span lengths to be utilized.

Proper erection techniques of steel beams are essential in order to keep from inducing any internal stresses into the beams that they are not designed to carry. Since erection plans are not normally required on simple spans, the Project Manager should assure himself/herself that the Contractor's method of erection would not damage the beams. Normally beams up to and including 50 feet in length are lifted with one pick up point. Beams over 50 feet in length are normally lifted with two pick up points, i.e., two cranes with one pick up point each or one crane with a spreader beam that provides two pick up points.

On continuous spans erection plans (see working drawings 508.03(d)1) are required and the Project Manager and Inspector should be familiar with the plans and require the Contractor to follow them. If the Contractor requests to deviate from the erection plans, then the Division Construction Engineer and the Construction Bureau should be consulted before the Contractor is allowed to proceed.

When erecting steel beams, the diaphragms/crossframes should be placed as erection proceeds in order to stabilize the beams. The diaphragms should be held in place with required erection bolts until all beams for the span have been erected, graded and all splices torqued. The diaphragms/crossframes can then be bolted in their final position. The bolts should be tensioned in accordance with the specifications.

When using high strength fasteners, rotational-capacity tests must be performed on each combination of production lots, nut lot and washer lot prior to using any of the fasteners. Thereafter a minimum of one rotational-capacity test must be performed prior to beginning the tensioning operation each day.

Forms shall not be welded to any part of the structural steel main members. 501.03(i)2.b(6).

High Strength Bolting Checklist

REFERENCES				
See ALDOT Standard Specifications for Highway Construction-latest edition Article's 508.03 and 836.33, Special Provisions, ALDOT-247-82 Marking of High-Strength bolts, nuts, and washers for structural steel joints				
GENERAL INFORMATION				
A Skidmore-Wilhelm Calibrator instrument shall be available that has been certified by the State Testing Laboratory [508.03(d)6]. If hands-on training is needed on how to interpret the Skidmore-Wilhelm results contact the State Testing Laboratory for training. Make sure your staff, is familiar with the calibration test performed to assure these bolt assemblies are installed properly? If not once again seek training.				
		Yes	**No**	**NA**
1	Are storage conditions acceptable and have any of the containers been opened or damaged prior to delivery?	Y	N	-
2	Have the proper number of samples, for all sizes, been selected and submitted for testing?	Y	N	-
3	Do you have MTR's (Manufacturers Testing Report) for all bolts to be used on the project?	Y	N	-
4	Prior to tensioning operations each day have the required rotational-capacity tests been performed?	Y	N	-
5	If Direct Tension Indicator washers are specified have you been provided with feeler gages for spot checking this operation?	Y	N	-
6	Is a calibrated manual torque or power/impact wrench adjusted to stall or cutout at a prescribed tension available for the Calibrated Wrench and Turn of nut methods?	Y	N	-
7	Are you spot checking behind these operations?	Y	N	-
8	All wrenches used in tensioning shall be calibrated, with the engineer present, at least once daily.	Y	N	-
9	Are the bolt assemblies being installed in the proper orientation, making sure that the nuts are on the proper side of beam/girder flange and web splices?	Y	N	-
10	Are the diaphragms or cross frame connections correct?	Y	N	-
11	If hole alignment becomes a major problem stop the bolting operations until the source of the problem is found and corrections implemented.	Y	N	-
12	Once the bolting operations have been completed make sure the bolt assemblies and adjacent areas are cleaned of all contaminates before allowing coating operations to begin.	Y	N	-
13	Do you have members of your staff that can be properly equipped, trained to work comfortably at high elevations to monitor bolting operations?	Y	N	-

2. Pre-tensioned/Pre-stressed Concrete Beams

These beams are usually AASHTO Types I, II, III, IV, BT54, BT63 or BT72 and are used on spans ranging from 34 feet to 140 feet long.

No erection plans are required for these beams since they are erected as simple span members and their lifting hooks are cast into the concrete.

If any cracks are noticed in the beams upon arriving on the job site or after erection, the Division Construction Engineer and the Construction Bureau should be advised in order to determine if any corrective actions should be taken.

Web walls may be poured and allowed to set up prior to the deck concrete being poured as indicated in the specifications.

3. Cast-In-Place Concrete Beams

These beams are used for both simple and continuous spans. They are formed and poured in the field and, depending on the plan requirement may be poured either monolithic with or prior to the deck concrete being poured. The Contractor must utilize good forming techniques to successfully construct these beams.

These beams are seldom used because of the money and time normally saved when using Pretensioned/Pre-stressed Concrete girders.

(I) Bridge Deck (2:6:B:1.3)

A bridge deck normally consists of cast-in-place reinforced concrete.

Improper deck construction will probably only initially be present in the appearance and riding surface of the bridge. The long-term effect will be premature deck deterioration and, therefore, high maintenance costs. Some of the main factors that can cause premature deck deterioration are:

1. Insufficient Concrete Strength, i.e., too much water in the concrete, concrete allowed to segregate or improper curing of concrete.

2. Improper Concrete Placement, i.e., moving concrete with vibrator, laying vibrator on steel reinforcement or rate of pour too slow allowing concrete to begin to take a set.

3. Insufficient Concrete Cover Over Steel Reinforcement, i.e., screed set improperly, grades figured incorrectly and minimum slab thickness not maintained.

The contractor should utilize good forming methods and construction techniques to satisfactorily construct a bridge deck. The Project Manager and Inspector should insure that the contractor's forms and forming methods are in accordance with their working drawings.

Forms shall not be welded to any part of the structural steel main members. 501.03(i)2.b(6).

Before the contractor sets his/her forms, the beams or girders must be profiled so that the forms can be set for the correct slab depth. After the profiles have been taken, they should be plotted on cross section paper using a large scale. The plan profiles should also be plotted so that a comparison can be made between the actual field condition and the plan grade.

At this point, the actual camber should be closely checked to see if it is within allowable construction tolerances. There are no specific construction tolerances concerning camber in our specifications; however, excessive camber causing the beam or girder to extend into the bottom of the theoretical slab cannot be tolerated. On the other hand, if all the camber called for on the plans is not put into the girder, the girder will sag below proper grade after the deck is poured. If the Project Manager feels that the camber is not tolerable, he/she should immediately see that the Construction Bureau is notified so that the proper corrections can be made.

After the beams or girders are determined to be within camber tolerance, the contractor can form the bridge deck. During forming the slab thickness between beams or girders should be maintained constant by varying the fillet depth along each member.

When installing permanent metal forms, welding is normally required. Since there is no welding allowed to the any steel girders, beams, stringers, etc., the contractor should use a method of connecting the support angles that will prevent welding in these areas. Normally, the contractor will use a metal strap that will span the width of the top flange and the welded connection is then made to the strap instead of the flange. When this is done a backing plate of galvanized steel must be placed below the strap in accordance with the specifications to prevent the welds from penetrating through the strap into the top flange of girder. The welds are typically one to two inches long and the straps are spaced 12 to 15 inches apart. If any welding is done to a steel girder, the Construction Engineer should be notified.

When placing the steel reinforcement, the contractor should utilize approved supports. These supports are specified in the Specifications but if metal supports are used, they may deform during the placement of the steel reinforcement. They should be replaced as necessary before the deck concrete is poured.

The placement of the steel reinforcement should be carefully checked to insure the correct size and amount is placed, that proper spacing is maintained between the bars and the bars are adequately and firmly tied. The spacing can be spot checked with a ruler and visually inspected instead of actually measuring every bar that is placed.

When using permanent metal deck forms the slab thickness, bottom steel reinforcement clearance, etc., are measured to the top corrugation of the form. If the bottom steel reinforcement were placed by measuring from the bottom corrugations the proper concrete cover would not be attained at the top corrugations. The same holds true for the proper slab thickness. Therefore, it is essential that measurements be made to the top corrugation.

Once the steel reinforcement is in place, the contractor must place the screed supports or headers in order for the concrete cover and slab thickness to be checked. When using a longitudinal screed, transverse headers will be set for the screed to run on. When using a transverse screed, longitudinal rails or supports will be set up outside the overhang for the screed to run on.

After the screed is in place and set with the appropriate camber, a trial run should be made over the deck. During this trial run, the distance from the top mat of the steel reinforcement to the bottom of the screed should be measured and recorded. This distance should be equal to the required concrete cover shown on the plans less the deflection expected in the beams or girders due to the weight of the concrete for longitudinal screeds. This distance should be equal to the required concrete cover shown on the plans for transverse screeds. The required concrete cover should, therefore, be present once the beams have deflected. The slab thickness should also be measured and recorded during the trial run in the same manner used to check the clearance on the top mat of steel reinforcement. These measurements should be taken in each bay (midway between each girder) at the following locations: each end, the quarter points and the center of the pour.

Once the concrete has been placed and screeded, the actual concrete cover over the top mat of steel reinforcement and the actual slab thickness should be measured and recorded. The slab thickness may vary by ± 1/4 inch as long as the surface tolerance of 1/8 inch in ten feet is maintained. These measurements should be taken in two bays at the following locations as a minimum: each end and the center of the pour. Any variations greater than those previously mentioned will require that additional checks be made. The contractor should provide a work bridge as required in the specifications for taking these measurements.

The final finish is then applied and it is obtained by broom finish, wood floating or burlap drag. The curing should begin immediately behind this finishing operation. Plastic shrinkage cracks and other problems that can be detrimental to the deck can occur if the curing is delayed.

The straight edging of the deck concrete, as specified in the Standard Specifications, should be performed in conjunction with the initial finish or immediately thereafter. This should allow time to correct any areas not meeting specification tolerances.

The final texture will be obtained by cutting/sawing transverse grooves into the deck after it has been cured in accordance with the Specification unless otherwise shown on the plans.

Grooving the bridge deck after the concrete has been cured requires special equipment designed especially for grooving hardened concrete. Because of the differences that are present with the equipment manufacturers, the contractor should discuss his/her equipment and procedure at the pre-pour conference. The following are adjustments that can be allowed during the grooving operation:

1. The location of the first groove at an open joint can be spaced from two to eight inches away from the back edge of the embedded armor plate or expansion dam.

2. If the equipment is not capable of grooving the deck continuously from one side of the bridge to the other to within two feet of the barrier rails or curbs, then a location has to be determined for the grooves to be discontinued and the machine turned. On normal crown bridges this can be done at the center of a pavement stripe. On single lane bridges or multilane bridges that will not have a centerline pavement stripe, this can be performed at the shoulder stripe or at another lane edge pavement stripe. The ends of the grooves should be located consistently apart not to exceed two inches.

3. On horizontally curved bridges the grooves should be spaced appropriately on the inside of the curve and will fan as they are

continued to the outside of the curve. This should also be discussed at the pre-pour conference and the contractor should make every effort to keep the fanned portion to a minimum spacing.

4. On bridges that have skewed open joints, “stair stepping” will be allowed at the joints since the grooves will not be running parallel with the joint. This is a triangular section of the deck that will not be grooved because of the skew. The maximum width to be grooved in one pass should be limited to two feet.

1. Check List for Bridge Deck Construction

The following checklist should be used by the Project Manager to insure that the construction of the bridge decks is properly inspected:

2. Pre-Pour Preparation:

1. Insure that contractor profiles the girders and checks the camber prior to setting the deck forms.

2. For steel girders and diaphragms, inspect all high strength bolts to insure that they were properly installed and tensioned.

3. Working drawings with design calculations must be on file for all falsework for deck and overhang. Distribution stamp from the Construction Engineer required on all falsework previously submitted and distributed. [See Special Provision 06-0204(2).]

Insure that all forms are installed in accordance with the appropriate drawings.

4. Insure that all forms are mortar tight.

5. If stay-in-place forms are to be used, Bridge General Note (BGN) Note 27 must be on the plans.

a. Check to insure that all stay-in-place materials meet all material requirements. [See Sub item 501.03(i) 3b]

b. On precast concrete girders, the form supports should be cast into the girders in accordance with the approved shop drawings.

c. On steel girders, the form supports should be attached as shown on the falsework drawings. However, no welding should be allowed to the girder. [See Sub item 501.03(i) 3b.]

d. Stay-in-place form sheets must be securely fastened to form supports with a minimum bearing length of one inch at each end. Spacing of fasteners should be in accordance with the falsework drawings.

e. Transverse construction joints should be located at the bottom of a flute in the stay-in place forms, where possible, with 3/8” holes drilled at no more than 12” apart.

f. All form welds shall be cleaned of slag and wire brushed just prior to placing of the deck concrete.

6. An approved job mix formula must be on file in the project office prior to pouring the deck.

7. On simple spans, construction joints should be located as required in the specifications unless approved otherwise by the Construction Engineer. [See Sub item 510.03(c)6b.]

8. Vertical construction joints must be formed with substantial bulkheads or headers capable of supporting the weight of the wet concrete.

9. Material certificates must be on file for all reinforcing steel used in the deck. Heat numbers on the reinforcing steel should be checked against the numbers on the certificates.

10. Steel reinforcement should be properly maintained during storage on the project (Off the ground). [See Sub article 508.03(c).]

11. Steel reinforcement should be inspected carefully for proper placement in the deck with regard to the plans for size, spacing and clearances.

12. All reinforcement must be rigidly wired (or spot-welded, if approved by the Construction Engineer) and properly supported in position. [See Item 502.03(c)4.]

13. All splices of reinforcement should be checked for proper overlap of bars. [See Item 502.03(d)1.]

14. Deck drains should be checked to insure that their location and size is in accordance with details shown on the plans.

15. A chamfer strip must be located on the overhang forms to provide a continuous “V” groove as required in Sub item 510.03(c)6g.

16. All edges and corners of forms at angles of 90 degrees or less must be chamfered and filleted unless otherwise shown on the plans. [See Paragraph 501.03(i)3a(2)]

17. All expansion joint devices and expansion joint openings should be checked to insure that they are set correctly prior to pouring the concrete adjacent to the joint. [See Sub item 510.03(c)6h.]

18. If grounding is required by the plans, each exterior girder of bridges or portions of the bridges using steel girders shall be made electrically continuous in accordance with the requirements given in Item 510.03(c)8.

19. A pre-pour conference must be held between the contractor, concrete producer and the Project Manager prior to placing any bridge deck concrete. As a minimum, the following questions should be addressed with full documentation provided in the project diary:

a. What rate of placement will be maintained?

b. How many workers will be available for the pour?

c. What type of screed will be used?

d. How will the concrete be delivered to the forms? [Lift bucket, pump, etc.]

e. How many vibrators and generating plants are available?

f. If the weather turns cold, how will the concrete be protected?

g. If rain occurs before initial set occurs, how will the concrete be protected?

h. Are the materials and equipment necessary for f. and g. above available on the job site?

i. What method and type of finishing will be utilized?

j. What method and type of curing will be utilized?

k. How many work bridges will be available for use during the pour?

20. When a transverse screed is used check the following items:

a. The screed must be supported by vertically adjustable rails set a sufficient distance from the gutter line to allow free movement of the screed from gutter line to gutter line.

b. Supports for the screed rail must be spaced a maximum of 18” center to center with slab overhang support brackets spaced a maximum of 24” center to center unless shown otherwise on the working drawings.

c. The contractor should set the grade on the screed rails to account for the deadload deflection and provide the required final profile grade.

d. The screed rails must be completely in place for the full length of the pour.

21. When a longitudinal screed is used check the following items:

a. The screed must be supported at the ends by a transverse header and/or by a section of previously poured deck.

b. If the deck being poured is on a super-elevated section, the screed must be operated from the low side to the high side.

22. After the screed is in place and the proper camber set, a trial run shall be made over the full width and length of the deck during which the contractor should check all aspects of the screed and supports for proper adjustment.

23. After this check, the screed shall be run again to allow the Engineer to take and record measurements [See Sub item 510.03(c)6c] as follows:

a. The slab thickness in each bay (midway between girders) at each end, the quarter points and the center of the pour.

b. The steel clearances on the top mat of steel reinforcement in the same locations as for "a" above.

24. Prior to placing concrete all sawdust, chips and other construction debris and extraneous matter shall be removed from the interior of the forms. (Either washed down or blown out by air)

3. Concrete Placement:

1. The inspector should sample and test the concrete in accordance with the Department's Testing Manual.

2. Concrete test specimens should be placed in the protected environment provided by the contractor in accordance with Sub article 501.02(d).

3. If web-walls are to be poured and allowed to set up prior to pouring the bridge deck as allowed in Sub item 510.03(c)6b., extra cylinders should be made if the contractor desires a break prior to seven days.

4. During the placement of the concrete, the contractor shall continuously check the alignment of the side forms, overhang forms and headers. Any yielding of the forms or falsework shall be corrected immediately.

5. Vibrators shall be manipulated, so as to thoroughly work the concrete around the reinforcement and into the corners and angles of the forms. However, vibrators shall not be used to make concrete flow in the forms over distances so great as to cause segregation. [See Sub item 501.03(e)1c.]

6. The rate of placement of the concrete should be monitored to insure that all concrete between construction joints is placed and compacted in a continuous operation before initial set takes place. [In case of breakdown or other suspension of placement prior to completion see Sub item 510.03(c)6b.]

7. Once the concrete has been placed and screeded, the actual concrete cover over the top mat of steel reinforcement and the actual slab thickness should be measured and recorded. [See Pre-Pour Preparation page 46, item 24.]

8. The deck should be straight edged in conjunction with the final finish or immediately thereafter. All deficient areas should be marked and corrected by approved methods. [See Sub item 510.03(c)6d.]

4. Curing of Deck Concrete:

1. The Engineer should ascertain if the proposed equipment supplied by the contractor for determining the evaporation rate has been approved by the Materials and Tests Engineer.

2. Prior to pouring a bridge deck slab (and during the pour if it takes more than two hours), the evaporation rate must be determined by the project inspector. If the rate exceeds 0.2 pounds per square foot

per hour the contractor must take the necessary action to reduce the rate if they wish to proceed with the pour in order to reduce the risk of plastic shrinkage cracks. [See Sub item 501.03(k)2a.]

3. Immediately after the final pass of the screed on any section of the slab exceeding five feet, the evaporation control curing operation must begin. [See Sub item 501.03(k)2b.]

4. If fogging is the chosen method of evaporation control the inspector should insure that it is maintained until the moist curing after finishing is begun.

5. If an evaporation barrier material is the chosen method of evaporation control the inspector should insure that it is applied under pressure at a rate of one gallon to not more than 200 square feet of surface area.

6. The inspector should insure that the chosen method of final curing is applied immediately after the finishing operation is completed and maintained in a satisfactory condition for the required curing period of seven days. [See Sub item 501.03(k)2c.]

7. No traffic or other superimposed load should be permitted over the bridge deck until the concrete has reached a minimum compressive strength of (4000 psi) from test cylinders. [See Item 501.03(k)3.]

REFERENCES		
ALDOT Standard Specifications for Highway Construction, AWS D1.5-2002 Bridge Welding Code		
GENERAL INFORMATION		
Field Welding is defined as any welding performed on an ALDOT Construction project outside of a fabrication shop. There are some instances when field welding is performed. There are some important elements involved in all field welding and we will address these to provide a checklist for the field inspector. The ALDOT welding experts are employees of the Bridge Bureau and are classified as Structural Steel Inspectors. They all carry their CWI (Certified Welding Inspector certification). They work every day in the Fabrication Shops across the country performing QC/QA Inspections. They are very knowledgeable and experienced in welding processes and techniques. They are available for consultation by requests made through the Bridge Bureau. This information is not a substitute for good common sense and judgment. This information serves as a guide to assist you in the field and give you a generic checklist of information to check.		
Welding Terms and Definitions		
Electrodes- The consumables to be used to join metal together. Also called "Rods" or Sticks"- see rod classifications		
Rod Classifications		**E 70 1 8**
E-stands for electrode		
70-On SMAW the first 2 digits stand for the minimum tensile strength of the welding electrode. The designation 70 correlates to the electrode having a tensile strength of **70 KSI**.		
1- The third digit on a **SMAW** electrode stands for the position in which the electrode can be used: A **1** or **2** may be used.		
	The number **1** means the electrode can be used in all positions.	
	The number **2** means the electrode can be used only in the flat and horizontal positions.	
8- The fourth digit on a **SMAW** electrode indicates the type of coating.		
	The numbers **6** or **8** classify the electrode as low-hydrogen.	
Hydrogen is one of the major causes for weld defects as care must be taken to ensure no moisture is picked up in the coating on the electrodes. Heavy **rust** is a source for hydrogen. Special care should be taken to insure that all rust, paint and debris are cleaned from the surfaces to be welded.		
Rod Storage: Electrodes shall be purchased in hermetically sealed containers or shall be dried for at least **2 hours** between **450 and 500 degrees** for **70XX** electrodes.		
Immediately after opening the hermetically sealed container electrodes not being used must be stored in a storage oven (also known as a hot box) and held at **250 degrees**.		
After electrodes have been removed from the hermetically sealed container or from the storage oven the electrodes may be exposed to the atmosphere for a **maximum period of 4 hours.**		
In the event the rods have been exposed to the atmosphere for a period **less than 4 hours** they must be placed back in the storage oven and dried for a period of **no less than 4 hours**.		
In no case shall electrodes that have been wet be used.		
SMAW- This is the designation for the welding process. Shielded Metal Arc Welding or "Arc Welding" or "Stick Welding".		
Pre-heat- The designated preheat requirements for welding of metals depends on the thickness of the metals to be welded. AWS. D1.5, Table 4.4. The purpose of preheat is to remove surface condensation and other forms of moisture that otherwise cause **porosity or weld cracking**. Pre-heat also serves to prevent shrinkage crack formation by slowing down the heat dissipation of the cooling weld. Heat on one side of the metal and measure by use of temp sticks or laser thermal gauge on the other side to insure complete temperature through metal thickness.		

Welding process and grade of steel	< 3/4 in.	Over 3/4 in. to 1-1/2 in.	Over 1-1/2 in. to 2-1/2 in.	Over 2-1/2 in.

SMAW, A-36,A-572, A588	**50**	**70**	**150**	**225**

Heat straightening- Requires approval from the engineer. Maximum heat input temperature is **1100 degrees**. You can verify this by the use of a temperature stick, also called heat crayon. No artificial cooling is allowed until the base metal has been cooled naturally to **600 degrees F.**

Leads	Typically an electrode holder, also called a stinger.
Ground	Typically a clamp. Make sure arc strikes do not occur in this area. If so make sure they are removed by grinding.

Weld Type

EXAMPLE 1 F: A Flat position Fillet Weld. **1** is the position- this is the position of the welding being performed. **F** designates the type of weld. (**F**illet verses **G**roove)

1F-Flat fillet	**1G-Flat groove**	**Downhill welding** is disallowed.
2F-Horizontal fillet	**2G-Horizontal groove**	
3F-Verticle fillet	**3G-Verticle groove**	
4F-Overhead fillet	**4G-Overhead groove**	

Surface preparation- Is covered in the AWS D1.5 Bridge Welding Code 3.2

Discontinuities-arc strikes, undercut, rolled weld, weld spatter, lamination, porosity, cracks. AWS 1.5

Welder Qualification- Also known as certification. 836.46(b)

This is a card issued by the DOT (Materials & Tests Bureau, Robert Wise 334-206-2383) that has the welder qualifications on it. The specification requires the field welder to have a current qualification card on his person at all times that he is doing field welding. (Check the expiration date)

Name, Social Security Number, Position of Qualification and expiration date is included on the card.

The Certification card will be numbered as follows: **WS-34-06**

WS Stands for Welded Steel

34 Stands for the number of welders certified for the given year. This would be the 34th welder certified in 2006.

06 Stands for the year of the test.

WS-34-06 may also have a suffix on the end. It could be **R, 1, 2** or **3**. The **R** means the welder passed by retest and the certification is only good for 1 year, he must retest. If they have a **1, 2** or **3** on the end it means they were renewed for that number of years and no recertification was required. Therefore a welder could have the same card for up to 4 years and then have to recertify.

Certified position: Most certified welders for ALDOT carry a ***3F*** certification. This qualifies them for welding in the vertical, horizontal or flat position for fillet welding. In order to be certified for overhead, they must have a ***4F*** on their card.

If at any time a certified welder is performing poor quality work, you have the authority to stop him from working and instruct him he will need to recertify.

Common places for authorized welding:

NO WELDING to MAIN MEMBER. See Sub article 836.01(b)

Splicing H-piling for foundation piles. ALDOT certified **3F** required. 505.03(j), I-131

Permanent and Temporary steel casings for Drilled Shafts. Contractor is responsible, no welding specifications apply.

Roadway Armor Plates ("Armor Plates"). Uncommon to field weld armor plates. If these are welded they would require a **1G** certification or on widening projects would require a **3G** qualification. Most joints are Bolted Field Splice. I-131,

Pile points for H-piling for foundation piles. Flat position only, ALDOT Certified **1G**. 505.03(k), I-131

Sway bracing and battens for steel H-pile bents. Requires **3F** and **4F** qualified.I-131,

Pile Cap Channels. Requires ALDOT certified **4F.** I-131

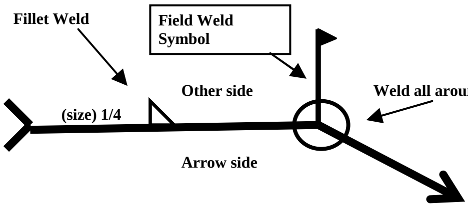
Sole plates being welded to bearing assemblies. Requires ALDOT certified **4F** and **3F**.I-131,

Approved Repairs: Welding secondary details to main bridge members, such as stiffeners and connection angles. Requires an approved Welding Procedure.

Drilled Shafts. Welding to reinforcement is prohibited unless written approval from the Bridge Engineer.506.02(e)

Welded Shear Connectors. This is a specialized welding process and may be done in the field at the contractor's discretion. 5 days advanced notice to the Bridge Engineer required. 508.03(d) 9. This type of welding does not require certification.

Welding Symbols



(J) Bridge Railing (2:6:B:1.4)

The solid barrier rails are the standard bridge rail presently being used by the Department. These rails have 3/4-inch open joints provided in them at locations shown on the plans. These joints are required so that the rails will not act as continuous beams and become load-carrying members.

1. Pre-cast Barrier Rails

Pre-cast barrier rails used on bridges are normally only used on the secondary system with the short span pre-cast bridges. These rails are usually pre-cast by the same fabricator that cast the other bridge members and they are bolted in place in the field.

2. Cast In Place Barrier Rails

Some contractors will form the barriers and cast them in place. The forms are usually metal and are supported from the bridge deck. The contractor's method of anchoring the forms is his/her choice as long as it is acceptable to the Engineer. Small threaded metal inserts are allowed for use by the contractor to anchor his/her forms. These inserts are drilled into the bridge deck and are grouted flush with the top of the deck once the forms are removed.

3. Slip Formed Barrier Rails

Slip forming barrier rails is another method of casting the barrier rails in place. This method allows the contractor to form, pour the barriers and remove the forms in one operation. The forms are attached to a slip-forming machine and the machine travels the length of the bridge, constructing the barriers as it proceeds. A contractor utilizing this method must assure himself/herself that the steel reinforcement details, etc. shown on the plans do not have to be altered for his/her particular slip form machine. If alterations are required, then the Project Manager should be given this information and he/she should forward it to the Division Construction Engineer and Construction Bureau for approval. When the slip forming method is used the open joints shall be sawed in the proper locations to a minimum of 5/16 of an inch in width. It is critical that this operation be performed in a timely manner to prevent uncontrolled shrinkage cracking. The guidelines provided in the specifications should be used in determining the proper timing of this operation. If shrinkage cracking does occur the contractor should be required to submit a procedure for sealing the cracks. This procedure should be submitted to the Construction Engineer (through the proper channels) for approval.

On Cast-In-Place and Slip Formed Barrier Rails, curing compounds should be applied to the barrier rails as soon as possible after the forms are removed. A coated finish, if used by the contractor, should not be applied until adequate time, as directed by the

Specifications, has elapsed since the curing compound was applied. The Project Manager should always see that the coated finish is applied in accordance with the Specifications and the manufacturer's recommendations.

Curing of the pre-cast barrier rails is covered in the Specifications.

Checklist for Field Painting

REFERENCES
ALDOT Standard Specifications for Highway Construction, Structural Steel Painting Council (SSPC), Project Plans, Project Special Provisions
GENERAL INFORMATION
Bridge Painting is performed initially in the fabrication shops. Even in the fabrication shops paint problems are encountered and addressed. This checklist assumes that the primer coat has been applied in the shop and that field painting is required to complete the intermediate and top coats. This checklist also addresses bridge recoating which would include blasting and cleaning steel pile bents, bearings, cross frames and diaphragms, finger expansion joints and miscellaneous metals. Basically the painting requirements are the same for shop or field painting and the paint system is only as good as the inspection of the surface preparation and application of the coatings. You must review the plans and project notes prior to the preconstruction meeting.

	Contractor & Equipment Arrive On-Site	YES	NO	NA
1	Has the contractor submitted his Surface Preparation Plan for Removal of Existing Coatings (SPPREC)? [521.07]	Y	N	
2	Has the SPPREC plan been approved?	Y	N	
3	Have you read the SPPREC.	Y	N	
4	Does the coating materials conform to the requirements given in Section 855, "Coatings, Paints, Enamels, and Varnishes for Metal and Wood Structures? [521.02]	Y	N	
5	What coating system is required for this project, 1,2 or 3 ?[521.02]	Y	N	
6	What is the required film thickness and required color of each coat according to Article 855.05?	Y	N	
7	If proprietary coating is being used: Contractor shall submit a written notification to include, the name and address of the supplier, product names of each coat proposed for application, the supplier number from the list of approved coating systems. Has the contractor submitted this notification?	Y	N	
8	Verify the paint has not exceeded its shelf life?	Y	N	
9	Verify the paint is not being stored in areas subject to temperatures beyond the recommended limits.	Y	N	
10	Has the contractor given 14 calendar day notice to the Project Manager, prior to application of the coating? [521.03]	Y	N	
	Blast Cleaning [521.04]	**YES**	**NO**	**NA**
11	**System 1 and 2**	Y	N	
12	*System 1= SSPC-SP 10 Near White Blast Cleaning.	Y	N	
13	*System 2= SSPC-SP 6 "Commercial Blast Cleaning".	Y	N	
14	Do the contractor cleaning methods and products for cleaning surfaces on existing bridges result in a non-hazardous blast waste? [521.04(a)] (I.e. Blastox, etc...)	Y	N	
15	**System 3:** Hand or Power tool Cleaning, water jetting in order to remove loose paint or rust.[521.04(b)]	Y	N	
16	Surface Roughness after blast cleaning= 25UM to 75UM, verified by Press-o-film type tape, provided by the contractor. [521.04(c)] Record in your DWR.	Y	N	
17	Did you make a complete visual check on steel that has been blast cleaned and readied for coating?	Y	N	
18	Are all surfaces to receive coating cleaned and free of all contaminates, weld spatter, flux, slag, fume, mill scale, oil, grease, and other objectionable deposits?	Y	N	

19	Under no circumstances shall the steel surface be allowed to rust. [521.12]	Y	N	
Containment System [521.05]		**YES**	**NO**	**NA**
20	Is a containment system required?	Y	N	
21	Does the vertical and horizontal screening have the collection/recovery system in place during the actual removal?	Y	N	
22	Does the containment system cause a hazard to the traveling public?	Y	N	
23	Is the containment system working in accordance with OSHA acceptance, adequate worker visibility, prevention of any material leaving the enclosure?	Y	N	
24	Is there any dust outside the containment structure? **Stop the operations.**	Y	N	
Collection and Disposal of Coating Material Waste [521.06]		**YES**	**NO**	**NA**
25	Is the removed material and debris being properly stored in approved containers?	Y	N	
26	Did you approve of the disposal site?	Y	N	
27	Did the contractor store and dispose of the contaminated debris in accordance with the requirements of ADEM?	Y	N	
28	Did ADEM require any additional testing and did the contractor perform the required tests?	Y	N	
29	The contractors approved SPPREC addresses the need for a non-hazard waste. Did the contractor test the required representative waste?	Y	N	
30	Did the contractor have the sample analyzed for hazardous material using the Toxic Constituents Leaching Procedure (TCLP)?	Y	N	
31	Hazardous waste has been detected; did the contractor submit an explanation for the cause?	Y	N	
32	Did the contractor submit his plan to prevent hazardous waste for the remainder of the job?	Y	N	
33	Did the contractor submit his plan for the disposal of hazardous waste?	Y	N	
34	Did you get approval for continuing the painting operations?	Y	N	
35	Have you received the required regulatory documentation, including ADEM form 8700-12?	Y	N	
Application of Coatings [521.10]		**YES**	**NO**	**NA**
36	Is the coating being applied in accordance with the manufacturer's instructions and precautions?	Y	N	
37	Did the manufacturer's representative clear up and resolve your concerns about his recommendations?	Y	N	
38	Did the contractor apply his coating within the required 24 hours after cleaning?	Y	N	
39	Did the contractor apply the subsequent coats as prescribed by the paint manufacturer?	Y	N	
Equipment for Application of the Coating [521.11]		**YES**	**NO**	**NA**
40	Is the coating being applied by sprayer, roller or brush?	Y	N	
41	If by roller or brush is the area to be coated flat?	Y	N	
42	If by sprayer make sure the paint is not thinned unless approved by the manufacturer.	Y	N	
43	Monitor the spraying operation, is there drift occurring? Suspend the operation.	Y	N	
44	Is the equipment clean?	Y	N	
45	Does the contractor have the proper wet/dry film thickness gauges?	Y	N	
Workers Protection [521.14]		**YES**	**NO**	**NA**
46	Is the contractor in compliance with all the requirements of	Y	N	

	OSHA and other regulatory agencies?			
Ambient Conditions for Coating Surface Preparation [521.15]		**YES**	**NO**	N
47	Has there been any rain, fog, snow, or dew prior to application of the coating?	Y	N	
48	Coatings shall not be applied when the steel surface temperature is within 5F° of the dew point or when steel temperature is below 32F°.	Y	N	
49	Is the steel temperature at or expected to go below 32 F?	Y	N	
50	Did you have the contractor demonstrate the dew point, humidity and steel temperature?	Y	N	
51	Is the surrounding air temperature above 40° and not expected to drop to or below 32 prior to drying?	Y	N	
52	Is the relative humidity below 85%?	Y	N	
Requirements for applying additional coats over a shop primer [521.17 & 18]		**YES**	**NO**	**NA**
53	Is the previous coat cured per manufacturer's specifications? Have the contractor show you proof.	Y	N	
54	Did you measure the thickness of the primer? (You must measure multiple areas in order to check subsequent coats for proper thickness) **Record these in your DWR**.	Y	N	
55	Have all debris, oil, grease, overspray, weld spatter and rust been removed?	Y	N	
56	Did the contractor use cleaning methods and materials that will not damage the primer or previous coats?	Y	N	
57	Immediately after erection of materials (all connections are complete) all steel shall be coated. Has the contractor completed steel erection? (On structural steel, where concrete decks are required, the coating shall not be applied until the concrete deck has been poured and all mortar and spatter has been removed)	Y	N	
58	Is the contractor taking the necessary precautions to prevent overspray from damaging pedestrians, vehicles and other traffic that moves within the vicinity of the bridge?	Y	N	
59	Is coating being protected from discoloration and disfigurement by dust, insects, and other causes, during the curing process?	Y	N	
Post Painting Inspection (Best Management Practices)		**YES**	**NO**	**NA**
60	Inspect coated surface, are there any sags, runs or drips?	Y	N	
61	Did the contractor apply the proper wet/dry thickness of paint? (**Record the thickness in your DWR**)	Y	N	
62	Are there any thin coated areas?	Y	N	
63	Has the contractor made all necessary repairs?	Y	N	
Method of Measurement		**YES**	**NO**	**NA**
64	Are you in agreement with the contractor on the surface area that is required to be coated?	Y	N	
65	Does this match the amount that the bid was based on?	Y	N	

APPENDIX A Guidance for Testing of Bridge Items

See ALDOT-195 BUREAU OF MATERIALS AND TESTS TESTING MANUAL for complete instructions.

GENERAL INSTRUCTIONS

This manual aids uniform sampling and testing procedures by the Alabama Department of Transportation. Compliance with these procedures ensures all materials incorporated in a project can be documented as conforming satisfactorily with specification requirements and established Department policies. Revised or additional schedules and procedures are issued periodically. They should be immediately placed in the appropriate section of this manual. Note that the primary units used in this document are English. For projects that may be administered in metric units, appropriate metric values have been included in parentheses. English and metric units are provided in a manner consistent with the intent of the specifications and may not be exact conversions.

The Sampling and Testing Program

A copy of the Department's official sampling and testing program is for reference and study by project personnel. It defines their responsibilities for acceptance of materials incorporated in the work. Many items are produced or fabricated away from the project site and, inspected and tested by other Department personnel or agencies. Testing manuals are available on the ALDOT intranet:
http://csnts006/Docs/Bureaus/Materials+and+Tests/Testing/Testing+Manual/
Also available on the internet:
http://www.dot.state.al.us/Docs/Bureaus/Materials+and+Tests/Testing/Testing+Manual/Testing_Manual_Main.htm

Thoroughly study procedures in ALDOT-195 **before** allowing contractors to incorporate these items.

See ALDOT-195 BUREAU OF MATERIALS AND TESTS TESTING MANUAL for complete instructions.

TYPES OF SAMPLES AND TESTS

A. Quality or Informational Samples and Tests are, in general, performed on a pre-contract basis in order to determine the eligibility of a source to furnish materials or products that will consistently meet acceptance test requirements.

B. Acceptance Samples and Tests (see below, table) are those performed during construction for determining if contract requirements are being fulfilled.

C. Certified Acceptance Samples and Tests are performed by authorized producers shown in the Manual of Materials, Sources and Devices with Special Acceptance Requirements which contains a current list of pre-qualified producers and products.

D. Comparison and Correlation Samples and Tests are used to determine if any significant variation in results is occurring between laboratories or operators performing test(s) on a given lot or standardized sample of material.

E. Independent Assurance Samples and Tests (see below, table) are similar to comparison samples but may represent different lots of material than used for acceptance sampling and tests.

Acceptance Samples and Tests

ITEM	Material	SECTION
Structural Portland Cement Concrete	Quality Control Operations, Mix Components, Portland Cement Concrete, Quality Control Tests, Ready Mix Concrete, Air Entraining Agents, Reducers, Retarders, Curing Materials Water Stops Joint Fillers and Sealers, Reinforcement Steel, *Welding Electrodes, Permanent Steel Deck Forms, *Bridge Coating Material, bridge Joint Seal	501
Steel Reinforcement	Reinforcement Steel Bars, Prestressing Strands, Wire Mesh, Welded Steel Wire, Fabricated Bar and Rod Mat, Spiral	502

	Reinforcement, Electrodes for Welding.	
Structure Foundations	Foundation Backfill, Concrete, Piling	503
Piling	Precast or Prestressed Concrete Piles, Cast in Place Concrete Piles, Steel Piles, Timber Piles Treated or Untreated, Timber Sheet Piles, Steel Sheet Piles, *Pile Point Protectors	505
Structural Steel and Miscellaneous Metals	Structural Steel and Miscellaneous Metals, High Strength Fasteners, *Paints Oils and Pigments, Anchor Bolts	508
Bridge Bearings	Elastomeric Bearing Pads	511
Precast NonPrestressed Concrete Bridge Members	Abutment Caps, Bent Caps, Span Sections, Curb Spans, Abutment Panels, Wing Panels, Wing Cap Panels	512
Prestressed Concrete Bridge	Girders and/or Span Sections	513
Steel Bridge Painting	*Paints, Oils and Pigments	521
Bridge Joint Seals	Preformed Elastomeric Compression Seals, Un-Reinforced Diaphragm Seal, Reinforced Diaphragm Seal,	522

* See Materials lists.

Independent Assurance Samples and Tests

ITEM	**Material**	**SECTION**
Structural Portland Cement Concrete	Mix Components, Portland Cement Concrete	501
Steel Reinforcement	Reinforcement Steel Bars	502

Piling	Precast or Prestressed Concrete Piles, Cast in Place Concrete Piles, *Pile Point Protectors	505
Drilled Shafts	See Section 501	506
Prestressed Concrete Bridge	See Section 505	513

* See Materials lists.

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