RESPONSE TO 4100000 INDUSTRY REVIEW COMMENTS

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Ghulam Mujtaba

1. COMMENT: Section 410-1 Description- Last paragraph: Materials Acceptance and Testing of Precast Box Culverts: Discussion has been made with the industry and Legal Office related to the submittal of the notarized certification statement at the beginning of each project and submittal of the delivery ticket with the list of the products with each shipment. I recommend the following wording in lieu of the last paragraph:

   At the beginning of each project, provide a notarized statement to the Engineer from a company designated representative certifying that the plant will manufacture the products in accordance with the requirements set forth in the Contract Documents and plant's approved quality control plan. The quality control manager's stamp on each product indicates certification that the product was fabricated in conformance with the Contractor's quality control plan, the Contract, and this Section. Ensure that each shipment of precast concrete products to the project site is accompanied with a signed or stamped delivery ticket providing the description and the list of the products.

   RESPONSE: This correction will be made.

2. COMMENT: Section 410-2 Materials –First sentence of the first Paragraph: The subjects and other nouns of the sentence do not match with each other. The plural word "Materials" has been mentioned. In the sentence "a certification statement" in lieu of "certification statements" and "source" in lieu of "sources" have been used. I suggest the following change:

   For materials that are used in the manufacture of the box culverts, provide a certification statement from each source, showing that the delivered material meets the following:

   RESPONSE: This wording was based on a similar section in 449-2 but will be changed to the following:

   "Ensure that the materials used for the construction of precast box culvert have ~~a~~ certification statement<u>s</u> from <u>each</u> ~~the~~ source, showing that they meet the applicable requirements of the following ~~Specifications~~:"

3. COMMENT: Section 410-3.1 Second Paragraph, Last Sentence:Start a new sentence "Also 346-9.2.1 and 346-9.5 do not apply" in lieu of combining it with the previous sentence.

   RESPONSE: This correction will be made.

4. COMMENT: Section 410-3 Last Paragraph, first sentence:

Change **"…for QC personnel"** to **"...for the training and other qualification requirements of QC personnel".**

RESPONSE: This correction will be made.

5. COMMENT: Section 410-3 :
Add a new sub-article 410-3.2 and renumber the current 410-3.2 to 410-3.3. The sub-article 410-3.2 has deleted the verification inspection requirements of 346 and it has not described any alternative to it . I suggest the following:

   410-3.2 Quality Assurance Inspection and Testing: The Engineer will perform periodic inspections, sampling, and testing to ensure of the quality and acceptability of the materials, methods, techniques, procedures and processes being utilized by the manufacturing facility in the fabrication of precast concrete box culverts. The quality assurance inspection and testing will be performed in accordance with Section 6.3, Volume I, of the Materials Manual.

   RESPONSE: This correction will be made.

6. COMMENT Section 410-3.2 Last Paragraph, the sentence before the last:
Change "**the project**" to "**the project site**"

   RESPONSE: This correction will be made.

7. COMMENT: Section 410-6.1 Last sentence:
Change within "a 1 1/2 inch" to "within a distance of 1 1/2 inch".

   RESPONSE: The correction will be made as **"within a distance of 1 1/2 inch [38 mm]"** and the previous metric equivalent will be corrected to **"1/2 inch [13 mm]".**

8. COMMENT: Section 410-6.4.3 Second Line :
Change **"are not be more than.."** to **"…are not to be more than…."** Or preferably **"shall not be more than…".**

   RESPONSE: The correction will be made as **"… are not more than…"**

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Daniel Cobb

COMMENT: 410.6.4.5 -- Review first sentence
... plane .... DOES or ...planes ..... DO

RESPONSE: This section will be corrected to **"planes …do"**

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Jose Rodriguez

1) COMMENT: Page 2, 410-1, third paragraph: "...unless approved by the District Structures Engineer" should be removed. The proposed phrase would result in shop drawings with precast wingwalls and headwalls being submitted only to be rejected if that's the District preference. Alternately, the following could be used: "...unless otherwise noted in the Contract Documents." That way, the contractor knows up front that, if precast wingwalls and headwalls are not specifically allowed in the plans, then they cannot be used.

RESPONSE: This phrase will be changed to **"... unless otherwise noted in the Contact Documents"**. The District Structures Offices will need to monitor contract plans to ensure that Consultant designs do not allow for precast wingwalls and headwalls if it conflicts with the District policy.

2) COMMENT: Page 6, 410-4.1.1, last sentence: If larger haunch dimensions are allowed, then the drainage engineers need to be made aware they'll have to account for that possibility. The haunch dimensions could increase from 2" x 2" to 12" x 12". This increase could have a substantial impact on the hydraulic capacity of box culverts (particularly the smaller ones).

RESPONSE: The effect of a increasing the haunch from 2" to 12" has very little effect on the hydraulic capacity of the box culvert when flowing full, because the shape becomes more efficient and in some cases the hydraulic radius actually increases. However the following limitations will be added to the end of this paragraph:

> **", but not greater than 8 inches [205 mm] for box culverts with internal spans less than six feet, or 12 inches [305 mm] for box culverts with larger internal spans"**

3)COMMENT: Page 6, 410-4.2, first and second sentences: "410.12" should be "410-12" and "loading rating" should be "load rating".

RESPONSE: This change will be made.

4)COMMENT: Page 6, 410-4.2, second paragraph: "Engineer of Record" should be "Specialty Engineer". The way the term Engineer of Record is used here is in conflict with the definition in the specifications.

RESPONSE: This change will not be made.
"Contractor's Engineer of Record" is a new definition in the July 2006 WorkBook under Section 001. Specialty Engineers are not usually pre-qualified under Rule 14-75 to perform bridge load ratings.

5) COMMENT: Page 6, 410-5, second paragraph, first sentence: "...unless otherwise approved by the District Structures Engineer" should be removed. Alternately, the following could be used: "...unless otherwise noted in the Contract Documents." (See comment #1.)

RESPONSE: This phrase will be changed to **"... unless otherwise noted in the Contact Documents"**.

6) COMMENT: Page 8, 410-6.4.6, last sentence: Metric equivalents were not provided for 1/4" and 1/2".

RESPONSE: The following metric equivalents will be provided **"[6 mm]"** and **"[13 mm]"**.

7) COMMENT: Page 8, 410-6.5 and 410-6.6: The metric equivalents for 1000 psi do not agree (10 MPa vs 7 MPa).

RESPONSE: The metric equivalent in 410-6.5 will be corrected to **"[7 MPa]"**.

8) COMMENT: Page 11, 410-12, last sentence: This sentence should read "These shop drawings must include the proposed layout, lifting devices, a note describing the casting method for the precast box culverts and **details of** any modifications to cast-in-place sections or connections thereto." Also, add a requirement that all details must be submitted at the same time. We have often received shop drawings for the precast sections first and the modified cast-in-place details (often prepared by someone other than the precaster) later. This makes it difficult to coordinate the components.

RESPONSE: The phrase **"details of"** will be added to this sentence and the following sentence will be added to the end of the paragraph: **"All details must be submitted as a complete package including modifications to cast-in-place sections."**

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Jennifer Taylor

COMMENT: Section 410-12 Shop Drawing
ADD ' Shop drawing must include proposed bedding material and method of backfilling'

RESPONSE: This change will not be made.
Shop drawings are intended for the structural details and fabrication of the precast units which generally prepared by the precast manufacturer or their Engineer. Selection of backfill material and backfill methods, are activities that are not unique to precast box culverts and as such are also required for other cast-in-place or precast concrete structures and pipe. Furthermore these selections do not need to be determined prior to fabrication of the precast units and so they should be handled using the appropriate procedures similar to other products under Section 125.

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Kathy Gray

COMMENT: Section 410-10.1 General: Delete the reference to Section 125. Section 125 has adequate backfilling requirements but not adequate foundation soil compaction requirements. Section 410-10.1 General: Delete the statement "Lay all precast box culvert sections on a dry, unyielding foundation." The term "unyielding foundation" is vague and unenforceable. The foundation soil preparation requirements need to be defined in terms of required materials and

compaction. I recommend the soils within 2 feet of the bottom of the foundation be limited to A-3 or A-2 soil compacted to the requirements of Section 125-8.1.6.
Section 410-10.2 Bedding: I recommend the bedding material consist of A-3 or A-2 soils instead of No. 57, 67 or 68 stone. There is no practical way to check the density of No. 57, 67 or 68 stone. The A-3 and A-2 soil density can be easily checked with conventional methods. If the No. 57, 67 or 68 stone is to be used for bedding, some method of compaction should be provided for to ensure a stable foundation. As a minimum, I recommend the stone be placed in 6-inch maximum lifts compacted with a minimum of 5 passes of a mechanical tamper.

RESPONSE: Excavation and foundation preparation are equally applicable to cast-in-place box culverts which are not cover under Section 410 and so the reference to Section 125 will remain. Section 125-4.1 requires removal of material in stream beds to 4 feet below grade. I agree that this section is not very clear about the requirements for box culverts. A new sub-section 125-4.5 should probably be added specifically addressing box culvert foundations.

The term "unyielding foundation" in 410-10.1 will be changed to **"slightly yielding foundation, to ensure uniform bearing across the full width of the bottom slab."** We acknowledge that it is not very enforceable, however it is qualitative and will guide the Engineer in making on-site decisions. This wording comes directly from ASTM C1433 and C1577. The bedding material will be changed to select material from Index No. 505 and the thickness will be reduced to 6" to simplify compaction and minimize underflow.
Compaction requirements will be added to 410-10.2 as follows:

> **"Place bedding in maximum 6 inch [150 mm] compacted layers below the culvert to a minimum width of 12 inches [300 mm] outside the exterior walls of the culvert and meet the density requirements of 125-9.2."**

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Richard Newsome

COMMENT: This new spec. requires the Contractor when installing a precast box culvert section to place 12 inches of 57, 67 or 68 stone for bedding material (410-10.2). Years ago it was found that when coarse aggregate was used for bedding for either precast or poured in place box culverts, that water would flow through the aggregate as an alternate path and wash dirt out from under the box culvert and cause failures.

Why are we requiring or even allowing the above construction practice if it has caused box culverts to fail in the past.

RESPONSE: This is a phenomena call "piping" that can occur anytime a permeable backfill or parent material and a significant differential head occur at a culvert installation. The State Drainage Office advises that with Florida's typically flat grades, this problem has occurred only infrequently. Extending the cutoff wall is a good countermeasure against piping through the bedding so long as the installation is not in coarse, uniform highly permeable sand.

Cut-off walls are provided at the ends of the precast box culverts typically 2 feet or more (determined by the designer) below the bottom of the box to minimum the under flow. Coarse

aggregate material is less likely to result in loss of soil fines and settlement when underflow does occur beneath the culvert, however it does increase the permeability. The bedding material will be changed to Index 505 select material, but coarse aggregate will be permitted with the approval of the Engineer when a 4 foot strip of coarse sand bedding material is provided at each end of the culvert and wrapped in a D-4 filter fabric as follows:

> **"When coarse aggregate is approved for use as an alternate bedding material, wrap the bottom and sides of the coarse aggregate with a layer of Type D-4 geotextile filter fabric as specified in Design Standards Index No. 199, and substituted the coarse aggregate with select material within four feet [1.2 m] of the cut-off or toe walls at each end of the precast box culvert."**

The bedding thickness in 410-10.2 will be changed from 12 inches to 6 inches to reduce the potential for underflow, and a requirement in 410-5 will be added as follows:

> **"Extend the depth of cut-off or toe walls an additional 6 inches [150 mm] with the limits of the bedding material…. Bedding material is not required for cast-in-place wingwall footings**."

Also see the response to Larry Jones' comments below.

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Larry Jones

COMMENT: This Spec change needs revision:

Underflow-
I agree that underflow should be prevented rather than encouraged; this application is not similar to an earthen dam where a gravel toe provides a benefit. In a pipe/culvert application open graded bedding material creates the greatest piping potential when it extends from some point along the pipe/culvert continuously to the outlet. Using lower permeability bedding material within several feet of the outlet, a proper cutoff wall or both provides increasingly more protection against piping of soils from below the culvert. Therefore, your requirement to increase the depth of the cutoff wall to 2' plus the depth of any gravel is a very good idea.

RESPONSE: The bedding material in 410-10.2 will be change to Index 505 select material with a thickness of 6 inches and the use coarse aggregate qualified to be consistent with 125-8.3.4, as follows:

> **"Provide bedding that consists of a minimum 6 inch [150 mm] depth of select material, with not more than 15% fines passing the No. 200 US Standard sieve, in accordance with Design Standards Index No. 505 or other granular material approved by the Engineer. Place bedding in maximum 6 inch [150 mm] compacted layers below the culvert to a minimum width of 12 inches [300 mm] outside the exterior walls of the culvert and meet the density requirements of 125-9.2. When coarse aggregate is approved for use as an alternate bedding material, wrap the bottom and sides of the coarse aggregate with a layer of Type D-4 geotextile filter fabric as specified in Design Standards Index No. 199, and substituted the coarse aggregate with select material within four feet [1.2 m] of the cut-off or toe walls at each end of the precast box culvert.**

COMMENT: Compaction-
Gravel should only be allowed as a last resort when bedding materials must be prepared below the water surface. Material below the water level should be compacted with hand tampers only. When gravel is required, only sand with less than 10% fines should be placed within (about) ten feet of either cutoff wall. As a general rule, dewatering should be required in order for the existing materials to be compacted properly for a prepared bedding surface. If the existing materials are pumping or otherwise not compacting they need to be dewatered better and allowed to dry, be stabilized, or removed and replaced; and then properly compacted.

RESPONSE: Section 410-10.1 requires dewatering and laying all precast box culverts on a dry foundation. Bedding material will be changed as shown above.

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Douglas Holdener

COMMENT: The efforts of the Structures Design Office to improve the precast box culvert specification will result in greater efficiencies amongst the inter-relation of projects' engineering, manufacturing, and installation processes. The proposed use of standardized designs will greatly reduce the amount of time spent by Engineers assessing manufacturing feasibility and submittal reviews.

Per Section 410-4.2, it is our understanding that submittal drawings for standard designs will not require loading/design calculations or the sign and seal of a Professional Engineer. A Specialty Engineer's seal will, however, be required for load rating analysis, special designs, or design modifications.

RESPONSE: This is correct except that a "Contractor's Engineer of Record" from a pre-qualified firm, as defined in the revised Specification subsection 1-3, must sign and seal bridge load ratings and special designs, not a Specialty Engineer. Two individual pre-qualified Specialty Engineers may be used in lieu of a pre-qualified firm in accordance with subsection 1-3.

The last sentence of 410-4.1.3 will be reworded as follows:

> **"Perform a bridge load rating in accordance with the Structures Design Guidelines, for any redesign with a total span equal to or greater than 20 feet [6.096 m], when measured between the inside face of end supports, along the centerline of the roadway crossing."**

COMMENT: Per Section 410-1, it is also our understanding that the shipment and delivery ticket procedures for precast box culverts will be equivalent to those recently enacted for precast concrete pipe. Said delivery procedures would require the one-time submittal of a Material Certification statement, signed and notarized, accompanying or prior to the first shipment. Subsequent shipments would not require the signature or notarization, but instead subsequent shipment delivery tickets would be affixed with a stamp describing and listing the products.

RESPONSE: This is correct. The last paragraph of 410-1 will be change to meet the new requirements as follows:

> **"At the beginning of each project, provide a notarized statement to the Engineer from a company designated representative certifying that the plant will manufacture the products in accordance with the requirements set forth in the Contract Documents and plant's approved quality control plan. The quality control manager's stamp on each product indicates certification that the product was fabricated in conformance with the Contractor's quality control plan, the Contract, and this Section. Ensure that each shipment of precast concrete products to the project site is accompanied with a signed or stamped delivery ticket providing the description and the list of the products."**

COMMENT: It is also our understanding that - if this specification is approved - while the proposed Section 410 and Standard Index Numbers 291 and 292 may not be implemented until January 2007, a Contractor may elect to submit the new Index 291 or 292 as submittal drawings in the interim period between July 1, 2006 and January 1, 2007.

RESPONSE: The Contractor may submit designs matching the Department's published designs however these will need to be shown on the manufacturer's drawings and must be signed and signed by a Specialty Engineer.

COMMENT: It is our understanding that the Standard Index 291 will greatly improve guidance on connections between precast and cast-in-place components. The standard "rules of order" for submittal drawing preparation is to provide a submittal drawing for that product which you produce. In this case, a precast box culvert Manufacturer will be responsible for a submittal drawing that illustrates the exposed steel for the last precast box piece upstream of the endwall/wingwall. This submittal drawing will indicate the connection method (mechanical coupler OR dowel), steel bar size, depth of embedment into the precast box, spacing on center, and length of extension/protrusion from the precast box. Each of these parameters will be as per FDOT Index 291.Based on our review of the draft Index 291, we are uncertain as to the required bar size and length of bar to protrude from the precast box section. It is our recommendation that the length of protrusion range from 12 inches to 18 inches.

RESPONSE: The bar extensions will be clarified on proposed Index No. 291 to show 1'-6" extensions of the longitudinal reinforcing or supplemental #4 bars at 1'-0" minimum spacing.

COMMENT: It is appropriate for the precast box culvert specification to specify bedding and backfill requirements. The precast box culvert specification should also be sensitive to the requirements of Section 125 for excavation. Soil conditions and groundwater conditions vary throughout the state. The scope of bedding requirements in Section 125, specifically 125-4.4, does impose requirements to adjust for unsuitable, or even pre-existing suitable, soil conditions.

In our discussions with experienced precast box culvert Contractors, it is our understanding that decisions are often made to exceed the four-inch typical undercut requirement

and the 12-inch bedding requirement based on soil borings and professional judgments of the Contractor and Engineer. It is also our understanding that in-situ soil conditions sometimes provide suitable conditions for reducing the 12-inch bedding or using alternate soils, or even native soils.

The proposed box culvert specification requires a 12-inch coarse aggregate or other material bedding. Additionally, the specification references Sections 120 and 125. It seems that some of the reviewers concerns may already be addressed by Section 125. However, it also seems that there may be a conflict or misinterpretation as to the applicable bedding requirements for precast box culverts: (a) Section 125, (b) Section 410-10, or (c) combination of both.

Section 125-8.3.4 provides requirements for placing bedding in wet conditions; coarse aggregate of various gradations is allowed in wet conditions to provide a stable bedding surface. Section 125-8.3.4 also provides direction to use a filter fabric, which would mitigate soil migration. Section 125-8.3.2 specifies the bedding material to be A1, A2, A3, or A4 (concrete only). Is it the intent of the Department to allow this material also for precast box culvert beddings? Section 125-8.1.6 specifies that compaction is to be done in 6-inch lifts above the water level.

The proposed Section 410 specification should provide general requirements but also the versatility for Contractors and Engineers to make such installation judgments about bedding material and thickness as needed based on soil and groundwater conditions. Any foreseen needs to improve specific bedding, backfill, and compactions requirements can be conducted more efficiently through a separate review of Sections 120 and 125.

RESPONSE: The bedding material thickness will be specified as 6” minimum. The Contractor has the option to increase this thickness. Bedding material will be changed to Index 505 select material, with additional requirements when coarse aggregate is approved by the Engineer as an alternate granular material. See the response to Larry Jones’ comments above for more detail.

COMMENT: In certain circumstances, bedding in excess of 12 inches is required. However, other circumstances are suitable for bedding less than 12 inches. The current specification does seemingly direct the Contractor towards using coarse aggregate. While it does allow for “other granular material,” it can be interpreted to exclude the use of A1, A2, A3, or A4 (for concrete only) soils. We believe that alternate soil materials, namely A1, A2, A3, or A4, should be allowed for bedding and backfill materials. We also believe that alternate bedding thickness less than 12 inches or greater than 12 inches should be allowed. Allowing these alternate materials and bedding thickness would provide versatility for varying soil and groundwater conditions throughout the state. Would the Department consider incorporating such alternate materials and bedding thickness allowances into Section 410-10 in the effort to recognize varying installation conditions?

RESPONSE: See the previous response on this issue.

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