

State of Illinois
Department of Transportation
Bureau of Materials and Physical Research
Springfield

POLICY MEMORANDUM

Revised: July 14, 2016

19-08.5

This Policy Memorandum supersedes number 19-08.4 dated November 26, 2014

TO: REGIONAL ENGINEERS AND HIGHWAY BUREAU CHIEFS

SUBJECT: QUALITY CONTROL/ QUALITY ASSURANCE PROGRAM
FOR PRECAST CONCRETE PRODUCTS

DEFINITIONS

AGGREGATE TECHNICIAN – An individual who has successfully completed the **Department's** 5-day Aggregate Training Course. Once trained, the **Department** will not require the individual to take the class again for recertification purposes.

BUREAU - Bureau of Materials and Physical Research, Illinois Department of Transportation.

COMPONENT MATERIALS - Materials that are used in the **Precast Concrete Product** manufacturing process. This includes cement, finely divided minerals, aggregates, water, reinforcement steel, and admixtures.

CONCRETE TESTER - An individual who has successfully completed the **Department's** Portland Cement Concrete Tester Course. Once trained, the Department will not require the individual to take the class again for recertification purposes. The Concrete Tester shall be monitored on a daily basis by an individual who has successfully completed the American Concrete Institute (ACI) Certification Program for Concrete Field Testing Technician - Grade I.

DEPARTMENT - Illinois Department of Transportation. The definition reference is in Section 101 of the **Standard Specifications**.

DISTRICT - District office, Illinois Department of Transportation.

ENGINEER - The Director of Highways of the Department of Transportation of the State of Illinois, or authorized representative. The definition reference is Section 101 of the **Standard Specifications**.

INSPECTOR - A representative of the **Department** who is authorized to inspect the **Precast Concrete Products, Plant** and **Laboratory** of the **Producer**. This individual will have successfully completed the American Concrete Institute (ACI) Certification Program for Concrete Field Testing Technician – Grade I. Once trained, the **Department** will not require the individual to take the class again for recertification.

LABORATORY - A **Quality Control** laboratory which has all the equipment necessary to perform the **Test Procedures** required by the **Specifications**.

LOT - A quantity of **Precast Concrete Products**, all being of like size, material, and strength designation, manufactured by the same process. The definition reference is AASHTO M 262.

MISCELLANEOUS COMPONENTS - Products not manufactured by the **Producer** but which are supplied to projects such as gaskets, mastic, castings, etc.

MIXTURE AGGREGATE TECHNICIAN – An individual who has successfully completed the **Department’s** 3-day Aggregate Training Course. Once trained, the **Department** will not require the individual to take the class again for recertification purposes.

PLANT - A **Producer’s** facility for manufacturing **Precast Concrete Product**.

PRECAST CONCRETE PRODUCTS - Any non-prestressed precast concrete product. This includes the products listed under the Products Key of the “[Qualified Producer List of Certified Precast Concrete Producers](#)” (link embedded) and other products as determined by the **Engineer**. The Products Key does not include composite concrete handholes (Article 1088.05 / Highway Standards 814001 and 814006), composite concrete gulfbox junctions (Article 1088.07(b)), precast concrete railroad crossings, or precast prestressed concrete products.

PRODUCER - Manufacturer of a **Precast Concrete Product**.

QUALITY ASSURANCE - All those planned and systematic actions necessary to provide adequate **Department** confidence that the **Precast Concrete Product** will satisfy given requirements for quality.

QUALITY CONTROL - The sum total of activities performed by the **Producer** to make sure a **Precast Concrete Product** meets the requirements of this Policy Memorandum, the **Quality Control Plan**, and **Specifications**.

QUALITY CONTROL MANAGER - An employee of the **Producer** who has experience, responsibility, and authority to make sure a **Precast Concrete Product** meets the requirements of this Policy Memorandum, the **Quality Control Plan**, and **Specifications**. The Quality Control Manager shall have completed the **Technician** training. Refer to Section 17.2. However, this training requirement for **Producers** that only make dry cast block and/or dry cast brick is waived because the actual dry cast block/brick is tested for strength (cylinders are not made).

QUALITY CONTROL PLAN - A document which explains how the **Producer** proposes to control the equipment, materials, and production methods to ensure the specified **Precast Concrete Product** is obtained.

REVIEW AND APPROVAL OF SHOP DRAWINGS – The process of approving the structural adequacy of a precast item, by persons granted the authority by the **Engineer**. Examples include the Bureau of Bridges and Structures, a consultant contracted by the **District**, or the Engineer of Record. This process does not imply or include **Verification** of erection layout, dimensions and configurations of the precast item.

SPECIFICATIONS - Specifications for a **Precast Concrete Product** which includes the **Standard Specifications**, supplemental specifications and recurring special provisions, highway standards, shop drawings, contract plans, project special provisions, AASHTO Specifications, and ASTM Specifications.

STANDARD SPECIFICATIONS - The **Department's** Standard Specifications for Road and Bridge Construction.

TECHNICIAN - An individual who has successfully completed the American Concrete Institute (ACI) Certification Program for Concrete Field Testing Technician - Grade I. Once trained, the **Department** will not require the individual to take the class again for recertification purposes.

TEST PROCEDURE - A physical test specified in the **Specifications**. Refer to the **Department's** Manual of Test Procedures for Materials or AASHTO/ASTM publications.

VERIFICATION – Checking the actual layout, dimensions and configurations of **Precast Concrete Products** as staked in the field versus the **Precast Concrete Products'** plan dimensions and configurations as shown on the shop drawings. Verification does not imply or include any check for structural adequacy of the precast item.

SAFETY

Producer's Responsibilities for Safety

The **Producer's** safety program shall meet the requirements of law.

The **Producer's** safety program shall take into consideration the **Department's** inspection activities, and shall adequately protect the **Inspector**.

The **Producer's** ongoing operations shall not place the **Inspector** in an unsafe situation. For example, a policy of good housekeeping shall be maintained to prevent hazardous conditions.

A copy of the **Producer's** safety program shall be provided to the **Inspector**.

The **Producer's** equipment shall have working backup alarms; however, good safety practices shall not solely depend on them.

Inspector's Responsibilities for Safety

Read and abide by the **Department's** Employee Safety Code (Departmental Order 5-1) and references 1-1 B 8 (Work Conditions), 8-5 (Equipment and Clothing), and 11-3 P (Safety Rules) in the Personnel Policy Manual (Departmental Order 3-1). When working in the proximity of moving equipment, it is a good practice to make eye contact with the equipment operator or signal in some manner to make sure the individual is aware of your presence.

Read and abide by the job safety analysis. It is recommended that a job safety analysis be developed for the **Inspector's** position.

Read and abide by the **Producer's** safety program.

Do not perform an inspection activity which may place you in an unsafe situation, and notify the **Producer** of the need for corrective action.

Do not accept **Precast Concrete Products** when inspection is prevented because of safety.

1.0 SCOPE

This Policy Memorandum defines the **Quality Control / Quality Assurance** program for **Precast Concrete Products**. It includes:

1. **Producer** certification and revocation of certification.
2. **Quality Control** and **Quality Assurance** requirements.
3. Material and product acceptance, repair, and rejection **Specifications**.
4. Responsibilities of the **Producer** and the **Department**.

2.0 APPLICATION

- 2.1 This Policy Memorandum applies to all **Producers** who wish to be certified by the **Department** to provide **Precast Concrete Products** for projects. The **Precast Concrete Products** that the **Producer** is certified to produce (see also Section 5.0) will be indicated on the "Qualified Producer List of Certified Precast Concrete Producers."
- 2.2 The Policy Memorandum applies to **Precast Concrete Products** listed under the Products Key of the "Qualified Producer List of Certified Precast Concrete Producers." Additional products may be included in this Program as determined by the **Engineer**.
- 2.3 The **Producer** shall implement the **Quality Control** testing and inspection requirements of the Policy Memorandum for all customers, whether private, commercial, or government. This is applicable only to **Precast Concrete Products** indicated on the "Qualified Producer List of Certified Precast Concrete Producers." **Department** material requirements shall not apply to all customers. **Precast Concrete Products** which are not manufactured according to **Department** material requirements shall be marked or stored separately. Separate stockpiles shall be demarcated to the satisfaction of the **Engineer**. Rejected stock that is not removed shall be stored separately and demarcated to the satisfaction of the **Engineer**.
- 2.4 This Policy Memorandum does not apply to composite concrete handholes (Article 1088.05 / Highway Standards 814001 and 814006), composite concrete gulfbox junctions (Article 1088.07(b)), precast concrete railroad crossings, or precast prestressed concrete products.

3.0 AUTHORITY

The authority for this Policy Memorandum is cited below and is found in the **Standard Specifications**:

1. Article 106.01- "At the option of the **Engineer**, materials may be approved at the source of supply before delivery is started."
2. Article 106.05- "The source of supply of each material used shall be approved by the **Engineer** before delivery is started."

4.0 ADMINISTRATION

- 4.1 The **Bureau of Materials and Physical Research** has primary responsibility for the overall administration of this Policy Memorandum.
- 4.2 The **District Materials Engineers** have primary **Quality Assurance** responsibility for the **Producers** within their **Districts** and for **Producers** located in adjacent states within 50 miles of the Illinois state line.
- 4.3 The **Bureau** has primary **Quality Assurance** responsibility for **Producers** located in adjacent states that are 50 or more miles from the Illinois state line, unless other arrangements are made with a **District**.
- 4.4 The **Bureau** will maintain a current list of **Producers** certified to provide products under this Policy Memorandum. To view or download the "Qualified Producer List of Certified Precast Concrete Producers" on the Internet, go to: <http://idot.illinois.gov>. The list is found under Doing Business; Material Approvals; Precast/Prestress; Qualified Product List. There is an Index which includes the contact person for questions about the list. A link has also been provided on the web page for an e-mail subscription to receive notice of changes to any list.

5.0 CERTIFICATION - INITIAL APPLICATION

- 5.1 A **Producer** may request certification to provide **Precast Concrete Products** by submitting the following documentation:
1. A **Quality Control Plan** conforming to the minimum requirements in Attachment A.
 2. A completed "[Concrete Plant Survey](#)" (link embedded). See also Attachment E.
- 5.2 All requests for certification will be conducted by the **District** or **Bureau** who has **Quality Assurance** responsibility for the **Producer**. The evaluation will consist of the following:
1. Inspection and approval of the **Producer's Plant** and **Laboratory**. The **Producer** should also have the required forms for manufacturing each **Precast Concrete Product**, but this is not required.
 2. Evaluation and approval of the **Producer's** proposed **Quality Control Plan**.
 3. Evaluation and approval of the **Producer's** prior performance, when applicable.
 4. Sampling and testing of **Component Materials** by the **Department**. Acceptable test results are required for approval.
 5. The option to sample and test a minimum of three (3) units for each **Precast Concrete Product** to verify compliance with **Specifications**. Additional sampling and testing may be performed for each mix design, casting method, and curing method used on a single product. Acceptable test results are required for approval.

For pipe, mandatory sampling and testing a minimum of three (3) different sizes is required. The same class of pipe shall not be used for all three sizes. At least one size of pipe shall be tested with a different class. A minimum of three (3) units per pipe size shall be tested. Acceptable test results are required for approval.

5.3 Any deficiencies will be documented in writing by the **District** or **Bureau** who has **Quality Assurance** responsibility for the **Producer**. Subsequent inspections will be performed by the responsible **District** or **Bureau**. The inspections will be scheduled upon written notice from the **Producer** that corrective action has been completed.

5.4 After the responsible **District** or **Bureau** has determined the approval or denial of the **Producer's** request for certification to provide **Precast Concrete Products**, the **Bureau** will notify the **Producer**.

6.0 CERTIFICATION – CONTINUED CERTIFICATION OF PRODUCER

Continued certification of a **Producer** to provide **Precast Concrete Products** will be determined by the **Department** based on:

1. Compliance with this Policy Memorandum, the approved **Quality Control Plan**, and **Specifications**.
2. Verification of the **Quality Control** program through **Quality Assurance** testing and inspection.

The **Bureau** will notify the **Producer** when certification is discontinued. The **Department** reserves the right to immediately discontinue certification for poor product **Quality Control**, excessive occurrences of manufacturing defects, or as determined by the **Engineer**.

The **Producer** will remain off the “Qualified Producer List of Certified Precast Concrete Producers” until the **Engineer** is satisfied the **Producer** has taken sufficient corrective action to be reinstated. The **Bureau** will notify the **Producer** when certification is reinstated.

7.0 CERTIFICATION - REVOCATION OF PRODUCER’S CERTIFICATION

7.1 The **Department** may revoke a **Producer's Certification** by removing the **Producer** from the “Qualified Producer List of Certified Precast Concrete Producers” for a stated period of time under any of the following circumstances:

1. Misrepresentation of materials or products.
2. Submittal of false records.
3. Failure to follow this Policy Memorandum.
4. Failure to follow the approved **Quality Control Plan**.
5. Failure to comply with the physical standards of the **Specifications**.
6. Performs work determined by the **Department** to be detrimental to the quality of the **Precast Concrete Product**.

7.2 A **Producer** under revoked certification status shall not provide **Precast Concrete Products** to the **Department**.

7.3 The **Producer** may re-apply for certification status at the end of the revocation period. Re-application shall be in writing and include the specific steps taken to correct the cause for loss of certification. The **Bureau** will notify the **Producer** when certification is reinstated.

8.0 DISPUTE RESOLUTION

The Regional **Engineer** and the **Bureau** Chief of Materials and Physical Research, or their designated representatives, shall mediate any dispute arising from the administration of this Policy Memorandum. If the resolution of the dispute is not satisfactory to the **Producer**, the **Producer** may submit a written appeal to the Director of Highways, or his/her designee.

9.0 PRODUCERS' RESPONSIBILITIES - GENERAL

It is the **Producer's** responsibility to:

1. Make application for certification.
2. Designate a **Quality Control Manager**.
3. Provide personnel with minimum required training.
4. Prepare a **Quality Control Plan**.
5. Ship only **Precast Concrete Products** that have been manufactured according to this Policy Memorandum, the **Quality Control Plan**, and the **Specifications**.
6. Reimburse the **Department's** transportation, per diem (meals), lodging, and incidental travel costs for initial certification inspections, re-certification inspections, or **Quality Assurance** inspections. For transportation and lodging costs, the provider of these services shall bill the **Producer** directly. Travel costs will apply if the **Bureau** has **Quality Assurance** responsibility for the **Producer's Plant** and the trip from the **Bureau** to the **Plant**, the **Plant** inspection, and the return trip to the **Bureau** cannot be completed within one day's normal work hours of 8:00 AM to 4:30 PM. Reimbursement for travel costs shall be provided no later than 30 calendar days after receipt of costs submitted by the **Department**.

10.0 PRODUCERS' RESPONSIBILITY - QUALITY CONTROL

Quality Control is the responsibility of the **Producer**, who shall:

1. Implement the **Quality Control Plan**, utilize sufficient personnel and backup for production **Quality Control**, and notify the **Engineer** of **Precast Concrete Product** production. In particular for **Plants** inspected by the **District**, production notification shall be provided to the **Engineer** for a start-up of a new product; the manufacture of a non-routine product; the manufacture of bridge slabs, pile caps, other structural members, piles, pile

extensions, or three-sided structures; or as required by the **District**. For **Plants** inspected by the **Bureau**, notification shall be provided for any **Department** projects.

2. Designate a **Quality Control Manager** who has direct responsibility for the **Quality Control** of all **Precast Concrete Products** produced under this Policy Memorandum. The **Quality Control Manager** shall report directly to the **Plant** manager for all **Quality Control** issues. The duties of the **Quality Control Manager** are listed in Attachment B.
3. Monitor all **Component Material** stockpiles for compliance with the **Specifications** and any requirement for **Department** approval.
4. Monitor all production equipment and processes for compliance with the **Specifications**.
5. Record **Quality Control** test results.
6. Verify compliance with the physical standards of the **Specifications**.
7. Identify, repair, and document the repair of defects where allowed by the **Specifications**.
8. Reject or declare unacceptable **Precast Concrete Products** that do not comply with the **Specifications**. Most products that do not comply with the **Specifications** shall be rejected. In some cases, according to Sections 23.0 and 24.0, the **Producer** has the option to reject or declare unacceptable three-sided structures (including wing walls, headwalls, etc.) and bridge slabs (i.e., "Channel Beams" and "Bridge Approach Slabs") that do not comply with the **Specifications**. Remedy proposals for three-sided structures and bridge slabs that have been declared unacceptable shall be submitted according to the "Procedure to Remedy an Unacceptable Precast or Precast Prestressed Product at the Plant" located in Appendix A of the **Department** Manual for Fabrication of Precast Prestressed Concrete Products.
9. Ship only **Precast Concrete Products** that have been produced according to this Policy Memorandum, the **Quality Control Plan**, and the **Specifications**.
10. Monitor shipping procedures such as loading, labeling, and record keeping.
11. Provide personnel, equipment, and handling for any sampling requested by the **Engineer**.
12. Perform **Quality Control** in a manner which includes the recognition of obvious defects and provides for their immediate correction. **Quality Control** shall also include appropriate action when passing test results are near **Specification** limits, or to resolve test differences with the **Inspector**. **Quality Control** may require increased testing, communication of test results, modification of operations, suspension of mixture production, rejection of material, or other actions as appropriate. The **Inspector** shall be immediately notified of any failing tests and subsequent remedial action. Passing tests shall be reported not later than the start of the next work day.

11.0 DEPARTMENT RESPONSIBILITIES - QUALITY ASSURANCE

The **District** or **Bureau** has primary responsibility for **Quality Assurance**, including the duty and responsibility to:

1. Verify the **Producer's Quality Control Plan** is being implemented.
2. Designate an **Inspector** who will administer the **Department's Quality Assurance** Program.
3. Observe the **Producer's Quality Control** activities.
4. For the manufacture of pile caps, other structural members, piles, pile extensions, or box culverts; at least one visit per structure shall be performed.
5. As determined by the **District** or **Bureau**, **Precast Concrete Products** (except for three-sided sided structures and bridge slabs) will be checked for dimensions and dimensional tolerances in accordance with this Policy Memorandum and the **Specifications**. This will be performed at the **Producer's Plant**, or at a location determined by the **District** or **Bureau**.
6. As determined by the **District** or **Bureau**, **Precast Concrete Products** that require shop drawings (except for three-sided sided structures and bridge slabs) which include, but may not be limited to, box culverts, noise abatement walls, modular retaining walls, mechanically stabilized earth retaining walls, pile caps, decorative structural elements, and other structural members) will be checked for conformance with the shop drawings. This may be done on or before the day of a pour at the **Producer's Plant**.
7. For the manufacture of three-sided sided structures (including wing walls, headwalls, etc.) and bridge slabs (i.e., "Channel Beams" and "Bridge Approach Slabs") the following **Quality Assurance** levels will apply in addition to other outlined **Quality Assurance** requirements:
 - a. **Quality Assurance** observations of all fabrication details, such as: conformance with the shop drawings; reinforcement placement; radii of bend in bent reinforcement; form erection; and placement of inserts, chairs, and lifting devices will be performed at a minimum level of 50%.
 - b. **Quality Assurance** dimensional tolerance measurements will be performed at a minimum level of 50%.
 - c. **Quality Assurance** crack measurements will be performed at a level of 100%.
 - d. **Quality Assurance** visual inspection will be performed at a level of 100%. The brief visual inspection shall consist of examining the product for placement of reinforcement or other hardware protruding from the product, overall dimensions, chips, spalls, or anything else out of the ordinary. If a three sided-structure or bridge slab was loaded on a truck and subsequently unloaded at the plant because delivery could not be made, it is recommended to perform another visual inspection before the next attempt for delivery because damage may have occurred.
8. Witness **Quality Control** testing or conduct **Quality Assurance** split sample testing a minimum of once a month for concrete strength. Independent

sample testing is optional. This may be for each **Precast Concrete Product** or may represent multiple **Precast Concrete Products**. In addition, the **District** or **Bureau** will witness a three-edge-bearing test once a month. The **Department** reserves the option to witness testing, perform independent sample testing, or perform split sample testing for slump, air, aggregate gradation, absorption, permeability, hydrostatic, density, freeze/thaw, linear drying shrinkage, and abrasion resistance tests. The witness of testing, independent sample testing, and split sample testing will be done in a random manner as determined by the **Inspector**. In addition, the **Inspector** will witness and take immediate possession of or otherwise secure the **Department's** split sample obtained by the **Producer**. The **District** or **Bureau** may reduce the **Quality Assurance** test frequency if production for the **Department** is minimal or sporadic over a period of time.

At the request of the **Inspector**, the **Producer** shall obtain split samples in sufficient quantities to allow comparison of test results. A split sample is one of two equal portions of a field sample, where two parties each receive one portion for testing. Split samples shall be tested by the **Producer** and the **Inspector**. Aggregate split samples and any failing strength specimen shall be retained until permission is given by the **Inspector** for disposal. The results of all **Quality Assurance** tests by the **Inspector** will be made available to the **Producer**. However, **Producer** split sample test results shall be provided to the **Inspector** before **Department** test results are revealed. Differences between the **Inspector's** and the **Producer's** split sample test results will not be considered extreme if within the following limits.

<u>Test Parameter</u>	<u>Acceptable Limits of Precision</u>
Slump	0.75 in. (20 mm)
Air Content	0.9%
Compressive Strength	900 psi (6200 kPa)
Aggregate Gradation*	See "Guideline for Sample Comparison" in Appendix A of the Manual of Test Procedures for Materials
Slump Flow	1.5 in. (40 mm)
Visual Stability Index	Not Applicable
J-Ring	1.5 in. (40 mm)
L-Box	10%
Hardened Visual Stability Index	Not Applicable

*Gradation testing is not required except as stated in Section 18.1.

When acceptable limits of precision have been met, but only one party is within specification limits, the failing test shall be resolved before the material may be considered for acceptance.

Split Sample Testing

If either the **Inspector's** or the **Producer's** split sample test result is not within the specification limits, and the other party is within specification limits, immediate retests on a split sample shall be performed for slump, air content, aggregate gradation, slump flow, visual stability index, J-ring value, or L-box

blocking ratio. A passing retest result by each party will require no further action. If either the **Inspector's** or the **Producer's** slump, air content, or aggregate gradation split sample retest result is a failure, or if either the **Inspector's** or **Producer's** strength test result is a failure, and the other party is within specification limits; the following actions shall be initiated to investigate the test failure:

- (a) The **Inspector** and the **Producer** shall investigate the sampling method, **Test Procedure**, equipment condition, equipment calibration, and other factors.
- (b) The **Inspector** or the **Producer** shall replace test equipment, as determined by the **Inspector**.
- (c) The **Inspector** and the **Producer** shall perform additional testing on split samples, as determined by the **Inspector**.

For aggregate gradation, slump, air content, slump flow, visual stability index, J-ring value, and L-box blocking ratio, if the failing split sample test result is not resolved according to (a), (b), or (c), and the mixture has not been placed, the **Producer** shall reject the material, unless the **Inspector** accepts the material for incorporation in the work according to Article 105.03 of the **Standard Specifications**. If the mixture has already been placed, or if a failing strength test result and hardened visual stability index is not resolved according to (a), (b), or (c), the product will be considered unacceptable.

If a continued trend of difference exists between the **Inspector's** and the **Producer's** split sample test results, or if split sample test results exceed the acceptable limits of precision, the **Inspector** and the **Producer** shall investigate according to items (a), (b), and (c).

Independent Sample Testing

An independent sample is a field sample obtained and tested by only one party. For aggregate gradation, slump, air content, slump flow, visual stability index, J-ring value, L-box blocking ratio, and hardened visual stability index, if the result of a **Quality Assurance** test on a sample independently obtained by the **Inspector** is not within specification limits and the mixture has not been placed, the **Producer** shall reject the material, unless the **Inspector** accepts the material for incorporation in the work according to Article 105.03 of the **Standard Specifications**. If the mixture has already been placed or the **Inspector** obtains a failing strength test result, the product will be considered unacceptable.

9. Periodically sample and test all **Component Materials**. The minimum will be once per year, except for admixtures. Admixtures will be sampled and tested if quality is a concern.
10. Authorize or direct random sampling at the **Plant** or the jobsite.
11. Authorize third-party (Consultant) sampling or testing for **Quality Assurance**.
12. Increase the sampling frequency or randomly inspect the **Producer's Plant** and **Laboratory** at any time. As a minimum, an annual inspection of the

Plant and **Laboratory** will be performed. The inspection will be performed by the **District** or **Bureau**, or the **District** and **Bureau**.

12.0 DEPARTMENT RESPONSIBILITIES - ACCEPTANCE OF PRODUCTS

Product acceptance will be based on the **Standard Specifications** and the following sections:

- 12.1 The **Producer's** compliance with all contract documents for **Quality Control**.
- 12.2 Validation of the **Producer's Quality Control** test results by witnessing **Quality Control** and/or by comparison with the **Inspector's Quality Assurance** test results using split samples. Any **Quality Control** or **Quality Assurance** test determined to be flawed may be declared invalid only when reviewed and approved by the **Inspector**. The **Inspector** will declare a test invalid only if it is proven that improper sampling or testing occurred. The test result is to be recorded and the reason for declaring the test invalid will be provided by the **Inspector**.
- 12.3 Comparison of the **Inspector's Quality Assurance** test results with **Specification** limits using samples independently obtained by the **Inspector**.
- 12.4 **Producer's** recorded results indicating the product meets or exceeds the **Specifications**.
- 12.5 Measurements of the product with respect to the contract plans and allowable tolerances.
- 12.6 Visual inspection of the completed product for damage prior to shipping.
- 12.7 Affixation of an ILL OK Stamp for three-sided structures (including wing walls, headwalls, etc.) and bridge slabs (i.e., "Channel Beams" and "Bridge Approach Slabs"). See also Section 20.0.

13.0 DEPARTMENT RESPONSIBILITIES - REJECTION OF PRODUCTS

- 13.1 The **Engineer** may reject or declare unacceptable **Precast Concrete Products**:
 - 1. Not manufactured according to this Policy Memorandum, the approved **Quality Control Plan**, or the **Specifications** (which includes shop drawings, as appropriate).
 - 2. Without proper identification markings.
 - 3. With defects as defined in Sections 23.0 and 24.0.
 - 4. Manufactured with misrepresented materials, such as using non-specification materials or unapproved materials.
 - 5. When production or shipping records are false.
- 13.2 Three-sided structures (including wing walls, headwalls, etc.) and bridge slabs (i.e., "Channel Beams" and "Bridge Approach Slabs") may be rejected or declared unacceptable in accordance with Sections 23.0 and 24.0. Other

Precast Concrete Products may be rejected. If a three-sided structure or bridge slab is declared unacceptable at the **Plant**, the **Producer** has the option to reject the product or submit a remedy proposal according to the "Procedure to Remedy an Unacceptable Precast or Precast Prestressed Product at the Plant" located in Appendix A of the Department Manual for Fabrication of Precast Prestressed Concrete Products. If a three-sided structure or bridge slab is declared unacceptable at the jobsite, the Contractor has the option to remove and replace the product or submit a remedy proposal according to the "Procedure to Remedy an Unacceptable Precast or Precast Prestressed Product at the Jobsite" located in Appendix A of the **Department** Manual for Fabrication of Precast Prestressed Concrete Products.

- 13.3 The Resident **Engineer** or Physical Test **Engineer** shall notify the responsible **District** or **Bureau** of any **Precast Concrete Products** rejected or declared unacceptable at the jobsite.

14.0 DEPARTMENT RESPONSIBILITIES - RECORD KEEPING

The **District** and/or **Bureau** will:

1. Maintain a diary or inspection form for each **Plant** which documents the date of the visit and the time frame. The diary or inspection form will include items inspected, any repairs observed, and any corrective action taken while present during the visit.
2. Maintain test results of samples taken during the **Plant** inspection visits.
3. Maintain test records of **Component Materials**.
4. Maintain a current list of **Producers** certified to provide **Precast Concrete Products**.
5. Retain the shipping ticket or bill of lading in the Resident **Engineer's** job file.
6. Prepare MISTIC reports that identify the **Producer** and quantities of **Precast Concrete Product** delivered.

15.0 QUALITY CONTROL PROGRAM - QUALITY CONTROL PLAN

Notice of **Quality Control Plan** Revision – The **Quality Control Plan** shall remain in effect until the **Producer** submits an updated document or the **District** or **Bureau** requests the **Producer** to update the **Quality Control Plan**. The **Producer** shall immediately notify the **District** or **Bureau** in writing of any changes to the approved **Quality Control Plan**. The revised **Quality Control Plan** shall be submitted for approval to the **District** or **Bureau** who has **Quality Assurance** responsibility for the **Producer**. The **District** shall forward a copy of all **Quality Control Plans** and related documents to the **Bureau**. The **Bureau** will retain a copy of all expired **Quality Control Plans** and related documents for a minimum period of three (3) years.

16.0 QUALITY CONTROL PROGRAM - FACILITIES

- 16.1 **Plant** - Production facility buildings, beds, forms, and equipment used to manufacture products under this program shall comply with the applicable

Specifications. Failure to maintain environmental or dimensional standards will be cause for corrective action by the **Producer**.

- 16.2 **Laboratory and Test Equipment** - The **Laboratory** shall have the facilities and equipment required by the **Specifications** for sampling and testing **Precast Concrete Products**.

Test equipment shall be maintained and calibrated as required by the appropriate test method, and when required by the **Inspector**. This information shall be documented on the **Department's** "Calibration of Concrete Testing Equipment" forms.

See Forms [BMPR PCCQ01](#), [BMPR PCCQ02](#), [BMPR PCCQ03](#), [BMPR PCCQ04](#), [BMPR PCCQ06](#), [BMPR PCCQ08](#), [BMPR PCCQ09](#) and [BMPR PCCQ10](#) (links embedded). The **Producer** shall meet the concrete sampling and testing equipment requirements in the **Department's** "Required Sampling and Testing Equipment for Concrete" document, which can found in the Manual of Test Procedures for Materials.

Test equipment used to determine compressive strength shall be calibrated annually or more often if results indicate a possible discrepancy. Calibration shall be performed by an independent agency using calibration equipment traceable to the National Institute of Standards and Technology (NIST). The **Producer** shall provide the **Department** a copy of the calibration documentation.

- 16.3 **Publications and Similar Documents** - The **Producer** shall maintain on-site, a current copy of **Specifications** and **Test Procedures** that apply to the manufactured **Precast Concrete Products**.

17.0 QUALITY CONTROL PROGRAM - PERSONNEL/TRAINING

- 17.1 The **Producer** shall employ qualified **Quality Control** personnel to perform all specified **Test Procedures**.

- 17.2 For testing wet and dry cast products, the **Quality Control Manager** and **Technician** shall have successfully completed the American Concrete Institute (ACI) Certification Program for Concrete Field Testing Technician - Grade I. A **Concrete Tester** may provide assistance with testing as explained under "Definitions." The **Quality Control Manager** shall be an employee of the **Producer**. Consultant personnel may be used for all remaining personnel, provided they have completed the required training.

- 17.3 Consultant personnel may be used as backup when required in the **Quality Control Plan**, provided they have completed the required training.

18.0 QUALITY CONTROL PROGRAM - MATERIALS

- 18.1 **General** - The **Producer** shall use only materials (cement, finely divided materials, aggregates, water, reinforcement steel, and admixtures) that meet the applicable **Specifications**. The sources of all **Component Materials** shall be approved by the **Department**, and the Aggregate Gradation Control System (AGCS) Policy Memorandum will apply to all aggregate.

An exception will be granted for the AGCS program if the **Producer** is the responsibility of the **Bureau**. However, an exception will not be given for the aggregate quality requirement. To obtain an AGCS exception, the **Producer** shall indicate that their aggregate source is not in Illinois and does not participate in the AGCS program. The exception will be allowed if the **Producer** can meet the requirements of Option A or B.

Option A Requirements (**Producer** is **Bureau** responsibility):

1. For each aggregate source, the gradation number(s) used by the **Producer** shall be tested for washed gradation according to Illinois Test Procedures 11 and 27. The minimum frequency shall be twice each month, at uniform intervals. The acceptable gradation bands of the aggregate shall be established by the **Producer**, and this information shall be provided to the **Department**. Approval of the coarse aggregate gradation bands will be given if the critical sieve, as determined by the **Engineer**, does not exceed ± 8 percent. Approval of the fine aggregate gradation bands will be given by the **Engineer** if no sieve exceeds ± 20 percent.
2. The washed aggregate gradation testing may be done by the **Producer**, a consultant hired by the **Producer**, a ready mixed concrete producer (if supplying concrete to the **Producer**), or by the aggregate source. The aggregate testing source shall meet the aggregate sampling and testing equipment requirements in the **Department's** "Required Sampling and Testing Equipment for Concrete" document, which can be found in the Manual of Test Procedures for Materials. The aggregate equipment may be for a low or high volume operation. The **Laboratory** will be inspected by the **Bureau**.
3. The individual performing the test shall have obtained **Department** training either as an **Aggregate Technician** or **Mixture Aggregate Technician**. Course information is available on the Internet at the [Lake Land College](#) website (link embedded) and contact the **Bureau** if assistance is required.

Option B Requirements (**Producer** is **Bureau** responsibility):

1. The **Department's** AGCS program may be substituted with another State agency's aggregate gradation control system program, if determined to be comparable to the **Department's** program. At this time, Indiana's Certified Aggregate Program (CAP) and Michigan's Prequalified Supplier Program for Aggregates are considered to be comparable to the **Department's** program.

18.2 Cement, Finely Divided Minerals, Aggregates, Reinforcement Steel, and Admixtures - The **Producer** shall maintain documentation (delivery tickets, invoices, etc.) from an approved source.

18.3 Miscellaneous Components - All **Miscellaneous Components** furnished by the **Producer** shall comply with the applicable specification. The **Producer** shall maintain copies of manufacturer's certifications of quality and performance for gaskets, mastic, castings, and any other material supplied to projects.

19.0 QUALITY CONTROL PROGRAM - MANUFACTURING CONTROL

19.1 **Quality Control** - Under the supervision of the **Quality Control Manager**, the **Producer** shall monitor production for compliance with the **Specifications** and the **Quality Control Plan**.

19.2 **Shop Drawings** - The **Quality Control Manager** shall ensure that the product is manufactured according to the **Specifications**, which may include shop drawings approved by the **Engineer**. Attachments F, G, H, I, J, K, L, and M provide detailed information on shop drawing requirements for various **Precast Concrete Products**. Shop drawings shall have a signature block indicating "drawn by" and "reviewed by". The drawer and reviewer shall be separate people.

If shop drawings require approval, no casting shall start unless the **Producer** has a set of approved shop drawings, or has written or e-mail verification of approval. Shop drawings shall be according to Article 1042.03(b) and Attachments F and J of this Policy Memorandum. Shop drawings, whether or not they require the **Engineer's** approval, shall be provided to the **Inspector**. A set of contract plans with special provisions shall be made available to the **Inspector** upon request.

Welded wire fabric and reinforcement bars for precast box culverts (including wingwalls, headwalls, etc.) with zero fill shall be epoxy coated according to Article 1006.10. Otherwise, the reinforcement shall be non-coated.

Substitution of reinforcement bar splicers indicated on the contract plans or three-sided structure plans will not be permitted. Substitution of inserts, connections, or lifting devices shown on the contract plans shall require approval of the Bureau of Bridges and Structures.

If UNC threaded inserts (i.e., "Ferrule Loops" or equivalent) are indicated on the contract plans and/or shop drawings for connecting headwalls or wingwalls to culverts, the **Inspector** shall contact the Bureau of Bridges and Structures or the **Bureau** of Materials and Physical Research for further dispensation.

When compressive strength is determined by cores, acceptable core locations shall be shown on the shop drawings. Refer to Note 13 of Attachment D.

19.3 **Mix Design** - The **Quality Control Manager** shall ensure that all mix designs are verified by the **Engineer** and shall notify the **Engineer** if a mix design or **Component Material** is changed.

19.4 **Welding Reinforcement** – Section 5.1.1 "General" (paragraphs four through seven) of the Manual for Fabrication of Precast Prestressed Concrete Products shall apply to manual welding. Tack welding, in lieu of tying, for the purpose of securing reinforcement is permitted only as follows.

1. Machine tack welding of wire for circular wire cages.
2. Manual tack welding, only as necessary, to supplement machine tack welding for circular wire cages.
3. Pipe elbows according to Highway Standard 542601 and pipe tees according to Highway Standard 542606.

4. Box culverts according to ASTM C 1577.
5. Manual tack welding of bar for manhole lids and bases. Refer to Attachment N for approved locations.
6. Three-sided structures according to ASTM C 1504.

19.5 Identification Markings - The **Producer** shall apply identification marks immediately after forms are removed or after curing is completed. The marks shall be etched/indented into the concrete, or painted/inked with waterproof marking according to Attachment C.

20.0 QUALITY CONTROL PROGRAM - CURING AND SHIPPING

The **Quality Control Manager** shall monitor and document compliance with the curing methods, curing periods, and holding periods for each **Precast Concrete Product**. When steam, supplemental heat, or insulated blankets (with or without steam/supplemental heat) are used, refer to the [Manual for Fabrication of Precast Prestressed Concrete Products](#) (link embedded) for production requirements. Any exemptions or revisions to these requirements will be provided in this Policy Memorandum. If a **Producer** believes a requirement is unreasonable in the manual referenced above, a reason for the exemption or revision shall be provided to the **Bureau** for review and approval.

Handling of Precast Concrete Products shall be according to Article 1042.03(e)(6), except that three-sided structures (including wingwalls, headwalls, etc.) and bridge slabs (i.e., "Channel Beams" and "Bridge Approach Slabs") shall not be handled until the concrete has attained 80% of its specified compressive strength. In addition, bridge slabs shall be handled according to Section 3.6.1 of the Manual for Fabrication of Precast Prestressed Concrete Products (link embedded).

The **Quality Control Manager** or authorized employee of the **Producer** shall make final inspection of the **Precast Concrete Product** just prior to and after loading when shipping to the jobsite. This would apply to product manufactured by the **Producer** or another **Producer**.

Three-sided structures (including wing walls, headwalls, etc.) and bridge slabs (i.e., "Channel Beams" and "Bridge Approach Slabs") released for shipment by the **Inspector** shall be stamped ILL OK for notification to the Resident **Engineer**. These products shall not be stamped ILL OK prior to the **Inspector** receiving the final distribution shop drawings. It is recommended to place the stamp where information that identifies the product is written. If an ILL OK stamp has become worn, it is to be discarded and a new stamp obtained from the **Bureau** of Materials and Physical Research. Consultants who do inspection for the **Department** are responsible for their ILL OK stamps. The ILL OK stamp ink can fade with time, and therefore the stamp should be applied near the time of shipment.

When inspecting the ILL OK stamps, refer to [Departmental Inspectors with ILL OK stamps](#) (link embedded) and/or [Consultants with ILL OK stamps](#) (link embedded).

The **Inspector** is to never apply the ILL OK stamp before repairs are completed and inspected for approval. It is understood that the **Inspector** conducts **Quality**

Assurance activities and is not present during or directly involved with every aspect of the fabrication process. The ILL OK stamp is evidence of the validation of the **Producer's Quality Control** activities by the **Inspector's Quality Assurance** activities.

If a three-sided structure or bridge slab is shipped without an ILL OK stamp, the **Inspector** shall notify the Resident **Engineer** (Owner or Representative of the Owner in the case of Local Agency projects). The Resident **Engineer**, Owner, or Representative of the Owner shall issue a PS02 form and is responsible for communicating with the **Inspector** at the **Plant** regarding QA, QC, acceptance and rejection issues.

In very rare cases, the receiving **District** or Local Agency may request a product to be delivered prior to approval of a remedy. In this situation, the **Inspector** shall not stamp the product ILL OK. Release of the product may occur only after BMPR has been notified who is the Engineer of Record (Illinois Licensed Structural Engineer) that is responsible for the product. BMPR will notify the **Inspector** when the product may be released.

21.0 QUALITY CONTROL PROGRAM - PRODUCT STORAGE

The **Producer** shall provide adequate and accessible storage for finished **Precast Concrete Products** awaiting inspection and/or shipment. The storage area shall be free of vegetation. **Precast Concrete Products** shall not be stored directly on dirt or mud.

Storage of bridge slabs (i.e., "Channel Beams" and "Bridge Approach Slabs") shall be according to Section 3.6.2 of the Manual for Fabrication of Precast Prestressed Concrete Products (link embedded).

22.0 QUALITY CONTROL PROGRAM – MINIMUM QUALITY CONTROL SAMPLING AND TESTING

22.1 The **Producer** or designated consultant shall perform **Quality Control** sampling and testing. Section 1020 of the **Specifications** and Section 1042 of the **Standard Specifications** provides general information on precast concrete requirements. Refer to 7.0 "Determining the Concrete Mix Design Target Strength" in the Portland Cement Concrete Level III Technician Course - Manual of Instructions for Design of Concrete Mixtures for information on determining the concrete mix design target strength.

22.2 The minimum required sampling and testing shall be according to Attachment D, and it is not required to be random.

The list below indicates individual test results which may be used to represent multiple **Precast Concrete Products** that are similar in nature. A **Producer's QC Plan** shall clearly indicate the combinations of **Precast Concrete Products** that are to be represented by individual test results.

1. A single slump or air content test may represent multiple **Precast Concrete Products** provided the same mix design is used for the various products.

2. A single concrete compressive strength [two (2) 6- by 12-in. (150- by 300-mm) or three (3) 4- by 8-in. (100- by 200-mm) cylinders] may represent multiple **Precast Concrete Products** provided the same mix design and curing method (for product and cylinders) is used.
3. A single concrete compressive strength (one core), absorption test, permeability test, hydrostatic test, density test, freeze/thaw test, linear drying shrinkage test, or abrasion resistance test may represent multiple **Precast Concrete Products** provided the same mix design, casting method, and curing method are used.

If the minimum required sampling and testing is not specified for a **Precast Concrete Product**, the **Bureau** shall be contacted to amend Attachment D. In the interim, the **Producer** shall propose the sampling and testing in the **Quality Control Plan** for approval by the **Engineer**.

- 22.3 Tests performed by the **Producer** to satisfy the requirements of in-state or out-of-state agencies are acceptable for meeting test frequency requirements.
- 22.4 Pipe products that fail a test for a specific class may not be used for the class that the test data meets, unless identification markings are corrected to the satisfaction of the **Engineer**. Documentation by the **Engineer** shall accompany shipments to a project.
- 22.5 A **Precast Concrete Product** shall be rejected if it fails **Specification** test requirements. A sample of any item, class, or size that fails may be rechecked with two additional samples from that item, class, and size, provided they are from the same **Lot**. The **Engineer** will define the **Lot**, which normally will be by concrete batch or day of production. Both samples shall meet **Specifications** for the **Lot** to be accepted.

23.0 QUALITY CONTROL PROGRAM - VISUAL INSPECTION

The **Producer** is responsible for the visual inspection of all **Precast Concrete Products** before shipping. The minimum guidelines are specified below. [Photographs of Precast Concrete Products](#) (link embedded) that are acceptable, unacceptable, and unacceptably repaired can be found on the Internet.

1. PHYSICAL MEASUREMENTS – The product shall be rejected, or three-sided structures (including wing walls, headwalls, etc.) and bridge slabs (i.e., “Channel Beams” and “Bridge Approach Slabs”) may be declared unacceptable and a remedy proposal may be submitted if it does not meet dimensions or dimensional tolerances of the **Specifications** and this Policy Memorandum.

In regards to overpacking and featheredge, this is excess material present in the bell end of the product (i.e., pipes, manholes, etc.). This is caused by mix packed past the end of the barrel during production. The product shall be rejected unless dimensional tolerances are satisfied.

If delamination occurs, the **Precast Concrete Product** shall be rejected.

The **Specifications** for dimensional tolerances of three-sided structures include Articles 11.1, 11.2, and 11.3 of ASTM C 1504.

The **Specifications** for dimensional tolerances of bridge slabs include those outlined in Section 1.2.4 of the [Manual for Fabrication of Precast Prestressed Concrete Products](#) (link embedded) for deck beams as applicable.

The **Specifications** for dimensional tolerances of precast box culverts and concrete rectangular end sections include Articles 11.1, 11.2, 11.3 and 11.4 of ASTM C 1577.

2. CRACKS – The following provides guidance on unacceptable and acceptable cracks in **Precast Concrete Products**:
 - a. The product shall be rejected if a crack passes entirely through the wall of any Precast Concrete Product.
 - b. A single end-crack that does not exceed the depth of the joint in a product is not a cause for rejection.
 - c. Except for three-sided structures (including wing walls, headwalls, etc.) and bridge slabs (i.e., “Channel Beams” and “Bridge Approach Slabs”), the reinforced product shall be rejected if it has a surface crack width of 0.01 in. (0.30 mm) or greater that exceeds a length of 12 in. (300 mm), regardless of position. If the total length of several cracks 0.01 in. (0.30 mm) or greater that add up to a length in excess of 24 in. (600 mm), the product shall be rejected. The non-reinforced product shall be rejected if it has a surface crack width of 0.01 in. (0.30 mm) or greater that exceeds a length of 2 in. (50 mm), regardless of position. If the total length of several cracks 0.01 in. (0.30 mm) or greater that add up to a length in excess of 4 in. (100 mm), the product shall be rejected.
 - d. For cracking in three-sided structures (including wing walls, headwalls, etc.), the product shall be rejected or declared unacceptable and a remedy proposal may be submitted if there are 3 or more cracks with widths greater than 0.007 in. (0.18 mm) but less than 0.01 in. (0.30 mm), or has 1 or more cracks with a width greater than or equal to 0.01 in. (0.30 mm).
 - e. For cracking in bridge slabs (i.e., “Channel Beams” and “Bridge Approach Slabs”), the product shall be rejected or declared unacceptable and a remedy proposal may be submitted if there are 1 or more cracks with widths greater than 0.007 in. (0.18 mm).
3. HONEYCOMB OR VOIDS - If honeycomb or voids are deeper than $\frac{3}{4}$ the depth of the coarse aggregate and exceed 5 percent of the surface area of the product, it shall be rejected. All other honeycomb or voids equal to or less than $\frac{3}{4}$ the depth of the coarse aggregate may be repaired provided it does not exceed 5 percent of the surface area.

Pipe with honeycomb or voids on the inside shall be rejected. However, as determined by the **Engineer**, an occasional pipe with voids resulting from the manufacturing process may be accepted. The voids shall be equal to or less than $\frac{3}{4}$ the depth of the coarse aggregate, and shall not exceed 1 percent of the interior surface area. This exception shall not apply to honeycomb.

4. SMOOTHNESS of the barrel - The inside of a pipe or box culvert shall be rejected if it is not substantially free from surface roughness. Substantial surface roughness will unduly impede the design flow of water.
5. IMPROPER REINFORCEMENT PLACEMENT - A thin layer of concrete over the steel may be detected by shadowing. Further inspection may be necessary to determine the proper depth of cover as stated in the appropriate **Specification** (which may include the shop drawing or Highway Standard). A product shall be rejected if it has improper concrete cover over the reinforcement. The exposed ends of longitudinal steel, stirrups, lift holes, or spacers used to position the reinforcement (cage) during concrete placement is not cause for rejection. Any other exposed steel is considered a defect and the product shall be rejected. Three-sided structures (including wing walls, headwalls, etc.) and bridge slabs (i.e., "Channel Beams" and "Bridge Approach Slabs") may be declared unacceptable and a remedy proposal may be submitted for other deviations in reinforcement placement not listed above.

The **Specifications** for position of reinforcement for three-sided structures includes Article 11.4 of ASTM C 1504.

The position of reinforcement for bridge slabs, pile caps, piles and extensions, decorative bridge structural elements, and other structural members shall be within $\pm 1/2$ in. (12 mm) of the contract plan dimensions.

The **Specifications** for position of reinforcement for precast box culverts and concrete rectangular end sections includes Article 11.5 of ASTM C 1577.

6. CHIPPED OR DAMAGED ENDS - The product shall be rejected if the damage is halfway or more into the joint and has a length of more than 10 percent of the end circumference or perimeter. This damage is considered sufficient to prevent a satisfactory joint in the field.
7. MARRED OR DISCOLORED SURFACES – If a surface of the product is marred or discolored, and is architectural in nature and/or visible to the public after installation, it shall be rejected.
8. IDENTIFICATION MARKINGS - The product shall be rejected if the identification markings are not legible or are absent.
9. LAMINATIONS AND WEAK SURFACE (Self-Consolidating Concrete) – Refer to Sections 3.5.5.2 and 3.5.5.3 of the [Manual for Fabrication of Precast Prestressed Concrete Products](#) (link embedded).
Products with laminations, folds or weak surface shall be rejected.
10. OTHER DEFECTS – The product shall be rejected if the repair size exceeds 2 percent of the cross-sectional area or $1/2$ percent of the surface area of the product.

24.0 QUALITY CONTROL PROGRAM - REPAIRS

In cases where a remedy proposal has been submitted and approved and other cases where a remedy proposal is not required, the **Producer** may repair a **Precast Concrete Product** unless rejection is required per Section 23.0. However, the **Engineer** may not accept a repaired **Precast Concrete Product** if it will not perform as intended (diminished service life), there are excessive occurrences of manufacturing defects, or the workmanship of the repair is poor. The **Producer** shall follow the guidelines below, the **Quality Control Plan**, and the approved remedy proposal (when applicable) when doing a repair.

1. CRACKS which do not exceed the cause for rejection may not have to be repaired unless repair is required by the applicable **Precast Concrete Product** AASHTO/ASTM standard specification, the contract documents, or as directed by the **Engineer**.

Cracks that are 0.007 in. (0.18 mm) or wider shall be repaired according to Section 590 of the **Standard Specifications**.

Cracks that are less than 0.007 in. (0.18 mm) in width shall be repaired according to Section 587 of the **Standard Specifications** if the **Engineer** determines a concrete sealer is sufficient. Otherwise, the **Producer** shall use a suitable epoxy (Type, Grade, Class) according to ASTM C 881.

2. HONEYCOMB OR VOIDS; CHIPPED OR DAMAGED ENDS; OTHER DEFECTS which do not exceed the cause for rejection – All loose material shall be removed and the area cut back until the coarse aggregate will break under chipping rather than dislodging. The sides of the repair area shall be shaped with one or more faces having a minimum depth of 1 in. (25 mm) and as perpendicular as possible to the surface of the area. The area shall be cleaned by brushing. Exposed reinforcement steel shall be cleaned of foreign substances and detrimental corrosion. The repair shall be according to Item 4.
3. HOLES - Core holes obtained for strength testing shall be repaired according to Item 4.
4. REPAIR MATERIALS - The prepared surface and up to 4 in. (100 mm) outside the repair area shall be wetted a minimum of 1-hour before application of the repair material. The surface shall be maintained in a dampened condition during the 1-hour period. Immediately before placing the repair material, any excess water shall be removed. Anchoring of patches through the use of drilled and chemically adhered rebar or bolts is generally not required, but is also not prohibited. Under certain circumstances, however, anchoring of patches may be necessary. The repair material shall be a no-slump concrete mix using the product's **Component Materials** which can be packed solidly into the repair area by hand, under vibration, or using oil free compressed air. The proportions of the repair material shall be adjusted to ensure adequate consolidation. A coarse aggregate shall only be used when the minimum depth of the repair is at least 3 times the maximum aggregate size. The presence of reinforcement should also be considered when selecting aggregate for the repair material. The maximum aggregate size shall be no more than $\frac{3}{4}$ of the clear spacing around the reinforcement. The patch material shall be cured for 3-days according to Article 1020.13(a)(3) or (5) of the

Specifications, and shall obtain a strength equivalent to or higher than the specified strength for the **Precast Concrete Product**. At the discretion of the **Department**, a strength verification test may be performed according to Illinois Modified AASHTO T 22 and T 23.

As an alternative to the no-slump concrete mix, a prepackaged repair material may be used, provided the resulting appearance or color is not objectionable to the **Engineer**. The prepackaged repair material shall be a no-slump mix which can be packed solidly into the repair area by hand or under vibration. Curing shall be according to the manufacturer's recommendations. The prepackaged repair material shall be from the "[Qualified Product List of Nonshrink Grouts](#)", the "[Qualified Product List of Packaged, Dry, Rapid Hardening Cementitious Materials for Concrete Repairs](#)", the "[Qualified Product List of Polymer Modified Portland Cement Mortar](#)," or the "[Qualified Product List of Packaged, Dry, Combined Materials for Mortar](#)" (links embedded). The prepackaged material shall be appropriate for the size and depth of repair, and shall obtain a strength equivalent to or higher than the specified strength of the **Precast Concrete Product**. At the discretion of the **Department**, a strength verification test may be performed according to the **Department's** material specification for the packaged product.

As an alternative to a no-slump concrete mix or prepackaged repair material, the **Producer** may propose to use a suitable epoxy (Type, Grade, Class) according to ASTM C 881. This alternative is typically advantageous for very shallow or small repairs where aesthetics is not a concern.

25.0 PRODUCT SHIPPING DOCUMENTATION

25.1 Shipment Ticket (or Bill of Lading) – **Producers** shall submit shipment tickets weekly (unless otherwise directed) to the inspecting **District** or the inspecting **Bureau** at the **Plant**. The shipment ticket shall indicate contract number, quantity, size, class, **Miscellaneous Components**, and other information requested by the inspecting **District** or inspecting **Bureau**. In addition, if shipment of a **Precast Concrete Product** to a project is from a **Producer** who is not the manufacturer (i.e. the product was manufactured by another **Producer**), this shall be indicated on the shipment ticket. The inspecting **District** or inspecting **Bureau** for a **Producer** shall perform assignments (using the shipment ticket) into the **Department's** Materials Integrated System for Test Information and Communication (MISTIC) database.

25.2 Materials Integrated System for Test Information and Communication (MISTIC) and "Qualified Producer List of Certified Precast Concrete Producers" – MISTIC is a database for tracking the use of approved materials. The "Qualified Producer List of Certified Precast Concrete Producers" provides information on **Producers** and the **Precast Concrete Products** they are qualified to supply to the **Department**. Attachment O provides MISTIC Material Codes for **Precast Concrete Products** and the correlated Product Keys used in the Approved List.

For more information on MISTIC or the "Qualified Producer List of Certified Precast Concrete Producers", or to get a new Material Code or Product Key created, contact the **Bureau**.

26.0 RECORD KEEPING

- 26.1 Diary - The **Quality Control Manager** shall maintain a diary of all activities related to **Precast Concrete Product** sampling, testing, repairs, corrective actions, and essential observations. The **Producer** shall retain diary records for a minimum period of three years.
- 26.2 Tests and Equipment Calibration - The **Producer** shall retain **Quality Control** test records and equipment calibration records for a minimum period of three years.
- 26.3 Invoices - The **Producer** shall retain copies of purchase orders and/or invoices for all **Component Materials** and **Miscellaneous Components** for a minimum period of two years.
- 26.4 Other Documents - The **Producer** shall retain **Quality Control Plans**, shop drawings, shipping records, etc. for a minimum period of three years.

27.0 SELF-CONSOLIDATING CONCRETE

Refer to Section 1020 of the [Standard Specifications](#) (link embedded).



Brian A. Pfeifer, P.E.
Engineer of Materials
and Physical Research

DHT/JAB

**ILLINOIS DEPARTMENT OF TRANSPORTATION
MODEL QUALITY CONTROL PLAN FOR PRECAST CONCRETE PRODUCTS**

Effective: November 1st, 2013

INSTRUCTIONS: The Producer shall respond to all items addressed in this model. This is applicable to work performed by the Producer or work subcontracted. Examples are provided to assist the Producer, and any innovations to the quality control process may be presented. If an item does not pertain to the Producer's particular operation, it shall be marked "Not Applicable" or "N/A."

Refer to [Model Quality Control Plan](#) (link embedded) for an electronic form version that simplifies completion. Note that the instructions and examples provided herein are not included in the electronic form version.

**QUALITY CONTROL PLAN
PRECAST CONCRETE**

Producer: _____

P.O. Box: _____

Street Address: _____

City/State/Zip Code: _____

Phone No.: _____

Fax No.: _____

Name of Plant or No.: _____

E-Mail Address: _____
(Owner/Partner/
Corporate Officer
and/or QC Manager)

Web Page Address: _____

PRODUCER RESPONSIBILITIES

This Quality Control plan explains how **(Insert name of firm/corporation)** proposes to control the equipment, materials, and production methods to ensure the specified product is obtained.

The Producer agrees to read, understand, abide, and implement all the requirements in the Department's Policy Memorandum **(insert number)**, "Quality Control/Quality Assurance Program for Precast Concrete Products", and the Policy Memorandum will be considered a part of this Quality Control Plan.

PRODUCER'S ACKNOWLEDGEMENT

(Insert name of firm/corporation) desires to obtain advance approval of materials to be supplied to Department of Transportation contractors as more fully described herein. I and the company understand that the Department of Transportation reserves the right in its contracts to approve materials at the source of supply as provided in Article 106.01 of the Standard Specifications for Road and Bridge Construction. I and the company further understand that approval of company supplied material pursuant to this request does not constitute a contract to supply material to the State of Illinois or any of its contractors, and that the Department of Transportation does not assure or guarantee that any materials approved hereunder will be supplied to the State or any of its contractors. In consideration of approval, I and the company

agree to the terms, conditions, and performance standards of the Standard Specifications for Road and Bridge Construction and Policy Memorandum (insert number), "Quality Control/Quality Assurance Program for Precast Concrete Products," a copy of which has been received.

I. PRODUCER PRODUCTS OR PRODUCT LINES

INSTRUCTIONS: List products to be manufactured. Refer to the "Products Key" on the [Qualified Producer List of Certified Precast Concrete Producers](#) (link embedded) for the list of categories.

Example:

C:1 Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
D:4 Manhole Type A

II. SHOP DRAWINGS

INSTRUCTIONS: The wording for shop drawings is provided for the Producer as indicated below.

Shop drawings will be according to the Standard Specifications for Road and Bridge Construction and other documents as issued by the Department.

III. CONCRETE PLANT AND DELIVERY TRUCKS

INSTRUCTIONS: Provide the following information if concrete is provided by a ready-mix plant.

Concrete Plant Name: _____

Concrete Plant Location: _____

Concrete Producer No.: _____

INSTRUCTIONS: Provide the following information if concrete is mixed at the Producer's precast plant facility.

Plant Equipment Manufacturer: _____

Plant Capacity: _____

List of Delivery Trucks and Their Capacity: _____

List Other Delivery Methods: _____

NOTE: The plant and delivery trucks are to be approved according to Article 1020.11(b) and Section 1103 of the Specifications.

IV. PRODUCER QUALITY CONTROL LABORATORY

Laboratory Name (if independent lab is used): _____

Location: _____

Contact Person: _____

Telephone No.: _____

Fax No.: _____

The quality control laboratory is _____ sq. ft.

The laboratory was approved on _____ by (District # or BMPR) _____.

In the event of lab equipment failure, _____ (backup lab name) will provide back up equipment.

V. PRODUCER QUALITY CONTROL PERSONNEL

INSTRUCTIONS: List all quality control personnel. If the plant will be working more than one shift or during weekends, provide contact information for the Quality Control Manager and applicable personnel after normal work hours.

Individual's Name: _____

American Concrete Institute (ACI) Training: _____

Company Name: _____

Telephone Number: _____

_____ is the ACI Concrete Field Testing Technician – Grade I who will be responsible for mixture control and adjustments when product is manufactured. _____ is the backup ACI Concrete Field Testing Technician – Grade I.

_____ is the Quality Control Manager who will be responsible for overall product quality control. _____ is the backup Quality Control Manager.

_____ is the Plant Manager.

_____ is the individual who will make final inspection of product just prior to loading and shipping.

VI. MIX DESIGNS

INSTRUCTIONS: Provide mix design information as stated in 1.1 “Volumetric Mix Design and Mix Design Submittal” of the Portland Cement Concrete Level III Technician Course-Manual of Instructions for Design of Concrete Mixtures, which can be found at the [Lake Land College](#) website (link embedded).

Otherwise state: “Only mix designs previously verified by the Department will be used”.

INSTRUCTIONS: Based on the ASTM 1260 test information provided for the aggregates, indicate the mixture option selected for minimizing the risk of alkali-silica reaction. Refer to Section 1020 of the [Standard Specifications](#) (link embedded).

VII. PRODUCER SAMPLING AND TESTING

INSTRUCTIONS: If the Producer will use a test frequency higher than that specified in Attachment D, indicate this higher test frequency for the precast concrete product. If the minimum required sampling and testing is not specified for a precast concrete product, indicate the sampling and testing that will be used.

INSTRUCTIONS: When cylinders are used for compressive strength testing, indicate how the specimens will be cured and the location for compression strength testing.

Example:

Plastic cylinder molds [4 by 8 in. (100 by 200 mm)] will be used to cast strength specimens. The plastic cylinder mold will be covered with a plastic cylinder lid. Testing will be performed at the manufacturing plant.

INSTRUCTIONS: The concrete strength test of record shall be according to specifications, which in many cases is a 28 day test. A day earlier than the requirement may be submitted by the Producer for a precast concrete product. Refer to Attachment D for more detailed information concerning strength testing requirements for specific products.

Example:

For precast box culvert, compressive strength testing will be performed at 28 days. Additional cylinders will be made if testing at an earlier age is desired.

INSTRUCTIONS: For concrete pavers according to ASTM C 936, the Producer shall provide ASTM C 1645 (saline test solution) freeze/thaw test results which indicate the concrete paver has adequate resistance to freeze/thaw. For precast block or articulated block revetment mat, the Producer shall provide ASTM C 67 freeze/thaw test results or ASTM C 1262 freeze/thaw test results which indicate the precast concrete block has adequate resistance for freeze/thaw.

VIII. FAILING TESTS AND DEFECTIVE WORK

INSTRUCTIONS: Indicate the communication procedures between the Producer, the Concrete Producer, the Consultant, and Department personnel in the event of failing tests or observation of defective work. This may also be in flow chart form.

Example:

In the event of failing tests or observation of defective work at the precast plant, the ACI Concrete Field Testing Technician - Grade I will be responsible for notifying the Quality Control Manager. The Quality Control Manager will be responsible for notifying the Department's Inspector.

IX. AGGREGATE MATERIALS

INSTRUCTIONS: The wording for "A) Aggregates" and "D) Maintaining Aggregate Quality at the Plant" is provided for the Producer. Indicate the material sources for "B) Coarse Aggregates" and "C) Fine Aggregates". If applicable, attach proposed mix plant

gradation bands in accordance with the Department's "Development of Gradation Bands on Incoming Aggregate at Mix Plants."

A) Aggregates

1. Aggregate Gradation Control System (AGCS) Program – Aggregate Source is Participant

Certified aggregate gradation bands (including master band, if required) will be obtained from the aggregate source for all certified aggregates, prior to any shipment of material to the plant.

2. Aggregate Gradation Control System (AGCS) Program – Aggregate Source is Non-Participant

NOTE: Item 2 is permitted only when the Bureau of Materials and Physical Research has Quality Assurance responsibility for the Producer, and the Aggregate Source is not in Illinois.

For _____ (indicate Aggregate Source), gradation number(s) _____ will be tested for washed gradation according to Illinois Test Procedures 11 and 27. The minimum frequency will be twice each month, at uniform intervals. The acceptable gradation band for gradation number(s) _____ will be _____.

The washed aggregate gradation testing will be done by _____ (indicate Producer or Consultant hired by Producer or Aggregate Source). The quality control laboratory information is as follows:

Laboratory Name (if independent lab is used): _____

Location: _____

Contact Person: _____

Telephone Number: _____

The quality control laboratory is _____ sq. ft.

The laboratory was approved on _____ by BMPR.

In the event of lab equipment failure, _____ (backup lab name) will provide back up equipment.

The training information for the individual who will perform the gradation testing is as follows:

Individual's Name: _____

Training (Aggregate Technician or Mixture Aggregate Technician): _____

Company Name: _____

Telephone Number: _____

3. Aggregate Gradation Control System (AGCS) Program – Aggregate Source Participates in Comparable Program

NOTE: Item 3 is permitted only when the Bureau of Materials and Physical Research has Quality Assurance responsibility for the Producer, and the Aggregate Source is not in Illinois.

_____ (Aggregate Source) participates in the _____ (Indiana Certified Aggregate Program (CAP) or Michigan Prequalified Supplier Program for Aggregates) for gradation number(s) _____.

B) Coarse Aggregates

Coarse Aggregate Material: (Example: CA 11 - Crushed Stone)

ASTM C 1260 Expansion: _____ (This is not required for limestone or dolomite aggregate.)

Department Producer/Supplier Number: _____

Company Name: _____

Company Address: _____

Contact Person: _____

Telephone Number: _____

C) Fine Aggregates

Fine Aggregate Material: (Example: FA 01 - Natural Sand)

ASTM C 1260 Expansion: _____ (This is not required for limestone or dolomite aggregate.)

Department Producer/Supplier Number: _____

Company Name: _____

Company Address: _____

Contact Person: _____

Telephone Number: _____

D) Maintaining Aggregate Quality at the Plant

Aggregates shall be stockpiled and handled in a manner which minimizes segregation and degradation, prevents contamination, and produces a uniform gradation, before placement in the plant bins.

Aggregates which are dumped directly into plant bins from delivery trucks will have a uniform gradation.

Aggregate which does not meet gradation requirements included herein or Department specifications for quality will not be used for Department projects. Product manufactured with non-compliant aggregate material will not be supplied to Department projects.

X. CEMENT AND FINELY DIVIDED MINERALS

INSTRUCTIONS: The wording is provided for the Producer as indicated below. A producer/supplier of cement or finely divided minerals who is not on the approved list shall make arrangements with the Department for lot testing.

Cement will be from the "[Approved/Qualified Producer List of Qualified Cement Plants](#)" (link embedded) and finely divided minerals will be from the "[Qualified Producer List of Finely Divided Minerals](#)" (link embedded) and are as follows:

(List Sources)XI. MORTAR FOR ELBOWS AND TEES

INSTRUCTIONS: The wording is provided for the Producer as indicated below. When fabricating elbows and tees, a packaged rapid hardening mortar or nonshrink grout is required.

The packaged rapid hardening mortar will be from the "[Qualified Product List of Packaged, Dry, Rapid Hardening Cementitious Materials for Concrete Repairs](#)" (link embedded) and is follows:

(List Sources)

or

The nonshrink will be from the "[Qualified Product List of Nonshrink Grouts](#)" (link embedded) and is as follows:

(List Sources)XII. WET CAST ADMIXTURES

INSTRUCTIONS: The wording is provided for the Producer as indicated below.

The wet cast admixtures will be obtained from the "[Qualified Product List of Concrete Admixtures](#)" (link embedded) and are as follows:

(List Sources)XIII. DRY CAST ADMIXTURES

INSTRUCTIONS: Indicate the material source for each dry cast admixture used in the manufacture of product. The Department does not maintain an approved list of dry cast admixtures.

Brand Name: _____

Company Name: _____

Company Address: _____

Contact Person: _____

Telephone Number: _____

XIV. REINFORCING BAR AND WELDED WIRE REINFORCEMENT FABRIC

INSTRUCTIONS: The wording is provided for the Producer as indicated below.

Reinforcing bar will be from the [“Qualified Producer List of Reinforcing Bar and/or Dowel Bar Producers”](#) (link embedded), and welded wire reinforcement fabric will be from the [“Qualified Producer List of Welded Wire Reinforcement Fabric Producers”](#) (link embedded). Cold drawn wire will be sampled and tested by the Department.

All steel products will be domestic as specified in Article 106.01 of the Standard Specifications for Road and Bridge Construction. Sources are listed below:

(List Sources)

XV. MISCELLANEOUS MATERIALS

INSTRUCTIONS: The wording is provided for the Producer as indicated below.

Any miscellaneous material used in the manufacture of a product or product lines, or any miscellaneous material supplied to Department projects will comply with applicable Department material specifications.

XVI. PRE-PRODUCTION, PRODUCTION, AND POST-PRODUCTION INSPECTION

INSTRUCTIONS: Indicate any additional pre-production, production, and post-production inspection procedures to those specified in the Department’s Policy Memorandum, “Quality Control/Quality Assurance Program for Precast Concrete Products.”

INSTRUCTIONS: List the person or persons who will provide notification of production according to Section 10 of the Department’s Policy Memorandum, “Quality Control/Quality Assurance Program for Precast Concrete Products”

Production Notification: _____ will provide notification of production in accordance with Section 10 of the Policy Memorandum Quality Control/Quality Assurance Program for Precast Concrete Products.

XVII. IDENTIFICATION MARKINGS

INSTRUCTIONS: Indicate if identification markings will be etched into the concrete or painted/inked with waterproof marking for pipe, box culvert, drainage structures, bridge beams, three-sided structure, and temporary concrete barrier.

Example:

For pipe (which includes pipe elbows and pipe tees) identification markings will be etched into the concrete.

XVIII. CURING OF PRODUCT

INSTRUCTIONS: Indicate the curing method and period to be used for each precast concrete product.

Note: When a precast concrete product has attained the specified strength, the earliest the product may be loaded, shipped, and used is on the fifth calendar day. The first calendar day shall be the date casting was completed.

Example:

Pipe (which includes pipe elbows and pipe tees) will be steam cured until the next day after casting.

Segmental concrete block wall (retaining wall block) will be cured in a moist room for 24 hours.

XIX. SHIPPING

INSTRUCTIONS: Indicate the individuals who will make final inspection of the Precast Concrete Product just prior to and after loading when shipping to the jobsite. This would apply to product manufactured by the Producer or another Producer.

XX. REPAIR PROCEDURES

INSTRUCTIONS: Indicate if a no-slump concrete mix or prepackaged material will be used for repairs. Indicate any additional repair procedures to those specified in the Department's Policy Memorandum, "Quality Control/Quality Assurance Program for Precast Concrete Products."

Example:

A nonshrink grout manufactured by _____ and on the Approved list of Nonshrink Grouts will be used. No additional repair procedures will be used.

INSTRUCTIONS:

To be completed by Producer. Return with Quality Control Plan.

QUALITY CONTROL PLAN SIGNATURE SHEET

(IF AN INDIVIDUAL)

Firm Name _____

Print Name of Owner _____

Signature of Owner _____

Date: _____

(IF A CO-PARTNERSHIP)

Firm Name _____

Print Name of Partner _____

Signature of Partner _____

Date: _____

(IF A CORPORATION)

Corporate Name _____

Print Name of Authorized Representative _____

Signature of Authorized Representative _____

Date: _____

(ALL)

Business Address: _____

P.O. Box: _____

Street Address: _____

City/State/Zip Code: _____

DUTIES OF THE QUALITY CONTROL MANAGER¹

Duties of the **Quality Control Manager** shall include, but are not limited to the following:

1. Notify the **District/Bureau of Precast Concrete Product** production.
2. Understand the **Specifications** and related documents regarding **Quality Control/Quality Assurance (QC/QA)** for all the products manufactured at the **Plant**. Remain familiar with the most current approved **Quality Control Plan** and any approved amendments to the **Plan**.
3. Manage overall product **Quality Control** and be responsible for each stage of fabrication and production.
4. Ensure the **Laboratory**, Concrete **Plant**, and Delivery Trucks are approved by the **Inspector**.
5. Ensure the test equipment is maintained and calibrated as required by the appropriate **Test Procedure**.
6. Ensure products meet the requirements of the **Specifications**.
7. Ensure the **Inspector** is notified of any material supply problems.
8. Ensure the **Inspector** is properly notified of test results. Consult with the **Inspector** when questions arise concerning acceptance or rejection of materials or the final product.
9. Ensure all observations, inspections, adjustments to the mix design, test results, retest results, and corrective action are documented promptly, and in the specified format.
10. Supervise **Quality Control** personnel.
11. Ensure sufficient personnel are provided to perform the required inspections, sampling, testing and documentation. Ensure work is accurate and done in a timely manner.
12. Provide the **Inspector** a means to contact him/her when not at the **Plant** unless another individual at the **Plant** has been given authority to make decisions.
13. Submit proposals to **District/Bureau Inspectors** for repairs to concrete products that do not conform to the **Specifications**.

Note 1. The **QC Manager** may further assign **Quality Control** testing responsibilities as needed or required. Personnel testing aggregate only shall have successfully completed the IDOT 3-day **Mixture Aggregate Technician** or 5-day **Aggregate Technician** Course. Personnel conducting fresh concrete testing only shall have successfully completed the American Concrete Institute (ACI) Concrete Field Testing Technician – Grade I Course. An individual who has successfully completed the **Department's** Portland Cement Concrete Tester Course may provide assistance with sampling and testing, provided the individual is monitored on a daily basis by an individual who has successfully completed the ACI Concrete Field Testing Technician – Grade I Course. However, any adjustments to the mix shall be made by

personnel who have successfully completed the ACI Concrete Field Testing Technician – Grade I Course.

DUTIES OF TECHNICIAN

Duties of the **Technician** shall include, but are not limited to the following:

1. Understand the **Specifications** and related documents regarding **QC/QA**. Read the **Quality Control Plan** and any amendments to the **Plan**.
2. Maintain and calibrate test equipment as required by the appropriate **Test Procedure**.
3. Sample the mixture.
4. Perform temperature, slump, slump flow (self-consolidating concrete (SCC)), flow (CLSM), J-Ring (SCC), L-Box (SCC), hardened visual stability index (SCC), dynamic segregation index (SCC), and air content tests and compare with **Specifications**. If test results are unsatisfactory or near specification limits, take appropriate action and retest when applicable.
5. Perform unit weight test and determine yield.
6. Make strength and hardened visual stability index (SCC) specimens. Transport strength specimens properly and ensure correct curing. Break strength specimens. NOTE: If an individual has the responsibility of breaking strength specimens only, such as at a Consultant's **Laboratory**, this individual is required to have successfully completed the ACI Concrete Field Testing Technician – Grade I Course or the Concrete Strength Testing Technician certification by ACI.
7. Monitor truck revolutions and haul time.
8. Determine the required quantity of water and admixtures for adjusting the mixture, to meet **Specifications** and field conditions. For further information for making concrete mixture adjustments, see the **Quality Control/Quality Assurance** Training Class for cast-in-place concrete. This manual is called “Portland Cement Concrete Level I Technician Course”, and can be found at the [Lake Land College](#) website (link embedded).
9. Observe the discharge of a mixture by the delivery truck, and take appropriate action if a problem is identified.
10. For a mixture which is not mixed on the jobsite (i.e. at the **Plant**), ensure the required information per Article 1020.11 (a)(7) is recorded on the delivery truck ticket.
11. Document all observations, inspections, adjustments to the mix design, test results, retest results, and corrective actions promptly, and in the specified format.
12. Maintain communications with **Plant** personnel (concrete **Plant** operator) to control the mixture, for compliance with the **Specifications**.
13. Notify the **Inspector** of test results.

14. Report test results to the **Quality Control Manager**.
15. Supervise the **Concrete Tester**.

DUTIES OF CONCRETE TESTER

Duties of the **Concrete Tester** shall include, but are not limited to the following:

1. Sample the mixture.
2. Perform temperature, slump, slump flow (self-consolidating concrete (SCC)), flow (CLSM), J-Ring (SCC), L-Box (SCC), hardened visual stability index (SCC), dynamic segregation index (SCC), air content and unit weight tests.
3. Make strength and hardened visual stability index (SCC) specimens.
4. Monitor truck revolutions and haul time.
5. Observe the mixture and notify the **Technician** of any problems.
6. Assist the **Technician** with adjustments to a mixture, by adding water or an admixture.
7. For a mixture which is not mixed on the jobsite (i.e. at the **Plant**), ensure the required information per Article 1020.11 (a)(7) is recorded on the delivery ticket.
8. Document all observations, inspections, adjustments to the mix design, test results, retest results, and corrective actions promptly, and in the specified format.
9. Report truck revolutions, haul time, and test results to the **Technician**. Immediate notification is required if truck revolutions, haul time, or test results are near specification limits or unsatisfactory.

DUTIES OF MIXTURE AGGREGATE TECHNICIAN

Duties of the **Mixture Aggregate Technician** shall include, but are not limited to the following:

1. Obtain and split aggregate samples.
2. Perform gradation test for coarse and fine aggregates.
3. Document test results.

DUTIES OF AGGREGATE TECHNICIAN

Duties of the **Aggregate Technician** shall include, but are not limited to the following:

1. Obtain and split aggregate samples.
2. Perform gradation test for coarse and fine aggregates.
3. Document test results.

REQUIRED MINIMUM IDENTIFICATION MARKINGS FOR PRECAST CONCRETE PRODUCTS

Identification Marking	Pipe				Box Culvert (Notes 2 & 3)	Drainage Structures	Bridge Slabs	Three-Sided Structure	Temporary Concrete Barrier (Note 5)	Rectangular End Sections for Pipes
	Reinforced	Non- Reinforced	Elliptical	Arch						
Producer Mark (Refer to Approved List)	X	X	X	X	X	X	X	X	X	X
AASHTO/ASTM Designation	M 170/C 76 X	M 86/C 14 X	M 207/C 507 X	M 206/C 506 X	C 1577 M 259 & M 273 X	X				X
Class or Marking Required by Specification	X (Note 1)	X	X (Note 1)	X		X (Note 4)				
Date of Manufacture	X	X	X	X	X	X	X	X	X	X
Span, Rise, Table, Station, Skew, Top, and Design Earth Cover(s)					X (Note 6)					

Note 1: Pipe with quadrant reinforcement shall be marked with the letter "Q".

Note 2: ASTM C 1577 (LRFD Design) effective with Jan. 1, 2012 Standard Specifications. Precast box culverts shall be marked as ASTM C 1577 (no Table designation required).

Note 3: AASHTO M 259 & M 273 discontinued with Jan. 1, 2012 Standard Specifications. If an HS-20 loading is required for a precast box culvert, it shall be marked as either AASHTO M 259 Table 1 or AASHTO M 273 Table 1, as appropriate. If an Interstate loading is required for a precast box culvert, it shall be marked as either AASHTO M 259 Table 2 or AASHTO M 273 Table 2, as appropriate.

Note 4: Marking shall be "MH" for manhole base, riser, conical tops, and grade rings.

Note 5: Temporary concrete barrier shall include the marking: "ILLINOIS F SHAPE"

Note 6: Station and skew only required for LRFD box culverts. "Top" painted on top inside surface only required for LRFD box culverts. LRFD box culverts shall be marked with both (minimum and maximum) design earth covers from the contract plans.

**MINIMUM REQUIRED QUALITY CONTROL SAMPLING & TESTING
PRECAST CONCRETE PRODUCTS**

Precast Product	Specification Reference	QC Test/ Test Method/Frequency
Bridge Slabs	Std. Spec. Art. 504.05 Std. Spec. Art. 1042.03	Compressive Strength: Cylinder – R 60 & T 280 (1)(12) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2)
Pile Caps	Std. Spec. Art. 504.05 Std. Spec. Art. 1042.03	Compressive Strength: Cylinder – R 60 & T 280 (1)(12) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2)
Other Structural Members	Std. Spec. Art. 504.05 Std. Spec. Art. 1042.03	Compressive Strength: Cylinder – R 60 & T 280 (1)(12) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2)
Piles and Extensions	Std. Spec. Art. 512.03 Std. Spec. Art. 1042.04	Compressive Strength: Cylinder – R 60 & T 280 (1)(12) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2)
Decorative Bridge Structural Elements	Contract Specific Special Provision	Compressive Strength: Cylinder – R 60 & T 280 (1)(12) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2)
Three-Sided Precast Concrete Structures	Std. Spec. Art. 504.05 Std. Spec. Art. 1042.03 Guide Bridge Special Provision (GBSP) #15 (16) ASTM C 1504	Compressive Strength: Cylinder – R 60 & T 280 (3)(12) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2)

**MINIMUM REQUIRED QUALITY CONTROL SAMPLING & TESTING
PRECAST CONCRETE PRODUCTS**

Precast Product	Specification Reference	QC Test/ Test Method/Frequency
Box Culvert Sections	Std. Spec. Art. 540.06 Std. Spec. Art. 1042.05 ASTM C 1577* AASHTO M 259** & 273** Bureau of Design and Environment (BDE) Special Provisions: "Concrete Box Culverts with Skews > 30 Degrees and Design Fills ≤ 5 Feet" *Effective Std. Spec. Jan. 1, 2012 **Discontinued Std. Spec. Jan. 1, 2012	Compressive Strength: Cylinder – R 60 & T 280 (3)(12) , or Core – T 280 (4)(13) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2)
Box Culvert End Sections	Std. Spec. Art. 540.06 Std. Spec. Art. 1042.05 ASTM C 1577* AASHTO M 259** & 273** Bureau of Design and Environment (BDE) Special Provisions: "Concrete Box Culverts with Skews > 30 Degrees and Design Fills ≤ 5 Feet" *Effective Std. Spec. Jan. 1, 2012 **Discontinued Std. Spec. Jan. 1, 2012	Compressive Strength: Cylinder – R 60 & T 280 (3)(12) , or Core – T 280 (4)(12) Slump – R 60 & T119 (2) Air Content – R 60 & T 152 or T 196 (2)

**MINIMUM REQUIRED QUALITY CONTROL SAMPLING & TESTING
PRECAST CONCRETE PRODUCTS**

Precast Product	Specification Reference	QC Test/ Test Method/Frequency
Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe <i>(Includes Elbows and Tees)</i>	Std. Spec. Sections 542, 550, and 552 Std. Spec. Art. 1042.06(a) AASHTO M 170 Hwy. Standards: 542601; 542606	Strength, Compressive or Crushing: Cylinder – R 60 & T 280 (5)(12) , or Core – T 280 (5)(13) , or Three-edge bearing – T 280 (5)(14) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2) Absorption – T 280 (19)
Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe	Std. Spec. Sections 542, 550, and 552 Std. Spec. Art. 1042.06(b) AASHTO M 207	Strength, Compressive or Crushing: Cylinder – R 60 & T 280 (5)(12) , or Core – T 280 (5)(13) , or Three-edge bearing – T 280 (5)(14) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2) Absorption – T 280 (19)
Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe	Std. Spec. Sections 542 and 550 Std. Spec. Art. 1042.06(c) AASHTO M 206	Strength, Compressive or Crushing: Cylinder – R 60 & T 280 (5)(12) , or Core – T 280 (5)(13) , or Three-edge bearing – T 280 (5)(14) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2) Absorption – T 280 (19)
Concrete Sewer, Storm Drain, and Culvert Pipe	Std. Spec. Sections 542, 550, and 601 Std. Spec. Art. 1042.06(d) AASHTO M 86	Crushing Strength: Three-edge bearing – T 280 (5)(14) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2) Absorption – T 280 (19) Permeability – T 280 (6) (19) Hydrostatic – T 280 (6)
Concrete Drain Tile	Note: This product is no longer used.	

**MINIMUM REQUIRED QUALITY CONTROL SAMPLING & TESTING
PRECAST CONCRETE PRODUCTS**

Precast Product	Specification Reference	QC Test/ Test Method/Frequency
Rectangular Concrete End Sections for Pipe Culverts	Std. Spec. Sec. 542 Std. Spec. Art. 1042.02 Std. Spec. Art. 1042.03(b)(c)(d)(e) Hwy. Standard: 542001 Bureau of Design and Environment (BDE) Special Provision "Concrete End Sections for Pipe Culverts"	Compressive Strength: Cylinder – R 60 & T 280 (5)(12) , or Core – T 280 (5)(13) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2)
Rectangular Concrete End Sections for Elliptical Pipe Culverts	Std. Spec. Sec. 542 Std. Spec. Art. 1042.02 Std. Spec. Art. 1042.03(b)(c)(d)(e) Hwy. Standard: 542011 Bureau of Design and Environment (BDE) Special Provision "Concrete End Sections for Pipe Culverts"	Compressive Strength: Cylinder – R 60 & T 280 (5)(12) , or Core – T 280 (5)(13) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2)
Reinforced Concrete Flared End Sections	Std. Spec. Art. 542.07(b) Std. Spec. Art. 1042.07 AASHTO M 170 Hwy. Standard 542301	Compressive Strength: Cylinder – R 60 & T 280 (5)(12) , or Core – T 280 (5)(13) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2)
Reinforced Concrete Elliptical Flared End Sections	Std. Spec. Art. 542.07(b) Std. Spec. Art. 1042.07 AASHTO M 207 Hwy. Standard 542306	Compressive Strength: Cylinder – R 60 & T 280 (5)(12) , or Core – T 280 (5)(13) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2)

**MINIMUM REQUIRED QUALITY CONTROL SAMPLING & TESTING
PRECAST CONCRETE PRODUCTS**

Precast Product	Specification Reference	QC Test/ Test Method/Frequency
Inlet Boxes for Pipe Culverts and Medians Type 24A-G Type 36A Type 48A Flush Inlet Box for Median Shoulder Inlet	Std. Spec. Art. 542.07(d) Std. Spec. Art. 610.03 Std. Spec. Art. 1042.08 Std. Spec. Art. 1042.12 Hwy. Standards: Type 24A: 542501 Type 24B: 542506 Type 24C: 542511 Type 24D: 542516 Type 24E: 542521 Type 24F: 542526 Type 24G: 542531 Type 36A: 542536 Type 48A: 542541 Flush Inlet Box for Median: 542546 Shoulder Inlet with Curb: 610001	Compressive Strength: Cylinder – R 60 & T 280 (5)(12) , or Core – T 280 (5)(13) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2)
Headwall for Pipe Drain	Std. Spec. Art. 601.05 Std. Spec. Art. 1042.09 Hwy. Standard: 601101	Compressive Strength: Cylinder – R 60 & T 280 (5)(12) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2)
Catch Basins: Type A Type B Type C Type D	Std. Spec. Art. 602.04 Std. Spec. Art. 1042.10 AASHTO M 199 Hwy. Standards: 602001; 602006; 602011; 602016; 602601 (7)	Compressive Strength: Cylinder – R 60 & T 280 (5)(12) , or Core – T 280 (5)(13) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2) Absorption – T 280 (19)
Manhole Type A	Std. Spec. Art. 602.04 Std. Spec. Art. 1042.10 AASHTO M 199 Hwy. Standards: 602401; 602406; 602411; 602416; 602421; 602601 (7)	Compressive Strength: Cylinder – R 60 & T 280 (5)(12) , or Core – T 280 (5)(13) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2) Absorption – T 280 (19)

**MINIMUM REQUIRED QUALITY CONTROL SAMPLING & TESTING
PRECAST CONCRETE PRODUCTS**

Precast Product	Specification Reference	QC Test/ Test Method/Frequency
Inlets Type A Type B	Std. Spec. Art. 602 Std. Spec. Art. 1042.10 AASHTO M 199 Hwy. Standards: Type A: 602301 Type B: 602306; 602601 (7)	Compressive Strength: Cylinder – R 60 & T 280 (5)(12), or Core – T 280 (5)(13) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2) Absorption – T 280 (19)
Drainage Structures Type 1, 2, 3, 4, 5 & 6	Std. Spec. Section 602 Std. Spec. Art. 1042.10 AASHTO M 199 Hwy. Standards: 602101; 602106	Compressive Strength: Cylinder – R 60 & T 280 (5)(12), or Core – T 280 (5)(13) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2) Absorption – T 280 (19)
Valve Vault Type A	Std. Spec. Art. 602 Std. Spec. Art. 1042.10 AASHTO M 199 Hwy. Standard: 602501; 602601 (7)	Compressive Strength: Cylinder – R 60 & T 280 (5)(12), or Core – T 280 (5)(13) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2) Absorption – T 280 (19)
Bridge Approach Drains	Std. Spec. Art. 609.03** Std. Spec. Art. 1042.11** Hwy. Standards: 609006** **Discontinued Std. Spec. Apr. 1, 2016	Compressive Strength: Cylinder – R 60 & T 280 (5)(12), or Core – T 280 (5)(13) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2)
Right of Way Markers	Std. Spec. Section 666 Std. Spec. Art. 1042.13 Hwy. Standard: 666001	Compressive Strength: Cylinder – R 60 & T 280 (5)(12) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2)
Drainage Markers	Std. Spec. Section 667 Std. Spec. Art. 1042.13 Hwy. Standard: 667001	Compressive Strength: Cylinder – R 60 & T 280 (5)(12) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2)

**MINIMUM REQUIRED QUALITY CONTROL SAMPLING & TESTING
PRECAST CONCRETE PRODUCTS**

Precast Product	Specification Reference	QC Test/ Test Method/Frequency
Permanent Survey Markers	Std. Spec. Section 667 Std. Spec. Art. 1042.13 Hwy. Standard: 667101	Compressive Strength: Cylinder – R 60 & T 280 (5)(12) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2)
Section Markers	Std. Spec. Art. 1042.13	Compressive Strength: Cylinder – R 60 & T 280 (5)(12) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2)
Temporary Concrete Barrier	Std. Spec. Section 704 Std. Spec. Art. 1042.14 Hwy. Standard: 704001	Compressive Strength: Cylinder – R 60 & T 280 (8)(12) , or Core – T 280 (8)(13) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2)
Erosion Control: Precast Block Revetment Mats	Std. Spec. Section 285 Std. Spec. Art. 1042.15 ASTM D 6684	Compressive Strength: Cylinder (Wet Cast)* – R 60, T 22 & T 23 (9) Core (Wet Cast)* – T 24 (9) *See Key at end of Attachment D Coupon (Dry Cast) – ASTM C 140 (9) Slump – R 60 & 119 (2) Air Content – R 60 & T 152 or T 196 (2) Absorption – ASTM C 140 (9) Density – ASTM C 140 (9) Freeze/Thaw – ASTM C 67 or C 1262 (6)(15)
Erosion Control: Precast Articulated Block Revetment Mats	Std. Spec. Section 285 Std. Spec. Art. 1042.15 ASTM D 6684	Compressive Strength: Cylinder (Wet Cast)* – R 60, T 22 & T 23 (9) Core (Wet Cast)* – T 24 (9) *See Key at end of Attachment D Coupon (Dry Cast) – ASTM C 140 (9) Slump – R 60 & 119 (2) Air Content – R 60 & T 152 or T 196 (2) Absorption – ASTM C 140 (9) Density – ASTM C 140 (9) Freeze/Thaw – ASTM C 67 or C 1262 (6)(15)

**MINIMUM REQUIRED QUALITY CONTROL SAMPLING & TESTING
PRECAST CONCRETE PRODUCTS**

Precast Product	Specification Reference	QC Test/ Test Method/Frequency
Concrete Brick	Std. Spec. Sections 602, 603, and 605 Std. Spec. Art. 1042.15 ASTM C 55	Compressive Strength – ASTM C 140 (9) Absorption – ASTM C 140 (9) Linear Drying Shrinkage – ASTM C 426 (10)(15)
Concrete Masonry Units	Std. Spec. Sections 602 and 603 Std. Spec. Art. 1042.15 ASTM C 139 (Solid) ASTM C 90 (Hollow)	Compressive Strength – ASTM C 140 (9) Absorption – ASTM C 140 (9) Linear Drying Shrinkage (Hollow Units Only) – ASTM C 426 (10)(15)
Concrete Pavers	Special Provision (Check Sheet #LRS14) or Std. Spec. Art. 1042.15 ASTM C 936	Compressive Strength – ASTM C 140 (9) Absorption – ASTM C 140 (9) Freeze/Thaw – ASTM C 1645 (Saline Test Solution) (6)(15) Abrasion Resistance – ASTM C 418 (6)(15)
Segmental Concrete Block Retaining Walls	Std. Spec. Art. 522.12 Std. Spec. Art. 1042.21	Compressive Strength: Cylinder (Wet Cast)* – R 60, T 22 & T 23 (5)(12) *See Key at end of Attachment D Coupon (Dry Cast) – ASTM C 140 (9) Slump – R 60 & 119 (2) Air Content – R 60, T 22 & T 23 (2) Absorption – ASTM C 140 (9) Freeze/Thaw – The test is not required because of the low wall height specified in the Bridge Manual.
Facing Panels for Mechanically Stabilized Earth Systems	Std. Spec. Art. 522.09 Std. Spec. Art. 1042.19	Compressive Strength: Cylinder – R 60 & T 280 (5)(12) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2)

**MINIMUM REQUIRED QUALITY CONTROL SAMPLING & TESTING
PRECAST CONCRETE PRODUCTS**

Precast Product	Specification Reference	QC Test/ Test Method/Frequency
Noise Abatement Walls (Reflective Type)	Contract Specific Special Provision	Compressive Strength: Cylinder – R 60 & T 280 (5)(12) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2)
Modular Retaining Walls	Std. Spec. Art. 522.10 Std. Spec. Art. 1042.18	Compressive Strength: Cylinder – R 60 & T 280 (5)(12) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2)
Non-smooth Facing Panels for Mechanically Stabilized Earth Systems	Std. Spec. Art. 522.09 Std. Spec. Art. 1042.19	Compressive Strength: Cylinder – R 60 & T 280 (5)(12) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2)
Bumper Blocks (Wheel Stops For Cars)	Contract Specific Special Provision	Compressive Strength: Cylinder – R 60 & T 280 (5)(12) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2)
Picnic Tables, Trash Receptacles, Planters	Contract Specific Special Provision	Compressive Strength: Cylinder – R 60 & T 280 (5)(12) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2)
Splash Blocks	Contract Specific Special Provision	Compressive Strength: Cylinder – R 60 & T 280 (5)(12) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2)

**MINIMUM REQUIRED QUALITY CONTROL SAMPLING & TESTING
PRECAST CONCRETE PRODUCTS**

Precast Product	Specification Reference	QC Test/ Test Method/Frequency
Handholes	Std. Spec. Section 814 Std. Spec. Art. 1042.17 Hwy. Standards: 814001; 814006	Compressive Strength: Cylinder – R 60 & T 280 (5)(12) Slump – R 60 & T 119 (2) Air Content – R 60 & T 152 or T 196 (2)
All	Various	Temperature – R 60 & T 309 (11)
All	Various	Aggregate Moisture: Coarse – T 255 or IL Test Proc. 302 or IL Test Proc. 303 (11) Fine – T 255 or IL Test Proc. 301 or IL Test Proc. 302 or or IL Test Proc. 303 (17)
All	Various	Self-Consolidating Concrete (SCC) – SCC-1, SCC-2, SCC-3, SCC-4, and SCC-6 (18)

NOTES

All test methods are AASHTO unless indicated otherwise.

1. For every seven units constructed per day, a minimum of four (4) 6- by 12-in. (150- by 300-mm) or six (6) 4- by 8-in. (100- by 200-mm) test cylinders of concrete shall be made. If less than seven units are constructed per day, a minimum of four (4) 6- by 12-in. (150- by 300-mm) or six (6) 4- by 8-in. (100- by 200-mm) test cylinders per day shall be made.
2. The minimum frequency per day shall be to test the first load of concrete, thereafter when strength specimens are molded or as needed to control production. The air content test is not required for dry cast products.
3. The minimum frequency shall be not less than six (6) 6- by 12-in. (150- by 300-mm) or nine (9) 4- by 8-in. (100- by 200-mm) test cylinders from a group (one day's production of each concrete strength) of box sections.
4. The minimum frequency shall be one core from a box section, selected at random from each group of fifteen box sections of a single size or fraction of such a group from each continuous production run.
5. The minimum frequency shall be one test per week.
6. The minimum frequency shall be one test per year.
7. Highway Standard 602601 (Precast Reinforced Concrete Flat Slab Top) may be used in lieu of the tapered tops shown on Highway Standards 602001 (Catch Basin Type A), 602011 (Catch Basin Type C), 602306 (Inlet Type B), 602401 (Manhole Type A), and 602501 (Valve Vault Type A).
8. The minimum frequency shall be one core or two (2) 6- by 12-in. (150- by 300-mm) test cylinders, or three (3) 4- by 8-in. (100- by 200-mm) test cylinders per day. If stripping of forms and moving the temporary barrier prior to the test of record is desired, a minimum of two (2) 6- by 12-in. (150- by 300-mm) or three (3) 4- by 8-in. (100- by 200-mm) additional test cylinders per day will be required.
9. The minimum test frequency shall be per ASTM.
10. The minimum frequency shall be one test every two years.
11. As needed to control production.
12. The compressive strength shall be equal to or exceed the specified concrete strength. One compressive strength test shall be defined as the average of two (2) 6- by 12-in. (150- by 300-mm) cylinder breaks or three (3) 4- by 8-in. (100- by 200-mm) cylinder breaks. Per Illinois Modified AASHTO T 23, cylinders shall be 6 by 12 in. (150 by 300 mm) when the nominal maximum size of the coarse aggregate exceeds 1 in. (25 mm). Compressive strength testing prior to the test of record is permitted. However, a minimum of two (2) 6- by 12-in. (150- by 300-mm) cylinders or three (3) 4- by 8-in. (100- by 200-mm) cylinders are to be reserved for testing

on the test of record. Refer to 7.0 “Determining the Concrete Mix Design Target Strength” in the Portland Cement Concrete Level III Technician Course - Manual of Instructions for Design of Concrete Mixtures for more information which can be found at the [Lake Land College](#) website (link embedded). The precision and bias provided in T 22 may be used to evaluate test results.

13. The strength of one (1) core shall equal or exceed the specified concrete strength. Compressive strength testing prior to the test of record will not be permitted. In general, cores should be taken at or near midpoint(s) of products along their length, width and/or height. Cores should not be taken near sharp radii or right angled corners, or near edges in products. Refer also to Section 19.2.
14. **Producer** option for pipe ≥ 42 in. (1050 mm), but required for pipe < 42 in. (1050 mm). Compressive strength using cylinders or cores is not permitted for pipe < 42 in. (1050 mm). When testing a **Precast Concrete Product** with the three-edge-bearing test, record the load which produces a 0.01 in. (0.25 mm) crack, and also the ultimate failure load. The product shall not be used on a project. If the load reaches 110 percent of the design 0.01 in. (0.25 mm) crack load without cracking, the testing may be stopped and testing to ultimate load is not required. The product may be used on a project.
15. Testing requirement is for an individual mix design. Shape, size or color of **Precast Concrete Product** may vary.
16. GBSP’s can be found on the internet at [Guide Bridge Special Provision \(GBSP\)](#) (link embedded).
17. Once per week when a moisture sensor is used, otherwise daily.
18. Slump flow, visual stability index, J-ring, L-box, and hardened visual stability index shall be performed on the first batch poured each day. Thereafter, slump flow, visual stability index, J-ring, and L-box, shall be performed when strength specimens are molded or as needed to control production.

The **Producer** shall have the option to perform either the J-ring or L-box test.

The **Producer** shall retain hardened visual stability index cut cylinders until permission is given by the **Inspector** for disposal.

19. May be required at any time at the discretion of the Engineer.

Refer to Section 22.2 for information on using tests to represent multiple **Precast Concrete Products**.

Key:

R 60* = ASTM C 172	T 24 = ASTM C 42	T 152 = ASTM C 231
T 22 = ASTM C 39	T 119 = ASTM C 143	T 196 = ASTM C 173
T 23 = ASTM C 31	T 255 = ASTM C 566	

*Note: AASHTO R 60 is formerly AASHTO T 141.



Concrete Plant Survey

Instructions: **Please type or print neatly.** Fill in the blanks or mark the item with an "X". The "Concrete Plant Survey" is submitted once every five years, unless the plant equipment is changed, or equipment is added to the plant.

Producer No: _____ Plant Name: _____ Permanent Portable
 Company Address: _____ Phone No.: _____
 Plant Address: _____ Phone No.: _____
 (Indicate "Various" if Portable Plant or "same" if plant shares company address.)

Plant Manufacturer: _____ Model # _____ Serial # _____

Indicate Plant Type Below:
 Wet Batch Plant (Stationary / Central-Mixed):
 Mixer Capacity: (Cubic Meters) _____ (Cubic Yards) _____ * Type _____
 Mixer Capacity: (Cubic Meters) _____ (Cubic Yards) _____ * Type _____
 * Indicate: Non-Tilting; Tilting; Vertical Shaft; or Horizontal Shaft
 Dry Batch Plant: (Truck / Transit-Mixed):
 Capacity as Determined by the Weigh Hopper: (Cubic Meters) _____ (Cubic Yards) _____
 Capacity as Determined by the Weigh Hopper: (Cubic Meters) _____ (Cubic Yards) _____

Slurry Mixer Type: Vortex Paddle None

Batching System Manufacturer: _____

Batching System Type:
 Automatic** Semi-Automatic** Manual**
 ** Reference: Article 1103.03 of Standard Specifications for Road and Bridge Construction (January 1, 2012)
 Automatic Actuation: Computer Punch Card Step Switch

*** Material(s)	Scale Capacity For Weighing (Do not consider Weigh Hopper) (kg / lbs)	Scale Graduation Interval (kg / lbs)	Scale Graduation Interval (Percent of Scale Capacity)	**** Scale Type
_____	_____/_____ _____/_____	_____/_____ _____/_____	_____ _____	_____
_____	_____/_____ _____/_____	_____/_____ _____/_____	_____ _____	_____
_____	_____/_____ _____/_____	_____/_____ _____/_____	_____ _____	_____
_____	_____/_____ _____/_____	_____/_____ _____/_____	_____ _____	_____
_____	_____/_____ _____/_____	_____/_____ _____/_____	_____ _____	_____

*** Indicate the materials(s) weighed by each scale. This should include Fine Aggregate, Coarse Aggregate, Cement, Finely Divided Minerals, Water, and Admixtures.
 **** Indicate: Beam; Dial; or Load Cell
 Weighing of Aggregates in Weigh Hopper: Individually Cumulatively
 Weighing of Cement and Cementitious Materials in Weight Hopper: Individually Cumulatively

Number of Silos: Cement: _____ Fly Ash: _____ GGBF Slag: _____ Microsilica: _____
 Number of Aggregate Bins: Outside: _____ Inside or Partially Enclosed: _____

**GUIDELINES FOR SHOP DRAWING REQUIREMENTS FOR VARIOUS
PRECAST CONCRETE PRODUCTS***

*(Version with ASTM C 1577 Effective In Std. Spec. Jan. 1, 2012)

This attachment summarizes the shop drawing submittal, review and approval process for **Precast Concrete Products**. It provides general guidance on shop drawing requirements to **Districts**, the Bureau of Bridges and Structures, Local Agencies, Engineers of Record, Contractors, **Producers** and Suppliers.

This attachment should be considered supplemental to Article 1042.03(b) of the **Standard Specifications**, and/or the applicable Guide Bridge Special Provision or GBSP (noted in the list below). Each of these documents provides additional information that is either required or helpful in fulfilling the requirements for shop drawing submittal, review and approval for **Precast Concrete Products**.

Precast Concrete Products requiring submittal of shop drawings to the **Engineer** for review and approval include, but may not be limited to, the following:

Product	Product Key*	Supplemental Information
Box Culverts Sections and Box Culvert End Sections (Including Headwalls and Wingwalls)	B:1 and B:2	Note 1, 8, 9, 10
Three-Sided Precast Concrete Structures	A:6	GBSP #15, Notes 2, 3, 8, 9, 10
Precast Noise Abatement Walls	H:2	Bridge Manual Section 3.12, Notes 3, 4, 5, 6, 8, 9
Precast Modular Retaining Walls	H:3	Notes 2, 3, 4, 5, 9
Segmental Concrete Block Walls	G:6	Notes 2, 3, 4, 5, 9
Mechanically Stabilized Earth Retaining Walls	H:1	Notes 2, 3, 4, 5, 9
Bridge Slabs	A:1	Notes 6, 7
Pile Caps	A:2	Note 6
Decorative Bridge Structural Elements	A:5	Note 6
Reinforced Concrete Rectangular End Sections	C:5	Note 7, 9
Other Structural Members	A:3	Notes 4, 6
Non-Standard Manholes, Lids and Drainage Structures	Various	Note 6
Other Precast Products	Various	Note 6

*Product Key as listed in ["Qualified Producer List of Certified Precast Concrete Producers"](#) (link embedded).

1. Shop Drawing Submittal, Review and Approval:

Unless otherwise directed by the **Engineer**, the general shop drawing submittal, review and approval processes for **Precast Concrete Products** shall be as given herein. Exceptions and special instructions are given in Notes 1 through 10 later in this attachment. Also see Attachment G. No work for a **Precast Concrete Product** shall be done until the submittal has been approved.

For **District** projects, unless Note 9 applies, shop drawings may be submitted for review and approval to the Bureau and Structures (BBS) or a Consultant contracted by the **District**. For Local Agency Projects, refer to Section C below. If there is a question as to who the applicable shop drawing reviewer is, contact the BBS Shop Drawings and Fabrication Unit at 217-558-0285.

A. District Projects – Review and Approval by Bureau of Bridges and Structures

Shop drawing submittal shall be from the **Producer** to the BBS for structural adequacy review and approval. At least two sets of shop drawings shall be included in the submittal (note that PDF files are

GUIDELINES FOR SHOP DRAWING REQUIREMENTS FOR VARIOUS PRECAST CONCRETE PRODUCTS*

*(Version with ASTM C 1577 Effective In Std. Spec. Jan. 1, 2012)

not accepted by the BBS, only hardcopies). One set of drawings will be returned from the BBS to the **Producer**. This set will either be marked “Approved”, “Approved as Corrected”, or “Revise and Resubmit.” If re-submittal and re-review is required, this process shall follow the procedure just described above.

After approval, the **Producer** shall furnish the BBS with at least 5 sets of corrected prints for distribution. The actual number of corrected prints required will be indicated in a letter sent with the set of drawings marked “Approved” or “Approved as Corrected.”

B. District Projects – Review and Approval by Consultant Contracted by District

The shop drawing submittal shall be from the **Producer** to the Consultant for review and approval, with copies of transmittal letters also going to the BBS and receiving **District**. (Note that the **District** Project Implementation **Engineer** should contact the **District** Project Development **Engineer** to determine if hours are provided in the design consultant’s contract to review shop drawings.) At least two sets of shop drawings shall be included in the submittal. One set of drawings will be returned from the Consultant to the **Producer**, with copies of transmittal letters also going to the BBS and receiving **District**. This set will either be marked “Approved”, “Approved as Corrected”, or “Revise and Resubmit” (or similar language). If re-submittal and re-review is required, this process shall follow the procedure just described above.

After approval, the **Producer** shall furnish the Consultant with at least 3 sets of corrected prints. The Consultant shall forward 2 sets of these prints to the BBS (note that PDF files are not accepted by the BBS, only hardcopies) with the Consultant’s approval stamp on every sheet. (If Note 5 applies, the BBS will also review the shop drawings. If re-submittal and re-review is required, the re-submittal shall follow the procedure described above in “**District** Projects – Review and Approval by Bureau of Bridges and Structures”.) The BBS will affix its approval stamp on every sheet of one set which will then be forwarded to the **Producer**, with copies of transmittal letters also going to the receiving **District**. The **Producer** shall furnish the BBS with at least 5 sets of approved shop drawings for distribution. The actual number of corrected prints required will be indicated in a letter sent with the set of drawings stamped by the BBS.

C. Local Agency Projects

Shop drawings should be submitted from the Contractor to the Local Agency, which may forward them to the Engineer of Record (EOR) or their own reviewer for review and approval, unless the Local Agency specifically requests review and approval by the BBS through the **District** Bureau of Local Roads and Streets. Note that if a request is made to the BBS, review time cannot be guaranteed. At least two sets of shop drawings shall be included in the submittal (note that PDF files are not accepted by the BBS, only hardcopies). One set of drawings will be returned from the designated reviewer through the Local Agency to the Contractor. This set will either be marked “Approved”, “Approved as Corrected”, or “Revise and Resubmit” (or similar language). If re-submittal and re-review is required, this process shall follow the procedure just described above.

After approval, the Contractor shall furnish the Local Agency with at least 5 sets of corrected prints for distribution.

GUIDELINES FOR SHOP DRAWING REQUIREMENTS FOR VARIOUS PRECAST CONCRETE PRODUCTS*

*(Version with ASTM C 1577 Effective In Std. Spec. Jan. 1, 2012)

2. Distribution of Shop Drawings (District and Local Agency)

At least one set of shop drawings shall be distributed to the **District** responsible for **Plant Quality Assurance** (note that for out-of-state **Producers**, BMPR may be responsible for **Quality Assurance**). Two or more sets, as required, shall be retained by the receiving **District** or Local Agency for the Resident **Engineer**, As-Built plans, etc. If a Structure Number is assigned, at least one set of shop drawings shall be distributed to the BBS (or designated reviewer for Local Agency Projects). If the shop drawings contain a box culvert section, box culvert end section, or a three sided precast structure, a digital copy (preferably an adobe file) of shop drawings approved by Districts, local agencies or their consultants shall be emailed to: DOT.Bridge.ShopDrawings.PCBC@illinois.gov for use by the Bureau of Bridges and Structures. The email message shall include the contract number, structure number, route, section, county, span, rise, design fill, station, common roadway name, latitude and longitude associated with the structure. The Contractor is responsible for ensuring that the **Producer** has an approved set of shop drawings.

3. Notes Section

Note 1 Shop drawings are required for all precast concrete box culverts. However, review and approval may, or may not be required. **Verification** of layout, run length and configuration should be completed, as per the [“Construction Inspector’s Checklist for Precast Concrete Box Culverts”](#) (link embedded), for all precast box culverts regardless if shop drawing review and approval is required or not. The receiving **District** or Local Agency will determine if review and approval is required according to the guidelines given below (Local Agencies may request assistance from a **District** or the Bureau of Bridges and Structures in making this determination) See also Attachments H, K, L and M for more complete information. Attachment H references ASTM C 1577, and Attachments K, L, and M generally reference AASHTO M 259 and M 273. However, Attachments K, L and M should still be used for guidance.

The contract plans will list two design fills, the edge of shoulder (minimum) fill and the maximum fill. When using the design table in ASTM C 1577 or the Special Provision “Concrete Box Culverts with Skews > 30 Degrees and Design Fills ≤ 5 Feet (BDE)” to compile shop drawings, **Producers** shall select the largest steel areas required (i.e., A_{s1} , A_{s2} , A_{s3} , A_{s4} , etc.) within the design fill range (i.e., from maximum to minimum) from ASTM C 1577. See also Reference Box D in Attachment H for how fill information will appear on the contract plans.

Reinforcement A_{s6} required by the Special Provision “Concrete Box Culverts with Skews > 30 Degrees and Design Fills ≤ 5 Feet (BDE)” is detailed in Figure 1.

When reinforcement bars are substituted for welded wire fabric, the area of steel required by the design table in ASTM C 1577 or the Special Provision “Concrete Box Culverts with Skews > 30 Degrees and Design Fills ≤ 5 Feet (BDE)” (i.e. circumferential and/or distribution steel) shall be increased according to the ratio of the yield strength of welded wire fabric to the yield strength of reinforcing bars. Typically, this entails multiplying the required steel area for welded wire fabric by 65 ksi/60 ksi (448.2 MPa/413.7 MPa) or 1.083. The maximum spacing of reinforcement bars used as circumferential and/or distribution reinforcement shall be the lesser of 1.5 times the slab or wall thickness, or 18 in. (450 mm). For all cases in which reinforcement bars are substituted for welded wire fabric, A_{s6} steel consisting of #3 bars @ 12 in. (300 mm) centers shall be provided (see also Figure 1). In addition, it should be noted that the AASHTO LRFD Bridge Design Specifications updated the requirement for tensile reinforcement development lengths (i.e., lap splices) in 2015 (See Attachment I).

**GUIDELINES FOR SHOP DRAWING REQUIREMENTS FOR VARIOUS
PRECAST CONCRETE PRODUCTS***

*(Version with ASTM C 1577 Effective In Std. Spec. Jan. 1, 2012)

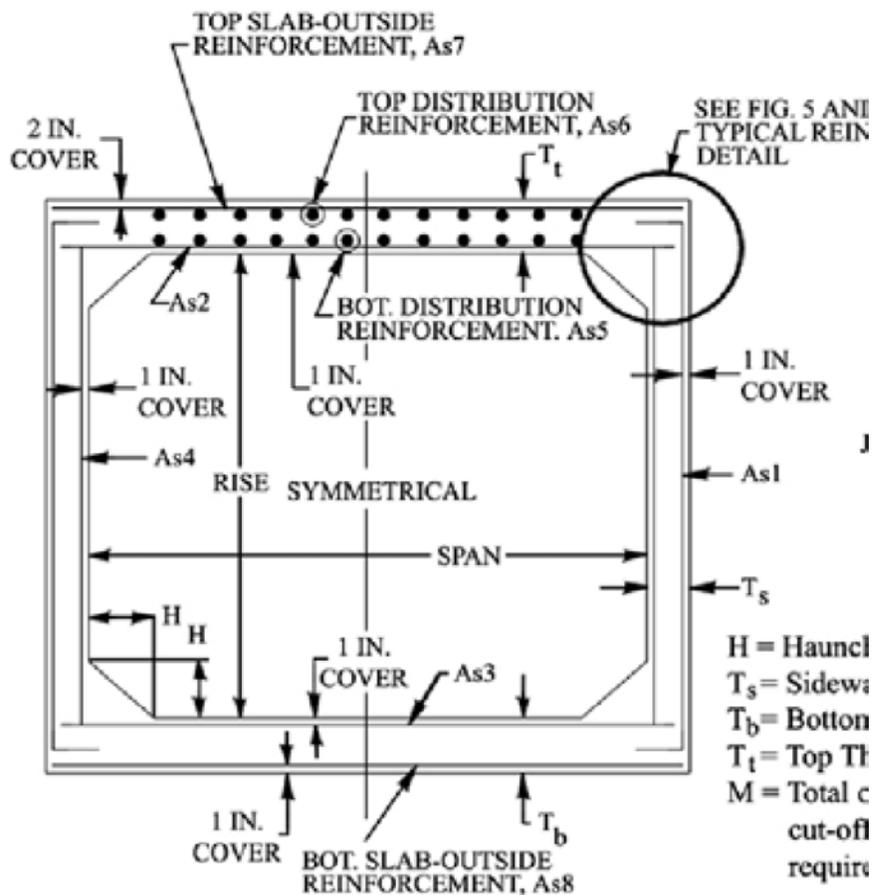


Figure 1

When deformed billet steel bars are used for the longitudinal reinforcement in the walls and bottom slabs of precast concrete box culverts, the maximum spacing detailed on the shop drawings shall be 18 in. (450 mm).

Welded wire fabric and reinforcement bars for precast box culverts (including wingwalls, headwalls, etc.) with zero fill shall be epoxy coated according to Article 1006.10. Otherwise, the reinforcement shall be non-coated.

As noted in Reference Box A of Attachment H, precast box configurations and loadings not addressed in ASTM C 1577 or the Special Provision "Concrete Box Culverts with Skews > 30 Degrees and Design Fills ≤ 5 Feet (BDE)" are permitted. However, these designs shall be according to the current version of the AASHTO LRFD Bridge Design Specifications (typically using the BOXCAR program), shall be detailed on the contract plans, shall be sealed by an Illinois Licensed Structural Engineer, and shall have similar slab and wall thicknesses of the nearest standard geometric configurations from ASTM C 1577.

One weep hole on exterior culvert walls shall be provided on the shop drawings for each precast box culvert section greater than 3 ft. in clear height. The weep hole shall be within the lower $\frac{1}{3}$ of the clear wall height and shall not intercept the haunch. When a precast box culvert is used as a pedestrian tunnel, weep holes should not be provided on the shop drawings. Instead, drainage for these

**GUIDELINES FOR SHOP DRAWING REQUIREMENTS FOR VARIOUS
PRECAST CONCRETE PRODUCTS***

*(Version with ASTM C 1577 Effective In Std. Spec. Jan. 1, 2012)

situations should be provided by other means such as a geotechnical wall drain connected to a longitudinal drain.

Precast box culvert shop drawing review and approval is required when:

- a. Depths of cover and/or box's span and rise are non-standard according to ASTM C 1577, and no detailed design is shown on the contract plans sealed by an Illinois Licensed Structural Engineer (similar to a cast-in-place box) (see also Reference Box A in Attachment H).
- b. There is an opening in the top slab.
- c. The skew of the box as shown on the contract plans is $> 30^\circ$ and at least one design fill listed on the contract plans is ≤ 5 ft. (1.52 m), or the box design is not listed in the Special Provision "Concrete Box Culverts with Skews > 30 Degrees and Design Fills ≤ 5 Feet (BDE)" (see also Reference Box B in Attachment H).
- d. There is a side wall opening that does not conform to the details given in Attachment K (see also Reference Box C in Attachment K).
- e. It is an end section with a skew.
- f. Haunch dimensions are altered from ASTM C 1577 and do not conform to the requirements of Article 11.7 of ASTM C 1577.
- g. A non-standard box or set of boxes is substituted for a standard ASTM C 1577 box or set of boxes which is permitted per contract special provision. This situation shall be documented in the as-built plans.
- h. Select granular backfill is not planned to be provided according to the requirements of Reference Boxes C and D in Attachment H, and the contract plans.
- i. Sidewall thickness is altered from the value shown in ASTM C 1577.
- j. Rebar is substituted for WWR.

Precast box culvert shop drawing review and approval is not required when:

- a. Depths of cover and box's span and rise and wall thickness are standard according to ASTM C 1577, or a detailed design is shown on the contract plans sealed by an Illinois Licensed Structural Engineer (similar to a cast-in-place box) (see also Reference Box A in Attachment H).
- b. The skew of the box as shown on the contract plans is $\leq 30^\circ$, or the skew is $> 30^\circ$ and the design fills are > 5 ft. (1.52 m), or the box design is listed in the Special Provision "Concrete Box Culverts with Skews > 30 Degrees and Design Fills ≤ 5 Feet (BDE)" (see also Reference Box B in Attachment H).
- c. Side wall openings conform to the details given in Attachment K (see also Reference Box C in Attachment K), and have standard depths of cover and sizes according to ASTM C 1577.
- d. Haunch dimensions are altered from ASTM C 1577 and conform to the requirements of Article 11.7 of ASTM C 1577.
- e. Select granular backfill is planned to be provided according to the requirements of Reference Boxes C and D in Attachment H, and the contract plans.

Box culvert shop drawing review and approval is not required, but the drawings are required to be sealed by an Illinois Licensed Structural Engineer when:

- a. Precast box culverts and precast box culvert end sections are originally designed as cast-in-place on the contract plans (see Attachment K, Reference Box B) according to LFD or LRFD. Note that this option is only applicable if the following note (or similar language)

**GUIDELINES FOR SHOP DRAWING REQUIREMENTS FOR VARIOUS
PRECAST CONCRETE PRODUCTS***

*(Version with ASTM C 1577 Effective In Std. Spec. Jan. 1, 2012)

does not appear on the contract plans “Precast culvert alternate is not allowed.”, and if the boxes and/or end sections satisfy Article 540.04 (see also Reference Box E in Attachment H).

- b. Precast box culverts are originally specified as AASHTO M 259 or M 273, and equivalent ASTM C 1577 boxes are provided. Note that this option is only applicable if the boxes satisfy Article 540.04 (see also Reference Box E in Attachment H).

For Local Agency Projects, shop drawings that require review and approval according to the criteria above may alternatively be sealed by an Illinois Licensed Structural Engineer (see Attachment M, Reference Boxes A and B). Local Agencies also have other options for acceptance of shop drawings when review and approval is not required (see Attachment M, Reference Box C).

Regardless of whether precast concrete box culvert shop drawings require review and approval, final distribution shall be according to the section above “Distribution of Shop Drawings (**District** and Local Agency)”.

Note 2 Submittal of complete design calculations is required along with shop drawings.

Note 3 Shop drawings and design calculations (if required) shall be sealed by an Illinois Licensed Structural Engineer.

Note 4 A copy of the approved shop drawings will only be archived by the Bureau of Bridges and Structures if the **Precast Concrete Product** is part of or attached to a bridge.

Note 5 Review and approval is required by the Bureau of Bridges and Structures even if the shop drawings have been reviewed and approved by a Consultant.

Note 6 If detailed design drawings are not provided on the contract plans, submittal of complete design calculations is required along with shop drawings sealed by an Illinois Licensed Structural Engineer.

Note 7 Shop drawing review and approval is not required when designs of the product with the same dimensions and configuration have been previously reviewed and approved by the Bureau of Bridges and Structures after January 1, 2013.

Note 8 Two additional sets of shop drawings shall be submitted to the **District** Project Implementation **Engineer**.

Note 9 Shop drawings shall be submitted directly to the Bureau of Bridges and Structures for review and approval, except for Local Agency Projects.

Note 10 The **District/Owner** shall archive a copy of the approved shop drawings.

Illinois Department of Transportation Shop Drawing Requirements

A. Reviewed and approved shop drawings are required for the following items and shall be processed as noted:

Plate Girders	Finger Plate Expansion Joints
Wide Flange Beams	Finger Plate Joint Trough
Miscellaneous Structural Steel	Modular Expansion Joints
PPC Bulb-T Beams	Elastomeric Bearings
PPC I-Beams	HLMR Bearings
PPC IL-Beams	Seismic Isolation Bearings
PPC Deck Beams	Fixed Bearings
Precast Concrete Box Culverts	Anchor Bolts
Three Sided Precast Concrete Structures	Pins and/or Link Plates
Overhead Sign Structures	Precast Deck Planks
Cantilever Sign Structures	Precast Fascia Panels
Butterfly (Twin Cantilever) Sign Structures	Metal Deck Forms
Bridge Mounted Sign Structures	Mechanically Stabilized Earth Walls
Monotube Sign Structures	Precast Noise Walls
Traffic Signal Mast Arms	Prefabricated Pedestrian/Bicycle Trusses (see Item 4 below)
High Mast Light Towers	

Other project-specific items not included in this list may also require approved shop drawings.

Special Requirement Items:

The Prime Contractor (PC) is responsible for the design and detailing of the following eight items. The seal and signature of an Illinois licensed Professional Engineer or Structural Engineer shall be affixed if required by the contract. The initial number and routing of supplier-prepared shop drawings (and computations if applicable) follows the attached review procedure diagrams, except as modified below. Districts should archive drawings, especially those not kept by the Bureau of Bridges & Structures (BBS).

1. Mechanically Stabilized Earth Wall (MSE) shop drawings and wall design computations require submittal to the BBS Bridge Design Section* and review by the BBS Geotechnical Unit, even if the shop drawings have been reviewed by a consultant. The BBS will archive shop drawings only for MSE walls that are part of bridge structures.
2. Precast Concrete Box Culverts, when required (reference BMPR Policy Memorandum 19-08), and Three Sided Precast Concrete Structures shop drawings shall be submitted directly to the BBS Fabrication Unit* for review, and two additional copies simultaneously submitted to the District Project Implementation Engineer. The District/owner shall archive shop drawings. BBS shall request distribution copies for Precast Concrete Box Culverts reviewed by this office. An electronic copy of all precast concrete box culvert shop drawings approved by the Districts, local public agencies or their consultants shall be forwarded to the BBS for this office's record and use as described in BMPR Policy Memorandum 19-08.

3. Seismic Isolation Bearing design details and computations shall be submitted to the BBS Bridge Design Section* or the design consultant, prior to the review of shop drawings. Shop drawings will not be accepted for review before the proposed designs are approved. The BBS will archive shop drawings.
4. Pedestrian/Bicycle Truss shop drawings and design computations for structures crossing over a state or federal route, or placed on an IDOT right-of-way, or having spans 150 ft. or longer, shall be submitted to the BBS Bridge Design Section* for structural review. If these structures are constructed by another governmental agency (county, municipality, park district, IL Dept. of Natural Resources, etc.), that agency is responsible for archiving the approved shop drawings for future reference.
5. Precast Noise Wall shop drawings shall be submitted directly to the BBS Bridge Design Section* for review and two additional copies simultaneously submitted to the District Project Implementation Engineer. The BBS will archive shop drawings only for the portions of noise walls that are installed on bridges.
6. "Stay-In-Place" Metal Deck Forms design calculations and shop drawings shall be submitted directly to the BBS Bridge Design Section*. The drawings will be reviewed by the BBS Fabrication Unit and BBS will archive the shop drawings.
7. Traffic Signal Mast Arm shop drawings from various manufacturers have been pre-approved by this office for specified loading configurations. The pre-approved shop drawings have been distributed to all District Project Implementation Engineers and may be used by construction personnel to accept shop drawings for loading conditions less than or equal to those that were pre-approved. For lengths or loadings that exceed pre-approved configurations, shop drawings, along with the contract signal plans, shall be submitted to the BBS Fabrication Unit* for review. Monotube Sign Structure shop drawings from manufacturers have not been pre-approved by this office, and must be submitted to the BBS Fabrication Unit* for review. The BBS will not archive final drawing records.
8. High Mast Light Tower shop drawings are to be sent to the central Bureau of Design and Environment for towers in Districts 2 through 9, and to the District 1 Bureau of Electrical Operations for towers in District 1. Luminaires, lowering devices and all electrical and mechanical components will be reviewed by those offices. Tower shop drawings and weld procedures are reviewed by the BBS Fabrication Unit* for structural details and specification conformance. The BBS will not archive final drawing records.

B. Shop Drawings for the following items need not be submitted for each project to the BBS or the review consultant, unless specified or special (non-standard) details are proposed for routine items:

Metal Railings for Bridges (Steel and Aluminum), Pedestrian/Bicycle Railing, Pre-Fabricated Inspection Platforms, Miscellaneous Items – Scuppers, Drain Piping, Navigation Lights and Mounting Hardware, Light Poles, Traffic Signal Poles and other small fabricated pieces such as embedded items for precast and pre-stressed concrete:

The fabricator shall furnish installation and detail drawings to the Contractor and Resident Engineer for field verification of locations and dimensions. These drawings shall be included in the project records. Shop fabrication inspection is not required, and the Resident Engineer's final acceptance may be based on proper fit and an overall visual inspection of the finished product.

Standard design base sheet notes require permanent tubular steel bridge traffic rail and rail posts to have Charpy-V Notch (CVN) toughness values certified by test. Test results, along with mill certification documentation, shall be submitted to the district.

CVN testing is not normally required for bicycle/pedestrian railing. All steel shall be domestic. Any paint used shall be accepted by the Bureau of Materials and Physical Research (BMPR)**. Current requirements of the BMPR concerning aluminum rail and posts shall be satisfied.

The manufacturer's maintenance instructions (periodic inspection checklists, lubrication schedules, etc.) for moveable, pre-fabricated inspection platforms shall be furnished to the Resident Engineer.

Neoprene Expansion Joints:

Each manufacturer should submit their standards to the BBS Fabrication Unit* for preapproval, thereby eliminating shop drawing review by IDOT on individual projects. The Contractor retains the responsibility for proper fit, installation and geometry, and must supply a copy of a preapproved standard to the Resident Engineer for field verification and inclusion in record drawings for the project. The BBS will not archive final drawing records.

For special, non-standard installations such as island medians, skew changes or partial replacements of dissimilar joints, shop drawings should be submitted to the BBS Fabrication Unit*.

The BMPR** will continue to receive material samples for lot testing.

Bridge Joint Sealing System (Preformed Joint Seal (PJS) or Strip Seal):

These joints' support plates are relatively simple and may be prefabricated in convenient lengths, allowing subsequent shop or field cutting to meet project requirements. Since details will be generic, no project-specific review is required, but fabricators may submit standard drawings for BBS preapproval. An installation scheme should be provided by the fabricator to the Contractor and Resident Engineer on jobs with complex geometry or multiple changes in cross slope.

When fabricators are producing the steel assemblies, the BBS Fabrication Unit * is to be notified and may verify the following: domestic material of proper grade; acceptable welding with approved procedures by qualified welders; adequate blast cleaning before painting; and proper application of an approved primer. Only one coat of primer (or optional hot-dip galvanizing) is needed and studs do not require paint.

Acceptance will be waived to the Resident Engineer at the jobsite, unless one of our fabrication inspectors is in the shop for other work and completes a BBS 59 release which includes the PJS or strip seal plates. The BMPR** will continue to lot test samples of the seal material.

Break-Away Wide Flange and Tubular Sign Posts:

Standard shop drawings from various fabricators have been pre-approved by the BBS and distributed to all District Project Implementation Engineers, and may be used by District personnel to accept shop drawings. The Contractor retains the responsibility for proper fit, installation and geometry, and must supply a copy of a preapproved standard to the Resident Engineer for field verification and inclusion in record drawings for the project. The BBS will not archive final drawing records.

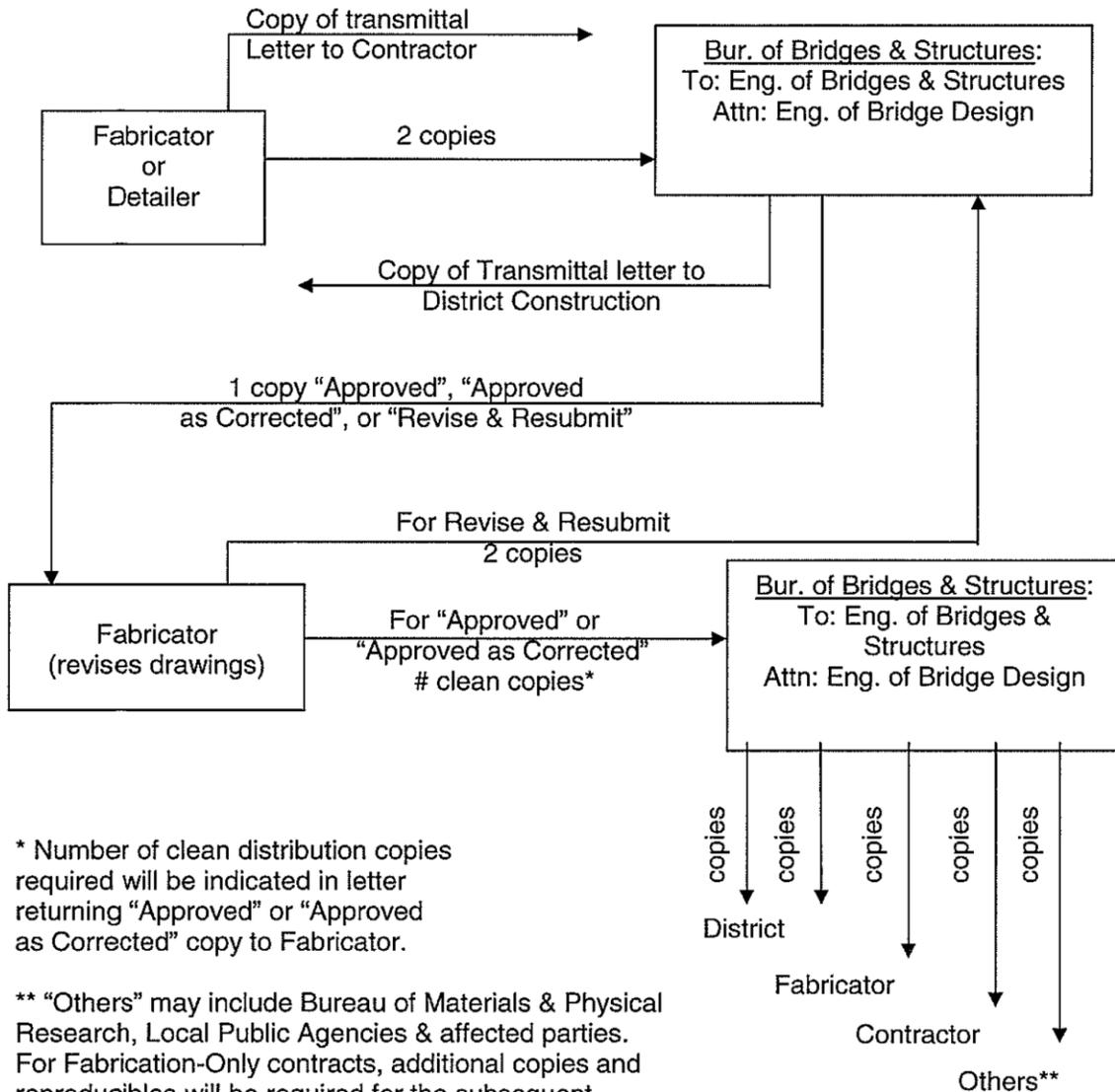
Fabric Reinforced Elastomeric Mats and Terminal Joint Wide Flange Beams:

The fabricator shall furnish installation and detail drawings to the Contractor and Resident Engineer for field verification of locations and dimensions. These drawings shall be included in the project records. Shop fabrication inspection is not required, and the Resident Engineer's final acceptance may be based on proper fit and an overall visual inspection of the finished product. The mat supplier is responsible for submitting samples to the BMPR** for lot testing.

* ILDOT Bureau of Bridges & Structures, Rm. 240,
2300 S. Dirksen Pkwy, Springfield, IL 62764:
Bridge Design Section, Fabrication Unit, or
Bridge Investigations and Repair Plans Unit, as applicable.

** ILDOT Bureau of Materials & Physical Research
126 East Ash, Springfield, IL 62704
Materials Testing Section

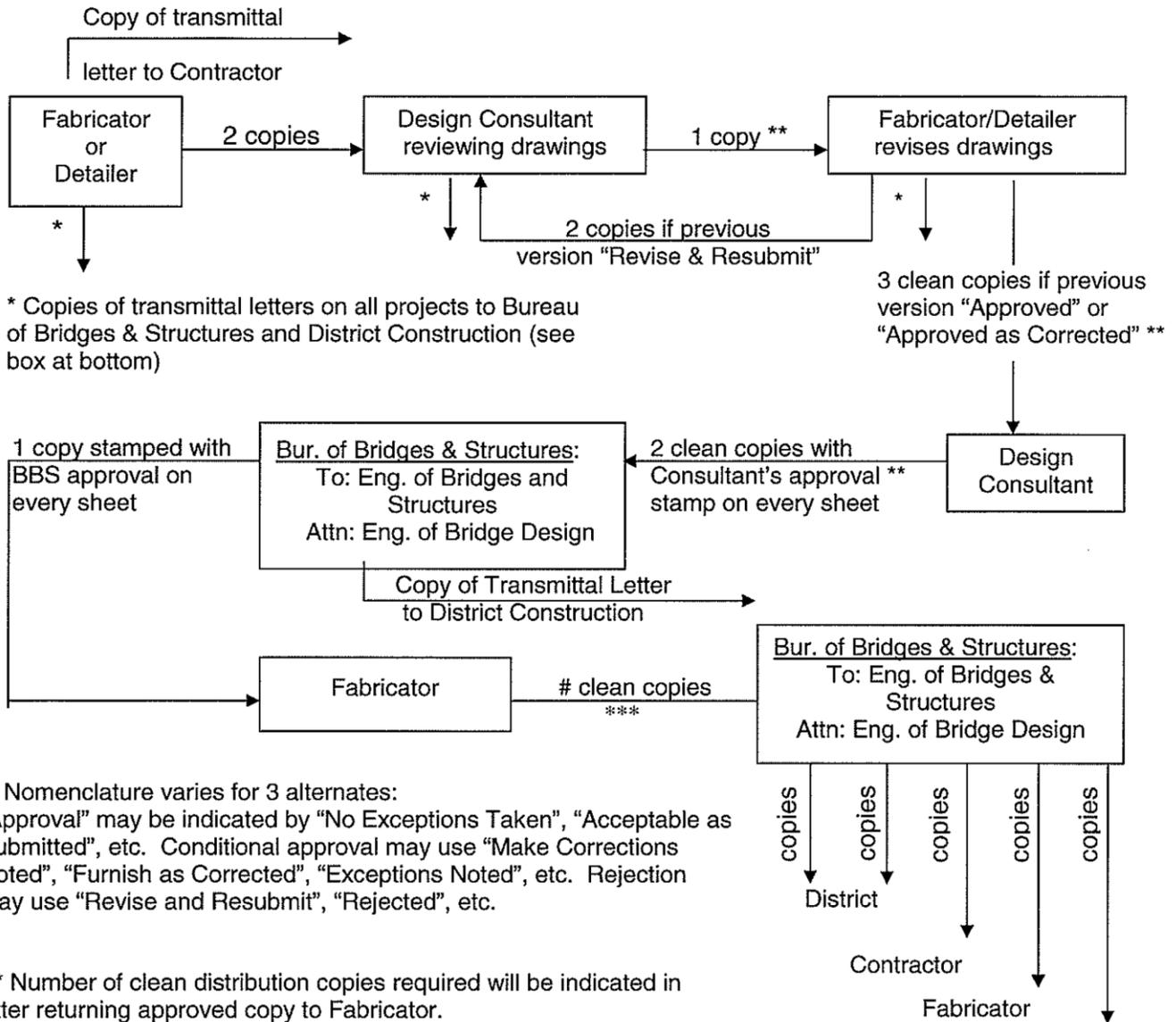
**Shop Drawing Review Procedure
for Bureau of Bridges & Structures as Primary Reviewer
("Special Requirements" not included)**



* Number of clean distribution copies required will be indicated in letter returning "Approved" or "Approved as Corrected" copy to Fabricator.

** "Others" may include Bureau of Materials & Physical Research, Local Public Agencies & affected parties. For Fabrication-Only contracts, additional copies and reproducibles will be required for the subsequent erection contract. Structures carrying railroads may also require reproducibles for the railroad.

**Shop Drawing Review Procedure
for Design Consultant as Primary Reviewer
("Special Requirements" not included)**



**** "Others" may include Bureau of Materials & Physical Research, Local Public Agencies & affected parties. For Fabrication-Only contracts, additional copies and reproducibles will be required for the subsequent erection contract. Structures carrying railroads may also require reproducibles for the railroad.

Bureau of Bridges & Structures:
To: Engineer of Bridges & Structures
Attn: Engineer of Bridge Design

District Construction:
To: Regional Engineer / Attn: District Project Implementation Engineer



Illinois Department of Transportation

Memorandum

To: ALL BRIDGE DESIGNERS 11.3 (REV)

From: D. Carl Puzey *D. Carl Puzey*

Subject: LRFD Design Requirements for Precast and Cast-In-Place Concrete Box Culverts

Date: November 2, 2011 (Revised January 27, 2012)

The Department is beginning implementation of AASHTO Load and Resistance Factor Design (LRFD) for buried structures, which includes culverts, pipes and three sided structures. This memorandum addresses concrete box culverts.

PRECAST CONCRETE BOX CULVERTS

Reference
Box A

Effective with the 2012 Standard Specifications for Road and Bridge Construction and beginning with the January 20, 2012 letting, all precast concrete box culverts and precast extensions of existing culverts shall utilize LRFD by applying the standard designs of ASTM C 1577. Precast box configurations and loadings not addressed in ASTM C 1577 may be designed utilizing LRFD with the latest version of the BOXCAR program, provided similar slab and wall thicknesses of the nearest standard geometric configurations from ASTM C 1577 are used. These non-standard precast box culvert sections shall have the design shown on the contract plans, similar to a cast-in-place box, and shall be sealed by an Illinois Licensed Structural Engineer. The following table is a list of standard precast box configurations that may be found in ASTM C 1577. Standard configurations are encouraged for new culvert designs. If the closest standard configuration is too tall for a specific application, consider setting the box invert deeper or utilizing more culvert barrels of a shallower configuration before using a non-standard configuration.

3 x 2	6 x 3	8 x 4	9 x 9	11 x 6
3 x 3	6 x 4	8 x 5		11 x 8
	6 x 5	8 x 6	10 x 5	11 x 10
4 x 2	6 x 6	8 x 7	10 x 6	11 x 11
4 x 3		8 x 8	10 x 7	
4 x 4	7 x 4		10 x 8	12 x 4
	7 x 5	9 x 5	10 x 9	12 x 6
5 x 3	7 x 6	9 x 6	10 x 10	12 x 8
5 x 4	7 x 7	9 x 7		12 x 10
5 x 5		9 x 8	11 x 4	12 x 12

It is important to note there are a few design limitations associated with ASTM C 1577. First, the design tables are adequate for skews up through 30 degrees and also for larger skews when the design fill is greater than 5 feet. Skews larger than 30 degrees with design fills less than or equal to 5 feet shall be handled with design tables that IDOT will provide through a (BDE) special provision entitled

ALL BRIDGE DESIGNERS

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November 2, 2011 (Revised January 27, 2012)

"CONCRETE BOX CULVERTS WITH SKEWS > 30 DEGREES AND DESIGN FILLS \leq 5 FEET (BDE)" prior to the January letting. Designs from this special provision or ASTM C 1577 do not require a seal by an Illinois Licensed Structural Engineer. This policy is summarized in the following chart.

Skew*	Design Fill	Specification
≤ 30	All Fills	ASTM C 1577
> 30	> 5 ft	ASTM C 1577
> 30	≤ 5 ft	IDOT Special Provision

*The skew is the angle between a perpendicular line to the box culvert and the centerline of the roadway.

Reference
Box B

Second, the design tables of ASTM C 1577 are based on a live load distribution of 1.15 in both directions through design fills ≥ 2 feet. To achieve this distribution, Porous Granular Embankment (PGE) backfill is required for all boxes meeting either of the following two conditions:

Reference
Box C

- Depth of fill ≥ 2 ft. and ≤ 8 ft.
- Depth of fill \leq span of largest box in configuration

The limits and quantities of the PGE necessary for the box installation shall be shown and included in the roadway plans.

Design fills less than 2 feet shall satisfy the requirements of AASHTO LRFD Article 4.6.2.10. The Department recommends PGE or a continuation of the roadway sub base up to the 2 feet of fill. Note that for Case 1, parallel to the span, the LLDF shall then be 1.15.

Roadway Plan Presentation

Over the years, many Districts have developed their own unique contract plan details for precast box culverts, some by repeating portions of the AASHTO details and tables and others by developing their own notes, tables and details. This transition from Load Factor Design (LFD) to LRFD design is a good opportunity to unify and promote consistent details throughout the State. Therefore, in lieu of the various past practices, we are recommending the following:

1. Each culvert shall be identified on the plan/profile sheets of roadway plans with the following information:

ASTM C 1577; Station; Size; Skew; Design Fill

Fabricators will be instructed in the Bureau of Materials and Physical Research (BMPR) policy memorandum "Quality Control/ Quality Assurance Program for Precast Concrete Products" to identify each precast box culvert section in the same way for easy identification and location in the field. Additionally, the policy memorandum requires fabricators to include their producer mark and the date of manufacture on each precast box culvert section.

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 Page 3
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2. Each set of applicable roadway plans shall have a Culvert Schedule including the following minimum information. The designer shall determine the design fill heights, and shall note whether PGE backfill is required.

Precast Box Culvert Schedule (ASTM C 1577)					
Station	Size (Span x Height)	Skew*	Design Fill (ft.)		PGE backfill required
			Edge of shldr. (minimum)	Maximum	

*Skews > 30° with design fills ≤ 5 ft. require a special design. See BDE Special Provision "CONCRETE BOX CULVERTS WITH SKEWS > 30 DEGREES AND DESIGN FILLS ≤ 5 FEET (BDE)". The skew is the angle between a perpendicular line to the box culvert and the centerline of the roadway.

Reference
Box D

3. The roadway plans shall clearly illustrate the intended limits, pay item and quantity of the PGE necessary for the box installation.

CAST-IN-PLACE (CIP) BOX CULVERTS

In order to allow some time for plan preparation, all CIP concrete box culverts and CIP extensions of existing culverts, beginning with the June 15, 2012 letting and beyond shall utilize LRFD according to the latest version and interims of the AASHTO LRFD Bridge Design Specifications. The Department anticipates issuing Standardized Design Tables of single span box culverts for the Culvert Manual. Until these tables become available, all CIP simple span box culverts, on the June 15, 2012 letting and beyond, will require a design sealed by an Illinois Licensed Structural Engineer. All multi-span CIP boxes will continue to require a design sealed by an Illinois Licensed Structural Engineer similar to our current policy.

Design Preferences

The same live load distribution of 1.15, as previously discussed for precast concrete box culverts, shall also be used for CIP boxes. As such, PGE will also be required for the same ranges of design fill.

CIP concrete box culverts shall be designed for the perpendicular span between the culvert walls. The main flexure reinforcement is therefore also placed at right angles to the wall. On skewed structures, the skewed areas near staged construction lines or end sections shall preferably be addressed with an edge beam design satisfying Article 4.6.2.1.4 of the AASHTO LRFD Bridge Design Specifications. However, there are circumstances where it may be more advantageous to place the flexure reinforcement along the skew rather than perpendicular to the walls. Examples may be culverts with short lengths, staged construction and large skew or shallow fills where an edge beam design requiring more slab depth may interfere with the roadway sub base. In these cases, the perpendicular span shall be used to design the slab thickness and the steel area.

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November 2, 2011 (Revised January 27, 2012)

- The steel area shall then be increased by the multiplication of $\sec^2\theta$ and the resulting area of steel placed along the skew. The skew, θ , is defined as the angle between a perpendicular line to the box culvert and the centerline of the roadway. Additionally, Article 5.5.4.2.1 of the AASHTO LRFD Bridge Design Specifications shall be satisfied such that the slab remains "tension controlled".

IMPLEMENTATION

In summary, all precast concrete box culverts and precast extensions of existing culverts, beginning with the January 20, 2012 letting, shall utilize LRFD by applying the standard designs of ASTM C 1577 and all CIP concrete box culverts and CIP extensions of existing culverts on the June 15, 2012 letting and beyond shall utilize LRFD according to the latest version and interims of the AASHTO LRFD Bridge Design Specifications.

Due to these time frames, it is possible to have a few scenarios that will require additional action. First, a LFD designed CIP box culvert may appear on some of the early 2012 lettings. If there is not a note stating otherwise on the plans, the contractor may still have the option to substitute a precast box culvert as permitted by Article 540.04 of the Standard Specifications. In these cases, a precast box culvert built according to ASTM C 1577 may be substituted provided the design requirements previously described are satisfied. To ensure all potential additional costs, such as PGE, are covered by the contract for this scenario, a BDE special provision of either "CONCRETE BOX CULVERTS WITH SKEWS \leq 30 DEGREES REGARDLESS OF DESIGN FILL AND SKEWS $>$ 30 DEGREES WITH DESIGN FILLS $>$ 5 FEET (BDE)" or "CONCRETE BOX CULVERTS WITH SKEWS $>$ 30 DEGREES AND DESIGN FILLS \leq 5 FEET (BDE)" shall be inserted into each applicable contract document.

Reference
Box E

Second, the contract plans may originally have detailed a precast concrete box based on the old AASHTO M 259 or M 273 (LFD design) but the equivalent standard ASTM C 1577 (LRFD designed) precast concrete box culvert may require PGE, depending on the design fill. To ensure all potential additional costs, such as PGE, are covered by the contract for this scenario, the appropriate BDE special provision as mentioned in the previous paragraph, shall be inserted into each applicable contract document.

The Bureau of Bridges and Structures will coordinate with the Bureau of Design and Environment to insure contracts with culverts, let before June 15, 2012, have the appropriate special provisions inserted. If there are any questions regarding these policies please contact Gary Kowalski at (217) 785-2914.

KLR/kktABD11.3LRFDrevised-20111102



Illinois Department of Transportation

Memorandum

To: ALL BRIDGE DESIGNERS

From: D. Carl Puzey ^{15.4} *D. Carl Puzey*

Subject: AASHTO Revisions for Tension Development Lengths

Date: June 11, 2015

The 2015 Interim Revisions to the AASHTO LRFD Bridge Design Specifications included changes to the tension development lengths for reinforcement. These revisions are based upon the combined recommendations of NCHRP Report 603 and ACI 318-11 which focused on eliminating many of the concerns regarding tension lap splices due to closely spaced bars with minimal cover, as well as, upgrading the provisions for concrete strengths up to 15 ksi. AASHTO Article 5.11.2 now uses λ modification factors to adjust the basic tension development length. These factors are similar to past code provisions with one exception being the λ_{rc} , reinforcement confinement modification factor. This factor encourages designers to utilize proper detailing through reinforcement cover, confinement and spacing. Another significant exception is the elimination of Class C splices in AASHTO Article 5.11.5.3.1. The net result of the code changes generally leads to longer tension development lengths especially with the smaller bar sizes.

The Department has developed and included a set of simplified reinforcement bar lap charts based on the new provisions to replace the current charts in the Design Aids of Section 4 - Appendix of the Bridge Manual. There are four general charts with combinations of concrete compressive strengths of 4.0 ksi and 3.5 ksi and with epoxy coated bars and unprotected bars. These four charts are further broken down into Class A and Class B laps based on reinforcement bar cover and spacing for both basic laps and horizontal bar laps with 12 inches of concrete cast beneath. Note, that in order to develop simplified charts we conservatively assumed A_{tr} , the term accounting for the cross sectional area of transverse confinement reinforcement within the λ_{rc} modification factor, equal to zero.

Our superstructure base sheets have been updated to depict the standard lap lengths for the common parapet and bridge deck reinforcement. The #4 and #8 parapet bars will now have lap lengths of 2'-8" and 5'-11" respectively and the #5 superstructure rebar will have a lap length of 3'-6". This lap length is conservatively based upon the governing bottom transverse reinforcement with 1 inch of cover. Note, that for slab bridges the cover on the bottom longitudinal bars shall be increased from 1" to 1 1/2" to improve detailing and reduce the required lap lengths. Other updated base sheets include the prestressed beams with revised laps based on 6.0 ksi concrete and the Bar Splicer Assembly base sheet, BSD-1, which eliminated the minimum lap length chart. Designers shall determine the appropriate lap length for each specified bar size and location based on the new charts and insert them directly on the base sheet chart.

Implementation

These revisions shall be effective with TS&L's approved after July 1, 2015. Please direct questions to Gary Kowalski of the Policies, Standards and Specifications Unit at (217) 785-2914.

Attachments

KLR/kktABD15.4-20150611

Tension Splices for Epoxy Coated Reinforcement in Normal Weight Concrete
($f'_c = 4,000\text{psi}$; $f_y = 60,000\text{psi}$)

Basic Lap					
Bar Size	Min. Cover	Class A ($1.0 l_d$)		Class B ($1.3 l_d$)	
		$s < 6''$ cts.	$s \geq 6''$ cts.	$s < 6''$ cts.	$s \geq 6''$ cts.
#4	1"	1'-10"	1'-10"	2'-5"	2'-5"
#5	1.5"	2'-5"	2'-3"	3'-1"	3'-0"
	1"	2'-9"	2'-9"	3'-6"	3'-6"
#6	1.5"	3'-5"	2'-9"	4'-5"	3'-7"
	1"	3'-9"	3'-9"	4'-10"	4'-10"
#7	2"	4'-0"	3'-2"	5'-2"	4'-2"
	1.5"	4'-0"	3'-7"	5'-2"	4'-8"
	1"	4'-10"	4'-10"	6'-3"	6'-3"
#8	2"	5'-2"	3'-8"	6'-9"	4'-9"
	1.5"	5'-2"	4'-6"	6'-9"	5'-11"
	1"	6'-0"	6'-0"	7'-10"	7'-10"
#9	2.5"	6'-7"	4'-1"	8'-7"	5'-4"
	2"	6'-7"	4'-6"	8'-7"	5'-10"
	1.5"	6'-7"	5'-7"	8'-7"	7'-3"
	1"	7'-4"	7'-4"	9'-7"	9'-7"
#10	2.5"	7'-4"	4'-11"	9'-6"	6'-4"
	2"	7'-4"	5'-7"	9'-6"	7'-2"
	1.5"	7'-4"	6'-10"	9'-6"	8'-11"
	1"	8'-11"	8'-11"	11'-7"	11'-7"
#11	2.5"	9'-0"	6'-0"	11'-8"	7'-10"
	2"	9'-0"	6'-8"	11'-8"	8'-8"
	1.5"	9'-0"	8'-2"	11'-8"	10'-7"
	1"	10'-6"	10'-6"	13'-8"	13'-8"

Horizontal Lap $w > 12''$ Concrete Cast Below					
Bar Size	Min. Cover	Class A ($1.0 l_d$)		Class B ($1.3 l_d$)	
		$s < 6''$ cts.	$s \geq 6''$ cts.	$s < 6''$ cts.	$s \geq 6''$ cts.
#4	1"	2'-1"	2'-1"	2'-8"	2'-8"
#5	1.5"	2'-8"	2'-7"	3'-6"	3'-4"
	1"	3'-1"	3'-1"	4'-0"	4'-0"
#6	1.5"	3'-10"	3'-1"	5'-0"	4'-0"
	1"	4'-3"	4'-3"	5'-6"	5'-6"
#7	2"	4'-6"	3'-7"	5'-10"	4'-8"
	1.5"	4'-6"	4'-1"	5'-10"	5'-3"
	1"	5'-6"	5'-6"	7'-1"	7'-1"
#8	2"	5'-10"	4'-1"	7'-7"	5'-4"
	1.5"	5'-10"	5'-2"	7'-7"	6'-8"
	1"	6'-10"	6'-10"	8'-11"	8'-11"
#9	2.5"	7'-5"	4'-8"	9'-8"	6'-0"
	2"	7'-5"	5'-1"	9'-8"	6'-7"
	1.5"	7'-5"	6'-4"	9'-8"	8'-3"
	1"	8'-4"	8'-4"	10'-10"	10'-10"
#10	2.5"	8'-3"	5'-6"	10'-9"	7'-2"
	2"	8'-3"	6'-3"	10'-9"	8'-2"
	1.5"	8'-3"	7'-9"	10'-9"	10'-1"
	1"	10'-1"	10'-1"	13'-1"	13'-1"
#11	2.5"	10'-2"	6'-10"	13'-3"	8'-10"
	2"	10'-2"	7'-6"	13'-3"	9'-9"
	1.5"	10'-2"	9'-3"	13'-3"	12'-0"
	1"	11'-11"	11'-11"	15'-6"	15'-6"

Notes:

Confinement reinforcement was conservatively assumed to be zero.
Larger covers for the smaller bars were intentionally omitted because additional cover does not reduce the lap length.

Tension Splices for Epoxy Coated Reinforcement in Normal Weight Concrete
(f'c = 3,500psi; fy = 60,000psi)

Basic Lap					
Bar Size	Min. Cover	Class A (1.0 l _d)		Class B (1.3 l _d)	
		s < 6" cts.	s ≥ 6" cts.	s < 6" cts.	s ≥ 6" cts.
#4	1"	2'-0"	2'-0"	2'-7"	2'-7"
#5	1.5"	2'-7"	2'-5"	3'-4"	3'-2"
	1"	2'-11"	2'-11"	3'-9"	3'-9"
#6	1.5"	3'-8"	2'-11"	4'-9"	3'-10"
	1"	4'-0"	4'-0"	5'-2"	5'-2"
#7	2"	4'-3"	3'-5"	5'-6"	4'-5"
	1.5"	4'-3"	3'-10"	5'-6"	5'-0"
	1"	5'-2"	5'-2"	6'-8"	6'-8"
#8	2"	5'-6"	3'-11"	7'-2"	5'-1"
	1.5"	5'-6"	4'-10"	7'-2"	6'-4"
	1"	6'-5"	6'-5"	8'-5"	8'-5"
#9	2.5"	7'-0"	4'-5"	9'-2"	5'-8"
	2"	7'-0"	4'-10"	9'-2"	6'-3"
	1.5"	7'-0"	6'-0"	9'-2"	7'-9"
	1"	7'-10"	7'-10"	10'-3"	10'-3"
#10	2.5"	7'-10"	5'-3"	10'-2"	6'-9"
	2"	7'-10"	5'-11"	10'-2"	7'-8"
	1.5"	7'-10"	7'-4"	10'-2"	9'-6"
	1"	9'-6"	9'-6"	12'-5"	12'-5"
#11	2.5"	9'-7"	6'-5"	12'-6"	8'-4"
	2"	9'-7"	7'-1"	12'-6"	9'-3"
	1.5"	9'-7"	8'-9"	12'-6"	11'-4"
	1"	11'-3"	11'-3"	14'-8"	14'-8"

Horizontal Lap w/>12" Concrete Cast Below					
Bar Size	Min. Cover	Class A (1.0 l _d)		Class B (1.3 l _d)	
		s < 6" cts.	s ≥ 6" cts.	s < 6" cts.	s ≥ 6" cts.
#4	1"	2'-3"	2'-3"	2'-11"	2'-11"
#5	1.5"	2'-11"	2'-9"	3'-9"	3'-7"
	1"	3'-3"	3'-3"	4'-3"	4'-3"
#6	1.5"	4'-2"	3'-4"	5'-4"	4'-4"
	1"	4'-6"	4'-6"	5'-10"	5'-10"
#7	2"	4'-10"	3'-10"	6'-3"	5'-0"
	1.5"	4'-10"	4'-4"	6'-3"	5'-8"
	1"	5'-10"	5'-10"	7'-7"	7'-7"
#8	2"	6'-3"	4'-5"	8'-2"	5'-9"
	1.5"	6'-3"	5'-6"	8'-2"	7'-2"
	1"	7'-4"	7'-4"	9'-6"	9'-6"
#9	2.5"	8'-0"	5'-0"	10'-4"	6'-5"
	2"	8'-0"	5'-5"	10'-4"	7'-1"
	1.5"	8'-0"	6'-9"	10'-4"	8'-9"
	1"	8'-11"	8'-11"	11'-7"	11'-7"
#10	2.5"	8'-10"	5'-11"	11'-6"	7'-8"
	2"	8'-10"	6'-9"	11'-6"	8'-9"
	1.5"	8'-10"	8'-3"	11'-6"	10'-9"
	1"	10'-10"	10'-10"	14'-0"	14'-0"
#11	2.5"	10'-11"	7'-3"	14'-2"	9'-5"
	2"	10'-11"	8'-1"	14'-2"	10'-6"
	1.5"	10'-11"	9'-10"	14'-2"	12'-10"
	1"	12'-9"	12'-9"	16'-7"	16'-7"

Notes:

Confinement reinforcement was conservatively assumed to be zero.
Larger covers for the smaller bars were intentionally omitted because additional cover does not reduce the lap length.

Tension Splices for Unprotected Reinforcement in Normal Weight Concrete
(f'c = 4,000psi; fy = 60,000psi)

Basic Lap					
Bar Size	Min. Cover	Class A (1.0 l _d)		Class B (1.3 l _d)	
		s < 6" cts.	s ≥ 6" cts.	s < 6" cts.	s ≥ 6" cts.
#4	1"	1'-3"	1'-3"	1'-7"	1'-7"
#5	1.5"	1'-7"	1'-6"	2'-1"	2'-0"
	1"	1'-10"	1'-10"	2'-4"	2'-4"
#6	1.5"	2'-3"	1'-10"	3'-0"	2'-5"
	1"	2'-6"	2'-6"	3'-3"	3'-3"
#7	2"	2'-8"	2'-2"	3'-5"	2'-9"
	1.5"	2'-8"	2'-5"	3'-5"	3'-1"
	1"	3'-3"	3'-3"	4'-2"	4'-2"
#8	2"	3'-6"	2'-5"	4'-6"	3'-2"
	1.5"	3'-6"	3'-0"	4'-6"	3'-11"
	1"	4'-0"	4'-0"	5'-3"	5'-3"
#9	2.5"	4'-5"	2'-9"	5'-9"	3'-7"
	2"	4'-5"	3'-0"	5'-9"	3'-11"
	1.5"	4'-5"	3'-9"	5'-9"	4'-10"
	1"	4'-11"	4'-11"	6'-5"	6'-5"
#10	2.5"	4'-11"	3'-3"	6'-4"	4'-3"
	2"	4'-11"	3'-9"	6'-4"	4'-10"
	1.5"	4'-11"	4'-7"	6'-4"	5'-11"
	1"	6'-0"	6'-0"	7'-9"	7'-9"
#11	2.5"	6'-0"	4'-0"	7'-10"	5'-3"
	2"	6'-0"	4'-5"	7'-10"	5'-9"
	1.5"	6'-0"	5'-5"	7'-10"	7'-1"
	1"	7'-0"	7'-0"	9'-2"	9'-2"

Horizontal Lap w/>12" Concrete Cast Below					
Bar Size	Min. Cover	Class A (1.0 l _d)		Class B (1.3 l _d)	
		s < 6" cts.	s ≥ 6" cts.	s < 6" cts.	s ≥ 6" cts.
#4	1"	1'-7"	1'-7"	2'-1"	2'-1"
#5	1.5"	2'-1"	2'-0"	2'-8"	2'-7"
	1"	2'-4"	2'-4"	3'-1"	3'-1"
#6	1.5"	3'-0"	2'-5"	3'-10"	3'-1"
	1"	3'-3"	3'-3"	4'-2"	4'-2"
#7	2"	3'-5"	2'-9"	4'-6"	3'-7"
	1.5"	3'-5"	3'-1"	4'-6"	4'-1"
	1"	4'-2"	4'-2"	5'-5"	5'-5"
#8	2"	4'-6"	3'-2"	5'-10"	4'-1"
	1.5"	4'-6"	3'-11"	5'-10"	5'-1"
	1"	5'-3"	5'-3"	6'-10"	6'-10"
#9	2.5"	5'-9"	3'-7"	7'-5"	4'-7"
	2"	5'-9"	3'-11"	7'-5"	5'-1"
	1.5"	5'-9"	4'-10"	7'-5"	6'-4"
	1"	6'-5"	6'-5"	8'-3"	8'-3"
#10	2.5"	6'-4"	4'-3"	8'-3"	5'-6"
	2"	6'-4"	4'-10"	8'-3"	6'-3"
	1.5"	6'-4"	5'-11"	8'-3"	7'-8"
	1"	7'-9"	7'-9"	10'-1"	10'-1"
#11	2.5"	7'-10"	5'-3"	10'-1"	6'-9"
	2"	7'-10"	5'-9"	10'-1"	7'-6"
	1.5"	7'-10"	7'-1"	10'-1"	9'-2"
	1"	9'-2"	9'-2"	11'-10"	11'-10"

Notes:

Confinement reinforcement was conservatively assumed to be zero.
Larger covers for the smaller bars were intentionally omitted because additional cover does not reduce the lap length.

Tension Splices for Unprotected Reinforcement in Normal Weight Concrete
($f'_c = 3,500\text{psi}$; $f_y = 60,000\text{psi}$)

Basic Lap					
Bar Size	Min. Cover	Class A (1.0 l_d)		Class B (1.3 l_d)	
		$s < 6"$ cts.	$s \geq 6"$ cts.	$s < 6"$ cts.	$s \geq 6"$ cts.
#4	1"	1'-4"	1'-4"	1'-9"	1'-9"
#5	1.5"	1'-9"	1'-8"	2'-3"	2'-2"
	1"	1'-11"	1'-11"	2'-6"	2'-6"
#6	1.5"	2'-5"	2'-0"	3'-2"	2'-7"
	1"	2'-8"	2'-8"	3'-5"	3'-5"
#7	2"	2'-10"	2'-3"	3'-8"	3'-0"
	1.5"	2'-10"	2'-7"	3'-8"	3'-4"
	1"	3'-5"	3'-5"	4'-6"	4'-6"
#8	2"	3'-8"	2'-7"	4'-10"	3'-5"
	1.5"	3'-8"	3'-3"	4'-10"	4'-3"
	1"	4'-4"	4'-4"	5'-7"	5'-7"
#9	2.5"	4'-8"	2'-11"	6'-1"	3'-10"
	2"	4'-8"	3'-3"	6'-1"	4'-2"
	1.5"	4'-8"	4'-0"	6'-1"	5'-2"
	1"	5'-3"	5'-3"	6'-10"	6'-10"
#10	2.5"	5'-3"	3'-6"	6'-9"	4'-6"
	2"	5'-3"	4'-0"	6'-9"	5'-2"
	1.5"	5'-3"	4'-11"	6'-9"	6'-4"
	1"	6'-4"	6'-4"	8'-3"	8'-3"
#11	2.5"	6'-5"	4'-4"	8'-4"	5'-7"
	2"	6'-5"	4'-9"	8'-4"	6'-2"
	1.5"	6'-5"	5'-10"	8'-4"	7'-7"
	1"	7'-6"	7'-6"	9'-9"	9'-9"

Horizontal Lap w/>12" Concrete Cast Below					
Bar Size	Min. Cover	Class A (1.0 l_d)		Class B (1.3 l_d)	
		$s < 6"$ cts.	$s \geq 6"$ cts.	$s < 6"$ cts.	$s \geq 6"$ cts.
#4	1"	1'-9"	1'-9"	2'-3"	2'-3"
#5	1.5"	2'-3"	2'-2"	2'-10"	2'-9"
	1"	2'-6"	2'-6"	3'-3"	3'-3"
#6	1.5"	3'-2"	2'-7"	4'-1"	3'-4"
	1"	3'-5"	3'-5"	4'-6"	4'-6"
#7	2"	3'-8"	3'-0"	4'-9"	3'-10"
	1.5"	3'-8"	3'-4"	4'-9"	4'-4"
	1"	4'-6"	4'-6"	5'-10"	5'-10"
#8	2"	4'-10"	3'-5"	6'-3"	4'-5"
	1.5"	4'-10"	4'-3"	6'-3"	5'-6"
	1"	5'-7"	5'-7"	7'-3"	7'-3"
#9	2.5"	6'-1"	3'-10"	7'-11"	4'-11"
	2"	6'-1"	4'-2"	7'-11"	5'-5"
	1.5"	6'-1"	5'-2"	7'-11"	6'-9"
	1"	6'-10"	6'-10"	8'-10"	8'-10"
#10	2.5"	6'-9"	4'-6"	8'-9"	5'-10"
	2"	6'-9"	5'-2"	8'-9"	6'-8"
	1.5"	6'-9"	6'-4"	8'-9"	8'-3"
	1"	8'-3"	8'-3"	10'-9"	10'-9"
#11	2.5"	8'-4"	5'-7"	10'-10"	7'-3"
	2"	8'-4"	6'-2"	10'-10"	8'-0"
	1.5"	8'-4"	7'-7"	10'-10"	9'-10"
	1"	9'-9"	9'-9"	12'-8"	12'-8"

Notes:

Confinement reinforcement was conservatively assumed to be zero.
Larger covers for the smaller bars were intentionally omitted because additional cover does not reduce the lap length.

Tension Splices for Epoxy Coated Reinforcement in Normal Weight Concrete
($f'_c = 5,000\text{psi}$; $f_y = 60,000\text{psi}$)

Basic Lap					
Bar Size	Min. Cover	Class A ($1.0 l_d$)		Class B ($1.3 l_d$)	
		$s < 6''$ cts.	$s \geq 6''$ cts.	$s < 6''$ cts.	$s \geq 6''$ cts.
#4	1"	1'-8"	1'-8"	2'-2"	2'-2"
	1.5"	2'-2"	2'-1"	2'-9"	2'-8"
#5	1"	2'-5"	2'-5"	3'-2"	3'-2"
	1.5"	3'-1"	2'-5"	4'-0"	3'-2"
#6	1"	3'-4"	3'-4"	4'-4"	4'-4"
	1.5"	3'-7"	2'-10"	4'-7"	3'-8"
#7	1.5"	3'-7"	3'-3"	4'-7"	4'-2"
	1"	4'-4"	4'-4"	5'-7"	5'-7"
	2"	4'-8"	3'-3"	6'-0"	4'-3"
#8	1.5"	4'-8"	4'-1"	6'-0"	5'-3"
	1"	5'-5"	5'-5"	7'-0"	7'-0"
	2.5"	5'-11"	3'-8"	7'-8"	4'-9"
#9	2"	5'-11"	4'-0"	7'-8"	5'-3"
	1.5"	5'-11"	5'-0"	7'-8"	6'-6"
	1"	6'-7"	6'-7"	8'-7"	8'-7"
	2.5"	6'-6"	4'-4"	8'-6"	5'-8"
#10	2"	6'-6"	5'-0"	8'-6"	6'-5"
	1.5"	6'-6"	6'-1"	8'-6"	7'-11"
	1"	8'-0"	8'-0"	10'-4"	10'-4"
	2.5"	8'-1"	5'-5"	10'-5"	7'-0"
#11	2"	8'-1"	5'-11"	10'-5"	7'-9"
	1.5"	8'-1"	7'-4"	10'-5"	9'-6"
	1"	9'-5"	9'-5"	12'-3"	12'-3"

Horizontal Lap w/>12" Concrete Cast Below					
Bar Size	Min. Cover	Class A ($1.0 l_d$)		Class B ($1.3 l_d$)	
		$s < 6''$ cts.	$s \geq 6''$ cts.	$s < 6''$ cts.	$s \geq 6''$ cts.
#4	1"	1'-10"	1'-10"	2'-5"	2'-5"
	1.5"	2'-5"	2'-4"	3'-2"	3'-0"
#5	1"	2'-9"	2'-9"	3'-7"	3'-7"
	1.5"	3'-6"	2'-9"	4'-6"	3'-7"
#6	1"	3'-9"	3'-9"	4'-11"	4'-11"
	2"	4'-0"	3'-3"	5'-3"	4'-2"
#7	1.5"	4'-0"	3'-8"	5'-3"	4'-9"
	1"	4'-11"	4'-11"	6'-4"	6'-4"
	2"	5'-3"	3'-8"	6'-10"	4'-9"
#8	1.5"	5'-3"	4'-7"	6'-10"	6'-0"
	1"	6'-1"	6'-1"	7'-11"	7'-11"
	2.5"	6'-8"	4'-2"	8'-8"	5'-5"
#9	2"	6'-8"	4'-7"	8'-8"	5'-11"
	1.5"	6'-8"	5'-8"	8'-8"	7'-4"
	1"	7'-6"	7'-6"	9'-8"	9'-8"
	2.5"	7'-5"	4'-11"	9'-7"	6'-5"
#10	2"	7'-5"	5'-8"	9'-7"	7'-4"
	1.5"	7'-5"	6'-11"	9'-7"	9'-0"
	1"	9'-0"	9'-0"	11'-9"	11'-9"
	2.5"	9'-1"	6'-1"	11'-10"	7'-11"
#11	2"	9'-1"	6'-9"	11'-10"	8'-9"
	1.5"	9'-1"	8'-3"	11'-10"	10'-9"
	1"	10'-8"	10'-8"	13'-10"	13'-10"

Notes:

Confinement reinforcement was conservatively assumed to be zero.
Larger covers for the smaller bars were intentionally omitted because additional cover does not reduce the lap length.

Tension Splices for Unprotected Reinforcement in Normal Weight Concrete
 (f'c = 5,000psi; fy = 60,000psi)

Basic Lap					
Bar Size	Min. Cover	Class A (1.0 l _d)		Class B (1.3 l _d)	
		s < 6" cts.	s ≥ 6" cts.	s < 6" cts.	s ≥ 6" cts.
#4	1"	1'-1"	1'-1"	1'-5"	1'-5"
#5	1.5"	1'-5"	1'-5"	1'-10"	1'-9"
	1"	1'-8"	1'-8"	2'-1"	2'-1"
#6	1.5"	2'-1"	1'-8"	2'-8"	2'-2"
	1"	2'-3"	2'-3"	2'-11"	2'-11"
#7	2"	2'-5"	1'-11"	3'-1"	2'-6"
	1.5"	2'-5"	2'-2"	3'-1"	2'-10"
	1"	2'-11"	2'-11"	3'-9"	3'-9"
#8	2"	3'-1"	2'-2"	4'-0"	2'-10"
	1.5"	3'-1"	2'-9"	4'-0"	3'-6"
	1"	3'-7"	3'-7"	4'-8"	4'-8"
#9	2.5"	3'-11"	2'-6"	5'-1"	3'-2"
	2"	3'-11"	2'-8"	5'-1"	3'-6"
	1.5"	3'-11"	3'-4"	5'-1"	4'-4"
	1"	4'-5"	4'-5"	5'-9"	5'-9"
#10	2.5"	4'-4"	2'-11"	5'-8"	3'-10"
	2"	4'-4"	3'-4"	5'-8"	4'-4"
	1.5"	4'-4"	4'-1"	5'-8"	5'-4"
	1"	5'-4"	5'-4"	6'-11"	6'-11"
#11	2.5"	5'-5"	3'-7"	7'-0"	4'-8"
	2"	5'-5"	4'-0"	7'-0"	5'-2"
	1.5"	5'-5"	4'-11"	7'-0"	6'-4"
	1"	6'-4"	6'-4"	8'-2"	8'-2"

Horizontal Lap w/>12" Concrete Cast Below					
Bar Size	Min. Cover	Class A (1.0 l _d)		Class B (1.3 l _d)	
		s < 6" cts.	s ≥ 6" cts.	s < 6" cts.	s ≥ 6" cts.
#4	1"	1'-5"	1'-5"	1'-10"	1'-10"
#5	1.5"	1'-10"	1'-9"	2'-5"	2'-4"
	1"	2'-1"	2'-1"	2'-9"	2'-9"
#6	1.5"	2'-8"	2'-2"	3'-5"	2'-9"
	1"	2'-11"	2'-11"	3'-9"	3'-9"
#7	2"	3'-1"	2'-6"	4'-0"	3'-3"
	1.5"	3'-1"	2'-10"	4'-0"	3'-8"
	1"	3'-9"	3'-9"	4'-10"	4'-10"
#8	2"	4'-0"	2'-10"	5'-3"	3'-8"
	1.5"	4'-0"	3'-6"	5'-3"	4'-7"
	1"	4'-8"	4'-8"	6'-1"	6'-1"
#9	2.5"	5'-1"	3'-2"	6'-8"	4'-2"
	2"	5'-1"	3'-6"	6'-8"	4'-7"
	1.5"	5'-1"	4'-4"	6'-8"	5'-8"
	1"	5'-9"	5'-9"	7'-5"	7'-5"
#10	2.5"	5'-8"	3'-10"	7'-4"	4'-11"
	2"	5'-8"	4'-4"	7'-4"	5'-7"
	1.5"	5'-8"	5'-4"	7'-4"	6'-11"
	1"	6'-11"	6'-11"	9'-0"	9'-0"
#11	2.5"	7'-0"	4'-8"	9'-1"	6'-1"
	2"	7'-0"	5'-2"	9'-1"	6'-8"
	1.5"	7'-0"	6'-4"	9'-1"	8'-3"
	1"	8'-2"	8'-2"	10'-7"	10'-7"

Notes:

Confinement reinforcement was conservatively assumed to be zero. Larger covers for the smaller bars were intentionally omitted because additional cover does not reduce the lap length.

GUIDELINES FOR SHOP DRAWING REQUIREMENTS FOR VARIOUS PRECAST CONCRETE PRODUCTS*

*(Version with AASHTO M 259 & 273 Discontinued In Std. Spec. Jan. 1, 2012)

This attachment summarizes the shop drawing submittal, review and approval process for **Precast Concrete Products**. It provides general guidance on shop drawing requirements to **Districts**, the Bureau of Bridges and Structures, Local Agencies, Engineers of Record, Contractors, **Producers** and Suppliers.

This attachment should be considered supplemental to Article 1042.03(b) of the **Standard Specifications**, and/or the applicable Guide Bridge Special Provision or GBSP (noted in the list below). Each of these documents provides additional information that is either required or helpful in fulfilling the requirements for shop drawing submittal, review and approval for **Precast Concrete Products**.

Precast Concrete Products requiring submittal of shop drawings to the **Engineer** for review and approval include, but may not be limited to, the following:

Product	Product Key*	Supplemental Information
Box Culverts Sections and Box Culvert End Sections (Including Headwalls and Wingwalls)	B:1 and B:2	Note 1
Three-Sided Precast Concrete Structures	A:6	GBSP #15, Notes 2, 3
Precast Noise Abatement Walls	H:2	Bridge Manual Section 3.12, Notes 2, 3, 4, 5
Precast Modular Retaining Walls	H:3	Notes 2, 3, 5
Segmental Concrete Block Walls	G:6	Notes 2, 3, 5
Mechanically Stabilized Earth Retaining Walls	H:1	Notes 2, 3, 4, 5
Bridge Slabs	A:1	Note 6
Pile Caps	A:2	Note 6
Decorative Bridge Structural Elements	A:5	Note 6
Other Structural Members	A:3	Notes 4, 6
Non-Standard Manholes, Lids and Drainage Structures	Various	Note 6
Other Precast Products	Various	Note 6

*Product Key as listed in ["Qualified Producer List of Certified Precast Concrete Producers"](#) (link embedded).

1. Shop Drawing Submittal, Review and Approval:

Unless otherwise directed by the **Engineer**, the general shop drawing submittal, review and approval processes for **Precast Concrete Products** shall be as given herein. Exceptions and special instructions are given in Notes 1 through 6 later in this attachment. No work for a **Precast Concrete Product** shall be done until the submittal has been approved.

A. District Projects – Review and Approval by Bureau of Bridges and Structures

Shop drawing submittal shall be from the Contractor to the receiving **District**, which will forward them to the Bureau of Bridges and Structures (BBS) along with all submitted documents and transmittals or copies thereof, for structural adequacy review and approval. At least two sets of shop drawings shall be included in the submittal (note that PDF files are not accepted by the BBS, only hardcopies). One set of drawings will be returned from the BBS through the receiving **District** to the Contractor. This set will either be marked "Approved", "Approved as Corrected", or "Revise and Resubmit." If re-submittal and re-review is required, this process shall follow the procedure just described above.

GUIDELINES FOR SHOP DRAWING REQUIREMENTS FOR VARIOUS PRECAST CONCRETE PRODUCTS*

*(Version with AASHTO M 259 & 273 Discontinued In Std. Spec. Jan. 1, 2012)

After approval, the Contractor shall furnish the receiving **District** with at least 5 sets of corrected prints for distribution.

B. District Projects – Review and Approval by Consultant Contracted by District

The shop drawing submittal shall be from the Contractor to the receiving **District**, which will forward them to the Consultant for review and approval. (Note that the **District** Project Implementation **Engineer** should contact the **District** Project Development **Engineer** to determine if hours are provided in the design consultant's contract to review shop drawings.) At least two sets of shop drawings shall be included in the submittal. One set of drawings will be returned from the Consultant through the receiving **District** to the Contractor. This set will either be marked "Approved", "Approved as Corrected", or "Revise and Resubmit" (or similar language). If re-submittal and re-review is required, this process shall follow the procedure just described above.

After approval, the Contractor shall furnish the receiving **District** with at least 3 sets of corrected prints, which the **District** will forward to the Consultant. The Consultant shall forward 2 sets of these prints to the BBS (note that PDF files are not accepted by the BBS, only hardcopies) with the Consultant's approval stamp on every sheet. (If Note 5 applies, the BBS will also review the shop drawings. If re-submittal and re-review is required, the re-submittal shall follow the procedure described above in "**District** Projects – Review and Approval by Bureau of Bridges and Structures".) The BBS will affix its approval stamp on every sheet of one set which will then be forwarded to the Contractor through the receiving **District**. The Contractor shall provide the **District** with at least 5 sets of approved shop drawings for distribution.

C. Local Agency Projects

Shop drawings should be submitted from the Contractor to the Local Agency, which may forward them to the Engineer of Record (EOR) or their own reviewer for review and approval, unless the Local Agency specifically requests review and approval by the BBS through the **District** Bureau of Local Roads and Streets. Note that if a request is made to the BBS, review time cannot be guaranteed. At least two sets of shop drawings shall be included in the submittal (note that PDF files are not accepted by the BBS, only hardcopies). One set of drawings will be returned from the designated reviewer through the Local Agency to the Contractor. This set will either be marked "Approved", "Approved as Corrected", or "Revise and Resubmit" (or similar language). If re-submittal and re-review is required, this process shall follow the procedure just described above.

After approval, the Contractor shall furnish the Local Agency with at least 5 sets of corrected prints for distribution.

2. Distribution of Shop Drawings (District and Local Agency)

At least one set of shop drawings shall be distributed to the **District** responsible for **Plant Quality Assurance** (note that for out-of-state **Producers**, BMPR may be responsible for **Quality Assurance**). Two or more sets, as required, shall be retained by the receiving **District** or Local Agency for the Resident **Engineer**, As-Built plans, etc. If a Structure Number is assigned, at least one set of shop drawings shall be distributed to the BBS (or designated reviewer for Local Agency Projects). The Contractor is responsible for ensuring that the **Producer** has an approved set of shop drawings.

GUIDELINES FOR SHOP DRAWING REQUIREMENTS FOR VARIOUS PRECAST CONCRETE PRODUCTS*

*(Version with AASHTO M 259 & 273 Discontinued In Std. Spec. Jan. 1, 2012)

3. Notes Section

Note 1 Shop drawings are required for all precast concrete box culverts. However, review and approval may, or may not be required. **Verification** of layout, run length and configuration should be completed, as per the [“Construction Inspector’s Checklist for Precast Concrete Box Culverts”](#) (link embedded), for all precast box culverts regardless if shop drawing review and approval is required or not. The receiving **District** or Local Agency will determine if review and approval is required according to the guidelines given below (Local Agencies may request assistance from a **District** or the Bureau of Bridges and Structures in making this determination) See also Attachments K, L and M for more complete information.

When reinforcement bars are substituted for welded wire fabric, the area of steel required by the applicable design table in AASHTO M 259 or M 273 (i.e. circumferential and/or distribution steel) shall be increased according to the ratio of the yield strength of welded wire fabric to the yield strength of reinforcing bars. Typically, this entails multiplying the required steel area for welded wire fabric by 65 ksi/60 ksi (448.2 MPa/413.7 MPa) or 1.083. In addition, the maximum spacing of reinforcement bars used as circumferential and/or distribution reinforcement shall be the lesser of 1.5 times the slab or wall thickness, or 18 in. (450 mm).

When deformed billet steel bars are used for the longitudinal reinforcement in the walls and bottom slabs of precast concrete box culverts, the maximum spacing detailed on the shop drawings shall be 18 in. (450 mm).

One weep hole on exterior culvert walls shall be provided on the shop drawings for each precast box culvert section greater than 3 ft. in clear height. The weep hole shall be within the lower $\frac{1}{3}$ of the clear wall height and shall not intercept the haunch. When a precast box culvert is used as a pedestrian tunnel, weep holes should not be provided on the shop drawings. Instead, drainage for these situations should be provided by other means such as a geotechnical wall drain connected to a longitudinal drain.

Precast box culvert shop drawing review and approval is required when:

- a. Depths of cover and/or box’s span and rise are non-standard according to AASHTO M 259 and M 273.
- b. There is an opening in the top slab.
- c. The skew is $\geq 60^\circ$.
- d. There is a side wall opening that does not conform to the details given in Attachment K (see also Reference Box C in Attachment K).
- e. It is an end section with a skew.
- f. Haunch dimensions are altered from AASHTO M 259 or M 273, and do not conform to Attachment L.
- g. Top slab, bottom slab or side wall thickness dimensions are decreased from the minimum requirements of AASHTO M 259 or M 273. Note that AASHTO M 259 and M 273 permit variations of increased thicknesses without limit.

**GUIDELINES FOR SHOP DRAWING REQUIREMENTS FOR VARIOUS
PRECAST CONCRETE PRODUCTS***

*(Version with AASHTO M 259 & 273 Discontinued In Std. Spec. Jan. 1, 2012)

Precast box culvert shop drawing review and approval is not required when:

- a. Depths of cover and box's span and rise are standard according to AASHTO M 259 and M 273.
- b. Side wall openings conform to the details given in Attachment K (see also Reference Box C in Attachment K), and have standard depths of cover and sizes according to AASHTO M 259 and M 273.
- c. The design conforms to the All Deputy Directors of Highways Memorandum given in Attachment L.
- d. Designs of a product with the same dimensions and configuration have been previously reviewed and approved (listed items a. through g. above) after January 1, 1995 (see Attachment K, Reference Box A).

Box culvert shop drawing review and approval is not required, but the drawings are required to be sealed by an Illinois Licensed Structural Engineer when:

- c. Precast box culverts and precast box culvert end sections are originally designed as cast-in-place on the contract plans (see Attachment K, Reference Box B). Note that this option is only applicable if the following note (or similar language) does not appear on the contract plans "Precast culvert alternate is not allowed."

For Local Agency Projects, shop drawings that require review and approval according to the criteria above may alternatively be sealed by an Illinois Licensed Structural Engineer (see Attachment M, Reference Boxes A and B). Local Agencies also have other options for acceptance of shop drawings when review and approval is not required (see Attachment M, Reference Box C).

Regardless of whether precast concrete box culvert shop drawings require review and approval, final distribution shall be according to the section above "Distribution of Shop Drawings (**District** and Local Agency)".

Note 2 Submittal of complete design calculations is required along with shop drawings.

Note 3 Shop drawings and design calculations (if required) shall be sealed by an Illinois Licensed Structural Engineer.

Note 4 A copy of the approved shop drawings shall only be transmitted to the Bureau of Bridges and Structures if the **Precast Concrete Product** is part of or attached to a bridge.

Note 5 Review and approval is required by the Bureau of Bridges and Structures even if the shop drawings have been reviewed and approved by a Consultant.

Note 6 If detailed design drawings are not provided on the contract plans, submittal of complete design calculations is required along with shop drawings sealed by an Illinois Licensed Structural Engineer.



Illinois Department of Transportation Memorandum

To: ALL DISTRICT ENGINEERS
 From: Ralph E. Anderson *Ralph E. Anderson*
 Subject: Precast Concrete Box Culvert Shop Drawings
 Date: March 1, 2002

Effective with the June 14, 2002 letting, the Department is implementing a new policy for shop drawings of Precast Concrete Box Culverts. Shop drawing approval by the Department will no longer be required for precast concrete box culverts which comply with (1) the IDOT Specifications, (2) the applicable requirements of the AASHTO Specifications and (3) the specific producer's QC/QA plan approved by the Department.

To accomplish this agenda, the designer will be required to clearly indicate the design fill height for every precast and cast-in-place culvert, including extensions, in the contract plans. To determine the design fill height, the maximum and minimum fill heights between the extreme edges of the shoulders shall be calculated. If the minimum fill height is less than 2' (0.6 m), the design fill height shall be designated as "< 2' " which corresponds to an AASHTO designation of M 273. If the minimum fill height is greater than or equal to 2' (0.6 m) but less than 3' (0.9 m), the design fill height shall be designated as 2' (0.6 m), which corresponds to an AASHTO designation of M 259. If the minimum fill height is greater than or equal to 3' (0.9 m) but less than 4' (1.2 m), the design fill height shall be designated as 3' (0.9 m), which corresponds to an AASHTO designation of M 259. If the minimum fill height is 4' (1.2 m) or greater, the design fill height shall be designated as the maximum fill height calculated between the edges of shoulders. The AASHTO designation for this case would also be M 259. Please refer to the Box Culvert Design Criteria charts (included herein) for a summary.

The design fill height shall be applicable to the entire culvert, including culvert extensions, even if the sections are beyond the edge of shoulder. Precast end sections connecting directly to precast box sections shall also conform to the same specification, as its adjacent box section. This will assure uniform wall and slab thicknesses between units and provide for a proper overlap connection. If a precast end section is not connected directly to a precast concrete box section, i.e. a cast-in-place collar or closure piece is used between the sections, the end section must provide the minimum reinforcement as shown on the contract plans.

ALL DISTRICT ENGINEERS
Page 2
March 1, 2002

In addition to identifying the design fill height on the plans, the designer must also designate in a similar fashion the span and rise of the box culvert opening, the proper AASHTO designation for the precast concrete box culvert, and whether interstate loading is required on the box culvert. Any structure under an interstate route must be designated for interstate loading and designed accordingly. The fabricator will be required to mark this information and more on the precast box culvert according to the revised Policy Memorandum for the Quality Control/Quality Assurance Program for Precast Concrete Products. The resident engineer will know whether a box culvert is suitable for a specific site by comparing the markings on the box culvert with the specific box culvert information on the plans.

BOX CULVERT DESIGN CRITERIA (English)

f_{min} / f_{max} (feet)	Design Fill Height (F) (feet)	AASHTO Designation ⁽¹⁾
$f_{min} < 2'$	$< 2'$	M 273
$2' \leq f_{min} < 3'$	2'	M 259
$3' \leq f_{min} < 4'$	3'	M 259
$f_{min} \geq 4'$	f_{max}	M 259

f_{min} = The minimum fill height over the culvert between the extreme edges of the shoulder.

f_{max} = The maximum fill height over the culvert between the extreme edges of the shoulder.

F = Design fill height for culvert.

⁽¹⁾ Add an "I" following the AASHTO designation for culverts where Interstate loading is applicable. (Ex. M 259 - I)

Superseded –
See
Attachment C

BOX CULVERT DESIGN CRITERIA (Metric)

f_{min} / f_{max} (meter)	Design Fill Height (F) (meter)	AASHTO Designation ⁽¹⁾
$f_{min} < 0.6 \text{ m}$	$< 0.6 \text{ m}$	M 273M
$0.6 \text{ m} \leq f_{min} < 0.9 \text{ m}$	0.6 m	M 259M
$0.9 \text{ m} \leq f_{min} < 1.2 \text{ m}$	0.9 m	M 259M
$f_{min} \geq 1.2 \text{ m}$	f_{max}	M 259M

f_{min} = The minimum fill height over the culvert between the extreme edges of the shoulder.

f_{max} = The maximum fill height over the culvert between the extreme edges of the shoulder.

F = Design fill height for culvert.

⁽¹⁾ Add an "I" following the AASHTO designation for culverts where Interstate loading is applicable. (Ex. M 259 - I)

Superseded –
See
Attachment C

ALL DISTRICT ENGINEERS

Page 3

March 1, 2002

Section 2.3.3 of the Culvert Manual describes applications where precast concrete box culverts may not be applicable. Plans prepared for cast-in-place culverts which preclude the use of the precast option should contain the note "Precast culvert alternate is not allowed". This note shall be placed next to the culvert on the Plan and Elevation sheet of the Roadway Plans and in the General Notes of the structural plans.

Fabricators are required to prepare shop drawings for all precast box culvert projects (which includes standard box sections, manholes, junction chambers and end sections). The shop drawings shall be available for (1) fabrication, (2) Quality Control personnel, (3) Quality Assurance personnel upon request and (4) provided to the IDOT District Construction office for their as-built records. Fabricators may provide steel reinforcement areas which exceed those shown on the AASHTO Design Table for a specific box culvert span, rise and design fill, provided the steel area does not exceed the largest area shown for all design fills in that same table.

Reference
Box A

Precast box culvert projects not meeting the IDOT Specifications and the applicable AASHTO Specifications will require shop drawing approval from the Department. Exceptions to these specifications (such as variances in haunch sizes) may be permitted provided they have been previously approved by the Department and included in the QC/QA plan of the fabricator. Shop drawing approval may also be waived for precast box culvert projects, which conform to the design parameters of previously approved shop drawings, by the Department after January 1, 1995.

The fabricator may, at his discretion, provide erection layout shop drawings on certain projects where he believes they are necessary to properly install the box culvert sections. In these cases, the fabricator shall provide the erection layout shop drawings to the contractor and IDOT project personnel prior to the erection of the box culvert sections.

Reference
Box B

Cast-in-place end sections and special sections detailed on the contract plans are understood to be structurally adequate. However, precast versions of these structural items will be subject to additional stresses due to handling and transportation. Consequently, shop drawings for precast special sections and end sections that were originally designed for cast-in-place concrete are required to be sealed by an Illinois Licensed Structural Engineer to assure the Department that the reinforcement and details have been evaluated to account for handling and transportation stresses. The Department does not require review or approval of these shop drawings however the fabricator must provide a sealed set with delivery of the product to the site in order for the resident engineer to accept the special end sections. These shop drawings shall be incorporated into the District "as built" plans.

ALL DISTRICT ENGINEERS

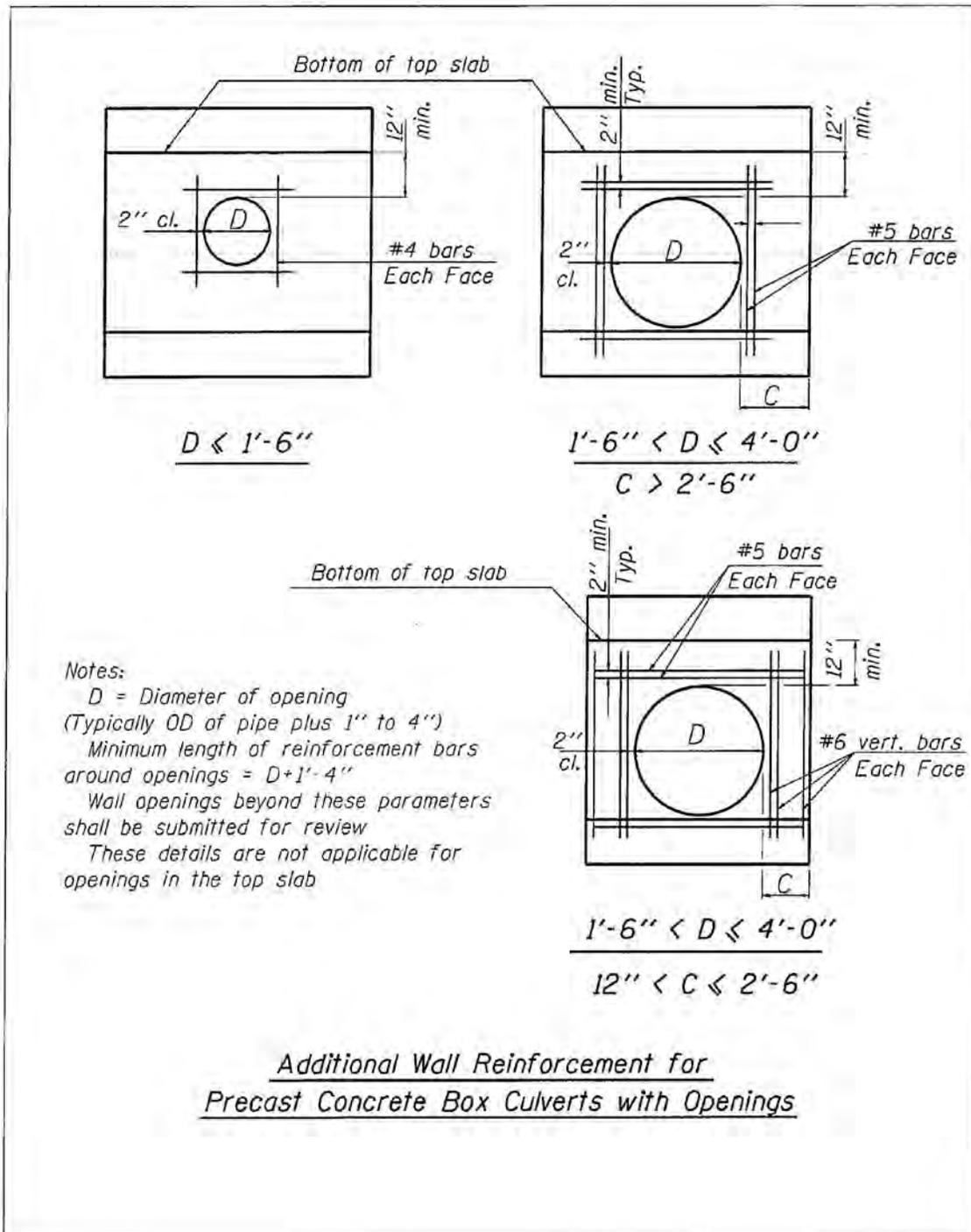
Page 4

March 1, 2002

Reference
Box C

Lateral pipes intersecting with box culverts are very common so recommended detailing practices for these situations are attached. Shop drawings of precast box culverts with lateral pipe connections that meet these details are not required to be submitted for approval. See Section 2.3 of the Culvert Manual for additional guidance on the general design and application of precast concrete box culverts.

Attachment
KLR2002.5/bb22294
cc- Gary Gould
Mike Hine
Darrell McMurray





Illinois Department of Transportation

Memorandum

To: ALL DEPUTY DIRECTORS OF HIGHWAYS

From: Ralph E. Anderson *Ralph E. Anderson*

Subject: Policy for Haunches on Precast Concrete Box Culverts

Date: January 11, 2008

Article 540.06 of the Standard Specifications for Road and Bridge Construction waives the requirement for shop drawing review of precast concrete box culvert sections that satisfy the AASHTO M 259 and M 273 specifications. Additionally, in the past, the Department's practice permitted minor haunch variations without shop drawing review. These variations were considered minor enough that no changes in reinforcement were required by the Department. The latest ASTM precast concrete box culvert specification, C 1577, combines the ASTM C 789 (M 259) and ASTM C 850 (M 273) specifications into one LRFD specification. It is anticipated that when AASHTO eventually adopts a similar specification, the Department will follow. The ASTM C 1577 specification now requires an adjustment in the A_{s1} reinforcement when haunch dimensions other than those shown in the specification are used.

In anticipation of the specification change and to clarify the Departments requirements for shop drawing reviews, we have developed a new simplified policy which accommodates small variances in haunch dimensions.

The new policy is:

Precast box culvert sections with spans less than 5 feet shall be built according to the design and detailing provided in the applicable AASHTO M259 and M273 specifications. No variation in haunch dimensions is permitted. Standard precast box culvert sections with spans of 5 feet or greater may have a +2"/ -0" variance from the standard haunch size, provided that the A_{s1} reinforcement is increased according to the formula below. Shop drawing review by the Department will not be required for precast concrete box culverts built according to these requirements.

$$A_{s1h} = (A_{s1} \text{ from AASHTO Table}) \times R_h$$

Where:

A_{s1h} = Adjusted A_{s1} reinforcement for larger haunch
 R_h = Reinforcement multiplier for haunch adjustment

ALL DEPUTY DIRECTORS OF HIGHWAYS

Page 2

January 11, 2008

Haunch increase (inch)	R_h
+1	1.03
+2	1.07

Note that AASHTO and the Department have always required an adjusted reinforcement area for all reinforcement if rebars are used instead of welded wire reinforcement. In these cases the area of steel from the chart shall be multiplied by the ratio of 65/60 to account for the difference in yield strengths.

Please advise the precast concrete box culvert fabricators in your region and your QA staff of this new policy.

Example:

Determine the required A_{s1} area of steel for an M 259 8' x 6' precast concrete box culvert with a 2' design earth cover. The fabricator has elected to build the box sections with a 10" haunch. He will substitute reinforcement bars for welded wire fabric.

The standard haunch from the chart = 8" and A_{s1} from the chart = 0.31. The fabricator is using +2" for haunch therefore $R_h = 1.07$ and shop drawing review by the Department is not required.

$$A_{s1h} = (0.31) \times (1.07) = 0.33$$

The fabricator is using rebars in lieu of WWR, therefore

$$\text{Required } A_{s1} = A_{s1h} \times (65/60)$$

$$A_{s1} = (0.33) \times (65/60) = \underline{0.36}$$

KLR/kktPolicyforHaunches-20080111

cc: Dave Lippert
Marvin Traylor, PCI of IL & WI



Illinois Department of Transportation

2300 South Dirksen Parkway / Springfield, Illinois / 62764

April 14, 2003

Precast Concrete Box Culvert Shop Drawings

County Engineers/Superintendent of Highways
Municipal Engineers/Director of Public Works
Consulting Engineers

#03-05

The Bureau of Bridges and Structures (BBS) issued an All District Engineers Memorandum (copy attached) on March 1, 2002 pertaining to the review and approval of shop drawings for precast concrete box culverts. This circular letter provides guidance in applying the information contained in that memorandum to local agency projects.

The memorandum states: "Effective with the June 14, 2002 letting, the department is implementing a new policy for shop drawings of Precast Concrete Box Culverts. Shop drawing approval by the department will no longer be required for precast concrete box culverts which comply with (1) the IDOT Specifications, (2) the applicable requirements of the AASHTO Specifications and (3) the specific producer's QC/QA plan approved by the department.

To accomplish this agenda, the designer will be required to clearly indicate the design fill height for every precast and cast-in-place culvert, including extensions, in the contract plans. To determine the design fill height, the maximum and minimum fill heights between the extreme edges of the shoulders shall be calculated."

SYNOPSIS OF BBS MEMORANDUM

1. The "No BBS Review/Approval" policy is only applicable to **standard** precast culvert sizes – "standard" culvert sizes considered to be those contained in AASHTO M 273 and M 259 (both English) and also in accordance with Section 540 of the department's Standard Specifications.
2. The design fill height, span x rise, proper AASHTO designation (and whether interstate loading is required) must be clearly shown on the design plans. The producer will be required to mark this information on the precast concrete box.

-2-

3. The producer is also **required** to provide the producer mark, AASHTO/ASTM designation, date of manufacture, and the span, rise, and design cover per Bureau of Materials and Physical Research (BMPR) Policy Memorandum for the Quality Control/Quality Assurance Program for Precast Concrete Products.

Reference
Box A

4. For **non-standard** precast culvert designs, the BBS will still review and approve precast concrete box culvert shop drawings. Alternatively, shop drawings with the seal, signature, and structural certification of an Illinois Licensed Structural Engineer may be accepted.

GENERAL – ALL DESIGNS

For local agency projects, it is recommended, for all designs, that the designer clearly indicate in the contract plans the design fill height, the span x rise, and the proper AASHTO designation for every precast and cast-in-place culvert, including extensions and end sections, as described in the BBS' memorandum of March 1, 2002. It is also recommended that the construction documents specify that the culverts be in accordance with BMPR Policy Memorandum for the Quality Control/Quality Assurance Program for Precast Concrete Products.

Note that shop drawings are still required for all precast concrete box culvert projects (including standard and non-standard box sections, manholes, junction chambers, extensions and end sections). For all non-standard precast culvert sizes, the review of the BBS, or a structural engineer's seal, signature and certification, are required for approval; non-standard designs shall not be approved based solely on a shop drawing review and approval without prior design certification.

A number of options are available to local agencies for the review and approval of shop drawings, for both non-standard and standard designs, for precast concrete box culverts.

NON-STANDARD DESIGNS

For precast concrete box culverts following the procedures contained in the March 1, 2002 BBS memorandum, shop drawings may be submitted for review and approval to the BBS through the District Bureau of Local Roads and Streets.

Submittal Procedure. The precast producer should submit shop drawings to the contractor, who is to then forward the shop drawings to the local agency/owner for their review and approval. If found acceptable, the shop drawings should be submitted to the IDOT District Office for forwarding to the BBS, to the attention of the Structural Services Engineer. Accompanying the shop drawings should be appropriate design plan sheets that indicate the design fill height, span x rise, proper AASHTO designation, etc. as indicated in the BBS' memorandum of March 1, 2002. The shop drawings should be no larger than 11"x17". The number of sets submitted should provide for one record set each to be retained by the BBS and the IDOT District office.

Reference
Box B

The shop drawings may be accepted by the local agency based on the seal and structural certification of an Illinois Licensed Structural Engineer. This would expedite the approval process, and a special provision specifying this requirement would need to be contained in the project specifications.

Suggested certification statement:

"I certify that to the best of my knowledge, information and belief, that this precast box culvert design is structurally adequate for the design fill height, span x rise, and AASHTO designation shown on the plans. The design is an economical one for the style of structure and complies with requirements of the current 'AASHTO Standard Specifications for Highway Bridges'."

Reference
Box C

STANDARD DESIGNS

Submittal Procedure. The producer should submit shop drawings to the contractor, who is to then forward the shop drawings to the local agency/owner for their review and approval.

1. The local agency may, at their discretion, accept the producer's shop drawings by following the procedures in the BBS' memorandum of March 1, 2002 along with specifying that the culverts must be in accordance with BMPR Policy
2. The local agency may approve the shop drawings by use of an Illinois Licensed Structural Engineer or an Illinois Licensed Professional Engineer, either under their employment or that of a qualified consulting engineer.
3. The local agency may require, by special provision, that the shop drawings provided by the contractor/producer be approved by an Illinois Licensed Structural Engineer or an Illinois Licensed Professional Engineer.

The local agency may choose to specify that the producer provides a certification statement. In this case, the following is suggested:

"I certify that the details shown in the precast concrete box culvert shop drawings for this project comply with the current applicable AASHTO design specifications and contract requirements. The shop drawings will satisfy the reinforcement and dimensional requirements of the contract.

Signature: _____ License No. _____
Date: _____

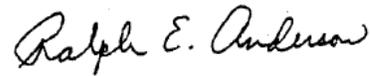
Printed Name: _____ Company: _____"

-4-

Local agencies should review the March 1, 2002 BBS' All District Engineers Memorandum to determine if they wish to utilize other criteria described in the memorandum. In addition to the above recommendations, the memorandum describes exceptions that the local agency may wish to consider as a means of accepting precast concrete box culvert shop drawings.

Questions in regard to the applicability of the procedures for the review and approval of shop drawings for precast concrete box culverts may be directed to Jim Klein at (217) 782-5928.

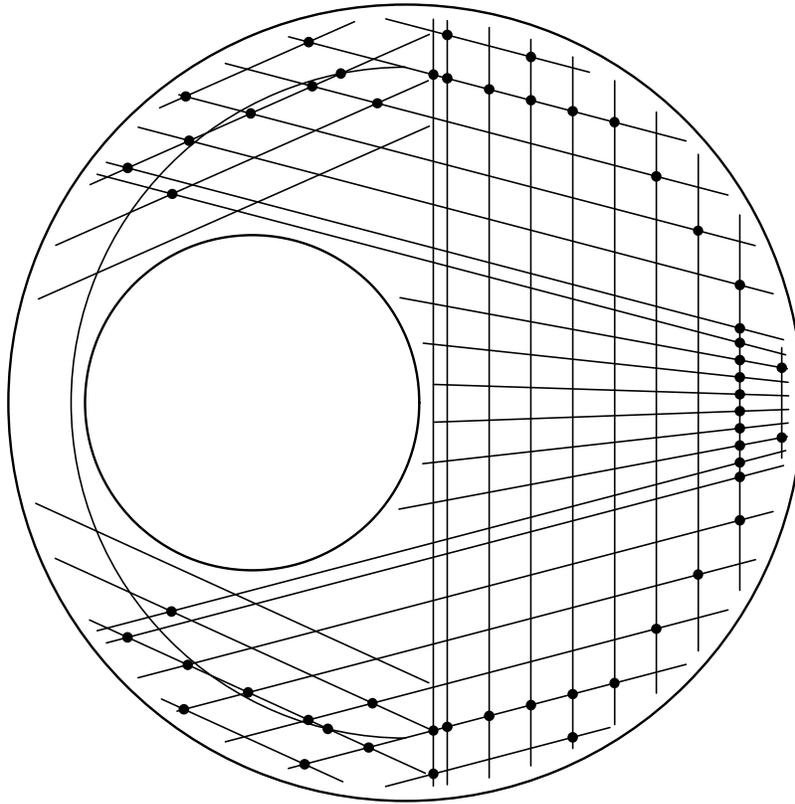
Sincerely,

A handwritten signature in cursive script that reads "Ralph E. Anderson".

Ralph E. Anderson
Engineer of Bridges and Structures

JKK/TP/TP

TACK WELDING OF REINFORCEMENT BARS



*ACCEPTABLE REBAR TACK WELDING
LOCATIONS FOR TYPICAL
MANHOLE LIDS AND BASES*

Key for:
Qualified Producer List of Certified Precast Concrete Producers
(Qualified Producer List Key) and
Materials Integrated System for Test Information and Communication
(MISTIC Material Code and Material Name)
(Revised 7/14/16)

Qualified Producer List Key	MISTIC Material Code	MISTIC Material Name
G4	25101	Blocks, Solid Segmental Barrel
G4	25104	Blocks, Solid Masonry Building
G3	25105	Brick, Solid Building
G4	25106	Blocks, Hollow Load Bearing (C-90)
G5	25113	Paver, Concrete
G1	25114	Blocks, Revetment Mat, Precast
G2	25115	Blocks, Revetment Mat, Precast, Articulated
D3, D4 & D5	25201	Risers & Grade Rings
D3, D4 & D5	25202	Risers, Concentric Cone (Straight)
D3, D4 & D5	25203	Risers, Eccentric Cone (Offset)
D3, D4 & D5	25204	Flat Top Slab, Concrete
D3, D4 & D5	25205	Bottoms, Precast
D1, D5 & D8†	25206	Inlet, Complete
D10	25208	Inlet, Precast Concrete, Special
D7	25209	Vault, Valve
I4	25210	Handholes
C1 & C4	25212	Plug, End, Concrete
C5	25213	End Section, Pipe, Concrete, Rectangular
D6	25214	Risers, Rectangular
D6	25215	Bottoms, Precast, Rectangular
D6	25216	Flat Top Slab, Rectangular
D3, D4 & D5	25217	Risers, Special
A1	25301	Beams, Bridge Precast
A2	25401	Caps, Precast Bridge Pier
A3	25501	Plank, Precast Concrete
F1	25504	Barrier, Precast Concrete Median
A6	25507	Wingwall, Precast Concrete
A1	25508	Slab, Approach, Precast Concrete
I1	25512	Wheel Stops, Precast Concrete
A3	25513	Retaining Wall, Special, Precast Concrete
A3	25514	Glare Shield, Precast Concrete
A3	25515	Footing, Precast
F1	25517	End Section, Precast Concrete Median Barrier
G6	25518	Retaining Wall Block
G6	25519	Retaining Wall Cap
H2	25520	Wall Panel, Reflective Noise Wall, Precast Concrete
Accepted by "Test"	25524	Wall Panel, Absorptive Noise Wall, Precast Concrete
A3	25521	Panel, Precast Concrete Parapet
H3	25522	Wall, Precast Modular Retaining
H1 & H4	25523	Panel, Mechanically Stab Earth Retaining Wall, Precast Concrete
C6	25701	Flared End Section, Reinforced Concrete, Circular
C6 & C7	25702	Toe Wall, Flared End Section
D2	25703	Headwall, Concrete
C7	25704	Flared End Section, Reinforced Concrete, Elliptical
I3	25803	Splash Block
I2	25901	Tables, Picnic, Concrete
I2	25902	Trash, Receptacle, Precast Concrete
I2	25903	Planter, Precast Concrete
A5	25904	Bollard/Pilaster, Precast Concrete

*Refer to Project Procedures Guide for information on "Test".

†Shoulder Inlet is now listed under D1.

Key for:
Qualified Producer List of Certified Precast Concrete Producers
(Qualified Producer List Key) and
Materials Integrated System for Test Information and Communication
(MISTIC Material Code and Material Name)
(Revised 7/14/16)

Qualified Producer List Key	MISTIC Material Code	MISTIC Material Name
E1	26001	Marker, ROW
E4	26002	Marker, Section
E2	26003	Marker, Drainage
E1 & E4	26004	Marker, Combination (Section & ROW)
E3	26005	Marker, Survey Concrete
E3	26006	Marker, Reference, Concrete
D4	26101	Manholes, Complete
D3	26102	Catch Basins, Complete
D4	26103	Tee, Manhole
D6	26104	Catch Basins, Square, Complete
A4	36601	Piling, Precast Concrete
C4	47601	Pipe, Class I, Concrete
C4	47602	Pipe, Class II, Concrete
C4	47603	Pipe, Class III, Concrete
C1	47701	Pipe, Reinforced, Concrete Class I
C1	47702	Pipe, Reinforced, Concrete Class II
C1	47703	Pipe, Reinforced, Concrete Class III
C1	47704	Pipe, Reinforced, Concrete Class IV
C1	47705	Pipe, Reinforced, Concrete Class V
C1	47706	Pipe, Reinforced, Concrete Class V Special
C2	47901	Pipe, Elliptical Reinforced, Concrete Class HE-A
C2	47902	Pipe, Elliptical Reinforced, Concrete Class HE-I
C2	47903	Pipe, Elliptical Reinforced, Concrete Class HE-II
C2	47904	Pipe, Elliptical Reinforced, Concrete Class HE-III
C2	47905	Pipe, Elliptical Reinforced, Concrete Class HE-IV
C2	47906	Pipe, Elliptical Reinforced, Concrete Class VE-II
C2	47907	Pipe, Elliptical Reinforced, Concrete Class VE-III
C2	47908	Pipe, Elliptical Reinforced, Concrete Class VE-IV
C2	47909	Pipe, Elliptical Reinforced, Concrete Class VE-V
C2	47910	Pipe, Elliptical Reinforced, Concrete Class VE-VI
C2	47911	Pipe, Elliptical Reinforced, Concrete Class HE-V Special
C1	48001	Tee, Reinforced Concrete Pipe
C1	48002	Elbow, Reinforced Concrete Pipe
C1	48004	Wye, Reinforced Concrete Pipe
C1	48006	Reducer, Reinforced Concrete
C1	48009	Trap, Half, Reinforced Concrete
B1	48211	Box Section, Reinforced Concrete AASHTO M273 Table 1
B1	48212	Box Section, Reinforced Concrete AASHTO M273 Table 2
B1	48215	Elbow, Box Section, Reinforced Concrete AASHTO M273 Table 1
B1	48216	Elbow, Box Section, Reinforced Concrete AASHTO M273 Table 2
B2	48218	Tapered End, Box Section, Reinforced Concrete AASHTO M273
B1	48231	Box Section, Reinforced Concrete AASHTO M259 Table 1
B1	48232	Box Section, Reinforced Concrete AASHTO M259 Table 2
B1	48233	Box Section, Reinforced Concrete AASHTO M259 Table 3
B1	48234	Elbow, Box Section, Reinforced Concrete AASHTO M259 Table 1
B1	48235	Elbow, Box Section, Reinforced Concrete AASHTO M259 Table 2
B1	48236	Elbow, Box Section, Reinforced Concrete AASHTO M259 Table 3
B2	48237	Tapered End, Box Section, Reinforced Concrete AASHTO M259
B1	48299	Box Section, Reinforced Concrete, Special
B1	48298	Elbow, Box Section, Reinforced Concrete, Special
B2	48297	Tapered End, Box Section, Reinforced Concrete, Special

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Qualified Producer List of Certified Precast Concrete Producers
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Qualified Producer List Key	MISTIC Material Code	MISTIC Material Name
B1	48261	Box Section, Reinforced Concrete ASTM C 1577 Table 1
B1	48262	Elbow, Box Section, Reinforced Concrete ASTM C 1577 Table 1
B2	48263	Tapered End, Box Section, Reinforced Concrete ASTM C 1577 Table 1
B1	48264	Box Section, Reinforced Concrete, LRFD
B1	48265	Elbow, Box Section, Reinforced Concrete, LRFD
B2	48266	Tapered End, Box Section, Reinforced Concrete, LRFD
C3	48302	Arch Culvert, Reinforced Concrete, Class A-II
C3	48303	Arch Culvert, Reinforced Concrete, Class A-III
C3	48304	Arch Culvert, Reinforced Concrete, Class A-IV
A6	48401	Bridge Section, Tri-Sided, Reinforced Concrete