

SECTION 810 Materials - General

810.1 Control of Materials

810.1.1 Approval of Materials Used in Work

The service life of a highway is dependent upon the quality of the materials used in its construction, as well as the method of construction. Control of materials is discussed in [standard spec 106.1](#). The spec provides that only materials conforming to the requirements of the contract must be used, and the contractor is responsible for furnishing materials meeting specified requirements. Only with permission of the project engineer can the contractor provide materials that have not been approved, as long as the contractor can provide evidence that the material will be approved later. The department's intention is to hold payment of items until the required materials information is provided by the contractor.

The standard specifications encourage recovered and recycled materials to be incorporated into the work to the maximum extent possible, consistent with standard engineering practice. [Standard spec 106.2.2](#) and Wisconsin statute 16.754 require using American made materials to the extent possible. On federally funded projects, all steel products must be produced in the United States, and manufacturing and coating processes must be performed in the U.S. Construction materials must also comply with Buy America requirements. "Buy America" requirements are discussed in [CMM 228](#).

810.1.2 Contractor and Department Designated Materials Persons

[Standard spec 106.1.2](#) requires the contractor to designate a contractor project materials coordinator (CPMC) who will be responsible for submitting all contractor materials information to the department. The department should also designate a WisDOT project materials coordinator (WPMC) who will be in direct contact with the contractor's designee.

[Standard spec 106.1.2](#) requires the CPMC to communicate with all subcontractors to ensure that sampling, testing, and associated documentation conforms to the contract. The contract also makes the CPMC responsible for submitting materials information from the prime contractor and subcontractors to the WPMC, promptly reporting out-of-specification test results, collecting and maintaining all required materials certifications, and regularly communicating with the WPMC regarding materials issues on the contract.

The WPMC should provide a project-specific sampling and testing guide (EGuide) to the contractor at the preconstruction conference. Select eGuide from the Log In tab on the Atwood Systems website located at:

<http://www.atwoodsystems.com/>

Both the CPMC and WPMC should review and supplement the E-guide before work operations begin to ensure that testing methods, frequencies, and documentation requirements conform to the contract.

The CPMC and WPMC are charged with working together throughout the life of the contract to ensure that contract materials requirements are met and any issues that might arise related to either non-conformance or non-performance are dealt with promptly. The ultimate goal is to make sure that problems with materials are brought to light and timely corrective action taken before those materials problems compromise the quality or acceptability of the completed work.

The CPMC should coordinate contractor materials related activities and do the following:

- Establish methods and work expectations with the WPMC.
- Provide all QMP test data and control charts from the prime contractor and subcontractors.
- Deal with all materials-related concerns from the WPMC.

The WPMC is responsible for administration of the contract with regards to contract materials requirements and should do the following:

- Communicate or meet weekly with the CPMC to discuss outstanding materials issues on the contract.
- Monitor the submittals from the CPMC to ensure timeliness and completeness.
- Review contractor submittals to verify materials requirements are met.
- Inform the Project Leader of nonconforming materials issues and discuss actions to be taken.
- Prepare materials documentation for inclusion into the project files.

810.1.3 Materials Coordinator Training

All contractor and department personnel serving in the role of project materials coordinators must be HTCP-certified by successfully completing the online Materials Coordinator Training course and exam. This course is also available and recommended for all other personnel who work with materials on WisDOT projects. The training provides details about the department's materials acceptance process as well as the roles and responsibilities of project materials coordinators. Materials Coordinator Training can be accessed at:

810.2 Approval of Materials

All materials used in a project are subject to the project engineer's approval before incorporation into the work. Approval of materials is discussed in [standard spec 106.3](#). Material approval is generally based on material tests and analysis and is implemented by using approved product lists, certification, or sampling and testing. Unless the contract specifies otherwise, the contractor must follow manufacturer's recommended procedures for products incorporated into the work. Refer to [CMM 845](#) for details of acceptance types.

Under the standard specifications, material testing is performed by the department on samples obtained by the department, samples obtained by the contractor under observation of the department, or on samples shipped to the central office laboratory. Sampling, testing, and documentation is performed according to WisDOT Manual of Test Procedures (MOTP), <https://wisconsindot.gov/Documents/doing-bus-eng-consultants/cnslt-rsrcs/tools/qmp/motp.pdf> and within CMM chapter 800.

810.3 Quality Management Program

Projects that include QMP specifications are sampled, tested, and documented according to [CMM 830](#) and following CMM sections to meet the requirements of the QMP provisions.

810.3.1 Quality Control (QC)

Under QMP specifications, the contractor provides a quality control (QC) program that includes all contractor/vendor activities performed in relation to production and placement of materials, including mix designs, process control, inspections, adjustments, operational techniques, sampling and testing, and documentation thereof. The contractor performs QC sampling and testing to meet the contract requirements and additional process control testing as needed.

810.3.2 Quality Verification (QV)

Quality verification (QV) sampling and testing is performed by department representatives, independent of QC sampling and testing, to validate the quality of the material. While the department performs all QV testing, some materials require contractor sampling under department observation.

810.3.3 Independent Assurance Program

The Independent Assurance Program (IAP) is an element of the QMP intended to ensure that test data from project acceptance testing is reliable. This is accomplished through annual, unbiased reviews of all QC and QV personnel to ensure sampling and testing is performed according to standards by certified personnel using appropriate equipment that is properly calibrated. Additional independent assurance (IA) testing may be performed on split samples for comparison purposes. Further information about the IAP can be found in [CMM 820](#).

810.4 Nonconforming Materials

810.4.1 General

The department does not want materials that do not meet contract specifications incorporated into the work. [Standard spec 106.5](#) gives the project engineer the authority to either reject nonconforming materials or to allow the nonconforming materials to remain in place. If materials are found to be unacceptable before or after placement into the work, the project engineer may reject the materials, and the contractor must remove the materials from the site at no cost to the department. Materials that have been tested and approved at their source or otherwise previously approved but have become damaged or contaminated before use in the work, are also subject to rejection by the project engineer.

To ensure consistency in the decisions made for acceptance of nonconforming material or workmanship, the project engineer should involve the region oversight engineer before finalizing any decision. This will help keep central office informed about contractor or material problems that may require action with a change in specifications or discipline of a contractor. If any technical questions remain about the acceptance or rejection of nonconforming materials refer to the appropriate technical expert in BTS.

810.4.2 Nonconforming Materials Allowed to Remain in Place

810.4.2.1 Deciding Whether or not to Allow Material to Stay in Place

Good engineering judgment is required when making decisions on nonconforming materials. The project engineer may choose to approve nonconforming materials, allow them to remain in place, and adjust the contract price. When making the decision to direct the contractor to remove and replace the materials versus leave the materials in place, it's important to consider the following:

- Long-term consequences on quality and durability.
- Implications on the project's life cycle costs, service life, serviceability, and maintenance.
- Socioeconomic, environmental, and aesthetic considerations.

- Impacts on traffic, staging, and construction timeframes.

810.4.2.2 Deciding Whether or Not to Apply Price Reduction

After the project engineer has decided to allow nonconforming materials to remain in place, he or she must carefully evaluate each situation in deciding whether to take a price reduction. The goal is to achieve consistency statewide in administering price reductions for nonconforming materials that are allowed to remain in place. Results of retests and related quality tests should be considered. The following list includes some examples of the types of factors the project engineer must consider when deciding if a price reduction is warranted and how much it should be:

- Has the contractor been conscientious to provide quality by carefully controlling materials and construction operations?
- Has the contractor been proactive and made good use of QC data to maintain and improve quality?
- Did the project engineer provide the contractor with nonconforming test results within the contractual timeframe, if specified?
- If timeframes are not specified, did the project engineer provide nonconforming test results in time for the contractor to make process or materials corrections?
- Upon becoming aware of a materials quality problem, has the contractor responded quickly to correct it?
- Is the nonconforming test an isolated incident or a recurring situation?
- How does the nonconforming test compare to the rest of the project data:
 - Have material test results been well within specification requirements or consistently at the very limit of what is acceptable?
 - How many tests are nonconforming vs. how many tests have passed?
 - How far out of spec is the nonconforming test?

810.4.3 Price Reductions Specified in the Contract with Administrative Items

If price reductions are included in the specifications or special provisions for certain nonconforming items, the price reductions should be administered using the appropriate 800 series administrative items. Since the price reductions are included in the contract language, the project engineer can add the 800 series items to the contract without going through the complete change order process. Approval by a DOT representative and contractor representative are not necessary, though it's good practice to communicate the changes to all parties. Further guidance on the 800 series administrative items is provided in [CMM 238](#). Instructions on entering change orders in AASHTOWare Project Construction™ are found at: <https://awpkb.dot.wi.gov/Content/constr/LETContract/ContractProgress/ChangeOrders.htm>.

For payment of nonconforming items with associated administrative items, pay for the installed quantity and bid price of the work item under the original bid item. The pay reduction will be accounted for using the administrative item. Compute the price reduction by multiplying the quantity of nonconforming material by the original unit price and the percent price reduction. The pay units of all administrative items are DOL. Document all calculations and use the total calculated price reduction as the quantity, with negative one dollar as the unit price. See Example 1 for calculating price reductions.

Example 1

- Contractor placed total of 19,000 SY of Concrete Pavement 9 inch
- 670 SY is 1/8" - 1/2" under plan thickness
- Standard spec 415.5.2 directs to pay 80% contract price for this range (20% reduction)
- Bid unit price is \$35/SY

Using original bid item, pay 19,000 SY at \$35/SY = \$655,000

Compute price reduction = 670 SY x \$35 x -0.20 = -\$4,690

Add the administrative item 804.6005 Nonconforming Thickness Pavement to the contract,

Unit Price = -\$1.00

Quantity = 4,690

Net pay = \$655,000 - \$4,690 = \$650,310

Paying for nonconforming items this way allows for clean tracking of as-built quantities. Administrative items can easily be tracked to monitor specific items that are frequently the target of price reductions. This can help the department develop improved specifications and construction methods.

810.4.4 Price Reductions Not Specified in the Contract

If specific price reductions are not outlined in the contract specifications or special provisions, [standard spec 106.5](#) gives the project engineer the option to take a price reduction on nonconforming materials

allowed to remain in place. The project engineer has latitude to decide whether a price reduction is appropriate, and what amount the price reduction should be.

For payment of nonconforming items, use full quantity and bid price of the original work item. Apply the price reduction by submitting a change order that creates a new item with the same bid item number but with the supplemental description "price reduction - nonconforming material - (reason)". In Example 2 below, the supplemental description for the new item is "price reduction - nonconforming material – gradation". Use the quantity of the nonconforming material. The unit price is the negative price reduction percentage multiplied by the original item’s unit price.

Example 2

- Contractor placed total quantity of 4,600 tons of base aggregate dense 1 1/4-inch
- Unit price = \$9.00/TON
- 450 TON out of gradation on a particular sieve
- The project engineer allowed the material to remain in place and apply a 20% price reduction.

Using the original bid item, pay the full 4,600 TON at \$9.00/TON = \$41,400

Submit a change order creating item 305.0120 with supplemental description "price reduction - nonconforming material - gradation"

Unit Price = -\$1.80 or (0.20 x \$9.00)

Quantity = 450 TON

Resultant price reduction = -\$810 or (450 TON x -\$1.80)

Net pay = \$40,590

Price reduction guidelines for noncontractual items are provided in the following section. Instructions on entering change orders in AASHTOWare Project Construction are found at:

<https://awpkb.dot.wi.gov/Content/constr/LETContract/ContractProgress/ChangeOrders.htm>.

810.5 Noncontractual Price Reduction Guidelines

The guidelines below do not provide guidance on the project engineer's initial decision to either reject the nonconforming material or allow it to remain in place. After that initial decision has been made, these guidelines are intended aid the project engineer in deciding whether a price reduction is appropriate, and what price reductions to consider.

Except for HMA, the guidelines themselves are not contractual, but they are intended to aid the project engineer in administering [standard spec 106.5](#) on nonconforming materials.

810.5.1 Nonconforming Concrete (Masonry, Pavement, or Ancillary)

The project engineer must justify and document the incorporation of any nonconforming materials into the project. The project engineer must determine the quantity of nonconforming material. Only one price adjustment will be applied to a given quantity of material. If the quantity in question is subject to more than one of the following conditions, apply the adjustment with the greater price reduction.

810.5.1.1 Slump

- 0.0" to 3/8" out of spec..... 0% price reduction
- >3/8" to 1 7/8" out of spec.....% reduction = 16 x difference between measured slump and spec limit
- >1 7/8" or more out of spec remove & replace or 50% price reduction

These price reductions assume concrete meets strength requirements. If strength has not been met, the project engineer may apply a greater price reduction or require remove and replace of concrete.

If the project engineer elects to take a slump test for slipform pavement, do not take a price reduction if both of the following are met:

1. Result of slump test is less than 4-inches.
2. Pavement meets edge slump spec as defined in [standard spec 415.3.11.8.4](#).

810.5.1.2 Air Content

- 0.5 % or more above spec.....10% price reduction^[1]
- 0.1% to 0.4% above spec5% price reduction^[1]
- 0.1% to 0.5% below spec 20% price reduction
- 0.6% to 1.0% below spec 30% price reduction
- More than 1.0% below spec remove & replace or 50% price reduction

^[1] On QMP projects, evaluate strength data. If strengths are acceptable, do not take a price reduction for high air content. Contractor is responsible to provide additional strength data, if necessary.

810.5.1.3 Temperature (for Concrete Masonry Only)

Concrete < or = 5 degrees below specified temp. range	10% price reduction
Concrete > 5 degrees below specified temp. range.....	25% price reduction

For high temperatures, consider the effectiveness of the contractor's temperature control plan and the contractor's compliance with their temperature control plan before taking a price reduction.

810.5.1.4 Time Limit

Use of concrete after time limit exceeded.....	25% price reduction
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810.5.2 Nonconforming Granular Materials

810.5.2.1 General

All conditions of [CMM 845](#) must be met. The project engineer must justify and document the incorporation of any nonconforming materials into the project. The project engineer must determine the quantity of nonconforming material. Only one price adjustment will be applied to a given quantity of material. If the quantity in question is subject to more than one of the following conditions, apply the adjustment with the greater price reduction.

Pay adjustments for Base Aggregate Open Graded and Base Aggregate Dense bid items are specified in [standard spec 730.5](#). For other granular materials, the project engineer follows the guidance here in 810.5.2.2 and 810.5.2.3.

810.5.2.2 Gradation

Apply to Backfill Granular, Backfill Structure, & Subbase.

≤ 3% out on any sieve	5% to 10% price reduction
> 3% to ≤ 5% out on any sieve	10% to 20% price reduction
> 5% out on any sieve	remove & replace or 20% to 40% price reduction

810.5.2.3 Wear, Soundness, Freeze-Thaw, or Plasticity

Apply to Backfill Granular, Subbase, & Select Crushed Material.

Non-conformance identified before placement	nonconforming material must not be used
Non-conformance identified after placement	remove & replace or 50% price reduction

810.5.3 Nonconforming Prestressed Girders

The project engineer must justify and document the incorporation of any nonconforming materials into the project. The project engineer must determine the quantity of nonconforming material. Only one price adjustment will be applied to a given quantity of material. If the quantity in question is subject to more than one of the following conditions, apply the adjustment with the greater price reduction.

Any girder judged to be structurally or otherwise unacceptable by WisDOT staff or agent thereof due to low strength, cracking, breakage, honeycombing or other deficiency will be rejected and replaced. (Note that honeycombing with exposed strand automatically falls in this category.)

Any girder judged to be acceptable but deficient by WisDOT staff or agent thereof due to any of the following problems will be subject to the pay deductions listed below. These guidelines for standard deductions are intended to be applied to typical problem severity in the majority of cases. In occasional cases where problem severity is lower or higher than typical, the pay deduction may be decreased or increased, respectively. Depending on the nature of the problem, repairs may or may not be required as a condition of acceptance. Standard deductions shown represent a percentage of bid price for the prestressed girder item.

810.5.3.1 Nonconforming Compressive Strength

Compressive strength below required level at required test age - [standard spec 503.5\(3\)](#). [Standard spec 503.5\(4\)](#) also provides a method for coring girders with nonconforming compressive strength cylinder test results to determine girder acceptability.

810.5.3.2 Nonconforming Fabrication Defects

Pay deductions for the following fabrication defects will be recommended by the QV inspection firm, approved by the quality assurance supervisor in BTS, and implemented by the project engineer. (For questions, contact Tirupan Mandal at 608-246-5320 or tirupan.mandal@dot.wi.gov) The following deductions will be applied to infrequent occurrences of the stated defects. For repeated occurrences of the same defect, these deduction rates will be doubled. Pay deductions may be waived for minor defects judged to be inconsequential.

- Misalignment of form and soffit joints - 1/8 inch or greater on flat surface - 5% deduction
- Inadequately sealed joints with significant mortar washout - 5% deduction
- Cracking/spalling caused by fabrication and curing - 5% deduction

- Dimensional Tolerances - deviation outside values specified in 503.3.2.1.1 - 5% deduction
- Honeycombing - judged to be repairable - 10% deduction
- Curing temperature - violation of any specified criteria in 503.3.2.2.1 - 10% deduction
- Broken/cracked flanges judged to be acceptable/repairable - 10% deduction
- Shipping girder before achieving required strength without permission of project engineer - 20% deduction

810.5.3.3 Nonconforming Shipping or Erection Damage

Pay deductions for the following defects due to shipping damage or erection damage at the job site will be made by the project engineer in consultation with BOS and BTS. (BOS contact: Aaron Bonk at 608-261-0261 or aaron.bonk@dot.wi.gov; BTS contact: Tirupan Mandal at 608-246-5320 or tirupan.mandal@dot.wi.gov). Please do not assess deductions for cracking without consulting the above contacts - certain fine cracking patterns are expected in our girders due to current girder designs.

- Cracking/spalling caused by shipping or erection damage - 5% deduction
- Broken/cracked flanges judged to be acceptable/repairable - 10% deduction
- Dimensional tolerances - sweep or differential camber - 5% deduction
 - Field measurement of sweep or camber is only necessary if an erection or forming problem occurs that cannot be corrected by the contractor. Routine field measurement of sweep and camber on all girders is not necessary or recommended. Note that deduction for sweep should not be assessed if the contractor can successfully correct the problem at the time of diaphragm installation.
 - If it becomes necessary to measure sweep for a girder that cannot be properly installed by the contractor, the only acceptable field location for measuring sweep is when the girder is sitting on the beam seats, in a laterally plumb position without any lateral restraint on the girder at any point between the bearing surfaces. Never measure sweep of a girder sitting on a truck bed, as one or both ends can be laterally out of plumb, causing torsion or lateral bowing that can result in erroneous measurements.
 - Sweep can be measured with a very taut stringline along the edge of the top flange of the girder. Be sure that wind does not influence the position of the stringline. If initial sweep is acceptable on the casting bed following strand release, then most later age sweep issues at the point of erection are typically temporary and reversible, related to environmental conditions.
 - Warm sun on the south side of a girder and/or cold wind along the north side can cause significant temporary sweep. Allowing the girder to sit overnight and reach a better equilibrium condition can ease the installation of steel diaphragms.
 - Problems with differential camber within a span are very rare, as currently the girder fabricators are required to cast all girders for a span within a short time, and stressing operations are very closely controlled and inspected at the plant. As with sweep, camber should only be measured in the field when the girder is sitting on the beam seats in a laterally plumb position. The camber should be measured with a survey rod and level at the ends and center point of a girder, either on top of the girder, or taking inverted measurements along the bottom flange from below.

810.5.4 Nonconforming Miscellaneous Items

The project engineer must determine the quantity of nonconforming material. Only one price adjustment will be applied to a given quantity of material. If the quantity in question is subject to more than one of the following conditions, apply the adjustment with the greater price reduction.

810.5.4.1 Items Requiring Special Guidance

If any of these items are nonconforming, consult personnel in the area of BTS that specializes in the item for guidance.

Examples of items in which it may be unacceptable to leave the nonconforming item in place, even at a reduced cost, include the following:

- Bar steel reinforcement (except for bend test requirements)
- Anchor bolts
- High strength bolts
- Geotextile fabric type MS
- Piling and pile coating

After consultation with BOS, bar steel reinforcement that conforms in all other respects, but fails the bend test requirements according to AASHTO M31, may be allowed to remain in place with a 20% price reduction on the bid item price.

810.5.4.2 Minor Nonconformance

If the material does not conform to the requirements of the contract, but is expected to substantially fulfill the needs of the project, apply one of the following two price reductions:

1. 20% price reduction on the bid item unit price
2. 50% price reduction on the material (invoice) cost

810.5.4.3 Major Nonconformance

When the material does not conform to the requirements of the contract and is insufficient to fulfill the needs of the project, but will be allowed to remain in place, the project engineer should not pay for the item.

Example:

Test results for riprap fabric are returned after the riprap has been placed, and fabric is significantly outside of the specifications. The project engineer may allow the fabric to remain in place but will not pay for it.