STATE OF OHIO
DEPARTMENT OF TRANSPORTATION
SUPPLEMENTAL SPECIFICATION 814

EMBANKMENT CONSTRUCTION USING PETROLEUM CONTAMINATED SOIL

June 2, 1998

814.01 Description: This work shall consist of using Petroleum Contaminated Soil (PCS) material, and/or constructing a mixture of PCS material and embankment material in accordance with these specifications and in reasonably close conformity with the lines shown on the plans or established by the Engineer; mixed, spread, compacted, shaped and finished.

The Contractor may elect to use PCS material as embankment material or may excavate PCS material detailed in the contract or found in the work. It is not a requirement of this specification to use the PCS material in the embankment. The use of PCS material may be allowed as per this specification.

Item 203, Roadway Excavation and Embankment shall apply: deviations from these are as follows.

814.02 Restrictions of Usage. The Contractor shall certify to the Engineer that the PCS material does not exceed the petroleum constituent concentrations stated in OAC 1301: 7-9-16(I)(1)(c)(ii)(b). These values are provided below:

Benzene	35 parts per million
Toluene	109 parts per million
Ethylbenzene	32 parts per million
Total Xylenes	165 parts per million

This certification shall include test results from an independent environmental consultant approved by the Department. The consultant shall perform BTEX testing by using United States Environmental Protection Agency (USEPA) test method SW 846 method 8020 or equivalent method. These tests shall be performed on every 90 metric tons (100 tons) of PCS used on the project.

The Contractor shall submit this certification and information in a suitable format to the Engineer 10 working days prior to the intended usage.

PCS shall not be allowed within the top 1.0 m (3 feet) of the final subgrade elevation or within 1.5 m (5 feet) from any exposed surface.

The final PCS material shall produce a stable embankment. The source, materials, construction and compaction techniques shall be approved by the Engineer.

814.03 Materials. The PCS material shall meet the requirements of Item 203 and the following additional requirements:

The PCS material shall be classified by an independent soils consultant approved by the Department as per Section 4.3 of the Department's "Specifications for Subsurface Investigation Manual". The soils consultant shall determine the suitability of the material under Item 203 Embankment Materials.

The soils consultant shall make a moisture density curve in accordance with AASHTO T 99 for every 225 metric tons (250 tons) of PCS material.

The soils consultant shall submit the above information in a suitable format to the Engineer at least 7 working days prior to the proposed work. This report shall be written and sealed by a Registered Professional Engineer.

814.04 Construction Requirements. The outer soil cover shall be raised uniformly with the PCS material. At no time shall the PCS material be dumped or spread on soft areas, in jurisdictional wetland, or in standing water.

The layers of PCS material shall be alternated with other Department approved soil layers (other than PCS material) .

PCS material shall be spread on the embankment or subgrade in 200 mm (8 inch) loose lifts.

Compaction shall be performed with a sheeps foot roller, self propelled roller or other approved equipment. The compaction operation shall be coordinated with the spreading operation to minimize the amount of PCS material spread out on the embankment. In no case shall the PCS material be left spread out and uncompacted overnight.

The PCS material shall be compacted at a moisture content to obtain the required density and embankment stability. The PCS mixture shall be compacted to a density required under 203.12 or to a density determined by 203.09(b). Any water needed to bring the material to the specified moisture shall be uniformly mixed throughout the lift.

814.05 Method of Measurement. The PCS material shall be paid as per the 203 Items in the contract documents.

814.06 Basis of Payment. The contract unit price per cubic meter(cubic yard) for the 203 Items in the contract documents shall include full compensation for furnishing all testing and certification documentation, labor, materials and incidentals for doing all work involved with the PCS material.

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION
SUPPLEMENTAL SPECIFICATION 842

CONCRETE FOR STRUCTURES

January 6, 1999

842.01 Description. This item shall consist of furnishing and placing portland cement concrete including reinforcing steel in accordance with these specifications and in reasonably close conformity with the lines, grades and dimensions shown on the plans. This item shall also include all costs associated with saw cutting grooves into the surface of superstructure concrete after the concrete has cured. Falsework and forms shall be in accordance with 508.

For prestressed concrete, see Supplemental Specification 865.

Concrete for structures shall met the requirements of Supplemental Specification 899 (Concrete - General), except as modified herein.

842.02 Materials. Materials shall conform to 899.02 except as follows:

Aggregate; all concrete above the ground line in a given substructure unit or all concrete for any given superstructure shall be made of aggregates of the same kind and colors, except upon permission of the Engineer.

Reinforcing materials; 509.02.

Curing materials; 705.05, 705.06 (white opaque), 705.07 Type 1 or 1D.

Joint filler;1/4 inch (6 mm) gray sponge 711.28, or preformed filler 705.03.

Seals; preformed elastomeric compression joint seals, 705.11.

842.03 Proportions. Concrete for structures shall be proportioned according to 899.03, using Class C or Class S as specified.

842.04 Concrete Test Specimens. On structures over 20 foot (6.1 m) span, two test cylinders will be made from each 200 cubic yards (150 m^3), or fraction thereof, of concrete that is incorporated each day in the work. On structures of 20 foot (6.1 m) span or less, not less than two cylinders will be made for each 50 cubic yards (35 m^3) of concrete.

When necessary to permit early removal of falsework or to permit backfilling, concrete test beams shall be made and tested according to standard methods on file in the office of the Director.

842.05 High-Early-Strength Concrete. The use of high-early-strength concrete shall be in accordance with 899.03. Curing and loading shall be in accordance with 842.14.

842.06 Mixing of Concrete. Mixing shall be according to 899.09.

When mixed, all concrete shall have a temperature of not more than 90 ºF (32 ºC), and the concrete shall be maintained under this temperature until deposited in the work.

When an air temperature of 60 ºF (16 ºC) or higher prevails at the time of placing concrete in a bridge superstructure over 20 foot (6.1 m) span, the Contractor shall add an approved chemical admixture (705.12, Type B or D) to the concrete.

842.07 Slump. Concrete shall have a slump such that it will be workable in the required position. It shall be of such a consistency that it will flow around reinforcing steel, but individual particles of coarse aggregate, when isolated, shall show a coating of mortar containing its proportionate amount of sand.

The slump of concrete placed by the vibration method shall be in accordance with 899.03, the slump being determined according to ASTM C 143.

842.08 Placing Concrete. The Contractor shall submit according to 501.06, a description of the procedures he proposes to use and notify the Engineer at least 24 hours in advance of placing concrete.

Superstructure concrete shall be placed only when the surface evaporation rate determined by using Figure 1 in ACI 308 is equal to or less than 0.2 lb./sq. ft./hour(1.0 kg/m^2/hour). The Contractor shall determine and document the ambient air temperature, concrete temperature, deck surface temperature, relative humidity, and wind velocity, subject to verification by the Engineer. No superstructure concrete shall be placed if the ambient air temperature is 85 ºF(30 ºC) or higher or predicted to go above 85 ºF(30 ºC)

during the concrete placement regardless of the surface evaporation rate.

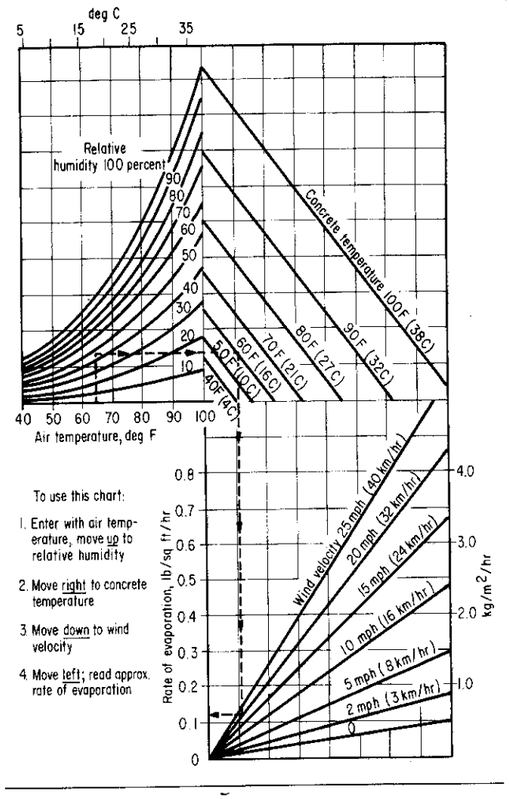
When a concrete deck is to be placed on continuous steel beams or girders, the placing of the concrete deck in any span shall not be started until all of the main beam or girder splices have been completed at least two piers beyond the pier or piers supporting the span in question.

Concrete for backwalls with steel expansion joints shall not be placed until the abutments have been backfilled to within 1 foot (0.3 m) of the bridge seat elevation and all structural steel or prestressed concrete beams have been erected, unless a different procedure is approved by the Director. The steel expansion joint shall serve as a template for the top of the backwall. If temporary bolts are used to support the backwall portion of an expansion device during the placing of the backwall concrete, these bolts shall be removed after the concrete has taken its initial set and before a change in temperature causes superstructure movement sufficient to damage the backwall.

In order that the concrete will be finished during daylight hours, the time of starting the concreting operations shall be subject to the approval of the Engineer.

The Contractor shall furnish assurance to the Engineer of an adequate and uniform source of supply of concrete to permit proper placing and finishing, and of the availability of coverings for protection in case of rain, before work will be permitted to start.

Figure1 ACI 308-81



Before placing the concrete, all forms and structural steel which will be in contact with the concrete shall be thoroughly cleaned and the space to be occupied by the concrete shall be free from all laitance, silt, dirt, shavings, sawdust, loose and built-up rust and other debris. The methods of depositing shall be such as to insure that all reinforcing steel is completely enveloped in concrete mortar and such that this condition can be verified by inspection. The method or device used for conveying the concrete from the mixer to its place in the work shall be such as to insure against separation of the coarse aggregate from the mortar. When concrete is being deposited in shallow members, such as slabs, it shall be placed with as short a vertical drop as practicable. The concrete shall be deposited so as to maintain a surface practically horizontal over the section being placed.

When a chute is used, its slope shall be such as to allow concrete of the proper consistency to flow readily without segregation. Concrete shall be deposited as near as possible to its final position.

Concrete shall not be dropped into the forms a distance of more than 5 feet (1.5 m). Drop chutes shall be used to limit free fall to 5 feet (1.5 m) and the delivery ends shall be as nearly vertical as practicable.

The use of mortar topping for concrete railing caps and other similar surfaces shall not be permitted.

The use of the vibration method of placing all concrete, in structures is required. The Contractor shall furnish and have in use sufficient vibration equipment of an approved type and size to properly compact each batch immediately after it is placed in the forms.

The vibrators shall generally be of a type that is applied directly to the concrete and have a frequency of at least 4500 impulses per minute, but where inaccessibility precludes this method of vibration, the vibrators shall be applied externally to the forms.

The concrete shall be deposited as near its final position as possible and shall not be caused to flow long distances by vibrators. Vibration shall be applied at the point of deposit and in the area of freshly deposited concrete. Vibrators shall be inserted into and withdrawn from the concrete slowly. The vibration shall be of sufficient duration and intensity to thoroughly compact the concrete, but not continued so as to cause segregation. Care must be used not to disturb partially hardened concrete.

Such spading as is necessary to insure smooth surfaces and dense concrete shall be done along form surfaces and in corners and locations impossible to reach with the vibrators, The Engineer shall with the collaboration of the Contractor closely observe the results obtained on the first concrete placed and such alterations shall be made in the mix, as permitted by these specifications, as are necessary to secure the best results.

The surface of the finished concrete shall be covered immediately with wet burlap.

842.081 Slipform Construction of Bridge Railing. Unless the plans eliminate the use of slipforming for this project, the Contractor is permitted the option of slipforming the bridge parapets and medians If the Contractor elects to slipform, the finished concrete shall meet the following tolerances from plan dimensions:

Reinforcing steel cover	-½ inch (-13mm) + ½ inch (+ 13 inch)
Top width dimension	-0 + 1/4 inch (+ 6 mm)
Bottom width dimension	-0 + ½ inch (+ 13mm)
Surface flatness	1/4 inch in 10 feet (6 mm in 3 meters)
Vertical alignment (Deviation from a line parallel to the grade line)	½ inch in 20 feet (13 mm in 6 meters)

All reinforcing steel joints and/or splices in the bridge railing steel shall be tied. A dry run to check for reinforcing clearance and rigidity of the reinforcing cages shall be required before any concrete is placed. The Contractor shall verify reinforcing clearances and make any adjustments to the cage to establish the required clearances during the dry run. Reinforcing steel cages are to be rigid (defined as no movement during the slipforming dry run). If the Engineer determines the cages are not rigid, the Contractor must stabilize the cages before any slipforming is performed. The Contractor may add any additional diagonal reinforcing steel between the front and rear vertical reinforcing faces to establish the required rigidity. Any additional reinforcing steel required to adequately stabilize the cages shall be the Contractor's expense.

Honeycombing, cracking, tearing and other defects shall be repaired or patched immediately upon exit from the slipform equipment. Defects shall be completely filled with concrete. The use of water to smooth or close the surface is not acceptable

Control Joints shall be constructed by sawing 1 1/4 inches (32 mm) deep into the perimeter of the parapet, after the concrete has taken its initial set but before any shrinkage cracks develop. Generally initial set is within 6 hours of batching of the concrete. All joints shall be sawed within 24 hours of placement. Joints shall be sawed by using an edge guide, fence or jig to insure that the joint is straight, true and aligned on all faces of the parapet. The joint width shall be the width of the saw blade, a nominal 1/4 inch (6 mm). The control joints shall be caulked with a polyurethane or polymeric material meeting Federal Specification TT-S-00227E

Slip formed concrete will require different slumps than those listed in 899 or other plan specified concrete. The consistency of the concrete should be such that the concrete exiting the slipform does not pull but is stiff enough to prevent waviness and sags in the finished surfaces. Method A, Water Curing, 842.14 is required. As slipformed concrete has a low water/cement ratio, timely application of the water cure is critical in helping control shrinkage cracks.

No water shall be added or applied to the concrete after it has left the truck.

The Contractor shall furnish all necessary platforms to protect against falling debris during the slipforming operation, to allow access for completing the finishing operation and to allow the inspector access.

The Engineer will inspect the slipformed surface for horizontal cracking no earlier than 21 days after completion of the slipforming operation. All horizontal cracks shall be repaired by epoxy injection. If a concrete sealer has been applied, any damage to the sealer shall be repaired after the epoxy injection has been completed. The aforementioned repairs shall be made at no additional cost to the State

842.09 Construction Joints. When construction joints are shown on the plans, all concrete between consecutive joints shall be placed in a continuous operation. Concrete shall not be placed against the side of any joint for at least 12 hours, or as required by 842.14.

Approval of the Director must be obtained for placing any construction joint not shown on the plans or permitted by 842.08 and 842.16.

The plans on which a day's work is to terminate shall be predetermined before depositing of concrete begins. They shall in general be perpendicular to the lines of principal stress and in regions of small shear. Horizontal joints will not be permitted in concrete girders and beams. Slabs acting with concrete beams or girders shall be deposited continuously with them unless composite construction is specified.

All construction joints shall be made with bulkheads provided with keys which clear all exposed surfaces approximately one-third the thickness of the joint.

Horizontal joints in piers, abutments and retaining walls generally shall be avoided and, when they are used, shall not be located within 2 feet (0.6 m) of the normal water level.

Construction joints not shown on the plans and above ordinary low water, in abutments, and in retaining walls that retain earth fills shall be waterproofed on the back with a 36 inch (1 m) strip of Type B waterproofing according to 512 at the Contractor's expense.

Joints in cantilevered members shall be avoided.

Horizontal construction joints shall have the surface of the concrete below the joint dampened immediately prior to placing adjoining concrete.

Horizontal construction joints between bridge slabs and superimposed curbs, parapets, sidewalks and median strips, shall be placed and protected the same as the remainder of the slab. They shall be cured in accordance with 842.14.

Care shall be exercised to avoid disturbing the bond of curb reinforcing steel protruding from the concrete. If the curb areas are used by workers when placing the deck concrete, the reinforcing steel shall be tied and/or braced to prevent its movement.

Where walls or columns support slabs or beams, the concrete in the vertical member shall be deposited up to the bottom of the supported member and a period of at least 2 hours shall elapse for settlement before placing concrete in the horizontal member.

842.10 Emergency. When the work is unexpectedly interrupted by break-downs, storms or other causes and the concrete as placed would produce an improper construction joint, the Contractor shall rearrange the freshly deposited concrete to provide a suitable construction joint. When such a joint occurs at a section on which there is shearing stress, he shall provide an adequate mechanical bond across the joint by forming a key, inserting reinforcing steel or by some other means satisfactory to the Engineer, which will prevent a plane of weakness.

842.11 Depositing Concrete Under Water. No concrete except for cofferdam seals shall be deposited under water, unless by special permission of the Director. If such permission is granted, care shall be exercised to prevent the formation of laitance.

Concrete shall not be deposited until any laitance, which may have formed on concrete previously placed, has been removed. Pumping shall be discontinued while depositing foundation concrete if it results in a flow of water inside of forms. If concrete other than cofferdam seals is deposited under water, the proportion of cement used shall be increased at least 10 percent at no extra expense to the State, to compensate for losses due to water. Concrete deposited under water shall be carefully placed in a compact mass in its final position by means of a tremie, a closed bottom dump bucket or other approved method and shall not be disturbed after being deposited.

842.12 Depositing and Curing Concrete During Cold Weather. When an atmospheric temperature of 32 ºF (0 ºC) or less exists at the time concrete is placed, or is predicted by weather forecasts to occur during the curing period, the following procedures shall apply:

The water or aggregate or both shall be heated as necessary to make the temperature of the concrete not less than 50 ºF (10 ºC) nor more than 70 ºF (21 ºC) when placed.

Concrete shall not be placed in contact with materials having a temperature of less than 32 ºF (0 ºC). If necessary, the forms, reinforcing steel and foundation materials shall be heated before the concrete is placed.

The concrete shall be protected from freezing and specified temperatures for curing shall be maintained by a heated enclosure, insulated forms or by either of these used in combination with flooding, except that insulation alone may not be used to protect and cure deck slabs less than 10 inches (250 mm) thick.

The heated enclosure shall surround the top, sides and bottom of the concrete to be placed during cold weather except that concrete surfaces which have been flooded need not be enclosed.

The concrete shall be cured by maintaining the surface temperature between 50 ºF and 100 ºF (10 ºC and 38 ºC) for a period of not less than five days except as modified below for concrete flooded with water. At the end of this curing period, the temperature shall be reduced at a rate not to exceed 20 ºF (11 ºC) in 24 hours until it is within 20 ºF (11 ºC) of atmospheric temperature.

Sufficient high-low thermometers shall be furnished and installed by the Contractor in such a manner that the surface temperature of the concrete may be readily determined. For deck slabs, the surface temperature shall include deck bottoms, deck facia and deck top surfaces.

Removal of falsework and opening to traffic shall be not earlier than specified by 842.14.

(a) When a heated enclosure is used. The enclosure and heating devices shall be as nearly complete before any concrete is placed as the placing will permit. Throughout the entire concreting operation, the completion of enclosures and the application of heat shall follow the placing of concrete as closely as possible.

Heat may be supplied by any method which will maintain the required temperature continuously with a reasonable degree of uniformity in all parts of the enclosure without discoloring the concrete.

Combustion-type heating units shall be vented from the enclosure.

If dry heat, other than free steam, is used with method (a) curing, all exposed concrete shall be covered with two thicknesses of burlap as soon after placing the concrete as it can be done without marring the surface. The burlap shall be wetted and kept continuously wet and shall not be removed during the heating period, except as required for rubbing. Wood forms without liners, left in place more than two days after the placing of concrete, shall be thoroughly wet at least once each day for the remainder of the heating period. If forms are removed during the heating period, the concrete shall be thoroughly drenched with water and covered with burlap as noted above for the remainder of the heating period.

Enclosures shall be strong and wind proof, and provide adequate space to allow free circulation of air around the forms and deposited concrete.

(b) When insulation is used. Sufficient thermometers shall be furnished and installed by the Contractor in such a manner that the surface temperature of the concrete may be readily determined. Whenever the surface temperature, as indicated by the thermometer readings, approaches 100 ºF (38 ºC), the forms or insulation shall be loosened or otherwise vented to keep the surface temperature within the specified limits. If the thermometer readings indicate that the minimum required temperature is not maintained, the structure shall be promptly enclosed and heated as provided above or flooded as specified below.

The insulating material shall be wind and water resistant. Precautions shall be taken at edges and corners to insure that such points of extreme exposure are adequately protected. The top surface of the concrete shall be protected by a tarpaulin, or other approved waterproof cover, placed over the insulation.

(c) When the concrete is to be flooded with water. The concrete may be flooded as soon as it can be done without damaging it. Flooding water shall be heated to a temperature of not less than 50 ºF (10 ºC) nor more than 100 ºF (38 ºC). The heated flood water may be discontinued after 48 hours if the concrete remains flooded to a depth of 1 foot (0.3 m) above its highest elevation for at least the subsequent 120-hour period.

842.13 Removal of Forms. In order to facilitate finishing, forms on vertical surfaces which are to receive a rubbed surface finish shall be removed as soon as the concrete has hardened sufficiently that it will not be damaged.

842.14 Curing and Loading. Concrete for structures shall have the falsework removed and be opened to traffic in not less time than is specified by the following table:

		Age of Concrete in Days	
	Span (a)	**No Beam Test**	**Beam Test (b)**
Removing Falsework	Over 10' (3.0 m)	14	5
	10' (3.0 m) or less and all pier caps	7	3
Traffic	Any	14	7

(a) Span in this circumstance is defined as the horizontal distance between faces of the supporting elements when measured parallel to the primary reinforcement.

(b) Applicable only when the average modulus of rupture for two tests is not less than 650 psi (4.5 MPa).

When the temperature of the air surrounding the concrete is above and maintained above 32 ºF (0 ºC) and below 50 ºF (10 ºC) and the provisions of 842.12 are not in force, the duration of the cure shall be based on a beam test, except that the curing time shall not be less than tabulated above.

When a beam test is not performed, the time specified above for removing falsework and opening to traffic shall be extended one day for each day the temperature of the air surrounding the concrete is below 50 ºF (10 ºC).

All superstructure concrete, all concrete which is to have a sealer applied, and all construction joints shall be cured in accordance with Method (a) Water Curing. All other concrete shall be cured either by Method (a) Water Curing or Method (b) Membrane Curing. However, if Method (b) is used on areas to be waterproofed, the membrane shall be removed.

Compression rings are not to be installed on pier columns or similar items of construction for the purpose of supporting falsework or subsequent construction until after a 72-hour curing period.

No load shall be applied or other work conducted that will damage new concrete or interfere with its curing. Where work is necessary on new concrete to complete a structure, such as building forms on a footing, workers and materials shall be kept off such concrete until such time as it will not be damaged by the work in progress, but in no case shall the elapsed time between placing the concrete and working on same be less than 36 hours. No work that will interfere with the curing shall be done on concrete placed during cold weather unless insulating material to retain the heat in the mix is placed during periods in the day when the presence of workers will not interfere with the normal curing procedure. When this is done, the normal protection shall be resumed immediately after work is suspended. Proper curing shall have preference and, if necessary, workers shall be kept off so that the concrete may be thoroughly wetted and kept wet until the curing is completed.

Method (a) Water Curing. All surfaces not covered by forms shall be protected immediately after brooming or final finishing with two thicknesses of wet burlap and kept wet by the continuous application of water for a period of not less than 7 days. Formed surfaces shall, after the removal of forms, be cured in like manner for the remainder of the curing period with the entire surface of the concrete being thoroughly drenched with water and covered immediately after forms are removed.

In lieu of continuous sprinkling, wet burlap covered with white polyethylene sheeting or plastic coated burlap blankets 705.06 may be used. They shall be placed wet with the burlap side against the concrete. Adjoining plastic coated blankets or polyethylene sheets used to cover wet burlap shall be lapped sufficiently and held securely in place at laps and edges so that positive moisture seal is provided. White polyethylene sheeting or plastic coated blankets containing holes or tears shall be covered with an additional covering of sheeting or blankets as directed.

Method (b) Membrane Curing. Immediately after the free water has disappeared on

surfaces not protected by forms and immediately after the removal of forms, if such are removed before the end of the 7-day curing period, the concrete shall be sealed by spraying as a fine mist a uniform application of the curing material 705.07, Type 1 or 1D, in such manner as to provide continuous, uniform, water impermeable film without marring the surface of the concrete.

The membrane curing shall be applied in one or more separate coats at the rate of at least 1 gallon per 200 square feet (1 L/5m^2) of surface. To assure that the proper amount of the curing material is applied, the number of gallons (liters) of curing material in the spray container shall be noted, and the correct area for that volume laid off so that the area of concrete surface to be covered will be such that the approved application rate will be secured. Curing material shall be thoroughly agitated immediately previous to use. If the film is broken or damaged at any time during the specified curing period, the area or areas affected shall be given a complete duplicate treatment of the curing material applied at the same rate as the first treatment.

Unless adequate precautions are taken to protect the surface of the membrane, workers, materials and equipment shall be kept off the membrane for the duration of the curing period.

842.15 Surface Finish. Immediately after the removal of forms, all cavities produced by form ties and all other holes, honeycomb spots, broken corners or edges and other defects shall be cleaned, dampened and completely filled, pointed or trued with a mortar of the same proportions as used in the concrete being finished. Exposed surfaces which are not satisfactory to the Engineer because of excessive patching and/or other corrective work, shall be grout cleaned or rubbed as required by the Engineer. Other contiguous exposed surfaces on the structure shall be finished in a similar manner to the extent required to produce a uniform appearance.

On all exposed surfaces, all fins and irregular projections shall be removed with a stone or power grinder, care being taken to avoid contrasting surface textures. Sufficient white cement shall be substituted for the regular cement in the filling of holes and other corrective work to produce finished patches of the same color as the surrounding concrete.

Grout Cleaning. Where grout cleaning is called for on the plans or is necessary for corrective work, the surface, after wetting, shall be uniformly covered with a grout consisting of one part cement to 1 1/2 parts fine sand, 703.03 and sufficient water to produce a consistency of thick paint. White portland cement shall be used for all or part of the cement in the grout, as directed by the Engineer, to give the color required to match the concrete. The grout shall be uniformly applied with brushes or a spray gun, and all air bubbles and holes shall be completely filled. Immediately after the application of the grout, the surface shall be vigorously scoured with a cork or other suitable float. While the grout is still plastic the surface shall be finished with a sponge rubber or other suitable float removing all excess grout. The finishing shall be done at the time when grout will not be pulled from the holes or depressions. After being allowed to thoroughly dry, the surface shall be vigorously rubbed with a dry burlap to completely remove any dried grout. There shall be no visible film of grout remaining on the surface after this rubbing and the entire cleaning operations of any area must be completed on the day it is started. If any dark spots or streaks remain after this operation, they shall be removed with a fine grained

silicon carbide stone, but the rubbing shall not be sufficient to change the texture of the surface. Unless otherwise directed by the Engineer, grout cleaning shall be delayed until the final clean up of the project.

Rubbed Finish. Forms shall be removed, if possible, within two days after concrete is placed. Corrections shall be made as outlined above. Rubbing of concrete shall be started as soon as the conditions will permit. Immediately before starting this work, the concrete shall be kept thoroughly saturated with water for a minimum period of two hours. Sufficient time shall have elapsed before wetting down to allow the mortar used in pointing insert holes and defects to be thoroughly set. Surfaces to be finished shall be rubbed with a medium coarse silicon carbide stone until all form marks, projections and irregularities have been removed, all voids filled and a uniform surface has been attained. The paste produced by rubbing shall be left in place at this time. No additional material other than water shall be applied to the surface. After all concrete above the surface being finished has been placed, the final finish shall be obtained by rubbing with a fine silicon carbide stone and water. This rubbing shall be continued until the entire surface is of a smooth texture and uniform in color. Any surfaces which have been given a rubbed finish, shall be protected from subsequent construction operations. Any surfaces which are not protected shall be cleaned and again rubbed, if necessary, to secure a uniform and satisfactory surface.

No extra payment will be made for any type of surface finish, the cost being considered as included in the price bid for concrete.

842.16 Roadway Finish. Concrete deck slabs shall be finished in accordance with the requirements of 451.12 except that construction joints shall not be edged, and a strip of surface 9 to 12 inches (220 to 300 mm) wide adjacent to curbs and barriers shall not be grooved. The use of a broom drag on concrete deck slabs may be in the longitudinal or transverse direction. The requirement for use of a finishing machine may be waived by the Engineer for small bridges where their use is impractical.

The finishing machine shall be approved by the Engineer. It shall be self-propelled and equipped with forward and reverse drive mechanisms that enable precision velocity control of the machine while moving in either direction. It shall be equipped with one or more rotating rollers, leveling augers and either a vibrating pan or vibrating rollers. Vibrating frequency for pans or rollers shall be variable from 1500 to 5000 pulses per minute. The Contractor shall furnish the necessary verification of these frequencies. The finishing machine shall be capable of finishing transversely while traveling in either direction across the deck. Screeds shall have provisions for raising them above the concrete surface. The finishing machine shall be of sufficient size to finish the full width of the decks between curbs or parapet walls. The wheels of the finishing machine shall run on temporary riding rails adequately supported on structural steel or falsework. The rail and rail supports shall be made of steel and shall be arranged so that the weight of the finishing machine and the operator cause zero vertical deflection while traveling across the deck. Rail shall be straight with no sections exceeding a tolerance of 1/8 inch in 10 feet (3 mm in 3.0 m) in any direction. All support rails shall be elevated a sufficient distance above the slab to permit the simultaneous finishing by hand of any portions not finished by the machine. Any rail supports shall be fabricated and installed in such manner

as to permit their removal to at least 2 inches (50 mm) below the top of the slab. Holes formed by the removal of such supports shall be filled during the final finishing of the slab. The concrete shall be delivered and distributed at a uniform and adequate rate ahead of the finishing machine by suitable mechanical equipment. Concrete shall be placed no more than 10 feet (3m) directly in front of the finishing machine.

Bridge decks that are to be waterproofed with a membrane shall be given a burlap drag finish.

842.161 Bridge Deck Grooving. After the concrete has cured, transverse grooves shall be sawed into the deck. The grooving shall conform to the following requirements:

Grooving shall be done utilizing diamond blades, mounted on a multi blade arbor on a self-propelled machine which has been built for grooving of concrete surfaces. The groove machine shall have a depth control device which will detect variations in the pavement surface and adjust the cutting head height to maintain the depth of the groove specified. The grooving machine will be provided with devices to control alignment. Flailing or impact type grooving equipment will not be permitted.

Grooves shall begin and end approximately one foot from any curb, parapet toe or deck edge and shall be perpendicular to the bridge center line.

The Contractor shall provide an experienced technician to supervise the location, alignment, layout, dimension, and grooving of the surface.

Grooves shall run in a continuous pattern across the surface. The grooving shall be terminated a minimum of 1 foot (300mm) from any device in place in a bridge deck, such as scuppers or expansion joints. The grooves shall be a random pattern spaced at 3/8 to 1 3/4 inch (10 to 45 mm), with 50 percent of spacings being less than 1 inch (25 mm). The grooves shall be approximately 0.15 inches (4 mm) deep and 0.10 inches (3 mm) wide.

At the beginning of each work shift, all grooving machines shall be equipped with a full complement of grooving blades that are capable of cutting grooves of the specified width, depth and spacing.

If during the course of work, a single grooving blade on any individual grooving machine becomes incapable of cutting a groove, work will be permitted to continue for the remainder of the work shift and the Contractor will not be required to otherwise cut the groove omitted because of the failed blade. Should two or more grooving blades on any individual grooving machine become incapable of cutting grooves, the Contractor shall cease operating such equipment until it is repaired.

The removal of all slurry and any remaining residue resulting from the grooving operation shall be continuous. The bridge deck surface shall be left in clean condition, free of all slurry and residue. Residue from grooving operations shall not be permitted to flow across shoulders or lanes occupied by public traffic or flow into gutters or other drainage facilities. Solid residue, resulting from grooving operations, shall be removed from the surface before such residue is blown by the action of traffic or wind.

The Contractor shall be responsible for providing water as necessary to perform the specified grooving in accordance with the specifications.

842.17 Sidewalk Finish. The concrete shall be struck off after placing with a template and finished with a float to produce a sandy texture.

842.18 Method of Measurement. The volume shall be the number of cubic yards (cubic meters) determined by calculations from plan dimensions, in place, completed and accepted.

Reinforcing steel, supports, mechanical connectors, and tie wires shall be incidental in the price bid for structural concrete.

No deduction will be made for the volume of the reinforcing steel, conduits or structural steel other than beam flanges embedded in deck slabs. No deduction will be made for the volume of any embedded timber or concrete piles.

Superstructure concrete includes the concrete in deflective parapets not having a metallic railing.

Deck concrete may be measured by either volume or area. The area of concrete shall be based on plan dimensions.

842.19 Basis of Payment. Payment will be made at contract prices for:

Item	Unit	Description
842	Cubic yard (cubic meter)	Class ___ concrete, _____
842	Cubic yard (Cubic meter), Square yard (square meter)	Class ___ concrete, bridge deck

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION
SUPPLEMENTAL SPECIFICATION 863

STRUCTURAL STEEL MEMBERS

October 12, 1999

863.01 Description. This item shall consist of preparing shop drawings, furnishing, fabricating, nondestructive testing, fabricator performed quality control(QC), documentation, cleaning, shop painting, and erecting of all structural steel, and other structural metals, as specified. It shall also include any work required to move existing steel structures to the plan location, to make necessary repairs and alterations, and to connect or join new with old construction. Approval of Construction Plans required under section 501.06 of the Department's Construction and Material Specifications are required for Structural Steel Members.

863.02 Fabricator Approval Procedure. Fabricators performing work under this specification shall be Pre-qualified by the Office of Structural Engineering (OSE). Requests for such Pre-qualification shall be made by the fabricator in writing. The Pre-qualification process and its requirements are listed in this specification. The Contractor shall select a fabricator from the Pre-qualified Fabricator List in effect the date of Contract Letting. The Contractor shall inform the District Construction Engineer and the Office of Structural Engineering of the selected fabricator.

The OSE may accept subletting of processes which require specialized machinery or knowledge not common to AISC certified fabricators. All requests for subletting shall be made in writing to the OSE. The OSE shall determine if the process is uncommon and evaluate the qualifications of the sublet company. The pre-qualified fabricator must supply a member of his quality control staff to physically witness and perform quality control during the sublet fabrication process.

863.03 Fabricator Pre-qualification. OSE will perform facilities inspections for pre-qualification evaluation of a fabricator. Fabricators meeting all qualification requirements will be assigned a fabrication level and will be included on the Pre-qualified Fabricator List. The Pre-qualified Fabricator list will be updated as necessary by the OSE.

Fabricators shall perform all fabrication in plants located within the continental limits of the United States.

Final conformance of fabrication to contract requirements is the responsibility of the

Contractor. A pre-qualified fabricator does not guarantee the Contractor that work performed will meet quality and conformance requirements of the contract.

863.04 Levels of Fabrication Qualification. There are seven levels of fabricator qualification. Each fabricator shall be listed at the highest level of fabrication they are qualified to perform.

Level	Description of Capabilities
Misc.	Miscellaneous products not designed to carry tension live load but requiring , shop drawings, material test reports, and inspection quality assurance by the Department such as; curb plates, bearings, expansion joints, railings, catwalk, inspection access, drainage or other products not covered by ODOT standard bridge drawings. Also retrofit cross frames, retrofit gusset plates or retro fit lateral bracing or other misc. structural members not included below
ONE	Single span, straight, rolled beam bridges without stiffeners, secondary and detail materials such as retrofit moment plates. Case II Loading
TWO	Multiple span, straight, rolled beam bridges without stiffeners. Case II loading
THREE	Single or multiple span, straight, dog legged or curved, rolled beam bridges including stiffeners. Case I or II Loading
FOUR	Straight or dog legged welded plate girder bridges Case I or II loading
FIVE	Straight, curved, haunched or tapered welded plate girder bridges Case I or II loading
SIX	Truss bridges, fracture critical bridges or bridges with fracture critical members Case I or II loading

863.05 Fabricator Evaluation and Required Qualifications. Fabricators requesting pre-qualification shall have a facilities inspection performed by OSE. A facilities inspection check list is included in this specification (Appendix I). During the inspection the fabricator will furnish OSE's representative with documentation to validate the fabricator meets the criteria listed below:

AISC Certification

Misc. - No AISC category required
Level 1 - Category SBr with P endorsement
Level 2 thru 5 - Category MBr with P endorsement
Level 6 - Category MBr with P and F endorsements

Welding procedure qualifications in conformance with 863.23

Qualified welders in conformance with 863.23

Inspection personnel meeting requirements of 863.052

863.051 Miscellaneous Level Required Qualifications. Fabricators requesting qualification for the Miscellaneous Level shall meet requirements listed in all sections of 863 except as follows: Sections 863.052, 863.06 ,863.061 and 863.081 shall not apply. Where quality control inspection is required by the QCFS or QCPS per section 863.052, the documentation and quality control shall be the responsibility of one employee designated by the Miscellaneous Level fabricator.

863.052 Personnel Qualifications. The fabricator shall designate at least one individual as Quality Control Fabrication Specialist (QCFS). The QCFS shall be a AWS Certified Welding Inspector qualified and certified in accordance with the provisions of AWS QC-1, Standard for Qualification and Certification of Welding Inspectors. The QCFS shall have a thorough understanding of the plans and specifications pertaining to the project. The QCFS shall be responsible for inspecting the work at all quality control (QC) points described in this specification and appendices. The QCFS is also responsible for assuring all equipment is in working order and inspected at the required intervals. The QCFS shall have the direct authority to stop work and report non-conforming work to the Contractor and OSE.

The fabricator shall furnish the QCFS with all tools and equipment necessary to perform quality control (QC) on all facets of the work. The person assigned as QCFS shall be designated the duties full time during the duration of the fabrication work specified in this supplemental specification. No other duties shall be assigned the QCFS that are not quality control inspection.

The fabricator shall designate one individual as Quality Control Paint Specialist (QCPS). The QCPS and the QCFS may be the same person. The QCPS shall have received formal training on paint inspection from one of the following firms: KTA Tator, S. G. Pinney, Corrosion Control Consultants or be NACE Certified. The QCPS shall be responsible for all quality control points (QCP) listed in sections 863.29 and 863.30. The QCPS shall have a thorough understanding of the plans and specifications pertaining to this project. The QCPS shall be responsible for inspecting the coating application equipment at required intervals. The QCPS shall have the direct authority to stop work and report non-conforming work to the QCFS, the Contractor and OSE. The person assigned as a QCPS shall be designated the duties full time during the duration of the coating work. The fabricator shall furnish the QCPS with tools and equipment to provide (QC) on all facets of the coating application

Personnel performing nondestructive testing of weldments shall be qualified in accordance with the American Society for Nondestructive Testings (ASNT) ANSI/ASNT CP-189-1995, Standard for Qualification and Certification of Nondestructive Testing Personnel. Only individuals qualified for NDT Level II may perform nondestructive testing. All nondestructive

testing shall be under the authority of the QCFS or can be performed by the QCFS if qualified.

The fabricator shall have a minimum QC staff level of one QCFS and one QCPS or one person qualified to perform both the QCFS and QCPS functions and the required NDT technicians to perform the non-destructive testing functions. The QCFS and QCPS shall be full time employees of the fabricator, except level one and two fabricators may choose to use outside personnel who meet the qualifications for the QCFS and/or QCPS. The use of outside QC personnel does not eliminate the requirements for the QCFS and QCPS being full-time during the project.

The qualifications of the QCFS, the QCPS, NDT personnel or outside agency personnel shall be approved prior to the fabricator being pre-qualified. Each QC specialist, NDT personnel or agency shall provide a resume listing, qualifications and work experience. QC specialists or NDT staff shall not be modified without the approval of OSE.

The QCFS and QCPS shall be responsible for documenting all inspection points (Appendix II) for each main material piece to show conformance with the requirements of this specification and contract documents. The fabricator is responsible for providing supervisory and any additional QC inspection personnel to control the work properly and to assure satisfactory materials and workmanship. The use of production staff or additional QC staff for specific quality control functions does not eliminate the QCFS's and/or QCPS's responsibility for documentation, QC and final acceptance of fabricated components at all required points.

863.06 Rating System. OSE shall evaluate the fabricator's level of quality during the fabrication process. This evaluation will include quality assurance reviews of shop drawings, material test reports, QC documentation, and shop QA inspection. The rating forms associated with these evaluations are in the Appendix II. OSE shall perform random and/or specific QA inspections. OSE may choose to waive any or all parts of the QA inspection.

The fabricator may also be evaluated by the District construction personnel concerning quality issues effecting field erection. If field evaluations are performed the results will be incorporated into OSE's final rating.

The Fabricator shall perform QC and provide documentation for each main material member at specified check, hold or witness points per Appendix II check lists.

Check points require QC inspection and documentation by the fabricator before the fabrication process continues.
Hold points require QC inspection and documentation by the fabricator before QA inspection can be performed by OSE. The fabrication process can continue after QA inspection.

Witness points require concurrent QC inspection by the fabricator and QA inspection by OSE to physically witness the welding or nondestructive testing .

The results of OSE and field construction QA evaluations shall be the fabricator's rating. This rating shall be reported to the fabricator and shall effect the future qualification of the fabricator as follows:

A Rated Fabricators: Fabricators that perform fabrication resulting in ratings of 90 percent and above, based upon the average of five*consecutive bid line numbers, within the last 24 months and with no individual rating less than 80 percent will be defined as an A rated fabricator. These fabricators shall have the A rating hold points and random QA inspection performed. The A rating hold point is a final shop inspection, prior to shipping or storage, for levels one thru five and all hold and witness points concerning level six. A single rating below 80 percent, or the average of five*consecutive ratings dropping below 90 percent, will result in the fabricator's pre-qualification being lowered to a B rating.

B Rated Fabricators: Fabricators that perform fabrication with ratings 89 to 80 percent, based upon the average of five*consecutive bid line numbers, within the last 24 months and with no individual rating less than 70 percent will be defined as a B rated fabricator. These fabricators shall have all B rating hold points and random QA inspection performed. The B rating hold points are: Radiographic film review, Ultrasonic Inspection witnessing, and final shop inspection prior, to shipping or storage, for levels one thru five and all hold and witness points concerning level six. A single rating below 70 percent, or the average of five* consecutive ratings dropping below 80 percent, will result in the fabricator's pre-qualification being lowered to a C rating.

C Rated Fabricators: The C rating is an interim level for fabricators, newly approved, to validate their QC performance and upgrade to the Department's B and/or A rating level. These fabricators shall have all C rating hold points and random QA inspection performed. The C rating hold or witness points are: Radiographic film review, Ultrasonic Inspection witnessing, Magnetic Particle Inspection witnessing, prime painting inspection and final shop inspection prior to shipping or storage for levels one thru five and all hold or witness points concerning level six .

The C rating is not a permanent qualification level for fabricators. Fabricators who fail to achieve an average rating above 79 percent but average between 70 to 79 percent based on five consecutive bid line numbers within the last 24 months, with no individual rating less than 60 percent, will be reduced one level on the pre-qualification list. The reduced level fabricator shall then have three additional consecutive bid line numbers, within the next 12 months to be averaged to achieve a B rating. Fabricators that still do not achieve a B rating will result in removal from the pre-qualified fabricator list. Any time the average of three consecutive ratings drops below 70 percent, the fabricator shall be removed from the Pre-qualified Fabricator List. The fabricator can request pre-qualification, 863.03, 36 months after removal.

Any rated fabricator that receives a single rating below 60 percent shall be removed from the Pre-qualified Fabricator List. The fabricator can request pre-qualification, 863.03, 36 months after removal.

Fabricators that are rated A and B must complete a minimum of five bid line numbers every two years. Fabricators not this active will be reduced to a C rated fabricator.

*Fabricators achieving an A or B grade in levels four through six must have a minimum of two projects out of the required five bid line numbers in the four through six level.

863.061 Fabricator Rating Review Process. Fabricator may request in writing a reconsideration of the performance rating by a board created by the Department. The board shall be comprised of the Deputy Director, Division of Engineering Policy or his representative, the Administrator of the Office of Structural Engineering or his representative and the Chief Structural Steel Inspector from the Office of Structural Engineering. The board shall hear appeals concerning the Fabricator's performance rating on a specific bridge bid line number. The board has no authority to hear appeals for revocation or suspension of a fabricator from the pre-qualification list.

Within ten days upon receipt of the Department's performance rating the Fabricator may write to the Office of Structural Engineering requesting that the board evaluate the rating. The Fabricator shall also submit additional documentation or evidence bearing on the performance of the work.

The Office of Structural Engineering shall schedule an informal hearing where the Fabricator shall have an opportunity to present Its case. The Department may have representatives at the hearing offering evidence in rebuttal. The board shall consider the evidence and issue its decision within fifteen days of the hearing.

863.07 General. All steel fabrication including the shop application of paint shall be performed in a Pre-qualified structural steel fabricating shop having permanent buildings of adequate size with equipment, heating and lighting facilities and experienced personnel to satisfactorily perform all necessary operations. Areas where flame cutting, air carbon-arc gouging, cambering, welding, cleaning and painting are performed shall be inside permanent buildings. The required air temperature levels shall be maintained while these operations are in progress. Shop assembly of large pieces for fit-up of field connections may be performed outdoors. These provisions will not apply to steel requiring fabrication at the bridge site in the repair, alteration or extension of an existing structure.

Where work consists of repairing and extending or altering existing structures the Contractor shall make such measurements of the original construction as may be required to join accurately old and new work. Shop drawings shall include these measurements. Measurements which may appear upon contract plans to indicate the extent and nature

of such repair or extension shall not relieve the Contractor of this responsibility.

Shop inspection or acceptance of shop drawings by the Department shall not relieve the Contractor of responsibility for erroneous or inconsistent dimensions, notations, omissions or other errors. All parts forming a structure shall be built in accordance with the contract. The Contractor will not be responsible for any contract plan errors.

The Fabricator shall notify OSE at least two weeks in advance of the beginning of shop fabrication, and furnish a proposed fabrication schedule for the work.

The Fabricator shall cooperate fully with the QA inspector, in his inspection of the work in progress. This shall include the storage of members completed during the QA inspector's absence, in such a manner, that he can completely and safely inspect the finished work, unless such hold or witness point inspections have received a written waiver.

Fabricated material shall not be shipped from the shop without prior hold point QA inspections unless such QA inspection is waived by OSE. Failure to conform to this requirement will result in a rating for the reference of 60 percent and reduction of the fabricator's rating to C or loss of pre-qualification if the fabricator's rating is currently a C.

Miscellaneous level structural steel members shall have final inspection performed at the pre qualified fabrication shop. Miscellaneous structural steel members that are not complete at the scheduled inspection, have been shipped to the job site without shop inspection or do not conform to the shop drawings supplied to the QA inspector will be cause for removal of the fabricator from the pre-qualification list. Complete shall be defined as final fabrication and coating with QC inspection, QC documentation and Contractor acceptance of shop drawings and material test reports. The miscellaneous level fabricator will be given a maximum of three written warnings within any 12 month period. The third warning will cause removal from the pre qualified list. The fabricator may be reinstated to the prequalified list after 12 months with a request for prequalification from the fabricator and performance of facilities evaluation by the Office of Structural Engineering.

The Fabricator shall provide office accommodations having a minimum floor area of 11 m^2 (120 square feet) and a minimum ceiling height of 2.1 m (7 feet). This office shall be equipped with adequate working and storage facilities, lighting and electrical outlets. It shall also contain a telephone with direct access to an outside trunk line which shall be for the exclusive use of the QA inspector.

In this specification where the terms "Main," "Secondary" or "Detail" are used, it shall be understood that reference has been made as follows: "Main," refers to material, members and fasteners that are primarily stressed by live load and structure weight; "Secondary," refers to material, members and fasteners that do not directly support live load or main members; "Detail," refers to material, members and fasteners that are essentially non stressed.

Where steel stamps are used for identification purposes, they shall be of the "mini-stress" or "stressless" type.

863.071 Fabricator Documentation Responsibility. The fabricator shall keep and maintain documentation records for each project bid line number concerning;

1. Fabricator approval
2. Shop drawing approval
3. Material test reports
4 Welding qualifications
5. Quality control inspection
6. Non Destructive Testing of welds

This documentation shall be made available for auditing, inspection and copying upon the Department's request. The documentation shall be archived for at least a five (5) year period from the date of final shipment from the fabrication shop.

Documentation systems are the fabricator's responsibility to establish. Quality control documentation shall include all material quality checks, dimensional checks, weld quality inspection, coating inspection checks, etc. to document both to the fabricator and to the Department that all fabrication has been thoroughly inspected and meets the specification requirements. Evaluation of the fabricator's performance by Departmental personnel, using forms defined in Appendix II, will include validation of the fabricator's actual records of inspection. This validation is intended to assure that rating of an individual component will reflect the overall quality of all components.

When establishing documentation records, processes and procedures the fabricator shall review the QA rating forms (Appendix II) which define the Department's QA requirements. The fabricator must establish sufficient QC requirements to perform quality fabrication. The QCFS shall provide a letter of acceptance for each QA inspection check point with a listing of each main member piece marks, dates of QC acceptance and specific check point data as noted on the QA rating forms.

863.08 Shop Drawing and Submittal Process. Structural steel and other metal structural elements which are to be assembled, main and secondary bridge structural steel or main bridge rehabilitation steel, finger joints, modular joints and non-standard joint sealing devices, pot bearings, spherical bearings and non-standard bearing devises and other similar items requiring either shop or field fabrication shall be detailed on shop drawings by the Contractor or Fabricator in accordance with AASHTO "Standard Specifications for Highway Bridges" and this supplemental specification.

Deviation from the contract plans or these shop drawings will not be permitted without the written order or consent of the OSE. Requests for such deviation or change shall be submitted in writing.

The Contractor's shop drawing submission shall include; a written acceptance letter and four copies of these drawings, unless additional copies are requested. The Contractor shall also furnish the fabricator's QCFS with one additional set of these drawings before the pre-fabrication meeting 863.081.

The Contractor shall accept these shop drawings and forward a submission to OSE. The submission shall be received by OSE, seven days before the pre-fabrication meeting, 863.081(levels 1 thru 6) or prior to the start of fabrication (miscellaneous level).

The pre fabrication meeting shall not be scheduled until the drawings have been received by OSE(levels 1 thru 6). Fabrication can begin after the prefabrication meeting is complete (levels 1 thru 6) or after receipt of these drawings (miscellaneous level).

The shop drawings shall be prepared by or under direct supervisory control of an Ohio registered professional engineer having personal professional knowledge of AASHTO Standard Specifications for Highway Bridges, AWS Bridge Welding Code D1.5 and Supplemental Specification 863. Each drawing of the four copies shall bear his or her signature and registration number or his or her Ohio Professional Engineer seal. The submitted shop drawings shall be free of all questions and comments.

The written acceptance from the Contractor shall document acceptance of the shop drawings including confirmation of field verification as required and descriptions of issues resolved between the Contractor, the Engineer, the Fabricator or the Department.

By accepting these shop drawings, the Contractor represents to the Department that all materials, field measurements, construction requirements, contract requirements, performance criteria and similar data have been verified. The Contractor further represents that these drawings have been coordinated and verified with the details of the work to be performed by other fabricators and entities on the project. No allowance for additional cost or delays will be made to the Contractor for incorrect fabrication as a result of failure to coordinate or perform this acceptance.

When changes on these shop drawings are requested by the Department, or the Contractor makes changes in addition to those expressly requested, the shop drawings shall be accepted as above with suitable revision marks to identify the changes.

For changes in location, addition or elimination of splices, acceptance shall be obtained prior to ordering material. After acceptance by the OSE, such plans shall be taken as supplemental to, but in no sense a substitute for, the contract. The QCFS shall be responsible for having documentation of any revised drawings or changes listed above

The prints shall be made from tracings, neatly and accurately drawn on sheets 559 mm x 864 mm (22 x 34 inches).

Shop drawings shall show details, dimensions, size of materials, match mark diagrams for

field connections, and other information necessary for the complete fabrication and erection of the metal work. These drawings shall also show a diagram identifying, by some unique mark, each area of a welded splice to be covered by a single radiograph.

The shop drawings for all multiple span beam and girder bridges shall include an overall layout with dimensions showing the relative unloaded vertical and horizontal position of beam or girder segments with respect to a full length base or work line; camber and horizontal curvature of the beams or girders and the effect of deck surface profile shall be accounted for in this relationship. Required offsets for vertical and horizontal curvature shall be shown at approximately each 1/4 of span length, at field splices and bearing points. Each horizontally curved member shall have offsets shown for each 3.0 m (10 feet) of length to a baseline strung from end to end of the member.

Shop drawings shall specifically identify each piece of steel as to grade(ASTM designation), CVN, Fracture Critical or any special testing requirements. Pieces made of different grades of steel shall not be given the same assembling or erecting mark, even though they may be of identical dimensions and detail.

The shop drawings shall indicate the welding procedure(WPS number) to be used for each joint. Locations and identification numbers of all radiographs taken shall be detailed on the shop drawings.

After all fabrication is completed, the Contractor shall have the Fabricator furnish a 35-millimeter microfilm copy of each shop drawing mounted on an aperture card in accordance with Supplement 1002 on file in the Department. If the details shown on a drawing apply to more than one bridge, an aperture card for that drawing shall be furnished for each bridge to which it applies, each card bearing the applicable bridge number. For structures carrying railroad traffic, an additional set of aperture card-mounted films or, at the option of the railroad, a set of full-size drawings on mylar shall be furnished for each railway company involved.

863.081 Pre-Fabrication Meeting. A pre-fabrication meeting (levels 1thru 6) shall be held at the fabricator's facilities, or another location agreeable to all parties, for review of any fabrication issues, including information on shop drawings, inspection, hold or witness points, unique fabrication items, special processes, scheduling, etc. for the project. Attendance at the meeting shall include the fabricator, the QCFS, the QCPS, OSE's QA inspector and may include the Contractor, or designated representative. The meeting will be conducted by the QCFS, who will also be responsible for distribution of minutes of the meeting documenting all issues discussed.

The time of the meeting shall be agreeable to all parties but no earlier than 7 days after receipt of Contractor accepted shop drawings, 863.08. Fabrication can begin after the prefabrication meeting is complete (levels 1 thru 6). Prefabrication meetings are not required for the Miscellaneous level

863.09 Material. Structural steel and other structure metals shall conform to 711, except steel bar stock utilized for end dams and scuppers may be any weldable grade of low or mild carbon steel commercially available. Welded shear studs shall conform to the AASHTO/AWS Bridge Welding Code, as amended by Supplement 1011. Steel plates for main and secondary members shall be cut and fabricated so that the primary direction of rolling is parallel to the direction of the main tensile or compressive stresses.

For these materials the Contractor shall submit certified test data to the OSE showing compliance with the requirement of 711. All certified test data shall be accompanied by copies of mill shipping notices or invoices showing the quantity and size of material being accepted.

The Contractor shall check this material data, provide a letter of written acceptance then forward the submission to OSE seven days prior to member shipment(level 1 thru 6) or prior to final OSE inspection (miscellaneous level).

A single copy of this material data is required for each structure, except where the structure carries railway traffic. Then one additional copy shall be submitted for each railway company involved.

Additionally for Level one through six structural steel members, one copy of main material, certified test data with a letter documenting the QCFS acceptance shall be given to the QA shop inspector before the material passes check point one.

Materials will not be accepted for shipment from the fabrication shop until the Contractor accepted material data is received by the OSE.

When electrodes to be used are not included in the Laboratory's list of approved electrodes and combinations of shielding, certified test data showing compliance with CMS section 711.08 shall be submitted to the Office of Materials Management.

863.10 Material Control. Each piece of steel to be fabricated shall be properly identified for the Engineer or QA Inspector.

The issuance of cutting instructions by the Fabricator to the shop shall be by cross-referencing of the assembly marks shown on the shop drawings with the corresponding item covered on the mill purchase order. The Fabricator's system of assembly-marking individual pieces of steel and the aforementioned issuance of cutting instructions shall be such as to provide a direct reference to the appropriate mill test report.

The Fabricator may furnish from stock, material that he can identify by heat number and mill test report. Any excess material placed in stock for later use shall be marked with the

heat number and the ASTM A 6 specification identification color code, if any, when separated from the full-size piece furnished by the supplier.

During fabrication, each piece of steel shall show clearly and legibly its specification identification color code and heat number. Individually marked pieces of steel which are used in furnished size, or reduced from furnished size only by end or edge trim, that does not disturb the heat number or color code or leave any usable piece, may be used without further color coding provided that the heat number and color code remains legible.

Pieces of steel which are to be cut to smaller size pieces shall, before cutting, be legibly marked with the ASTM A 6 specification identification color code and heat number.

Individual pieces of steel which are furnished in tagged lifts or bundles shall be marked with the ASTM A 6 specification identification color code and heat number immediately upon being removed from the bundle or lift. Pieces of steel which will be subject to fabricating operations such as blast cleaning, galvanizing, heating for forming, or other operations which might obliterate paint color code and heat number marking, shall be marked with steel stamps or by a substantial tag firmly attached or shall be approved by the QA Inspector for obliteration of material identify markings. Main material tested for CVN shall have heat numbers steel stamped into the material at locations acceptable to OSE.

The QCFS shall document by a cover letter documenting QCFS acceptance that material control is performed per specification.

863.11 Care of Material. Structural material shall be stored at the shop or field above the ground, upon platforms, skids or other supports. It shall be straight and have clean and dry surfaces before being worked in the shop. Any rusted or corroded material shall be cleaned prior to use and shall meet ASTM A 6 thickness tolerances after cleaning. The QCFS shall provide a cover letter documenting QCFS acceptance stating that care of material is performed per specification.

863.12 Workmanship and Straightening. If straightening of rolled material is necessary, it shall be done by methods that will not damage the member. When carefully planned and supervised, the application of localized heat is permitted for straightening. The temperature of the heated area shall not exceed 620° C (1150° F) as controlled by pyrometric stick or thermometers. Quenching to accelerate cooling is prohibited.

Fabricated structural steel shall be within the dimensional tolerances specified by Arts. 3.5 and 9.19 of the AASHTO/AWS Bridge Welding Code except where indicated otherwise in these specifications, and with the following additions: Waviness, the deviation of the top or bottom surface of a flange from a straight line or plan curvature, shall not exceed 3 mm (1/8 inch) when the number of waves in a 3.0 m (10 foot) length is four or less, or 1.6 mm (1/16 inch) when more than four, but sharp kinks or bends shall be cause for rejection. For the measurement of camber during lay down, the bearing points shall be relatively

positioned both horizontally and vertically to plan dimensions ± 3 mm (± 1/8 inch). Rolled beams shall be cambered as called for on the plans in the pre-qualified fabricating shop by use of heat or hydraulic jacks. Heating shall be controlled as specified above and follow a formal shop heating procedure. Plate girders shall be cambered by trimming web plates prior to assembly.

Camber shall be measured as the vertical offset between the steel and the common base line extending from abutment bearing to abutment bearing. The maximum camber tolerance at mid span shall be - 0 mm (in.) and the greater of + 19 mm (3/4 inch) or the designed haunch height. The maximum camber tolerance at mid span shall be prorated between the center of the span and each adjacent bearing to provide a smooth unbroken curve. The camber tolerances in Art. 3.5.1.3 of the AASHTO/ AWS Bridge Welding Code shall not apply.

During fabrication, shipping and erection, members shall be so supported and handled that camber is maintained.

The QCFS shall provide a cover letter documenting QCFS acceptance that workmanship and straightness are performed per specification.

863.13 Finish. Sheared edges of all main material shall be planed to a minimum depth of 6 mm (1/4 inch) except for ASTM A709 grade 36 material having a thickness of 16 mm (5/8 inch) or less. Burrs shall be removed. All fins, tears, slivers and burred or sharp edges that are present on any steel member shall be removed by grinding. If these conditions appear during the blasting operation, they shall be removed by grinding and the area re-blasted to the required surface profile.

Structural steel permitted by these specifications may be flame cut, provided a smooth surface free from cracks and notches is secured and provided that an accurate profile is secured by the use of a mechanical guide. Rolled and flame cut surfaces shall meet the requirements of the AASHTO/AWS Bridge Welding Code, as amended by Supplement 1011. The surface finish of bearing and base plates and other bearing surfaces that are in contact with each other or with concrete shall meet the ANSI surface roughness requirements as defined in ANSI B46.1, Surface Roughness, Waviness and Lay, Part I:

ANSI	
Steel slabs	50.0a m (2000)
Heavy plates in contact in shoes to be welded	25.0a m (1000)
Milled ends of compression members, milled or ground ends of stiffeners and fillers	12.5a m (500)
Bridge rollers and rockers	6.4a m (250)
Pins and pin holes	3.2a m (125)
Sliding bearings	3.2a m (125)

The QCFS shall provide a cover letter documenting QCFS acceptance that material finish is performed per specification.

863.14 Stiffeners. The bearing ends of bearing stiffeners shall be flush and square with the web and shall have at least 75 percent of this area in contact with the inner surface of the flange. The other end of the stiffener shall have a tight fit as defined below. Bearing stiffeners shall be positioned to be vertical after erection. Intermediate stiffeners which are not used in pairs shall be welded to the compression flange, the tension flange shall be a tight fit. Intermediate stiffeners to which cross frame angles are connected shall be welded to the top and bottom flange. A tight fit is defined as one in which the stiffener and flange are in physical contact over some portion of the end of the stiffener and having no gap in excess of 1.6 mm (1/16 inch). Welds attaching stiffeners to the web plate shall not extend into the clip area. All stiffeners shall be clipped to clear flange-web welds and fillet or rolled shapes. The clip shall be 65 mm (2 ½ inches) along the web and 25 mm (1 inch) along the flange.

The QCFS shall provide a cover letter documenting QCFS acceptance that stiffener details are performed per specification.

863.15 Fillers. Fills shown on the shop drawings shall be dimensioned to the nearest 1.6 mm (1/16 inch) in thickness, but not less than 3 mm (1/8 inch) thick, based on the dimensions for detailing and intended relative position of the abutting elements to be spliced. However, in the final shop assembly, fills shall be furnished with thicknesses sufficient to compensate for any misalignment of abutting elements due to standard rolling mill tolerances or differences in thicknesses of flanges and webs at the splice location. The actual fills used shall be such as to compensate for differences in total thickness or relative positions of more than 1.6 mm (1/16 inch). Fill plates in bolted joints shall be made flush with the perimeter of the splice plates and not be tack welded. The QCFS shall provide a cover letter documenting QCFS acceptance that fills are performed per specification.

863.16 Horizontally Curved Beams and Girders. Beams and girders shall be heat curved as specified by AASHTO Standard Specifications for Highway Bridges, except that flanges for girders may be cut to shape. When members are to be heat curved, the detailed procedure including necessary calculations shall be submitted to OSE for acceptance prior to starting work. The QCFS shall provide a cover letter documenting QCFS acceptance that heat curving procedures are performed per specification.

863.17 Joints and Splices. In bolted construction where tension or flexural members are spliced, not more than 6 mm (1/4 inch) clearance will be allowed between the abutting surfaces of spliced members. For spliced compression members, the abutting surfaces shall be truly faced so as to have a uniform bearing when properly aligned and completely

bolted.

In welded construction, all abutting surfaces shall receive the proper joint preparation as shown on accepted shop drawings. The preparation for field welded butt joints in main members shall be verified by a complete shop assembly as specified in 863.26. The opening in any joint, which is located in the finished structure so as to permit the entrance of water, shall be filled as directed by the Engineer with an approved caulking before paint is applied.

The QCFS shall provide a cover letter documenting QCFS acceptance that joints and splices are performed per specification.

863.18 Pin Holes. Pin holes shall be bored true to size, at right angles to the axis of the member and parallel to each other. The boring shall be done after the member is completely fabricated. Pin holes for up to 127 mm (5 inch) diameter pins shall not exceed the pin diameter by more than 0.51 mm (0.020 inches); holes for larger pins shall not exceed the pin diameter by more than 0.79 mm (0.031 inches). The QCFS shall provide a cover letter documenting QCFS acceptance stating that pin holes are performed per specification.

863.19 Pins and Rollers. Pins and rollers shall be of cold rolled steel and accurately turned to size; they shall be straight and smooth and entirely free from flaws. Pins over 230 mm (9 inches) in diameter shall be annealed. In pins larger than 230 mm (9 inches) in diameter, a hole not less than 50 mm (2 inches) in diameter shall be bored full length along the axis. One pilot and one driving nut shall be furnished for each size of pin. The QCFS shall provide a cover letter documenting QCFS acceptance stating that pins and rollers are performed per specification.

863.20 Holes for High-Strength and Bearing Bolts. Holes shall be cylindrical, perpendicular to the member, clean cut, and free of ragged edges. All burrs shall be removed by countersinking not more than 1.6 mm (1/16 inch) or by grinding. The finished size of the holes for high-strength bolts shall be not larger than nominal diameter of the bolt plus 1.6 mm (1/16 inch), and for bearing type bolts, the holes shall provide a driving fit. The diameter shall not vary by more than 0.8 mm (1/32 inch) from a true circle for 85 percent of the holes in a contiguous group, and not more than 1.6 mm (1/16 inch) for the remainder.

Punched holes shall be made with a die whose diameter does not exceed that of the punch by more than 1.6 mm (1/16 inch). Reaming and drilling shall be done with twist drills and, wherever possible, the reamer shall be directed by mechanical means. Holes for shop bolts shall be sub-punched or sub-drilled 5 mm (3/16 inch) less in diameter than the nominal diameter of the bolt, and shall be reamed to size with the parts assembled, except:

1. A709 grade 36 material thicker than 19 mm (3/4 inch) and grade 50 or 50W steel

thicker than 16mm (5/8 inch) shall not be punched.
2. Materials assembled and adequately clamped together may be drilled full size.
3. Secondary and detail material of A709 Grade 36 steel not thicker than 19 mm (3/4 inch) and grade 50 or 50W steel not thicker than 16 mm (5/8 inch) fastened with high strength bolts may be punched full size.

Holes for field bolts shall be made in the same manner as holes for shop bolts except:

1. Field splices in and connections to main material shall be reamed or drilled assembled per 863.26.
2. Assemblies such as floor beams connected to girders and rolled beam spans connected by diaphragms may be made through steel templates.

All holes punched full size, sub-punched, or sub-drilled shall be located with sufficient accuracy such that after assembling (before sub-punched or sub-drilled holes are reamed) a cylindrical pin 3 mm (1/8 inch) less in diameter than the nominal size of the punched hole may be entered perpendicular to the face of the member without drifting in not less than 75 percent of the contiguous holes in the same plane. All holes shall permit a pin 5 mm (3/16 inch) smaller than the nominal size of the punched holes to be inserted in the above manner. After holes are reamed or drilled full size, 85 percent of the holes in any contiguous groups shall have no offset greater than 0.8 mm (1/32 inch) between adjacent plies. The remainder of the holes shall not be offset more than 1.6 mm (1/16 inch) between adjacent plies. Plugging of improperly located holes is not permitted unless written approval has been obtained from the OSE. Steel templates shall have hardened bushings in holes accurately located in relation to the centerline of the connection as inscribed on the template. Where holes are made using a roto-broach, shell drill or other similar tool, hardened bushings need not be used in the template. The template shall be accurately positioned and bolted or clamped firmly in place prior to its use in reaming or drilling full size holes.

Templates used for reaming matching members or the opposite faces of a single member shall be exact duplicates. Templates used for connections on like parts or members shall be located with sufficient accuracy that the parts or members are duplicates and require no individual match marking.

Holes through multiple piles shall be reamed or drilled full size only when the plies of the joint are held tightly together with bolts or clamps. The joint shall also be pinned if the holes have been sub-punched or sub-drilled. The plies shall be disassembled and cleaned of burrs and shavings prior to final assembly.

Contractor shall have the option to drill or punch bolt holes full sized in unassembled pieces and/or connections including templates for use with matching sub-sized and reamed holes, by means of suitable numerically controlled (N/C) drilling or punching equipment. If N/C drilling or punching equipment is used the Contractor will be required to demonstrate the accuracy of the drilling or punching procedure according to 863.26

Other methods of preparing holes for high strength bolts may be given consideration upon written request to the OSE.

The QCFS shall provide a cover letter and specified check point data documenting QCFS acceptance that holes have been performed per specification.

863.21 High-Strength Steel Bolts, Nuts and Washers. High strength steel bolts, nuts and washers shall meet the provisions of 711.09.

1. General. The Engineer shall be furnished the necessary access to the work in order to observe the installation, tightening and checking of the bolts.

Based on the experience gained by the Engineer and Contractor during the use of the below described installation and inspection procedures for a particular bridge, the Engineer may elect to modify the amount of testing specified in order to expedite the work while still accomplishing properly compacted joints and tightened bolts. Consideration will be given to the use of other fastening systems or assemblies and bolt tightening procedures, if a written request is submitted to the Office of Structural Engineering in accordance with 108.05. The required bolt length shall be determined by adding to the grip the value shown in Table 1. The table values are generalized, with an allowance for manufacturing tolerances, to provide for the nut and positive "stick-through" at the end of the bolt. For each hardened flat washer that is used, add 4 mm (5/32 inch); and for each beveled washer, add 8 mm (5/16 inch). The length determined by the use of Table 1 should be adjusted to the next longer 6 mm (1/4 inch); when installed, the end of the bolt shall be flush with or project several thread lengths outside the face of the nut.

TABLE 1

Bolt Size	To determine required bolt length, add to grip*
mm	mm
M16	24
M20	28
M22	31
M24	35
M27	38
M30	41
M36	47

TABLE 1

Bolt Size	To determine required bolt length, add to grip*
inches	inches
½	11/16
5/8	7/8
3/4	1
7/8	1-1/8
1	1-1/4
1-1/8	1-1/2
1-1/4	1-5/8
1-3/8	1-3/4
1-1/2	1-7/8

*Total thickness of all connected material exclusive of washers.

Washers may, when necessary, be clipped at one location not closer than 7/8 of the bolt diameter from the center of the washer.

2. Preparation. Joint surfaces, including those adjacent to the bolt heads, nuts or washers, shall be free of paint (except for inorganic zinc primers), lacquer, dirt, oil, loose scale, rust, burrs, pits and other substances or defects which would prevent solid seating of the parts or would interfere with the development of complete frictional contact. No gaskets or other yielding material shall be interposed.

Bolts, nuts and washers shall have a residual coating of lubricant when received. Bolts, nuts and washers without their original lubrication shall not be used.

3. Installation. In the final assembly of the parts to be bolted, drift pins shall be placed in a sufficient number of holes (preferably not less than 25 percent for field erection) to provide and maintain accurate alignment of holes and parts, and sufficient bolts shall be installed and brought to a snug tight condition to bring all parts of the joint into complete contact. However, in each flange and web of each beam or girder a minimum of two drift pins shall be used. Snug tight shall be defined as the tightness attained when an impact wrench begins to impact or when the full effort of a man using an ordinary spud wrench is applied. Bolts shall then be installed in any remaining open holes and tightened to a snug tight fit, after which all bolts shall be tightened completely by the turn-of-nut method. Where difficulty is experienced with the fit of the connection and the bolts are used to draw the elements into contact, the bolts in the affected portion of the connection shall be checked for sustained snug tightness after all the bolts are installed. Drift pins shall then be replaced with bolts tightened in the same manner. Field Reaming of full sized shop holes shall not be allowed.

After the bolts are snug tight, the outer face of the nut shall be match-marked with the protruding portion of the bolt to provide the Engineer visual means of determining the relative rotation occurring between the bolt and nut during the process of final tightening. Such marks shall be made by the wrench operator with crayon or paint.

Each bolt shall have a hardened washer under the element (nut or bolt head) turned in tightening. Where an outer face of the bolted parts has a slope of more than 1:20 with respect to a plane normal to the bolt axis, a smooth beveled washer shall be used to compensate for the lack of parallelism. Galvanized A 325M (A 325) bolts shall not be reused. Re-tightening previously tightened bolts, which have become loose by tightening adjacent bolts, is not considered a reuse.

4. Tightening. Tightening of the bolts in a joint should commence at the most rigidly fixed or stiffest point, and progress toward the free edges, both in the initial snugging up and in the final tightening. If required because of bolt entering and wrench operation clearances, tightening may be done by turning the bolt. Impact wrenches, if used, shall be of adequate capacity to perform the required tightening of each bolt in approximately ten seconds.

5. Bolt Tension. Each bolt shall be tightened to provide, when all bolts in the joint are tight, at least the minimum bolt tension shown on Table 2 for the size of bolt used.

TABLE 2

Bolt Size mm	Bolt Tension* kN, minimum A 325 M
M16	91
M20	142
M22	176
M24	206
M27	267
M30	327
M36	475

TABLE 2

Bolt Size inches	Bolt Tension* kips, minimum A 325
½	12
5/8	19
3/4	28
7/8	39
1	51
1-1/8	56
1-1/4	71
1-3/8	85
1-1/2	103

*Equal to 70 percent of specified minimum tensile strengths of bolts, rounded off to the nearest kN (kip).

The bolt tension specified in Table 2 shall be attained by tightening all bolts in the joint the applicable amount of nut rotation specified in Table 3 by the turn-of-nut method.

TABLE 3
NUT ROTATION FROM SNUG TIGHT CONDITION

	Disposition of Outer Faces of Bolted Parts		
Bolt Length (as measured from underside of head to extreme end of point)	Both faces normal to bolt axis	One face Normal to bolt axis and other face sloped not more than 1:20 (bevel washer not used)	Both faces sloped not more than 1:20 from normal to bolt axis (bevel washer not used)
Up to and including 4 diameters	1/3 turn	½ turn	2/3 turn
Over 4 diameters but not exceeding 8 diameters	½ turn	2/3 turn	5/6 turn
Over 8 diameters but not exceeding 12 diameters	2/3 turn	5/6 turn	1 turn

Nut rotation is relative to bolt, regardless of the element (nut or bolt) being turned. For bolts installed by ½ turn and less, a tolerance of plus or minus 30° is permitted. For bolts installed by 2/3 turn and more, a tolerance of plus or minus 45° is permitted.

6. Inspection. (a) The first completed connection of each bridge on the project and as many subsequent connections as are deemed necessary by the Engineer shall be inspected as per paragraph (b) below. Thereafter, where the Engineer has approved the joint compactness and snug-tight condition of bolts prior to bolt tightening by the turn-of-nut method, the bolt tension as required in Table 2 shall be considered as attained if the amount of nut rotation specified by Table 3 is verified by the required match-marking.

(b) Bolts shall be inspected by the use of manual torque wrenches furnished by the Contractor. This testing shall be witnessed by the Engineer and shall be performed to his satisfaction. The inspection wrenches shall be calibrated at least once each working day in a device capable of indicating bolt tension. In this device, which shall have been approved by the Engineer, three bolts representative of the grade, size, length and condition used in the structure shall be placed and tensioned individually. A washer shall be used under the part being turned.

(c) Each of the three bolts shall be tightened in any convenient manner to the tension shown in Table 2. Then, the inspection wrench shall be applied by a slow steady pull to the tightened bolt and the torque required to turn the nut or head 5 degrees, approximately 25 mm (1 inch) at a 300 mm (12 inch) radius, in the tightening direction shall be determined. The average torque measured in the tensioning of the three bolts shall be taken as the job inspection torque.

(d) Bolts represented by the sample described in paragraph (b) which have been tightened in the structure, shall be inspected by applying, in the tightening direction, the inspection wrench and its job inspection torque to 10 percent of the bolts, but not less than two bolts, selected at random in each connection. If no nut or bolt head is turned by this application of the job inspection torque, the connection will be accepted as properly tightened. If any nut or bolt head is turned by the application of the job inspection torque, this torque shall be applied to all the bolts in the connection, and all bolts whose nut or head is turned by the job inspection torque shall be tightened with the inspection wrench to the job inspection torque. The connection shall then be reinspected in the original manner.

7. Calibration Devices. Each calibration device shall be periodically examined by a manufacturer of such devices or by a qualified testing laboratory. Such examination shall be made at least once each year or more often if requested by the Engineer. The testing agency shall certify that each calibration device furnishes, after re-calibration if necessary, an accurate indication of actual bolt tension.

The QCFS shall provide a cover letter documenting QCFS acceptance that any shop applied bolts have been performed per specification.

863.22 Bearing Bolts. Turned, ribbed or other approved bearing type bolts shall meet the provisions of CMS 711.10. The bolts shall be of sufficient length to project at least 6 mm (1/4 inch) beyond the nut when tightened, and the threads on the projecting end shall be

burred. The thread shall not extend into the shear planes of the contact surfaces between the connected parts. In determining whether the bolt threads are excluded from the shear planes, thread length of bolts shall be calculated as two thread lengths greater than the specified thread length as an allowance for thread run out. A washer not thicker than 6 mm (1/4 inch) may be used under the nut. The QCFS shall provide a cover letter documenting QCFS acceptance that shop applied bolts have been performed per specification.

863.23 Welding. All welding shall be performed by the shielded metal-arc, submerged arc, flux cored arc, or stud welding process. Consideration will be given to other methods of metal-arc welding if a written request is submitted to the OSE in accordance with CMS 108.05.

In other respects, the AASHTO/AWS Bridge Welding Code, as amended by Supplement 1011 shall govern the work. Welding performed on main members requires procedure testing (PQR) and an approved welding procedure (WPS). The shielded metal arc welding(SMAW) process is considered pre-qualified, and does not requires procedure testing(PQR) but requires an approved welding procedure(WPS). The fabricator shall have an approved PQR, WPS and Welder Qualifications prior to Fabricator Pre-qualification.

If after two repairs to the same area of a weld requiring radiographic quality, there is any part of the original defect remaining or there is a new reject able indication the OSE shall have the right to have the total joint cut apart, all deposited weld metal removed, joint preparation made and the total joint re-welded.

Copies of the accepted shop welding procedures (WPS) shall be posted at each welding location.

The designated QCFS and QA inspectors shall be physically at the facility during all fracture critical (FCM)welding. The fabricator shall not perform FCM welding without prior scheduling with the QCFS and the QA inspectors. The QCFS shall witness at the minimum percentages specified in appendix II, check all welding processes and provide a cover letter with specific check point data. This QCFS acceptance is required for each FCM member weld. For non FCM welds the QCFS shall make frequent inspections, check all welding processes and provide a cover letter with specific check point data documenting acceptance of the welds for each main member.

863.24 Stud Shear Connectors. Stud welding shall conform to the requirements of 863.23 , to the AASHTO/AWS Bridge Welding Code, as amended by Supplement 1011, and the following.
Stud shear connectors that are to be welded to the top flanges of beams or girders may be placed after the steel has been erected and suitable scaffolding or deck forming has been provided. Studs that are to be welded to beam or girder webs, end dams, bearing

plates, or to other secondary members and detail material may be placed in the shop. In addition to the stud bend tests of Article 7.6.6.1 of the AASHTO/AWS Bridge Welding Code, bend tests of stud shear connectors shall also be made at the start of each work day, when welding has been interrupted for an hour or more, when changing grounds, when changing weld settings or when changing cable loop due to arc blow. In any case, no more than 500 studs shall be welded to a beam or girder without the welds being field bend tested in accordance with the specified procedure. All tested studs that show no sign of failure as determined by the Engineer may be left in the bent position.

863.25 Threads for Bolts and Pins. Threads for bolts and pins shall conform to the Unified Standard Series ANSI B1.13M (ANSI B1.1-UNC) Class 6g (2A) for external threads and Class 6H (2B) for internal threads, except that pin ends having a diameter of 35 mm (1 3/8 inches) or more shall be threaded 4.23 mm/thread (6 threads to the inch). The QCFS shall provide a cover letter documenting QCFS acceptance that threading for bolts has been performed per specification.

863.26 Shop Assembly. All contact surfaces shall be free of paint, grease, oil, rust, loose mill scale and protruding edges or burrs. The flanges and webs shall not be assembled and welded to form girders or other similar members, nor shall any fabrication or assembly which would interfere with the repair of a butt weld be accomplished until radiographs of all butt welds in the component parts are examined and approved by the QCFS for the A rated fabricators or the QA inspector for B and C rated fabricators unless waived by the OSE.

All fit-up work shall be done with the members assembled in their unloaded position as shown on the shop drawing layout required by 863.08. While assembled in the shop, members shall be adequately supported to prevent misalignment or deflection, especially at joints. Supports shall be designated to prevent settlement during the fit-up, reaming or drilling of connections. The QCFS shall maintain records of the actual dimensions and relative positions of each assembly for each offset required by 863.08 and furnish a copy to the QA inspector, upon request. This provision shall apply to both horizontal and vertical dimensions. Members that become a part of two assemblies shall be repositioned for the second assembly to the dimensions recorded for the first assembly.

All connecting parts assembled in the shop for the purpose of reaming or drilling of holes for field connections or for fit-up of field welded connections shall be match-marked with steel stamps prior to disassembly.

Continuous beam and plate girders including sections adjacent to hinged, pin connected, sliding or rocker bearing joints shall have at least three adjacent segments assembled and holes reamed or drilled while assembled. The fit-up of field welded connections shall be checked by similar shop assembly.

Longitudinal or transverse beams and girders to which diaphragms and floor beams frame

or connect shall be shop assembled to check fit-up of connections to be field welded or to ream or drill holes for bolted connections. Trusses shall be assembled in lengths not less than three abutting panels before field connections are drilled or reamed while assembled.

When the Contractor elects to use numerically controlled (N/C) drilling or punching, assembly shall be performed as specified. Other methods of checking hole alignment and match marking may be given consideration upon written request to the OSE. If the Contractor's proposed methods of CNC assembly fail to produce specified results, the OSE can require the Contractor to perform the work per 863.20 and 863.26 at no additional cost to the Department.

Deck expansion devices shall be shop assembled after fabrication to check fit-up, straightness and roadway cross slope changes. Where a phased construction sequence is a mandatory part of the contract plans, part-width deck segments may be fabricated without the required shop assembly if shop drawings have incorporated a lay down, similar to 863.08, defining vertical offset dimensions from a full length common baseline to all roadway changes including sidewalks, rounding, crowns and field splice points of the expansion device.

Parts not completely assembled in the shop shall be secured by bolts, as far as practicable, to prevent damage in handling and shipping. Field splice plates shall be bolted in their final position in the shop or shifted laterally with respect to their final position so that the ends of the plates are flush with the ends of the member. Welding or tacking will not be permitted on bolted assemblies unless by written acceptance from OSE. Welding authorized shall be performed according to 863.23.

The QCFS shall provide a cover letter and specific check point data documenting QCFS acceptance that shop assembly has been performed per specification.

863.27 Nondestructive Testing. Nondestructive testing (NDT) shall conform to the AASHTO/AWS Bridge Welding Code, as amended by Supplement 1011, and this item. Welded repairs in main members for thick scabs, deep kerfs or nicks and similar gross flaws shall be subject to ultrasonic or radiographic inspection as directed by the OSE or Engineer (field repairs). All examined welds and base metal adjacent to a welded joint shall be subject to the quality requirements specified in 863.23. Welds requiring nondestructive testing shall be allowed to cool before they are tested.

The Contractor or Fabricator shall notify the Department in advance of specified non-destructive testing. Such notification is required even if specific QA hold or witness point inspections are not required for A and B rated fabricators.

Where controversy may arise, regarding the interpretation of radiographs, magnetic particle indications or the acceptability of welds, the OSE has the final authority to accept the welds. Field radiographic inspection shall be accepted by the OSE prior to subsequent construction activities that would make weld repair inaccessible.

1. Radiographic Inspection of Welds. All members subject to radiographic testing shall have the welds ground smooth. Web splices shall be ground only where radiographed, except at outside fascia surfaces which shall be ground full length. Radiographic inspection shall be made of the following welds:

(a) The full length of all butt welds in flange material of plate girders or rolled beams. 100% of butt welds in back up bars that remain in the structure.

(b) The top and bottom one-third of transverse web splices in plate girders or rolled beams including any cope holes.

(c) Butt welds in longitudinal stiffeners attached to tension areas of webs.

(d) Twenty-five percent of each longitudinal web splice as selected by the inspector.

(e) Full length of field flange cut repairs.

(f) Any other weld specified by the Contract or AWS Bridge welding code.

The radiograph identification mark shown on the shop drawing layout shall be steel stamped in the area marked "Weld Identification" of Figures 6.1A thru 6.1D of the AASHTO/AWS Bridge Welding Code in a manner to make it visible in the radiograph of the area without resorting to superimposed like markings. Steel Stamped identification marks on flange plates shall be placed so that after assembly of girders, they will be on the inside of flange, but out of the area to which the web will fasten. Films of repaired welds shall also be identified by the letter "R". Steel Stamped identification numbers shall not be placed within the weld area. Other required markings shall be made by using superimposed characters. Where areas being radiographed are adjacent to the edge of the plate, the film shall be located and a technique employed which will include the top and bottom images of the plate edge. Films 114 by 432 mm (4 ½ by 17 inches) shall be used where practicable. The minimum film size shall be 114 by 254 mm (4 ½ by 10 inches).

Whenever an unacceptable weld occurs in the web sections enumerated, an adjoining 300 mm (12 inch) length of weld not previously examined shall be radiographed. If unacceptable flaws are found in this adjoining segment, the remainder of the weld (if any) shall be examined.

Radiographs shall be submitted to the OSE for acceptance and shall be accompanied by certification from the Contractor or Fabricator that the radiographic examination was performed in conformance to these specifications, field sketches and by two copies of the radiographic technician's analysis report listing unacceptable defects and causes for rejection. The technician's report shall include identification and energy level or source strength in becquerels of the radiation source, film to source distance, film type, and exposure time for each radiograph as well as the signature of the technician and his NDT level. The contact films shall become the property of the Department. Field main material

repairs shall have sketches which clearly show specific locations, lengths and depths of field cuts or damages repaired by field welding.

2. Magnetic Particle Inspection of Welds. All welding required in the fabrication of each beam or girder shall be completed and all visual defects shall be corrected prior to the examination by magnetic particle inspection. Dry powder magnetic particle inspection shall be made of at least 0.3 m (1 foot) of each 3.0 m (10 feet) or fraction thereof for each size of weld in the following:

(a) Flange-to-web welds, including ends of girder after trimming.
(b) Moment plate to flange welds
(c) Bearing stiffener welds
(d) Other welds designated by the Contract or AWS Bridge Welding Code.

Test sections shall be random locations selected by the QA inspector and/or the QCFS, and the examination shall be conducted with the QA inspector observing for C rated fabricators, unless waived by OSE. The Fabricator shall position the welds as necessary for the inspection with consideration of safety and convenience to the inspecting personnel.

Welds shall be inspected after they have been cleaned. When magnetic particle testing is used, the procedure and techniques shall be in accordance with the the dry powder magnetic-particle examination of welds using the prod or the yoke method per AWS 6.7.6. The prod test equipment shall have a functioning ammeter. The prod magnetizing current shall be 100 amperes per 25 mm (inch) of prod spacing but not less than 400 amperes. Only aluminum prods shall be permitted.

When unacceptable defects are found in a section, both adjacent 1.5 m (5 foot) segments or the full length of the weld if it is a lesser amount shall be tested. Welds requiring repair shall be retested after repairs are complete. Consideration will be given to performance of MPI inspections prior to complete welding, if the fabricator's quality control plan is acceptable to the Department and additional processing does not produce a potential for cracking.

Not all of the enumerated surface defects of Article 9.21 of the AASHTO/AWS Bridge Welding Code will be located by an inspection of this type. Welds shall be considered unacceptable if they produce such indications that are in excess of the above quality standards.

The Fabricator shall record the piece mark, the location on the member, the defect description and the proposed repairs for any defects found.

3. Ultrasonic Testing of Welds. Ultrasonic inspection shall be made of the following:

(a) Complete joint penetration flange-to-web, T or corner joints, 25% for non FCM, 25% compression or shear FCM and 100%. Tension FCM.

(b) Complete penetration butt welds 100% tension FCM and 25% compression FCM,

(c) Other welds designated by the Contract or AWS Bridge Welding Code.

The QCFS shall provide a cover letter, specified certification, sketches and technician reports documenting QCFS acceptance that nondestructive testing has been performed per specification.

863.28 Shipping, Storage and Erection. Members damaged by improper handling, storing, transportation or erection shall be repaired or replaced, at the discretion of the OSE, at no expense to the Department.

During transportation, adequate blocking shall be in place between members to prevent movement and facilitate unloading. Field connection holes shall not be used for tie-down, unless they are reinforced by additional plates, angles or other material bolted in place. Bearing components shall be banded together.

Material to be stored either in the fabricating shop or in the field shall be placed on skids or blocks to prevent the metal from coming in contact with the ground. Girders and beams shall be placed and shored in an upright position for shipment ,field storage and shop storage. Field splice plates shall be bolted in their final position or shifted laterally with respect to their final position. All material shall be kept clean and properly drained. Bearing devices and anchorages shall be installed according to 516. Bearing surfaces and surfaces to be in permanent contact shall be thoroughly cleaned before the members are assembled.

During erection, drifting will be permitted to draw the parts into position, but the holes shall not be enlarged nor the metal distorted. Erection (drift) pins shall be cylindrical and not more than 0.8 mm (1/32 inch) smaller than the hole diameter. Field splices and connections shall have not less than one-half of the holes filled with pins and snug tight bolts (preferably half bolts and half pins) before the member is released from the hoisting equipment. Field splices and connections commenced prior to erection of the connected parts shall be completed before erection. Splices and connections subject to construction loads during erection shall have not less than three-fourths of the holes so filled. Permanent fastening of steel truss tension chord members shall be completed before the falsework is removed, but compression chord members shall not be permanently fastened until the span is released sufficiently from the falsework to bring the compression chord joints into full bearing. Elevations of panel points and ends of floor beams shall be properly regulated and maintained until the falsework is removed.

Enlarging by any method the holes of splices and/or connections between segments or elements of main members is prohibited without approval by the OSE.

Structures shall be adjusted to correct alignment and camber before permanent fastening is begun. Cross frames and lateral bracing in continuous beam or girder spans shall not

be permanently fastened in any span until all main connections in adjacent spans have been completed; however, sufficient bracing shall be installed to meet the requirements of 501.06. Where erection bolts are used, they shall be not less than 16 mm (5/8-inch) diameter. Bolts for unpainted applications of A709 Grade 50W (A588) steel shall be A 325, Type 3. Erection bolts shall be A 307 bolts with lock washers or nuts tack welded to the bolt, or A 325 bolts tightened to a snug tight condition as described in 863.21 and having nuts tack welded to the bolt. End cross frames and end dams shall be erected in a manner that assures all bearing parts will remain in bearing contact.

The QCFS shall provide a cover letter documenting QCFS acceptance that shipping from the shop and shop storage has been performed per specification.

863.29 Shop Painting. This section contains requirements for the application and inspection of the shop prime coat as specified in the contract plans. The payment for the shop prime coat is included in the price bid for structural steel.

The QCPS shall be responsible for being familiar with the applicable paint specifications called for in the contract plans. Where specific shop Quality Control Points (QCP) are established in the specification, the QCPS shall comply with those requirements. If no shop prime coat QCPs are defined in the applicable paint specification, the QCPs in this section shall be the responsibility of the QCPS to assure that all QCPs meet specifications

.

Shop Prime coat shall be as specified in the contract documents.

Quality Control Points. Quality control points (QCP) are points in time when one phase of the work is complete and ready for inspection by the fabricator and QA Inspector. The next operational step shall not proceed unless the QCP has been accepted or QA inspection waived by the QA Inspector. At these points the Fabricator shall afford access to inspect all affected surfaces. If QA Inspection indicates a deficiency, that phase of the work shall be corrected in accordance with these specifications prior to beginning the next phase of work. Discovery of defective work or material after a Quality Control Point is past or failure of the final product before final acceptance, shall not in any way prevent rejection or obligate the Department to final acceptance.

Quality Control Points (QCP)	(PURPOSE)
1.) Shop Solvent Cleaning	Remove asphaltic cement, oil, grease salt, dirt, etc.
2.) Shop Grinding Flange Edges	Remove sharp corners, per AWS
3.) Shop Abrasive Blasting	Blasted surface to receive paint, including repair of fins, tears, slivers or sharp edges

4.) Shop Prime Coat Application	Check surface cleanliness apply prime coat check coating thickness

Shop Solvent Cleaning (QCP # 1). The steel shall be solvent cleaned were necessary to remove all traces of asphaltic cement, oil, grease, diesel fuel deposits, and other soluble contaminants per SSPC-SP 1 Solvent Cleaning. Under no circumstances shall any abrasive blasting be done to areas with asphaltic cement, oil, grease, or diesel fuel deposits. Steel shall be allowed to dry before blast cleaning begins.

Shop Grinding Edges (QCP # 2). All corners of thermally cut or sheared edges shall have a 1/16 inch radius or equivalent flat surface at a suitable angle. Thermally cut material thicker than 1 ½ inch shall have the sides ground to remove the heat effected zone, as necessary to achieve the specified surface profile.

Shop Abrasive Blasting (QCP #3). All steel to be painted shall be blast cleaned according to SSPC-SP10. Steel shall be maintained in a blast cleaned condition until it has received a prime coat of paint.

Metallized or galvanized steel, and other surfaces not intended to be painted, shall be covered and protected to prevent damage from blasting and painting operations. Any adjacent coatings damaged during the blasting operation shall be repaired at the fabricators expense.

The abrasive shall produce an angular profile. After each use and prior to reuse, the abrasive shall be cleaned of paint chips, rust, mill scale and other foreign material by equipment specifically designed for such cleaning.

Abrasives shall also be checked for oil contamination before use. A small sample of abrasives shall be added to ordinary tap water. Any detection of a oil film on the surface of the water shall be cause for rejection. The QCPS shall perform and record this test at the start of each shift.

The surface profile shall be a minimum of 40 mm (1.5 mils) and a maximum of 90 mm (3.5 mils). The QCPS shall record the surface profile with replica tape ASTM D 4417 Method C. For Automated blasting process: Five each recorded readings at random locations on one member for 20% of the main members or one beam per shift (which ever is greater) and One(1) recorded reading for 10% of all secondary material. For Manual blasting process: five each recorded readings at random locations for each main member and one recorded reading for 25 percent of all secondary material.

Abrasives of a size suitable to develop the required surface profile shall be used. Any abrasive blasting which is done when the steel temperature is less than 3° C(5° F) above the dew point shall be re-blasted when the steel temperature is at least 3° C(5° F) above the dew point. The QCPS shall record temperature and dew point shall be recorded prior

to blasting and at the start of each shift.

All abrasives and residue shall be removed from all surfaces to be painted with a vacuum cleaner equipped with a brush-type cleaning tool, or by double blowing. All blast cleaned steel shall be kept dust free, dry and shall be prime coated within 24 hours. The QCPS shall perform and record the following test to ensure that the compressed air is not contaminated: blow air from the nozzle for 30 seconds onto a white cloth or blotter held in a rigid frame. If any oil or other contaminants are present on the cloth or blotter, abrasive blasting shall be suspended until the problem is corrected and the operation is verified by a repeated test. This test shall be done prior to blowing and at the start of each shift.

Abrasive blasting and painting may take place simultaneously as long as abrasive blasting debris and/or dust by the blowing operation does not come in contact with freshly painted surfaces. Work areas for blasting and painting shall be physically separated to eliminate contamination of the priming operation.

All fins, tears, slivers and burred or sharp edges that are present on any steel member or that appear after the blasting operation shall be conditioned per ASTM A6 and the area reblasted to provide the specified surface profile.

Shop Prime Coat Application(QCP # 4). The surfaces to be painted shall be clean and dry. Paint shall not be applied in rain, snow, fog or mist, or to frosted or ice-coated surfaces. After QCP #3 has been accepted prime painting shall be completed before the cleaned surfaces have degraded from the prescribed standards, but in every case within 24 hours. The QCPS shall record the time between blasting and priming. Failure to prime coat the within 24 hours will require re-blasting before prime coating. The QCPS shall record that the paint is applied when the ambient temperature and humidity are as specified. Primer shall be applied by spray methods. The paint may be thinned for spraying. The type of thinner and the amount used shall be as recommended by the printed instructions of the manufacturer.

Before the paint is applied, it shall be mixed to a uniform consistency and maintained during its application. Primer shall be spray applied and continuously agitated by a automated agitation system(hand held mixers are not allowed) during application. The paint shall be mixed with a high shear mixer. Paddle mixers or paint shakers shall not be used. Paint shall also not be mixed or kept in suspension by means of an air stream bubbling under the surface.

The primer shall be applied in a neat workmanlike manner as a continuous film of uniform thickness which is free of holidays, pores, runs or sags. Spray application shall produce a wet coat at all times; the deposition of semi-dry particles on the surface shall be avoided. The Fabricator shall take precaution to prevent contamination of surfaces that have been prepared for painting and surfaces freshly painted. The prime coat shall be applied within the shop. The steel shall not be handled unnecessarily or removed from the shop until

paint has dried sufficiently to allow thickness gaging and to resist being marred in handling and shipping.

A prime coat shall coat all surfaces including insides of holes, behind stiffener clips and contact surfaces of connection or splice material which are to be fastened with shop or field bolts. Surfaces which are to be imbedded in concrete and surfaces within 50 mm (2 inches) of field welds other than those attaching intermediate or end cross frames to beams or girders shall only receive a mist coat not less that .5 mils(12.5 um) nor more than 1.5 mils(37.5 um). Pins, pin holes and contact surfaces of bearing assemblies, except those containing self-lubricating bronze inserts, shall be painted with one coat of prime paint. Erection marks shall be applied after the prime coat is dry, using a thinned paint of a type and color which is completely concealed by and compatible with the second coat.

The QCPS shall record the actual dry film thickness for the prime coat as specified. Thick films shall be reduced by screening, sanding, or sweep blasting. Any re-coating of prime paint that has cured longer than 24 hours with prime paint shall be done as recommended by the paint manufacturer's printed instructions. If "mud cracking" occurs, the affected area shall be scraped to soundly bonded paint and the area re-coated. Uncured paint damaged by rain, snow or condensation shall be permitted to dry; the damaged paint shall then be removed and the surface repainted.

The primed coat shall be adequately cured before the intermediate coat is applied. This curing time shall be not less than that recommended by the paint manufacturer's printed instructions.

Testing Equipment. The Fabricator shall provide the QCSP inspector the following testing equipment in good working order for the duration of the project. When the Fabricator's people are working at different locations simultaneously, additional test equipment shall be provided for each crew for the type of work being performed. When test equipment is not available, no work shall be performed.

1. One Spring micrometer and 3 (unless otherwise specified on plans) rolls of extra-coarse replica tape.

2. One (Positector 2000 or 6000, Quanix 2200, or Elcometer A345FBI1) and the calibration plates, 38-200 mm and 250-625 mm (1.5 -8 mils and 10-25 mils) as per the NBS calibration standards in accordance with ASTM D-1186.

3. One Sling Psychrometer including Psychometric tables - Used to calculate relative humidity and dew point temperature.

4. Two steel surface thermometers accurate within 1° C(2° F) or One portable infrared thermometer available from:
   Model: Raynger ST Series (-18° C to 400°C)

Manufacturer: Raytek Inc.
Santa Cruz, Ca.
(800)227-8074

or accepted equal to the portable infrared thermometer

5. Flashlight 2-D cell

6. SSPC Visual Standard for Abrasive Blast Cleaned Steel SSPC-Vis 1-89

Handling. All paint and thinner shall be delivered to the fabricator in original, unopened containers with labels intact. Minor damage to containers is acceptable provided the container has not been punctured. Thinner containers shall be a maximum of 19 L (5 gallons).

Paint shall be stored at the temperature recommended by the manufacturer to prevent paint deterioration. The QCPS shall record storage temperatures.

Each container of paint and thinner shall be clearly marked or labeled to show paint identification, component, color, lot number, stock number, date of manufacture, and information and warnings as may be required by Federal and State laws. The QCPS shall record the lot number, stock number and date of manufacture.

All containers of paint and thinner shall remain unopened until used. The label information shall be legible and checked at the time of use. Solvent used for cleaning equipment is exempt from the above requirements.

Paint which has livered, gelled or otherwise deteriorated during storage shall not be used. However, thixotropic materials which can be stirred to attain normal consistency may be used. The oldest paint of each kind shall be used first. No paint shall be used which has surpassed its shelf life.

The Fabricator shall provide thermometers capable of monitoring the maximum high and low temperatures within the storage facility. The Fabricator is responsible for properly disposing of all unused paint and paint containers.

The Fabricator shall furnish TE-24 and the QCPS records for all materials used on the project to the QA Inspector.

Mixing and Thinning. All ingredients in any container of paint shall be thoroughly mixed immediately before use and the primer shall be continuously mixed by an automated agitation system (hand held mixers not allowed). Paint shall be carefully examined after mixing for uniformity and to verify that no unmixed pigment remains on the bottom of the

container. The paint shall be mixed with a high shear mixer (such as a Jiffy Mixer). Paddle mixers or paint shakers are not allowed. Paint shall not be mixed or kept in suspension by means of an air stream bubbling under the paint surface. The QCPS shall record that all equipment is working correctly.

All paint shall be strained after mixing. Strainers shall be of a type to remove only skins and undesirable matter, but not pigment.

No thinner shall be added to the paint without the QCPS's approval, and only if necessary for proper application as recommended by the manufacturer. When the use of thinner is permissible, thinner shall be added slowly to the paint during the mixing process. All thinning shall be done under supervision of the QCPS. In no case shall more thinner be added than that recommended by the manufacturer's printed instructions. Only thinners recommended and supplied by the paint manufacturer may be added to the paint. No other additives shall be added to the paint.

Catalysts, curing agents, or hardeners which are in separate packages shall be added to the base paint only after the base paint has been thoroughly mixed. The proper volume of catalyst shall then be slowly poured into the required volume of base with constant agitation. Liquid which has separated from the pigment shall not be poured off prior to mixing. The mixture shall be used within the pot life specified by the manufacturer. Therefore only enough paint shall be catalyzed for prompt use. Most mixed, catalyzed paints cannot be stored, and unused portions of these shall be discarded at the end of each working day.

COATING APPLICATION

General. Galvanized or metallized surfaces shall not be painted. All new structural steel shall be painted. The following methods of application are permitted for use by this specification, as long as they are compatible with the paint being used: air-less or conventional spray. Brushes, daubers, small diameter rollers or sheepskins may be used for places of difficult access when no other method is practical.

Cleaning and painting shall be so programmed that dust or other contaminants do not fall on wet, newly-painted surfaces. Surfaces not intended to be painted shall be suitably protected from the effects of cleaning and painting operations. Over spray shall be removed with a stiff bristle brush or wire screen without damaging the paint. No visible abrasives from adjacent work shall be left on the prime. Abrasives on the prime coat shall be removed.

Spray Application (General). All spray application of paint shall be in accordance with the following:

Spray equipment shall be kept clean so dirt, dried paint and other foreign materials are not deposited in the paint film. Any solvent left in the equipment shall be completely removed before using.

Paint shall be applied in a uniform layer with overlapping at the edges of the spray pattern. The border of the spray pattern shall be painted first; with the painting of the interior of the

spray pattern to follow, before moving to the next spray pattern area. A spray pattern area is such that the gun shall be held perpendicular to the surface and at a distance which will ensure that a wet layer of paint is deposited on the surface. The trigger of the gun should be released at the end of each stroke. The QCPS shall record that each spray operator demonstrated to the QCPS the ability to apply the paint as specified. Any operator who does not demonstrate this ability shall not spray.

The QCPS shall document that all spray equipment used follows the paint manufacturer's equipment recommendations . Equipment shall be suitable for use with the specified paint. to avoid paint application problems.

If air spray is used, traps or separators shall be provided to remove oil and condensed water from the air. The traps or separators must be of adequate size and must be drained periodically during operations. The following test shall be made by the Fabricator and verified by the QCPS to insure that the traps or separators are working properly.

The QCPS shall perform and record that air is blown from the spray gun for 30 seconds onto a white cloth or blotter held in a rigid frame. If any oil, water or other contaminants are present on the cloth or blotter: painting shall be suspended until the problem is corrected and the operation is verified by repeating this test. This test shall be made at the start of each shift and at 4 hour intervals. This is not required for an airless sprayer.

Application Approval. The end of the application of primer for each beam or girder shall be subject to QCPS inspection and approval to detect any defects which might result from the fabricator's methods. If defects are discovered, the fabricator shall make all necessary adjustments to the method of application to eliminate defects before proceeding with additional prime coat application.

Temperature. Paint shall not be applied when the temperature of the air, steel, or paint is below 4° C (40° F). Paint shall not be applied when the steel surface temperature is expected to drop below 4^0 C (40° F) before the paint has cured for the minimum times specified below:

	10° C (50° F)	16° C (60° F)	21° C (70° F)
Primer	4 hrs.	3 hrs.	2 hrs.

The QCPS shall record and monitor the above temperatures and times.

Moisture. Paint shall not be applied when the steel surface temperature is less than 3° C (5° F) above the dew point. Paint shall not be applied to wet or damp surfaces or on frosted or ice-coated surfaces. Paint shall not be applied when the relative humidity is greater than 85%. Paint shall not be applied outdoors. The QCPS shall record the relative humidity prior to painting, at every shift and 4 hour intervals

Repair Procedures. Damaged areas, and areas which do not comply with the requirements of this specification, shall be repaired in a manner to blend the patched area with the adjacent coating. The finished surface of the patched area shall have a smooth, even profile with the adjacent surface.

The QCPS shall submit his method of conducting repairs, correcting runs, sags , mud cracking and un-workman like conditions in writing to the OSE.

Dry Film Thickness. Prime thickness, shall be determined by use of Type 2 magnetic gage in accordance with the following:

Five separate spot measurements shall be made, spaced evenly over each 9 square meters (100 square feet) of painted surface area. Three gage readings shall be made for each spot measurement. The probe shall be moved a distance of 25 to 75 mm (1 to 3 inches) for each new gage reading. Any unusually high or low gage reading that cannot be repeated consistently shall be discarded. The average (mean) of the 3 gage readings shall be used as the spot measurement. The average of five spot measurements for each such 9 square meter (100 square foot) area shall not be less that the specified thickness. No single spot measurement in any 9 square meter (100 square foot) area shall be less than 80% of the specified minimum thickness nor greater than 120% of the maximum specified thickness. Any one of 3 readings which are averaged to produce each spot measurement, may under-run or over-run by a greater amount. The 5 spot measurements shall be made for each 9 square meter (100 square feet) of area.

The specified coating thickness is 3 mils minimum to 5 mils maximum.

Safety Requirements and Precautions. The fabricator shall meet the applicable safety requirements of the Ohio Industrial Commission and the Occupational Safety and Health Administration (OSHA).

Inspection Access. In addition to the requirements of CMS 105.11, the fabricator shall furnish, erect, and move scaffolding and other appropriate equipment, to permit the QA Inspector the opportunity to closely observe all affected surfaces. Material shall be separated for inspection and safely braced. This opportunity shall be provided to the Inspector during all phases of the work and storage.

The QCPS shall provide a cover letter and specified check point data documenting QCPS acceptance that shop painting has been performed per specification.

863.30 Cleaning A709 Grade 50W Steel (ASTM A 588) Before the new steel is shipped All the exposed surfaces of A 709 Grade 50W (A588) steel that are to be left unpainted shall be solvent cleaned where necessary to remove all traces of asphaltic cement, oil, grease, diesel fuel deposits, chalk, paint marks and other soluble contaminants per SSPC-SP 1 Solvent Cleaning. QCP #1 and QCP #2 shall apply per 863.29.

Fascia beams (girders) shall be shop blast cleaned to SSPC- SP6 commercial blast. QCP#3 shall apply per 863.29.

After the placement of the superstructure concrete. All the exposed surfaces of A 709 Grade 50W (A588) steel that are to be left unpainted shall be solvent cleaned where necessary to remove all traces of asphaltic cement, oil, grease, diesel fuel deposits, and other soluble contaminants per SSPC-SP 1 Solvent Cleaning.

The use of acid for cleaning will not be permitted.

The QCPS shall provide a cover letter and specified check point data documenting QCPS acceptance that shop cleaning has been performed per specification.

863.31 Method of Measurement. Structural steel shall be measured by either lump sum or the plan weight of steel, whichever is stipulated in the contract.

If the quantity of structural steel to be paid is the plan weight of steel, the actual number of kilograms (pounds) shall be computed from the accepted shop drawing by using a unit weight of 7850 kg/m^3 (490 pounds per cubic foot). Waste material, such as is removed by burning, cutting, machining, etc., shall not be considered as pay weight except for that material removed in the edge preparation for groove welds. Material removed to form bolt holes shall be included in the pay quantity provided that only those portions of the bolts projecting beyond the holes are included for payment. Only bolts and materials that remain in place shall be included. Any thickness and weight of members in excess of that called for on the plans (due to overweight or other cause) shall not be included in determining the weight to be paid for, unless an increase in size of a member has been requested by then OSE.

Pay weight for steel castings shall be based on scale weights of the finished pieces prior to painting. Castings shall be weighed by the Fabricator, in the presence of the inspector, and weights recorded on shop bills.

The weight of paint coat, galvanized coat, run-off bars, and weld metal in all field or shop butt welds shall not be included. Fillet welds may be included if completely itemized.

The weight of other metals and preformed bearing pads not separately itemized are to be included with the structural steel. The following unit weights in kg/m^3 (pounds per cubic foot) shall be used: Cast steel and deposited weld metal 7850 (490), cast iron 7210 (450), phosphor or leaded bronze 8810 (550), lead 11370 (710). The weight of preformed bearing pads shall be calculated as an equivalent volume of lead.

The number of welded stud shear connectors to be paid for shall be the actual number installed and accepted.

863.32 Basis of Payment. Payment will be made at contract prices for:

Item	Unit	Description
863	Lump sum	Structural steel members, miscellaneous level fabrication
863	Lump sum	Structural steel members, level one fabrication
863	Lump sum	Structural steel members, level two fabrication
863	Lump sum	Structural steel members, level three fabrication
863	Lump sum	Structural steel members, level four fabrication
863	Lump sum	Structural steel members, level five fabrication
863	Lump sum	Structural steel members, fracture critical, level six fabrication
863	Kilogram (pound)	Structural steel members, miscellaneous level fabrication
863	Kilogram (pound)	Structural steel members, level one fabrication
863	Kilogram (pound)	Structural steel members, level two fabrication
863	Kilogram (pound)	Structural steel members, level three fabrication
863	Kilogram (pound)	Structural Steel Members, level four fabrication
863	Kilogram (pound)	Structural steel members, level five fabrication
863	Kilogram (pound)	Structural steel members, fracture critical, level six fabrication
863	Each	Welded stud shear connectors

OHIO DEPARTMENT OF TRANSPORTATION
P.O. Box 899
25 South Front Street
Columbus, OH 43215-0899
614-466-4082 / 614-752-4824 fax / jrandall@dot.state.oh.us

Facilities inspection has been performed by _____ From the Office of Structural Engineering (OSE)____/____/_____ Based upon this report your facility will be evaluated for acceptance into the Prequalified Fabricator List as specified by SS863.02

Facilities Evaluation Check List

1. Company Name: _____
2. Address: _____
3. Phone:_____ Fax:_____ E Mail_____
4. AISC Certification, enclose copy of certification:_____
   a. Level Miscellaneous: No AISC certification
   b. Level 1 Fabricator: S Br category with P endorsement
   c. Level 2 thru 5 Fabricator: M Br category with P endorsement
   d. Level 6 Fabricator: M Br category with P and F endorsements
5. Company Representative
   a. President: _____
   b. Chief Engineer: _____
   c. Shop Superintendent: _____
   d. QCFS, enclose certifications: _____
   e. QCPS, enclose certifications: _____
   f. NDT Staff or Agency, enclose certifications: _____
6. Building Facilities:
   a. Indoor heated fabrication area, length and width (ft): _____
   b. Indoor heated paint area, length and width (ft): _____
   c. Lay down assembly area, length and width (ft): _____
   d. QA Inspection Office area meets specification 863.07

7A. Lifting Equipment:
   1. Overhead equipment maximum piece lifting capacity (Lbs.) _____
   2. Mobile equipment maximum piece lifting capacity (Lbs.)_____

7B. Material Preparation:
   1. Shearing and planed edges, comments: _____

   2. Cutting, manual guided methods required for levels 1 thru 3
   3. Cutting Automated guided methods required for levels 4 thru 6, maximum length:_____
   4. Bending processes available, comments: _____
   5. Reentrant corners and rounding edges, comments: _____

7C. Welding Processes
   1. Levels 1 and 2 must have SMAW, check for calibration paperwork: _____
   2. Level 3 thru 6 must have SMAW and FCAW or SAW, check for calibration paperwork: _____
   3. Electrode oven, check operation and calibration paperwork: _____
   4. Level 6, flux hoppers check for calibration paperwork: _____
   5. Current approved PQR, separate submission required.
   6. Complete package of WPS, separate submission required.
   7. Qualified welders, separate submission required.

7D. NDT Technicians or Agency:
   1. Level 3 fabrication requirements:
      a. Magnetic Particle Inspection(MPI): Dry powder with aluminum prods or probe check machine calibration per ASTM E709 each 6 month: _____
      b. MPI ANSI/ASNT CP-189-1995 Level II, enclose certifications
   2. Level 4 thru 6 fabrication requirements:
      a. MPI as per level 3 above
      b. Ultrasonic Testing (UT) Equipment: AWS D1.5-95 section 6.15 and qualification 6.17: _____
      c. UT ANSI/ASNT CP-189-1995 Level II , enclose certifications
      d. Radiographic Testing (RT) Equipment: AWS D1.5-95 section 6.12 viewer: _____
      e. Evaluation of production sample RT film and report per AWS D1.5-95 section 6.10: _____
      f. RT ANSI/ASNT CP-189-1995 Level II, enclose certifications

7E. Drilling and Punching Processes, check work in process meets SS863.20 and 26: _____

7F. Shop Bolting:
   1. Skidmore Tension Devise, calibrated yearly: _____
   2. Inspection Torque Wrench: _____

7G. Coating:
   1. Methods available for blast cleaning: _____
   2. Grit and shot mixture, examine sample work for profile: _____
   3. Methods available for painting: _____
   4. Check for operation of painting and paint inspection equipment see 863.29: _____
   5. Metallizing methods available: 85% Zinc, 15% Aluminum wire method: _____
   6. Galvanizing methods available: _____

Appendix II

FABRICATOR _____RATING FOR SHOP DRAWINGS

Project_____ Bid Line No. _____ Shop I.D. _____ Bridge:_____

Rater/Date _____ Reviewer/Date _____

Contractor Coordination (10 %) (1 point each)

	Y	N	NA
1. The contractor's P.E. has stamped and approved each shop drawing, including revisions.			
2. Shop drawing notes indicate that the contractor field verified the existing structure per the contract.			
3. Contractor submitted documentation addresses any contract changes due to, but not limited to, field conditions, plan errors or fabrication issues.			
4. Contractor accepted shop drawings were received seven (7) working days prior to the start of fabrication.			

Title Block (1%) (1 point each)

1. The project number is per the contract.			
2. All bid line numbers are shown and separated per the contract.			
3. The county, route and section of the structure are per the contract.			
4. The structure file number (SFN) is shown.			

General Notes (5%) (1 point u.n.o.)

1. The type and grade of steel are per the contract. (15 pts)			
2. Charpy V Notch (CVN) is specified per the contract. (15 pts)			
3. Non-destructive testing (NDT) is specified per the contract. (10 pts)			
4. Welding specifications are per the contract. (10 pts.)			
5. The system that produces high strength bolt holes is specified. (5 pts.)			
6. The match marking system is specified per supplemental specification 863.			
7. Surface preparation is specified per the contract.			
8. The coating system is specified per the contract.			
9. The rounding of all sheared or flame cut edges and corners is specified.			

Framing or Erection Plan (10%) (1 point u.n.o.)

	Y	N	NA
1. Main and secondary member piece marks correlate to detail drawings. (15 pts)			
2. The skew of substructures is per the contract.			
3. Transverse or radial center to center main member spacing is per the contract.			

4. The field splices are dimensioned from a centerline of bearing.			
5. The center to center of bearings is dimensioned along the full length base line.			

Lay down Assemblies (30%) (1 point u.n.o.)

Vertical Lay down Assemblies

1. A full length base line is from abutment to abutment. (5 pts)			
2. Cambers are dimensioned vertically from the baseline at points shown in the contract. At the minimum, these points shall be bearings, field splices and approximate span quarter points. (5 pts.)			
3. The baseline is horizontally dimensioned at the camber points. (5 pts)			
4. Vertical offsets are dimensioned to a consistent location on each member.			

Horizontal Lay down Assemblies

1. A full length base line is from abutment to abutment. (15 pts)			
2. Bearings, mid-ordinates and field splices are dimensioned to the centerline of web from a perpendicular to the baseline. (10 pts)			

Sub-Assemblies

1. Transverse or longitudinal main members, to which diaphragms and floor beams frame or connect, are detailed to locate bearings and splices from plan and elevation baselines. (15 pts)			

Main Member Details (30%) (1 point u.n.o.)

1. All material sizes, type, quantity and grade are per the contract. (30 pts)			
2. Fracture critical plates are identified per AWS and the contract. (25 pts)			
3. Fracture critical welds are identified by WPS number and FC designation per AWS and the contract. (25 pts)			
4. The bolt lengths, diameters, holes and types are shown per the contract. (20 pts)			
5. The splice pattern, edge distance, and maximum gap are per the contract (20 pts)			
6. All weld sizes, terminations and other details are per the contract. (20 pts)			
7. The bearing stiffeners are plumb at erection and have end fit conditions per the contract. (15 pts)			
8. The contract spacing for intermediate and connection stiffeners is not exceeded. (15 pts)			
9. All stiffeners have clips, section views and end fit conditions per the contract. (15 pts)			

Appendix II

10. End conditions, not limited to, integral or semi integral abutment details, flange clips, distances between end of member and center line of bearing or special fit-up are per the contract. (10 pts)
11. Re-entrant corners are provided with a 1" (25.4 mm) radius (10 pts)
12. Flange and web width or thickness transitions are per the contract. (10 pts)
13. Individual curved member camber diagrams are supplied with offsets at 10'-0" (3.048 m) centers. (5 pts)
14. Individual member camber diagrams are dimensioned at locations consistent with the contract. This includes approximate quarter span points. (5 pts.)
15. Radiograph locations and markings are identified per the contract. (2 pts)
16. Coated and un-coated areas are detailed per the contract.
17. Main member cross-sections are dimensioned.

Secondary Member Details (9%) (1 point u.n.o.)

1. Material size(s) and type(s) are shown per the contract. (15 pts)
2. Transverse bridge geometry is included in secondary member details. (10 pts.)
3. Shop and field weld sizes, terminations and other details are per the contract.(10 pts)
4. Bolt lengths, diameters, holes and types are shown per the contract. (10 pts)
5. Secondary member work points are dimensioned where necessary for the coordination of trades.
6. Strut and diagonal cross frame legs are matched on each side of the web.

Y= yes, N= no, NA = not applicable

Fabricator Rating = {Y / (Y + N) } x Section Factor (There are no partial points)

Contractor Coordination _____ (Y) / _____ (Y + N) x 10 = _____
Title Block _____ (Y) / _____ (Y + N) x 1 = _____
General Notes _____ (Y) / _____ (Y + N) x 5 = _____
Framing/Erection Plan _____ (Y) / _____ (Y + N) x 10 = _____
Lay down Assemblies _____ (Y) / _____ (Y + N) x 30 = _____
Main Member Details _____ (Y) / _____ (Y + N) x 35 = _____
Secondary Member Details _____ (Y) / _____ (Y + N) x 9 = _____

Appendix II

Fabricator_____**Rating for Performance of Shop Drawings**_____%

Appendix II

FABRICATOR _____ **RATING FOR TEST REPORTS**

Project:_____ **Bid line No.:**_____ **Shop ID.** _____ **Bridge No.:**_____
Rater/Date:_____ **Reviewer/Date:** _____

I. General Project Information	**Y**	**N**	**NA**
1. Project number is shown (1 point)			
2. Bid line number is called out (1 point)			
3. Bridge number is specified (1 point)			
4. Name of fabricator is identified (1 point)			
5 Bid line numbers are separated (1 point)			
6. Material test reports are cross referenced to drawing piece marking system (2 point)			

II. Complete Mill Test			
1. All materials shown on the shop drawings have test reports and shippers (30 points)			
2. Test reports meet all contract requirements; CMS, ASTM, CVN and/or Fracture Critical. (25 points)			
3. The producing mill is domestic (10 points)			
4. Test reports show material size, shape, & length (4 points)			
5. Test reports show grade of steel (3 points)			
6. Material quantity is shown on the Test Reports (2 points)			
7. Test reports show mill's name (2 points)			
8. Test reports show purchaser of material (2 points)			

III. Timeliness			
Test report submission was 7 working days prior to release for shipping (15 points)			

TEST REPORTS RATING TOTAL			

Y = yes, N = no, NA = not applicable
No partial points are available for a yes, no or not applicable section.

V. FOLLOW-UP SEQUENCE FOR INCOMPLETE MILL TEST

	DATE Performed	**DATE DUE**	**RESULT**
1. Fax and Phone call to the Contractor requesting incomplete information.			
2. Non-compliance letter and phone call to Contractor 30 days after sending fax.			
3. IOC to District after 10 days from sending non-compliance letter.			
4. District action performed.			

Appendix II

FABRICATOR_____ **RATING FOR SHOP FABRICATION**

Project: _____ **Bid line No.:**_____**Shop ID:**_____ **Level:**_____

Rater/Date:_____**Reviewer/Date:**_____

Check, Hold or Witness Point Descriptions for Levels of Fabrication 1 thru 5	**Yes**	**No**	**NA**
ASTM A709, Grade, Physical & Chemical Requirements, CVN : Check point one (1) QCFS acceptance by cover letter listing piece marks and dates			
Heat number and member description (1 point)			
Yield Strength, Fy (psi) (3 points)			
Tensile Strength, Fu (psi) (1 point)			
Elongation% and gage length (2 point)			
CVN minimum average energy(ft lb.) (1 point)			
Chemical Requirements (1 point)			
Heat No. Steel Stamped and matched to Mill Test Reports per 863.10 prior to release or painting (1 point)			
ASTM A6 Quality and permissible Variations: Check Point two(2) QCFS acceptance by cover letter listing piece marks and dates.			
ASTM A6, Permissible variations in cross-section (1 point)			
ASTM A6, Permissible variations in Straightness & Storage (1 point)			
ASTM A6 and 863.11, Surface indications, Pitting due to rusting (1 point)			
ASTM A6, Laminar indications (1 point)			
Material Preparation per AWS D1.5, AASHTO and 863: Check Point three (3) QCFS acceptance by cover letter listing piece marks and dates			
Cutting beyond (inside) the prescribed lines AWS 3.2.2 (1 point)			
Cutting roughness AWS 3.2.2 (1 point)			
Occasional notches AWS 3.2.2 (1 point)			
Cut Edge Discontinuities AWS 3.2.3 (1 point)			
Reentrant corners AWS 3.2.4 and Radii of Beam copes 3.2.5 (1 point)			
Rounding of edges main members AWS 3.2.9 (1 point)			
Shearing distortion 863.13 (1 point)			
Bending , 90 degrees to rolling direction, visual inspection look for cracks AASHTO (1 point)			

Cambering and Sweep per 863.12, AWS and AASHTO: Check Point four (4) QCFS acceptance by cover letter listing piece marks and dates.			
Cambering or Straightening, AASHTO shop procedure posted (1 point)			
1150 degrees F pyrometric sticks (follow shop procedure) (5 points)			
location and shape of heats (follow shop procedure) (1 point)			
location and number of support blocks (follow shop procedure) (1 point)			
Natural Cooling (follow shop procedure) (5 points)			
Straightness and camber are per 863.12 (5 points)			
Flange and Web Butt Splice Welding per AWS, 863.23 and AASHTO: Check Point five (5) QCFS acceptance by frequent audits and documentation of listed data for each splice and dates.			
Size, grade , piece mark and locations of parts to be fitted (1 point)			
Clean scale, moisture, grease & foreign material per AWS 3.2.1 (1 point)			
Groove weld fit up tolerance, AWS 3.3 (1 point)			
Shop Welding Procedure (WPS) identification and ODOT approval date. (5 point)			
Tackers Name and SS#, ODOT Qualified, procedure (1 point)			
Welders Name and SS#, ODOT Qualified, procedure (1 point)			
Flux and Wire combination, does it match WPS (1 point)			
Joint geometry tolerances per AWS figure 2.4 (2 point)			
Preheat Temperature (F) and Shop Temperature(F) (1 point)			
Amperage (Amps),Voltage (Volts),Travel Speed (IPM) (5 point)			
Back gouge and cleaning per AWS 3.2.6 (5 point)			
Visual inspection width, thickness AWS 3.6.3 (5 point)			
Visual inspection surface finish AWS 3.6.4 125 uin. (2 point)			
Radiographic Inspection per AWS, 863.27 and AASHTO: Check Point six (6), Hold Point for B & C Rated fabricators QCFS acceptance by cover letter listing piece marks , dates and with technician's reports.			
Radiographic inspection 100% flange butt welds and back up bar splices(ODOT review required, Critical process) (5 point)			
Radiographic inspection web butt welds, top & bottom 1/3 (ODOT review required, Critical process) (5 point)			

Radiographic inspection 100% longitudinal stiffeners butt welds (ODOT review required, Critical process) (5 point)			
Radiographic inspection 25% longitudinal web splice(ODOT review required, Critical process,) (5 point)			
Radiographic identification marked steel stamped and visible in radiographic film, correct image quality indicator (1 point)			
Top and bottom of plate edges visible in the radiographic film (5 point)			
Radiographic technician's signed analysis report (1 point)			
Ultrasonic Inspection per AWS, 863.27 and AASHTO: Check Point seven (7), Hold and Witness Point for B & C Rated Fabricators QCFS acceptance by cover letter listing piece marks , dates and with technician's reports.			
Ultrasonic inspection 25% of complete penetration T or corner joints . (ODOT review required, Critical Process, 100% QA witness with B and C rated fabricators (2 point)			
Ultrasonic technician's signed analysis report (1 point)			
Ultrasonic equipment qualification per AWS 6.17 (1 point)			
Flange to Web Fillet Welds per AWS, 863 and AASHTO: Check Point eight (8), QCFS acceptance by frequent audits , documentation of listed data for each member and dates.			
Size, grade , piece mark and locations of parts to be fitted (1 point)			
Clean scale, moisture, grease & foreign material per AWS 3.2.1 (1 point)			
Standard fillet weld fit up tolerance, 1/16" AWS 3.3 (1 point)			
Welding Procedure (WPS) identification and ODOT approval date (5 point)			
Tackers Name and SS#, ODOT Qualified, procedure (1 point)			
Welder Name and SS#, ODOT Qualified, procedure (3 point)			
Flux and Wire combination, does it match WPS (1 point)			
Preheat Temperature (F) and Shop Temperature(F) (2 points)			
Amperage (Amps),Voltage (Volts) and Travel Speed (IMP) (5 points)			
Visual inspection weld size and profile, AWS 3.6 (5 point)			
Stiffener Fitting per AWS, 863 and AASHTO: Check Point nine (9) QCFS acceptance by cover letter listing piece marks and dates.			
Bearing Stiffener, mill fit @ bearing, tight fit @ other end, 863.14 (1 point)			
Intermediate Stiffener without cross frames, tight fit at tension flange, 863.14 (1 point)			

Connection Stiffener weld fit at both flanges 863.14 (1 point)			
Clearance between clipped stiffener corners and fillets on rolled beams (1 point)			
Stiffener Fillet Welds per AWS, 863 and AASHTO: Check Point ten(10) QCFS acceptance by frequent audits ,documentation of listed data for each member and dates			
Size, grade , piece mark and locations of parts to be welded (1 point)			
Clean scale, moisture, grease & foreign material per AWS 3.2.1 (1 point)			
Standard fillet weld fit up tolerance, 1/16" AWS 3.3 (1 point)			
Welding Procedure (WPS) identification and ODOT approval date (5 points)			
Tackers Name and SS#, ODOT Qualified, procedure (1 point)			
Welder Name and SS#, ODOT Qualified, procedure (3 point)			
Flux and Wire combination, does it match WPS (1 point)			
Preheat Temperature(F) and Shop Temperature(F) (2 point)			
Amperage (Amps), Voltage(Volts) and Travel Speed (IMP) (5 point)			
Visual inspection weld size and profile, AWS 3.6 (5 point)			
Magnetic Particle Inspection per AWS, 863.27 and AASHTO: Check Point eleven (11), Hold and Witness point for C Rated Fabricators.QCFS acceptance by cover letter listing piece markes, dates and with technicians report's.			
Magnetic Particle Inspection 10% of flange to web welds and girder ends after trimming (ODOT review required, Critical Process) Dry powder prod method or probe. 100% QA witness with C rated fabricators. (2 point)			
Magnetic Particle Inspection 10% of Bearing Stiffener Welds (ODOT review required, Critical process) Dry powder prod method or probe. 100% QA witness with C rated fabricators. (2 point)			
Magnetic Particle technician's signed analysis report (1 point)			
Calibration of Magnetic Particle Equipment every 6 months (1 point)			
Shop Laydown per AWS, 863, and AASHTO: Check Point twelve (12) QCFS acceptance by frequent audits, documentation of listed data for each member and dates.			
Hole patterns, size, spacing, gage, accuracy, 863.20 (2 point)			
Hole deburring, 863.20 (1 point)			

Blocking horizontal & vertical dimensions @ bearings, after all welding is complete. 1/8" + or - 863.26 (5 point)			
Blocking camber dimensions @ points specified, after all welding is complete 863.12 (5 point)			
Horizontal curvature of curved members, after all welding is complete 1/8"/10'-0" AWS 3.5 (2 point)			
Fitup at bolted splice, 1/4" max gap SS863.11			
Shop applied bolts, nuts and washers accepted by TE-24			
Shop installed bolts calibration devise periodically examined per 863.21			
Bolts tightened per 863.21			
Center to center of field splices matches plan dimensions (1 point)			
Flatness at bearing seats, after all welding is complete AWS 3.5.1.9 (2 point)			
Cleaning per 863.27, SSPC and ASTM: Check Point thirteen (13) QCFS acceptance by documentation of listed data for each member and dates.			
Shop solvent cleaning per SSPC-SP1 where necessary (5 point)			
Shop grinding edges 1/16", material thicker than 1 ½" shall be checked for removal of the heat effected zone. (1 point)			
Shop blast cleaned SSPC-SP10, Automated process: Five(5) each recorded readings at random locations on one member for 20% of the main members and One(1) recorded reading for 10% of all secondary material with replica tape ASTM D4417 method C, 1.5 to 3.5 mil profile , 863.29 (10 point)			
Shop blast cleaned SSPC-SP10, Manual process: five(5) each recorded readings at random locations for each main member and one(1) recorded reading for 25% of all secondary material with replica tape ASTM D4417 method C, 1.5 to 3.5 mil profile, 863.29 (10 point)			
Steel ,Ambient (Dry bulb) and Wet bulb Temperatures, Humidity and Dew Point recorded prior to blasting and at the start of each shift (5 degree F above dew point). (2 point)			
Abrasive produces angular profile (1 point)			
Abrasive mix for oil contamination start of each shift (1 point)			
Removal of abrasives & residue by vacuum or double blowing (5 point)			
Test blow air for oil or other contaminants. Blotter test for 30 seconds at the start of each shift. Not required with vacuum (1 point)			
Condition all fins slivers and burred or sharp edges per ASTM A6. Re-blast to 1.5 to 3.5 mil profile, unless conditioned area is less than one square foot per main member (1 point)			

Painting per 863.29, SSPC and ASTM: Check Point fourteen (14), Hold Point for C Rated Fabricators. QCFS acceptance by documentation of listed data for each member and dates.			
Time and dates between blasting and painting (1 point)			
Ambient temperature & humidity (minimum 40 deg.F and 5 deg F above dew point) (5 point)			
Temperature of paint storage location (max/ min) (2 point)			
Paint TE-24, manufactures name and lot numbers (2 point)			
Painter mixes paint with a high shear mixer and strains (5 point)			
Painter is checking operation of automated agitation system with every new paint batch (5 point)			
Prime inside of bolt holes, behind stiffener clips (5 point)			
Prime thickness 3 to 5 mils: 3 gage readings for each spot measurement with 5 spot measurements in each 100 square foot (see additional instructions with paint system notes)(10 point)			
Workman like finish; mud cracking, holidays, pores, runs or sags. (5 point)			
Prime has dried sufficiently prior to handling (1 point)			
Cleaning ASTM A709 Grade 50W steel (A588) Check point fifteen (15). QCFS acceptance by documentation of listed data for each member and dates.			
Shop solvent cleaning per SSPC-SP1 where necessary (5 point)			
Shop grinding edges 1/16"(1 point)			
Shop blast fascia members cleaned SSPC-SP6 achieved			
Abrasive mix for oil contamination start of each shift (1 point)			
Removal of abrasives & residue by vacuum or double blowing (1 point)			
Test blow air for oil or other contaminants. Blotter test for 30 seconds at the start of each shift. Not required with vacuum (1 point)			
Condition all fins slivers and burred or sharp edges per ASTM A6. Re blast to 1.5 to 3.5 mil profile, unless conditioned area is less than one square foot per main member (1 point)			
Repair procedures, QA Inspection : Hold point sixteen (16), Required for all Fabricators.QCFS acceptance by documentation of listed data for each repaired member and dates.			
QCSF documentation describing problem and proposed repair method. (1 point)			
QA /OSE acceptance of proposed repair methods (1 point)			

Appendix II

Fabricator follows repair methods (2 points)			
NDT acceptance by QCSF and QA/OSE (2 points)			
Contractor acceptance and OSE received Shop drawings revised to show as built condition (1 point)			
Final Shop, Shipping or Storage, QA Inspection: hold Point seventeen (17), Required for all Fabricators. QCFS presents member and required QCSF documentaion from check points 1 thru 16 for QA acceptance.			

NA = Not Applicable, No partial points are available for a Yes, No or NA answer

Sum of {Y/(Y + N) x Section %}

Check Point 1_____(Y) / _____(Y + N) X 12 = _____
Check Point 2 _____(Y) / _____(Y + N) X 1 = _____
Check Point 3 _____(Y) / _____(Y + N) X 1 = _____
Check Point 4 _____(Y) / _____(Y + N) X 1 = _____
Check Point 5_____(Y) / _____(Y + N) X 12 = _____
Check Point 6_____(Y) / _____(Y + N) X 15 = _____
Check Point 7_____(Y) / _____(Y + N) X 12 = _____
Check Point 8_____(Y) / _____(Y + N) X 6 = _____
Check Point 9 _____(Y) / _____(Y + N) X 1 = _____
Check Point 10_____(Y) / _____(Y + N) X 1 = _____
Check Point 11_____(Y) / _____(Y + N) X 8 = _____
Check Point 12_____(Y) / _____(Y + N) X 9 = _____
Check Point 13_____(Y) / _____(Y + N) X 4 = _____
Check Point 14_____(Y) / _____(Y + N) X 4 = _____
Check Point 15_____(Y) / _____(Y + N) X 1 = _____
Check Point 16_____(Y) / _____(Y + N) X 12 = _____

Summation Fabricator rating for performance of QA Inspection = _____

Required Hold or Witness points
A Rating hold points = 7, 16 and 17
B Rating hold points = 6, 7, 16 and 17
C Rating hold or witness points = 6, 7, 11, 14, 16 and 17

Appendix II

FABRICATOR_____ RATING FOR SHOP FABRICATION LEVEL 6 (FCM)

Project: _____ Bid Line No.:_____Shop ID:_____

Rater/Date_____ Reviewer/Date _____

Check, Hold or Witness Point Descriptions for Level of Fabrication 6 , Fracture Critical Members (FCM)	**Yes**	**No**	**NA**
ASTM A709, Grade, Physical & Chemical Requirements, CVN : Check point One (1) QCFS acceptance by cover letter listing piece marks and dates			
Heat number and member description (1 point)			
Yield Strength, Fy (psi) (3 points)			
Tensile Strength, Fu (psi) (3 points)			
Elongation % and gage length (2 points)			
Material killed fine-grain practice (AWS 12.4.2) (5 point)			
Zone 2 CVN minimum average energy (A709 Table S1.3) (2 point)			
CVN impact testing "P" plate frequency (5 point)			
Chemical Requirements (1 point)			
Heat No. Steel Stamped and matched to Mill Test Report per 863.10 prior to release or painting (1 point)			
ASTM A6 Quality and permissible Variations: Check Point Two (2) QCFS acceptance by cover letter listing piece marks and dates.			
ASTM A6, Permissible variations in cross-section (1 point)			
ASTM A6, Permissible variations in Straightness & Storage (1 point)			
ASTM A6 and 863.11, Surface indications, Pitting due to rusting (1 point)			
ASTM A6, Laminar indications (1 point)			
Material Preparation per AWS D1.5, AASHTO and 863: Check Point Three (3) QCSF acceptance by cover letter listing piece marks and dates			
Cutting beyond (inside) the prescribed lines AWS 3.2.2 (1 point)			
Cutting roughness AWS 3.2.2 (1 point)			
Occasional notches AWS 3.2.2 (1 point)			
Cut Edge Discontinuities AWS 3.2.3 (1 point)			
Reentrant corners AWS 3.2.4 and Radii of Beam copes 3.2.5 (1 point)			
Rounding of edges AWS 3.2.9 (1 point)			

Shearing distortion 863.13 (1 point)			
Heat Bending , 90 degrees to rolling direction, visual inspection (document any cracking NDT required) AASHTO and AWS 12.12 (5 point)			
Cambering and Sweep per 863.12, AWS and AASHTO: Check Point Four (4) QCFS acceptance by cover letter listing piece marks and dates			
Cambering or Straightening, AASHTO and AWS 12.12 shop procedure posted (2 points)			
1150 degrees F pyrometric sticks (follow shop procedure) (5 points)			
location and shape of heats (follow shop procedure) (1 point)			
location and number of support blocks (follow shop procedure) (1 point)			
Natural Cooling (follow shop procedure) (5 point)			
Straightness and camber are per 863.12 (5 points)			
Flange and Web Butt Splice, Web-to-Flange CJP Welding per AWS, 863.23 and AASHTO: Hold and Witness Point Five (5) QCFS acceptance by witnessing, frequent audits and documentation of listed data for each splice and dates			
Size, grade, piece mark and location of parts to be fitted (1 point)			
Clean scale, moisture, grease & foreign material per AWS 3.2.1 (1 point)			
Groove weld fit up tolerance, AWS 3.3 (1 point)			
Shop Welding Procedure (WPS) identification and ODOT approval date. (5 point)			
Tackers Name and SS#, ODOT Qualified, procedure (2 point)			
Welders Name and SS#, ODOT Qualified, procedure (3 point)			
Flux and Wire combination, does it match WPS (2 point) Are Flux and Wire lot tested Check Temperature of Flux oven			
Joint geometry tolerances per AWS figure 2.4 (2 point) witness			
Preheat Temperature (F) and shop temperature(F) (3 point) witness			
Amperage (Amps), Voltage(Volts), Travel Speed(F) (3 point) witness			
Backgouge and cleaning per AWS 3.2.6 (3 point) witness			
Visual inspection width, thickness AWS 3.6.3 (5 point) witness			
Visual inspection surface finish AWS 3.6.4 125 uin. (5 point) witness			
Radiographic Inspection per AWS, 863.27 and AASHTO: Check Point Six (6) Hold point QCFS acceptance by cover letter listing piece marks, dates and with technician's reports.			

Radiographic inspection 100% flange butt welds and back up bars splices(ODOT review required, Critical process, Document separately) (5 point)			
Radiographic inspection web butt welds, top & bottom 1/3 (ODOT review required, Critical process ,Document separately) (5 point)			
Radiographic inspection100% longitudinal stiffeners butt welds (ODOT review required, Critical process, Document separately) (5 point)			
Radiographic inspection 25% longitudinal web splice(ODOT review required, Critical process, Document separately) (5 point)			
Radiographic identification marked steel stamped and visible in radiographic film, Hole-type image quality indicator (1 point)			
Top and bottom of plate edges visible in the radiographic film (5 point)			
Removal of weld reinforcement (1 point)			
Radiographic technician's signed analysis report (1 point)			
Ultrasonic Inspection per AWS, 863.27 and AASHTO: Check point Seven (7) Hold and witness point QCFS acceptance by cover letter listing piece marks, dates and with technicians reports			
Ultrasonic inspection 100% of complete penetration butt welds in FCM tension or reversal of stress flanges or back up bars. (ODOT review required, Critical Process, 100% QA witness (5 point)			
Ultrasonic inspection 25% of complete penetration butt welds in FCM compression flange or back up bar.(ODOT review required, Critical Process, 100% QA witness (2 point)			
Ultrasonic inspection 25% of complete penetration T or corner joints FCM subject to compression or shear. (ODOT review required, Critical Process, 100% QA witness (2 point)			
Ultrasonic inspection 100% of complete penetration T or corner joints FCM subject to tension or reversal of stress (ODOT review required, Critical Process, 100% QA witness (5 point)			
Ultrasonic technician's signed analysis report (1 point)			
Ultrasonic equipment qualification per AWS 6.17 (1 point)			
Repair procedure per AWS 12.17 hold and witness point Eight (8) QCFS acceptance by witnessing, frequent audits and documentation of listed data for each splice and dates			
Sketch of discontinuity with member piece mark and location on member (1 point)			
QA witness of discontinuity for determination of critical or non critical repairs (2 point)			
Noncritical repair, WPS and repair procedure pre approved (1 point)			

Critical repair, WPS and repair procedure approved for each repair by OSE (2 point)			
Welders Name and SS#, ODOT Qualified last 6 months or annual renewal (1 point)			
Preheat temperature prior to air carbon arc (1 point) witness*			
Grind surfaces to be welded smooth and bright (1 point) witness*			
Flux and Wire combination, does it match WPS (1 point) Are Flux and Wire lot tested, Check Temperature of Flux oven			
Joint geometry tolerances per AWS figure 2.4 (2 point) witness*			
Preheat Temperature (F) and shop temperature (F) (1 point) witness*			
Amperage (Amps), Voltage (Volts) and Travel Speed (IPM) (1 point) witness*			
Visual inspection width, thickness AWS 3.6.3 (2 point) witness*			
Visual inspection surface finish AWS 3.6.4 125 uin. (2 point) witness*			
Visual inspection weld size and profile, AWS 3.6 (2 point) witness*			
Non destructive testing as specified by repair procedure(5 points) witness*			
* witness required for critical repairs not required for non critical repairs			
Flange to Web Fillet Welds per AWS, 863 and AASHTO: Hold and witness Point nine(9),QCFS acceptance by witnessing, frequent audits and documentation of listed data for each splice and dates			
Size, grade, piece mark and locations of parts to be fitted (1 point)			
Clean scale, moisture, grease & foreign material per AWS 3.2.1 (1 point)			
Standard fillet weld fit up tolerance, 1/16" AWS 3.3.1 (1 point)			
Welding Procedure (WPS) identification and ODOT approval date (5 point)			
Tackers Name and SS#, ODOT Qualified, procedure (2 points)			
Welder Name and SS#, ODOT Qualified, procedure (3 points)			
Flux and Wire combination, does it match WPS Are Flux and Wire lot tested Check temperature of flux oven (2 points)			
Preheat Temperature (F) and shop temperature (1 point) witness			
Amperage (Amps)Voltage (Volts (1 point) Travel Speed (IMP) (5 points) witness			
Visual inspection weld size and profile, AWS 3.6 (5 point) witness			

Stiffener fitting per AWS, 863 and AASHTO: Check Point Ten(10) QCFS acceptance by frequent audits, documentation of listed data for each member and dates			
Bearing Stiffener, mill fit @ bearing, tight fit @ other end, 863.14 (1 point)			
Intermediate Stiffener without cross frames, tight fit at tension flange 863.14 (1 point)			
Connection stiffener weld fit at both flanges 863.14 (1 point)			
Clearance between clipped stiffener corners and fillets on rolled beams (1 point)			
Stiffener fillet welds per AWS, 863 and AASHTO: Hold and witness Point Eleven (11)QCFS acceptance by frequent audits, documentation of listed data for each member and dates			
Size, grade, piece mark and location of parts to be welded (1 point)			
Clean scale, moisture, grease & foreign material per AWS 3.2.21 (1 point)			
Standard fillet weld fit up tolerance 1/16" AWS 3.3 (1 point)			
Welding Procedure (WPS) identification and ODOT approval date (5 point)			
Tackers Name and SS#, ODOT Qualified, procedure (1 point)			
Welder Name and SS#, ODOT Qualified, procedure (3 point)			
Flux and Wire combination, does it match WPS (1 point) Are Flux and Wire lot tested Check temperature of flux oven			
Record Preheat Temperature(F) and shop temperature(F) (2 point) witness			
Amperage (Amps),Voltage(Volts), Travel Speed (IMP) (3 point) witness			
Visual inspection weld size and profile, AWS 3.6 (5 point) witness			
Magnetic Particle Inspection per AWS, 863 and AASHTO: Check Point twelve (12), Hold and witness for C rated fabricators. QCFS acceptance by cover letter listing piece marks, dates and with technicians reports			
Magnetic Particle Inspection 10% of flange to web welds and girder ends after trimming (ODOT review required, Critical Process, Document separately) Dry powder prod method or probe (2 point) 100% QA witness.			
Magnetic Particle Inspection 10% of Bearing Stiffener Welds (ODOT review required, Critical process, Document separately) Dry powder prod or probe method (2 point). 100% QA witness..			
Magnetic Particle technician's signed analysis report (1 point)			
Calibration of Magnetic Particle Equipment every 6 months (1 point)			

Shop Laydown per AWS, 863, and AASHTO: Check Point thirteen(13) QCFS acceptance by frequent audits, documentation of listed data for each member and dates			
Hole patterns, size, spacing, gage, accuracy, 863.20 (2 point)			
Hole de-burring, 863.20 (1 point)			
Blocking horizontal & vertical dimensions @ bearings, after all welding is complete. (document) 1/8" + or - 863.12 (document separately) (5 point)			
Blocking camber dimensions @ points specified, after all welding is complete 863.12 (document separately) (5 point)			
Horizontal curvature of curved members, after all welding is complete 1/8"/10'-0" AWS 3.5.1.4 (document separately) (2 point)			
Fit up at bolted splice, 1/4" max gap 863.17 (2 point)			
Center to center of bearings matches plan dimensions (1 point)			
Flatness at bearing seats, after all welding is complete AWS 3.5.1.9 (2 point)			
Cleaning per 863.27, SSPC and ASTM: Check Point fourteen(14)acceptance by documentation of listed data for each member and dates			
Shop solvent cleaning per SSPC-SP1 where necessary (5 point)			
Shop grinding edges 1/16", material thicker than 1 ½" shall be checked for removal of the heat effected zone. (1 point)			
Shop blast cleaned SSPC-SP10, Automated process: Five(5) each recorded readings at random locations on one member for 20% of the main members or one beam for each shift (which ever is greater) and One(1) recorded reading for 10% of all secondary material with replica tape ASTM D4417 method C, 1.5 to 3.5 mil profile (10 point)			
Shop blast cleaned SSPC-SP10, Manual process: five (5) each recorded readings at random locations for each main member and One(1) recorded reading for 25% of all secondary material with replica tape ASTM D4417 method C, 1.5 to 3.5 mil profile (10 point)			
Steel ambient (dry bulb) and wet bulb temperatures, humidity and dew point recorded prior to blasting and at the start of each shift (5 degree F above dew point). (2 point)			
Abrasive produces angular profile (1 point)			
Abrasive mix for oil contamination start of each shift (1 point)			
Removal of abrasives & residue by vacuum or double blowing (5 point)			
Test blow air for oil or other contaminants. Blotter test for 30 seconds at the start of each shift. Not required with vacuum (1 point)			

Conditioning all fins slivers and burred or sharp edges ASTM A6 then reblast to 1.5 to 3.5 mil profile, unless condition is less than one square foot per each side of the main member. (1 point)			
Painting per 863, SSPC and ASTM: Hold or Check Point fifteen(15)QCFS acceptance by documentation of listed data for each member and dates.			
Time and dates between blasting and painting (1 point)			
Ambient temperature & humidity (minimum 40 deg.F and 5 deg F above dew point) (1 point)			
Temperature of paint storage location (max/ min) (1 point)			
Paint TE-24, manufactures name and lot numbers (1 point)			
Painter mixes paint (high shear mixer) and strain (5 point)			
Painter is checking operation of automated agitation system with every new paint batch (5 point)			
Prime inside of bolt holes, behind stiffener clips (5 point)			
Prime thickness 3 to 5 mils: 3 gage readings for each spot measurement with 5 spot measurements in each 100 square foot (see additional instructions with paint system notes) (10 point)			
Workman like finish; mud cracking, holidays, pores, runs or sags. (5 point)			
Prime has dried sufficiently prior to handling (1 point)			
Cleaning ASTM A709 Grade 50W steel (A588) Check point sixteen (16). QCFS acceptance by documentation of listed data for each member and dates.			
Shop solvent cleaning per SSPC-SP1 where necessary (5 point)			
Shop grinding edges 1/16"(1 point)			
Shop blast fascia members cleaned SSPC-SP6 achieved			
Abrasive mix for oil contamination start of each shift (1 point)			
Removal of abrasives & residue by vacuum or double blowing (1 point)			
Test blow air for oil or other contaminants. Blotter test for 30 seconds at the start of each shift. Not required with vacuum (1 point)			
Condition all fins slivers and burred or sharp edges per ASTM A6. Re blast to 1.5 to 3.5 mil profile, unless conditioned area is less than one square foot per main member (1 point)			
Repair procedures, QA Inspection : Hold point seventeen (17), Required for all Fabricators.QCFS acceptance by documentation of listed data for each repaired member and dates.			

QCSF documentation describing problem and proposed repair method. (1 point)			
QA /OSE acceptance of proposed repair methods (1 point)			
Fabricator follows repair methods (2 points)			
NDT acceptance by QCSF and QA/OSE (2 points)			
Contractor acceptance and OSE received Shop drawings revised to show as built conditions (1 point)			
Final Shop, Shipping or Storage, QA Inspection: hold Point Eighteen (18), Required for all Fabricators. QCFS presents member and required QCSF documentation from check points 1 thru 17 for QA acceptance.			

Y = Yes, N = No, NA = Not Applicable, No partial points are available for a Y, N or NA answer

Sum of {Y/(Y + N) x Section %}

Check Point 1 _____(Y) / _____(Y + N) X 7 = _____
Check Point 2 _____(Y) / _____(Y + N) X 2 = _____
Check Point 3 _____(Y) / _____(Y + N) X 5 = _____
Check Point 4 _____(Y) / _____(Y + N) X 2 = _____
Check Point 5 _____(Y) / _____(Y + N) X 15 = _____
Check Point 6 _____(Y) / _____(Y + N) X 15 = _____
Check Point 7 _____(Y) / _____(Y + N) X 15 = _____
Check Point 8 _____(Y) / _____(Y + N) X 15 = _____
Check Point 9 _____(Y) / _____(Y + N) X 7 = _____
Check Point 10_____(Y) / _____(Y + N) X 2 = _____
Check Point 11_____(Y) / _____(Y + N) X 7 = _____
Check Point 12_____(Y) / _____(Y + N) X 15 = _____
Check Point 13_____(Y) / _____(Y + N) X 7 = _____
Check Point 14_____(Y) / _____(Y + N) X 7 = _____
Check Point 15_____(Y) / _____(Y + N) X 7 = _____
Check Point 16_____(Y) / _____(Y + N) X 7 = _____
Check Point 17_____(Y) / _____(Y + N) X 7 = _____

Summation Fabricator rating for performance of QA Inspection = _____

Required Hold or witness points = 5, 6, 7, 8, 9, 11, 12, 17 and 18

A Rating witness points require QC / QA inspection for 10 % of the work in progress.
B Rating witness points require QC / QA inspection for 25 % of the work in progress.
C Rating witness points require QC / QA inspection for 50 % of the work in progress.

Appendix III

Fabricator Rating: Summation of Appendix II check lists

Fabricator Rating For Performance Of Shop Drawings _____ x 20% = _____

Fabricator Rating For Performance Of Test Reports _____ x 20% = _____

Fabricator Rating For Performance Of Shop Fabrication _____ x 60% = _____

Fabricator Rating = _____

Fabricator Rating District's Construction Comments

Designer's Note

The selected bid item for 513 should be based on a comparison of the type of structure to be built versus the capability of the level of fabricator as defined in section 863.04. As example a continuous rolled beam bridge with no stiffeners would require a level 2 fabricator. If the rolled beam bridge had stiffeners required to attach cross frames then a level 3 fabricator would be specified.

A supplemental description should be added defining the type of steel

i.e.

863	Lump Sum	Structural Steel Members, Level Four (4), A 709, grade 36

For bridges with fracture critical members or fracture critical bridges a level 6 is required (See Section 863.04)

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION

SUPPLEMENTAL SPECIFICATION 899

CONCRETE - GENERAL

October 21, 1998

899.01 Description. This work shall consist of proportioning and mixing portland cement concrete.

899.02 Materials. Materials shall be:

Fine aggregate*	703.02
Fly ash	705.13
Coarse aggregate	703.02, 703.13***
Portland cement	701.01, 701.02, 701.03
	701.04, 701.05****
Ground granulated blast furnace slag	ASTM C 989, grade 100 or 120
Air entraining admixture.	705.10
Chemical admixture for concrete.	705.12**

*703.02 natural sand is required in 255, 451, 452, 453, 611, and 511 deck slabs.

**Admixtures shall contain no more than 50 parts per million chloride ions by weight of cement.

*** Applies only to 451, 452 and 453.

**** Use of Slag-Modified Portland Cement meeting ASTM C 595M, Type I(SM) is permitted; acceptance shall be in accordance with 701 and Supplement 1028. Type I(SM) may be used only between April 1 to October 1, and when 705.10 Air-Entraining Admixture is added at the mixer. Type I(SM) may not be used with Options 1 and 3.

Water used in concrete shall be free from sewage, oil, acid, strong alkalies or vegetable matter, and also shall be free from clay and loam. Water which is potable is satisfactory for use in concrete.

899.03 Proportioning. Proportioning shall be based on pre-determined cement content. Except as otherwise provided herein, each cubic yard (cubic meter) of concrete shall contain the specified weight of cement as determined by the yield calculation. The yield shall be within ± 1 percent of the theoretical yield of 27.00 cubic feet (1 m^3). The water-cement ratio shall not exceed the maximum specified. Below this limit, the quantity of water shall be adjusted to meet the slump requirements.

Concrete shall contain 6 ± 2 percent of total air, except as noted herein.

Slump shall be maintained within the range shown as nominal slump in the following table. No concrete shall be used in the work that has a slump greater than that shown as maximum in the table. When the slump is found to exceed the limit of nominal slump but is within the maximum limit, occasional loads of concrete may be used, provided an immediate adjustment is made in the mixture to reduce the slump of succeeding loads to within the nominal range shown.

Type of Work	Nom. Slump inch (mm)*	Max. Slump inch (mm)**
Concrete pavement (305, 451, 452, 453, 611, 615)	1-3 (25-75)	4 (100)
Structural Concrete (511, 610, 622)	1-4 (25-100)	5 (125)
Superstructure concrete (511)	2-4 (50-100)	4 (100)
Non-reinforced concrete (601, 602 603, 604, 608, 609, 612, 622)	1-4 (25-100)	5 (125)

*This slump may be increased to 6 inches (150 mm) provided the increase is achieved by the addition of a chemical admixture meeting the requirements of 705.12, Type F or G.

**This slump may be increased to 7 inches (180 mm) provided the increase is achieved by the addition of a chemical admixture meeting the requirements of 705.12, Type F or G.

Tests on the plastic concrete for pavement shall be made at the paving site or at a location designated by the Engineer. Tests for structure concrete shall be made at the site of the work at the point of placement.

The weights of fine and coarse aggregate shall be determined by the Engineer from the weights given in the Concrete Table. If high early strength concrete is specified, the Contractor may use high-early strength cement, additional cement, approved chemical admixtures, or a combination of these materials to achieve a modulus of rupture of 600 psi (4.2 MPa) in three days or less. If high-early-strength concrete is not specified, but is desirable to expedite the work, the Contractor may use these same materials at no additional cost to the state.

The weights specified in the Concrete Table were calculated for aggregates of the following bulk specific gravities: natural sand and gravel 2.62, limestone sand 2.68, limestone 2.65, and slag 2.30. The assumed specific gravities of fly ash and ground granulated blast furnace slag are 2.30 and 2.90, respectively. For aggregates of specific gravities differing more than plus or minus 0.02 from these, the weights in the table shall be corrected as indicated in paragraph (c).

CONCRETE TABLE

Quantities Per Cubic Yard (Meter)

Type of Coarse Aggregate	Dry Aggregates: Fine Aggregate lb (kg)	Dry Aggregates: Coarse Aggregate lb (kg)	Dry Aggregates: Total lb (kg)	Cement Content lb (kg)	Water-Cement Ratio Maximum
CLASS C (Using No. 57 or No. 67 Size)					
Gravel	1160 (688)	1735(1029)	2895(1717)	600 (356)	0.5
Limestone	1285(762)	1630(967)	2915(1729)	600(356)	0.5
Slag	1350(801)	1360(807)	2710(1608)	600(356)	0.5
CLASS F (Using No. 57 or No. 67 Size)					
Gravel	1270(753)	1810(1074)	3080(1827)	470(288)	0.55
Limestone	1345(798)	1730(1026)	3075(1824)	470(288)	0.55
Slag	1380(819)	1470(872)	2850(1691)	470(288)	0.55
CLASS S (Using No. 57 or No. 67 Size)					
Gravel	1125(667)	1735(1029)	2860(1697)	715(424)	0.44
Limestone	1260(747)	1530(908)	2790(1655)	715(424)	0.44
Slag	1280(759)	1370(813)	2650(1572)	715(424)	0.44

On projects specifying 451, 452, or 453, the following requirements shall apply. If No. 57 or 67 Size is approved, the quantities per cubic yard (cubic meter) will be in accordance with the above concrete table. If sizes No. 7, 78, or 8 are approved, the concrete shall contain 8 plus or minus 2 percent air, and the quantities will be in accordance with the following table:

Quantities Per Cubic Yard (Meter)

Type of Coarse Aggregate	Dry Aggregates: Fine Aggregate lb (kg)	Dry Aggregates: Coarse Aggregate lb (kg)	Dry Aggregates: Total lb (kg)	Cement Content lb (kg)	Water-Cement Ratio Maximum
CLASS C (Using No. 7, 78, or No. 8 Size)					
Gravel	1320(783)	1460(866)	2780(1649)	600(356)	0.5
Limestone	1380(819)	1410(837)	2790(1656)	600(356)	0.5

At any time during the construction period, the relative weights of fine and coarse aggregate as determined from the above table may be varied by the Engineer in order to insure a workable mix within the slump range and to control the yield. However, the total weight of aggregate per cubic yard (cubic meter) shall not be changed except as provided in the preceding paragraph as for the following conditions or both.

(a) For batch weights, the weights determined as described above shall be corrected to compensate for moisture contained in the aggregates at the time of use.

(b) If it is found impossible to prepare concrete of the proper consistency without exceeding the maximum water/cement ratio specified, a water reducing admixture conforming to requirements of 705.12 shall be used or the cement content shall be increased. However, the Contractor shall not be compensated for the admixture or additional cement which may be required by reason of such adjustment.

(c) If, during the progress of the work, the specific gravity of one or both of the aggregates changes, the batch weight shall be adjusted to conform to the new specific gravity.

(d) Unit weight determinations shall be made and the yield shall be calculated and maintained in accordance with ASTM C 138. Based on these determinations, the batch weights will be adjusted when necessary. However, the specified cement content shall be maintained within a tolerance of ± 1 percent and the maximum water-cement ratio shall not be exceeded.

(e) The amount of mixing water shall be adjusted for the moisture contained in the aggregate and for the moisture which they will absorb, in order to determine the amount of water to be added at the mixer.

(f) An approved set retarding admixture meeting the requirements of 705.12, Type B or Type D shall be required for concrete when the concrete temperature exceeds a nominal temperature of 75° F (24° C).

899.04 Proportioning Options. The Contractor may substitute one of the following options for all concrete items: The dry weights specified in these tables were calculated using the same specific gravities used in 899.03. The specific gravity used for ground granulated blast furnace (GGBF) slag is 2.90. Adjustments shall be made to the mix design due to specific gravities differing by more than 0.02. Other adjustments may be made as allowed in 899.03 and approved by the Engineer.

The requirements for Proportioning Option 1 are as follows. The cement content may be reduced as much as 15 per cent by weight with the substitution of an equivalent weight of fly ash meeting the requirements of 705.13. The water/cement ratio shall be based on the combined weight of cement and fly ash. Proportioning Option 1 shall meet the following Mix Design Concrete Table:

Quantities Per Cubic Yard (Cubic Meter).

Type of Coarse Aggregate	Dry Aggregates: Fine Aggregate lb (kg)	Dry Aggregates: Coarse Aggregate lb (kg)	Dry Aggregates: Total lb (kg)	Cement Content lb (kg)	Fly Ash lb (kg)	Water-CM Ratio Maximum
CLASS C Option 1 (Using No. 57 or No. 67 Size)						
Gravel	1140(676)	1700(1009)	2840(1685)	510(303)	90(53)	0.50
Limestone	1260(748)	1595(946)	2855(1694)	510(303)	90(53)	0.50
Slag	1320(783)	1330(789)	2650(1572)	510(303)	90(53)	0.50
CLASS F Option 1(Using No. 57 or No. 67 Size)						
Gravel	1260(748)	1800(1068)	3060(1815)	400(237)	70(42)	0.55
Limestone	1350(801)	1730(1026)	3080(1827)	400(237)	70(42)	0.55
Slag	1380(819)	1475(875)	2855(1694)	400(237)	70(42)	0.55
CLASS S Option 1 (Using No. 57 or No. 67 Size)						
Gravel	1060(629)	1640(973)	2700(1602)	608(361)	107(63)	0.44
Limestone	1230(730)	1490(884)	2720(1614)	608(361)	107(63)	0.44
Slag	1220(724)	1300(771)	2520(1495)	608(361)	107(63)	0.44
CLASS C Option 1 (Using No. 7, 78 or 8 Size)						
Gravel	1310(777)	1440(854)	2750(1631)	510(303)	90(53)	0.50
Limestone	1350(801)	1410(837)	2760(1638)	510(303)	90(53)	0.50

The requirements for Proportioning Option 2 are as follows. The cement content may be reduced as much as 50 pounds per cubic yard(30 kg/ m3), with the substitution of an equivalent volume of aggregate, provided the Contractor uses an approved water reducing admixture meeting the requirements of 705.12; Type A or Type D. Proportioning Option 2 shall meet the following Mix Design Concrete Table:

Quantities Per Cubic Yard (Cubic Meter).

Type of Coarse Aggregate	Dry Aggregates: Fine Aggregate lb (kg)	Dry Aggregates: Coarse Aggregate lb (kg)	Dry Aggregates: Total lb (kg)	Cement Content lb (kg)	Water-Cement Ratio Maximum
CLASS C Option 2 (Using No. 57 or No. 67 Size)					
Gravel	1190(706)	1785(1059)	2975(1765)	550(326)	0.50
Limestone	1320(783)	1675(994)	2995(1777)	550(326)	0.50
Slag	1385(822)	1395(828)	2780(1649)	550(326)	0.50
CLASS F Option 2 (Using No. 57 or No. 67 Size)					
Gravel	1315(780)	1880(1115)	3195(1896)	420(249)	0.55
Limestone	1410(837)	1810(1074)	3220(1910)	420(249)	0.55
Slag	1445(857)	1540(914)	2985(1771)	420(249)	0.55
CLASS S Option 2 (Using No. 57 or No. 67 Size)					
Gravel	1120(664)	1710(1015)	2830(1679)	665(395)	0.44
Limestone	1290(765)	1560(926)	2850(1691)	665(395)	0.44
Slag	1270(753)	1370(813)	2640(1566)	655(395)	0.44
CLASS C Option 2 (Using No. 7, 78 or No. 8 Size)					
Gravel	1370(813)	1510(896)	2880(1709)	550(326)	0.50
Limestone	1420(842)	1480(878)	2900(1720)	550(326)	0.50

The requirements for Proportioning Option 3 are as follows. The Portland cement content may be reduced as much as 50 pounds per cubic yard(30 kg/m3) with the substitution of an equivalent volume of aggregate, provided the Contractor uses an approved water-reducing admixture meeting the requirements of 705.12, Type A or D. The cementitious materials content shall consist of a combination, by weight, of a minimum of 70 percent Type I or Type IA Portland cement (701.04 or 701.01), and a maximum of 30 percent ground granulated blast furnace slag, ASTM C 989, grade 100 or 120. Proportioning Option 3 shall meet the following Mix Design Concrete Table:

Quantities Per Cubic Yard (Cubic Meter).

Type of Coarse Aggregate	Dry Aggregates: Fine Aggregate lb (kg)	Dry Aggregates: Coarse Aggregate lb (kg)	Dry Aggregates: Total lb (kg)	Cement Content lb (kg)	GGBF Slag lb (kg)	Water-CM Ratio Maximum
CLASS C Option 3 (Using No. 57 or No. 67 Size)						
Gravel	1185(703)	1775(1053)	2960(1756)	385(228)	165(98)	0.50
Limestone	1310(777)	1670(991)	2980(1768)	385(228)	165(98)	0.50
Slag	1385(822)	1385(822)	2770(1644)	385(228)	165(98)	0.50
CLASS F Option 3(Using No. 57 or No. 67 Size)						
Gravel	1320(783)	1870(1109)	3190(1892)	294(174)	126(75)	0.55
Limestone	1400(831)	1810(1074)	3210(1905)	294(174)	126(75)	0.55
Slag	1440(854)	1535(911)	2975(1765)	294(174)	126(75)	0.55

CLASS S Option 3 (Using No. 57 or No. 67 Size)

Gravel	1105(656)	1715(1017)	2820(1673)	465(276)	200(119)	0.44
Limestone	1280(759)	1555(923)	2835(1682)	465(276)	200(119)	0.44
Slag	1270(753)	1360(807)	2630(1560)	465(276)	200(119)	0.44

CLASS C Option 3 (Using No. 7, 78 or No. 8 Size)

Gravel	1370(813)	1500(890)	2870(1703)	385(228)	165(98)	0.50
Limestone	1410(837)	1480(878)	2890(1715)	385(228)	165(98)	0.50

GGBF = ground granulated blast furnace slag; CM = cementitious material.

The use of coarse aggregate in Portland cement concrete pavements is restricted by 703.13, as modified by the proposal.

Approval of Optional Mix Designs. A request to use any option design must be submitted to the Engineer for approval.

All admixtures used in the concrete mixture must be compatible and shall be dispensed in accordance with the manufacturer's recommendations.

If Portland cement with fly ash as an additive is used as described under Option 1 or ground granulated blast furnace slag is used under Option 3, the mix design shall be used only between April 1 and October 15, unless otherwise authorized by the Director. If Option 1 is used, an approved set retarding admixture meeting the requirements of 705.12, Type B or Type D shall be used if the concrete temperature exceeds a nominal temperature of 75° F (24° C) . If Option 2 or 3 is used, an approved water reducing set retarding admixture meeting the requirements of 705.12, Type D shall be used if the concrete temperature exceeds a nominal temperature of 75° F (24° C).

The proportioning adjustments under Options 1, 2 or 3 shall be the responsibility of the Contractor, and shall be in accordance with the ACI Standard "Recommended Practice for Selecting Proportions for Normal Weight Concrete" (ACI 211.1). The proportioning shall be based on developing an average compressive strength at 28 days of 4000 psi (28.0 MPa) for Class C, 3000 psi (21.0 Mpa) for Class F or 4500 psi (31.0 MPa) for Class S.

Optional mixes are not permitted with concrete bridge deck overlays using microsilica. For mixes used in latex modified and superplasticized dense concrete bridge deck overlays (Supplemental Specifications 847 and 848), and using Option 1 and 2, certified test data shall be provided for all requirements in accordance with Supplement 1045. Option 3 may not be used with concrete bridge deck overlays (Supplemental Specifications 847 and 848). The testing for Absorption, Scaling Resistance, and Volume Change will not be required for mixes used in dense concrete bridge deck overlays.

Only one source of fly ash shall be used in any one structure unless otherwise authorized by the Director. Bulk fly ash shall be stored in waterproof bins.

No option mixes shall be permitted in concrete mixes designed or intended to obtain high early strength.

899.05 Additional Classes of Concrete for Rigid Replacement.

Class FS. This mixture is a fast-setting Portland cement concrete for accelerated setting and strength development. The minimum cement content shall be 900 pounds per cubic yard (534 kg/m^3) and the maximum water — cement ratio shall be 0.40. The rigid replacement may be opened to traffic after four hours provided test beams have attained a modulus of rupture of 400 psi (2.8 MPa).

The concrete shall be kept plastic by means of a Type B or D admixture until the surface has been textured. The Type B or D admixture shall be used in accordance with the manufacturer's recommendations.

Calcium chloride shall be added and mixed with each batch of concrete just prior to placement. If calcium chloride with 94-97 percent purity is used, the addition rate shall be 1.6 percent by weight of the cement. If calcium chloride with 70-80 percent purity is used, the addition rate shall be 2.0 percent by weight of the cement. When calcium chloride in a water solution is used, the water used shall be considered as part of the concrete mixing water and appropriate adjustments shall be made for its inclusion in the total concrete mixture.

Any other approved accelerating admixture may be used at the rate recommended by the manufacturer, provided it will produce the required strength in the allotted time.

Immediately after the curing compound has been applied, the replacements shall be covered with polyethylene sheeting and further covered with building board as specified in ASTM C 208. The building board shall be wrapped in a black polyethylene sheeting and placed tight against the surrounding concrete and weighted down to protect the fresh concrete from the weather.

Class MS. This mixture is a moderate-setting portland cement concrete for accelerated strength development. The rigid replacement may be opened to traffic after 24 hours provided test beams have attained a modulus of rupture of 400 psi (2.8 MPa). The minimum cement content shall be 800 pounds per cubic yard (475 kg/m3) and the maximum water-cement ratio shall be 0.43.

The proportioning of the concrete materials to meet the requirements of each class of rigid replacement concrete specified shall be the responsibility of the Contractor. The coarse aggregate may be any one of the following sizes: No. 57, No. 6, No. 67, or No. 8. When No. 8 size is used, the entrained air content shall be 8 ±2 percent. Otherwise, the entrained air content shall be 6 ±2 percent.

The Engineer's approval of the concrete mix design will be based on the Contractor's submitted proportions and the foregoing information.

899.06 Equipment. Equipment shall be as follows:

(a) Batching Plants. Each plant shall be constructed and operated so that no intermingling of materials occurs prior to batching. The plant shall have weighing mechanisms which provide either a visible means of checking weights or a printed record. Dispensing mechanisms for water and admixtures shall have a visible means of checking quantities or shall produce a printed record.

Weighing mechanisms used for cement and aggregates shall weigh to an accuracy such that the weight indicated on the scale or printed ticket is within ± 0.5 percent of the correct weight. Devices for weighing or metering water shall measure to an accuracy of ± 1.0 percent throughout the range used.

All weighing and metering devices shall have been checked and their accuracy attested to within the 12-month period immediately prior to their use. This service may be performed by the Sealer of Weights and Measures or a scale servicing company. In lieu of the preceeding requirements, the concrete batch facilities may be approved if a Certificate of Performance has been issued by the National Ready Mixed Concrete Association.

To reach a capacity of 500 pounds (227 kg), ten standard test weights or the services of a scale servicing company shall be readily available for testing the weighing devices at the batch plant. All weights used in testing the weighing devices shall be sealed every 3 years by the Ohio Department of Agriculture.

Weighing and dispensing devices shall be tested as often as the Engineer may deem necessary to assure their continued accuracy.

(b) Mixers. Mixers and agitators shall conform to paragraphs 10, 11.2, 11.5 and 11.6 of AASHTO M 157, except that mechanical counters are permitted.

When a truck mixer is used for complete mixing, each batch of concrete shall be mixed for not less than 70 revolutions of the drum or blades at the rate of rotation designated on the metal plate on the mixer as mixing speed.

Bodies of nonagitating hauling equipment for concrete shall be smooth, mortartight, metal containers and shall be capable of discharging the concrete at a satisfactory controlled rate without segregation. Covers shall be provided when required by the Engineer. Trucks having dump bodies with rounded corners and no internal ribs or projections will be permitted for nonagitating hauling.

899.07 Handling, Measuring and Batching Materials. Aggregates from different sources and of different gradings shall not be stockpiled together. Aggregates that have become segregated, or mixed with earth or foreign material, shall be reworked or cleaned as directed by the Engineer, or rejected. Coarse aggregate shall be maintained with a uniform moisture content.

The fine aggregate and coarse aggregate shall be separately weighed in the respective amounts set by the Engineer as outlined in 899.03. Separate weighing devices shall be used for weighing the cement.

Batching shall be so conducted as to result in the weights of each material required within a tolerance of ± 1.0 percent for cement and ± 2.0 percent for aggregates. Water shall be measured by weight or volume to within a tolerance of ± 1.0 percent. Admixtures shall be dispensed to within ± 3.0 percent of the desired amount.

Methods and equipment for adding air-entraining agent or other admixture into the batch, when required, shall be approved by the Engineer.

899.08 Concrete Batch Plant Tickets. The Contractor shall furnish the Engineer a concrete batch

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION

SUPPLEMENTAL SPECIFICATION 905
OPEN HEARTH AND BASIC OXYGEN FURNACE STEEL SLAG AGGREGATE
USED FOR ITEMS 203, 304, 306, 307, 410, 411, 617, 503 OR 603

April 1, 1998

Open Hearth (OH) or Basic Oxygen Furnace (BOF) slag shall not be used for Aggregate or Soil for Item 603 Bedding or Backfill , for Items 306 Cement Treated Free Draining Base or 307 Non-Stabilized Drainage Base, Item 503.10 Backfill; or under, around or within 15 meters (50 feet) of any structure.

OH and BOF slag may be used in Item 203 Embankment, as defined in 203.02, if the OH or BOF slag is blended in a 3:1 mixture (3 parts natural soil and 1 part OH or BOF slag). The 3:1 mixture shall be placed at least 0.3m (1.0 ft) below the flow line of the underdrains or other drainage items susceptible to runoff as per 203.08. Aging and stock piling requirements of this specification are required.

OH and BOF slag may be used for surface course applications in Items 617, 410 and 411, if the OH and BOF slag meets the above specifications, and meets the aging and stock piling, deleterious substances, and crushing requirements of this specification.

BOF slag shall not be allowed for non-surface course applications in Items 304, 410, 411 or 617.

Recycled OH or BOF slag from Department or non-Department projects may be used in Item 203, or surface course applications in Items 617, 410 or 411, if the material meets the requirements of this specification.

OH slag may be used for Item 304 and for a non-surface course application in Items 617, 410 and 411, if the OH slag meets the above specifications and all the additions and deletions listed below;

Recycled OH or BOF slag from Department or non-Department projects shall not be allowed.

Deleterious substances (soft pieces) shall include soft lime, lime oxide or magnesia agglomerations or any foreign materials prone to rapid disintegration under construction processing and weathering conditions.

Deleterious substances(soft pieces) in accordance with Supplement 1029 (hand crushing of soft pieces) shall be less than 3 percent by weight.

Material passing the 75 μm(200 sieve) shall be less than 10 percent by weight.

No crushing of OH or BOF slag shall be allowed.

Identification of OH Slag. Clear, definitive and undisputable identification of the OH slag is required for OH slag used for Item 304 or for a non-surface course application in Items 617, 410 or 411.

The producer shall show the Department evidence that the material supplied is open hearth slag. This information shall consist of but not be limited to the following:

Steel producer, production dates, production rates, stockpiling dates, type of steel produced, and all known Department and non-Department projects where the material was previously used.

This identification of OH slag may be supplemented by other information approved by the Department or by using 10 years of good performance data. The producer shall submit to the Department projects where the OH slag has been used without expansion or tufa problems. The Department will review the above projects as part of the identification approval process.

All OH slag not identified as open hearth slag shall be considered basic oxygen furnace slag unless identified otherwise.

Tufa Performance Verified. Tufa is a precipitate form of calcium carbonate that can clog up the underdrain systems. Some OH slag sources clog up underdrain systems and some do not. Tufa performance verification will be based on field performance and Department's inspection of the underdrain systems.

Tufa performance verification is required for OH slag used for Item 304, or when OH slag is used for a non-surface course applications in Items 617, 410 or 411.

The producer shall submit to the Department past projects that are at least 10 years old that used the proposed OH slag source. The producer shall supply the Department with construction plans with the underdrains and underdrain outlets marked on the plans, or other suitable method, approved by the Department, showing the underdrain system. The producer shall mark the underdrain outlets in the field for inspection. The Department will inspect the underdrain systems for tufa deposits. If tufa deposits are found in the outlets or in the underdrain system, the OH slag source shall be rejected.

The following sources have previously been evaluated for tufa performance: Standard-Lafarge's Cuyahoga Heights and McDonald plants. Tufa performance verification is not required for these sources.

Aging and Stockpiling Requirements. All OH and BOF slag shall be stockpiled and aged as follows:

The material shall be graded and stockpiled into maximum size piles of 23,000 Metric ton (25,000 ton). Prior to and during the stock piling operation, these materials shall have water added to provide a uniform moisture content not less than their absorbed moisture. The stockpile shall be maintained in a moist condition during the required stock piling period.

The producer shall mix the stockpile when the outside surface of the pile has crusted over. The Department will inspect the stock pile every 2 months to ensure no crusting occurs. Frozen stockpile material shall not be mixed. The aging period shall be suspended when the stockpile is frozen for more than one month.

This aging period shall be at least 6 months in duration and shall start over if any new material is added to the pile during the aging period.

Expansion Testing. After the aging and stock piling requirements have been met, expansion testing is required for OH slag used for Item 304 or when OH slag is used for a non surface course applications in Item 617, Item 410 or Item 411.

Expansion Testing shall be performed in accordance with Pennsylvania Department of Transportation PTM No. 130, the ODOT equivalent to this test or expansion testing acceptable to ODOT.

The producer shall hire an independent AASHTO accredited and ODOT approved laboratory to perform at least half of the expansion testing. At the producer's option, up to half of the required expansion testing may be performed by the producer's lab. The Office of Materials Management shall observe the expansion testing and approve each independent and producer laboratory.

The expansion testing shall be performed for every 2300 metric tons (2500 tons) or fraction thereof of the material supplied.

The maximum allowable total expansion for each test shall be less than 0.50 percent. If any one test fails in the stockpile, the entire stockpile shall be rejected.

When sampling for expansion, the producer shall notify the Department at least 48 hours prior to the sampling. The Department will verify that the sample came from the correct stock pile and take independent spit samples , if required.

The expansion test data and a suitably presented summary of the expansion test data shall be submitted to the Department for approval. The Department reserves the right to perform independent testing to verify the laboratory results at any time.

The Department expansion test data shall take precedence over the producer or independent laboratory expansion testing results in the event of a conflict. The Department shall make the final determination on all conflicting data.

If the material fails the expansion testing, the material shall be stock piled for a minimum of 2 additional months from the date of last sampling and retested for expansion. No materials shall be approved for use until the material passes the expansion test.

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION
SUPPLEMENTAL SPECIFICATION 906

ANTISTRIP ADDITIVE FOR ASPHALT CONCRETE

May 5, 1998

On this project, if any gravel coarse aggregate or more than 25 percent natural sand or more than 20 percent reclaimed materials containing gravel coarse aggregate is used in any bituminous aggregate base designed in accordance with Supplement 1044 or any asphalt concrete designed in accordance with 441, then the Contractor shall perform the following additional tests:

1. Moisture damage potential test in accordance with Supplement 1051.
2. Washed gradation in accordance with AASHTO T 11 as modified by Supplement 1004.
3. Adherent fines test for each component in accordance with ASTM D 5711.

If the results of the moisture damage potential test show the Tensile Strength Ratio (TSR) of the bituminous aggregate base mix or asphalt concrete mix to be less than 0.70, then the mix shall be modified by one of the following antistrip additives:

Liquid Antistrip Material - The mix shall include liquid antistrip material at a rate of 0.50 to 1.00 percent by weight of the asphalt cement. The TSR of the bituminous aggregate base mix or asphalt concrete mix shall be greater than or equal to 0.80 after the addition of the liquid antistrip material.

Hydrated Lime - The mix shall include hydrated lime in the dry form at a rate of 1.0 percent by the dry weight of aggregate for asphalt concrete and 0.75 percent by the dry weight of aggregate for bituminous aggregate base. The hydrated lime shall meet the requirements of AASHTO M 303, Type 1. A list of approved sources of hydrated lime will be maintained by the Laboratory. To become an approved source, a source shall submit certified test data to the Laboratory showing their hydrated lime meets the requirements of AASHTO M 303, Type 1. Annual submittal of certified test data by January 1 each year will be necessary to maintain approval. The following information shall be provided to the Engineer for each shipment of hydrated lime: (1.) letter of certification; (2.) production date; (3.) shipment date; (4.) shipment destination; (5.) batch or lot number (6.) net weight.

The antistrip additive shall be included in the Contractors' mix design established in accordance with 441 or Supplement 1044. The following shall be submitted to the Laboratory with the proposed JMF:

1. All TSR data (before and after the addition of the antistrip additive).
2. Rate of addition of the liquid antistrip material, if used.
3. Product information, recent supplier State project information using the liquid antistrip material, and letter of certification (only for liquid antistrip material, if used).
4. Results of the washed gradation test of the individual components of the mix used in determining the combined gradation.
5. Results of the adherent fines testing for each component.

The Laboratory may perform additional tests in accordance with Supplements 1051, 1052, and 1004. These tests may be performed on material conforming to a proposed JMF or on material obtained during production of an approved JMF. If a change in the aggregate production is suspected, the District/ Laboratory may require the Contractor to perform washed gradations on components and calculate adherent fines to determine the need for additional TSR review. The Laboratory may obtain samples of the hydrated lime at any time to verify quality. If the quality of the hydrated lime is in question, the Laboratory may require independent laboratory testing for the hydrated lime supplier.

Antistrip additives shall be stored and introduced into the mix in accordance with Supplement 1053. Prior to the start of production,. the Laboratory shall approve the antistrip additive storage and feed systems. During production, if the antistrip additive is not being properly dispersed into the mix, the Laboratory may require modifications in the method of introducing the antistrip additive into the mix.

At the end of the project and at the end of each construction year on a multiple year project, the Contractor shall provide delivery tickets to the Engineer verifying the number of pounds of antistrip additive used is within 10 percent of the calculated amount of antistrip additive required for the total pounds of bitumen, based on the JMF, used in the bituminous aggregate base or asphalt concrete.

The cost of this additional testing and the addition of any antistrip additive shall be included in the contract price for the bituminous aggregate base or asphalt concrete.

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION

SUPPLEMENTAL SPECIFICATION 907

Sulphur Leachate Test for Air Cooled Blast Furnace Slag for Acceptance of Items 203, 304, 306, 307, 503, 603 and S.S.855 (Asphalt Treated Free Draining Base)

October 21, 1998

907.01 Description. Air cooled blast furnace slag used in Items 203, 304, 306, 307, 503, 603, and S.S.855 (Asphalt Treated Free Draining Base) must meet the requirements of this specification. This specification contains the required sampling procedure; sulphur leachate test procedure; and, the criteria that must be met for the material to be incorporated into the work.

907.02 Sampling Procedure. The following sampling method for obtaining samples of air cooled blast furnace slag for leachate tests shall be used:

1. Sampling: The material to be used should be sampled as the stockpile is being built.

2. When obtaining the sample after the stockpile is built: The sample may be taken by shovel or hand. The sample shall be selected randomly from both the exterior and interior of the stockpile. The producer shall use a heavy equipment for the excavation of the interior material.

3. Sampling Frequency: Each sample is to be taken in random increments over each 5200 tons (4720 metric tons) stockpiled.

4. Sample size and sample reduction: The field sample should be 80 to 100 pounds (35 to 45 kg). From this field sample, a test sample of 20 to 25 pounds (9 to 11 kg) shall be quartered out.

5. Documentation : Stockpile location and test results shall be maintained at the plant and shall be available upon request.

6. The Producer shall certify that this test has been performed prior to acceptance.

907.03 Sulphur Leachate Test Procedure and Criteria. The test procedure involves soaking the slag material in water for a specified period of time and then observing the color of the water. A greenish-yellow coloration indicates a problem. The smell of hydrogen sulfide(rotten eggs) usually accompanies the observation of colored water.

1. Equipment Needed:

A. A five-gallon (19-liter) bucket for soaking the sample.
B. Filter paper for filtering the water.
C. A funnel through which to filter the water.
D. A glass container for observing the water.
E. A rock color chart. This chart is used for color comparisons and is distributed by the Geological Society of America
F. Water shall be distilled or tap water let set in a bucket for a minimum of 12 hours.

2. Test Procedures.

A. Prepare a test sample of approximately 20 to 25 pounds (9 to 11 kg) from a field sample of approximately 100 pounds (45 kg).

B. For Item 306, Type 3 granular material in Item 603, and S.S.855(Asphalt Treated Free Draining Base), the test sample should then be rinsed over a No. 4 (4.75mm) sieve to remove any fines that may be clinging to the larger particles.

C. Place the test sample in bucket and fill with water until the sample is covered by at least ½ inch (13 mm) of water. Allow the sample to soak for 24 hours.

D. After soaking for 24 hours, throughly mix the water and collect a water sample of approximately 3.4 fl. oz. (100 mL).

E. Filter the water sample to remove the suspended solids which may interfere with the color observation.

F. If the color of the filtered water is equal to or darker than the moderate greenish- yellow color from the rock chart (hue 10Y), the material fails. If the water appears clear or lighter than the moderate greenish-yellow color from the rock chart (hue 10Y), then allow the sample to soak for another 24 hours and repeat steps "D" through "F".

G. If, after 48 hours, the water appears clear or less than the moderate greenish-yellow color from the rock chart (hue 10Y), then the material is acceptable.

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION

SUPPLEMENTAL SPECIFICATION 908

PERFORMANCE GRADE (PG) BINDER REQUIREMENTS

January 6, 1999

908.01 Performance Grade Binder Specifications. The requirements of 702.01 shall be replaced with AASHTO Provisional Standard MP1-93, 1997 AASHTO Provisional Standard version for Performance Graded (PG) binders as modified below:

PG 64-22 shall meet: Penetration, 77 F (25 C), 3.53 oz (100g), 5s -	55 - 75
PG 58-28 shall meet: Viscosity, poise, 140 F (60 C)-	800 min

The Materials and Manufacture section 5 shall be modified for all performance grades (PG) as follows:

5.1 The performance grade binder shall be an asphalt cement from the refining of crude petroleum, or combination of asphalt cements from the refining of crude petroleum, or asphalt cements and suitable liquid from the refining of crude petroleum, and possible organic modifiers for performance enhancement. Material from the crude refining stream will be considered neat. Use of any hydrocarbon material not taken directly from the crude refining stream shall be considered a modifier as in 5.2. Modifier or liquid direct from the refining stream may be used for adjustments but shall not be used for the purpose of substitution of crude refined asphalt cement in a performance grade asphalt binder.

5.2 Modifiers may be any organic material of suitable manufacture that is proven compatible with asphalt cement (does not separate appreciably in routine storage), and that is dissolved, dispersed or reacted in asphalt cement to improve its performance . The use of modifiers shall be limited to 6.0 percent by performance grade binder weight. Performance enhancement is defined as a decrease in the temperature susceptibility of the asphalt cement while maintaining desirable properties in a neat asphalt cement such as coatability, adhesiveness and cohesiveness. The use of any previously used whole material (liquid or solid) as a modifier is expressly forbidden. Reprocessed previously used materials may be applicable but materials and sources must be approved by the Department. Since no standard test procedures exist for reprocessed materials (and original tests were not developed with the use of such materials in mind), any test methods may be chosen by the Department for review. Department approval does not relieve the performance grade binder supplier from full responsibility for content and use of any previously used material nor guarantee suitable performance enhancement as defined above. The detected presence in a performance grade binder sample of any unapproved previously used material will mean immediate removal from certification. All constituent (modifier, etc.) MSDS sheets must be with the performance grade binder MSDS sheet supplied to a hot mix facility and accompany the supplier quality control plan on file in the Office of Materials Management.

5.3 The performance grade asphalt binder shall be homogeneous, free from water and deleterious materials, and shall not foam when heated to 350 F (175 C). The asphalt binder (before

modification or after modification if liquid modifier used) shall be proven fully compatible with a negative result by means of the Spot Test per AASHTO T 102 using standard naphtha solvent. If standard naphtha shows a positive result, a retest using 35 percent Xylene/ 65 percent Heptane (volume) may be used.

5.4 The performance grade asphalt binder shall be at least 99.0 percent soluble as determined by ASTM D 5546 or D 2042. Any insoluble component shall be substantially free of fibers and have discrete particles less than 75 m.

908.02 Viscosity Grade Cross Reference. All asphalt concrete and bituminous aggregate base specifying either AC-20 or AC-10 asphalt cement shall switch to a performance graded (PG) binder in accordance with the following chart:

Mix	Specified Binder	Use PG Binder (2)
441 designed for heavy traffic (1)	AC-20 AC-10	PG 64-22 PG 64-28 (3)
441 designed for medium or light traffic (1)	AC-20 AC-10	PG 64-22 PG 58-28
Any other specification (1)	AC-20 AC-10	PG 64-22 PG 58-28

(1) Mixes containing reclaimed pavement, where a grade change is necessary in accordance with 441.03, shall use a performance grade binder specified by Department policy covering testing and selection of binders for recycled mixes.
(2) The performance grade binder shall meet the requirements of the rest of this specification.
(3) Neat asphalt, unmodified

908.03 Contractor Storage Requirements. Storage of a performance grade binder shall be in accordance with 750.01, with the following additions:

1. If a Contractor is providing a binder other than a performance grade binder to customers other than the Department (excepting winter carryover work), a separate storage tank shall be used.

2. When the Contractor switches between different performance grade binders because of alternating mix types, a separate storage tank shall be used.

3. When the Contractor switches from any asphalt cement or other performance grade binder to a different performance grade binder using the same storage tank, the storage tank shall be at least 90 percent empty by tank height.

The Monitoring Team shall be notified before the delivery of the first load of each type of performance grade binder, with sufficient lead time to allow for verification of the condition of the storage tank. The Monitoring Team may sample the first storage tank load or give the Contractor permission to proceed with no tank verification, at their discretion.

908.04 Contractor Sampling Requirements. The Contractor shall take two 1 quart (1 liter) samples from the first transport truck load of performance grade binder before incorporation into the storage tank. The Contractor will label and date the samples and retain them in the plant laboratory for future reference by the Department, if necessary.