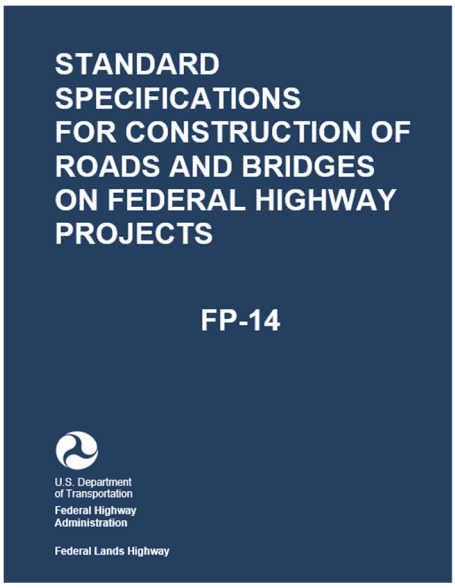
Forest Service Supplemental Specifications

To

Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects

FP-14



For

East Sylco Ridge NFSR 1333

February 2025

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FP-14 SPECIFICATIONS FOR BAKER CREEK AOP/INDIAN CREEK ROAD

All specifications not included in the specifications listing, but referenced by listed specifications, are applicable. The supplemental specifications shown on the specification list are physically attached. Section 100 through 149 of the Standard Specifications and all other Standard or supplemental specifications shown in the specification listing are applicable to this contract.

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Preface

Delete all but the first paragraph and add the following:

The Forest Service, US Department of Agriculture has adopted FP-14 for construction of National Forest System Roads.

101 - Terms, Format, and Definitions

101.01_National_11_9_2016

Add the following paragraph to Subsection 101.01:

101.01 Meaning of Terms.

Delete all references to the TAR (Transportation Acquisition Regulations) in the specifications.

101.03_National_11_9_2016

Add the following to Subsection 101.03:

101.03 Abbreviations.

(a) Acronyms.

AGAR — Agriculture Acquisition Regulations

AFPA — American Forest and Paper Association

FSAR — Forest Service Acquisition Regulations

MSHA — Mine Safety and Health Administration

NESC — National Electrical Safety Code

WCLIB — West Coast Lumber Inspection Bureau

(f) Miscellaneous unit abbreviations.

MP	—	milepost	location
ppm	—	parts per million	volume
STA		station	location

101.04_National_1_22_2020

Make the following changes to Subsection 101.04:

101.04 Definitions.

Delete these definitions and replace the following:

Bid Schedule — The Schedule of Items.

Bridge — A structure, including supports, erected over a depression or an obstruction such as water along a road, a trail, or a railway and having a deck for carrying traffic or other loads.

Contractor — The individual or legal entity contracting with the Government for performance of prescribed work. In a timber sale contract, the contractor is the "Purchaser".

Culvert — Any structure with a bottom, regardless of fill depth, depth of invert burial, or presence of horizontal driving surface, or any bottomless (natural channel) structure with footings that will not have wheel loads in direct contact with the top of the structure.

Drawings — (Public Works Contracts) Design sheets or fabrication, erection, or construction details submitted to the CO by the Contractor according to FAR Clause 52.236-21 Specifications and Drawings for Construction. Also refers to submissions and submittals.

Notice to Proceed — (Public Works Contracts) Written notice to the Contractor to begin the contract work.

Right-of-Way — A general term denoting (1) the privilege to pass over land in some particular line (including easement, lease, permit, or license to occupy, use, or traverse public or private lands), or (2) Real property necessary for the project, including roadway, buffer areas, access, and drainage areas.

Solicitation—(Public Works Contracts) The complete assembly of documents (whether attached or incorporated by reference) furnished to prospective bidders.

Add the following definitions:

Adjustment in Contract Price — "Equitable adjustment," as used in the Federal Acquisition Regulations, or "construction cost adjustment," as used in the Timber Sale Contract, as applicable.

Change — "Change" means "change order" as used in the Federal Acquisition Regulations, or "design change" as used in the Timber Sale Contract.

Forest Service — The United States of America, acting through the Forest Service, U.S. Department of Agriculture.

Neat Line — A line defining the proposed or specified limits of an excavation or structure.

Pioneer Road — Temporary construction access built along the route of the project.

Purchaser — The individual, partnership, joint venture, or corporation contracting with the Government under the terms of a Timber Sale Contract and acting independently or through agents, employees, or subcontractors.

Protected Streamcourse — A drainage shown on the plans or timber sale area map that requires designated mitigation measures.

Road Order — An order affecting and controlling traffic on roads under Forest Service jurisdiction. Road Orders are issued by a designated Forest Officer under the authorities of 36 CFR, part 260.

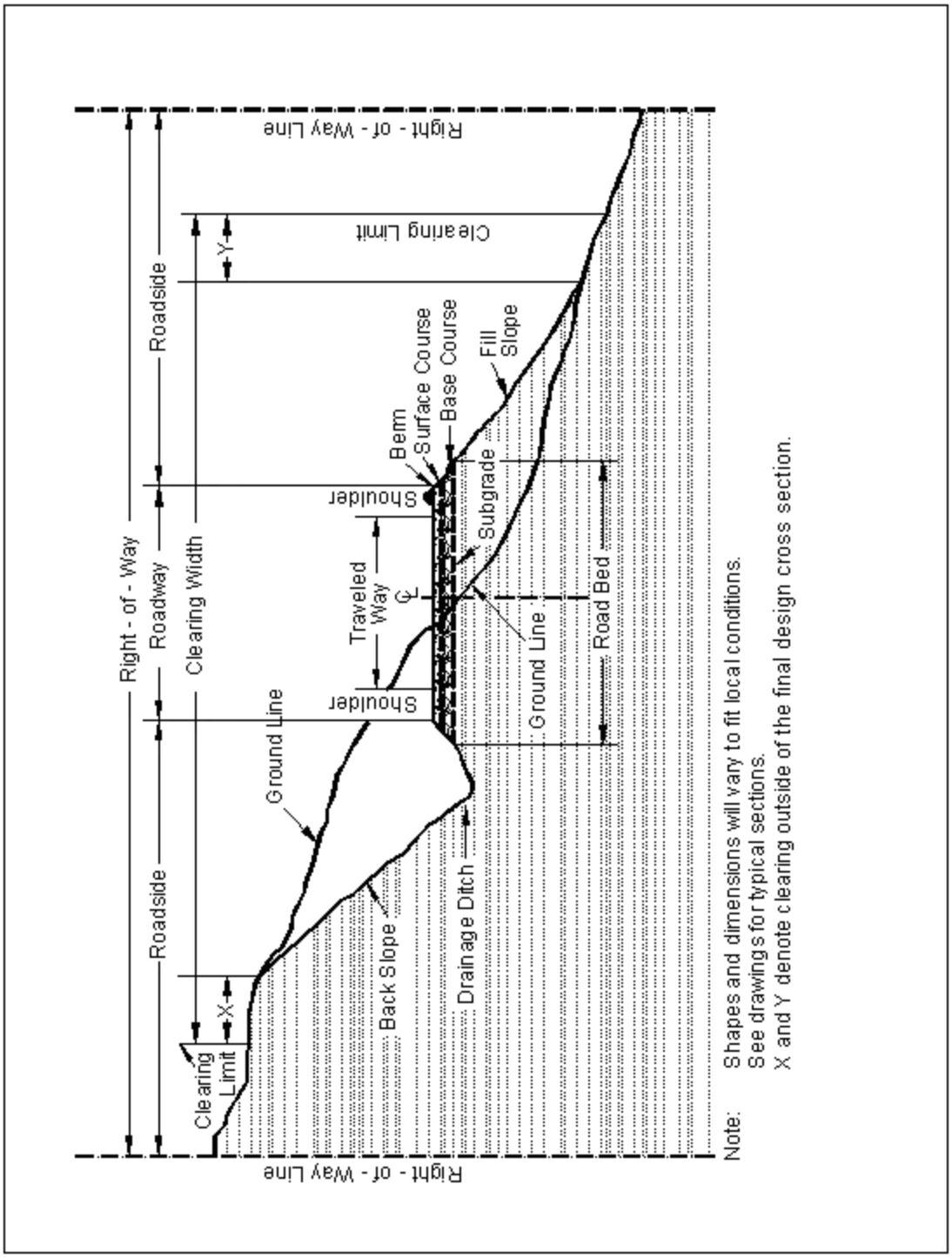
Shop Drawings — (Timber and Stewardship Contracts) Referred to as "Drawings" in FP-14, include drawings, diagrams, layouts, schematics, descriptive literature, illustrations, lists or tables, performance and test data, and similar materials furnished by Purchaser to explain in detail specific portions of the work required by the contract.

Utilization Standards —

The minimum size and percent soundness of trees described in Public Works contract specifications or Timber Sale and IRTC contract provisions to determine merchantable timber.

Add Figure 101-1—Illustration of road structure terms:

Figure 101-1—Illustration of road structure terms.



102 - Bid¸ Award¸ and Execution of Contract

102.00_National_11_9_2016

Delete Section 102 in its entirety.

Delete Section 102.

103 - Scope of Work

103.00_National_11_9_2016

Delete all of Section 103 except Subsection 103.01 Intent of Contract.

Delete Subsections 103.02, 103.03, 103.04, 103.05.

104 - Control of Work

104.00_National_11_9_2016

Delete Subsections 104.01, 104.02, and 104.04.

Delete Subsections 104.01, 104.02, 104.04.

104.06_National_11_9_2016

Add the following to Subsection 104.06:

104.06 Use of Roads by Contractor.

The Contractor is authorized to use roads under the jurisdiction of the Forest Service for all activities necessary to complete this contract, subject to the limitations and authorizations designated in the Road Order(s) or described in the contract, when such use will not damage the roads or national forest resources, and when traffic can be accommodated safely.

105 - Control of Material

105.05_National_6_29_2020

105.05 Use of Material Found in the Work.

Delete 105.05 (a) and (b) and the last sentence of the second paragraph and substitute the following:

Materials produced or processed from Government lands in excess of the quantities required for performance of this contract are the property of the Government. Place excess material safely at government-approved location, at no additional cost to government.

106 - Acceptance of Work

Delete Subsection 106.01 and replace with the following:

106.01 Conformity with Contract Requirements.

Follow the requirements of FAR Clause 52.246-12 Inspection of Construction.

References to standard test methods of AASHTO, ASTM, GSA, and other recognized standard authorities refer to the methods in effect on the date of solicitation for bids.

Perform all work to the lines, grades, cross-sections, dimensions, and processes or material requirements shown on the plans or specified in the contract.

Incorporate manufactured materials into the work according to the manufacturer's recommendations or to these specifications, whichever is more strict.

Plan dimensions and contract specification values are the values to be strived for and complied with as the design values from which any deviations are allowed. Perform work and provide material that is uniform in character and reasonably close to the prescribed value or within the specified tolerance range. The purpose of a tolerance range is to accommodate occasional minor variations from the median zone that are unavoidable for practical reasons.

When standard manufactured items are specified (such as fence, wire, plates, rolled shapes, pipe conduits, etc., that are identified by gauge, unit mass, section dimensions, etc.), the identification will be considered to be nominal masses or dimensions. Unless specific contract tolerances are noted, established manufacturing tolerances will be accepted.

The Government may inspect, sample, or test all work at any time before final acceptance of the project. When the Government tests work, copies of test reports are furnished to the Contractor upon request. Government tests may or may not be performed at the work site. If Contractor testing and inspection is verified by the Government, the Contractor's results may be used by the Government to evaluate work for acceptance. Do not rely on the availability of Government test results for process control.

Acceptable work conforming to the contract will be paid for at the contract unit bid price. Four methods of determining conformity and accepting work are described in Subsections 106.02 to 106.05 inclusive. The primary method of acceptance is specified in each Section of work. However, work may be rejected at any time it is found by any of the methods not to comply with the contract.

Remove, repair, or replace work that does not conform to the contract, or to prevailing industry standards where no specific contract requirements are noted. Removing, repairing, or replacing work; providing temporary traffic control; and any other related work to accomplish conformity will be at no cost to the Government.

(a) Disputing Government test results. If the accuracy of Government test results is disputed, promptly inform the CO. If the dispute is unresolved after reasonable steps are taken to resolve the dispute, further evaluation may be obtained by written request. Include a narrative describing the dispute and a proposed resolution protocol that addresses the following:

1. Sampling method;
2. Number of samples;
3. Sample transport;
4. Test procedures;
5. Testing laboratories;

6. Reporting;
7. Estimated time and costs; and
8. Validation process.

If the evaluation requires additional sampling or testing be performed, mutually agree with the Government on witnessing procedures and on sampling and testing by a third party laboratory. Use a third party laboratory accredited by the AASHTO accreditation program. Provide proof of the laboratory's accreditation for the test procedures to be used. Do not use the same laboratory that produced the disputed Government test results or that produced the test results used as a basis for the dispute.

The CO will review the proposed resolution protocol and may modify it before final approval and execution.

The Government will use the approved resolution protocol test results to determine the validity of the disputed testing. If the Government test results are validated, the Contractor will be responsible for all costs associated with developing and performing the resolution protocol. If the Government test results are not validated, the Government will be responsible for all costs associated with developing and performing the resolution protocol. If the validity of the Government test results cannot be determined, the Contractor and Government will equally share all costs associated with developing and carrying out the resolution protocol.

(b) Alternatives to removing and replacing non-conforming work. As an alternative to removal and replacement, the Contractor may submit a written request to:

1. Have the work accepted at a reduced price; or
2. Be given permission to perform corrective measures to bring the work into conformity.

The request must contain supporting rationale and documentation. Include references or data justifying the proposal based on an evaluation of test results, effect on service life, value of material or work, quality, aesthetics, and other tangible engineering basis. The CO will determine disposition of the nonconforming work.

Delete Subsection 106.02 and replace with the following:

106.02 Visual Inspection.

Acceptance is based on visual inspection of the work for compliance with the specific contract requirements. Use prevailing industry standards in the absence of specific contract requirements or tolerances.

107 - Legal Relations and Responsibility to the Public

107.05_National_7_18_2017

Delete Subsection 107.05.

Delete Subsection 107.05.

108 - Prosecution and Progress

108.00_National_11_9_2016

Delete Section 108 in its entirety.

Delete Section 108.

109 - Measurement and Payment

109.00_National_11_9_2016

Delete Subsections 109.06, 109.07, 109.08, and 109.09:

Delete Subsections 109.06, 109.07, 109.08, 109.09.

109.01_National_2_22_2019

Delete the third paragraph and Table 109-1 of Subsection 109.01 and replace with the following:

109.01 Measurement of Work.

Take measurements as described in Subsection 109.02 unless otherwise modified by the Measurement Subsection of the section controlling the work being performed. Table 109-1 indicates the accuracy required for quantities of the various pay units used in the Schedule of Items. Use this guide to determine the decimal placement in the final payment.

Table 109-1

Decimal Accuracy of Quantities for Final Payment

Pay Item	Level of Precision
Linear Foot	1
Exception--Timber, Steel, and concrete Piles	0.1
Station	0.1
Mile	0.01
Square Foot	0.1
Square Yard	0.1
Each	1
Acre	0.01
Gallon	1
M-Gals.	0.1
Cubic Yard	1
Exception--Structure Excavation; Sheathing Materials; Bedding, Bed Course, and Backfill Materials; Gabions;	0.1
Exception--Concrete; Masonry	0.01
Pound	1
Ton	0.1
Exception--Calcium Chloride; Sodium Chloride; Hydrated Lime; Bituminous Materials; Pavements; Bed Course Materials	0.01
Hour	0.1
MFBM	0.01
Station Yard	1
Cubic Yard Mile	1
Ton Mile	1

Add the following sentence to Subsection 109.02(b):

109.02 Measurement Terms and Definitions.

(b) Contract quantity.

Contract quantities will be adjusted only when there are errors in the original design of 15% or more.

153 - Contractor Quality Control

Delete Section 153 in its entirety and replace with the following:

Description

153.01 This work consists of obtaining samples for Contractor quality control testing, performing tests for Contractor quality control, providing inspection, and exercising management control to ensure that work conforms to the contract requirements. See FAR Clause 52.246-12 Inspection of Construction.

Construction Requirements

153.02 Contractor Quality Control Plan. Before the start of the work, submit a written quality control plan for acceptance. With prior approval, submission of a quality control plan for items of work not immediately scheduled to begin may be deferred.

Submit the following with the quality control plan:

(a) Process Control Testing. List the material to be tested by pay item, tests to be conducted, the location of sampling, and the frequency of testing.

(b) Inspection/control procedures. Address each of the following subjects in each phase of construction:

(1) Preparatory phase.
- (a) Review all contract requirements.
- (b) Ensure compliance of component material to the contract requirements.
- (c) Coordinate all submittals including certifications.
- (d) Ensure capability of equipment and personnel to comply with the contract requirements.
- (e) Ensure preliminary testing is accomplished.
- (f) Coordinate surveying and staking of the work.

(2) Start-up phase.
- (a) Review the contract requirements with personnel performing the work.
- (b) Inspect start-up of work.
- (c) Establish standards of workmanship.
- (d) Provide training as necessary.
- (e) Establish detailed testing schedule based on the production schedule.

(3) Production phase.
- (a) Conduct intermittent or continuous inspection during construction to identify and correct deficiencies.
- (b) Inspect completed work before requesting Government inspection acceptance.
- (c) Provide feedback and system changes to prevent repeated deficiencies.

(c) Description of Records. List the records to be maintained.

(d) Personnel Qualifications.
- (1) Document the name, authority, relevant experience, and qualifications of person with overall responsibility for the inspection system.

(2) Document the names, authority, and relevant experience of all personnel directly responsible for inspection and testing.

(e) Subcontractors. Include the work of all subcontractors. If a subcontractor is to perform work under this Section, detail how that subcontractor will interface with the Contractor's and other subcontractor's organizations.

Modifications or additions may be required to any part of the plan that is not adequately covered. Acceptance of the quality control plan will be based on the inclusion of the required information. Acceptance does not imply any warranty by the Government that the plan will result in consistent contract compliance. It remains the responsibility of the Contractor to demonstrate such compliance.

Do not begin the work until the quality control plan covering that work is accepted.

Supplement the plan as work progresses and whenever quality control or quality control personnel changes are made.

153.03 Testing. Perform testing according to the accepted quality control plan. Keep laboratory facilities clean and maintain all equipment in proper working condition. Allow unrestricted access for inspection and review of the facility.

153.04 Records and control charts.
Maintain complete testing and inspection records by pay item number and make them accessible to the CO.

153.05 Acceptance. The Contractor's quality control system will be evaluated under Subsection 106.02 based on the demonstrated ability of the quality control system to result in work meeting the contract requirements.

If the Government's testing and inspection indicate that the Contractor's quality control system is ineffective, make immediate improvements to the system to correct these inadequacies. Furnish notification in writing of improvements and modifications to the system.

Measurement and Payment

153.06 Do not measure Contractor Quality Control for payment.

155 - Schedules for Construction Contracts

155.00_National_11_9_2016

Delete Section 155 in its entirety.

Delete Section 155.

156 - Public Traffic

156.00_National_2_5_2019

Delete Section 156 in its entirety and replace with the following:

Description

156.01 This work consists of controlling and protecting public traffic adjacent to and within the project.

Material

156.02 Conform to the MUTCD and the following Sections and Subsections:

Permanent Traffic Control	633	
Traffic Signing and Marking Material		718
Concrete Barriers and Precast Guardwalls	618	
Temporary plastic fence		710.11

Construction Requirements

156.03 General. Accommodate traffic according to MUTCD, approved traffic control plan and this section. Perform work in a manner that ensures safety and convenience of the public. Unless otherwise provided for in Table 156-1, keep existing roads open to all traffic during road improvement work, and maintain them in a condition that will adequately accommodate traffic. Delays may not exceed **<number>** minutes at any one time followed by an open period of no less than **<number>** minutes. Accommodate public traffic on roads adjacent to and within the project until the project is accepted according to Subsection 106.07(b).

Submit traffic control plan at least 30 days prior to intended use. Perform no work that interferes or conflicts with traffic or existing access to the roadway surface until a traffic control plan has been approved.

Post construction signs and traffic control devices in conformance with MUTCD and Forest Service EM 7100-15. All required signs will be in place and approved prior to beginning work on project.

If the Contractor agrees in writing to allow public traffic to use a new road being constructed prior to completion, it will be considered an existing road for traffic control purposes.

156.04 Temporary Traffic Control. Install and maintain temporary traffic control devices adjacent to and within the project as required by the approved traffic control plan and the MUTCD. Install and maintain traffic control devices as follows:

(a) Furnish and install traffic control devices before the start of construction operations.

(b) All detours outside of clearing limits will be approved in writing by the Contracting Officer as part of the traffic control plan.

(c) Install only those traffic control devices needed for each stage or phase.

(d) Relocate temporary traffic control devices as necessary.

(e) Remove devices that no longer apply to the existing conditions.

(f) Immediately replace any device that is lost, stolen, destroyed, or inoperative.

(g) Keep temporary traffic control devices clean.

(h) Remove all temporary traffic control devices upon contract completion or when approved.

(i) When required, use flaggers certified by the American Traffic Safety Services Association, the National Safety Council, the International Municipal Signal Association, a state agency, or other acceptable organization. Perform the work described under MUTCD Part 6. Use type III, VII, VIII, or IX retroreflective sheeting on flagger paddles. Do not use flags. Flaggers must wear high visibility safety apparel as required by MUTCD 6E.02.

156.05 Temporary Closures. Road segments may be closed as shown in Table 156-1. The maximum consecutive days of closure shall be followed by a minimum number of consecutive days open to traffic as shown. Maintain traffic control devices during closure period(s). Appropriate barricades and signs will be erected and maintained as shown in the traffic control plan or as otherwise designated.

Prior to closing roads during construction, give written notice to the Contracting Officer at least 10 days in advance.

Table 156-1
Temporary Road Closures

Road Number	From Terminus	To Terminus	Maximum Consecutive Days of Closure	Minimum Consecutive Days Open
NFSR 1333	From NFSR 55	NFSR 302	Road may be closed during the construction project.	N/A

156.06 Acceptance. Public traffic work will be evaluated under Subsection 106.02.

Measurement and Payment

156.07 Do not measure Public Traffic for payment. Payment for contract work is provided indirectly. See Subsection 109.05.

157 - Soil Erosion and Sediment Control

Delete Subsection 157.04 and replace with the following:

157.04 General.

Thirty (30) days prior to the start of construction, submit a written plan according to subsection 104.03 with all necessary permits that provides permanent and temporary erosion control measures to minimize erosion and sedimentation during and after construction. Do not begin work until the necessary controls for that particular phase of work have been implemented. Do not modify the type, size, or location of any control without approval.

When erosion control measures are not functioning as intended, take corrective action to eliminate or minimize pollutants in storm water discharges from the project.

201 - Clearing and Grubbing

201.04_National_9_10_2018

Construction Requirements

Add to the end of paragraph (1) of 201.03:

The Contractor will stake the designated limits of clearing and the CO will review and approve clearing limits prior to commencement of activities. Provide 48 hours advanced notice for review.

The clearing limits may be adjusted in the field without this entailing a change in project scope.

Cleared material shall be properly cut and sorted to facilitate reuse in other project activities shown on the plans. Remaining material shall be disposed of by the Contractor in accordance with the plan general notes.

Delete paragraph (c) and replace with the following:

201.04 Clearing

(c) In areas outside the excavation, embankment, and slope rounding limits, cut stumps to maximum stump height shown in table below.

Utilization standards for merchantable timber are listed below. Fall and buck merchantable material into lengths not to exceed _____ feet. Pieces (logs) meet utilization standards when such pieces would have met Utilization Standards if bucking lengths were varied to include such material.

Minimum Utilization Standards				
Species	**Maximum Stump Height (inches)**	**Length (feet)**	**Diameter[1] (inches)**	**% Net Scale[2]**
Mixed Pine	6	8	4	
Mixed Hardwood	6	8	4	

[1] measured at inside bark at small end

[2] in % gross scale

Delete the first sentence of Subsection 201.06 and replace the following:

201.06 Disposal.

Merchantable timber is Government property.

203 - Removal of Structures and Obstructions

203.04_National_11_2_2016

Make the following changes to Subsection 203.04(b):

203.04 (b) General.

Delete the fifth paragraph of Subsection 203.04(b) and replace with the following:

Remove structures and obstructions in the roadbed to 12 inches (300 millimeters) below subgrade elevation. Remove structures and obstructions outside the roadbed to 12 inches (300 millimeters) below finished ground or to the natural stream bottom.

Delete the seventh paragraph of Subsection 203.04(b) and replace with the following:

When abandoning an existing culvert pipe, remove the upstream and downstream portion of the culvert to within 12 inches (300 millimeters) of the subgrade or embankment slope. Ensure the abandoned pipe is at least 48 inches (1200 millimeters) from a new culvert or structure. Seal the abandoned culvert ends with a tight-fitting plug of concrete at least 6 inches (150 millimeters) thick. Ensure the structure does not entrap water.

Add the following to Subsection 203.05:

203.05 Disposing of Material.

(e) Windrowing Construction Slash. Place construction slash outside the roadway in neat, compacted windrows approximately parallel to and along the toe line of embankment slopes. Do not permit the top of the windrows to extend above subgrade. Use construction equipment to matt down all material in a windrow to form a compact and uniform pile. Construct breaks of at least 15 feet at least every 200 feet in a windrow. Do not place windrows against trees.

(f) Scattering. Scatter construction slash in designated areas without damaging trees. Limb all logs. Place logs and stumps away from trees, positioned so they will not roll, and are not on top of one another. Limb and scatter other construction slash to reduce slash concentrations. When scattering for erosion control, place construction slash as flat as practicable on the completed slope.

(g) Chipping. Use an approved chipping machine to chip slash longer than 3 feet. Deposit chips on embankment slopes or outside the roadway to a loose depth less than 6 inches. Minor amounts of chips or ground woody material may be permitted within the roadway if they are thoroughly mixed with soil and do not form a layer.

(h) Debris Mat. Use tree limbs, tops, cull logs, split stumps, wood chunks, and other debris to form a mat upon which construction equipment is operated. Place stumps upside down and blend stumps into the mat.

(i) Decking. Remove brush from designated log deck areas. Limb and top logs.

Logs not meeting the Utilization Standards described in Subsection 201.04(c) shall be cut to lengths less than **<number>** feet and decked in designated log deck location.

Merchantable timber not associated with an existing timber sale shall be cut to length meeting the Utilization Standards described in Subsection 201.04(c).

Deck logs so that logs are piled parallel to one another; can be removed by standard log loading equipment; will not damage standing trees; will not interfere with drainage, and will not roll. Keep logs in log decks free of brush and soil.

(j) Removal to designated locations. Remove construction slash to designated locations.

(k) Piling. Pile construction slash in designated areas. Place and construct piles so that if the piles are burned, the burning will not damage remaining trees. Keep piles free of dirt from stumps.

204 - Excavation and Embankment

Delete Section 204 in its entirety and replace with the following.

Description

204.01 This work consists of excavating material and constructing embankments. This work also includes furnishing, hauling, stockpiling, placing, disposing, sloping, shaping, compacting, and finishing earthen and rocky material.

204.02 Definitions.

(a) Excavation. Excavation consists of the following:

(1) Roadway excavation. Material excavated from within the right-of-way or easement areas, except subexcavation covered in Subsection 204.02(a)(2) and structure excavation covered in Sections 208 and 209. Roadway excavation includes all material encountered regardless of its nature or characteristics.

(2) Subexcavation. Material excavated from below subgrade elevation in cut sections or from below the original ground-line in embankment sections. Subexcavation excludes the work required by Subsection 204.05 or 204.06.

(3) Borrow excavation. Material used for embankment construction that is obtained from outside the roadway prism. Borrow excavation includes unclassified borrow, and topping.

(b) Embankment construction. Embankment construction consists of placing and compacting roadway or borrow excavation. This work includes:

(1) Preparing foundation for embankment;

(2) Constructing roadway embankments;

(3) Benching for side-hill embankments;

(4) Constructing dikes, ramps, mounds, and berms; and

(5) Backfilling subexcavated areas, holes, pits, and other depressions.

(c) Conserved topsoil. Excavated material conserved from the roadway excavation and embankment foundation areas that is suitable for growth of grass, cover crops, or native vegetation.

(d) Waste. Excess and unsuitable roadway excavation and subexcavation that cannot be used.

Material

204.03 Conform to the following Subsections:

Topping	704.05
Unclassified borrow	704.06
Water	725.01(c)

Construction Requirements

204.04 Preparation for Roadway Excavation and Embankment Construction. Clear the area of vegetation and obstructions according to Sections 201 and 203.

Road pioneering, slash disposal, and grubbing of stumps may proceed concurrently with excavation and embankment. Maintain drainage during pioneering operations.

204.05 Conserved Topsoil. When designated, conserve topsoil from roadway excavation and embankment foundation areas. Stockpile conserved topsoil in low windrows immediately beyond the rounding limits of cut and embankment slopes or in other approved locations. Separate conserved topsoil from other excavated material. When designated, place conserved topsoil on completed slopes according to Section 624.

204.06 Roadway Excavation. Excavate as follows:

(a) Rock cuts. Blast rock according to Section 205. Excavate rock cuts to 6 inches (150 millimeters) below subgrade within the roadbed limits. Backfill to subgrade with topping or other suitable material. Compact the material according to Subsection 204.11.

(b) Earth cuts. Scarify earth cuts to 6 inches (150 millimeters) below subgrade within the roadbed limits. Compact the scarified material according to Subsection 204.11.

(c) Pioneer Roads. Conduct excavation and placement operations so material to be treated under Section 201 will not be incorporated into the roadway unless specified in the slash treatment method. Maintain drainage during pioneering operations.

Remove snow and ice in advance of the work and deposit beyond the roadway limits in a manner that will not waste material or generate sediment. Do not incorporate snow and ice into embankments. Place snow or ice in a manner to prevent resource damage.

(d) Drainage Feature. Drainage feature includes construction of all ditches, minor channel changes, drainage dips, catch basins, surface water deflectors, and other minor drainage structures. Compact the material according to Subsection 204.11. Excavate on a uniform grade between control points.

Do not disturb material and vegetation outside the construction limits. Retrieve material deposited outside the construction limits. Dispose of unsuitable or excess excavation material according to Subsection 204.14. Replace shortage of suitable material caused by premature disposal of roadway excavation.

Shape to drain and compact the work area to a uniform cross-section at the end of each day's operations.

204.07 Subexcavation. Excavate material to the required limits. Dispose of unsuitable material according to Subsection 204.14. Take cross-sections according to Section 152. Backfill subexcavated area with suitable material in horizontal layers not exceeding 12 inches (300 millimeters) in compacted thickness and compact according to Subsection 204.11. Prevent unsuitable material from mixing with suitable backfill material.

204.08 Borrow Excavation. Use suitable roadway excavation in embankment construction. Do not use borrow excavation when it results in excess roadway excavation. Deduct excess borrow excavation from the total borrow excavation quantity.

Obtain borrow source approval according to Subsection 105.02. Develop and restore borrow sources according to Subsections 105.03 and 105.06. Do not excavate beyond the established limits. When applicable, shape the borrow source to permit accurate measurements when excavation is complete.

204.09 Preparing Foundation for Embankment Construction. Prepare foundation for embankment construction as follows:

(a) Embankment over natural ground. Remove topsoil and break up the ground surface to a minimum depth of 6 inches (150 millimeters) by plowing or scarifying. Compact the ground surface according to Subsection 204.11.

(b) Embankments over an existing asphalt, concrete, or gravel road surface. Scarify gravel roads to a minimum depth of 6 inches (150 millimeters). Scarify or pulverize asphalt and concrete roads to 6 inches (150 millimeters) below the pavement. Reduce particles to a maximum size of 6 inches (150 millimeters) and produce a uniform material. Compact the surface according to Subsection 204.11.

(c) Embankment across ground not capable of supporting equipment. Dump successive loads of embankment material in a uniformly distributed layer to construct the lower portion of the embankment. Limit the layer thickness to the minimum depth necessary to support the equipment.

(d) Embankment on an existing slope steeper than 1V:3H. Cut horizontal steps in the existing slope to a sufficient width to accommodate placement and compaction operations and equipment. Step the slope as the embankment is placed and compacted in layers. Begin each step at the intersection of the original ground and the vertical cut of the previous step.

204.10 Embankment Construction. Incorporate only suitable roadway excavation material into the embankment. When the supply of suitable roadway excavation is exhausted, furnish unclassified borrow to complete the embankment. Obtain written approval before beginning construction of embankments over 6 feet (2 meters) high at subgrade centerline. Construct embankments as follows:

(a) General. At the end of each day's operations, shape to drain and compact the embankment surface to a uniform cross-section. Eliminate ruts and low spots that could hold water.

During all stages of construction, route and distribute hauling and leveling equipment over the width and length of each layer of material.

Compact embankment side slopes with a tamping foot roller, by walking with a dozer, or by over-building the fill and then removing excess material to the final slope line. For slopes 1V:1¾H or steeper, compact the slopes as embankment construction progresses.

(b) Embankment within the roadway prism. Place embankment material in horizontal layers not exceeding 12 inches (300 millimeters) in compacted thickness. Incorporate oversize boulders or rock fragments into the 12-inch (300-millimeter) layers by reducing them in size or placing them individually as required below. Compact each layer according to Subsection 204.11 before placing the next layer.

Material composed predominately of boulders or rock fragments too large for 12-inch (300-millimeter) layers may be placed in layers up to 24 inches (600 millimeters) thick. Incorporate oversize boulders or rock fragments into the 24-inch (600-millimeter) layer by reducing them in size or placing individual rock fragments and boulders greater than 24 inches (600 millimeters) in diameter as follows:

(1) Reduce rock to less than 48 inches (1200 millimeters) in the largest dimension;

(2) Distribute rock within the embankment to prevent nesting;

(3) Place layers of embankment material around each rock to a depth not greater than that permitted above. Fill voids between rocks; and

(4) Compact each layer according to Subsection 204.11(a) before placing the next layer.

(c) Embankment outside of roadway prism. When placing embankment outside the staked roadway prism, place material in horizontal layers not exceeding 24 inches (600 millimeters) in compacted thickness. Compact each layer according to Subsection 204.11.

204.11 Compaction. Compact the embankment using one of the following methods as specified.

(a) Placement Method 1. Use AASHTO T 27 to determine the quantity of material retained on a No. 4 (4.75-millimeter) sieve. Compact as follows:

(1) More than 80 percent retained on a No. 4 (4.75-millimeter) sieve. Adjust the moisture content to a level suitable for compaction. Fill the interstices around rock with earth or other fine material as practical. Use compression-type rollers at speeds less than 6 feet (1.8 meters) per second and vibratory rollers at speeds less than 3 feet (1 meter) per second. Compact each layer of material full width with one of the following and until there is no visible evidence of further consolidation:

(a) Four roller passes of a vibratory roller having a minimum dynamic force of 40,000 pounds (180 kilonewtons) impact per vibration and a minimum frequency of 1000 vibrations per minute;

(b) Eight roller passes of a 20-ton (20-metric ton) compression-type roller; or

(c) Eight roller passes of a vibratory roller having a minimum dynamic force of 30,000 pounds (130 kilonewtons) impact per vibration and a minimum frequency of 1000 vibrations per minute.

Increase the compactive effort for layers deeper than 12 inches (300 millimeters) as follows:

- For each additional 6 inches (150 millimeters) or fraction thereof, increase the number of roller passes in Subsection 204.11(a)(1)(a), by four passes; or

- For each additional 6 inches (150 millimeters) or fraction thereof, increase the number of roller passes in Subsection 204.11(a)(1)(b) and (c), by eight passes.

(2) 50 to 80 percent retained on a No. 4 (4.75-millimeter) sieve. Classify the material according to AASHTO M 145. Adjust the moisture content of material classified A-1 through A-5 to a moisture content suitable for compaction. Adjust the moisture content of material classified A-6 and A-7 to within 2 percent of the optimum moisture content. Use AASHTO T 99 to determine the optimum moisture content of the portion of the material passing a No. 4 (4.75-millimeter) sieve. Multiply this number by the percentage of material passing a No. 4 (4.75-millimeter) sieve, and add 2 percent to determine the optimum moisture content of the material.

Use nonvibratory rollers at speeds less than 6 feet (1.8 meters) per second and vibratory rollers at speeds less than 3 feet(1 meter) per second. Compact each layer of material full width according to Subsection 204.11(a)(1).

(3) Less than 50 percent retained on a No. 4 (4.75-millimeter) sieve. Classify the material according to AASHTO M 145. For material classified A-1 or A-2-4, determine the maximum density according to AASHTO T 99, Method C.

Adjust the moisture content of material classified A-1 through A-5 to a moisture content suitable for compaction. Adjust the moisture content of material classified A-6 and A-7 to within 2 percent of the optimum moisture content.

Use compression-type or vibratory rollers. Compact each layer of material full width to at least 95 percent of the maximum density. Determine the in-place density and moisture content according to AASHTO T 310 or other approved test procedures. When required, use AASHTO T 224 to correct for coarse particles.

(b) Placement Method 2. Adjust the moisture content of the material to a moisture content suitable for compaction. Fill the interstices around rock with earth or other fine material as practical. Operate roller compaction equipment over the full width of each layer until there is no visible evidence of further consolidation or, if when a sheepsfoot roller is used, the roller "walks out" of the layer. Make at least three complete passes. Use compression-type rollers at speeds less than 6 feet (1.8 meters) per second and vibratory rollers at speeds less than 3 feet (1 meter) per second. Ensure rollers meet the following requirements:

(1) Steel wheeled rollers, other than vibratory, capable of exerting a force of not less than 250 pounds per inch (4.5 kilogram/millimeter) of width of the compression roll or rolls.

(2) Vibratory steel wheeled rollers equipped with amplitude and frequency controls with a minimum dynamic force of 30,000 pounds (130 kilonewtons) impact per vibration, specifically designed to compact the material on which it is used.

(3) Pneumatic-tired rollers with smooth tread tires of equal size that will provide a uniform compacting pressure for the full width of the roller and capable of exerting a ground pressure of at least 80 psi (550 Kilopascals).

(4) Sheepsfoot, tamping, or grid rollers capable of exerting a force of 250 pounds per inch (4.5 kilogram/millimeter) of width of roller drum.

(c) Placement Method 3. Adjust the moisture content of the material to a moisture content suitable for compaction. Fill the interstices around rock with earth or other fine material as practical. Operate hauling and spreading equipment uniformly over the full width of each layer until there is no visible evidence of further consolidation. Make at least three complete passes.

(d) Placement Method 4. Adjust the moisture content of the material to a moisture content suitable for compaction. Fill the interstices around rock with earth or other fine material as practical. Operate hauling and spreading equipment uniformly over the full width of each layer.

(e) Placement Method 5. Adjust the moisture content of the material to a moisture content suitable for compaction. Compact the complete surface with a bucket of an excavator larger than 39,000 pounds (18 metric ton) Gross Vehicle Weight using a minimum of three blows. Overlap compaction by ½ width of bucket.

(f) Placement Method 6. Adjust the moisture content of the material to a moisture content suitable for compaction. Compact using an approved mechanical tamper for a minimum of three complete passes.

When compacting with rollers or hauling and spreading equipment is not practical, use approved mechanical tampers for a minimum of three complete passes.

204.12 Drainage Features. Slope, grade, and shape all drainage features. Remove projecting roots, stumps, rock, or similar matter. Maintain all drainage features in an open condition and without sticks, and other debris.

Form furrow ditches by plowing or using other acceptable methods to produce a continuous furrow. Place excavated material on the downhill side so the bottom of the ditch is approximately 18 inches (450 millimeters) below the crest of the loose material. Clean the ditch using a hand shovel or other suitable method. Shape to provide drainage without overflow.

204.13 Sloping, Shaping, and Finishing. Complete subgrade, slopes, drainage features, culverts, riprap, and other underground minor structures before placing aggregate courses. Slope, shape, and finish to the designated tolerance class as defined in Table 204-2 as follows:

(a) Sloping. Leave earth slopes with uniform roughened surfaces, except as described in Subsection 204.13(b), with no noticeable break as viewed from the road. Except in solid rock, round tops and bottoms of slopes including the slopes of drainage ditches. Round material overlaying solid rock to the extent practical. Scale rock slopes. Slope rounding is not required on tolerance class D through M roads.

If a slide or slipout occurs on a cut or embankment slope, remove or replace the material and repair or restore damage to the work. Bench or key the slope to stabilize the slide. Reshape the cut or embankment slope to an acceptable condition.

(b) Stepped slopes. Where required, construct steps on slopes of 1⅓V:1H to 1V:2H. Construct the steps approximately 18 inches (450 millimeters) high. Blend the steps into natural ground at the end of the cut. If the slope contains non-rippable rock outcrops, blend steps into the rock. Remove loose material found in transitional area. Except for removing large rocks that may fall, scaling stepped slopes is not required.

(c) Shaping. Shape the subgrade to a smooth surface and to the cross-section required. Shape slopes to gradually transition into slope adjustments without noticeable breaks. At the ends of cuts and at intersections of cuts and embankments, adjust slopes in the horizontal and vertical planes to blend into each other or into the natural ground.

(d) Finishing. Ensure that the subgrade is visibly moist during shaping and dressing; smooth and uniform, and shaped to conform to the typical sections. Remove material larger than 6 inches (150 millimeters) from the top 6 inches (150 millimeters) of the roadbed. Remove unsuitable material from the roadbed, and replace it with suitable material. Scarify to 6 inches (150 millimeters) below the bottom of low sections, holes, cracks, or depressions and bring back to grade with suitable material.

Maintain proper ditch drainage.

204.14 Disposal of Unsuitable or Excess Material. Dispose of unsuitable or excess material at designated sites or according to Subsection 203.05(a)

When there is a pay item for waste, shape and compact the waste material in its final location. Do not mix clearing or other material not subject to payment with the waste material.

204.15 Acceptance. See Table 204-1 for sampling, testing, and acceptance requirements.

Material for embankment and conserved topsoil will be evaluated under Subsections 106.02 and 106.04.

Excavation and embankment construction will be evaluated under Subsections 106.02 and 106.04.

Subexcavation will be evaluated under Subsections 106.02 and 106.04.

Measurement

204.16 Measure the Section 204 pay items listed in the bid schedule according to Subsection 109.02 and the following as applicable:

(a) Roadway excavation. Measure roadway excavation in its original position as follows:

(1) Include the following volumes in roadway excavation:

(a) Roadway prism excavation;

(b) Rock material excavated and removed from below subgrade in cut sections;

(c) Unsuitable material below subgrade and unsuitable material beneath embankment areas when a pay item for subexcavation is not listed in the bid schedule;

(d) Ditches, except furrow ditches measured under a separate pay item;

(e) Conserved topsoil;

(f) Borrow material used in the work when a pay item for borrow is not listed in the bid schedule;

(g) Loose scattered rocks removed and placed as required within the roadway;

(h) Conserved material taken from pre-existing stockpiles and used in Section 204 work, except topsoil measured under 624; and

(i) Slide and slipout material not attributable to the Contractor's method of operation.

(2) Do not include the following in roadway excavation:

(a) Overburden and other spoil material from borrow sources;

(b) Overbreakage from the backslope in rock excavation;

(c) Water or other liquid material;

(d) Material used for purposes other than required;

(e) Roadbed material scarified in place and not removed;

(f) Material excavated when stepping cut slopes;

(g) Material excavated when rounding cut slopes;

(h) Preparing foundations for embankment construction;

(i) Material excavated when benching for embankments;

(j) Slide or slipout material attributable to the Contractor's method of operation;

(k) Conserved material taken from stockpiles constructed at the option of the Contractor;

(l) Material excavated outside the established slope limits; and

(m) Road pioneering for the convenience of the Contractor.

(3) When both roadway excavation and embankment construction pay items are listed in the bid schedule, measure roadway excavation only for the following:

(a) Unsuitable material below subgrade in cuts and unsuitable material beneath embankment areas when a pay item for subexcavation is not listed in the bid schedule;

(b) Slide and slipout material not attributable to the Contractor’s method of operations; and

(c) Drainage ditches, channel changes, and diversion ditches.

(b) Unclassified borrow, and topping. When measuring by the cubic yard (cubic meter) measure in its original position. If borrow excavation is measured by the cubic yard (cubic meter) in-place, take initial cross-sections of the ground surface after stripping overburden. Upon completion of excavation and after the borrow source waste material is returned to the source, retake cross-sections before replacing the overburden. Do not measure borrow excavation until suitable roadway excavation is depleted.

(c) Embankment construction. Measure embankment construction in its final position. Do not make deductions from the embankment construction quantity for the volume of minor structures.

(1) Include the following volumes in embankment construction:

(a) Roadway embankments;

(b) Material used to backfill subexcavated areas, holes, pits, and other depressions;

(c) Material used to restore obliterated roadbeds to original contours; and

(d) Material used for dikes, ramps, mounds, and berms.

(2) Do not include the following in embankment construction:

(a) Preparing foundations for embankment construction;

(b) Adjustments for subsidence or settlement of the embankment or of the foundation on which the embankment is placed; and

(c) Material used to round fill slopes.

(d) Rounding cut slopes. If a pay item for slope rounding is included in the bid schedule measure rounding cut slopes horizontally along the centerline of the roadway. If a pay item is not included for slope rounding is not included in the bid schedule payment will be considered indirect to roadway excavation.

(e) Waste. Measure waste by the cubic yard (cubic meter) in its final position. Take initial cross-sections of the ground surface after stripping over-burden. Upon completion of the waste placement, retake cross-sections before replacing overburden.

(f) Slope scaling. Measure slope scaling by the cubic yard (cubic meter) in the hauling vehicle.

(g) Subexcavation. Measure subexcavation by the cubic yard (cubic meter) in its original position.

(h) Drainage features. Measurement includes all excavation, embankment, shaping, and grading necessary for a completed drainage feature.

Payment

204.17 The accepted quantities will be paid at the contract price per unit of measurement for the Section 204 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section.See Subsection 109.05.

Table 204-1
Sampling, Testing, and Acceptance Requirements

Material or Product (Subsection)	Type of Acceptance (Subsection)	Characteristic	Category	Test Methods Specifications	Sampling Frequency	Point of Sampling	Split Sample	Reporting Time
Source								
Topping (704.05)	Measured and tested for conformance (106.04 & 105)	Classification[1]	–	AASHTO M 145	1 per soil type and source of material	Processed material	Yes	Before using in work
Unclassified borrow (704.06)	"	"	–	"	"	"	"	"
Production								
Topping (704.05) and (204.11(a))	Measured and tested for conformance (106.04)	Moisture-density	–	T 99, Method C[2]	1 per soil type, but not less than 1 per each 13,000 yd^3 (10,000 m^3)	Processed material	Yes	Before using in work
		Density	–	AASHTO T 310 or other approved procedures	1 per 3500 yd^2 (3000 m^2), but not less than 3 per layer	In-place	No	Before placement of next layer
Unclassified borrow (704.06) and (204.11(a))	"	Moisture-density	–	T 99, Method C[2]	1 per soil type, but not less than 1 per each 13,000 yd^3 (10,000 m^3)	Processed material	Yes	Before using in work
		Density	–	AASHTO T 310 or other approved procedures	1 per 3500 yd^2 (3000 m^2), but not less than 3 per layer	In-place	No	Before placement of next layer

Material or Product (Subsection)	Type of Acceptance (Subsection)	Characteristic	Category	Test Methods Specifications	Sampling Frequency	Point of Sampling	Split Sample	Reporting Time
Production (continued)								
Earth embankment (204.11(a))	Measured and tested for conformance (106.04)	Classification	–	AASHTO M 145	1 per soil type	Source of material	Yes	Before using in work
		Moisture-density	–	T 99, Method C(2)	1 per soil type, but not less than 1 per each 13,000 yd^3 (10,000 m^3)	"	"	"
		Density	–	AASHTO T 310 or other approved procedures	1 per 3500 yd^2 (3000 m^2), but not less than 3 per layer	In-place	No	Before placement of next layer
Top of subgrade (204.11(a))	"	Density	–	AASHTO T 310 or other approved procedures	1 per 2500 yd^2 (2000 m^2), but not less than 3 per layer	In-place	No	Before placement of next layer
Finished Product								
Roadbed (204.13)	Measured and tested for conformance (106.04)	Final line & grade	–	Field measured	Determined by the CO	Determined by the CO	No	Before placement of next layer

(1) Not required when using Government-provided source.
(2) Minimum 5 points per proctor.

Table 204-2
Construction Tolerances

Location Description	Tolerance Class (a)												
	A	B	C	D	E	F	G	H	I	J	K	L	M
Roadbed width (ft)	+0.5	+0.5	+1.0	+1.0	+1.0	+1.0	+1.5	+1.0	+2.0	+2.0	+2.0	+2.0	+2.0
Subgrade elevation (ft)	±0.1	±0.2	±0.2	±0.5	±0.5	±1.0	±1.0	±1.5	±2.0	±3.0	±2.0	±3.0	(c)
Centerline alignment (ft)	±0.2	±0.2	±0.5	±0.5	±1.0	±1.0	±1.5	±1.5	±2.0	±3.0	±3.0	±5.0	(c)
Slopes, excavation, and embankment (% slope[(b)])	±3	±5	±5	±5	±5	±5	±10	±10	±10	±10	±20	±20	±20

(a) Maximum allowable deviation from construction stakes and drawings.
(b) Maximum allowable deviation from staked slope measured from slope stakes or hinge points.
(c) Unless otherwise shown the centerline alignment and subgrade elevation, as built, have no horizontal curves with a radius of less than 80 feet, and no vertical curves with a curve length of less than 80 feet when the algebraic difference in the grade change is less than 10 percent, or a curve length of less than 100 feet when the algebraic difference of the grade change is greater than or equal to 10 percent. The centerline grade is not to exceed 20 percent in 100 feet of length.

208 - Structure Excavation and Backfill for Selected Major Structures

208.07_National_11_8_2016

Add the following to Subsection 208.07:

208.07 Dewatering.

Construct diversions according to Subsection 157.10 Diversions. Submit dewatering plans according to Subsection 104.03.

209 - Structure Excavation and Backfill

209.09_National_7_18_2017

Make the following Changes to Subsection 209.09:

209.09 Backfill.

Add the following to Subsection 209.09(a):

(a) General.

Backfill without damaging or displacing the culvert or structural plate structure. Replace any pipe that is distorted by more than 5 percent of nominal dimensions, or that is ruptured or broken.

Add the following to Subsection 209.09(b)

(b) Pipe culverts.

Do not place or backfill pipe that meets any of the following conditions until the excavation and foundation have been approved in writing by the CO:

- Embankment height greater than 6 feet at subgrade centerline.
- Installation in a protected stream course.
- Round pipe with a diameter of 48 inches or greater.
- Pipe arches with a span of 50 inches or greater.
- Any box culvert or structure other than pipe culverts.

209.10_National_7_17_2017

Delete Subsection 209.10 and replace with the following:

209.10 Compacting.

Compact the embankment using one of the following methods as specified.

(a) Compaction Method 1. Use AASHTO T 27 to determine the quantity of material retained on a No. 4 (4.75-millimeter) sieve. Compact as follows:

(1) More than 80 percent retained on a No. 4 (4.75-millimeter) sieve. Adjust the moisture content to a level suitable for compaction. Fill the interstices around rock with earth or other fine material as practical. Use compression-type rollers at speeds less than 6 feet (1.8 meters) per second and vibratory rollers at speeds less than 3 feet (1 meter) per second. Compact each layer of material full width with one of the following and until there is no visible evidence of further consolidation:

(a) Four roller passes of a vibratory roller having a minimum dynamic force of 40,000 pounds (180 kilonewtons) impact per vibration and a minimum frequency of 1000 vibrations per minute;

(b) Eight roller passes of a 20-ton (20-metric ton) compression-type roller; or

(c) Eight roller passes of a vibratory roller having a minimum dynamic force of 30,000 pounds (130 kilonewtons) impact per vibration and a minimum frequency of 1000 vibrations per minute.

Increase the compactive effort for layers deeper than 12 inches (300 millimeters) as follows:

- For each additional 6 inches (150 millimeters) or fraction thereof, increase the number of roller passes in Subsection 209.10(a)(1)(a), by four passes; or
- For each additional 6 inches (150 millimeters) or fraction thereof, increase the number of roller passes in Subsection 209.10(a)(1)(b) and (c), by eight passes.

(2) 50 to 80 percent retained on a No. 4 (4.75-millimeter) sieve. Classify the material according to AASHTO M 145. Adjust the moisture content of material classified A-1 through A-5 to a moisture content suitable for compaction. Adjust the moisture content of material classified A-6 and A-7 to within 2 percent of the optimum moisture content. Use AASHTO T 99 to determine the optimum moisture content of the portion of the material passing a No. 4 (4.75-millimeter) sieve. Multiply this number by the percentage of material passing a No. 4 (4.75-millimeter) sieve, and add 2 percent to determine the optimum moisture content of the material.

Use nonvibratory rollers at speeds less than 6 feet (1.8 meters) per second and vibratory rollers at speeds less than 3 feet(1 meter) per second. Compact each layer of material full width according to Subsection 209.10(a)(1).

(3) Less than 50 percent retained on a No. 4 (4.75-millimeter) sieve. Classify the material according to AASHTO M 145. For material classified A-1 or A-2-4, determine the maximum density according to AASHTO T 99, Method C..

Adjust the moisture content of material classified A-1 through A-5 to a moisture content suitable for compaction. Adjust the moisture content of material classified A-6 and A-7 to within 2 percent of the optimum moisture content.

Use compression-type or vibratory rollers. Compact each layer of material full width to at least 95 percent of the maximum density. Determine the in-place density and moisture content according to AASHTO T 310 or other approved test procedures. When required, use AASHTO T 224 to correct for coarse particles.

(b) Compaction Method 2. Adjust the moisture content of the material to a moisture content suitable for compaction. Fill the interstices around rock with earth or other fine material as practical. Operate roller compaction equipment over the full width of each layer until there is no visible evidence of further consolidation or, if when a sheepsfoot roller is used, the roller “walks out” of the layer. Make at least three complete passes. Use compression-type rollers at speeds less than 6 feet (1.8 meters) per second and vibratory rollers at speeds less than 3 feet (1 meter) per second. Ensure rollers meet the following requirements:

(1) Steel wheeled rollers, other than vibratory, capable of exerting a force of not less than 250 pounds per inch (4.5 kilogram/millimeter) of width of the compression roll or rolls.

(2) Vibratory steel wheeled rollers equipped with amplitude and frequency controls with a minimum dynamic force of 30,000 pounds (130 kilonewtons) impact per vibration, specifically designed to compact the material on which it is used.

(3) Pneumatic-tired rollers with smooth tread tires of equal size that will provide a uniform compacting pressure for the full width of the roller and capable of exerting a ground pressure of at least 80 psi (550 Kilopascals).

(4) Sheepsfoot, tamping, or grid rollers capable of exerting a force of 250 pounds per inch (4.5 kilogram/millimeter) of width of roller drum.

(c) Compaction Method 3. Adjust the moisture content of the material to a moisture content suitable for compaction. Fill the interstices around rock with earth or other fine material as practical. Operate hauling and spreading equipment uniformly over the full width of each layer until there is no visible evidence of further consolidation. Make at least three complete passes.

(d) Compaction Method 4. Adjust the moisture content of the material to a moisture content suitable for compaction. Fill the interstices around rock with earth or other fine material as practical. Operate hauling and spreading equipment uniformly over the full width of each layer.

(e) Compaction Method 5. Adjust the moisture content of the material to a moisture content suitable for compaction. Compact the complete surface with a bucket of an excavator larger than 39,000 pounds (18 metric ton) Gross Vehicle Weight using a minimum of three blows. Overlap compaction by ½ width of bucket.

(f) Compaction Method 6. Adjust the moisture content of the material to a moisture content suitable for compaction. Compact using an approved mechanical tamper for a minimum of three complete passes.

When compacting with rollers or hauling and spreading equipment is not practical, use approved mechanical tampers for a minimum of three complete passes.

249 – Composite Road Construction

Description

249.01 Work. Perform clearing and grubbing, excavation and embankment, and erosion control.

During clearing and grubbing, treat merchantable timber and construction slash, including all trees designated for removal.

Excavation and embankment includes borrow excavation; drainage excavation; placing all excavated material; and shaping the area of excavation and embankment, including approaches, turnarounds, ditches and drainage dips.

Perform erosion control by furnishing and placing seed, fertilizer, mulch and tackifier.

Construct the roadway in conformance with the dimensions "shown on the plans" or as staked on the ground.

Construction Requirements

249.02 Clearing and Disposal. Protect construction stakes and construction control markers. Remove or treat all trees, snags, downed timber, brush, and stumps within the clearing limits according to the following specifications:

(a) Merchantable Timber. Deck or remove timber meeting Utilization Standards as "shown on the plans."

(b) Unmerchantable Timber. Treat unmerchantable timber as "shown on the plans."

(c) Large Construction Slash. Treat construction slash larger than 6 inches in diameter or longer than 3 feet by one or more of the following methods, as "shown on the plans."

Method A. Windrow construction slash inside the clearing limits. When slash is windrowed, place it approximately parallel to the roadway outside the toe of the fill slope.

Method B. Scatter construction slash outside the area of excavation and embankment without damaging trees. Limb all logs. Place logs and stumps away from trees, positioned so they will remain in place and are not on top of one another. Limb and scatter other construction slash to reduce slash concentrations.

Method C. Construct piles that are free of soil, with smaller slash well mixed with larger slash. Buck unmerchantable logs into lengths less than 30 feet prior to placement in piles. Place constructed piles so future burning will not damage remaining trees.

Method D. Construct piles of construction slash in the areas "shown on the plans" or staked on the ground. Construct piles so burning does not damage standing trees. Burn the piles until all the material remaining in the pile is charred or ash.

Method E. Bury the construction slash outside the excavation and embankment limits at the locations "shown on the plans" or staked on the ground. Construct mats in layers, and cover the mats with at least 18 inches of rock and soil. Slope the final surface to drain.

Method F. Construct a debris mat of construction slash on the fill slopes. Use tree limbs, tops, cull logs, split stumps, wood chunks, and other debris to form a mat. Place stumps upside down and blended into the mat as "shown on the plans."

Method G. Transport construction slash to a location "shown on the plans" or designated by the C.O.

Method H. Chip or grind construction slash through a chipping machine or machine designed and operated to grind slash and stumps into pieces such as a tub grinder. Deposit chips or ground woody material on embankment slopes or outside the excavation and embankment limits to a loose depth not exceeding 6 inches. Minor amounts of chips or ground woody material may be permitted within the excavation and embankment limits if they are thoroughly mixed with soil and do not form a layer.

(d) Small Construction Slash. Construction slash less than 6 inches in diameter and less than 3 feet in length may be incorporated into embankments so long as the material is distributed so that it does not result in concentrations or matting.

Immediately remove slash deposited in stream courses.

Fell all dead trees outside the clearing limits that lean toward the road and are sufficiently tall to reach the roadbed. Fell danger or unstable live trees designated on the ground outside the clearing limits before felling timber in the immediate clearing vicinity.

Leave stump heights less than 12 inches or one-third of the stump diameter, whichever is greater, measured on the side adjacent to the highest ground. Leave felled trees outside the clearing limits in place, and treat them no further unless otherwise "shown on the plans."

249.03 Pioneering. Do not undercut the final back slope during pioneering operations. Deposit material inside the excavation and embankment limits. Do not restrict drainage.

249.04 Grubbing. Grub within the limits as "shown on the plans." Stumps outside the grubbing limits may remain if cut no higher than 6 inches or one-third the stump diameter, which ever is greater, above the original ground, measured on the uphill side, unless otherwise "shown on the plans." Grub stumps that will protrude through the subgrade or have less than 6 inches of cover.

249.05 Excavation and Embankment. Construct the roadway to conform to the typical sections "shown on the plans". Protect backslopes from being undercut. Embankment may be placed by side casting and end dumping.

Locate and use borrow material, remove and treat unsuitable or excess material, as "shown on the plans".

Place rocks that are too large to be incorporated into the embankment outside the traveled way on the downhill side such that they will not roll, obstruct drainage, or hinder roadbed use and maintenance.

Leave slopes that are to be seeded in a roughened condition.

Shape and finish the roadbed to the condition ordinarily accomplished by a crawler tractor with dozer blade to provide drainage of surface water, unless otherwise "shown on the plans." Do not permit individual rocks to protrude more than 4 inches above the subgrade of the roadbed.

Width tolerance for the roadbed is (+) 30 inches unless otherwise "shown on the plans."

249.06 Erosion Control. Perform erosion control measures, including seeding, as "shown on the plans". Use methods and rates of application, and types of seed, fertilizer, mulch, and tackifier, as specified in Section 625 and as "shown on the plans". Apply materials uniformly to the areas to be treated.

Measurement

249.07 Method. Measure the Section 249 items listed in the Bid Schedule according to Subsection 109.02.

Payment

249.08 Basis. The accepted quantities will be paid at the contract price per unit of measurement for Section 249 pay items listed in the Bid Schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

301 - Untreated Aggregate Courses

301.03_National_7_17_2017

Add the following to Subsection 301.03:

301.03 General.

Written approval of the roadbed is required before placing aggregate.

For pit run or grid-rolled material, furnish material smaller than the maximum size, no gradation will be required otherwise. After processing on the road, remove all oversize material from the road and dispose as directed by the CO.

Provide additives or binder, if required, at the proportions specified.

Develop and use Government furnished sources according to Section 105.

If the aggregate is produced and stockpiled before placement, handle and stockpile according to Section 314.

301.05_National_7_17_2017

Delete Subsection 301.05 and replace with the following:

301.05 Compacting.

Compact each layer full width. Roll from the sides to the center, parallel to the centerline of the road. Along curbs, headers, walls, and all places not accessible to the roller, compact the material with approved tampers or compactors.

Compact the aggregate using one of the following methods as specified:

(a) **Compaction A.** Operating spreading and hauling equipment over the full width of the travelway.
(b) **Compaction B.** Operate rollers and compact as specified in Subsection 204.11(a)(1).
(c) **Compaction C.** Moisten or dry the aggregate to a uniform moisture content between 5 and 7 percent based on total dry weight of the mixture. Operate rollers and compact as specified in Subsection 204.11(a)(1).
(d) **Compaction D.** Compact to a density of at least 95 percent of the maximum density, as determined by AASHTO T 99, method C or D.
(e) **Compaction E**. Compact to a density of at least 95 per-cent of the maximum density, as determined by AASHTO T 180, method C or D.

For all compaction methods, blade the surface of each layer during the compaction operations to remove irregularities and produce a smooth, even surface. When a density requirement is specified, determine the in place density and moisture content according to AASHTO T 310 or other approved test procedures.

Add Section 571:

571 – Prefabricated Bridges – Complete Specification

Description

571.01 This work consists of designing, fabricating, delivering, and installing prefabricated modular bridge components.

Materials

571.02 Conform to the following Subsections:

Bridge Railing	556
Structural Metal	717
Prestressed Concrete	553
Reinforcing Steel	554
Steel Structures	555
Structural Concrete	552
Timber Structures	557
Material for Timber Structures	716

Construction Requirements

571.03 General. Fabricate precast and precast pre-stressed concrete at a facility certified by PCI or NPCA. Other facilities may be approved after review of plant quality control plan.

571.04 Design Requirements. For required loadings use the most recent AASHTO "Standard Specifications for Highway Bridges".

When design of the structure is required, submit plans and calculations signed by a professional engineer registered in the state where the bridge will initially be located or in the state where the fabricator's offices are located.

571.05 Design Drawings. Submit design drawings, calculations, and shop drawings according to Subsection 104.03.

571.06 Storing, Transporting and Erecting. Notify the CO at least 5 Days before delivering bridge components.

Do not ship concrete components until concrete cylinder tests, manufactured of the same concrete and cured under the same conditions as the members; indicate that the concrete in each member has attained the minimum required design strength. Before transporting concrete components, provide written certification from a professional engineer that the members were fabricated and visually inspected according to the contract and meet minimum quality requirements. Store, transport, and erect concrete components in the upright position with the points of support and directions of the reactions, with respect

to the member, approximately the same as when the member is in its final position. Prevent cracking or damage during hoisting, handling, and storing of the precast units. Replace units damaged by improper handling or storing.

Furnish all tools, devices, special equipment, and material needed for installation in well-marked watertight containers suitable for long-term, outdoor storage.

571.07 Abutments. Construct precast modular abutments according to the plans and approved shop drawings.

571.08 Contractor-Furnished Prefabricated Steel Bridge. Furnish the following items for approval prior to delivery of the bridge component:

a) Certification of structural steel, fasteners, and hardware.

b) Certification of galvanizing process used.

c) Steel fabricator certification that steel fabrication and quality control meet the requirements of the AISC Code of Standard Practice; and that all welding meets the requirements of ANSI/AASHTO/AWS D 1.5 Bridge Welding Code.

d) A complete list of all bridge components, hardware, and fasteners.

e) Complete instructions and drawings. Provide drawings that are black line, of reproducible quality, on ANSI sheet size D (24 inches by 36 inches). Furnish the same information in an approved electronic format.

Mark each major component of the bridge with a project identification number and an individual part identification number in a location that is clearly visible, both when stacked in storage and erected at the site.

571.09 Non-pressure Epoxy Grout Anchors. Furnish non-pressure epoxy grout to cement anchor dowels and bolts. At least 15 days prior to use submit for approval manufacture's test information on the non-pressure epoxy grout proposed for use.

Immediately prior to placing dowels or bolts, clean drill hole of dust and other material. Fill hole halfway with grout. Insert dowels by rotating it though one complete turn while tapping it down. Insert bolts according to manufacturer's instructions. If necessary add more grout to fill the hole.

571.10 Acceptance. Furnish a production certification for timber, including glued-laminated lumber, structural steel, and fabricated steel. Furnish a certification for all wood treatment, fasteners, hardware, galvanizing processes, and non-pressure epoxy grout.

Measurement

571.11 Measure the Section 571 items listed in the bid schedule according to Subsection 109.02.

Payment

571.12 The accepted quantities, measured as provided in Subsection 109.02 and above, will be paid at the contract price per unit of measurement for the Section 571 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

625 - Turf Establishment

625.00_National_7_18_2017

Delete Section 625 in its entirety and replace with the following:

Description

625.01 This work consists of soil preparation, watering, fertilizing, seeding, and mulching. Seeding and mulching methods are designated as dry or hydraulic.

Material

625.02 Conform to the following Subsections:

Agricultural limestone	713.02
Fertilizer	713.03
Mulch	713.05
Seed	713.04
Tackifiers	713.11
Water	725.01(b)

Construction Requirements

625.03 General. Apply turf establishment to prepared ground or any disturbed area between **<Date1>** and **<Date2>.** Apply turf establishment to the areas shown on the plans or worklists within **<number>** days after completion of ground disturbing activities.

Seeded areas damaged by construction activities shall be reseeded within 10 days of the damage. Do not seed during windy weather or when the ground is excessively wet, frozen, or snow covered.

Assure that all seed and mulch used in the work conforms to the weed free requirements of Section 713.

625.04 Preparing Seedbed. Ensure that the surface soil is in a roughened condition favorable for germination and growth.

625.05 Watering. Maintain moisture as follows:

<Describe watering requirements for the project here.>

625.06 Fertilizing. *Deleted N/A*

625.07 Seeding. Apply seed by the following methods:

(a) Dry Method. Apply the seed with approved power driven seeders, drills, or other mechanical equipment. Hand-operated seeding methods are satisfactory on areas inaccessible to mechanical equipment; or

625.08 Mulching. Apply Mulch within **48** hours after seeding by the following methods.

(a) Dry Method. Spread straw mulch material by hand at a rate of 3200 pounds per acre. Anchoring of mulch material is recommended. Contractor is responsible for replacing mulch that has blown or washed away until permanent groundcover is achieved.

625.09 Protecting and Caring for Seeded Areas. Protect and care for seeded areas including watering according to 625.05. Repair or apply supplemental applications of seed, mulch, fertilizer, and water according to 625.05 as many times as needed until turf is established or final acceptance.

625.10 Acceptance. Material for turf establishment will be evaluated under Subsections 106.02 and 106.03. Placing of turf establishment will be evaluated under Subsections 106.02 and 106.04. All areas which fail to show a uniform stand of grass for any reason, except for the presence of rock at the surface, shall be treated repeatedly until a uniform stand of at least 90% coverage is attained with no bare area greater than ten square feet.

Measurement

625.11 Measure the Section 625 pay items listed in the bid schedule according to Subsection 109.02 and the following as applicable:

Measure Permanent Seeding and Mulching by the acre measured on the ground surface.

Seed, mulch and and water will not be measured but will be considered indirect to Permanent Seeding and Mulching. Mixing soil and topsoil shall be indirect to the work.

Payment

625.12 The accepted quantities will be paid at the contract price per unit of measurement for the Section 625 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

628 – Bioengineering Plant Material – Complete Specification

628.00_0804_CNF_8_31_2020

Description

628.01 This work consists of furnishing and installing herbaceous plugs, live stakes and transplants as specified on the plans or listed in the bid schedule. Work must be supervised by an individual with proper training and experience. Contractor shall be responsible for ensuring that all vegetation meets or exceeds requirements provided in the plans and specifications.

All planting of dormant plant material shall occur during the dormant season, from November 1 through March 31. All planting of herbaceous plugs shall be installed during the growing season at times when conditions are suitable for survival.

Material

628.02 Conform to the following Subsections:

Herbaceous plugs will consist of species designated in the construction plans. Submit plant material source at least 14 days prior to ordering. The CO must approve any plant substitutions. Any substitutions must be native to the project site's state and physiographic region.

Live stake cuttings shall be approximately one-half inch to one-and one half inches (0.5" to 1.5") in diameter. Cuttings will not exceed two inches (2") in diameter and shall not be less than 0.25" in diameter. Cuttings shall be two feet (2') to three feet (3') in length and reasonably straight.

Live stakes shall be cut at a 45° angle at the basal end and cut flat on the top end. The basal end is the end that will take root and will be the end installed in the ground.

Live stake cuttings shall consist of a mix of three (3) or more of the approved plant species as set forth in the details. Species selection and percentages may be adjusted based on availability and approval of the Designer prior to purchase and installation. Final locations and configurations will be determined in the field by the Designer.

Transplants shall be categorized as herbaceous or woody. Transplants shall come from within the project area. Herbaceous transplants shall be harvested using hand or machine methods.

Construction Requirements

628.03 General. Keep materials moist and properly stored during transport and storage to ensure viability. Transport, store and install materials so as to prevent damage to materials. Protect plant materials from drying and overheating during transport and during the installation process. Replace damaged materials. Do not plant in frozen ground. Submit plant list to CO for approval prior to ordering.

628.04 Live Stakes. Live stakes should not be split during installation. If split is less than 1/6 the cutting length, the top maybe re-trimmed to remove damaged portion. Replace live stakes that splits exceding 1/6 cutting length. Live stakes should be green throughout the length of the stake when installed.

Provide continuous shade and wind protection to live plants.

Live stakes shall be installed in accordance with the plans and details. Live stakes will be installed in the ground using a dead blow hammer. The top end of the stake will protrude approximately 3" above the finished ground elevation. On sloped ground surfaces, stakes will be installed perpendicular to the finished grade slope.

Place live stakes so that 80% of their length is buried. Ensure full contact between soil and cutting. In the event of hard ground, a 0.5" metal bar may be used to initiate a pilot hole for live stakes.

Install live stake at the spacing and density as shown in the project drawings or as directed by the CO.

628.05 Watering. Herbaceous plugs and transplants should be watered upon installation and throughout the construction period when soil moisture is lacking. For this purpose, the construction period shall be that period during which the contractor is on-site working on other components of the work.
628.08 Mulching. Transplants shall be mulched with on-site material (e.g. leaves) as directed by CO.
628.09 Acceptance. CO will visually accept bioengineering plant materials.

Measurement

628.10 Measure the Section 628 pay items listed in the bid schedule according to Subsection 109.02 and the following as applicable:

Transplants shall be measured by each – for woody plants or plants with one obvious above ground stem measure each plant – for clumping plants, a 9"x9" clump shall be measured as a unit of each.

Payment

628.11 The accepted quantities will be paid at the contract price per unit of measurement for the Section 628 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

633 - Permanent Traffic Control

633.00_National_11_8_2016

Delete the first sentence of Subsection 633.02 and replace with the following:

633.02 Material.

Conform to the MUTCD, USDA Forest Service EM-7100-15, and the following Section and Subsections:

Make the following changes to Subsection 633.03:

633.03 General.

Delete the first paragraph of Subsection 633.03 and replace with the following:

Furnish and install permanent traffic control devices according to the MUTCD, USDA Forest Service EM-7100-15 and permanent traffic control plans. Provide traffic control devices that are crashworthy.

Add the following sentence to Subsection 633.03:

Sign panel layout proofs shall be approved by the CO prior to ordering.

Add the following to Subsection 633.05(a):

633.05 (a) Fabrication.

(3) Protective Overlay Film. When specified, cover the entire face of a sign with a clear high-performance, solvent-resistant, ultraviolet-stabilized, pressure-sensitive adhesive, protective overlay film. Use 3M Scotchlite Premium Protective Overlay Film Series 1160 or approved equivalent.

(4) Edge Film. When specified, edge film shall be 3 inches wide vinyl film that is pressure-sensitive, premium quality, clear, and ultraviolet-resistant.

Add Section 648:

648 - Stream Simulation – Complete Specification

648.00_National_7_18_2017; CNF_8-31_2020

Description

648.01 This work consists of furnishing and installing alluvium, rock, boulders, logs, trees, rootwads, cover logs, brush and branch roughness elements and specified stream simulation material, channel and bank and structure key pieces (rock fill) to simulate the natural character of the project reference reach.

Work includes developing materials from onsite or designated borrow locations, purchasing additional rock as required, hauling, staging and mixing materials, conducting gradation testing for stream simulation material, placing bedding and backfill to construct stream simulation channels.

Material

648.02 Conform to the following Subsections, as applicable:

Soil Erosion & Sediment Control	157
Riprap	251
Bioengineering Plant Material	628
Rolled Erosion Control Products	629
Rock	705

Furnish instream structures, bank and channel key piece materials (boulders, boulder clusters, ribs, steps, riffles, etc.) (reference: 705.07) and stream simulation streambed mix (Table 648-2) as required in the drawings.

When a new source is prepared, or at the direction of the CO if a visual change in the particle size distribution is observed, perform stream simulation gradation test using FLH Method 521 “Riprap Gradation by Wolman Count” to test piles of mixed bed material or perform in-stream pebble count to determine whether in-situ material is suitable for use. Gradation requirement for material is as listed in the table provided (Table 648-2), or + or – 5% for each screen size listed in the gradation when no tolerance is provided. In gravel-and/or cobble-bed streams, assume sub-surface material has 10% more fines than surface layer. Supplement class sizes that are lacking to provide a well-graded mix that falls between the minimum (min) and maximum (max) mix design.

When in-situ material does not meet specified gradation, follow the guidance below to determine required extent of excavation:

If in-situ material is finer than specified, excavate until in-situ material meeting one of the following conditions is encountered: (1) material meeting streambed simulation specifications;

(2) depth of excavation is below lower VAP and in-situ material is coarser than streambed simulation specifications; (3) bedrock is encountered; or

If in-situ material is coarser than specified. Otherwise, excavate to lower VAP, then backfill with stream simulation material to design grade as specified in section 648.10. Combine supplemental bed mix material according to 648.06. Add key pieces and recompact bed around key pieces.

Use streambed material that is similar in shape / angularity as that found in the natural stream channel or as designated in the specifications.

Request approval of rock to be used for steps, banks and all grade control structures prior to scheduled placement.

For wood structures, cover logs, rootwads, and roughness elements, provide native log materials, limbs and brush that are sound, and free of defects that would affect structural integrity or accelerate decay. Use log, limb and brush material of the size requirements designated on the plans. For Brush Toe Geolifts bioengineering practice dead material can be incorporated when approved by CO or designee.

For Brush Toe Geolift, dead material may be incorporated when approved by CO or designee. Brush toe geolift material shall be a minimum of 4' in length and have a diameter typically ranging from 1 – 3". Material shall be cut or trimmed to the appropriate length to fit the plans and on-site installation requirements. Stakes used to secure portions of the practice shall be as shown on the plans.

Construction Requirements

648.03 General. Place streambed simulation material on a prepared surface to form a well-graded, low permeability mass, similar in appearance and texture to the natural streambed or as required in the contract.

Protect completed work, metal and concrete structures and environmentally sensitive areas when completing this work.

648.04 Equipment Operations. Maintain equipment utilized in and around streams in a clean and orderly fashion. Immediately repair any fluid or fuel leaks. To the greatest extent possible, remove all contaminated material from the site and dispose of in accordance with all State and Federal laws.
An oil spill contamination kit is required on each job site when working in and around the stream. Composition of the kit is dependent on the job; determine contents of the kit as needed for each job and provide in proposed. At a minimum, include tarps and oil-absorbent pads. Provide boom material for instream operations associated with ponds, lakes, and intertidal areas, and when required in the contract.

648.05 Equipment Limitations. Equipment shall not be larger than necessary to efficiently complete the required work. Submit a list of equipment anticipated to be used for the job at the prework meeting.

648.06 Excavation. Segregate stream channel material excavated to achieve subgrade and stockpile separately from other general fill to facilitate re-use as or incorporation into stream simulation material.

Incorporate suitable in-situ streambed materials into the project to the lines and grades shown on the plans. Control excavation activities to minimize disturbance to the adjacent channel and banks. Tarp or otherwise protect stockpiled material to manage the moisture content. When working in key pieces to bed and bank, excavate to add key pieces and subsequently recompact bed and banks around key pieces.

Excavate according to Subsection 209.04.

648.07 Dewatering. See Section 157.10.

648.08 Rewatering. After washing or tamping in stream simulation bed material as prescribed below, and conducting all other structure, channel, and bank work, conduct rewatering activities to minimize sediment movement downstream of the site upon completion of instream work. Slowly wet the site and rewater through a sediment detention device (hay bales, silt fence, sediment filtration bag) in areas within close proximity to spawning gravel or during low stream flow conditions. After the initial sediment pulse is removed from upstream of the sediment detention device, slowly breach the coffer/diversion dams to avoid a large pulse of water being sent thru the newly constructed channel.

648.09 Rock Removal. As directed by CO, remove bedrock encountered during excavation to the lines and grades required in the contract. CO may alternatively modify the lines and grades to be constructed.

648.10 Place Streambed Simulation Material. Begin construction from the downstream end working upstream. Changes to construction flow will be allowed on a case by case basis due to poor stream to culvert alignment, traffic requirements, limited access, and preservation of existing trees reinforcing the banks. Deviation from construction flow (downstream to upstream) should be noted on the proposed construction sequence as part of the erosion control plan – if necessary, changes to sequencing should be approved by CO.

Material should be sufficiently dry prior to placement to facilitate required compaction. Place stream simulation rock in one or more layers with a layer depth less than **12** inches. Place stream simulation rock by methods that do not cause segregation or damage to the prepared surface. Place or rearrange individual rocks to obtain a uniformly dense, compact, low permeability mass, matching stream simulation bed details. Compact placed stream simulation material and fill all voids left during placement of Stream Bed Simulation Rock, banks, structures, key pieces and stream bed or protective rock materials adjacent to footings, abutments, concrete structures, or corrugated pipes with stream simulation material or fine alluvial material from on-site. If voids cannot be filled with on-site material, the CO or designee may approve alternate fill material on a case-by-case basis. Use water pressure, metal tamping rods, and similar hand operated equipment to force material into all surfaces and subsurface voids between the structure and rocks, and between individual rocks. Ensure the streambed is sealed to limit permeability.

Notify the CO at least 48 hours in advance of the streambed material installation.

648.11 Rock Bedforms (steps, weirs, riffles, pools), Forcing Features & Bank Construction. Construct bedforms and banks as required in the plans and specifications. Construction will proceed from downstream to upstream. Machine or hand place key pieces of the required size class, along with smaller materials of varying sizes to fill voids. Follow plan requirements for the placement of stream and bank key pieces and stream structures. Construct low flow channel through the center approximately 25% of the bedwidth, or as directed by the CO. Place structures and key pieces so the tops are uneven, containing several high and low points to concentrate water during low flows. Allow for gaps as shown on the plans and mimicking reference reach conditions. Place rock and log structures higher at the outside edge of the culvert (culvert wall) or bridge (abutment) and slope down to the outside edge of the constructed low flow channel at the slope designated on the plans or at 5(H):1(V) when no slope is designated. The designated slope does not need to be continuously even but should not leave lower gaps near the culvert wall or abutment where this could result in deeper flow along the wall or abutment.

Construct structures with footer rocks when shown on the plans. Use footer rocks of the size shown on the plans or the same size class as the top (header) rocks when the size is not specified. Fill all voids with smaller materials as construction progresses to minimize permeability. Use footers to cradle headers where shown on the plans or when directed. Use footers to serve as “splash rock” downstream of cascade over header rock where shown on the plans or when directed.

Extend rock structures into the bank as shown on the plans. When building in fill areas, extend rock structures horizontally and vertically to undisturbed solid ground to minimize risk of flow cutting around the back or underneath structure.

Incorporate key bank pieces into bank construction. Key and lock smaller materials of varying sizes to fill voids. Bank materials will be hand keyed in place and compacted depending on the size of materials used as designated on the plans and in the field by the CO. Construct bank faces to be uneven, protruding into the channel, and be rough in appearance to mimic reference reach. Construct the top of the bank to be uniform and incorporate planting media in accordance with Section 628. Blend constructed banks and margins at the edge of the structure walls into the existing stream banks at dimensions similar to those found in the field, or as required in the contract.

When single or clusters of channel key piece rock are incorporated into the stream bed, these shall typically be buried to a minimum of 50% of the diameter. Where in conflict, defer to the plans and protrusion requirements specified therein. Fill and compact voids around these structures.

Notify the CO at least 48 hours in advance of the installation of streambed, banks and structures

648.12 Log Structures, Rootwads, Cover Logs and Roughness Elements. Preserve, prepare and store on- site resources for reuse. Locate and place log, rootwad, cover log, roughness elements and bioengineering structures as shown on the plans and/or directed in the field by the CO. Apply cross slopes on applicable structures in the same manner as for rock structures.

Extend log structures into the bank as shown on the plans. When building in fill areas, extend structures horizontally and vertically to undisturbed solid ground to minimize risk of flow cutting around the back or underneath structure. Log structures may be supplemented with rock for this purpose. Obtain approval from CO prior to implementing in this manner.

Adequately anchor, pinch or buttress log structures, including cover logs, rootwads and roughness elements as shown on the plans or directed in the field. Roughness elements do not require as much securing and anchoring as other structures but the intent is for a lot of the placed material to remain in place during moderate flows up to bankfull.

648.13 Bioengineering Structures. Preserve and prepare woody material for incorporation into structures. Construct according to the detail(s) shown on the plans or as directed in the field.

For Brush Toe Geolift in pools, the top of brush layer shall be set to higher than the invert elevation of the downstream head of riffle so that approximately three inches of brush is exposed above the water surface during baseflow. In riffles, it is desired that brush be flush with edge of water allowing for a reasonable tolerance for construction method accuracy.

Alluvium, colluvium and soil shall be installed in lifts above the brush layer and wrapped with coir in accordance with the plans. In some cases, it is desired to have the top of the lift set 3-6 inches higher

than the bankfull elevation to create a berm along the top of the structure and reduce risk at the matting/soil interface. Implement this feature when shown on the plans and blend with the surrounding topography.

Acceptance

648.14 Acceptance. Placing streambed simulation material will be evaluated under Subsections 106.02 and 106.04.

Measurement

648.15 Measurement. Measurement is in linear feet along the Thalweg of the stream as shown in the pay items.

The following Items are incidental to the work under the 648 Pay Item:

On-site Materials

Do not measure harvesting/excavating, processing and re-use of on-site materials including rock and woody material separately for payment. This shall apply to the designated construction limits and any adjacent area within 75 yards that does not require special equipment to be brought in for harvest, transport, or sorting. Materials greater than 4' below the ground surface are not included within this incidental work, except when materials are being removed for other activities associated with the project.

Off-site Materials

Where required due to insufficient on-site materials for stream simulation practices, supplemental rock or woody materials brought in from offsite shall be measured as listed on the bid schedule.

Measurement shall be for the actual quantity of materials furnished and integrated into the work.

Incidental Stream Simulation Activities

Do not measure channel, stream bed, and stream bank construction or construction/placement of rock structures, bank and channel key pieces, cover logs, rootwads, roughness or reinforcement elements separately for payment when installation is consistent with plans in quantity and character.

Measure Off-site Materials according to section 109.02 and the following:

Where required due to insufficient on-site materials for stream simulation practices, supplemental rock or woody materials brought in from offsite shall be measured as listed on the bid schedule.

Payment

648.16 The accepted quantities, measured as provided in Subsection 109.02, will be paid at the contract unit price per unit of measurement for Section 648 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05

701 - Cement

701.02_National_7_10_2017

Add the following to Subsection 701.02:

701.02 Masonry and Mortar Cement.

Keep mortar in the original manufacturer's labeled containers until used. Protect as specified for Portland cement in 701.01. Do not use mortar after the expiration date shown on the container or 1 year from date of purchase, whichever date occurs first.

Store, mix, place and cure in accordance with the manufacturer's instructions; submit a copy in advance of use to the CO.

Furnish mortar that is a chemical action concrete of the magnesium ammonium phosphate family and requires no curing under ambient temperatures of 36° - 100° F. Require recommendation by its manufacturer specifically for use in prestressed concrete bridge member keyways that are to be part of the finished wearing and running surface of the bridge, subjected to normal roadway contaminants and conditions promoting wear of normal bridge deck concrete.

Typical properties of the mortar, when tested neat without aggregate, are as follows, except when noted:

- Compressive strength (ASTM C 109 modified) of 6000 psi at 24 hours at 72° F or above, and when used below 50° F, 5000 psi.
- Modulus of elasticity (ASTM C 469) at 7 and 28 days of 4177 ksi and 4554 ksi.
- Freeze-thaw durability (ASTM C 666, Procedure A Modified) of a relative dynamic modulus greater than 80 percent after 300 cycles.
- Scaling resistance to deicing chemicals (ASTM C 672) after 5 and 25 cycles at a rating of 0, shall show no surface scaling; after 50 cycles at a rating of 1.5 shall show only slight surface scaling.
- Sulfate resistance (ASTM C 1012) length change after 52 weeks shall be no greater than 0.9 percent.
- Coefficient of thermal expansion (CRD-C 39-81) when run with 1inch x 1 inch x 11 inch bars and neat mixes without aggregate, shall be within 10 percent of 7150 psi/degree Fahrenheit.
- Flexural strength (ASTM C 78 Modified) of 3 inch x 4 inch x 16 inch prisms shall be 3.8 550 psi at 24 hours for the mortar only, and 670 psi with 3/8 inch pea gravel.

Submit independent tests for the mortar recommended for use from 50° - 100° F, when used to fill test specimens conforming to the Government's bridge box beam test keyway, showing the following results:

Lateral (horizontal) shear between adjacent members: Range of 14 k/ft of keyway

Vertical shear between adjacent members: 16 k/ft of keyway

Direct tension between adjacent members: 6 k/ft of keyway.

Submit independent tests for the mortar recommended for use from 36° - 50° F, when used to fill test specimens conforming to the Government's bridge box beam test keyway, showing the following results:

- Lateral (horizontal) shear between adjacent members: Range of 2.4 k/ft of keyway
- Vertical shear between adjacent members: 6 k/ft of keyway
- Direct tension between adjacent members: 4 k/ft of keyway.

Two products that meet these requirements are BASF/Master Builders Technologies Regular Set-45 [for use below 50° F] and Set-45 Hot Weather Formula [for use from 50° - 100° F].

Use Set-45 Hot Weather Formula in air temperatures from 50° - 100° F. Use Regular Set-45 only in air temperatures below 50° F. When used in temperatures below 36° F, use approved weather precautions designed to prevent the mortar from freezing. Except when used in bridge deck keyways and blockouts, Regular Set-45 may be extended by the addition of 20 pounds of washed and clean 3/8 inch minus pea gravel per 50 pound bag when placed in thicknesses over 1.5 inches, or when approved by the CO.

Unless using one of the two products described above, submit products proposed for use to the CO for approval, and accompany them with the manufacturer's submittals substantiating all requirements in this section, including (1) graphs or charts showing the time, temperature, humidity, and curing requirements to achieve mortar strengths equal to the adjacent concrete; and (2) complete recommendations for storage, mixing, application and curing procedures.

703 - Aggregate

Delete 703.05 and replace with the following:

703.05 Subbase, Base, Surface Course, and Screened Aggregate.

(a) Subbase or base aggregate. Furnish hard, durable particles or fragments of crushed stone, crushed slag, or crushed gravel conforming the following:

(1) Gradation	Table 703-2
(2) Liquid limit, AASHTO T 89	25 max.
(3) Plastic limit, AASHTO T 90	Nonplastic
(4) Los Angeles abrasion, AASHTO T 96	40% max.
(5) Sodium sulfate soundness loss (5 cycles), AASHTO T 104	12% max.
(6) Durability index (coarse), AASHTO T 210	35 min.
(7) Durability index (fine), AASHTO T 210	35 min.
(8) Fractured faces, ASTM D 5821	50% min.
(9) Free from organic matter and lumps or balls of clay	

Do not use material that breaks up when alternately frozen and thawed or wetted and dried.

Obtain the aggregate gradation by crushing, screening, and blending processes as necessary. Fine aggregate, material passing the No. 4 sieve, shall consist of natural or crushed sand and fine mineral particles.

(b) Surface course aggregate. Furnish hard, durable particles or fragments of crushed stone, crushed slag, or crushed gravel conforming the following:

(1) Gradation	Table 703-3
(2) Liquid limit, AASHTO T 89	35 max.
(3) Plastic Index, AASHTO T 90	
a) If the percent passing the No. 200 sieve is less than 12%	2 to 9
b) If the percent passing the No. 200 sieve is greater than 12%	Less than 2
(4) Los Angeles abrasion, AASHTO T 96	40% max.
(5) Sodium sulfate soundness loss (5 cycles), AASHTO T 104	12% max.
(6) Durability index (coarse), AASHTO T 210	35 min.
(7) Durability index (fine), AASHTO T 210	35 min.
(8) Fractured faces, ASTM D 5821	75% min.
(9) Free from organic matter and lumps or balls of clay	

Do not use material that breaks up when alternately frozen and thawed or wetted and dried.

Do not furnish material that contains asbestos fibers.

Obtain the aggregate gradation by crushing, screening, and blending processes as necessary. Fine aggregate, material passing the No. 4 sieve, shall consist of natural or crushed sand and fine mineral particles.

(c) Screened aggregate – Furnish hard, durable particles or fragments of stone, slag, or gravel conforming the following:

(1) Gradation	Table 703-13
(2) Plastic Index, AASHTO T 90	Less than 9
(3) Los Angeles abrasion, AASHTO T 96	55% max.
(4) Free from organic matter and lumps or balls of clay.	

Do not use material that breaks up when alternately frozen and thawed or wetted and dried.

Obtain the aggregate gradation by crushing, screening, and blending processes as necessary.

Delete Table 703-2 and replace with the following:

Table 703-2
Target Value Ranges for Subbase and Base Gradation

Sieve Size	Percent by Mass Passing Designated Sieve (AASHTO T 27 and T 11)				
	Grading Designation				
	A (Subbase)	B (Subbase)	C (Base)	D (Base)	E (Base)
2½ inch	100				
2 inch	97 – 100	100	100		
1½ inch		97 – 100			
1 inch	65 – 79 (6)		80 – 100 (6)	100	
3/4 inch			64 – 94 (6)	86 – 100 (6)	100
1/2 inch	45 – 59 (7)				
3/8 inch			40 – 69 (6)	51 – 82 (6)	62 – 90 (6)
No. 4	28 – 42 (6)	40 – 60 (8)	31 – 54 (6)	36 – 64 (6)	36 – 74 (6)
No. 40	9 – 17 (4)			12 – 26 (4)	12 – 26 (4)
No. 200	4.0 – 8.0 (3)	4.0 – 12.0 (4)	4.0 –7.0 (3)	4.0 – 7.0 (3)	4.0 – 7.0 (3)

( ) The value in the parentheses is the allowable deviation (±) from the target values..

Delete Table 703-3 and replace with the following:

Table 703-3
Target Value Ranges for Surface Gradation

Sieve Size	Percent by Mass Passing Designated Sieve (AASHTO T 27 and T 11)					
	Grading Designation					
	F	G	H	S	T	U
1 1/2 inch	100			100		
1 inch	97-100	100		72 – 92 (6)	100	
3/4 inch	76-89 (6)	97 - 100	97 - 100			100
1/2 inch					71 – 91 (6)	
3/8 inch	56-68 (6)	70 – 80 (6)	80 – 92 (6)	51 – 71 (6)		71 – 90 (6)
No. 4	43-53 (7)	51 – 63 (7)	58 – 70 (7)	36 – 53 (7)	43 – 60 (7)	50 – 68 (7)
No. 8				26 – 40 (6)	30 – 46 (6)	34 – 51 (6)
No. 16	23-32 (6)	28 – 39 (6)	28 – 40 (6)			
No. 40	15-23 (5)	19 – 27 (5)	16 – 26 (5)	14 – 25 (5)	16 – 28 (5)	19 – 30 (5)
No. 200	10.0-16.0 (4)	10.0 – 16.0 (4)	9.0 – 14.0 (4)	8.0 – 15.0 (4)	8.0 – 15.0 (4)	8.0 – 15.0 (4)

( ) The value in the parentheses is the allowable deviation (±) from the target values.
If the plasticity index (PI) is greater than 0, the TV range for the No. 200 sieve size is 8-12 (4).

Add Table 703-13:

Table 703-13
Gradation Requirements for Screened Aggregate

Sieve Size	Percent by Mass Passing Designated Sieve (AASHTO T 27 and T 11)						
	Grading Designation						
	L	M	N	O	P	Q	R
6 inch	100	100					
4 inch			100	100			
3 inch					100	100	
2 inch							100
No. 4		15-45		15-45		15-45	

704 - Soil

704.08_National_11_8_2016

Make the following changes to Subsection 704.08:

704.08 Select Granular Backfill.

Delete Subsection 704.08(a)(2)

704.08 Select Granular Backfill. (a) Quality requirements. (2)

Delete Table 704-2 and replace with the following:

704.08 Select Granular Backfill. Table 704-2

Table 704-2
Select Granular Backfill Gradation

Sieve Size	Percent by Mass Passing Designated Sieve (AASHTO T 27 & AASHTO T 11)
4 inch (100 mm)	100
No. 40 (425 µm)	0 – 30
No. 200 (75 µm)	0.0 – 8.0

705 - Rock

705.08_National_7_18_2017

Add the following Class to Table 705-1 in Subsection 705.02:

705.02 Riprap. Table 705-1.

Table 705-1
Gradation Requirements for Riprap(1)

Class	% of Rock Equal or Smaller by Count, DX	Range of Intermediate Dimensions,(2) inches (millimeters)	Range of Rock Mass,(3) pounds (kilograms)
0	100	6 – 8 (150 –200)	17 – 41 (8 – 19)
	85	5 – 6 (150 – 150)	10 – 17 (5 – 8)
	50	2 – 5 (50 – 125)	0.6 – 10 (0.3 – 5)
	15	0 – 2 (0 – 50)	0 – 0.6 (0 – 0.3)

Add Subsection 705.08:

705.08 Streambed Simulation Rock.

(a) Simulation Material. Furnish a mixture of soil, gravel, cobble, and boulders to simulate a natural streambed. The cobbles and boulders should be hard, durable rock that conforms to test values in 705.02.

Table 705-4
Gradation requirements for Streambed Simulation Material (inches or sieve size)

Bed Class	100% passing	84% passing	50% passing	16% passing	10% passing
A*	80	14	3	1	No. 4
2	5	2	3/4	1/4	No. 10
4	10	4	1 3/4	1/2	No. 10
6	14	6	2 1/2	3/4	No. 10
8	22	8	3	1	No. 10
10	24	10	4	1	No. 10
12	30	12	5	1 1/2	No. 10
14	36	14	6	1 3/4	No. 10
16	42	16	7	2	No. 10
20	48	20	8	3	No. 10
24	60	24	10	3	No. 10
36	72	36	14	4	No. 10
48	96	48	18	6	No. 10

(b) Streambed Channel Rock. Furnish hard durable rock that is resistant to weathering and water action, free of organic or other unsuitable material, similar in color to those in the area, and at least as angular as that found in the natural stream channel. Do not use shale, rock with shale seams, or other fissile or fissured rock that may break into smaller pieces in the process of handling and placing. Conform to test values in 705.02.

Table 705-5
Gradation Requirement for Channel Rock (CR)

Class	Mass (Pounds)	Approximate Cubic Dimension (inches)
CR - 0	12 - 90	6 - 12
CR - 1	90 - 300	12 - 18
CR - 2	300 - 700	18 - 24
CR - 3	700 - 1350	24 - 30
CR - 4	1350 - 2400	30 - 36
CR - 5	2400 - 3700	36 - 42
CR - 6	3700 - 5500	42 - 48
CR - 7	5500 - 7900	48 - 54
CR - 8	7900 - 10800	54 - 60
Note: Mass / Pounds of channel is based on a sphere of the approximate cubic dimensions composed of granite. Mass will vary with rock type. Inspection should be performed by using the cube root of the A axis * B axis * C axis of each piece.		