

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: The work covered by this section consists of site clearing, grading, general and building excavation, disposal of debris and spoils, dewatering, preparation of subgrade, foundations, borrow, embankment, structural and general backfill, restoration, and cleanup necessary to construct the project, all as shown on the drawings and as specified herein.
- B. Related Sections: Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements.
- C. Method of measurement: The quantity of fill material acceptably placed in the embankment will be measured and computed in cubic yards by the average end area method, to the nearest cubic yard.
  - 1. The soil preparation not otherwise included elsewhere will be inclusive.
- D. Basis for payment:
  - 1. Unit Price: If the work of this section is so designated to be paid, the Contractor will be paid the Contract Unit Price for the calculated quantity of material provided as shown on the Drawings and as specified herein.
    - a. Additional payments for increased quantities, labor or equipment usage will only be allowed if a change order is warranted due to a change in project scope or for unforeseen conditions, as determined by the Project Engineer, in accordance with the provisions of the General Conditions of the Contract.

1.02 QUALITY ASSURANCE:

- A. Codes and Standards: Perform all excavation work in compliance with applicable requirements of governing authorities having jurisdiction.
- B. Safety: All excavation work and methods of construction shall conform to the State of Iowa Bureau of Labor and all OSHA Standards.

1.03 JOB CONDITIONS:

- A. Site information shown on the Drawings regarding existing conditions is of a general nature. Visit the site and be familiar with existing conditions.
- B. Observe weather conditions. Attempt no work in frozen conditions without the approval of the DNR Construction Inspector.

1.04 PROTECTION OF PERSONS AND PROPERTY:

- A. Protect from damage existing buildings, walks, paving, fencing, sod, and other items noted to remain. Maintain bench marks, monuments, property stakes, and other reference points.
- B. Protect existing underground utilities to remain. Notify the DNR Construction Inspector of underground utilities or structures encountered but not indicated on drawings.
  - 1. Contractor responsibilities: Correcting damage caused to existing construction, utilities, surfacing, and other items noted to remain at no additional expense to the Owner.
- C. Barricade open excavations occurring as part of this work and provide warning lights.

1.05 EXPLOSIVES:

- A. The use of explosives is not permitted.

PART 2 - PRODUCTS

2.01 GENERAL FILL AND EMBANKMENT MATERIAL:

- A. Materials to be incorporated in the top 12 inches of earth embankment or general fill shall be earthy materials, free from stones larger than 2 inches, broken concrete, roots, or other materials that would significantly affect scarifying, compacting and finishing the subgrade. It is anticipated that the majority of excavation material from the required excavation will be acceptable for this use. Obtain approval of fill material prior to any placement from the DNR Construction Inspector.

2.02 STRUCTURAL BACKFILL MATERIAL:

- A. Structural backfill material shall consist of a natural sand or a mixture of sand with gravel, crushed stone, or other broken fine material to fill all voids in coarser material. The maximum size of any gravel, stone, or broken or fragmented material shall be of such size that 100 percent passes a 6-inch sieve. The liquid limit of the material shall not be greater than 25 and the plasticity index shall not be more than 6. The portion of the material which passes a No. 4 sieve shall conform to the following requirements:

<u>Sieve Size</u>	<u>Weight Passing</u>	Percentage By
No. 4	100	
No. 40	Not more than 75	
No. 100	Not more than 15	
No. 200	Not more than 8	

- B. The material shall be capable of being compacted to 95 percent maximum density without undue weaving and heaving as defined by ASTM D698, Method D.
- C. Obtain approval of fill material prior to any placement from the DNR Construction Inspector.

2.03 GRANULAR DRAINAGE FILL MATERIAL:

- A. Granular drainage fill for use under concrete slabs and walks where shown on the Drawings shall consist of granular, free--draining material, consisting of clean bank run gravel or crushed stone of full range of sizes. Maximum size of aggregate shall be 3/4 inch. 15 to 50% of that portion of weight of fill shall pass the No. 4 sieve.

2.04 TOPSOIL:

- A. Topsoil: Friable clay loam surface soil reasonably free of subsoil, clay lumps, stones and other objects over two inches in diameter, and without weeds, roots and other objectionable materials.

PART 3 - EXECUTION

3.01 SITE CLEARING:

- A. General: Remove vegetation, improvements, or obstructions interfering with installation of new construction. Removal includes digging out of stumps, roots, boulders and any other necessary items, the removal of which is not covered in the work of another section.
- B. Clearing and Grubbing: Clear site of trees, shrubs, and other vegetation, except those indicated or directed to be left standing.
  - 1. Completely remove stumps, roots, boulders and other debris protruding through the ground. Use only hand methods for grubbing inside drip line of trees indicated to be left standing.
  - 2. Depressions: Fill depressions caused by clearing and grubbing operations with satisfactory soil materials, unless further excavation work is required or indicated.
  - 3. Material for clearing and grubbing may be burned in accordance with IAC 567-23.2 and additional local ordinances. Unburned materials may be buried at locations designated by the Engineer.
  - 4. Material from clearing and grubbing may be processed by such means as chipping of logs, down timber or brush, for mulching material, or salvage of logs and down timber for firewood. Other vegetation may be disked into the existing ground surface. Field fence shall be removed from the project.

3.02 LAYING OUT WORK:

- A. Unless otherwise noted, DNR surveyor will locate new construction, set slope and grade stakes, and otherwise fully lay out work. Contractor will provide intermediate staking to maintain proper grades and control, check existing grades at site against grades or contours indicated on Drawings, and report any differences to Project Engineer before beginning of grading.
- B. Preserve stakes and markers. Replace at no cost to the Owner stakes or markers carelessly or willfully damaged by operations. Assume responsibility for accuracy of lines, grades, and dimensions.

3.03 STRIPPING AND SALVAGING OF TOPSOIL:

- A. Preparation: Mow or otherwise remove weeds, grass and other vegetation on entire area expected to be disturbed by the work of this section.
- B. Sod: Shred sod by shallow plowing, blading or disking throughout the entire area.
- C. Excavation of topsoil: Not required for this project.

3.04 DEWATERING:

- A. Dewatering System: Provide, maintain and operate sufficient well points, headers, pumps, trenches, and sumps to keep all excavations for structures free from water at all times. Submit proposal to the DNR Construction Inspector for review prior to construction.
- B. Surface Runoff: Grading shall be controlled around the excavation to prevent surface water from running into the excavations for the structure.
- C. Saturated Foundations: Prior to placing any concrete for foundations, remove soils in footing excavation that have become saturated with surface water.

3.05 EXCAVATION - GENERAL:

- A. General: General excavation consists of removal of materials of whatever nature, including boulders smaller than 1 cubic yard in volume, required for the construction of structures, roads, and walks. The method of excavating shall be at the Contractor's option, exercising great care to leave the final grade in an undisturbed condition. If final grade is disturbed, it shall be restored to requirements and to the satisfaction of the DNR Construction Inspector. Prior to placing any concrete for footings and foundation work, the Contractor shall notify the DNR Construction Inspector to inspect the excavation and shall obtain approval to proceed with the pour.
- B. Frozen Ground: Provide frost protection for all structural excavation work. Do not place concrete for foundation work on frozen ground.
- C. Protection of Existing Work: Protect existing work, including underground utilities and piping, from damage caused by excavation work. Repair any damage to existing work, utilities, or piping at Contractor's expense.
- D. Storage of Fill Materials: Store excavated fill material away from excavations to avoid slides. Deposit excess earth on site, where directed by DNR Construction Inspector.
- E. Removal of Unsuitable Materials: Cross-sectional dimensions and depths shown on Drawings shall be subject to such changes as may be found necessary by the DNR Construction Inspector to secure foundations free from soft, weathered, shattered and loose or other objectionable materials. Remove unsuitable material encountered and replace with granular materials from established pits satisfactory to the DNR Construction Inspector. Compact granular materials to at least 95 percent of maximum density.

1. When the excavation of unsuitable materials and replacement with granular fill material directed by the DNR Construction Inspector is found to be above normal expectations, it will be paid for at the unit prices listed in the Contractor's submitted cost breakdown. What constitutes normal expectations will be determined by the Project Engineer. The Project Engineer's decision will be final.
- F. Disposal of Excavated Materials: Materials free from sticks, roots, and other objectionable material may be used on site as directed by the DNR Construction Inspector.
1. Remove excavated materials not suitable for fill as approved by Construction Inspector.

3.06 PLACEMENT OF EMBANKMENT MATERIAL:

- A. Deposit loose material in horizontal layers of not more than eight (8) inches in depth. Provide surface drainage of installed embankment material at all times during construction. Do not place embankment material on frozen ground nor use any frozen embankment material during construction.
- B. Smooth out deposited material to a uniform depth using suitable motor patrol, bulldozer, or self-propelled, tamping-type roller with blade attachment. Continue the initial smoothing and leveling during compaction to provide a surface free of ruts and other irregularities.
- C. Compaction: The desired compaction is to be obtained by the operation of an approved tamping type roller. Compaction will be considered in compliance with a minimum of one roller pass per inch depth of each lift, and continuing until the roller is supported on its tamping feet, as determined by the DNR Construction Inspector.
- D. Should a moisture problem be encountered in compacting the material, the manipulation necessary to incorporate water or to dry the material shall be considered incidental to embankment construction.

3.07 STRUCTURAL EXCAVATION:

- A. Excavate to elevations and dimensions indicated on the Drawings; allow additional space as required for construction operations and inspection.
- B. Remove all existing construction encountered within the excavation to a depth of 6 inches below the indicated elevation of footings and subgrades to receive floor slabs, walks, and paving.
- C. If suitable bearing is not encountered at depth indicated on the Drawings for foundations, immediately notify the DNR Construction Inspector and do not proceed until instructions are given and necessary measurements made for the purpose of establishing additional volume of excavation.
- D. Excavate last 4 inches by hand, if machines are used for excavation.
- E. Fill with concrete, at Contractor's expense, unauthorized excavation carried below bottom of foundation levels shown.

- F. The DNR Construction Inspector will inspect and approve the bottoms of all excavations prior to concrete placement.

3.08 STRUCTURAL BACKFILL:

- A. Start backfill around foundations not less than 24 hours nor more than seven (7) days after application of waterproofing. Backfill walls and piers to approximately the same elevation on each side to equalize pressure.
- B. Compact structural backfill to same requirements as construction of embankments, Section 3.06.

3.09 PLACING BACKFILL ADJACENT TO WALLS AND FOOTINGS:

- A. Deposit fill on each side of piers, walls and free standing structures simultaneously to approximately the same elevation. Protect below grade waterproofing, dampproofing and insulation with a single thickness of 1/2" fiberboard, 1/8" asphalt impregnated board or other approved means. Place fill in workable condition, free of clods, frost, or debris, in 8" lifts, and thoroughly compact each lift with mechanical tamper.
- B. Do not operate heavy equipment for spreading and compacting backfill closer to any wall than a distance equal to the height of the backfill above the top of the footings. Backfill adjacent to walls shall be compacted to the same density as the adjacent fill with a small vibratory or hand tamping compactor.

3.10 PREPARATION OF EARTH SUBGRADE FOR CONCRETE:

- A. When excavating for footings or bottom mat slabs to be cast on native soil, excavate to final grade in a manner so as to not disturb the existing soil. If the soil is disturbed, compact it to the satisfaction of the DNR Construction Inspector. If the soil is not capable of compaction to the satisfaction of the DNR Construction Inspector, remove the disturbed material, and replace it with thoroughly compacted structural backfill material. Do not place concrete on surfaces that are muddy, frozen or contain frost. If during the course of construction, bottom surfaces become muddy or saturated with water, remove the undesirable material and replace with compacted structural backfill as indicated above.

3.11 PLACING PIPE IN FILL:

- A. When it is necessary to place pipe culverts, drain piping, or other appurtenances in general or structural backfill, bring the fill up to at least one foot above the top of the pipe or appurtenances. Do not leave areas of backfill depressed to allow for trenches. After the compacted fill is complete, excavate for the pipe or appurtenances. Backfill materials and compaction are to conform to the fill in which it is placed.

3.12 TRIMMING AND CLEAN UP:

- A. Final trimming and cleaning up shall consist of work as follows:
  - 1. Smooth out all irregularities , fill all washouts, make slopes uniform, slightly rounded at top and bottom, and compact the entire area of the fill to the required lines, grades and cross sections, within one-tenth foot (0.1) above or below the established grade.

2. Where additional material is required, provide similar fill as the one used. Obtain such material from source approved by the DNR Construction Inspector.
3. When work is completed, remove and dispose of surplus material including stumps, trees and brush, and leave premises in a condition acceptable to the DNR Construction Inspector.

3.13 FINISH GRADING:

- A. After completion of rough grading, scarify areas to be seeded fertilized and mulched to a minimum depth of 4", as approved by the DNR Construction Inspector. Grade surfaces to eliminate water pockets or irregularities. Eliminate soil lumps and round off abrupt changes in slope. Spread excess earth on site as directed by DNR Construction Inspector. Topsoil removal, stockpiling, and deposit will not be required for this project.

3.14 SITE RESTORATION:

- A. All disturbed areas within the boundaries of this project (including borrow areas) not specifically receiving a finished surface are to be seeded in accordance with Section 02930.

END OF SECTION 02200

## CLASS "D" AND "E" SLOPE PROTECTION AND EROSION CONTROL

PART 1 - GENERAL1.01 SUMMARY:

- A. Section includes: All material, labor and equipment necessary for the placement of riprap required for the protection of and to prevent soil erosion on designated slopes where shown on the drawings and as specified herein. Also included are material, labor and equipment necessary for soil and slope preparation as shown on the drawings not included elsewhere.
- B. Related Sections:
  - 1. Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements.
- C. Method of measurement: All slope protection and erosion control will be delivered in tons. Weigh on accurate scales designed for weighing loaded trucks. Load vehicles to insure against loss of material between the scales and the point of delivery. No deduction will be made for the weight of moisture naturally occurring in the material. Material will not be deposited nor spread until the scale ticket is delivered to the DNR Construction Inspector and the weight of the material verified.
  - 1. The soil preparation not otherwise included elsewhere will be inclusive.
- D. Basis for payment:
  - 1. Unit Price: If the work of this section is so designated to be paid, the Contractor will be paid the Contract Unit Price for the calculated number of tons for each class of material provided as shown on the Drawings and as specified herein.
    - a. Additional payments for increased quantities, labor or equipment usage will only be allowed if a change order is warranted due to a change in project scope or for unforeseen conditions, as determined by the Project Engineer, in accordance with the provisions of the General Conditions of the Contract.

1.02 REFERENCES:

- A. Standards of materials and construction shall conform with the Standard Specifications for Highway and Bridge Construction, 2001 Series of the Iowa Department of Transportation.
  - 1. Section 4130 - Revetment Stone
- B. Where conflicts arise between the Drawings and Code Requirements, the latter shall prevail, unless Drawings are more stringent. Bring all conflicts to the attention of the Project Engineer and the DNR Construction Inspector.

1.03 SUBMITTALS:

- A. Samples: Submit, for verification purposes, samples of each type of material to be used in the work of this section, as requested by the DNR Construction Inspector.
- B. Weight tickets: Provide weight tickets for each truckload.
  - 1. Include the Contractor's name, date of delivery designation of mixture, load identification number, net weight of load and any other data which would aid in the identification of the load.
  - 2. Only weight tickets issued by a state licensed scale will be accepted.

1.04 QUALITY ASSURANCE:

- A. Qualification of Workers: Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the requirements and the methods needed for proper performance of the work of this section.

1.05 MATERIAL HANDLING:

- A. Class "D" Revetment Stone: Use a loading method which assures reasonable compliance with specified requirements and is acceptable to the DNR Construction Inspector. The DNR Construction Inspector will visually inspect material prior to loading and may reject material too fine or too coarse and require Contractor to load from another area.
- B. Class "E" Revetment Stone: Class "E" material shall be processed to the extent that most of the material 3 in. and less shall be removed.

1.06 PROJECT/SITE CONDITIONS:

- A. Existing Conditions: Survey job conditions prior to commencing work. Bring any discrepancies between existing conditions and the Drawings and Specifications to the attention of the Project Engineer/DNR Construction Inspector.
  - 1. Interface with existing conditions in accordance with the obvious intent of Drawings and Specifications. Claims for extra payments as a result of failure to examine existing conditions at the site will not be allowed.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Revetment Stone: Provide Revetment Stone (Riprap), where indicated on the drawings, meeting the requirements of IDOT Standard Specification Section 4130 for gradation shown and which when subjected to the freezing and thawing test of the IDOT Laboratory, Method 211, Method C, shall not lose more than 10% for stones crushed to 1-1/2" to 3/4"(nominal) for Class "D" revetment. Class "E" revetment shall not exceed 10% Method A. In addition the percentage of

abrasion loss when tested in accordance to AASHTO T96 shall not exceed 50. Do not use material which split in layers less than 4-inches thick, when exposed to natural weathering regardless of the above tests results.

1. Class "D" and Class "E" revetment stone shall be taken from blasted rock or broken concrete. Class "D" material shall not require additional processing. After visual inspection and prior to loading, the engineer may designate material as too fine or too coarse and may require material to be loaded from another area. Class "E" material shall be processed to the extent that most of the material 3 in. and less shall be removed.

Revetment shall be well-graded material with a nominal top size of 250 lb.\* and meeting the following additional size limitations.

<u>Stone Weight</u>	<u>Minimum % Larger Than Stone Weight</u>
90 lb	50
5 lb	90

\*Note: The Engineer may approve using riprap containing material larger than 250 lb.

- B. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Project Engineer.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION:

- A. Examine the areas and conditions under which work of this section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

#### 3.02 PREPARATION:

- A. Surface Preparation: Begin with trench excavations to the elevations shown on the Drawings. Shape and dress the slope to be protected so that the revetment surface will be in compliance with the lines and grades shown on the Drawings.
  1. To control placement provide a grid system designating those areas shown on the Drawings to receive stone protection.
  2. The DNR Inspector will inspect the prepared base directly prior to placement of revetment.

#### 3.03 APPLICATION:

- A. Special Techniques: Spot loads and distribute over the surface marked in grid. Do not place any material until prepared base has been accepted by the DNR Construction Inspector.
- B. Place stone riprap to produce a reasonably well-graded mass of stone with the minimum practicable percentage of voids and in full course thickness in one operation.

1. Distribute the largest stones so that the entire mass conforms approximately to the gradation specified.
  2. Where necessary, allow some roughness in surface to break up wave action and decrease the velocity of the mass while keeping the mass fairly compact with all sizes of material in proper proportions.
  3. Hand place or rearrange individual stones with mechanical equipment as necessary to secure results as specified.
- C. Tolerances: Control distribution based on the assumed density of 100 lbs per cubic foot and the actual weights delivered.

END OF SECTION 02270

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: The work covered by this section consists of furnishing all materials, labor, and equipment necessary or required to install engineering fabric as shown on the Drawings and as specified herein.
- B. Related Sections: Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements as well as, but not necessarily limited to, the following:
  - Section 02200 - Earthwork
  - Section 02270 - Slope Protection and Erosion Control
- C. Measurement: Measure the quantity of material installed, to the nearest square yard.
- D. Method of Payment:
  - 1. Contract Unit Price: When payment for the work of this section is so designated, the contractor will be paid the Contract Unit price per square yard.
    - a. In the event that the estimated quantity is larger than the quantity provided, pay the Owner a deduct for the difference in cost for both quantity and labor.
    - b. Additional payments for increased quantities or labor will only be allowed if a change order is warranted due to a change in project scope or for unforeseen conditions, as determined by the Project Engineer, in accordance with the provisions of the General Conditions of the Contract.
  - 3. The Owner will make no additional payments for additional material or labor to correct deficiencies, shortages, or mistakes by the Contractor.

1.02 REFERENCES:

- A. Standards of materials and construction shall conform with the Standard Specifications for Highway and Bridge Construction, Series of 2001, of the Iowa Department of Transportation.

1.03 CONTROL OF MATERIALS:

- A. General: Use materials as specified in this section, tested and approved for use by the DNR Construction Inspector in accordance with the applicable portions of 2001 Series, IDOT Section 4196.
- B. Field Testing: Testing of materials and workmanship will continue throughout the project as conducted by the DNR Construction Inspector. Cooperate in these tests in any way needed to obtain the required data and samples.

- C. Unacceptable materials: Unacceptable materials will be rejected in accordance with 2001 Series, IDOT Section 1106.04.

1.05 JOB CONDITIONS:

- A. Review job conditions prior to commencing work. Bring any discrepancies between existing work and the Drawings and Specifications to the attention of the Project Engineer/ DNR Construction Inspector.
- B. Observe weather conditions. Attempt no work in frozen conditions without written approval from the DNR Construction Inspector.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Provide material in accordance with 2001 Series, IDOT Standard Specifications Section 4196.
- B. Engineering Fabric: Provide engineering fabric of a nonwoven synthetic material formed into a stable network such that the filaments or yarns retain their relative position to each other. The material shall be mildew, rot, insect, and rodent resistant and shall be inert to commonly encountered chemicals found in soil. During all periods of shipment and storage, the fabric shall be maintained, wrapped in a heavy-duty protective covering to protect the fabric from direct sunlight, ultraviolet rays, mud, dirt, dust, and debris. The material shall be free of defects or flaws which significantly affect it's physical properties. A competent laboratory must be maintained by the producer of the fabric at the point of manufacture to ensure quality control. Each roll of fabric in the shipment is to be labeled with a number or symbol to identify that particular production run.
  - 1. Fabric for use under riprap will be capable of withstanding normal installation stresses and have the following minimum properties:

<u>Property</u>	<u>Value</u>	<u>Test Method</u>
A. Grab strength, dry; lb.....	150.....	ASTM D-4632
B. Elongation, dry; %.....	20.....	ASTM D-4632
C. Water permeability, K; 0.02 - 0.30.....		ASTM D-4491
D. Apparent opening size.....	40.....	ASTM D-4751

PART 3- EXECUTION

3.01 GENERAL:

- A. Accomplish the work of this section in accordance with the applicable portions of the 2001 Series, IDOT Standard Specifications for Highway and Bridge Construction.

3.02 PREPARATION OF SUBGRADE:

- A. Shape subgrade prior to starting the work of this section, as directed by the DNR Construction Inspector, and as recommended by the fabric manufacturer.
- B. Install fabric according to the details in the Drawings and according to the manufacturers recommendations.

3.03 CLEAN UP:

- A. Upon completion of construction, remove all excess materials and construction debris, and restore any damage done to existing buildings or landscape.

END OF SECTION 02272

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: The work covered by this section consists of furnishing all materials, labor, and equipment necessary or required to place erosion stone or gabion fill as shown on the Drawings and as specified herein.
- B. Related Sections: Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements as well as, but not necessarily limited to, the following:
  - Section 02270 - Slope Protection and Erosion Control
  - Section 02273 - Gabions
- C. Measurement: Weigh the quantity of material installed, to the nearest ton., as determined by scale tickets delivered with the material.
- D. Method of Payment:
  - 1. Contract Unit Price: When payment for the work of this section will be so designated, the contractor will be paid the Contract Unit price per ton.
    - a. Additional payments for increased quantities or labor will only be allowed if a change order is warranted due to a change in project scope or for unforeseen conditions, as determined by the Project Engineer, in accordance with the provisions of the General Conditions of the Contract.
  - 2. The Owner will make no additional payments for additional material or labor to correct deficiencies, shortages, or mistakes by the Contractor.

1.02 REFERENCES:

- A. Standards of materials and construction will conform to the Standard Specifications for Highway and Bridge Construction, Series of 2001, of the Iowa Department of Transportation.

1.03 CONTROL OF MATERIALS:

- A. General: Use materials as specified in this section, tested and approved for use by the DNR Construction Inspector in accordance with the applicable portions of 2001 Series, IDOT Standard Specifications.
- B. Samples and Tests: Submit samples of materials to the DNR Construction Inspector in advance of the anticipated use to avoid construction delays.
  - 1. Submit samples and tests in accordance with Section 01300 of these Specifications.

- C. Field Testing: Testing of materials and workmanship will continue throughout the project, conducted by the DNR Construction Inspector.
  - 1. Cooperate in these tests in any way needed to obtain the required data and samples.
- D. Unacceptable materials: Unacceptable materials will be rejected in accordance with 2001 Series, IDOT Section 1106.04.

1.05 JOB CONDITIONS:

- A. Review job conditions prior to commencing work. Bring any discrepancies between existing work and the Drawings and Specifications to the attention of the Project Engineer/DNR Construction Inspector.
- B. Observe weather conditions. Attempt no work in frozen conditions without written approval from the DNR Construction Inspector.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Gabion Stone: Provide crushed stone erosion stone or gabion fill as required by 2001 Series, IDOT Section 4109, gradation No. 34, comprised of the following limits:

<u>SIZE OPENING, INCHES</u>	<u>PERCENT PASSING BY WEIGHT</u>
9	100
3	0

PART 3- EXECUTION

3.01 GENERAL:

- A. Accomplish the work of this section in accordance with these Specifications and as directed by the DNR Construction Inspector.

3.02 INSTALLATION OF EROSION STONE/GABION FILL:

- A. Erosion stone is to be placed after the subgrade preparation is complete as approved by the DNR Construction Inspector.
- B. Gabion fill is to be placed after the baskets are assembled in their final location and all interior diaphragms are securely fastened in place.

3.03 CLEAN UP:

- A. Upon completion of construction, remove all excess materials and construction debris, and restore any damage done to existing buildings or landscape.

END OF SECTION 02275

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: The work covered by this section consists of furnishing all materials, labor, and equipment necessary or required to do the grading, placing and compacting of granular base materials as shown on the Drawings and as specified herein.
- B. Related Sections: Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements as well as, but not necessarily limited to, the following:

Section 02200A - Earthwork With M & D Compaction

- C. Measurement: Measure the quantity of material delivered in tons.
  - 1. Weigh on accurate scales designed for weighing loaded trucks.
  - 2. Load vehicles to insure against loss of material between the scales and the point of delivery.
  - 3. No deductions will be made for the weight of moisture naturally occurring in the material.
  - 4. Material will not be deposited and spread until the scale weight ticket is delivered to the DNR Construction Inspector and the weight of material verified.
    - a. Include the Contractor's name, date of delivery, designation of mixture, load identification number, gross, tare, and net weights of load and any other data which would aid in the identification of the load.
    - b. Only weight tickets issued by a state licensed scale will be accepted.
- D. Method of Payments:
  - 1. Contract Unit Price: When payment for the work of this section is so designated, the Contractor will be paid the Contract Unit price per ton.
    - a. Material will not be deposited and spread until the scale weight ticket is delivered to the inspector and the weight of material verified.

- b. In the event that the estimated quantity is larger than the quantity provided, pay the Owner a deduct for the difference in cost for both quantity and labor.
    - c. Additional payments for increased quantities or labor will only be allowed if a change order is warranted due to a change in project scope or for unforeseen conditions, as determined by the Project Engineer, in accordance with the provision of the General Conditions of the Contract.
- 2. Lump Sum Payment: If this method of payment is so designated, the Contract Documents provide for payment of a lump sum bid amount for the entire project, part of which is the work of this contract, or a lump sum payment for the work of this section as indicated.
  - a. The quantity of material provided will be verified by scale tickets and compared to the estimated quantity provided as part of the Contractor's Price Breakdown.
  - b. In the event that the estimated quantity is larger than the quantity provided, the Contractor shall pay the Owner a deduct for the difference in cost for both quantity and labor.
  - c. Additional payments for increased quantities or labor will only be allowed if a change order is warranted due to a change in project scope or for unforeseen situations, as determined by the Project Engineer, warranting additional material and labor to accomplish the original work of this section.
- 3. The Owner will make no additional payments for additional material or labor to correct deficiencies, shortages or mistakes by the Contractor.

## 1.02 REFERENCES:

- A. Standards of materials and construction shall conform with the Standard Specifications for Highway and Bridge Construction, Series of 2001 of the Iowa Department of Transportation:

Section 1106 - Control of Material  
Section 2111 - Granular Subbase  
Section 4109 - Aggregate Gradation  
Section 4121 - Granular Subbase Material

1.03 CONTROL OF MATERIALS:

- A. General: Use only materials as specified for this section and tested and approved for use by the DNR Construction Inspector in accordance with the applicable portions of 2001 Series, I.D.O.T. Section 1106.
- B. Samples and Tests: Submit samples of materials to be used to the DNR Construction Inspector in advance of anticipated use to avoid construction delays.
  - 1. Test and inspect and obtain approval of the DNR for each consignment of material before it is incorporated in the work.
  - 2. Unless otherwise designated elsewhere provide samples, and tests, and apply a basis for acceptance in accordance with the current AASHTO "Standard Specifications for Transportation, Material and Methods of Sampling and Testing" including published interim standards.
- C. Field Testing: Testing of materials and workmanship will continue throughout the project as conducted by the DNR Construction Inspector.
  - 1. Cooperate in these tests in any way needed to obtain the required data and samples.
- D. Unacceptable Materials: Unacceptable materials will be rejected as follows:
  - 1. The DNR field inspector will consider unacceptable and reject any material not conforming to the specified requirements.
  - 2. The DNR Inspector will also reject previously accepted material, delivered to the site, which have become damaged before actual incorporation into the work.
  - 3. Promptly remove from the site all rejected material.
  - 4. Unless otherwise authorized by the Project Engineer, do not incorporate corrected rejected material into the work.

1.05 JOB CONDITIONS:

- A. Survey job conditions prior to commencing work.
  - 1. Bring any discrepancies between existing work and the Drawings and Specifications to the attention of the Project Engineer/DNR Construction Inspector.
- B. Observe weather conditions.

1. Attempt no work in frozen conditions without written approval from the DNR Construction Inspector.

## PART 2 - PRODUCTS

### 2.01 MATERIALS:

- A. Provide material in accordance with 2001 Series, IDOT Standard Specifications Section 4121.
- B. Class A Crushed Stone: Provide Class A crushed stone consisting of a uniform mixture of coarse and fine particles produced by crushing ledge rock, predominantly limestone, dolomite, or quartzite.
  1. Provide material meeting the requirement of IDOT Standard Specifications Section 4121 for gradation number 11 with a maximum of 4 percent mud balls and a minimum of 4 percent passing No. 200 sieve.
  2. The percentage of wear when tested in accordance with AASHTO T96, grading B, shall not exceed 45.
  3. Gradation: Provide material, which when tested, will meet the requirements of IDOT gradation No. 11 as follows:

<u>% Passing</u>	<u>Sieve Size</u>
100	1 inch
97-100	3/4 inch
30-75	No. 4
15-45	No. 8
6-16	No. 200

## PART 3 - EXECUTION

### 3.1 GENERAL:

- A. Accomplish the work of this section in accordance with the applicable portions of the 2001 Series, IDOT Standard Specification for Highway and Bridge Construction.

### 3.02 PREPARATION OF SUBGRADE:

- A. Preparation and correction of Subgrade: Conform to 2001 Series, I.D.O.T. Section 2111.

1. Blade loose granular material present on the roadbed into windrow and store on the shoulder area, then correct the subgrade to required profile and cross section.
  - a. Wet and consolidate material moved in this operation so that the subgrade on which the next course is placed is smooth, firm, compacted earth.
2. Profile and Cross section requirements:
  - a. Check the cross section with an accurate template extending at least halfway across the width of the subgrade and correct deviations of more than one (1) inch from the template.
  - b. Remove dips or humps from profile to provide a good riding surface.

3.03 PLACING OF CRUSHED STONE COURSE:

- A. Construct base course using crushed rock top course material as defined by IDOT 2001 Series. Place the course in accordance with applicable sections of the IDOT Standard Specifications for Granular Surfacing, Standard Compaction as defined by the IDOT Standard Specifications.

3.05 CLEAN UP:

- A. Upon completion of construction, remove all excess materials and construction debris, and restore any damage done to existing buildings or landscape.

END OF SECTION 02505

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: The work covered by this section consist of furnishing all materials, labor, and equipment necessary or required to do the grading, placing and compacting of fill materials and surfacing, crushed stone paving for roadways and/or parking areas as shown on the Drawings and as specified herein.
- B. Related Sections: Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements as well as, but not necessarily limited to, the following:

Section 02200 - Earthwork

- C. Measurements and Payments:
  - 1. Measure the quantity of material delivered in tons.
  - 2. Weigh on accurate scales designed for weighing loaded trucks.
  - 3. Load vehicles to insure against loss of material between the scales and the point of delivery.
    - a. No deductions will be made for the weight of moisture naturally occurring in the material.
    - b. Material will not be deposited and spread until the scale weigh ticket is delivered to the inspector and the weight of material verified.
  - 4. The Contract Documents may provide for payment of a lump sum bid amount for the entire project.
    - a. The quantity of material provided will be verified by scale tickets and compared to the estimated quantity provided as part of the Contractor's Price Breakdown.
    - b. In the event that the estimated quantity is larger than the quantity provided, the Contractor shall pay the Owner a deduct for the difference in cost for both quantity and labor.
    - c. Additional payments for increased quantities or labor will only be allowed if a change order is warranted due to a change in project scope or for unforeseen situations, as determined by the Architect, warranting

additional material and labor to accomplish the original work of this section.

- c. The Owner will make no additional payments for additional material or labor to correct deficiencies, shortages or mistakes by the Contractor.

D. Basis of payment:

- 1. Include in the contract amount, an amount for the cost of the work of this section based on unit price per ton for the surfacing material which shall be full compensation for furnishing all material, tools, equipment and labor necessary to complete the work of this section in conformance with the Drawings and Specifications.
- 2. This shall be full payment for furnishing, delivering, depositing and spreading the surfacing material as directed and approved by the DNR Construction Inspector.
- 3. The DNR Construction Inspector will:
  - a. Verify that all quantities are in accordance with requirements.
  - b. Calculate the value of deducts owed the Owner at the unit price provided in the Contractor's Price Breakdown.

1.02 REFERENCES:

- A. Standards of materials and construction shall conform with the Standard Specifications for Highway and Bridge Construction, Series of 2001 of the Iowa Department of Transportation.

1.03 SUBMITTALS:

- A. Provide submittals as required in section 01300.

1.04 CONTROL OF MATERIALS:

- A. General: Use materials as specified in this section, tested and approved for use by the DNR Construction Inspector in accordance with the applicable portions of 2001 Series, I.D.O.T. Section 1106.
- B. Samples and Tests: Submit samples of materials to the DNR Construction Inspector in advance of the anticipated use to avoid construction delays. Submit samples and tests in accordance with 2001 Series, IDOT Section 1106.02.
- C. Field Testing: Testing of materials and workmanship will continue throughout the project as conducted by the DNR Construction Inspector. Cooperate in these tests in any way needed to obtain the required data and samples.

- D. Unacceptable Materials: Unacceptable materials will be rejected in accordance with 2001 Series, IDOT Section 1106.04.

1.05 JOB CONDITIONS:

- A. Survey job conditions prior to commencing work. Bring any discrepancies between existing work and the Drawings and Specifications to the attention of the Architect/DNR Construction Inspector.
- B. Observe weather conditions. Attempt no work in frozen conditions without written approval from the DNR Construction Inspector.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Provide Class "A" crushed stone consisting of a uniform mixture of coarse and fine particles produced by crushing ledge rock, predominantly limestone, dolomite, or quartzite.
  - 1. Percentage of wear: No more than 45, when tested in accordance with AASHTO T96, Grading B.
  - 2. Gradation: In accordance with gradation number 11, section 4109 of IDOT Standard Specifications, as follows:

<u>Percent</u>	<u>Sieve Size</u>
100	1
20-75	4
20-40	8
6	200

- 3. Additional Requirements: Provide material containing no more than 4% mud balls.

PART 3 - EXECUTION

3.01 GENERAL:

- A. Accomplish the work of this section in accordance with the applicable portions of the 2001 Series, IDOT Standard Specification for Highway and Bridge Construction.

3.02 PREPARATION OF SUBGRADE:

- A. Conform to 2001 Series, IDOT Section 2111. If unsuitable subgrade materials are encountered, remove this material to a depth as indicated by the DNR Construction Inspector and replace with suitable ballast material.

3.03 PLACING OF CRUSHED STONE COURSE:

- A. Construct base course using crushed rock top course material as defined by 2001 Series, IDOT Section 4121. Place the base course in accordance with applicable sections of the IDOT Standard Specifications for Granular Subbase, Standard Compaction as defined by the IDOT Standard Specifications.

3.05 CLEAN UP:

- A. Upon completion of construction, remove all excess materials and construction debris, and restore any damage done to existing buildings or landscape.

END OF SECTION 02506

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: Seedbed preparation and application of seed mixtures and fertilizer to all areas designated on the Drawings or all areas within the boundaries of this project having been disturbed by works of this project and not receiving finished surfacing, as determined by the DNR Construction Inspector and as specified herein.
- B. Related Sections: Drawings and General Provisions of the Contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements as well as, but not necessarily limited to, the following:

Section 02200 - Earthwork

1.02 REFERENCES:

- A. Standards of materials and construction shall conform with the Standard Specifications for Highway and Bridge Construction, 2001 Series of the Iowa Department of Transportation.

1.03 QUALITY ASSURANCE:

- A. Codes and Standards: Perform all work of this section in accordance with the requirements of the "Standard Specifications" 2001 I.D.O.T. Section 2601.

1.04 PROJECT/SITE CONDITIONS:

- A. Environmental Requirement:
  - 1. Weather conditions shall be observed. Seeding shall be performed only during normal application periods, optimum temperature, moisture and climatic condition to promote germination and plan growth. Normal application periods are between March 1 and May 31 and between August 10 and September 30.
- B. Existing Conditions: Survey job conditions prior to commencing work. Bring any discrepancies between existing work and the Drawings and Specifications to the attention of the Project Engineer/DNR Construction Inspector.

1.05 SEQUENCING AND SCHEDULING:

- A. Properly coordinate the work of this section with all other trades.
- B. Do not start the work of this section until the work of all other trades has been completed unless otherwise approved by the DNR Construction Inspector.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. All topsoil used for seedbed shall be in accordance with Section 02200.
- B. All seeds shall be "redtag" quality or better supplied from the latest available crop, free of noxious weed seed and supplied in the following varieties and percentages of weight.
- C. Provide mixture of types and quantities as specified herein for seeding of areas designated by the Project Engineer, the DNR Construction Inspector as indicated on the Drawings, and as specified herein.

- 1. Class "A" Mixture: For areas to remain in semi-natural state where mowing is required only as a temporary control measure.

Fescue, Kentucky 31	25 lbs. per acre
Switchgrass (Blackwell)	8 lbs. per acre
Alfalfa (Northern Grown)	5 lbs. per acre
Birdfoot Trefoil (Empire)	4 lbs. per acre
Alsike Clover	4 lbs. per acre

- 2. Class "B" Mixture: For same situation as where Class "A" mixture is used but where a lighter mix is preferable.

Fescue, Kentucky 31	20 lbs. per acre
Switchgrass (Blackwell)	3 lbs. per acre
Alfalfa (Northern Grown)	4 lbs. per acre
Birdfoot Trefoil (Empire)	4 lbs. per acre
Alsike Clover	4 lbs. per acre

- 3. Class "C" Mixture: For area designated as fine seeded, lawns or other mowed grass areas.

Bluegrass, Kentucky	70%
Ryegrass, Perennial, Fineleaf	10%
Fescue Creeping Red	20%

4. Class "D" Mixture: For all areas, unless otherwise specified, where a prairie grass in natural state is required.

Big Bluestem	30 lbs. per acre
Switchgrass (Blackwell)	5 lbs. per acre
Sideoats Grama	5 lbs. per acre
Little Bluestem	5 lbs. per acre

- D. Seed is to be delivered on site in separate packaging for each individual type of seed within each mixture and mixed in the presence of the DNR Construction Inspector if required. Commercial mixture in the quantities as specified will be acceptable at the discretion of the DNR Construction Inspector, if these quantities are verifiable.
- E. Seed mixture for this project to be Class "A" mixture.

#### 2.02 FUNGICIDE:

- A. All seeds for permanent seeding shall be treated with a non-mercurial fungicide (75% concentration or equivalent) at the rate of 5-1/2 ounces per 100 pounds of seed.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION:

- A. Examine the areas and conditions under which work of this section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

#### 3.02 SEEDBED PREPARATION:

- A. The area to be seeded shall be raked or graded to fill washes or gullies. Pick up and dispose of all debris, including stones, boulders, logs, stumps, or other foreign material that will interfere with the seeding operation.

#### 3.03 FERTILIZER APPLICATION:

- A. Spread fertilizer over the area at the rate of 750 pounds per acre of 15-15-15 (or equivalent).
- B. Unless otherwise indicated, spread all fertilizer with a mechanical spreader, which will secure a uniform rate of application.
- C. Spread fertilizer after the preliminary preparation of seedbed and prior to the sowing of any seeds.

- D. Disk the fertilizer and roll the area prior to seeding.
- E. On area inaccessible to field machinery, spread fertilizer after preparation of the seedbed and thoroughly rake into the soil.
- F. Application of fertilizer in combination with seeding by hydraulic seeder as specified in I.D.O.T. Section 2601.04H will be acceptable at the discretion of the DNR Construction Inspector.

3.04 SEED APPLICATION:

- A. Preparation: Mix all seeds specified for this project thoroughly at the project site prior to placing in spreading equipment.
- B. On all areas accessible to field machinery, all grass seeds may be sown with a gravity, cyclone or hydraulic seeder as specified herein. On areas inaccessible to field machinery, the use of hand-cyclone seeder will be permitted.
- C. Apply seed mixture at a rate of four pounds per 1,000 square feet, unless otherwise indicated, during fair, calm weather. One half of the seed mixture shall be sown in one direction and the remainder at right angles to the first sowing.

3.05 SEED APPLICATION IN MAINTAINED LAWNS:

- A. For maintained lawns to be seeded as part of this project, apply fertilizer prior to preparation of the seedbed.
- B. A rotary tiller will be required for preparation of the seedbed. The seedbed after tilling will be raked firm, smooth and free of clods, rocks and other debris.
- C. Roll the seedbed shall both before and after the application of seeds. Apply seeds over damp soil by broadcast seeding.
- D. Roll, seed, and fertilize by hand or with hand operated equipment in areas inaccessible to field equipment.

3.06 SPRING OVERSEEDING:

- A. Seedbed preparation will not be required provided the overseeding is applied when the ground is free from frost action after March 1 and before April 1 or as directed by the DNR Construction Inspector.

3.07 MOWING:

- A. When requested by the DNR Construction Inspector, mowing may be required prior to permanent seeding or anytime during the growing season.

3.08 MULCHING:

- A. All seeded areas are to be mulched unless otherwise designated in the contract documents.
- B. All areas requiring mulch are to be mulched as soon as seed is sown and final rolling is completed.
- C. Mulch is to be evenly and uniformly distributed and anchored into the soil. The application rate for reasonably dry material shall be approximately 1-1/2 tons of dry cereal straw, 2 tons of wood excelsior, or 2 tons of prairie hay per acre, or other approved material, depending on the type of material furnished.
  - 1. All accessible mulched areas are to have mulch consolidated into the soil with a mulch stabilizer, and slope areas are to be tugged on the contour.
  - 2. Crawler type or dual wheel tractors are to be used for the mulching operation. Equipment is to be operated in a manner to minimize displacement of the soil and disturbances of the design cross section.

END OF SECTION 02930

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: All labor, materials, and equipment required to construct, shore, and remove all forms to accommodate all concrete specified in Section 03300, Cast-In-Place Concrete, as shown on the Drawings, and as specified in other sections of these specifications.
- B. Related Sections: Drawings and General Provisions of the Contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements as well as, but not necessarily limited to, the following:  
  
Section 03200 - Concrete Reinforcement  
Section 03300 - Cast-In-Place Concrete

1.02 REFERENCES:

- A. Safety: All formwork and methods of construction shall conform to the requirements of the state of Iowa Bureau of Labor and all OSHA Standards.
- B. A.C.I. 347.

1.03 SUBMITTALS:

- A. Provide concrete mix formula to Construction Inspector.
- B. Manufacturer's Data: Within 30 calendar days after award of the contract, submit manufacturer's data and installation instruction for proprietary materials including form coatings, ties and accessories, and manufacturer's form system if used.
- C. Shop Drawings: When requested by the DNR Construction Inspector or the Project Engineer for the purpose of explaining details or structural integrity, the Contractor shall submit those drawings requested prior to construction of the project.

1.04 QUALITY ASSURANCE:

- A. Formwork: Design of formwork is the responsibility of the Contractor.
- B. Standards: Comply with all applicable provisions of ACI 347.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Form Materials:
  - 1. Construct formwork for exposed concrete surfaces with smooth-faced undamaged plywood, undented metal, or other panel-type materials acceptable to the DNR Construction Inspector, to provide continuous, straight, plumb, smooth cast surface, furnish in largest practical sizes to minimize number of joints.

2. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without reflection or bowing.
- B. Form Ties:
1. Provide factory-fabricated, adjustable length removable or snap-off metal form ties, designed to prevent form deflection and to prevent spalling concrete surfaces upon removal.
  2. Provide ties so that portion remaining within concrete after removal of exterior parts is at least 1-1/2" from the outer concrete surface. Form ties shall not leave a hole larger than 1" diameter in the concrete surface.
- C. Form Coating: Provide commercial formulated form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces requiring bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds.

## 2.02 DESIGN OF FORMWORK:

- A. General:
1. Design, erect, support, brace, and maintain formwork so that it will safely support vertical and lateral loads that might be applied, until such loads can be supported by the concrete structure.
  2. Carry vertical and lateral loads to ground by formwork system and in-place construction that has attained adequate strength for that purpose.
  3. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation, and position.
  4. Design forms and falsework to include assumed values of live load, dead load, weight of moving equipment operated on formwork, concrete mix, height of concrete drop, vibrator frequency, ambient temperature, foundation pressures, stresses, lateral stability, and other factors pertinent to safety of structure during construction.
  5. Provide shore and struts with positive means of adjustment capable of taking up formwork settlement during concrete placing operations, using wedges or jacks or a combination thereof.
  6. Provide trussed supports when adequate foundations for shores and struts cannot be secured.
  7. Support form facing materials by structural members spaced sufficiently close to prevent objectionable deflection.
  8. Fit forms placed in successive units for continuous surfaces to accurate alignment, free from irregularities, and within allowable tolerances.
  9. Provide camber in formwork as required for anticipated deflections due to weight and pressures of fresh concrete and construction loads.
  10. Provide formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins.
- B. Earth Forms: Side forms of footings may be omitted and concrete placed directly against excavation only when requested by the Contractor and accepted by the DNR Construction Inspector. When omission of forms is accepted, provide additional concrete 1" on each side of the minimum design profiles and dimensions shown.

## PART 3 - EXECUTION

### 3.01 EXAMINATION:

- A. Examine the substrate and conditions under which work of this section is to be performed, and correct unsatisfactory conditions which would prevent proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

### 3.02 ERECTION:

#### A. General:

1. Construct forms complying with ACI 347, to the exact sizes, shapes, lines, and dimensions shown, and as required to obtain accurate alignment, location, grades, level, and plumb work in finish structures.
2. Provide for openings, offsets, sinkages, keyways, recesses, moldings, reglets, chamfers, blocking, screeds, bulkheads, anchorages, inserts, and other features required. Use selected materials to obtain required finishes.
3. Forms for openings and construction which accommodates installation by other trades whose materials and products must be fabricated before the opportunity exists to verify the measurements of adjacent construction which effects such installations, shall be accurately sized and located as dimensioned on the Drawings. In the event that deviation from the Drawing dimensions results in problems in the field, the Contractor shall be responsible for resolution of the conditions as approved by the Project Engineer, without additional expense to the Owner.

#### B. Fabrication:

1. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where the slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and assure ease of removal.
2. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Brace temporary closures and set tightly to temporary openings on forms in as inconspicuous locations as possible, consistent with design requirements. Form intersecting planes to provide true, clean-cut corners.

#### C. Falsework:

1. Erect falsework and support, brace and maintain it to safely support vertical, lateral, and asymmetrical loads applied until such loads can be supported by in-place construction. Construct falsework so that adjustments can be made for take-up and settlement.
2. Provide wedges, jacks, or camber strips to facilitate vertical adjustments. Carefully inspect falsework and formwork during and after concrete placement operations to determine abnormal deflection or signs of failure; make necessary adjustments to produce work of required dimensions.

#### D. Forms for Exposed Concrete:

1. Drill forms to suit ties used and to prevent leakage of concrete mortar around tie holes. Do not splinter forms by driving ties through improperly prepared holes.
  2. Provide sharp, clean corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, square intersections.
  3. Use extra studs, walers, and bracing to prevent objectionable bowing of forms between studs and to avoid bowed appearance in concrete. Do not use narrow strips of form material which will produce bow.
  4. Assemble forms so they may be readily removed without damage to exposed concrete surfaces.
- E. Corner Treatment: Unless shown otherwise, form chamfers with 3/4" x 3/4" strips, accurately formed and surfaced to produce uniformly straight lines and tight edge joints on exposed concrete. Extend terminal edges to required limit and miter chamfer strips at changes in direction.
- F. Control Joints: Locate as directed by DNR Construction Inspector or as indicated on the Drawings.
- G. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Verify size and location of openings, recesses and chases with the trade requiring such items. Accurately place and securely support items to be built into forms.
- H. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before concrete is placed. Retighten forms immediately after concrete placement as required to eliminate mortar leaks.

### 3.03 INSTALLATION:

- A. Embedded Items:
1. General: Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of the items to be attached thereto.
  2. Edge Forms and Screeds: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in the finished slab surface. Provide and secure units to support types of screeds required.
- B. Shores and Supports: Comply with ACI 347 for shoring construction, and as herein specified. Submit a shore removal and re-shoring schedule and drawings for the DNR Construction Inspector review before proceeding with this work. Do not proceed until schedule and drawings have been reviewed.

### 3.04 APPLICATION:

- A. Form Coating: Coat form contact surfaces with form-coating compound before reinforcement is placed. Do not allow excess form coating material to accumulate in the forms or to come in contact with surfaces which will be bonded to fresh concrete. Apply in compliance with manufacturer's instructions.

### 3.05 FIELD QUALITY CONTROL:

- A. Inspection: Concrete shall not be placed in forms until inspected by DNR Construction Inspector and permission is given to start placing concrete.

### 3.06 CLEANING:

- A. General: Formwork not supporting concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 10 degrees C (50 degrees F) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operation, and provided that curing and protection operations are maintained.
- B. Formwork: Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements may not be removed in less than 14 days, and not until concrete has attained design minimum 28-day compressive strength. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of the concrete location or members, as specified in other sections.
- C. Form-Facing Material: Form-facing material may be removed four days after placement, only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.
- D. Reuse of Forms: Clean and repair surfaces of forms to be reused in the work. Split, frayed, delaminated or otherwise damaged form-facing material will not be acceptable. Apply new form-coating compound material to concrete contact surfaces as specified for new formwork. When forms are reused for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets.

END OF SECTION 03100

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: All reinforcing steel, steel mesh, and accessories and the installation of these items for all concrete reinforcement for this project.
- B. Related Sections: Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements as well as, but not necessarily limited to, the following:

- Section 03100 - Concrete Formwork
  - Section 03300 - Cast-In-Place Concrete

1.02 REFERENCES:

- A. Comply with all applicable provisions of the following standards:
  - 1. CRSI "Manual of Standard Practice"
  - 2. ACI 315 "Details and Detailing of Concrete Reinforcement"
  - 3. ACI 318 "Building Code Requirements for Reinforced Concrete"

1.03 SUBMITTALS:

- A. Shop Drawings: Submit complete shop drawings of all materials proposed to be furnished and installed under this section in accordance with ACI "Manual of Standard Practice for Detailing Concrete Structure," ACI 315. Show:
  - 1. Bar schedule, stirrup spacing, diagrams of bent bars, arrangements and assemblies.
  - 2. Review shop drawings requirements with DNR Construction Inspector before ordering shop drawings.
- B. Mill Certificates: Submit steel producer's certificates of mill analysis, tensile and bend tests for reinforcing steel.

1.04 DELIVERY, STORAGE AND HANDLING:

- A. Delivery: Deliver reinforcement to the job site bundled, tagged, and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.
- B. Storage: Store reinforcement at the job site in a manner to prevent damage and accumulation of dirt and excessive rust.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Steel and Wire Reinforcement: Reinforcing steel shall consist of deformed bars of the size called for on the Drawings. Steel shall conform to ASTM A615 Grade 40. Deformation shall conform to ASTM A305. Mill certificates showing conformity with these requirements shall be furnished to the Project Engineer for each melt. Wire reinforcement shall conform to ASTM A82. Welded wire fabric shall conform to ASTM A185.
- B. Tie Wire: No. 16 double annealed iron wire.
- C. Accessories: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement in place:
  - 1. Use wire bar-type supports complying with CRSI recommendations, unless otherwise indicated. Do not use wood, brick and other such unacceptable materials.
  - 2. For slabs on grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
  - 3. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with either hot-dip galvanized or plastic protected legs.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION:

- A. Examine the substrate, formwork, and the conditions under which concrete reinforcement is to be placed, and correct conditions which would prevent proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

#### 3.02 INSTALLATION:

##### A. General:

- 1. Comply with the specified standards for details and methods of reinforcement placement and supports, and as herein specified.
- 2. Clean reinforcement to remove loose rust and mill scale, earth, and other materials which reduce or destroy bond with concrete.
- 3. Position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.
- 4. Place reinforcement to obtain the minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports together with 16 gauge wire to hold reinforcement accurately in position during concrete placement operations. Set wire ties so that twisted ends are directed away from exposed concrete surfaces.
- 5. Bars are to be tied at all intersections except where spacing is less than one foot in each direction, in which case alternate intersections are to be tied.
- 6. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh.
- 7. Provide sufficient numbers of supports and of strengths to carry reinforcement. Do not place reinforcing bars more than 2" beyond the last leg of any continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

8. Splices: Provide standard reinforcement splices by lapping ends, placing bars in contact, and tightly wrapping tie wire around bars.
9. Galvanized or epoxy coated reinforcement: Weight of reinforcement will be calculated from the theoretical weight of the nominal sizes and actual lengths of the various sizes of reinforcement shown on the plans. No adjustment in weight will be made for galvanizing or epoxy coating.

END OF SECTION 03200

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: Provisions for all labor and materials required to construct all walls, footings, piers and slabs, and all other work or items classified as cast-in-place concrete.
1. All concrete foundations and slabs as shown on the project plan, floor plans and building sections, as well as all other concrete not specified elsewhere, are classified as cast-in-place concrete.
- B. Related Sections: Drawings and General Provisions of the Contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements as well as, but not necessarily limited to, the following:

Section 03100 - Concrete Formwork  
Section 03200 - Concrete Reinforcement

1.02 REFERENCES:

- A. Codes and Standards: Comply with provisions of following codes, specifications and standards except where more stringent requirements are shown or specified.
1. Uniform Building Code, U.B.C., 1985 edition.
2. American Concrete Institute (ACI).
- a. Manual of Concrete Practice.
- b. ACI 301 - Specifications for Structural Concrete for Buildings.
- c. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.
- d. ACI 305 - Hot Weather Concreting.
- e. ACI 306 - Cold Weather Concreting.
- f. ACI 308 - Standard Practice for Curing Concrete.
- g. ACI 318 - Building Code Requirements for Reinforced Concrete.
3. American Society for Testing of Materials (ASTM).
- a. ASTM C33 - Standard specification for concrete aggregates.
- b. ASTM C31 - Making and curing compressive and flexural strength test specimens in the field.
- c. ASTM C94 - Standard specification for ready-mixed concrete.
- d. ASTM C138 - Test for unit weight, yield and air content of concrete.

- e. ASTM C143 - Test for slump test of portland cement concrete.
  - f. ASTM C150 - Standard specification for portland cement.
  - g. ASTM C260 - Standard specification for air-entraining admixture for concrete.
  - h. ASTM C309 - Standard specification for liquid membrane-forming compounds for curing concrete.
  - i. ASTM C494 - Standard specification for chemical admixtures for concrete.
  - j. ASTM D994 - Standard specification for pre-formed expansion joint filler for concrete.
  - k. ASTM D1850 - Standard specification for concrete joint sealer, cold application type.
- 4. Concrete Reinforcing Steel Institute (CRSI).
    - a. Manual of Standard Practice.
  - 5. State of Iowa Building Code, latest edition.

1.03 SUBMITTALS:

- A. Product Data: Submit manufacturer's product data with application and installation instructions for proprietary materials and items, accessories, admixtures, patching compounds, water stops, joint systems, curing compounds, dry-shake finish materials, and others as required by Project Engineer.
- B. Samples: Submit samples of materials specified as requested by Project Engineer including names, sources and descriptions.
- C. Quality Control Submittals:
  - 1. Design Data: Submit data on proposed design mixes when trial batch method is used.
  - 2. Test Reports: Employ, when necessary, at Contractor's expense, a testing laboratory acceptable to the Project Engineer to perform material evaluation tests and submit reports.
  - 3. Material Certificates: Provide materials certificates in lieu of materials laboratory test reports when permitted by Project Engineer. Material certificates shall be signed by Manufacturer and Contractor certifying that each material item complies with or exceeds specified requirements.

1.04 QUALITY ASSURANCE:

- A. Qualifications:
  - 1. During the progress of installation of the work of this section, provide at least one worker who shall be thoroughly familiar with the specified requirements, completely trained and experienced in the necessary skills, and who shall be present at the site and shall direct all work performed under this section.
  - 2. Use adequate numbers of skilled workers to ensure installation in strict accordance with the approved design.

1.05 DELIVERY, STORAGE, AND HANDLING:

- A Protection: Use all means necessary to protect the materials of this section before, during, and after installation and to protect the work and materials of all other trades.
- B Replacement: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Project Engineer and at no additional cost to the Owner.

1.06 PROJECT/SITE CONDITIONS:

- A Environmental Requirements: Weather conditions shall be observed. No work shall be attempted in frozen conditions without written approval from the DNR Construction Inspector.
- B Existing Conditions: Review job conditions prior to commencing work. Bring any discrepancies between existing work and the Drawings and Specifications to the attention of the Project Engineer/DNR Construction Inspector.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A Subject to compliance with requirements, products from the following manufacturers can be incorporated into the work of this section.
  - 1. Euclid Chemical Co., 19218 Redwood Road, Cleveland, Ohio 44110.
  - 2. Master Builders Co., Ltd., 79 Kincort Street, Toronto, Ontario M6M3E4.
  - 3. Sika Chemical Corporation, P. O. Box 297, Lyndhurst, New Jersey 07071.
  - 4. Chem-Master Corporation, 477 Industrial Parkway, Chagrin Falls, Ohio 44022.
  - 5. W. R. Grace and Co., 62 Wittemore Avenue, Cambridge, Massachusetts 02140.
  - 6. W. R. Meadows, Inc., P. O. Box 543, Elgin, Illinois 60120.
  - 7. Protex Industries, Inc., 1331 West Evans Avenue, Denver, Colorado 80223.
  - 8. Sonneborn Building Products, 7711 Computer Avenue, Minneapolis, Minnesota 55435.
  - 9. Antihydro Co., 265 Badger Avenue, Newark, New Jersey 07108.
  - 10. L & M Construction Chemicals, Inc., 8316 Blondo Street, Omaha, Nebraska 68134.
  - 11. Glifford-Hill and Co., Inc., Woodland Green, Charlotte, North Carolina 28210.
  - 12. The Celotex Corporation, 1500 North Dale Mabry Highway, Tampa, Florida 33607.
  - 13. J & P Petroleum Products, Tex-Mastic Construction Materials, 2715 South Westmoreland, P. O. Box 4206, Dallas, Texas 75208.

2.02 MATERIALS:

- A Portland Cement: ANSI/ASTM C 150, Type I or Type III, high early-strength cements, unless otherwise acceptable to Project Engineer.
- B Normal Weight Aggregates: ANSI/ASTM C 33, and as herein specified.

1. Coarse aggregate for concrete shall consist of gravel or crushed stone particles, from a source approved by Iowa D.O.T., or combinations of these materials. The aggregate shall meet these requirements:
    - a. Abrasion loss: The percent of wear, determined in accordance with AASHTO T 96, Grading A or B, shall not exceed 35 for gravel and 50 for other crushed stone.
    - b. Durability: Coarse aggregate durability shall be a minimum of Class 1. Aggregate of Class 2 or Class 3 durability may be furnished by the Contractor, with the Project Engineer's approval, and at no extra cost to the Owner.
    - c. Gradation: Coarse aggregate shall meet requirements of D.O.T. Section 4109, Gradation No. 3, 4, or 5.
    - d. Maximum size of coarse aggregate: Not more than three-fourths minimum clear spacing between reinforcing bars and not more than one-fifth of smallest dimension of slab or member for which concrete is being used. Coarse aggregate for un-reinforced slabs maximum size one-third of slab thickness.
  2. Fine aggregate for concrete shall consist of clean, hard, durable mineral aggregate particles free from injurious amounts of silt, shale, coal, organic matter, or other deleterious material, and shall be from a source approved by Iowa D.O.T. The aggregate shall meet these requirements:
    - a. Gradation: Fine aggregate shall meet the requirements of D.O.T. Section 4109 for Gradation No. 1.
- C. Water: Water for concrete shall be clean, potable and free from injurious amounts of foreign matter.
- D. Water-Reducing Admixtures: ANSI/ASTM, C 494, Type A and contain not more than one percent (1%) chloride ions.
- "Eucon WR-74;" Euclid Chemical Co.  
 "Pozzolith 322N;" Master Builders.  
 "Plastocrete 160;" Sika Chemical Corp.  
 "Chemtard;" Chem-Masters Corp. or approved equal
- E. Air-Entraining Admixture: ANSI/ASTM C 260, added to mixer in lieu of air-entrained cement.
- "Darex (AEA);" W. R. Grace Co.  
 "Ad-Aire;" Carter-Waters Corp.  
 "Protex AES;" Protex Industries, Inc.  
 "Seal-Tight;" W. R. Meadows, Inc. or approved equal
- F. Liquid Membrane-Forming Curing Compound: Liquid type membrane-forming curing compound complying with ANSI/ASTM C 309, Type I, Class A unless other type acceptable to Project Engineer.
- "Masterseal;" Master Builders.  
 "A-H 3 Way;" Sealer' Anti-Hydro Waterproofing Co.  
 "Ecocure;" Euclid Chemical Co.  
 "Clear Seal;" W. R. Grace.  
 "Kure-N-Seal;" Sonneborn-Contech.  
 "Polyclear;" Upco Chemical/USM Corp.  
 "L & M Cure;" L & M Construction Materials.  
 "LR-151;" Protex Industries.  
 "Hardtop;" Gifford - Hill. or approved equal

1. Curing compound shall form a continuous unbroken membrane which shall adhere to moist concrete and which will not disintegrate, check or peel from the surface, nor show signs of such deterioration within 30 days after application under actual working conditions. The compound shall be sufficiently transparent and free from color so there will be no permanent change in the color of the concrete. The compound shall contain, however, a temporary dye of sufficient color to make the membrane clearly visible for a period of at least four hours after application.

2.03 EQUIPMENT:

- A. Batching, Mixing, and Delivery Equipment: Use transit-mixed concrete from approved batching and mixing plant. Batch, mix, and transport concrete to site in accordance with ANSI/ASTM 94.
- B. When air temperature is between 85°F. (30°C) and 90°F. (32°C), reduce mixing and delivery time from 1 1/2 hours to 75 minutes; and when air temperature is above 90°F. (32°C), reduce mixing and delivery time to 60 minutes.

2.04 ACCESSORIES:

- A. Pre-formed Joint Filler: ASTM D 994 and as herein specified.
  1. Pre-formed non-extruding resilient material, one-half (1/2) inch wide and of the depth required to bring surface to within one-half (1/2) inch of finished surface.
  2. Available Products: Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to, the following:
    - "Flexcell;" Celotex Corporation.
    - "Sealtight;" W. R. Meadows, Inc.
    - "Tex Mastic;" J & P Petroleum Products. or approved equal
- B. Joint Sealer: ASTM D-1850 Concrete Joint Sealer, cold-application type.
- C. Vapor Barrier: Under slabs on ground, 4 mil polyethylene film, when required by the Drawings.
- D. Storage: Store all cement materials in weather-tight enclosure, clear of ground, and protected from weather with suitable covering.
- E. Embedded Items: Verify and coordinate embedded items furnished by other trades.
- F. Keyways and/or Expansion Tubes: IDOT Section 4191, Series of 2001, or as required by the Drawings.
- G. Admixtures: Use air-entraining admixture in exterior exposed concrete, unless otherwise indicated as determined by ANSI/ASTM C 138. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having air content within following limits:
  1. Concrete structures and slabs exposed to freezing and thawing or subjected to hydraulic pressure:

<u>Maximum Size Aggregate</u>	<u>Amount of Air (%)</u>
1 1/2" or 2"	5% + 1%
3/4" or 1"	6% + 1%
3/8" or 1/2"	7 1/2% + 1%

2.05 MIXES:

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method used, use an independent testing facility acceptable to Project Engineer for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing unless otherwise acceptable to Project Engineer.
- B. Design mixes to provide normal weight concrete with the following properties for Class B-4 concrete, as indicated on drawings and schedules:
  - 1. 400 psi 28-day compressive strength; 492 lbs. cement per cubic yard minimum; W/C ratio, 0.600 maximum.
- C. Consistency: The quantity of water required for the proper consistency of concrete shall be determined by the slump test in accordance with ANSI/ASTM C 143. Slump allowances shall be as follows:
  - 1. Vertical Wall Sections, Columns -- Maximum slump, 4 inches, plus or minus one inch tolerance.
  - 2. Footings, Beams, Slabs -- Maximum slump, 3 inches, plus or minus one inch tolerance.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION:

- A. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.
- B. Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moistened wood forms immediately before placing concrete where form coatings are not used.

#### 3.02 PREPARATION:

- A. Drain and pump all water from excavations, forms, and any locations where concrete is to be placed. Bottom of excavations shall be undisturbed earth free of frost or debris, level and compacted. Do not place any concrete until the DNR Construction Inspector has inspected and approved forms and soil conditions, and until reinforcing, sleeves, and embedded items have been placed. Clean all dirt and debris from transporting equipment. Clean reinforcement of all foreign matter. Clean forms and oil or wet (except in freezing conditions) surfaces. Compact, level, and dampen base fill material under slabs on grade. Prior to placing concrete, install polyethylene vapor barrier under interior slabs. Do not puncture or otherwise damage vapor barrier or membrane waterproofing.
- B. Transport concrete to prevent separation of materials in accordance with ACI practices. Do not add water to concrete during transporting. Handle from mixer to point of placement with carts, buggies, or conveyors. Do not dump concrete from mixer or from transporting equipment with a free fall of more than three feet. Deposit concrete as nearly to its final position as possible. Clean transporting equipment at frequent intervals during placement. Do not use partially hardened or contaminated concrete.

#### 3.03 PLACEMENT OF CONCRETE:

- A. Place concrete in accordance with ACI 304 "Recommended practice for measuring, mixing, transporting and placing concrete" and as herein specified.
- B. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot

be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.

- C. Place concrete continuously so that fresh concrete is not placed against hardened concrete to form seams or planes of weakness. Work concrete into corners and around reinforcement. Machine vibrate sufficiently to insure thorough compaction and complete embedment of reinforcing. Stop placement at point of no shear, or where directed, and erect tight, plumb dams through forms. Place concrete between construction joints in one continuous operation. Locate construction joints in slabs under partitions. Brush on neat cement when pouring against hardened concrete.
  
- D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
  - 1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.
  - 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least six (6) inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
  
- E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
  - 1. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  - 2. Bring slab surfaces to correct level with straight edge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
  - 3. Maintain reinforcing in proper position during concrete placement operations.
  
- F. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306, "Cold Weather Concreting," and as herein specified.
  - 1. When air temperature has fallen to or is expected to fall below 40°F. (4°C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 40°F. (4°C), and not more than 80°F. (27°C) at point of placement, and maintain minimum temperature over the entire work for no less than 72 hours.
    - a. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
    - b. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

- G. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305, "Hot Weather Concreting," and as herein specified:
1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90°F. (32°C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated in total amount of mixing water.
  2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
  3. Wet forms thoroughly before placing concrete.
  4. Use water-reducing retarding admixture (Type A) when required by high temperatures, low humidity, or other adverse placing conditions.
- H. Construction Joints: Contractor to submit placement and type of construction joints to Project Engineer for review prior to placement of any concrete on the project.
- I. Expansion Joints: Install expansion joint filler where interior slabs abut exterior walls, interior bearing walls and columns, at perimeter of concrete equipment pads, and other necessary locations as determined by the inspector. Omit expansion joint filler and install 15 lb. felt, centered below doors, to break bond at exterior doors with concrete platforms, unless otherwise shown on the Drawings.
- J. Construction Joints: When placing of concrete in any section of a structure must be interrupted, a construction joint shall be located as shown on the drawings in a manner that will not impair the strength or appearance of the structure, or as approved by the Engineer. The surface of the concrete in horizontal joints, except in the area near the form, shall be left rough to increase the bond with concrete that is to be placed later. Keyways shall be embedded not less than 1 ½ inches by 3 inches into the surface of the concrete. Construction joints shall be located in planes perpendicular to the principal lines of stress and at points designated by the Engineer.
- K. Control Joints: Cut control joints in all exposed concrete slabs on grade, as directed by the Inspector. Locate in a uniform pattern throughout parking areas. Verify location and cut to depth of one-sixth (1/6) of slab thickness with minimum of three-fourths (3/4) inch depth. Cut with carborundum saw, approximately six (6) to twenty-four (24) hours after placing concrete and when a minimum amount of raveling occurs in concrete.
1. On exterior walks, score with one-fourth inch by one inch (1/4" x 1") deep control joints. Use straight edge guide when scoring joints. Where required depth of control joint cannot be made by scoring, cut joints with carborundum saw.

### 3.04 CONCRETE FINISHING:

- A. Finish on Formed Surfaces: All finished or formed surfaces shall conform accurately to the shape, alignment, grades and sections as shown on the Drawings. Surfaces shall be free from fins, bulges, ridges, offsets, honeycombing or roughness, and shall present a finished, continuous, hard surface. All sharp angles, where required, shall be rounded or beveled.
1. Rough Form Finish:
    - a. Provide as-cast rough form finish to formed concrete surfaces that are to be concealed in the finish work or by any other construction.

- b. Standard rough form finish shall be the concrete surface having the texture imparted by the form facing material used, with tie holes and defective areas repaired and patched, and all fins and other projections exceeding one-fourth inch (1/4") in height rubbed down or chipped off.
- 2. Smooth Form Finish:
  - a. Provide as-cast smooth form finish for formed concrete surfaces that are to be exposed to view, or that are to be covered with a coating material other than cement plaster applied directly to the concrete.
  - b. Produce smooth form finish by selecting form material to impart a smooth, hard, uniform texture and arranging them orderly and symmetrically with a minimum of seams.
  - c. Repair and patch defective areas with all fins and other projections completely removed and smoothed.
- B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with a smooth troweled finish.
- C. Slab and Floor Finish: For all floor and flat roof surfaces and all exterior concrete floor, sidewalk and flat slab surfaces, the Contractor shall be particularly careful to provide an adequate slope to the drains or to suitable points of disposal. The direction of slope and the amount of crowning generally are shown on the Drawings; otherwise, they shall be as prescribed by the Project Engineer or the DNR Construction Inspector. Dry topping will not be allowed on any of the finishes.
  - 1. Scratch Finish:
    - a. Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tile and other bonded applied cementitious-finish flooring material.
    - b. After placing slabs, plane the surface to a tolerance not exceeding one-fourth inch (1/4") in twenty-four inches (24") when tested with a straight edge.
    - c. Slope surfaces uniformly to drains where required.
    - d. After leveling, roughen the surface before the final set by using stiff broom brush or rake.
  - 2. Float Finish:
    - a. Apply float finish to monolithic slab surfaces that are to receive trowel finish and other finishes hereinafter specified, and to slab surfaces which are to be covered with insulation, and as otherwise shown on the Drawings or in the schedules.
    - b. After placing concrete slabs, do not work the surface further until ready for floating.
    - c. Begin floating when the surface water has disappeared and when the concrete has stiffened sufficiently to permit operation of a power-driven float, hand float, or both.
    - d. Consolidate the surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units.

- e. Check and level the surface plane to a tolerance not exceeding one-fourth inch (1/4") in ten feet (10'-0") when tested with a ten-foot (10'-0") straight edge placed on the surface at not less than two different angles.
  - f. Cut down high spots and fill low spots, uniformly slope surfaces to drains where required.
  - h. Immediately after leveling, re-float the surface to a uniform, smooth, granular texture.
3. Trowel Finish:
- a. Apply trowel finish to monolithic slab surfaces that are to be exposed to view, unless otherwise shown, and to slab surfaces that are to be covered with resilient flooring, carpeting, paint, or other thin-film finish coating system.
  - b. After floating, begin the first trowel finish operation using a power-driven trowel. Begin final troweling when the surface produces a ringing sound as the trowel is moved over the surface.
  - c. Consolidate the concrete surface by the final hand troweling operation, free from trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding one-eighth inch (1/8") in ten feet (10'-0") when tested with a ten-foot (10'-0") straight edge.
  - d. Grind smooth those surface defects which would telegraph through applied floor covering system.
4. Coordinate the required finish with the Project Engineer or DNR Construction Inspector prior to the application.

3.05 CONCRETE CURING:

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- 1. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than seven (7) days.
  - 2. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least seven (7) days in accordance with ACI 308, "Standard Practice for Curing Concrete." Avoid rapid drying at end of final curing period.
- B. Curing Method: Perform curing of concrete by moist curing, by moisture-retaining cover curing, by curing compound, and by combinations thereof as herein specified.
- 1. Provide moisture curing by the following methods:
    - a. Keep concrete surface continuously wet by covering with water.
    - b. Continuous water-fog spray.
    - c. Covering concrete surface with specified absorbent cover, thoroughly saturating cover with water and keeping continuously wet. Place absorbent cover to provide coverage of concrete surfaces and edges, with four-inch (4") lap over adjacent absorbent cover.
  - 2. Provide moisture-cover curing as follows: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least three

inches (3") and sealed by waterproof tape or adhesive. Immediately repair any holes and tears during curing period using cover material and waterproof tape.

3. Provide curing compounds for slabs as follows: Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within two (2) hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Re-coat areas subjected to heavy rainfall within three (3) hours after initial application. Maintain continuity of coating and repair damage during curing period.
4. Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring, painting, and other coatings and finish materials, unless otherwise acceptable to the coating manufacturer.

### 3.06 MISCELLANEOUS CONCRETE ITEMS:

- A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.
- B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on the Drawings or required for the machine and equipment actually furnished. Set anchor bolts for machines and equipment to template, at correct elevations, complying with certified diagrams or templates of the manufacturer furnishing the machines and equipment. Provide isolation joints surrounding bases where indicated or required.

### 3.07 FIELD QUALITY CONTROL:

- A. Test of Materials and Installed Work: Materials and installed work may require testing and re-testing, as directed by Project Engineer, at any time during progress of work. Allow free access to material stockpiles and facilities. Tests, not specifically indicated to be done at Owner's expense, including re-testing of rejected materials and installed work, shall be done at Contractor's expense.
  1. Slump Tests: Take one slump test for each 10 cubic yards, or as directed by Project Engineer, of concrete placed at one operation in accordance with ASTM C 143. Keep job record of test results and location.
  2. Control Tests: During placement of concrete, take three standard 6" test cylinders in accordance with ACI 318-63 and ASTM C 31 for each type of concrete used. Test one at seven (7) days and one at twenty-eight (28) days. Take one set for every 20 cubic yards and any fraction with a minimum of one set of three cylinders for each day's pour. Tag cylinders to show date and location of test cylinder. Have compressive strength tests made by independent laboratory and results sent directly to Project Engineer. Hold remaining cylinders in case of breakage. Should retention at job site delay testing beyond seven (7) days, fourteen (14) day test is acceptable. Keep test cylinders shaded and damp until sent to laboratory.

### 3.08 REMEDIAL WORK:

- A. General: Reinforce or replace deficient work as directed by the Project Engineer or DNR Construction Inspector and at no additional cost to the Owner.
- B. Patching: Repair defective areas and fill form-tie holes and similar defects in accordance with ACI 301. Where, in the opinion of the DNR Construction Inspector, surface defects such as honeycomb occur, repair the defective areas as directed by the Project Engineer or DNR Construction Inspector.

3.09 PROTECTION OF CONCRETE CONSTRUCTION:

- A. All surfaces shall be protected against injury. During the first 72 hours after placing the concrete, any wheeling, working or walking on the concrete shall not be permitted. All slabs subject to wear shall be covered with a layer of sand or other suitable material as soon as the concrete has set. Sisalcraft paper or other similar tough waterproof paper may also be used, provided all joints between adjacent strips of paper are carefully sealed. This does not alter the requirements for proper curing.
- B. Do not place concrete slabs or top surfaces of walls during rain unless acceptable protective shelter is provided; and during such weather, all concrete placed within the preceding 12 hours shall be protected with waterproof canvas or other suitable coverings. These shall be provided and kept ready at hand.
- C. All concrete construction shall be protected from excessive loading. Installation of mechanical and electrical equipment shall be accomplished by employing shores, bearing plates, frames, cranes and temporary beams.

END OF SECTION 03300