SECTION 320 Roadway and Drainage Excavation

320.1 General

Roadway and drainage excavation includes all excavation necessary and required for grading and draining a roadway, other than excavation for structures, borrow excavation, or excavation specifically provided for in the contract for other items of work.

It is the intent of the standard specifications that all suitable material excavated while grading and draining a given section of the roadway is used, to the extent required, in the construction of the embankments in that section.

Borrow excavation or selected borrow excavation should not be furnished until all suitable excavated material from within a section of roadway has been utilized in the construction of embankments within that section. See standard spec 208.1.

If there are significant changes such as a significant increase or decrease in quantities, increased EBS, changes in staging, or having to waste unsuitable excavation that was figured in the mass haul for the division, the contractor may be justified in seeking payment by change order for additional hauling costs under standard spec 104.2.2.4.

It is the intent of standard spec 205.1 that the graded roadway will conform closely to plan requirements for finished elevation grade and section. Prior authorization by the engineer is required to excavate areas of the right-of-way outside the roadway grading limits, unless allowed by the plans or the contract in order to change the grade of the roadway, to balance quantities of excavation, or for other justifiable purposes. Minor adjustments of slopes may be made as required to meet existing conditions or to provide an improvement in general appearance, such as blending with the natural terrain at the beginning and end of cut sections. Low areas within the right-of-way may be filled, embankments uniformly widened, and slopes flattened with waste excavation to the extent that no interference with drainage or disagreement with general intent of the planned work will result.

Standard spec 205.3.4 requires that the finish grading operations closely follow the rough grading. On many projects, progressive, section-by-section completion of the rough grading operations will allow early completion of the finish grading and early placing of subbase and base courses. The engineer should ensure that rough grading does not damage adjacent completed trimming and finishing work on the roadway.

Excavation for a roadway may be classified or common in the contract. When classified, WisDOT will determine each class of excavation during the excavation and the necessary measurements will be taken to compute the quantity.

320.1.1 Before Construction

Before the start of grading operations, the engineer should review the project for special needs relative to grading. The engineer should observe the drainage of the adjacent lands and determine that required intercepting embankments and flumes have been staked at the correct locations. The needs, timing, location, and marking of slope stakes should be discussed with the contractor and a procedure should be established to avoid confusion and delay to progress of the work.

A complete photographic record of conditions related to drainage before start of construction operations is highly desirable for use if adjacent owners later claim a change in drainage patterns has been caused by the highway construction. The engineer should appoint a member of the project construction staff to take, label, and catalog the photos, which should then be placed into the project field file.

320.1.2 Environmental Concerns

It is required by standard spec 205.3.3 that the contractor provide and maintain drainage during the grading of the roadway. Keeping the grade smooth and slightly higher in the center for quick runoff of rainwater and maintaining ditches open for free drainage will help to prevent saturated subgrades. Where seepage is encountered in cut sections, immediate draining with temporary ditches will benefit working conditions. Observations should be made of the effects of the flow of surface water on backslopes. The points of water concentration should be noted so the need for flumes or other erosion control devices may be determined. In marsh excavation or disposal areas, it is necessary to maintain or provide for drainage. Ditches and channels should be kept in a well-drained condition with no standing water.

Standard spec 107.18, standard spec 107.20, and standard spec 205.3.6 establish controls relative to the contamination, pollution, or siltation of streams, lakes, or other waterways. The engineer should observe the area of rough grading open to the elements and the length of exposure, as well as the contractor's operations in streams and adjacent to streams or other waterways. The engineer should be prepared to restrict the exposed area of erosive land and the length of exposure or require changes in the contractor's operations to avoid or minimize contamination, siltation, or obstruction of waterways. It is essential that

temporary and permanent erosion control measures be coordinated and performed in conjunction with the grading operations to ensure effective and continuous erosion control. Refer also to CMM 645.

A sufficient area of grade needs to be opened up by stripping the topsoil off the excavation and embankment areas. This allows for initial surface drying of any underlying fine-grained soils. It also allows for more drying opportunity during grading operations. Larger areas allow both room and time for drying.

Standard spec 205.3.15 requires the contractor to minimize dust from the subgrade during grading. If the engineer determines dust abatement is needed, the engineer should ensure it is done, either under the contract or by change order, using water or approved dust control materials. Liberal use of dust control, without leading to a muddy subgrade condition, is encouraged to minimize air pollution, improve driving vision, and retain subgrade quality.

320.1.3 Borrow Pits Adjacent To Right-of-Way

When borrow excavation is required under the contract, and the contractor's borrow pit is located adjacent to the right-of-way where the roadway is in a cut section, it is often apparent that grading of the right-of-way, to remove the ridge of earth that would otherwise remain between the borrow pit and the roadway slope, would be beneficial to the general appearance of the finished roadway.

The quantity of excavation between the vertical plane of the right-of-way line and the slope line of the roadway excavation as determined from the slope stakes set for the roadway grading may be paid as borrow excavation if the engineer gives written approval to do so.

If the engineer does not agree to pay this material as borrow it must be measured and computed as a separate quantity of roadway excavation used to replace a like quantity of borrow excavation and will be paid for at the unit price designated in the contract or in a change order if required. In establishing the change order unit price for this excavation, consideration should be given to the following points:

- Use of the material to replace contract quantities of borrow excavation.
- Where the material will be used.
- Whether within or beyond the limits of the division applicable to its excavation.
- Necessity of excavation, such as correcting or improving the appearance of the roadside due to the contractor's borrow pit being adjacent to the right-of-way.

Pertinent requirements relating to limits of excavation, required restoration of site, including top soiling and seeding, and any other conditions of requirements applicable to the site, must be shown in the contract or change order.

320.2 Preparing Roadway Foundation

Standard spec 205.3.1 provides the requirements for preparing roadway foundation. Clearing and grubbing should be completed, and objectionable material should be removed in the proposed grading area before the start of excavation. Standard spec 107.20 limits the amount of area that can be exposed to erosive elements. When excavated materials are used in roadway embankments, heavy sod and other unstable soils should be removed and disposed of outside the roadbed foundation.

All pavements, asphaltic surfaces, or rigid base courses in the area of roadbed slopes or underlying proposed embankments should be removed completely within 2 feet below proposed finished grade line or as shown on the plan.

All material suitable for use as topsoil should be stripped and salvaged for use on the contract as salvaged topsoil or topsoil, consistent with the requirements of the erosion control plan. Standard spec 205.3.1 provides that if available, additional quantities of topsoil must be salvaged and used as salvaged topsoil to replace contract quantities of topsoil. This may require change order and price negotiation. Depending on the length of haul and availability of topsoil from outside the project, it may not be economical to make such a change.

The existing ground underlying proposed embankments, within the limits of assumed one-to-one slopes extending outward and downward from the finished shoulder lines, should be prepared in a manner to provide a firm and unyielding support for the roadbed. All heavy sod, perishable material, and unstable soils should be removed from the area, and the foundation compacted to the extent necessary to support the embankment and to allow attainment of the required density. The stability of fills will be improved through the removal of silty soils or frost susceptible material and backfilling with selected material from the excavation or, if the contract so provides, with granular backfill material. The inspector should carefully establish the limits of undercutting or EBS. Underdrains use may have to be investigated.

Where an embankment is to be constructed on a hillside, the creation of a plane of slippage should be avoided by benching the foundation. This is accomplished by cutting vertical and horizontal planes in the foundation as fill material is placed and compacting the cut material together with fill material. Benching is incidental to the embankment construction. It is not a separate pay item.

320.3 Salvaged Topsoil

Topsoil is usually removed for two reasons:

1. Undesirable foundation materials.
2. It is needed for salvaged topsoil.

Standard spec 205.3.1 shows the contractual requirements to remove topsoil because of being unsuitable foundation material and standard spec 205.3.3 shows how to pay for the item. Removal of topsoil for salvage purpose is described in standard spec 625.

Topsoil, when it is required to be salvaged and used under the contract, should be stripped to the extent available from cut sections and fill sections as necessary to fulfill the requirements of the contract. Salvaged topsoil may be stored on the right-of-way and outside the grading limits until used, provided it is stockpiled in a manner to preclude any interference with free drainage of the project. Seeding of the piles to avoid erosion will be paid by the state. The restrictions imposed by the ECIP must be complied with.

The engineer and the contractor should discuss early on in the project topsoil quality and quantities available and required. Topsoil should be removed from the sites of roadway excavation and embankment. Topsoil need not be removed in embankment areas outside the one to one unless it is needed to cover the slopes.

According to standard spec 205.3.3, within the roadbed foundation, the contractor will be paid for EBS to remove unstable topsoil beyond the quantities needed to cover the slopes.

On borrow jobs, the engineer must monitor the topsoil quantities and the removal of topsoil closely. The contractor should not remove topsoil that does not need to be removed since this will result in additional borrow quantity for the project. The quantity of excess topsoil removed and sold should be deducted from the quantity of borrow excavation if the excess could have been used outside the one to one.

320.4 Excavation Below Subgrade

Standard spec 205.5.2 provides specific requirements for EBS. EBS is necessary when frost-heave material, water-bearing soil, or other unacceptable materials are discovered in the roadway foundation. The unfit material must be completely removed to the limits the engineer directs, and the areas must be backfilled with selected soils that are carefully placed in layers and thoroughly compacted. Payment for excavating and backfilling EBS areas differs depending on whether or not the engineer has approved the subgrade.

If EBS is deemed necessary and the engineer has not yet approved the subgrade, excavation and backfilling of the "hole" are performed and paid for under the appropriate contract items, or as extra work if there are no appropriate items.

If the engineer has already approved the subgrade and subsequently directs EBS, the department recognizes that the costs to excavate and replace the unfit material may be greater than contract prices. To compensate for post grading EBS work, up to a limit of $25,000, the department will pay for excavation at 3 times the contract excavation price and backfill at the contract unit price. It's important to note the $25,000 limit includes both the 3 times EBS excavation work and the backfill work at contract unit price. If the contract does not contain bid items for this work, it will have to be paid as changed work. After the limit of $25,000 is reached, further required post grading EBS work will be paid for following the pricing procedures prescribed in standard spec 109.4.

Humus-bearing soils and other excavated materials not suitable for embankment construction must be disposed of in accordance with the requirements of standard spec 205.3.12.

320.5 Grading the Roadway and Intersections

In order to utilize all desirable material in the construction of the roadway, all intersections, approaches, and entrances should be graded at the time of excavating and grading the roadway. Requirements for the locating, layout, and grading of entrances are provided under CMM 780 Constructing and Restoring Access Points.

Frequent inspection will be necessary during the excavation operations to ensure the roadway, intersections, approaches, ditches, and channels are excavated to the required grade, width, and slope; that rock in the roadbed is properly undercut; and that proper disposal is made of any unsuitable or surplus material.

Inspection of the subgrade, especially in cut sections, is necessary to check for frost-susceptible materials, seepage, ground water, logs, stumps, or other conditions that could result in non-uniform or detrimental subgrade conditions. A careful inspection of ditches and backslopes will often give clues to the location of objectionable materials. Areas of seepage should be investigated to determine the need for underdrains. Pertinent information should be entered in the grade inspector's diary.

Standard spec 205.3.4 provides specific requirements for the excavation of frost-heave material, water-bearing soil, and other unacceptable material from below the subgrade. Backfill in these areas must be selected soils that are carefully placed in layers and thoroughly compacted.

The installation of underdrains frequently used to drain water-bearing soils and intercept flow of water from aquifers is covered in standard spec 612. Filter fabrics are often used in conjunction with underdrains or alone to solve specific subgrade problems related to underground water flow.

Special attention should be given to areas of transition from cut to fill. These areas should be investigated for potential undercutting to provide a gradual change in soil textures and conditions. Prompt inspection of these areas is important to complete necessary improvements before excavating equipment is moved from the area or before subbase or base is placed. According to standard spec 205.5.2, EBS done after rough grading operations are complete will be paid at a unit price of three (3) times contract bid price for common excavation.

Generally, the department does not pay for EBS in fills constructed under the contract but will pay for EBS if the fills were constructed under a previous contract.

The engineer is encouraged to seek assistance from the region for a joint inspection and analysis of any subgrade and related problems. The region will then recommend treatment of the subgrade and prepare solutions to related problems for the engineer's decision.

320.6 Rock Excavation

At the start of excavation, the contractor and engineer must set the methods used to determine rock from common excavation. See standard spec 205.2.2 and standard spec 205.2.3 to distinguish between common and rock excavations.

It is the intent of standard spec 205.3.7.1 that rock be excavated in reasonably close conformity with the designated limits. Blasting operations should be performed in a manner to avoid an excess of over breakage. Cross sections for determining rock quantities should be taken as soon as overburden has been removed and at that time as to cause a minimum of interference with the contractor's operations. Allowed overbreak will be paid for where rock excavation is the bid item. Overbreak will not be measured or paid for where pre-splitting rock is required. Sub-excavation of 6 inches below earth subgrade is required by standard spec 205.3.7.1.

Pre-splitting of rock slopes must be done before interior blasting. Pre-splitting may be done as a separate operation from interior blasting, or time delay fuses may be used to fracture the slope line before charges are detonated in the interior portion of the excavation.

Test sections up to 100 feet in length must be used to determine the best spacing, size, and loading of the drill holes. Testing must be performed before starting pre-splitting operations and whenever changes in the characteristics of the rock produce unacceptable slopes with the size and spacing of drill holes in use.

The test section plan should be approved before use. After the test section has been pre-split and the rock face exposed, a careful examination of the rock face should be made to determine whether adjustments in drill hole size or spacing, or in the size of the charge should be made to improve the split face.

Careful planning of offset benches should be done to ensure the toe of the completed slope coincides with the toe of the slope shown on the plans.

The completed drill hole must be measured for payment under the item of pre-splitting rock from the top of the hole to the ditch bottom, to the bottom of the rock if above the ditch bottom, or to a specified bench elevation, as appropriate to the situation or the plan and contract provisions.

320.7 Finish Grading

The finish grading operation consists of shaping and trimming the subgrade to the required lines and grade, and dressing the slopes of cuts, fills, channels, and ditches to a neat and finished appearance. Standard spec 205.3.12 requires that the finish grading operation follow as closely as practicable the completion of the rough grading.

Before the start of finish grading operations, the engineer should make note of the features to be corrected during finish grading and record them on a "punch list." The contractor will be given the engineer's punch list of work to be done during the finish grading operations. Frequent checking by WisDOT will be required to determine the finishing work is acceptable. The engineer should conduct level checks along ditches, as necessary, to determine they drain properly.

Standard spec 205.3.13 requires the slopes and banks of existing ditches, channels, dikes, and the like be rounded or modified to allow vehicles which have left the road to safely traverse such features. The

engineer should review with the contractor the location and extent of this work. Necessary excavating, topsoiling, fertilizing, and seeding will be measured and paid for under the pertinent contract bid items.

Blue top hubs are set before final grading to assist in securing the final grade, crown, and width of roadbed. However, the final test of the roadbed is its riding quality. The engineer should drive the entire roadbed to check crown and high or low spots and order any necessary correction.

All finish grading operations, including rounding of cut slopes, should be completed for a given area before the topsoil is placed.

320.8 Finishing Roadway

The work of finishing roadway as specified in standard spec 213 is required whether or not the contract contains a separate item for Finishing Roadway. If there is no bid item provided, Finishing Roadway is incidental to associated bid items.

Frequent inspections should be made during the finishing operations for assurance the specified work is acceptably performed.

Finishing Roadway requires, in addition to the clean out of drainage structures installed under the contract, that existing drainage structures be cleared of all material deposited in the structures as a result of construction operations. An inspection should be made, before the start of construction operations, of all existing drainage structures which are to remain in place, in order to ascertain the amount of material, if any, in the structures. The contractor is not required to remove any material deposited in drainage structures not resulting from the contractor's operations, unless otherwise provided on the plans or in the special provisions.

320.9 Surplus of Unsuitable Material

Standard spec 205.3.12 provides that material unacceptable for constructing embankments, but suitable to support vegetation must be used for salvaged topsoil if needed. All other surplus material that is not suitable for constructing embankments, but is suitable to uniformly widen embankments, flatten slopes, and fill low areas must be used for such purposes unless otherwise provided. Widening embankments and flattening slopes generally would mean used outside a 1:1 slope from the finished shoulder line.

Standard spec 208.1 requires using suitable material from roadway and drainage excavation or excavation for structures before furnishing borrow or selected borrow excavation.

Surplus excavation that cannot be used on the project must be disposed of by the contractor outside the right of way. When the contractor hauls the material outside the right of way for disposal, it becomes the contractor's property. Standard spec 205.3.12 contains the requirements for the disposal.