PART IV

TECHNICAL SPECIFICATIONS

SECTION 201 -- CLEARING AND GRUBBING

Description

1.1 This work shall consist of clearing, grubbing, removing, and disposing of all vegetation and debris within the limits shown on the plans or specified below, except such objects as are designated to remain or are to be removed in accordance with other sections of these specifications. This work shall also include the preservation from injury or defacement of all vegetation and objects designated to remain.

1.2 Areas which will be approved under clearing and grubbing, outside of the limits shown on the plans for clearing and grubbing will be those where the wooded growth is considered by the Engineer to be comparable to that existing in the designated areas and where full-scale clearing and grubbing operations are required. Areas of only scattered small growth, grass, weeds, crops, or occasional small roots may require some work but will not be included for payment under this item.

1.3 The items of trees, stumps, and roadside clean up will be limited to work performed outside of the areas designated under 1.1 and 1.2.

Construction Requirements

3.1 Clearing and Grubbing, Trees, and Stumps.

3.1.1 No trees shall be cut until designated by the Engineer. Particular reference is made to fruit, ornamental, or shade trees or plants at the edge of the roadside slopes. Cut or scarred surfaces of trees or shrubs selected for retention shall be painted with an approved wound dressing or treated according to other accepted arboricultural practices.

3.1.1.1 The Contractor usually is required to file an intent to cut and will pay all charges, fees and taxes as may be required under Chapter 79 of the RSA.

3.1.2 All trees ordered cut shall become the property of, and shall be disposed of by the Contractor, except as provided hereinafter. In the interest of energy and material conservation, the Contractor shall salvage wood from cut trees in accordance with standard commercial logging practices.

3.1.3 Unless otherwise shown on the plans, clearing and grubbing shall extend 10 feet beyond the excavation and 5 feet beyond embankment slopes.

3.1.4 The Contractor shall perform the work of clearing and grubbing to include the removal of only the materials here specified. In order to conserve topsoil, the Contractor shall make use of rake teeth on bulldozers in the process of removing stumps and brush unless other equipment is permitted.

3.1.5 Except in areas to be excavated, excavation caused by grubbing operations shall be filled with suitable material which shall be compacted to conform to the surrounding ground.

3.1.6 All stumps and large roots within the limits of the roadbed shall be completely removed to a depth of 3 feet below subgrade unless a greater or lesser depth is specified on the plans. Stumps within the limits of the roadbed below such depth, and stumps under embankments or outside the roadbed shall be cut off within 6 inches of the existing ground surface except in the area to be rounded at the top of backslopes, where stumps are to be cut off flush with the surface of the final slope line, or removed.

3.1.7 All stumps, roots, branches, brush, weeds, and other perishable material resulting from the clearing and grubbing operations shall be disposed of by an approved method. The Contractor's attention is directed to RSA 149-M regarding the fact that stumps and roots from grubbing operations have been classified as solid waste. As such, these stumps shall be disposed of in permitted sites, through firms having facilities to convert the stumps to marketable products or by grinding or chipping. Permits for sites are obtained from the N. H. Department of Environmental Services, Division of Waste Management. It is the responsibility of the person disposing of the stumps to obtain all the necessary permits and comply with the New Hampshire Solid Waste Rules and Design Standards in effect at the time of disposal.

3.1.7.1 All wood less than 5 inches in diameter and not cut into 4 foot lengths for firewood shall be chipped. Burying of brush shall not be permitted. Stumps, roots and rotten wood may be buried at approved sites on or off the project. Approved sites shall have a minimum of 24 inches of cover material and shall be graded and shaped as directed by the Engineer. If burial is to be on private land, the agreements as to how the area is to be left shall be set forth on the forms provided by the Department in accordance with 106.10 disposal areas. Three signed copies of the agreements shall be furnished to the Engineer. Approval of the proposed disposal area will be contingent upon agreement by the Contractor and the property owner to leave the area in such shape that it will blend with the surrounding terrain and that erosion will be kept to the minimum. Without special permission, slopes shall not be left steeper than 3:1. No disposal area shall be left in such condition that erosion, after completion of the work, might result in water pollution by silt or other deleterious substances. Areas shall be left in such shape and condition that material will not wash and block or obstruct drainage ways. If holes caused by settlement appear, they shall be filled as directed. A release from the property owner is required prior to final acceptance.

3.1.7.2 Except in the case where wood is piled neatly for future use, storage locations should be outside the limits of view from the project, other highways, and residences.

3.1.7.3 When ordered, available chipped material shall be stockpiled in the quantity directed to be used for erosion control. The Contractor may market any remaining chips or dispose of them by other approved methods.

3.1.7.4 Unless otherwise ordered, disposal areas shall be covered with material capable of supporting vegetation and either fertilized and seeded with grass seed or planted with seedlings. Seedlings shall be set out in accordance with accepted horticultural practices as directed in the agreement.

3.1.7.5 Unless permission is given to preserve access roads to disposal areas adjacent to highways, such access roads shall be obliterated.

3.1.8 When fence lines go through wooded areas, a strip three feet wide shall be cleared for the fence line.

3.2 Roadside Cleanup.

3.2.1 Roadside cleanup of leaning, dead, unsound and unsightly trees, branches, stubs, refuse, and slash, generally to a limit of approximately 15 feet outside the limits specified in 3.1.3 above, shall be performed where and as directed, and the material shall be disposed of as provided in 3.1. All tree trimming in connection with roadside cleanup shall be done by competent workmen in accordance with good tree surgery practice.

3.3 Trimming of Trees.

3.3.1 On trees or shrubs designated to remain, low hanging branches and unsound or unsightly branches shall be removed as directed. Branches of trees extending over the roadbed shall be trimmed to give a clear height of 20 feet above the roadbed surface. All trimming shall be done by skilled workmen and in accordance with good tree surgery practice.

Method of Measurement

4.1 Clearing and grubbing will be measured by the acre, horizontally, to the nearest 0.01 of an acre, including the area shown on the plans to be cleared and grubbed, together with areas of clearing and grubbing, as ordered, outside the limits shown on the plans.

4.1.1 When fence goes through a wooded area, a strip 3 feet wide will be paid as clearing for fence lines, to the nearest .01 of an acre.

4.1.2 Clearing and grubbing in connection with borrow sources will be subsidiary.

4.2 Trees will be measured by the number of trees of each class removed.

4.2.1 The class of the tree shall be determined by circumference measurement at a height of 4 feet above the average ground. Small trees shall be classified as trees measuring more than 28 inches (approximately 9 inches in diameter) and less than 75 inches (approximately 24 inches in diameter). Large trees shall be classified as trees

measuring 75 inches or over. Trees 28 inches or under in circumference will be classed as brush and such work shall be subsidiary.

4.2.2 Trees 28 inches or under in circumference will be classified as brush, and as such, their clearing will be considered subsidiary.

4.3 Stumps will be measured by the number of stumps removed measuring more than 28 inches in circumference at the cutoff. Stumps of trees cut by the Contractor will not be measured.

4.4 Roadside cleanup will be measured by the acre, horizontally, to the nearest 0.01 of an acre.

Basis of Payment

5.1 The accepted quantity of clearing and grubbing will be paid for at the contract unit price per acre.

5.1.1 When no quantity for clearing and grubbing is included in the contract, the work shall be subsidiary.

5.1.2 When no quantity for clearing for fence lines is included in the contract, the work shall be subsidiary.

5.2 The accepted quantities of trees and stumps will be paid for at the contract unit price per each of the class specified.

5.2.1 When and item for removing trees but no item for removing stumps appears in the contract, each stump shown on the plans as a tree and removed as ordered will be paid for as 1/2 a tree of the respective size shown.

5.2.2 This item will not include trees and stumps removed from areas paid for under clearing and grubbing, roadside cleanup, or trees or stumps previously disposed of.

5.2.3 When there is no item for removing small trees and there is an item for large trees, small trees shall be paid for at 1/2 the contract price of large trees; conversely large trees shall be paid for at 2 times the contract price for small trees.

5.2.4 When there are no quantities for either trees or stumps in the proposal, trees and stumps removed shall be subsidiary.

5.3 The accepted quantity of stumps will be paid for at the contract unit price per each.

5.3.1 When no quantity of stumps is included in the contract, work ordered to remove stumps will be paid as extra work.

5.4 The accepted quantity of roadside cleanup, will be paid for at the contract unit price per acre.

5.4.1 When no quantity of roadside cleanup is included in the contract, work ordered of such nature will be paid for as extra work.

5.5 Trimming of trees where directed outside of the areas measured under the item of roadside cleanup will be paid for as extra work.

Pay items and units:

201.01	Clearing	Acre
201.02	Grubbing	Acre
201.1	Clearing and Grubbing	Acre
201.21	Removing Small Trees	Each
201.22	Removing Large Trees	Each
201.31	Tree Pruning, Small Trees	Each
201.32	Tree Pruning, Large Trees	Each
201.4	Removing Stumps	Each
201.5	Roadside Cleanup	Acre
201.6	Clearing for fence Lines	Acre
201.7	Selective Clearing and Thinning	Acre
201.89	Fertilizing Individual Trees	Ton
-----	Roadside Cleanup	Extra Work
-----	Trimming of trees	Extra work

SECTION 202 -- REMOVAL OF DRAINAGE & SEWER STRUCTURES

Description

1.1 This work shall consist of the removal and salvage or satisfactory disposal of pipes and other drainage and sewer structures as designated on the plans or ordered.

1.2 The work shall also consist of the removal and salvage or satisfactory disposal of and other items as designated on the plans or ordered.

Construction Requirements

3.1 Existing pipes, catch basins, manholes and other drainage and sewer structures which are not to remain as integral parts of a drainage or sewer system, shall be removed as directed. Those under roadways in use by traffic shall not be removed until satisfactory arrangements have been made to accommodate the traffic.

3.2 When the engineer determines that pieces of pipe removed are suitable for re-use, they shall be stockpiled where directed within the project area and when not suitable for re-use, they shall be disposed of by the contractor. Catch basin and drop inlet grates, manhole covers, frames and all such castings and granite curb inlets shall be carefully removed and likewise stockpiled for re-use on the project or salvaged by the City. Other parts of catch basins, drop inlets and manholes shall be disposed of by the contractor.

3.3 Trenches and holes resulting from removal operations except those within the limits of subsequent excavation shall be backfilled in accordance with the provisions of Section 209. If caving has occurred the caved material shall be removed before backfill is undertaken. All excavated material shall be used or disposed of in accordance with the provisions of Section 206 and 209.

Method of Measurement

4.1 Pipe removed will be measured by the linear foot within the specified size group, measured in place prior to removal if practicable; otherwise the length of pipe removed will be computed as the product of the number of commercial lengths and the nominal lengths.

4.1.1 All solid rock will be measured as rock structure excavation. Boulders, mortared structures such as headwalls and the like found to measure 1 cubic yard or more will also be measured as rock structure excavation when such excavation is performed for pipe removal, but pipe itself will not be measured as rock.

4.2 Catch basins, drop inlets and manholes removed, will be measured by each, no extra measurement will be made of granite curb inlets removed unless an item therefore is included in the contract.

4.3 Curb removed for storage will be measured by the linear foot.

Basis of Payment

5.1 The accepted quantities of pipes, box culverts, catch basins, drop inlets, manholes and other obstructions demolished or removed will be paid for at the contract unit price per unit of measurement for each of the pay items listed hereinafter.

5.1.1 No payment will be made herein for the removal of pipes, box culverts, catch basins, drop inlets, manholes and other obstructions encountered within the payment limits of another excavation item in the contract.

5.2 There will be no separate payment for items paid for herein except that rock measured under 3.1.1 will be paid for as rock structure excavation. There will be no deduction from borrow for material used to fill the remaining cavities.

5.3 Existing pavement removed will be paid for under the pertinent excavation items.

5.4 When no basis of payment for the removal of structures and obstructions shown on the plans is included in the proposal, such work will be subsidiary.

Pay items and units:

202.41	Removal of Existing Pipe 0-24" diameter	L.F.
202.42	Removal of Existing Pipe over 24" diameter	L.F.
202.5	Removal of Catch Basins, Drop Inlets and Manholes	Each
202.51	Removal of Granite Curb Inlets	Each
202.6	Curb Removal for Storage	L.F.

SECTION 203 -- EXCAVATION AND EMBANKMENT

Description

1.1 This work shall consist of excavation of all material not being removed under some other item, placement and compaction of all material required for the work, and necessary disposal of all other material. The excavation will be classified as described below. Embankment-in-place shall mean material placed under such item. Rehandling Surcharge Material shall consist of removing and redepositing the surplus surcharge material which has been used to displace or consolidate soft material below specified sections of fill.

1.2 This work shall consist of furnishing and placing an impervious material in conformity with the lines, grades, and dimensions shown on the plans or as ordered. The intent is to form a soil layer that is as impervious as possible, to minimize infiltration of storm water runoff into the ground.

Classification of Material

2.1 Common excavation shall consist of all excavation not included as rock excavation or not otherwise classified. Glacial till or boulder clay will be considered as common excavation.

2.2 Rock excavation shall consist of all solid rock which cannot be removed without blasting or ripping. It shall also consist of boulders and parts of masonry structures when found to measure two cubic yards or more.

2.3 Unclassified excavation shall consist of all materials of whatever character encountered in the work.

2.4 Muck excavation shall consist of deposits of saturated or unsaturated mixtures of soils and organic matter not suitable for foundation material regardless of moisture content.

2.5 Borrow shall consist of approved material required for the construction of fills or other portions of the work.

2.6 Impervious material shall be natural, inorganic soil that is free from foreign matter such as construction debris, trash, wood, roots, leaves, and other organic matter.

2.6.1 Some examples of soils that are considered acceptable for impervious material are clay, glacial till, and well graded soils with high silt contents. Impervious material shall be as follows when tested in accordance with AASHTO T 27:

Seive Size	Percentage by Weight Passing
6 inch	100
2 inch	95 - 100
No. 4	70 – 100
No. 40	35 – 100
No. 200 in total	25 - 100

2.6.2 For a preliminary determination of compliance with the specification for grading and for determination of the maximum dry density, the Contractor shall submit to the Engineer samples of materials to be used for impervious material prior to its placement. Samples may be taken from the pit or from stockpiles. Sampling and testing shall conform to AASHTO T 27, R 13, and T 99. Materials not meeting these specifications shall not be placed.

Construction Requirements

3.1 General. The excavation and embankments shall be finished to reasonably smooth and uniform surfaces.

3.1.1 Conservation of growth. Excavation shall be carefully performed in proximity of trees and shrubs designated to be saved on the plans or as ordered. Any roots which have to be removed shall be cleanly cut, and the larger ones shall be painted with approved wood dressing or treated according to other accepted arboricultural practices.

3.1.2 Topsoil and other humus material. Topsoil and desirable humus material shall be removed in excavation areas and also in fill areas to such depths as the Engineer may direct. Such material shall be reserved and shall be stockpiled in accessible piles which can be measured readily and accurately by the Engineer. Unless otherwise permitted, each stockpile shall contain a minimum of 200 cubic yards, and have a height of at least 4 feet.

3.1.3 Material found in the roadway. Sand, gravel, or other materials found in the roadway may be used under the specific item in accordance with 104.05 when permitted.

3.1.4 Removing abandoned road surface. Old road surfaces shown or ordered to be removed shall be stripped neatly to the depth and width as shown on the Plans or as ordered.

3.1.5 Drives. Drives shall be retained or constructed as shown on the plans or as ordered.

3.1.6 Degraded material. When the Contractor's selected method of excavation operations results in saturation of non- porous materials and as a consequence the excavation must be wasted, a deduction from borrow will be made of the amount wasted. The quantity shall be as determined by the Engineer.

3.2 Rock Excavation.

3.2.1 Preliminary work. When rock excavation is to be performed the overburden shall be removed, or trenches shall be excavated through the overburden at the intervals directed, normally

25 feet, but in no case closer than 10 feet apart to permit cross-sectioning of the rock in its original position. Generally, the use of power equipment will be satisfactory. Rock removed prior to sectioning will be considered as common excavation.

3.2.2 Blasting operations. The required slopes or configurations shown on the plans or ordered shall be constructed in a safe and stable condition while insuring the safety and convenience of the public.

3.2.2.1 The Engineer will, at all times, have the authority to prohibit or halt the Contractor's blasting operations if it is apparent that through the methods being employed, the required slopes are not being obtained in a stable condition or the safety and convenience of the public is being jeopardized.

3.2.2.2 The Contractor shall schedule his operations so that all rock excavation within 300 feet of any portion of a proposed bridge or within 100 feet of any other proposed structure is completed before any structure work is started.

3.2.2.3 All loose and unstable material, all breakage and potentially unstable rock slides, even if located beyond the payment lines, shall be removed or stabilized, to the Engineer's satisfaction during or upon completion of the excavation in each lift. Drilling of the next lift will not be allowed until this work has been completed. It shall be the responsibility of the Contractor to perform all phases of this work to produce the required slopes.

3.2.2.4 All blasting operations, including the storage and handling of explosives and blasting agents, shall be performed in accordance with the applicable provisions of the Standard Specifications and all other pertinent Federal, State, and local regulations. Whenever explosives are used, they shall be of such character and in such amount as is permitted by the State and local laws and ordinances and all respective agencies having jurisdiction over them.

3.2.2.5 The Contractor shall observe the entire blast area to guard against potential hazards before commencing work. The Contractor shall not be allowed to store explosives on the project site or on City owned property unless prior approval is granted by the Department.

3.2.2.6 Drill hole conditions may vary from dry to filled with water. The Contractor will be required to use whatever type(s) of explosives and/or blasting accessories necessary to accomplish the specified results.

3.2.3 The Contractor shall submit the following information to the Engineer at least two weeks prior to commencing drilling and blasting operations:

a) Sequence and schedule of production blast rounds, including the general method of developing the excavation, lift heights, starting locations, estimated starting dates, estimated rates of progress, etc.
b) Written evidence of the licensing, experience and qualifications of the blaster who will be directly responsible for the loading and firing of each shot.

c) Name and qualifications of the person responsible for designing and directing the Contractor's blasting operation.

d) Name and qualifications of the independent seismologist or blasting consultant proposed for use in conducting pre- blast condition surveys.

e) Name and qualifications of the independent seismologist of blasting consultant proposed for use in monitoring blast vibration (see section 3.2.5.2). A sample of a previous vibration analysis and/or report shall be included with the qualifications. The seismologist or blasting consultant shall be subject to the Engineer's approval.

f) Listing of instrumentation which the seismologist or blasting consultant proposes to use to monitor vibrations together with performance specifications, instrumentation user's manual supplied by the manufacturer(s). (See section 3.2.5.6).

3.2.4 Blasting log. A blasting log must be completed daily for every primary blast and copies must be provided to the Engineer. An example of a typical blasting log is shown in Figure 1. The drilling contractor may use a different format for his blasting log if it has been approved by the Engineer.

3.2.5 Blast vibration control and monitoring. The Contractor shall be required to comply with the blasting vibration limits established herein. The Contractor shall provide for monitoring of the blasting vibrations (both ground and air concussions) produced as a result of the construction activities and shall provide for a Pre-Blast Condition survey of structures. The Contractor shall cooperate in adjusting his blasting procedures to maintain the vibration limits specified herein and to minimize vibration-related claims and complaints.

3.2.5.1 Vibration limits.

3.2.5.1.1 Ground Limits. The maximum peak particle velocity (PPV) of ground vibration (in any of the three mutually perpendicular components of particle velocity) for above- ground, residential structures shall not exceed the following limits:

Ground Vibration

Type of Structure	Peak Particle Velocity, Inches/Sec Frequencies Below 40 HZ	 Frequencies 40 HZ or Greater
Modern Homes -Drywall Interiors	0.75	2.0
Older Homes -Plaster on Wood Lath for Interiors	0.50	2.0

3.2.5.1.2 The maximum peak particle velocity of ground vibrations (in any of the three mutually perpendicular components of particle velocity) for non-residential structures shall not exceed 2.0 inches/sec.

3.2.5.1.3 The maximum PPV of ground vibrations, in any of the three mutually perpendicular components of particle velocity, for underground utilities shall not exceed 2.0 in/s. Buried pipelines and other utilities owned by private utility companies are sometimes subject to lower limiting values imposed by the owner. The Contractor shall verify the maximum allowable PPV of ground vibration allowed by the individual utilities.

3.2.5.1.4 Deteriorated structures or utilities, structures housing computers or other sensitive equipment, and manufacturing processes that are sensitive to vibrations may require lower PPV limits than stated in this specification. If lower limits are required, a special prevision describing the limits or conditions required will be included in the proposal.

3.2.5.1.5 The Contractor shall not conduct blasting operations within 20 ft of newly placed concrete regardless of the age of the concrete. For blasting greater than 20 ft away from new concrete, the following vibration limits apply:

Ground Vibration Limits for New Concrete
Maximum PPV (in/s)

Distance to Blasting	Type I Concrete		Type II Concrete	
(ft)	<24 hrs	>24 hrs Old	<24 hrs	>24 hrs Old
20 - 50	2.0	4.0	1.5	3.0
40 - 150	1.5	3.5	1.0	2.5
> 150	1.0	3.0	0.5	2.0

Type I concrete construction shall be considered to be concrete which is not designed to undergo structure bending or deflection. In general, a concrete section shall be considered Type I if the vertical dimension is not more than twice the horizontal dimension. Examples of Type I concrete construction are fill or mass concrete, spread footings, and slabs cast on grade.

Type II concrete construction shall be considered to be concrete which is not Type I, and includes structural walls and slabs over an open span.

3.2.5.1.6 Air concussion. The contractor shall conduct all blasting activities in such a manner that the peak airblast overpressure at all above ground, occupied structures in the vicinity of blasting does not exceed 128 decibels (dB).

3.2.5.1.7 If blast induced ground vibrations exceed the limits for maximum peak particle velocity, then alternative rock excavation techniques may be necessary. All non-explosive methods of rock excavation are subject to approval by the Engineer.

SECTION 203

FIGURE #203-1

BLASTING LOG

1. Company name: _____

2. Location of Shot (Station): _____

3. Shot #: _____ 4. Time: _____ 5. Date: _____

6. Weather: _____

_____

7. Wind Direction: _____ 8. Temperature: _____

9. Distance & Direction to Nearest Structure: _____ & _____

10. Depth of Water (ft.): _____

11. Total Explosives Allowed Per Delay Period:

Weight of Explosive(s) (lb)= (Distance in Feet* / 50)^2 = _____

*Distance to nearest structure

12. Diameter of Holes (in.): Production _____ Presplit _____

13. Hole Depth (ft.): _____

14. Total # of Holes: _____

15. Drill Pattern - Burden x Spacing (ft.): _____

20. Density of Explosive(s) Used: _____

21. Kind of Delay Periods: _____

22. Total # of Delay Periods: _____

23. Length of Delay Periods (ms): _____

24. Total of Explosives Used (lbs.): _____

25. Maximum # of Holes Per Delay Period: _____

26. Maximum Amount of Explosive(s) Per Delay Period (lbs): _____

27. Powder Factor = $\frac{\text{Pounds of Explosives Per Hole}}{\text{Cubic Yards of Rock Per Hole}}$

Powder Factor = (lbs/yd^3) _____

FIGURE #203-1 (continued)

28. Scale Distance = $\frac{\text{Distance in Feet}}{(\text{Weight Per Delay Period})^{1/2}}$

Scale Distance = _____

29. Method of Firing: _____

30. # Series, Circuits: _____

31. Location of Seismograph: _____

_____

a. Distance from Shot and Direction: _____

b. Person Taking Reading: _____

c. Seismograph Reading: _____

d. Peak Sound Pressure Level: _____

e. Vibration Measurements: _____

Transverse
Vertical
Longitudinal

DIAGRAM OF SHOT

Name of Blaster: _____

License Number of Blaster: _____

3.2.5.2 Seismologist/Blasting Consultant. The Contractor will be required to retain a seismologist or Blasting Consultant to monitor, record, analyze, and report the seismic vibrations being caused by blasting activities. The name of the Seismologist/Blasting Consultant and a resume of his qualifications shall be submitted to the Engineer for approval no later than the preconstruction conference. No drilling or blasting shall take place until such approval is given. The Seismologist/Blasting Consultant shall not be an employee of the Contractor, subcontractor, explosives manufacturer, or explosives distributor.

3.2.5.3 Seismologist/Blasting Consultant qualifications. The Seismologist shall be experienced in the subject of vibrations emanating from construction activities. He shall be qualified to thoroughly analyze seismic parameters of the energy source, the energy transmission path, recording site and the ground motion spectra. Minimum qualifying requirements to perform the necessary documentation and analysis are as follows. A bachelor of science degree with accredited course work in at least three of the following disciplines: Seismology, Geophysics, Geophysical Data Processing, Geomechanics, Geophysical Engineering, Vibration Engineering, Soil and/or Rock Mechanics, Foundation and/or Explosive Engineering, Advanced Calculus, Time-Series (Fourier) Analysis.

3.2.5.4 Seismologist/Blasting Consultant duties. The Seismologist/Blasting Consultant will direct and instruct the Contractor in his operations to control vibrations within acceptable levels. The Seismologist/Blasting Consultant shall be in charge of making the preliminary blast survey and unless otherwise permitted in writing, shall be present at the site of the blasting during all blasts. The Seismologist/Blasting Consultant shall provide and utilize all necessary equipment to observe and record vibrations to ascertain that acceptable levels of vibrations are not exceeded. The Seismologist shall monitor, report his findings, and submit his recommendations on a daily basis to the Engineer. He shall determine the level of observed vibrations attributed to the project's blasting activities and their subsequent effect on surrounding structures.

3.2.5.5 Pre-blast condition survey. The Seismologist or Blasting Consultant shall conduct a pre-blast condition survey of all existing structures and conditions on the site, adjacent to the site, or in the vicinity of the site. This survey shall extend to such structures or conditions as may be affected by the Contractor's construction operations As a minimum, condition surveys shall be performed on all structures (including swimming pools and mobile homes) within 500 feet of anticipated blasting areas.

3.2.5.5.1 The pre-blast condition survey shall consist of a written description of the interior and exterior condition of each of the structures examined. Descriptions shall locate any existing cracks, damage, or other defects and shall include such information so as to make it possible to determine the effect, if any, of the construction operations on the defect. Where significant cracks or damage exists, or for defects too complicated to describe in words, photographs shall be taken. A good quality videotape survey with appropriate audio description of locations, conditions, and defects can be used. Prior to the start of work, a copy of the pre-blast condition survey shall be submitted to the Engineer for review.

3.2.5.5.2 The Seismologist or Blasting Consultant shall give written notice to the owner of the property concerned, tenants of the property, and any representative of local authorities required to

be present at such survey. The notice shall state the dates on which surveys are to be made. Copies of all notices shall be provided to the Engineer.

3.2.5.5.3 Prior to the start of blasting activities, the Contractor shall place an advertisement in the local newspaper and provide a notice to adjacent property owners and tenants identifying the project, blasting contractor, site location, warning signals and precautions being taken by the blasting contractor to minimize disturbance to residents.

3.2.5.5.4 Upon completion of all earth/rock excavation and blasting work, the Contractor shall conduct a post-blast survey of any properties, structures, and conditions where complaints of damage have been received or damage claims have been filed. Notice shall be given to all interested parties so that they may be present during the final examination. Records of the final examination shall be distributed the same as the original pre-blast condition survey.

3.2.5.6 Vibration monitoring instrumentation. All vibration monitoring instrumentation proposed for use on the project by the Contractor shall comply with the following characteristics:

a) Measure, display, and provide a permanent record on a strip chart of particle velocity components.
b) Measure the three (3) mutually perpendicular components of particle velocity in directions vertical, radial and perpendicular to the vibration source.
c) Have a velocity frequency response of 2 Hz to 150 Hz, and be capable of measuring peak particle velocity of up to 10 inches per second.
d) All seismographs used on the project shall display the date of the most recent calibration.
e) Calibration must have been performed within the last 12 months and must be performed to a standard traceable to the National Bureau of Standards.

3.2.5.7 Report of Monitoring Results.

3.2.5.7.1 Following each blast, the Contractor shall immediately report the measured vibrations to the Engineer. In the event seismic vibrations caused by the Contractor's operations approach the established limits for this project, the Engineer may require the Contractor to modify his blasting operations to reduce the vibrations. If the seismic ground vibration and/or air concussions caused by the Contractor's blasting operation attain or surpass the established limits, the operations shall cease. Blasting shall not be resumed until measures have been taken to reduce, to the satisfaction of the Engineer, the produced vibrations and/or air concussions below established limits. The seismologist or blasting consultant should assist the Contractor in the design of his blasting to eliminate the problems and to avoid liability claims.

3.2.5.7.2 Within 24 hours following each blast, the Contractor shall submit to the Engineer in writing the following items:

a) Details of the round as shot to include the information shown on the sample blasting log (see Figure 203-1)
b) Results of blast monitoring at each instrument location, including peak particle velocity in inches per second (in/sec), as well as a copy of the strip chart recording for each monitoring

location, marked with the date, time, location of the equipment, and signature of seismograph operator.

3.2.5.8 Pre-blast meeting. A pre-blast meeting shall be held prior to the start of any drilling or blasting activities. The purpose of the meeting shall be to review the blasting procedures and vibration monitoring requirements, and to facilitate coordination between all parties involved. Individuals attending the pre-blast meeting should include the Project Engineer, the Contractor, the Contractor's seismologist or blasting consultant, the Contractor's Blaster, the research geologist, any utility affected by the blasting operation, and any other personnel the Engineer deems appropriate.

3.2.5.9 Blast scheduling. The Contractor shall notify the Engineer of blast round schedules in accordance with the following requirements:

a) At least 24 hours in advance, notification of estimated time of blast.
b) At 30 minutes prior to a blast give a stand-by notification.

3.2.5.10 Warning signals. Adequate warnings shall be given to all personnel in proximity to the blast site at least 3 minutes in advance of each blast. The Contractor shall use sirens and/or horns with sufficient intensity such that they can be heard for a minimum distance of 1,000 ft.

3.2.5.11 Flyrock control. Before the firing of any blast in areas where flying rock or debris may result in personal injury or damage to property, the rock to be blasted shall be covered with approved blasting mats, soil, or other equally serviceable material, to prevent flyrock. The method of flyrock control shall be subject to approval by the Engineer.

3.2.5.12 Responsibility for blasting operations. Review of the Contractor's blasting submittals by the Department or its Engineer shall not relieve the Contractor of his responsibility for the accuracy, adequacy, and safety of the blasting; exercising proper supervision and field judgement; preventing damage to structures; and producing results within the limits required by the State of New Hampshire regulations and these Specifications. The Blasting Contractor shall be solely and completely responsible for the safety of all persons and property during the performance of his work. The Contractor shall take whatever measures he deems necessary, in addition to the requirements herein, to protect the safety of persons and property, both at the construction site and away from the site. The Contractor shall have full and complete responsibility for handling, discharging or settling of any and all damage or annoyance claims resulting from the blasting activities on the project. Any monitoring and/or review of the Contractor's procedures and performance conducted by the Department or its Engineer shall not relieve the Contractor of his responsibility for safety at and away from the site, and for preventing damage to adjacent structures or property.

3.3 Presplitting.

3.3.1 Presplitting will be required in rock slopes where the designed slope is 1:2 or steeper and the rock is 10 feet or more in depth above the subgrade, measured along the slope.

3.3.2 Presplitting is defined as the establishment of a free surface of a shear plane in rock by the controlled usage of explosives and blasting accessories in appropriately aligned and spaced drill holes so that the resulting split rock will not be affected by subsequent blasting and excavation operations adjacent thereto. The purpose of presplitting is to minimize damage to the rock backslope helping ensure long-term stability. When presplitting, the detonation of the presplit line shall be before detonation of any production holes. Production blasting refers to the main fragmentation blasting resulting from more widely spaced production holes drilled throughout the main excavation area adjacent to the presplit line. Production holes shall be detonated in a controlled delay sequence.

3.3.3 Prior to drilling, all overburden and all loose and disintegrated rock shall be removed down to solid rock in the vicinity of the presplit lines as shown on the plans. Potentially dangerous boulders beyond the excavation limits shall also be removed as ordered.

3.3.4 Presplitting shall extend a minimum of 50 feet ahead of the limits of fragmentation blasting within the section, unless otherwise permitted.

3.3.5 Unless otherwise approved, holes not greater than 3 inches in nominal diameter, and spaced 36 inches on center, shall be drilled along the presplit line and at the required slope inclination to the full depth of the cut or to a predetermined stage (lift) elevation. The proper angle of drilling shall be maintained at all times so that each presplitting hole is parallel to its adjacent one and does not deviate more than 1 foot in 35 feet, neither in the plane of the specifed slope line nor in its vertical alignment. The toe of the completed slope shall coincide, within those limits, with the toe of the slope shown on the plans. All drilling equipment used to drill presplit holes shall have mechanical or electrical devices affixed to the equipment to accurately determine the angle at which the drill steel enters the rock, unless alternate methods for aligning the drill steel are approved by the Engineer.

3.3.6 Presplitting holes shall not exceed 35 feet in depth unless permitted. Rock deeper than 35 feet shall usually be presplit in lifts, but no lift shall be less than 10 feet in depth. No payment will be made for additional excavated quantity caused by offsetting of presplit holes beyond the specified presplit lines in the top or successive lifts. Presplitting holes in successive lifts will be designed to offset 2 feet inside of the previously presplit face.

3.3.7 Before placing the charge, each hole shall be inspected and tested for its entire length to ascertain the possible presence of any obstructions. No loading will be permitted until the hole is free of all obstructions for its entire depth. All necessary precautions shall be exercised so as to prevent debris from falling into holes prior to loading and so that the placing of the charge will not cause caving of material from the walls of the holes.

3.3.8 The spacing of the blasy holes specified above, the distribution and type of explosives, methods of detonation, and blasting techniques specified below shall be adjusted as necessary according to the breakage characteristics and structure of the bedrock encountered so as to presplit the rock along the required face.

3.3.8.1 Results of presplitting shall be exposed for the Engineer's examination and evaluation.

Based upon the Engineer's judgement of results obtained during the progress of the excavation, changes ordered in drilling or blasting methods shall be implemented by the Contractor.

3.3.9 Continuous column cartridge explosives manufactured especially for presplitting shall be used for all presplitting. The maximum diameter of explosives used in presplit holes shall not be more than ½ the diameter of the presplit hole, unless otherwise approved. The bottom charge of a presplit hole may be larger than the line charges, but shall not be large enough to cause overbreak. The upper portion of all presplit holes, from the topmost charge to the hole collar, shall be stemmed.Unloaded and unstemmed guide holes (gs release holes), when used between presplit holes, shall be drilled in the same plane and to the same tolerance as the presplit holes. The guide holes shall extend the full depth of the lift, unless otherwise permitted.

3.3.9.1 If presplitting charges are fired with detonating cord, the cord shall extend the full depth of each hole. If full or fractional portions of dynamite cartridges are used with detonating cord, the dynamite shall be securely affixed to the cord.

3.3.10 All space in each blast hole not equipped by the explosive charges shall be filled with stemming material. Stemming material shall be clean stone chips or other approved angular granular material as shown below.

Required Grading of Stemming Material

Seive Size	**Percentage by Weight Passing**
3/8 inch	100
No. 4	20 - 25
No. 8	0 – 10

3.3.11 All presplit holes may be detonated simultaneously or delayed proviving the hole to hole delay is no more than 25 milliseconds. The detonation of presplit charges shall precede the detonation of adjacent fragmentation charges within the section by a minimum of 25 milliseconds.

3.3.12 The line of blast holes immediately adjacent to the presplitting slope holes shall be drilled 4 feet from and on a plane approximately parallel to the plane of the presplitting slope holes. No portion of these holes or any other blast holes will be permitted closer than 4 feet to the presplit lines. All precautions as necessary shall be taken so as to avoid fracturing the rock beyond the presplit face.

3.3.13 The Engineer may order the discontinuance of the presplitting operations when the rock formation is of such character that no apparent advantage is gained.

3.3.14 The Contractor may use cushion (trim) blasting if conditions warrant it and, in the opinion of the Engineer, satisfactory results are obtained during the test shot(s). Cushion blasting is similar to presplitting except that the detonation along the cut face shall be performed after the detonation of all production holes. Difference in delay time between the trim line and the nearest

production row shall not be greater than 75 milliseconds nor less than 25 milliseconds. With the exception the above criteria, requirements previously given for presplitting shall also apply to cushion blasting.

3.4 Unclassified excavation. When the excavation is unclassified, either in the proposal or by the Contractor's bid, the Contractor may make arrangements with the Engineer for the taking of sufficient measurements of the rock in its original position to enable subsequent determination of the quantity of rock involved in any overbreakage. If the Contractor elects not to make such arrangements, he shall have no claim for rock overbreakage.

3.5 Muck Excavation.

3.5.1 The excavation of muck shall be handled in a manner that will not permit the entrapment of muck within the backfill. The backfilling of the excavated area shall follow immediately behind the excavation of the muck in order that any soft material which is pushed ahead of the backfill can be removed. With muck removal, the Contractor shall allow the Engineer adequate opportunity to take all the necessary elevations and measurements for determining the volume removed.

3.5.2 Any suitable muck removed shall be incorporated in portions of the embankment slopes as directed, or used for other approved purposes.

3.6 Subgrade and Slopes.

3.5.1 Removal and replacement of unsuitable material. Where excavation to designed elevations results in a subgrade or slopes of unsuitable material, the Engineer will require the removal of the unsuitable material to such limits as he may direct. Muck shall be removed as shown or ordered. The backfilling shall be done with approved material and compacted to the design subgrade or slope lines unless otherwise ordered. Material placed in wet slopes shall be one of the following: (1) material meeting the requirements of 304.2; (2) rock, when rock is available from excavation, or (3) a mixture of both.

3.6.2 Backfill of over-excavated subgrade in rock. All over-excavated subgrade in rock shall be replaced with approved porous granular materials such as sand, gravel, broken rock, or any combination thereof. Non-porous materials will not be acceptable.

3.7 Embankments.

3.7.1 General. The Contractor shall place and compact embankment materials in full uniform layers at thicknesses specified below or ordered. Continuous leveling and manipulation shall be employed to ensure uniform density. Where end dumping is employed, embankment material shall be dumped on the layer of embankment being constructed and bulldozed ahead into place. End dumping over completed work which allows material to roll into place will not be permitted.

3.7.2 Backfill of holes. Holes resulting from the removal of stumps, boulders, and the like, within the zone of anticipated frost action shall be filled and compacted with material similar to that surrounding the hole.

3.7.3 Placing on steep slopes. Benching or terracing of slopes steeper than 3 to 1 shall be performed in conjunction with the placing of embankments abutting such slopes, in the manner directed.

3.7.4 Placing in unstable areas. Material used to backfill excavated muck shall consist of rock or granular material so graded that, of the material passing the No. 4 sieve, not more than 70 percent will pass the No. 40 sieve and not more than 25 percent will pass the No. 200 sieve. The material shall be placed in one continuous lift to a maximum elevation of 4 feet above the water level, unless otherwise directed.

3.7.5 Placing rock on roadway. Rock fragments in fills shall be placed in layers of such thickness as the Engineer may direct, and in no case in excess of 4 feet. The lifts shall be worked in such a manner as to close the voids with spalls and fines. When sufficient spalls or fines are not available to close the voids, earth shall be used to make a tight surface prior to placing the next lift.

3.7.6 Placing embankment material at pile locations. In areas where piling is to be driven, the embankment, unless otherwise permitted, shall be made and compacted before driving the piles. No rock fragments, boulders, or other solid material shall be placed where such material could interfere with pile driving operations.

3.7.7 Placing Earth on Roadway.

3.7.7.1 Earth shall be placed in layers the full width of the roadway, generally parallel to the finished grade. The layers shall not exceed 12 inches of loose depth unless otherwise directed. Each layer shall be spread to a uniform thickness and compacted to the required density prior to placing the next layer. Continuous grading or shaping shall be carried out concurrently with the compactive effort to ensure uniform density throughout each layer material. Embankment material to be placed adjacent to granular backfill shall be placed concurrently with the granular backfill to provide lateral support.

3.7.7.2 Embankments shall be graded at all times to ensure the run-off of water. Any saturation of non-porous materials due to the Contractor's selected method of operation will require the suspension of additional work on the area until rectification by drying, removing and replacing, or draining has restored the fill to a stable condition at the Contractor's expense.

3.7.8 Winter construction methods. No embankments shall be constructed on frozen earth materials. Each layer of material placed shall be compacted to the required density before it freezes. All frozen material shall be removed from the top of embankments prior to placing additional material. The frozen lumps of earth removed shall be placed outside of the limits of an assumed 1-1/2 to 1 slope from the break in the shoulder and inside the designed or ordered slope line. If the above specified conditions cannot be met, earthwork operations shall be suspended. In no case shall the scarifying or breaking up of frost be accepted instead of removal.

3.7.9 Backfill at structures. Backfill at structures shall conform to 504.3.4.3

3.7.10 Embankment foundation. Unless otherwise shown on the plans or ordered, where the existing ground is 3 feet or less below subgrade, the top 6 inches within the limits of the roadbed shall be compacted to the same density as that required of the first layer of material to be placed on it.

3.8 Density Requirements and Tests.

3.8.1 For all earth materials at least 95 percent of maximum density shall be obtained. The maximum density determination will be made as specified in AASHTO T 99. (Standard Proctor Test). The in-place density determination will be made by AASHTO T 191, (Sand Cone Method), AASHTO T 204 (Drive Cylinder Method), or by AASHTO T 238 and T 239, (Nuclear Method). If the required density cannot be achieved with the equipment at hand, the Contractor shall obtain whatever equipment is necessary to achieve the specified density. Manipulation of tills, silts, and clays, or any combination thereof, (including aeration where necessary) will be required to produce a stable fill of the required density.

3.8.2 Those materials which cannot be tested for maximum density in accordance with AASHTO T 99 may be tested for maximum density by the following procedure.

3.8.2.1 Test Strip Procedure. At the beginning of the compaction operation, the maximum density shall be determined by compacting a short control section or "test strip" at a suitable moisture content until no further increase in density can be obtained. The densities shall be obtained by the use of nuclear density testing equipment. A new test strip may be required by the Engineer where there is a significant change in the gradation of material being placed. Compacting of the test strip shall be done with an approved vibratory roller or compactor producing a dynamic force of at least 27,000 pounds.

3.9 Disposal of Surplus and Waste Material.

3.9.1 Definitions.

(a) Surplus material. Excess material from excavation beyond the minimum requirements of the project but otherwise suitable for use.

(b) Waste material. Material unsuitable for use in the work, except in noncritical areas.

3.9.2 If the material is surplus, written permission from the Engineer must be obtained before the Contractor may dispose of such material outside of the work.

3.9.3 When practicable and wherever directed, surplus and waste material shall be utilized for flattening slopes or for other grading within the project.

3.9.4 When specified on the plans, surplus material shall be hauled off the project for use elsewhere for highway purposes. Such material shall be placed in accordance with the appropriate specification.

3.9.5 In case it is impossible to dispose of all the surplus and waste material in the manner described above and when the contract does not contain the item of embankment-in- place, the remainder shall be disposed of as directed or permitted. It shall be the Contractor's responsibility to secure disposal areas for surplus and unsuitable material in case such areas are not shown on the plans.

3.9.6 If disposal of surplus and waste material is by burying, the cover material shall be graded and shaped as directed by the Engineer. Without special permission, slopes shall not be left steeper than 2:1. No disposal area shall be left in such condition that erosion might result in water pollution by silt or other deleterious substances. Areas shall be left in such shape and condition that material will not wash and block or obstruct drainage ways. If holes caused by settlement appear, they shall be filled as directed.

3.9.7 Unless otherwise ordered, disposal areas shall be covered with material capable of supporting vegetation and either fertilized and seeded with grass seed or planted with seedlings. Seedlings shall be set out in accordance with accepted horticultural practices as directed in the agreement.

3.9.8 Unless permission is given to preserve access roads to disposal areas adjacent to highways, such access roads shall be obliterated.

3.9.9 When the contract requires the removal of existing pavement but does not require recycling the contractor is encouraged to save this bituminous material for future reuse. This material is considered to be a valuable resource because of the residual asphalt contained in it. Therefore, no existing bituminous pavement removed shall be incorporated in the embankment. It also must be disposed of in accordance with the Department of Environmental Services Waste Management Division regulations.

3.10 Borrow.

3.10.1 Use of borrow. It shall be the Contractor's responsibility to schedule the excavation so as to incorporate all suitable materials in the work. Premature use of the item of borrow resulting in wasting of suitable excavation will cause the deduction from borrow of the quantity of suitable material wasted as determined by the Engineer.

3.10.2 Sources. Unless otherwise designated in the contract, the Contractor shall make its own arrangements for obtaining borrow and shall pay all costs involved. See 106.02. All sources of borrow, whether within the right-of- way or elsewhere, shall be approved in writing before any borrow is removed. Permission to remove material beyond the template lines within the right-of-way and adjacent thereto will be contingent on many factors and if permission is granted, it will be given by the Engineer only after review by all interested parties. Permission may be contingent, among other considerations, upon consent of the Contractor to leave regular and uniform slopes in the area. Slopes excavated beyond the template lines without authorization shall be refilled when ordered at no expense to the City. When permission to remove material beyond the template lines within the right-of-way is granted, the unit price of that material will be contingent upon material type agreed upon prior to authorization.

3.10.2.1 The Contractor shall notify the Engineer when an approved pit is stripped, if necessary, so that it may be cross-sectioned by the City forces. No material shall be removed prior to cross-sectioning or beyond the limits established and defined jointly by the Contractor and the Engineer. Pits shall be graded to permit accurate final cross sections to be taken.

3.11 Embankment-in-place. When the embankment is constructed under this item, all construction requirements herein shall apply except 3.10.1. Slopes excavated beyond the template lines without authorization shall be refilled when ordered, at no expense to the City.

3.12 Surcharges. When the item of borrow is included in the proposal and surcharges are required, the material removed after consolidation shall be properly placed in locations reserved for the excess material.

3.13 Impervious material shall be placed in 6 in maximum lifts and shall be compacted to at least 95 percent of the maximum dry density. During compaction, the moisture content of the impervious material shall be between 1 percent below and 3 percent above the optimum moisture content. The maximum dry density and the optimum moisture content shall be as determined by AASHTO T 99 (Standard Proctor Test).

3.13.1 Manipulation of the soil, as specified in 203.3.8.1, shall be required before compaction when the material's moisture content is beyond the limits specified above.

Method of Measurement

4.1 Excavation, embankment-in-place, borrow, impervious material, and rehandling surcharge material will be measured by the cubic yard in accordance with 108.01. Material removed from outside of template lines without prior approval will not be measured.

4.1.1 When the Contractor is directed to excavate beyond the template lines shown, the material removed will be measured under the appropriate excavation item.

4.2 When the item of embankment-in-place is included in the proposal, no measurements of any borrow pits will be made for the purpose of establishing pay quantities for any item and the item of borrow will not appear in the proposal.

4.3 When borrow is included in the contract, the amount to be paid will be computed by the common pit method as follows: All borrow, together with material for base courses when obtained from sectioned pits, will be totaled. All materials which are paid for by in-place measurement, all materials utilized for the Contractor's benefit and not incorporated in the work, all unauthorized fills and waste, and all material specified to be deducted from borrow will be subtracted from this total to give the net borrow quantity. See 3.1.6 and 3.10.1.

4.4 When the contract does not specifically provide for payment for embankment-in-place, the work of embankment construction will not be measured as such but will be considered incidental to borrow and to the various classifications of excavation.

4.5 Surcharges will be sectioned in place immediately prior to removal, and the designed or revised subgrade template will be used as the final section.

4.6 Where presplitting is required, excavated rock will be measured only to the slope and depth lines shown on the plans or ordered.

4.7 (NHDOT)

4.8 Where presplitting is not required, actual overbreakage of rock in the slopes will be measured and allowed to a maximum of 24 inches (measured horizontally) beyond the required slope lines where adequate cross-sections have been taken of the original rock in accordance with the provisions of 3.2.1 and 3.3. No allowance for overbreakage will be made below the subgrade elevation.

4.9 Where the Engineer determines that the removal of additional rock is necessary due to conditions clearly not attributable to the Contractor's methods of operations, the payment lines will be adjusted to the limits ordered, to include only rock actually removed within such limits.

4.10 Impervious material will be measured by the cubic yard of material placed within the lines shown on the plans or as ordered.

Basis of Payment

5.1 The accepted quantities of excavation and embankment will be paid for at the contract price per cubic yard for each of the pay items listed below that is included in the contract, with the following stipulations:

5.1.1 The item of embankment-in-place will be paid only for those materials for which payment is not specified under a separate item.

5.1.2 When surcharges are required, that portion of the surcharge ordered removed will be paid for as rehandling surcharge material.

5.1.3 Excavation of unstable materials in the slopes of roadway cuts will be paid for as provided in 585. Backfill of such slopes shall be with material meeting the requirements of 585 or approved ledge and will be paid for as 585 unless otherwise shown on plans.

5.1.4 Topsoil excavation will be paid for as common excavation except when overlying muck excavation, in which case such topsoil excavation will be full payment for excavating, transporting and stockpiling surplus topsoil at approved locations.

5.1.5 Roadside ditches adjoining excavated areas will be paid for as common, rock, or unclassified excavation, as appropriate, unless such ditches are shown on the plans or ordered to be paid for under another item.

5.1.6 When conflicting pay lines for more than one type of excavation exist in an area, payment will be made to the limits of each type of excavation in the following order of priority unless otherwise indicated on the plans:

(1) Common, Rock, Muck, or Unclassified Excavation
(2) Channel Excavation
(3) Structure Excavation
(4) Bridge Excavation

5.2 No payment will be made for materials used to shim unauthorized over-excavated areas back to designed slope lines and subgrade, or for materials placed outside of designed or ordered slope lines.

5.3 No payment will be made under the item of embankment- in-place, nor deduction made under the item of borrow, for materials used to backfill holes left by the authorized removal of stumps, boulders and the like.

5.4 No separate payment will be made for aeration, or compaction equipment or methods of operation.

5.5 Except for any extra work which may be ordered, payment for borrow or embankment-in-place will include all work required in connection with pits.

5.6 When common excavation is the only class included in the contract, any rock encountered will be paid for at a price equal to 5 times the unit price for common excavation, under item number 203.2.

5.7 When no item for muck excavation is contained in the contract, work conforming to that classification will be paid for as common excavation.

5.8 Benching or terracing performed under 3.7.3 will be subsidiary except that rock removed as ordered will be paid for under 203.2.

5.9 The accepted quantity of presplitting holes or extra drilled holes without explosives will be paid for at the contract unit price per linear foot, complete as specified, except that when no item for presplitting holes is included in the contract, such work will be subsidiary.

5.10 All costs incurred by the Contractor in maintaining a blasting log and in adopting revised blasting methods shall be considered incidental to the contract unit prices for rock excavation and presplit blasting.

5.11 The cost of all blast vibration control and monitoring, pre-blast condition surveys, post-blast surveys, blasting precautions and other protective measures necessary to prevent damage and the subsequent creation of claims in connection with blasting shall be included under Item 203.2.

5.12 The accepted quantity of impervious material will be paid for at the contract unit price per cubic yard complete in place. (Overhaul will not be paid for.)

Pay Items and Units:

203.1	Common Excavation	Cubic Yard
203.2	Rock Excavation	Cubic Yard
203.3	Unclassified Excavation	Cubic Yard
203.4	Muck Excavation	Cubic Yard
203.5	Borrow	Cubic Yard
203.51	Granular Borrow	Cubic Yard
203.52	Impervious Material	Cubic Yard
203.6	Embankment-in-place	Cubic Yard
203.7	Rehandling Surcharge Material	Cubic Yard
203.81	Presplitting Holes	Linear Foot
203.82	Extra Drilled Holes Without Explosives	Linear Foot

SECTION 204 -- DRILLING AND BLASTING ROCK

Description

1.1 This work shall consist of drilling and blasting rock for roadway and pipe construction.

Classification of Materials

2.1 Where used in these specifications, rock shall be construed to mean all solid rock which cannot be removed without blasting.

3.1 General

The Blasting Contractor's attention is directed to the rock drilling regulations adopted by the N.H. Department of Health and Human Services, Division of Public Health Services under the authority of the provisions of RSA 147:2 (Supp.).

The storage, handling, transportation and use of explosives shall conform with all Federal, State and local laws and regulations, including the rules and regulations of the Director of State Police and the provisions below.

The Blasting Contractor's attention is called to RSA 158:9-a (Supp.) which in part, provides that licenses must be obtained from the Director of State Police in order (1) to use, purchase, or transport explosives, or (2) to store explosives.

When the use of explosives is necessary for the prosecution of the work, the Blasting Contractor shall exercise the utmost care not to endanger life or property, including new work. The Blasting Contractor will be responsible for all damage resulting from the use of explosives.

All explosives shall be stored in a secure manner. All storage places shall be clearly marked. Explosives shall be stored in a magazine which shall be located in respect to buildings, railways, and highways in a manner as required by the Director of State Police.

The Blasting Contractor shall notify each property owner and public utility company having structures in proximity to the site of the work of his intention to use explosives. Such notice shall be given sufficiently in advance to enable the parties to take such steps as they may deem necessary to protect their property from injury.

Explosives shall be used only during daylight hours, shall be handled only by competent workmen, and particular care shall be taken to insure that no unexploded charges remain in the work.

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The Blasting Contractor shall notify each property owner and public utility company having structures in proximity to the site of the work of his intention to use explosives. Such notice shall be given sufficiently in advance to enable the parties to take such steps as they may deem necessary to protect their property from injury.

Explosives shall be used only during daylight hours, shall be handled only by competent workmen, and particular care shall be taken to insure that no unexploded charges remain in the work.

All persons within the danger zone of blasting operations shall be warned and no blasting shall be done until the zone has been cleared. Sufficient flaggers shall be stationed outside the danger zone to stop all approaching traffic during blasting operations.

4.1 Blasting Operations

4.1.1 The Engineer shall, at all times, have the authority to prohibit or halt the Contractor's blasting operations if it is apparent that through the methods being employed, that the safety and convenience of the public is being jeopardized.

4.1.2 All blasting operations, including the storage and handling of explosives and blasting agents, shall be performed in accordance with the applicable provisions of the Standard Specifications and all other pertinent Federal, State, and local regulations. Whenever explosives are used, they shall be of such character and in such amount as is permitted by the State and local laws and ordinances and all respective agencies having jurisdiction over them.

4.1.3 The Contractor shall observe the entire blast area to guard against potential hazards before commencing work. The Contractor shall not be allowed to store explosives on the project site or on City owned property unless prior approval is granted by the Department.

4.1.4 Drill hole conditions may vary from dry to filled with water. The Contractor will be required to use whatever type(s) of explosives and/or blasting accessories necessary to accomplish the specified results.

4.2 Blasting Log

4.2.1 A blasting log must be completed daily for every primary blast and copies must be provided to the Engineer. An example of a typical blasting log is shown in Figure 204-1. The drilling contractor may use a different format for his blasting log if it has been approved by the Engineer.

4.3 Blast vibration control and monitoring.

4.3.1 The Contractor shall be required to comply with the blasting vibration limits established herein. The Contractor shall provide for monitoring of the blasting vibrations (both ground and air concussions) produced as a result of the construction activities and shall provide for a pre-blast condition survey of structures. The Contractor shall cooperate in adjusting his blasting procedures to maintain the vibration limits specified herein and to minimize vibration-related claims and complaints.

4.3.1.1 Vibration limits.

4.3.1.1.1 Ground Limits. The maximum peak particle velocity of ground vibration (in any of the three mutually perpendicular components of particle velocity) for above-ground, residential structures shall not exceed the following limits:

Ground Vibration

Peak Particle Velocity Inches/Sec		
	Frequencies	*Frequencies*
Type of Structure	*Below 40 HZ*	*40 HZ or Greater*
Modern Homes		
-Drywall Interiors	*0.75*	*2.0*
Older Homes		
-Plaster on Wood		
Lath for Interiors	*0.50*	*2.0*

4.3.1.1.2 The maximum peak particle velocity of ground vibrations (in any of the three mutually perpendicular components of particle velocity) for non-residential structures shall not exceed 2.0 inches/sec.

4.3.1.1.3 The maximum peak particle velocity of ground vibrations (in any of the three mutually perpendicular components of particle velocity) for underground utilities shall not exceed 2.0 inches/sec. Buried pipelines and other utilities owned by private utility companies are sometimes subject to lower limiting values imposed by the owner.

4.3.1.1.4 Deteriorated structures or utilities, structures housing computers or other sensitive equipment, and manufacturing processes that are sensitive to vibrations may require lower peak particle velocity limits than stated in this specification.

4.3.1.1.5 Air concussion. The contractor shall conduct all blasting activities in such a manner that the peak airblast overpressure at all above ground, occupied structures in the vicinity of blasting does not exceed 128 decibels (dB).

4.3.1.1.6 If blast induced ground vibrations exceed the limits for maximum peak particle velocity, then alternative rock excavation techniques may be necessary. All non- explosive methods of rock excavation are subject to approval by the Engineer.

BLASTING LOG

FIGURE #204-1

*1. Company name:*_____

*2. Location of Shot (Station):*_____

*3. Shot #:*_____*4. Time:*_____*5. Date:*_____

*6. Weather:*_____

_____

*7. Wind Direction:*_____*8. Temperature:*_____

*9. Distance & Direction to Nearest Structure:*_____*&*_____

*10. Depth of Water (ft.):*_____

11. Total Explosives Allowed Per Delay Period:

$$\text{Weight of Explosive(s)} = \frac{2}{2500} = \text{[Distance in Feet]} = \_\_\_\_\_$$

*12. Diameter of Holes (in.): Production*_____*Presplit*_____

*13. Hole Depth (ft.):*_____

*14. Total # of Holes:*_____

*15. Drill Pattern - Burden x Spacing (ft.):*_____

*16. Type and Height of Stemming (ft.):*_____

*17. Depth of Sub-Drilling (ft.):*_____

*18. Mats or Other Protection Used:*_____

*19. Types of Explosive(s) Used: Presplit*_____
*Production:*_____

*20. Density of Explosive(s) Used:*_____

*21. Kind of Delay Periods:*_____

*22. Total # of Delay Periods:*_____

*23. Length of Delay Periods (ms):*_____

*24. Total of Explosives Used (lbs.):*_____

*25. Maximum # of Holes Per Delay Period:*_____

*26. Maximum Amount of Explosive(s) Per Delay Period (lbs):*___

$$\text{27. Powder Factor} = \frac{\text{Pounds of Explosives Per Hole}}{\text{Cubic Yards of Rock Per Hole}}$$

Powder Factor = _____

$$\text{28. Scale Distance} = \frac{\text{Distance in Feet}}{\text{(Weight Per Delay Period)}^{0.5}}$$

Scale Distance = _____

*29. Method of Firing:*_____

*30. # Series, Circuits:*_____

*31. Location of Seismograph:*_____

_____

a. Distance from Shot and Direction:

b. Person Taking Reading:

c. Seismograph Reading:

d. Peak Sound Pressure Level:

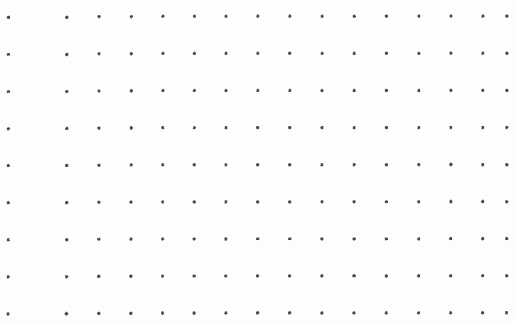
e. Vibration Measurements:

Transverse

Vertical

Longitudinal

DIAGRAM OF SHOT



*Name of Blaster:*_____

*License Number of Blaster:*_____

4.3.1.2 Pre-blast condition survey. Blasting Contractor shall conduct a pre-blast condition survey of all existing structures and conditions on the site, adjacent to the site, or in the vicinity of the site. This survey shall extend to such structures (including swimming pools and mobile homes) or conditions as may be affected by the Blasting Contractors operations.

4.3.1.2.1 The pre-blast condition survey shall consist of a written description of the interior and exterior condition of each of the structures examined. Descriptions shall locate any existing cracks, damage, or other defects and shall include such information so as to make it possible to determine the effect, if any, of the construction operations on the defect. Where significant cracks or damage exists, or for defects too complicated to describe in words, photographs shall be taken. A good quality videotape survey with appropriate audio description of locations, conditions, and defects can be used. Prior to the start of work, a copy of the pre-blast condition survey shall be submitted to the Engineer for review.

4.3.1.2.2 The person conducting the pre-blast condition survey shall give written notice to the owner of the property concerned, tenants of the property, and any representative of local authorities required to be present at such survey. The notice shall state the dates on which surveys are to be made. Copies of all notices shall be provided to the Engineer.

4.3.1.2.3 Prior to the start of blasting activities, the Contractor shall place an advertisement in the local newspaper identifying the project, Blasting Contractor, site location, warning signals and precautions being taken by the Blasting Contractor to minimize disturbance to residents.

4.3.1.2.4 Upon completion of the blasting work, the Contractor shall conduct a post-blast survey of any properties, structures, and conditions where complaints of damage have been received or damage claims have been filed. Notice shall be given to all interested parties so that they may be present during the final examination. Records of the final examination shall be distributed the same as the original pre-blast condition survey.

4.3.1.3 Vibration monitoring instrumentation. All vibration monitoring instrumentation proposed for use on the project by the Contractor shall comply with the following characteristics:

a) Measure, display, and provide a permanent record on a strip chart of particle velocity components.

b) Measure the three (3) mutually perpendicular components of particle velocity in directions vertical, radial and perpendicular to the vibration source.

c) Have a velocity frequency response of 2 Hz to 150 Hz, and be capable of measuring peak particle velocity of up to 10 inches per second.

d) All seismographs used on the project shall display the date of the most recent calibration.

e) Calibration must have been performed within the last 12 months and must be performed to a standard traceable to the National Bureau of Standards.

4.3.1.4 Report of Monitoring Results.

4.3.1.4.1 Following each blast, the Contractor shall immediately report the measured vibrations to the Engineer. In the event seismic vibrations caused by the Contractor's operations approach the established limits for this project, the Engineer may require the Contractor to modify his blasting operations to reduce the vibrations. If the seismic ground vibration and/or air concussions caused by the Contractor's blasting operation attain or surpass the established limits, the operations shall cease. Blasting shall not be resumed until measures have been taken to reduce, to the satisfaction of the Engineer, the produced vibrations and/or air concussions below established limits.
4.3.1.4.2 Within 24 hours following each blast, the Contractor shall submit to the Engineer in writing the following items:

a) Details of the round as shot to include the information shown on the sample blasting log (see Figure 204-1)

b) Results of blast monitoring at each instrument location, including peak particle velocity in inches per second (in/sec), as well as a copy of the strip chart recording for each monitoring location, marked with the date, time, location of the equipment, and signature of seismograph operator.

4.3.1.5 Preblast meeting. A preblast meeting shall be held prior to the start of any drilling or blasting activities. The purpose of the meeting shall be to review the blasting procedures and vibration monitoring requirements, and to facilitate coordination between all parties involved. Individuals attending the preblast meeting should include the Project Engineer, the Blasting Contractor, the Contractor's Seismologist/Blasting Consultant, the Research Geologist and any other personnel the Engineer deems appropriate.

4.3.1.6 Blasting schedule. The Contractor shall notify the Engineer of blast round schedules in accordance with the following requirements:

a) At least 24 hours in advance, notification of estimated time of blast.

b) At 30 minutes prior to a blast give a stand-by notification.

4.3.1.7 Warning signals. Adequate warnings shall be given to all personnel in proximity to the blast site at least 3 minutes in advance of each blast. The Contractor shall use sirens and/or horns with sufficient intensity such that they can be heard for a minimum distance of 1,000 ft.

4.3.1.8 Flyrock control. Before the firing of any blast in areas where flying rock or debris may result in personal injury or damage to property, the rock to be blasted shall be covered with approved blasting mats, soil, or other equally serviceable material, to prevent flyrock. The method of flyrock control shall be subject to approval by the Engineer.

4.3.1.9 Responsibility for blasting operations. Review of the Contractor's blasting submittals by the Department or its Engineer shall not relieve the Contractor of his responsibility for the accuracy, adequacy, and safety of the blasting; exercising proper supervision and field judgement; preventing damage to structures; and producing results within the limits required by the State of New Hampshire regulations and these Specifications. The Blasting Contractor shall be solely and completely responsible for the safety of all persons and property during the performance of his work. The Contractor shall take whatever measures he deems necessary, in addition to the requirements herein, to protect the safety of persons and property, both at the construction site and away from the site. The Contractor shall have full and complete responsibility for handling, discharging or settling of any and all damage or annoyance claims resulting from the blasting activities on the project. Any monitoring and/or review of the Contractor's procedures and performance conducted by the Department or its Engineer shall not relieve the Contractor of his responsibility for safety at and away from the site, and for preventing damage to adjacent structures or property.

4.4 All drilling and blasting work performed by the Contractor shall produce slopes or configurations in reasonably close conformity with the lines, grades, cross- sections and dimensions shown on the plans.

4.5 All rock shall be removed from the proposed excavations by City forces in accordance with the Blasting Contractor's blasting schedule. The rock shall be sufficiently broken so that it may be conveniently handled by equipment at the disposal of the City.

Method of Measurement & Basis of Payment

5.1 Drilling operations shall be measured by the number of hours of actual drilling time. The hourly rate shall include the cost of a track drill, compressor and operator.

5.2 The Blaster shall be compensated at an hourly rate for the actual time performing blasting operations.

5.3 Powder shall be paid for by the pound for the actual number of pounds used to accomplish the work.

5.4 Blasting Caps shall be paid for per each for the actual number used to accomplish the work.

5.5 Blasting Mats shall be paid for by the day for the number of days they are used.

5.6 Seismic monitoring shall be paid for by the day for the number of days of actual monitoring.

5.7 Pre-blast Condition Surveys will be paid for at actual cost for each job site. Compensation for pre-blast surveys will be paid only upon submitted of "paid" invoices. No markups above the invoice will be allowed.

Pay Items and Units:

204.1	Drilling	Hour
204.2	Blaster	Hour
204.3	Powder	Pound
204.4	Blasting Caps	Each
204.5	Blasting Mats	Day
204.6	Seismic Monitoring	Day
204.7	Pre-blast Survey	Allowance

SECTION 205 -- REMOVAL OF STRUCTURES

Description

1.1 This work shall consist of the demolition, removal, and satisfactory disposal of buildings including contents, foundations, fuel storage tanks, and other obstructions pertaining thereto, as designated on the plans or in the contract.

1.2 Salvaging of designated materials, backfilling of any resulting trenches, holes, or pits including dug wells and cesspools, removing or breaking up, as ordered, of septic tanks, backfilling the resultant spaces, furnishing and erecting temporary barricades, and the final grading and cleaning up of the site shall be included under this work unless such work is included under other items in the contract.

Construction Requirements

2.1 General.

2.1.1 The Contractor's attentions is directed to 103.05 Rights In and Use of Materials Found on Project. The Contractor must also comply with all Federal, State and local laws and regulations as to removal, transportation and disposal of structures and obstructions. As ordered, the Contractor shall raze, remove, and dispose of all buildings and foundations, structures, fences, and other obstructions, any portions of which are on the right-of-way except utilities and those for which other provisions have been made for removal. All designated salvageable material shall be removed, without unnecessary damage, in sections or pieces which may be readily transported, and shall be stored by the Contractor at specified places within the project limits. Unusable perishable material shall be destroyed. Nonperishable material not designated for salvage shall be buried as directed or, with written permission of the property owner, may be disposed of off the project provided the material remains outside the limits of view from the project, other highways, and residences. Copies of all such agreements with property owners shall be furnished to the Engineer. If disposal is by burial on private land it must be in accordance with 105.10.

2.1.2 Blasting or other operations necessary for the removal of an existing structure or obstruction, which may damage new construction, shall be completed prior to placing the new work.

2.2 Demolishing Buildings.

2.2.1 In the case of buildings to be demolished, notice will be given the Contractor when any building becomes available, and upon notice of availability, ownership of the building or buildings, including all equipment, fixtures, building materials, and debris remaining on the lot, except plant belonging to a public or private utility company, shall transfer from the City to the Contractor.

2.2.2 A permit from the Manchester Building Department is required before the demolition of any building.

2.2.3 The Contractor shall ascertain whether any water, sewer, gas, electric, or telephone services are still connected to the building; if so, he shall disconnect and terminate them in compliance with the requirements of the controlling municipality or company and then proceed with the demolition of the building.

2.2.4 The Contractor shall protect all openings resulting from demolition or removal by use of temporary barricades as necessary for protection and safety of the public. All barricades and obstructions shall be illuminated at night when ordered.

2.2.5 Basements remaining in embankment areas shall be cleared of all interior partition walls, materials, equipment and debris. When directed, to provide vertical drainage, the floor shall be thoroughly broken up into pieces no larger than 4 square feet or shall be perforated at least every 10 feet, lengthwise and crosswise, with holes 1 square foot or more in area. Foundation walls generally shall be pushed in or removed to at least one foot below the adjacent ground level.

2.2.5.1 When the Engineer has ascertained that the above provisions have been complied with, the basement shall be filled to the level of the surrounding ground with the same type of materials as that found at the site, compacted as ordered.

2.2.6 When the buildings have been substantially demolished and removed by others, the Engineer may require the Contractor to remove and dispose of rubbish and debris, demolish foundations, break up cellar floors, clean the cellar of partitions and other materials, clean up the site, and grade, loam, seed, fertilize and mulch the area.

2.2.7 All materials that result from building demolition shall be disposed of by an approved method. The Contractor's attention is directed to RSA 149-M in that building demolition material is classified as a solid waste and as such shall be disposed of only in permitted sites. N.H. Department of Environmental, Division of Waste Management is the permitting agency.

2.3 Removal of Underground Storage Tanks and Hazardous Materials.

2.3.1 The Contractor shall perform all work as shown on the plans and specified in the contract.

2.3.2 Contractor's attentions is directed to the regulations which may affect the removal operations relative to contaminated soil identification, removal and disposal; tank removal, transportation and disposal; and site safety as follows:

National Fire Safety Code, Chapter 30, Appendix B
New Hampshire Hazardous Waste Rules He-P 1905
Water Supply WS 411

US Laws 49CFR 173.29 and 40CFR part 280

Method of Measurement

3.1 Individual buildings, or groups of buildings when such are designated as a separate unit, will each be measured as a unit. When more than one unit is specified in the contract, separate item numbers will appear for each separate and complete unit.

Basis of Payment

4.1 The following provisions are in connection with the item of demolishing buildings:

4.1.1 There will be no separate payment for the cost of any utility work including charges, if any, which may be made by the municipality and utility Companies.

4.1.2 The City cannot assume responsibility and must be held harmless for damage to buildings or losses of or from buildings between the date of advertising for bids and the time the Contractor can take possession.

4.1.3 Work performed under 2.2.5 and 2.3 will be paid for either under pertinent items of the contract or as provided under 108.04.

4.2 When no basis of payment for the removal of structures and obstructions shown on the plans is included in the proposal, such work will be subsidiary.

Pay items and units:

205.1	Demolishing Buildings	L.S.

SECTION 206 --STRUCTURE EXCAVATION FOR PIPES AND OTHER MINOR STRUCTURES

Description

1.1 This work shall consist of the excavation and backfill or disposal when necessary of all materials required to be removed to complete the work as shown on the plans or ordered. Excavation for the following shall be included under this item; inlet ditches and outlet ditches, drainage pipes, sewer pipes, manholes, catch basins, drop inlets, headwalls, conduits and channels with less than a 10 foot bottom width. Excavation for roadway ditches not adjoining roadway excavation will be included in this item unless otherwise specified.

Classification of Materials

2.1 Common Structure Excavation shall consist of all excavation described above which is not classified as rock structure excavation. Glacial till or boulder clay will be considered as common structure excavation.

2.2 Rock structure excavation shall consist of all solid rock which cannot be removed without blasting or ripping. It shall also consist of boulders and parts of masonry structures when found to measure 1 cubic yard or more except as provided in 604.5.2.2.

2.3 Unclassified structure excavation shall consist of all structure excavation encountered.

Construction Requirements

3.1 General

3.1.1 All excavations performed within City streets, rights-of-way and easements shall be governed by the City's Street Excavation Regulations, except as may be otherwise approved by the Engineer.

3.1.2 The contractor shall call DIG SAFE (1-800-225-4977) 72 hours prior to the start of excavation.

3.1.3 Where excavations are to be made through existing pavement, the pavement shall be saw cut ahead of the excavation in order to provide a clean uniform edge. The pavement shall be cut along lines 12 inches outside of the trench walls in order to minimize undermining. All existing paved areas shall be restored as specified in Section 404.

3.1.4 All excavation shall be open cut, unless otherwise specified or permitted by the Engineer, and shall be removed to the limits shown or ordered. The excavated material shall be incorporated in the work or disposed of as directed. See also 209.2.1.5.

3.1.5 Excessive widths of trench will not be permitted. The walls of trenches shall be kept as nearly vertical as practicable below the level of the top of the pipes. Trenches shall be shored in accordance with OSHA Regulations.

3.1.6 Unauthorized excavation below the specified depths shall be backfilled with approved material as specified in Section 209.

3.1.7 Unsuitable material shall be removed to the limits directed and replaced with approved material as specified in Section 209.

3.1.8 Unless otherwise permitted by the engineer, no more than one hundred (100) feet of trench shall be open at any time and in dry ground, at least thirty (30) feet of trench shall be excavated to within six (6) inches of specified subgrade in advance of the pipe laying.

3.1.9 Excavated or other material shall not be stored nearer than four (4) feet from the edge of any excavation and shall be so stored as to prevent its falling or sliding back into the excavation.

3.1.10 Sides, slopes and faces of all excavations shall meet accepted engineering requirements by scaling, benching, barricading, rock bolting, wire meshing or other equally effective means. Special attention shall be given to slopes which may be adversely affected by weather or moisture content.

3.1.11 Sides of trenches in hard or compact soil including embankments, shall be shored or otherwise supported when the trench is more than five feet in depth and eight feet or more in length. In lieu of shoring, the sides of the trench above the five foot level, may be sloped to preclude collapse, but shall not be steeper than one foot rise to each one half (1/2) foot horizontal. When the outside diameter of a pipe is greater than six feet, a bench of four feet minimum shall be provided at the toe of the sloped portion.

3.1.12 In locations where oxygen deficiency or gaseous conditions are possible, air in the excavation shall be tested. Controls shall be established to assure acceptable atmospheric conditions. When flammable gasses are present, adequate ventilation shall be provided or sources of ignition shall be eliminated. Attended emergency rescue equipment, such as breathing apparatus, a safety harness and line, basket stretcher etc., shall be readily available where adverse atmospheric conditions may exist or develop in an excavation.

3.1.13 Where people are required to be in trenches four (4') feet deep or more, ladders extending from the floor of the trench excavation to at least three (3') feet above the top of the excavation shall be provided and located to provide means of exit without more than twenty-five (25') feet of lateral travel.

3.2 Sheeting

3.2.1 The contractor shall be held responsible for the sufficiency of all sheeting and bracing used and for all damage to persons or property resulting from the improper quality, strength, placing, maintaining or removing of the same.

3.2.2 The engineer may require that structural calculations relative to supporting systems, i.e., piling, cribbing, shoring etc., be done by an engineer registered in the State of New Hampshire who shall be engaged as the contractor's representative. The engineer may also require that such shoring, bracing or underpinning be inspected daily or more often as conditions warrant, by the engineer in the employ of the contractor in order to insure that the protection is effectively maintained.

3.2.3 While the contractor is responsible for the safety of trenches, the engineer may require additional support for trench walls in the form of sheeting, walling and bracing whenever in his opinion, the safety of personnel, utilities, the work or property requires it.

3.2.4 Sheeting may be timber or steel adequately walled and braced as approved by the Engineer. Materials used for sheeting, sheet piling, cribbing, bracing, shoring and underpinning, shall be in good serviceable condition and timbers shall be sound, free from large or loose knots and of proper dimensions.

3.2.5 The use of trench boxes shall not be permitted in areas where any part of the foundations of adjacent structures are within an area determined by a line drawn from the trench bottom to the ground surface at a 1:1 slope. Where the stability of adjoining buildings or walls may be endangered by excavations, shoring, bracing or underpinning shall be provided as necessary to ensure their safety.

3.2.6 If it is necessary to operate heavy equipment or store heavy materials on a level above and near an excavation, the side of the excavation shall be sheet piled, shored and braced as necessary to resist the extra pressure due to such superimposed loads.

3.2.7 Sheeting shall be driven ahead of the excavation to avoid loss of material from behind the sheeting. If voids occur behind the sheeting they shall be immediately filled with approved material and compacted.

3.2.8 When tie rods are used to restrain the top of sheeting or other retaining systems, the rods shall be securely anchored well back of the angle of repose.

3.2.9 When tight sheeting or sheet piling is used, full loading due to groundwater table shall be assumed unless prevented by weep holes, drains or other means.

3.2.10 Additional stringers, ties and bracing shall be provided to allow for any necessary temporary removal of individual supports.

3.2.11 All sheeting and bracing not left in place shall be carefully removed so as not to disturb or endanger the work or other structures. All voids shall be immediately

backfilled with approved material and compacted. Where sheeting is ordered to be left in place, it shall be cut off at least three feet below finished grade, but no less than one foot above the top of the pipe.

3.3 Rock Structure Excavation

3.3.1 The contractor's attention is called to the following rock drilling regulations adopted February 2, 1970, by the N.H. State Department of Health & Welfare, Division of Public Health under authority of the provisions of RSA 147:2 (Supp).

3.3.2 Use of Explosives. See 106.10.

3.3.3 Blasting Operations. See 203.3.2.2.

3.3.4 Drilling and Blasting Rock. See 204.

Method Of Measurement

4.1 Structure excavation will be measured by the cubic yard in accordance with 108.01.

4.1.1 The lower limits shall be 6 inches below the bottom of the outside of the pipe barrel or structure in earth and 12 inches below the bottom of the outside of the pipe barrel or structure in rock, as designated in Figure 209-1, or as provided below. (The term "bottom of the outside of the pipe barrel" shall mean the nominal manufactured wall thickness of the wall below the flow line, with nothing extra for bells and beads.) The upper limits shall be the original ground or rock surface. Common structure excavation for pipes, manholes, catch basins and drop inlets shall be subsidiary except as provided below.

4.1.1.1 The depth of unsuitable material removed as directed below grade will be measured for payment. In case the width ordered is wider than the specified payment limits in 4.1.2, the extra excavation will be measured in accordance with Figure 1.

4.1.1.2 When excavation is required to place the pipe or structure more than 1 foot deeper than the excavation shown on the plans, the depth of excavation below such limit will be measured for payment.

4.1.2 Unless otherwise shown on the plans, the horizontal limits shall be as follows for pipes:

Inside Diameter	Total Width
Up to 12 inches	36 inches
12 inches to 24 inches	I.D. + 24 inches
Over 24 inches	2 x I.D.

4.1.3 The horizontal limits for end sections shall be the same as the pipe to which they are attached.

4.1.4 The horizontal limits for structures such as manholes, catch basins, headwalls and the like will be 1 foot outside of the base of the masonry and parallel or concentric hereto.

4.2 All material classified as rock encountered within the neat lines established under this section will be measured. No payment will be made for any overbreakage below or beyond the limits specified.

4.3 In case a conflict of horizontal limits exists in payment lines as where a pipe enters a manhole, the greater limit will be used for computing the quantity.

4.4 Sheeting where ordered and/or approved satisfactorily driven, waled and braced will be measured by the engineer in place, by the square foot from the bottom of the trench excavation to the top of sheets or existing grade, whichever is less. Each side of the trench shall be measured for payment.

4.5 Sheeting left in place where ordered and/or approved and satisfactorily driven will be measured by the engineer by the square foot from the bottom of the trench to the top of sheet left in place. Each side of the trench shall be measured for payment.

Basis Of Payment

5.1 The accepted quantity of excavation will be paid for at the contract unit price per cubic yard.

5.2 Backfill or bedding material specified or ordered will be paid for under Section 209.

5.3 When common structure excavation is the only class included in the contract, any rock encountered will be paid for at a price equal to five times the unit price for common structure excavation under Item 206.2.

5.4 When structure excavation items are included in the contract, but no items for exploratory purposes are in the contract, payment for excavation made for investigations or exploratory purposes will be paid for under Item 206.19 at five times the unit price for the class of excavation encountered.

5.5 If neither 206.1 nor 206.2 nor an item for exploratory purposes is included in the contract, any structure excavation encountered, including excavation for investigation or exploratory purposes, will be paid in accordance with the provisions of 108.04 (extra work).

5.6 The contractor will be paid the contract unit price per square foot of sheeting and/or sheeting left in place which price shall constitute full compensation for all materials, labor, equipment and incidental work necessary for the satisfactory completion of this work.

5.7 When structure excavation is specified as included in another item, no separate payment will be made for such work in connection with that item.

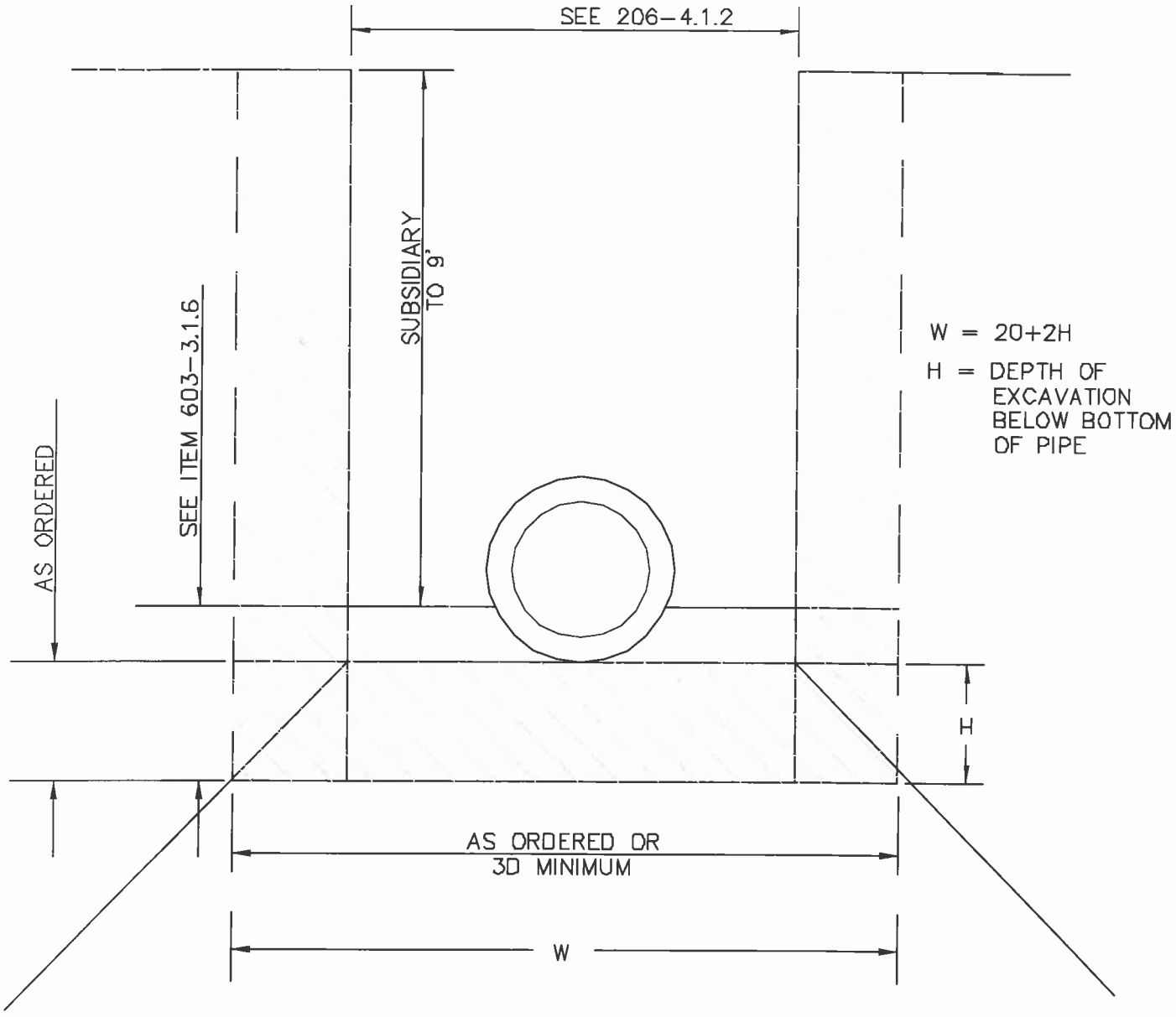
5.8 No separate payment will be made for pre-blast and post blast surveys or blasting monitoring work.

Pay items and units:

206.1	Common Structure Excavation	C.Y.
206.19	Common Structure Excavation, Exploratory	C.Y.
206.2	Rock Structure Excavation	C.Y.
206.3	Sheeting	S.F.
206.39	Sheeting Left-in-place	S.F.

UNSUITABLE EXCAVATION

CROSS HATCHED AREAS SHOWN
ARE PAYMENT AREAS



UNSUITABLE EXCAVATIONS

S:\DWG\DETAILS\206-1 CLVRT-UE.DWG

NOT TO SCALE
FIGURE 206-1

SECTION 209 -- BEDDING & BACKFILL

Description

1.1 This work shall consist of furnishing and placing bedding and backfill under and around pipes and other minor structures at the locations shown on the plans or ordered.

Materials

2.1 The materials shall consist of stones, rock fragments and fine hard durable particles resulting from the natural disintegration of rock. Materials that break up when alternately frozen and thawed or wetted and dried shall not be used for bedding or backfill. The materials shall be free from injurious amounts of organic material and shall conform to the following gradations:

2.1.1 Sand. One-hundred (100) percent shall pass the one (1) inch sieve, Eighty-five to one hundred percent shall pass the No. 4 sieve and not more than five percent of the material passing the No. 4 sieve shall pass the No. 200 sieve.

2.1.2 Screened Gravel. One hundred percent shall pass the one (1) inch sieve, ninety to one hundred percent shall pass the three quarter (3/4) inch sieve, twenty to fifty-five percent shall pass the three eights (3/8) sieve, zero to ten percent shall pass the No. 4 sieve and zero to five percent shall pass the No. 8 sieve.

2.1.3 Granular Backfill. Not more than 15 percent of the material passing the No. 4 sieve shall pass the No. 200 sieve and the material shall conform to the following gradations.

2.1.3.1 Granular backfill-sand consist primarily of particles with 100 percent passing the 3 inch sieve and 70 to 100 percent passing the No. 4 sieve.

2.1.3.2 Granular backfill-gravel shall consist of a mixture of stones or rock fragments and particles with 95 to 100 percent passing the 3 inch sieve and 25 to 70 percent passing the No. 4 sieve.

2.1.4 Crushed stone shall be one-half (1/2) inch to three quarter (3/4") inch in size.

2.1.5 Backfill material shall consist of material excavated during the course of construction or suitable material from another source, as determined by the engineer.

Construction Requirements

3.1 Bedding.

3.1.1 Bedding material for sewers shall be screened gravel or crushed stone as ordered by the Engineer and shall meet the requirements of 2.1.2 and 2.1.4. Bedding

material for reinforced concrete drain pipes shall be granular backfill meeting the requirements of 2.1.3 and approved by the Engineer.

3.1.1.1 The minimum depth of bedding shall be six (6) inches below the bottom of the outside of the pipe barrel or structure in earth and twelve (12) inches below the bottom of the outside of the pipe barrel or structure in rock. See 206.4.1.1.

3.1.1.2 Bedding material shall be spread the full width of the trench and shall extend up to a level of one half (1/2) the diameter of the pipe barrel.

3.1.1.3 Care shall be exercised to thoroughly compact the bedding under the haunches of the pipe and to insure that the bedding is in intimate contact with the sides of the pipe.

3.2 Sand Cushion.

3.2.1 Sand cushion material shall meet the requirements of 2.1.1.

3.2.1.1 For sewers, sand cushion material shall be spread the full width of the trench and shall extend a minimum of twelve (12") inches above the top of the outside of the pipe barrel or as approved.

3.2.1.2 Suitable backfill material may be substituted for the sand cushion over reinforced concrete and ductile iron pipes provided that no stones larger than 2 inches will be in contact with the pipe, and as specifically approved by the Engineer.

3.3 Backfill.

3.3.1 Backfill material shall be free from debris, pieces of pavement, frozen material, organic matter, topsoil, clay and pieces of ledge or rocks larger than six (6") inches.

3.3.1.1 Backfill materials shall be placed in compacted layers not to exceed a depth of 6 inches.

3.3.1.2 Care shall be taken to ensure that the first 2 to 3 feet of backfill above the sand cushion over Poly Vinyl Chloride (PVC) pipes is placed carefully rather than dropped, so as to avoid damaging the pipe from impact during placement.

3.4 Compaction.

3.4.1 All bedding, sand cushion and backfill materials shall be compacted at near optimum moisture content, in layers not exceeding 6 inches in compacted thickness, by pneumatic tampers, vibratory compactors, or other approved means. Care shall be exercised to thoroughly compact the bedding material under the haunches of the pipe and to insure that the compacted backfill is in direct contact with the sides of the pipe.

Bedding and backfill materials shall be compacted to not less than 95 percent of AASHTO T99, Method C.

Method Of Measurement

4.1 Bedding and backfill materials will be measured by the cubic yard of compacted material placed within the lines shown on the plans or as ordered.

4.1.1 Backfill of over-excavated areas beyond or below the lines and grades shown or ordered will not be measured for payment.

4.1.2 No deduction will be made from bedding and backfill of the volume occupied by the pipe.

Basis of Payment

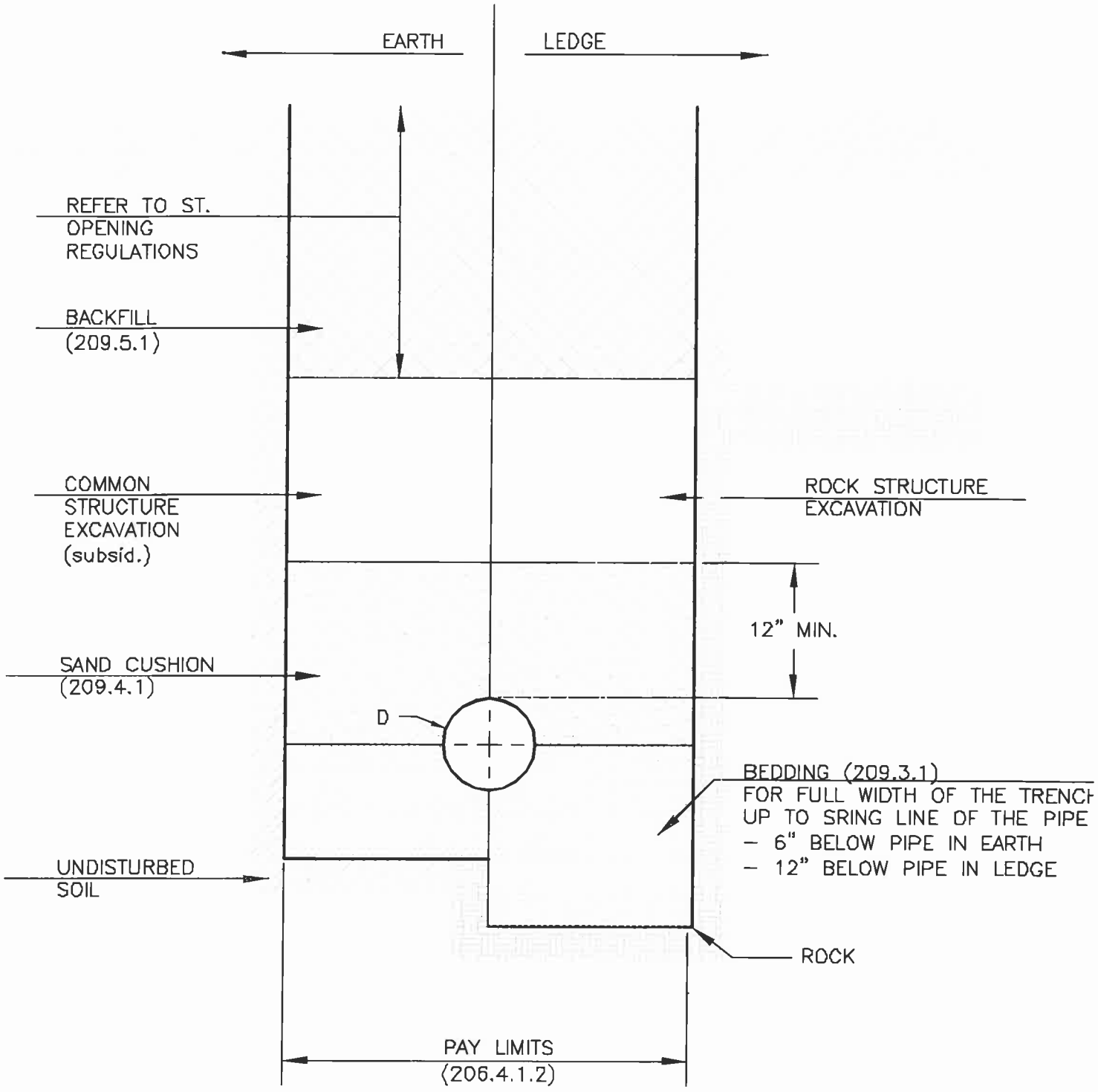
5.1 The accepted quantity of bedding and backfill materials will be paid for at the contract unit price per cubic yard complete in place.

5.1.1 No extra payment will be made for suitable backfill material from another source when such material is ordered by the Engineer. See 209.2.1.5.

5.1.2 When bedding and backfill are included in another item, no separate payment will be made for such material in connection with that item.

Pay items and units:

209.1	Sand for Sand Cushion	Cubic Yard
209.2	Screened Gravel	Cubic Yard
209.3	Granular Backfill (Sand)	Cubic Yard
209.4	Granular Backfill (Gravel)	Cubic Yard
209.5	Borrow for Trench Backfill	Cubic Yard
209.650	1/2" Crushed Stone	Cubic Yard
209.675	3/4" Crushed Stone	Cubic Yard



EXCAVATION PAY LIMITS FOR TRENCHES

9:\DWG\DETAILS\209-1 PayLimits.dwg

NOT TO SCALE

FIGURE 209-1

SECTION 214 -- FINE GRADING

Description

1.1 This work shall consist of the final grading necessary to make the subgrade, the area under the surface course, the roadway outside the surface course, and other locations as directed by the Engineer conform to the lines shown on the plans or established by the Engineer.

Construction Requirements

3.1 The surface of each course of material shall be fine graded to conform to the typical section of the plans prior to placing the succeeding course.

3.2 Shoulders, slopes, and ditches shall be shaped with suitable machinery supplemented by hand labor to reasonably smooth surfaces that will be in keeping with the character of the adjacent terrain and merge into it without any noticeable break. Culverts and waterways shall be cleared of all obstructions. Rubbish, brush, loose rock, boulders, and all other debris from the construction work shall be removed and disposed of as directed.

3.3 To be acceptable under this item, the entire project area must present a uniformly finished appearance at the completion of the work.

Method of Measurement

4.1 Fine grading will be measured as a unit. If the project is altered to require substantial changes in the length, width, or character of the fine grading from such length, width, or character shown on the plans, the contract lump sum price will be subject to a negotiated revision.

Basis of Payment

5.1 The accepted quantities will be paid for at the contract lump sum price for fine grading not otherwise classified.

5.2 When no quantity for this item is included in the contract, this work shall be subsidiary.

Pay items and units:

214	Fine Grading	Lump Sum

DIVISION 300 – BASE COURSES

SECTION 304 -- AGGREGATE BASE COURSE

Description

1.1 This work shall consist of furnishing and placing base courses on a previously prepared subgrade or course as shown or ordered.

Materials

2.1 General.

2.1.1 The materials shall consist of hard durable particles or fragments of stone or gravel. Materials that break up when alternately frozen and thawed or wetted and dried shall not be used for aggregate base course materials. Fine particles shall consist of natural or processed sand. The materials shall be free from injurious amounts of organic material.

2.1.2 Crushed stone and crushed ledge rock shall be processed material obtained from a source which has been stripped of all overburden. The processed material shall consist of clean durable fragments of ledge rock of uniform quality reasonably free of thin or elongated pieces.

2.1.3 Recycled bituminous pavement shall consist of pulverized pavement blended with gravel or crushed gravel and shall have a bitumen content of 3 percent (See Section 306).

2.2 Gradation. The required gradation of base course material shall conform to Table 304-1. The required gradation of recycled bituminous pavement shall conform to 306.2.1.1.

2.3 Sand. The maximum size of any stone or fragment shall not exceed 3/4 of the compacted depth of the layer being placed but in no case larger than 6 inches.

2.4 Gravel. The maximum size of stone particles shall not exceed 3/4 of the compacted thickness of the layer being placed but in no case larger than 6 inches.

2.5 Crushed gravel. At least 50 percent of the material retained on the 1 inch sieve, shall have a fractured face.

2.5.1 When the quantity of crushed gravel in the proposal is 5,000 cubic yards or less, the fractured faces requirement and the grading requirements for the 1 inch sieve for crushed gravel may be waived, to permit the use of Modified Crushed Gravel. See Table 304-1 for gradation.

2.6 Crushed gravel for unpaved drives. This item shall be used for the surface course of drives which are not designated to be paved. The material shall meet the gradation requirements of either crushed gravel or crushed stone (fine) as shown in Table 304-1.

2.7 Crushed stone base course (fine gradation). Acceptable sand may be blended as necessary to obtain the proper gradation for the fine aggregate portion.

2.8 Crushed stone base coarse (coarse gradation). Acceptable sand may be blended as necessary to obtain the proper gradation for the fine aggregate portion.

2.8.1 The substitution of crushed stone meeting the gradation requirements of crushed stone base course (fine gradation) for all or part of this item will not be permitted.

2.9 Recycled bituminous pavement. Additional crushed gravel shall meet the requirements of Table 304-1. Additional asphalt shall meet the requirements of 702, as specified.

Construction Requirements

3.1 General.

3.1.1 Upon approval, base course materials found within the project limits may be used under the specific item in accordance with 103.05 of these specifications.

3.1.2 Permission may be given to substitute gravel or a mixture of sand and gravel for any sand course when sand is designed as part of the base. The substitution must be made across the entire section and will not be allowed for short or discontinuous segments.

3.1.3 Permission may be given to substitute crushed gravel for gravel or crushed stone (fine gradation) for crushed gravel. The substitution must be made across the entire section and will not be allowed for short or discontinuous segments.

3.1.4 Permission may be granted to use reclaimed stabilized base in lieu of crushed gravel or crushed stone base course (fine grading) providing that the material meets the requirements of Section 306 – Reclaimed Stabilized Base.

3.1.5 Crushed aggregate base course material shall be produced and placed in its final location with as little segregation as possible.

3.2 Aggregate Crushing Plant.

3.2.1 The equipment for producing crushed gravel shall be of adequate size and with sufficient adjustments to produce the required materials without unnecessary waste. The

plant shall be capable of removing excess sand. The engineer may order final screening of crushed aggregate if flat and elongated pieces are present in objectionable amounts.

3.2.2 The equipment for producing crushed stone and crushed ledge rock shall consist of sufficient units with sufficient adjustments to produce the required material. The plant shall be capable of removing undesirable material and excess fines. In order to meet the required gradation, the Contractor may produce acceptable material in one operation or combine coarse and fine piles through a proportioning hopper to create a combined stockpile.

3.3 Stockpile Construction.

3.3.1 All crushed aggregate base course materials will be stockpiled. The engineer shall be notified in advance as to when the manufacturing and stockpiling of crushed aggregate is to be started.

3.3.2 A stockpile equal to at least 20 percent of the bid quantity shall be constructed before the hauling and placing phase of the work begins and that quantity shall be maintained until approximately 80 percent of the bid quantity has been placed.

3.3.3 Stockpiles shall be constructed in layers to minimize segregation. The desired optimum thickness of layers is 4 feet; in no instance shall the thickness be more than 6 feet. Each layer shall be completed before the next layer is started. Construction of stockpiles by the direct use of a fixed conveyor belt system or by dumping over a bank, will not be permitted.

3.4 Placing.

3.4.1 The subgrade or preceding course shall be brought to the specified crown and grade and maintained in a smooth condition free from holes and ruts. If the hauling equipment should cause ruts in the subgrade or previously placed base course, the equipment shall be operated only on the course being placed behind the spreading equipment.

3.4.2 Care shall be taken to avoid segregation during placement. When base course material is dumped in piles, it shall be dumped on the course being placed and spread at once onto the previously placed layer. If spreading equipment is not available, dumping will not be permitted. Any segregation which occurs shall be remedied or the materials removed and replaced at no additional cost to the City.

3.4.3 The Contractor's method of operation shall be such that oversized stones will not be delivered to the project.

3.4.4 When the base course is to be surface-treated and no pavement is to be laid upon it, stones having any dimension greater than 3 inches shall be removed from the upper 4 inches of the top layer.

3.4.5 Prior to fine grading, hard spots in the surface of the top layer shall be eliminated by scarifying the top 4 inches.

3.4.6 To prevent segregation of crushed aggregate during spreading and to assist in obtaining the required density of the mixture, water shall be added to the crushed aggregate prior to performing the grading operations. The course shall be maintained in the moist condition until it is covered.

3.4.7 Crushed aggregate shall be hauled from an approved stockpile. Placing material obtained directly from the conveyor to the roadway without first stockpiling will not be permitted.

3.4.8 The base course material shall be spread in the amount necessary for proper consolidation and shall be shaped true to grade and cross section by means of power graders or other approved equipment.

3.4.9 Surface voids in crushed stone base course (fine gradation) shall be eliminated by the addition of filler material to just fill the voids. Any surplus filler material shall be removed. The finished surface shall be uniform, true to grade, and free from segregation. The Contractor shall furnish and place filler material to correct any visible segregation prior to paving. The filler material shall be spread, scarified if required, into the course and recompacted to the required density. Filler material shall meet the gradation requirements of sand. The final gradation of crushed stone base course (fine gradation) shall meet the requirements of Table 304-1.

3.5 Testing for Gradation.

3.5.1 Sampling procedure shall conform to AASHTO T 2. Testing procedure shall be in accordance with AASHTO T 27. Materials not meeting the gradation requirements shall not be placed on the road.

3.5.2 The amount of material finer than the #200 sieve shall be determined according to AASHTO T 11 which specifies dry sieving after washing. Samples for acceptance testing of the material in place will be taken as the spreading operations progress on each lift just prior to the beginning of the compaction operations on that lift. For a preliminary determination of compliance with the specification for gradation, samples of sand and gravel may be taken from the pit and samples of crushed aggregate may be taken from the stockpile or from the final phase of the crushing operation.

3.5.3 Previously tested and accepted material contaminated by earthen, organic, or other foreign matter, or degraded by hauling equipment, to such an extent that the material no longer meets the gradation requirements, shall be removed and replaced or otherwise made acceptable at the Contractor's expense.

3.6 Compaction.

3.6.1 Unless shown on the plans or ordered otherwise, the compacted depth of sand courses shall not exceed 12 inches. The compacted depth of any layer of gravel, crushed gravel or crushed stone placed shall not exceed 8 inches. The compacted depth of any layer of crushed ledge rock shall not exceed 24 inches.

3.6.2 Compaction of base course material shall be done with approved vibratory rollers and adequate water to meet the requirements of 3.7. A roller producing a dynamic force of at least 27,000 pounds shall be used for layers up to 12 inches. For layers between 12 inches and 24 inches, the roller shall produce a dynamic force of at least 42,000 pounds. Rolling and shaping shall continue until the required density is attained.

3.6.3 Rolling and shaping patterns shall begin on the lower side and progress to the higher side of the course while lapping the roller passes parallel to the centerline. Rolling and shaping shall continue until each layer conforms to the required grade and cross section and the surface is smooth and uniform.

3.6.4 Water shall be uniformly applied over the base course materials during compaction in the amount necessary for proper consolidation.

3.6.5 When vibratory equipment is being operated, the amplitude of vibrations will be adjusted as necessary to avoid causing damage to adjacent buildings and property.

3.7 Density Testing.

3.7.1 The density of sand courses shall be determined by AASHTO T 191 (Sand Cone Method), AASHTO T 204 (Drive Cylinder Method), or AASHTO T 238 (Nuclear Methods). The density shall not be less than 95 percent of the maximum density determined in accordance with AASHTO T 99 (Proctor Density) or a control strip. See 3.8.

3.7.2 The density of gravel and crushed gravel courses shall be determined by AASHTO T 191 (Sand Cone Method), or AASHTO T 238 (Nuclear Methods). The density of crushed stone base courses will be determined by the Nuclear Method. The density shall not be less than 95 percent of the maximum density as determined by AASHTO T 99 (Proctor Density) or a control strip. See 3.8.

3.8 Control Strip Procedure.

3.8.1 At the beginning of the compaction operation a control strip of at least 100 lineal feet in length and span the width of the section being placed shall be constructed. The density requirement shall be determined by compacting the control strip at a suitable moisture content until no further increase in density can be measured. The remainder of the course shall be compacted to a density not less than 95 percent of the maximum control strip density, as measured by the nuclear density testing equipment. A new control strip will be required when there is a significant change in the gradation of the

material being placed, or a change in compaction equipment. Compaction of the control strip shall be done with approved vibratory rollers or compactors capable of producing a dynamic force of at least 27,000 pounds.

3.9 Winter Construction.

3.9.1 Base course materials shall not be placed on or above frozen material if the depth from the top of the contemplated course to the bottom of the frozen material would exceed 2-1/2 feet.

3.9.2 If the density requirements are not attained for any layer before the material freezes, no further material shall be placed on that layer.

Method of Measurement

4.1 Base course materials will be measured by the cubic yard of compacted material placed within the lines shown on the plans or as ordered.

Basis of Payment

5.1 The accepted quantity of base course materials will be paid for at the contract unit price per cubic yard complete in place.

5.2 Filler material used to eliminate voids in crushed stone base course (fine gradation) shall be subsidiary.

Pay items and units:

304.1	Sand	Cubic Yard
304.2	Gravel	Cubic Yard
304.3	Crushed Gravel	Cubic Yard
304.35	Crushed Gravel for Unpaved Drives	Cubic Yard
304.4	Crushed Stone Base Course (Fine Gradation)	Cubic Yard
304.5	Crushed Stone Base Course (Coarse Gradation)	Cubic Yard
304.6	Crushed Ledge Rock	Cubic Yard
304.7	Recycled Bituminous Pavement	Cubic Yard

Table 304-1 Base Course Materials

Required gradation							
Item No.	304.1	304.2	304.3	304.3	304.33	304.4	304.5
Item	Sand	Gravel	Crushed Gravel	Modified Crushed Gravel	Crushed Aggregate For Shoulders	Crushed Stone (Fine)	Crushed Stone (Coarse)
Sieve Size	Percent Passing By Weight						
6 in	100	100	---	---	---	---	---
5 in	---	---	---	---	---	---	---
4 in	---	---	---	---	---	---	---
3-1/2 in	---	---	---	---	---	---	100
3 in	---	---	100	100	---	---	85 - 100
2 in	---	---	95 - 100	95 - 100	---	100	---
1-1/2 in	---	---	---	---	100	85 - 100	60 - 90
1 in	---	---	55 - 85	---	90 - 100	---	---
3/4 in	---	---		---	---	45 - 75	40 - 70
No. 4	70 - 100	25 - 70	27 - 52	27 - 55	30 - 65	20 - 45	15 - 40
No. 200 (In Sand Portion)*	0 - 12	0 - 12	0 - 12	0 - 12	---	---	---
No. 200 (In Total Sample)	---	---	---	---	0 - 10	0 - 5	0 - 5

* Fraction passing the No. 4 sieve

SECTION 306 -- RECLAIMED STABILIZED BASE

Description

1.1 This work shall consist of scarifying if necessary, and pulverizing the existing pavement together with a base course material. It may require removal and rehandling, and the addition of other materials shown on the plans or as ordered.

Materials

2.1 General.

2.1.1 The material shall consist of the existing pavement blended with the underlying gravel or additional crushed gravel. Reclaimed stabilized base shall have a minimum bitumen content of 3 percent and conform to the following gradation:

Sieve Size	Percent Passing By Weight
3 in	100
1-1/2 in	80 - 100
3/4 in	55 - 90
No. 4	40 - 70
No. 200	3 - 10 "Total Sample"

2.1.2 Additional crushed gravel shall meet the requirements of crushed gravel or crushed stone base course (fine gradation).

2.1.3 Additional asphalt shall meet the requirements of 702, as specified.

Construction Requirements

3.1 The existing pavement shall be pulverized together with the underlying base course or additional crushed gravel. The pulverizing operation shall blend the existing pavement and base course into a homogeneous mass, utilizing the bitumen contained in the pavement as a stabilizer. The quantity of material mixed with the existing pavement shall be adjusted as necessary to meet the material specification of 2.1.1.

3.2 The reclaimed stabilized base shall be processed, utilizing scarifying equipment and a travelling hammermill or other approved reclaimers. Equipment such as a milling machine or a rock crushing plant will not be permitted.

3.3 Water shall be applied, as ordered, for the purpose of dust control and to ensure proper compaction. Water may be added during fine grading to improve workability.

3.4 Compaction requirements shall conform to 304.3.6.

3.5 Gradation and bitumen content shall be determined by AASHTO T 164.

3.6 Prior to placing the processed material, the roadbed shall be shaped to the specified crown and grade. If the existing roadbed is disturbed, it shall be compacted in accordance with 304.3.6.

3.7 Excess material, unless specified otherwise, shall become the property of the Contractor.

3.8 Care shall be exercised to save all pavement for reclaiming if trenches are constructed prior to processing.

3.9 If the reclaimed stabilized base is not sufficient to complete the project, additional crushed gravel shall be used to make up the deficiency.

3.10 Reclaimed stabilized base specified to be removed and rehandled may be processed in the roadway or off site. The reclaimed stabilized base shall be returned to the highway and placed on the prepared roadbed to the depths specified.

3.11 Additional asphalt may be required to obtain the minimum 3 percent bitumen content.

3.11.1 The asphalt shall be applied by a liquid distributor or other approved methods, at a rate specified by the Engineer. The asphalt shall be blended with reclaimed stabilized base using approved mixing equipment.

3.11.2 Asphalt shall not be applied when rain is threatening, during rain storms, or when the air temperature is below 50 degrees Fahrenheit (10 degrees Centigrade).

3.11.3 Prior to the addition of asphalt, the moisture content of the reclaimed stabilized base shall be adjusted by aerating or adding water if required.

Method of Measurement

4.1 Reclaimed stabilized base shall be measured by the square yard in place limited to the widths shown on the plans.

4.2 Additional crushed gravel will be measured by the cubic yard, as determined by using 80 percent of the loose volume of the material measured in vehicles in accordance with 109.01.

4.3 Asphalt will be measured by the ton or gallon in accordance with 108.01.

Basis of Payment

5.1 The accepted quantity of reclaimed stabilized base will be paid for at the contract unit price per square yard, complete in place, at the depth specified.

5.2 Additional crushed gravel or crushed stone base course (fine gradation) will be paid for under Item 304.3 or 304.4.

5.3 The accepted quantities of asphalt will be paid for at the contract unit price per ton or gallon, complete in place.

Pay items and units:

306.106	Reclaimed Stabilized Base Processed In Place, 6 in Deep	S.Y.
306.108	Reclaimed Stabilized Base Processed In Place, 8 in Deep	S.Y.
306.110	Reclaimed Stabilized Base Processed In Place,10 in Deep	S.Y.
306.206	Reclaimed Stabilized Base Removed and Rehandled, 6 in Deep	S.Y.
306.208	Reclaimed Stabilized Base Removed and Rehandled, 8 in Deep	S.Y.
306.210	Reclaimed Stabilized Base Removed and Rehandled, 10 in Deep	S.Y.
306.31	Asphalt for Reclaimed Stabilized Base	Pound
306.32	Asphalt for Reclaimed Stabilized Base	Ton