TOWN OF GRANTHAM, NEW HAMPSHIRE

Design Criteria
Construction Specifications
Construction Details
For
Road and Drainage Construction

Amended & Approved by the Grantham Planning Board – June 2008

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INTRODUCTION

This booklet has been prepared to serve as a guide for and a control over, the construction of roads and drainage facilities in the Town of Grantham. The intent is to assure proper design and construction of facilities which may be turned over to the Town for perpetual maintenance. Further it is to assure proper design and construction of facilities which will affect the health and general welfare of the community and to prevent depreciation of property values. These guidelines are also to be used to reconstruct or upgrade existing Town roads. Finally, it is to assure that development is compatible with the long range development plan of the Town, know as the Master Plan.

It is not the intent of the booklet to conflict with zoning policies or general overall supervision of development by the Board of Selectmen and Planning Board; rather it is intended to supplement such policies by providing the technical details necessary to carry out general policy in a successful manner.

Furthermore, the intent is to provide a guide which will assure rapid, expeditious approval of subdivision plans as well as the approval of completed works which are to be turned over to the Town for dedication.

It is the subdivider's and/or developer's and their engineer's responsibility to require their contractors to familiarize themselves with theses specifications and construction details and to carry them out in order to minimize the cost of future maintenance of facilities to be constructed.

Standards not shown in the Construction Details shall follow the *NH Dept. of Transportation: Standard Specifications for Road and Bridge Construction (NHDOT Standards).* Equivalent substitutions or deviations from the design criteria, the specifications or the construction details may be only after a vote of approval by the Board.

It is recommended that the procedures and plat details outlined in the Subdivision Regulations be referred to an followed for guidance. For all classes of roads, subdividers and/or developers are required to retain competent engineering and legal counseling to deal with technical matters and provide the necessary detailed information. It is recommended that the first step be a "Consultation" with the Board before the formal hearings are initiated. This permits the Planning Board to initiate studies to determine what problems it must consider in acting upon petitions for formal approval. Questions of traffic, traffic circulation, water supply, septic disposal and drainage are some of the major items the Town must consider.

It should be noted that the Board may require the subdivider and/or developer to provide an extra copy of the Preliminary Layout plans at least seventeen (17) days prior to the presentation of the plans to the Planning Board so that it may be reviewed by appropriate consultants. This time schedule is necessary in order than an intelligent office and field investigation can be relative to the proposed submittal and appropriate comments

returned to the subdivider and/or developer for revisions where necessary. In the same manner, it is required to present the final plans seventeen (17) days prior to the formal hearing.

Please note that Section XX of the Subdivision Regulations regarding waivers applies to this Appendix.

SECTION I – DESIGN CRITERIA

A. **Street Design:** Proposed streets shall be in harmony and conformance with existing and proposed streets and land use as described in the Master Plan, Zoning Ordinance or Official Map. Street patterns shall give due consideration to contours and natural features. Where required by the Board, provision shall be made for the extension of the street pattern to abutting undeveloped property. Every proposed street in a subdivision shall be laid out and constructed as required by the following standards:

1. All streets shall be constructed and all bridges, culverts, drainage structures, storm sewers, gutters, drainage ditches, and other improvements required by the subdivision plat and accompanying documents, shall be installed in conformance with the Construction Details and Specifications for Roads and Drainage Construction.

2. The plan of any proposed subdivision shall show all work required to connect and complete the improvements and any utilities between the proposed street pattern and any connecting street in an existing subdivision.

3. Where a subdivision abuts an existing street with an inadequate alignment or right-of-way width, the subdivision plat shall include in the street dedication all land needed to meet the standards established by these regulations and as approved by the Board.

4. Where a proposed subdivision abuts an existing subdivision, the subdivider shall make every attempt to design the street system of the proposed subdivision to connect with dead-end or “stub” streets of the existing subdivisions.

5. Subdivision streets shall be so laid out as to provide a curvilinear street pattern.

6. The layout of the street pattern shall be based upon a local street system connected to a collector street system.

7. Local access streets shall be designed so as to discourage excessive traffic speeds.

8. Except where it is impracticable because of the character of the land, streets shall intersect so that within seventy-five (75) feet of the intersection the street lines are at right angles and in no case less than seventy-five (75) degrees. The grade within one hundred (100) feet of an intersection shall not exceed two (2) percent. No structure or planting shall impair corner visibility.

9. Multiple intersections involving a junction of more than two (2) streets shall be prohibited.

10. The minimum distance between center line offsets at street jogs shall be one hundred fifty (150) feet.

11. Permanent dead-end streets should, where possible, not exceed fifteen hundred (1500) feet in length and shall terminate in a suitable turnaround as specified in Appendix F.

12. Temporary dead-end streets, where future extension to another outlet is approved by the Board or where indicated on the plan, may exceed fifteen hundred (1500) feet in length. In such cases, the full width of the right-of-way to the subdivision property line shall be reserved as a street R.O.W.

13. If a dead-end street is of a temporary nature, a turnaround and easements(s) therefore shall be provided and provisions made for future extension of the street and reversion of the easement(s) to the adjoining property(s) when the extension is completed.

14. No street should have a name which will duplicate or closely duplicate names of existing streets. The continuation of an existing street should have the same name.

15. Signage may be required as appropriate per MUTCD *(Manual on Uniform Traffic Control Devices)* or as supplemented by the NHDOT. Bonding for such will be required for installation by the Town.

B. **Classification of Streets:** The classification of existing streets shall be as defined in the Master Plan or Official Map or by the Board where such Master Plan or Official Map does not exist. The classification of new streets shall be as determined by the Board in accordance with the following table. The following standards of design shall apply to streets related to subdivision.

STANDARDS FOR STREET DESIGN

For purposes of these regulations, Local Access and Collector roads are defined by the average daily traffic for each as listed below.

	Private	Local Access	Collector
Average Daily Traffic	N/A	0-400	400+
Minimum Right of Way	50’	50’	50’
	Or as required by topography, slopes ditches and roadway		
Minimum Travel Surface Width in feet *	18	20	22
Minimum Should Width			

In feet each side *	2	2	4
Minimum Distance from Center of Road to Center of Ditch	15’	16’	18’ or as required by topography
Maximum Grade	12%	12%	10%

For Local Access and Collector Roads the following shall be designed in accordance with AASHTO National Standards consistent with established speed limits:

Minimum Horizontal Curve radii in feet
Minimum Vertical Curve length in feet
Minimum Vertical Sight Distance
Minimum Length of Tangents between curves

* All cross-section horizontal distances shall be measured perpendicular to straight-line sections and radial to curved sections.

Shoulder width shall be increased by 2.5 feet when guardrail is specified.

The Board may modify the gradient for short lengths of streets where in its judgement existing topographic conditions or the preservations of natural features indicate that such modification will result in the best subdivision of land.

The Board may require greater width of right-of-way where, in its judgement, the demands of the present or future traffic make it desirable or where topographic conditions create a need for greater width for grading.

Private Roads: The mylar for any subdivision which includes a private road must state on the mylar that the road is private.

Any plans including private roads must be drawn by a surveyor, a registered engineer, or other qualified person(s) as determined by the Board and must include the layout, cross sections and erosion control plan. Such plans must be approved by the Board. All state and local permits will need to be obtained. Any costs of inspections and plan review shall be borne by the subdivider.

Construction inspections for private roads must be made by an agent of the Board at the grubbing stage, after the base course is in place and at completion. Culvert size will be determined by the Road Agent or engineer and must be approved by the Board.

C. **Monumentation:** The boundaries of all new roadways shall be monumented as required by the Board.

D. **Street Improvements:** In rural areas, streets will have a minimum travel surface width, as prescribed previously, with shoulders not less than two (2) feet wide. The Board may require a greater travel surface width and shoulders for Collector streets. In village areas, the Board may require a greater width of right-of-way, paving and sidewalks.

In the case of subdivisions adding sufficient traffic to change the road classification, any existing street which provides either frontage to new lots or access to new streets shall meet the minimum standards established in B. above for such streets. Where a subdivision requires undue expenditures by the Town to improve existing streets to conform to minimum requirements, the Board may disapprove such subdivision until the Selectmen certify that funds for the improvements have been assured. Subdividers may be required to provide part or all of the funds needed.

E. **Parking:** All subdivision developments require off-street parking to be provided at the rate of at least two (2) parking spaces per dwelling unit. In order to provide for efficient road maintenance, snow plowing and access by emergency, police and fire vehicles, no parking of vehicles within the traveled way shall be permitted.

F. **Pedestrian Walks:** Where necessary in the judgement of the Board, rights-of-way for pedestrian travel and access may be required between subdivisions or its parts, or between a subdivision and public property.

G. **Drainage:** An adequate surface storm water drainage system for the entire subdivision area shall be provided. Adequate drainage shall be provided so as to reduce exposure to flood hazards. Storm drainage shall be carried to existing water courses, or connect to existing water courses, or connect to existing storm drains. If the storm water drainage system creates any additional flow over any adjacent property, the subdivider and/or successors in title shall hold the Town harmless from any claims for damage resulting therefrom and provide necessary flowage easements including at least a 15' easement on one side of the watercourse of sufficient length to maintain the undisturbed water flow.

For purposes of preparing drainage plans, the following basic design criteria shall be utilized: Subdivision drainage facilities shall be based upon a design flow with a minimum return interval of 25 years. The design of natural watercourse channels shall depend upon the drainage area according to the following criteria:

DESIGN RETURN INTERVALS FOR NATURAL WATERCOURSES

Drainage Area	Recurrence Interval
Between 4 and 20 sq. miles	50 years
Less than 4 square miles	25 years

H. **Sediment and Erosion Control:**

1. General: The purpose of this section is to control soil erosion and to prevent the resulting sedimentation from occurring in subdivision areas by requiring proper provisions for water disposal and the protection of soil surfaces during and after construction in order to promote the public health, safety, convenience and general welfare of the community.

2. Standards: The following standards shall be observed by the subdivider in the design, layout and engineering of the proposed subdivision in both the Preliminary Layout Phase (Section IX) and the Final Plat Phase (Section X).

    a. Stripping of vegetation, regarding or other development shall be done in such a way that will minimize soil erosion.

    b. Whenever practical, natural vegetation shall be retained, protected, and supplemented.

    c. The disturbed area shall be kept to a minimum and the duration of exposure shall be under a maximum of six (6) months. In no case shall completed areas be left past October 1 without being seeded.

    d. Temporary seeding and/or mulching shall be used to protect exposed critical areas during development.

    e. Provisions shall be made to accommodate the increased run-off caused by changed soil and surface conditions during and after development.

    f. Runoff from disturbed areas shall be routed through sedimentation basins or other acceptable devices to maintain water quality. Sedimentation control devices shall be maintained until a healthy vegetative mat is established over all disturbed area. Maintenance shall include removal of accumulated sediment and replacement of haybales when sediment has accumulated to one-half bale height.

    g. Diversions, sediment basins, and so forth, shall be constructed prior to any on-site grading or disturbance of existing surface vegetation.

    h. Construction schedule must be submitted and approved by Board or agent (e.g. frozen ground should not be excavated or built upon).

    i. Applicants with projects requiring site specific permits shall submit permit approvals prior to plat signing by Planning Board. Where standards imposed by NHDES in review of site specific permits conflict with guidelines contained herein, the more stringent standards shall apply.

SECTION II – CONSTRUCTION SPECIFICATIONS

A. **Construction of Roads, Streets and Drainage Facilities – General:**

Materials: All materials to be used shall meet the requirements as specified, unless the same are altered by specific requirements under any itemized specification or by equivalents approved by the Planning Board. In the absence of specific reference to specifications, the materials(s) to be incorporated into any project and the work performed are intended to conform to the New Hampshire Department of Transportation specifications, as determined by the Planning Board or its agent.

B. **Basis of Construction:** In order to assure the structural integrity of the subgrade and foundation course, the following rules shall apply:

1. Wherever possible underground utilities shall be constructed outside the traveled shoulder areas and ditches of the roadway.

2. Where utilities and/or culverts cross the roadway, the trenches shall be backfilled with acceptable bank run gravel or select earth backfill (approved by the Planning Board or its agent) and shall be compacted in 6-inch layers with vibrating compaction equipment. Note: The developer will be responsible for assuring compaction of all trenches crossing the roadway including utility (culvert, etc.) trenches.

3. After properly shaping the subgrade and obtaining approval from the Planning Board or its agent, the foundation course may be placed. The entire foundation course, including shoulders, shall be thoroughly compacted with vibratory compaction equipment.

4. Where embankments (fills) are constructed under the roadway section, the entire height of this embankment shall be constructed with the use of standard and appropriate compaction equipment. This equipment shall consist of sheepsfoot rollers, vibratory rollers or similar equipment. This embankment area shall be compacted to 95% modified AASHTO density. If required by the Planning Board or its agent, the developer shall provide certified compaction test results from a competent soils testing laboratory.

C. **Roadway Excavation:** The entire roadway section shall be cleared and grubbed. All sod and topsoil is also to be removed from the roadway section and stockpiled on the site until the requirements of the Typical Street sections have been fulfilled. All stumps, brush, trees, and other rubbish shall be disposed of in a manner satisfactory to Town Ordinance or Regulation. In general, excavation and filling shall follow "Division 200-Earthwork", *NHDOT: Standards*, except as noted herein.

D. **Subgrade Preparation:**

1. **Work:** All topsoil, other unsuitable soil and organic material shall be removed from the area under the "Typical Road Sections" prior to constructing or shaping the subgrade.

2. **Method:** The subgrade shall be excavated and shaped following the depth and alignment of the stakes established by the Project Engineer for this purpose. The stakes shall be at intervals of no more than 50 feet or 25 feet when ordered by the Planning Board or its agent.

   After excavation to the proper depth, the subgrade shall be graded and crowned 3/8 inch for each foot of width on each side of the centerline and as shown in the "Typical Road Section". The subgrade shall then be rolled with a 10-ton or vibratory roller. Any unsuitable material found below the subgrade shall be removed and replaced with bank run gravel or select earth backfill approved by the Planning Board or its agent. Should the subgrade become rutted, it shall be regraded and rolled prior to the placement of the base.

   No base material shall be placed over unstable trenches or soft spots in the subgrade. Should such a complication exist, the soil is to be removed and replaced with bank run gravel or select earth fill approved by the Planning Board or its agent and thoroughly reshaped and compacted.

E. **Road Base (Foundation Course)**

In general, "Division 300-Base Courses" *NHDOT: Standards* shall apply to base course materials, their placement, testing, etc. except as noted herein.

1. **Work**

   Option #1: The Contractor shall furnish and place a base in two (2) lifts as shown in the "Typical Road Sections".

   Option #2: The Contractor shall furnish and place a base in one lift provided proper compaction equipment is used.

   Option #3: The Contractor shall furnish and place a base in three (3) lifts as shown in the "Typical Road Sections".

2. **Material**

   16" of bank run gravel and 6" of crushed gravel. The crushed gravel to be used, must be in compliance with Division 300, Section 304, Items 1-3 of the New Hampshire Department of Transportation, *Standard Specifications for Road and Bridge Construction* must be supplied to the Planning Board or its agent at least

14 working days in advance of the use of such material. All such certification must be compiled by a competent soils testing laboratory. In no case shall the material passing the No. 200 sieve be greater than 10% by weight.

F. **Drainage Structures:** Culverts shall be constructed of vitrified clay, concrete, PVC or coated corrugated metal pipe. Other pipe materials will be accepted only after approval by the Planning Board or its agent.

1. All culverts shall be designed for proper strength classification by the developer or his agent with the calculations being submitted with the plans. When specifying the pipe to be used, the depth of cover, nature of foundation soil, type of bedding and trench width shall be considered. When design conditions cannot be met in the field, the developer shall be responsible for providing extra strength pipe, extra strength bedding, cradle or encasement so that design conditions are met. All pipe which falls under the roadway shall be designed so that it is capable of carrying H-20 loading at the pipe depth and is of a minimum diameter of 15".

2. All culverts shall have both the inlet and the outlet ends of the pipe protected by means of headwalls or rip-rap. Headwalls are to be constructed of either concrete or stone and shall be protected from any possible frost action. In no case will frozen concrete or mortar be accepted. When rip-rap is to be used, conforming to the roadway slopes, it shall comply with New Hampshire Department of Transportation 585, Rap-Rap. When approved by the Planning Board or its agent, 5-7 inch Crushed Stone, Class C, may be considered. In the case of headwall construction, the following specifications from the above noted source shall apply:

    1. Section 520, Concrete Masonry-Class B Concrete
    2. Section 544, Reinforcing Steel
    3. Section 570, Stone Masonry

3. Any special structures or construction shall be properly designed in accordance with and approved by the Planning Board or its agent prior to the commencement of the work. Sufficient time must be allowed for the review of plans and specifications. Drainage inlets, headwalls, etc. shall be designed in accordance with these specifications and the typical details that follow.

4. All pipe, fittings, etc. shall be handled carefully so as to prevent damage. All joint surfaces and fittings shall be clean and shall fit in such a manner that all joints will be tight and free of leaks. Proper workmanship and tools shall be used when handling and installing the pipe so that the quality and strength is not impaired. Where, in the judgement of the Planning Board or its agent the strength of the pipe has been impaired, the materials will be rejected.

5. Necessary precautions shall be taken at all times to prevent the flooding of adjacent property. Drainage ditches, necessary stream channel location or other positive means of diverting/controlling the water shall be employed. Water shall not be allowed to drain into a pipe or trench under construction. Water shall not be allowed to accumulate in the trenches but shall be drained or pumped away from the work area to established drainage channels.

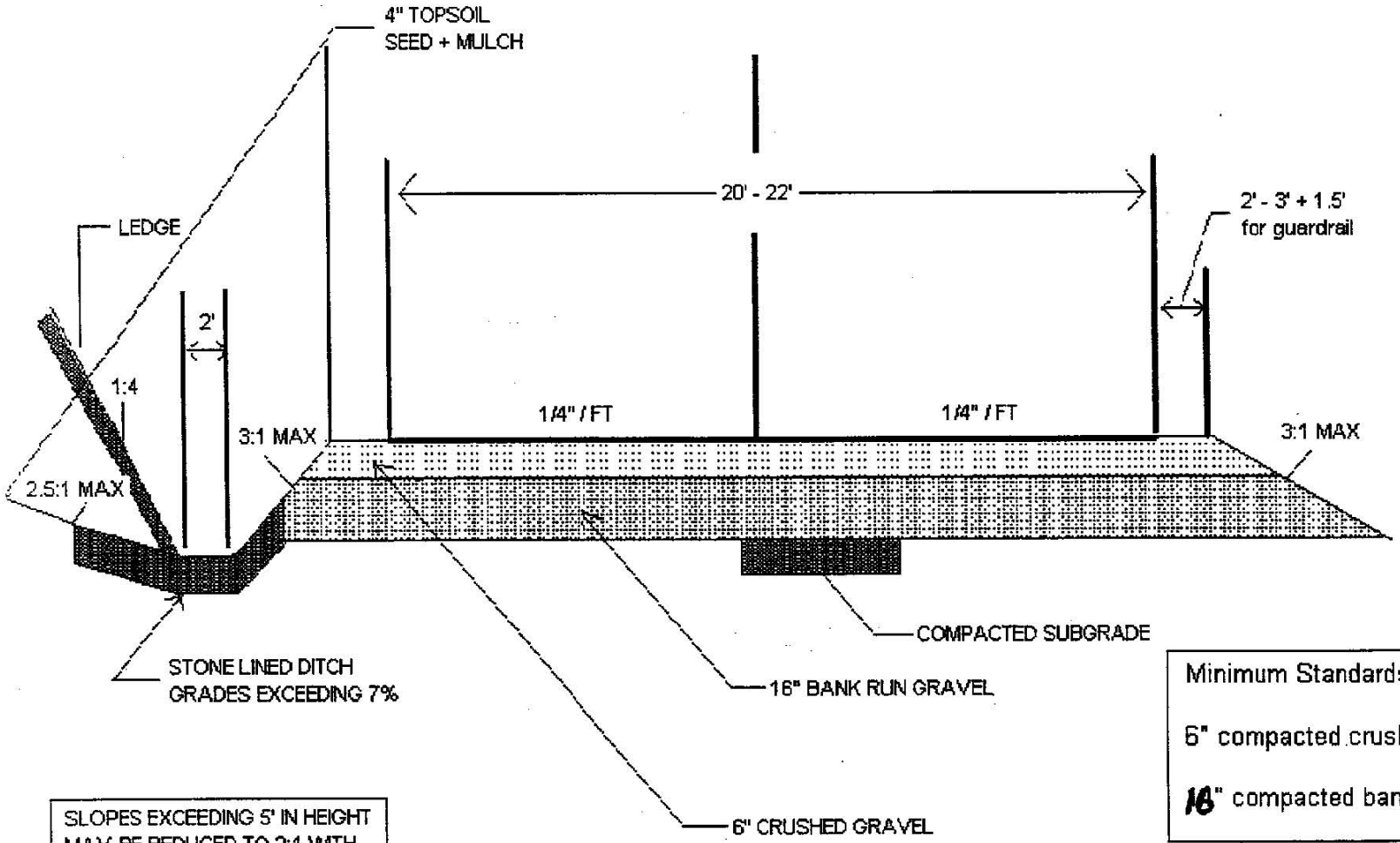
6. In no case shall pipe be installed without grade stakes being set to the line and grade shown on the approved plans.

7. Prior to the installation of the pipe, the trench bottom shall be shaped flat to the designed line and grade. Low areas shall be filled to grade with suitable material and thoroughly compacted prior to installing the pipe. Where solid rock or boulders are encountered, the material shall be undercut to a depth of at least 8 inches and backfilled with suitable material and thoroughly compacted. When the trench bottom becomes soft, spongy or otherwise unsuitable and special conditions are not specified on the approved plans, all such material under the pipe and for a width equal to 3 diameters of the pipe shall be removed and replaced with gravel or other suitable material thoroughly compacted.

8. Care must be taken when backfilling around and over the pipe so that the pipe is maintained to the true line and grade as per #6 above. The backfill around the pipe and for a minimum height of 12 inches above the pipe will be free of stone in excess of 4 inches in its greatest dimension. This material will also be compacted in accordance with manufacturers specifications so that the pipe will be properly protected against deformation.

9. Where open drainage courses are constructed, all disturbed areas are to be seeded and/or rip-rapped as soon as possible after construction. When an area is not completed prior to October first, temporary seeding shall be applied to reduce erosion during the winter and spring.

SECTION III – CONSTRUCTION DETAILS



SLOPES EXCEEDING 5' IN HEIGHT MAY BE REDUCED TO 2:1 WITH STEEL BEAM GUARDRAIL

Minimum Standards:

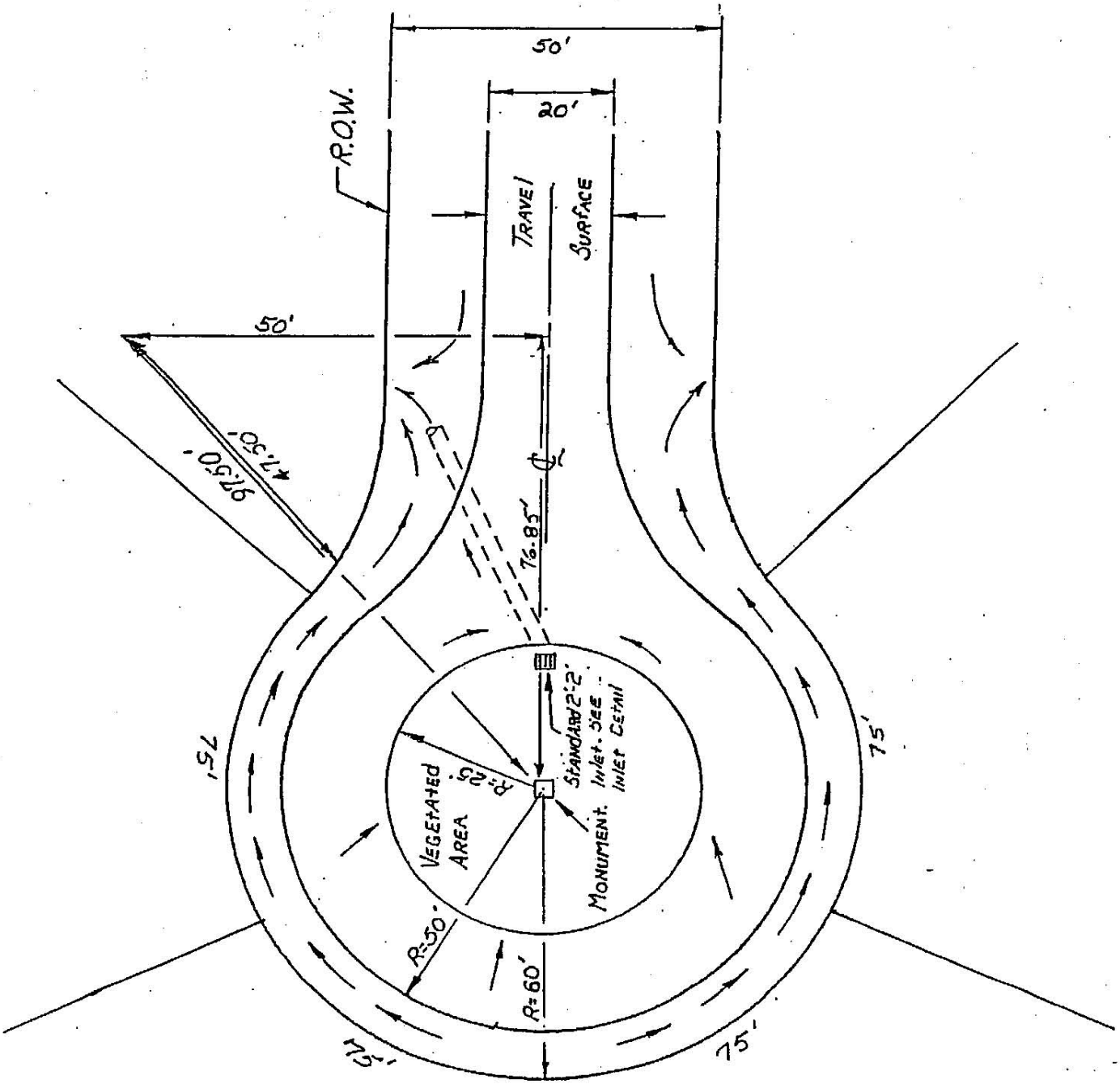
6" compacted crushed gravel

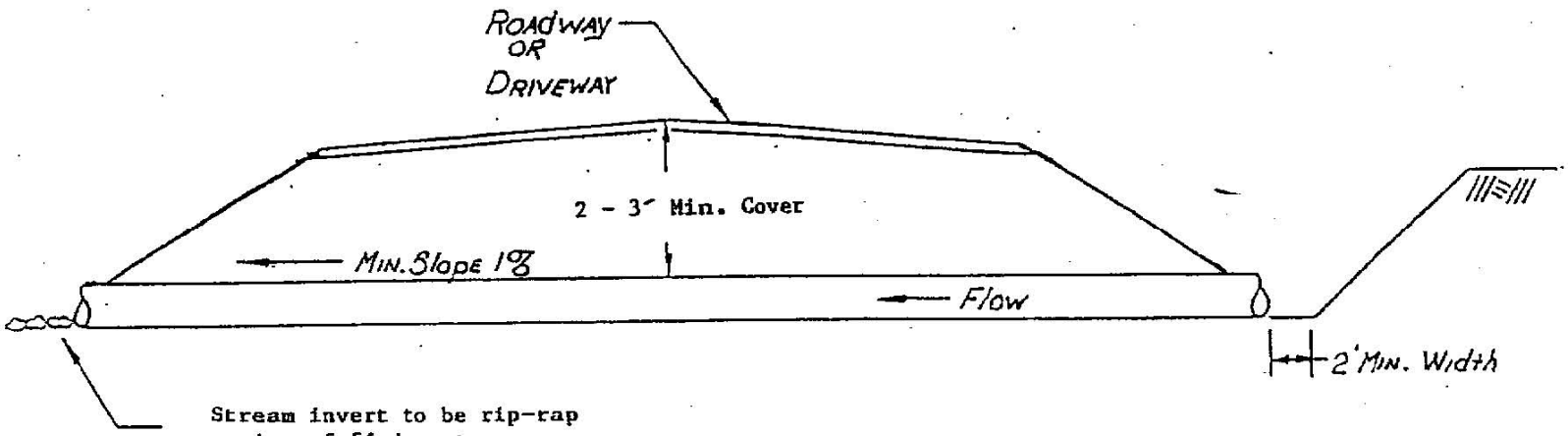
16" compacted bank run gravel

TYPICAL ROAD CROSS SECTION

N.T.S.

TYPICAL CUL-DE-SAC DETAIL



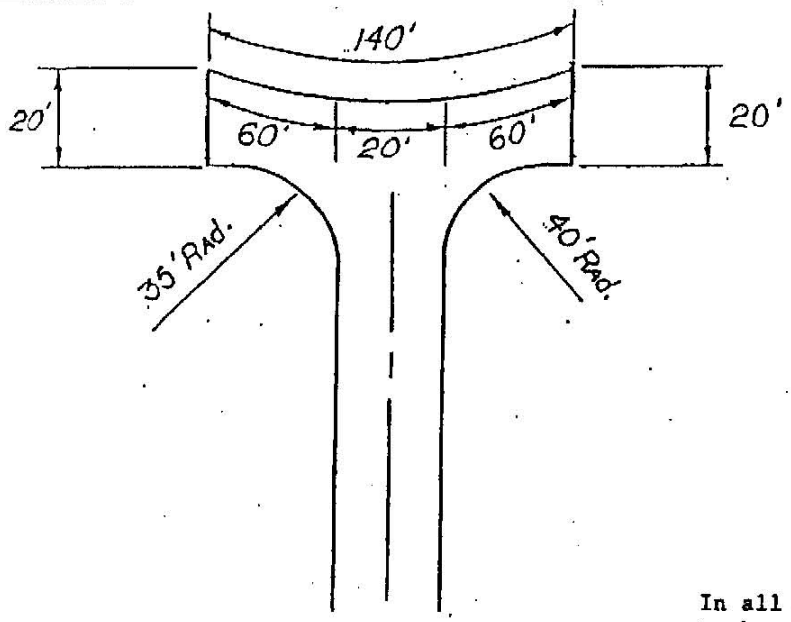


TYPICAL CULVERT SECTION

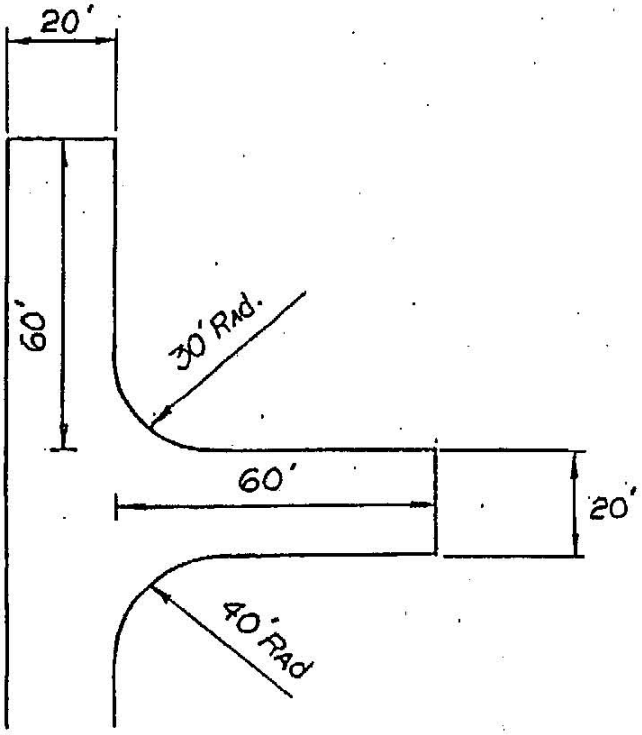
In all cases, the inlet and outlet ends of the culverts will be protected by means of a headwall, rip-rap, end section or other method approved by the Planning Board or its agent.

See Section II-F, Drainage Structures, for details related to pipe design, bedding, headwalls, rip-rap, etc. Also see diagrams showing Typical Headwalls, Rip-rap and End Sections.

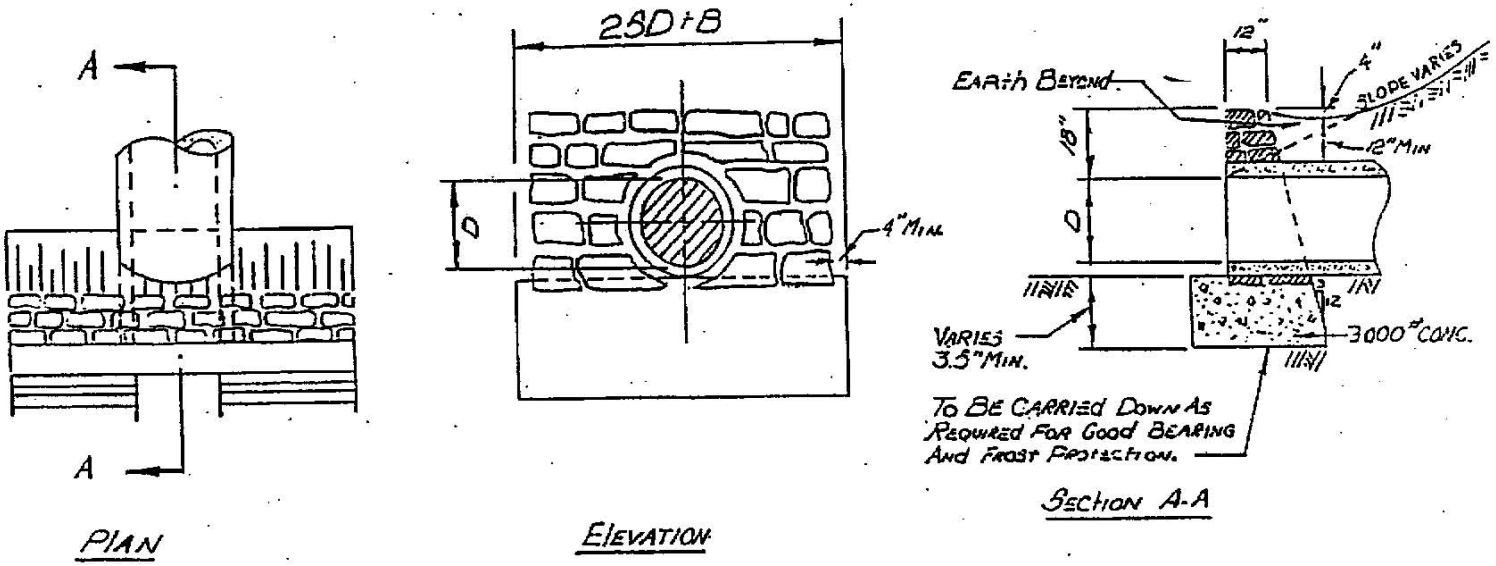
Minimum diameter of culverts to be 15" or as determined by the Board or its agent. Minimum length for driveway culverts to be 30'.



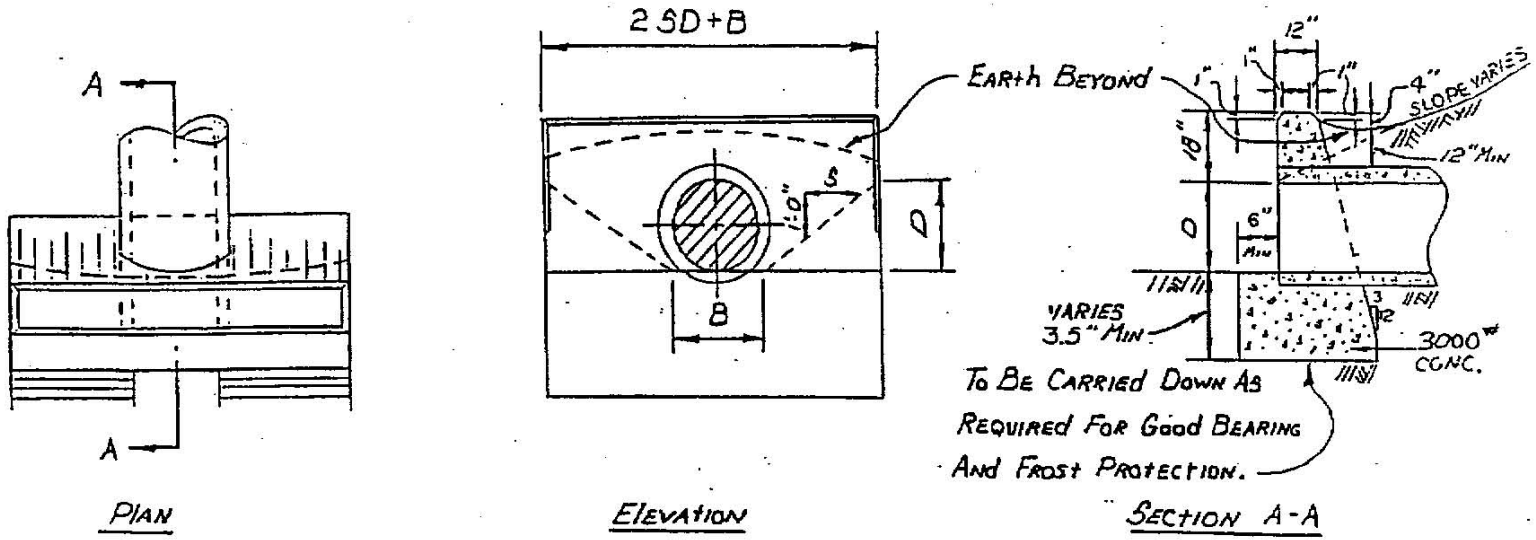
In all cases the turnarounds are to have the same R.O.W. width as the street entering. R.O.W. to extend a minimum of 10' beyond pavement.



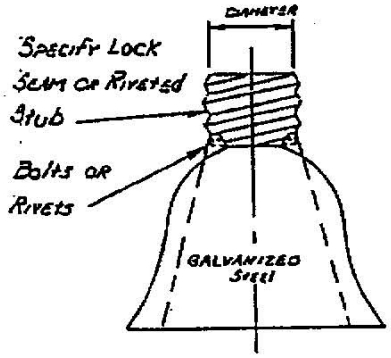
TYPICAL TURNAROUND



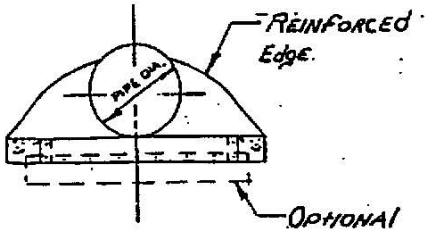
TYPICAL MORTARED STONE MASONRY HEADWALL
FOR ROADWAYS

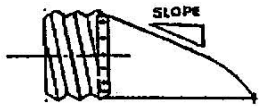


TYPICAL CONCRETE HEADWALL
FOR ROADWAYS



TYPICAL PLAN

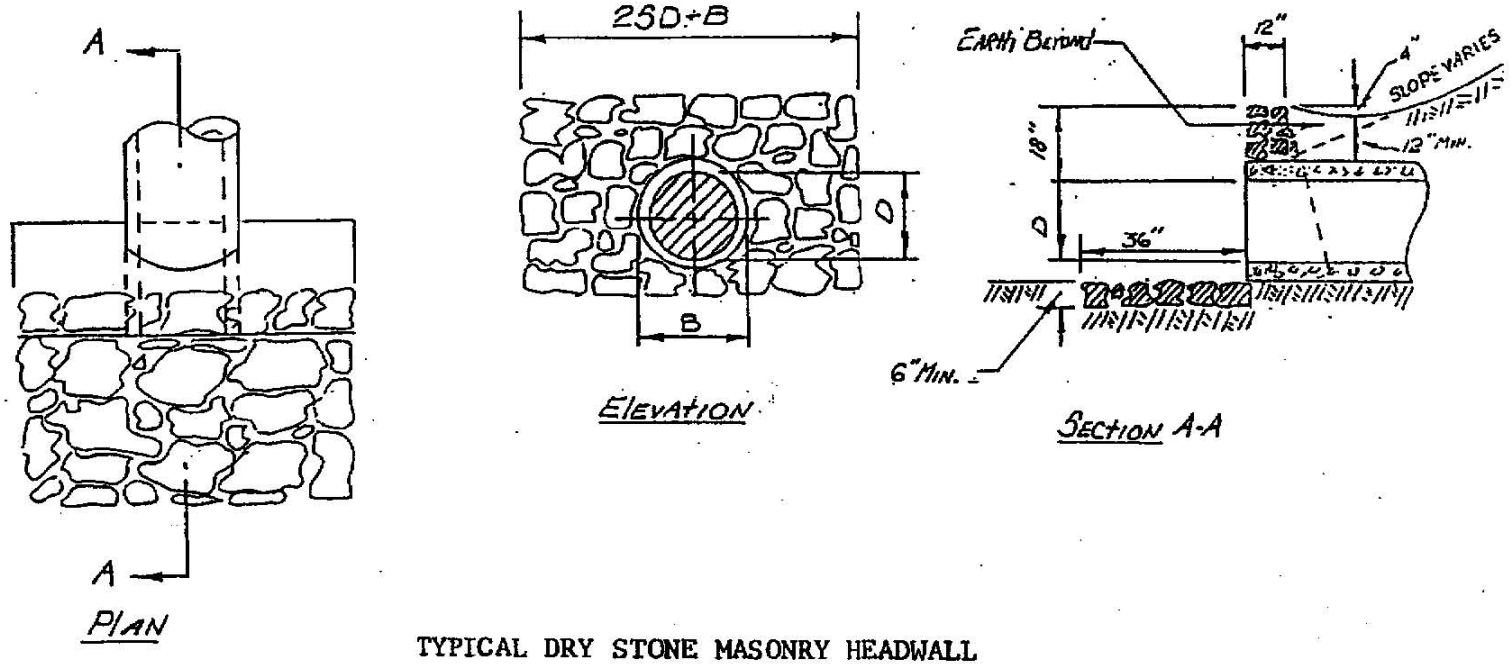




TYPICAL ELEVATION

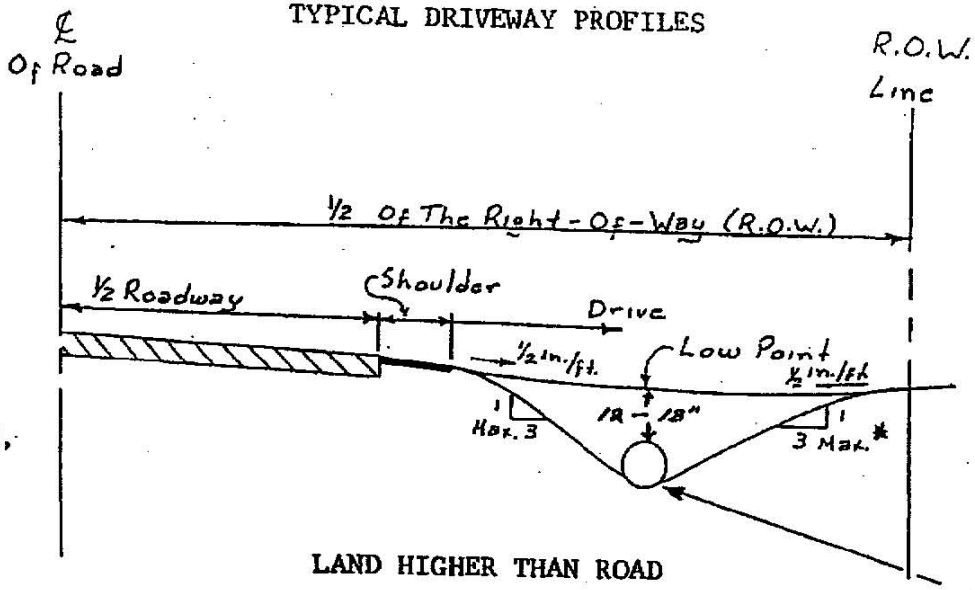
TYPICAL CROSS SECTION, PIPE OR PIPE-ARCH, WITH #3 CONNECTION TO LOCK SEAM OR RIVETED STUB

TYPICAL METAL END SECTION



TYPICAL DRY STONE MASONRY HEADWALL
FOR ROADWAYS

TYPICAL DRIVEWAY PROFILES



LAND HIGHER THAN ROAD

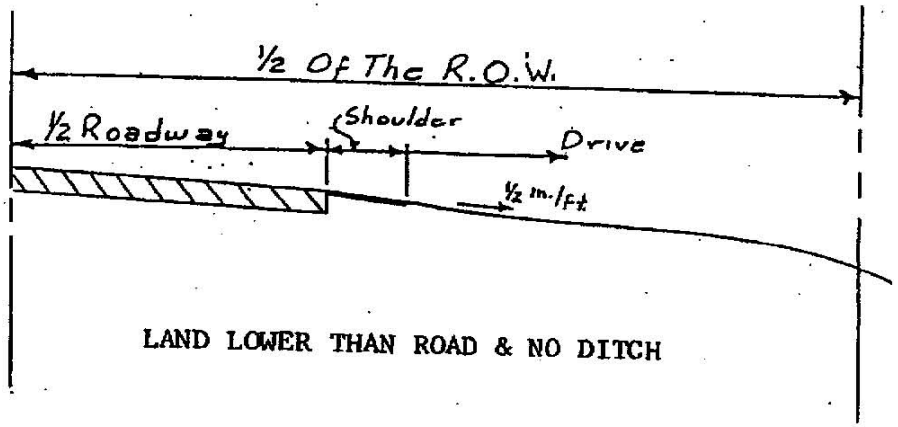
Applicant will be responsible for restoration of any damage within the R.O.W and will seed, fertilize, etc. to prevent erosion and run-off water from entering the road.

The grade from the travelled way to a point 25 feet beyond the property line shall be no more than 4%

Earth cutting may be required for proper grading.

* Except when ledge is encountered. In that case 1 1 will be acceptable.

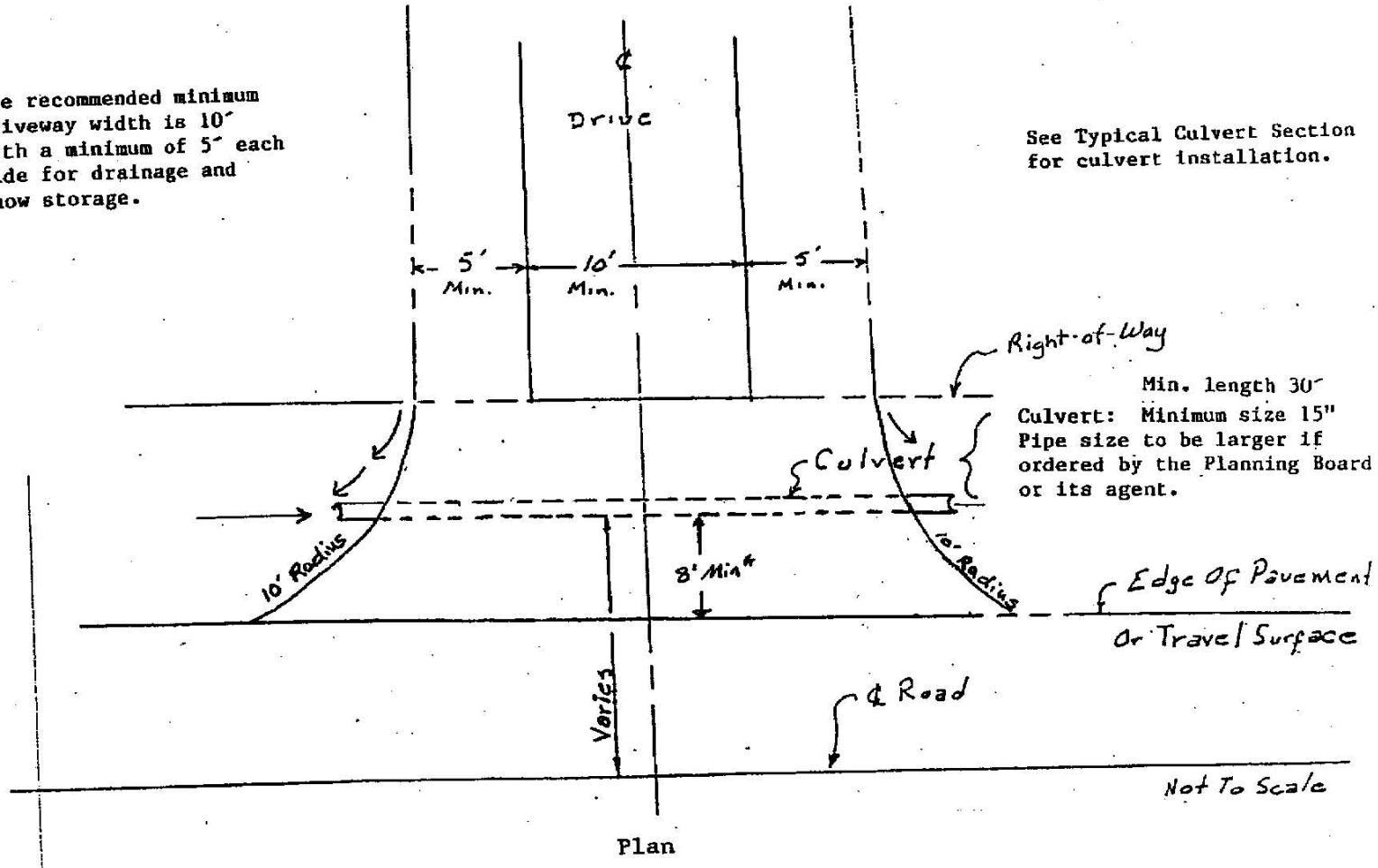
CULVERT:
Min. length 30'
Min. dia. 15"
Larger if ordered by the Planning Board or its agent. Exact location, slope, size, etc. to be determined by the Planning Board or its agent.



LAND LOWER THAN ROAD & NO DITCH

Earth fill may be required for proper grading.

The recommended minimum driveway width is 10' with a minimum of 5' each side for drainage and snow storage.



Plan

See Typical Culvert Section for culvert installation.

Min. length 30'
Culvert: Minimum size 15" Pipe size to be larger if ordered by the Planning Board or its agent.

TYPICAL DRIVEWAY APPROACH

* unless otherwise approved by the Planning Board or its agent.