TOWN OF BENNINGTON, VERMONT

ARTICLE 21. CONSTRUCTION ORDINANCE

Purpose

The purpose of this ordinance is to provide a comprehensive set of design and construction standards for public sewer systems, water systems, and street and highways in the Town of Bennington. These standards outline the Town of Bennington policies, the responsibilities of all parties, and establish minimum requirements for materials' quality, design criteria, and construction methods. Inspection standards to achieve the goals stated and implied in this ordinance, as well as all other applicable Town ordinances, are also included.

General Requirements

Outlines inspection policies, enforcement remedies, permits procedures and fees, and bonding requirements

Definitions

Defines all major terms included.

21-2.01	Street
21-2.02	Owner
21-2.03	Town Engineer
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This ordinance is hereby adopted by the Board of Selectmen of the Town of Bennington on ths 15th day of December 1987, and shall unless a petition is filed as provided by law, become effective upon the expiation of sixty (60) days after said date of adoption.

TOWN OF BENNINGTON

CONSTRUCTION ORDINANCE

Article 21

Dated: 11/11/1987

Adopted: 3/16/1988

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21-1 General Requirements

21-1 General Requirements

21-1.01 PURPOSE

The purpose of this manual is to provide a comprehensive set of design and construction standards for public sewer systems, water systems, and street and highways in the Town of Bennington. These standards outline the Town of Bennington policies, the responsibilities of all parties, and establish minimum requirements for material's quality, design criteria, and construction methods. Inspection standards to achieve the goals stated and implied in this manual, as well as all other applicable Town ordinances are also included.

21-1.02 POLICIES

A. Inspection

For all projects, inspections shall be required in three phases unless otherwise stated in this manual or any other applicable Town ordinance

1. Preliminary design inspections (plans and sites)

1.a. Field inspections - periodic inspection for compliance

2. Completion - inspection to be performed before completion (i.e. final pavement layer, covering of pipe, etc.)

3. Final inspection - inspection to be performed when all work is completed.

21-1.03 ENFORCEMENT

Inspections and enforcement of these regulations are the responsibility of the Town Engineer or agent designated by and acting under the authority of the Board of Selectmen and Town Manager.

21-1.04 ENFORCEMENT REMEDIES

When a person(s) violates any provision of this Ordinance and fails upon seven (7) days notice to correct the noted deficiency and thereby comply with the Ordinance, the Town may seek an action of tort to stop any ongoing work and seek corrective action and associated penalties. Any work completed in violation of this Ordinance is at risk. The Town shall not be liable for any repairs or replacement or reconstruction of such work.

21-1.05 ENFORCEMENT PENALTIES

Any person found in violation of this Ordinance shall be subject to a fine not to exceed $500.00 for each violation. Each day a violation continues shall constitute a separate violation.

21-1.06 DESIGN

All design criteria shall be applied consistent with existing or planned conditions.

21-1.07 TOWN CODES

A. All work performed shall conform to all applicable Town codes and these standards. Where lack of detail exists on approved plans, these standards shall take precedence. Under no circumstances shall a lack of detail or the presentation of incomplete or inadequate detail on plans be misconstrued as tacit approval to violate these standards.

B. All plans shall first be approved by the appropriate Town Department or office: Planning, Building & Zoning, Water, Sewer, Highway.

21-1.08 STATE CODES

All State regulations shall apply to all projects where applicable, in addition to the standards set forth in this manual, except where the standards set forth in this manual, except where the standards impose greater restrictions. All VOSHA requirements shall be met when working under the provisions of this Ordinance.

21-1.09 PERMITS

A permit shall be obtained by anyone intending to excavate in any street or sidewalk or other public right-of-way for any reason. Permits for new construction or repairs to sewer and water, driveways, and street openings are required where applicable prior to receiving a building or zoning permit from that department. These construction permits will be obtained from the Town Manager's Office, 205 South Street, Bennington, Vermont. The Town Engineer shall qualify and define the conditions of the permit in accordance with these standards and other Town regulations bylaws, etc.

A. Application: The owner or his agent shall make application for permit on the proper form furnished by the Town together with the required fee. The owner or his agent may be required to supply appropriate plans or sketches along with the application to adequately explain the specific work involved.

B. The Town Engineer may issue the required permit when the application is in order and he is satisfied as to the necessity and appropriateness of the application. The Town Engineer may insert reasonable conditions in the permit.

C. Driveway Permits: On all Town streets, permits are required from the Town prior to construction of any driveway entrance. On State Highways, driveway entrance permits must be obtained from the State Highway Department on Bowen Road.

D. Berms, Curbs, Paving and Catch Basins: No paving, sub-grade, berms, curbs,

catch basins, drain lines, drop inlets, manholes, sidewalks or other structure of any system belonging to the Town, or located in a Town right-of-way shall be disturbed or paved without a valid permit having been issued therefore.

E. Duration of Permits: Any permit shall become null and void if construction has not begun within 90 day of issue.

21-1.10 REVISIONS

A. Revisions concerning the layout and design of streets, utilities, public water or sewer systems, which originate with the owner shall be submitted in writing to the Town Engineer or acknowledgment and approval.

B. Revisions classified as major in the judgement of the Town Engineer shall be resubmitted to the appropriate department (that is, the department where approval was first granted), for their consideration and approval, approval with conditions, or denial.

C. If any of the above designated work is commenced or completed without proper notification or approval as specified, such work, installation or construction shall be at the peril of the owner. Peril shall be defined here as any liabilities that may occur as a result of any action taken by the Town including denial by the appropriate department.

21-1.11 OBSTRUCTIONS

Wherever obstructions not shown on the plan(s) are encountered during the work in progress, and interfere to the extent that a alteration in the plan is required, the Town Engineer shall require the owner to submit properly revised plans.

21-1.12 CONSTRUCTION COSTS

All work performed by Town Departments for the benefit of the property owner such as water taps, sewer taps, curcus, or similar work will be at the expense of the property owner per fee schedules established by the Town Manage and included in Appendix A.

21-1.13 FEES

Water and Sewer connection permit fees will be assessed at ten (10) dollars for a residential permit and twenty-five (25) dollars for a commercial or industrial permit which will be paid to the Town at the time the application is filed.

This fee will be reduced to five (5) and fifteen (15) dollars respectively in such cases where an adequate service line exists to the property.

Any access to highways including road or sidewalk cuts or any other construction requiring a Highway access permit shall be assessed the following fees: Residential, ten (10) dollars; commercial, twenty five (25) dollars.

21-1.14 BONDING REQUIREMENTS

The Town of Bennington may require a bond or irrevocable letter of credit for any and all work prescribed by this ordinance. Such bond or letter of credit amount shall be determined by Town Engineer and shall be posted by the applicant or developer prior to any construction.

Any requirements hereunder are in addition to any requirements as set forth in the Bennington Subdivision Regulations.

21-2 Definitions

21-2.01	Street
21-2.02	Owner
21-2.03	Town Engineer
21-2.04	Public Sewer
21-2.05	Public Water
21-2.06	Water System
21-2.07	Sewer System

21-2 Definitions

The following definitions shall apply throughout this document unless specifically provided otherwise.

21-2.01 STREET

A Town Road or State Highway, or a Street shown on a subdivision plot approved by the Planning Commission. The word "Street" shall include the entire right-of-way.

21-2.02 OWNER

Actual owner, his builder and/or developer, or any other person acting as his agent.

21-2.03 TOWN ENGINEER

Town Engineer shall mean that person(s) designated and approved by the Board of Selectmen and Town Manager for the purposes of implementing the requirements set forth herein.

21-2.04 PUBLIC SEWER

A system of sanitary sewers owned and operated by the Town of Bennington.

21-2.05 PUBLIC WATER

A system of water supply owned and operated by the Town of Bennington.

21-2.06 WATER SYSTEM

Includes the works and auxiliaries for the collection, treatment, storage and distribution of water from the source of supply to the ultimate consumer.

21-2.07 SEWER SYSTEM

Includes the work and auxiliaries for the collection and treatment of wastewater from the effluent discharge from the water system.

21-3 Construction Standards - Highways

21-3 Construction Standards - Highway

21-3.01 SCOPE

The standards include the procedures for the development of a street in any subdivision or other development including initial layout and constructions. They are intended to supplement the Bennington Subdivision Regulations, the Procedures To Be Used For Taking Over Highways By The Town of Bennington, and other standards as may be applied in connection with State Highway funds.

21-3.02 LAYOUT OF LINE AND GRADE

All line and grades shall be laid out by a Registered Surveyor, certified in the State of Vermont, retained by the Owner. Survey control shall be used and maintained throughout the entire construction period to insure completion of construction as per the approval plans. Construction will be halted by the Engineer if survey control is not provided. No street grade shall exceed 10 percent.

21-3.03 CLEARING, GRUBBING, TREE PROTECTION

A. Remove all stumps, brush, roots, boulders, and dead and diseased trees from the entire area of the street.

B. Preserve trees with at least 1-1/2 inch caliper in accordance with the Town of Bennington Subdivision Regulations (Section 2.07, Trees and Plantings). No tree shall be closer than five (5) feet from the outside edge of the paved or traveled potion of the street. Damaged trees shall be trimmed and painted with asphalt or other protective coating.

21-3.04 SUBGRADE PREPARATION

A. Ready a firm foundation the entire length and width of the street, remove unacceptable material, and replace with materials acceptable to the Town Engineer. A jackhammer shall be used whenever work in the highway requires removal or disturbance of asphalt. (A saw may be used in place of the jackhammer).

B Strip all soft materials, (loam, muck, and clay) from the line of the streets for the full length and width to a depth which will provide a firm foundation with the replacement by suitable material.

C. Rough grade the sub-grade to conform to the profile and cross section on the Engineer approved plans,

D. Rough grading is to be done so as to insure that the gravel base will be at least eighteen (18) inches in depth for streets and driveways and twelve (12) inches for sidewalks.

21-3.05 SAND, GRAVEL AND SOILS

Subgrade in sand or gravel soils shall be fifteen (15) inches below the finished grades for streets and driveways.

21-3.06 LEDGE, BEDROCK OR OUTCROPS

Excavate ledge, rock or boulders appearing at grade to a depth of six (6) inches below the subgrade level.

21-3.07 INFERIOR SOILS

Where indications are that the soils are extremely wet, clay-based or otherwise inferior the Town may require certification of the design by a Soils Engineer.

21-3.08 COMPACTION AND FILL

Inspected and approved ditch materials may be reused for backfill, but in no case shall individual rocks or boulders exceeding twenty (20) pounds or six (6) inches in diameter. Backfill shall be compacted in eighteen (18) inch lifts, unless otherwise instructed by the Engineer. Compaction methods must be approved by the Engineer. Final subgrade approval by the Engineer is required.

21-3.09 GRAVEL BASE INSTALLATION

A. Apply gravel base in two (2) layers. Used crushed gravel, with no stone size larger than four (4) inches in diameter for the first layer. Apply in one or two lifts and compact. Rough grade to conform to the profile and cross section on approved plans. Use crushed gravel, with no stone larger than two (2) inches in diameter for the second layer. Use a total minimum of eighteen (18) inches of processed gravel.

B. Finish grade and compact all gravel base material to conform to the profile and cross section of the approved plans.

21-4 Tests

21-4.01	Gravel Tests
21-4.02	Compaction Tests

21-4 Tests

21-4.01 GRAVE TESTS

Gravel sample tests for gradation (particle size distribution) by sieve analysis may be required by the Engineer when, in his opinion, improp type or sized material is discovered in place or in use.

21-4.02 COMPACTION TESTS

A. Compact all gravel base layers to not less than 95% if the maximum dry density of the material utilizing the standard A.A.S.H.O. test designation T-99 compaction test method C at optimum moisture content. **More information is available in the Vermont Standard Specifications for Construction 401.03 Division 400.** On small jobs, this section may be waived by the Town. Such waiver must be in writing.

B. All tests are the owner's expense. Inspection and approval must be obtained from the Engineer when the gravel base is completed. No paving may begin until such time as written approval is received from te Town Engineer.

C For road repairs, compaction shall be layered tamping with mechanical or heavy compaction equipment to the degree necessary to achieve a smooth patch after paving.

21-5 Curbs

21-5.01	Granite Curbs
21-5.02	Concrete Curbs

21-5 Curbs

Granite, precast reinforced cement, or formed and poured concrete may be used for curbs in accordance with street types as designated by the Planning Commission. Curbing may be installed either after the road subbase is completed or when the road gravel base is completed.

21-5.01 GRANITE CURBS

A. Use curb stone of uniform thickness and as indicated on plans. Use minimum lengths of six (6) feet unless otherwise specified.

B. Install granite curbing to uniform lines and grades. Use survey control. Tightly mortar joints between adjacent sections. Mix well with water, two parts clean sand to one part Portland cement for mortar. Discard mortar that has set before use; do not retemper.

21-5.02 CONCRETE CURBS

A. Formed and poured in place, or precast curbs, set on the prior approved base are acceptable. Selected curbing must be shown on plans.

B. Use metal or wood forms. Wood forms shall be two inch surfaced plans, free from warp, and straight. Metal forms shall have a flat top surface.

C. Forms shall equal curb depth. Securely brace and stake forms to prevent leakage. Clean and oil or wet forms before pouring concrete.

D. Place expansion joints every ten (10) feet. Fit joints to a maximum 1/8 inch opening.

E. Protect finished surface from overexposure to hear or frost.

F. The space in front and back of the curb shall be filled and compacted in maximum six (6) inch layers with the same material as bedding.

G. Precast concrete curb in section, shall not exceed ten (10) feet in length.

21-6 Paving

21-6 Paving

21-6.01 BITUMINOUS MATERIAL

Bituminous materials shall conform to current State of Vermont, Department of Highways, Standards Specifications for Construction (Section 702).

21-6.02 UNACCEPTABLE CONDITIONS

Pavement shall not be applied under the following conditions:

A. Frozen gravel base

B. Air temperature less than 42°F

C. Rain, hail, snow, etc.

21-6.03 BINDER COURSE

A. Apply at least three (3) inches of bituminous concrete to equal at least two (2) inches of material after final compaction. Apply the full width of the street.

B. Allow this application to set one full winter or as approved by the Engineer. When spring thaw is complete, the owner shall request an inspection by the Engineer prior to proceeding.

C. Upon approval of the binder course. The wearing course may be applied.

21-6.04 BINDER COURSE DEFICIENCIES

A. Binder course deficiencies shall be recorded by the Engineer.

B. Level visible depressions or high spots to uniform grades. Compact each leveling area.

C. Clean loose, unbound material from potholes or other damaged areas. Refill and compact.

D. An inspection by the Engineer shall be required upon completion of leveling and patching.

21-6.05 WEARING COURSE

Raise all manholes and valves to final grade. Apply wearing course (top mix) to two (2) inch thickness measured after compaction, the full width of the street.

21-6.06 GRAVEL SURFACE

(Optional if the Town accepts gravel in addition to paved roads).

The top surface shall consist of 6 inches of crushed gravel free from large stones. Maximum size stone allowable for top layer must pass a 1-1/2 inch screen. **Refer to the Vermont Agency of Transportation Standard Specifications for Construction 2006. 704.12 Table 704.12A Aggregate for surface course and shoulders. The base surface shall consist of 12" of crushed gravel or bank run gravel if accepted by the Engineer. Refer to 704.05 Crushed Gravel For Subbase, Table 704.05A in the Vermont Agency of Transportation Standard Specifications for Construction 2006. Geotextile Fabric shall be used between base and subbase after subbase has been compacted. Fabric type will vary due to application, contractor shall ask engineer before construction begins.**

The final surface shall be graded and crowned to allow sufficient surface drainage and avoid puddling.

21-7 Sidewalks

21-7 Sidewalks

21-7.01 LOCATION

Construct sidewalks parallel and concentric to the centerline of the roadway, as close to the street right-of-way as possible. A grass strip of at least three (3) feet in width between the road pavement and sidewalks may be required at the Town's discretion. Deviations on alignments to preserve trees or other natural features may be allowed by the Town.

Sidewalks shall be five (5) feet in width and five (5) inches thick minimal, Type II Class B concrete meeting or exceeding 4000# mix. As to specifications provided by the Town Engineer. Expansion joints to be every twenty (20) feet, dummy joints to be every five (5) feet. Refer to Vermont Agency of Transportation Standard Specifications for Construction 2006; 618.04.

21-7.02 DIMENSIONAL REQUIREMENTS

Sidewalks shall be a minimum five (5) foot width and a depth of five (5) inches, except at driveways, where the depth shall increase to eight (8) inches.

A. The base shall be six (6) inches of compacted gravel.

B. Use forms as specified in Section 3.07 Curbs for formed and poured concrete.

C. Pour ten (10) foot lengths at the most at one time and score slabs at five (5) foot maximum lengths.

D. Joints shall be one-half inch expansion materials, approved by the Engineer, spaced at (10) foot maximum intervals and conform to the sidewalk cross section as per approved plans.

E. The finished surface shall be protected from overexposure to heat and frost.

F. Backfill to a rolled depth for four (4) inches to the property line, and to the top of the curb.

21-8 Driveways

21-8 Driveways

21-8.01 DIMENSIONS

Portions of driveways within the Town right-of-way shall be constructed upon a base of twelve (12) inches of clean gravel or crushed stone, measured after compaction. Apply concrete or asphalt to a depth of six (6) inches.

21-8.02 INTERSECTIONS

A private road or driveway intersections with a Town Highway shall have a traveled surface of at least the (10) feet in width and it shall intersect with said highway at a horizontal angle or ninety (90) degrees unless otherwise approved. Said entry must provide adequate surface drainage.

21-8.03 CULVERTS

If a culvert is deemed necessary by the Town, at the connection of such intersection, it shall be 18" (minimum) metal or corrugated Polyethylene pipe with a smooth inside covered with bank run or processed gravel rock not to exceed two and a half (21/2) inch diameter.

Culvert shall be installed in lengths sufficient to extend beyond the drive to allow for proper headwall installation.

21-9 Construction Standards - Water Systems

21-9 Construction Standards - Water Systems

21-9.01 GENERAL REQUIREMENTS

This item shall consist of the excavation and backfilling required for the complete construction of the water mains and services. This shall include valves, fittings, hydrants and all other appurtenances necessary to complete the water main system as located on the drawings. All materials and installation shall be in accordance with the Department of Health, the Department of Environmental Conservation, and the Town of Bennington.

21-9.02 FIELD INSPECTION

All materials and construction operations are subject to inspection and approval in the field be the Town Engineer. All pipe, hydrants, valve and accessories shall be laid, jointed and tested under pressure for defects and leaking under the methods specified hereinafter.

21-9.03 MATERIALS APPROVED

All pipe, valves and hydrants must be approved by the Superintendent of the Water Department before construction may begin.

Materials

A. Ductile Iron Water Pipe: Pipe shall be a minimum of six inch diameter Tyton Ductile Iron Class 52 conforming to current ANSI/AWWA C151/A21.51 latest revision. Push on joint pipe shall be minimum thickness Class 52. Push on joint accessories shall conform to applicable requirements of ANSI.AWWA C110/ANSI A21.10.

Pipe shall be cement mortar lined on the inside in accordance with ANSI/AWWA C104/A21.4 except that the cement lining thickness shall not be less than three-sixteenths inch (3/16"). A plus tolerance of one-eighth inch (1/8") will be permitted.

Pipe outside coating shall be an asphaltic coating approximately 1 mil. thick. The coatings shall be applied in accordance with "The Handbook for Ductile Iron Pipe".

B. Tapping Sleeves: Shall be of the split sleeve design, constructed with two solid half sleeves bolted together. Sleeves shall be constructed of stainless steel (ASTM A240), and shall have a minimum working pressure of 250 psi Powerseal 3490 MJ or approved equal

Cast iron sleeves shall have mechanical joint ends with side gasket seals. Fabricated steel sleeve shall have end and side gasket seals and all exterior exposed surfaces shall be fusion-bonded epoxy coated

to a minimum of 10-mil thickness. Where the branch outlet is not greater than 50% of the main size, an "O" ring seal is acceptable with fabricated steel sleeves.

All bolts and nuts used with the fabricated steel sleeves shall be ANSI Type 204 or 302 stainless steel. All bolts used with all pipe sleeves shall, upon final tightening and testing, be brush coated heavily with bitumastic cold applied material to thoroughly cover all exposed surfaces of the bolts and nuts.

C. Tapping Valves: Shall conform to AWWA C500-86 Standard for Gate Valves. Valves shall open clockwise and shall have a minimum working pressure of 250 psi. Inlet flange shall be Class 125 conforming to ANSI Specification B16.1 and outlet connection shall be as specified on the Contract Drawings for the type of pipe required for the branch or lateral pipeline. Buried tapping valves shall be provided with a two inch (2") square wrench nut and shall be installed with a cast iron valve box as required to allow positive access to the valve operating nut at all times.

Each valve shall have makers name, pressure rating, and year in which manufactured cast on the body. Prior to shipment from the factory, each valve shall be tested by hydrostatic pressure equal to twice the specified working pressure. Buried valves shall be installed with a valve box.

D. Fittings: Ductile iron fittings shall conform to AWWA C110 and ANSI Specification A21.10, 350 pounds working pressure, and be of a compact body design.

E. Gate Valves Resilient Seat: Valves shall be manufactured to meet all requirements of AWWA Specifications C500-86. Valves twelve inches (12") and smaller shall be bubble tight, zero leakage at 200 psi working pressure. Valves shall have non-rising stems, open clockwise, and be provided with a two-inch (2") square-operating nut with arrow cast in metal to indicate direction of opening.

F. Valve Box: Cast iron New England style slide-type; five and one-quarter inch (5 1/4") shaft; five inch (5") by six foot (6').

G. Hydrant: Kennedy GUARDIAN with six foot (6') bury and National Standard thread. The hydrant shall have at least 15 inches between the bottom of the steamer cap and the ground. The Contractor shall verify the hydrant requirements with the local fire department.

21-9.04 STORAGE SAFETY

All pipe fittings, valves, hydrants and other accessories shall be kept and stored so as to remain substantially free from dirt and foreign material; at no time will the above stated items be used as temporary storage for tools, yarn, jointing composition, rubber boots, overalls or any other material that might be inadvertently left in the pipe. Valve and hydrants shall be drained and stored so as not to be damaged by freezing.

21-9.05 PIPE FAILURE

Any failure that should occur in the pipe, structures, valves, hydrant and related accessories before final acceptance of work shall be repaired and/or replaced at the expense of the owner. A successful water pressure test is not to be interpreted as final acceptance.

21-9.06 MATERIALS HANDLING

All materials shall be handled with care so as to prevent dropping. Water pipe, fittings, valves, hydrants and accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Pipe shall not be skidded or rolled against pipe already on the ground.

21-9.07 WATER MAIN LOCATION AND COVER

The water main shall be laid and maintained to the required lines and grades with fittings, valves and hydrants at the required locations; spigot centered in bells and all valves and hydrant stem plumb. Cover over the water main shall be five 5' 6" minimum, unless otherwise approved. If cover is less than 5' 6", insulation shall be used in a manner approved by the Town Engineer.

21-9.08 EXCAVATION PROCEDURE

A. The owner shall be responsible for notifying utility companies in reasonable advance of his work in order for them to stake out on the ground surface the exact locations of underground facilities and structures. If deemed necessary by the Town Engineer, the owner shall be required to explore and excavate to determine the location of the existing underground structures.

B. Caution shall be exercised by the owner in the excavation and preparation of the trench so as not to damage or alter inadvertently known or unknown existing underground structures. The owner shall be held responsible for repair of such structures and shall have no claim against the Town if any utility, structure or pipeline is not shown in the correct location or is absent from a plan.

C. If excavating a street with improved pavement, excavation shall be controlled so as not to disturb excess pavement beyond trench limits. Trench edges shall be cut prior to excavation. Pavement edges shall be cut straight and parallel before resurfacing.

21-9.09 TRENCH EXCAVATION AND INSTALLATION

A. All pipe and fittings shall be inspected and tested in accordance with the manufacturer's specifications and the aforementioned AWWA Specifications. The Contractor shall furnish for approval certification from the pipe manufacturer that all tests have been performed with satisfactory results. Pipe shall not be installed without the Engineer's approval.

B. Pipe, fittings, and accessories shall be carefully handled to avoid damage. Prior to the date of acceptance of the project work by the Owner, the Contractor shall replace any new pipe or accessory found to be defective at any time, including after installation, at no expense to the Owner. All installation and testing shall be done in accordance with AWWA Standard M41 and ANSI Specification A21.11.

C. All pipe showing cracks shall be rejected. If cracks occur in the pipe, the Contractor may, at his own expense and with the approval of the Engineer, cut off the cracked portions at a point at least 12" from the visible limits of the crack and use the sound portion of the pipe.

D. All pipe and fittings shall be cleared of all foreign matter and debris prior to installation and shall be kept clean until the time of acceptance by the Owner.

E. At all times, when the pipe laying is not actually in progress, the open ends of the pipe shall be closed by temporary watertight plugs or by other approved means. If water is in the trench when work is resumed, the plug shall not be removed until all danger of water entering the pipe has passed. The pipe shall be installed in trenches and at the line and grade shown on the Contract Drawings. Any deflection joints shall be within the limits specified by the manufacturer.

F. Trench excavation is not to be advanced substantially ahead of the pipe laying operation, with backfilling proceeding as soon as the pipe is laid. An orderly and timely sequence of these operations will result in the least amount of hindrance to adjacent landowners, pedestrian traffic and vehicular traffic.

G. All piping and appurtenances connected to the equipment shall be supported so that no strain will be imposed on the equipment. (If the equipment manufacturer's specifications include that piping loads are not to be transferred, the Contractor shall submit certification of compliance).

H. Concrete thrust blocks shall be installed on all plugs, tees, and bends deflecting 11 1/4 degrees or more. Care shall be taken to ensure that concrete will not come in contact with flanges, joints, or bolts. The required area of thrust blocks are indicated on the plans or shall be as approved by the Engineer. They shall be Figure U-585 as manufactured by U.S. Pipe, Clow, or equal.

I. Conductivity bonds or wedges shall be installed at every pipe joint. (Min 4)

J. Whenever sewers cross under water mains, the water main shall be laid at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer. This vertical separation shall be maintained for that portion of the water main located within 10 feet horizontally of any sewer it crosses. Where waterline runs parallel to sewer main pipes will be separated by a minimum of 10' measured from edge of pipe to edge of pipe

K. There shall be no physical connection between the distribution system and any pipes, pumps, hydrants, or tanks that are supplied or may be supplied with water that is, or may be contaminated.

L. All trenching safety standards shall be in conformance with all applicable State and Federal guidelines and as specified on the plans.

M. The Contractor shall, at all times, keep the trenches entirely free of water until all work is finished and ready for backfilling.

N. Valve boxes are to be installed on all buried valves. The boxes shall be cast iron with a minimum 5 1/4" diameter and long enough to extend from the valve to finished grade. The boxes shall enclose the operating nut and stuffing box of the valves. Valve boxes shall not transfer loads onto the valve.

O. Chlorination of the water service shall be conducted only after the service has been flushed and a clear stream is obtained as determined by the Engineer. All chlorination testing shall be done by an independent third party approved by the Engineer and the Department of Health.

The Contractor shall furnish all labor, equipment, materials, and tools necessary to disinfect the pipe and appurtenances in accordance with the AWWA Standard for Disinfecting Water Mains C651. (Tablet method not acceptable.)

21-10 Minimum Standards

21-10.01 Location

21-10.02 Pipe Clearance

21-10.03 Water Main and Sewers Separation

21-10 Minimum Standards

21-10.01 LOCATION

Water mains shall be located in public rights-of-way in all cases. Exceptions may be allowed by the Town only in extreme extenuating circumstances.

21-10.02 PIPE CLEARANCE

A. A clearance of at least six (6) inches below and on each side of all pipe, valves and fittings shall be maintained for pipes 24" in diameter or less and nine (9) inches for pipes larger that 24" in diameter.

B. The above specified minimum clearances are the minimum clear distances which will be permitted between any part of the pipe and appurtenances being laid and any part, projection or point of such rock, boulder or stone.

21-10.03 WATER MAIN AND SEWERS SEPARATION

A. Water mains shall be laid at least ten (10) feet horizontally from sanitary sewer, storm sewer or sewer manhole, with the distance being measured edge to edge.

B. Where local conditions prevent a horizontal separation of ten (10) feet. A water main may be laid closer provided that:

1. The bottom of the water main is at least 18" above the top of the sewer;

2. Where 18" cannot be obtained, the sewer shall be constructed of materials and joints that are equivalent to the water main and shall be pressure tested to assure water-tightness prior to backfilling.

C. Where water mains cross house sewers, storm sewers or sanitary sewers, a separation of at least 18" between the bottom of the water main and the top of the sewer shall be maintained.

D. Where local conditions prevent this, sewer passing over and under water mains should be constructed of material designated by the Town Engineer. Water mains passing under sewers in addition shall be protected by providing:

1. necessary structural support for sewers to prevent excessive deflection of joints and settling on the breaking of the water main;

2. That the length of water pipe be centered at the point of crossing so that the joints will be equidistant.

E. If deemed necessary by the Town Engineer, a concrete cradle will be constructed around the water main to protect it from damage due to a pipe or culvert crossing. Where concrete cradles are called for on the plans, a detailed drawing of the of the construction dimensions must be provided.

21-11 Control of Trench Water

21-11.01 Trench

21-11.02 Pipeline

21-11.03 Uncompleted Portions

21-11 Control of Trench Water

21-11.01 TRENCH

The owner shall be responsible for maintaining the trench in a dry and satisfactory condition. The owner shall provide such pumping machinery, equipment and tools as are necessary to handle any ground water or drainage water encountered in the work.

2-11.02 PIPELINE

Water must not be allowed to enter the completed pipeline during the pipe laying operation as well as after the pipe has been laid prior to placing the pipeline into service.

21-11.03 UNCOMPLETED PORTIONS

All open portions of the pipeline that have not been completed, such as hydrant branches, branch lines and the end of the pipeline, during period when pipelaying operations are shut down must be adequately protected so as to prevent entrance of ground and drainage water from the trench. Extreme care is to be exercised by the owner to prevent the entrance of any sewage from the broken house connections or main line sewers into the new water main.

21-12 Piping Requirements

21-12.01 Pipe & Fittings Cleaning

21-12.02 Pipe Cutting

21-12.03 Deflection of Joints

21-12 Piping Requirements

21-12.01 PIPE AND FITTINGS CLEANING

A. Before the pipe is laid, all lumps, blisters and excess coaltar coating shall be removed from the bell and spigot end of each pipe. In addition, the outside of the spigot and the inside of the bell shall be wire crushed and wiped clean and dry and free from oil and grease.

21-12.02 PIPE CUTTING

SDR-35 Gravity PVC pipe shall be cut on the job with approved type cutter, fitted with a carbide tip cutting blade, that will pass around the pipe in a circular motion. The use of saws will not be permitted. In general, sufficient short lengths of SDR-35 Gravity PVC valves and appurtenances will be varied so as to permit the installation of these items without cutting the SDR-35 Gravity PVC pipe.

21-12.03 DEFLECTION OF JOINTS

A. Deflection of pipe from a straight line, either horizontally or vertically, to avoid obstructions or plumb stems or where long radius curves are permitted shall not be allowed to exceed limits for satisfactory caulking of the joint or as set by manufacturer's specifications.

21-13 Valve and Blow-off Chambers

21-13.01 Dead-End Water Lines

21-13.02 Accessory Chambers

21-13.03 Air Relief Valve

21-13 Valve and Blow-off Chambers

21-13.01 DEAD-END WATER LINES

At all dead-end water lines, there shall be a hydrant in order to flush the line or as a means to place a pressure test on the system.

21-13.02 ACCESSORY CHAMBERS

Valve, blow-off or other such appurtenance chambers in the distribution systems shall not be connected directly to any storm drains or sanitary sewer. Such chambers shall be drained to the ground surface where they are not subject to flooding by surface water or to absorption pits underground.

21-13.03 AIR RELIEF VALVES

The open end of an air relief pipe should extend from a manhole or enclosing chamber to a point at least one foot above the ground and be provided with a screened downward facing elbow.

21-14 Hydrants

21-14.01 Placement

21-14 Hydrants

21-14.01 PLACEMENT

To provide maximum accessibility and minimum damage from vehicles, hydrants shall be places as follows:

A. The hydrant barrel shall be set so that no portion of the pumper of hose nozzle cap will be less than six (6) inches from the gutter face of the curb when placed behind the curb. When placed behind the sidewalk and the property line, no portion of the nozzle cap shall be less than six (6) inches behind the sidewalk.

B. Position: All hydrants shall stand plumb and have their nozzles parallel with or at right angles to the curb with the pumper nozzle facing the curb except hydrants that have (2) hose nozzles 90° apart; these will be set with each nozzle facing the curb at an angle of 45°. Hydrants shall be set to the established grade, with the center of the nozzle at least 15" above the ground.

C. Connection to the Main:

1. Fire hydrants shall be connected only to water mains adequately sized to carry fire flows, minimum 8". The connection to the main shall be with a six (6) inch ductile iron branch containing a six (6) inch gate valve.

D. Hydrant Drainage:

1. Drainage is to be accomplished by excavating to the bottom of the hydrant area approximately two (2) feet in every direction from the center of the hydrant. This area is to be backfilled to about six (6) inches above the waste opening in the hydrant using washed gravel or crushed stone of .25" size or pea variety. Backfill around the hydrant barrel is to be of granular native soil.

2. Hydrant drains should be plugged and barrels pumped dry during freezing weather. The plugging will become mandatory when groundwater rises above the drain port. This will be done only at the discretion of the Town Engineer. Where hydrant drains are not plugged, they shall drain to the ground surface or to dry wells constructed exclusively for the purpose. Hydrant drains shall not be connected to or located within ten (10) feet of sanitary sewers or storm drains.

21-15 Water Tests

21-15 Water Tests

21-15.01 PRESSURE AND LEAKAGE TESTS

Under the direction of the Town Engineer or his agent, pressure and leakage tests are to be run simultaneously upon completion of the pipeline. Water for these purposes is the be drawn from the existing water system under the supervision of the Town Engineer. The tests will be conducted no less than two (2) days after the line is filled with water.

21-15.02 ELEVATION VARIANCES

The Engineer reserves the right to valve off and test portions of the line on pipelines where the elevation along the route varies substantially or where the construction is extensive.

21-15.03 PROCEDURES

The Contractor shall furnish all gauges, testing plus, caps,and all other necessary equipment and labor to perform a pressure test. All pressure testing shall be done by an independent third party, approved by the Engineer and Town of Bennington Water Department. The Contractor shall develop and maintain for two hours, 150 percent (150%) of the working pressure measured in pounds per square inch or 200 psi, whichever is greater. Failure to hold the designated pressure for the two-hour period constitutes a failure of the section tested. No pipe installation shall be accepted if the leakage is greater than that determined by the leakage formula: 21-16.03/ All testing shall be conducted in accordance with AWWA C600 latest revision.

21-15.04 PUMP TESTING

Each section of the pipeline to be tested shall be slowly filled with water from the existing system. The specified test pressure, based on the elevation of the lowest point of the line or section under test, shall be applied by means of a pump connected to the pipe. Before applying the specified test pressure, air shall be expelled completely from the pipe and valves.

21-15.05 EXAMINATION OF PIPE

All exposed pipe, fittings, valves and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings or valves that are discovered following the pressure test shall be repaired or replaced with sound material and the test repeated.

21-16 Leakage Test

21-16.01 Performance

21-16.02 Definition

21-16.03 Leakage Formula

21-16 Leakage Test

21-16.01 PERFORMANCE

A leakage test shall be conducted simultaneously with the pressure test.

21-16.02 DEFINITION

Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the specified pressure after the air in the pipeline has been expelled and the pipe has been filled with water.

21-16.03 LEAKAGE FORMULA

No pipe installation will be accepted if the leakage formula is greater than that determined by the following formula:

$$L = \frac{ND\sqrt{P}}{7400}$$

L is the allowable leakage in gallons per hour;
N is the number of joints in the length of pipeline tested;
D is the nominal diameter of the pipe in inches;
P is the average test pressure during the leakage test in pounds per square inch gauge.

21-17 Disinfection

21-17.01 Minimum Chlorine Concentrations

21-17.02 Length of Chlorination

21-17 Disinfection

21-17.01 MINIMUM CHLORINE CONCENTRATIONS

A. The finished pipeline shall be disinfected with chlorine concentration of approximately 50 ppm before being placed in service.

B. This may be accomplished pumping sodium hypochlorite solution into the new water Main after the initial filling and pressure testing is completed.

21-17.02 LENGTH OF CHLORINATION

The chlorinated water is to remain in the new pipeline for a period of 24 hours with measures taken to prevent this chlorinated water from flowing back into the existing system.

21-18 NEW WATER MAIN FLUSH PROCEDURES

21-18 NEW WATER MAIN FLUSH PROCEDURES

21-18.01 REQUIREMENTS

After testing and disinfection is completed, new water mains will be required to be properly flushed under the direction of the Town Engineer or his agent.

21-18.02 PROCEDURE

Flushing should be accomplished at a velocity consistent with the existing system's capacity to supply water. Highly chlorinated will be flushed to a sanitary sewer where possible or at a rate that the surrounding area will drain. Flushing highly chlorinated water to storm drains or nearby waterways in not permitted.

21-18.03 CHLORINE RESIDUAL

After clean water is obtained at the flush point, the flow of water at reduced rates should be maintained for at least one hour. When the flush operation is completed, the new main is to be placed in service with occasional checks being made to determine any build-up of chlorine. If chlorine is detected, a flush is to be performed at slow rates until the main is cleared.

21-19 Location Points

21-19.01 Service Lines

21-19.02 Hardware

21-19.03 Back Flow Preventer

21-19 Location Points

21-19.01 SERVICE LINES

Curb boxes, corporations and any horizontal deflection in a house/apt service line will be properly located by exact distance to a permanent set of points. The Town Engineer or his agent will be supplied with this information. The Town Engineer will determine the exact location of corporations and curb stops prior to the actual construction.

21-19.02 HARDWARE

All hardware of significance such as mains, gate valves, reducers and hydrants on the proposed Town water mains and private mains will be properly shown on the As-Built plan, two (2) copies of which will be submitted to the Town Engineer for approval and filing.

21-19.03 Back Flow Preventers/Pressure Reducers

All municipal water services shall contain a back flow preventer and pressure reducer in accordance with National Standards. Pressure reducers may be waived by the Town Engineer if the installation is determined to be in a low/moderate pressure zone.

21-20 Construction Standards - Sewer Systems

21-20 Construction Standards - Sewer Systems

21-20.01 LINE AND GAUGE

Lines shall be laid out by a Registered Engineer or a Licensed Surveyor prior to any sewer construction. The location and grade of the entire length of the sewer invert must be clearly marked using offset stakes. It will be the owner's responsibility to replace any grade stakes disturbed or lost during the construction phase. Laser control is encouraged. Minimum grade for sewer line shall be 1/8" per 100 feet. Service lines may be laid flatter depending on circumstances, but resulting problems shall be the owner's responsibility.

21-20.02 LOCATION

Sewer mains shall be located in public rights-of way in all cases. Exceptions may be allowed by the Town only in extreme extenuating circumstances.

21-21 Excavation

21-21.01 Improved Pavement

21-21.02 Trench Bottoms

21-21.03 Rock Excavations

21-21 Excavation

21-21.01 IMPROVED PAVEMENT

In excavating trenches in the streets with improved pavement, excavation shall be controlled so as not to disturb excess pavement beyond trench limits. Trench edges shall be cut prior to excavation. Pavement edges shall be cut straight and parallel before resurfacing.

21-21.02 TRENCH BOTTOMS

Trench bottoms shall be excavated as flat as possible, to a minimum depth of six (6) inches below the bottom of the barrel of the pipe to be laid. Compacted granular material shall be used to refill areas excavated in excess of this amount.

21-21.03 ROCK EXCAVATIONS

Rock shall be uncovered and removed to a depth of nine (9) inches below sewer grade. A minimum clearance of nine (9) inches on each side of the sewer shall be provided. The space between may be used for width allowance.

21-22 Water Control

22-22.01 Groundwater Diversion

21-22.02 Pipe Flotation

21-22 Water Control

21-22.01 GROUNDWATER DIVERSION

The owner shall provide all pumping machinery, equipment and tools that may be necessary to divert any groundwater, sewage or drainage water encountered to maintain the trench in a dry state. No pipe shall be laid in water. Pipes must be securely bedded and jointed, and backfilling must reach an elevation of a minimum of one (1) foot above the top of the pipe before any water may be permitted to rise in the trench.

21-22.02 PIPE FLOTATION

Pipe weight is not sufficient to prevent lifting if water rises in trench. The possibility of pipe floatation shall be prevented by appropriate bracing or loading methods. If the excavation cannot be maintained dry, the pipe line may be filled with clean water to overcome buoyancy. Pipe line sections damaged due to flotation shall be removed and replaced with pipe equal to the original. This shall be the responsibility of the owner.

21-23 Piling Excavated Material

21-23.01 Unacceptable Locations

21-23.02 Accessibility

21-23 Piling Excavated Material

21-23.01 UNACCEPTABLE LOCATIONS

Excavated material shall be piled in a manner to avoid:

a. sidewalks and driveways
b. work areas
c. hydrants under pressure
d. valve pit covers
e. valve boxes
f. manholes
g. curb stop boxes
h. utility controls
I. natural water courses
j. gutters, unless other provisions have been made for drainage

21-23.02 ALL EXCAVATED MATERIALS

Shall conform to all OSHA/VOSHA materials handling requirements.

21-23.03 ACCESSIBILITY

The above areas shall be left accessible until completion of work.

21-24 Backfilling

21-24 Backfilling

21-24.01 REQUIREMENTS

Trenches and other excavations shall be backfilled, unless otherwise directed by the Engineer, as soon as pipe has been laid or the completion of other structures has occurred and authorization has been given by the Engineer. Authorization by the Engineer guarantees that inspection and satisfactory workmanship has occurred for all work completed up to this point. As a minimum, complete the following (4) items prior to final backfill:

1. Surveying locations of underground utilities for record documents.
2. Testing, inspecting, and approval of underground utilities.
3. Removal of trash and debris from excavation.
4. Removal of temporary shoring and bracing, and sheeting.

21-24.02 PROCEDURES

Materials and specifications for backfilling shall be as follows:

UTILITY TRENCH BACKFILL

A. Place and compact bedding course on rock and other unyielding bearing surfaces and to fill unauthorized excavations. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

B. Place and compact initial backfill of satisfactory soil material or sub-base material, free of particles larger than 1 inch, to a height of 12 inches over the utility pipe or conduit.

   1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.

C. Coordinate backfilling with utilities testing.

D. Fill voids with approved backfill materials as shoring and bracing, and sheeting is removed.

E. Place and compact final backfill of satisfactory soil material to final sub-grade.

MOISTURE CONTROL

A. Uniformly moisten or aerate sub-grade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air-dry satisfactory soil material that is too wet to compact to specified density. Stockpile or spread and dry removed wet satisfactory soil material.

COMPACTION

A. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill materials evenly on all sides of structures to required elevations. Place backfill and fill uniformly along the full length of each structure.

C. Percentage of Maximum Dry Density Requirements: Compact soil to not less than the following percentages of maximum dry density according to ASTM D1557:

1. Under structures and pavements, compact the top 12 inches below sub-grade and each layer of backfill or fill material at 95 percent maximum dry density.

SUBBASE AND BASE COURSES

A. Under pavements and walks, place sub-base course material on prepared sub-grades. Place base course material over sub-bases to pavements.

1. Compact sub-base and base courses at optimum moisture content to required grades, lines, cross sections and thickness to not less than 95 percent of ASTM D 4254 relative density.
2. Shape sub-base and base to required crown elevations and cross-slope grades.

FIELD QUALITY CONTROL

A. Testing Agency Services: Allow testing agency to inspect and test each sub-grade and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.

1. Trench Backfill: In each compacted initial and final backfill layer, perform at least one field in-place density test for each 150 feet or less of trench, but no fewer than two tests.

B. When testing agency reports that sub-grades, fills, or backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, recompact and retest until required density is obtained.

C. The owner will not be permitted to fill around manholes or other structures until the plaster and cement mortar joints have set thoroughly, and the Town Engineer approves filling.

PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace material to depth directed by the Engineer; reshape and recompact at optimum moisture content to the required density.

C. Settling: Where settling occurs during the Project correction period, remove finished surfacing, backfill with additional approved material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Contractor shall be responsible for transport, stockpiling and storage of all satisfactory surplus soil at an approved off-site storage area. All waste materials, soils and debris shall be disposed of at a State-approved C&D landfill.

21-24.04 RESURFACING

Resurfacing shall be completed in accordance with the requirements of the Highway Standards for paving (see Section **20-6** of this manual).

21-25 Materials

21-25 Materials

21-25.01 SIZE

The minimum size of a sewer main shall be eight (8) inches in diameter. Smaller sizes may be approved for service line connections depending on flow estimates.

21-25.02 PIPE AND FITTINGS

A. Pipe for main sewers shall be PVC Schedule 35 gravity sewer pipe, unless other materials are specifically approved by the Engineer in writing on plans. In any event, all pipe shall have been made by manufactures who incorporate standard, established, testing procedures thereby guaranteeing pipe design for use in sanitary sewer construction. When considering other materials for sewers, the Engineer shall review local conditions, including but not limited to use of sewer (residential-commercial-industrial); soil characteristics, septicity; weight of external loadings; abrasion and pH. The Engineer shall also consider the trench width and depth and any special construction procedures used. Joints shall consist of molded and vulcanized rubber rings designed to fit the pipe and installed according to the direction of the manufacturer.

B. Pipe and fittings for force mains shall be PVC force main pipe designed by a Vermont Registered Engineer and approved by the Town Engineer.

C. Pipe strength: Manufacturer's testing procedures for pipe shall include specifications for crushing strength, flexural strength and impact loading. When a conflict occurs between drawing specifications and manufacturer's requirements (in reference to pipe strength), the manufacturer's requirements will rule. Where warranted by the Engineer's review on local conditions, the pipe strength requirement may be increased.

21-25.03 PLUGS

If construction is suspended for any reason, open pipe ends shall be closed with plugs of a type generally used for the procedure. A minimum number fo plugs consistent with the job shall be readily available for emergency use. The type and quantity of plugs ordered shall be specified on the plans for approval by the Engineer.

21-25.04 CONNECTIONS

A. Branches - shall be of SDR35 Gravity PVC sewer pipe materials in Y's made by the same manufacturer as the sewer pipe and designed for this use.

B. Saddles - Approved Ductile Iron saddles may be used when constructed of a standard to fit the main sewer pipe. A Town Engineer approved saddle using a sealing gasket and a stainless steel wrap around band and stainless steel bolts/nuts will be used for all Direct Taps. All other types of connections must be approved by the Town Engineer prior to use.

21-25.05 HOUSE SERVICE CONNECTIONS

A. House service connections shall be made of cast iron PVC SDR 35 building sewer pipe. Elbows, bends and stoppers shall be of materials consistent for use with building sewer pipe and installed according to manufacturer's specifications.

****Connection of any house sump pump, subdrain or roof drain to this sanitary connection is prohibited.****

B. The owner shall mark the location of each "Y" branch or saddle. This location shall be marked on the plans "As-Built" and measured to the nearest downstream manhole. These records shall be delivered to the Engineer within 15 days of completion.

C. Lift pumps - Town Engineer approved sanitary sewer pipe shall be used where it is necessary to install an individual house service lift pump. The individual sewer lateral shall pitch toward the main trunk line from the edge of the right-of-way, with a minimum 1% grade.

21-26 Testing

21-26 Testing

21-26.01 WATER TESTING

A. Sewer tests shall include losses or gains of water through pipe walls, joints, house connection fittings and pipe, and losses through manholes. The Engineer shall determine the type of tests to be performed. Either an infiltration or exfiltration test shall be performed for all gravity sewers. Groundwater conditions in the area where the lines are to be tested will determine the type of test, to be decided by the Engineer. A continuous four (4) hour infiltration test shall be carried out by the owner (with the supervision of the Engineer) in areas having a high groundwater level. Isolation tests will be used for certain sewer line sections to determine the quality of water entering the pipe during a continuous 24 hour measuring period. Water tight plugs will be used to section off the sewer lines. The maximum allowable infiltration or exfiltration shall be 200 gallons per inch of pipe diameter per mile per day.

B. An exfiltration test may be performed on lines where the sewer has been installed in a dry area. Watertight plugs will be used to isolate certain sewer sections. The line will then be filled to a depth of three (3) feet above the top of the pipe at the highest manhole in the line. Water loss will be determined by measuring the quantity of water required to refill the line to the original level in a four (4) hour period. An air test may be substituted if approved by the Engineer. See A-5 Environmental Protection Rules; ASTM Standard C828-80.

21-26.02 STRAIGHTNESS TESTING

Sewers must be straight between manholes. A laser test or a lamping test to determine straightness shall be utilized, unless the Engineer approves another straightness testing method.

21-26.03 LINE REPAIR

Lines shall be repaired where testing shows the need, then retested. This procedure shall be repeated until favorable results have been obtained (using the limits established in this manual or references incorporated in this manual, and any other ordinance as adopted).

Appendix "A"

FEE SCHEDULE 2016

** Highway Costs per Hour INCLUDE (1) Operator

Equipment	Per	Current Rate
Service Truck - 1 Ton	Hour	$ 35.00
With trailer	Hour	$ 50.00
Dump Truck - Single Axle	Hour	$ 65.00
Tandem Axle		$ 90.00
Dump Truck - 1 Ton	Hour	$ 50.00
Freightliner Sweeper	Hour	$ 185.00
Loader - JD 544	Hour	$ 90.00
Tractor - Sidewalk Trackless/mini loader	Hour	$ 85.00
Tractor – Challenger with mower	Hour	$ 185.00
Backhoe – John Deere 310	Hour	$ 115.00
Asphalt Reclaimer & Babcat	Hour	$ 205.00
Roller	Hour	$ 50.00
Bobcat	Hour	$ 85.00
Sno-Go Blower with loader	Hour	$ 195.00
Excavator - CAT 318 Wheeled	Hour	$ 145.00
Chipper - Morbark	Hour	$ 100.00
Grader - JD	Hour	$ 175.00
Paver	Hour	$ 185.00

Water / Wastewater Equipment

February 2016

Equipment	Per	Current	
Sewer Jetter w/Truck	Hour *(2 hr min)*	$ 75.00	*($150.00 min.)*
Sewer Vac Machine w/Truck	Hour *(2 hr min)*	$ 75.00	*($150.00 min.)*
Backhoe - CAT	Hour	$115.00	
Backhoe - John Deere 710	Hour	$ 125.00	
w/ Hydralic Hammer	Hour	$ 175.00	

Backhoe - John Deere 110	Hour	$ 115.00	
Vibratory Compactor	Hour	$ 25.00	
Generator	Hour	$ 25.00	
Jack Hammer	Hour	$ 35.00	
Air Exchange System	Hour	$ 25.00	
2 1/2" Dishcharge Pump	Hour	$ 25.00	
Camera Equipment (incl labor)	4 hour min.	$ 75.00	*($300.00 min.)*
Sewer Tape	Hour	$ 25.00	
Pipe Locator	Hour	$ 50.00	
Leak Detector	Hour	$ 50.00	
Dump Truck - 1 Ton	Hour	$ 40.00	
Hydra Thaw	2 hour min.	$ 75.00	($150.00 min.)
Cable Pull	DAY / Use	$ 100.00	

Water / Sewer Services

February 2016

Service	Per	Current	
Water Turn OFF / ON	*(Reg Time)*	$ 25.00	
Water Tap 3/4" or 1"		$ 225.00	*(includes Labor & Basic Materials)*
Sewer Tap 4"		$ 225.00	
Liquid Dye	Bottle	$ 25.00	
Coliform Analysis		$ 25.00	
BOD Analysis		$ 45.00	
TSS Analysis		$ 25.00	
Freeze Kit		$ 25.00	

Attachment 2: Minimum Town Road and Bridge Standards that include Water Quality Best Management Practices

January 4, 2011

TOWN ROAD AND BRIDGE STANDARDS
TOWN OF BENNINGTON, VERMONT

The Town of Bennington hereby adopts the following Town Road and Bridge Standards which shall apply to the construction, maintenance and repair of all town roads and bridges.

The standards listed here are considered minimum and are presented for purposes of guiding construction and maintenance personnel. The standards listed here include three types of management practices and are designed to: ensure the safety of the traveling public, minimize damage to road infrastructure during flood events, and enhance water quality protections by minimizing sediment delivery to surface waters and/or wetlands. The select board reserves the right to modify the standards for a particular project, where, because of unique physical circumstances or conditions, there is no possibility that the project can be completed in strict conformance with these provisions. Any modifications to the standards must be done in a manner that protects the underlying intent of the management practice, be it public safety, flood hazard avoidance, or water quality protection. Fiscal reasons are not a basis for modification of the standards. Questions about modifications to the standards should be directed to the VTrans District Office.

Any new road, whether or not that road is proposed to be conveyed to the town, shall be constructed according to the minimums of these standards. If any federal and/or state funding is involved in a project, the VTrans district office will be notified prior to any field changes taking place that would alter the original scope of work.

Roadways

- All new or substantially reconstructed roads will have at least a 15-inch thick processed gravel subbase, with gravel roads having the top 3 inches (minimum) as crushed gravel.
- All roadways will be graded so water does not remain on the road surface. For roadways that are not superelevated, this generally means a 2-4% ($^1/_4$" - $^1/_2$" per ft) crown for gravel roads and a 1-2% ($^1/_8$" - $^1/_4$" per ft) crown for paved roads to promote sheeting of water.
- Proper grading techniques for gravel roadways will be used to avoid creating a ridge or berm between the crown and the ditch.
- Any berm along the roadway shoulder that prevents the proper sheeting of water will be removed.

Ditches and Slopes

Soil exposed during ditch and slope construction or maintenance will be treated immediately following the operation. Priority should be given to areas vulnerable to erosion immediately adjacent to or discharging to surface waters and/or roadway drainage facilities. The following are minimum erosion control measures:

- Seed and mulch ditches with grades less than 2%. Use biodegradable, non-welded matting and seed on ditches with grades between 2% and 5%. Stone line all ditches with grades greater than 5%; alternatively, install stone check dams. Dams should be comprised of a well graded stone matrix 2 to 9 inches in size. Dams should not exceed 2 feet in height and check dam crest should be at least 6" below the top of the ditch.

- Create parabolic (wide "U" shaped) ditches when constructing new or substantially reconstructing ditches, rather than narrow "V" shaped ditches. Ditches with gradual side slopes (maximum 2H: 1V ratio) and a wide bottom (at least 2 feet) are preferred.
- Use biodegradable, non-welded matting to stabilize side-slopes where slopes are greater than 1:1; apply seed and mulch to any raw or exposed side-slope if slopes are less than or equal to 1:1.
- Ditches should be turned out to avoid direct outlet into surface waters. There must be adequate outlet protection at the end of the turnout, either a structural (rock) or vegetative filtering area.

Culverts and Bridges

- All new driveway culverts will have a minimum diameter of 15 inches.
- All new roadway culverts will have a minimum diameter of 18 inches.
- Any culvert with a drainage area greater than 0.25 sq mi will require a hydraulic engineering study. Culverts will be designed to convey the Q25 design storm with minimal surcharge.
- All bridges (structures with spans greater than 6 feet) and open bottom structures will require a hydraulic engineering study. Structures will be designed to convey the Q25 design storm and allow for passage of ice and debris.
- When installing or replacing culverts, use appropriate techniques such as headwalls and wingwalls, where there is erosion or undermining or where it may occur.
- Install a splash pad or plunge pool at the outlet of drainage culverts where there is erosion or where erosion may occur. Splash pads and plunge pools are not appropriate for use in streams supporting aquatic life.

Guardrail

When roadway, culvert, bridge, or retaining wall construction or reconstruction projects result in hazards such as foreslopes, drop offs, or fixed obstacles within the designated clear-zone, a roadside barrier such as guardrail shall be installed. The most current version of the AASHTO Roadside Design Guide will govern the analysis of the hazard and the subsequent treatment of that hazard.

Access Management

The town will have a process in place, formal or informal, to review all new drive accesses and development roads where they intersect Town roads, as authorized under 19 V.S.A. Section 1111. Towns may reference VTrans A-76 Standards for Town & Development Roads and B-71 Standards for Residential and Commercial Drives.

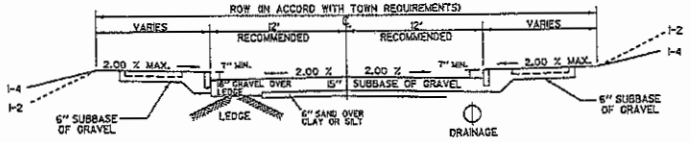
Training

Town highway maintenance crews will collectively attend a minimum total of 6 hours of training per year on best road management practices. The town will keep documentation of their attendance.

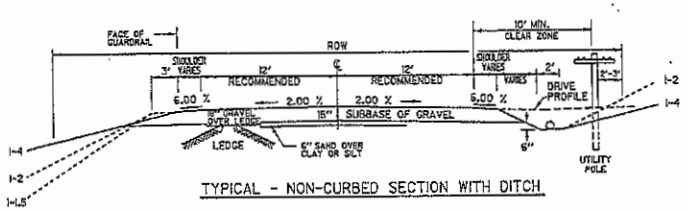
Passed and adopted by the Selectboard of the Town of Bennington **, State of Vermont on** June 27 **, 20**11 **.**

Select Board:

ROADWAY TYPICALS

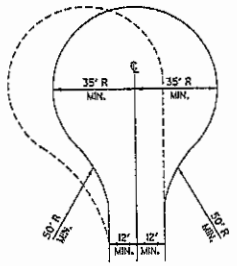


TYPICAL - CURBED SECTION WITH 5' SIDEWALKS

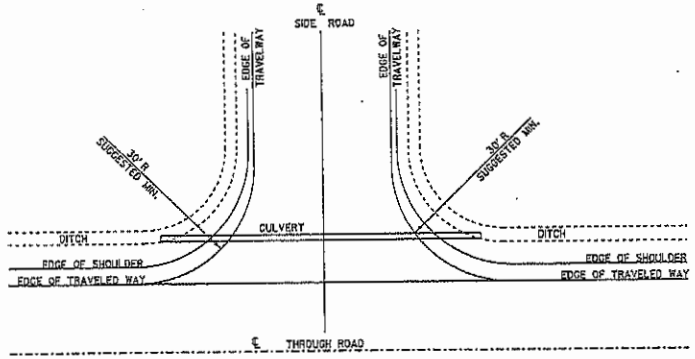


TYPICAL - NON-CURBED SECTION WITH DITCH

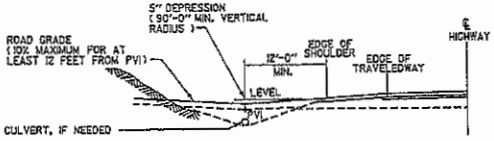
CUL-DE-SAC FOR DEAD END ROADS



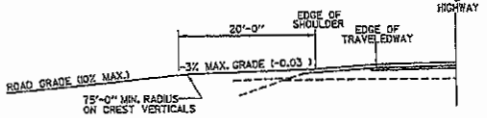
INTERSECTION OF THROUGH ROAD AND SIDE ROAD



FOR THROUGH ROADS WITH SIDEWALKS & CURBING, SEE STANDARDS C2 & C3.
PROVIDE DROP INLETS ON EACH SIDE OF SIDE ROAD AT INTERSECTION AS NECESSARY.



PROFILE OF INTERSECTION (CUT SECTION)
SHOWING 5" DEPRESSION



PROFILE OF INTERSECTION (FILL SECTION)

GENERAL NOTES FOR LOCAL ROADS

1. SUBBASE, SAND CUSHION AND SUBGRADE SHOULD BE CONSTRUCTED AND COMPACTED TO THE DIMENSIONS SHOWN IN ACCORDANCE WITH VAOT STANDARD SPECIFICATIONS FOR CONSTRUCTION. WHERE LOCAL ORDINANCES HAVE BEEN ADOPTED RELATIVE TO ROAD DIMENSIONS AND CONSTRUCTION, THEY SHOULD GOVERN. THE DIMENSIONS SUGGESTED ARE INTENDED TO BE APPLIED ONLY IN LOW TRAFFIC VOLUME CONDITIONS (AVERAGE DAILY TRAFFIC LESS THAN 250 VEHICLES PER DAY), AND WHERE HEAVY TRUCK TRAFFIC IS INFREQUENT.

2. EXPOSED EARTH SLOPES SHOULD BE SEEDED, FERTILIZED AND MULCHED IN ACCORDANCE WITH VAOT STANDARD SPECIFICATIONS FOR CONSTRUCTION.

3. DRAINAGE:

   ROADWAY - 18" MINIMUM DIAMETER, OF METAL, REINFORCED CONCRETE OR POLYETHYLENE PIPE, WITH DROP INLETS OR CATCH BASINS, AS REQUIRED. HYDRAULIC ANALYSIS TO DETERMINE APPROPRIATE PIPE DIAMETER IS RECOMMENDED FOR ALL LIVE STREAM CROSSINGS AND ELSEWHERE WHERE LARGE STORM FLOWS MAY BE EXPECTED.

   DRIVES - 15" MINIMUM DIAMETER, OF METAL, REINFORCED CONCRETE OR POLYETHYLENE PIPE.

   UNDERDRAIN - 6" MINIMUM DIAMETER, OF METAL, PVC PLASTIC OR POLYETHYLENE PIPE.

   LOCATION, DEPTH AND CONSTRUCTION DETAILS SHOULD FOLLOW PRACTICE SPECIFIED BY LOCAL ORDINANCE OR THE VAOT STANDARD SPECIFICATIONS FOR CONSTRUCTION.

4. HORIZONTAL CURVATURE - THE FOLLOWING WILL APPLY:

DESIGN SPEED	MINIMUM RADII RURAL (1)	MINIMUM RADII URBAN (2)
25 MPH	185 FT.	180 FT.
30 MPH	275 FT.	300 FT.
35 MPH	380 FT.	460 FT.
40 MPH	510 FT.	675 FT.
45 MPH	660 FT.	945 FT.
50 MPH	835 FT.	1280 FT.

(1) BASED ON CROSS SLOPE = 6.0 %
(2) BASED ON MAINTAINING NORMAL CROWN SECTION THROUGHOUT CURVE ; EFFECTIVE CROSS SLOPE = 2.0 %

FOR OTHER SUPERELEVATION RATES, SEE CHAPTER III OF THE AASHTO "A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS" FOR APPROPRIATE CURVE RADII.

5. GRADIENT OF ROADS - 10% MAXIMUM GRADE SUGGESTED, ALTHOUGH GRADES UP TO 16 % MAY BE ALLOWED IN MOUNTAINOUS TERRAIN.

6. GUARD RAIL - PROVIDE GUARD RAIL WITH TREATED WOOD OR STEEL POSTS, OF A DESIGN IN ACCORDANCE WITH VAOT STANDARD SPECIFICATIONS FOR CONSTRUCTION, THE AASHTO ROADSIDE DESIGN GUIDE, AND VAOT STANDARD DRAWINGS. GENERALLY, WHERE SLOPES ARE 1:3 OR STEEPER, AND THE HEIGHT OF DROPOFF AT EDGE OF SHOULDER EXCEEDS 5', GUARD RAIL SHOULD BE INSTALLED. ALSO, WHERE SLOPES ARE 1:3 OR FLATTER, GUARD RAIL MAY NOT BE NEEDED IF THE AREA AT THE BOTTOM OF THE SLOPE IS FREE OF HAZARDS. THE LOCAL VAOT DISTRICT TRANSPORTATION ADMINISTRATOR MAY BE CONTACTED FOR ASSISTANCE.

7. PAVING - ROADS WITH GRADES EXCEEDING 7% SHOULD BE PAVED UNLESS WAIVED BY THE LOCAL GOVERNING BODY. FOR TRAFFIC VOLUMES GREATER THAN, OR EQUAL TO, 250 VEHICLES PER DAY, OR WHERE HEAVY TRUCKS ARE COMMON, A PAVEMENT DESIGN SHOULD BE PERFORMED TO DETERMINE APPROPRIATE THICKNESSES OF SUBBASE AND PAVEMENT.

8. TRAVELED WAY AND SHOULDER WIDTHS - WIDTHS SHOWN ON THIS STANDARD ARE FOR LOW SPEED/LOW TRAFFIC VOLUME CONDITIONS. FOR ADDITIONAL GUIDANCE IN THE DESIGN OF LOCAL ROADS AND STREETS, SEE THE LATEST EDITION OF AASHTO'S PUBLICATION "A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS", OR THE VAOT "VERMONT STATE STANDARDS".

9. UTILITY LINE LOCATION TO CONFORM TO LOCAL REQUIREMENTS.

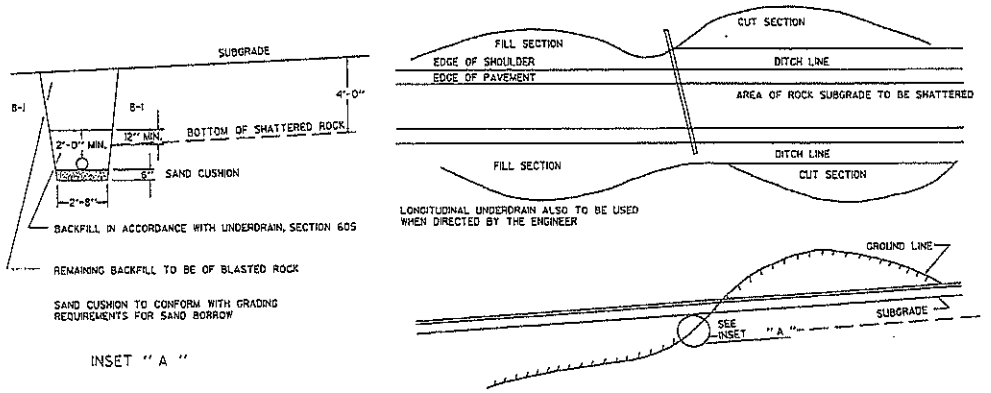
REVISIONS AND CORRECTIONS
JAN. 21, 1971 - ORIGINAL DATE OF ISSUE
MAR. 12, 1971 - DIMENSIONS CHANGED ON TURN-A-ROUND
JULY 13, 1973 - INTERSECTION PROFILES ADDED
DEC. 7, 1993 - REVISED TO REFLECT CURRENT DESIGN CRITERIA
JUNE 1, 1994 - REISSUED, WITHOUT CHANGE, UNDER NEW SIGNATURES.
MAR. 10, 1995 - REISSUED, WITHOUT CHANGE, UNDER NEW SIGNATURES.
MARCH 3, 2003 - REVISED TO REFLECT CURRENT DESIGN CRITERIA

APPROVED
DIRECTOR OF PROGRAM DEVELOPMENT
CHIEF OF UTILITIES
FEDERAL HIGHWAY ADMINISTRATION

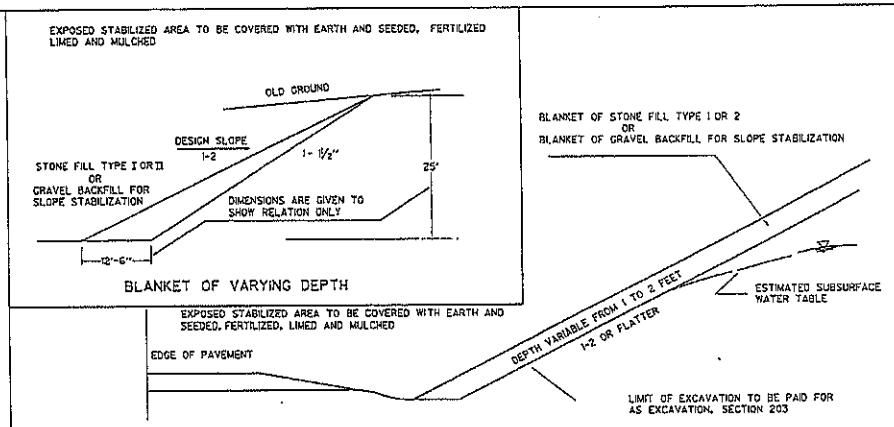
STANDARDS FOR TOWN & DEVELOPMENT ROADS

VERMONT AGENCY OF TRANSPORTATION

STANDARD A-76

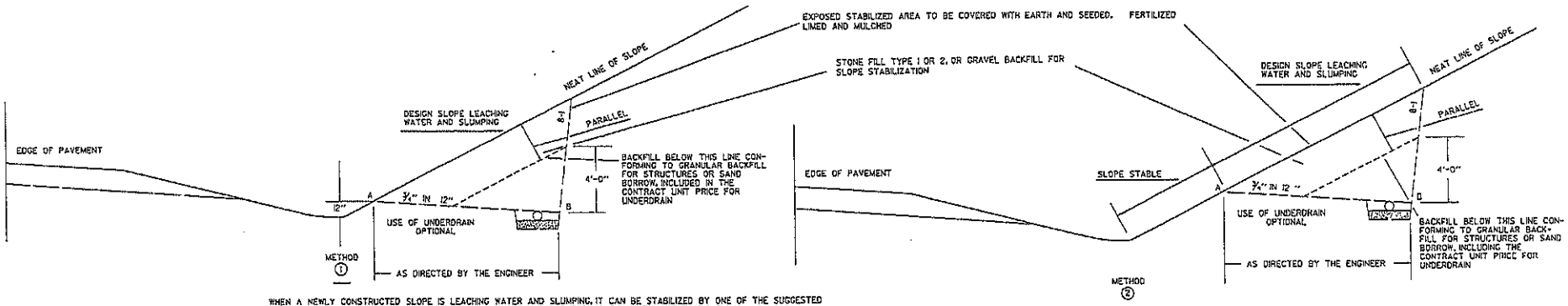


USE OF UNDERDRAIN WITH SHATTERED ROCK SUBGRADE



BLANKET OF VARYING DEPTH

BLANKET SLOPE STABILIZATION METHOD



WHEN A NEWLY CONSTRUCTED SLOPE IS LEACHING WATER AND SLUMPING, IT CAN BE STABILIZED BY ONE OF THE SUGGESTED METHODS SHOWN ABOVE. EXCAVATION ABOVE LINE A-B, TO BE PAID FOR AS EXCAVATION, SECTION 203.
GRAVEL USED FOR BACKFILL TO MEET THE SPECIFICATIONS AND TO BE PAID FOR AS GRAVEL BACKFILL FOR SLOPE STABILIZATION.
ROCK USED FOR BACKFILL TO MEET THE SPECIFICATIONS AND TO BE PAID FOR AS STONE FILL, TYPES I OR II.
EXCAVATION BELOW LINE A-B, TO BE PAID FOR AS TRENCH EXCAVATION.

REVISIONS AND CORRECTIONS

DEC. 6, 1971 - ORIGINAL APPROVAL DATE
DEC. 12, 1974 - STONE FILL ADDED FOR STABILIZATION
JUNE 1, 1994 - REISSUED, WITHOUT CHANGE, UNDER NEW SIGNATURES.

APPROVED

APPROVED FOR THIS PROJECT AND/OR DESIGN IMPLEMENTATION, FHWA FINAL APPROVAL PENDING

Stanley D. McArthur, P.E.
DIRECTOR OF ENGINEERING

John D. Murphy, P.E.
DESIGN ENGINEER

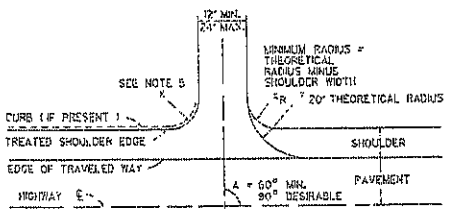
USE OF UNDERDRAIN WITH SHATTERED ROCK SUBGRADE

METHODS OF SLOPE STABILIZATION

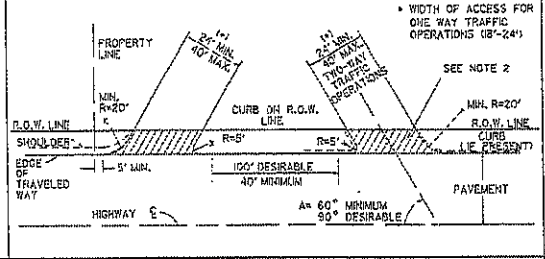
VERMONT AGENCY OF TRANSPORTATION

STANDARD B-11

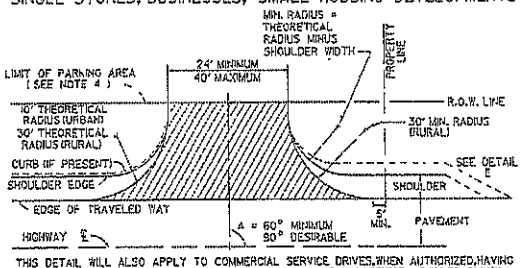
DETAIL A — RESIDENTIAL DRIVE



DETAIL B — DUAL COMMERCIAL DRIVE TO BE USED ONLY UNDER SPECIAL CONDITIONS

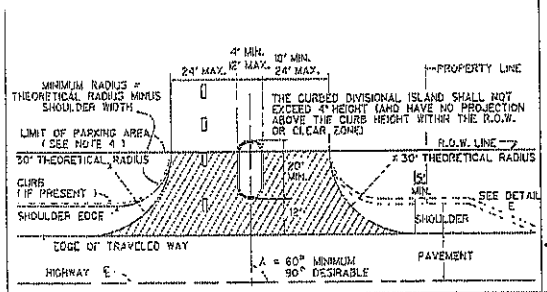


DETAIL C — TWO-WAY UNDIVIDED COMMERCIAL DRIVE FOR SINGLE STORES, BUSINESSES, SMALL HOUSING DEVELOPMENTS

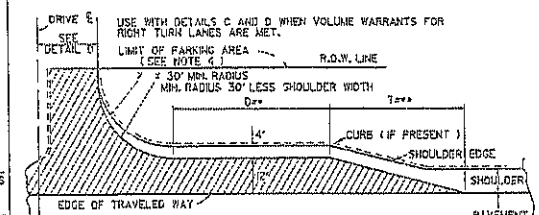


THIS DETAIL WILL ALSO APPLY TO COMMERCIAL SERVICE DRIVES, WHEN AUTHORIZED, HAVING A MAXIMUM WIDTH OF 20'. THE SERVICE DRIVE WILL HAVE A "SERVICE VEHICLES ONLY" SIGN PLACED AT THE HIGHWAY ROW LINE. SIGN SHALL BE 18"X 24" AS PRESCRIBED IN THE "STANDARD HIGHWAY SIGNS BOOK", A SUPPLEMENTAL PUBLICATION TO MUTCD.

DETAIL D — TWO-WAY COMMERCIAL DRIVE WITH DIVISIONAL ISLAND FOR SHOPPING CENTERS, LARGE HOUSING DEVELOPMENTS, INDUSTRIAL PLANTS AND SERVICE STATIONS



DETAIL E — RIGHT TURN LANE FOR COMMERCIAL DRIVE (UNSIGNALIZED INTERSECTIONS ONLY)

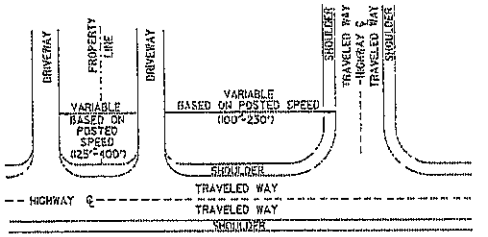


* STORAGE LENGTH IS VARIABLE DEPENDING ON TRAFFIC VOLUME AND MUST BE ADJUSTED TO PROVIDE PROPER DECELERATION LENGTH. REFER TO VAOT STANDARD E-19T.

TAPERS

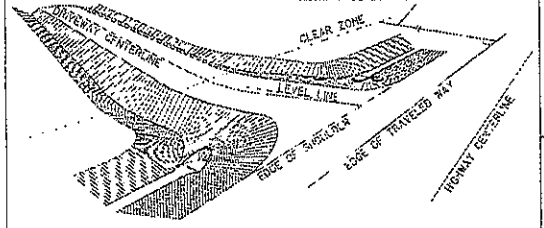
SPEED (MPH)	30	35	40	50
LENGTH (MINIMUM)	100	120	140	180
RATE	8:1	10:1	12:1	15:1

DETAIL F — MINIMUM HORIZONTAL SEPARATION BETWEEN DRIVEWAYS AND INTERSECTING SIDEROADS

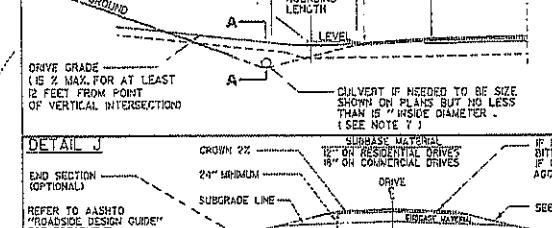


* MINIMUM UNLESS NO OTHER REASONABLE ACCESS IS AVAILABLE AND PRIOR APPROVAL IS GRANTED BY THE VAOT ITEMS SUCH AS TRAFFIC SIGNALS, HIGH TRAFFIC VOLUMES, OR FUNCTIONAL CLASS OF HIGHWAY SHOULD BE CONSIDERED WHEN DETERMINING APPROPRIATE SEPARATION DISTANCE. WHEN CURRENT RECOMMENDED SEPARATION DISTANCE CANNOT BE OBTAINED RESTRICTION OF TURNING MOVEMENTS MAY BE REQUIRED.

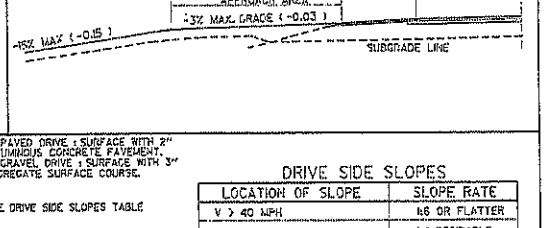
DETAIL G — PERSPECTIVE SKETCH OF DRIVE INTERSECTION SHOWING DEPRESSION



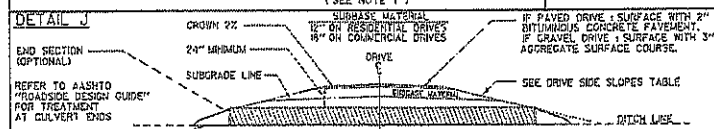
DETAIL H — PROFILE OF DRIVE INTERSECTION SHOWING 5" DEPRESSION (CUT SECTION)



DETAIL I — PROFILE OF DRIVE INTERSECTION (FILL SECTION)



DETAIL J



SECTION A-A

DRIVE SIDE SLOPES

LOCATION OF SLOPE	SLOPE RATE
V > 40 MPH	1:6 OR FLATTER
URBAN AREAS, OR V ≤ 40 MPH	1:4 DESIRABLE 1:2 ALLOWABLE
OUTSIDE CLEAR ZONE	1:2 OR FLATTER

NOTES:

1. THIS SHEET IS INTENDED FOR USE BY DESIGNERS ON HIGHWAY PROJECTS AND IN CONJUNCTION WITH A PERMIT FOR WORK WITHIN HIGHWAY RIGHTS OF WAY (FORM TA 3101). ALL CONSTRUCTION REQUIRED BY THE PERMIT AND INDICATED ON THIS SHEET SHALL BE THE RESPONSIBILITY OF THE APPLICANT AND IS SUBJECT TO THE APPROVAL OF THE VT. AGENCY OF TRANSPORTATION. WHEN USED WITH THE PLANS FOR A HIGHWAY CONSTRUCTION PROJECT, THIS SHEET IS INTENDED TO BE A GUIDE FOR THE DESIGNER CONCERNING DRIVE WIDTHS, HORIZONTAL, VERTICAL AND GEOMETRIC CHARACTERISTICS.
2. ALL COMMERCIAL DRIVES SHALL BE PAVED FROM THE EDGE OF THE TRAVELED WAY TO THE HIGHWAY RIGHT-OF-WAY, TO THE FARTHEST POINT OF CURVATURE ON THE DRIVEWAY EDGE OR AS DIRECTED BY THE DISTRICT TRANSPORTATION ADMINISTRATOR. THIS PAVING IS INDICATED IN DETAILS (B THRU E) BY HATCHING.
3. DEPTH OF SUBBASE AND PAVEMENT TO BE THE SAME AS HIGHWAY OR AS SHOWN IN DETAIL J WITHIN THE LIMITS OF THE HIGHWAY RIGHT-OF-WAY.
4. VEHICULAR ACCESS FROM PARKING AREAS TO THE RIGHT-OF-WAY AT OTHER THAN APPROVED ACCESS POINTS WILL BE PREVENTED BY THE CONSTRUCTION OF CURBING OR OTHER SUITABLE PHYSICAL BARRIER.
5. IF CURB IS PRESENT, SEE APPROPRIATE CURB DETAIL STANDARD OR MATCH TOWN/CITY STANDARD CURB TREATMENT.
6. WHERE TRAFFIC VOLUME FOR A PROJECT IS SUBSTANTIAL THE AGENCY MAY REQUIRE SPECIAL LANES FOR TURNING SIGNALS OR OTHER MODIFICATIONS. BASED ON TRAFFIC STUDIES THE AGENCY WILL DETERMINE SPECIFIC TREATMENT TO BE USED. ON DEVELOPER PROJECTS, THE AGENCY WILL WORK WITH THE APPLICANT TO IMPLEMENT CHANGES TO THE STATE HIGHWAY.
7. CIRCULAR DRAINAGE CULVERTS UNDER DRIVES SHALL HAVE A MINIMUM INSIDE DIAMETER (I.D.) OF 15". PIPE ARCHES USED UNDER DRIVES SHALL HAVE A MINIMUM INSIDE CROSS-SECTIONAL AREA EQUIVALENT TO THAT PROVIDED BY A 15" CIRCULAR PIPE.
8. THE OFFSET BETWEEN THE PROPERTY LINE AND THE EDGE OF THE DRIVEWAY MAY BE GOVERNED BY LOCAL ZONING LAWS. DRIVEWAY WIDTH RESTRICTIONS SHOWN PERTAIN ONLY TO THE AREA WITHIN THE HIGHWAY R.O.W. OR THE END OF THE TURNING RADIUS WHICHEVER IS GREATEST.
9. DRIVEWAY GRADES STEEPER THAN THOSE SHOWN MAY BE ALLOWED AS LONG AS A 20' APPROACH AREA IS ACHIEVED FOR THE VEHICLE TO PAUSE BEFORE ENTERING THE HIGHWAY. (WHERE CURB & SIDEWALKS EXIST, SEE STANDARDS C-2A & C-2B)
10. INTERSECTION SIGHT DISTANCES, EQUAL TO OR GREATER THAN THOSE SHOWN BELOW, SHOULD BE PROVIDED IN BOTH DIRECTIONS FOR ALL DRIVES ENTERING ON PUBLIC HIGHWAYS, UNLESS OTHERWISE APPROVED BY THE DISTRICT TRANSPORTATION ADMINISTRATOR. INTERSECTION SIGHT DISTANCE IS MEASURED FROM A POINT ON THE DRIVE AT LEAST 15 FEET FROM THE EDGE OF TRAVELED WAY OF THE ADJACENT ROADWAY AND MEASURED FROM A HEIGHT OF EYE OF 3.5 FEET ON THE DRIVE TO A HEIGHT OF 3.50 FEET ON THE ROADWAY.

SIGHT DISTANCE CHART

POSTED SPEED OR DESIGN SPEED (M.P.H.)	MINIMUM STOPPING SIGHT DISTANCE (FT)	MINIMUM INTERSECTION SIGHT DISTANCE * (FT)
25	155	280
30	200	335
35	250	390
40	305	445
45	360	500
50	425	555
55	495	610
60	570	665
65	645	730

THE ABOVE VALUES ARE TAKEN FROM THE 2004 AASHTO "A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS & STREETS."

NOTE : ADVANCE WARNING SIGNS WILL BE REQUIRED IF OBTAINABLE INTERSECTION SIGHT DISTANCES ARE BELOW MINIMUM STOPPING SIGHT DISTANCES.

THE CHART IS ENTERED TO SELECT DESIGN VALUES BASED ON THE POSTED SPEED LIMIT IN MPH. VALUES FOR DESIGN ARE CALCULATED BASED ON THE DESIGN SPEED IN MPH.

* ASSUMES A GAP OF 7.5 SECONDS IN THE TRAFFIC STREAM ON THE HIGHWAY MAINLINE BASED ON THE HIGHWAY DESIGN SPEED IN MPH. THIS ALLOWS A STOPPED PASSENGER VEHICLE TO ENTER THE MAINLINE FROM THE DRIVE WITHOUT UNDULY INTERFERING WITH THE HIGHWAY OPERATIONS.

REVISIONS AND CORRECTIONS

DEC. 11, 1992 - THIS STANDARD SUPERCEDES B-7 (7/23/80R), B-7A (3/12/90), AND B-13 (12/14/78).
JUNE 1, 1994 - REISSUED, WITHOUT CHANGE, UNDER NEW SIGNATURES.
MAR. 10, 1995 - REISSUED, WITHOUT CHANGE, UNDER NEW SIGNATURES.
NOV. 16, 2000 - CHANGES MADE TO CONFORM WITH LANGUAGE AND DIMENSIONS IN ACCESS MANAGEMENT PROGRAM GUIDELINES.
FEB 1, 2004 - CHANGES MADE TO SIGHT DISTANCE CHART TO CONFORM WITH NEWEST AASHTO CRITERIA.
JULY 8, 2005 - CHANGE MADE TO OBJECT HEIGHT TO CONFORM WITH AASHTO CRITERIA

APPROVED

DIRECTOR OF PROGRAM DEVELOPMENT

CHIEF OF UTILITIES AND PERMITS

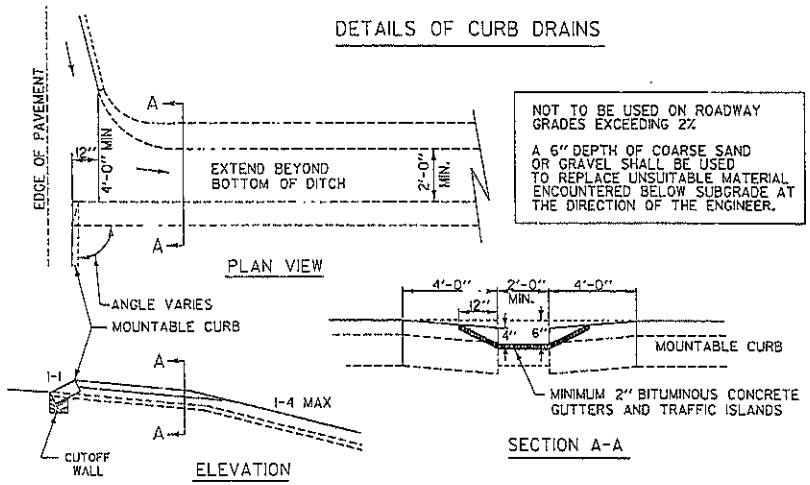
FEDERAL HIGHWAY ADMINISTRATION

STANDARDS FOR RESIDENTIAL AND COMMERCIAL DRIVES

VERMONT AGENCY OF TRANSPORTATION

STANDARD B-71

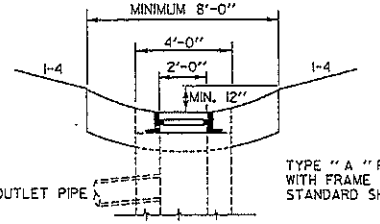
DETAILS OF CURB DRAINS



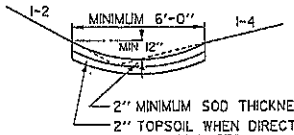
NOT TO BE USED ON ROADWAY GRADES EXCEEDING 2%

A 6" DEPTH OF COARSE SAND OR GRAVEL SHALL BE USED TO REPLACE UNSUITABLE MATERIAL ENCOUNTERED BELOW SUBGRADE AT THE DIRECTION OF THE ENGINEER.

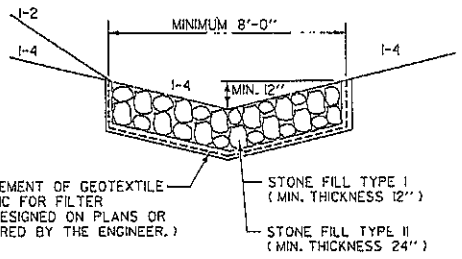
DROP INLET WITH GRATE IN TREATED GUTTER



SODDING

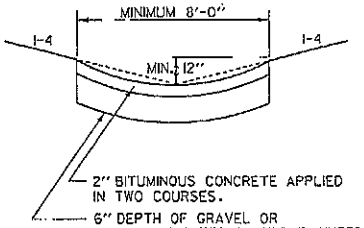


STONE FILL TYPE I
STONE FILL TYPE II

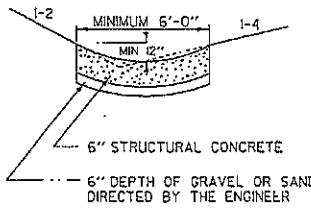


EXCAVATION PAID FOR AS COMMON EXCAVATION.

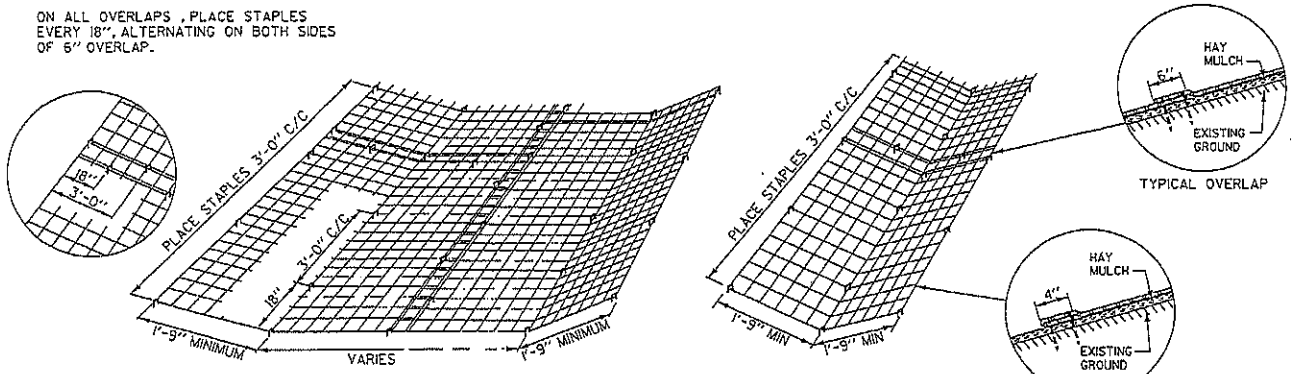
BITUMINOUS CONCRETE GUTTERS AND TRAFFIC ISLANDS



PORTLAND CEMENT CONCRETE GUTTER



ON ALL OVERLAPS , PLACE STAPLES EVERY 18", ALTERNATING ON BOTH SIDES OF 6" OVERLAP.



DETAILS OF PLACING EROSION MATTING

REVISIONS AND CORRECTIONS

APR. 2, 1986 - ORIGINAL APPROVAL DATE

JUNE 1, 1994 - REISSUED, WITHOUT CHANGE, UNDER NEW SIGNATURES.

APPROVED

APPROVED FOR THIS PROJECT AND/OR DESIGN IMPLEMENTATION. FHWA FINAL APPROVAL PENDING.

DIRECTOR OF ENGINEERING

DESIGN ENGINEER PE

TREATED GUTTERS

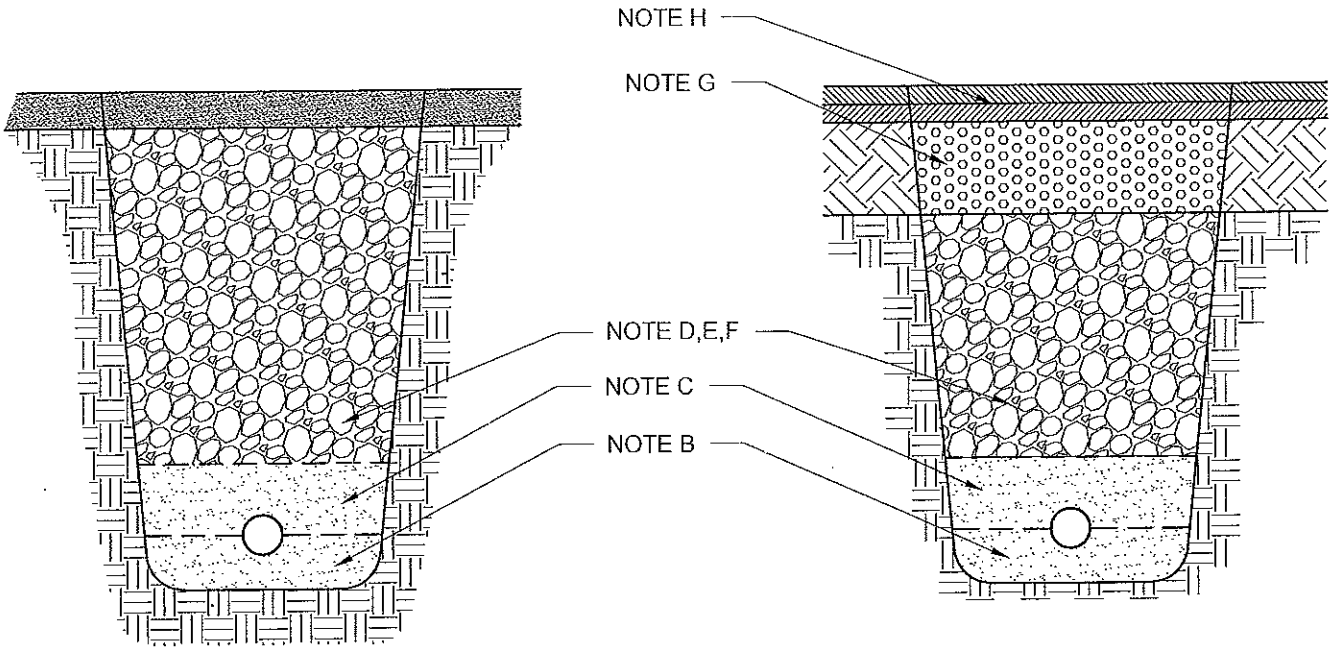
VERMONT AGENCY OF TRANSPORTATION

STANDARD D-3

Appendix "B"

CONSTRUCTION TYPICAL DRAWINGS

WATER & SEWER



TYPICAL TRENCH DETAIL

Scale: NTS

INSTALLATION SPECIFICATIONS

A. MINIMUM BURIAL DEPTH 5'-6" (4'-0" FOR SEWER) IF CONDITIONS PREVENT MINIMUM BURIAL DEPTH, ALL SECTIONS OF LINE LESS THAN MIN. DEPTH SHALL BE INSULATED WITH 1" THICKNESS RIGID FOAM INSULATION PER FOOT LESS THAN MINIMUM.(MIN. 2" thickness 250 psi)

B. BED PIPE IN 6" OF CRUSHED STONE (PASSING 1/2" BUT RETAINED ON #4 SIEVE PIPE SHALL NOT BE LAID IN UNCOMPACTED SOIL OR IN WATER. IF IN LEDGE CONDITIONS, BED PIPE IN A MINIMUM OF 6" OF CLEAN SAND. DO NOT REST PIPE ON LEDGE ROCK.

C. BACKFILL OVER PIPE W/ 12" MINIMUM SAND, COMPACTED ENTIRE WIDTH OF TRENCH. BACKFILL WITH BEDDING STONE TO 12" DEPTH IF IN WATER.

D. REMAINDER OF BACKFILL TO BE SELECT EARTH OR BANK RUN GRAVEL NOT GREATER THAN 6" IN LARGEST DIMENSION. BACKFILL TO BE COMPACTED IN 6" LIFTS UNDER ROADS AND PAVED AREAS.

E. BACKFILL SHALL CONSIST OF SUITABLE MATERIAL REMOVED FROM EXCAVATION, AND SHALL BE FREE OF CLODS, DEBRIS, FROZEN CHUNKS, PAVEMENT PIECES, LARGE STONES, ORGANIC MATERIAL OR ANY OTHER MATERIAL DEEMED UNSUITABLE BY THE ENGINEER.

F. BACKFILL SHALL BE COMPACTED TO 95% OF MAXIMUM DRY DENSITY IN ALL TRENCH EXCAVATIONS. (85% OF LAWN/GRASS AREA)

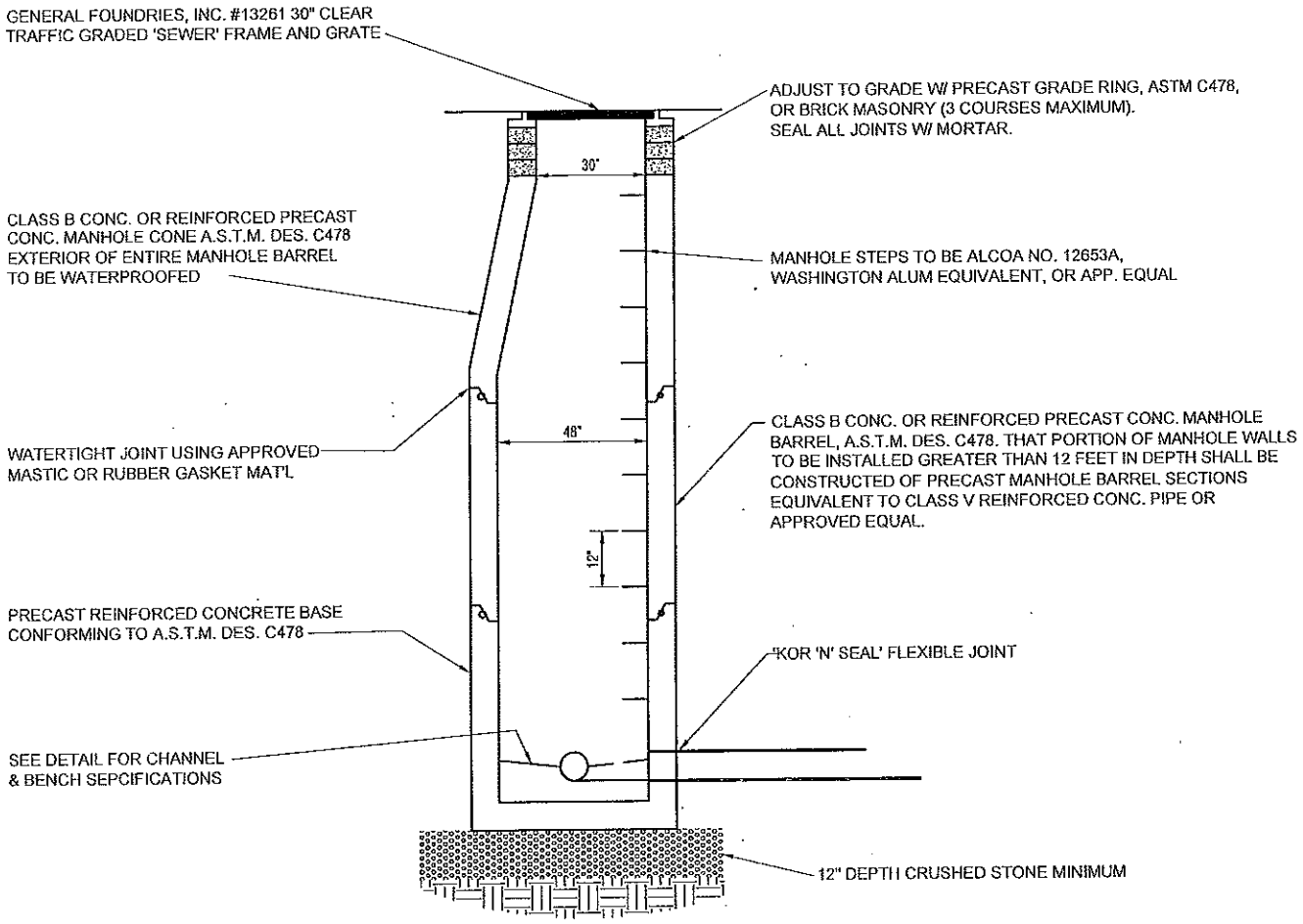
H. EDGES OF PAVEMENT SHALL BE CUT PRIOR TO EXCAVATION TO PREVENT LIFTING OF REMAINING PAVEMENT, AND FOLLOWING EXCAVATION PRIOR TO PAVEMENT PATCHING. APPLY EMULSION TO EDGE OF EXISTING PAVEMENT PRIOR TO PAVING.

MINIMUM PAVEMENT INSTALLATION:

MUNICIPAL ROADWAY:	TOP: 1.5"/ TYPE 3 (1/2") BASE: 2.5'/TYPE 2 (3/4")
STATE ROADWAY:	TOP: 1.5"/ TYPE 3 (1/2") BASE: 2.5"/ TYPE 2 (3/4")
PAVED DRIVEWAYS:	TOP: 1"/ TYPE 4 (3/8") BASE: 2"/ TYPE 2 (3/4")

G. MINIMUM SUBBASE INSTALLATION:

MUNICIPAL ROADWAYS:	12" BANKRUN GRAVEL 6" CRUSHED GRAVE FINE GRADED
STATE ROADWAY:	18" BANKRUN GRAVEL 6" CRUSHED GRAVEL FINE GRADED
DRIVEWAY:	8" BANK RUN GRAVEL 6" CRUSHED GRAVEL FINE GRADED

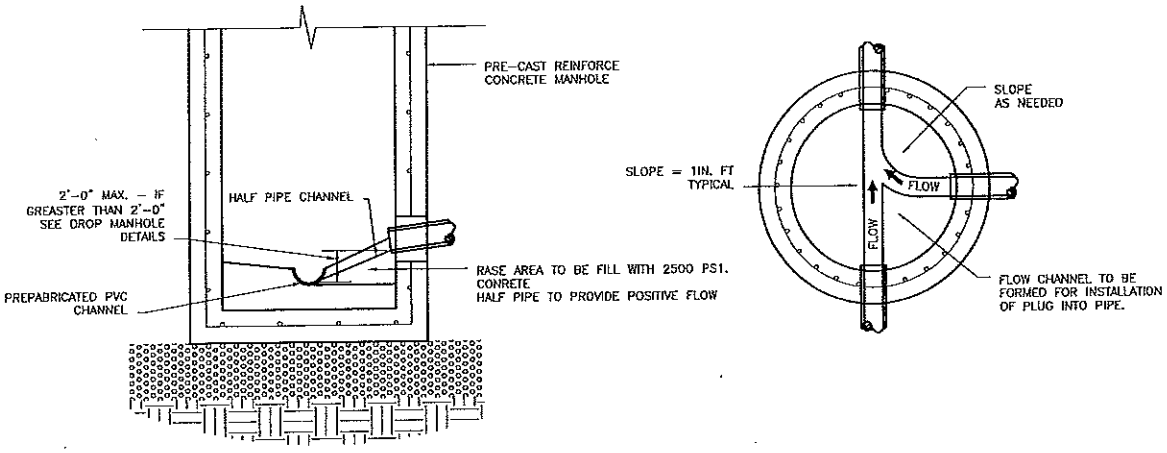


NOTES:

1. INVERTS TO BE CONSTRUCTED ONLY AFTER SUCCESSFUL COMPLETION OF LEAKAGE TESTS.
2. EXTERIOR JOINTS TO BE SEALED ONLY AFTER SUCCESSFUL COMPLETION OF LEAKAGE TESTS
3. INTERIOR JOINTS SHALL NOT BE GROUNDED.
4. IF DEPTH OF MANHOLE IS 7' OR LESS FROM RIM TO CENTERLINE INVERT, THEN A FLAT TOP SHOULD BE SUBSTITUTED FOR THE CONE SECTION.

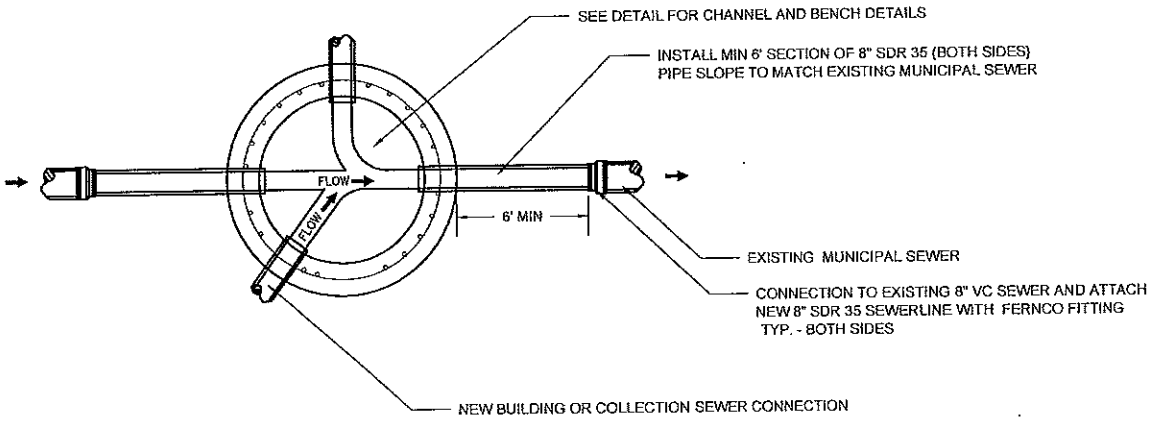
TYPICAL MANHOLE DETAIL

Scale: NTS



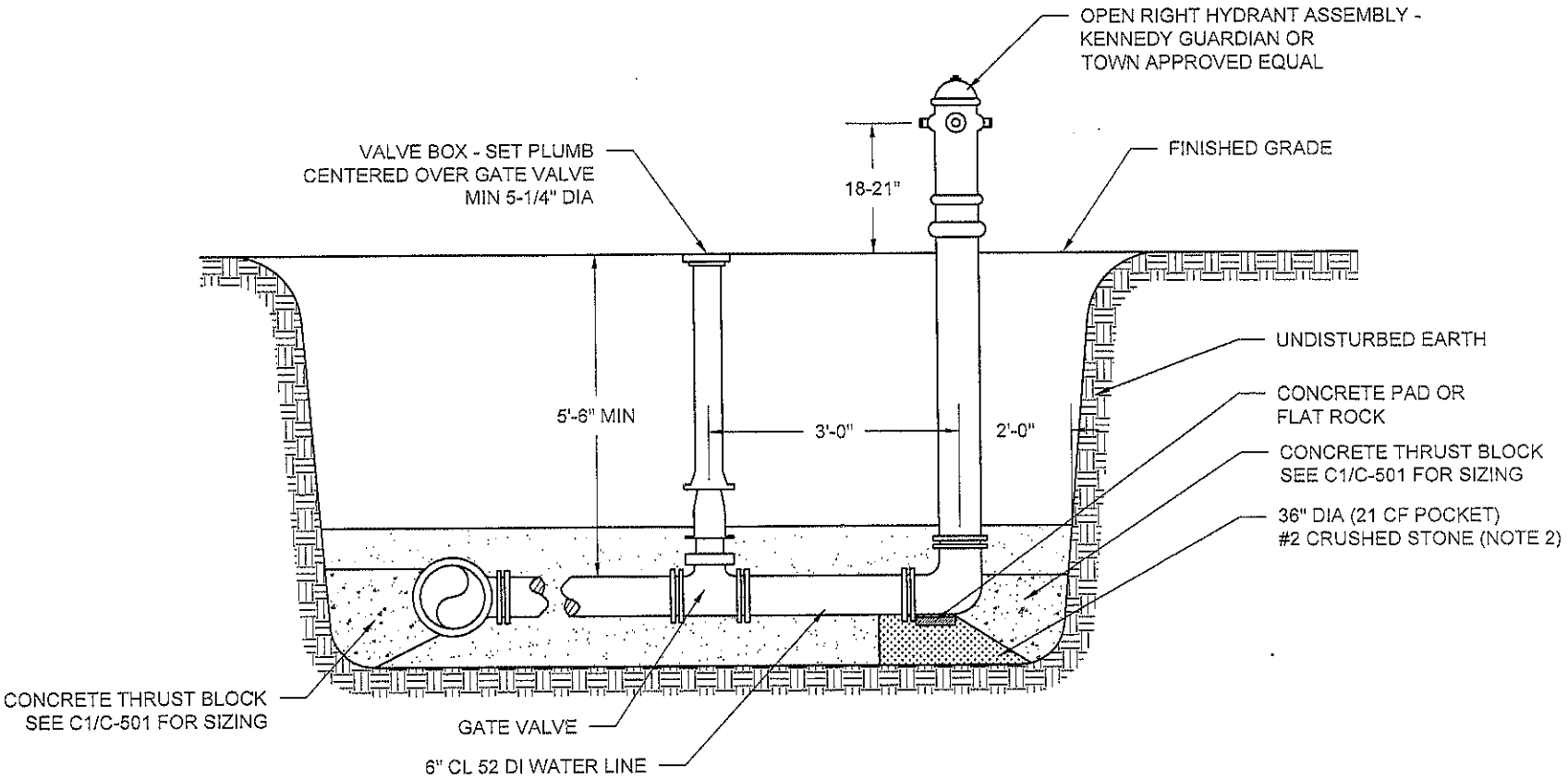
TYPICAL CHANNEL AND BENCH DETAIL

Scale: NTS



CONNECTION TO EXISTING SEWER DETAIL

Scale: NTS

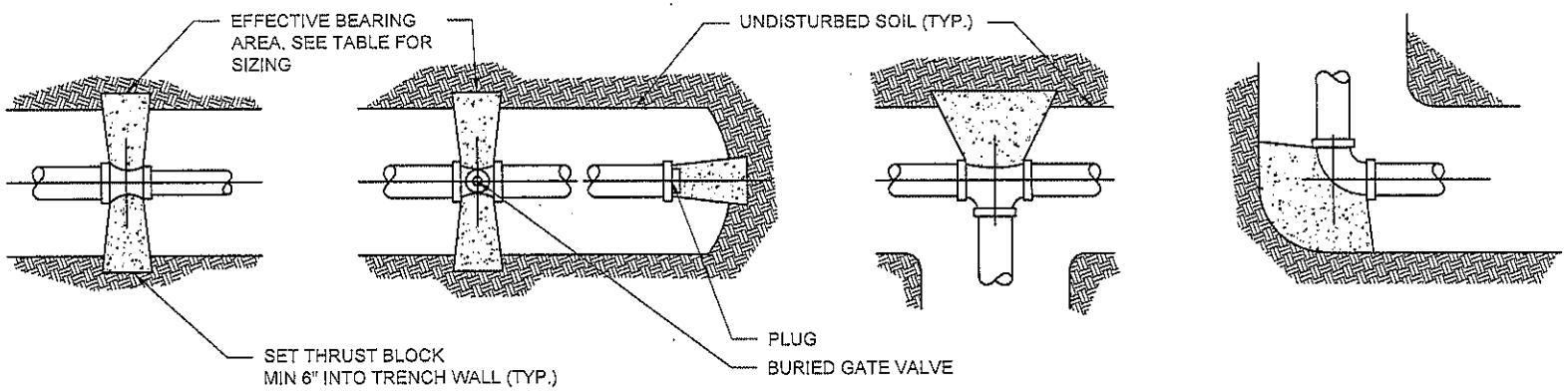


HYDRANT ASSEMBLY DETAIL

NTS

NOTES:

1. ALL MECHANICAL JOINT FITTINGS SHALL HAVE "MEGALUG" RETAINER GLANDS
2. HYDRANT DRAIN SHALL BE PLUGGED IF HYDRANT IS LOCATED WITHIN 10 FEET OF A NON-PRESSURE RATED SEWERLINE OR MANHOLE OR IN AN AREA WITH SEASONAL HIGH WATER TABLE ABOVE DRAIN OR AS DESIGNATED BY THE ENGINEER



REDUCER
NTS

VALVE/DEAD END
NTS

TEE
NTS

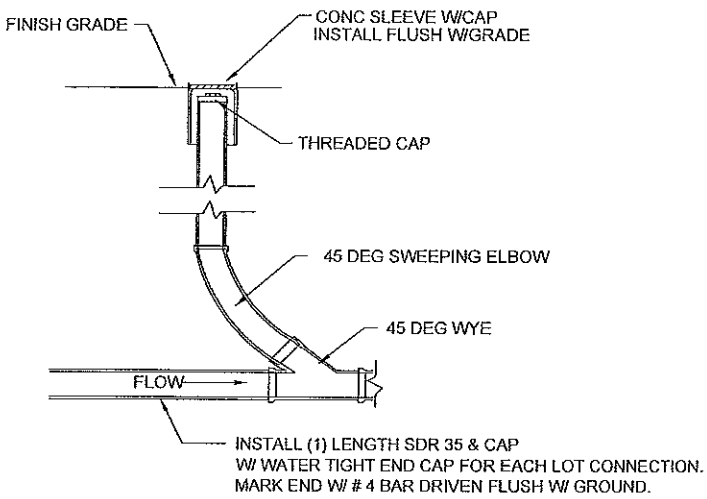
90°, 45°, OR 22.5° BEND
NTS

MINIMUM BEARING SURFACE AREA OF CONCRETE THRUST BLOCKS (IN SQUARE FEET)

REDUCERS			4-8"				10"				12"				SOIL CONDITION	SAFE BEARING LOAD (PSF)
8X6	10X8	12X8	ENDS & TEES	90° ELB	45° ELB	22.5° OR LESS	ENDS & TEES	90° ELB	45° ELB	22.5° ELB	ENDS & TEES	90° ELB	45° ELB	22.5° OR LESS		
3.0	5.0	6.0	4.0	6.0	3.0	2.0	6.0	8.0	5.0	2.0	8.0	12.0	6.0	3.0	SOUND SHALE	10000
3.0	5.0	6.0	4.5	6.5	3.5	2.0	8.0	11.0	6.0	3.0	10.0	14.0	7.5	4.0	CEMENTED GRAVEL AND SAND	4000
7.0	7.0	11.0	7.0	9.0	5.0	3.0	10.0	14.0	7.0	4.0	14.0	19.0	11.0	5.0	COARSE AND FINE COMPACT SAND	3000
8.0	9.0	14.0	15.0	20.0	10.0	5.0	21.0	31.0	15.0	8.0	30.0	40.0	20.0	10.0	MEDIUM CLAY (CAN BE SPADED)	2000
8.0	11.0	16.0	20.0	28.0	15.0	8.0	29.0	41.0	22.0	11.0	41.0	58.0	31.0	16.0	SOFT CLAY	1000
MAX WATER PRESSURE 300 PSI																

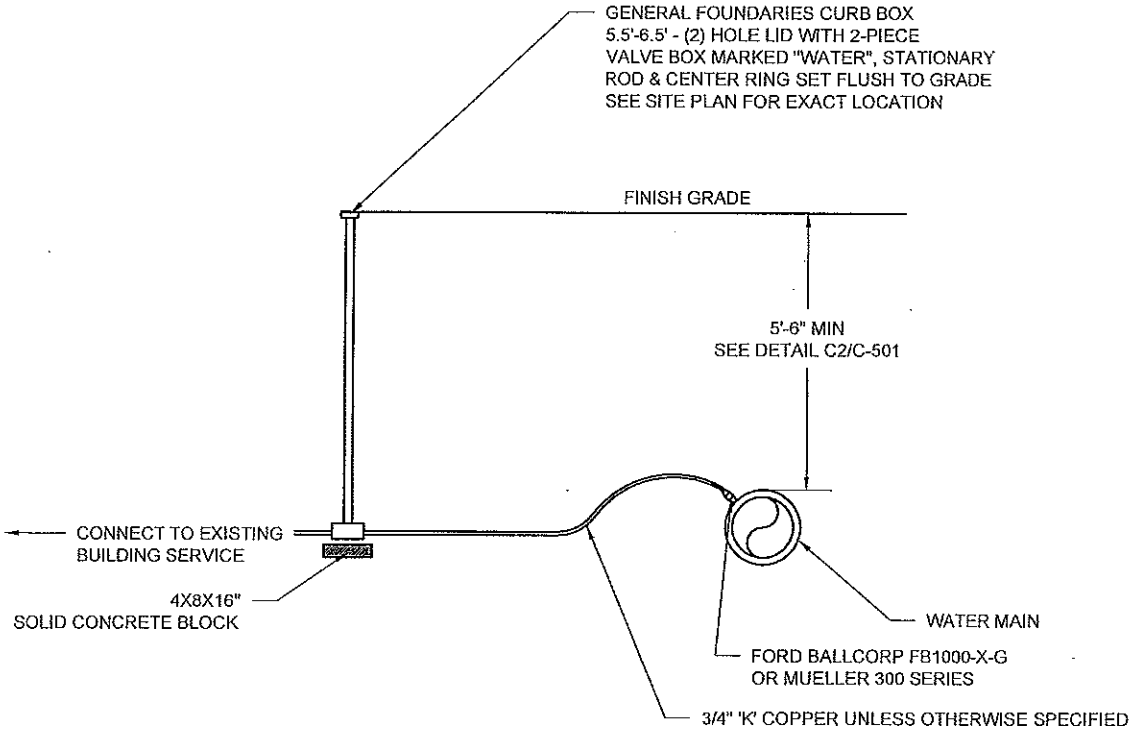
TYPICAL CONCRETE THRUST BLOCK DETAIL
NTS

NOTES:
1. PLACE 3 MIL MINIMUM POLYETHYLENE SHEETING BETWEEN ALL CONCRETE THRUST BLOCKS AND PIPE AND/OR FITTINGS TO PREVENT BONDING



TYPICAL CLEANOUT DETAIL

Scale: NTS



CURB STOP TYPICAL

Scale: NTS

NOTES:

1. COTRACTOR TO SUPPLY A MINIMUM OF (3) TIE DISTANCES FOR CORPORATIONS, CURB STOPS, END OF SERVICE AND ANY OTHER FITTINGS IN THE SERVICE LINE AS A PART OF ALL AS-BUILT DRAWINGS.