

\*\*\* Replaces T-5-91 \*\*\*  
Changes limited to last paragraph of Background.

TO: All H.Q. DIRECTORS: Prof. Services, Planning & Major Projects  
All REGIONAL MANAGERS: Prof. Services, Planning & Operations  
All DISTRICT HIGHWAYS MANAGERS

SUBJECT: PLASTIC DRAINAGE PIPE: GUIDELINES FOR USE AND DESIGN

PURPOSE:

To set forth the Ministry's technical requirements for selection of plastic pipe material and type, and to indicate acceptable installation methods.

BACKGROUND:

Drainage pipe made of poly vinyl chloride (PVC) and polyethylene (PE) first appeared on the B.C. market in the early 1950's. During the last 10 years, usage has increased dramatically.

At various times, manufacturers have changed or modified their product designations, and there is now some confusion between these "in-house" grades and the standard designations of ASTM, CSA, and other agencies. For example, ribbed pipe is often referred to as "Class IV" or "Class V" as if these were industry standards. In reality, these "Classes" are Perma-Loc's own designations for their pipes of stiffness 70 kPa (10 psi) and 320 kPa (46 psi), respectively, and are meaningless when dealing with other suppliers.

Plastic pipe is light and easy to handle, is easily cut and joined, and is acid-resistant. Disadvantages include brittleness during cold weather; it is easily damaged during handling, installation and maintenance.

PVC pipe has been used on MOTH projects as covered roadside drainage, sub-drains, drain fields, culverts and storm sewers. Some PVC pipe has been installed as liners in rotted corrugated steel pipe; the difference in roughness results in little or no loss of flow capacity. Hydraulic design requirements for plastic pipe is generally similar to those for steel and concrete pipe.

PE pipe has not been generally used on MOTH work due mainly to its low stiffness. However, stiffer PE pipe is now available on the market.

GUIDELINES:

A. RECOMMENDED USES

Plastic drainage pipe is intended for "open channel" applications, for either temporary or permanent installation where damage cannot be caused by maintenance. Acceptable permanent uses include subdrainage, storm sewers, drain fields, and as culverts under driveways and local roads.

#### B. NON-RECOMMENDED USES

With the exception of areas with unusually-high acidity, plastic pipe normally should not be used for through culverts under main highways.

Plastic pipe becomes brittle in cold weather. Also, because of its low thermal conductivity compared with other materials, steaming ice-blocked culverts can be difficult. Plastic pipe should, therefore, not be used where it would be exposed to potential damage at temperatures below -18 deg C.

#### C. DESIGN BASED ON PIPE STIFFNESS AND IMPACT STRENGTH

The most important parameter to be considered in designing for service performance is pipe stiffness - the load per unit length which will cause a unit of radial deflection. Impact strength is a measure of how tolerant a pipe is to disturbance during handling, installation and maintenance.

The Ministry Standard Specifications require the following values:

<u>MOTH Standard Spec.</u>	<u>Sect. 317 (PE)</u>	<u>Sect. 318 (PVC)</u>
Pipe Stiffness, kPa	210.	320.
Impact Strength, joules	36.8	93. to 250. (dep. on diam.)

PE pipe is currently available in one series of variable stiffness, the 400 mm diameter pipe with 250 kPa, the rest being between 120 and 195 kPa. PVC pipe is available in two stiffness grades: 70 kPa (10psi) and 320 kPa (46 psi).

For each pipe stiffness, the range of allowable depth of cover is limited by: live load for minimum depth; and dead load for maximum depth. The stiffer the pipe, the greater is the range. It is important that the design of each installation be based on pipe stiffness, and the range of allowable depth of cover be given. In no case should the cover be less than 1.0 metre.

For general use with normal handling and installation methods, the Ministry prefers to use PVC drainage pipe; its greater impact strength and stiffness provide greater resistance to damage, and a greater range of allowable depth.

#### D. PRECAUTIONS

Storage: Some batches of PVC pipe may not have a UV protection chemical added during manufacturing. Such pipe should be covered if stored in the open. The designer should consider special protective measures for untreated pipe installed in exposed locations. It must be remembered that swabbing the pipe with asphalt at the entry and exit will alter the hydraulic capacity of the pipe, and that the asphalt is easily eroded.

Handling: Follow the manufacturer's instructions. Chains or cables must not be used; nylon strap slings are recommended. Extra caution is needed to avoid impact during cold weather, especially below minus 18 deg C (zero deg F).

Field cutting and joining: Use the manufacturer's recommended methods, equipment, fittings, adaptors, gaskets and lubricant.

**Installation:** Follow recommended procedures and dimensions for trench shoring, preparing foundation and pipe bedding, and in the selection and compaction of haunching and backfill material. Manufacturers' handbooks give detailed instructions.

**Maintenance:** Arrange so that damage to the plastic pipe by backhoe, gradall, or other machinery is avoided. Design must provide for protection of exposed pipe ends, such as concrete end walls. Sandbag end walls may be sufficient for temporary installations.

**REFERENCES:**

Standard Specifications for Highway Construction, Section 317 (PE)  
Standard Specifications for Highway Construction, Section 318 (PVC)  
Plastic Materials: ASTM D1248 (PE) and ASTM D1784 (PVC)  
Pipe Dimensions: ASTM D794 and ASTM D3034  
Pipe Stiffness: ASTM D2412  
Uni-Bell PVC Pipe Association: handbook and other publications  
The Big 'O' Drain Tile Company: handbook and bibliography

**SOME CURRENT SUPPLIERS:**

PVC- "Ultra-Rib" from Scepter Manufacturing Co. Ltd., 1388 Derwent Way,  
Annacis Business Park, New Westminster, B.C. V3M 6C4  
Contact: Mr. C.J. (Chris) Hiebert Tel: 525-8621 FAX: 525-8607

- "Perma-Loc" from Canon West Pipe, 20460 Duncan Way, Langley, B.C.  
V3A 7A3 Tel: 534-8631 FAX: 534-7616 WATTS: 663-5864  
Contact: Mr. D.H. (Dave) Thiessen

- "Flex-Lox Saniflex" from Flex-Lox Pipe Limited, P.O. Box 400,  
Abbotsford, B.C. V2S 5Z5 Tel: 852-4242 FAX: 852-6298  
Contact: Mr. Bob Drummond

PE - "Big 'O'" from The Big 'O' Drain Tile Company Limited, P.O. Box  
203, 45785 Luckakuck Way, Chilliwack, B.C. V2P 6J1  
Contact: Mr. Barry Nybo Tel: 858-7281 Telex: 043 61514

**MOTH CONTACTS:**

Highway Engineering: Wayne Bobroske, Senior Design Advisor,  
Tel: 387-7770 FAX: 387-0091  
Materials Lab: Steve Geddes, Senior Geotechnical Laboratory Scientist,  
Tel: 387-4360 FAX: 356-2012



E.A. Lund, P. Eng.  
Chief Highway Engineer

c.c. A.D.M. Highways Operations  
c.c. A.D.M. Planning & Major Projects  
c.c. All Regional Directors