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GUIDE FOR LAYING LINING OF CANALS WITH HOT BITUMEN OR BITUMINOUS FELTS

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(*Continued on page* 2)

(*Continued from page* 1)

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0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 28 February 1979, after the draft finalized by the Canals and Canal Linings Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 For conserving water, preventing water logging and many other purposes, canal systems are being provided with various types of linings. Use of hot bitumen or bituminous felts for canal lining is one of the alternatives.

0.3 Bitumen, a bye-product of petroleum industry and well known for its binding and water-proofing qualities is being increasingly used in lining work all over the world. Its main advantage over the conventional materials is that no water is required during construction and no curing is necessary. The structure can be put to use immediately after the construction is over.

0.4 Bitumen lining consists of spraying a layer of bitumen at high temperature on the prepared subgrade. It is protected from damages due to animal traffic and weathering by giving suitable covering of soil (*see* Fig. 1).

0.5 At places where spraying *in-situ* is costlier and time consuming, bitumen felts of adequate thickness and durability are used as the lining material. These felts are also given a suitable covering of soil to avoid damages (*see* Fig. 2).

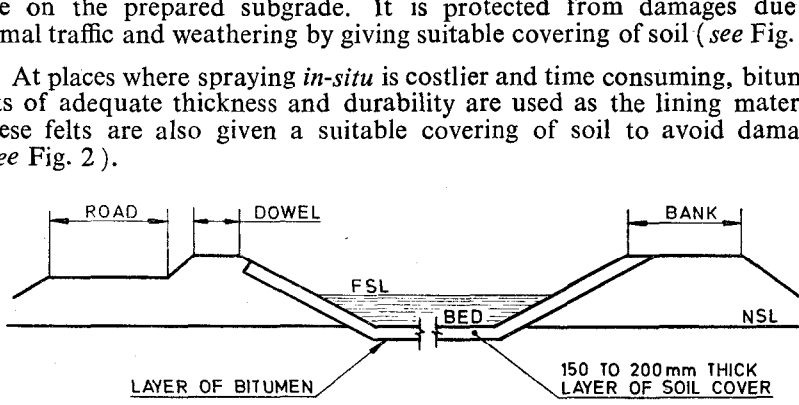

FIG. 1 BITUMEN LINING

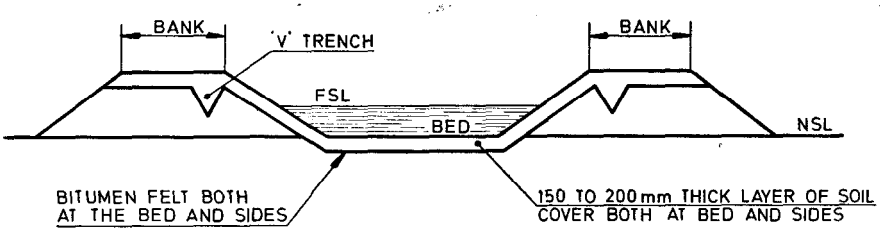

FIG. 2 BITUMEN FELT LINING

1. SCOPE

1.1 This standard provides guidelines for laying lining of canals with: (a) hot bitumen, and (b) bitumen felts.

1.2 These guidelines apply to minor distributaries and minors.

2. TERMINOLOGY

2.0 For the purpose of this standard the following definitions shall apply:

2.1 Lip Cutting — It is the extra width provided at the inner face of the bank under compaction to allow for any lapses in compaction due to the inability of compacting rollers to cover the edge of the bank.

2.2 Made Up Ground — Excavated soil or rock deposited for the purpose of filling a depression or raising a site above natural level of the ground.

2.3 Subgrade — The surface specially prepared against which lining shall be laid.

2.4 Bitumen — It is a non-crystalline solid or viscous material having adhesive properties, derived from petroleum, either by natural or refinery processes and substantially soluble in carbon disulphide.

2.5 Membrane — Any functionally continuous flexible structure of bitumen or prefabricated impregnated bituminous felts suitably reinforced.

2.6 Primer — Usually a medium curing cut back bitumen or road tar of sufficiently low viscosity when used as an initial application to improve adhesion.

3. INFORMATION REQUIRED

3.1 The information on the following points shall be required before taking up the work of lining:

a) *Nature of Soil* — The nature of the soil influences infiltration, cohesion, permeability and water holding capacity, etc. It should be known whether the soil is sandy, loam, silt, silty clay.

b) *Position of Subsoil Water Level* — The position of subsoil water level be observed before taking up the work of lining. The lining technique to be adopted depends upon the position of water table.

c) *Cross-Section of the Canal* — The bed width, depth, bed slope are required to be known from the L-section of the canal to be lined.

4. BITUMEN AS LINING MATERIAL

4.1 The bitumen used shall conform to S 35 of IS:73-1961* or 85/25 specified in IS:702-1961†.

4.2 Bitumen Felts — The bitumen felts used shall be as per Type 2 Grade II of IS:7193-1974‡.

5. PREPARATION OF SUBGRADE

5.1 Cutting Reaches — The subgrade should be suitably shaped to the required cross-section before applying the lining.

5.2 Filling Reaches — In the case of filling reaches the compaction and lip cutting should be suitably planned to consider the position of bitumen lining so that the channel attains the designed cross-section after the protective cover is laid over the asphaltic lining.

5.3 Compaction of the Soil — The compaction of the subgrade is to be done at optimum moisture content in accordance with IS:2720 (Part II)-1973§. The subgrade should be allowed to dry before the lining is applied.

5.4 Side Slope — The side slope should be flatter than the angle of repose. For normal soils, the slope could be $1\frac{1}{2}:1$. For sandy soils the section should have a slope of 2:1 or flatter.

5.5 Weed Growth — For preventing weed growth, it will be advisable to sterilize the soil by use of sodium chlorate or sodium carbonate which may be sprayed as a 5 percent solution in water at the rate of 2 l/m^2 of the subgrade. The tree roots and any other sharp projections are also removed before laying the lining.

*Specification for paving bitumen (*revised*).
†Specification for industrial bitumen (*revised*).
‡Specification for glass fibre base coal tar pitch and bitumen felts.
§Methods of test for soils; Part II Determination of water content (*second revision*).

6. LINING TECHNIQUE

6.1 Bitumen Lining — Crude oil or emulsified bitumen is sprayed over the subgrade at the rate of 0·5 l/m^2. A water resistant film is formed due to surface tension which results in a good bond between the bitumen and the subgrade. Bitumen of grade mentioned in **4.2** is heated in heating pans up to a temperature of 175°C. The hot bitumen is spread on the sides first and then on the bed with a spraying equipment. Lining thickness varying from 3 to 6 mm (3·25 to 6·5 kg/m^2) is laid. The membrane so formed is covered with suitable protective cover of soil to protect it from damage.

6.2 The following procedure is adopted for using bitumen felts:

a) The prefabricated asphaltic membranes are laid with an overlapping of 100 mm at the sides and ends. The overlap should be provided in the direction of the flow of water;

b) The overlapping joint is sealed with hot bitumen (grade 90/15 or 115/15) at the rate of 0·5 kg/m^2 or suitable cold adhesive; and

c) Suitable protective covering is then laid over the membrane.

7. PROTECTIVE COVER

7.1 Soil Cover — The bitumen lining is given a covering of soil varying from 150 to 200 mm in thickness which is quite sufficient.

8. PRECAUTIONS

8.1 While heating the bitumen it should be ensured that the material is not overheated. It should be properly stirred for uniform heating. Nobody should be allowed to walk on the sprayed bitumen to avoid damage to the lining. In the case of felts no sharp tools should damage the lining.