HIGHWAYS DEPARTMENT

GUIDANCE NOTES ON UNREINFORCED CONCRETE SLABS FOR RIGID PAVEMENT

Research & Development Division

RD/GN/013
September 1990

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Prepared by :

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Unreinforced Concrete Slabs for Rigid Pavement

1. Introduction

Unreinforced concrete slabs with transverse contraction joints have been used in other countries over recent years with considerable success. However, only a limited area of unreinforced concrete slabs have been used in Hong Kong. The purpose of these guidance notes is to promote the trial use of unreinforced concrete slabs to evaluate any construction problem that might be encountered and to monitor the long term performance of the slabs before a decision is made to adopt its mandatory use.

2. Reinforced Concrete Slabs

2.1 Reinforced concrete road slab construction has been used for a number of years in Hong Kong. Steel reinforcement is introduced to control cracking, which would otherwise occur as a result of tensile stresses developing in the slabs due to frictional forces between the slabs and the subgrade or sub-base. These frictional forces develop as a result of contraction of the slabs between transverse joints when the slabs are curing and subsequently due to changes in temperature and/or humidity. The most commonly used reinforcing steel is BS 4483 ref. C636, which permits the use of wide joint spacings of up to 20 metres. At such joint spacing, movements at expansion and contraction joints of several millimetres can occur; consequently, a wide sealing groove to accommodate a joint seal that is capable of such movement is required. The drawback with this construction is the frequent occurrence of defects at joints such as loss of sealant and joint spalling. This can be followed by step faulting of the slabs and cracking near the joints, which have significant maintenance implications. Loss of sealant at joints is due to :

(i) loss of adhesion between the sealant and the concrete,

(ii) fracture or disintegration of the sealant due to ageing or fatigue,

(iii) extrusion of the sealant from under-designed sealing grooves,

(iv) poor initial preparation and construction technique,

(v) improper sealant selection or installation.

2.2 The joint defects described above increase our maintenance costs and cause riding discomfort to road users; therefore, unreinforced concrete slabs with narrow unsealed contraction joints could provide a solution avoiding the above joint defects while enhancing riding quality.

3. Unreinforced Concrete Slabs

3.1 Concrete carriageway shall be constructed in accordance with Section 10 of the Mandatory Particular Specification in Civil Engineering Manual Volume II Part 2 Chapter 5 Appendix 7. Road Note 1 shall be used for the pavement thickness design of unreinforced concrete slabs. In order to eliminate the use of mesh reinforcement while avoiding transverse cracking, closely spaced contraction joints must be provided. These allow the slabs to warp. In addition, high temperature stresses are avoided and the slabs can contract freely preventing high frictional resistance stresses in the subgrade or sub-base. Maximum spacing and detail of contraction joint shall conform to HyD Standard Drawing H1002, 1003/1 & 1004. Transverse expansion joints shall be provided at about 100 metre intervals and at junctions. For pavement wider than 4.5m, longitudinal joint conforming to HyD Standard Drawing H1003/2 shall be provided between the traffic lanes. For details of unreinforced concrete slabs around manholes & utility pits, see sketches GN/013/01 & 02.

3.2 Benefits from using unreinforced concrete slabs are lower construction cost with the saving on mesh reinforcement and the potential for continuous pouring, although there will be additional costs associated with the closer spacing of joints. In addition, as the sawn groove contraction joint is narrow and joint sealant is not required, the contraction joints of unreinforced concrete slabs should be relatively maintenance free. For areas with a lot of ironware, unreinforced concrete slab with closely spaced joints are more appropriate.

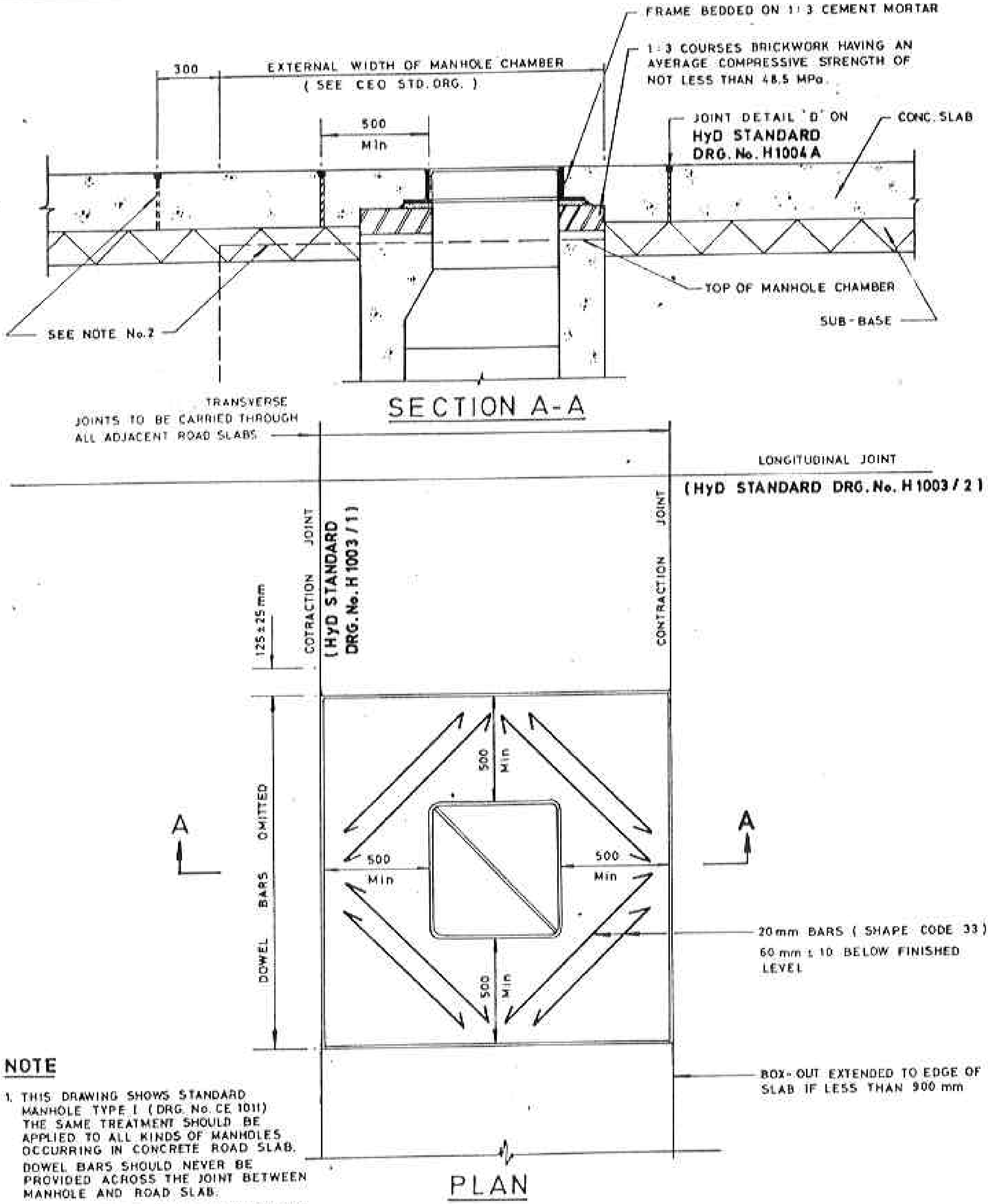
3.3 For single lane minor road reconstruction works such as reinstatement of trench and replacement of a short section of existing reinforced concrete slab (100 metres or less), the structure of the reconstructed slabs shall conform with that of the adjacent slabs.

4. Choice of Sites

From now on, the type of concrete slabs to be constructed under Subheads 6004TX, 6006TX and 6007TX would be recommended by the Research and Development (R&D) Division when the item is submitted for technical vetting. Problems encountered in unreinforced concrete slab construction should be brought to the attention of the R&D Division. When sufficient research data on the performance of unreinforced concrete slabs in Hong Kong are collected, the use of unreinforced concrete slabs will be fully evaluated and a recommendation to the Director will then be made by the R&D Division on whether the use of unreinforced concrete slabs should be made mandatory for all rigid pavement.

5. Record of Construction

Details of unreinforced concrete slabs constructed including location plan, panelling layout, typical secions and dates of construction should be submitted to R&D Division. R&D Division will carry out the monitoring of the performance of the constructed unreinforced concrete slabs.



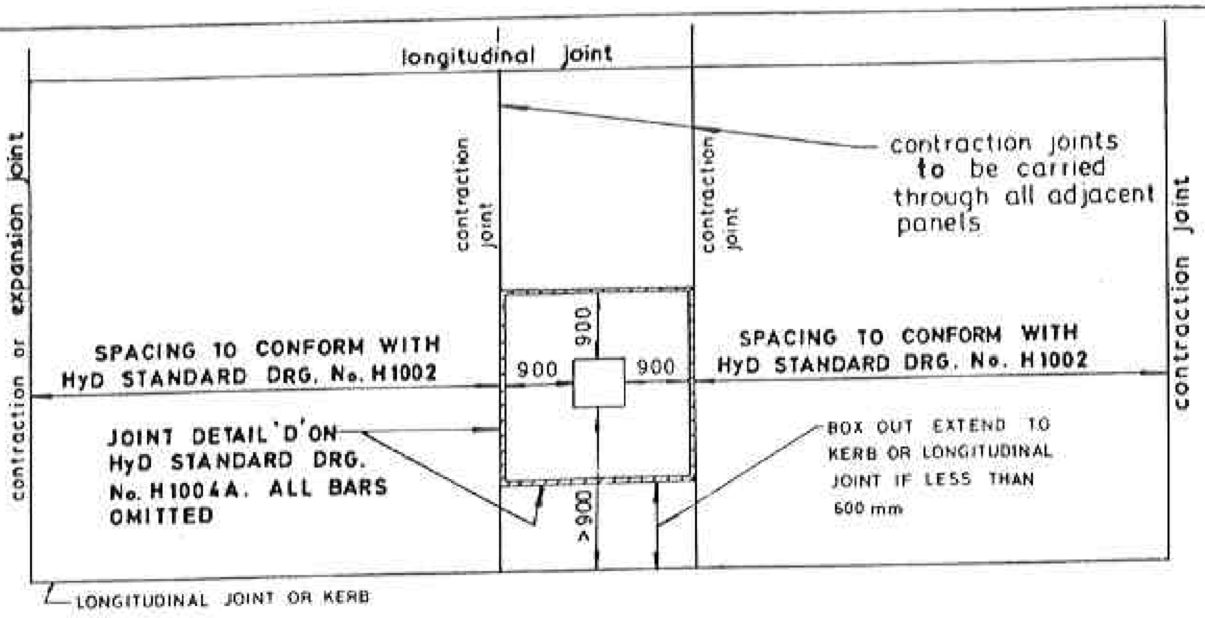
NOTE

1. THIS DRAWING SHOWS STANDARD MANHOLE TYPE I (DRG. No. CE 1011) THE SAME TREATMENT SHOULD BE APPLIED TO ALL KINDS OF MANHOLES OCCURRING IN CONCRETE ROAD SLAB. DOWEL BARS SHOULD NEVER BE PROVIDED ACROSS THE JOINT BETWEEN MANHOLE AND ROAD SLAB.
2. BOX-OUT TO BE ENLARGED WHEN TOP OF MANHOLE CHAMBER IS AT OR ABOVE FORMATION LEVEL. WIDTH OF MANHOLE CHAMBER DEPENDS ON THE TYPE OF MANHOLE TO BE USED. REFER TO CEO STANDARD DRAWING FOR DIMENSIONS.

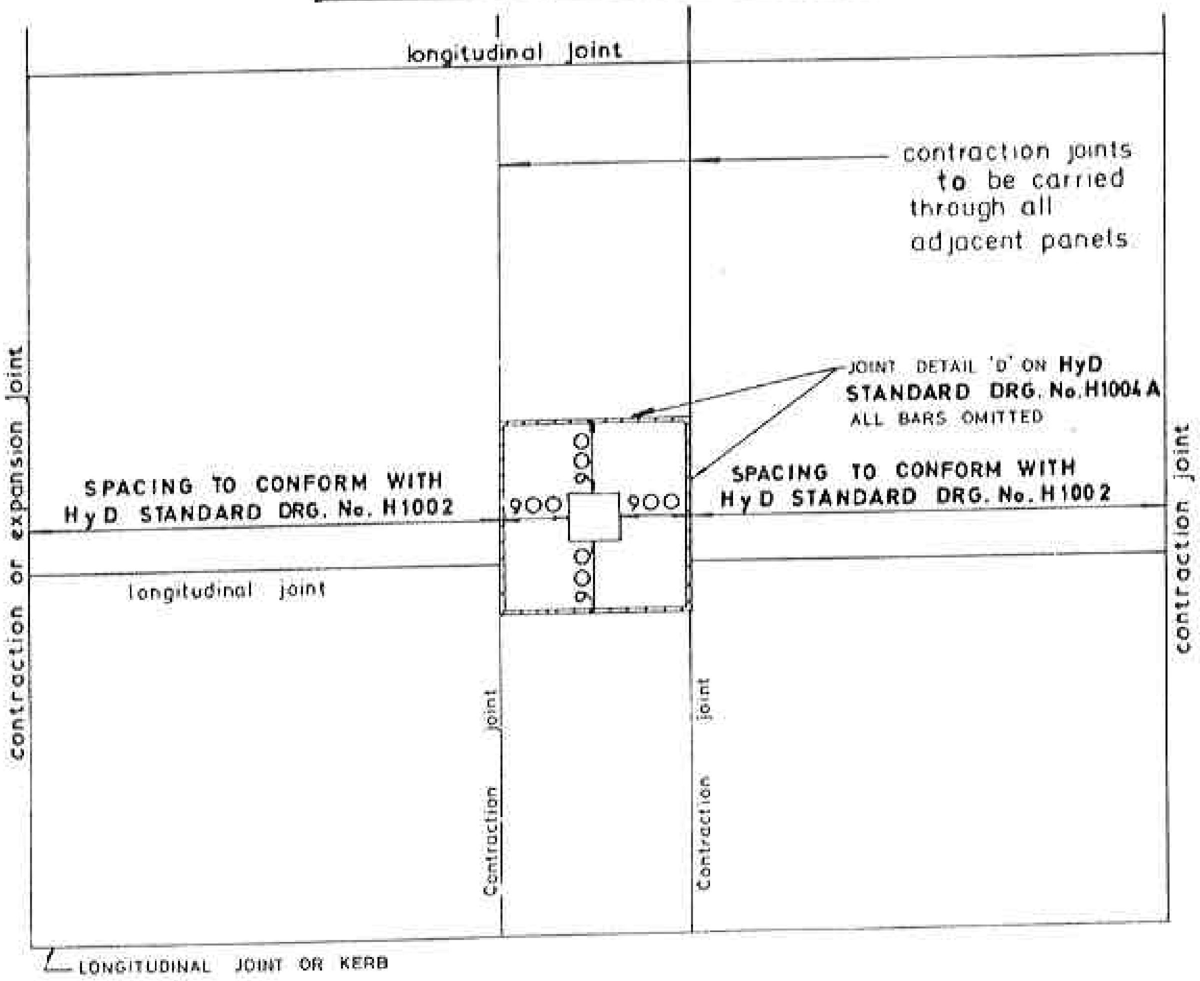
DETAIL OF CONC. ROAD SLAB AROUND MANHOLE

ALL DIMENSIONS ARE IN MILLIMETRES

SKETCH GN/013/01



CASE I : UTILITY PIT COVER



CASE II : UTILITY PIT COVER

NOTES :

1. ALL DIMENSIONS ARE IN MILLIMETRES
2. SEE HyD STANDARD DRG. No. H3004 / 1 & 2 FOR BOX OUT DETAILS FOR GULLIES.

DETAIL OF REPLACEABLE SLAB AROUND UTILITY PITS

SKETCH GN / 013 / 02