

**RECOMMENDED PRACTICE
FOR
TOOLS, EQUIPMENT
AND
APPLIANCES
FOR
CONCRETE PAVEMENT
CONSTRUCTION**



**THE INDIAN ROADS CONGRESS
1986**



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RECOMMENDED PRACTICE FOR TOOLS, EQUIPMENT AND APPLIANCES FOR CONCRETE PAVEMENT CONSTRUCTION

1. INTRODUCTION

1.1. Even though greater mechanisation of concrete pavement construction has a lot to commend itself both from the point of quality and output of construction, in view of peculiar socio-economic infra-structure of our country most of our constructions are bound to be carried out with a minimum of mechanisation for quite some time. In addition to small mechanised units, semi-mechanised concrete pavement construction requires a number of small, though none-the-less special, tools and appliances for various manual phases. While comparatively larger units such as those for batching of concrete materials, mixing and compaction of concrete, etc., are manufactured commercially in the country and standard specifications for these exist to ensure their performance, no such standards are available for the smaller tools and appliances. They are also not commercially available and have normally to be got fabricated by the field engineer for the particular project.

1.2. In the absence of any guidelines in respect of these smaller tools and appliances, the field engineers have been experiencing difficulties when executing concrete paving jobs. It has, therefore, been felt necessary to provide some basis for the fabrication of such tools and appliances in keeping with the performance requirements, by way of three dimensional sketches and brief description of the essential features. For plants fabricated commercially, reference has been drawn to the relevant standards.

1.3. This recommended practice was prepared by the Cement Concrete Road Surfacing Committee (personnel given below). It was then processed and approved by the Specifications and Standards Committee in their meeting held on the 18th and 19th November 1971. Later, it was finally approved by the Executive Committee in their meeting held on the 26th and 27th April 1972 and by the Council in their 78th meeting held at Nainital on the 10th July, 1972.

This recommended practice is closely allied to IRC : 15-1970* and should be used in conjunction with that standard.

* 'Standard Specifications and Code of Practice for Construction of Concrete Roads'

PERSONNEL OF THE CEMENT CONCRETE ROAD SURFACING COMMITTEE

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2. TOOLS, EQUIPMENT AD APPLIANCES

2.1. A list of tools, plants and appliances required for semi-mechanised concrete pavement construction as practised in this country, is given below. The list is arranged according to different phases of work, starting from subgrade compaction to the sealing of joints.

Phase 1. Subgrade & Sub-Base Compaction

- (i) Compaction equipment (three wheeled or tandem roller, pneumatic roller, vibratory roller or sheep's-foot roller)
- (ii) Watering devices (water-lorries, Bhistics (water carriers) or watering cans)

Phase 2. Fixing Formwork & Preparing the Sub-Base for Concreting

- (i) Formwork and iron stakes
- (ii) Bulk-head
- (iii) Scratch templates or strike boards
- (iv) Pick axes, shovels & spades

Phase 3. Concrete Manufacture

- (i) Shovels and spades
- (ii) Sieving screens
- (iii) Weigh batcher/Aggregate measuring boxes
- (iv) Water pump
- (v) Water measures
- (vi) Concrete mixer

Phase 4. Transportation, Laying and Compaction of Concrete

- (i) Wheel barrows/Iron pans
- (ii) Wooden bridges
- (iii) Spades

- (iv) Concrete Vibrators : Internal and Screed type
- (v) Wooden hand tamper

Phase 5. Finishing Operations : Surface & Joints

- (i) Wooden bridges
- (ii) Float
- (iii) Three metre long straight edge
- (iv) Mild steel sections for making joint grooves
- (v) Edging Tools : edging tool & double-edging tool
- (vi) Canvas belt
- (vii) Long handled broom
- (viii) Graduated wedge gauge & straight edge
- (ix) Diamond cutter (for making saw-cut joints)
- (x) Grinder (for grinding local high spots)

Phase 6. Curing

- (i) Hessian cloth or polyethylene sheeting

Phase 7. Cleaning & Sealing of Joints

- (i) Iron raker
- (ii) Coir brush
- (iii) Cycle pump
- (iv) Kerosene stove
- (v) Thermometer
- (vi) Transferring pot
- (vii) Painter brush
- (viii) Pouring kettle
- (ix) Scraper

2.2. Plate I illustrates the various tools, plants and appliances arranged on a flow chart of concrete pavement construction in accordance with the phase of construction in which required.

2.3. Apart from the tools, equipment and appliances required for construction, as mentioned in para 2.1, it will be necessary to set-up a well-equipped field laboratory for regularly carrying out quality control and acceptance checks. Equipments required for such a laboratory are listed in *Annexure 1*.

3. MATERIALS FOR TOOLS, EQUIPMENT AND APPLIANCES

Materials used in the manufacture of tools, equipment and appliances should conform to the relevant Indian Standards, whenever such standards exist. Standards for the most frequently employed materials, viz., mild steel, wood and wood screws are given below :

- (i) IS : 3629-1966 Specifications for Structural Timber in Building.

- (ii) IS : 226-1969 Specifications for Structural Steel (Standard Quality).
- (iii) IS : 808-1964 Specifications for Rolled Steel Beam, Channel and Angle Section.
- (iv) IS : 3954-1966 Specifications for Hot Rolled Steel Channel Section for General Engineering Purposes.
- (v) IS : 451-1961 Specifications for Wood Screws.
- (vi) IS : 1173-1967 Specifications for Hot Rolled and Slit Steel Tee Bars.

Standards for other materials, needed only for particular tools, are indicated under description of the concerned tool. Where no Standards are available, the materials used should be of approved quality to ensure satisfactory performance.

4. OUTLINE SPECIFICATIONS FOR TOOLS, EQUIPMENT AND APPLIANCES

4.1. Phase 1 : Subgrade and Sub-base Compaction

4.1.1. Compaction equipment

Road rollers for compaction of subgrades and sub-bases should be 6-8 or 8-10 tonne three wheel or tandem smooth-wheel rollers (conforming to IS : 5502-1969*), vibratory rollers (conforming to IS : 5500-1969**), sheep's-foot rollers (conforming to IS : 4616-1968%), or pneumatic-tyred rollers (conforming to IS : 5501-1969@) suitable for the materials to be handled.

4.1.2. Watering equipment

Water-lorries of suitable capacity, with appropriate water-sprinkling attachment at the rear ensuring uniform distribution of water over the entire width and adjustment of the rate of flow to the desired level, should be used for watering. Where such water-lorries are not available, ordinary watering-cans such as those conforming to IS: 4065-1967⁺ about 25 kg capacity may be used for the purpose.

* Standard Specifications for Smooth-Wheeled Diesel Road Rollers

** Standard Specifications for Vibratory Rollers

% Standard Specifications for Sheep's-foot Rollers

@ Standard Specifications for Pneumatic-tyred Rollers

+ Standard Specifications for Watering Cans, or Bhisties (Water-carriers)

4.2. Phase 2 : Fixing Formwork and Preparing Sub-base for Concreting

4.2.1. Formwork and iron stakes

The formwork should consist of mild steel channels for straight lengths and wooden sections reinforced with mild steel angles for curved portions. Manufactured sections are also available in the market and may be used if they meet the construction requirements. The general requirements for formwork as given in IRC : 15-1970 should be complied with. The details of mild steel stakes for fixing mild steel channel and wooden formwork are given in Fig. 1.

4.2.2. Bulk head

The bulk-head, used for closing the construction at an expansion joint, or for making an emergency construction joint in case of machinery breakdowns, should consist of a hardwood beam with hole drilled along its centre line to accommodate the dowel bars if provided, and with its top and bottom faces conforming to the cross-profile of the finished pavement and sub-base course respectively. Sometimes a two-piece bulk-head is preferred from the point of construction convenience. Fig. 2 shows a typical bulk-head.

In case of dowelled constructions, the bulkheads should be used in pairs, one being positioned at the joint proper, and the second a little further, to keep the projecting part of the dowels in proper alignment.

4.2.3. Scratch template or strike board

The scratch template used for checking the trueness of the subgrade or sub-base surface should consist of a hard wood board fitted with handles, with its lower face conforming to the desired cross profile or camber and having steel nails fixed thereto at regular intervals. A typical scratch template for slabs not exceeding 4 m in width is shown in Fig. 3.

4.2.4. Pick-axe, powrah, spade and shovel

Pick-axes, powrahs, spades and shovels used for correcting low and high spots in the subgrade, granular sub-base or concrete should conform to the relevant Indian Standards, viz., IS: 273-1961*, IS:274 (Part I)—1966** and IS : 1759-1961†. The wooden handles for picks

* Specifications for Picks and Beaters

** Specifications for General Purpose Shovels

† Specifications for Pówráhs

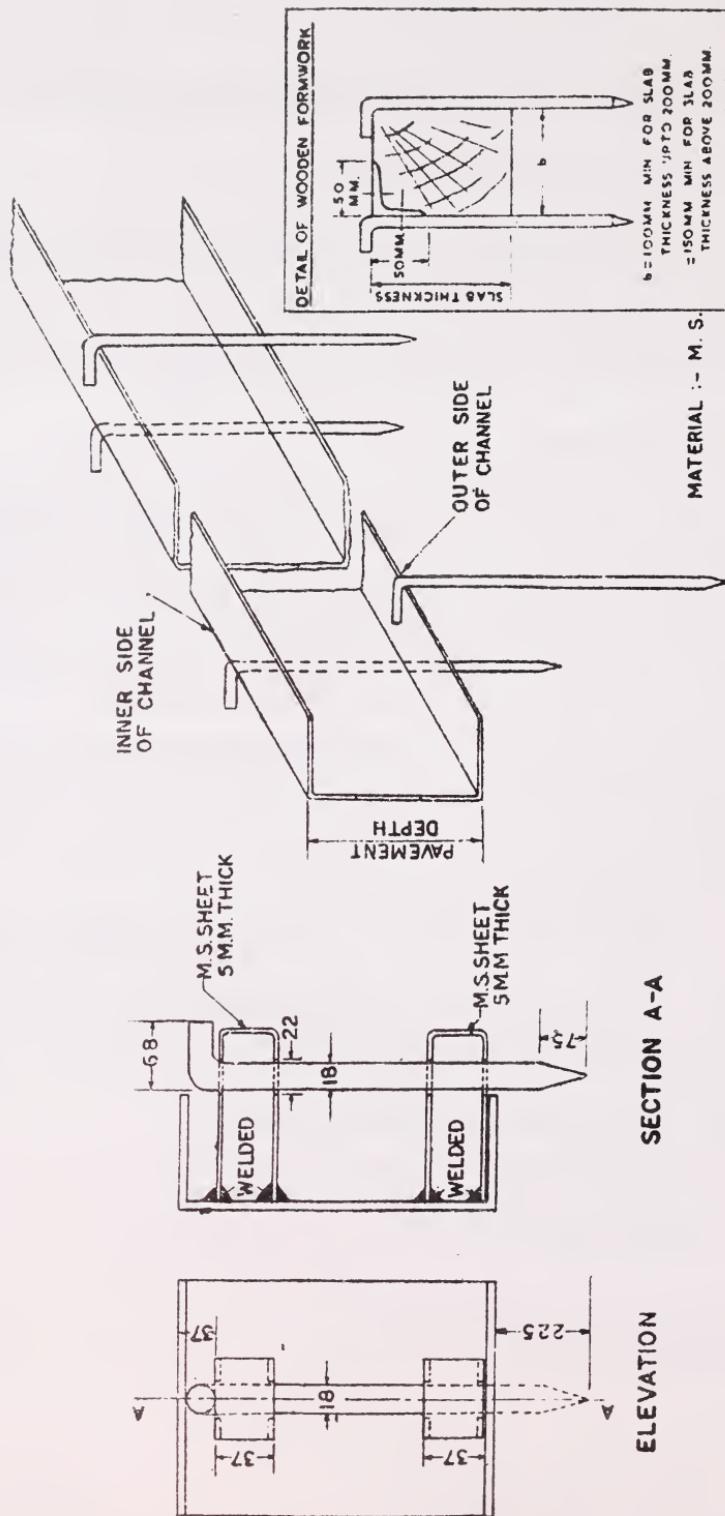


Fig. 1. Iron stake and steel channel

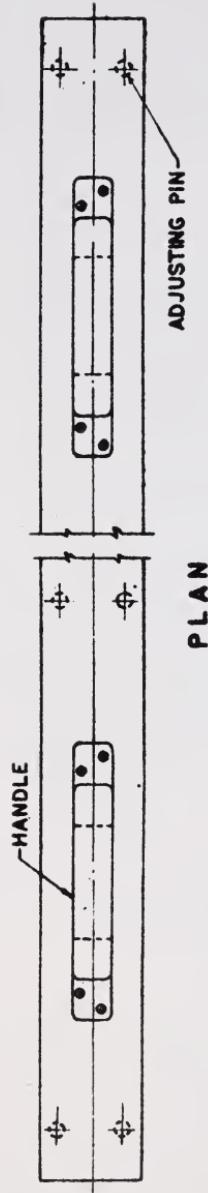
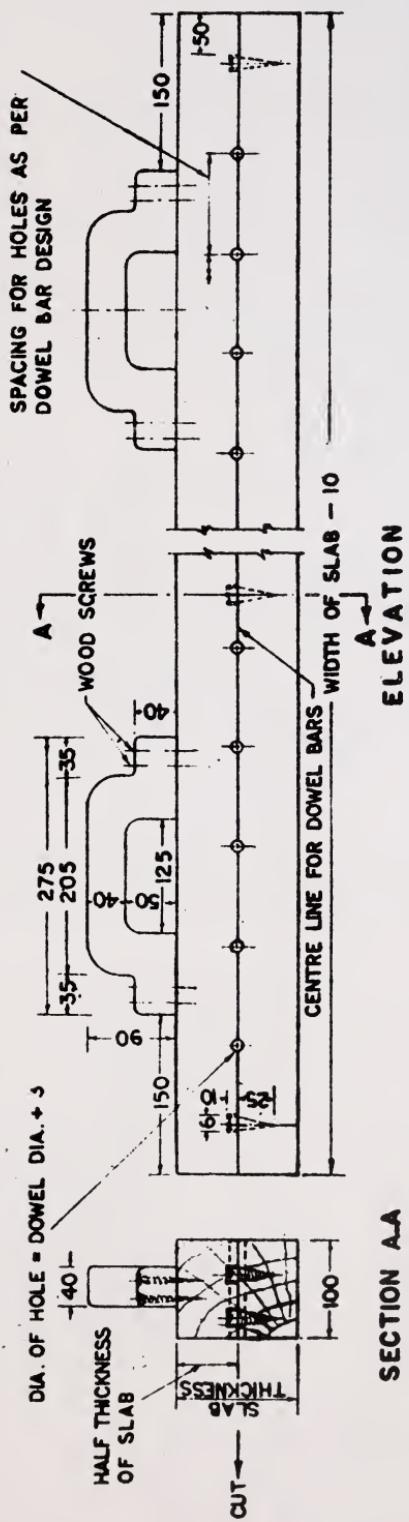
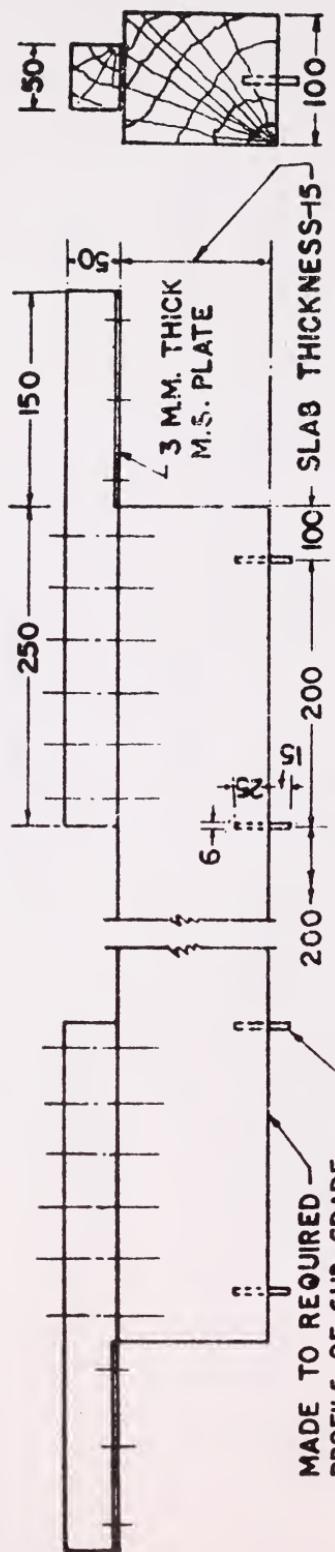


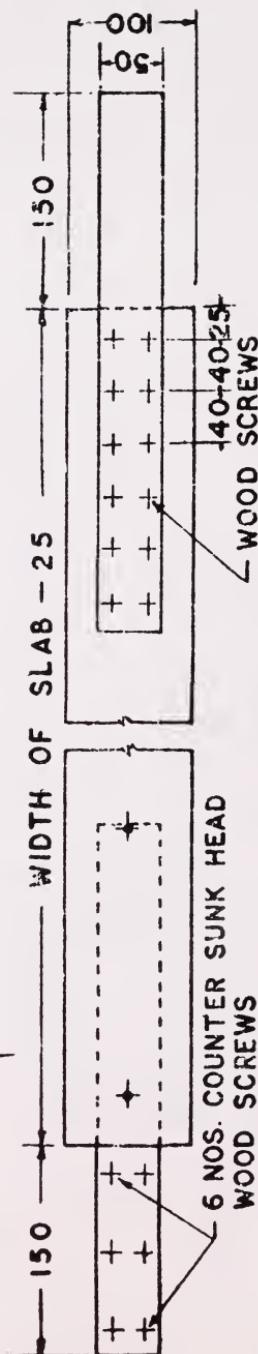
Fig. 2. Wooden bulk head

MATERIAL:—Seasoned teak or sal wood

Note:—1. All dimensions are in millimetres
2. Provision of handles is optional



SIDE VIEW
ELEVATION
NAILS PROJECTION IS M.M.—
BELOW THE BOTTOM OF
TEMPLATE



HALF TOP PLAN HALF BOTTOM PLAN

MATERIAL :— Seasoned sal or déodar wood

The width of 100 mm shown is for sal wood

For deodorar it should be increased to 150 mm

Note :—All dimensions are in millimetres

Fig. 3. Scratch template (or strike board)

should conform to IS: 2892-1964†, for powrahs to IS: 5942: 1970††, and for shovels to IS: 2897-1965@. The spades may be of any standard make.

4.3. Phase 3 : Concrete Manufacture

4.3.1. Sieving screens

The sieving screens for aggregates should consist of hard-wood or steel frame, to which the square-mesh wire cloth of appropriate mesh size, conforming to the IS:2405-1963# is fixed. The screens should be provided with a stand to support them in position during use. The drawing of a typical sieving screen is shown in Fig. 4.

4.3.2. Weigh batcher (for weigh batching)

The weigh-batchers for proportioning concrete aggregates should conform to IS:2722-1964*.

4.3.3. Aggregate measuring boxes (for volume batching)

In case volume batching is permitted for aggregates, the aggregate measuring boxes should consist of deep, narrow, wooden boxes fixed with handles on either side for carriage. Some typical boxes of different capacities are given in Fig. 5. It should be ensured that the sides and bottoms of the measuring boxes retain their shape during use and do not bulge when loaded. If needed, wooden stiffening battens should be used at the sides or bottoms to ensure this.

4.3.4. Water pumps

Water pumps, if required for pumping water for concrete mixing and curing operations, may be of centrifugal type conforming to IS: 1520-1960**, or any other suitable pump of approved quality and make.

4.3.5. Water measures

For the purpose of correct gauging of the mixing water, fluid measures of capacity 6 to 15 litre may be used. Where concrete mixers are fitted with water measures, it is preferable to use them.

Alternatively, empty five-litre, two-litre and one-litre tins may be used as water measures. In the last case it should be ensured that the tins are not bent or deformed and they deliver correct

† Specifications for Wooden Handles for Picks and Beaters

†† Specifications for Wooden Handles for Powrahs

@ Specifications for Wooden Handles for Shovels

Specifications for Wire Cloth and Perforated Plates for Industrial Sieves

* Specifications for Portable Swing Weigh Batchers for Concrete (Single and Double Bucket Type)

** Specifications for Horizontal Centrifugal Pumps for Clear Cold Fresh Water

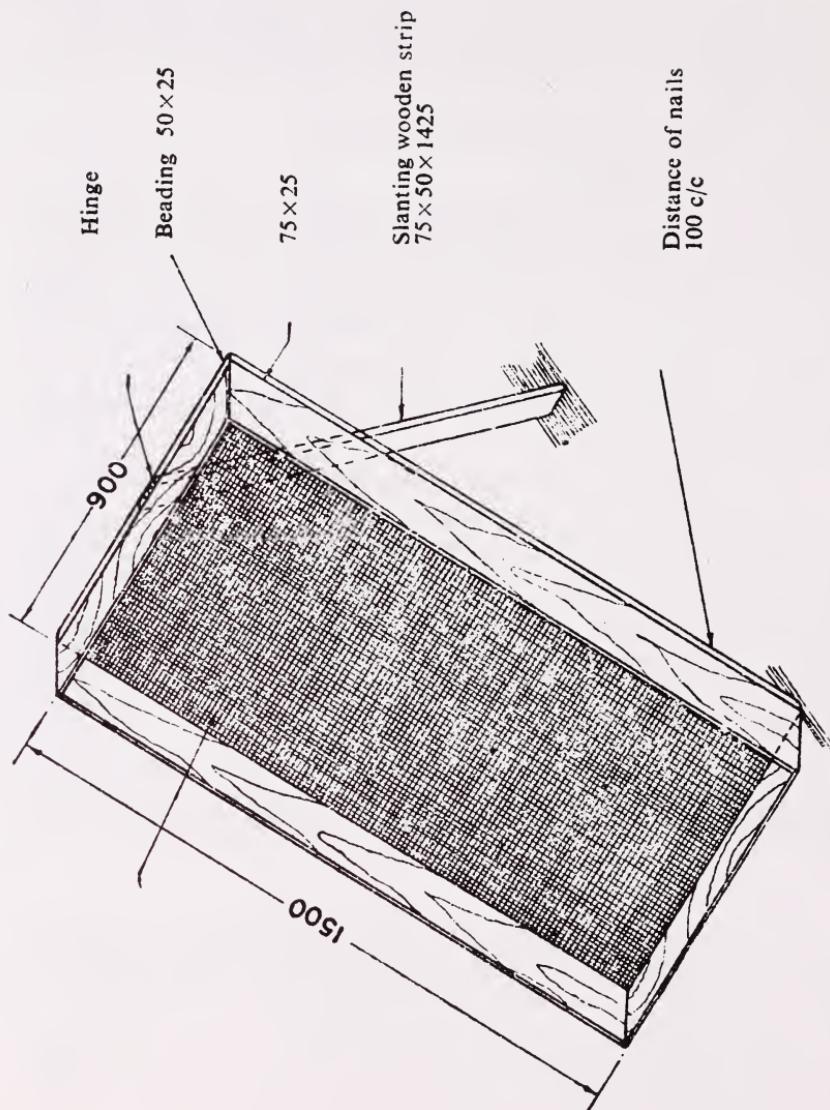


Fig. 4. Screen

MATERIAL :—Seasoned teak or sal wood

*OTE :—Dimensions are in millimetres

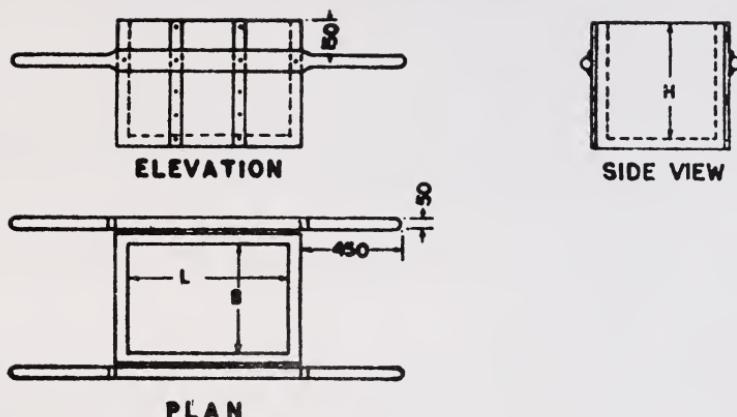


Fig. 5. Wooden measuring boxes

MATERIAL :— Deodar or teak wood

NOTE :—

1. All dimensions are in millimetres
2. Thickness of planks = 25 mm

Box capacity	Approximate capacity in F.P.S. units	Length in metres	Breadth in metres	Height in metres
0.015 m ³	1/2 cubic foot	(L) 0.25	(B) 0.20	(H) 0.30
0.030 m ³	1 cubic foot	0.30	0.25	0.40
0.0375 m ³	1½ cubic feet	0.30	0.25	0.50
0.06 m ³	2 cubic feet	0.40	0.20	0.50
0.075 m ³	2½ cubic feet	0.50	0.30	0.50

volume of water to the nearest 0.05 litre. The tins should be provided with suitable handles.

4.3.6. Concrete mixer

The concrete mixers should be of the required capacity and conform to IS: 1791-1968*, when tested in accordance with IS: 4634-1968**. Mixers having rated capacity less than 200 litres of mixed concrete per batch should not be used.

4.4. Phase 4 : Transportation, Laying and Compaction of Concrete

4.4.1. Wheel barrow

Wheel barrows (with single or two wheels) when used to transport concrete over short distances from the mixer to the position of placement should conform to IS: 2431-1963† and IS: 4184-1967†† respectively.

4.4.2. Wooden bridges

Wooden bridges, used for spanning the slabs to enable the masons to carry out surface finishing operations on the compacted concrete, or to enable placement of concrete in case of reinforced concrete pavements without disturbing the reinforcement mesh, should conform to the dimensions shown in Fig. 6, for a limiting slab width of 4m. For finishing operations alone, a lighter bridge (limiting slab width 4 m) as shown in Fig. 7, may be adopted. For larger slab width, suitable design should be prepared for each case.

4.4.3. Concrete vibrators

The concrete vibrators of immersion and screed board types for compaction of concrete at site should conform to the IS:2505-1968% and IS:2506—1964@ respectively. In the former case petrol-driven engine could also be permitted.

4.4.4. Hand tamper board

The hand tamper, used in lieu of screed board vibrator for compacting concrete for minor jobs, or as an emergency stop-gap

* Specifications for Batch Type Concrete Mixers

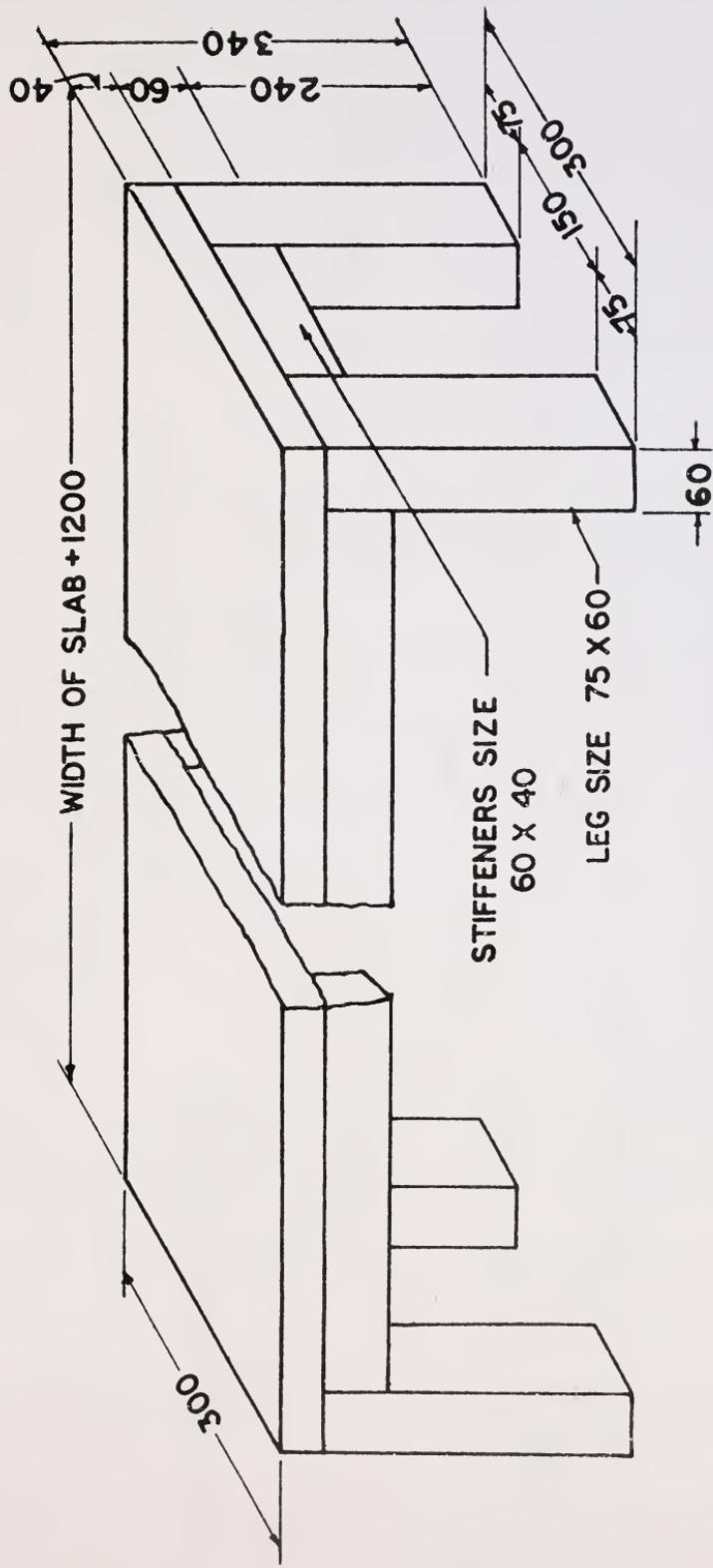
** Method of Test and Performance for Batch Type Concrete Mixers

† Specifications for Steel Wheel Barrows (single wheel type)

†† Specifications for Steel Wheel Barrows (with two wheels)

% Specifications for Concrete Vibrators-Immersion Type (meant for electrically driven ones only)

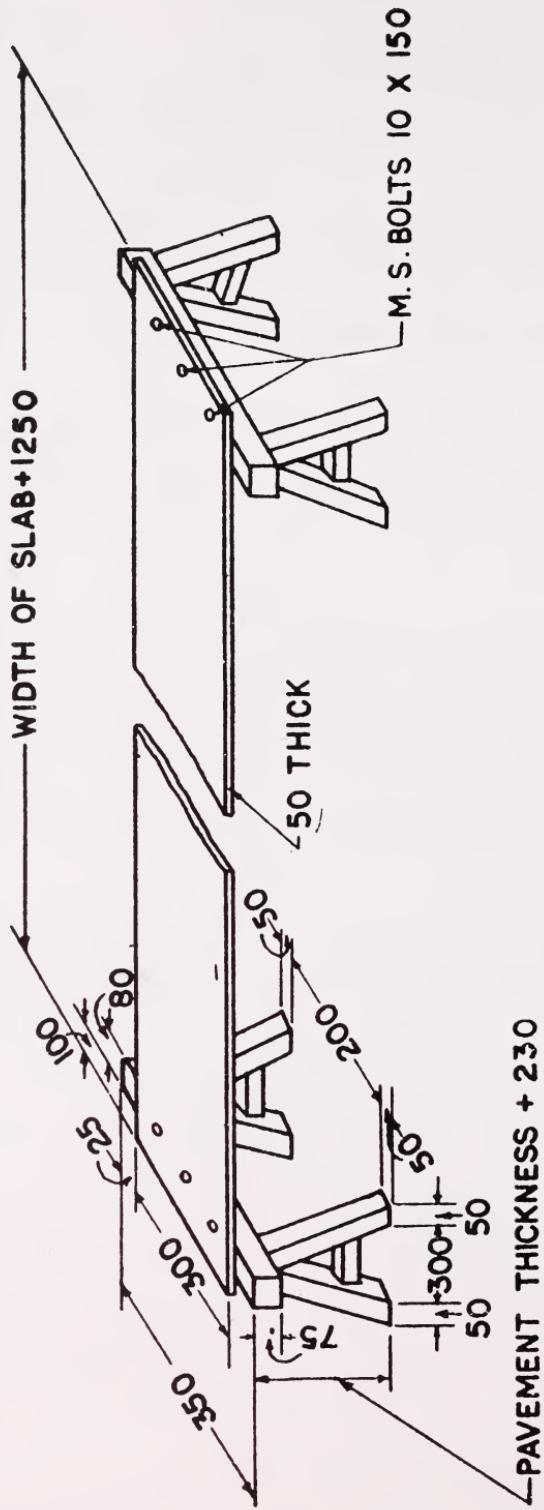
@ Specifications for Screed Board Concrete Vibrators



MATERIAL :—Seasoned deodar or sal wood

NOTE :—All dimensions are in millimetres

Fig. 6. Wooden bridge



MATERIAL :—Seasoned deodar or sal wood

Note :—All dimensions are in millimetres

Fig. 7. Wooden bridge

arrangement in case of breakdown of the screed board vibrators, should consist of a hard wood beam of rectangular section of sufficient weight to ensure adequate compaction and should be fixed securely with sturdy handles to withstand the tamping action. A typical dimensioned sketch is included in Fig.8. The lower face of the tamper board should conform to the desired profile of the pavement cross-section, and be fitted with a mild steel shoe of appropriate width, as in the case of screed board (IS: 2506—1964) to prevent wear.

4.5. Phase 5. Finishing Operations: Surface and Joints

4.5.1. Float

The float used for smoothing the compacted concrete, should be made of hard wood board of dimensions shown in Fig. 9, planed to true surface and fixed with a suitable handle as illustrated.

4.5.2. Straight edge

The straight edge used for checking the trueness of the finished pavement surface in the longitudinal direction should consist of a hard-wood section 3 m long fixed with handles as per dimensions shown in Fig. 10. The lower face of the straight edge should be planed to a true surface.

4.5.3. Mild steel sections for joint grooves

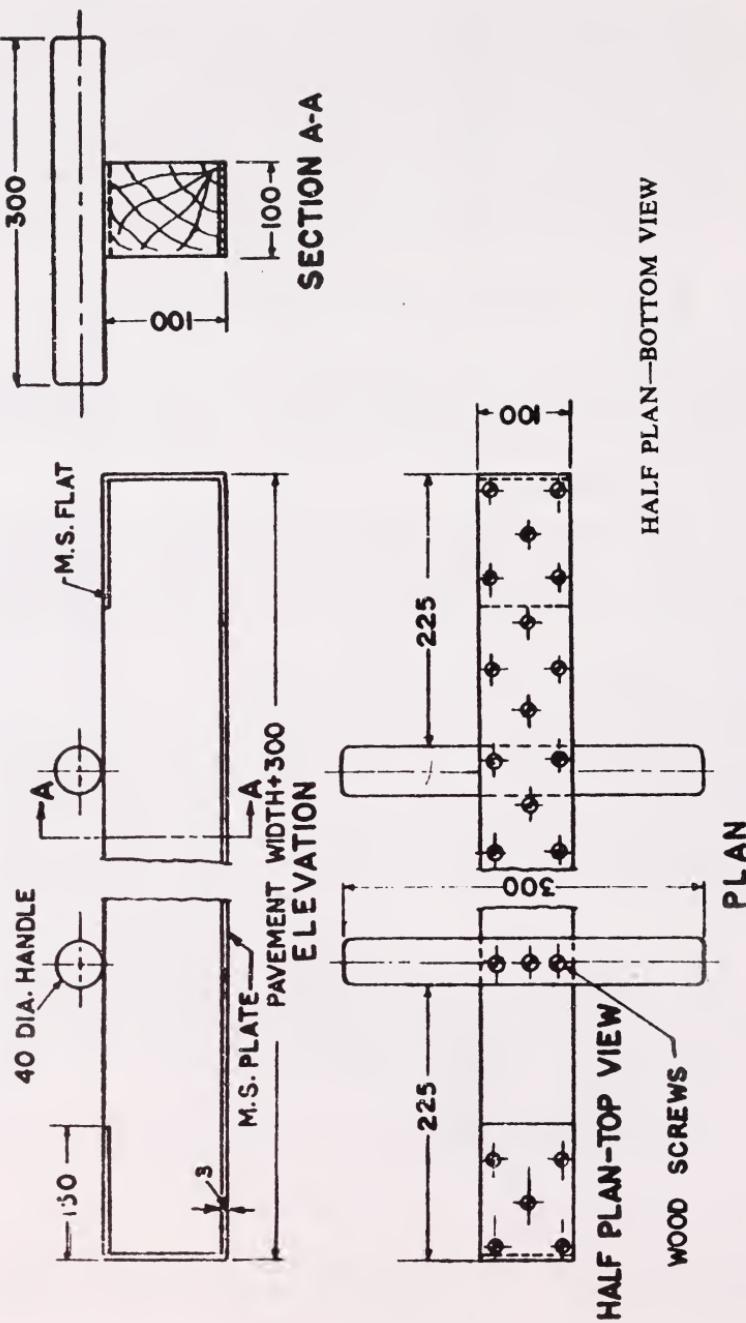
The mild steel section for forming the groove of dummy contraction joint should consist of a flat section with flat supporting pieces fixed thereto (Fig.11). Alternatively, T-Section of appropriate size with webs cut at the ends to provide support over the formwork should be adopted. In either case, to facilitate lifting, the flat supports should be provided with suitable mild steel handles welded below their extreme ends or with holes as illustrated in Fig.11 A & B respectively.

The mild steel section for protection of groove over the expansion joint filler during construction should consist of rectangular or square bar section, depending on the expansion joint width, with mild steel handles fixed (Fig. 12). Its length should be 5 mm less than the pavement width to facilitate removal.

The top and bottom edges of these mild steel sections should be shaped to correspond to the camber of the pavement at the joint.

4.5.4. Edging tools

The single-edging tool used for rounding the transverse edges at expansion joints and the longitudinal edges should conform to the

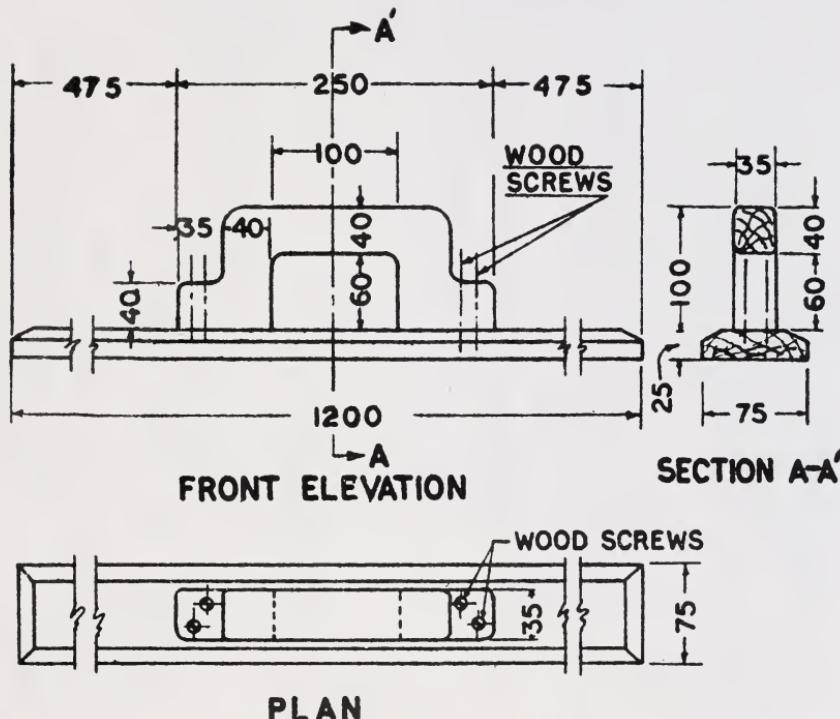


MATERIAL:—Seasoned teak or sal wood; the size indicated is for sal wood.

For teak wood it should be 120 mm × 100 mm

NOTE:—All dimensions are in millimetres

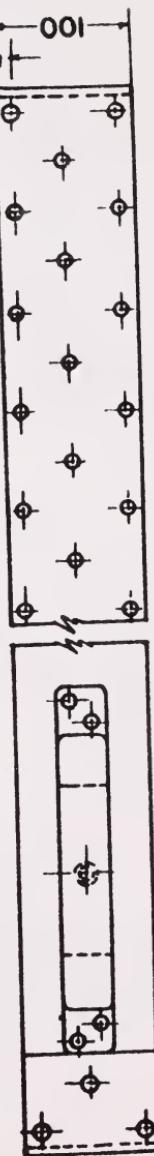
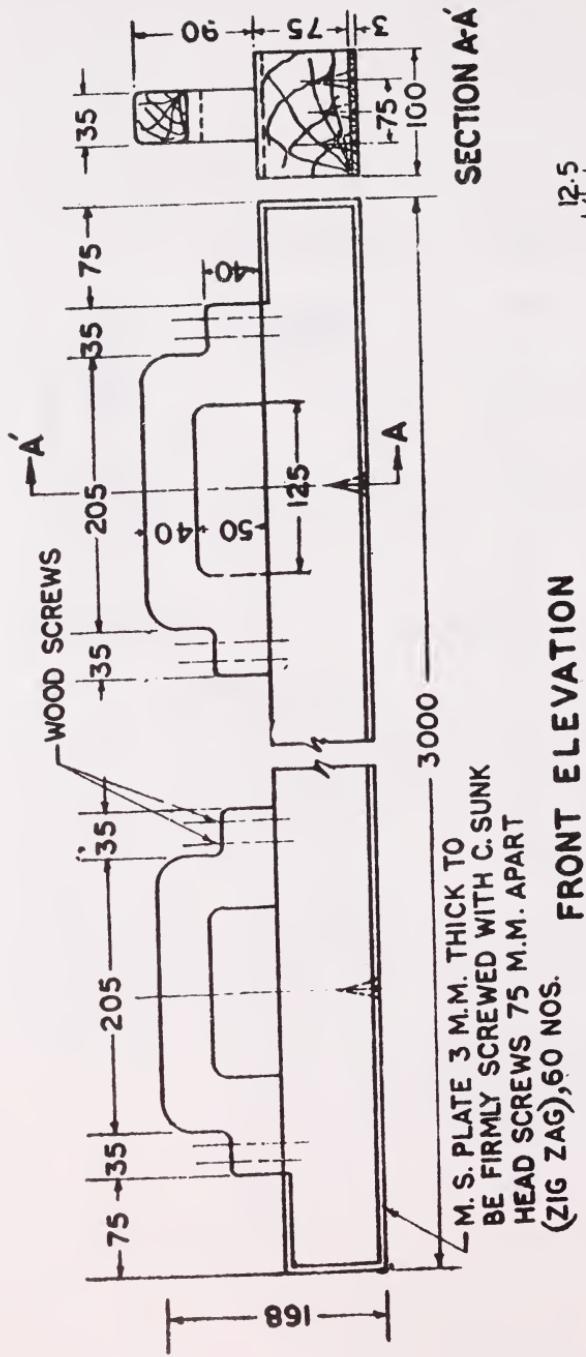
Fig. 8. Wooden hand tamper



MATERIAL :—Seasoned teak or sal wood

NOTE :—All dimensions are in millimetres

Fig. 9. Float



HALF PLAN - TOP VIEW
HALF PLAN - BOTTOM VIEW

MATERIAL :—1. Seasoned teak or sal wood
2. M.S. plate 3 mm thick
NOTE :—All dimensions are in millimetres
Fig. 10. Straight edge

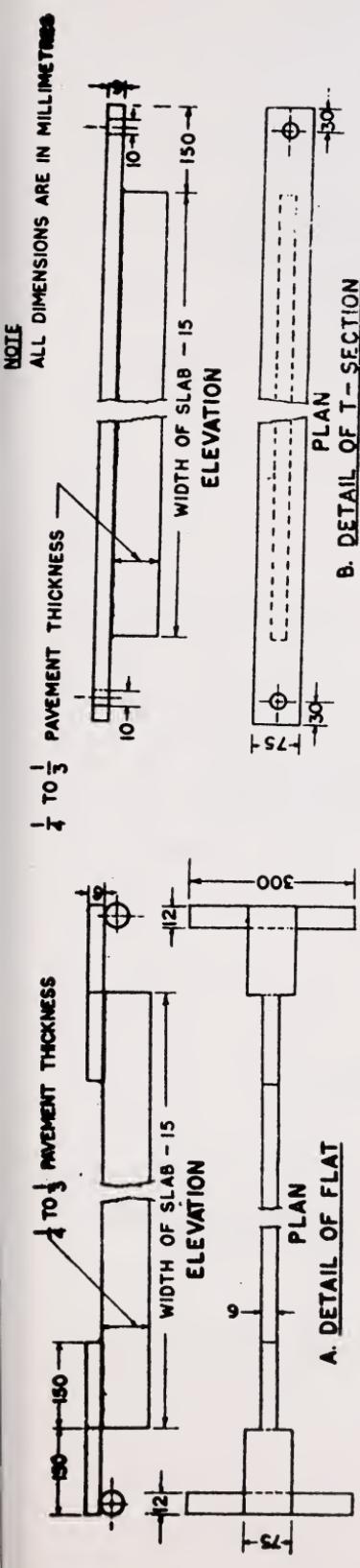
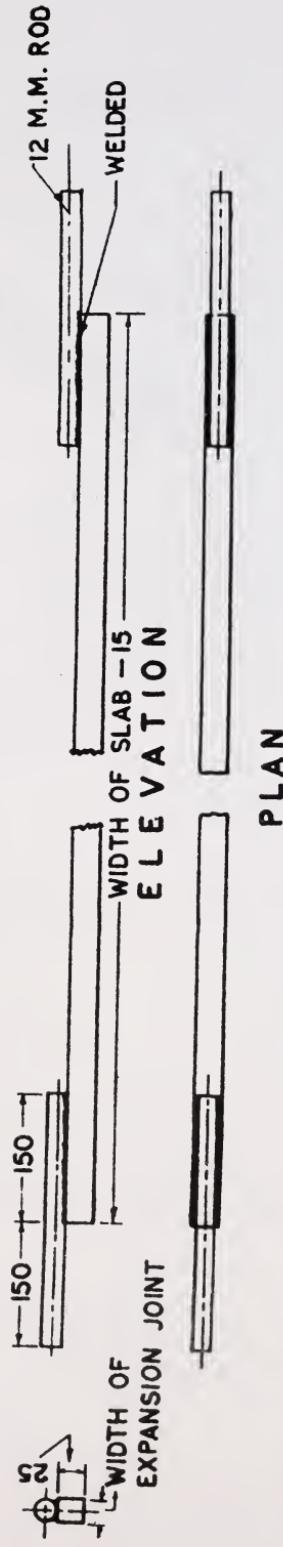


Fig. 11. M.S. sections for contraction joint

MATERIAL :—
 1. M.S. flat
 2. M.S. rod

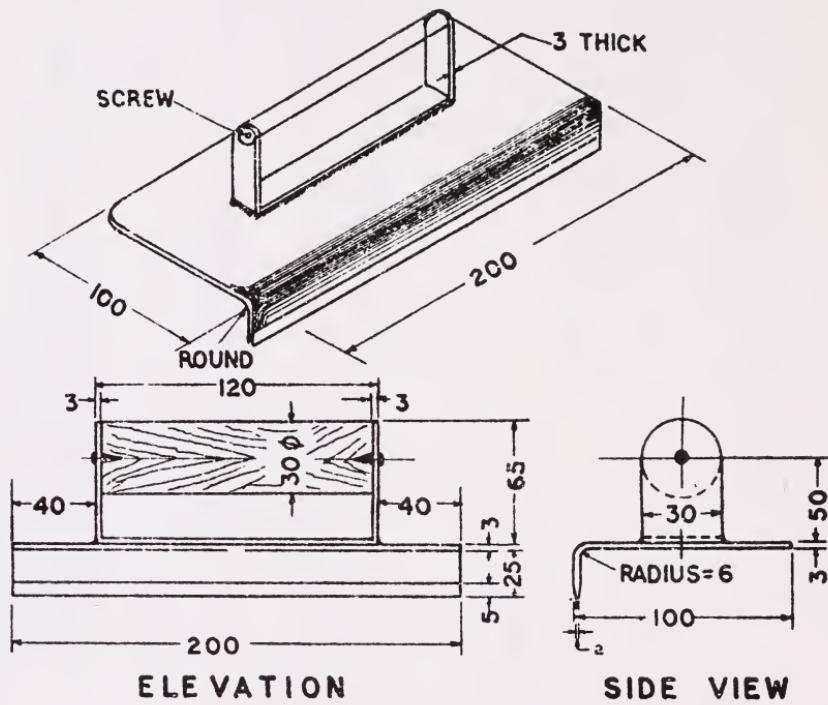


MATERIALS : M.S. flat or square
M.S. rod

NOTE :—
 1. All dimensions are in millimetres
 2. Top and bottom edges of the sections should be shaped to correspond to the camber of the slab at the joints.

Fig. 12. M.S. Section for expansion joint

requirements indicated in Fig. 13. The double edging tool, used for



MATERIALS :—

1. Handle—Seasoned teak or sal wood
2. Plate—Mild steel sheet 3 mm thick

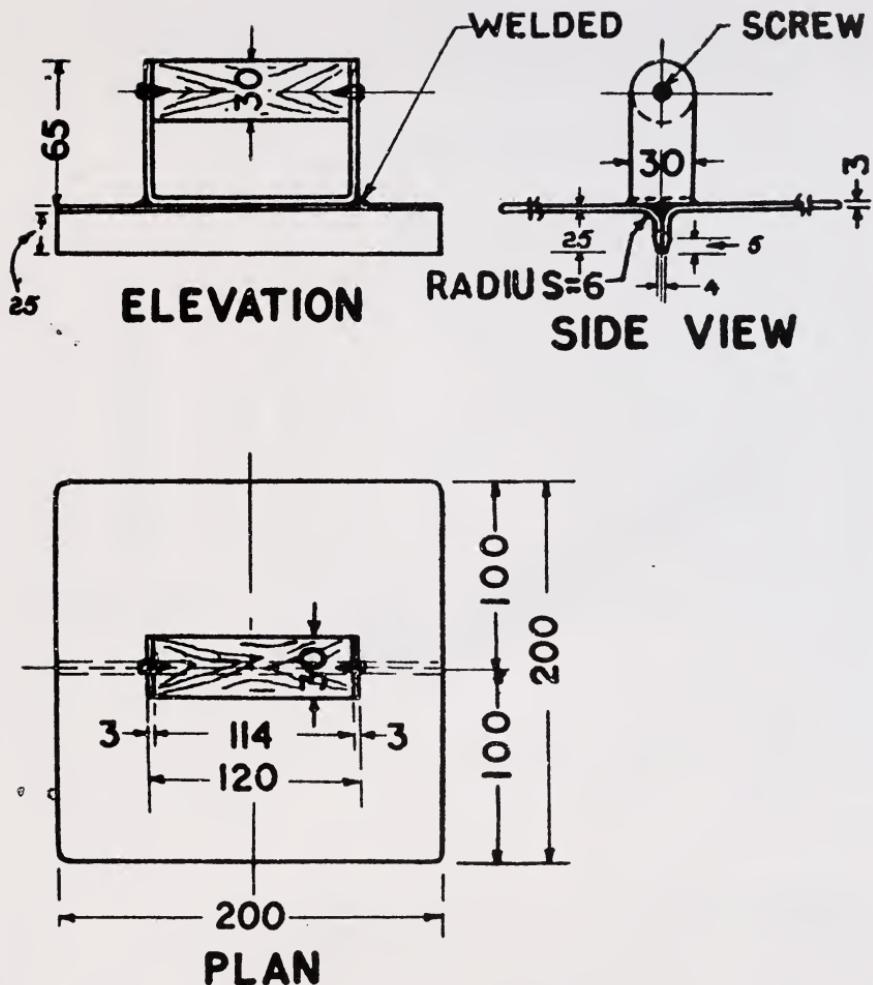
NOTE :—All dimensions are in millimetres

Fig. 13. Edging tool

rounding transverse edges at dummy contraction joints, to ensure same level on either side of the joint should correspond to Fig. 14.

4.5.5. Canvas belt

Just before the concrete becomes non-plastic, the pavement surface is belted with a canvas belt. The belt should have width not less than 200 mm and be at least 1 m longer than the slab width as

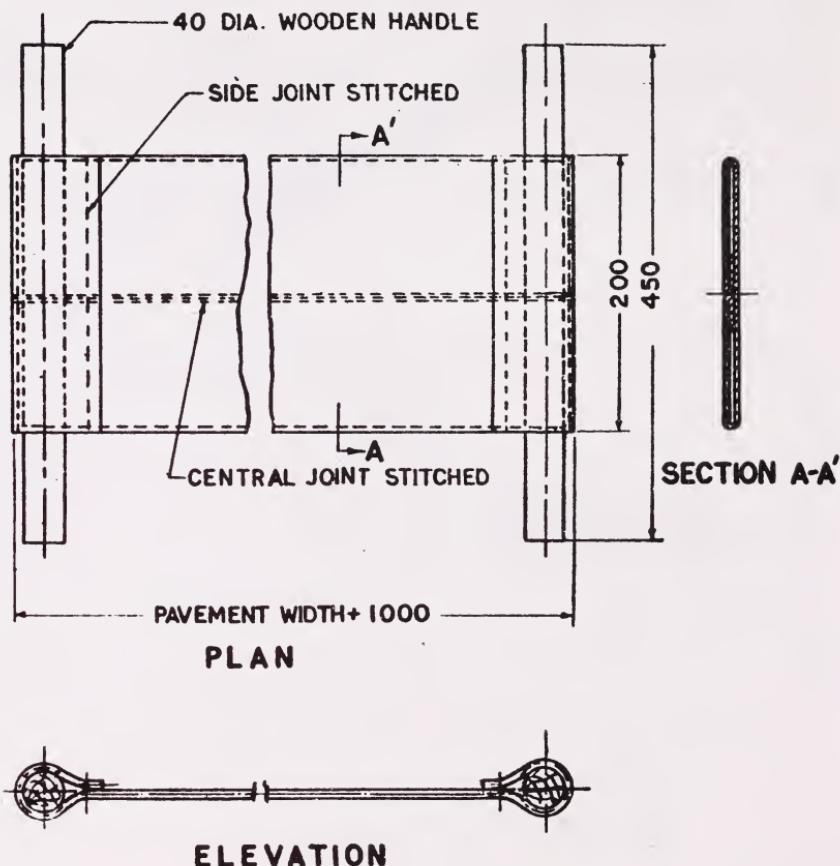


MATERIAL :—
 1. Handle—Seasoned teak or sal wood
 2. Plate—Mild steel sheet 3 mm thick

NOTE :—All dimensions are in millimetres

Fig. 14. Double edging tool

per IRC: 15-1970. It should be made from canvas cloth conforming to IS:1424-1970*, and should be provided with stitched folds at either end to pass the wooden handles (Fig.15) through.



MATERIAL :—1. Belt canvas having two folds
2. Round handles, seasoned teak or sal wood

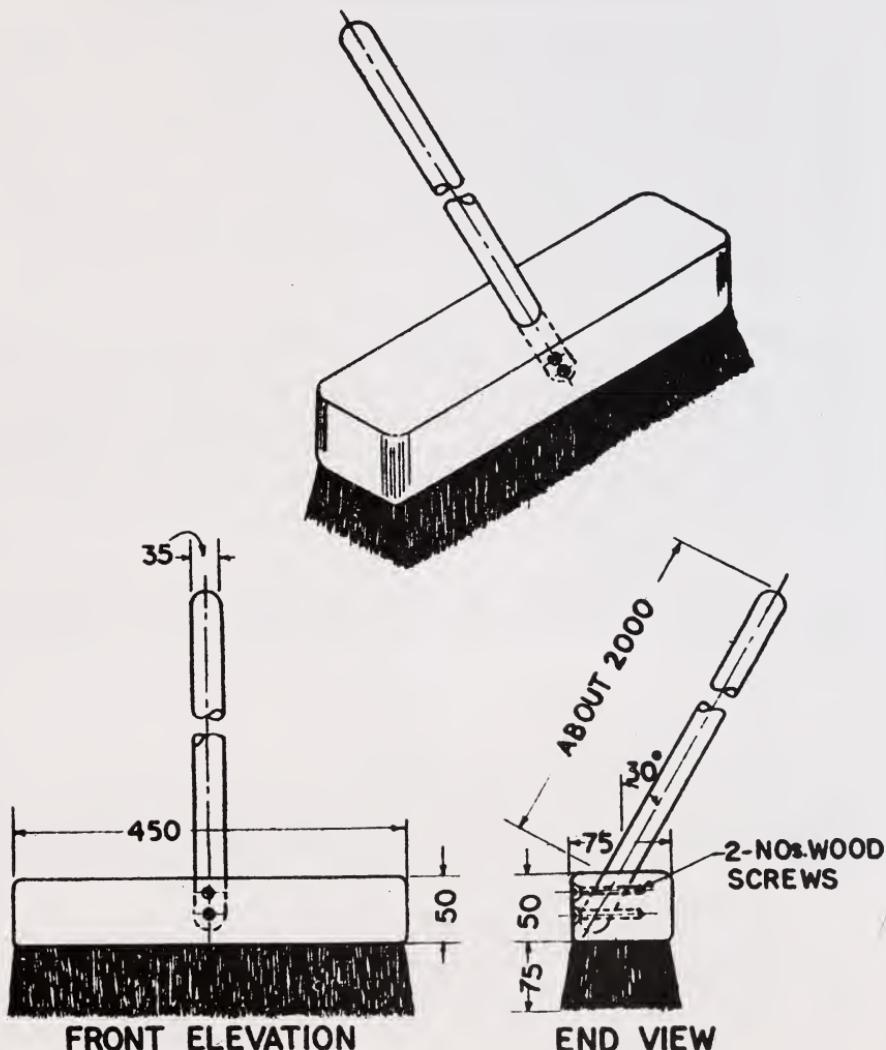
NOTE :—All dimensions are in millimetres

Fig. 15. Belt

* Specifications for Cotton Canvas, Scoured, Dyed or Water-proofed

4.5.6. Long-handled coir broom

The long handled coir-broom for giving broom marks across the pavement surface to make it skid-resistant should conform to the requirements given in Fig. 16. The coir fibres should meet the



MATERIAL :-

1. Handle=Bamboo
2. Brush =Wooden, with bristles of hard coir fibre (grade 3 or higher grade corresponding to IS:898-1964)

NOTE :-All dimensions are in millimetres

Fig. 16. Coir fibre brush

requirements of IS:898—1964*, and be of grade 3 or higher than this specification. The broom should be replaced when the coir bristles wear down to a length of about 40 mm.

4.5.7. Graduated master straight edge with wedge scale

The master straight-edge, used in conjunction with the graduated wedge (conforming to IS:226—1969)** to check high and low spots along any line on the pavement should consist of a 3 m long mild steel channel section (conforming to IS:3954—1966***) with mild steel stands welded at either end. The dimensions should be as shown in Plate II. It should be ensured that the lower face of the straight edge is truly straight, and that the height of its stand is exactly the same as of the wedge gauge at the zero mark in the centre.

4.5.8. Diamond cutter

Rotating disc diamond cutter of travelling type should be capable of giving the cut to required depth and width and should have appropriate arrangement for lowering and raising the blade to any desired level. It should also have suitable guides for enabling a straight cut to be made along the desired line. The diamond cutter having water-feeding arrangement may be of any approved standard make.

4.5.9. Grinder

Portable electrical grinder with flexible shaft drive of approved design should be used for grinding any high spots on the hardened concrete surface.

4.6. Phase 6. Curing

4.6.1. Hessian cloth

Hessian cloth used in initial curing of concrete should be obtained in rolls of 1 to $1\frac{1}{2}$ m width. The quality should conform to the requirements of IS:2818—1971†. Alternately, other hessian cloths of approved quality may be used.

4.6.2. Polyethylene sheeting

The sheeting, if used for membrane curing should have minimum thickness of 100 gauge and should be of approved quality.

* Specifications for Coir Fibre

** Specifications for Structural Steel (Standard Quality)

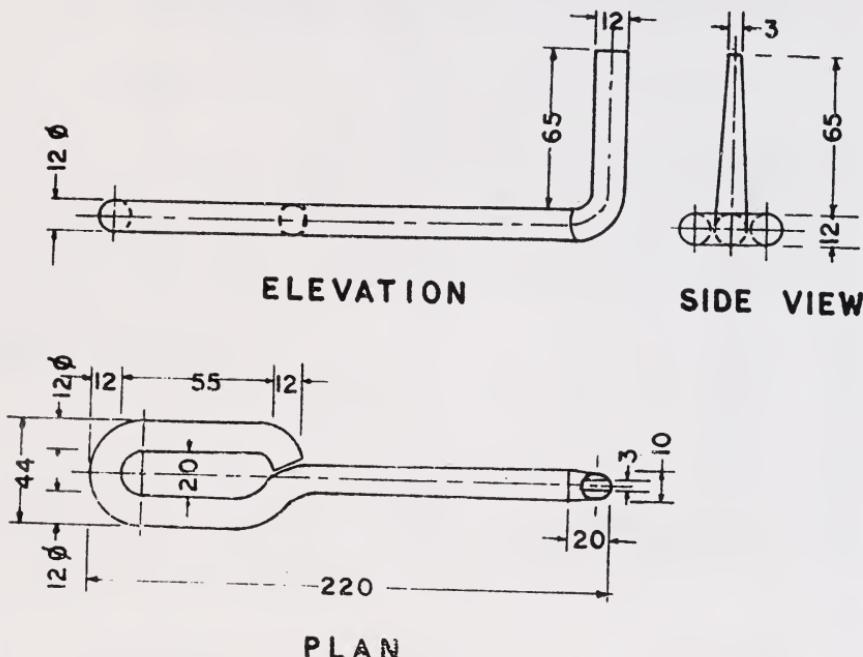
*** Specifications for Hot Rolled Steel Channel Sections for General Engineering

† Specifications for Indian Hessian

4.7. Cleaning and Sealing of Joints

Details of tools needed for cleaning and sealing the joint grooves are as under :

- (i) Iron raker, for removing any foreign material from the joint grooves (Fig. 17).



MATERIAL :—M.S. rod 12 mm dia
 NOTE :—All dimensions are in millimetres

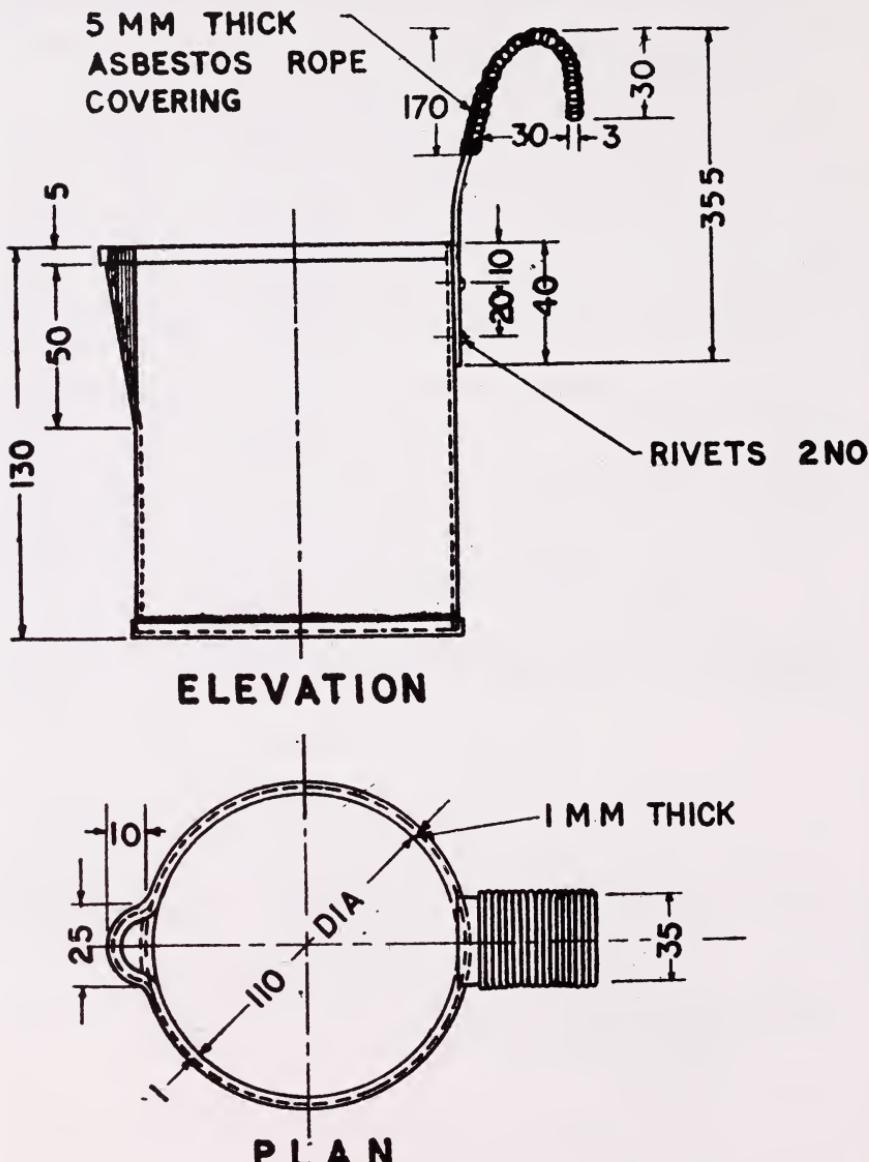
Fig. 17. Raker

- (ii) Coir brush, for cleaning the joint grooves. It should conform to the requirements of para 4.5.6, except that there should be no handle and length should be only 300 mm.
- (iii) Cycle pumps, for blowing off loosened foreign material from the joint grooves. May be of any make of approved quality.
- (iv) Kerosene stove, for heating the joint sealing compound drums. May be of any standard make of approved quality. If a pressure type kerosene stove is used, it should conform to IS: 1342-1968.*
- (v) Thermometer 0-300°C, for controlling the temperature of the joint sealing compound. It should conform to the requirements of IS: 2480-1964**.

* Specification for Oil Pressure Stove

** Specifications for General Purpose Glass Thermometers

- (vi) Transferring pot, for transferring heated joint sealing compound from the drum to the pouring kettle (item viii) (Fig. 18).



MATERIAL :—Mild steel

NOTE :—All dimensions are in millimetres

Fig. 18. Transferring pot

- (vii) Painting brush, 25 mm size, flat type, for applying the primer coat to the cleaned joint groove before pouring the sealing compound. May be of any make of approved quality.
- (viii) Pouring kettle, for pouring the heated sealing compound in the cleaned and primed joint groove (Fig. 19).
- (ix) Scraper, for scraping off any excess sealing compound overflowing the joint groove (Fig. 20).

MINIMUM BALANCED SET OF TOOLS, EQUIPMENT AND APPLIANCES

5.1. For smooth progress of work, without any bottlenecks, it is essential to acquire a minimum balanced set of tools, equipment and appliances needed for different phases of construction. Details of such a balanced set for small sized constructions envisaged herein, with a daily concreting output of 20-30 cu.m., are given in *Annexure 2*.

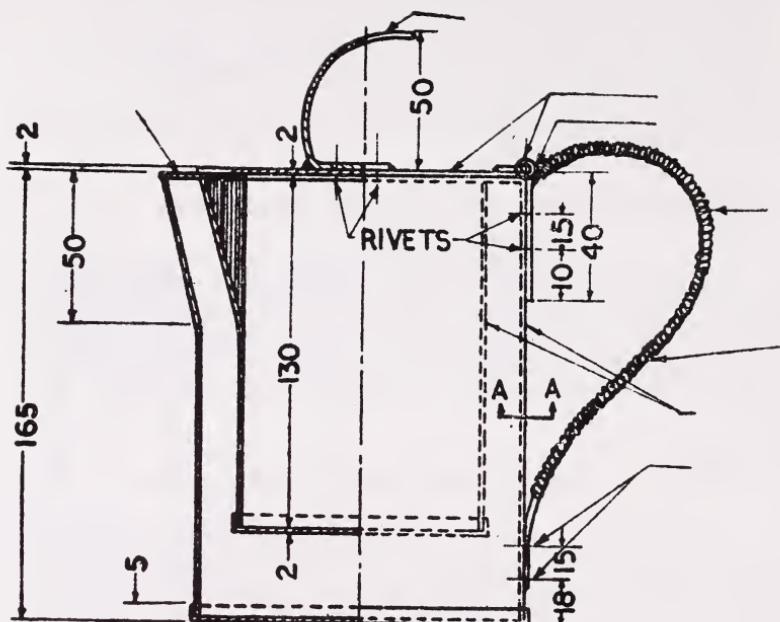
6. ANCILLARY ITEMS OF TOOLS AND EQUIPMENT

6.1. In addition to the tools, equipment and appliances covered in preceding Clauses, certain ancillary items will be needed at concrete paving works for taking measurements, marking distances, storage of water, routine repairs to machinery, etc. A list of these items is given at *Annexure 3*. Though by no means exhaustive, the list includes all such items which will generally be needed.

7. MAINTENANCE AND UPKEEP OF TOOLS, EQUIPMENT AND APPLIANCES

7.1. The need for proper maintenance and upkeep of various tools, plants and equipments cannot be over-emphasised to ensure quality construction. Some of the tools and equipments especially tend to develop inaccuracies and defects with use. Their constant checking and rectification should form a part of daily routine. Points deserving attention in this respect are brought out in *Annexure 4*.

Gap at the top between
two containers to be
covered with M.S. circular
ring plate 2 mm thick



Lid handle
2 mm thick
M.S. plate

Top lid to
be hinged
Welded

5 mm thick
asbestos
rope
covering

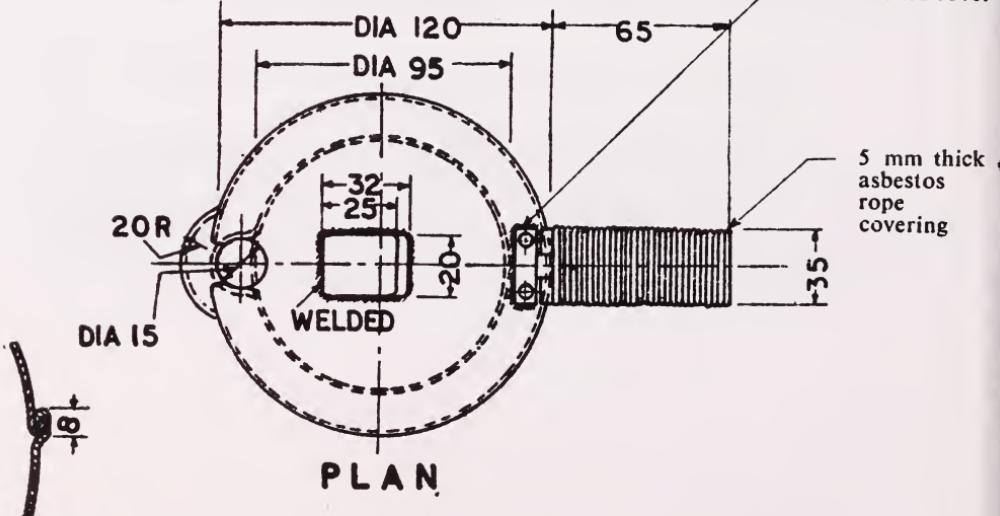
Handle

1 mm thick
Rivets

Rivets

Lid hinge
welded
on the top of
the lid cover

HALF SECTIONAL ELEVATION



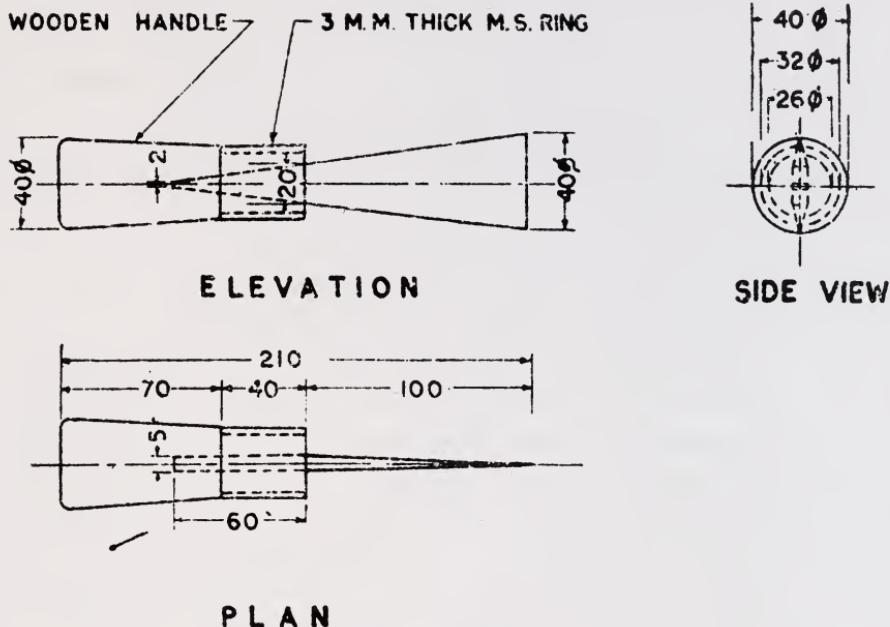
5 mm thick
asbestos
rope
covering

Detail of joint at A-A

MATERIAL :—Mild steel

NOTE :—All dimensions are in millimetres

Fig. 19. Pouring kettle



NOTE :—All dimensions are in millimetres

Fig. 20. Scraper

Annexure 1**DETAILS OF FIELD EQUIPMENT**

The minimum equipment essential for carrying out control and acceptance tests is given below :

(i)	I.S. Test Sieves 45 cm dia, I.S. size, 45.0 mm, 22.4 mm, 11.2 mm and 4.60 mm with lid and pan (as per IS 460-1978).	- One set
(2) (a)	IS Test Sieves, 20 cm dia., IS sizes 2.36 mm, 1.18 mm, and 600, 300, 150 and 75 microns, with lid and pan (as per IS 460-1962)	- One set
	(b) Fine camel hair brush for cleaning the sieves	- One No.
(3)	Graduated glass cylinder 200 ml. capacity	- Two Nos.
(4)	Semi-automatic balance, 7 kg capacity	- One No.
(5)	Semi-automatic balance, 1 kg capacity	- One No.
(6)	*15 cm cube-moulds (for two day's casting) (as per IS : 516-1959 clause 2.9.1)	- 12 Nos.
(7)	*75 cm x 15 cm x 15 cm beam moulds (for two day's casting) (as per IS : 516-1959 clause 7.4.1)	- 12 Nos.
(8)	Tamping rods for compacting cube/beam moulds (as per IS : 516-1959 clauses 2.9.3 & 7.4.2 respectively)	- 2 Nos. (1 each)
(9)	Slump cone, complete with tamping rod and 30 cm steel rule (as per IS : 1190-1959 clause 3.1.2)	- 2 sets
(10)	Dial type spring balance, 100 kg capacity	- 1 No.
(11)	Enamel trays; 30 cm x 15 cm x 5 cm	- 6 Nos.
(12)	Pycnometers	- 2 Nos.
(13)	Field oven with kerosene stove	- 1 No.
(14)	Hand operated hydraulic compression testing machine 100 ton capacity with attachment for flexu- ral testing of beam samples	- 1 No.
(15)	Riffle box	- 2 Nos.
(16)	Sample tins, beakers, graduated cylinders, wash- bottle, thermometer (0-100°C), steel spatula, pair of tongs, etc.	-

N.B. *In case the max. size of the aggregate employed at a project does not exceed 10 mm, 10 cm cube moulds and 50 cm x 10 cm x 10 cm beam moulds may be used as permissible in IS: 456-1964.

(17) Scoop, trowel and shovel for handling the materials

— One each

(18) Core cutting machine for 10 cm or 15 cm cores

— 1 No.

Note :—The list is meant for a daily output of about 20-30 cu.m. of concrete. But except in the case of beam/cube moulds, the equipment listed can adequately cope with a daily concrete output of upto 90 cu.m., provided that workheads are in close vicinity so as to enable the same equipment to be used centrally. Additional 6 beam/cube moulds will have to be provided in this case for every additional 30 cu.m. of concreting per day.

In case the workheads are far apart and it is not convenient to use the same equipment for several workheads, the minimum required equipment will have to be provided at each workhead separately.

Annexure 2**MINIMUM BALANCED SET OF TOOLS, EQUIPMENT
AND APPLIANCES**

	<i>No. required</i>	<i>No. standby</i>
1.. (a) Suitable Compaction Equipment	1	—
(b) Bhisty (water-carriers)	6	
2. Pick-axe	12	—
Spade	12	—
Shovel	6	2
3. Scratch Template or Strike Board	1	1
4. (a) Formwork for two day's work	A few lengths	
(b) Stakes for formwork	100	25
5. Sieving Screens	One set (45, 22.4, 11.2 and 5.60 mm)	One set
6. Weigh Batcher (Double-Hopper, Swing Type)	1	—
7. Aggregate Measuring Boxes (for volume batching only)	One set (0.015, 0.03, 0.0375 m ³)	One set
	Alternative to No. 6, in case permitted.	
8. Water Measures	One set (5, 2, 1 and 0.5 litre)	One set
9. Concrete Mixer	1	1 (desirable but not mandatory)
10. Concrete Vibrators		
(a) Internal Vibrators		
(i) for highway pavements	1	1
(ii) for airfield pavements	3	1
(b) Screeb Board Vibrators	1	1
11. Wheel Barrows (0.08-0.11m ³ capacity)	8 (may be increased depending upon lead)	
12. Hand Tamper Board	1	1
13. Float	4	2
14. Straight Edge	1	1
15. Bulk-head	2	1

	<i>No. required</i>	<i>No. standby</i>
16. Mild Steel Sections for Making Joint Grooves		
(a) for expansion joints	1	—
(b) for contraction joints	5	1
17. Edging Tools		
(a) Edging tool	1	1
(b) Double edging tool	1	—
18. Canvas Belt	2	—
19. Long-handled Coir Broom	1	5
20. Graduated Master Straight Edge with Wedge Gauge	1 set	—
Diamond Cutter (optional)	1	(3 diamond blades)
Portable Grinder	1	—
21. Wooden Bridges	4	2
22. Hessian Cloth	Sufficient to cover one day's work (200 sq. m.)	
23. Tools for Joint Sealing		
(a) Iron Raker	1	—
(b) Coir Brush	1	1
(c) Cycle Pump	1	—
(d) Kerosene Stove	1	—
(e) Thermometer (0-300°C)	1	1
(f) Painter Brush (25 mm)	1	3
(g) Transferring Pot	1	—
(h) Pouring Kettle	1	—
(i) Scraper	1	—

Replacements for any items becoming unserviceable should be made promptly so that the required number along with needed standbys for smooth working is always available.

Annexure 3**ANCILLIARY ITEMS OF TOOLS, EQUIPMENT, ETC., FOR CONCRETE
PAVING WORKS**

	<i>No. required</i>
For Checking Levels & Marking Distances	
Dumpy Level and Levelling Staff	1 each
Steel Tape (30 m), Metallic Tape (30 m)	1 each
Coconut Coir Rope (12 mm dia.)	2 kg
Ranging Rods	5
For Preparation of Sub-base for Concreting	
Coir Brushes	10
Metal Hand Rammer (as per IS: 4183-1967)	1
Rose Cans	6
For Manufacture of Concrete including Handling of Materials	
Panjas	6
Cane Baskets	24
Empty Drums for water storage (200 litre capacity)	25
Empty Tins (18 litre capacity)	10
Iron Pans	24
M.S. Sheets (3 m x 1½ m x 6 mm approx.)	3
Knife	1
Tarpaulins (5 m x 5 m approx.)	4
For Fixing & Removing Formwork	
Mason's Thread	2 balls
Hammers (5 kg, ½ kg)	2 each
Crow Bar (40-50 mm dia, 1500 mm length)	1
Mason's Trowel and Straight Edge	1 each
Spirit Level (30 mm)	1
Spares for Repairs to Equipment	
Assorted nuts, bolts, nails and screws.	

Spares for concrete mixer, screed vibrator (especially handle-springs & rubber-belts), internal vibrator and weigh batcher,

Tool kit for general purpose including sets of pliers, wrenches, etc. This does not include items such as storage shed for cement, water storage tank, appurtenance for traffic diversion and regulation, etc., items which do not strictly form a part of tools, equipment and appliances, but which are nevertheless essential for any concrete paving job.

Annexure 4

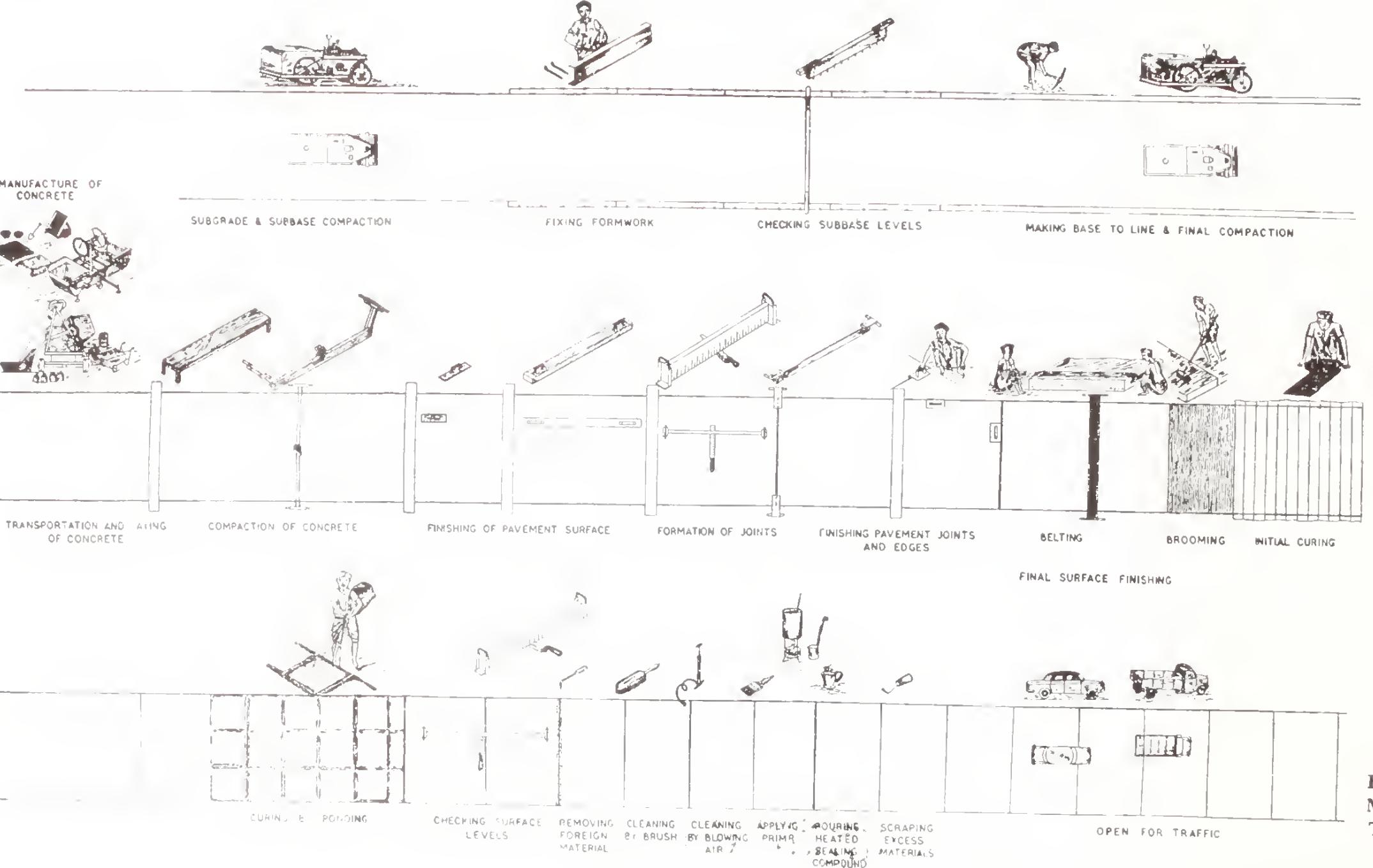
ROUTINE MAINTENANCE AND UPKEEP OF TOOLS, EQUIPMENT AND APPLIANCES

The following points should form a part of routine daily check-up of plant so as to ensure quality construction :

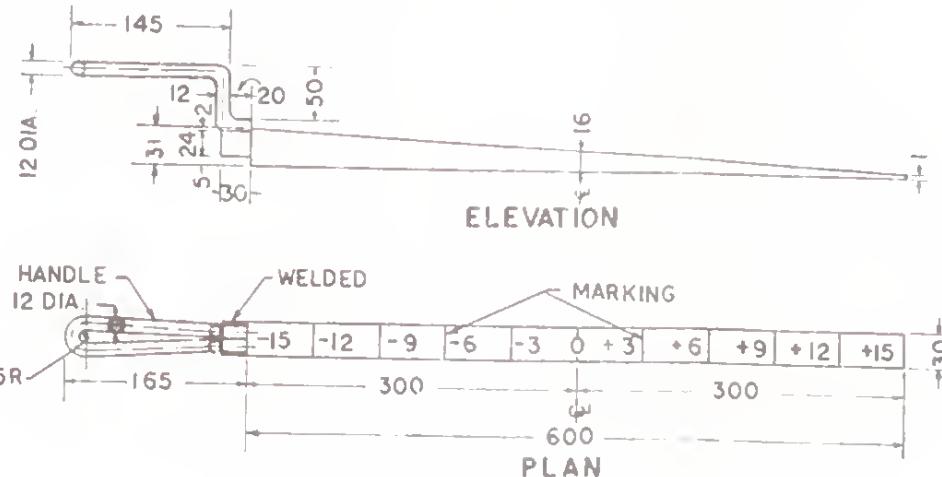
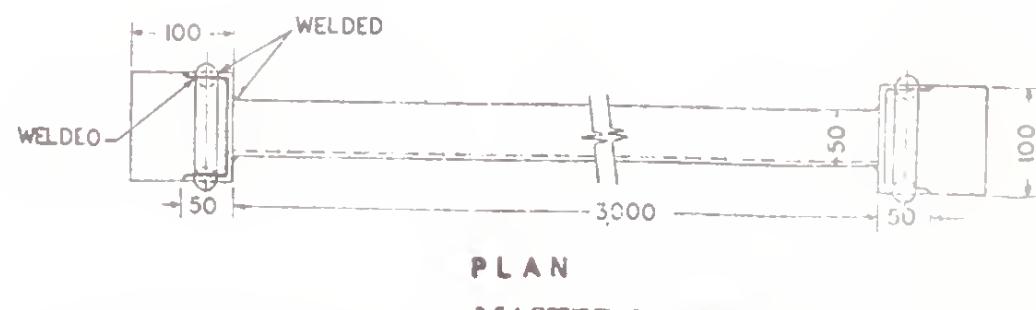
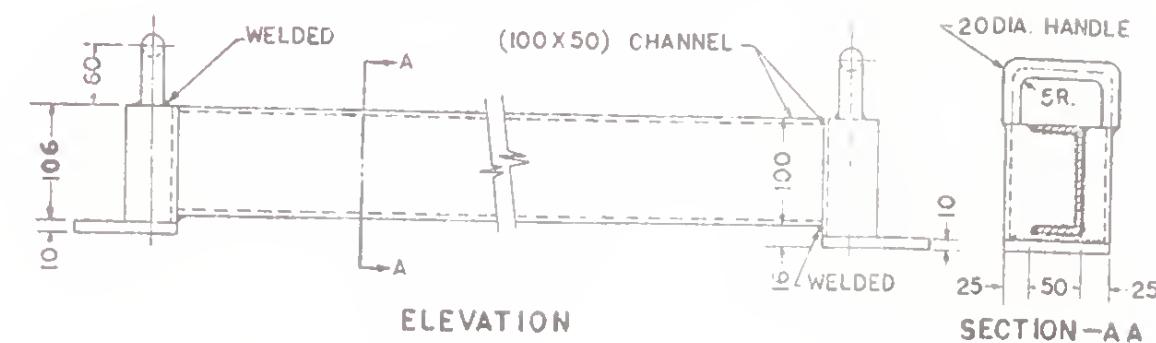
1. **Scratch Template or Strike Board:** The trueness of setting of nails to cross-profile should be checked daily before commencement of work.
2. **Formwork:** (1) The straightness of formwork in both the horizontal and vertical planes should be ensured before each use. When fixed, it should be checked with a 3 m straight edge and any departure greater than 1.5 mm duly rectified. (2) The formwork should be thoroughly cleaned and should not have any foreign material sticking thereto.
3. **Sieving Screens:** It should be ensured that the sieves are thoroughly clean and that there is no displacement or breakage of the mesh wires, etc.
4. **Weigh Batcher:** (1) The calibration of the weigh batcher scales should be checked regularly by means of a set of standard weights over the full working range in use. (2) The knife-edge supports should be regularly cleaned. (3) Free movement of the dial needle should be ensured.
5. **Measuring Boxes:** Wherever volume batching is permitted, the trueness of shape and correctness of dimensions of the measuring boxes should be ensured.
6. **Water Measures :** The calibration of the water measures should be checked regularly against standard graduated cylinders.
7. **Concrete Mixer :** (1) Any worn out mixer blades (worn more than 20 mm) should be replaced. (2) After any break in construction longer than 20 minutes and at the end of the day's work, the mixer drum should be thoroughly washed and cleaned.
8. **Concrete Vibrators:** Regular servicing of the units should be got done to keep them in good working order.
9. **Surface Finishing Tools:** Floats and straight edge, should be daily checked before use for trueness, and any departure from a true plane surface should be rectified before use.
10. **Mild Steel Sections for Making Joint Grooves:** The trueness and straightness should be checked before use, especially in case of the mild steel flats for making contraction joint grooves, as they are sometimes likely to get bent during insertion in the concrete.

11. **Canvas Belt:** Should be thoroughly washed and cleaned after each use.
12. **Long Handled Coir Broom:** The coir bristles should be checked for wear, and worn out brooms should be replaced.
13. **Graduated Master Straight Edge with Wedge Gauge:** The trueness of the straight edge and wedge gauge should be checked before use. It will not be normally necessary to make this check daily, and initial checking before commencement of work should generally suffice.

TOOLS, EQUIPMENT AND APPLIANCES



FLOW CHART OF CONCRETE PAVEMENT CONSTRUCTION SHOWING TOOLS AND APPLIANCES NEEDED FOR DIFFERENT PHASES

GRADUATED WEDGE SCALE**MASTER STRAIGHT EDGE**

NOTE :— All dimensions are in millimetres

