



**Indian Roads Congress
Special Publication 22**

**RECOMMENDATIONS
FOR THE SIZES FOR
EACH TYPE OF ROAD
MAKING MACHINERY TO
CATER TO THE
GENERAL DEMAND OF
ROAD WORKS**

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RECOMMENDATIONS FOR THE SIZES FOR EACH TYPE OF ROAD MAKING MACHINERY TO CATER TO THE GENERAL DEMAND OF ROAD WORKS

1. INTRODUCTION

The need for mechanisation in road works is assuming considerable importance in recent times to meet the compelling demand to improve the quality and speed in completion of large road construction programme launched in the country. The fluctuations in the availability of labour force, labour management and climate conditions of certain areas not conducive to the deployment of large labour force are other factors promoting the growth of mechanisation comparatively at a faster rate. Therefore, a stage has come when it is necessary to focus attention to standardising the road making machinery. The fixing of sizes is a first step towards this end in order to ensure reasonable uniformity in the manufacture of machinery and its spare parts.

A subcommittee of the Road Making Machinery and Mechanisation Committee of the Indian Roads Congress was set up earlier to go into the problem of fixing two or three economical sizes for each type of road making machinery to cater to the general demand of road construction work. The draft recommendations made by this subcommittee were approved by the Manufacture of Road Making Machinery and Mechanisation Committee in their meeting held at Gandhinagar on the 28th November, 1972. The Executive Committee in their meeting held at New Delhi on the 17th February, 1973 approved these recommendations which were later considered by the Council in their 81st meeting held at Cochin on the 26th April, 1973 when it was decided to refer back these recommendations to the "Highway Construction and Mechanisation Committee" (redesignated in place of Manufacture of Road Making Machinery and Mechanisation Committee) for revising the same, in light of certain observations made by them.

The modified list indicating the recommended sizes for each type of road making machinery to cater to the general demands of

road construction works as finalised by the Highway Construction and Mechanisation Committee (personnel given below) in their meeting held at Calcutta on the 19th December, 1977 and later approved by the Executive Committee and the Council in their meetings held on the 3rd and 19th January, 1979 respectively is given in *Appendix*. Items of bridge works are not covered in these recommendations as it is intended to bring out separate recommendations.

The intention, however, is not to prevent the manufacturer from developing other sizes of equipments or even equipments other than those listed here depending upon demand and proven better performance level. Continual review of the list of equipment and their sizes on the basis of further experience, increase in the extent of mechanisation, and future production pattern in the country is not only desirable but also necessary.

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2. FACTORS GOVERNING THE PROPER SELECTION OF TYPE AND SIZE OF EQUIPMENT

Various factors are required to be considered when selecting the type and size of equipment needed for road works. Some of the

factors governing selection are:

- (i) equipment already available, and how well the additional equipment match;
- (ii) facilities available for operation and maintenance, including the personnel available;
- (iii) nature and quantity of work, terrain, and specification to be adopted;
- (iv) time schedule for completion;
- (v) output norms for completing the work on schedule; and
- (vi) cost of production.

3. ADVANTAGES OF STANDARDIZATION

The advantages of standardization, in principle, are as follows:

- (1) Reasonable standards can be ensured for the manufacture of equipment and spare parts thereof and for their operation and maintenance.
- (2) A close liaison between the manufacturers on the one hand and the construction engineers and contractors on the other hand could be arranged, so that problems of both can be discussed together and resolved to the best advantage, and equipments modified wherever necessary to suit the local conditions. This may be difficult if the number of types and sizes of each equipment is large.
- (3) The equipment can be used economically not only for a particular work in the project for which it is procured, but also for other kinds of work in the same road project.
- (4) The operation and maintenance of standardised equipment is comparatively easier.
- (5) The delivery of equipment and spares is expeditious and disposal easy at favourable cost.
- (6) Trained personnel can be made available without difficulty.

4. RECOMMENDATIONS

(1) Preparation of site including jungle clearance

The equipment most frequently used for preparation of site, clearing and grubbing, including removal of trees, stumps and bushes is the crawler tractor with a dozer blade attached. Other attachments such as rooter, stumpers, tree stingers, etc., facilitate the removal of trees and stumps. The following sizes of tractors would be utilised for this type of work:

	<i>Draw-bar Horse Power</i>
Light Clearance	90-120
Heavy Clearance	160-200

(2) Earthwork

It is generally found that for earthwork involving lifts of more than 3 metres and borrow-pits located at long leads from the roadside land, it may be necessary to use heavy earth-moving machinery for hauling and depositing earth.

The equipment generally used for medium hauls is scraper, which is of two types, viz., (i) Towed scraper pulled by Tractors and (ii) Self-propelled Motorised scraper. While the towed scrapers are usually economical for leads upto 300 metres, motorised scrapers are economical for leads beyond 300 metres.

The towed scrapers commonly required for the job and also indigenously manufactured is of about 13 cubic metres heaped capacity. The tractor needed for pulling the towed scraper should be of 180-250 Drawbar Horse Power.

Motorised scrapers of about 15 to 17 cubic metres, heaped capacity are at present manufactured in the country, and this size is suitable where large quantity of earthwork involving long leads is involved. Normally motorised scraper requires a pusher while loading. A heavy duty tractor of 230-300 Drawbar Horse Power would be suitable for use as pusher.

There are locations involving a short haul of less than 100 metres, where earthwork has to be done by use of dozers alone. Particularly, on hill roads, the pioneering work is done by dozers. For such initial pioneering work, dozers of size 90-120 Drawbar Horse Power would be suitable. For major dozing and removal of excavated rock, a bigger size 160-200 Drawbar Horse Power would be needed. Dozers are also used for ditching, back filling, trimming, pusher loading and spreading. While crawler dozers are preferred for working in muddy, loose, soft soil or rock cuttings, rubber tyred dozers, are preferred when distance involved is considerable because of greater output due to higher speed and manoeuvrability involved.

Motor grader is useful for spreading and grading of earthwork. As the grader blade can be adjusted to any angle in vertical plane, grader is effectively used for trimming and maintaining the side slope of an embankment. This machine is also used for spreading stone materials for bases and sub-bases and in the absence of paver finisher, it can be utilized for spreading bituminous macadam and asphaltic concrete. Since the quality of bituminous macadam and asphaltic concrete work will not be as good as with paver finisher, the use of grader for this purpose should be only under compelling circumstances. With the attachment of scarifier, the hard gravel and WBM surface can be loosened and reshaped with grader blade. Motor graders of about 110 BHP are made indigenously.

Front end loaders are either tracked or tyred type. This machine is very useful in loading materials in trucks. This unit can also be used to feed hoppers or bins of hot mix plants with aggregates expeditiously. The machine is also useful for light excavation, dozing and land clearing. The front end loaders of 0.5 to 1.5 cubic metres capacity are made indigenously.

(3) Soil stabilisation

Soil stabilisation is aimed at maintaining or increasing the performance of soil as a construction material, by mixing with it other soils and/or special stabilising agents, like cement, lime, flyash, and compacting the resulting mixture at about optimum moisture content. At present the soil stabilisers are not being manufactured indigenously as sufficient demands are not there.

However, for scarifying the top loose soil upto the required depth, pulverising the soil and mixing throughly with sand, etc., the rotillor is being made in the country, and is capable of working to a width of 1.25 metre, and a depth of 200 mm.

(4) Compaction of earthwork, sub-base and base

The most versatile equipment used in the country for compacting earthwork, sub-base and base courses is the conventional 3-wheeled static Roller of 8-10 tonnes capacity. This equipment is also used for bituminous work.

For compaction of non-cohesive soils, vibratory rollers would be suitable. At present vibratory rollers of 3.6 tonnes capacity are being manufactured in the country. A slightly bigger size, will have higher output, and when manufactured in the country could prove very useful for road works. Even though license has been given, perhaps due to lack of demand, the manufacture of bigger size vibratory rollers has not yet been taken up. For restricted application such as Municipal road works, where at present standard 8-10 tonnes static rollers are being used, it would be desirable to use roller like tractamount Roller of 8 tonnes capacity which have multi-purpose application. The tractor can be used for operating roller and as wheeled type tractor for haulage. The use of these on miscellaneous works such as Municipal works, can free the 3-wheeled 8-10 tonnes rollers for use on large-scale road construction.

Sheepfoot rollers of single or double drum are needed, where compaction of clayey soil is required. For compaction of shoulders and restricted locations behind bridge and culvert abutments, where a heavy roller cannot be used effectively, earth rammers or pneumatic rammers will be required. As these compaction equipments are not in general demand, the sizes have not been specified.

(5) Watering

Watering is an important aspect in the compaction of earthwork and for consolidation of granular and stabilised sub-bases and base courses. In such cases, truck-mounted water-tankers, and trailer-mounted water-tankers of capacity of about 3500-4500 litres would be required.

(6) Bituminous work

For ensuring good riding surface and controlled quality of workmanship, the use of equipment in bituminous work is finding importance increasingly. The use of equipment in bituminous work also helps execution of road works expeditiously to the quality required.

For bituminous hot-mix work, the bigger size of hot mix plant 20-30 tonnes per hour and 30-45 tonnes per hour capacity, and the smaller size plant, 6-10 tonnes per hour would be required depending on the magnitude of work. All these sizes are at present being indigenously manufactured. It would be desirable to have all these plants made mobile for the ease in shifting from one location to another.

The Paver-finisher of capacity 45 to 75 tonnes per hour, is considered suitable for paving job. Bitumen boilers of 1000-1500 litres capacity are good enough for doing bituminous work at site e.g., tack coat, surface dressing, etc.

(7) Rock-cutting and quarrying

The basic equipment required for rock cutting and quarrying is air compressor. For initial work in hill roads, small compressor of 3 to 4.5 cubic metres per minute capacity, capable of operating single jack hammer is needed. This unit can be transported by manual labour or by animals from one site to another. For subsequent development work, compressors of capacity of about 6 cubic metres and 10 cubic metres per minute, capable of operating 2 jack hammers would be needed. The requirement of compressors in terms of cubic metres of air for hill road work is somewhat high because of losses due to long pipe-line.

For crushing rock to produce aggregate, stone crushers of 400 mm × 225 mm and 400 mm × 250 mm sizes capable of producing 14-18 tonnes per hour are suitable. Granulators of sizes 300 mm × 175 mm and 300 mm × 100 mm are capable of yielding 5-8 tonnes per hour and are suitable for producing smaller size aggregates.

(8) Haulage of materials

Tipping trucks are needed for haulage of materials. Tipping trucks of 5 tonnes and 7.5 tonnes capacity would be suitable for general use for carriage of earth and other materials. Three tonnes capacity tipping trucks would be suitable for hilly terrain and where sharp turnings are to be negotiated and smaller loads have to be transported. A tipping truck with 10 tonnes capacity would be suitable for haulage on good roads and where the quantity of material to be hauled is large.

**RECOMMENDED SIZES EACH TYPE OF ROAD MAKING
MACHINERY TO CATER TO THE GENERAL
DEMAND OF ROAD WORKS**

<i>S. No.</i>	<i>Name of Equipment</i>	<i>Size recommended by the Committee</i>
1.	(a) Crawler tractor with dozer attachment	90-120 Drawbar H.P. (for light jungle clearance)
	(b) -do-	160-200 Drawbar H.P. (for heavy jungle clearance)
2.	(a) Towed scrapers	13 cubic metres heaped capacity
	(b) Crawler tractor for pulling towed scraper	180-250 Drawbar H.P.
3.	(a) Motorised scraper	15-17 cubic metres heaped capacity
	(b) Pusher	230-300 Drawbar H.P.
4.	Tipping trucks fitted with engines of about 110 H.P. to 125 H.P.	(i) 5 tonnes and 7.5 tonnes (for general application) (ii) 10 tonnes (for good roads and large quantity of work)
5.	Motor grader	90-120 Drawbar H.P.
6.	(a) Static road rollers (3 wheeled/tandem)	8-10 tonnes
	(b) Vibratory roller	4 tonnes
	(c) Tractamount rollers	8 tonnes
	(d) Water tankers, truck mounted and trailor mounted, with sprinkling arrangement	3500-4500m litres
7.	Hot mix plants	6-10 tonnes per hour, 20 to 30 tonnes per hour and 30 to 45 tonnes per hour capacity
8.	Loader	0.5 to 1.5 cubic metres bucket capacity

9.	Paver finisher	45 to 75 tonnes per hour handling capacity of hot mix aggregate
10.	Bitumen boiler	1000 to 1500 litres capacity
11.	Bulk bitumen truck	7000 litres capacity
12.	Air compressor	(a) 3 to 4.5 cubic metres per minute (for initial exploratory work) (b) 6 cubic metres per minute and 10 cubic metres per minute (for large work)
13.	Stone crusher (a) (400 mm × 225 mm) (b) (400 mm × 250 mm)	14 to 18 tonnes per hour
14.	Granulator (a) (300 mm × 175 mm) (b) (400 mm × 100 mm)	5 to 8 tonnes per hour
15.	Rotillor	Working Width: 1.25 metres Depth: 200 mm
