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No. RW-22015/7/89-RMP *Dated the 14th February, 1991*

To

All the Engineer-in-Chiefs/Chief Engineers of State PWDs and Union Territories dealing with N.Hs; All the Secretaries of State Govts/Union Territories; Director General (Border Roads).

Subject: Use of proper stone crushers for obtaining aggregates for road works.

In road construction, the requirement of different sizes of crushed aggregates varies a lot. For base courses, coarse aggregates are needed more than the other fractions. For bituminous layers the range of aggregate sizes

varies from fine to coarse according to the specifications viz. bituminous macadam, dense bituminous macadam, semi-dense-bituminous concrete, bituminous concrete, pre-mix carpet, mix seal etc. The need for right sizes of aggregates is all the more critical for higher specifications like dense bituminous macadam and bituminous concrete.

2. By and large, the conventional method of producing aggregates in the country has been single jaw crushers with rotary screens apart from hand broken methods. Hand breaking is not permitted currently by the Ministry on major jobs. However, production of aggregates even by single jaw crusher has limitations and it is not possible to produce material of required sizes and quality. This is because with such crushers and rotary screens, proper sizes of aggregates cannot be obtained since variation in sizes is not possible and also screening is not fully effective.

3. In view of the above, it is critical that integrated crushing and screening plants having multi-stage crushing units with primary and secondary crushers and vibratory 4-deck screens working in close circuit should be installed on all major works. This system provides enough flexibility in operation and the product-mix can be varied suiting the requirements of work. By changing the size of screens in the vibratory screen system, it is possible to restrict the production of unwanted sizes and the bigger sizes can be again diverted for re-crushing. The matter was discussed in the meeting of the Chief Engineers held at Shimla on 29th April, 1990. A copy of agenda on this item is enclosed for information at Appendix 'A'. Keeping in view the requirement of correct sizes of aggregates and viability of investment in relation to the size of work it was proposed that the use of such crushers be made compulsory on all road works costing more than Rs. 5 crores.

4. It has, therefore, been decided that henceforth on all road projects costing Rs. 5 crores and more, the use of multi-stage crushing system having primary and secondary crushing units with four-deck vibratory screens working in close circuit should be made obligatory. Such a crushing unit should be owned by the contractor himself as besides the advantages stated above, it will ensure regular supply of aggregates which has been a bottleneck in the progress of major projects.

5. It is, therefore, requested that the above requirement may be clearly brought out in tender documents for all major NH works with effect from 1.4.91. Also, the contents of this letter may be brought to the notice of all field officers.

6. Receipt of this letter may please be acknowledged.

Appendix A to Ministry's Circular No. RW-22015/7/89-RMP dated the 14-2-91.

Copy of Agenda Item No.4 of Memorandum for the Chief Engineers meeting held at Shimla on 28-29 April, 1990. forwarded to all the States vide letter No. NH-18011/8/89-PL dated 20th April, 1990.

Item No. 4: "Development of Stone Crushing System"

In the road construction work the requirement of the crushed aggregates varies. In the base course the requirement of coarse aggregates is more than the other fraction. For bituminous layers also the requirement varies according to the specifications namely B.M., dense B.M. semi dense bituminous concrete, bituminous concrete, premix carpet, mix seal etc. With the adoption of dense B.M. and bituminous concrete which have very closed grading the requirement of proper sizes of aggregates has become all the more critical.

2. By and large the conventional method of producing aggregates so far in the country has been single jaw crusher with rotary screen. This system has to following limitations:

(i) Because of single stage crushing the size of the feed stone cannot exceed more than 150-200mm.

(ii) It generally produces more proportion of coarse aggregate.

(iii) Product size can be varied only to a limited extent e.g. from coarse to medium size but it cannot produce more fine aggregates.

(iv) Smaller sizes and fines are mainly got as by-product.

(v) Rotary screens are not effective in separating the aggregates in proper sizes.

(vi) Capacity of rotary screen is limited to about 10 cu m per hour,

In view of the above, integrated crushing and screening plant having multi-stage crushing with primary hand secondary crushers and vibratory 4 deck screens working in closed circuit is the answer. This system provides enough flexibility in operation and the product mix can be varied suiting to the requirement of the work. By changing the size of the screens in the vibratory screens, it is possible to restrict the production of unwanted gradation by suitability diverting the feed for recrushing.

Generally primary crusher is a jaw crusher and a secondary crusher either a jaw crusher or cone crusher (granulator). Vibratory screens generally have 4 decks with different sizes of screens. Different varieties of crushers and vibratory screens with capacities from 20 tons per hour to 100 tons and above with suitable vibratory screens and belt conveyor system are being manufactured in the country.

The system of integrated crushing and screening plant has to be promoted in highway construction. This could be either at quarry point, or the contractor himself acquiring such a plant. Complete plant with primary and second crushers vibratory screens etc. of 40-50 tons/hr capacity may approximately cost Rs. 30 lakhs. The exercise in the attached Annexure-I will show that this could be made mandatory for job sizes of 10 km of new construction or 30 km of strengthening work. Such work approximately cost Rs. 2 crores which are awarded after pre-qualification of contractors. As an alternative, the cut-off point could be still higher. In any case, this requirement can be made obligatory for all major works under World Bank/ADB financing.

Chief Engineers may consider the proposal:

Annexure-I

Enclosure to Item No. 4 of Memorandum for the Chief Engineers meeting held at Shimla on 28-29th April 1990

A.	*New Road Construction Assumptions*	
	(i) Length of the road with 7m width	1 km
	(ii) Layers requiring aggregates	
	(a) Base course of WBM or WMM	250 mm
	(b) Bituminous course	115 mm
	(c) Wearing course	40 mm
	Total	405 mm
	or	0.405 m
	Aggregate Required	
	For pavement	1000x7x.405x2.5 = 7087.5 Tons
	Add for providing 1.5 m wider paved shoulders.	
	Thickness of WBM + PC or MC	245 mm
	Aggregate required/km	1000x3x.245x2.5 = 1837.5 Tons.
	Total aggregate/km of road length	7087.5 + 1837.5 = 8925 Tons
	Add 10% wastage. Hence total weight of material/km length	8925 + 892.5
	Say	= 9820
	10 km length	= 98200 Tons
B.	*Strengthening of Existing Roads-Assumptions.*	
	(a) Layers provided	150 mm
	(b) Wearing course	25 mm
	Total	175 mm
		= .175 m
	Net requirement of various sizes of stones =	= A x Thickness
		= 1000x7x.175x2.5
		= 3062.5 Tons.
	Add for hard shoulder 1.5 m wide on either side	= 1837.5 Tons
	Total aggregate/km length	= 4900 Tons
	Add 10% for wastage	= 4900 + 490
		= 5390
	Say	=5400 Tons
	10 km length	= 54000 Tons
	Requirement of Crusher	
	Suppose the project time	2 years
	Actual working day/year	250 days.
	The work of crushers should be completed 3 months before completion of the project working days available	250x1.75 yrs
		437.5x6 hrs/day
	Total working hrs available	2625 hrs.
	Say	2600 hrs.
A	Requirement of Crusher Capacity for the execution of New 10 km Road	98200
		2600
	Add 25% for efficiency.	37.76 Tons/hr
		37.76 + 9.44
		47.20
	Crusher Capacity	48 Tons/hr.
B	Requirement of Crusher Capacity of 10 km of existing road	54000
		2600
		20.76 T/hr.
	Add 25% for efficiency Crusher capacity	20.76 + 5.19
		25.95
	Say	26 Ton/hr capacity.