404.36

No. RW/NH-33041/2001-S&R (R) **Dated the 16th May, 2006**

To

The Engineer-in-Chief and Chief Engineers of State PWDs and UTs (dealing with National Highways and other Centrally sponsored schemes); The Chairman, National Highways Authority of India; The Director General (Border Roads); The Director, Central Road Research Institute; The Director, National Institute for the Training of Highways Engineers.

Subject : Use of Rubber and Polymer of Modified Bitumen in Road Works–Process of Transportation of Modified Bitumen–regarding

Guidelines on use of Polymer and Rubber Modified Bitumen in Road Construction have been laid down in IRC:SP:53 (First Revision–2002). However, the provisions contained in this are not elaborate as far as transportation of modified bitumen is concerned. It is pertinent to note in this regard that in addition to the safety and handling

procedure applicable to normal penetration grade bituminous materials, special attention needs to be given for the transportation of modified bitumen so that there is no deterioration in its quality and its effectiveness is retained. Some of the essential requirements for this purpose are:-

(i) Necessity of having effective re-heating system and circulation devices to maintain the specified temperature of modified bitumen during transit to enable constant circulation of the bitumen, which in turn helps in avoiding settling down of the modifier.

(ii) Necessity to ensure that the modifier does not degrade during the process of transportation.

(iii) To safeguard against segregation of CRMB during long storage.

2. In due consideration of the importance of these aspects, Ministry had constituted a Committee for preparation of specific guidelines on the process of transportation of modified bitumen. A copy of the report of the Committee is enclosed herewith. It is requested that the comments/observations on this may be sent to the Ministry at the earliest so as to reach the Ministry latest by 16.06.2006 for enabling finalization of guidelines in the regard.

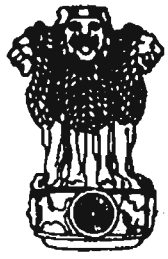
(Enclosure to Ministry of Shipping, Road Transport & Highways, Department of Road Transport & Highways, letter No. RW/NH-33041/2001-S&R (R) dated 16.5.2006)

REPORT

ON

THE PROCESS OF TRANSPORTAION

OF MODIFIED BITUMEN



GOVERNMENT OF INDIA
MINISTRY OF SHIPPING, ROAD TRANSPORT & HIGHWAYS
(DEPARTMENT OF ROAD TRANSPORT & HIGHWAYS)
DECEMBER 2005

be ensured. The heat loss during transit should be maintained by reheating with the help of gas/oil burners by circulating heat through the fire tubes and should be carried out intermittently. Before off loading the bitumen from bulk carrier/tanker at the hot mix/storage site, it should be ensured that the modified bitumen is properly circulated to ensure a homogenous mix.

3.3.3 When the tanker is empty or the level of modified bitumen falls below the upper part of the fire pipe in the tanker, heating should not be done as it may prove to be hazardous.

3.3.4 It should be ensured that pump, discharge/circulation pipes are cleaned after use to avoid chocking of material. Suitable arrangement to have the chock valves in the pipeline should be made to ensure proper cleaning of the pumps/pipe line.

A sketch of the suggestive Transport Tanker is given vide **Annexure-II.**

3.3.5 Storage Tanker

For the storage of modified bitumen a special type of storage tank is necessary. It is recommended that modified bitumen, particularly CRMB should be used immediately after arrival at site, or soon within short period. During this period, there should be adequate circulation and heating of the CRMB in the storage tankers to ensure maintenance of its temperatures.

The storage tank should be well insulated having proper arrangement for circulation through the circulation pump coupled with motor. To maintain the temperature, the storage tank should have couple of fire tube circulating through the storage tanks and should be heated with a oil burner to pass hot air to maintain the temperature of minimum of 170°C during its storage before its use. The insulation for storage tank should be provided to minimize heat loss during storage.

3.3.6 However, there may be instances when it may not be possible to use modified bitumen immediately after its receipt at site in such situation the modified bitumen needs to be stored for longer period. Under such circumstances it is recommended to allow the bitumen to cool in the tank but before its use. Just before actual use, it should be heated to required viscosity accompanied by proper agitation thorough circulation by taking molten bitumen from the bottom of the storage tank to the top in order to maintain it as a homogenous mixture. When the temperature of the product reaches the prescribed temperature and required viscosity is achieved, the heating should be stopped to avoid the over heating of bitumen.

A sketch of suggested bitumen storage tank is given vide **Annexure-III.**

3.4 Precautionary instruction in equipments

Following instructions should be followed during transportation, storage and use:

(i) Modified bitumen must be heated at the prescribed temperature before it is loaded in the tanker.

(ii) The storage tanker should be well insulated having suitable arrangement for heating and circulation during transit.

(iii) The discharge and circulation pipe should also be well insulated to minimize heat loss.

(iv) Proper capacity pump should be installed to ensure that entire quantity of modified bitumen in the bulk carrier is circulated within half an hour and also tanker is unloaded within half an hour.

(v) Modified bitumen should be circulated and heated before it is unloaded in the storage tank.

(vi) Heating should be stopped before the level of modified bitumen reaches the top of the fire tubes.

(vii) Circulation process should continue till the stock lasts in the transport tanker.

(viii) The pump should be installed at the bottom of the tank and not on the sides.

(ix) The circulation/delivery pipes should be cleaned daily after operation.

(x) Do not stand in front of the discharge value while operating, as hot product may splash or leak.

(xi) Never use naked flame to check the level of bitumen in the tank/tanker.

(xii) Never do decantation with untrained staff.

(xiii) Keep children away from the place of decantation.

(xiv) Keep plenty of water and First Aid Kit available at the site.

3.5 Safety Measures

3.5.1 Bitumen is a hazardous material particularly when in a heated condition. All the prescribed safety standards for transportation and storage of such material shall therefore be followed. Requirements of Rules 129 to 137 of the Motor Vehicle Act, 1989 shall be complied with in respect of display of class label of the hazardous material, emergency information panel, supplying information by consigner to the owner of the vehicle and the driver regarding the material being carried etc. Every driver of a goods carriage transporting such material shall observe at all times all the precautions necessary for prevention of fire, explosion or escape of hazardous goods carried by him while goods carriage is in motion. When it is not being driven, he shall ensure that the goods carrier is parked in a place which is safe from fire, explosion or any other risk and is at all times under the control and supervision of himself or some other competent person above the age of eighteen years.

3.5.2 Fire fighting equipment as per statutory safety standards shall be installed wherever required.

3.5.3 All hot pipes shall be properly insulated and covered with appropriate leggings.

3.5.4 Appropriate cautionary sign boards shall be displayed at all identified risky spots/places.

3.5.5 The crew/labourers associated with handling and blending of modified bitumen should be properly trained.

3.5.6 The crew/labourers associated with handling of bulk bitumen shall be issued with hand-gloves and gum boots etc. In the interest of their own safety, it shall also be ensured that these are used by them while working.

3.5.7 Necessary arrangement for providing first aid in case of emergency should be available at site.

CHAPTER-4

QUALITY CONTROL REQUIREMENTS

4.1 Modified bitumen must be tested for the requirements as per Table vide para 2.5, including testing for viscosity requirement at the following frequencies and situations:

(a) One per batch (batch blending) or two per day (for continuous blending) during blending at site.

(b) Each load delivered to site when blended at the bitumen supplier's terminal.

(c) Beginning of each day from the storage tank when storing the modified bitumen at project site. The sample may be obtained from the discharging pipelines exiting the storage tank prior to its incorporation into the mix.

4.2 Quality control records shall be maintained properly for the modified bitumen at the production center as well as at site where it used in the construction of roads.

4.3 Quality control requirements where CRMB is used in bituminous mixture:

- CRMB must be used in the bituminous mix as soon as it is produced as its quality may start to deteriorate from degradation of rubber. It is therefore, necessary for the CRMB producing agency that a relation between time and viscosity is developed and whenever there is a change in source of bitumen and/or crumb rubber, the same may be repeated.
- Since crumb rubber in CRMB has a tendency to separate from bitumen and settle down, it (CRMB) should be kept to circulate continuously or agitated by mechanical means through high duty pumps during its transportation to HMP and its storage tank.
- Since modified bitumen is substantially stiffer than ordinary bitumen, compaction of bituminous mix containing CRMB should become promptly to adequate compaction in procurement.

4.4 Quality control requirements where CRMB is used in the construction of bituminous pavement:

- Soapy water or silicone emulsion should be sprayed on truck beds so that asphalt mix does not stick to the bed. Use of diesel is not desirable at all for this purpose.
- Since the viscosity of CRMB is more than that of unmodified bitumen, higher mix temperatures are needed to obtain adequate compaction of the pavement.
- CRMB sets faster than unmodified bitumen. Therefore, compaction of asphalt mix should begin promptly after lay down by the paver. If the mix has cooled down, it may not be possible to obtain adequate compaction, which is very important for pavement durability.
- The compaction should be done with conventional and vibratory tandem rollers and pneumatic tyred rollers may be used only in the finished layers.

CHAPTER-5

SUGGESTIONS AND RECOMMENDATIONS

5.1 Some of the states of USA are still using modified bitumen. Particularly CRMB. They have reported very good experience of using modified bitumen till date. Hence, use of modified bitumen in road construction should be encouraged.

5.2 Presently, required facilities for blending modifiers with the conventional bitumen are available at some refineries only in the country, which results in longer haul for transportation of CRMB/PMB. To avoid long distances or time delay it is felt necessary to develop blending facilities at various places.

5.3 The required properties of ground tyre rubber for use in the production of CRMB must be specified through IRC:SP-53-2002.

5.4 Viscosity being the key property of the modified bitumen, rather than temperature, viscosity values applicable to various stages must be specified in the standards and specifications. Further, sufficient training of field staff must be ensured to make the staff familiar with the viscosity tests and other key requirements. Viscosity test must also be included in Table 5 of IRC:SP-53-2002.

5.5 It must be ensured that for the transportation of modified bitumen, the tankers are equipped with high duty circulation pump, controlled heating arrangement, insulation etc. It will be the responsibility of the manufacturer to ensure that the supply of modified bitumen is made through those tankers only which have suitable arrangements as mentioned above. The maximum distance to which modified bitumen can be transported will depend upon the time viscosity curve. If it degrades, viscosity will decrease and it will not meet minimum viscosity requirement.

5.6 The Transportation Tanker and the Storage Tank suggested in this report may be made compulsory by the Organizations using modified bitumen on road works.

5.7 The safety measures and precautions suggested in the report may be prescribed by the User Organizations through guidelines or circulars.

5.8 The manufacturer should maintain adequate quality control record of all blending activities. This

shall include at a minimum the following information for each batch of modified bitumen:

(i) Customer's name
(ii) Delivery date
(iii) CRMB grade
(iv) CRMB producer
(v) CRMB quantity
(vi) Source Ground tyre rubber
(vii) All the requisite test results including viscosity and viscosity time graph

5.9 Manufacturers of modified bitumenj shall provide the above details (para 5.6) to the user agency and shall certify that for each load delivered to project site, modified bitumen has been produced in accordance with laid down requirements.

5.10 User agency should carry out all the requisite tests including viscosity test at the time of taking delivery of modified bitumen and the test results be properly documented and published in various highways magazines/journals etc. for the use of researchers.

No. RW/NH-33040/3/2001-S&R(R) **Dated, the 21st December, 2005**

OFFICE MEMORANDUM

Subject : Constitution of a Committee on the Process of Transporation of Modified Bitumen

Kindly refer to Ministry's letter of even no. dated 12th September 2005 on the subject cited above.

2. I have great pleasure in submitting the Report of the Committee on the process of Transportation of Modified Bitumen. The report covers hte requiremnets of transportation of modified bitumen in detail including the details of main equipment required for transportation and storage of modified bitumen.

3. We are hopeful that following the suggestions/recommendations of the Committee by the executing agencies, the transportation of modified bitumen will be safer and will maintain its original properties.

4. I would like to take this opportunity to express my sincere thanks to the members of the Committee for giving useful suggestions and also Shri Kamlesh Kumar, Superintending Engineer (S&R) whose inputs and suggestions have been very useful in finalizing this Report.

No. RW/NH-33041/3/2001-S&R(R) **Dated, the 12th September, 2005**

NOTICE

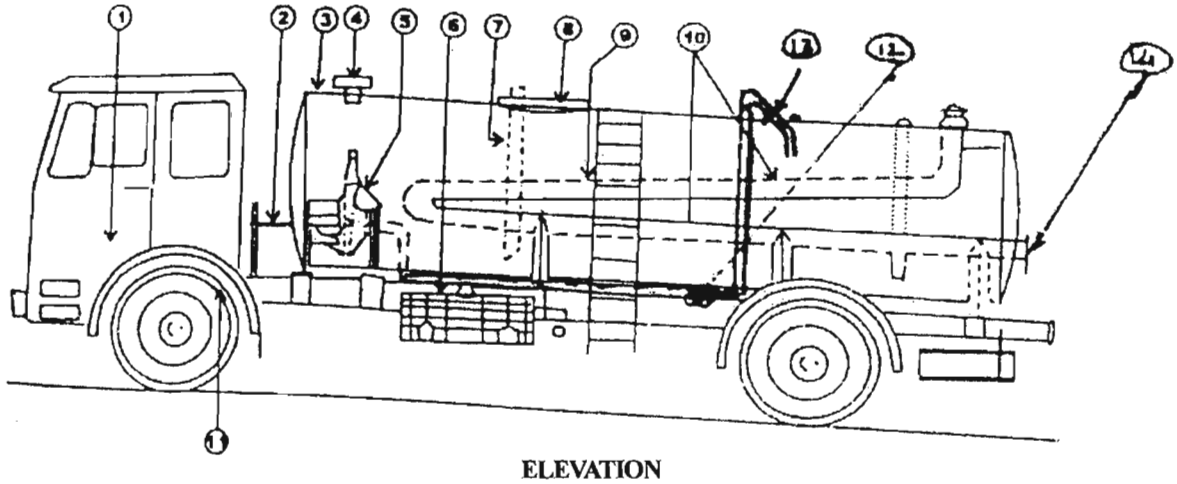
Subject: Constitution of a Committee on the process of transportation of modified bitumen.

With the approval of the competent authority, it has been decided to consitute a Committee consisting of the following for preparing specific guidelines on the process of transportation as well as necessary operations such as agitation and controlled heating of modified bitumen during transportation and mixing.

(i)	Chief Engineer (Standards & Research) MORT&H	–	Convenor
(ii)	Chief Engineer (Mechanical) MORT&H	–	Member
(iii)	Regional Officer, Bangalore MORT&H	–	Member
(iv)	Regional Officer, Chandigarh MORT&H	–	Member
(v)	Representative from CRRI	–	Member
(vi)	Representative from NHAI, HQ	–	Member

2. The Committee is requested to furnish its recommendations within two months.

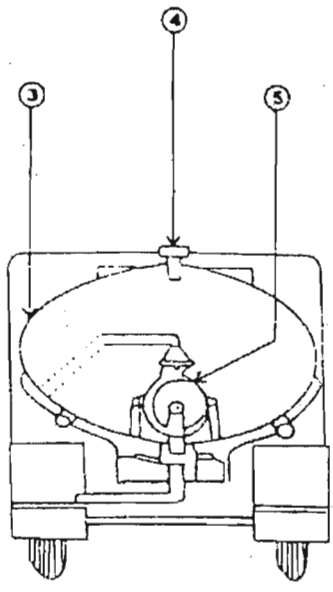
Bitumen Transportation Tank General Construction



ELEVATION

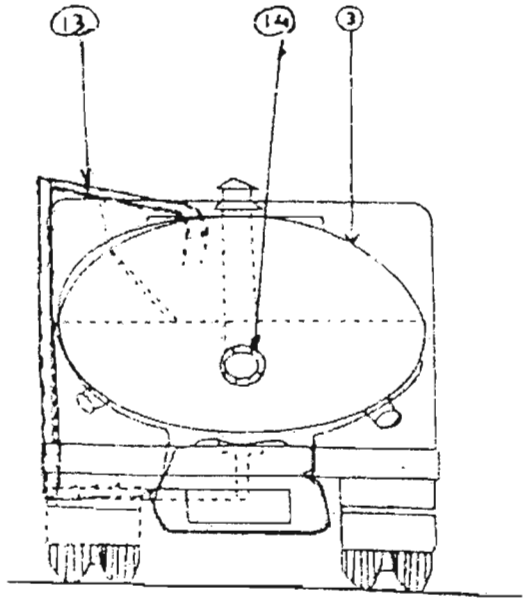
1. Engine
2. Power Take off Shaft
3. Tank
4. Pressure Vent
5. Pump
6. Diesel Tank
7. Tank Content Gauge
8. Mainhole Cover
9. Thermometer
10. Flue Pipe
11. Passenger Take off arrangement
12. Discharge valve
13. Circulation pipe
14. Fitmgnt for oil/gas B

Bitumen Transportation Tank General Construction



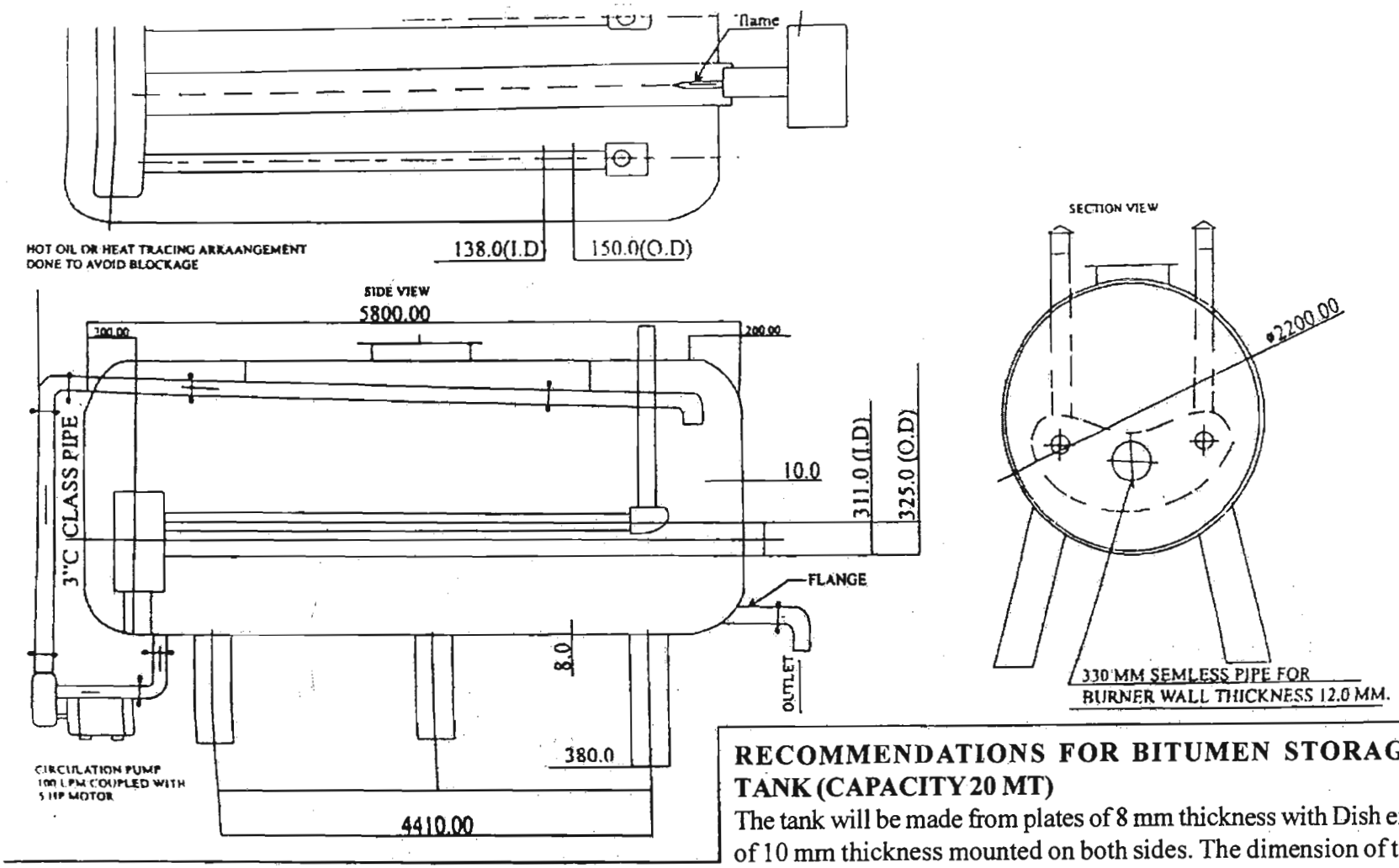
Sectional Elevation

3. Tank
4. Pressure vent
5. Pump



End View

3. Tank



RECOMMENDATIONS FOR BITUMEN STORAGE TANK (CAPACITY 20 MT)

The tank will be made from plates of 8 mm thickness with Dish end of 10 mm thickness mounted on both sides. The dimension of the tank would be L-5800 mm, Diameter-2200 mm, height-2550 mm and it will be mounted on six foundation foots of 12 mm & 18 mm thickness. The heating arrangement will be through burner & pipes. A recycle arrangement will be made through a drain fixed in the bottom of the tank which will be fitted with a 'Rotodel' pump having capacity of 100 LPM and Motor of 5 HP. Separate arrangement will be made for feeding the plant through separate two way value. The tank is insulated with 3 mm glass wool. Existing tanks fitted with pumps for circulating the product can also be used.