FORMATION REHABILITATION BY BLANKETING USING C.C. CRIB/CUBE & RAIL CLUSTER METHOD

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PREFACE

This report is prepared on the basis of IPWE technical presentations & papers, site inspection and literature survey. The views expressed are subject to modification from time to time in the light of future developments on the subject. The views do not represent the views of the Ministry of Railways (Railway Board), Government of India.

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(A.K.Singh)                                                        (Nand Kishore)
Director/GE                                                     Executive Director/GE
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FORMATION REHABILITATION BY BLANKETING USING CC CRIB/CUBE METHOD

1.0 INTRODUCTION:

Occurrence of unstable formation due to foreseen or unforeseen reasons is the bane of all railways. Huge expenditure is involved in maintaining such unstable and weak stretches on account of loss of ballast due to puncturing into formation and additional tamping effort required due to frequent disturbance in track geometry. With introduction of higher speed and heavier axle load, rehabilitation of unstable formation has become very essential.

2.0 REFERENCE:

Vide letter no. 2002/CE-II/5 dated 27.07.2004, Railway Board instructed RDSO to study the C.C. crib method, carry out site visits and standardize the procedure so that the method could be adopted on various railways. This method was initially devised by Shri S.P.S. Jain, the then PCE/S.E. Railway and was put to work in field conditions.

3.0 SCOPE:

This report covers technical details of the C.C. crib/Cube method, compaction aspects of blanket and suggests further improvements in the method.

4.0 METHODS OF REHABILITATION TRIED IN PAST:

Various methods, which have been tried in the past on Indian Railways to rehabilitate unstable formations are as follows:

i) Lime piling & L.S.P.I.
ii) Ballast piling
iii) Cement grouting
iv) Cationic bituminous emulsion
v) Vinyl drains
vi) Open cross drains filled with coarse grained material
vii) Sal balli/Sleeper/Rail piling
viii) Layer of laterite block
ix) Polyethylene and other similar impervious sheets
x) Geotextiles
xi) Geojute and sand layer

None of the above methods, tried over Indian Railways in the past, has been found suitable for rehabilitation. Experience gained over a period suggests that blanketing is the most practical, effective and economical method of rehabilitation. A layer of coarse-grained material properly compacted is termed as a blanket layer. Properly designed thickness of blanket reduces the stresses transferred to the sub grade to safer levels, known has threshold stress.
5.0 REHABILITATION PRACTICES OVER INDIAN RAILWAYS:

Various methods for laying of blanket are as follows:

i) With Aluminum Alloy Girder (RDSO Method)
ii) Track Dismantling Method
iii) With manually operated portals
iv) With C. C. Crib and rail clusters (S E Railway Method)
v) With rail clusters (Eastern Railway Method)
vi) Lifting of track with deep screening
vii) Fully mechanized methods tried over the world Railways.

The advantages & disadvantages of various methods have been detailed in RDSO Report No. GE-39 issued in March-2003. This report focuses on C. C. crib and rail cluster method only.

6.0 C.C.CRIB METHOD:

A technical paper on this method titled as, “Sand blanketing of bad formation by using C. C. Crib and rail clusters” was presented in IPWE seminar, 2002 by Shri S.P.S. Jain, the then PCE of S.E. Railway. The details are reproduced below:

i) **Components of the equipment**: Mainly there are 2 components, which are used in this method. The first one is a pair of CC Crib and the second part is one set of 2 clusters, each of 3 x 90R rails 10 ft. long, and a few wooden sleepers and steel bolts etc.

ii) **Assembly**: The 2 CC cribs are bolted together by means of high tensile nuts and bolts and covered all-round by thin steel sheets, except in the back side and at the bottom, where thicker plates of 3mm and 5 mm are provided for better load bearing characteristics.

The rail clusters of 3 x 90R rails 10 ft. long is a standard CE’s drawing and can be adopted upto a span of 10 ft. on B.G. with 20 kmph speed restriction.

iii) **Principle**: The principle behind the method is that rail cluster is used to relieve the small patch of track. One end of the rail cluster is supported on single layer of 12 ft. long CC Crib, and the other end is supported on wooden sleepers put across the track. At first stage, the formation below the rail cluster and just in front of CC Crib is worked upon. The CC Crib as well as rail cluster move forward very akin to cutter machine, leaving behind a gap in the formation, which is immediately filled by blanketing material.

iv) **Step-by-step method**: 
(a) First of all a suitable block of 30-45 minutes is taken and in this block, ballast is removed and formation is cut to desired depth and size to accommodate the pair of CC Crib.

(b) Thereafter, the block is cancelled after supporting the track properly over the CC Crib.

(c) Now the rail cluster is inserted below the sleeper kept on top of the CC Crib and the other end on the wooden sleepers.

(d) Speed restriction of 20 kmph shall be imposed immediately thereafter and traffic allowed to pass.

(e) The work will proceed against the direction of traffic.

(f) After the ballast in between sleeper is removed, the formation in front of CC crib and below the rail cluster is dug for 2 ft. depth and 2 ft. width for a length of 12 ft across the track i.e. 6 ft. on either side of center of track.

(e) Now the CC crib is pushed forward by one ft. by means of ropes, manually. This will leave a gap of 1 ft. behind the CC Crib.

(f) Before laying the blanket, geo-textile is spread in the gap as shown in the figure. The geo-textile shall form a layer of separation between the blanketeting material and parent formation. (Fig. 1)

(Fig. 1 Blanket laying with CC crib and rail clusters)

(g) The blanket material is kept ready in gunny bags by the side of track so as not to delay its pouring in the formation void behind the CC Crib.

(h) This gap then is filled by proper blanket material duly approved for quality laid down by the RDSO.

(i) The blanket material is topped upto sleeper level where it is left for compaction under traffic.

(j) While this process is going on, a further cut in the formation in front of the CC Crib is made and room is made for further movement of CC Crib forward.

(k) The process is repeated in a cyclic manner.

(l) The rail cluster is shifted forward by means of rope at suitable interval by incremental method so as to execute the work under traffic block and without jeopardizing track safety.
At a time, 5-6 sets of such rail cluster and CC Crib are inserted so as to execute the work simultaneously at number of locations on one particular site.

(v) Disadvantages of CC crib method

During execution, following disadvantages have been experienced:

a) At a time, very short length of blanketing - about one foot is possible.
b) CC crib is very heavy - about 300 kg and difficult to shift manually or with wire ropes.
c) Work can not be done on metal sleepered track.
d) Output of work is very low about 1.5 m to 2 m per day.
e) CC crib penetrates into soil and it becomes difficult to lift and move forward even with the help of dip lorry.
f) Uneven settlement takes place at the two ends of CC crib after passage of traffic leading to unsafe conditions at times.
g) Sometimes see-saw conditions in rail cluster is generated due to improper support at the ballast end for the rail cluster.

7. IMPROVISATION IN C. C. CRIB METHOD:

Though C. C. crib method, is very simple and economical for formation rehabilitation but due to constraints as mentioned above, a need for improvement was felt while executing work with this method. To overcome the few of these constraints, S.E. railway had effected certain changes in the CC crib method. The method which has been detailed in IPWE paper titled as, “Formation rehabilitation in Amarda-Jaleswar: Using CC cribs, rail clusters and further improvisation” in 2004 by Sr. DEN/South/Kharagpur. This method, hereafter referred to as ‘CC cubes’ is reproduced below:

7.1 Arrangements

To tide over the limitations of the earlier method, the following arrangements are made :-

(i) The C.C. crib is cut into three parts. Both the outer one thirds parts with star stiffeners are retained, termed as C.C. cubes, and the middle part is discarded. Outer truncated parts size is 60 x 60 x 60 cm.
(ii) The C.C. cube is encased in a 5 mm thick steel plate leaving one out of the six faces open.
(iii) A 12 m long rail clusters of three 52 kg rails is used instead of 3 m long rail clusters of three 90 R rails.
(iv) The 12 m long rail cluster is supported at every 3 m on the C.C cubes. (cross-section of supporting arrangements shown in fig. 2)
Fig. 2 Cross-section of supporting arrangements

The open face of CC Cube is kept vertical facing away from the track.

7.2 Activities

(i) Imposition of 20 kmph speed restriction.

(ii) Insertion of rail clusters under traffic block of about 2 hrs (fig.3)

(iii) Excavation of 900 mm wide and 900 mm deep (below sleeper bottom) trench across the track @ 3000 mm c/c (Fig. 4)
(iv) Lowering of CC cubes in trenches and supporting rail clusters on CC cubes (Fig. 5)

v) Excavation of caked ballast/Earth in between the trenches upto 900 mm below the sleeper bottom (Fig. 6)
Existing soil/caked ballast

Fig. 6  Excavation of existing formation/caked ballast between CC cubes

vi) Filling of blanket material without removal of CC cubes and rail clusters (Fig. 7)

Blanket material

Fig. 7  Filling of blanket material between CC cubes

vii) Lifting of track with jack and pulling forward the rail clusters by turfer at the leading end

viii) Removal of CC cubes and filling the balance cavity with blanketing material upto bottom of sleeper

Fig. 8  Pulling of rail cluster, cubes and blanketing

ix) Insertion of the released C.C. cubes under the rail clusters at 3 m from the leading set of C.C. cubes by lowering in the trench excavated in advance.

7.3 Progress: 18 m per day per set, due to ease in handling of C. C. cubes, with a batch of 110 men.

7.4 Advantages:
(i) Due to light weight & small size, C.C. cubes are easier to handle vis-à-vis C.C. crib.
(ii) Once the rail cluster is in position, the C.C. cubes can be inserted from the sides without traffic block.
(iii) Part filling of cavity is possible because C.C. cubes do not span continuously across the track.
(iv) Better output & utilization of man power due to excavation in the leading 3 m spans of the rail cluster and blanketing in rear portion simultaneously.

7.5 Constraints:

i) The track is still to be lifted for pulling forward the rail clusters and the work is to be done under 20 kmph speed restriction.
ii) The required depth of excavation has to be ensured at site since the CC cubes do not ensure it fully by default.

7.6 Precautions:

(i) Work to be executed only under the personal supervision of at least a J.E/P. Way.
(ii) During progress of work and after passage of train, track parameters are required to be monitored and track needs to be attended as required.
(iii) Proper track protection to be ensured at all times.
iv) A railway watchman is required to be provided round the clock.

8.0 SITE INVESTIGATION BY RDSO

For studying and suggesting improvements in the method, site near Balasore was visited by RDSO team twice. First in Sep’2004 by Shri S.K.Awasthi, ARE/GE & Shri S.K.Ojha, SRE/GE alongwith Shri A.K.Sahu, ADEN/BLS when rehabilitation work was going on between Balasore & Nilgiri road stations, Balashore-Bhadrak section, Kharagpur division, S.E.Rly. Second inspection was carried out in Dec’2004 by Shri A.K.Singh, Director/GE, Shri S.K.Awasthi, ARE/GE & Shri S.K.Ojha, SRE/GE alongwith Shri A.K.Sahu, ADEN/BLS when rehabilitation work was going on between Amarda road & Jaleswar stations, Balasore-Kharagpur section, Kharagpur division, S.E.Rly

This is a double line section on Group ‘B’ Howrah-Chennai route (partly electrified). On this section, approximately 33 to 35 trains ply daily & traffic density on UP line is 10 GMT and on DN line is 11 GMT. The sectional speed of this section is 105 kmph.

8.1 Balasore –Nilgiri road stations:
At this stretch, permanent speed restriction of 60 kmph was continuing on account of weak formation. The track is LWR with PSC sleeper at sleeper density of 1665 per km.

At the time of first inspection in September 2004, formation rehabilitation work with blanketing using CC cube and rail cluster method was in progress at km 240/14-16 (UP line). In this stretch, work was started in June 2004 and total length where rehabilitation work is to be carried out in this stretch is 715 m on UP line between km 240/7-33. As reported by the railway officials at site, an average progress of 10 to 12 m per day had been achieved so far with manpower of 60 to 80. However, on the day of inspection, only 6 m progress could be achieved with 60 manpower.

When this stretch was again visited in December 2004, no rehabilitation work was going on. Progress achieved so far is 300 m. The zone of permanent speed restriction, though reduced to few TP lengths, is still continuing in the stretch where rehabilitation work has not been done. AEN/Balasore reported that in the stretch where rehabilitation work was over, no track maintenance problem is being faced. Prior to execution of blanketing work, cross level variation was noticed to the tune of 30 mm, specially in summer and rainy season. At km 240/11-13, ballast cushion was found varying from 8 to 10 inches below bottom of sleeper after execution of work. The quarry dust has been used as blanket material and it was got tested by railways from S. M. Consultants, Balasore. As per testing, the material has the following properties:

<table>
<thead>
<tr>
<th>%age of fines</th>
<th>Cu</th>
<th>Cc</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.5%</td>
<td>1.67</td>
<td>0.68</td>
</tr>
</tbody>
</table>

The material being used does not conform to the specification of blanket material as per the ‘Guidelines for Earthwork in Railway Formation, July 2003. The values of Cu and Cc are less than the specified values. This will result in poorly graded material and lead to low density. Wooden mallets were used for compaction of blanket material and no water was added to quarry dust to get optimum moisture content for maximum compaction. Turfers of 3 tonne capacity were used for pulling the rail clusters.

8.2 Amarda –Jaleswar stations:

At this stretch, permanent speed restriction of 60 kmph had been imposed on account of weak formation. At the time of first inspection, no blanketing was going on in this stretch, however when the section was again visited in December 2004, formation rehabilitation work was in progress between
Initially, work was started with CC crib method in 60 m stretch but due to field problems faced in executing work with this method, remaining blanketing work was planned with CC cube method after incorporating improvements in the CC crib method.

Total quantum of rehabilitation work in this stretch is about 5 km – roughly from km 192 to km 197. Work was started in Oct 2002 from km 197/6 and stopped at km 194/6 in June 04. Again, work was started on 9.12.2004 from km 194/6. On the day of inspection, work was going on between km 194/4-6. After resumption of work, total 54 m was executed in span of 5 days amounting to average daily progress of 11m. During this period, the number of labourers employed varied from 60 to 80. The quarry dust which is being used as blanket material was got tested by railways from S. M. Consultants, Balasore. As per testing report, quarry dust has the following properties:

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of fines</td>
<td>0.25</td>
</tr>
<tr>
<td>Cu</td>
<td>4.33</td>
</tr>
<tr>
<td>Cc</td>
<td>2.56</td>
</tr>
</tbody>
</table>

Wooden mallets were being used for compaction and no water was being added to quarry dust. As a result, lot of quarry dust was flying around at the time of dumping it into track. Capacity of turfer used for pulling of rail clusters was 3 tonne.

9.0 OBSERVATIONS & SUGGESTIONS IN CC CUBE METHOD BY RDSO

i) Presently, 3 tonne turfer is being utilized in pulling the rail clusters, and both the clusters can be pulled at the same time by employing separate turfer for each cluster. It was observed that it is possible to pull rail cluster by 2.5 m in 6 to 8 minutes time by turfer being employed now. However, at the time of observation, rail cluster was clear of ballast, which might otherwise hinder this operation. The time taken is not much and appears to be quite reasonable. However, if this operation is to be further expedited, turfer of higher capacity say 5 tonne or more should be used for pulling the rail clusters.

The ballast particles rolled down close to rail cluster offer high resistance to pulling effort and hence regular removal of ballast from the side of rail cluster should be done. Small size rollers/pipes can also be used on CC cubes/wooden blocks for quick shifting of rail clusters. These rollers can be lubricated with grease.

ii) Excavation - At present, excavation is being done manually. Survey of excavators available in market was done as well as meetings were held with representatives of leading manufacturers of excavators. It was revealed that excavators which can dig out earth from beneath the sleeper...
under running traffic conditions are simply not available. JCBs with small size bucket are available but they also suffer from the handicap of limited boom length, due to which it may not be possible for JCB operator to watch the various maneuvers of the machine - a prerequisite for safe working of machine. Moreover, the boom of JCB will infringe the running track. In view of this, possibility of mechanization of excavation is ruled out under the present circumstances.

iii) Dumping of blanket material - At present, blanket material is being dumped manually into track from the location where it is stacked. It is first put into pan with the help of shovel, then the pan is carried on head and material is dumped into track. To save on time and to expedite progress, blanket material can be kept at site in gunny bags which can be dumped at site when required.

iv) Compaction of blanket material was being carried out with wooden mallets, this may not give sufficient compactive effort and as a result, blanket may not have desired density. Later on, track may exhibit settlement due to poor compaction of blanket. Also, there was no watering arrangement for compacting the material near OMC. In absence of water, lot of dust was flying around, with the result that progress of work was being hampered as workers had to wait for dust to settle down in order to have clear visibility. Blanket material is in general are coarse in nature and they are amenable to compaction only with the help of vibratory energy. Adequate importance and time should be given to compaction activity. For exploring use of vibratory compactors, market survey was carried out. Survey revealed that there a number of companies which are manufacturing vibratory plate compactors with small plate sizes which can easily be inserted in between the two adjacent PRC sleepers and compact the blanket material. Details of few of these models are given below:

<table>
<thead>
<tr>
<th>S. No</th>
<th>Name (Make)</th>
<th>Model No</th>
<th>Weight (kg)</th>
<th>Plate Size (mmx mm)</th>
<th>Compacting thickness (mm)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Plate Compactor (Fuji)</td>
<td>PRO-40</td>
<td>52</td>
<td>498X330</td>
<td>-</td>
<td>Annexure- I</td>
</tr>
<tr>
<td>2</td>
<td>Tamping rammer, (Fuji)</td>
<td>FR-75</td>
<td>72</td>
<td>330X280</td>
<td>-</td>
<td>Annexure- II</td>
</tr>
<tr>
<td>3</td>
<td>Vibratory tamper (BOMAG)</td>
<td>BT60/4 &amp; BT65/4</td>
<td>62&amp;68</td>
<td>350X735</td>
<td>550 &amp; 650</td>
<td>Annexure- III</td>
</tr>
<tr>
<td>4</td>
<td>Vibratory plate</td>
<td>BP8/34</td>
<td>54</td>
<td>545 x 340</td>
<td>-</td>
<td>Annexure - IV</td>
</tr>
<tr>
<td></td>
<td>Vibratory Plate compactor (Ingersoll-Rand)</td>
<td>GX160KI</td>
<td>90</td>
<td>480 x 585</td>
<td>300</td>
<td>Annexure - V</td>
</tr>
<tr>
<td>---</td>
<td>----------------------------------------</td>
<td>--------</td>
<td>---</td>
<td>----------</td>
<td>----</td>
<td>---------------</td>
</tr>
<tr>
<td>6</td>
<td>Upright rammer (Ingersoll-Rand)</td>
<td>GX120AR</td>
<td>71</td>
<td>270 x 330</td>
<td>530 mm</td>
<td>Annexure - VI</td>
</tr>
<tr>
<td>7</td>
<td>Vibratory Plate compactor (L &amp; T)</td>
<td>CPT140B</td>
<td>80</td>
<td>490 x 440</td>
<td>-</td>
<td>Annexure - VII</td>
</tr>
<tr>
<td>8</td>
<td>Vibratory Plate compactor (Continental)</td>
<td>MARK VC-20</td>
<td>-</td>
<td>730 x 570</td>
<td>254</td>
<td>Annexure - VIII</td>
</tr>
</tbody>
</table>

In view of availability of these small plate size compactors, there is no reason why they should not be used. However, the effect of these compactors on progress of work can only be adjudged after introduction of same in field.

v) It was observed that for taking out CC cubes, its open end is pulled out by labourers while the opposite side is pushed out with the help of crow bar. It is felt that the open side of CC cube can also be welded with a 5 mm thick plate as provided on other sides and handles can be provided on any two opposite sides at convenient locations. This will not only help in moving CC cubes from one location to other but also reinforce the CC cube.

vi) For taking out CC cubes, track is to be lifted with the help of jacks. After removal of cubes, space vacated is filled up with blanket material and thereafter, ballast is put over blanket and packing is carried out. This operation requires 30 to 40 minutes. As CC cubes constitute support system for track, removal thereof without block protection may endanger safety. At site, this operation is presently being carried out by monitoring train position but without block. To avoid unsafe conditions for passage of traffic specially on busy routes, clear block of required duration should be arranged for shifting of CC cubes and rail cluster.

vii) At present, partial blanketing is being done as the formation is being dug out in 5.5 m width. Due to existence of original soil by the side of blanket, drainage is impaired. To facilitate drainage, boulder cross drains of size 1.5 m X 0.6 m extending from inner end of excavation to outer side of formation are being provided @ 12 m c/c. It is felt that over a period of time, these drains may get choked as the formation soil can enter into pore space of boulders easily. To prevent such possibility, boulder can be wrapped around in geo-textile at sides and bottom of cross drains where it comes in touch with soil. Other problem with these drains, as pointed out by section DEN Shri V. K. Chaudhary that at the
point immediately above these boulder drains, track sags a little bit, resulting in unevenness over boulder drains. The stretch where these drains have been provided was trolleyed and unevenness was measured at a number of locations, however, there was nothing unusual about the pattern of unevenness in this stretch vis-à-vis the stretch where boulder drains have not been provided. One plausible reason for this could be that the track has been machine tamped in recent past.

However, boulder drains can be completely done away with if full formation width blanketing is carried out. The extra work in the outer portion beyond sleeper end can be carried out easily.

viii) As of now, wooden sleepers are being used on the side of excavated portion at the end of day to stop falling of ballast, blanket & bank soil. At the time of dumping of blanket material, extraction of these sleepers becomes difficult. If three steel plates of adequate size and thickness with handles on top—one for space between two rails and two for side portions are used in place of wooden sleepers, this operation may take less time as steel plates can be taken out while standing on the track.

ix) Work should always be executed in presence of railway officials and sufficient safety measures should be adopted during blanketing and after initial passage of traffic and monitoring of track parameters.

10. SUGGESTIONS FOR IMPROVEMENTS IN CC CUBE METHOD

The present method can be further improved by incorporating following items:

i) Sufficient water should be sprinkled on blanket during compaction so as to bring the water content near OMC. This will not only help in achieving maximum dry density but also reduce dust nuisance during execution of work.

ii) For effective compaction of blanket material should be compacted in layers using vibratory plate compactors.

iii) To retain formation soil, blanket and ballast, steel plates of adequate size and thickness with handles on top should be used in place of wooden sleepers.

iv) One open side of CC cube can be welded with a 5 mm thick plate as provided on other sides and handles can be provided on any two opposite sides at convenient locations which will not only help in moving CC cubes from one location to other but also add to the stability of the CC cube.

v) Turfer of higher capacity say 5 tonne or more should be used for pulling the rail clusters. Small size rollers/pipes preferably lubricated with grease can also be used on CC cubes/wooden blocks for quick shifting of rail clusters.
11. CONCLUSIONS:

Comparative position of CC crib vis-à-vis CC cube and suggested improvements by RDSO, in the light of discussion above, is as follows:

<table>
<thead>
<tr>
<th>S. No</th>
<th>Item</th>
<th>CC crib</th>
<th>CC cube</th>
<th>Improvements suggested by RDSO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CC Crib size &amp; No.</td>
<td>2ft x 2ft x 6 Ft - two no. (All faces covered by plates)</td>
<td>2ft x 2ft x 2 Ft -10 nos. (All faces covered with plates except one face)</td>
<td>-Same size&lt;br&gt;-All faces may be covered with 5 mm thick plates and provide handles on two opposite sides.</td>
</tr>
<tr>
<td>2</td>
<td>Rail cluster</td>
<td>- Length: 3m&lt;br&gt;-rail section: 90 R&lt;br&gt;- No. of rail cluster : 2&lt;br&gt;- No. of rails in each cluster: 3</td>
<td>-Length: 12m&lt;br&gt;-rail section: 90 R&lt;br&gt;- No. of rail cluster: 2&lt;br&gt;- No. of rails in each cluster: 3</td>
<td>No change</td>
</tr>
<tr>
<td>3</td>
<td>Traffic block</td>
<td>Initially 30-45 minutes block for removal of ballast &amp; excavation for insertion of cc crib</td>
<td>Initially 2 hrs block for removal of ballast and insertion of rail cluster</td>
<td>No change</td>
</tr>
<tr>
<td>4</td>
<td>Excavation</td>
<td>Manually</td>
<td>Manually</td>
<td>No change</td>
</tr>
<tr>
<td>5</td>
<td>Filling/ dumping of blanket material</td>
<td>Dumped from gunny bags</td>
<td>Manually with shovels &amp; pans.</td>
<td>Manually but blanket material may be dumped from gunny bags already stored.</td>
</tr>
<tr>
<td>6</td>
<td>Compaction</td>
<td>By train vibrations</td>
<td>Wooden mallets &amp; by train vibrations</td>
<td>Compaction should be done with small size vibratory plate compactors/ upright rammers.</td>
</tr>
<tr>
<td>7</td>
<td>Pulling of rail cluster</td>
<td>Manually by wire ropes</td>
<td>By turfer of 3.0 tonnes capacity</td>
<td>Pulling may be done with turfer of 5.0 tonnes capacity and small size roller/ pipes lubricated with grease should be used for quick and easy shifting of rail cluster.</td>
</tr>
<tr>
<td>8</td>
<td>Shifting of CC Crib/Cube</td>
<td>Manually pulled with wire ropes</td>
<td>Manually by lifting</td>
<td>No change</td>
</tr>
<tr>
<td></td>
<td>Block for shifting of CC crib/ cube &amp; remaining blanketing and ballasting</td>
<td>No block ( S.R. 20 kmph)</td>
<td>No block ( S.R. 20 kmph)</td>
<td>30-45 minutes block may be required on busy routes.</td>
</tr>
<tr>
<td>---</td>
<td>--------------------------------------------------------------------------</td>
<td>--------------------------</td>
<td>--------------------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>10</td>
<td>Supporting arrangement for retention of soil/blanket material</td>
<td>Wooden sleeper provided on sides of excavated portion.</td>
<td>Wooden sleeper</td>
<td>Steel plates of adequate size &amp; thickness with handles on top may be used to retain soil/blanket from sides.</td>
</tr>
<tr>
<td>11</td>
<td>Drainage arrangement (when full width of blanket is not envisaged/planned)</td>
<td>No mention</td>
<td>Cross drains of 1.5m x 60 cm boulder filled provided @ 15 m c/c</td>
<td>Cross drains may wrapped with geo-synthetics or full width blanket should be adopted.</td>
</tr>
<tr>
<td>12</td>
<td>Progress</td>
<td>1.5 m –2 m per day</td>
<td>9 m 12 m per day</td>
<td>Progress may be increased with more number of sites tackled simultaneously (say about 50 m per day with executing the work at 4 locations).</td>
</tr>
</tbody>
</table>

Railway may consider the suggestions & improvements given in para 9.0 & 10.0. After receiving feedback from railways, the points shall be suitably incorporated and the method shall be finalised.
12. REFERENCES:

1. Railway Board’s letter no. 2002/CE-II/5 dated 27.07.2004


OFFICERS AND STAFF ASSOCIATED WITH PREPARATION OF REPORT

This report has been prepared by Shri A. K. Singh, Director/GE, under the guidance of Shri Nand Kishore, Executive Director/GE. Valuable assistance has been rendered by

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