

INDIAN RAILWAYS BRIDGE MANUAL

(Edition 1998)

ADVANCE CORRIGENDUM SLIP NO. 18 DATED 17.12.2008

Add new para 224 in IRBM as below:

224 Dismantling of arch bridges:

1. In case of running lines, prior CRS sanction for methodology/safety precautions, drawings etc. shall be obtained for dismantling work of the arch bridge.
2. Arch is a structure, which transmits heavy horizontal thrust to abutments and piers. In case of abutments, this load is resisted by heavy section of abutment and soil fill behind it. At piers, in case of multi span arches, horizontal thrust due to dead load is balanced. If both spans are loaded, horizontal thrust due to live load also gets balanced, but, in case of only single span being loaded, pier has to bear unbalanced horizontal thrust. Piers are, therefore, designed to take up only unbalanced horizontal thrust which is quite less as compared to total thrust at abutment.
3. Whenever in multi span arches, if one span is dismantled, large unbalanced horizontal thrust comes on pier and there can be collapse of pier along with other spans. Following procedure, suitable for both single and multi span arches, can be followed to safely dismantle arch bridges:
 - (a) **Dismantling with explosives:** - Explosives can be used to bring down all spans of an arch bridge at one go. This will require cordoning off the area likely to be affected by the explosion and long time to remove the debris thereafter. This method can only be used if the arch is not near habitated area and experts can be engaged to take up such work.

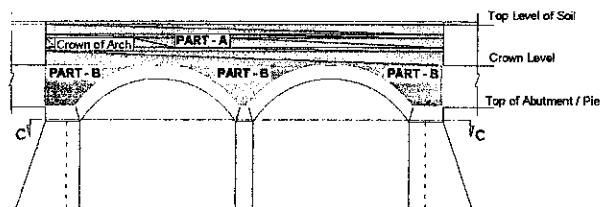
(b) Dismantling with machinery: - Special type of machinery with long jib can be used to dismantle one span of arch in one go. As unbalanced horizontal thrust may cause collapse of all or few other spans of the bridge, whole work should be planned in a single block and all the spans should be dismantled in one block. It must be ensured that work is completed in the block and no portion of the arch is left without dismantling in the block. This procedure will require cordoning off the whole area and engaging suitable machinery.

(c) Part-by-part dismantling: - The above two methods, though safe, may not be possible under many circumstances. In part-by-part dismantling method, dismantling is done in such a systematic manner that at no point, there is excessive unbalanced horizontal thrust on piers.

Step by step procedure shall be as under :-

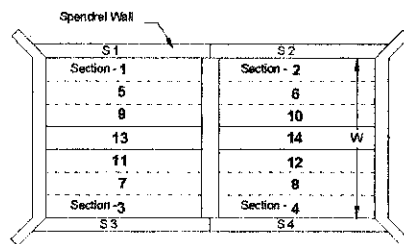
(i) Divide the depth of soil into two parts, i.e. **Part 'A'** from top of soil to the depth up to the level of Crown of arch. **Part 'B'** is from Crown level to the top of Abutment / Pier as shown in Fig. 1(a).

(ii) Divide the width (W) of Bridge into equal parts each about 50cm wide for the width of each span as shown in Fig. 1(b). (Fig 1(b) shows bridge divided into seven parts, it will be more for wider bridges). No. of divisions should be odd number.



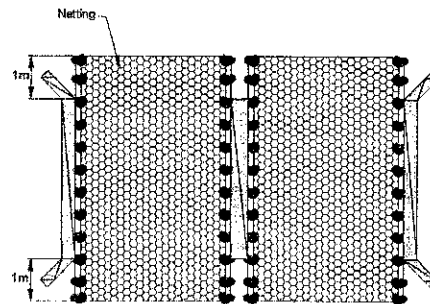
SECTIONAL ELEVATION

Fig. 1(a)



PLAN

Fig. 1(b)



Section CC

Fig. 1(c)

(iii) Engage four parties to remove soil. First party will start removing soil from the **Section 'A1'**. It means start removing soil in the **section- 1** from top level and depth upto the level of crown of arch i.e. **Part 'A'** as shown in the sketch. Second party will simultaneously remove the soil from **Section- 2 Part 'A'** i.e., **A2**. It means soil from top level to the depth up to the crown. Third and four parties shall work in section A3 & A4.

(iv) After completing A1, A2, A3 & A4, follow the sequence Section – A5, A6, A7, A8, and then A9, A10, A11 & A12 and then A13 & A14. After this exercise Section A is cleared. This procedure ensures that there are no unbalanced lateral forces.

(v) Similarly follow the same sequence for removing soil of Part – B.

(vi) Provide thick nylon netting supported on piers so as to arrest any falling debris as shown in fig 1(c).

(vii) Now each of four parties should break spandrel wall S1, S2, S3 & S4 simultaneously under block, as some debris can fall on track.

(viii) After breaking spandrel wall, arch barrel of section 1, 2, 3 & 4 shall be broken under block protection by each of four parties. In next block, section 5, 6, 7 & 8 shall be broken and so on.

(ix) At the end, last middle section 13 and 14 will remain (since arch has been divided into odd numbers of parts), which should be dismantled by pulling it down with the help of ropes or some long jib machinery. While dismantling last section, no person should be on top of the arch.

(x) Afterwards piers can be dismantled in systematic manner from top to bottom.

In case of 3 span arches, no. of parties required shall be 6, in case of 4 span arches, no. of parties required shall be 8 and so on.

4. General

- (a) The dismantling of arches should be done under proper supervision and as per approved scheme of dismantling.
 - (b) At major dismantling sites, minimum level of supervision shall be Senior Section Engineer(in-charge), who should be nominated by Dy. Chief Engineer/Sr. DEN in writing.
 - (c) Dismantling Plan should be approved by Chief Bridge Engineer in case of Open Line Organization or H.O.D. In case of Construction Organization. Dismantling plan should invariably mention the sequence of dismantling operations, equipments to be used for dismantling, area likely to be affected by debris, any adjacent buildings likely to be affected and action to be taken thereof.
 - (d) Proper barricading should be done to stop access of unauthorized personnel near the dismantling area. Wherever necessary, assistance of RPF should be taken to prevent people from coming close to dismantling area. Signages warning people not to enter the danger zone should also be displayed.
 - (e) Proper announcement through Public Address System should be done at regular intervals to keep the onlookers away from the major dismantling affected zone.
 - (f) The adjacent buildings likely to be affected by dismantling should also be evacuated.
 - (g) In area where law and order is likely to be affected, assistance of local police should be taken to keep people away from dismantling area.
 - (h) Dismantling would be done under rail and road traffic diversions/blocks.
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