SOUTH CENTRAL RAILWAY

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No.W. 71/BR/Bridge Policy Dated.27-11-2015

CAO/C/SC, CPM/RVNL/SC

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Sub: Provision of cross drainage during doubling/tripling and flood protection Works –Reg.

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Recently during heavy rainfall in Guntakal Division, there was an incident of piping under the track bank due to stagnation of rain water between UP and DN lines in between NRE-MMPL block section. On detailed investigations it is noted that the there is a distance of around 10m between UP and DN lines at this location and the area in between the UP and DN lines was filled with water. At this location in between UP and DN line longitudinal drain was not provided by RVNL during doubling work and further water stagnated at this location due to change of gradient (i.e, from falling gradient to rising gradient) in the track, which ultimately lead to piping under the track and consequent slippage of bank of UP line track.

This situation could have been avoided, if RVNL had taken care to provide a cross drain at the location where there was change of gradient, which would have avoided stagnation of rain water.

It is instructed that RVNL and Construction organization must take care of this aspect in all future doubling/tripling works and provide sufficient span culvert to ensure cross drainage of water at suitable intervals and at change of gradient locations which creates a sag and where there is a possibility of stagnation of rain water. In addition to it, pitching and other bank protection measures are also to be provided on the downstream of the cross drainage bridge to protect the bank from erosion. Divisions are also advised to take care of this aspect while approving L-section and bridge drawings.

Further it is observed in recent flood, adequate suitable protection measures were not noticed for protection of bridges/culverts with shallow foundation which is leading to damage to them and embankment on their approaches. In this connection guidelines for providing protection arrangement in terms of drop wall, curtain walls, pitching on embankment` and pitching on downstream of drop wall to protect against erosion of soil on downstream of drop wall etc. as provided in old IR Way and Works Manual for the use of Bridge Inspectors "Appendix to Chapter X" is reproduced below (copy also enclosed) for guidance.

1. DANGER AND ALERT LEVELS

Every bridge must have the "danger level" distinctly painted on its abutment or pier. This level will indicate that if water level reaches this mark the safety of the bridge is likely to be adversely affected and all traffic may have to be suspended.

The marking of danger level should be done with great care. A thorough study with reference to the highest flood level, and the scoured depth so far experienced, should be made and the danger level marked at a height which will really constitute a danger to the bridge structure.

Adequate and satisfactory arrangements should be made for observing and reporting danger levels.

2. BRIDGES ON SMALL STREAMS WITH OPEN FOUNDATIONS :

Such bridges form a large contraction in the flow of the stream when water heads up behind them during floods. These should be provided with protection work in the form of stone pitching or Pucca flooring with drop walls, and pitching also on the downstream side of the drop walls if the foundations are not resting on inerodable strata. If hydraulic jump is likely to occur on the downstream side, it should be located on masonry floor or stone pitching. Where railway bridges are expected to function like sluices in a dam, due to heading up of water behind the embankment, the pitching should be carried to an appropriate length on the downstream side, ending in a lip wall. The length should be decided by the Engineer-in-Charge taking into account all the relevant factors.

Extreme care is necessary in passing trains over such bridges during high floods, especially when the afflux, i.e. the difference in levels of flood water on the up and down stream side of the bridge is appreciably high, as there is not only a danger from high velocity but also from sub soil flow which may carry away solid particles from below and result in piping.

Shallow wells should be considered on the same lines as open foundations. The stream bed between them should be adequately protected with pitching where necessary. This pitching may be carried down to an adequate length and ended in a lip wall, to protect against damage from high velocities and the formation of hydraulic jump on bare ground, if such a jump occurs.

Splayed wing walls are preferable to box type as they guide the water flow smoothly. During receding floods the toe of the bank may be under-cut. To guard against this, pitching of the bank may be necessary for a certain length. This pitching should be protected by a small flexible apron masonry or boulder toe wall to prevent its slipping. In cases where pier abutments are provided, small dum-well shaped projections on both sides of abutments are useful in preventing erosion along the bank during floods.

When the difference in water levels on up and down stream sides of the bank is appreciable, the Railway embankment functions as an earth dam. At a certain difference of levels on either side, piping may develop inside the embankment. Presence of rat holes, fox holes or holes dug by porcupines, may also lead to such piping of water and consequent damage to bank. This may easily be detected on the down stream side where muddy water may be observed boiling out of the bank slope. As a palliative measure, a cover of stones or empty cement bags filled with ballast or cinder should be applied immediately on these places to serve as an inverted filter and prevent washing out of earth particles. The running of trains on such embankments may be dangerous, as bank will sink due to saturation of soil and formation of piping inside them. Extreme care should, therefore, be exercised in running trains over such embankments , during and after floods.

3. BRIDGES WITH WELL FOUNDATIONS

A careful record should be maintained on the scour depths observed at bridges with well foundations. Whenever an appreciable scour, which is likely to progress below the permissible limits, is noticed at such a bridge, a reserve of pitching stones should be maintained nearby, for laying mattresses around the foundations in case trouble arises. The stone mattress should however be provided only when the scour goes down below permissible limits. Indiscriminate dumping of stones, in cases where scour is within permissible limits, may result in the formation of an inerodible bed which may cause a rise in flood levels and increased velocity resulting in deep scour on the down stream

side. At bridges where velocities are very high, the pitching stone may be tied in wire nets, before it is thrown around the foundations. After each flood, the scour conditions should be carefully studied, and protection provided at as low level as possible. On bridges where scour has gone beyond permissible limits, no traffic should be permitted until an Engineering Official, not below the rank of an Inspector, has thoroughly satisfied himself that bridge foundations are safe to carry the traffic. Extreme care is necessary in such cases, as the reduced depth of embedment may cause tilting of piers under traffic, thus damaging the bridge structure permanently.

It is advised that these instructions shall be followed in all cases of new bridges construction by RVNL, Construction organization, Divisions in cases of rebuilding of bridges and in case of bridges where there has been damage due to flood in the past or anticipated damage in future.

Encl: As above.

27/11/15

(S.N Singh)
Principal Chief Engineer

Copy to CBE; CTE; CE/TM; CPDE; CQE; CE/W.S & F; CE/TP – for information.

Extract

The Indian Railways way and Works Manual for the use of Bridge Inspector /

APPENDIX TO CHAPTER X.

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