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दक्षिण मध्य रेलव  
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CAO/C/SC

GM/RITES/SC, CPM/RVNL/SC, CPM/RVNL/BZA, CPM/RVNL/CHENNAI  
Sr.DEN/Co-ord/SC, GTL, BZA, HYB, GNT & NED

**Sub:** Open foundations -Keying into Rock and Provision of steel rock anchorages.

1. For Open foundations in Bridges, following provisions are available in various Manuals, Codes & Specifications regarding keying of foundations into rock:

1.1. Para 403(2) of IRBM: The foundation should be taken to a depth not less than 1.75m below the lowest anticipated scoured bed level in ordinary soil. In rocky soil, it will be adequate if it is properly keyed into the rock for a minimum of 0.3m in case of hard rock and 1.5m in case of soft rock. Sloping rock may be suitably benched. Fissures and weathered rocks should be avoided.

1.2. RDSO report no. BS-127 (Guidelines on type of foundations for Rly bridges): Same provisions given above have been reiterated in this report.

1.3. IRC-78 (2014): Minimum embedment of the foundations into the rock shall be:

1.3.1. Moderately strong rocks (UCS > 12.5 Mpa or SPT N value > 500): 0.6m

1.3.2. Moderately weak rocks (UCS < 12.5 Mpa but  $\geq$  2.5 Mpa or SPT N value >100 but < 500) : 1.5m

1.4. Para 2.6.5 of IRUSS 2019: In rocky strata, foundation should be keyed in the rock for depths mentioned below unless otherwise specified or approved:

1.4.1. Hard rocks like igneous granites or gneissic rocks with crushing strength of 100kg/Sqcm or more: 0.6m

1.4.2. Other types of rocks with crushing strength of 20 kg/sq.cm or more: 1.5m

1.4.3. Other cases to be decided by Engineer / Designer after considering presence of fissures, cavities, bedding planes and ultimate crushing strength.

2. Considering all the above provisions, following instructions are issued on keying of foundations into Rock for uniform adoption in the field.

2.1. Where actual depth of foundation at site is more than or equal to the design depth of foundation and founded on Hard / Soft rock, no keying into the rock will be necessary. Further, provision of Steel Rebar anchors drilled into rock will not be required in such cases. Sloping rock if encountered in the foundation, shall however be suitably benched.

2.2. Where rock is encountered at a shallower depth which is less than the design depth of foundation, keying for a depth of 0.6m in hard rock and 1.5m in soft rock shall be ensured. If keys are provided, there is no necessity to provide Steel Rebar anchors drilled into rock. If sloping rock surface is encountered, the keying depth shall be reckoned from the levelled/benched rock surface. Further, it shall be ensured that the entire excavated portion of the rock in the key is filled with concrete fully without any gaps in the sides. In case of fissured / weathered rocks or rocks with cavities / bedding planes, it shall be referred to concerned Design office for a solution.

2.3. Where keying is not feasible in the hard rock encountered at a shallower depth, steel rebar anchoring of the foundation in to the hard rock shall be done. Design of steel anchorages in such cases shall be a part of foundation design which should clearly mention the following details for proper execution by field officials:

- (a) the dia of steel anchor rod to be used;
- (b) length of steel rod to be embedded in the rock & foundation base;
- (c) spacing of steel rods
- (d) locations in the foundation base where such anchorages are to be provided.

2.4. Steel anchorages into the hard rock in open foundations may also be required in cases where the original foundation design has been made considering provision of steel anchors due to stability requirements of tall or slender abutments/piers.

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22/12/2021  
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C/-CTE, CGE, CE/RSW, CE/W, CE/P&D, CE/SD, CE/TP, CE/TM & CE/WS&F for information please

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