New Equipment & Systems Approval - Hollow Steel Sleeper for Wayside Equipment Installation

1. **Determination of Need**

   ARTC, in conjunction with the rolling stock operators, is undertaking the installation of rolling stock wayside monitoring equipment at a number of sites in NSW, Vic and SA.

   Installation of this equipment requires the running of cables, power and data, to and from the track side monitoring equipment sensors to the data collection and processing equipment located in specially equipped huts at each site.

   A mechanism is required to allow the cables to pass from equipment sensors on one side of a track or tracks, to the equipment hut on the other side of the track.

   For the monitoring equipment to have maximum effectiveness downtime from damage by ballast or other debris thrown about by passing trains needs to be minimised; to this end, the mechanism by which the cables pass under the track is required to enclose the cables, and to be both robust and long lasting.

2. **Significant Change or Not**

   This change in equipment is assessed as **MINOR**

3. **Review Panel**

   - John Cowie - Manager, ISP, Standards and Systems
   - Tim Calver - Standards and Technical Services Engineer
   - Ian Domleo – Senior Track and Civil Consultant

4. **Equipment Suitability**

   Equipment chosen for the task is a steel hollow sleeper as per VAE Railways Systems drawing VAM 13768 rev B (attached).

   The sleeper is derived from the in-bearers which are part of the assembly of a 60kg Standard Gauge Tangential Turnout currently being trailed in NSW.

   Sleeper cross section, material thickness and grade are the same as for the in-bearer of the Turnout. The hollow sleeper varies in that it is not notched at one end as is the in-bearer, removing an area of stress concentration, and there are two lengths of sleeper being used.

   1. 4.50m to which acoustic monitoring equipment will be mounted; and
   2. 4.00m, to act only as a cable conduit.
VAE initially undertook a Finite Element Analysis of the turnout in-bearer with attachments as follows.

1. VAE Railways Systems drawing number VAM 13768 rev B;
2. VAE Railways Systems drawing number VAM 13575 rev D;
4. VAE Approval Application – Point Layout Operation and Components Inbearer Steel Sleepers for Spherolock; and
5. VIPAC Engineers and Scientists LTD drawing number 5656-0114

Further to this analysis Worley Parsons also undertook a Finite Element Analysis (attached) on the in-bearer sleeper to accurately represent the loading conditions experienced. Results varied from the initial analysis completed by VAE and on further inspection of the VAE report it was concluded that the load assumptions were inadequate for the typical condition experienced by the in-bearer sleeper.


The suitability of the sleeper was determined to be adequate for its application.

5. Approval

Worley Parsons performed an FEA analysis reviewing the initial VAE analysis, assessment of an improved design, assessment of as-installed arrangement and assessment of unbraced sleeper arrangement for both the 2.6m and 4.5m long sleepers to be installed.

Results obtained for the long sleeper show that the 35t axle load induces a minimum factor of safety of 1.1 in fatigue. As the minimum factor of safety is above 1.0 and with added conservatism within the analysis, the 4.5m long sleeper is proven to be of adequate design.

The short sleeper shows a minimum factor of safety of less than 1.0 in the as-designed configuration. A re-design was performed and analysed in an effort to increase the factor of safety. The re-designed short sleeper has a minimum factor of safety of around 1.2 in the region of a non load bearing weld with an allowable 35MPa (BS 7608:1993). The remaining factors of safety values calculated for the design are all now greater than 1.2 and as such, the design is deemed to be adequate for the proposed load. The final analysis performed gives an indication of the suitability of the design to be used without welding in the struts. The results show that the unbraced design is adequate, with a minimum factor of safety of 1.33, provided the strut has never been installed or has been removed entirely.
The approval for installation of the in-bearer sleepers is warranted at 35t axle load and is applicable ARTC network wide.

6. Conditions of Approval
   - All future installations of in-bearer sleepers should be constructed as to **Not** include the cross-braced struts as designed by VAE.
   - Only to be installed in track in good complying condition e.g good drainage, ballast depth, compaction, ballast shoulder, well compacted.
   - No modification to sleeper whatsoever without written approval from ARTC Standards & Systems department e.g drilling, welding, notching, cutting etc.

7. Sign off
   Review Panel:

   - John Cowie  
     *per signed original*  
     Date 07/08/2006

   - Tim Calver  
     *per signed original*  
     Date 07/08/2006

   - Ian Domleo  
     *per signed original*  
     Date 07/08/2006

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ELEVATION

DUE GALVANIT WHT TO SLEEPER AFT HANING

TYPICAL (SEE NOTES)

PLAN VIEW