ANALELE UNIVERSITĂȚII
"EFTIMIE MURGU" REȘIȚA
ANUL XV, NR. 1, 2008, ISSN 1453 - 7397

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Experimental Stress Analysis at Railway Inspection Pit

Railway inspection pits are used in railway halls. The purpose of inspection pits is to allow the working under the vehicle. Inspection pits can be found in locomotive depots, factories etc. The new design for a inspection pit in a railway hall involve tests in purpose of homologations the railway infrastructure. Before the homologation committee meeting, tests are made; after the test, a testing report is made which it will be part at homologation documents.

Keywords: *strain gauges, inspection pit, Catman, stress analysis, Centipede*

1. Introduction

In the railway halls, it can be see two types of inspection pits:
- Inspection pits without pockets (Figure 1);
- Inspection pits with pockets (Figure 2).

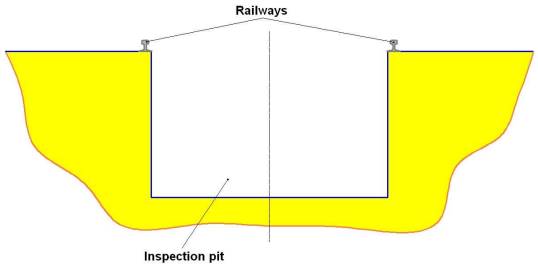

Figure 1. Inspection pits without pockets

The difference between inspection pit without pockets and inspection pits with pockets consisting the pockets which are rooms which allow the access at the vehicles both from the interior and the exterior of the railways. At inspection pits

without pockets the railway are mounted on hall ground. At inspection pits with pockets the railway are mounted on concrete blocks with the same length as the inspection pit.

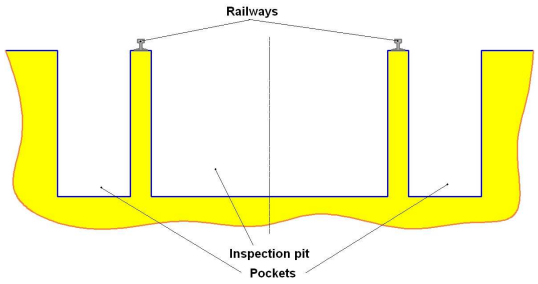

Figura 2. Inspection pits with pockets

The inspection pit with pockets presented in this paper have 2 rows of metal columns which are embedded in base of the hall. On the columns, are mounted the railways (Figure 3).

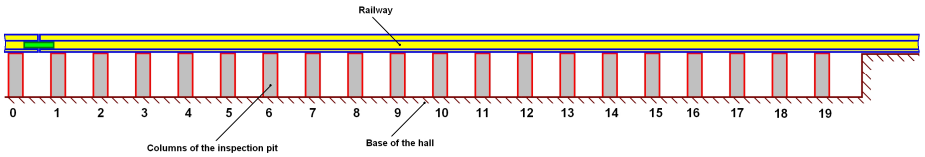

Figure 3. Inspection pit with railways mounted on columns

2. Testing method

The testing method has the next steps:

- Hottinger LY 11 6/120 strain gauges (SG) was glued (with Hottinger Z70 rapid adhesive) on four columns of the inspection pit;
- The connection between SG and the measuring device (Hottinger Centipede 100) was made by signal cables. The acquisition data was made on a laptop with acquisition software Hottinger Catman 4.5;
- The columns was noted with numbers (Figure 3). Each column represent also the space point where measuring and recording of data from SG was made. SG was glued on the next columns:

- Column no. 10 (SG 9 & 10);
- Column no. 13 (TER 7 & 8);
- Column no. 16 (TER 1÷6);
- Column no. 16' (TER 11÷16). Column no. 16' is symmetrically

with column no. 16 reported to the longitudinal axe of the inspection pit, and SG 11÷16 are symmetrically with SG 1÷6. SG from column 16 and 16' shown the asymmetry of load for each axle of the testing locomotive. The distance between columns 10, 13 and 16 it is almost distance between axes of the same bogie from electrical locomotive Co-Co;

- A locomotives truck train was used to create the necessary load for testing the inspection pit. The first locomotive from the truck train was used as reference for the test. It was pushed and stopped on each column. The reference for stopping at a fixed point was considered the first axe from the first bogie of reference locomotive. Recording of the strains from the columns was made.

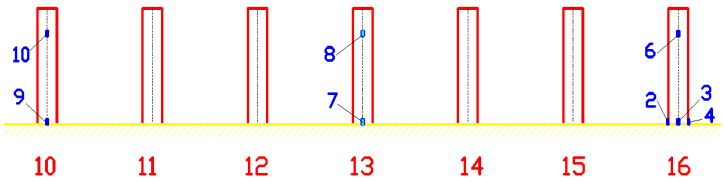

Figure 4. The measuring points

3. Results

The tests revealed that when the first axle from the locomotive is above the column 16-16', the second axle of the bogie is almost above the column 13 and the third axle of the bogie is almost above column 10. For this particular position of the locomotive, the higher strain is recorded at column 13 because on that column are cumulated stresses form the axle stopped above him, from the first and the third axle of the bogie (because the influence given from a axle can be detected from the SG when the axle it is almost at 1m far from the column). In figure 5 and 6 are presented the stresses measured with SG 7 and SG 8. The curves from figures 5 and 6 are made in Catman 4.5 graphic module (QuickView window).

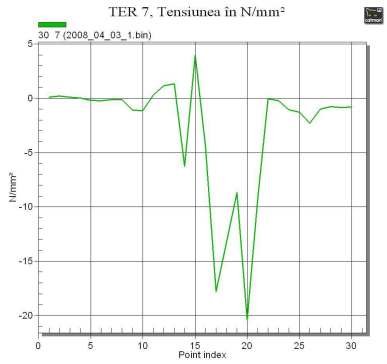

Figure 5. Stress for SG 7 in N/mm^2

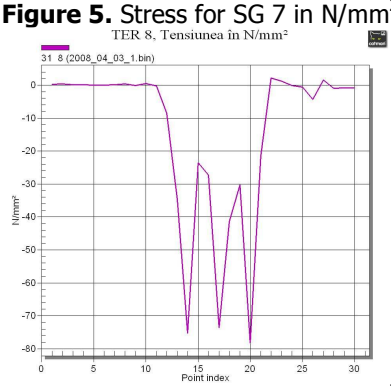

Figure 5. Stress for SG 8 in N/mm^2

The stress was calculated based on measured strain with Hooke's law:

$$\sigma = E \cdot \varepsilon \,, \qquad (1)$$

4. Conclusion

The stresses calculated based on measured strains were smaller than permissible stress of the material.

References

[1] Avril J. *Encyclopedie Vishay d'Analyse des Contraintes*, Vishay-Micromesures France.
[2] *Catman 4.5 User's Guide,* Hottinger Baldwin Messtechnik GmbH.
[3] Hoffman K. *An Introduction to Measurement using Strain Gages,* Hottinger Baldwin Messtechnik GmbH Darmstadt.

[4] Mănescu T.Ş., Olaru S., Copaci I., Creangă F. *Tensometria electrică în cercetarea experimentală*, Editura Mirton, 2006.
[5] Mocanu D.R. & colectiv *Analiza experimentală a tensiunilor,* Editura Tehnică 1977.
[6] *Multipoint Measuring Unit Centipede 100 Operating manual,* Hottinger Baldwin Messtechnik GmbH.
[7] Vaughan J. *Application of B&K Equipment to Strain Measurements,* Brüel & Kjær.

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