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PROBLEMS APPEARING IN THE OPTIMUM CONDITIONS DEVELOPMENT OF URBAN TRANSPORT ON TRAM RAILS

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ABSTRACT

The quality of a welded joint always depends on taking into account and adhering to many boundary conditions. The work is to be done considering quality assurance conditions, the reliability and maintenance of tram rails.

1. GENERAL PROBLEMS

The quality of a welded joint always depends on taking into account and adhering to many boundary conditions.

The work is to be done considering quality assurance conditions, the reliability and maintenance of tram rails [1÷10].

2. RELIABILITY OF TRAM RAILS

The reliability of tram rails in urban transport – tram, can be defined [6, 10] qualitatively and quantitatively. Qualitatively it represents the capability of a rail tram sector to assure the circulation of urban transport vehicles, at the established speeds and weights considering the travellers' safety and comfort during an imposed period.

Quantitatively, the reliability represents the probability that a certain sector of tram rails can assure the circulation of urban transport vehicles considering the safety and comfort conditions at the established speeds and weights during a stipulated period (expressed in time units: hours, days, weeks, month or years, or even the interval between two successive repair works).

The reliability is a non-measurable characteristic, but as quantitatively it is a probability (having a value in the range 0 and 1), it can be calculated by mathematical statistics and probabilities theory methods..

The reliability can be evaluated indirectly, too, by following several functional indexes, statistically and probabilistically, (for example: following a certain level of the railway geometrical characteristics, between certain specified limits, a certain degree of comfort etc) [10].

Suppose $P_{(s)} = P_{(x1 ? x ? x2)}$,

where : - x is an aleatory magnitude representing a certain functional index of the railway (rail tram);

- x_1 and x_2 are acceptable limits for x
- $P_{(s)}$ the probability to maintain the functional indexes of the rail.

In the same category, the indirect one to evaluate the reliability, there the rail efficiency is also included.

The reliability problem is appreciated, examined, treated and watched by:

- the elaboration of a reliability evaluation methodology (reliability prediction)
- the assurance of an imposed reliability level [10].

3. THE MAINTENANCE OF TRAM RAILS

The maintenance of tram rails represents the concept that characterises the capacity of the system to be rehabilitated. It expresses the capability of a system to be maintained or rehabilitated to the state it can accomplish the function it was conceived for, in stipulated exploitation conditions, when the maintenance is performed in given conditions, with specified procedures and remedies [10].

Quantitatively the maintenance of tram rails, is also a probability, one that the system is rehabilitated in a certain time interval, after an interruption in its running.

The reliability and maintenance of tram rails are complementary considering their capability in the exploitation process.

The maintenance of tram rails represents the activity to maintain the qualitative characteristics and it can be preventive (by supervision and revision), but corrective, too consisting in replacing defect components, "in situ" rehabilitation, respectively [6, 10].

The maintenance of rail welds has been done according to the flowchart shown in figure 1 [3, 4, 5].

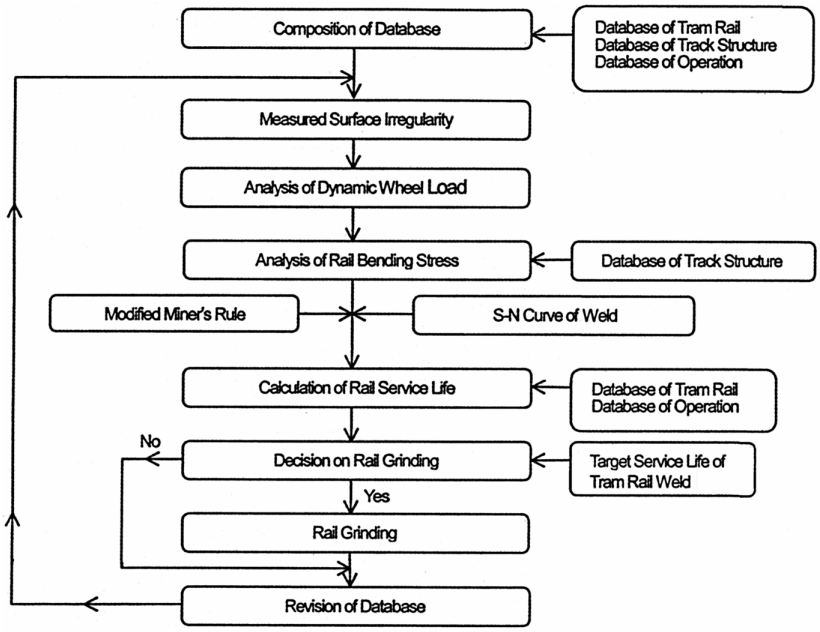

Figure 1. Maintenance flowchart of surface irregularity at rail weld [1,4]

Moreover, it should be noticed that serious discontinuities are accidentally formed in welds. To prevent rail weld failures, it is important to perform reliable welding by utilizing appropriate welding processes, welding conditions, inspection methods and well-trained

Train rail welding has assumed a important role as one of the most important technologies for tram railways. Therefore, continual efforts for the progress of tram rail

welding technologies are needed to build up the safety and impose to reduce the maintenance cost of tram rail tracks.

4. WELDING WORK ON T RACKS

In carrying out overhaul and repair work on rails in almost all cases it is inevitable that these works has to be carry out in the track during operation, on tracks carrying traffic. Taking quality assurance into account this results, additionally in some substantially less favourable conditions for making the welds. The following factors are particularly worth to mention:

- limited time for the completion of the work, since the track concerned should and must be closed only for the shortest possible time in order to disrupt moving traffic as little as possible.
- moving traffic on adjacent lines, which demands a part of the concentration and attention because of the danger of an accident and thus could, under some circumstances, possibly distract from the correct execution of the welds.
- climatic conditions (low temperatures, rain or snow etc.).
- with construction work associated with the production of continuous welded tracks the welders are the last link in the manufacturing chain and thus are generally also under particular time constraints.

Even if there are outstanding regulations, guidelines and work instructions for the safety, nevertheless there is always a high risk in carrying out the work with its corresponding (sometimes negative) effects on the concentration upon the work and thus on the result and/or the quality [4].

5. QUALITY ASSURANCE OF THE WELDED JOINT S

Welding is among the "special processes" in accordance with ISO 9000, all quality assurance measures are to be taken before manufacture. Errors and their removal are costly. This applies in particular to welded joints and repairs on rails in track and points [4].

In executing and accepting welds on tram rails the following main criteria must be considered [4]:

a) Selection of the welding contractor concerning requirement criteria (tram speed, frequency of demand etc.).

b) Selection of the welding contractor through compliance with the conditions (valid operating licence).

c) Supervision by the Client while the welding is being carried out with the assistance of trained welding personnel (“Four eyes” principle).

d) Execution, acceptance and approval of the welds.

“Acceptance” should be understood here to mean the acceptance for operational use by the locally responsible construction supervisor [4].

Work has been started on a European and/or worldwide standardisation of the rules and regulations for ensuring the quality of welded joints and the training of the technical personnel in rail welding.

6. TRAINING OF TECHNICAL PERSONNEL FOR RAIL AND REPAIR BY WELDING

A substantial element of quality assurance for welding in general and, tram rail welding in particular, apart from the fulfilment of the operating conditions, is that the welding personnel, the

- ? welding supervisor and
- ? welder,

should meet the requirements.

Welding, training and testing of the welders is mandatory. Stringent demands are made in respect of manual skills in particular but also in relation to theoretical knowledge (extension of the welder qualification test to EN 287 / ISO 9606) for welding and repair by welding on rails [4].

7. CONCLUSIONS

7.1. The tram rails are in actuality again within the integration context of ROMANIA into the EUROPEAN COMMUNITY, when aspects linked with the rehabilitation of the infrastructure and superstructure are considered as priority. The trend is to apply the tram rails welding and rehabilitation using efficient welding technologies from the economical and technical point of view [1÷10].

7.2. It is important to perform reliable welding for joints by utilizing appropriate welding processes and repair technology by welding, inspection methods and well/trained welding personnel.

7.3. A substantial element of quality assurance for welding in general, tram rail welding in particular is that the welding personnel.

REFERENCES

[1]. ABE, N. si FUKUI, Y.: Estimation of rail service life by bending fatigue at welded part, The 3-rd Transportation and Logistics Conference, JSME, Kawasaki, Japan, 1994, December, p. 99-104

[2]. BARON, T. s.a.: Calitate si fiabilitate, vol. I si II, Editura TEHNICA Bucuresti, 1988

[3]. FUKADA, Y. s.a.: Experienta în întretinerea sinelor de cale ferata în Japonia, Conferinta IIW/IIS, Bucuresti, România, 2003, 10 iulie, p. 123-138

[4]. KÖSTERMANN, H. s.a.: Asigurarea calitatii în domeniul sinelor de cale ferata în Germania, Conferinta IIW/IIS, Bucuresti, România, 2003, 10 iulie, p. 113-122

[5]. NAKATA, M. s.a.: Welding of railroad rails, Nippon Kokan Technical Report overseas 32 (1981), p. 34-46

[6]. POPESCU, M. s.a.: Reabilitarea „in situ" a elementelor de infrastructura la caile de transport urban, contract AMTRANS, Raport de cercetare 2003-2005

[7]. SAKA, K. s.a.: Elongation of Service Life, Japan Railway Civil Engineering Association, 2002, vol. 40, nr. 3, p. 17-20

[8]. TATSUMI, T. s.a.: Criteria of Soundness Evaluation on Enclosed Arc Welds of Rails, Report RTRI, 2000, vol. 144, p. 37-42

[9]. xxx: Conferinta Internationala a Comitetului Mecanic de Uzura a Sinelor, Canbridge, 1990

[10]. ZAROJANU, D.: Fiabilitatea cailor ferate, Editura AGIR, Bucuresti, 2001