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ScienceDirect

Procedia Engineering 134 (2016) 469 – 474

Procedia Engineering

www.elsevier.com/locate/procedia

9th International Scientific Conference Transbaltica 2015

Research of Innovations of Diesel Locomotives and Bogies

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Abstract

During manufacturing of diesel locomotives, their basic parameters must be adapted to the requirements of that specific environment. One of the central issues is the choice of bogies. The article present the examples of selecting a bogie by using multi-criteria optimization methods. The methods are adapted for Siemens bogies models SF1, SF2, SF3 and SF6. The solutions obtained by different methods were compared, and shortcomings of certain multi-criteria optimization methods for selection of a bogie model according to its parameters were established.

Peer-review under responsibility of the organizing committee of Transbaltica 2015

Keywords: locomotive; bogie models; characteristics of bogies; multi-criteria optimization; ratings method.

1. Overview of different diesel locomotive researches

Despite of economic or political situation, transport remain one of the most important branches of the economy.

Stable global demand in diesel locomotives is observed (Fig. 1a) (Мировой рынок … 2010; Мямлин 2014). Market growth is determined by new technical solutions and the need of the majority of the countries to renew their existing electric traction rolling stock (Fig. 1b).

During the past several years there was a significant general increase in the portion of the electric traction rolling stock, however locomotives comprise no more than 30% of the total locomotive stock, while diesel locomotive are continued to be most frequently used (Мировой рынок … 2012; Myamlin et al. 2015).

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Peer-review under responsibility of the organizing committee of Transbaltica 2015
doi:10.1016/j.proeng.2016.01.069

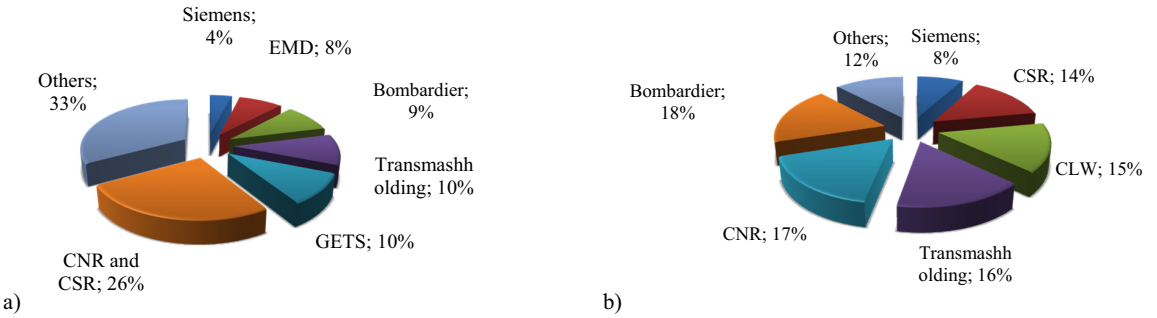

Fig. 1. Distribution of the production quantitate of the main world manufacturers: a) new locomotives; b) new electric trains.

In the past years production of new locomotives was continuously increased by two Chinese corporations: China North Locomotive and Rolling Stock (CNR) and China South Locomotive & Rolling Stock (CSR), who became the main suppliers of diesel locomotives and electric trains (Мировой рынок … 2010; Мямлин 2014). Aside from CNR and CSR, dominating position on the electric trains market (Fig. 1, b) is sustained by Bombardier, while Alstom and Siemens are among the largest suppliers. These three companies together take up one third of the market (Мировой рынок … 2012; Мямлин 2014).

The well-known manufacturer Siemens is increasingly active in offering its products, and its role on the European market (Fig. 1, a, b) is continuously growing. Let us analyse the improvement tendencies (Fig. 2) of the locomotive structure of this company, which is the world's leader of one railway product.

Figure 2 demonstrates that Siemens is among top ten largest manufacturers of railway machinery suppling not only rolling stock, but also control systems and services.

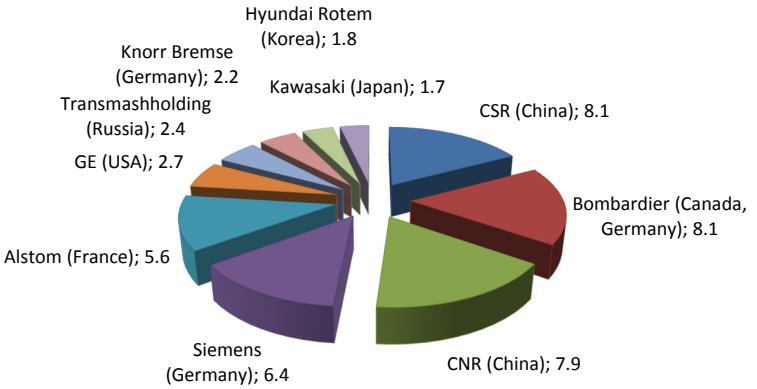

Fig. 2. Top ten largest manufacturers of railway machinery, billion Euro.

2. Examples of structural features of diesel locomotive bogies

We will now analyse peculiarities of technical solutions applied in the structures of locomotives of the Siemens company, as one of the leading manufacturers, by focusing on the structural parts of the bogies.

Bogie SF1 (Fig. 3) was created for electric locomotives with the highest speed of 230 km/h, which can be used to transport passengers and freight (Мямлин 2014). Here is an example of their application: Austrian railway locomotive Taurus. The bogie is designed for European railroads and areas with a large number of curves. Geometric characteristics of this series of bogies are presented in figure 3.