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Efforts to Reduce Bogie Weight

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Recently, there have been many talks about life cycle costs, which consist mainly of the costs of maintenance and electric power. An accepted opinion holds that the amount of electric power needed to run a car is proportional to the car's weight, provided that other conditions on car operation are the same. This opinion suggests that weight reduction is highly effective in promoting energy saving. The present overview presents some efforts that have been undertaken to reduce bogie weight.

A bogie bears the entire weight of a car body, including that of passengers, while absorbing vibration from a track. In designing many components of a bogie, such as wheel sets, spring gear and a frame, care is taken to provide them with a sufficient strength, since they are used in a non-redundant system without backups. Specifically, these parts are designed using FEM strength analysis, to achieve a required strength while controlling weight. To reduce maintenance costs, the number of parts has been reduced by adopting multi-functional designs, e.g. through the introduction of unit constructions; these efforts have also contributed to reducing bogie weight. Iron-based materials are used for many bogie components, for reasons related to function. However, nonferrous materials with smaller specific gravities are used for some parts, to achieve weight reduction. For instance, aluminum is used to manufacture gear boxes, axle box bodies, brake disks and other parts that are lighter than conventional products. So far, these measures have been implemented to meet the requirements of only a small number of users. However, we will try to persuade more users to adopt the measures, because we think that they are advantageous in reducing life cycle costs.

To illustrate results achieved through the above-explained efforts for weight reduction, the table below shows a comparison in weight between the conventional bolstered bogie and the now widespread bolsterless bogie, which began to be used about 15 years ago.