

# A Study of Method for Assessing The Overall Environmental Impact of Railways

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In modern society, there is a cry for measures to curb global warming and other far-reaching environmental impacts, as well as local environmental impacts (environmental pollution, etc.) that have long presented various different problems. Under this condition, industry has been striving to understand and to reduce emissions of environmental pollutants. Recently, efforts have also been made to assess the effects of those pollutants on the environment and economy.

In view of this, we have carried out a quantitative analysis of the global environmental impact of transportation facilities by means of life cycle assessment (LCA). The assessment method we use is the Japanese version of the life cycle impact assessment method, based on endpoint modeling (LIME) that has been advanced in the LCA project?an R&D project sponsored by the Ministry of Economy, Trade and Industry. This assessment method consists of calculating the amounts of various environmental pollutants emitted from all transportation facilities (inventory analysis) and the effects of the individual pollutants on the environment (impact analysis), converting those effects in terms of monetary value, and assessing them as external costs (Fig. 1).

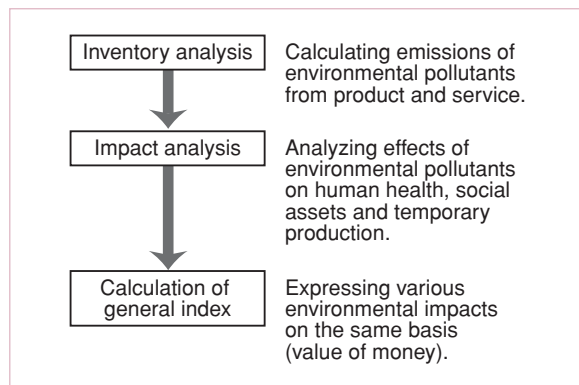
In order to reach external costs, we first calculated the amounts of environmental pollutants (CO<sub>2</sub>, NO<sub>x</sub>, SO<sub>x</sub>) emitted from various types of transportation facilities. For the Tokaido Shinkansen, giving consideration to its life stages, we studied the quantities of materials and energies used in the development of ground facilities and the

manufacturing, operation and maintenance of vehicles, and calculated the masses of the individual pollutants (Fig.

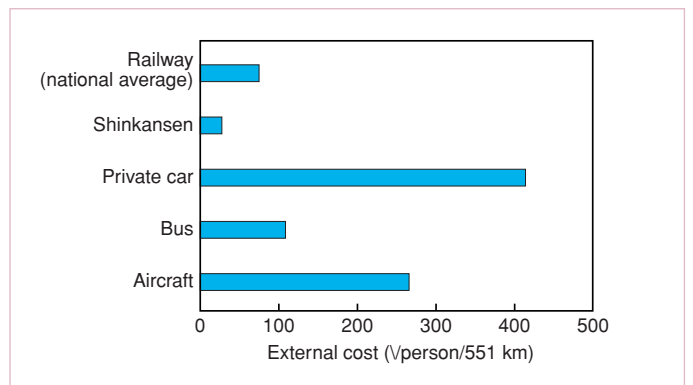
2). Concerning automobiles and aircraft, we calculated the masses of individual pollutants emitted from their infrastructure against the yen amounts of transactions shown in the latest inter-industry relations table. The quantities of energy used were obtained from the latest statistics.

On the basis of the calculated amounts of pollutant emissions, for each of various types of passenger transportation facilities, we calculated the external cost per person between Tokyo and Shin-Osaka (distance: 551 km). As a result, it was found that the external cost of the Shinkansen was about ¥31/person/551 km. On the other hand, the external cost for the national average of railways in Japan in the same 551 km section was estimated to be about ¥73/person (Fig. 3).

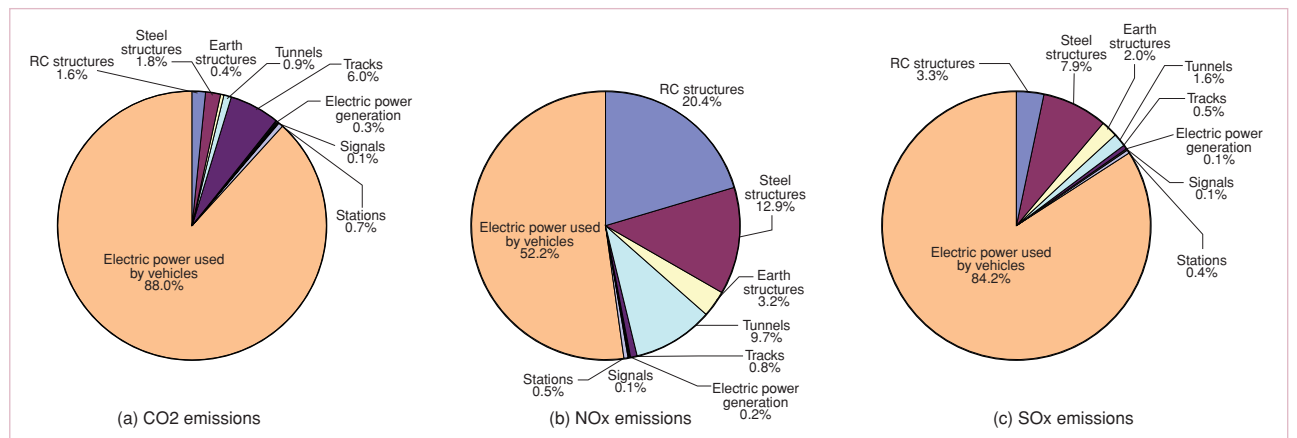
Converting environmental impacts in terms of external cost by means of LIME as above has the advantage of permitting any industry to easily express various kinds of environmental impacts numerically. In the future, we intend to improve the accuracy of the assessment method and apply it in various other sections.



**Figure 1.** Overall environmental assessment based on LIME.



**Figure 3.** External cost by transportation facility between Tokyo and Shin-Osaka.



**Figure 2.** Breakdown of emissions of environmental pollutants by type in the construction, manufacturing and operation of Tokaido Shinkansen.