**News Release** 

# RTRI Puts "the Signal Arrangement Examination Function" into Practical Use as an Additional Function to the Running Time and Headway Calculation System "SPEEDY"

The Railway Technical Research Institute (RTRI) has put the signal arrangement examination function into practical use. This function has been developed as an additional function to SPEEDY, a system calculating train performance curves. Train performance curves provide valuable information for calculating station-to-station running time, a step essential to create train timetables. This examination function enables to significantly streamline the process of proposing a signal arrangement (setting block sections and determining the position of signals), which needs to be examined when planning track layouts for constructing new stations or when establishing new lines.

## 1. Running Time and Headway Calculation System [SPEEDY]

Train performance curves show the relationships between speeds and positions continuously changing during station-to-station operation and mark the passage of running time. These processes previously required a lot of time and experts who have extensive knowledge of vehicles, ground equipment, train operation, and the like. Based on thus created train performance curves, station-to-station running time was calculated.

To streamline such time-consuming processes, RTRI developed a system named "SPEEDY" (**S**ystem for train **PE**rformance **E**valuation, **D**rawing and anal**Y**sis) in 1992. SPEEDY has enabled to immediately create train performance curves simply by entering vehicle and equipment data and basic running conditions. Since then, the functions of SPEEDY have been continuously improved and utilized now to determine headways (operation time intervals between trains), which are necessary to create train timetables. Among the functions thus improved, RTRI specifically selected the headway determination function and developed it into the signal arrangement examination function.

#### 2. Background of the Development of the Signal Arrangement Examination Function

When constructing new stations or establishing new lines, operation conditions often must be drastically changed. To operate the required number of trains even under such circumstances, it is necessary to determine a specific target headway (hereinafter referred to as "the target headway") for realizing an appropriate signal arrangement.

In signal arrangement examinations, the signal arrangements plan is used to create a diagram showing transitions of signals from R (red) to Y (yellow) and G (green), based on the running position of the preceding train (signal aspect transitions). Headways are calculated based on



Fig. 1 Flow of work for signal arrangement examination

the diagram. The adjustment of the proposed signal arrangement is repeated until the calculated headways are shorter than the target value and the number of signals is as small as possible (Fig. 1). It previously took two to three days for a person in charge with expertise to prepare a single signal arrangement proposal for a section of several kilometers in an urban area.

To save labor and de-skill such time-consuming examination processes, RTRI has developed a method to promptly examine signal arrangement proposals and put it into practical use as an additional function to SPEEDY.



Railway Technical Research Institute



## 3. Overview and Features of the Developed Signal Arrangement Examination Function

This function assists in preparing signal arrangement, promptly examining and editing the arrangement outcomes (Fig. 2). For a route length of several tens of kilometers, the examination results of the proposed signal arrangement can be output in a few seconds. To determine as appropriate signal arrangement as possible, minor adjustments are required to be made to the original signal arrangement proposals, and then the reevaluation process is repeated.



Fig. 2 Screen showing examination results obtained

This function has the following features:

- Signal aspect transitions are examined to ensure that the predetermined speed is not exceeded when decelerating according to the signal aspect, and headways are examined to ensure that the headway of each signal is shorter than the target headway. These results thus obtained are shown on the same screen along with the track alignment (Fig. 2), which makes it relatively easy to add, relocate, or delete signals, or to change or compare signal aspect transitions with reference to the examination results.
- Signal aspect transitions and headways are examined based on the train performance curves configured in accordance with individual examinations under conditions such as train conditions (maximum speed, acceleration performance, and the like), track equipment conditions (gradient, speed limit, and the like), and running conditions (passing or stopping at each station, track number used, and the like).
- In the case of a section with three signal aspects (R, Y, and G), the signal arrangement that meets the predetermined target headway can be automatically proposed based on vehicle and equipment data and basic running conditions, and the like (Fig. 3).



Fig. 3 Example of proposed signal arrangement (with a target headway of 2 min. 30 sec.)

### 4. Miscellaneous

This function is available as an additional feature to SPEEDY from JR Souken Information Systems.

The technologies used for the previously developed system have been patented (Japanese Patent No. 7329465).