Various types of information displayed inside train stations is there for the purpose of assisting passengers in catching trains to their destinations. It is the "signs" that help these passengers travel smoothly until they arrive at their destinations. In order to ensure smooth travel inside stations and via trains, both physical services, such as the installation of escalators or elevators, and abstract services, such as information services, must work together. The "Law for Promoting Easily Accessible Public Transportation Infrastructure for the Aged and the Disabled" (hereinafter the "Barrier-Free Transportation Law") promulgated on May 17, 2000, and effective as of November 15, 2000, states that ensuring smooth travel for transporting disadvantaged persons is an important issue. This paper reports the result of research on accessibility (station user-friendliness) associated with "signs," which is currently one of the research subjects of the Frontier Service Development Laboratory.

1 Introduction

 JR East uses various signs and information desks as a method of disseminating information to passengers traveling towards their destinations. Experimental in-station signs were first used at Shinjuku and Akihabara stations in 1988. In 1990, a design manual for signs was created, and since then, signs have been improved. After more than 10 years since the creation of the manual, however, some parts of the manual were found to be not in harmony with passenger needs. Especially from the point of view of "barrier-free" or "universal design," the necessity of reviewing how to display characters (words) or of using pictograms has surfaced. The position of the information display as well as the information itself also must be improved.

In response to these issues, JR East reviewed the sign manual and is now improving in-station signs using the revised manual. JR East is not only working on improvement of signs at newly built, renovated, or repaired stations, but also is working on improvement of the signs themselves.

2 Necessity of signs

Why do we need signs? As signs exist for the purpose of assisting people in their travel, at first, stations must have a space structure in which no inconvenience will arise when passengers travel even if only the minimal of signs are displayed. For example, assume all stations are structured in the way that "restrooms can be found immediately beyond the ticket gate, and the men's restroom is always on the right side and the women's restroom is always on the left side." If this were the general rule, then there would be no need for signs indicating the way to the restrooms, and at the same time, this would naturally be regarded as a consideration for visually impaired individuals. It is, however, impossible to structure every single station in the above mentioned way. In fact, there is a wide variety of shapes for station floors due to station structures. Also, in some cases, space inside stations is becoming increasingly complicated because of repeated alterations and revisions of various station facilities for efficient use of station space as management resources, and also because of in-station shop operation as a daily-life oriented service business. To eliminate such complexity, signs are one of the most essential station tools.

3 History of in-station sign improvement

Before privatization, JNR was using standardized signs as seen in the picture (Fig. 1) in accordance with its sign manual, "Rules Regarding the Railway Sign Standard." After JNR's breakup and privatization in April 1987, the individual JR companies took over the sign manual containing "Rules Regarding Railway Signs." The content of the rule book was virtually the same as that of JNR and was identical for all JR companies. Problems regarding sign rules found in the JNR sign manual (Rules Regarding the Railway Sign Standard) are as follows:
No information was provided regarding transfer to train lines of other railroad companies inside the same station.

Rules for face designs (content of sign panels) were specified, but there were no rules for signs taking passenger flow into consideration.

Rules for use of English only applied to station names.

There were only a few rules regarding colors.

The base color of signs that JNR used was black background with colored characters/letters, and the signs were lit up from inside. Since the rules did not specify the color of characters/letters, the difference of brightness between the base color and character/letter color was also not clearly specified.

The manual did not clearly specify character/letter size and arrangement of signs, instead stating that they should be "appropriately" decided.

As listed above, there were a large number of ambiguous statements in the manual, and also, some rules no longer matched the current way of thinking.

After privatization, individual JR companies created their own manuals around 1990. Signs that passengers see have played a significant role not only in terms of support for smooth flow of passengers, but also in terms of creation of an in-station environment and establishment of a corporate identity of each of the JR companies. Therefore, creation of signs that are easier to understand became necessary.

### 3.1 Current status of in-station sign improvement

As represented by the ideas of "barrier-free" and "universal design" that are now frequently mentioned, the Japanese population is rapidly aging, and it is predicted that, in 2010, one in every four persons will be 65 years old or older, creating an aging society. Also, creating an environment in which elderly people and physically handicapped people can lead self-supporting daily and social lives is an urgent task as there is an increasing demand for opportunities for physically handicapped people to participate in various social activities. Train stations are not exceptions. It is necessary to give special considerations to not only elderly or physically handicapped people, but also to those people whose movements are restricted, such as injured passengers, passengers with small children, or passengers with heavy luggage.

The 2002 Soccer World Cup was one of the opportunities to promote

![Fig.1: JNR standardized signs](Left: suspended signs, Right: sign beside stairs)

<table>
<thead>
<tr>
<th>Year</th>
<th>Details of improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1987</td>
<td>Established &quot;Rules Regarding Railway Signs&quot;</td>
</tr>
<tr>
<td>1988</td>
<td>Created signs for Shinjuku and Akihabara stations</td>
</tr>
<tr>
<td>1990</td>
<td>Established &quot;JR East Design Manual&quot;</td>
</tr>
<tr>
<td>1996</td>
<td>Improved signs at Shibuya and Nagano stations</td>
</tr>
<tr>
<td>1998</td>
<td>Improved signs at Shinbashi and Sendai stations</td>
</tr>
<tr>
<td>1999</td>
<td>Improved signs at Ikebukuro, Takadanobaba, Hamamatsucho, and Shinagawa stations</td>
</tr>
<tr>
<td></td>
<td>Improved time tables on Yamanote-line platforms</td>
</tr>
<tr>
<td></td>
<td>Created revised design manual</td>
</tr>
<tr>
<td>2000</td>
<td>Improved signs at Tokyo, Shinjuku, and Ochanomizu stations</td>
</tr>
<tr>
<td>2001</td>
<td>Revised the sign manual</td>
</tr>
<tr>
<td>2002</td>
<td>Improved signs at Ueno station (opening of &quot;Ueno,&quot; the station building)</td>
</tr>
<tr>
<td></td>
<td>Revised signs in response to the World Cup (signs written in Chinese and Korean)</td>
</tr>
<tr>
<td></td>
<td>Created additional parts for the sign manual</td>
</tr>
<tr>
<td>2003</td>
<td>Created improvement plans for major stations (Tokyo, Shinjuku, Shibuya, and Ikebukuro stations)</td>
</tr>
<tr>
<td></td>
<td>Improved buildings and signs at Asagaya and Tsudanuma stations</td>
</tr>
<tr>
<td></td>
<td>Improvement of signs scheduled for Omiya and Tachikawa stations as part of the Cosmos Plan</td>
</tr>
<tr>
<td></td>
<td>Improvement of building and signs at Yokohama station</td>
</tr>
<tr>
<td></td>
<td>Signs at other stations will be sequentially improved</td>
</tr>
</tbody>
</table>

![Fig.2: Top left: platform number guide sign, Top right: platform sign, Bottom left: changeable information sign (departure information), Bottom right: exit and transfer guide sign](Image)
internationalization of train stations, but further improvement is necessary. Revision of the design manual is another urgent task in order to support various types of passengers so that the usability and amenity of stations will be improved. JR East revised the "JR East Sign Manual" created in 1990 and has been improving in-station signs since then as seen in Fig. 2 and Table 1.

4 Problems with current in-station signs

Passengers frequently complain that in-station signs are hard to understand. Possible reasons for this can be listed as follows:

1) There are many types of information that need to be conveyed to passengers via signs as stations have a large number of platforms as well as entrances/exits. It is difficult for passengers to find the information that they need due to such a large number of ticket gates and platforms, and other accompanying guidance information.

2) Station structures are complicated as a result of building improvements, the addition of floors, and existence railroad lines of other companies. For example, in Tokyo and Ueno stations, concourses under elevated railway tracks and also underground concourses have multiple levels, creating complicated spaces (shapes) for passengers who are not familiar with these stations.

3) A large number of paid advertisements and station posters are displayed in stations, and there is no definite physical separation as to where advertisements or signs should be displayed. Therefore, signs are difficult to find because they may overlap each other or they may be displayed behind advertisements.

4) The method of displaying signs is not standardized (Fig. 3). At some stations, signs have not been improved yet or signs with unique designs are used and displayed. Therefore, signs are not standardized, possibly causing confusion to passengers. It is necessary to standardize the design of signs so that passengers can quickly retrieve and understand the information they need.

Problems with signs may originate not only from the issue of their face designs but also from station structures or arrangement of signs. The above mentioned problems are frequently observed especially at terminal stations or stations having lines of multiple companies. For example, trains of five different railway companies stop at Shinjuku station, and information must be displayed in a limited amount of space. This may cause passengers difficulty in understanding the signs. As for problem 3) above, regarding the relationship between advertisements and signs, the latest version of the sign manual (2002) only shows conceptual diagrams of the issue. Therefore, a large number of problems still remain. Also, there is the problem of location of information desks.

5 Comprehensive station design for improved amenity

In FY2002, the Frontier Service Development Laboratory conducted a survey in order to obtain clues for realistic solutions in order to materialize "stations with much amenity" based on the subject "comprehensive station design for improved amenity." In this survey, the components of "station amenity" are categorized and the current status of each category was quantitatively examined.

5.1 Overview of "amenity elements"

In a discussion of "comprehensive station design for improved amenity," the factors that can influence "station amenity" (Fig. 4) may consist of three elements. Amenity elements are divided and categorized as described above so that they can be understood in a relative way, leading to understanding of "amenity" in terms of use of stations.
With the above three concepts at the core, the overall image of ideal future station space and facilities was created.

"Smooth flow": examination of shapes of stations that facilitate passenger flow and station facilities that support flow

"Dissemination of appropriate information": examination of the way advertisements and signs are supposed to be

"Comfortable environment": examination of thermal, photo, and auditory environments, and designs

5.2 Overview of the "amenity research"

Focusing on stations in the Tokyo metropolitan area, a survey of the actual conditions "sign investigation (joint research with Institute of Art and Design, University of Tsukuba)" was conducted as an element of "smooth flow" and "dissemination of appropriate information." Then, for "comfortable environment" we conducted studies on "thermal environment," "photo environment (joint research with Department of Architecture and Building Science, Graduate School of Engineering, Yokohama National University)," and "auditory environment." We also conducted a "passenger survey" to obtain supplementary information to establish relationships among the individual studies. As an important part of station amenity, we conducted the "study on signs seen at major stations in the Tokyo metropolitan area" in order to examine signs that are easy to understand. This was a joint research effort with Institute of Art and Design, University of Tsukuba (course by Prof. Kiyoshi Nishikawa).

6.1 Understanding of shape of space inside stations and major travel routes

As described in paragraph 2) of section 4 above, the floor layouts of Tokyo, Ueno, and Shinjuku stations were complicated and thus difficult to use. Also, some information displays were not ideally located. Information, especially such as route maps or time tables, must be located in places where passengers tend to stop, and also it is necessary to provide passengers with easy-to-understand space.

6.2 Passenger survey regarding signs

A passenger survey was conducted regarding information display and 402 valid responses were obtained. Major examples of survey responses are as follows:

1) As the structure of stations becomes more complex, the demand for providing information that gives directions increases. For example, install a station direction guide with the current location in places where it is easy for passengers to see.

2) There is a demand for the elimination of confusing or overlapping display of advertisements/signboards and in-station signs. For direction guidance, improvement in arrow symbols and the addition of distance information are requested. Also, there were a large number of complaints regarding station guide maps. For these information displays, respondents felt it was difficult to know where the signs were and that the face designs of the signs were difficult to understand. There was also a demand for displaying the intermediary stops on LED time tables.

3) The effectiveness of manual guidance by humans such as station staff or staff at information centers was confirmed. The leaflet-type station guide maps distributed at attended ticket gates or information centers were especially highly appreciated. From now on, it will be important to raise awareness of the existence of such maps.

4) Many respondents claimed that information via characters (words) was easier to understand than information expressed by pictograms or colors. It has been pointed out that some colors that are currently in use have low visibility and also that it is difficult to associate information and color since many colors are used to express information. As a result of the survey, the effectiveness of color-coded information identification system and the use of pictograms are both questionable.

Based on these results, the current status of stations that require improvement must be investigated in further detail (via interviews with passengers, for example), and comprehensive improvement of these stations must be carried out including items such as leaflet-type station guide maps.

6.3 Station staff survey regarding signs

Similarly, a survey regarding signs was conducted with station staff
members. Based on 127 valid responses, the survey results can be summarized as follows:

1) Questions from passengers at a particular station reflect characteristics of that station, the structure of the station, or trains that depart from/arrive at the station (questions about departure times, for example). In Tokyo station, there are many questions regarding locations (platforms, restrooms, and so on), and in Ueno and Omiya station, questions regarding trains (platform number, stops, and so on) are frequently asked.

2) Verbal guidance by station staff members also reflects characteristics of stations such as their structure. As examples of convenient tools for giving guidance to passengers, station staff members listed station guide maps or route maps that can be handed out, information about landmarks, and colored tape on the floor representing the various train-lines.

3) Requests regarding display of information that gives directions included face-design related requests such as clearly separating the partitions of multiple direction guides and using an arrow symbol for each guide item, and requests related to relationships between information display and display of paid advertisements.

4) Staff members at Ueno station requested that station guide maps be installed at locations where the maps stand out. Passengers who use Ueno station showed positive reactions to the handmade signs, and in fact, there were a large number of these signs posted inside the station.

Based on these survey results, it will be necessary to prioritize the importance of signs at each station and to closely examine installation methods and information content of these signs.

6.4 Pilot study for understanding sign usage by passengers and their route search activities

In this study, subjects were given train transfer instructions, and during the course of the study, their behavior and gaze direction were recorded by eye-mark recorders and IC recorders (Fig. 5). The study result indicated the following:

1) The importance of signs was confirmed when the subjects were not familiar with transferring from one train to another. The subjects frequently looked at signs, especially to check routes.
2) Route maps were needed to check which railway headed toward their destination. Information on intermediary stops before the train's final destination was especially important.
3) There were some cases where signs were in the visual fields of the subjects but were not recognized as signs. It is necessary to define requirements for signs that are easily recognized.
4) Adequacy of the methodology of the experiment was confirmed. Similar to section 6.3 above, it is necessary to prioritize signs to be improved and narrow down the content of improvement.

7 Future subjects and vision

1) A sign system or basic plan for signs is the future issue. Since most signs are related to giving directions using arrow symbols, a large volume of information is included in signs and displayed in many places. The most important issue is to examine the way of creating and installing signs giving as little information as possible and at as few places as possible. It will be necessary to thoroughly discuss and plan the locations where signs will be installed and the methodology of information desks, and the installation of signs for landmarks for stations whose sign systems will be either newly created or revised in order to solve the above problems.
2) Stations that have undergone improvement many times have a large number of supplemental signs, old signs, and handmade signs. Therefore, signs to be revised in the future must be integrated in the sign system.

In order to deal with these two issues, examination of face design and the sign system is included in the FY2003 plan.

References:
1) Transportation Ecology Mobility Foundation: "Guidelines for Facilitation of Travel in Passenger Facilities of the Public Transportation System", 2001
2) KAMOSHIDA Atsuko: "Planning Easy-to-Understand In-Station Signs for Elderly Passengers", The Kyoyo-Hin Foundation, 1999, pp. 28-52