RailwayGIS  Google Earth & Railway

The Application of Google Earth in JR EAST

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Summary of Passenger Railway Network in JAPAN

<table>
<thead>
<tr>
<th>Passenger Railway Companies</th>
<th>Passenger Line Lengths (km)</th>
<th>Number of Stations</th>
</tr>
</thead>
<tbody>
<tr>
<td>JR East</td>
<td>7,526</td>
<td>1,699</td>
</tr>
<tr>
<td>JR Kyushu</td>
<td>2,121</td>
<td>556</td>
</tr>
<tr>
<td>Others (combined)</td>
<td>10,357</td>
<td>2,342</td>
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</tbody>
</table>
The life cycles of the various drawings used in the railway operation are digitized nowadays within individual work processes, but there still is a need for paper when they are to be interchanged between the processes.

The greatest problem in improving this situation has been in the area of the large-scale “Alignment Plan”.

We at JR East and JR Kyusyu have successfully introduced “Railway GIS System”, which is a railway space information system utilizing the GIS technology, to realize a seamless data flow that begins and ends with digitalized information eradicating all paper media.

By the use of this system, it is intended to put into the data form all of the work processes needed to realize information sharing through integration of the drawing management data base and the maintenance and assets ledger management data base, thereby contributing to the improvement of the productivity over the entire scope of the company operation.
Railway Space Information Management System
(Railway GIS)

Constructed with the orthophoto image data, the digital map data of a 1/2500 reduced scale and the basic railway information, this system serves for the management, updating and distribution of such information through the communication network.

The “Railway GIS” was constructed by timely and low cost acquisition of such information as aerial photographs and alignment plans which had been produced for various railway projects and disaster control purposes as needed.

By this approach, a large cost reduction was realized compared with making alignment plans afresh, while enabling sharing of updated and coordinated information, resulting in work efficiency improvement.
Approach to Digitalization in JR East

- **Digitalization of Alignment Plan Mapping**
  - April, 2000: Institution of Standard Survey Work Specifications

- **Application of CAD to Civil and Construction Engineering**
  - April, 2000: Institution of Standard Civil and Construction Engineering Specifications
  - April, 2000: Institution of Standard Specifications for Making Electronic Data Files for Civil and Construction Works
  - April, 2000: Institution of Standard Geological Survey Work Specifications

- **Maintenance and Management of Electronic Maps**
  - January, 2004: Revision of Standard Specifications for Making Electronic Data Files for Civil and Construction Works

- **Aperture Cards**
- **Microfilm**

**Year 2000**

- Electronic mapping (Railway GIS)
  - 2001: Trial mapping of Tokyo – Takao section of Chuo Line
  - 2002: Completion of mapping covering 800 km of metropolitan area rail routes and 800 km of SHINKANSEN routes

**Year 2001**

- 2003: Commencement of mapping work for all lines of JR East (7500 km) and of making Universal Mapping Data Base

**Year 2004**

- 2004: Commencement of application to JR East’s business system covering all of its lines.
Specifications for Digitalization of Electronic Maps Including Alignment Plans, Etc.

Example of Display Image Showing Electronic Alignment Plan

Example of Display Image Showing Plural Lines
Flow of Digital Information Life Cycle

Conclusion of Construction Work

Assets Consolidation
- Location Plans
- Assets Drawings

New Installation
- Registration
- Removal
- Deletion

Facilities in Operation

Electronic Maps
- Data Retrieval
- Correction of Electronic Maps
- Inspection Data Verification

Maintenance Ledger Data Base

Facilities Management System

Verification of Ledger Data

Drawing Management Equipment at Each Branch Office

Inspection of Structures
**Improvement of Space Management by Means of Railway GIS**

-**Improvement of Railway Space Information Management by GIS Technologies**-

Alignment Plans, Plans and Longitudinal Section Drawings of Stations (Analog)
- 7470km  1695 stations
- No. of drawings: 4853

Electronic Alignment Plan (Digital)

- Application to Civil and Structural Assets
- Application to Next-generation MARS
- Application to Chuetsu Earthquake Hazard Maps
- Application to Construction Division’s Data Base
- Application to Noise Maps
- Other Purposes

Commencement of Work at JR Kyushu for all of its routes; Fiscal year 2005

Application to “Assets Keeper” (the assets management system designed for semipublic railway operators and small to medium size private railway companies)

System No.1 Installed at Isumi Railway Co.
Application to Individual Operation Areas

- Railway GIS Makes It Possible to Produce Accurate Documents in Short Time And with
- Full Utilization of All Available Resources
Profile of “Assets Keeper”

- Repair History
- Assessment of Health Level
- Checkout for Maintenance
- Ledger Management
- Routine Work

- Preestimation of Degradation Maintenance Plan
- On-site Checkout with PDA Collation with Past Checkout Data Registration of New Data on Data Base
- Road Ledgers, Plans Actual Distance Reports Bridge Status Reports Checkout Reports Design Documents
- Sharing of Information and Documents Production of Theme Drawings

- Repair Work Ledgers Construction Work Records Damage Photos

- Assessment of Health Level
- Checkout for Maintenance
- Routine Work

- Road Ledgers, Plans Actual Distance Reports Bridge Status Reports Checkout Reports Design Documents

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Function of “Assets Keeper”

- **Display Functions**
  - Displays degradation level of the facilities on the geographical map, on a year-by-year basis
  - Overlapped display of the aerial photo and the alignment plan

- **Retrieval Function**
  - Retrieves the map from the address or kilometerage
  - Displays the ledger from the icon of the facilities

- **Interaction with Site Inspection Information Terminal (PDA)**
  - Registration of checkout plans and records

- **Ledger Management Function**
  - Ledger display editing by year and by structure
  - Registration of checkout photos
  - Registration of checkout plans and reports
  - Display of checkout report lists

- **Memorandum Function**
  - Complaint messages related to track work, etc. can be noted down.
Google Earth & Railway

“Google Earth & Railway” displays high-resolution satellite photos, three-dimensional terrain data and map information on the Google Earth system in Japan. It can also zoom in, zoom out and show bird’s eye views of super imposed route maps and rail facilities.

Google Earth is provided by Google Inc.

- disaster prevention plan, drawings and maintenance management
- tourism, travel business
- city planning, shopping centers and in-station retailing development, marketing
Google Earth & Railway

Possibilities
“Google Earth & Railway” covers major cities and rail route in JR East’s service territory area. In the future, it will provide the services in a wide range of fields for the whole of Japan.

- Transportation
  - Customer service
  - Disaster prevention plan
  - Maintenance management
  - Environmental measure

- Tourism
  - Tourism, travel brochures
  - Internet info-service
  - Promotion, event

- Life-style services
  - City planning, building construction
  - Marketing
  - Shopping centers and in-station retailing development
  - Environmental measure
  - Maintenance management
  - Internet info-service
  - Promotion, event
  - Tourism, travel brochures
Examples of Expanded Functions

- Examples of Improvements in Accuracy of Traceability
  1) Display of discrepancy between timetable and actual train location
  2) Display of list of cognizant government offices at time of emergency
  3) Management of vehicle running records and train locations

- Examples of Passenger Service Improvements
  1) Real-time train location display
  2) Train approach guide (at station and on cellular phone)
  3) Passenger guidance at time of service disorder

Train Location Information Server

Packet Communication Network

- Train Location Detecting System
- Maintenance Vehicle Dispatching Support System
- Other advanced strategies for railway operators.
Passenger is guided from present location (GPS) through to platform/car door via nearest entrance and ticket gate. Passenger’s present location can be detected from gate passage information. Guidance service even to cellular phone will be carried out with 3-D contents instead of image distribution, in the future.

Marketing analysis can be done by the use of SUICA usage histories and Railway GIS.

Marketing Analysis

Passenger with Mobile SUICA can pass ticket gate freely.

Passenger purchases a reserved seat ticket.

In-building Passage Search
Real-time Rendering
Image Distribution

Passenger can find his or her present location by the use of SUICA.

Present location can be found from wireless LAN or GPS simulator antennas.
In the railway operating industry, implementation of “Digital Life Cycle Management” was started as a means to keep the created data in constantly updated conditions through their life cycles.