GIS BASE MAP FOR INDIAN RAILWAYS

January 2013
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Need for a GIS system

- Indian Railways is a geographically distributed system
- Assets are spread across the country
- Assets are of three types
  - Fixed assets, distributed: railway track, overhead electrified lines
  - Fixed assets, location-specific: stations, yards
  - Moving assets: locomotives, coaches, wagons, track machines
- Map interface is needed for
  - Locating assets
  - Tracking trains
  - Planning future investments
Need for GIS (cont’d)

- **Visualization:** GIS makes it easy to visualize different inputs and outputs from applications.
- **Geospatial relationships:** It simplifies the management of geographically distributed assets.
GIS view
Schematic view of IR
Schematic from TMS data
IR’s Base map - contents

- Commonly mapped features such as:
  - Administrative boundaries
  - Communications / transportation
  - Hydrology
  - Settlements
  - Transmission lines
  - Relief
  - Vegetation / forests
  - Railway specific features
    - Track and permanent way
    - Distributed assets
      - Linear
      - Non-linear
## Railway specific features in Base Map

<table>
<thead>
<tr>
<th>Layer</th>
<th>Land</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Features</strong></td>
<td>Land owned by Railways, mostly on both sides of the track</td>
</tr>
</tbody>
</table>
| **Data Available** | • Station diagrams, paper records, land patta / khasra records, engineering drawings, etc.  
                        • Partly in digital form |
| **Approach** | • 1 m resolution data to be used for major railway areas (such as stations, yards, etc.)  
                        • 2.5 m resolution data to be used for land along the railway lines  
                        • AutoCAD drawings, drawings available in paper format can be digitized and superimposed into the GIS data. |
### Railway specific features in Base Map

<table>
<thead>
<tr>
<th>Layer</th>
<th>Civil Engineering Assets</th>
</tr>
</thead>
</table>
| **Features**| • Track, formation (Permanent Way)  
               • Buildings  
               • Cuttings, embankments  
               • Level crossings  
               • Bridges, culverts. |
| **Data Available** | Engineering drawings |
| **Approach**    | • 2.5 m resolution data can be used for non focus areas.  
                    • 1 m resolution data can be used for focus areas.  
                    • Available track data as attributes (like broad gauge/ meter gauge/ narrow gauge; electrified / non-electrified; up/down line, etc.)  
                    • Nomenclature for segmentation of track  
                    • Location of level crossings, culverts, bridges, embankments, cuttings etc |
# GIS Data Layers

<table>
<thead>
<tr>
<th>Layer</th>
<th>Signaling and Telecom Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Features</strong></td>
<td>Signaling and interlocking system at stations / sections, and OFC (optical fiber cable) network. S&amp;T equipment at a station are signals, lever frames, location boxes, relays, power supply equipment, cables, control phones etc.</td>
</tr>
<tr>
<td><strong>Data Available</strong></td>
<td>Schematic diagram</td>
</tr>
<tr>
<td><strong>Approach</strong></td>
<td>Once Land and civil engineering assets are mapped, signaling and Tele-communication assets can be mapped with the help of station layout diagrams etc.</td>
</tr>
</tbody>
</table>
### GIS Data Layers

<table>
<thead>
<tr>
<th>Layer</th>
<th>Electrical OHE (overhead electrification assets)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Features</td>
<td>Location of OHE masts, catenaries, cables, and other equipment, substations, neutral sections, etc</td>
</tr>
<tr>
<td>Data Available</td>
<td>Schematic diagram</td>
</tr>
<tr>
<td>Approach</td>
<td>Once land and civil engineering assets are mapped, OHE assets can be mapped</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Layer</th>
<th>Maintenance Facilities</th>
</tr>
</thead>
</table>
| Features               | • Location of production units, maintenance sheds, sick lines – coaching and freight  
                         | • Maintenance workshops                           |
| Data Available         | Drawings of the facilities                       |
| Approach               | To be delineated on map from building and track data |
Preparation of Base Map

- Identification of focus areas and non-focus areas
  - The focus areas will include Railway assets in cities, stations, yards, workshops, major bridges, and other areas where high resolution mapping is important.
  - Non-focus areas will include permanent way and its surrounding land in the hinterland where high-resolution mapping is not important.
Preparation of Base Map (cont’d)

• Procurement of SOI Toposheets
  • 1:25,000 scale for focus areas or where available
  • 1:50,000 scale for non-focus areas
• Procurement of Satellite imagery from NRSC
  • 1 meter resolution PAN data for focus areas
  • 2.5 meter resolution PAN data for non-focus areas (where required)
• Collection of existing data such as State-level Spatial Data Infrastructure (SSDI) and other sources
• Geo-referencing of satellite data, collection of Ground Control Points (GCP)
Subsequent phases

- Movement of trains
- Hospitals and medical facilities
- Accident relief medical equipment
- Accident relief trains
- Civil administration – police stations, district administration, disaster management authority
Interfacing the GIS with applications

- Asset management systems for asset location
- Train operations management systems for train running position
- Planning systems to visualize system bottlenecks
- Project management systems to visualize project progress
Architecture

- Central database
- Exposing map on the Internet / intranet
- Using web services to provide interfaces with the different applications
- System for updation of data and configuration control of the database
- Access control
THANK YOU