Railway Asset Management System in Turkey: A GIS Application

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INTRODUCTION

- The associations working on transportation fields use available data to define the goals and target related with services or facilities purposes.
- Asset Management Systems concept is important on transportation field and it cover facilities, infrastructure and superstructure components of the transportation systems.
- GISs are computer-based systems for the capture, storage, manipulation, display, and analysis of geographic information. In this study, stations, segments, traffic accidents, maintenance and renewal works of Turkish State Railways were transferred into GIS environment and developed a data base and realized analysis.

ASSET MANAGEMENT SYSTEMS CONCEPT IN TRANSPORTATION FIELD

Although a number of definitions are used for asset management, asset management is the systematic process of maintaining, upgrading, and operating physical assets cost effectively. With this definition, asset management is a decision making tool that creates a framework for both long and short term planning.

The basic cycle of an asset management program:

- Inventory your assets
- Conduct a condition assessment standards
- Develop and apply performance standards
- Evaluate your assets against those standards
- Analyze the alternatives that might be followed to maintain or upgrade those assets
- Make decisions on the allocation of resources
- Implement your investment plan
- Develop and use performance measures to determine the performance of your assets, and
- Collect feedback information and make adjustments as needed

RAILWAY ASSET MANAGEMENT SYSTEMS

Railway AMS should include and combine all kinds of specialised monitoring, data collection, and decision support systems. This should be the case for track, but also for all other railway infrastructure elements like bridges, switches and crossings, overhead lines, level crossings, tunnels, culverts, etc.

Figure 1. GIS background layout of an AMS.

What is GIS?

GEOGRAPHICAL INFORMATION SYSTEMS

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GISs are computer-based systems for the capture, storage, manipulation, display, and analysis of geographic information. The multiple functionality afforded by GIS distinguishes it from older technologies. The integration of multiple functionality within one rather seamless environment dispenses users from mastering a collection of disparate and specialized technologies. As it turns out, this aspect is often held by organizations as one of the decisive criteria in their decision to adopt GIS technology because of its efficiency benefits.

Components of GIS:

Hardware: The computer and the secondary devices attached to it, which enable GIS to operate, are called as hardware.
Software: Software is sum of algorithms written in high level programming languages in order to storage, analyze, and display geographical data.
Data: Data is the most important component of GIS. The complexity of data sources and huge amount of data having different structures require much more time and high costs.
People: GIS technology has a wide application with human creativity. People manage the required systems to solve real world problems, and prepare long and short term plans.
Methods: GIS works properly only when plans and work principles are prepared precisely. These plans and principles are generally in the form of models and applications specific to each organization.

GEOGRAPHICAL INFORMATION SYSTEMS IN RAILWAY ENGINEERING

GIS technology serves three distinct transportation needs:
a) infrastructure management,
b) fleet and logistics management, and
c) transit management.

▪Railways around the world find great utility in using geographic information systems (GIS) to manage key information for rail operations, maintenance, asset management, and decision support systems.

▪The list below identifies the major functions or disciplines in which GIS has been successfully deployed in railway organizations [6]:

a) Real estate management
b) Facility management
  -Track
  -Power
  -Communications and signaling
c) Asset tracking
d) Commodity flow analysis
e) Emergency response management
f) Environmental and construction management
g) Intermodal management
h) Passenger information
i) Capacity planning
j) Marketing
k) Supply chain management
l) Site selection
m) Risk management

A case study for Turkish State Railways

Turkish State Railways network was rectified and coordinated using Mercator projection. In this study, ED 50 (European Datum) and UTM 36 projection were used. Rasters and vectors data were used to represent the railway network, stations, switches and crossings. MapInfo Professional was selected as the geographic analysis software. Raster, Vector and table data were transferred into MapInfo Professional database for geographical analysis.

Turkish State Railways network transferred into GIS environment in order to provide high quality decision support systems (DSS).

This data contains general data, layout and operating data, general data on superstructure and infrastructure, geometry measurements, inspections and other measurements, work history and map data of the railway network on the analysis segment base.

Turkish State Railway Network componets were defined as follows:

- Railways (polyline),
- Stations and switches (point)

Figure 2. Turkish State Railways networks, stations and section properties on GIS

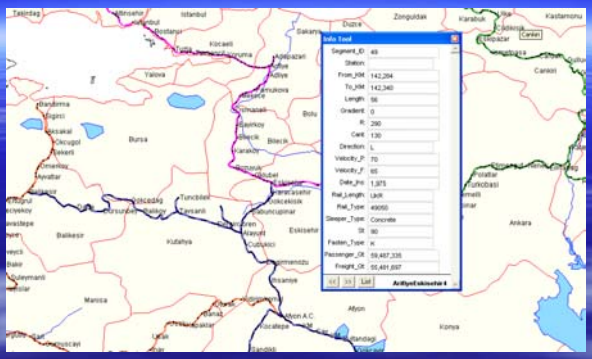

Figure 3. Segments properties on GIS

Figure 4. External factors on GIS

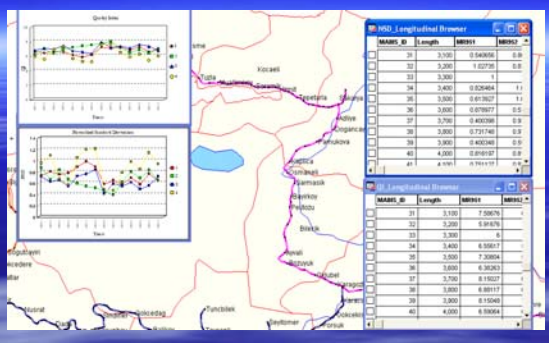

Figure 5. Quality Index and normalized standard deviations of the segments on GIS

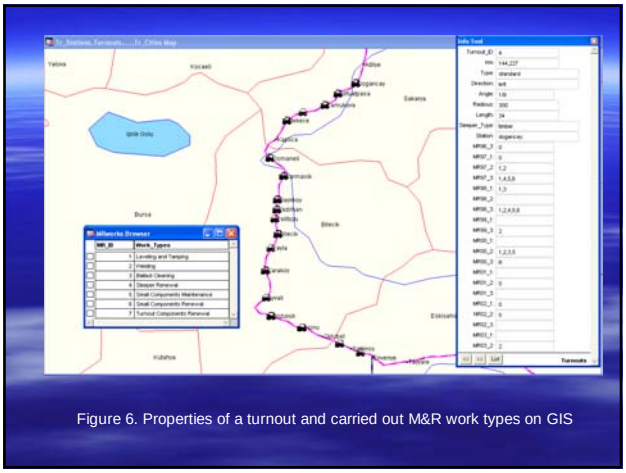

Figure 6. Properties of a turnout and carried out M&R work types on GIS

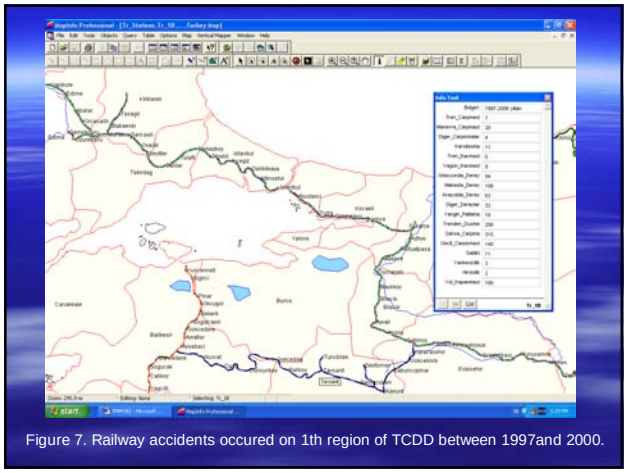

Figure 7. Railway accidents occured on 1th region of TCDD between 1997and 2000.

CONCLUSION

Information will be available on a facilities condition and performance, which can help managers to develop a plan schedule, and prepare short and long-range strategies with an AMS. GIS can be used to determine the location of an event or asset and its relationship or proximity to another event or asset, which may be the critical factor leading to a decision about design, construction, or maintenance. The aim of this paper was to demonstrate the capabilities of GIS in analyzing the track assets and providing consequent decision support regarding with them.