

Autonomous Track Geometry Measurement System (ATGMS)

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Objective:

Improve safety by reducing derailments due to track Geometry defects

Goal:

Develop a system for autonomously and automatically measuring track geometry from a revenue vehicle at track speed

Autonomous Track Geometry Measurement System

Background:

- Track Geometry Defects are one of the leading causes of train derailments.
- Track Geometry is inspected visually at regular intervals by railroad inspectors
- Track Geometry is also recorded by major railroads using dedicated inspection cars at various intervals
- FRA regional offices routinely performs visual track inspections and its HQ safety staff makes routine track geometry measurements through their ATIP program and provides the data to the railroads.


Track Safety Standards

Track Class and Maximum Speed

Track Class	Maximum allowable speed for freight trains	Maximum allowable speed for passenger trains
Excepted	10	N/A
1	10	15
2	25	30
3	40	60
4	60	80
5	80	90
6	110	110
7	125	125
8	160	160
9	200	200

**Track Safety Standards
Part 213**

Subpart A to F
Class of Track 1-5




Department of Transportation
Federal Railroad Administration –
Office of Safety

*Print date November 30, 1998
Effective Date: September 21, 1998*

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**Track Safety Standards
Part 213**

Subpart G
Class of Track 6 and Higher
Includes Defect Codes

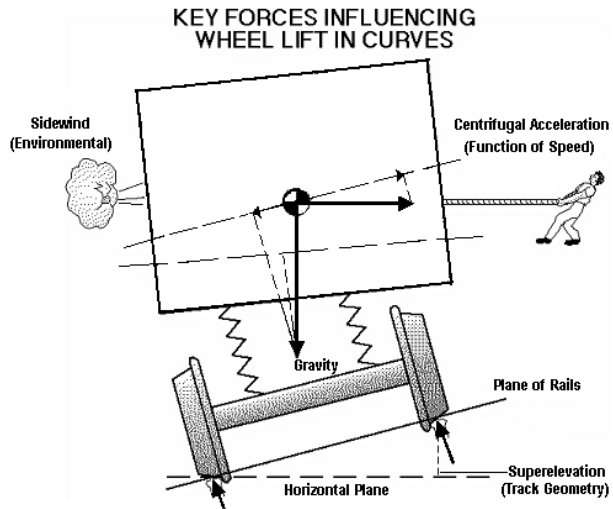


Department of Transportation
Federal Railroad Administration –
Office of Safety

*Print date April 10, 2000
Latest Revision Date: October, 1998*

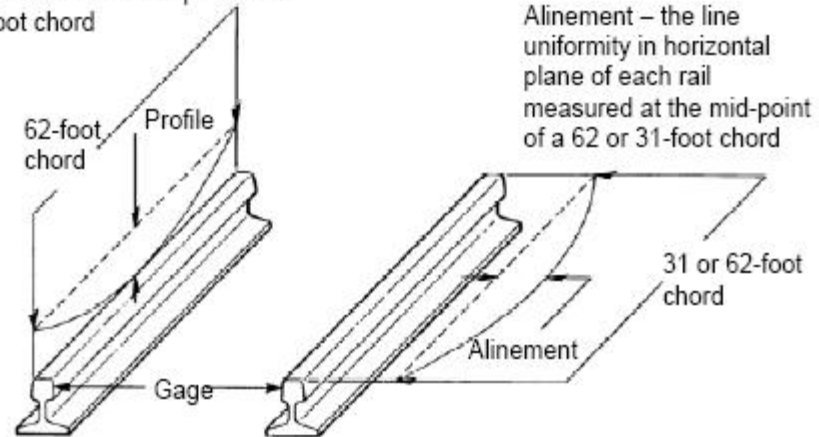
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Curvature, Superelevation



Gage, Alinement, Profile

Profile – the surface uniformity in the vertical plane of each rail measured at the mid-point of a 62-foot chord



Gage – the distance between the rails measured $\frac{5}{8}$ inch below top surface of the rail

Autonomous Track Geometry Measurement System

Onboard Unit

Location Determination

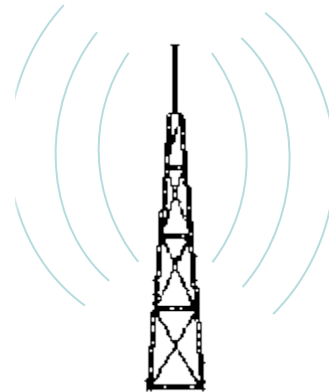
- GPS /DGPS or
- DGPS with Inertial Navigation

Processor

- Data collection/analysis
- Remote diagnostic capabilities
- Remote software enhancements
- Remote/self-recovery



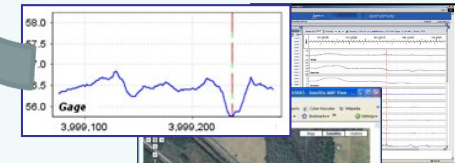
Measurement Sensors



Communication
Link



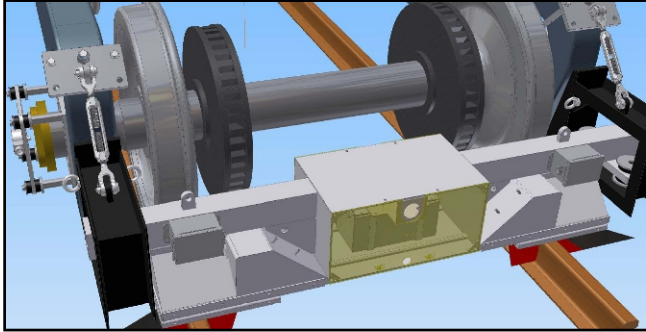
Processing Server



Inspection
Results

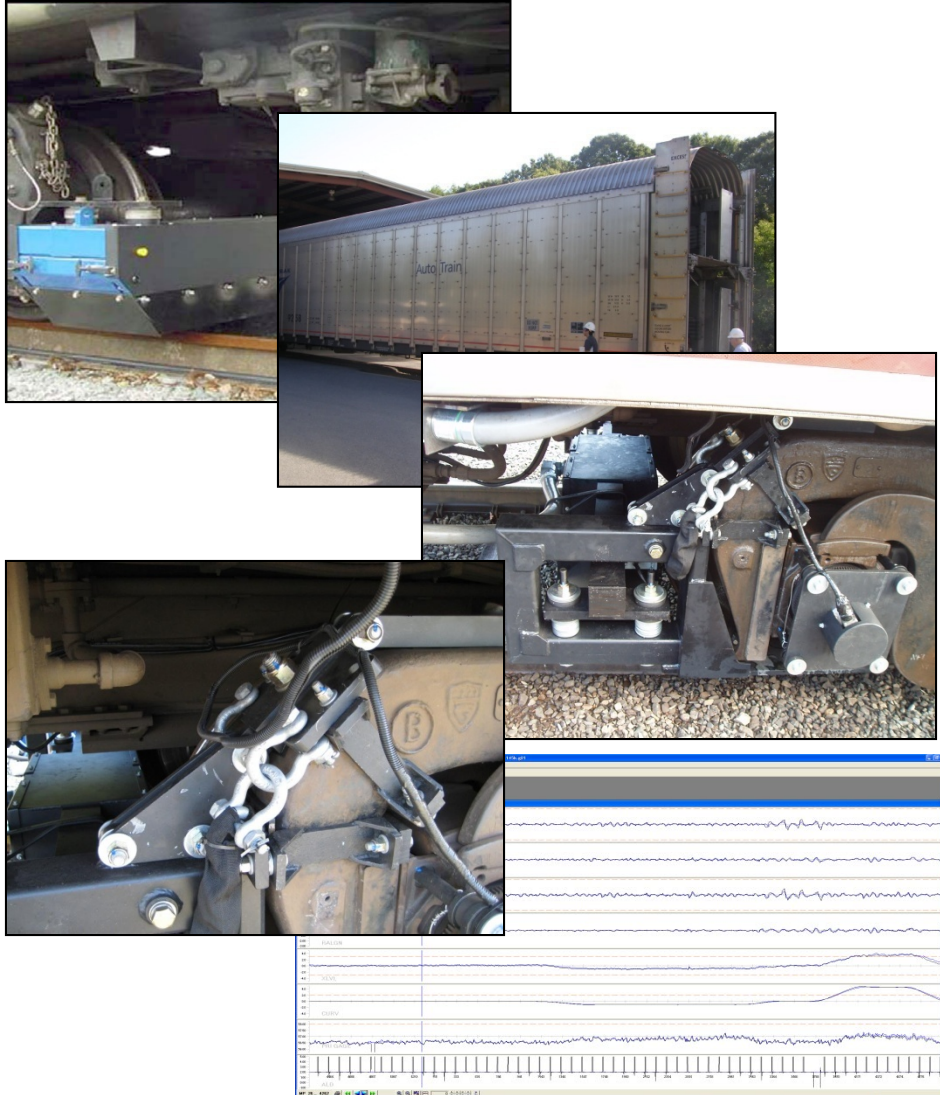
Database

Federal Railroad Administration Autonomous Track Geometry Measurement System (ATGMS)



- Track conditions can be monitored every time the car with the ATGMS moves on track.
- Normal business and traffic will not be interrupted for testing by dedicated test cars.
- The system offers an effective reduction in complexity, size and cost of traditional geometry systems without compromising performance.

ATGMS Project Summary



- Design has been completed
- Was tested on Hi-railer for the road test
- Being tested and refined on Amtrak train since Spring of 2008. Collected more than 100,000 miles < 1 year
- New system is being built for operation on Northeast Corridor

Near Future Activities

- Improvement and implementation of exception filtering to decrease number of false exceptions without “manual” intervention.
- On track verification of geometry exceptions to validate the measurements.
- Participating railroads will be encouraged to use the ATGMS website to view the information and provided feedback.
- **A key aspect of the acceptance of this technology will be to establish operating procedures acceptable by FRA and railroads.**

- Demonstrate to industry
- Foster industry acceptance
- Develop self power system
- Introduce low cost/low power robust sensors
- **Establishment of Procedures and Recommended Practices for System and Data Usage**
- **Development of Appropriate Regulations**

Federal Railroad Administration

ATGMS Web

Secure Site

Autonomous Track Geometry Measurement System

The screenshot shows the ATGMS web application interface. On the left is a photograph of a train. The main area contains a login form with fields for "User Name" (containing "tajaddini.ali") and "Password" (masked with dots), and a "Login" button. To the right is a "Data Selection" table with columns for "Region", "Subdivision", and "Survey". Below the table are several filter sections for "Geometry Defects", "VTI Defects", and "Include Risks", each with radio buttons for "All", "None", and "Advanced".

Data Selection

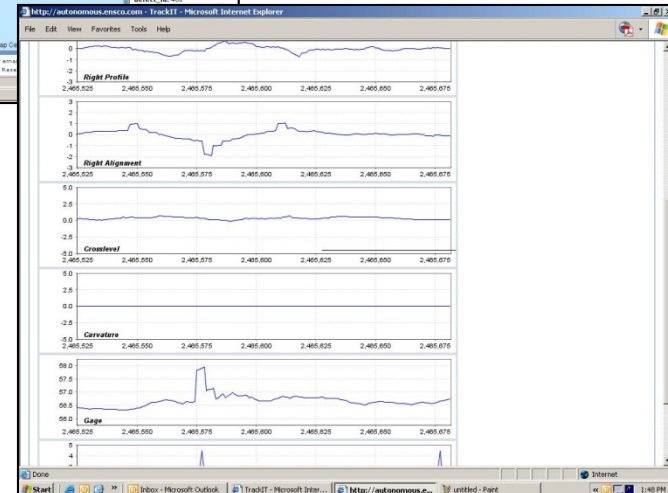
The screenshot shows the GIS Map interface. It features a map of a rail line with a red line indicating a selected track. To the right of the map is an "Identify Results" panel displaying metadata for the selected track, including "Coordinate Position", "Geographic MADS", "Alignment", and "Single Wide" information.

GIS Map

Google Map

The screenshot shows a Google Map interface with a satellite view of a rail yard. A red location pin is placed on the map, and a data popup is visible. The popup contains detailed information for a specific track, including "Latitude", "Longitude", "id", "type", "value", "defect_id", "class", "Alignment", "Gage Wide", and "Gage" data.

Geometry



Acknowledgment:

Contractor, Ensco, Inc

Volpe

Amtrak

CSX Railroad