From: "Richard C Semenick " [redacted]
To: <[redacted]
Date: 8/25/2006 2:09:29 PM
Subject: Fwd: Tuesday August 29th - NTSB TC82 Trip

Bob,

Tuesday's (August 29, 2006) TC-82 Geometry Car ride is set up. If you need transportation to Hicksville Station please advise. I will be attending with you along with those typically responsible for the territory.

Of those copied, if you plan to attend let us know.

>>> Patricia Hasley 8/25/2006 10:49 AM >>>
Richie,

The TC-82 will be measuring Port Jefferson Branch on Tuesday August 29th. The TC-82 will pick you and the NTBS representatives at Hicksville Station TK#3 around 9:30 a.m.

Below is the measurement schedule for that day

Schedule 6 Tuesday August 29, 2006

Ready Babylon 9:00am
Deadhead to Divide 3 station
Record #2 Port Jefferson Eastward from Divide to Hunt 3
Record Single Track Eastward from Hunt 3 to Port Jefferson
Deadhead to Stony and Record Siding Westward
Deadhead to Post and Record Siding Westward
Deadhead to Fox and Record Siding Westward
Deadhead to Duke and Record Siding Westward
Deadhead to Hunt 3
Record #1 Port Jefferson Westward from Hunt 3 to Divide into 1 Station
Deadhead to Babylon and Lay-up

Patricia Hasley
Engineer Track Geometry
[redacted]

CC: "Brian J Finn" [redacted], "Frank W Kronenberg" [redacted], "Jane Dietz" [redacted], "Jose R Fernandez" <[redacted]>, "Patricia Hasley" [redacted], "Raymond P Kenny" [redacted], "Susan M McGowan" [redacted], "Neil Boyle" [redacted]

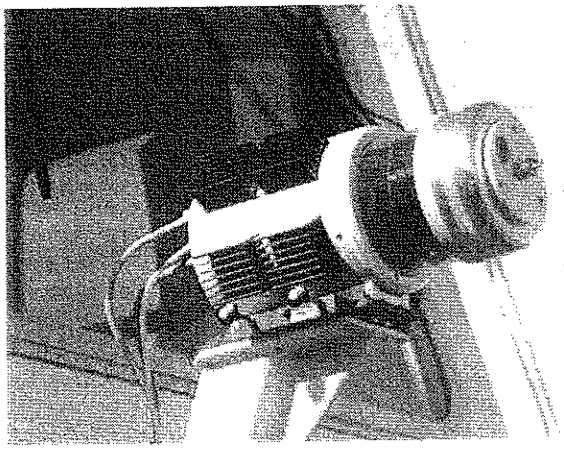
Plasser Clearance / Ballast Measuring System

Key Features

- High-speed profile measuring system
- Used for clearance measurement as well as ballast cross section measurement
- Scan range 360°
- Up to 40 scans/sec
- Sealed weatherproof housing (IP64)
- Reliable time of flight measurement principle
- Easy and flexible Ethernet interface
- External distance synchronization input
- 1001 measurement points per revolution
- Laser class 2 in scanning mode (eye save)
- Additional point mode (non-scanning) with co-aligned visible beam pointer
- Laser class 1 in point mode (eye save)

System Description

The Plasser Clearance / Ballast Measuring System utilizes a Laser Mirror Scanner, type LMS-Q250. The Laser Mirror Scanner is a high speed profile measuring device based upon accurate distance measurement using an electro-optical range detection method and a beam scanning mechanism. The rugged housing makes the scanner work even in harsh environments. The Laser Mirror Scanner scans a 360° range, delivering profile data at almost 360° (5°-355°) per scan. A visible laser beam is available in point-measurement mode (non-scanning), allowing easy alignment of the unit. Interfacing is provided via a parallel and serial connection or by means of the additional IB90-ETH box with an Ethernet network. Its programmability and accessibility over standard Ethernet makes system integration a snap. An external RS-422 trigger input provides for distance synchronization in non-stationary operation such as tunnel and ballast measurement.



System Integration

The Laser Mirror Scanner is connected to the Plasser Server via an Ethernet Network connection. Via this network, the Laser Mirror Scanner receives all commands and messages from the Plasser Server and sends all acquired data to the Plasser Server.

The Plasser Server receives one data packet (1001 points, containing measured distance and quality indication of measurement) from the Laser Mirror Scanner for every foot (or 25cm) traveled. The index of the points indicates the current angle of the laser beam.

To keep the Laser Mirror Scanner location synchronized with the Plasser Server, the Laser Mirror Scanner is connected to the system foot pulse. This pulse tells the Laser Mirror Scanner to send the next data packet via the network to the Plasser Server.

The acquired data is distributed from the Plasser Server over the network to the Tunnel Client program. This program is designed to display, analyze and print the acquired crosscuts and ballast sections.

Measuring tunnel clearances faster

Dipl-Ing Bernhard Metzger
Plasser Measuring Systems

AN ACCURATE knowledge of loading gauge clearances is critical if a rail operator is to be certain that loads can be carried safely. But over time the clearance along a line can change for several reasons. The track can move out of position, perhaps being lifted during maintenance, and tunnels can deteriorate.

There are several ways to measure lineside clearance, of which the two most widespread are mechanical and laser. An improved laser design jointly developed by Plasser American Corp and Riegl GmbH of Austria is now in use with New York City Transit and Taipei Metro.

With older equipment, users had to stop the recording car to measure each cross-section, which took up to 5 min. Even with a 'fast' recording time of 1 min per cross-section, it took nearly 17 h to measure a 1 km tunnel with one section every metre.

Table I. Adjustable measuring modes

Rev/sec	Measured Points per Revolution	Accuracy mm
0 (no rotation)	–	Determined by travel speed
10	1001	± 12.5
20	1001	± 12.5
24	1001	± 12.5
40	501	± 25.0

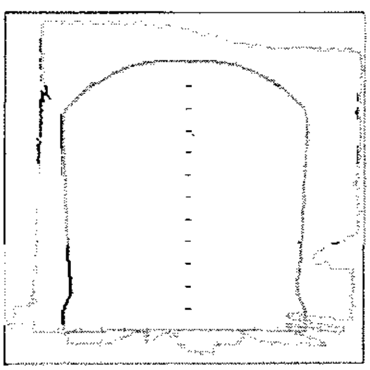
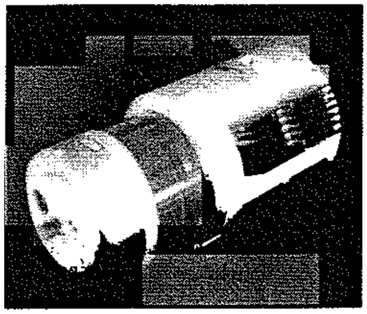


Fig 3. TunnelClient in standard mode. The current header, location and track geometry parameters are shown, with the actual measured data and the corresponding clearance diagram. The measured data violates the clearance in the lower right corner, and therefore this part of the profile is shown in red. As this profile is of a curve, the clearance diagram is enlarged on both sides to adjust for radius and superelevation



The rugged laser sensor can be bogie-mounted, with rubber mounts. The scanner itself is filled with inert gas

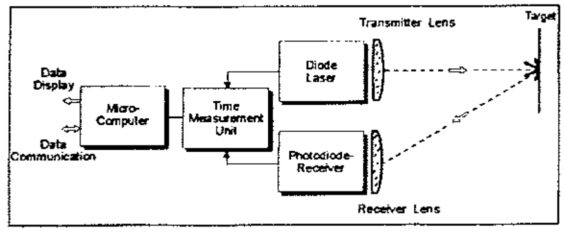
This meant the task could take several days, if the line could not be closed for such a long period. Modern equipment can achieve the same quality of data in milliseconds, cutting the time for an equivalent task to just 42 sec.

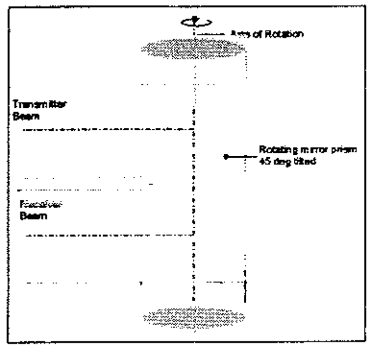
Measurement is carried out using a 'time-of-flight' technique. A periodically-driven laser diode is used to send out infra-red light pulses. These are reflected by surrounding objects, and the echo is picked up by a photodiode. The interval between the transmitted and received pulses is measured using a quartz-stabilised clock (Fig 1).

The laser beam is scanned around a 350° arc, producing almost a full circle (the 10° looking vertically down is reserved for calibration). Measurement around this circle can be taken up to 40 times per second. The speed at which measurements can be carried out is inversely proportional to the number of points measured during each revolution and the accuracy required (Table I). There is also an option to measure individual points without rotating the beam. It is possible to calculate average measurements by taking two or more crosscuts in one sampling interval, which is usually 250 mm.

Using the survey data, the distance between the laser and the target is calculated. The computer also records the position of the rotating mirror prism and the intensity of the back-scattered light from the target. All the measurement options are set from within the Plasser Computer Measuring & Analyser System, so the user does not need to interact directly with the software. Data is transferred via a TCP/IP ethernet. The control system gets a pulse every data sampling interval, keeping the data synchronised with the car's other measuring systems.

Plasser has produced a software package called TunnelClient, to





Above: Fig 1. Signal and data paths in the measuring and analyser system

Left: Fig 2. Laser light is transmitted and received using a prism with mirrored surfaces at 90° to each other and 45° to the laser and photodiode

evaluate the measured cross-sections. It can display and print individual sections, including automated printing of profiles at a pre-settable distance. There are 10 different user definable clearance diagrams, analysis of sections against a clearance diagram, with adjustments for curvature and superelevation. The system can also display the minimum clearance between two locations. Data can be output in ASCII and database upload formats.

With additional software, the equipment could also measure the distance to the neighbouring track or the height of the used ballast. •

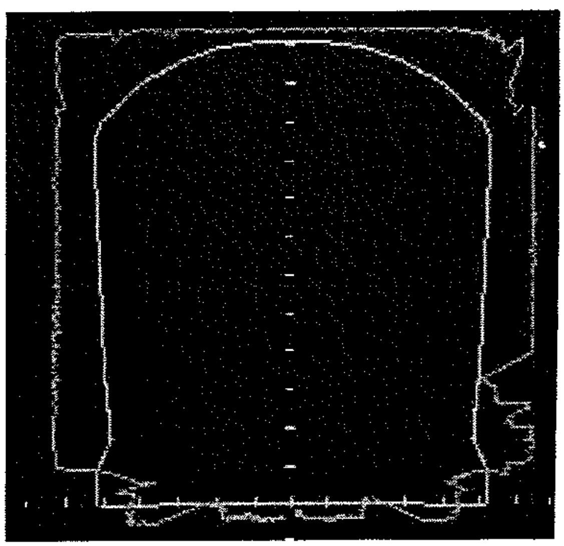


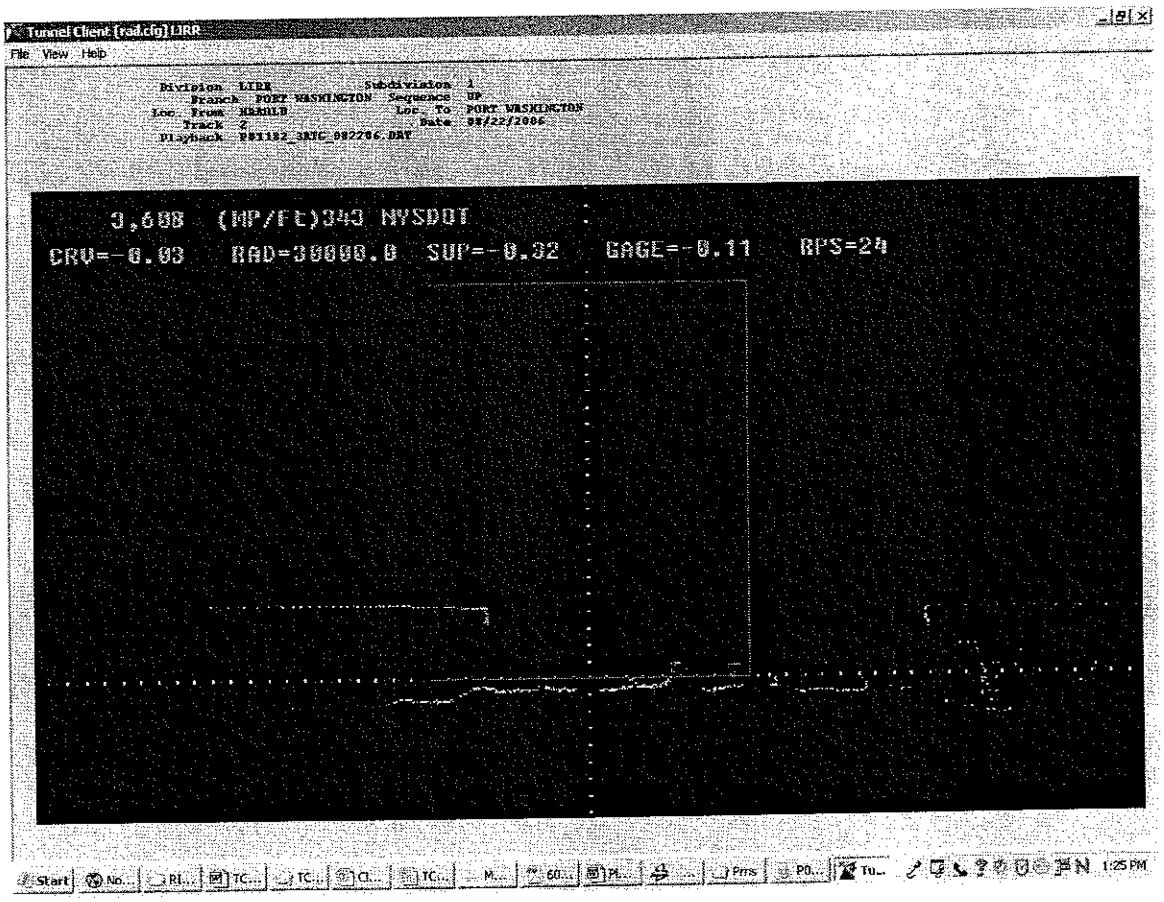
Fig 4. TunnelClient in minimum mode. At the end of a measuring run the program will display the overall clearance by assembling the smallest distance to the laser scanner for every measured angle. The ASCII data file will provide the location where each minimum was measured

The Riegl Tunnel Measuring System is used to measure the clearance inside tunnels, below bridges or between other wayside structures and the track using a Laser Range Finder. The measurement range is up to 30 ft with an accuracy of + or – 1 inch.

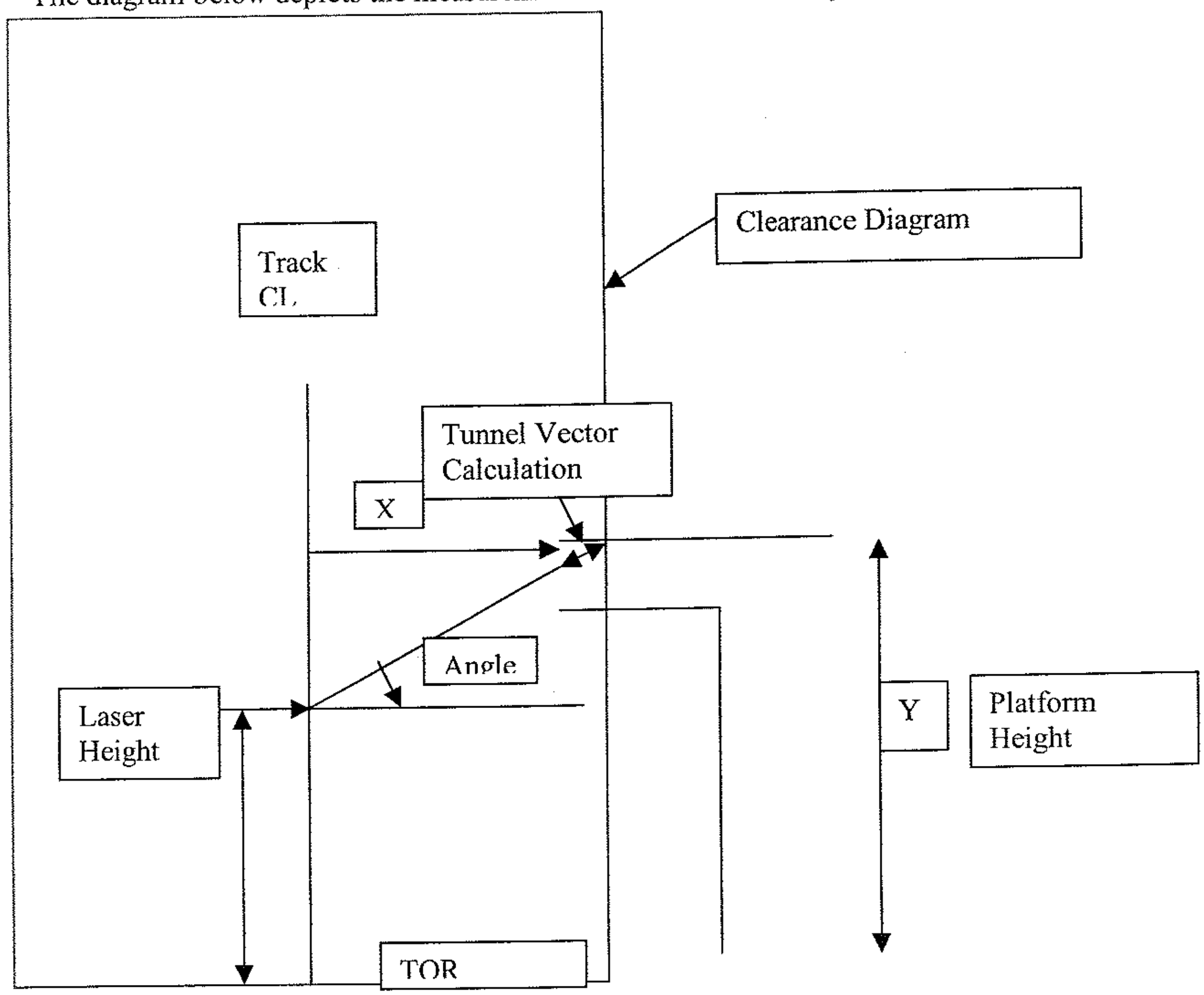
The scanner generates crosscuts by rotating a mirror 350° around its own axis between 10 and 40 times per second. Up to rotational speeds of 24 rotations per second, 1001 points are measured. For each of the measured point X and Y coordinates from Top of Running Rail and Track Centerline are generated.

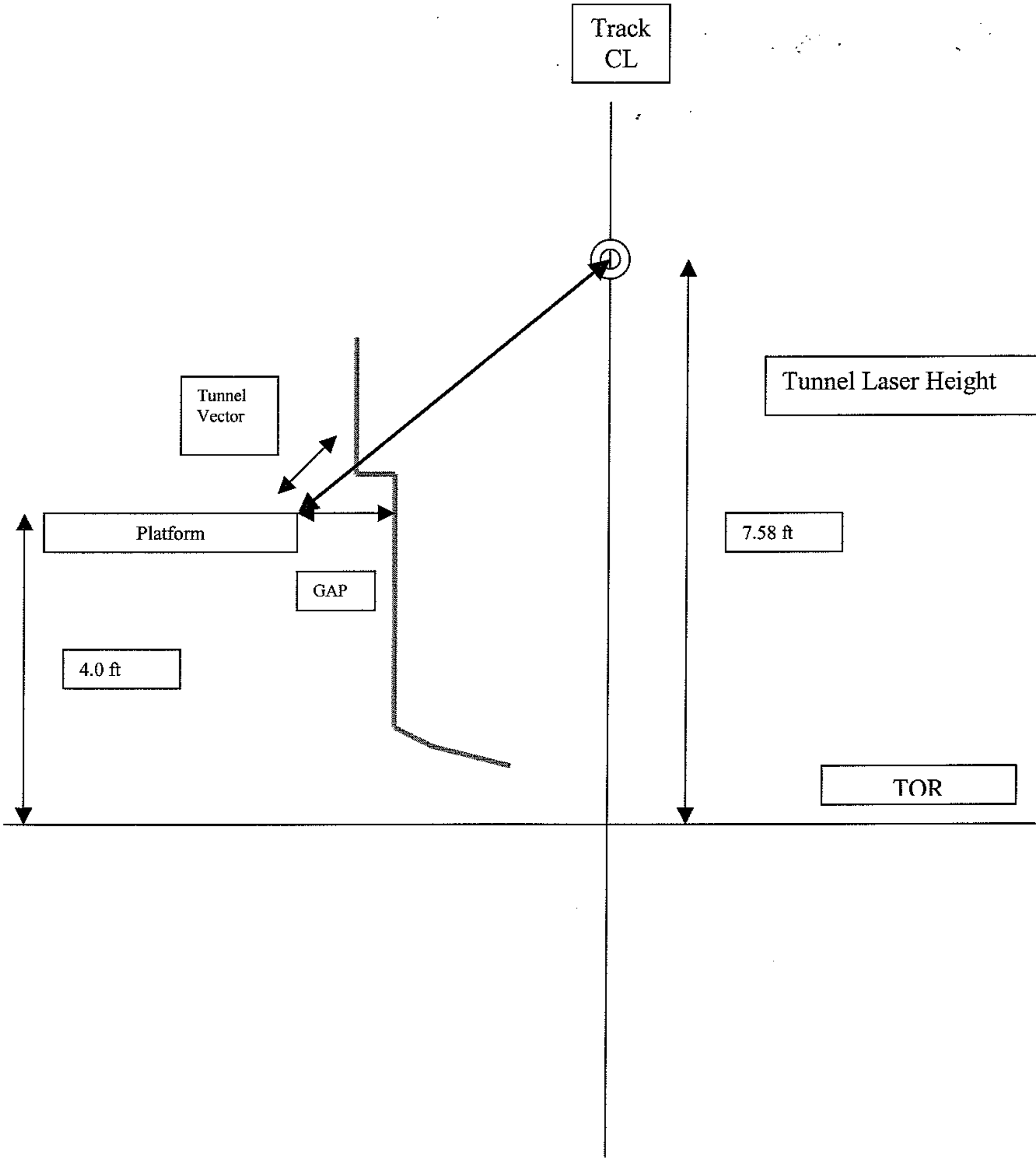
The data collected is display and analyze using Plasser's EMTunnelClient and TunnelConverter programs.

The figure bellow is a display of the data collected with the Tunnel System at station platform.

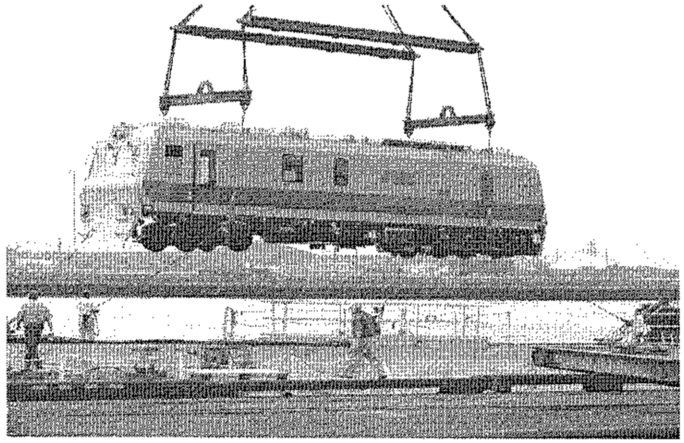


The diagram below depicts the measurements collected with the system.





Track
CL
Tunnel
Vector
Tunnel Laser Height
Platform
7.58 ft
GAP
4.0 ft
TOR

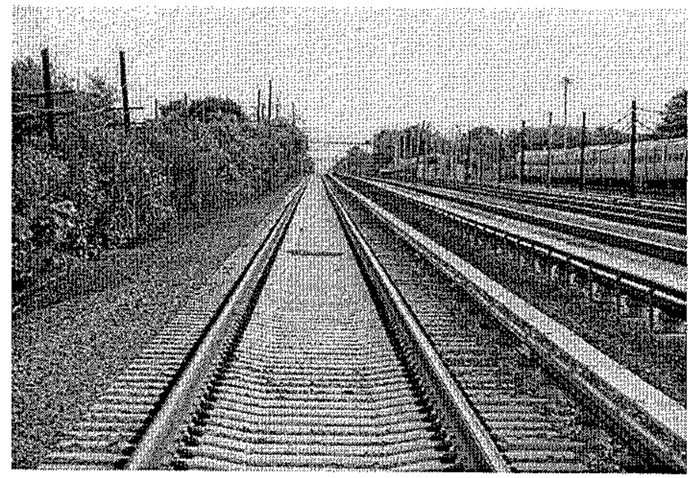


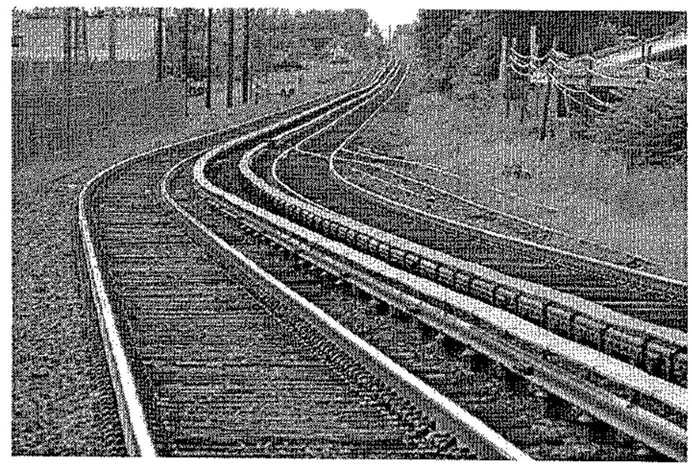
TC-82 Track Geometry Car and More

Long Island Rail Road
Engineering Department

Concerns of the Engineering Department

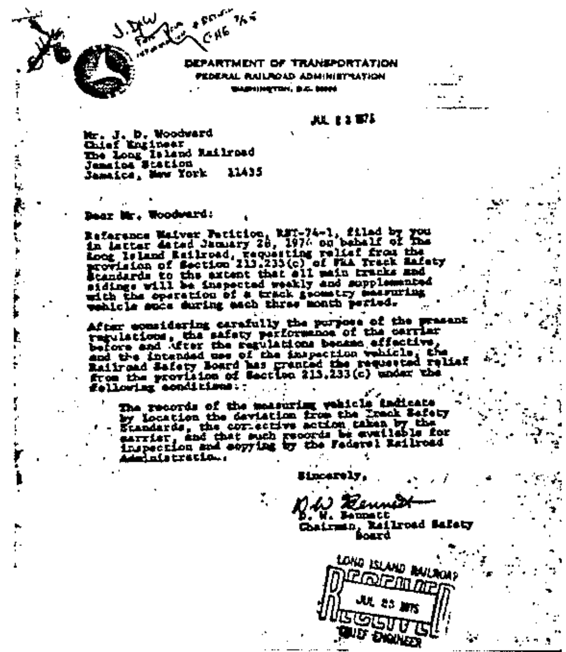
- **Safety Standards**
  - **FRA**
  - **LIRR**
  - **MNT**
- **Track Maintenance**
- **Quality Control**
- **Ride Comfort**





TC–80 The First

- First in United States with On Board Computer (1974)
- Basic Measurements (Profile, Alignment, Cross level, and Gauge)
- FRA Waiver (Sec 213.233 (c)
  July 23, 1975)
  - Allowed the use of Track Geometry Car For Inspection of Track
  - Altered Requirements for Track Walkers
  - Cost Reduction in Manpower for Track Patrol



DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION
WASHINGTON, D.C.

JUL 23 1975

Mr. J. D. Woodward
Chief Engineer
The Long Island Railroad
Jamaica Station
Jamaica, New York 11435

Dear Mr. Woodward:

Reference Waiver Petition, RST-74-1, filed by you in letter dated January 28, 1974 on behalf of The Long Island Railroad, requesting relief from the provision of Section 213.233(c) of FRA Track Safety Standards to the extent that all main tracks and sidings will be inspected weekly and supplemented with the operation of a track geometry measuring vehicle once during each three month period.

After considering carefully the purpose of the present regulations, the safety performance of the carrier before and after the regulations became effective, and the intended use of the inspection vehicle, the Railroad Safety Board has granted the requested relief from the provision of Section 213.233(c) under the following conditions:

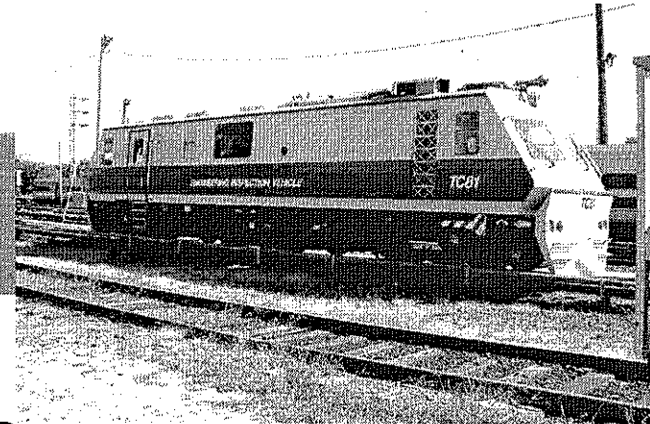
> The records of the measuring vehicle indicate by location the deviation from the Track Safety Standards, the corrective action taken by the carrier, and that such records be available for inspection and copying by the Federal Railroad Administration.

Sincerely,

R. W. Bennett
Chairman, Railroad Safety Board

LONG ISLAND RAILROAD
RECEIVED
JUL 23 1975
CHIEF ENGINEER

TC–81 Geometry Car



- Delivered to LIRR in 1988
- Refined Measurement System
- Rail Profile Measurement System
- Infrared Camera System
- R.O.W. Video System
- Offboard Analysis

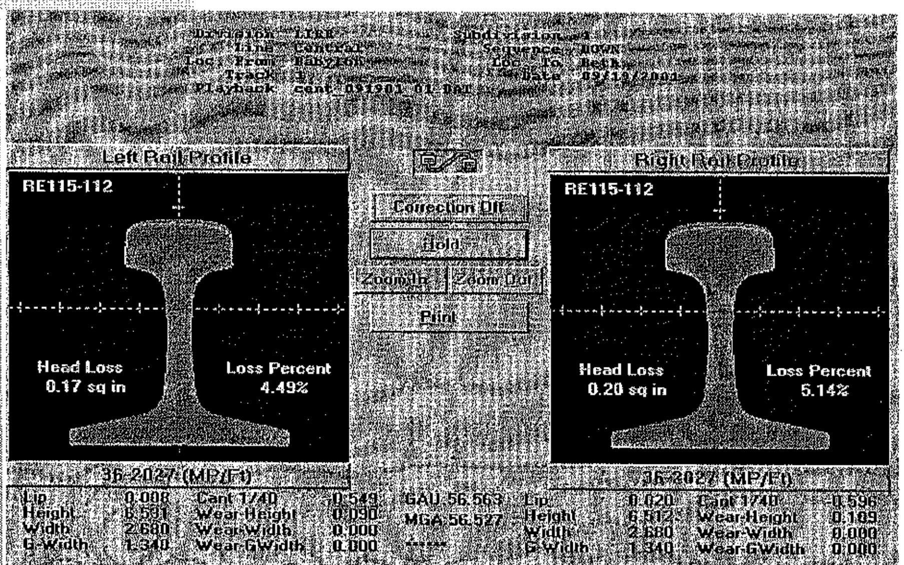
Presenting The ***TC-82*** *(August 2001)*

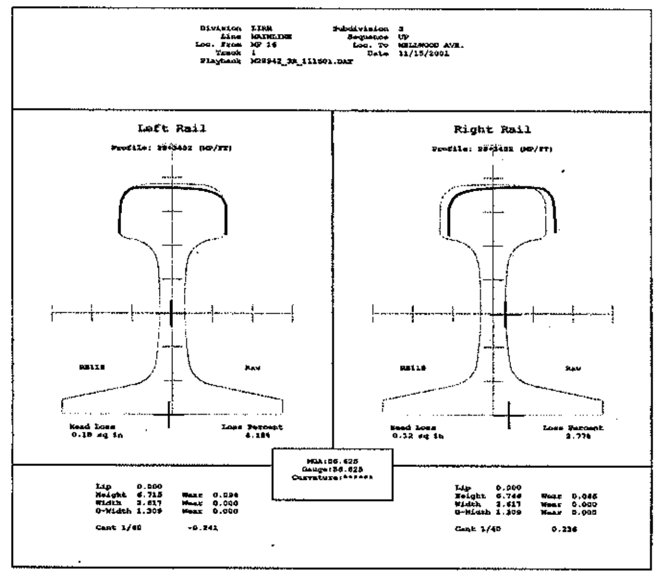
TC-82 Inspection Vehicle

- State of Art Geometry Measurement System – Non Contact
- R.O.W. Video System
- Infrared Cameras
- Third Rail Measurement System
- *Rail Profile System with Rail Weight Identification
- *Gauge Restraint Measurement System (GRMS)
- *Tunnel/Clearance Measurement System
- *Automatic Location using GPS and in track Transponders

Improved Technology

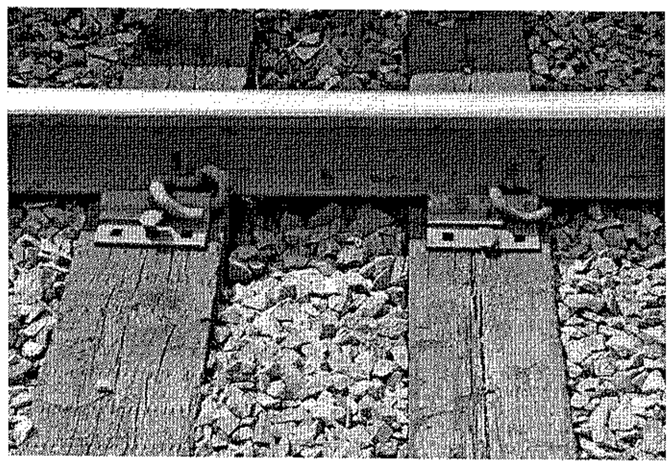
- **KLD – Orian Rail Profile System VI Improved over previous system with rail identification and better graphics**





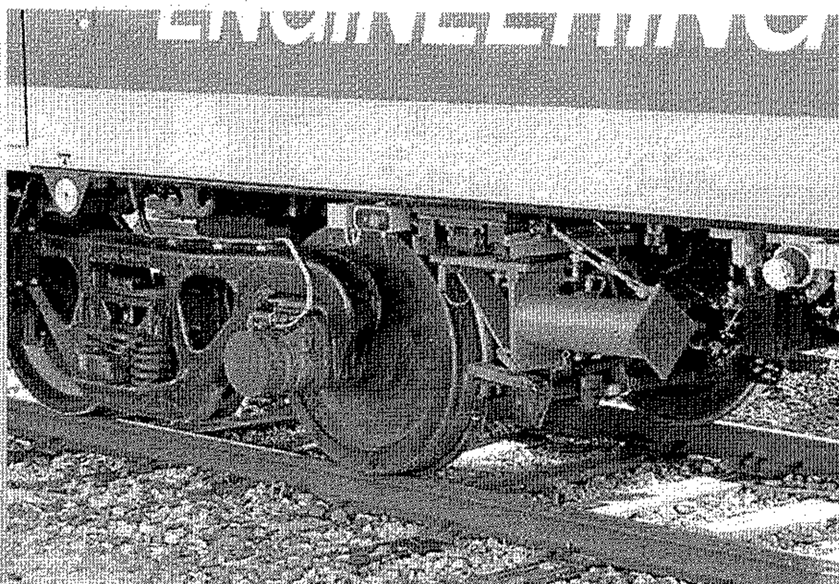
New Technology

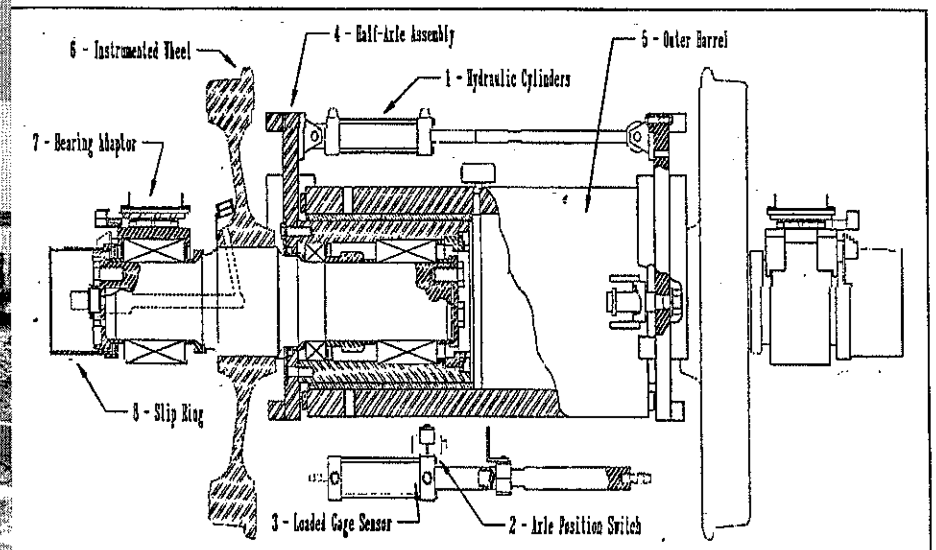
- Gauge Restraint Measurement System, GRMS for short – Measures the holding strength of the rail fasteners and wood components



Gage Restraint Measurement Axle

Vertical Load of 20,000lbs and Lateral Load of 14,000lbs





> ***Gage is measured and load applied by the Split-Axle system positioned as the trailing axle of the leading truck on the TC82 Track Geometry Car***

Gage Widening Ratio

GWR = &MEASURED X 16000

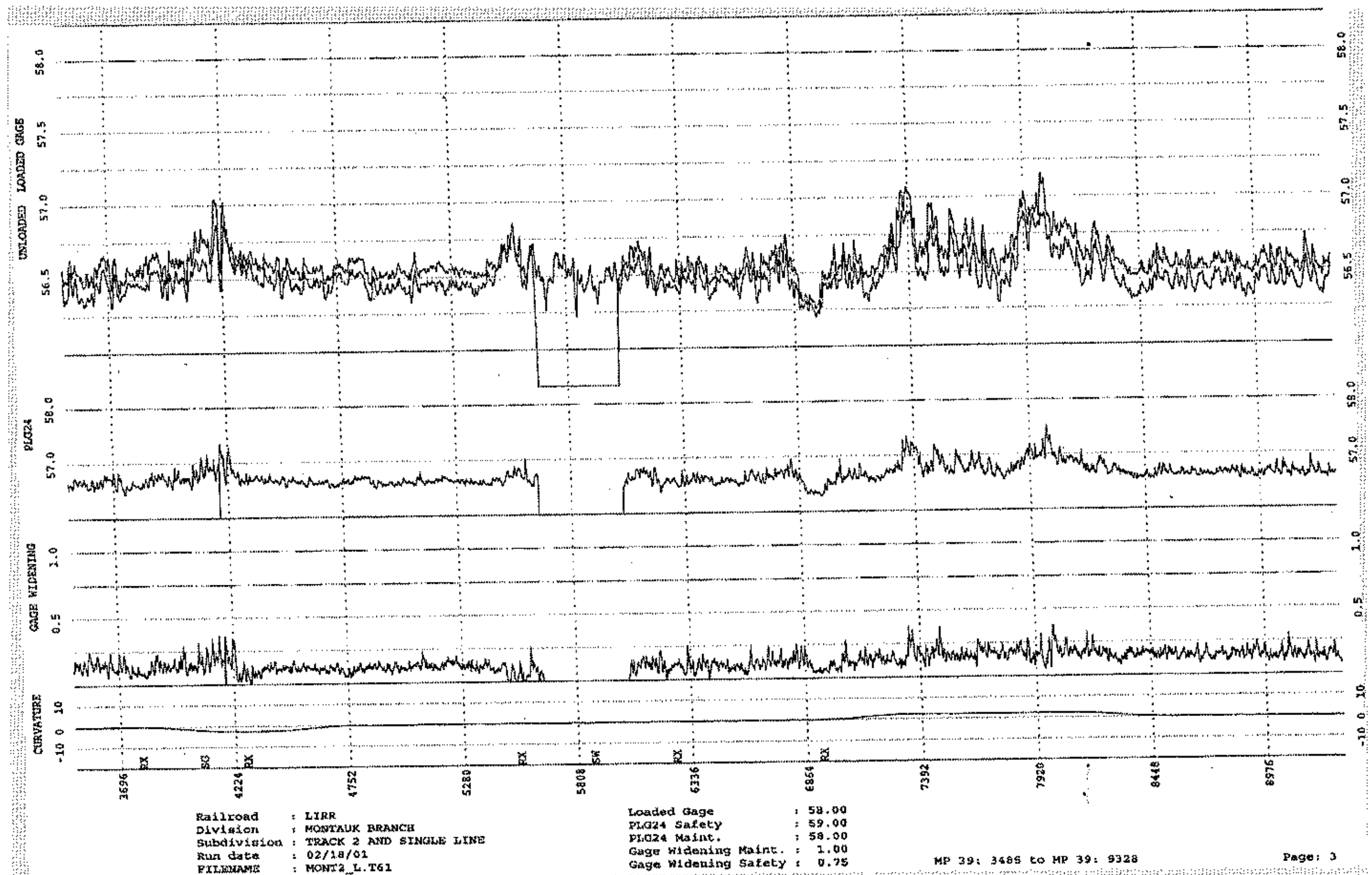
LGRMS

PLG = GAGE unloaded + (A FACTOR X &MEASURED)

A Factor is = 0.574 – (3.40/append load) + (252/(applied load)$_2$)

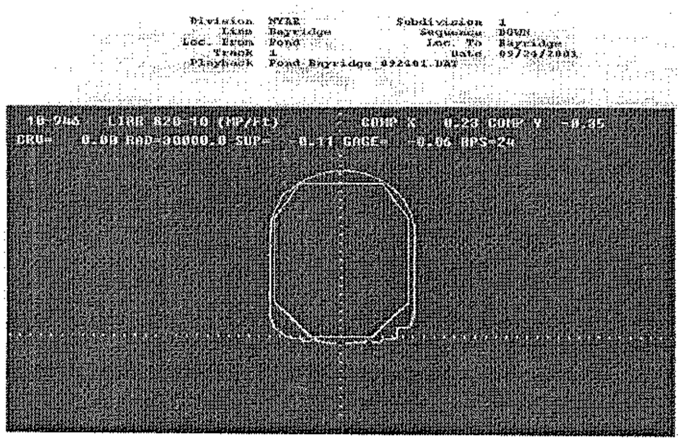
GRMS Display

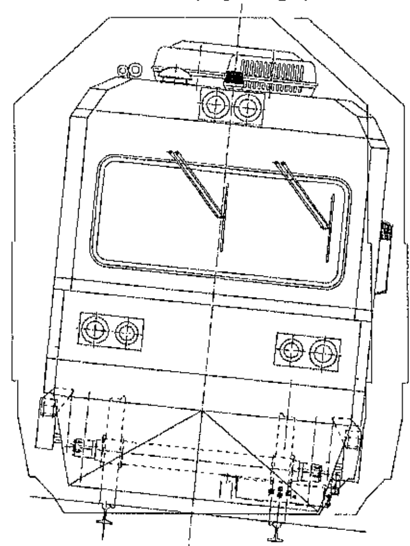
- Loaded /Unloaded Gage →
- Projected Loaded Gage →
- Gage Widening →



New Technology

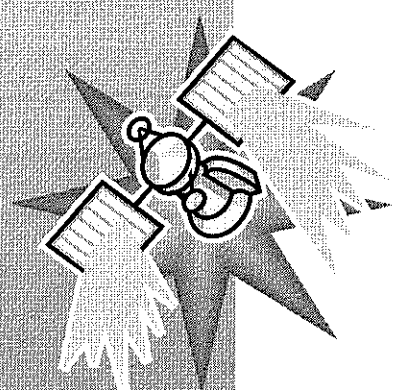
- **Tunnel Measurement System**
  - Tunnel Clearance
  - Platform Height
  - Bridge Walls
- **NYS-DOT** – Current Contract with the Dot for study on system clearances

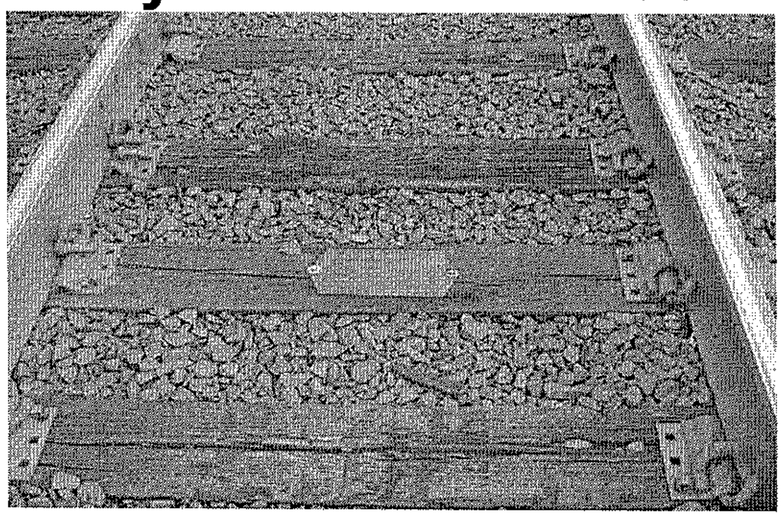




New Technology

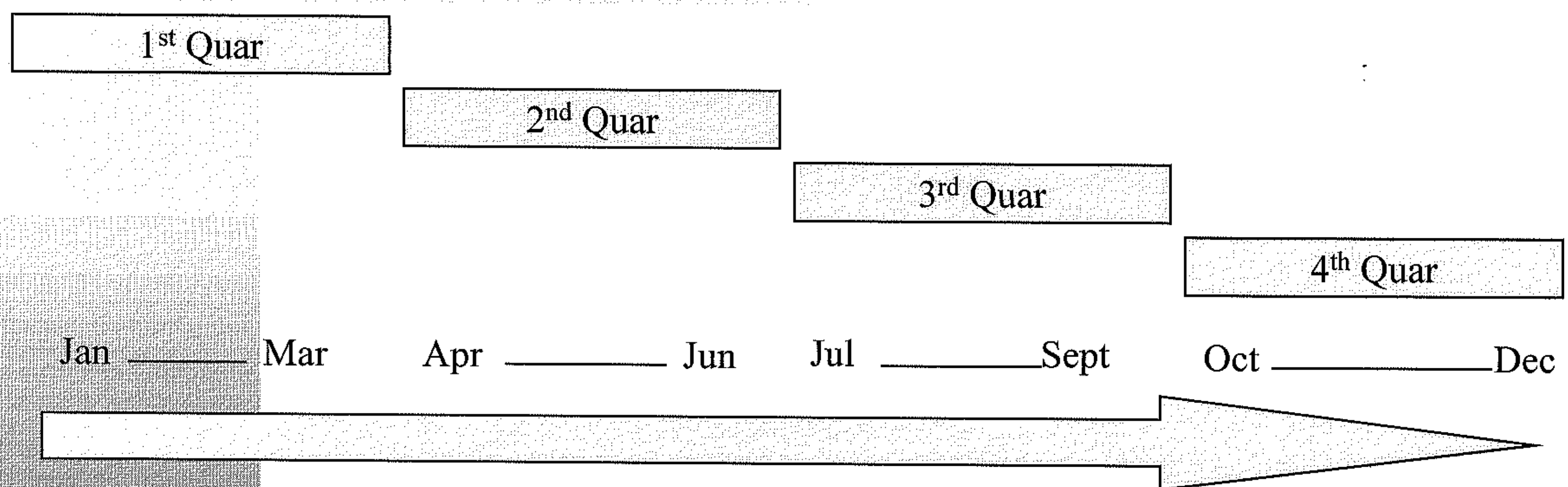
- **Automatic Location Identification and Recorder (ALD) – Thru the use of GPS and in track Transponders, the Geometry Car will run consistently on the same track.**





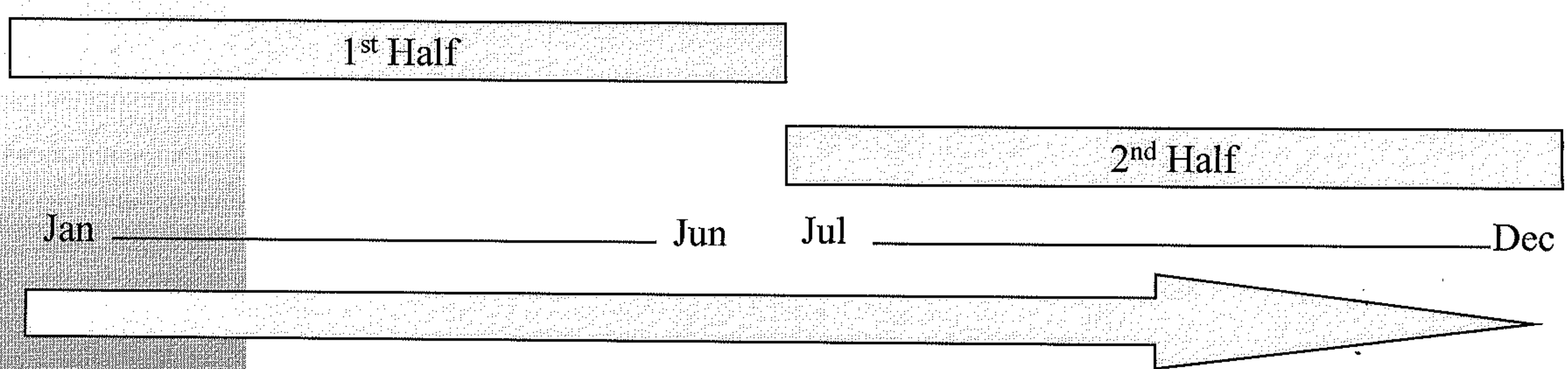
Measurement Schedule

- Main Line Track – 4 Times per Year
  - **Geometry Parameters**
  - **Rail Profile**
  - **GRMS – ½ of LIRR System**
  - **Third Rail**



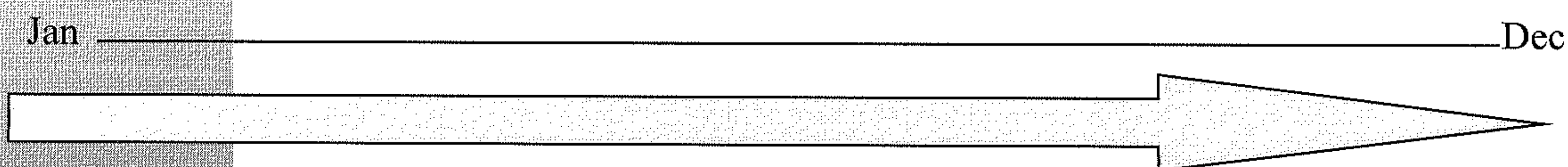
Measurement Schedule

- Yards and Controlled Sidings – 2 Times per Year
  - –**Geometry**
  - –**Rail Profile**



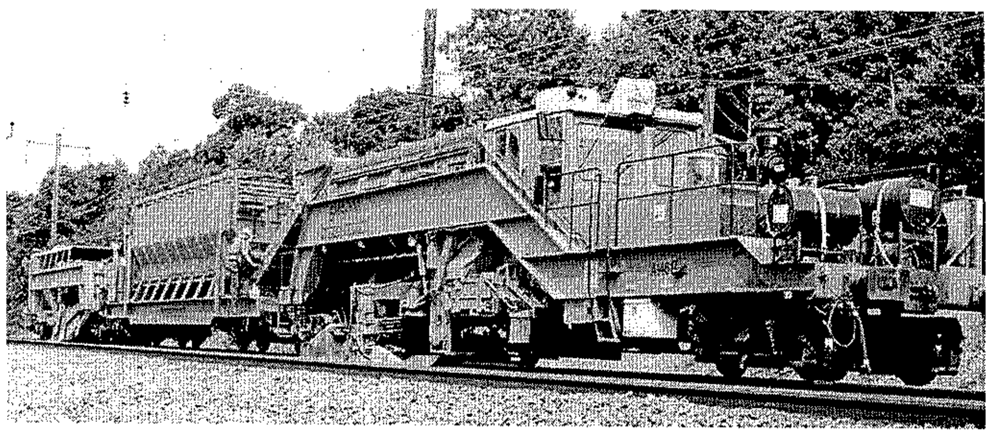
Miscellaneous Schedules

- Tunnel / Clearance
- R.O.W. Video
- GPS Mapping
- Signal Testing
- Inspection Trips
- Transponder Verification



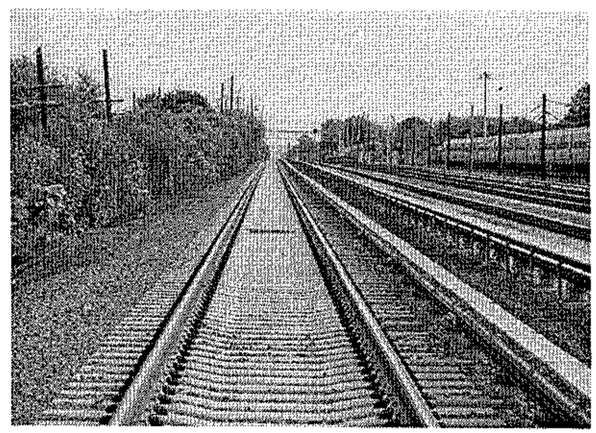
Future Improvements for Track Safety

- **Direct Interface From the TC82**



Conclusion

- Safety
- Ride Comfort
- Track Maintenance
- Quality Control



Just the Beginning of the Future