SmartGrind User Interface
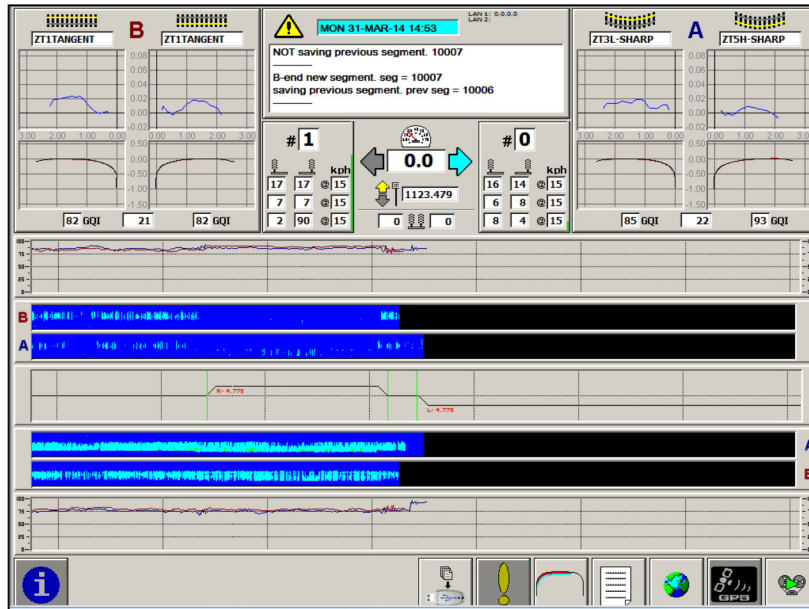
PROTRAN
TECHNOLOGY

A Harsco Rail Company

Features:

- Fully autonomous grinding pattern selection
- Adjust grinding targets based on track properties
- Minimizes metal removal
- Jupiter system integration

SMARTGRIND

GRIND PATTERN RECOMMENDATION SOFTWARE

SmartGrind is an analysis package which recommends grinding patterns in _real-time_ to a grinding operator/machine for segments of rail based on a rail template

- SmartGrind utilizes digital rail profile data
- Rail templates are aligned to the measured rail profile
  - A difference curve can then be generated
  - Different rail templates can be set for varying degrees of curvature
- SmartGrind creates/selects best grinding pattern by either:
  - Comparing difference curve to a pattern library
  - Creating targeted dynamic grinding patterns in real-time
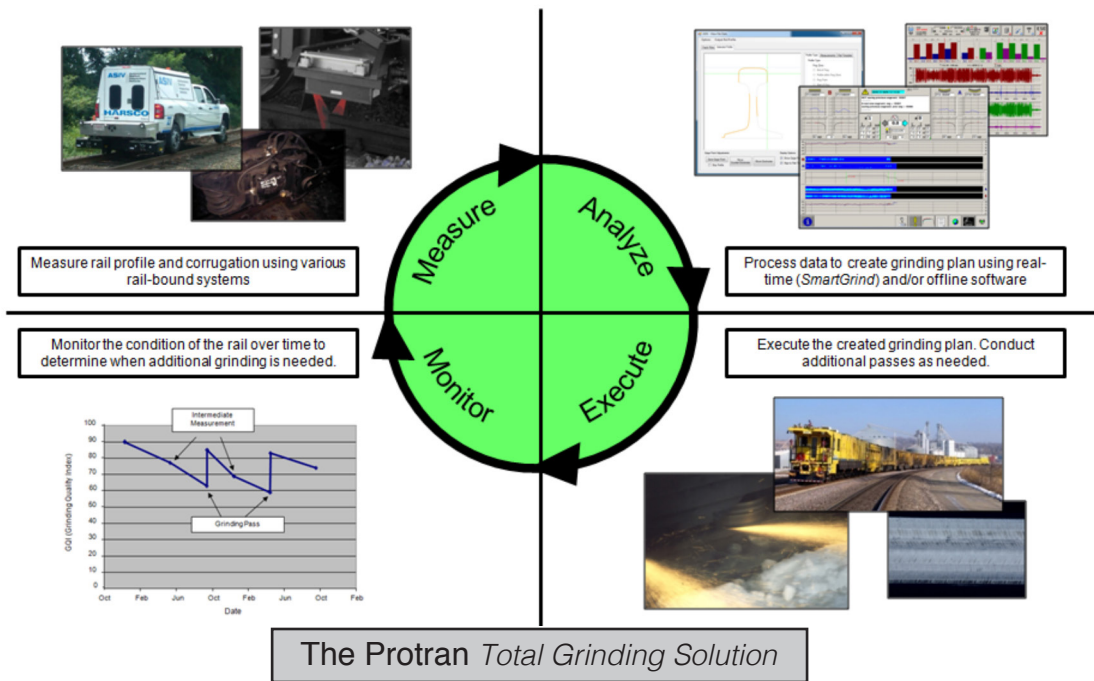- GOAL: Remove least amount of metal

HARSCO 96 Stone Grinder

Total Grinding Solution

SmartGrind plays a key role in the Protran Total Grinding Solution by helping the customer increase rail life through grinding in the most efficient and economical way possible.

Measure rail profile and corrugation using various rail-bound systems

Process data to create grinding plan using real-time (*SmartGrind*) and/or offline software

Monitor the condition of the rail over time to determine when additional grinding is needed.

Execute the created grinding plan. Conduct additional passes as needed.

The Protran *Total Grinding Solution*

Benefits of SmartGrind:

- Increased rail life
- Reduced plug rail requirements
- Improved wheel/rail contact
- Reduced rail wear
- Reduced rail corrugations
- Extension in surfacing cycle
- Reduced fuel consumption
- Reduced broken rail derailments

SmartGrind aims to remove as little metal as possible to achieve a target rail shape for any segment of rail in real-time. Excessive metal removal can decrease rail life and increase cost to a railroad.


Monetary Cost of Excessive Metal Removal
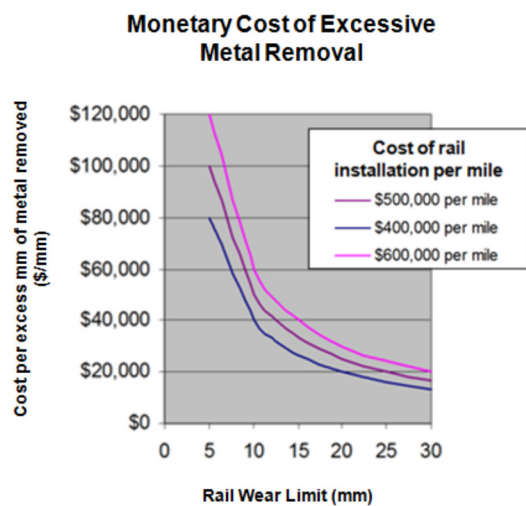
Cost of rail installation per mile
— $500,000 per mile
— $400,000 per mile
— $600,000 per mile

User Interface

SmartGrind is designed for use on a touch screen. The interface is intuitive and simple to use. SmartGrind requires little human interaction once basic information is selected. The operator will be shown in real-time:

- The measured rail profiles aligned to the appropriate template
- The difference curve
- A grind quality index (GQI) trace of pre and post grind analyses
- A "heat map" showing the magnitude and locations on the rail head requiring grinding
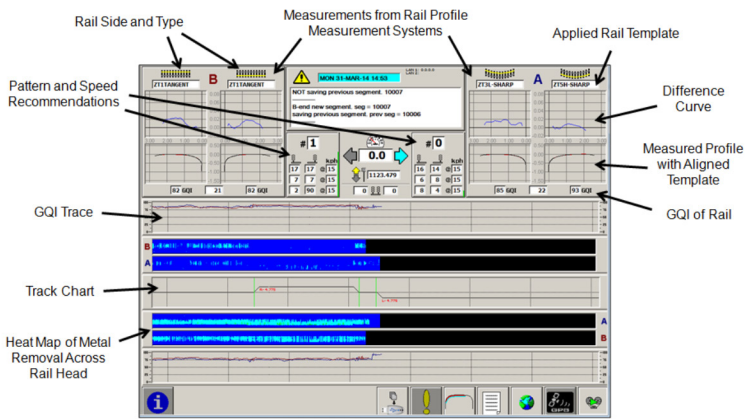
SmartGrind Data Processing

SmartGrind uses measured rail profile data obtained from measurement systems mounted on a grinding train in conjunction with a set of predetermined rail templates to determine the best grinding pattern and train speed to call. SmartGrind uses the following logic when determining grinding requirements:
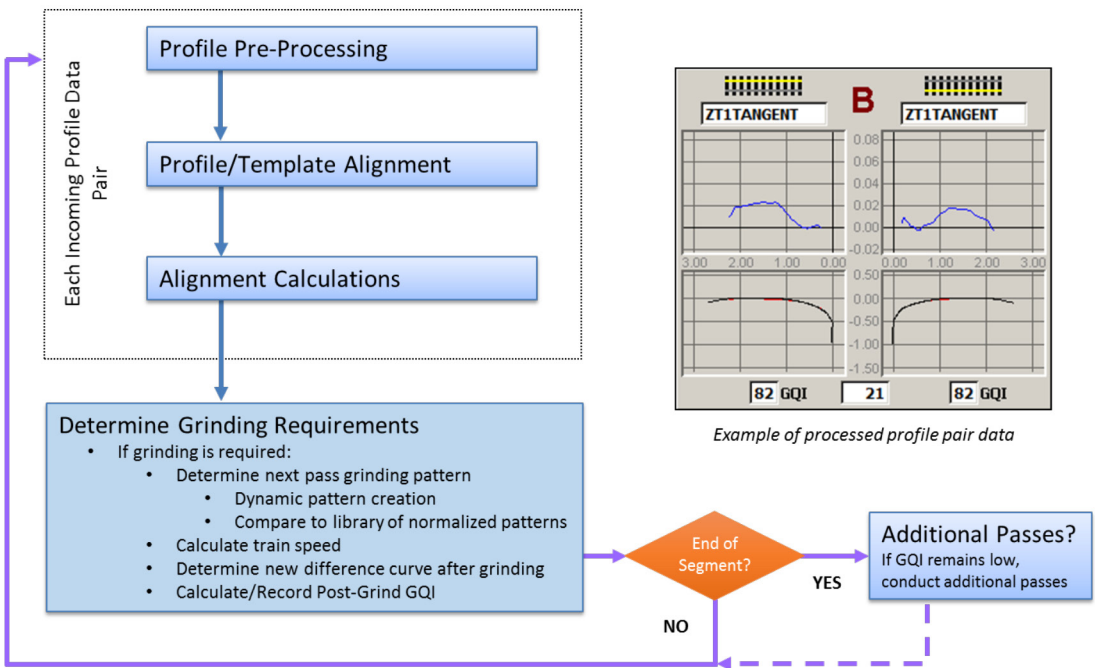

*Example of processed profile pair data*

Dynamic Pattern Generation

The SmartGrind Dynamic Pattern Generation Module is an add-on to the existing SmartGrind software. This module creates a grinding pattern (motor angles and powers) based on the calculated difference curve of a profile using a "Chase-the-peak" methodology using fanned motor clusters.

Under this methodology and using proprietary metal removal equations, the shape of the rail profile (and subsequent difference curve) is determined after the pass of each single grinding stone so that the position and required power of the next stone can be accurately determined.
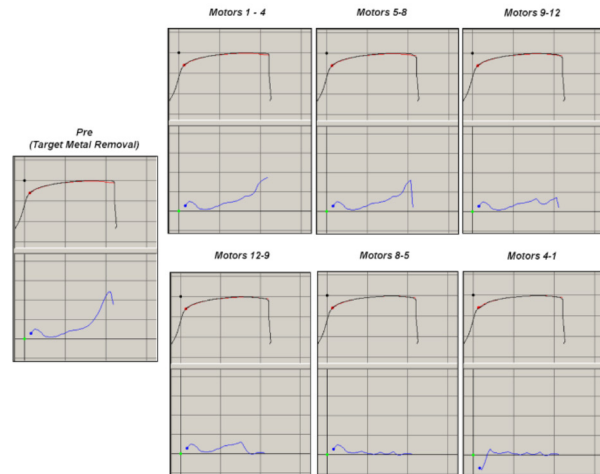
Dynamic Pattern Generation using 24 motors
(Rail profile alignment and difference curves shown)
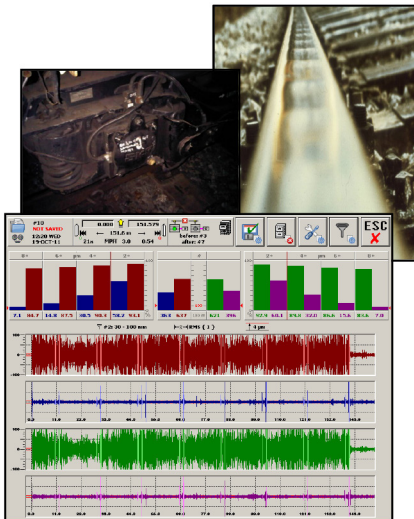
Corrugation Detection System

The Protran Corrugation Measurement System is a low cost accelerometer bases measurement system which can be mounted to the axle of most track bound vehicles. This system can be standalone or work in conjunction with SmartGrind. By sending analytic results to SmartGrind, SmartGrind is now able to make real-time decisions on the type of grinding to conduct: Profile Grinding or Corrugation Grinding.

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