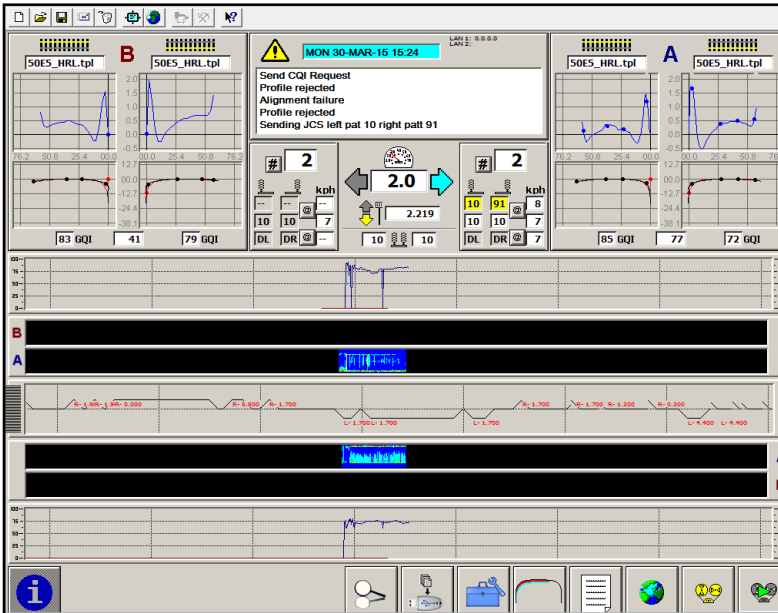


PROTRAN TECHNOLOGY

A Harsco Rail Company

Features:

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



SmartGrind User Interface

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



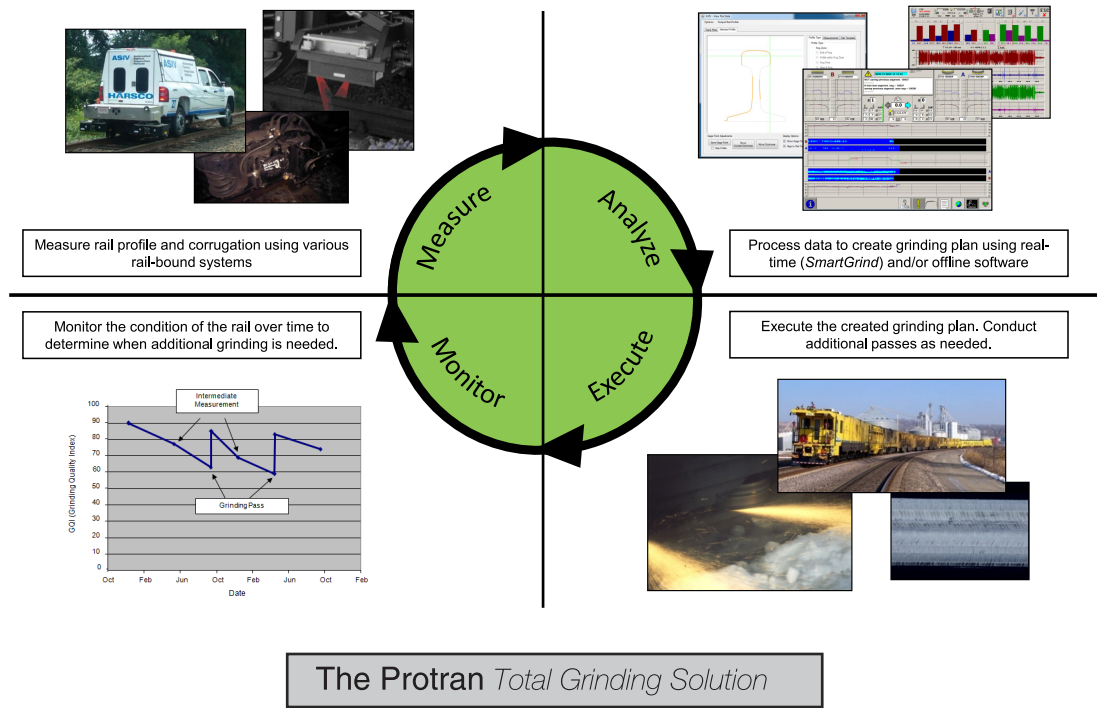
HARSCO 96 Stone Grinder

SMARTGRIND

GRIND PATTERN RECOMMENDATION SOFTWARE

Total Grinding Solution

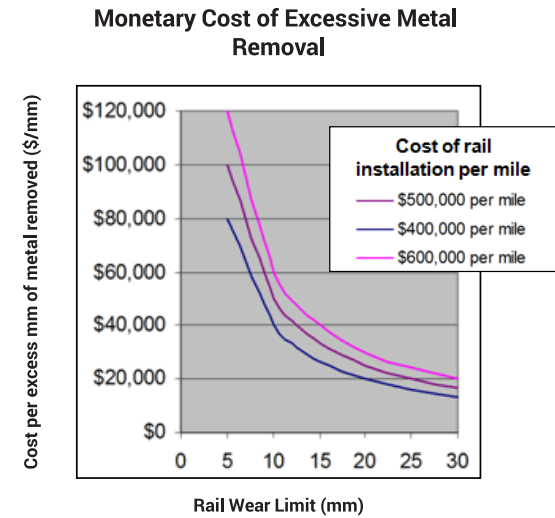
SmartGrind plays a key role in the Protran Total Grinding Solution by helping the customer increase rail life through grinding in the most efficient and economical way possible.



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.



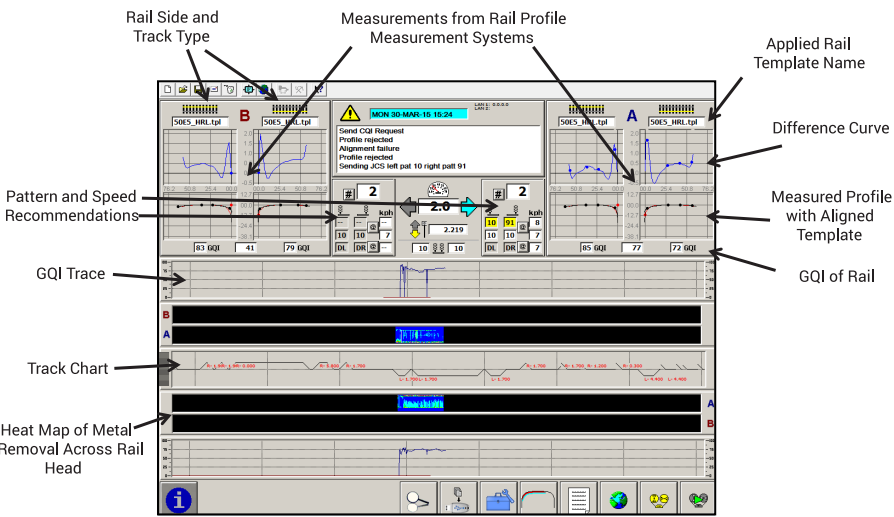
SMARTGRIND

GRIND PATTERN RECOMMENDATION SOFTWARE

User Interface

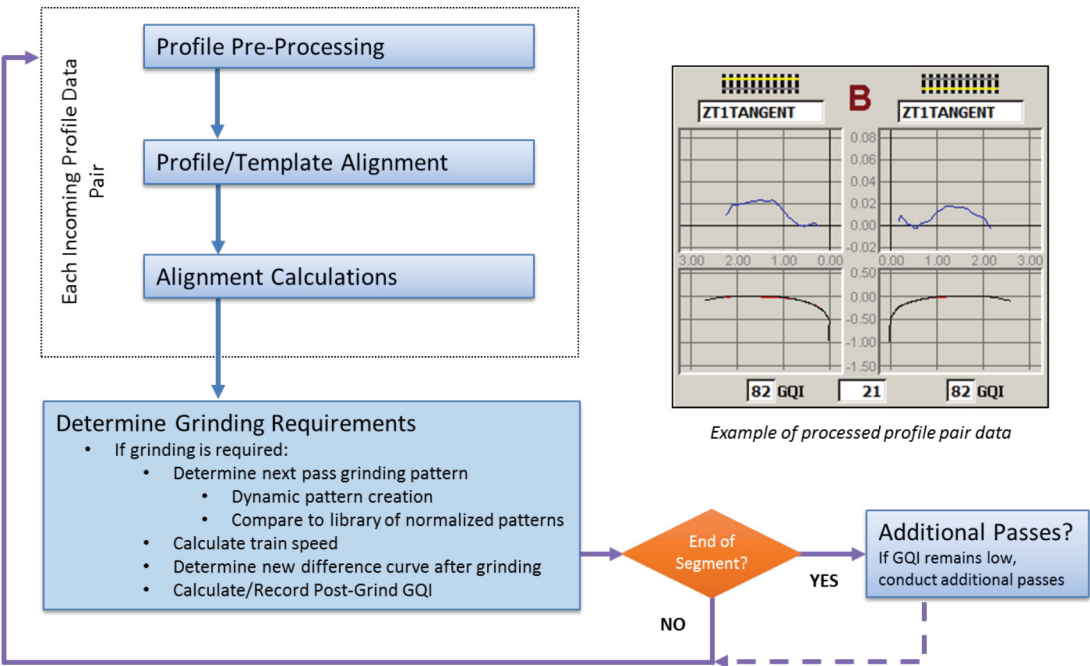
SmartGrind is designed for use on a touch screen. The interface is intuitive and simple to use. SmartGrind requires little human interaction once basic information is selected. The operator will be shown in real-time:

- 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:



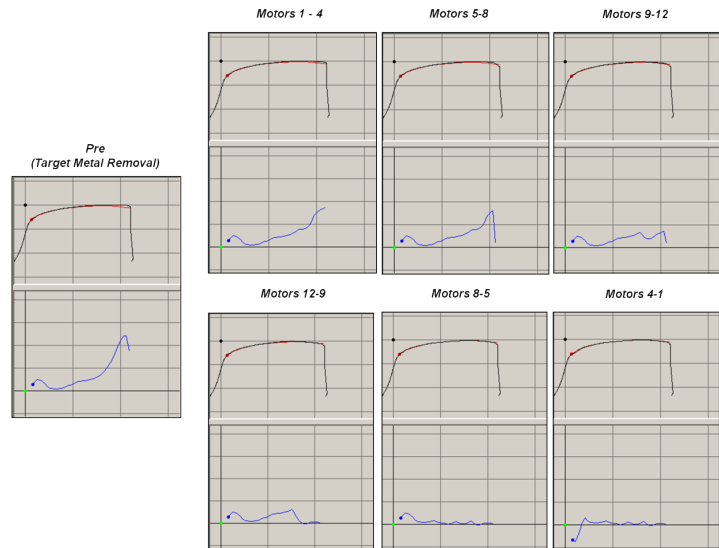
SMARTGRIND - OPTIONAL FEATURES

GRIND PATTERN RECOMMENDATION SOFTWARE

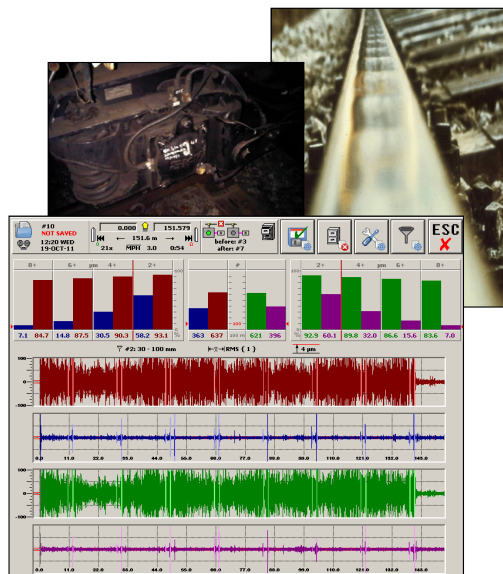
Dynamic Pattern Generation

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 Detection System is a low cost accelerometer based 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.

PROTRAN
TECHNOLOGY

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