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## SmartGrind Real Time Profile Grinding Analysis System

The *SmartGrind* software package, developed by ZETA-TECH Associates, Inc. for Pandrol Jackson, is a real time Rail Profile Grinding management tool. As rail replacement continues to be one of the largest expenses for high density main line railroads, maintenance techniques that extend rail life and reduce rail costs are closely scrutinized.

*SmartGrind* is a new tool designed for just this purpose. The fascinating and unique aspect of *SmartGrind* is that the analysis is performed in real time. A set of optical rail profile measuring systems is networked to the *SmartGrind* computer which accepts the as-captured rail profile for each rail. Two systems are used which capture rail profile ahead-of, and behind the grinder.

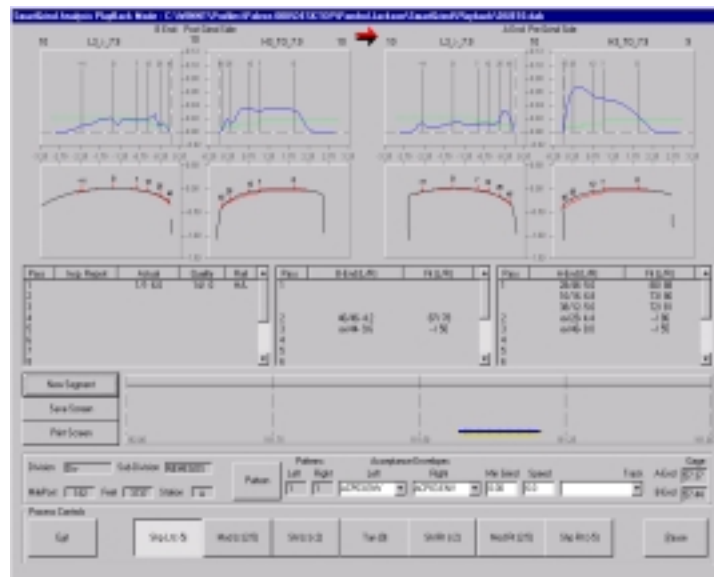
In order to calculate a dynamic difference profile (amount of rail head to be ground), a library of desired rail head profiles (templates) are stored within the system. Through a closed onboard network to the optical rail profile measurement system, *SmartGrind* captures the rail profiles and then uses sophisticated algorithms to match the profiles to the standard rail templates. The templates for each rail are based on degree and direction of a curve. The obtained information is used to determine:

1. Best Pattern to use for grinding
2. Number of Grinding Passes in order to achieve a predefined acceptance envelope
3. Speed at which to grind

*SmartGrind* has the ability to communicate with one or two optical rail profile measurement systems simultaneously. This allows for a pre- and post- grind analysis. Upon completion of the first pass, the system examines the trailing profile and determines if the rail is within tolerance or if additional passes are required to achieve the desired profile.

*SmartGrind's* main window has several output view ports as shown in the figure below. These view ports display the pre- and post-grind profile (right and left rail) and the calculated difference profiles. In addition a pre- and post- grind list box displays vast amounts of data, such as the total number of passes needed to achieve a profile, the predefined pattern numbers (top three choices shown based on a fit index) associated with the passes, and the speed at which to grind.

*SmartGrind* also has post-processing routines that allow the user to review captured data and adjust parameters in order to evaluate changes in grinding philosophy. In order to achieve this, the system saves the captured rail profile data along with input location data such as milepost, curve data, grinding speed, patterns used, etc.



The *SmartGrind* system provides the grinding operators with the ability to effectively monitor the status of a predefined grinding program and adjust that program accordingly, based on actual data collected at real time. Utilizing the actual profiles collected, *SmartGrind* determines the appropriate patterns and speed to be used for as many passes required to achieve the predefined template within an acceptable range. Alternatively, the system can be used offline and ahead of time to plan a

grinding program.

The *SmartGrind* system was developed as a 32 bit native Windows™ application to be run on Windows 95 or higher. The graphical user interface provides the user with intuitive and easy to understand information requiring a minimum of interaction.