Enhanced Tie Condition Inspection Using Hand Held Recording Systems

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In order to most effectively and efficiently maintain the railroad's right of way, maintenance managers must have accurate knowledge of the exact condition of that expensive resource. With today's emphasis on cost effective maintenance and cost control, the need for information is even greater than in the past.

To obtain this "condition" information, railroads are supplementing the traditional track inspectors "tools" with a broad range of computerized equipment. These tools range from high speed automated track inspection systems to monitor, measure, and record the condition of the track to a new generation of computerized hand held devices for the accurate recording and subsequent analysis of track condition data. These inspection systems address virtually all of the key parts of the track structure, to include rails, ties and track geometry.

The inspection tools used for measurement of rail and track geometry condition have been around for many years and have become accepted parts of every railroad's inspection program. However, new inspection tools for ties are only now becoming available to supplement and complement the traditional tie inspector's "calibrated eye". These new tie inspection tools have evolved in two distinct directions. One direction is towards a new generation of vehicle mounted inspection systems, the track strength inspection vehicles which have recently been introduced. These vehicles are designed to locate "weak spots" in the track, corresponding to locations of inadequate tie and/or fastener strength. These vehicles also provide railroads with the ability to develop a more generalized indication of the tie/fastener strength on a continuous basis.

The second direction that these new inspection tools has taken is that of hand held (computerized) data collection and analysis systems that allow the tie inspector to record the condition of each tie individually. This information then lends itself to more detailed analysis of such critical tie information as number and size of clusters, presence of FRA violations, tie counts, etc. By matching the inspection method used by most railroad tie inspectors, such a tool allows the tie inspector to be more productive, without impeding his basic function of providing a comprehensive survey of tie condition along the inspected track.

TieInpect

This second direction is illustrated by the newly developed *TieInspect* system. *TieInspect* , developed by ZETA-TECH Associates, Inc. of Cherry Hill, New Jersey is a computerized crosstie inspection system designed to aid the tie inspector in accurately and efficiently collecting tie condition data based on the inspector's (and individual railroad's) condition criterion. *TieInspect* aids the tie inspector by providing an easy to use mechanism that allows for the collection and storage of condition data for each and every tie inspected. It thus provides a complete database of historical and current tie condition. Furthermore, the included offline software allows the railroads to both view and analyze the collected data.

Combining a palmtop computer and an ergonomically designed handgrip input device (Figure 1) *TieInspect* accommodates the tie inspector's traditional inspection technique (Figure 2), while giving him the flexibility to record a whole range of important additional information. Thus, the unit records condition data (good, marginal, bad), for every tie, together with information about location (including MP updates),

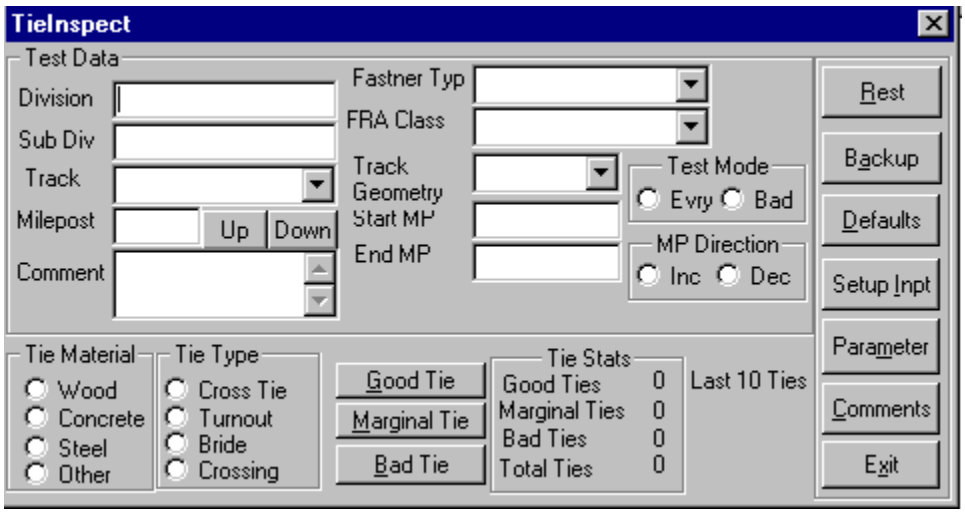
curvature (tangent, mild, moderate, or severe) , tie type (cross-tie, switch-tie, bridge tie, grade crossing), tie material (wood, concrete, steel, or other), events, notes, and other relevant track and condition data. This data is stored in a database within the palmtop computer, and then subsequently downloaded (via a serial connection) to a Windows 95or NT computer for analysis, display, and storage.

Figure 1: *TieInspect* Showing all Components

Figure 2: TieInspect being used by Inspector

The *TieInspect* system provides for two different modes of inspection capability, corresponding to the needs (and desires) of the inspector and the railway. The first mode is a detailed record of the condition of **every** tie, broken down into three categories; good, marginal (moderate), or bad. This mode provides the most comprehensive set of data for subsequent analysis. The second mode is that of recording bad ties only together with bad tie clusters. In this mode, two numbers are kept per mile, the bad tie count and a cluster count. In both modes, supplemental notes can be entered into the palmtop together with all of the location information required (see Figure 3). Either mode can be selected by the inspector.

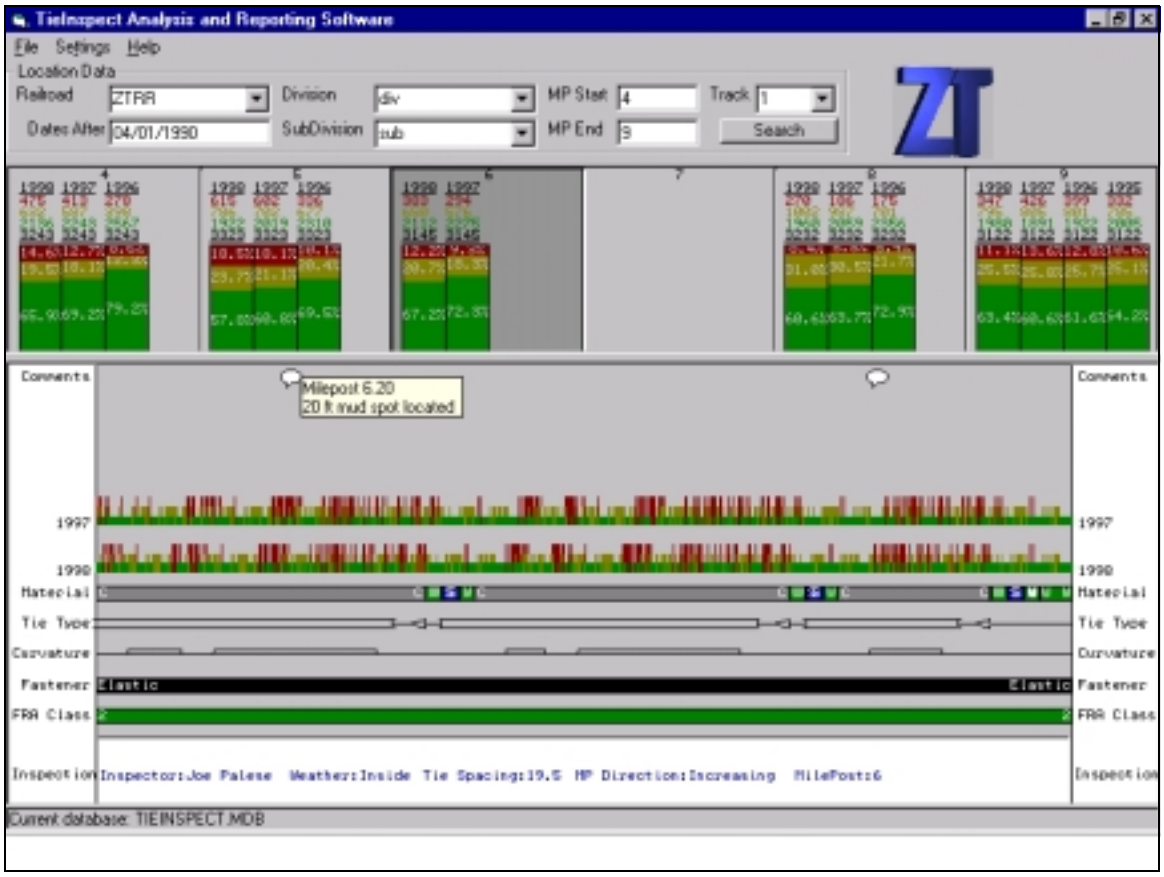
Figure 3: *TieInspect* Input Screen



Analytical Output

The key to any such inspection system is the data collected and the use to which that data can be put. This is certainly the case with the *TieInspect* system which collects and stores the data (in either mode) in a readily accessible data base. This data base, which is initially on the palmtop computer, is then downloaded into any host PC for follow up data analysis, storage, and long term planning. The *TieInspect* host software provides any user with the ability to upload the inspection information and creates a historical database of the inspection data. The data can then be viewed for several mileposts in both a summary and detailed format, presenting the distribution and counts of good, marginal, and bad ties (Figure 4). In addition, bad tie clusters (by cluster size from 2 to 10) and FRA defects are listed by location to aid in maintenance planning.

Figure 4: *TieInspect* Analysis Output Screen



Within each user defined set of boundaries for a precise segment of track, a bar chart shows the summary data for each milepost in that segment, by each inspection date The summary data include the tie count and percentage of ties in each condition category. By clicking on a milepost, a detailed graphical representation of the tie inspection data is presented for each date of inspection. This graph displays the location of bad tie clusters, as well as all of the other information collected during inspection. The locations of curves, track class boundaries, different tie types and different tie material are also shown. Comments entered by the inspector appear as “balloons” at the milepost markers. [Figure 4]. Lists of clusters (by size) and FRA defects are also identified.

Use in Maintenance Planning

By providing tie condition data to the railroad, in this form, railroads can now extend their maintenance planning capabilities to the crosstie area as well as the more traditional rail and geometry areas. This new detailed level of information provides railroad maintenance managers much more than just exception reports. By providing an ongoing "map" of the condition of the ties in track, inspection systems such as *TieInspect* form the basis for a sophisticated condition data base that allows for the prediction of future maintenance requirements as well as the identification of immediate maintenance needs.

The use of this new inspection information to predict longer term maintenance needs is a growing trend among railroads and will continue to be of value to maintenance officers, particularly as better and more accurate information about the condition of their track assets, to now include crossties, is obtained. Using this tie information to forecast tie lives, optimize tie maintenance practices, and plan tie replacement programs is the next step in the evolution of railroad inspection programs and the efficient use of railroad resources.