

## PWMIS Permanent Way Management Information System

*PWMIS* is a comprehensive maintenance management package for prediction of track component degradation and maintenance planning. *PWMIS* was developed for the China Ministry of Railways.

*PWMIS* consists of four subsystems that perform the key track component life analyses to forecast maintenance requirements: *RailLife™*, *TrackLife*, *BallastLife*, and *TieReport*.

Each of these subsystems analyzes an individual track component independently and, where applicable, jointly with other subsystems to determine the degradation and failure rates of that track component. These degradation rates are then used to determine the life cycles of each component, and forecast the maintenance due dates.

*RailLife™* is a comprehensive rail degradation and life and forecasting model. It performs Weibull Analysis for rail fatigue forecasting and Multi-Variate Regression Analysis for rail wear forecasting on predefined rail segments. From these analyses, *RailLife™* provides recommendations for relay rail replacement and for spot rail replacement (curve patch).

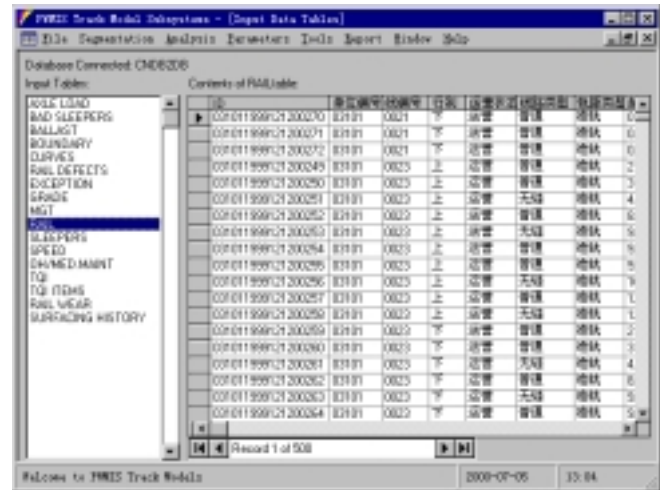
*TrackLife* is a comprehensive surfacing cycle analysis model used for forecasting surfacing maintenance requirements. It uses statistical analysis, engineering analysis and exception report analysis on historical track geometry degradation data to forecast future surfacing needs.

*BallastLife* is a forecasting approach for determining track undercutting cycles. The forecasting technique is based on empirical analysis which estimates ballast life as determined by ballast quality and other environmental parameters.

*TieReport* is a reporting facility. It reports the number of bad ties by type on a mile-by-mile basis.

The *PWMIS* interface communicates with a DB2 database using ADO data controls and ODBC connections. It allows for more than one database to be connected at one time, enabling output data to be written to a different database from the input database.

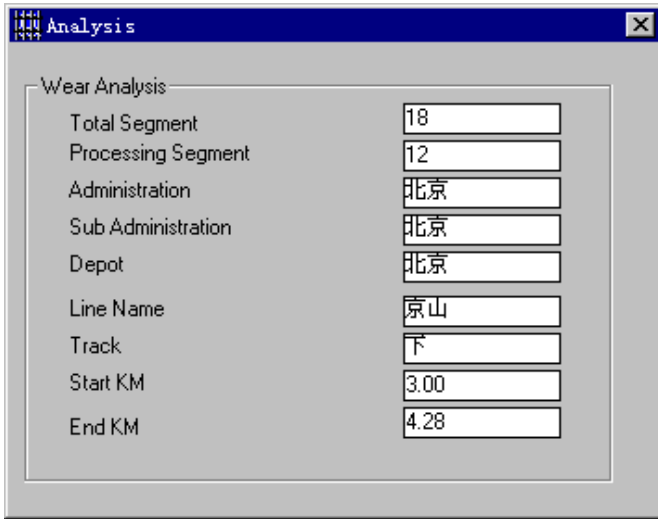
The *PWMIS* interface allows the user to view the input data from the client's DB2 database. It also allows the user to view and delete output tables.



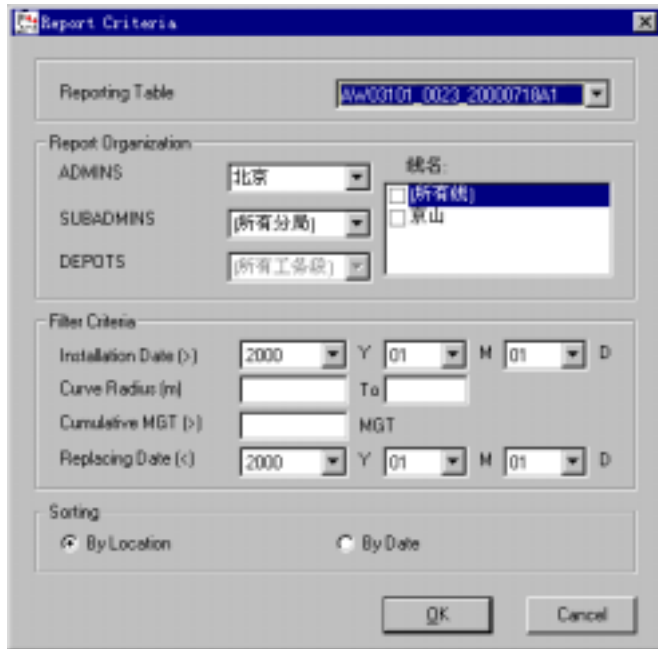
*PWMIS* divides the track into "homogeneous" segments. It first divides the track based on track characteristics such as curvature, rail weight, rail installation dates, sleeper types, ballast type, etc. If necessary, the track is further divided according to operational parameters such as: operating speed, annual tonnage, cumulative tonnage, axle load, etc. *PWMIS* can segment the track by depot boundaries or by line. *PWMIS* automatically creates the output segmentation file names, which can be overridden by the user.



After the track segments are created the user can run the PWMIS analysis models, either individually or jointly. The analysis status is displayed while PWMIS performs the analyses.



PWMIS comes with a built-in custom report generator. With a few clicks on the report criteria dialog interface, the user can create up to 20 types of different reports.



The custom report facility accesses both input and output databases to generate the reports according to the filter criteria specified by the user.

The reports can be viewed in either tabular format or graphical presentation. These reports can also be saved and later retrieved within the program.

To enable maximum flexibility, PWMIS also provides an Ad-Hoc facility for the user to create more complicated reports

using a third party report writer such as *Crystal Reports*™. When the user activates the feature, PWMIS will shell out to the third party report program.



PWMIS also comes with other user – specific features such as the ability to calibrate the model to better suit the user's specific experience and situations. The model parameters can also be changed, enabling sensitivity analysis to be performed. In addition, the user can also customize the way the data is displayed.

Finally, PWMIS software was developed in a bilingual environment. Therefore, it can be easily modified for use in any language.