Improved Performance from Premium Turnouts

Research attention is currently being focused on the examination of alternate turnout designs aimed at improving performance and reducing the maintenance associated with turnouts in mainline track. Turnout maintenance costs become more important as the effects of heavy-axle-load traffic become better defined and understood.

Among the types of turnout "improvements" that are being introduced are:

- Development of new turnout designs and geometries.
- Improvement of existing turnout designs.

Railroads are currently experimenting with new turnout designs, configurations and geometries to reduce wheel/rail dynamic forces and the severe loading environment experienced by the turnout. While a comprehensive listing of these new designs is beyond the scope of this article, a brief listing of these new designs illustrates the direction and overall approach being taken to reduce the dynamic forces associated with turnouts.

One such design is the tangential-geometry turnout. In this design approach, the switch entry angle is virtually eliminated, thus reducing the wheel/rail forces developed when the railway vehicle enters the turnout (1).

A second such design is the swing nose frog. While this system has been around for many years on European railway systems, it has only recently been adopted on heavy-axle-load lines in North America. In this design, the "open throat" of the frog is eliminated, thus reducing wheel impact forces as the wheel transitions across the toe of the frog. A brief listing of the different types of swing nose frogs is presented in Table 1.

In the case of improvements made to existing North American "standard" turnout designs, the types of improvements being made range from the use of non-conventional tie and/or fastener systems to fully welding the turnout. A "premium" turnout of standard AREA design can include such features as thick-web switch points, elastic fasteners (on wood ties), concrete switch ties, thick-wall frogs or simply the use of fully-heat-treated rail throughout the frog and switch areas.

The benefits of these improvements are generally related to longer component life under traffic and reduced maintenance costs, both in labor (required to maintain the turnouts) and materials (repair or replacement).

This can be seen in test results from the FAST Heavy Axle Load testing program, which are presented in Figure 1. This figure presents the cumulative number of

TABLE 1
Types of Swing Nose Frogs Construction[1]

A. Swing Nose Frogs with Welded Vees
   1. Electro slag welded vee, no post heat treatment
   2. TIG welded vee, post heat treatment
   3. Lincoln Verti-Shield process with hard-facing overlay.

B. Swing Nose Frogs with Bolted Welded Vee Construction
   1. Vee is bolted together, wing rails or body of frog are made from cast manganese.
   2. Vee is bolted together, wing rails are made from standard sections.

C. Swing Nose Frogs with Cast Manganese Vee
   1. Vee and wing rails or body of frog are made from cast manganese.

D. Swing Nose Frogs with Forged Vee
   1. Front of Vee is made from forgings, then flash butt welded to rails. Remainder of frog from standard rails.

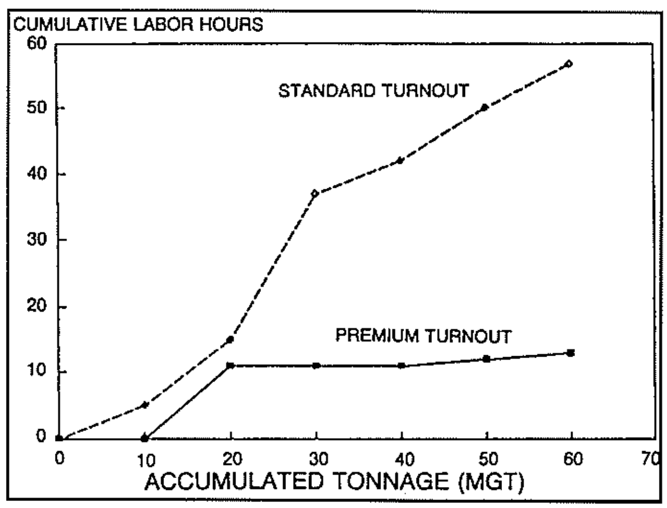

Figure 1 — Comparison of maintenance hours required for premium and standard turnout components (2).

labor hours required to maintain two types of turnouts under heavy-axle-load (125ton) traffic at FAST. Both are AREA No. 20 turnouts located in facing-point configuration and subject to identical traffic loadings. (In fact, the premium turnout replaced the standard turnout at the same location in the FAST test track.) The standard turnout has a railbound manganese thin-wall frog, standard (300 BHN) wing and heels rails, a curved, 39-foot Samson switch point with standard (300 BHN) rail, and conventional cut spike fastenings on wood switch ties. The premium turnout has an explosion-hardened RBM frog, fully-heat-treated wing and heels rails, a 50-foot, thick-web switch with fully-heat-treated rail, and elastic fastenings on wood switch ties (2).

As can be seen from this Figure, for 60 MGT of traffic, the premium No. 20 turnout required approximately 75% less maintenance (in total hours of labor) than did the standard No. 20 turnout. (Part of this difference was due to a cracked switch point on the standard turnout.)

So, it appears that use of premium turnouts, of both conventional and non-conventional design, can result in an extension of component lives and a reduction in the maintenance required to keep the turnouts in operation. However, premium turnouts generally are more costly than the corresponding standard turnouts. Therefore, their advantages must be weighed against their additional costs in light of operating and financial constraints. But alternate turnout designs do appear to offer a potential for improving turnout performance and reducing turnout-maintenance costs.

References

(1) Sauer, S. J., "Swing Nose Frogs and Tangential Geometry turnouts on the Burlington Northern Railroad," Bulletin of the American Railway Engineering Association, Bulletin 726, Volume 91, May 1990.

(2) Read, D. M., "FAST/HAL Turnout Performance Experiment," Bulletin of the American Railway Engineering Association, Bulletin 728, Volume 91, December 1990.