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ECONOMICS OF IMPROVED-SUSPENSION TRUCKS

by Thomas S. Guins

Summary

Results from Phase III of the Facility for Accelerated Service Testing (FAST)/Heavy Axle Load implementation program show that higher equipment costs associated with improved-suspension trucks are more than offset by reductions in expenditures for track capital and maintenance, equipment maintenance, and fuel. These tests conducted at the Federal Railroad Administration's (FRA) Transportation Technology Center have provided the direct information required to evaluate the reduction in track maintenance and degradation from improved-suspension trucks on 315,000-pound cars.

The results have been compared to previous phases conducted with typical three-piece trucks, and demonstrate that for heavy-haul service these trucks have the potential for achieving cost reductions in the range of 1 to 2 percent in total direct cost. Further cost reductions in the range of 7 to 8 percent are possible for 286,000-pound cars equipped with improved-suspension trucks, as compared to 263,000-pound cars equipped with standard three-piece trucks.

For the cases analyzed, potential returns on investment in the range of 35 to 85 percent warrant serious investigation of improved trucks as a means to increase productivity of specific services over specific routes. Results are highly route- and service-specific. Thus, individual car owners should analyze their specific service alternatives.

Key improvements in asset life are as follows:

Reduction in fuel consumption of 8 percent

Increase in wheel-set life of 25 percent

Increase in truck-rebuild cycle of 33 percent


Reduction in rail grinding due to corrugations of 50 percent

Life increase of 90 percent of tangent rail life in curves of 2-degrees and lower

Improvement of 50 percent in rail life in curves greater than 2 degrees due to reduced wear and grinding

The FAST program is a cooperative Association of American Railroads and FRA effort.



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INTRODUCTION AND CONCLUSIONS

Recent test results indicate that the cost increase of installing improved-suspension trucks for heavy-haul service is more than offset by reductions in expenditures for track capital and maintenance, equipment maintenance, and fuel. Phase III of the Facility for Accelerated Service Testing (FAST)/Heavy Axle Load (HAL) implementation program showed the significant increases in track-maintenance costs as wheel loads were increased from 33,000 pounds to 39,000 pounds. However, improved trucks may reduce the lateral wheel loads for heavier cars to a level consistent with 33,000-pound wheel loads and standard three-piece trucks.

Three designs are currently being tested and evaluated as part of the HAL program at the FAST within the Federal Railroad Administration's Transportation Technology Center. These three designs provide incremental improvements as compared to the standard three-piece trucks. The three designs included in the current testing are:

- **Standard Car Truck's S-2-HD Design**
 - Frame brace
 - Primary suspension shear pad
 - D5 secondary suspension
- **Buckeye Steel Castings XC-R VII**
 - Increased friction wedge surface area and coil force
 - Primary suspension shear pad
 - D5 secondary suspension with hydraulic dampers
- **American Steel Foundries AR-1**
 - Passive radial steering arms
 - Primary suspension shear pads
 - D5 secondary suspension with hydraulic dampers

Detailed economic assessments of these designs have been undertaken as test data on actual performance is generated in the controlled environment at FAST. The three improved-suspension trucks are in the FAST consist simultaneously. Therefore, these results do not address the economics of each of these prototype designs individually, but rather compare the cost stream generated by generic improved-suspension trucks of this type with conventional freight cars equipped with three-piece trucks. The FAST results are used to establish the economic benefit of the changes in the performance characteristics of freight cars equipped with improved trucks. In addition to the performance dimensions of stability, curving, and dynamic behavior, the energy consumption related to the rolling resistance and weight of the freight-car trucks have been considered. The life-cycle costing methodology documented in this paper can be used to evaluate other premium truck and suspension designs.

ROUTES

The example routes evaluated are the two typical coal routes used in the previous HAL analyses: an 80-million-gross-ton (MGT) high-tonnage western route, and a 30-MGT moderate-tonnage eastern route. The cars in the west are assumed to have a 12 mph cycle-time average speed, while those in the east are assumed to have a 6 mph cycle-time average speed. The eastern route contains a significantly larger percentage of curved track than the western route.

TRACK COSTS

A comparison of the track costs of the Phase III (using improved-suspension trucks) with

the Phase II (using standard three-piece trucks) studies showed a 3.7-percent, 3.8-percent, and 3.9-percent decrease in track costs in the “west” for 263K, 286K, and 315K traffic respectively, and 4.3-percent, 5.0-percent, and 5.3-percent savings respectively in the “east.” Each of these comparisons are with all other conditions constant; i.e., route characteristics, evaluation tools, and costs. Exhibits 1 and 2 show these changes in track cost by component for the “west” and “east,” respectively. The improvements in track costs are due to the improved curving characteristics of the improved-suspension trucks.

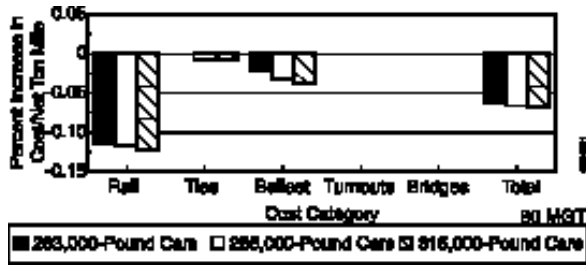


Exhibit 1. HAL Track-Maintenance Cost: Improved vs. Standard Three-Piece Truck, Generic Western Route, Length-Limited

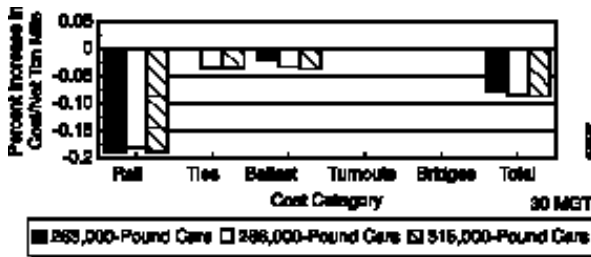


Exhibit 2. HAL Track-Maintenance Cost: Improved vs. Standard Three-Piece Truck, Generic Eastern Route, Length-Limited

TOTAL DIRECT COSTS

Exhibits 3 and 4 show the total impact of the improved-suspension trucks on direct transportation costs in the “west” and “east” for the length-limited operating scenario (the direct

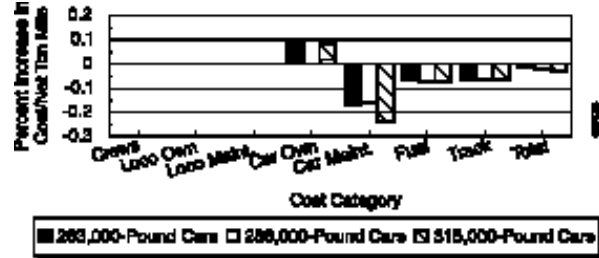


Exhibit 3. Linehaul Cost: Improved vs. Standard Three-Piece Truck, Generic Western Route, Length-Limited

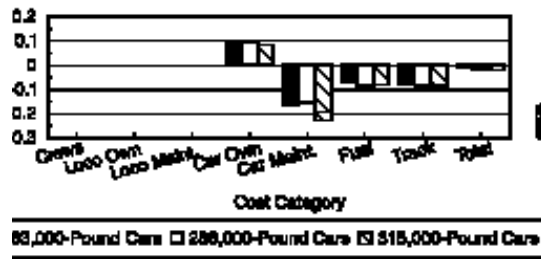


Exhibit 4. Linehaul Cost

costs for the weight-limited case vary only slightly from the length-limited case). Overall, the improved trucks are shown to be economically effective in both scenarios evaluated and for all three types of cars. This is shown by the net decrease in total direct costs with the 10 percent premium for freight cars equipped with the improved trucks.

KEY IMPROVEMENTS IN ASSET LIFE

The cars equipped with improved-suspension trucks place significantly less stress on both the track structure and the freight car. The primary areas of benefit are:

- Fifty percent increase in life of rail in curves higher than 2 degrees
- Twenty-five percent increase in wheel-set life
- Thirty-three percent increase in truck-rebuild interval
- Six to 8 percent decrease in fuel consumption

- In 2-degree and lower curves, rail life increased to 90 percent of tangent rail life.

HAL AND IMPROVED TRUCKS

The combination of improved-suspension trucks and increased axle loads can provide a significant improvement in transportation efficiency. The percent reduction in total direct cost of transportation service for cars equipped with improved-suspension trucks, as compared to 263,000-pound cars equipped with standard three-piece trucks, is shown in Exhibit 5. For the 286,000-pound cars the savings in total direct costs is in the range of 7 to 8 percent.

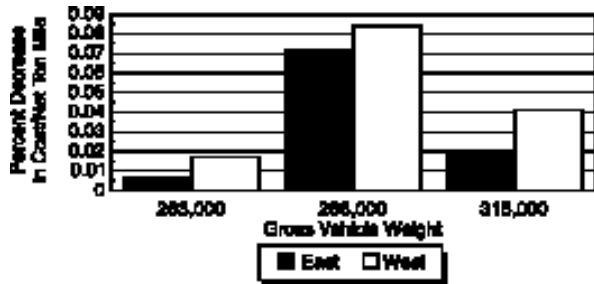


Exhibit 5. Reduction in Total Direct Cost: Cars Equipped with Improved-Suspension vs. 263,000-Pound Cars Equipped with Standard Three-Piece Trucks

CONCLUSIONS/RECOMMENDATIONS

The Phase III operation provides the first controlled-environment comparison of improved-suspension trucks and standard three-piece trucks. The results provide the basis on which individual roads can examine the applicability of improved trucks to their own operation.

For example, cases have been evaluated using the same two typical coal routes used in the previous HAL analyses: an 80-MGT high-tonnage western route and a 30-MGT moderate-tonnage eastern route. For each route evaluations were performed assuming a tonnage-restricted and a train-length-restricted train operation. The rates of return for each case for a range of cost increases are shown in Exhibit 6. These results show an attractive rate of return over a broad range of additional costs for the improved-suspension trucks. Because the heaviest axle load cars cause more track damage, the rate of return is highest for the 315K cars. However, as shown in Exhibit 5, the 286,000-pound cars continue to offer the greatest overall potential savings for the cases studied.

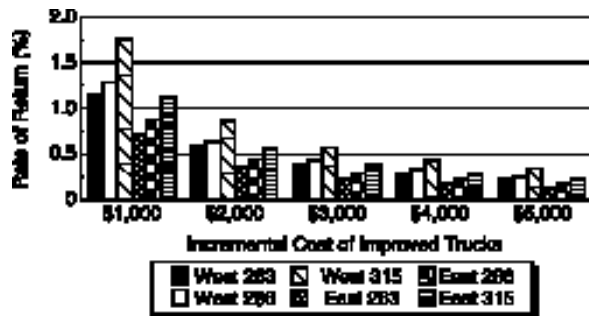


Exhibit 6. Rate of Return

Note: Contact Tom Guins at (202) 639-2259 with questions or comments about this document.

E-mail: tom_guins@ttci.aar.com

Web site: www.ttci.aar.com

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