Economics of Alternate Repair Welding Techniques

Although different techniques of track maintenance have been used for years in the railroad industry, there is an ongoing search for improvements that can result in a better quality of repair of the components, at a lower cost. One technique being examined is that of in-situ maintenance welding, used to repair the running rail and turnouts.

In the case of the running rail, maintenance-welding techniques have been employed to repair discrete railhead defects, such as engine burns and battered joints, often in conjunction with rail grinding. For turnouts, and, in particular, frogs and switch points, maintenance welding has been used to build up areas that have experienced severe batter, plastic deformation and cracking under severe impact loading. This type of in-situ repair is of particular importance in reducing turnout maintenance costs, which can be as much as 24 to 25 times greater (in material cost per year) than the rest of the track structure maintenance costs[1].

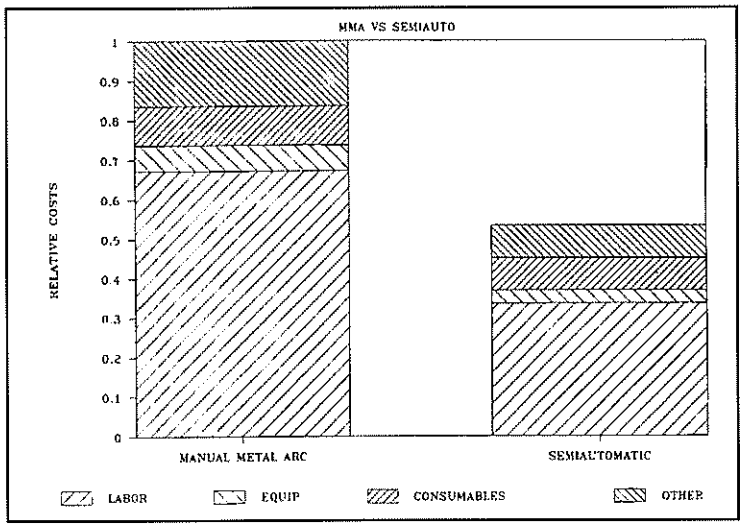

Figure 1 — Relative costs for frog repair[2]

Comparing welding techniques

Recent research by British Railways into conventional maintenance-welding techniques has led to a comparison of the conventional Manual Metal Arc (MMA) technique (using 'stick" electrodes) and the semi-automatic technique using flux-cored wire[2]. Noting that satisfactory weld performance can be obtained with proper selection of weld material[2], analysis of the two techniques showed a significant increase in the total amount of weld material deposited with the semi-automatic technique during the in-situ repair of a crossing frog (See Table 1). The semiautomatic welding technique leads to an improvement in productivity and a reduction in unit costs. This is illustrated in Figure 1, which presents a normalized breakdown of the costs of repairing a crossing frog

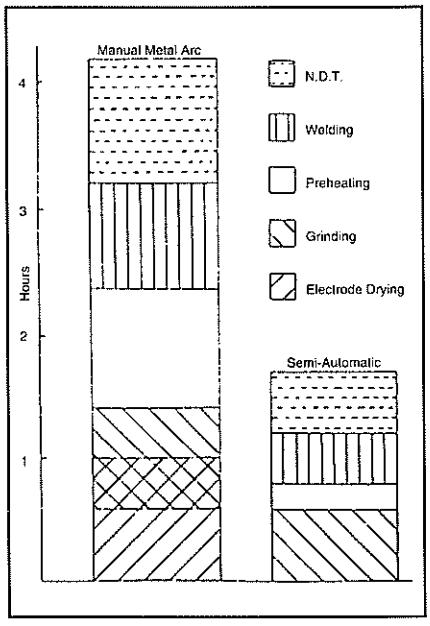

Figure 2 — Comparison of times for wheelburn repairs[2]

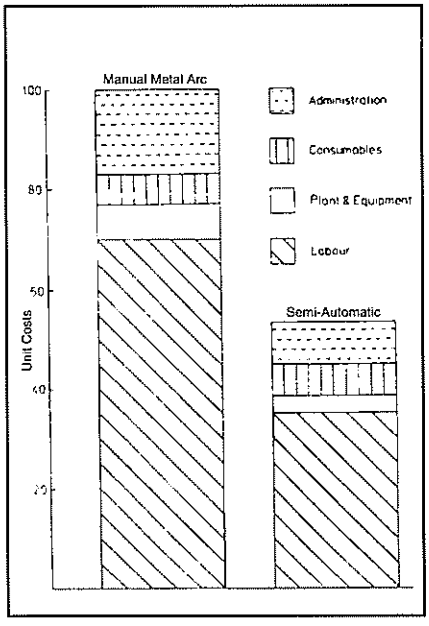

Figure 3 — Comparison of costs for track repairs per unit volume of deposited weld metal[2]

in the field, using both techniques (based on the distribution of costs presented in Reference 2). As can be seen in this Figure, the cost of frog repair, using the semi-automatic technique, is slightly more than half of the cost of repair using the Manual Metal Arc technique. In both cases, the cost of labor was the dominant cost in the activity, representing almost two-thirds of the total cost of the repair. The cost of equipment and consumables represented a small fraction of the overall cost.

This improvement in productivity and costs was also observed in the case of engine-burn repair. This is illustrated in figures 2 and 3[2]. As can be seen in these two Figures, both the time required to repair an engine burn (Figure 2) and the relative cost are reduced by a factor of 2 (or greater). This is accomplished, as in the case of the frog repair, by the elimination of electrode drying and by a significant reduction in the preheat requirements. This is combined with the increased efficiency in the amount of weld metal deposited per unit of welding time already noted in Table 1.

As in the case of the turnout repair, labor represented approximately two-thirds of the total cost, with equipment and consumables representing a relatively small percentage of total costs.

Table 1. Calculation of amount of weld metal deposited in one shift (2)

Item	Welding Process	
	Manual Metal Arc	Semiautomatic
Welding time in 7.5-hr shift (hr)	2.25	3
Arcing time		
Percent of welding time (measured in laboratory trials)	40	50
Hours	1	1.5
Deposition rate[a] (kg/hr)	1	2.35
Total amount of weld metal deposited in one shift[b] (kg)	1	3.5

[a]Welding Institute Standard Data.
[b]Arcing time in hours times deposition rate.

Table 1 — Calculation of amount of weld metal deposited in one shift[2]

It is further noted that similar improvements appear to be attainable for other maintenance welding activities, as well. This suggests that improvements in welding techniques offer the potential for cost reduction through the introduction of more efficient equipment and techniques for the maintenance of the track structure.

References

(1) Hamilton, W., "Gauging Turnout Problems and Costs," *Railway Track & Structures*, Feb. 1988.

(2) Johnson, R. S., "Technical and Financial Appraisal of a Contemporary Repair Technique for Rails and Crossings," *Rail Replacement and Management*, Transportation Research Record 1174, Transportation Research Board, Washington. D.C., 1988.