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INCREASED PAYLOAD THROUGH TRACTOR-TRAILER TARE WEIGHT REDUCTION

BACKGROUND

Log haul costs are determined, in large part, by the amount of payload that can be carried. In many cases, significant increases in payload may be realized by making modifications to existing vehicles. This was the case at James Maclaren Industries in Thurso, Quebec, where a tractor-trailer was modified to meet the following objectives:

- Reduce the tare weight of the vehicle and thus increase the potential payload.
- Increase the spacing between the lift-axle and the tridem axle group of the semi-trailer to increase its maximum axle load allowed under the Quebec highway weight regulations.
- Optimize the payload by installing an on-board weighing device to ensure a full payload on each trip.

The vehicle chosen for this trial was a 1986 Kenworth W900B tractor and a Manac-Rodech quad-axle logging semi-trailer with one air-lift axle (Figure 1). The modifications were done by Whelan Limited of Ottawa, Ontario and by the Maclaren woodlands garage in Thurso. FERIC had the opportunity to examine the modified unit and talk to the principals involved.

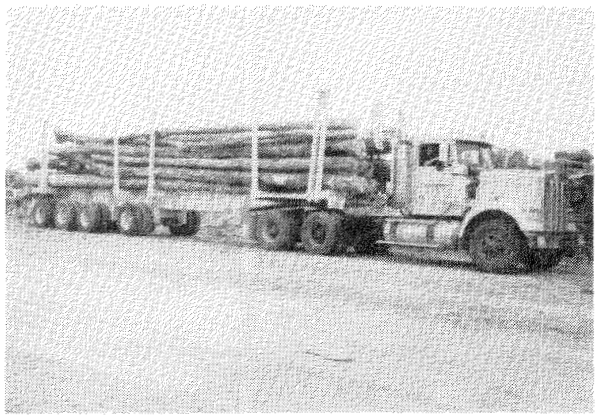

Figure 1. Modified tractor-trailer combination.

DESCRIPTION OF THE MODIFICATIONS

Three modifications were made on the tractor to reduce the tare weight. One of the two 545-litre fuel tanks was removed, leaving enough fuel capacity to easily complete the normal two trips per shift. The steel headache rack (bulkhead) and service platform were replaced with lighter aluminum models. Finally, the old Hendrickson model RS-480 rubber block suspension was replaced with a Neway ARD-250-200 air suspension which did not save any weight but which allowed for an on-board weigh scale.

The modifications to the Rodech semi-trailer were more elaborate. Two pairs of pickets along with their cross-members were removed while a third pair was moved. The two spare tire racks were eliminated (the company prefers to send out a service truck if necessary). The decking material was changed from steel to aluminum reinforced with a steel "I" beam. A further modification to the trailer was to extend it by 0.38 metres at the rear and to replace the rear bumper/pulling plate assembly with a lighter design. Finally, as was done on the tractor, all of the undercarriage was replaced. The original Granning model T350AX-25 lift axle was replaced with a Neway model AL-76-A air suspension, repositioned 90 cm forward of the tridem. The tridem axle group was changed from a Reyco 74-2XX-WB leaf-spring suspension to a Neway AR-95A-17HD air suspension.

TARE WEIGHT REDUCTION AND PAYLOAD INCREASE

The total tare weight reduction was approximately 1700 kg with full fuel tanks. Approximately 1000 kg (including 400 kg less fuel) was trimmed from the Kenworth tractor and 700 kg off the Rodech semi-trailer. The change in suspension had no significant

impact on the vehicle weight. The cost of the modifications excluding the suspension system changes was about $10 000. This translates to between a one and two-year payback period.

Because of the new Quebec regulations regarding vehicle weight and dimensions which came into effect October 1, 1991, the dimensional changes to the semi-trailer had less impact than Maclaren had hoped. In fact, under the new law, the maximum allowable G.V.W. is the same for both configurations at 55 500 kg. With the decrease in tare weight, the new design allows 5% more payload to be carried (35 180 kg vs. 33 480 kg).

An analysis using software for load distribution calculation, produced by the Ministère des Transports du Québec, showed that the change in configuration does, however, allow for more flexibility in placing the load on the trailer. With the increased inter-axle distance, the allowable weight of the tridem axle group was increased from 30 000 kg to 32 000 kg. With the old configuration, the drive axle group and the trailer axle group would have been loaded to 99.8% of their legal capacity with a full legal payload placed ideally on the trailer. Obviously, if the center of gravity is shifted slightly forward or backward, one or the other axle group would be overloaded, or conversely, a smaller payload would have been necessary to respect axle weight limits. With the new axle configuration, the drive axle group is loaded to 96.8% and the trailer axle group is loaded to 96.4% of their capacity with full gross vehicle weight. Therefore, the load can be shifted slightly without causing axle overloads. To have this safety margin with the old configuration, the payload would have to be reduced by 3%, an 8% overall reduction compared to what the new configuration can carry.

ON-BOARD WEIGH SCALE

To take full advantage of the tare weight reduction, an on-board weigh scale was installed. The Neway weigh scale, which is still at the prototype stage, uses the air suspension pressure to determine the load being carried. The system has two air pressure captors, one for the drive axle group and another for the semi-trailer tridem axle group. The outputs are displayed as axle group weight in the cab. More information on this weighing device will be available when it is marketed.

CONCLUSION

As was shown, with a minimum of investment, it is possible to decrease the tare weight of a vehicle without the need for substantial modifications. The 1700 kg reduction in this case could have been achieved without the change in suspension systems. This reduction in tare weight resulted in a 5% increase in payload. Furthermore, because of the repositioning of the lift axle, which can usually be done without replacing it, more load placement flexibility was introduced while still respecting the allowable axle weights.

This trial demonstrates the importance of specifying a new tractor or semi-trailer not only for performance and durability but also for maximizing payload to minimize haul costs.

DISCLAIMER

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