

DIRECT DELIVERY OF SUGARCANE TO THE MILL USING MINI SPILLER TRAILERS

BY R. N. STATHAM

Tongaat-Hulett Sugar Mills and Estates (Pty) Ltd, Maidstone

Abstract

In 1984, the rationalisation of the cane transport system made the grower responsible for the costs of transporting cane to the mill. An economic study indicated that large savings could be made by implementing direct delivery from fields within 12 km of the mill. The specific requirements of the estates, mill and transport departments, that were considered in the design of the tractor and trailer rig, are presented. Construction details are also noted, together with the successful operating performance infield and at the mill. The 1989/90 commercial operating costs of three systems of transporting cane from field to factory were compared. These were direct delivery using two 6-ton mini spiller tandem trailers, infield 6-ton basket trailers – transshipment – hilo transport, and infield 6-ton selfloading trailers – transshipment – hilo transport. Direct delivery was found to be the cheapest method of transport by more than R2.00 per ton. After two years of operation, some design improvements will be implemented to future trailers. These are described.

Introduction

Prior to 1984, all cane transport costs from growers' farm loading zones to the mills were centrally funded by the sugar industry, with the result that growers were not motivated to consider cheaper methods of transport. In 1984, the Rorich Commission recommendations were instituted, placing the full costs of cane transport on the grower. This new arrangement made it imperative that each grower decide, on an economic basis, the most suitable transport system for his circumstances.

For the past 30 years at Maidstone, the estates have been compelled to use an in-house hilo transport system. Until very recently, any alternative method of delivery that did not use the company transport was doomed, because of the fear that it would affect the viability of the transport department.

However, with ever-increasing pressure upon estates to improve their profits, it became evident that senior management would allow more economical methods of transport to be investigated. Estate management could see some obvious benefits of a decentralised approach to cane transport, these being:

- reduced short season penalties, imposed by cane transporters
- revenue benefits from fresher cane if direct delivery were used
- the breakdown of barriers to increase productivity
- reduced transport costs of cane grown close to the mill.

With the above in mind, estate's management embarked upon an investigation into the benefits of a direct delivery system for cane growth within approximately 12 km of the Maidstone mill. It was decided to select about 50 000 tons of cane, grown on relatively flat land, on Wewe estate.

The existing system there was to load windrowed cane mechanically into single or tandem 6-ton basket trailers. The

bundled cane was then transhipped into hilo transport on a loading zone about 2 km from the field. The hilo was offloaded by spillers at the mill.

Operational requirements

After discussion with the estates, mill, transport and cane supply management teams, the following requirements were determined:

Estate objectives

- The new system had to be designed to deliver the selected 50 000 tons of cane to the Maidstone Mill during daylight hours, and to be more cost effective than the current method of delivery
- The direct delivery trailers had to be mechanically loaded by a Bell loader.
- A single trailer should be designed to carry about 6 tons and should be no longer than 5,5 metres. This was to ensure that, when the trailers were hauled in tandem in the field, the whole unit would be manoeuvrable. Also, experience had shown that where conditions were such that only single trailers could be loaded, a 6 to 8-ton payload was an acceptable mass to work with, and kept field damage to a minimum
- The trailers must be fitted with a quick hitch/unhitch system, to enable single trailers to be coupled quickly and efficiently at the field edge before being hauled to the mill in tandem
- High flotation general purpose tyres should be fitted to achieve infield access in damp or very sandy conditions
- If possible a 58 kW tractor should be the prime mover, to retain standardisation of the estate haulage tractor fleet
- The whole haulage unit should be fitted with a fail-safe braking system, and must comply with the Road Ordinance.

Mill and transport specifications

- Because of a lack of storage space for additional bundle cane, deliveries to the mill had to be unloaded using the spiller facility. Therefore the trailers had to have spiller bars fitted
- Twelve tons, tipped at one time, was a minimum requirement to cater for sampling and to ensure the economical operation of the spiller offloader
- No special modifications to the two mill offloaders could be undertaken to assist the mini trailers. Any such changes could seriously jeopardise the efficient offloading of the whole fleet of existing hilo trailers
- The operation of the spiller unloaders would have to be undertaken by the tractor operator. This was to fall in line with the tasks of other vehicle drivers.

Design features

The design that emerged out of the many requirements, is shown in Fig 1. The main features of the design are:



FIGURE 1 One of the 8 tandem mini-spiller rigs in operation

- The total loaded weight of the rig is 20,8 tons and well within the hauling capacity of a 58 Kw tractor on flat land, with good road conditions
- A basic basket trailer design, which has proved itself over six years of operation at Maidstone, is the SASA Experiment Station 6-ton basket trailer. With relatively few modifications, T.I. Trailers of Camperdown fitted a spiller bar, and correctly positioned the double axles on each



FIGURE 2 A quick hitch coupling device

trailer to achieve optimum weight transfer. To achieve maximum flotation, and an ability to traverse infield drains, two axles per trailer were fitted, with braking on the front axles only

- The rig is fitted with an hydraulic fail-safe braking system. This system was developed by the Stanger branch of N.M.F., and is designed to stop and hold a loaded rig on a steep incline, should the tractor engine cut out for any reason
- To achieve maximum weight of cane in the trailer, the loader's grab is able to compact each load through two slots built into the sides of the trailer opposite the spiller bar
- The quick coupling device was developed during the first year of operation. The concept used is simply to pull the front and back boxes together with an hydraulic ram, as pictured in Fig 2.

Construction features

There are a number of important construction aspects which have contributed towards the low running costs of the rig. The important features are as follows:

- The basic design of the basket trailer has two main objectives in mind: strength and minimum weight
- This was achieved by the use of hollow-section mild steel tubing which has many constructional advantages, e.g. easy to handle, cut and weld. It is strong, light, and the finished product has fewer crevices in which rust can occur.
- The drawbar is of torque-tube design, which is stronger than the conventional long drawbar, and far lighter
- The sides of the trailer are constructed with a slight taper from bottom to top, to ensure the smooth 'unrolling' of the load when lifted by the spiller bar
- The trailer has mesh floors to allow any extraneous matter to fall through during transport
- Four 12.00 × 16 run flat tyres are fitted to each trailer to improve flotation and to reduce the likelihood of punctures.

Justification

The economic justification indicated that a 38% Internal Rate of Return was possible from direct delivery within a radius of 12 km of the mill, despite the fact that R284 000 of capital expenditure was required to construct trailers and to purchase 3 additional tractors.

Operational results

Very few alterations were necessary to ensure excellent operation, both infield and at the mill.

Infield performance highlights were:

- Better than expected trailer weights, due to the constant compaction of the cane while it was being loaded (Table 1)
- The trailers could be used infield in tandem more than 90% of the time, because the correct weight distribution resulted in increased traction on the rear wheels of the tractor. This was further assisted by the flotation qualities of the trailer tyres
- Turn around times were generally better than expected, due mainly to faster road speeds being obtained
- Cane reached the mill, on average, 24 hours earlier than other cane that had to be transhipped.

Highlights at the mill were:

- The tractor operator very quickly acquired the skill to stop his rig exactly as required under the spiller loader, to achieve a 'one shot' unload
- The spilling action of the bundle out of the trailer was effortless and extremely clean; so much so that, in subsequent trailers, the hold-down bar was eliminated.

Table 1

Summary of performance results, compared with expected results, after 2 years of operation

Operation	Expected results	Actual results achieved
Tons/day	210	284
Average payload	12	16
Litres/100 tons	74	50
Trips per day/unit	5	4,4
Average speed	18 km/h	22 km/h

Economic results

A review of the 1988/89 results clearly indicated that the first year's operation had been a success, both operationally and economically. Consequently it was decided to expand direct delivery to Pencarrow estate in 1989/90, thereby adding a further 30 000 tons. The trailers were constructed internally at the Tongaat-Hulett Group Automotive Workshops. The price of one trailer is about R25 000 complete with quick hitch.

At the end of the 1989/90 season the operating costs for the three methods of haulage used on Maidstone Estates was extracted. These are presented in Table 2.

Table 2

Comparative costings of the three methods of haulage used on Maidstone Estates, expressed as Rands/ton cane

Cost components	Method of delivery		
	Direct delivery	Typical bundle system	Typical basket system
Operators	R0,45	R0,52	R0,32
Overtime/bonus	R0,15	R0,05	R0,06
Tractors	R2,10	R1,87	R1,15
Trailers	R0,40	R0,26	R0,21
Transshipment	-	R1,40	R1,40
Hilo transport	-	R2,33	R2,33
Total	R3,10	R6,43	R5,47

The costs are in-company costs, which cannot be compared directly with those achieved by other growers. The hilo transport costs are those that can be expected for cane within a 12 km radius of the mill. The results show clearly the savings that can be expected, if direct delivery is used in the correct application. Sixty percent of the saving is due to eliminating transshipment.

Conclusions

When used in specific circumstances, direct delivery can be considerably cheaper than other methods of cane haulage. The tandem mini-spiller rig has delivered 106 000 tons to date. This had been done effectively, and has met the objectives set by both the estates and the mill. Rig drivers take about 18 months to become really competent operators.

After two years of operation, a number of improvements will be considered for the next expansion phase:

- The torque tube will be constructed of high tensile steel, to be able to withstand the greater than expected stresses
- There should be an additional set of back lights situated high up on the trailer tail board. This would improve visibility in traffic, where the tail lights are sometimes obscured by vehicles
- The floor of the trailers will be constructed of metal slats and not mesh, which is not strong enough
- The hook at the rear of the front trailer should not be secured to the back axle of that trailer, because it tends to pull the axle out of line
- Consideration will be given to improving the fail-safe braking system. The hydraulic fail- safe system does not operate if a hose is severed
- Rig operators will be instructed in the correct infield technique, to reduce further the trampling of windrowed cane.

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