SHORT COMMUNICATION

THE COMPLEXITIES OF INTRODUCING THE FREDD VEHICLE SCHEDULING SYSTEM INTO THE DARNALL MILL AREA

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Abstract

Compared with leading producers of good quality, low cost sugar, the South African sugarcane supply chain is still inefficient. Innovative solutions are needed if the SA sugar industry is to remain competitive and sustainable in a global environment. FREDD, which is a vehicle dispatching/scheduling programme designed in Australia, was introduced as a pilot project at the Darnall mill in late 2005. The project's objectives were to (i) customise FREDD to a South African mill, (ii) reduce vehicle cycle times, thereby reducing the number of vehicles in the fleet and maximising vehicle utilisation and (iii) synchronise the vehicle arrival rate with the mill's crush rate. During implementation, many lessons were learnt about the complexities of the supply chain and their effects on the system's efficiency. Issues that were highlighted included cane stock levels on farms, the large number of vehicle configurations, the number of grower groups, communication and communication infrastructure, real-time system monitoring and information feedback. The project showed that vehicle dispatching/scheduling can operate successfully under South African conditions, but this demands co-ordinating the supply chain from a central location. In addition, the need for buy-in and co-operation from all parties is vital in realising the significant cost savings that are possible.

Keywords: harvesting, vehicle scheduling, Sugar Logistics Improvement Programme, SLIP, FREDD, supply chain, transport

Introduction

The transport component of the sugarcane supply chain has been identified as one area where significant savings can be realised at relatively low cost. It is believed that the main cause of the inefficiencies is the lack of a single central plan to co-ordinate the system holistically. In the absence of dynamic vehicle scheduling, a typical sugarcane transport system symptomatically exhibits excessive queuing times, large numbers of 'no cane' stops, significant over-fleeting and poor vehicle utilisation (Giles *et al*, 2005). At the Darnall Mill, several hauliers of various sizes operate in the area with no co-ordination between hauliers. Road and zone infrastructures are sometimes inadequate and do not allow for a vehicle to travel to any collection point. Growers may also choose a specific transport system, and have specific loading windows at different zones. Long queue times exist at the mill and hauliers have to acquire additional vehicles to move the cane. Studies have, however, shown that this is a perpetuating scenario where more vehicles result in increased delays (Giles *et al*, 2005).

In contrast to the South African scenario, the road transport systems at the three New South Wales mills and the Tableland mill in Australia are centrally controlled using a vehicle dispatching/scheduling programme named FREDD. Dines *et al.* (1999) designed and implemented FREDD at two sugar mills in New South Wales. This system is computer based, and is linked to a Global Positioning System (GPS) and harvesting telemetry to provide real-time system information to a control centre. The benefit is that their average mill turn-around time is ±700% lower than in South Africa and their vehicle utilisation is approximately 260% higher.

SLIP highlighted many areas of opportunity for improvement and, in an effort to address the situation, FREDD was implemented at the Darnall mill. The aim of this short communication is to briefly describe the FREDD scheduling system, and highlight the lessons learnt during this exercise.

Methods

FREDD was developed in close consultation with fleet control personnel in New South Wales, and allows for real-time scheduling as opposed to pre-planned methods of scheduling (Dines *et al.* 1999). Under full operation, the FREDD system constitutes:

- A GPS monitor on all harvesters and trucks
- Updates on cane stocks at zones using UHF/VHF radio
- Remote Frequency Identity (RFID) tags on cane bins and trucks that are scanned at the weighbridge and in the millyard
- LAN and WAN facilities, which allows quick inter-computer communication with factory computers and the weighbridge.

The FREDD system automatically issues trip instructions to vehicles at tare-out, with the objective of maintaining a constant supply of sugarcane to the mill. The system uses real-time GPS information to automatically adjust schedules to account for unplanned variations in cycle time. It will feed information to the mill crushing station, and automatically synchronise the crushing rate with cane delivery.

A pilot run of FREDD at Darnall was funded by Crickmay and Associates, the SLIP programme, the South African Cane Growers' Association (SACGA), the Department of Transport (DOT) and the South African Sugarcane Research Institute (SASRI). The FREDD system was customised to suit special issues that were not previously included in the Australian configuration. Four significantly different approaches between Darnall and New South Wales were:

- A need for restricted loading windows
- Multiple hauliers and specific vehicle configurations that were assigned to specific growers
- A large number cutting fronts
- A relatively large number of vehicles and loading points.

Figure 1 illustrates the user-friendly FREDD software interface[1]. The screen illustrates the various factors related to the scheduling system and includes a typical arrival pattern.

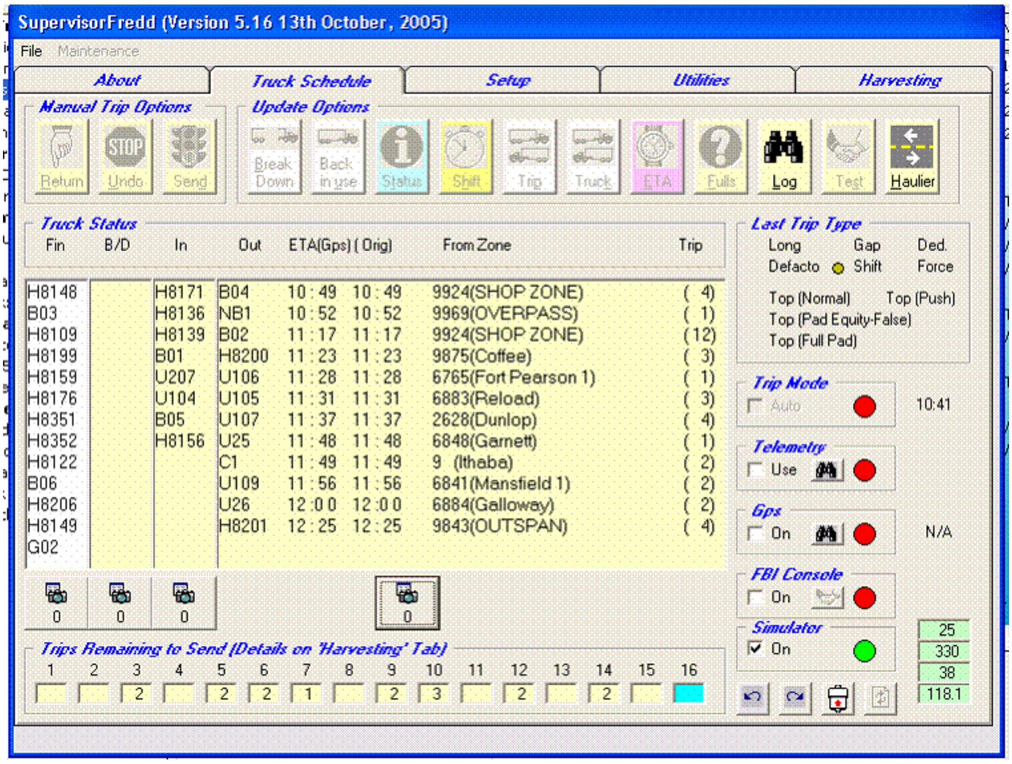

Figure 1. A typical user screen of the FREDD system.

The trial was carried out over a 12-week period, during which both quantitative and qualitative information was collected for assessment. Many issues regarding the present Darnall system were revealed and suggested changes were made.

Results and Discussion

Benefits of the central co-ordination and scheduling system became particularly apparent after implementation. It was estimated that approximately 35% of the current fleet vehicles would become redundant with a fully functional FREDD system. Operations became more transparent and communication improved. Important lessons that were learnt during the trial included:

- The current Darnall supply chain was complex and rigid. Certain vehicles could only service specific zones because the growers/haulier required/chose certain configurations
- Some growers had specific loading windows
- Lack of sufficient communication between all parties
- Growers not making cane available rateably
- Variable cycle times on specific routes
- Non-equitable cane supply arrangements
- Transport systems were extremely sensitive to shift changes and fuelling strategies
- Vehicle cleaning accounted for a significant proportion of cycle time.

[1] Further details on FREDD can be obtained from Ryan Giles at <ryan@cricmay.co.za>

Ideally, the most efficient system would allow all vehicles to be dispatched to any supply point at any time, and would include appropriate vehicle and cane supply management systems.

In the Darnall context, and in addition to FREDD, this will require that:

- Hauliers and growers should become larger consortiums
- Vehicles, roads and zones should conform to certain standards with regard to accessibility and field to zone system
- 24-hour operations should be considered
- Reliable communication system should be put in place
- Stock and transport should be synchronised
- The mill crush rate should be regulated by anticipated vehicle arrivals
- An on-board GPS system should be installed in all haulage vehicles.

Figure 2 shows the situation at the Darnall mill with regard to queues before and after the implementation of FREDD.

Figure 2(a) and (b). The long queue situation before FREDD was implemented, (c) a FREDD controller at the Darnall mill, and (d) the improved queue situation at Darnall using a functional scheduling system.

Conclusion

The FREDD system is a proven solution for sugarcane transport optimisation. It has been shown that it does work in South Africa, and it is estimated that successful implementation of the system could result in transport cost savings of over 25%. The system does, however, require compromise and co-operation between all parties involved. A single and dedicated supply chain management office needs to be established. Communication must be improved, including onboard GPS computers and, where possible, hauliers should have the flexibility to load cane at any cane supply point. Ideally, the mill crush rate should be synchronised with the transport system.

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