Train Operations on Queensland's Cane Railways Part 2: Mills and Safeworking

by Lynn Zelmer with Lincoln Driver, Carl Millington and Greg Stephenson

Last issue we looked at the difference between a railway and a tramline, and sugar cane train operations in general. This issue we'll look at how the mill systems function with safeworking to ensure safe and efficient operation of the systems.

Mill Systems

Mill systems exist because they are an economic means of transporting cane. Other activities are ancillary to this function or to maintain the network. Only Victoria and Macknade Mills are now transporting bulk sugar by tram, although in earlier eras many mills did transport bagged sugar. Thus some of the ancillary functions have been taken over by road transport or utilise the Queensland Rail systems, as several mills do for molasses transport.

The mill tramways did not have the legal ability (and they certainly didn't have the finances) to compulsorily acquire the kind of formation (right-of-way) enjoyed by the government railways. Instead lines ran along shire road allowances or via an easement across a farmer's field. As a result some cane lines share bridges with road traffic and run behind or between properties, along the front of residential properties, or even down the middle of urban streets. In Nambour, for example, the Moreton Mill could only be accessed by trains crossing the Bruce Highway in the centre of the town. Traffic lights were triggered by the train crew to stop traffic to allow them to cross the intersection.

Cane bins, as with wholestick trucks before them, do not have brakes, thus experienced drivers and locomotive brakes are critical for controlling anything more than a very small rake of bins. Some mills have locomotives fitted for multiple operation to provide additional power and braking, and others use radio controlled brake vans located at the rear of the rake and/or radio controlled mid-train locomotives. An end of train marker, an upright stick of cane in earlier decades and a standardised sign today, allows the driver to see that the train is still following.

Farm pickup points can be as simple as a single dead-end siding or loop, but are usually more complex with both full and empty bin delivery areas. Tractors and other vehicles shunt the bins at some sidings, at others gravity will be used to minimise the damage from shunting the bins with non-rail equipment. Where side- or end-tipping infield transporters are used the pickup point can be a simple loop with enough space for the transporters to move along the empty bins as they dump their loads.

'Fly shunting' to drop empties into dead-end sidings was quite common in the steam days but may be less common in the current health and safety conscious environment. A rope from loco to bin might be used to move bins in and out of dead-end sidings, and tractors regularly shift both empty and full bins around the farm sidings.

TITLE PHOTO: Mackay Sugar: Marian Mill's 'endless chain', a between the rail axle pusher system for automatic bin movement out of the tippler, September 1990. Many mills started off using a winch and cable system for moving small rakes of bins, now most have some form of more sophisticated bin movement system. Lynn Zelmer photographer

And it's a fallacy to suggest that the sugar cane railway operations only involve the movement of long rakes of full and empty cane bins. Yes, a lot of activities do involve moving cane bins, but even that may require moving small rakes of bins between farm sidings and a marshalling yard, making up or breaking down a larger rake, and moving these large rakes between the marshalling yard and the mill. Working a farm siding involves spotting empty bins in one direction and picking up fulls in the other—sometimes resulting in quite complex shunts being required to remove full bins (or wholestick trucks in an earlier era) to make room for empties.

Empty bins can be rerailed using portable jacks if the derailment isn't too severe, but more severe accidents might require special train movements (perhaps a rail-based ambulance in earlier eras on a shire tramway) or at least the dispatch of a road-based crane for lifting locomotives or bins. Rerailing full bins will always require a crane of some description. Derailments, other accidents and weather events can also cause major system damage, often requiring special train movements. Examples include road/train accidents, low lying bridges needing replacement because of floods, the accidental damage that required the replacement of several spans of Macknade's Herbert River bridge and recurrent washouts in flood prone areas.

Where the growing areas are concentrated the mills likely operate small locomotives and relatively short trains distributing empties and delivering full bins directly to the mill if close enough, or to a regional assembly point (marshalling yard) where larger rakes are assembled and moved to the mill by larger locomotives. Just as with larger gauge systems, larger locomotives and higher speeds require better trackwork and the engineering standards on some of these through routes meet or exceed those of the mainline railways.

The Farleigh Mill map circa 1983 shows a combination of two network types. The two small star networks could be worked from the mill with light locomotives and relatively short rakes. The far ends of some lines had special operating constraints as trackwork was poor and the ground wet enough that locomotives could not safely operate. Instead small rakes of bins might be moved to and from the farm sidings by tractor or hauled out using a rope—or perhaps by horse power in an earlier era.

The long northern extension operates into a far flung growing area. The grade near Summit (43) was a limiting factor and required doubling for all mill-bound trains. In other words, half the rake was separated and chocked so that it couldn't move, while the other half was taken over the Summit. It was then chocked and left while the crew returned for the other half of the rake. The reunited rake then completed its trip to the mill. A multimillion dollar realignment has since reduced, but not eliminated, the grade.

Qunaba, Millaquin and the ex-Wallaville Mill networks on the 1978 Bundaberg area map also appear to be star type networks. Cane from the several radiating branch lines is collected at the current Wallaville marshalling yard, for example, and assembled into longer rakes for a heavy locomotive to deliver to Bingera Mill. Fairymead and Bingera (ignoring the Wallaville concentration) systems are much more spread out. The Isis Mill has one area of concentration plus a couple of branching networks. Deregulation of the cane industry has meant that by 2002 Isis Mill had added a long extension northward towards Bundaberg in order to access cane grown by farmers who used to deliver to Millaquin Mill.

In Australia at least, cane is delivered to the mill tippler by rail. Road transport may be used to deliver cane from more isolated paddocks to the nearest rail siding, and to deliver cane to a mill siding from farms close to the mill. Cane delivered to the mill siding is loaded into bins and moved straight into the mill, likely spending a very short time on the rail system before being dumped at the tippler.

Depending on the size of the mill/operation, mill yards can have a storage capacity from a couple of hundred to a thousand or more bins, as well as both locomotive and bin maintenance facilities. Out depots may be used for overnight locomotive storage and maintenance so that the locomotive and crew working more distant lines don't have to come back to the mill every night. Out-depots and marshalling yards might be old mill locations, as at Wallaville, transfer points for cane grown in an area where the geography is too rough for a rail extension, as in the Finch Hatton area, or to service a new cane growing area which does not (yet) justify extending the rail system.

Depending on the mill, and the era in which you are operating, the mill system might also haul everything from firewood to juice (the unprocessed sugar syrup) to bagged sugar to molasses and bulk sugar. Many mills shipped bagged sugar on their mill systems and a few operated links to nearby ports with bulk sugar wagons. While early mills may have had their own molasses tankers, today most molasses would be shipped either by road transport or Queensland Rail.

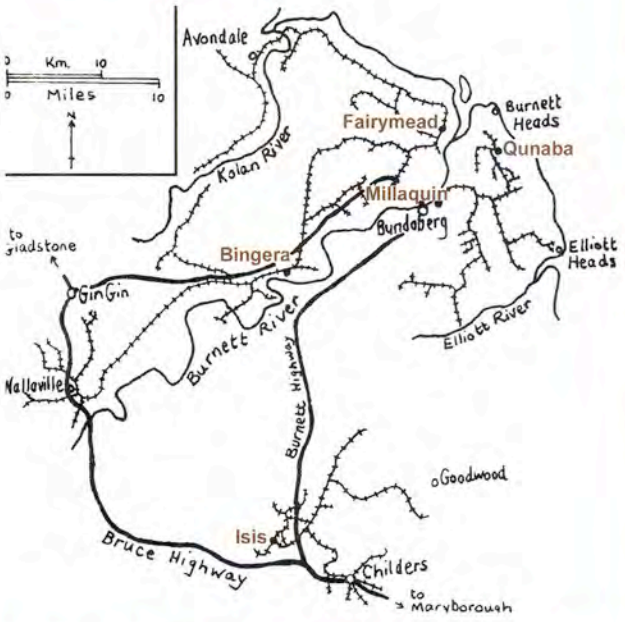
Then there are the (generally out-of-season) maintenance trains: bridge gangs, fettler's wagons and poison trains. Until the most recent changes in liability and rail safety some mills ran tourist trains as part of their mill tour programs. In earlier decades some cane hauling systems also carried passengers and freight, and shire railways also carried cane, since they provided the only transport option for isolated communities.

ABOVE: Exiting the branch line... 'Warning: Call base for clearance before passing this point', Mackay Sugar system, October 2001. Lynn Zelmer photographer.

BELOW: This Finch Hatton transfer point is orphaned some kilometres from the rest of the Mackay Sugar rail system in 1992. Trailer hauled bins will be filled in the field and brought here for transfer to the rail. The concrete ramp is designed so that the tractor can pull the trailer over the ramp and back up to allow the bins to transfer by gravity. A road truck will also drop empty bins here for filling.

There is a single set of points dimly visible above the post, with another transfer point to the right so that gravity assists in loading the bins for the truck's return journey to where it can transfer the bins to the rail system. The cut-off plastic drum mounted on the post stores bin tickets for identifying the source and type of cane in the bin, delivery time, etc. Lynn Zelmer photographer.

Some examples of mill rail networks

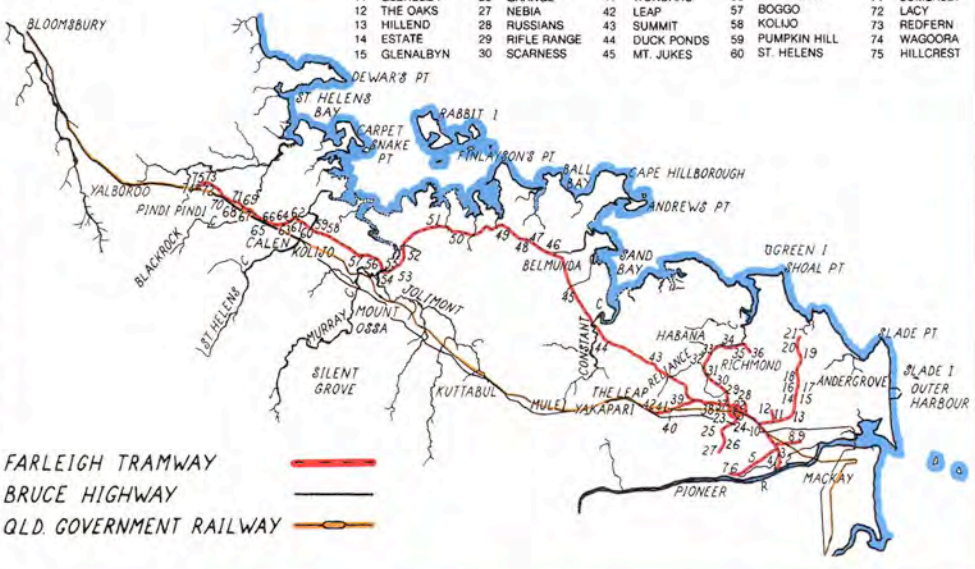


ABOVE: Mill networks in the Bundaberg area, 1978. Communities such as Goodwood and Wallaville were mill locations in earlier decades, although not all had rail networks. Cane collected over the original Wallaville Mill's rail network is assembled into long rakes in the new Wallaville yard, then has a relatively long run to Bingera Mill using heavier locomotives. Map source: Browning, John and Mewes, David (1978), Australian Sugar Industry Locomotives: Current rosters, sugar mills & bulk sugar terminals, Australian Narrow Gauge Railway Museum Society, p10.

LEFT: Isis Mill rail network, circa 2002, showing both concentrated areas of collection and longer runs to further growing areas. Compare this network with the Isis Mill network on the 1978 Bundaberg area map. The area closest to Bundaberg, which is just off the top of the map, has been added since the deregulation of the sugar industry and allows growers near Bundaberg to ship to either Isis Mill or Millaquin Mill. This map has been compiled from several sources, apologies for any errors, especially in names and locations of farm sidings/loops.

KEY TO SIDINGS

1	PIONEER	16	IONA	31	AMHURST	46	BELMUNDA	61	PIT
2	FOULDEN	17	FARVEL	32	HABANA RD.	47	HILLSBOROUGH	62	WEWAK
3	CORALEA	18	RICHMOND	33	KRISIN'S	48	SPRINGCLIFF	63	CALEN
4	SUNNYBANK	19	QUARRY	34	NEILL'S RD.	49	MURRINDA	64	SAWYER
5	SPRINGVALE	20	EIMEO	35	ETOWRI	50	SEAFORTH DEPOT	65	WHIPTAIL
6	ASHLEA	21	BUCASIA	36	NINDAROO	51	LONG MILE	66	JUMPER
7	FURSDEN CK.	22	WAINAI	37	KOCH'S	52	SURPRISE	67	MOONDABA
8	SUGAR SHED	23	BASSETT	38	ROSEWOOD	53	JOLIMONT	68	BLACKROCK
9	MARAJU	24	VALLEY VIEW	39	FOREST HILL	54	MT. OSSA	69	WOOTAROO
10	WIRI	25	MEADOWS	40	MAVIS BANK	55	MATHERS	70	PINDI
11	GLENELLA	26	GRANGE	41	WUNDARU	56	MT. PELION	71	SOMERSET
12	THE OAKS	27	NEBIA	42	LEAP	57	BOGGO	72	LACY
13	HILLEND	28	RUSSIANS	43	SUMMIT	58	KOLIJO	73	REDFERN
14	ESTATE	29	RIFLE RANGE	44	DUCK PONDS	59	PUMPKIN HILL	74	WAGOORA
15	GLENALBYN	30	SCARNESS	45	MT. JUKES	60	ST. HELENS	75	HILLCREST



RIGHT: Farleigh Mill is located at the red dot near Siding 22. In 1983 the North Coast main line was 62.69 km long, and the lines around Farleigh totalled 46.67 km, both plus sidings and loops. The grade near Summit (43) was a significant limiting factor on the northern line, however a multimillion dollar realignment has since reduced the grade. Adapted from Manning, KW (1983), "In Their Own Hands", Farleigh Cooperative Sugar Milling Association.

Safeworking

To keep a slack coupled rake buffered up from the top of a long bank the summit is approached fairly smartly as the couplings are tight. As the engine comes over the top the brakes are applied, lightly at first, then with increasing pressure as the rake buffered up. The trick is to have the trucks or wagons have their slack run in one at a time as the rake comes over the summit. The slack is allowed to run out again as the rake reaches the bottom of the bank. (Loveday, p72.)

Safeworking on a shire or cane tramway operating passenger and goods services as well as hauling cane may have used a manual token control system. Possession of a locomotive-specific staff in the early years of the Douglas Shire tramway, for example, gave that train the right to travel through a section of track.

Trains had to stop with some frequency for water and coal/wood, and the crew needed meal and smoko breaks. Breaks might be taken at the end of the line once empties had been dropped off, or at a convenient hotel along the route. In some case the train occupied the through line during the refuelling or break, only a problem if another train needed to pass.

CRUSHING PRIORITY SHEET

DRIVERS ARE TO RECORD NUMBER OF BINS AND NAME OF LOOP OR SIDING WHERE FULLS ARE STORED.

- Fold along line. Place consignment notes inside.
- Either hand consignment notes to next driver, or send to weighbridge.
- Cane is to be shunted to full yard and crushed by order of lowest priority number.

FOLD **FOLD**

LOCO **RUN**

STORED AT

NO. OF BINS

PRIORITY NO.

ALWAYS PULL THE RAKE WITH LOWEST PRIORITY

UNLESS TRAFFIC OFFICER ADVISES DIFFERENTLY

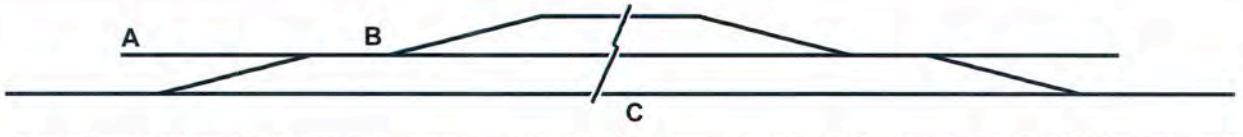
...one evening we were approaching the South Mossman River with 75 or 76 loaded cane trucks, say about 175 or 176 tons gross load. As we came down to the river the rake became uncoupled about halfway back. We pulled the front half well up the far bank well clear of the see-sawing rear part of the rake. When things settled down (the fireman) dropped off the engine and went back to recouple.

Just then (the cane inspector) pulled up in his car, returning from a day in Cairns and the line being roadside just there, walked over to the engine to inquire what the hold-up was. ... (He) drove off into the town to tell the traffic office that we had been held up. (Loveday, p74.)

In more recent years, cane railways operated under a simplified form of timetable and train order. The Traffic Office maintains a system map, likely with tags or other tokens (or a computerised variant today) to indicate where locomotives are operating in the system. The basic timetable was supplemented by specific train orders delivered by hand, telephone or radio. Since on many branch lines there is only ever a single locomotive operating, the timetable may simply be an indication of start, duration and completion times, assuming no problems. It's likely that most of the cane railways were using train radio systems by the late 1950s, albeit with some reception problems where signals were blocked by cuttings, hills, or distance. Those problems continue today as mobile phone coverage remains uneven, even in well populated regional communities.

LEFT: This form was used by the Isis traffic officer/weighbridge clerk to know the order of priority for rakes in the mill yard and some outlying storage sidings. The loco crew would send the tickets to the traffic office; they would place them behind this form and then hang that form on the corresponding line hook. Good system especially after a mill maintenance day.

BELOW: This 1992 bin ticket (consignment note) identifies the type of cane in the bin and where it came from. The tickets were attached to the bin for removal as the bin is collected by mill train or road truck. Hopefully the stub also contained details of the load for follow-up by the farmer or contractor if required. Lynn Zelmer photographer.



A simple farm siding, perhaps 500 metres long in level country. The loaded bin ramp (A) is roughly 450 mm above the through road (C), the storage tracks (starting at B) are roughly 300 mm above the through road with the elevation falling slightly to the empty bin pickup point at the right of the siding (see photo of haul over pickup point). The through road is ballasted with gravel and is separated from the shire maintained gravel or bitumen road which parallels it by a shallow ditch. Other tracks are trash covered, with standing water in the wet season.

Operating problems varied widely, with derailments being a common cause of delays. Drivers also learned where the radio systems were out of range, allowing them to hide out for a period of time. Stories from the steam days suggest that loco failures or other delays might be quite common near the local pub favoured by a particular crew.

Radio control is just as important for operating in a yard or mill area as on a branch or trunk line. Locomotives entering the yard or mill control area will slow down or stop until they have permission to enter on a specific track. Locomotives shunting the area require similar permission to move from their assigned track and trains with empty bins.

This continued through to the 1990s, when GPS systems began to be explored. As more accurate GPS systems became available both locomotives and brake vans were equipped with devices that allow the Traffic Officer to know where trains are at any time and for drivers to know that the rake was still connected. The latter was important for trains both with and without brake vans. Loose bins are always undesirable, but a brake van separated from the rest of the train was unable to assist the locomotive in braking.

Some visual safeworking is still permitted, such as where trains might follow each other at close intervals. Similarly, when trains pass one might help the other by reporting potential problems with the rake, assist in making up the train or push up brake wagons, etc.

It's quite common for mill systems to interconnect but even when mills have the same owner, locomotives will generally be assigned to a specific mill. In any event they will require clearance, usually via radio, to enter the other mill's system.

Some of the newest locomotives are fitted with the same type of computer systems common on mainline locomotives and drivers can manage their acceleration and braking using computer modelling as a guide. Some mills also use hand held radio control to allow a driver to shunt the train remotely and thus perform the role of both driver and offsider.

The necessity to provide equitable transport for all farmers supplying cane to the mill has been mentioned above. As it became possible for trains to move faster and pull heavier loads it became important to service the network more efficiently. Some mills have adopted the use of computer modelling to optimise cane cutting, bin and locomotive allocation, and train scheduling.

From time to time the Chief Engineer and/or the Chief Cane Inspector also issue general instructions to locomotive drivers, traffic officers and cane inspectors. These include speed restrictions and detailed load limits for a each locomotive type, always with the directive 'You must take account of the prevailing weather conditions'. Such limits cannot be exceeded without the approval of a Traffic Officer. Varying load limits along a line lead to breaking a rake to take a section in two passes, or may require bins to be pushed out by a tractor if the locomotive is too heavy for a particular bridge or section of track.

Bin Tickets and Other Forms

Bin tickets are left in box at the front of the truck dumps (farm siding). Truck drivers fill out the tickets before dumping the full bins from the truck. When collecting a rake of fulls from a truck dump, the assistant would have to walk the rake to the front of the dump to collect the tickets. As a driver you hoped that a) the assistant checks all the couplings on the way to the ticket box, b) checks the tickets off against the bins on the way back to the loco and c) doesn't drop the tickets at some stage, because truck dumps could produce a lot of tickets!

For infield transporter operations, the ticket book would be on a clipboard on the side of the first bin at the start of a fresh rake of empties. As the rake is filled, the clipboard moves down the rake as it gets filled out. Sometimes when the loco crew arrives to collect fulls, they will have to complete the ticket or start a new ticket book themselves if the amount of bins exceed the ticket bin places.

With the tickets as a loco crew, you would mark the first bin on the ticket that would be tipped—not all mill lines went straight to the mill. Adies line at Isis for example, worked in reverse—with an F in a circle and the last bin with an L in a circle. You would then number the top of the ticket, so if you did drop them, you could put them back in the correct order and keep the weighbridge clerk happy. On the run sheet, you had to enter the first and last bin number from each siding you collected from.

If you had to make up a load from stored cane, it was most likely that you would have to use a loco ticket because you would need to 'split' a farm ticket. There were two ways in which this was done at Isis. If you were leaving behind a couple of bins from the farm ticket, you would draw a line around the bins that you would be leaving behind at the siding on the farm ticket, with a note 'still to come'. Using a loco ticket you write out the same details as on the farm ticket, block, cane type, burn/cut time, etc., and the bin numbers you are leaving behind. The loco ticket would then stay with the stored rake.

If you want only a couple of bins, you would fill out a loco ticket with the details of the bins you would be taking. On the farm ticket you would circle the bins that you took and write a note 'gone to mill'.

If by some chance you had a rake of unknown cane or a missing ticket at Isis, you could look up the farm details in a reference book carried on the loco, checking the group number on your running sheet and maybe complete some details on the loco ticket. If not, you advise the traffic officer who might tell you to forget that pickup, and get a cane inspector to go hunting the contractor.

At the mill you would give/send the tickets to the weighbridge. The tickets would be found on the front of the leading bin for any rake that was stored outside the mill yard.

LEFT: Bin identification equipment at Mackay Sugar's Marian Mill, September 1990. Main picture left to right on posts are a washer unit for bin mounted barcodes, a barcode reader with lights, and a second washer.

The inset shows the barcode label on a full bin being washed as it moves into the mill. It is likely the shed behind contains control equipment for the washers and barcode reader. The bins behind are waiting to be repaired. Lynn Zelmer photographer

ABOVE: Even bogie locomotives need extra help with large rakes of cane. Here is Mackay Sugar's B-B DH loco #55 Balberra (Walkers 657 of 1970, rebuilt TulkGon 1994) running light with a bogie brake van, 25 August 2005. Jonathan Bayliss photographer.

BELOW: Two of the forms for use by drivers. The locomotive and brake wagon maintenance form is required every shift. Similar reports would have been required in the steam era. The cardboard bin repair tag advises the traffic office that the bin must be routed to the truckshop after tipping.

LOCO AND BRAKE WAGON SHIFT REPORT

LOCO No. SHIFT DATE

B/WAGON No. TIME CHECKED AM PM

INSPECTION AND MAINTENANCE

LOCO	OK	AMOUNT	YES	NO	WAGON	OK	AMOUNT	YES	NO
WATER LEVEL					WATER LEVEL				
ENGINE OIL LEVEL					ENGINE OIL LEVEL				
CONVERTER OIL LEVEL					FUEL LEVEL				
FAN OIL LEVEL					GREASED				
FUEL LEVEL					LIGHTS				
GREASED					MARY & ROLL BACK				
LIGHTS					ELECTRONIC				
SANDS					SANDS				

ENGINE PERFORMANCE		GOOD		FAIR					
LOCO BRAKING									
WAGON BRAKING									
RADIO									

DEFECTS - FAULTS - ACCIDENTS - DERAILMENTS CAUSE

SIGNATURE OF DRIVER

BIN REPAIR

BIN No. .....

S / Y

WHEELS/AXLES .....

STEELWORK .....

COUPLINGS .....

OTHER

BELOW: Mackay Sugar, Marian Mill: derailed bins on northern line, September 1990. The bins in this rake would be split, allowing some bins to proceed. Navvies would be called in to rerail or remove the derailed bins using a crane, probably one on a road vehicle. The likely cause of this derailment was an obstruction, perhaps a piece of ballast caught between a timber and the rail, at a farm grade crossing. Lynn Zelmer photographer.

BELOW: Mossman Mill's Cook and Ivy (0-6-0 DH Com-Eng, fitted for multiple operation) with a rake of loaded canetainers, Mossman 1995. Multiple unit operation allows the mill to make good use of 1960 era locomotives to haul heavier trains. The bogie canetainers allow more efficient loading and train operations. Greg Stephenson photographer.

At Isis, farm tickets were yellow, loco tickets white, and all ticket books had carbon copies. The above bin ticket system is fairly generic throughout the mills.

Moreton on the other hand used ticket cards. The farmer would fill out these cards with farm, crop and bin number details and place them in a holder on the side of the bin next to the bin number. The loco crew still noted first and last bins collected on their running sheet. At the mill, the yard man would walk the rake and collect the cards, and hand them into the weighbridge.

The crushing priority form was used by the Isis traffic officer/weighbridge clerk to know the order of priority for rakes in the mill yard and some outlaying storage sidings. The loco crew would send the tickets to the traffic office, and they would place them behind this form and the hang that form on the corresponding line hook. This made a good system, especially after a mill maintenance day.

Defective bins are either shunted out into a siding or lifted off by the navvies and a crane. Defective bins that can travel will be booked by tagging the bin, marking the bin ticket and advising the traffic office. This must be done so when the bin gets tipped it will be shunted to the truckshop. Mills that have fully automated bin checking and tippler arrangements, like Isis, would see a defective bin noted in the computer system and then automatically shunt it out to the truckshop after it had been tipped. Defective bins that couldn't be railed due to a broken buffer (coupler) would be either repaired by the navvies on site or trucked back to the mill. In some extreme cases the bin might be totally stuffed and the contents tipped onto the ground for reloading into another bin by a front end loader.

Integration with the 'Railway'

In the next issue we'll look at interactions with the government owned Queensland Railway system, especially where the 2' gauge cane railways cross the 3' 6" system.

ABOVE: Mackay Sugar: interior of a Clyde DHI-71 cab with train controls, September 1990. The coiled cord for the loco's radio handset is just visible below the upper control panel. Lynn Zelmer photographer.

Acknowledgments and References

Loveday, EM (undated but describing his WWII experiences). 'Adventures in Paradise', likely in an AMRA publication, c 1997. From the Ted Ward Collection.

While hopefully no details have been lost, some images have been quite extensively restored in Photoshop to obtain a publication quality image.

Further information can be found in pervious issues of Narrow Gauge Downunder and on the CaneSIG (www.zelmeroz.com/canesig) or Modelling the Railways of Queensland Convention (QldRailHeritage.com/mrqc) web sites. Additional photos are available in the rail heritage image collection (www.zelmeroz.com/albumquery/_search.php/).

BELOW: End-of-rake markers come in a variety of styles, this triangular end-of-rake marker is on a rake of full bins, likely behind Mackay Sugar's 0-6-0 DH #54 Oakenden (Com-Eng FB3169 of 1963), 25 August 2005. Jonathan Bayliss photographer