The Upfield railway line
safe-working system: a
unique heritage

David Moloney

David Moloney is a part-time conservation officer with the National Trust of Australia (Victoria). David is also a freelance historian working in heritage, planning and research of mining contamination. He has also written church and environmental histories. His father was a railway signalman for many years.

Until last year the safety of the southern portion of the Upfield railway line, just four kilometres from the centre of Melbourne, was governed by the application of human muscle-power to 19th-century mechanical gear.

The Upfield railway is an exceptionally concentrated precinct of 19th-century railway buildings which includes an outstanding aggregation of safe-working structures. The National Trust argued that the railway was the most intact example of British 1880s style manual safe-working operation remaining in Australia. The railway included some successful Victorian inventions, and equipment which is rare or no longer in existence outside Victoria (including in Britain).

Before the railway's modernisation, a 3.3 kilometre section of line contained five sector (wheel operated) wooden gates and signal boxes, nine manual wooden gates and 14 somersault semaphore signals, some with archaic wooden posts and kerosene lamps. Much of this heritage was concentrated in the southern 400 metres of the precinct.

The Upfield line was essentially a 19th-century Winters double line block and interlocked safe-working system. As a train proceeded along the 'blocks', into which the line was divided for safe-working, a succession of signalmen and gatekeepers telegraphed bell codes to their colleagues, and levered rods, chains, wheels, and counter-weights into life. Wooden gates and semaphore signals, with interlocked fail-safe devices, secured the train's passage, then, with military rigour, reversed positions as it passed on.

In the age of the microchip, raw, ingenious contrivances of iron and wood creaked, clattered and crashed away, wonderfully exposed to the curiosity of any wandering youngster. The sight of gate-keepers laconically throwing the heavy gates across the path of inner suburban traffic was a glorious anachronism. (The whimsy wore off as the traffic built up, and the wait wore on.)

This dinosaur is now a skeleton. In 1998 the line was one of the last safe-working systems in Victoria to be upgraded to automatic and centrally-controlled electric light signals and boom barrier crossings. Heritage interests succeeded in preserving some non-operational relics of the system in situ. The elegant Victorian gothic stations survive of course, together with decommissioned signal boxes, gate-keepers cabins, two sets of gates and many of the signals.

The Upfield railway history

The North Melbourne-to-Coburg railway (the first stage of the present Upfield line) was constructed in 1881-84. It was built to serve the densely-populated South Brunswick (Jewell) area and the developing residential area of Coburg.

The Brunswick area was then the centre of Melbourne's clay industries, and the Hoffman Patent Brick and Tile Company and Cornwall's Pottery subsequently became important customers of the line. The railway allowed heavy clay products to penetrate distant markets. Companies established sidings and even purchased locomotives to facilitate access. Other industries included Thomas Warr and Co., which built a large bluestone grain and wool store at Moreland on the less congested northern portion of the line.
Figure 1 Brunswick Station (1888). A substantially red-brick and stucco gothic style station building identical in style to the other 1880s stations on the line (Jewell, Moreland and Coburg). The original building has a modern addition at the end, but the station is enhanced by 19th century buildings nearby, including the large Railway Hotel and licorice factory chimney stack. The large pepper tree is a typical early railway planting.

A feature of the new railway was its high number of closely-spaced level crossings. Whereas slightly later railways, such as the Collingwood to Clifton Hill, approached the difficulties of traversing densely settled inner-city areas by grade separation (a raised earth viaduct with steel girder bridges spanning the streets below), manually-operated wooden gate crossings were installed at the unusually frequent crossroads on the Upfield line. The original line had 13 of these crossings, most in the Brunswick area.

The Winters block telegraph (or a very similar block system) was installed in 1885. The line was duplicated between South Brunswick (Jewell) and Coburg in 1891-92. In 1889-92 the station yards were interlocked and four sets of sector gates installed. In the early-20th century the line was extended and electrified and services improved.

In the mid-20th century the railway declined. While it remained busy for passengers and parcels, by the 1980s services had been curtailed, closure or replacement by light-rail was recommended. Community pressure was instrumental in the decision to continue and overhaul its safe-working system, which was completed in 1998.

The railway's significant technical features

Signal Boxes
The wooden signal boxes on the Upfield line at Jewell (1889), Brunswick (1890) and Moreland (1892), were the last signal boxes in the metropolitan area to retain their original double line block safe-working instruments.

The Winters block instruments are believed to remain within the Heritage Victoria registered signal boxes but some may have been removed for spare parts. The few remaining sections of the Winters block system in Victoria are scheduled for removal.
The gate wheels and signal frames survive. (See figures 2 and 3)

The Upfield signal boxes are of additional significance for being fitted with both types of mechanisms extensively used on the Victorian railway system — the A-pattern tappet (Jewell) and the rocker frames (at Brunswick and Moreland).
The Jewell cam and tappet type, although similar to those in NSW and Britain, is particularly interesting because it is thought to have been designed by Victoria Railways. Jewell is the last box of this type to keep its original double line block working instruments in the metropolitan area.

None of the rocker type survive in Britain. Although most of the levers and interlocking were removed from Brunswick and Moreland as the goods sidings were closed down, these are standard and could be reinstalled.

The Jewell and Brunswick boxes have the earlier king post barge treatment. The Moreland box has scalloped bargeboards, now rare (and possibly unique) in Victoria. All the boxes have been boarded up in a rather unsightly manner and without occupants their windows have been targets for vandals. The brick Coburg signal box (1928) is a good example of the later power style signal box. A similar box, Anstey, built 1927, was demolished in 1998.

Gates

Before 1998 the Upfield railway was the only known line in Australia with both hand- and wheel-operated interlocked gates operating. In addition to many manual gates, the line retained now rare examples of standard McKenzie and Holland sector gates and the last example of Cottew gates known to survive anywhere.

Boom barriers have now replaced the last interlocked sector gates at the Jewell, Brunswick, Anstey and Batman signal boxes. Although the gates have been removed, the connections between the Union Street signal box and the sector gates remain. Apart from Lydiard Street in Ballarat (which will be altered for power-assisted semi-automatic operation) and Kyneton (whose future is doubtful), Victoria has no other interlocked sector gates. None are known to regularly operate elsewhere in Australia or Britain.

Figure 4 Gatekeeper's cabin and gates before decommissioning. The gatekeepers were a part of the social life of the community. Some had planted trees and gardens behind their cabins.
The locally invented gate-stop mechanism in the middle of Gaffney Street, Coburg, is all that remains of the Cottew gates since the Upfield line’s upgrade. The Cottew gates will be donated to the railway museum at Williamstown.

The National Trust hoped at least one would be kept, perhaps in a condition capable of occasional operation for demonstration purposes. Street closure was the most likely means to enable this, but the local community did not support the idea.

The removal of the Cottew gates at Gaffney Street is unfortunate (see figure 5). None are known in Australia or overseas. Thankfully, the gates are on their way to the Australian Railway Historical Society museum at Williamstown.

The Cottew gate is thought to have been invented in Victoria. The design, a significant improvement on the standard McKenzie and Holland type, did not feature in British pattern books. The whole of its driving mechanism consisted of above-ground rodding, enabling much cheaper installation, maintenance and repair. By contrast, the driving parts of the McKenzie and Holland design were contained in a 1.5 metre deep brick well, and the road had to be pulled up to carry out repairs.

The first Cottew gate was installed on the now defunct Kew line in c.1890. Nearly half of the interlocked wheel-operated gates built in Victoria were of this type. However, the standard McKenzie and Holland type continued in use at multi-rail crossings where very long gates were needed, space was limited, and the road crossing had a large skew to the rail.

Another significant heritage feature of sector gates are the gate-stop mechanisms in the middle of the roadways (see figure 5). These pins, which rose and dropped in concert with the gates, were invented by Victoria Railways signal engineers Herbert and Wion. They are now very rare — those associated with the Gaffney Street Cottew gates survive.

The Upfield railway’s manual ‘weigh and works’ type gates are an even older type. Once common, they are now exceedingly rare. The only set of hand-operated gates
still operating in Victoria is at New Street, Hampton. None are known to operate in Britain. Street closures have enabled two sets of these gates to be kept on the Upfield line at Barkly and Reynard streets (see figure 6). These gates survive in their original form, although the associated pedestrian gates have been modified.

At Park Street the gates have been cosmetically re-erected beside the new boom barriers. All of the early gate-keepers cabins, an interesting feature of the crossings, have been retained (see figure 7)
Signals
Semaphore signals are a key part of the historic safe-working system, with gates and signal boxes, integral to the aesthetic character of the railway precinct. The position of signals also demonstrates the operation of the railway (its crossings, former sidings etc.).

The Upfield railway was the only remaining example of the high-density suburban signalling implemented in the late 1880s-1910. It remains a highly important ensemble of a century of improvements in semaphore signal technology. Some of these developments were local (Victorian) inventions. Nine of the 14 decommissioned semaphore signals on the line have been retained, mostly by moving them a few metres back from the track, and turning them 90 degrees (see figure 8 and 9).

Somersault semaphores
Virtually all the signals on the line were somersault semaphore signals. The pivots of somersault signals are situated towards the centre of the semaphore rather than the end, enabling a counterweight to automatically return the signal to 'danger' upon failure. The system was developed as a response to an early railway disaster in England, when the weight of snow made the signal show the line clear. McKenzie and Holland began producing the signals in Victoria in the early 1890s. They were used throughout the Victorian system. Western Australia and Tasmania were the only other Australian railway systems to adopt these signals. A few may still operate in Western Australia. Despite their importance, Britain has only seven left.

Home and distant signals
Home and distant signals on the same mast are a result of short block sections, generally in inner-urban areas, where they were once common. Before the upgrade, the Upfield line had six of the eight signals of this type in Victoria. The distant's were all...
Fixed at Proceed With Caution by this time — three survive. (See figure 8.)

The colour scheme of these signals is also rare. When the distant signal is on the same mast as the home signal, the distant signal is red with a white chevron, rather than the normal design, yellow with a black chevron.

**Mast types**

The Upfield line was almost certainly Victoria's best collection of masts from different periods: wooden (? - c.1910); riveted lattice (c.1910 - late-1950s/early-1960s); tubular pipe (used in the 1920s); batten (c. 1960s - ?); and tubular (currently used for light electric light signals).

Of the five 19th-century timber masts on the Upfield line, three have been kept. These masts are now exceedingly rare. Until recently a few were lit by kerosene lamps.

One of the signals is also highly significant for its 'spectacle' glass (the red and green lights shone at night). It is the last known example of the 'bottle green', the original spectacle colour used in Victoria (see figure 10). No other example is known in Australia, and it would be wise to remove it to a museum for security. The line contained all the variations of signal spectacle colours used over the years, from bottle green to grass green to turquoise blue.

A tubular pipe signal mast with an elongated metal finial (compared to the onion-shaped finial on modern pipe masts), almost certainly a rare 1920s type, has been removed.

The line's sole surviving ground-disc signal, used to control the sidings now all removed from the line, was also removed. Victorian ground-discs, now scarce, were different in design (and operation) from those used in New South Wales and South Australia. They may not survive (or even have been used) in Queensland or Western Australia.

**Drop-off slot controllers**

Drop-off slot controllers are a unique feature of the Upfield precinct. They are a mechanical fail-safe device of levers and welded weights at the base of signals which ensured the line was cleared at different points before the signal could be cleared.

Levers were operated at either two signal-boxes or two gatekeepers' ground frames, or at a signal box and a gatekeeper's ground frame, for a signal to clear. The operators had to clear at least one of the Upfield signals by way of these 'slots'. (See figure 11.)

Although this type of mechanism was once common, no other signals of this type are known to remain in Victoria. There were 10 'slot' signals in the heritage precinct of the Upfield line before upgrading — six now remain.

**Reid's patent reverser**

The signal on the Upfield line fitted with a Reid patent reverser has been kept beside the line. The reversers are becoming much less common in Victoria — the metropolitan area has only a few.

W. Reid invented this device in 1907. The device was also adopted in South Australia and New South Wales, where it is thought to be still in use. It is one of very few.
Australian signal inventions adopted in more than one state.

The purpose of the device is the same as the drop-off slot controller, but it is electric and contained in a box attached to a signal mast. It is integrated into the track circuit and representative of the developing automation which has completely replaced the original suburban safe-working systems. (See figure 11.)

**Motorised signal**

The lower quadrant motorised mast on the Upfield railway line was removed in the recent works. Again, motorised signals, relatively common a few years ago, are becoming scarce in Victoria, especially in the metropolitan area. This may well have been Victoria's last motorised home signal.

The shorter distances between signal stations on the Upfield line meant signals could be physically controlled from signal boxes, with less need to use electric motors. Nevertheless, this signal represented another significant development in semaphore signal technology.

**Some conservation issues**

The Heritage Victoria registration of the Upfield line has enabled some of the most important heritage elements of the line to be preserved. Recently, a permit was refused to demolish the vernacular goods shed on the Jewell station. In addition, the former operation of the safe-working system has been documented on film.

However, efforts to preserve the Upfield line were hindered by the absence of an inventory or typological assessment of railway signals, gates and safe-working in Victoria. As a result, there was little knowledge about comparable fabric, limited understanding of the finer points of technical significance, and insufficient appreciation of the crucial inter-relatedness of the safe-working components under consideration. The initial assessment of the line was conducted in parts. For example, signal boxes and gates were assessed independently from the signals. Victoria's remaining safe-working heritage still lacks a typological study.

Perhaps the most significant features of the Upfield line are the least visible — linkages between components and the interlocking. The rodding, cables, chains and telegraph wires are in a sense the essence of this safe-working system. Developed in the late-19th century, this system represented a major improvement on the original 'time' based safety system, which did not use communication between signal stations or interlocking.

The chains could be reinstated at the bases of signals. Full reconnection of a few of the signals near signal boxes would enable occasional demonstration and a proper understanding of the surviving heritage relics. (Even if the opportunity is unavailable at present, saving the fabric while it is still available should be considered). The Heritage Victoria registration should ensure that signal-box interlocking mechanisms are retained in working condition.

Interpretation is also needed. Without interpretation, the line's technical heritage features can only be superficially appreciated. Interpretation also demonstrates the heritage fabric (especially the vulnerable wooden gate-keepers cabins) is appreciated.
and would help protect it from neglect and vandalism.

Other conservation details and ongoing maintenance require attention. For example, a few ladders still provide access to signal masts facilitating the theft of semaphores, lamps etc. by unscrupulous railway enthusiasts. More picket fencing could be reinstated around some of the gate cabins. Hopefully, a heritage clause will be incorporated into the contracts for the ensuing privatisation of the line.

*The author would like to acknowledge the technical and historical information provided by signalling historian Andrew Waugh and railway historian Andrew Ward.*