The Ballarat Railway Station and Yards
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SUMMARY A discussion of the various engineering aspects of the Ballarat railway station and yards is given. In particular the roof structures of the train hall and carriage sheds, the lattice girder pedestrian overbridge, historic trackwork, and the mechanical signalling system in the Ballarat area.

1. INTRODUCTION

The Ballarat railway station and its associated yards, has been in existence since 1862 when the railway was extended from Geelong to Ballarat. The station building has been commented upon by such famous people as Anthony Trollope and Mark Twain, for its architectural style and grace, typical of some of the more famous stations in England at the time. It's clock tower, which only recently received a clock, is a well known landmark, and it's booking hall was recently (1983), restored to its nineteenth century glory after a disastrous fire in 1982 which nearly saw the station demolished. Figure 1 shows the station viewed from the west.

Figure 1. Ballarat Railway Station

But for all its architectural attributes, which are there for anybody to see, it is the station, and the railyards, nineteenth century engineering significance that this paper is presenting.

2. THE TRAIN HALL AND CARRIAGE SHEDS

The original station built in 1862 consisted only of the train hall with no significant attached buildings, these were added between 1888 and 1891. The clock was not installed in the tower until 1984.

Figure 2 shows a general internal view from the east of the train hall which once spanned four tracks, but this has now been reduced to three to give greater side clearance for trains. The overbridge can be seen connecting the two platforms.

The contractors for the train hall in 1862 were Samuel Ames and Co of Melbourne, with the structural design of the roof frames done by Ames.

The roof trusses span 85 feet and are basically triangular girders with elliptical lower chords of fabricated wrought iron using rolled sections and flat bar. The top compression chords consist of 8" x 5/16" flat bar sandwiched between two 3" x 2" x 1/4" angles, and the lower tension chord tie bars being two parallel 5" x 1/4" flat bars. The compression diagonals are of 3" x 3" x 1/2" T section hot riveted to the chords. The tension verticals are of 3/4" round rod at the outer frame, increasing to 13/16" and 1.1/16" at the centre. All verticals are pin jointed to the tie bars and the girder top chords.

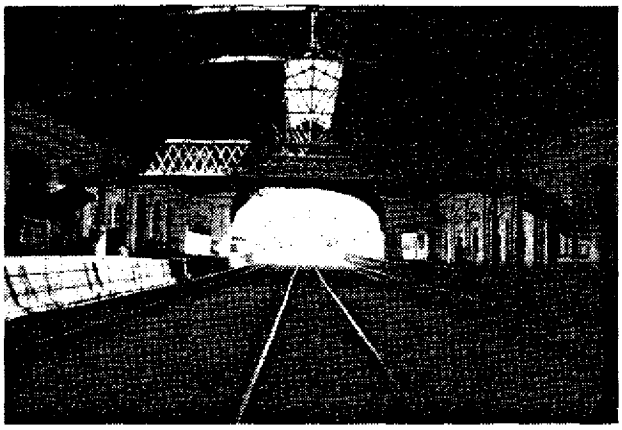

Figure 2. Train Hall and Overbridge

There are 17 roof frames spaced over a 240 ft length and are braced longitudinally with 13/16" wrought iron rod diagonals and lower horizontal bars, all pin jointed. Figure 3 shows the general arrangement of the roof girder frames, and figure 4 the bracing.

In figure 4 can also be seen the roof purlins and roof lining. The purlins are of 3" x 3" x 1/2" T section wrought iron and use diagonal bracing with a forged compression spacer at the centre of each purlin span. Close inspection of the spacers on all purlins will show considerable bending at the root due to the tension in the bracing. The roof cladding consists of 6" x 3" oregon rafters with chamfered edges supporting baltic pine lining, on top of which was laid the outer skin of slate tiles. The current skin consists of corregated iron on the north roof face, and the (mostly) original tiles on the south. The pine lining constitutes a stressed skin which gives great in plane rigidity to the roof. The grubby appearance of the roof lining is due to

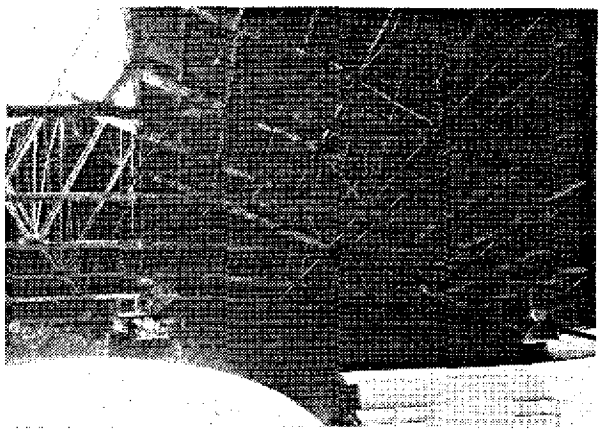

Figure 3. Train Hall Roof Frames

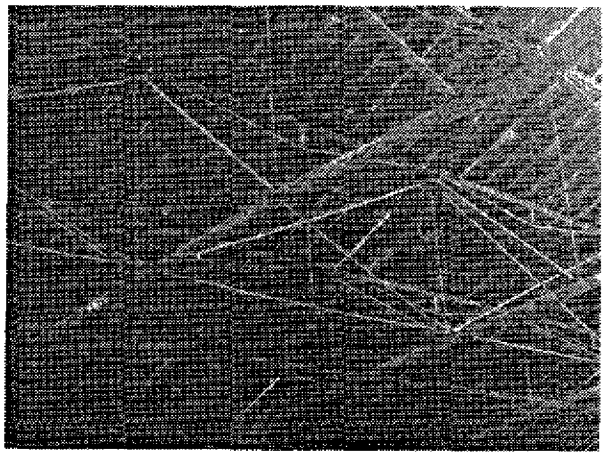

Figure 4. Train Hall Purlins and Bracing

100 years of steam engines and the fire of 1982.

The roof girder frames are supported by a pair of cast iron sliding bearing plates at each end, the lower plate being moulded into the masonry platform walls. The plates are not visible as they were encased within the walls to form a parapet above the outer building roofs.

Figure 5 shows details of part of the roof girders where the braced purlins connect to them. (The rather poor quality of this figure is due to it being a direct photo copy of the drawing by Ames of 1862 on linen).

The use of wrought iron fabricated roof frames with pine roof lining and slate covering produced a very light and open train hall roof which is both structurally sound and aesthetically pleasing.

Figure 6 shows the structure of the carriage sheds located directly to the south of the main station building. The sheds are of solid blue stone and they too are aesthetically pleasing as is the station.

The roof frames for these sheds are of similar structure to the main train hall, but being of much smaller span, 50 feet 4 inches, the lower tension chords are of 1.3/8" wrought iron rod at the end sections, and 1" rod at the centre sections, rather than flat bar. The top chords are of 4" x 4" x 1/2" T section iron, the compression members of 3" x 3" x 3/8" T section, and the verticals of 5/8", 3/4", and 1.1/4" diameter rod. Again the roof structure is given in plane rigidity by the use of pine lining, which here is in much better condition than the train hall.

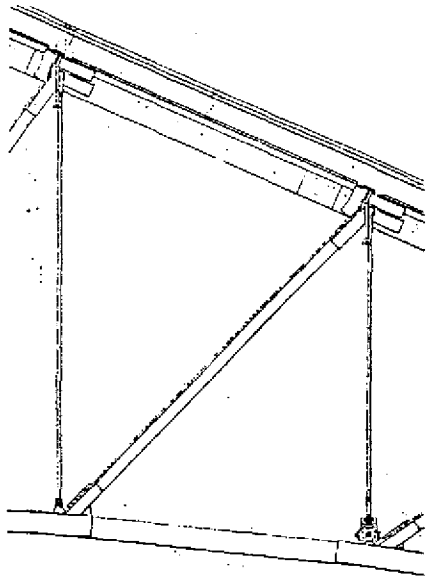

Figure 5. Bracing Joint to Roof Frame

Figure 6. Carriage Shed Roof Frames

The cast iron bearers for the roof frames are shown in figure 7, into which the framing members are rigidly clamped. The bearers are then pinned to the blue stone walls.

3. THE PEDESTRIAN OVERBRIDGE

The pedestrian overbridge connecting platforms one and two was not constructed as part of the original train hall, but was added in 1877 by C.N. Retallack and Co. The bridge is a true through type lattice girder bridge with all of the diagonal members taking load. Figure 8 shows part of one of the two girders forming the bridge.

The main compression diagonals are formed from 3" x 3" x 3/8" wrought iron angle, while the tension members are of 2" x 1/4" flat bar. All joints are hot riveted. The top compression chord is of 7" x 3.1/3" x 1/2" channel, and the bottom tension chord is a compound member formed by 65 lb. rail riveted to the centre of a 12" wide, 1/2" plate, with 3"

angle iron riveted to the plate edges. The footpath bearers are formed from an unknown hardwood supported on diagonal angle irons joining the girders on each side of the walkway. The walkway is currently asphalt covered. The complete bridge rests on four decorative cast iron pillars set into the platform, figure 9.

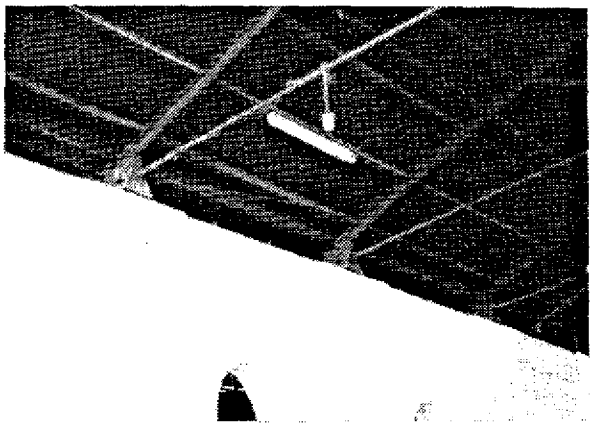

Figure 7. Cast Iron Bearing Plates

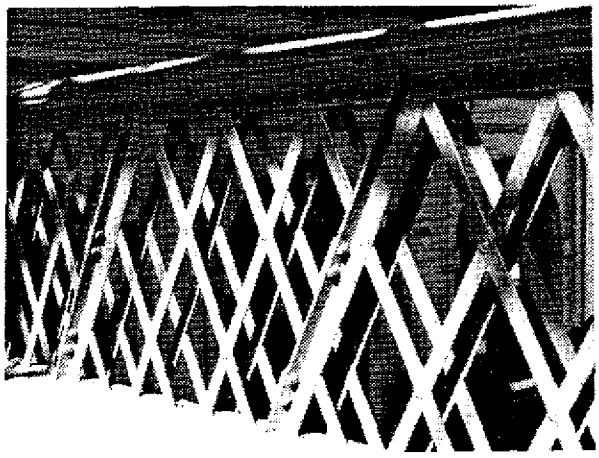

Figure 8. Overbridge Girder Detail

The stairs at each end are supported by decorative cast iron side plates into which the still original, though well worn, baltic pine steps are let.

4. TRACKWORK

The original line from Geelong to Ballarat was built by the contractors Evans, Merry and Co., but later transferred to Williams, Little and Co., for completion. The line was constructed to the prevailing English standards of the time but of broad gauge (1600 mm), double tracked using double headed, bull head, wrought iron rail imported from England. As track replacement proceeded in later years, the now standard flat bottomed steel rail was substituted.

Four mainlines lead into Ballarat from Melbourne, Geelong, Maryborough (Mildura line), and Adelaide, with additional branch lines in the past from Buninyong, Skipton and Cressy, and Waubra and Daylesford on the Maryborough line.

The main western line through Ballarat is currently double tracked from Warrenheip Junction, 6 km to the east, and Linton Junction, 4 km to the west. Current plans for the tracks west of Ballarat are for the current UP line (Northern track) to be the bi-directional main line, with the current DOWN line (South track) to be a service line to various industries to the west of Ballarat.

Figure 9. Overbridge Pillars

Within the Ballarat yard, separate running lines provide a connection between the station and loco depot at Ballarat East. Carriage sidings are located on the south east side of the main station with the goods and marshalling yards to the north.

The railyards at Ballarat developed in various stages to the situation which existed up until mid 1991 when track changes for fast freight handling and signal modernisation began. Figures 10 and 11 show the old layout of the yard up to 1991 as viewed to the east and west respectively from the main signal box.

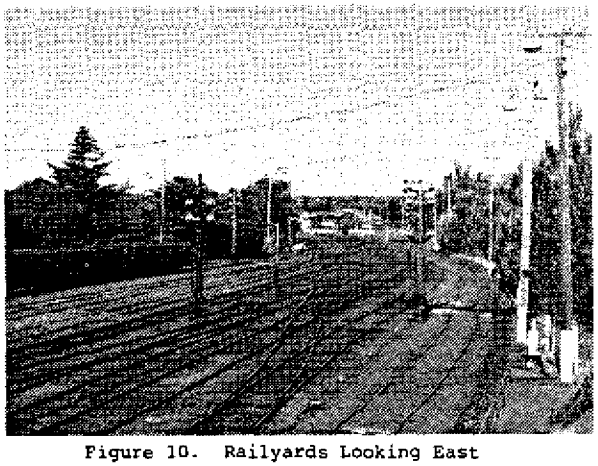

Figure 10. Railyards Looking East

One aspect of great historical interest is the existence of some original bull head rail supported in cast iron chairs leading into the southerly of the two carriage sheds. But of even more significance, is the mounting of this rail on longitudinal sleepers. The rail, chairs and sleepers are shown in Figure 12. The current bull head rail is of a later date than the original track, and is of Blaenavon steel from Wales.

Longitudinal sleepering was used by I.K. Brunel on the Great Western Railway in England in the late

1830's, and forms a very stable and smooth riding track, but it was gradually superseded by cross sleepering due to the high capital and maintenance costs of longitudinal sleepers.

Figure 11. Railyards Looking West

The example still in existence in the Ballarat railyards was in use up until 1987, but was cut off from the yards with some rationalisation and redesign of the carriage shed area after then. It is thought that this example of bull head rail is one of the last remaining examples in Australia.

Figure 12. Bull Head Rail

5. SIGNALLING SYSTEM

There are five signal boxes controlling the Ballarat area, beginning from the east these are the Ballarat East Box, A Box, B Box, C Box, and D Box. Figure 13 shows Ballarat A Box, and figure 14 a typical somersault type semaphore signal, No 21 controlled from A Box. All the lever frames in the Ballarat boxes are by McKenzie and Holland.

The area at the time of writing contains the largest remaining concentration of operating mechanical signals in Australia with each signal box communicating via bell codes and block signals.

Ballarat East Box is located at the eastern end of the railyards and has 39 levers with rocker type interlocking gear and was installed in 1886. This box also has gate operating gear for the currently two sets of gates protecting Humffray Street. In the new signalling plan these gates will be removed and replaced by automatic barrier gates. Ballarat East Box controlled the Buninyong line junction, which was closed in 1946.

Ballarat A Box is situated centrally on the southern edge of the yards and has 118 levers with tappet interlocking. A Box controls all the yard movements including main line, carriage and engine sidings, and freight siding entry to the main lines. Figure 15 shows the tappet interlocking gear below the operating floor of the box. Many of the levers in this box are currently out of use and others are progressively being removed from use as the track modernisation occurs. The current lever frame was installed in 1910. The yard views in figures 10 and 11 were taken from A Box.

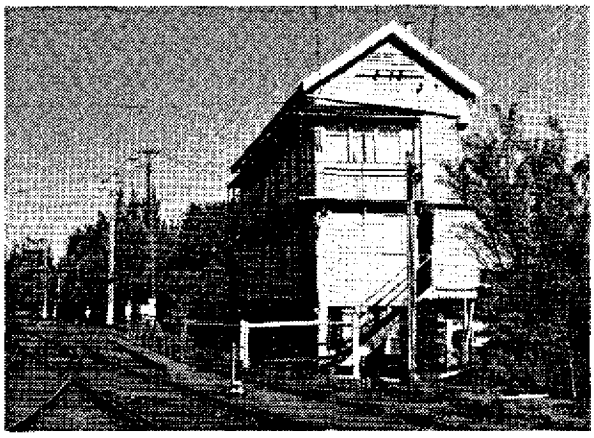

Figure 13. "A" Signal Box

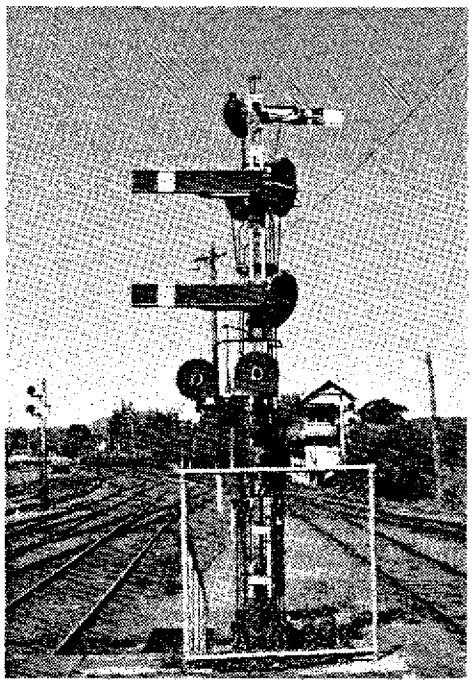

Figure 14. Starter Signals, Platform 1

Ballarat B Box, located at the western end of the station area, and controls entry and exit from the yards to the western main lines. The current B Box equipment was installed in 1885, has 35 levers, is rocker interlocked, and is a rebuilt McKenzie and Holland model 5a. Figure 16 shows the rocker interlocking gear below the operating floor. D Box controls the controversial Lydiard Street gates which V/Line wish to replace with automatic barriers, but Ballaarat City wish to retain to enhance the heritage streetscape of Lydiard Street.

C Box is located approximately one kilometer to the north-west of B Box and controls the Maryborough junction with the main western line. The

Maryborough line is single tracked and an electric staff controls entry and exit from this line. C Box equipment was installed in 1886 and has rocker interlocking gear. It also controls the Macarthur Street level crossing gates.

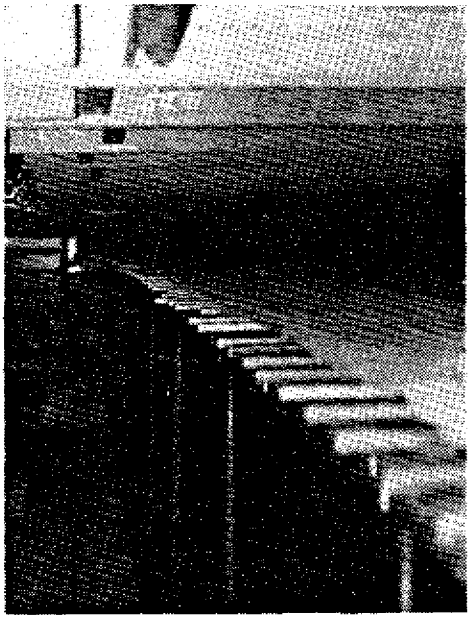

Figure 15. Tappet Interlocking Frame

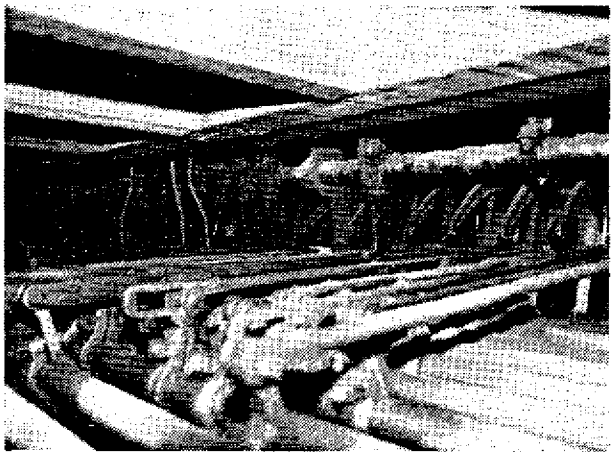

Figure 16. Cam Interlocking Frame

D Box is located about 3 kilometers further west of C Box and is the final box in the system. It controls entry and exit to the single track main line to the west (Adelaide), using electric staff authority from the dual Ballarat track network, it also controls the junctions to the Ballarat cattle yards and the disused Linton line. There are also two industrial sidings controlled from this box. D Box was installed in 1890 with 30 levers and rocker interlocking. It also controls the Gillies Street level crossing gates which are currently being replaced with automatic barriers.

The modernisation of the Ballarat rail system will see all the signal boxes replaced by a centralised control system using colour light signalling within the next year.

6. CONCLUSION

Although in about a years time the signalling system in the Ballarat area will be totally replaced with a centralised traffic control system using the latest colour light signals and communications systems, the other historical aspects of the railyards will remain well into the foreseeable future. The Victorian Government and V/Line have been approached regarding the preservation of the longitudinally sleepered, bull headed rail, and this has been placed on the historic buildings register. There is a rumour that the lattice girder overbridge in the train hall is to be removed with upgrading of the running lines to higher speed and greater clearance, but this has not been substantiated. The station building will remain for a long time yet, but it does require some cleaning and maintenance. Hopefully this will not be an excuse for the government to remove the train hall roof at a later date.

Although the signalling system and boxes are to be removed, V/Line has agreed that Box B at the Lydiard Street crossing will be handed over to the Ballarat Historical Society for preservation. This will include the lever frame, interlocking gear, and some representative mechanical signals. Unfortunately from the historical point of view, it would appear that the associated level crossing gates will be removed; but these too have been offered to the Historical Society, and V/Line are willing to leave them in place, but folded back to the footpaths and inoperable.

Despite the modernisation of the running lines, many historical aspects of the Ballarat railyards and station will remain accessible to the public for many years yet, and will hopefully fulfill both a general, and engineering history function.

7. ACKNOWLEDGEMENTS

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