October, 1962.

BALLARAT TRAMWAYS - TRACKS

HISTORY.

Electric trams commenced running in Ballarat in August, 1905. Routes were the same as present ones, with the exceptions that Lydiard Street North route terminated at Gregory Street, and the Mt. Pleasant route terminated at Gladstone Street. The Sebastopol route was electrified to Rubicon Street in 1911, and finally to the Queen Street terminus in 1913.

With the exception of the Sebastopol line from Rubicon Street to the terminus, the tracks were constructed with 83 lb., 90 lb., and 96 lb. grooved rails, laid on longitudinal concrete stringers - 18 inches wide by 6 inches deep - and the intervening spaces between rails, plus 18 inches outside the rails were paved with blue stone setts. The portion of the Sebastopol route mentioned above was constructed of secondhand 70 lb. tee rail (from the horse tram routes) on wooden sleepers with open ballast.

In 1930, a report from the Electric Supply Co. of Victoria (the tramway owners of that date) to the State Electricity Commission, during acquisition negotiations, estimated the remaining life of the rail in the system, to be 15 years.

During the years 1934 and 1937, after the S.E.C. had acquired the Tramways Undertaking, major re-construction of the tracks was carried out at a total cost of £106,000. This re-construction consisted of re-laying all tracks on wooden sleepers, with the exception of a portion of Lydiard Street, at the City end. Subterranean track drains were constructed along all routes, except the open ballast section of the Sebastopol route from Rubicon Street to the terminus, and the portion of Lydiard Street not constructed on sleepers.

The Lydiard Street route was extended from Gregory Street to Norman Street, and a loop line was constructed at Grenville Street. Approximately 23% of rail was replaced with 80 lb. B.H.P. tee rail and bolted check rail. The tee rail along the open ballast section of the Sebastopol route was reversed during re-construction, to bring the worn inner portion of the rail to the outside, thus allowing the previously unworn edge of the rail to accommodate the flanges of tram wheels.

The portion of Lydiard Street, (from the railway crossing to, and including the Sturt Street intersection) referred to above, as not having subterranean track drains, was re-constructed with a concrete platform 6 inches thick, and the width of track plus 9 inches each side. Transverse wooden sleepers - 4" x 4" - were set in the concrete every 8 feet, and the flanges of the rails were dog-spiked to them. The concrete platform was then topped with blue metal, and road surface sealed at the level of the top of the rails.

A large quantity of special work in the system was replaced during re-construction.

PRESENT CONDITION OF TRACKS.

"What is the life of the rails in the Ballarat system?" This is one of the most difficult of track problems, and it is not possible to answer it, with any degree of accuracy, because of the numerous factors which enter into the causes of rail wear. Such factors are, grades and curvature of the route, the weight, design and mechanical condition of the trams, operating speed, the number and location of stopping places, the frequent use of brakes, stability of rail foundations, weather conditions, and the design and composition of rails and wheel tyres. The rate of wear varies throughout an individual system, as it does with different tramways systems.

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PRESENT CONDITION OF TRACKS (Cont'd.)

The 70 lb. tee rail in the open ballast section of the Sebastopol route is at least 69 years old. Some records refer to it as secondhand rail, when first laid for the horse tram route in 1893. The 83 lb., 90 lb. and 96 lb. grooved rail in the system is 57 years old, and the 80 lb. tee rail with bolted check, laid during the re-construction period, has been in service for 27 years.

The attached drawing shows profiles of heads of rails at various locations (chosen at random) throughout the System, compared in most cases with the profiles in the same locations in 1954, and again compared with the original profiles of the rails. The amount and variation in rate of wear can be appreciated from these comparisons.

The amount of wear and subsequent weakness of the rail has greatly reduced the safety of a rail system charged with the responsibility of transporting the public. An even greater factor in this regard is the corrosion which has taken place over the years to the feet and webs of rails in the system, and the insecurity of rail fastenings because of this. The instability of the track foundations and the constant water problems in many locations further contribute to the possibility of a major disaster through rail or track failure.

This problem of rail instability is evidenced by the fact that 80% of the track maintenance expenditure each year (which was £12,000 in 1961/62) is taken up with sleeper packing, tightening rail fastenings, and repairing road surface broken and distorted by movement of rail and/or foundations.

Special work throughout the system is also considerably worn. Over the years many crossovers and open mates have been replaced with fabricated work, and although no switch castings have been renewed, they have always been well maintained. The age and structure of the metal in these castings is making maintenance increasingly more difficult, and the replacement of many of these more complex and costly pieces of special work will soon be necessary.

The accompanying photographs show the condition of rail and track in the system, and some of the problems facing the Track Maintenance Staff.

Photo. 1 shows the wear and corrosion that has taken place on a piece of 83 lb. grooved rail removed from the Sturt Street track - north side - opposite the Post Office. The original height of the rail was 6⅝ inches, and the width of the foot of the rail has corroded from 6 inches to 4-15/16 inches, with more than a 50% reduction in the original thickness of the foot in some places.

Photo. 2 shows corrosion on the foot of another piece of rail, which has considerable 'life' in the ball of the rail. The original dimension from the side of the web to the outer edge of the foot was 2¼ inches.

Photo. 3 taken on the Sebastopol route near Sayle Street, shows the result of insecure rail fastening, unstable foundations and the effect of water on ballast and filling, when sleepers and rail 'pump' with each passing tram. The tyre flanges now run on the left hand side of the rail in the photo. The worn portion on the right is flange wear, prior to the rails being reversed during re-construction.

Photo. 4. The effect of water being 'pumped' by loose sleepers and rail can again be seen in this picture, taken just north of Vickers Street on the Sebastopol route.

PRESENT CONDITION OF TRACKS (Cont'd.)

Photo. 5. Because of the corrosion of rails and the impossibility of being able to prevent movement, road surface breaks away, allowing water to enter, continuing the corrosion process, and allowing a break down in the solidity of the foundations, thus creating further movement and a continuance of the cycle. (The condition of the rail is clearly shown here also - worn check, wide groove, and swaged and broken outer edge of the ball of the rail.
Photo 6 - an illustration of distorted road surface due to rail movement and water action

Photo. 7 shows the same problem in Lydiard Street opposite the 'Regent' Theatre. This section is constructed on a concrete platform mentioned earlier in the report, and has no subterranean track drains.

Photos. 8 and 9 taken in Main Road and Lydiard Street North, respectively, are further examples of road surface damage due to rail movement, and also show a constant hazard to motor vehicle tyres, in the form of slivers of steel from the swaged portion of the ball, on the outer sides of the rails.

Photo. 10 shows the switch casting at the South end of the Mill Street loop. The worn portion left of centre of the picture is shown closer up in Photo. 11. This wear is caused by the tyre as it leaves the ball of the rail, and is fully borne by the switch blade as a tram enters the points. Photo. 12 is another typical example of this, at the Bell Street loop, north end. Continual building up with weld metal, without being able to pre-heat or stress relieve satisfactorily in situ, finally alters the structure of the parent metal, and cracking and fractures occur. These cracks can be seen in Photo. 13 of the crossover, at the north end of the Bell Street loop.

The rail profiles, and photographs used to illustrate the facts contained in this report, are not the worst examples in the system, but locations chosen at random, in an endeavour to show that the <u>entire</u> track system has reached a stage where nothing short of major rehabilitation would return it to the safe standard it should be.