

GEOLOGICAL REPORT ON THE RAILWAY TUNNEL AT  
RHYNDASTON

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The tunnel is situated a short distance to the south-east of Rhyndaston, a station on the main line railway from Hobart to Launceston. It has a length of approximately three-quarters of a mile and a general north-south bearing.

The rocks through which the tunnel has been driven belong to the lower or Ross sandstone series of the Triassic System. The principal rock types are sandstones and mudstones. The sandstones are fine to medium-grained, and consist almost wholly of grains of quartz sand with smaller amounts of clayey material and flakes of mica. In several localities in Tasmania particular beds are saliferous and contain common salt and epon salts, and it is possible that all beds contain a small amount of these minerals. The sandstones show a large range of structures as regards their bedding planes. Massive beds with the bedding planes several feet apart are common. The other extreme is represented by the thinly bedded, and in fact almost shaley beds. There are, of course an almost complete range of structures from the thickly to the thinly bedded sandstones. In addition to the regular bedding described above, current or false bedding is very common. In the current bedded parts the beds are thin (average about three inches) and the bedding is inclined at angles ranging up to 25° from the normal bedding.

Some of the sandstones are very fine in grain and are so thinly bedded that they resemble shales.

The mudstones consist mainly of clayey material. They are well-bedded without being shales and are also well jointed.

The normal bedding of the above rocks is horizontal or at very small angles thereto. If there is any departure from the horizontal, in the northern part of the tunnel, the dip is to the north, and in the southern part it is to the north east. At the southern end there is a steeper dip of some 20° to the south-west, but it does not appear to persist far into the tunnel. The tunnel has a uniform down-grade from the northern to the southern end.

The object of the examination was to ascertain the state of the roof thereof, as a few small lumps had recently fallen. There are two possible factors which might endanger the safety of the tunnel, and these will be discussed separately below:-

1. Geological Structure -

The tunnel was constructed with vertical sides and an arched roof, and, except for the two ends and three places of apparent weakness where brick-work was built in, it is unprotected. Thus the geological structure is largely instrumental in determining the strength and safety of the roof of the tunnel.

The thickly bedded sandstones form an excellent roof and fortunately a considerable part of the tunnel is composed of these rocks. These rocks enable a good arch to be given to the roof and having few bedding planes and joints are generally strong.

The thinly bedded sandstones do not form such a good

roof as the thickly bedded ones. The bedding planes divide the rocks into a number of slabs ranging in thickness from two inches upwards. This structure makes it difficult to construct an arch and when constructed it is not so strong as the above. The weakness is due to the outermost slab becoming, as a result of several factors, weakened and detached from the others and finally breaking.

The ordinary effect of exposure to the atmosphere is quite sufficient to bring this about and is probably one of the most important factors in producing it. Another factor which probably helps the process is the exhaust steam and smoke from the locomotives. The effect of this is probably twofold consisting, firstly of a vibration set up by the force of the exhaust, and, secondly, the penetration of the steam and smoke between the different layers of rock when an entry has been made possible.

Fortunately only one thin, lenticular bed of mudstone was passed through in the tunnel. The mudstones have little strength and would form a very weak roof. In addition, they are generally well bedded and jointed and so are continually breaking away. The small bed cut has no detrimental effect on the strength of the tunnel.

## 2. Chemical and Abrasive Actions -

In some cases the Ross sandstones are readily disintegrated by chemical and abrasive actions. The chemical action would be brought about by gases or liquids capable of attacking, altering or softening the cementing material in the sandstones. The abrasive action is due to the effect dust laden wind on the rocks, when fretting and surface disintegration occurs.

It was thus possible that the hot steam and smoke with particulars of dust and gases such as sulphur dioxide, carbon dioxide, carbon monoxide &c. might have such actions in the tunnel. The examination proved that this was taking place to only a slight extent and in such a manner as not to endanger the safety of the roof.

Instead of endangering the roof the exhaust appears rather to protect it. This is due to a coating formed probably by the oil, soot etc. in the exhaust which is formed on the roof.

The examination appeared to prove that the bricks in the built-in portions have been disintegrated to a much greater extent than the rocks, as the bricks have in places been affected to a depth of at least one inch.

Near the southern end of the tunnel a few thin beds of sandstone are fretted and it appears that this has been caused by the abrasive action of the steam &c. The total result is however small and is not affecting the safety of the roof.

## Conclusions and Recommendations -

The geological structure of the tunnel and the possible factors liable to endanger the safety of the roof have been fully described above.

The effects of chemical and abrasive action are negligible. In support of this, and indeed to show how remarkably well the tunnel is preserved, it may be stated that the drill holes, pick-marks &c. which were made during the construction of it, are still clearly visible in it.

The only source of trouble is those parts where thinly-bedded sandstones form the roof. Portions of these beds or slabs became weakened and detached and will finally fall. The few small falls of rock which have taken place recently and the few places which were found during the examination to require breaking down, were all caused by this process.

This trouble cannot be prevented unless those parts of the tunnel are built in with brick work, concrete or other material. The amount of trouble is however small, and does not require this protection. It can be readily dealt with by careful examinations at short intervals (the present interval of two weeks appears to be sufficient in the present state of the tunnel) and the breaking down of an affected and damaged portion. If any particular spots should give more signs of trouble than they do at present, they should be subjected to examination at shorter intervals, and the question of covering and supporting them should be considered.

With these examinations and precautions the tunnel can be regarded as being just as safe as it has been during the past fifty odd years of existence.

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30th April, 1928.