

The Engineer

Wednesday April 13 1883

THE Malta Railway, which was opened for traffic on February 28th, is one of which some account will be found interesting. It is about $6\frac{3}{4}$ miles in length and extends from the middle of Valletta, the chief port of the island, to Citta Veechia or Notabile, the ancient capital, and the traditional residence of St. Paul during his abode on the island. Although so short, the railway possesses several features of interest, both in the nature of the works and the circumstances under which they have been constructed. Casual visitors to Malta are apt to come away with the impression that the island is a mere rocky and barren appendage to the great harbours and naval and military establishments, of which Valletta is the nucleus, and surprise has even been expressed that railways should be wanted in the island at all. As a fact, however, much of the soil of Malta is extremely fertile, and the density of the population is quite exceptional, as will be seen from the following comparative table:

	Isle of Wight	Isle of Man	Malta
Area in square miles	164	227	95
Population	56,000	55,000	133,000
Population per square mile	341	242	1,400
Miles of railway constructed	34.25	43.5	6.75
Population per mile of railway	1600	1264	21,000

Of the total population of Malta, about 100,000 are directly served by the railway, or about 16,000 per mile of line. Valletta proper is situated on a high narrow tongue of land which divides the Grand Harbour from the Quarantine Harbour. An imposing rampart and ditch separate Valletta from the suburb of Floriana, which lies at the root of the tongue. Outside Floriana is another line of rampart and ditch, which cuts off the communication with the main land. As the High-street -Strada Reale- of Valletta is the centre of all life, business, and amusement in Malta, it was essential to place the terminus of the railway there, opposite the Opera House. *see Fig. 5.*

Military and topographical conditions alike required that the level of the rails at the terminus should be some 35ft. below the level of the street, hence it was necessary to design an underground terminus. *see engravings, Figs. 1, 2, 3, and 4, page 288.* The booking-office and waiting-rooms are on the street level, whence steps conduct to the underground platforms. These, last are lighted partly by gas, and partly in the daytime by the light from the end of the tunnel station, which opens on the escarp of the main ditch of Valletta, probably the most imposing military obstacle to assault in all Europe.

The main ditch is crossed by a timber viaduct of four spans of 22ft, 6in. each, and one of 38ft., at the end of which -that is, at the counterscarp of the main ditch- the line becomes single, and enters another tunnel 913 yards in length, by which it is conducted through and under the succession of fortifications lying between the main ditch and the outside of Floriana. The tunnel is ventilated at frequent intervals by the shafts which were used for its construction. The alignment of the tunnel was settled after much consideration, in order to meet, as far as possible, the requirements of the military and civil authorities, which was no easy matter, a tunnel directly through the outworks of an important fortress being almost unprecedented. It was subsequently discovered that an ancient subterranean reservoir - the position of which had not been previously known would - be intersected by the proposed line. In order to avoid this reservoir without altering the general alignment of the tunnel, it was decided to go round it, and so the tunnel has the rare feature of a double S curve in the middle of it. The delicate operation of setting out this peculiar alignment underground was successfully accomplished by the resident engineer, so that the headings met with a difference of about 1 in. only.

At half a mile from the terminus there is a second underground station for Floriana -*see drawings, Figs. 6, 7, and 8.* At this point the rails are about 90 ft. below the surface of the ground. The long stairs necessary to reach the platform are arranged so that to make the descent and ascent as easy as possible. The line here is

single, and space for the platform is provided by increasing the span of the arch forming the roof of the tunnel on one side only. At 47 chains the line crosses a ditch and enters a short tunnel 33 yards long, crosses a second ditch, cuts through the countersearp, and at 54 chains emerges on the glacis of the outer fortifications. The tunnel is constructed on a falling gradient - towards Notabile - of 1 in 72. Thence to 31/4 miles the gradients are generally level, but from 31/4 miles to the end of the line is almost a continuous ascent, beginning at 1 in 66, increasing to 1 in 50 for the greater part of the distance and terminating by a short piece of 1 in 40 up to the entrance of the Notabile terminus, which is level. There are intermediate stations at Floriana, Hamrun, Misida, Birchircara, Balzan, Lia Attard, and San Salvatore, with passing places at Hamrun and Birchircara. The central depot is at Hamrun, where engine and carriage sheds are provided.

Land being very valuable and reluctantly parted with, advantage has been taken of the circumstance that the cuttings are almost entirely in rock to form the embankment with handpacked pitched slopes of 1/2 to 1, the more regularly shaped stones being selected for the outside, and the interior of the bank filled up with rubble. The train consequently presents the curious appearance of running along the top of a wall. The permanent way consists of a Vignoles steel rail weighing 45 lb. to the yard, fish-jointed, secured to the sleepers at the ends and middle of each rail by fang bolts, and at intermediate sleepers by dog spikes. The fang bolts have their nuts on the top of the flange of the rail, so as to avoid opening out the road for screwing up; the dog spikes are cylindrical, with blunt ends and the usual head. The flanges of the rail are not notched, but the square washers of the fang bolts are placed chock up against the ends of the fish-plates, so as to prevent the rails "creeping" down the inclines; the gauge is one metre. The carriages, which were supplied by the Railway Carriage Company, Oldbury, are on the American system, with seats placed longitudinally and a central gangway through the cars. From the end platforms convenient steps afford the means of descent to the station platforms, which are 9 in. only above rail level. The engines, which were supplied by Messrs. Manning, Wardle, and Co., Leeds, are tank engines with six wheels coupled, cylinders 10 1/2 in. diameter, 18 in. stroke; the only peculiarity about them is that arrangements are provided for turning the exhaust steam into the tank when passing through the tunnel, in order to keep the atmosphere as pure as possible.

The engineers were Messrs. Wells-Owen, and Elwes M.M. Inst. C.E., of Westminster, who were represented in Malta by Mr G. J. Burke, A.M. Inst. C.E., as resident engineer.