THE CENTRAL PACIFIC RAILROAD FERRY.

Until recently, trains running to and from Oakland upon the Central Pacific Railroad, were compelled to make a somewide detour to skirt the eastern and southern sides of Pablo Bay, which is one of the indentations of San Francisco Bay. Oaklands is situated immediately opposite the city of San Francisco that stands on the north point of the narrow strip of land forming the western enclosure of the bay; the distance between Oaklands and San Francisco is about five miles. Some thirty-five miles to the west, and a little to the north, Pablo Bay contracts until the distance between its north and south banks is only about two miles; this contraction forms the Straits of Carquinez, and on each side opposite each other, are the towns of Benicia and Porta Costa. It is at this point that the Central Pacific Railroad Company have established the ferry which forms the subject of the illustrations. By means of it the circuitous route around Pablo Bay is avoided, and passengers are taken direct to Benicia and thence to Oaklands, the terminus of the railway. Fig. 1 is a longitudinal section of the ferry, showing the arrangement of the stage by which the trains are transferred to and from the boat; this part of the work is also shown in Fig. 2. Fig. 3 is a transverse section of the ferry, and Fig. 4 is a plan showing the general arrangement of the boat as well as of the sidings and approaches. Fig. 5 is a perspective view of the boat, and Fig. 6 is a sketch of the whole work.

The ferry, which is named the Solano, is a vessel of 3,540 tons, and is of the following dimensions:

	ft.	in.
Length of main deck	494	8
" hull	406	2
Width over all	116	0
" between wheel casings....	64	0
Height amidships	18	6
" at ends	15	9
Draught when loaded	6	6

The boat is propelled by two separate vertical beam engines; they were built by Messrs. Harlan and Hollingsworth, of Wilmington, Delaware. The cylinders are 5 ft. 2.24 in. in diameter, and 11 ft. .28 in stroke; each engine is intended to develop 2000 H.P. There are eight steam boilers, each 7 ft. .25 in. in diameter, and 28 ft .24 long. They are made of steel, and have 143 tubes 3.94 in. in diameter, and 16 feet long; the total heating surface is 19,630 square feet. The wheels are 30 ft. in diameter, and have 24 floats; each wheel can be worked independently of the other. It will be seen from the engravings that the ferry has four lines of rails, and as they extend from end to end, there is sufficient accommodation for forty-eight freight cars or twenty-four passenger cars, with locomotive and tender. The boat is chiefly used for passenger service, freight being taken by the old route, and transferred at Oaklands to finish running to San Francisco. As the amount of freight thus carried is very considerable, the service is an important one, and the boats are large enough to carry a number of wagons, which are unloaded in the San Francisco depôt.

The general construction of the Solano is indicated in the illustrations. Beneath each line of rail runs a deep Pratt truss, the top flange of which is attached to the deck, and the bottom to the hull of the boat; the latter is divided by bulkheads into twelve compartments. There are four balanced rudders at each end of the vessel, 10 ft. 6 in. long, and 6 ft. 6 in. high: those are worked by hydraulic steering gear, but can be actuated by hand when desired. The pilot house is more than 40 ft. above the deck. The stages for embarking and disembarking trains are massive iron structures, 98 ft. 6 in. long, and weighing 150 tons. They are provided with four lines of rails, and are controlled by hydraulic gear to adapt their position to the rise and fall of the tide.—*Eng.*

ASPHALTUM.

In considering the history of the artificial materials employed for constructive purposes, we find that the necessities of earlier times were fully met by the use of tiles, asphaltum and concrete; and these, it would seem, if properly used, are quite adequate to the wants of our own times. It is worthy of remark, however, that asphaltum, which was largely employed in ancient times as a cementing material, and which has proved itself (from relics of highest antiquity) to be a most durable material for this purpose, should have fallen in o comparative disuse among modern nations. There is no material which is better fitted, by reason of its plasticity, tenacity, impermeability to water and indifference to atmospheric influences, to be employed for terraces, foot walks, roadways, hydraulic construction, etc. An admirable substitute for the asphaltum of the ancient builders is found in the bituminous limestones, which in some parts of Europe are extensively employed for the above named uses. The city of Paris has introduced this material perhaps more largely than any other for paving its more prominent boulevards and avenues. For this purpose the asphaltic rock is first roasted to render it friable, then reduced to powder, and introduced, in small quantities at a time, into a vessel containing some bitumen. When the mixture has attained the proper consistency, previously heated sand or gravel is added in suitable quantity, and the thoroughly mixed material is thereupon either introduced into molds and allowed to harden, or is at once spread in place.

The asphaltic rock which is found to make the best cement is that of the Val de Travers, in the canton of Neufchatel in Switzerland, which contains about 90 per cent of calcium carbonate and about 10 per cent of bitumen.

The admirable qualities of asphaltum for roadways in cities have come to be universally admitted, and the beautiful specimens of such roadways which may be seen in Paris and other European cities, is the theme of unstinted praise of observant tourists from our own less fortunate cities. What these superiorities are may be well worth a brief consideration. The genuine rock asphalt pavement, as seen in its best examples in French and German cities, is smooth-surfaced, homogeneous, hard, tough and elastic. It affords a minimum of resistance to draught and the minimum of wear to vehicles. In point of security of foothold it affords ordinarily, wet or dry, sufficient friction, although when covered with ice it becomes very slippery. It has been observed that while one horse in 1,308 falls on a stone-faced street, but one in 1,409 falls on asphalt. On levels and easy gradients, therefore, the asphalt roadway may be considered the equal of stone in the matter of foothold for horses. On steep gradients, however, while affording a minimum of resistance to draught, it does not afford sufficient foothold, and hence for such situations, especially where heavy traffic must be provided for, it must be discarded in favor of the small granite block, which for such locations has come to be looked on as the only adequate roadway. In another particular, namely, in respect to noise, the asphalt roadway has prëeminent merits. The noise from an asphalt pavement is only a slight clicking of the horses hoofs; the wheels give out no sound thereon. It is absolutely dustless, and hence produces no mud. Its wear on traveled streets has been estimated at about one-25th of an inch per annum, and even this diminutive lessening in thickness has been by some estimated to result from compacting rather than from abrasion or wear. Being absolutely impervious, it absorbs no unwholesome liquids, and gives out no noxious vapors, consequently is always pure and clean when its surface defilement has been removed. Its merits from a sanitary standpoint in this respect cannot be too highly extolled, and deserve more than the passing consideration we can here devote to it. It may be readily and thoroughly cleansed by scraping, sweeping or washing. As regards durability, asphalt roadways can compare favorably with any others. Neither heat, cold, attrition, nor hammering sensibly affects it. In respect to the case, rapidity and thoroughness with which it may be repaired, it has no equal. In respect to cost, it may be ranked with the granite roadway, though in Paris its cost is about one-third less than granite.

We have dwelt at some length on the properties of asphaltum for roadways, for the reason that American cities are, as a rule, woefully behind the age in the paving of their streets, for the reason, probably, that it is so very difficult in this country to apply the rules that hold good in private business transactions to public work. The result of this has been that the idea entertained of an asphaltum roadway in this country, is associated in the minds of most Americans with the abominations in which coal tar figures largely in the place of asphaltum, and which have not unfitly been dubbed "poultice" pavements. This association does grave injustice to the true asphaltum roadway, of which some fine examples may be seen in American cities, and which will undoubtedly become more and more generally adopted as it merits are made manifest.

Summing up the comparative merits of the several materials employed for this purpose, we may say that while for very heavy traffic granite blocks are the best adopted, and for steep gradients, wood; for all other and general purposes, pavements made from the natural rock asphalt, or from true asphaltum and hard fine gravel, or sharp sand, will give the most satisfactory results.—*Ex.*