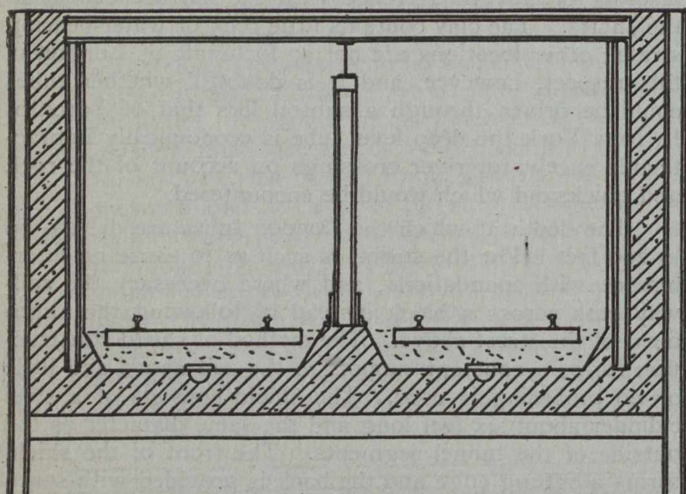
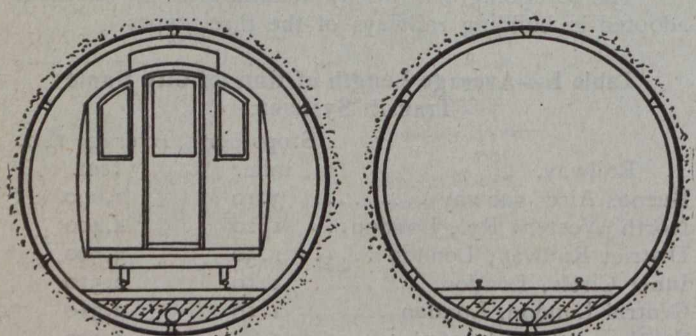
which are all dependent on the number of passengers carried.

The cars illustrated in this study for elevated and subway operation are typical of the more recent rapid transit practice without being quite as large as those now employed by the Boston Rapid Transit and the New York Municipal Railways. Cars 70 feet long and 10 feet wide require so much extra clearance, especially at curves, that a much more expensive subway is necessary to accommodate them. The car illustrated, which is of a more normal type, is 60 feet long and 8½ feet wide, seating 64 passengers at the rush hour and carrying 180 in all. The weight of the car fully equipped but empty is 80,000 lbs., whilst loaded with 180 passengers it weighs 105,200 lbs. Its equipment consists of two 600-volt motors rated at 120 kw. each fully ventilated and multiple unit control, and the standard train is of five cars capable of carrying a total of 900 passengers during the rush hours. Such a train as already mentioned can operate over elevated or subway tracks indiscriminately.



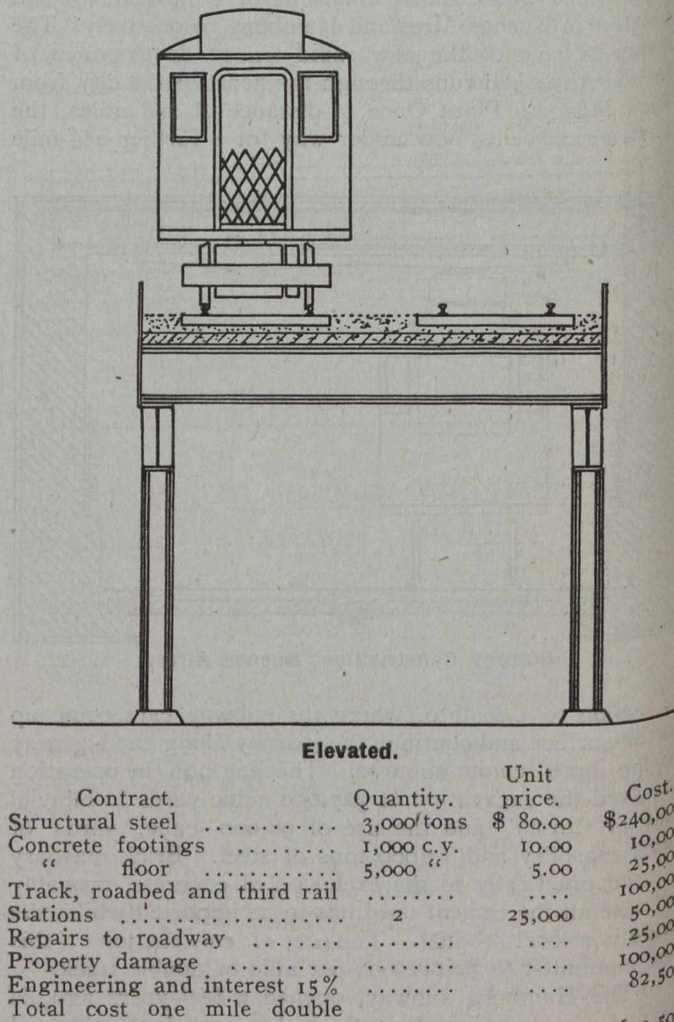
Hamburg Subway.



Tube.

Contract.	Quantity.	Unit price.	Cost.
Sinking shafts, excavating with shield, placing tunnel segments, grouting and finishing	..	....	$2,000,000
Track, roadbed and third rail	..	....	100,000
Stations, including elevators and fans	2	....	100,000
Repairs to roadway	..	....	20,000
Engineering and interest 15%	..	....	330,000
Total cost one mile double track tubes	..	....	2,550,000

Turning to the tube car it will be seen that the capacity and weight are both lower than the above. Moreover, as mentioned before, space considerations permit of only the leading and trailing trucks of the five-car train being used to carry motors. In order to maintain the same schedule speeds as the subway train the rated kilowatts per ton must correspond with the figure 4.3 and to obtain this the four motors must each be of 200 kw. rated capacity. This involves certain disadvantages. For one thing, the weight of the train is largely concentrated on the leading and trailing trucks which is liable to throw more wear on the track, particularly at curves, than where the weight is more distributed. Secondly, motors of such heavy output for mounting beneath a car have to be of such compact design that full ventilation is not possible and there is not such a wide margin of power for emergencies. Furthermore, as already noted, the carrying capacity of the tube train per ton of gross weight is lower than that of the subway, consequently with the same speeds and headway the tube will be able to transport fewer passengers although its cost of construction is the same or slightly higher than that of a subway. It may be said, however, that the tunnel need not be limited to a 12-foot bore; why not drive a 16 or 20-foot tube and obtain greater capacity? The answer is, of course, prohibitive cost. Approximately the cost of a tube tunnel increases as the 3/2 power of the diameter whilst the capacity is only directly proportional to the bore, so that the satisfactory economic limit for the latter is found to be around 12 feet and by far the greater mileage of tube railways are 12 feet inside diameter or less.



Elevated.

Contract.	Quantity.	Unit price.	Cost.
Structural steel	3,000 tons	$ 80.00	$240,000
Concrete footings	1,000 c.y.	10.00	10,000
" floor	5,000 "	5.00	25,000
Track, roadbed and third rail	....	....	100,000
Stations	2	25,000	50,000
Repairs to roadway	....	....	25,000
Property damage	....	....	100,000
Engineering and interest 15%	....	....	82,500
Total cost one mile double track, elevated	....	....	632,500

The diagram showing the outline features of the two forms of car also shows the seating arrangements and it will be noted that a large proportion of the floor area is