State have changed so that it is absolutely necessary to build these higher type roads to hold up under the traffic. You will find by and by, even in Manitoba, that you must step up to the higher type whether you want to or not.

A great mistake is being too often made in not providing for maintenance. It seems to me folly to provide money for local road improvements and turn them over to some body without instructions for annual maintenance. The principle laid down yesterday, that maintenance should not be taken care of out of debenture funds is absolutely correct. It should not be; but, at the same time, it seems to me that a province investing in roads should make provision out of the annual tax levy to provide an annual maintenance fund. In most of the progressive states now a good part of this maintenance fund is provided in some form of wheel tax. The automobiles are getting the brunt of it. In Massachusetts about $500,000 is raised from automobiles through registration or license fees, and while automobilists object very strenuously to a special tax, they do not object to a tax to be applied to the upkeep of the roads. This provides an easy way of getting maintenance money, and the people who have to pay seem to do so very cheerfully when they know it is to be applied to the roads and used economically. If the tax is not raised in that way, it has to be raised in some other way. To make the auto pay for upkeep seems to be a cheerful way out of the difficulty.

The personal equation in road work is a very great one; and too much attention cannot be paid to securing good men for good road work. Live men who attend road conventions, who take every means to learn their business and take pride in the local roads, should be obtained. The engineering part of the question must receive more and more attention, as we go up the scale of roads. Certainly the problems are becoming more difficult, and it takes more technical training to understand the new problems. Old engineers have had new problems confront them, and have begun, as it were, to go to school again; these conventions are a good thing. You learn a lot, and also run up against other men at work on the same problems as yourselves. The mere exchange of ideas is worth all the trouble and cost of the road school. You meet the man across the way on an equal footing and can talk your problems over to much better advantage. We must work together, and the more we can exchange ideas and get on to the little kinks of our neighbors, and give ours, the easier the whole problem becomes.

INTERNATIONAL ENGINEERING CONGRESS.

Members of various American engineering societies taking part in the International Engineering Congress to be held in San Francisco, September 20-25, 1915, will be interested to note that the following headquarters have been selected:—The headquarters of the American Society of Civil Engineers, and of the American Institute of Electrical Engineers, will be at the St. Francis Hotel. The American Society of Mechanical Engineers will be at the Clift Hotel, and the American Institute of Mining Engineers, at the Bellevue.

The Grand Trunk Pacific Railway has announced that contracts have been let and other arrangements made for the installation of crude oil as locomotive fuel on their passenger engines to be operated between Prince Rupert, B.C., and Jasper, Alta., a distance of 718 miles. It is expected that this installation will be complete by next June. The announcement does not cover the use of oil-burners on freight engines, it is understood that these will continue to use coal, at least for the present.

CONCRETE BALLASTED DECK CONSTRUCTION OF RAILWAY VIADUCTS.

THE use of concrete ballasted decks on steel railway bridges has extended during recent years to structures of considerable size. Several viaducts on the new line of the Chicago, Milwaukee and St. Paul through Montana, as well as others on the Santa Fe, Illinois Central and Burlington, bring the subject of solid floor bridge construction prominently to the attention of railway engineers. The "Railway Age Gazette," in commenting upon this feature of construction, to be found most frequently in the middle west, traces in an interesting way its development since the origin of solid floor construction in Chicago about 10 years ago, when it was employed for track elevation subways. According to the account, it was, in that instance, necessary to construct solid floors to prevent moisture from seeping through the bridge to the street below. The heavy cost of maintenance, the special track construction required and the noise created by the shallow steel floors first used, led to the adoption of concrete slabs carrying the ballast and standard track construction. A similar development was also brought about near this time by the necessity for greater protection of timber bridges from fire, leading the Santa Fe, the Rock Island, and other roads to apply creosoted timber ballasted decks to these structures. The resulting uniformity of track construction and more satisfactory riding qualities soon led to the adoption of the same type of deck on other structures.

The choice between creosoted timber and concrete ballasted decks is purely an economic one. On roads such as the Santa Fe, passing through large timber areas and possessing extensive treating facilities, the timber deck is somewhat cheaper, although the difference is not great. The difference in weight is also not a material factor. Therefore, on roads not accessible to a suitable supply of timber or without treating facilities, a concrete deck is as economical as creosoted timber at the present time, and its relative economy will increase materially with the rising cost of timber.

Confined at first to track elevation, subways and other short spans, the use of the solid floor has been extended gradually until the St. Paul, the Santa Fe, and several other roads have made this standard for all deck girder structures and are applying it on many through and deck spans of medium length. The St. Paul has placed such a deck on several 135-ft. deck girder spans and on deck truss spans 160 ft. long. While not important for short spans, the increased dead load resulting from the solid floor becomes of greater consequence as the length of span is increased. However, the advantages of the solid floor are resulting in a general increase in the length of spans to which this type of floor is being applied. The Santa Fe is placing a creosoted timber ballasted deck on spans 306 ft. long in its bridge crossing the Missouri River at Sibley, Mo., and the New York Connecting Railroad is using concrete ballasted deck on the entire elevated section of its four-track line nearly 10 miles long, including the Hell Gate arch with a span of 1,000 ft.

With the concrete ballasted deck built in units, several difficulties are presented to the designer. In the first place, when casting a large number of slabs in forms it is very difficult to insure exact uniformity of dimensions. Any error in the forms becomes cumulative and noticeable when multiplied in a number of slabs. The joints between the different slabs have not been waterproofed in any way and there has been some fear that with the moisture and