has been quite a move on the part of some roads, none of those which have had long and extensive experience in the matter, however, to use wheels with 11 in. hub diameter on 5½ in. x 10 in. axles, and even on 5 in. x 9 in. axles, on the groud that 1¼ in. is not sufficient for a minimum hub wall thickness and tended to "loose wheels." From a manufacturer's standpoint I have no reason to take exception to this move. A heavier wheel means a higher price, and so long as a railway wishes to pay for excess metal I do not know that it is within a manufacturer's province to object But as one of the engineers who has had to do with the solid steel wheel subject from its infancy, and who is more or less responsible for the dimensions, I wish to assume just as definite and positive an attitude on this point as words will permit me to express.

I have long been in touch with this particular point and have had considerable personal experience in the boring and mounting of wheels, and since this question was raised recently I have made a further study of it and consulted with representatives of those roads which are qualified by long and extensive experience to speak definitely and intelligently on the subject. I find that one large system, having over 200,000 solid steel wheels in service, has had less than a dozen loose wheels in the past six or seven years, despite the fact that 1¼ in. minimum hub wall thickness has been the adopted practice, and that in the early days of the solid steel wheel industry, when manufacture was not as accurate in some ways as at present, many wheels went into service with 1⅛ in. hub wall thickness. Of still greater interest, perhaps, is the fact that close investigation of each one of these few cases of loose wheels developed the fact that the trouble was due, solely and entirely, to improper boring and mounting and had no reference whatsoever to the wall thickess of the hub of the wheel. From another large system, with upwards of 90,000 solid steel wheels in service, I learn that in six or seven years only three or four cases of loose wheels have developed, despite the hub wall thickness of 1¼ in. minimum; investigation of these few cases showed them to be due to improper boring and mounting.

Such being the experience of those whose long and extensive use of solid steel wheels certainly qualifies them to know whereof they speak, I look upon it as a piece of undue assumption when a road with a limited experience, both in time and in quantity, sets out to be aggressive along a line with which it is unfamiliar. A hub wall thickness of 1¼ in. is all that is required with properly designed and manufactured solid steel wheels mounted on axles with wheel-seats up to and including 7 in. diameter; those who are troubled by loose wheels under such conditions must look to their own shop practice, to their boring-mills, their axle-lathes, and their wheel-presses.

Some roads in wishing for something larger than a 5½ in. x 10 in. axle have, for reasons of their own, doubtless, neglected to adopt the M. C. B. standard, 6 in. x 11 in., and have gone to the use of sort of an "in-between," 6 in. x 10 in., which renders it necessary to add these two extra designs of wheels. As I am discussing wheels I do not like to encroach on another subject, but it seems to me that as much axle trouble is caused by over-heating as by lack of section, and that conditions are not much improved by increasing the section without proportionate increase in bearing. In other words, is there any great advantage in a 6 in. x 10 in. axle over a 5½ in. x 10 in., the adoption of the 6 in. x 11 in. axle, instead of a mere "in-between"? I refer to this as merely another one of those features which has its effect on the cost of manufacture, and therefore the price to the railways of solid steel wheels.

Another point is brought up by the suggestion that, though shown as standard designs, I would like to eliminate the 30½ in. engine truck wheel, 33½ in. engine truck wheel, and two of the wheels used for cars, solely because they mean the use of solid steel wheels with a 3 in. rim thickness. Experience tends to prove that a 2½ in. rim thickness in connection with solid steel wheels makes for efficiency and economy, and that the use of 3 in. thickness is to be avoided. In the first place, one must consider the rim of a solid steel wheel as being of two general parts, the allowable wearing-body, being that depth which can be properly used in service, and the minimum allowable rim thickness, which necessitates removal from service. For example, in a rim thickness of 2½ in., it may be said that there is 1½ in. of allowable wearing-body, with 1 in. thickness remaining which calls for removal from service under M. C. B. Rules. It must be borne in mind that this 1½ in. of allowable wearing-body cannot be entirely used in road service. From time to time while the wheel is in service certain deformations of contour will occur, after varying mileages and with correspondingly varying depths of metal worn from tread, which necessitate removal of the wheel from service for re-machining to restore the contour.

Long experience, with general averages on numerous roads and under varying conditions, indicates that the allowable wearing-body in a rim 2½ in. thick will split-up far more economically than the wearing-body in a 3-in. rim, or, to put it in another way, as a general average proposition a road will secure more actual sixteenths of an inch of wearing-body, and fewer sixteenths of an inch of waste metal in the allowable wearing-body of a 2½ in. rim than in a 3 in. rim. And though this broad statement of fact may seem to over-shoot the mark, and to evoke remonstrance from those who have not given the point specific attention, all I ask is the opportunity for co-operative study with any railway official of conditions on his road, and I will be able to clearly demonstrate the correctness of my statement. To properly meet the conditions a solid steel wheel should possess, throughout the depth of its allowable wearing-body, an attrition-resistance equal to that of the rail, and, to obtain this, certain limits must be recognized in rim thickness from a manufacturing standpoint. Not alone must a high degree of attrition-resistance be obtained initially, but it should be maintained, as uniformly as possible, throughout the allowable wearing-body: this quality is largely secured by the work, and the depth of penetration of the work, which is put upon the rim. There is no process of manufacture of solid steel wheels known to-day which will produce as good and serviceable a wheel with a 3 in. rim thickness as with a 2½ in. rim thickness. Based on the records of a good many thousand wheels which have been worn out in service, the mileage-life of a solid steel wheel with 2½ in. rim thickness is greater than one with 3 in. rim thickness, all other things being equal.

I have always been, and I am to-day, a strong and persistent opponent of the use of the term "shelling" in connection with solid steel wheels. There has been too much of a tendency to call all defects shelling, owing to either convenience or lack of familiarity with the subject, whereas proper analysis would have classed the defect under one of three or four other and more specific headings, which would have enabled the manufacturer to handle the matter far more intelligently and in a manner decidedly more for the benefit of the railway. Shellig may be the easiest thing to think of, or to say, but it is absolutely non-specific under normal conditions in connection with solid steel wheels, and in 99 cases in a 100 means nothing at all. The chilled por-