what they were talking about, but that he did, as he measured it with a rule, and the highest portion of the rupture stood just 3½ feet above the sand cushion. It could easily be discerned that there was a slight movement in these four streets at a distance away from the intersection of more than 100 feet. Evidences were apparent that along with this movement had been an outward force pushing against the curb, increasing as it approached the place of rupture.

Fifty-six hours after the rupture a change of more than 40 degrees in temperature had taken place. The contraction that followed drew the pavements away from the curb. Near the intersection and next to the curbs on either side, the contraction showed itself to be a full inch.

Another rupture, of which I was unable to secure photographs, I had an opportunity to observe while the expansive force was in operation. Evidences were easily noted 200 feet back in one direction from the intersection, in which were placed four manholes. The portion of the street approaching this intersection from the opposite direction had the advantage of a much more perfectly constructed pavement. It was built by a different contractor and under different specifications. The cement filler was in the joints, filling them completely from top to bottom. The mixture was uniform and the expansion cushion fairly adequate. This portion of the street, although subjected to the heat of the sun equal to the other portion, with the assistance of the four manholes, stood apparently immovable. It had no transverse expansion cushion, but relief from expansion was sufficient at the curb; at least with what was held in compression the brick retained perfect contact with the sand bed.

The street opposite, approaching the intersection in which the expansion movement was particularly noticed, was not so well constructed. The cement in the interstices was irregular; the sand cushion had not been properly compressed, so that there was an uneven flow of the sand in the interstices from the original rolling of the brick; there was no compressive relief apparent in the street at all. As the intersection was approached, it was observed that the outward force of the street was much more severe near the rupture than 100 feet away from it, but the shattering and the crushing were all confined within that portion of the street improperly constructed. No part of that portion of the street properly constructed was harmed at all.

It so happened that prior to the construction of the Indianapolis Motor Speedway a temporary brick surface was put down about 16 feet in width and 200 feet long, for the purpose of merely testing a brick surface as to its adaptability as a race course, before it was finally decided to brick the entire track. This particular portion was poorly constructed, particularly in the application of the cement filler; the interstices were neither filled completely to the bottom, nor were they full and flush with the surface. And, although we warned of disaster to come and urged that it be eliminated, for the sake of economy it afterwards became a part of the track as finished. But little of this entire track was finished with the expansion cushion—simply a case of putting off until a more convenient season. Along this temporary portion, no expansion provision had been made. On account of weakness of the cement filler, it was unable to sustain a uniform compressive strength with the rest of the pavement. A bulge occurred at this weak side. The superintendent of the speedway at once concluded that he ought to relieve the strain by taking out two courses of brick across the entire pavement. Proceeding from the point of the rupture in the better constructed portion of the pavement, he soon discovered that as he weakened the pavement there was a slight movement or creeping of the entire pavement. He then went to the opposite side of the track and began to take out two courses of brick at that side of the pavement, but there was a time when the equilibrium was past and the resisting force at the center of the pavement was too weak to withstand the expansion pressure and the force found relief in a sudden crush, frightening the workmen so much that one declined to have anything more to do with it.

We secured photographs which show clearly two things to have occurred: The weak portion received the greatest rupture from the crushing force; the pavement sheared in the center and crept on the sand cushion the full width of the brick more than the other portion. The other portion of the pavement, being uniform throughout in strength, did not show a rupture, but simply closed up the crevices from which had been extracted two courses, and stopped. It is clearly obvious that the expansive force of this portion of the pavement had found relief in compression. Yet in this stretching out process no crack occurred, so tough and strong was the pavement in its monolithic structure.

It had been decided by the owners of the speedway to change an overhead bridge to a subway passage. This change, in the interest of economy, necessitated taking up a strip of pavement the full width of the track. The superintendent, on account of his experience as described, was a little at loss to know how to proceed. The writer advised that, as he took out his first line across the track, he insert wooden blocks in a way to be drawn simultaneously and to do the work in the night time, taking advantage of the lowest possible temperature. This course was pursued, and an opening made, which was followed by extreme high temperature. The closure followed from either direction nearly the entire width of the brick and then the pavement, by contraction, receded one-half the width of its advance and again no crack occurred in this action of contraction and expansion.

From this observation and experience gained, we are confirmed in several matters, sustaining our No. 1 Directions. First, demonstrating conclusively the force at work, destructive of the courses of brick that are found on either side of every transverse expansion provision. It is simply a jamming together—a movement of the entire street in opposite direction toward a weak portion. Many examples of this character can easily be seen in this city of Grand Rapids. It confirms us in the view that no transverse cushion should be provided. Second, it fully supports our contention and insistence for a uniform mixture of sand and cement. It is easily discerned that much of the expansive force can be and is taken up in compression. If the pavement is uniform in strength much relief in compression is afforded and can be depended upon. Third, in every operation of compression from two opposite directions, a certain portion of relief at least is diverted to another direction. You may say that this last statement is not exactly borne out by the observations and experiences cited. But suppose it is not entirely proven and you do provide for a full and complete relief of all of the expansive forces in the other two directions by a cushion along the curb, then you have at least relieved the pavement of one-half its expansion force, and with this, together with what relief is found in compression, the pavement is relieved or held intact to such an extent that it is scarcely subject to any injury whatever from expanding and contracting forces.

To further assure us that no bad results will follow if proper provision for expansion is made along the curb, it is necessary to heed the importance of having the cement filler uniform in strength, so we insist that the sand cushion be compressed in order that there shall be no flow of sand into the joints, which should be occupied in full by the cement