The Highway Game—Offense vs. Defense

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We might liken highway construction and maintenance to a basketball game. You are all familiar with that game as it is played today. The comparison of highway work with basketball, like all analogies, cannot be carried too far. However, it might be interesting to take a look at the teams as they line up for play.

We shall designate the highway team "Construction" and the opposing team "Destruction." The team with the flashing red uniforms now warming up on the floor is Destruction. At center they have Illegal Load, a towering 6 foot 9 inch boy who is hard to stop. At the forwards they have Legal Load, 6 foot 3 inch (not as tall as his big brother but quite formidable), and Weather (always in there pitching and tough to guard). He is also 6 feet 3 inches. The guards are played by a pair that work well together—Old Age, 6 feet 4 inches and Obsolete Design, 6 feet 2 inches. They can pick them off the back board and can also shoot baskets if given half a chance.

Now our team, Construction, is coming on to the floor. They are dressed in black. The captain and center is Personnel—he is 5 feet 8 inches and a real scrapper. He quit growing during World War II. The guards are State Funds and Federal Funds, both 5 feet 6 inches. They are good boys but not fully developed. At the forwards we have Contractors and Material Producers. They too are 5 feet 6 inches. Both are good men and have great possibilities but they are handicapped by the guards—they just can't seem to get the help they should from the funds boys.

Our highway team has been losing consistently to the Destruction team for several years. The prospects for today's game, in view of the relative size of the players, do not look too promising. We are not discouraged. We will be back next year and really expect to go places. Industry and general public are getting interested in our team and are proposing to furnish the boys some vitamin pills that will surely stretch them out. Also, there is some talk that the con-

ference may rule ineligible that big center of the opposition. That would sure help.

A CLOSE LOOK AT THE HIGHWAY PROBLEM

So much for the basketball game. Now let's get realistic and take a close look at the highway problem. If you have been even a casual observer of the highways during the last 10 years you have noted that road construction has not kept pace with road use. Some times, however, individual observation and resulting conclusions may be faulty. Let's see what those, who should know, say about highway deficiencies. U. S. Bureau of Public Roads Commissioner, Thomas H. MacDonald, at the A.A.S.H.O. meeting in Omaha in November of 1951 reported that the accumulated deficiencies in the primary road system of the United States now totaled 75,000 miles, and that they are growing by some 5,000 to 6,000 miles a year. Mr. R. A. Moyer, in the chairman's address at the annual meeting of the Highway Research Board in Washington in January of 1952, stated that the California Division of Highways had recently reported that out of the 14,000 miles of state highways in that state 11,300, or 81 percent, showed deficiencies of one kind or another. The California Division of Highways further reported that in 1941 deficiencies totaled 440 million dollars. Five years later, in 1946, the deficiencies were 1 billion 700 million dollars. A later report indicates that the 1951 deficiencies amounted to slightly more than 3 billion dollars, or eight times the 1941 deficiencies if allowance is made for construction expenditures since 1941 which totaled one-half billion dollars. During the past three years California has expended on construction of state highways 94 million dollars per year. At that rate it would require 30 years to overcome the 1951 deficiencies. Mr. Moyer further reported that Owen & Dearing estimate that at the present rate of construction on the 37,000-mile interstate system, about 100 years would be required to complete the job of eliminating existing deficiencies.

PLANS AND PROCEDURES IN IOWA

How shall we overcome these deficiencies? One of our leading highway magazines is carrying on, through representative highway engineers, a debate as to whether present State standards of construction are too high. One school of thought contends that we should cut out so-called frills, lower standards of construction, and thus build more miles of road at a faster rate. The other school

argues that we should keep our standards on a high plane and build not only for the present needs but for the future as well. Happily, many of the engineers taking part in this debate advocate a middle course. That is what we are doing in Iowa, and that is the course that I would like to discuss briefly with you today. I will try to show you how we propose to reduce the highway deficiencies and why we have adopted the specific plan which we are using.

In sports we hear various arguments in favor of a strong defense or a strong offense. It has been my observation that the team that wins most consistently is one that is well balanced between offense and defense. The need for the development of both offense and defense is exemplified in football's double platoon system. We in Iowa are for the double platoon system in the highway game.

In 1947 our legislature set up a Highway Investigation Committee. This committee made an intensive study of all highway needs in Iowa. The study covered secondary roads, primary roads, and city streets. This investigation committee submitted its report to the 53rd General Assembly in 1948. The report was detailed and quite voluminous. So far as primary roads are concerned the gist of the report was that 482 million dollars would be required to rehabilitate the primary road system and that such work should be done in a period of 20 years. This would require approximately 24 million dollars a year. The report was accepted by the 53rd General Assembly, and both the 53rd General Assembly in 1948 and the 54th General Assembly in 1950 enacted a number of laws to implement the program.

This comprehensive plan of the Highway Investigation Committee, as implemented by the legislature, constitutes our highway offense. In carrying on this offense we expect to build the very best roads and bridges that we know how to build. We will not compromise best practices in order to build more roads faster. If the citizens of Iowa are not satisfied with the intensity of this offense then they will have to provide more funds so the tempo can be stepped up.

The largest and most expensive item in this primary road program is the reconstruction, widening and modernizing of the 5,400 miles of rural pavement which is 20 feet or less in width. The average age of these pavements is 22 years. The building of 18-foot pavements on the primary roads was discontinued in 1933, yet we now have about 3,950 miles of 18-foot pavements. Likewise, the construction of 20-foot pavements was discontinued in 1942, but we have 1,450 miles of 20-foot pavements. We have made a

good start on this reconstruction program. In our opinion we have held this class of work to a little higher type of construction than many other states have seen fit to adopt. Extra right-of-way is secured, culverts are lengthened, bridges widened, and the road completely regraded, which means widening of shoulders and flattening of both fore and back slopes. If the curvature is unsatisfactory, or if the sight distances are too short, the old pavement is torn out and a new grade constructed and a complete new pavement built on these sections.

RESURFACING TYPES AND COSTS

Our resurfacing work is of two types: (a) bituminous, and (b) concrete. In the case of bituminous resurfacing our widening is constructed of rolled stone and black base, or Portland cement concrete. The resurfacing consists of two 1½-inch hot mix courses, Most of our pavements to begin with are 18 feet in width and all the widening is to a 24-foot width. In the case of concrete resurfacing the widening and resurfacing is built as a unit and all of Portland cement concrete. The average cost per mile during the last four years for widening and resurfacing, regardless of resurfacing type, has been as follows:

Right-of-Way	$ 3,041
Bridges and Culverts	10,609
Grading	11,899
Widening and Resurfacing	44,422
Detours	1,233
Miscellaneous	851
	$72,055

The cost of widening and resurfacing alone, exclusive of right-of-way, bridges and culverts, grading, and detours, has been

Bituminous Concrete—115.7 miles—$4,300,000 or an average of about $37,000 per mile;

Portland Cement Concrete—39.4 miles—$2,050,000—or approximately $52,000 per mile.

It can be seen that this is not a cheap method of rehabilitation. As a matter of fact, our construction experience during the last few years indicates that completely new 24-foot pavements cost on an average of $86,000 per mile, which is only $14,000 per mile higher

than the rehabilitation cost described above. In many cases we believe a better road can be secured and at a very slight increase in cost by securing new right-of-way and building a complete new pavement rather than widening and resurfacing the old pavement.

If we were to use our entire primary road construction fund of 24 million dollars annually for this widening and resurfacing we could build only about 332 miles per year. Obviously we can't use all the construction money for this type of work, so the progress must needs be slower. Will this so-called offense then satisfactorily solve our road problem? I think not. I know that motor vehicles cannot travel on plans and programs no matter how complete or adequate they may be. Time is an important factor in this whole problem that must not be overlooked. It takes time to plan the overall needs—it takes time to arrange the financing of the needs in an adequate way—it takes time to prepare the detailed plans for even the first group of projects under a comprehensive plan—it takes time to award contracts, to secure necessary right-of-way and to accomplish the construction work. What is to happen to our roads (deficient as they are) while we are getting our offense into gear?

After the spring breakup of 1951 the Iowa State Highway Commission decided that the maintenance department simply did not have the funds and the facilities necessary to put our disintegrating pavements in satisfactory shape for travel. We had just passed through the worst winter and spring that the state had experienced for 15 years. This bad weather was the last straw that broke the camel's back. Other factors, of course, were the age of our pavements and increased traffic.

On January 1, 1951 we had on our primary road system 5,723.9 miles of high type pavement, practically all cement concrete. Of this mileage 496.7 miles were over 25 years old; 2,672.5 miles were between 20 and 25 years of age; so we had 3,169.2 miles, or approximately 55 percent of the total, over 20 years of age.

Most of these old pavements were built in the late 1920's and early 1930's, at which time the average traffic was about 500 vehicles per day. Present figures indicate our average traffic is 1,200 vehicles per day.

Another factor in the deterioration of our concrete pavements is the fact that we were not building as good pavements 20 or 25 years ago as we are today. We have learned, for instance, that some aggregates which from a laboratory standpoint appear satisfactory are not satisfactory when placed in a pavement and put under traffic conditions. Some such aggregates were used in a limited mileage of

our early pavements. These aggregates are now excluded from use in pavement by our present specifications.

Our 1951 spring check up indicated that of these older pavements about 1,000 miles were really in precarious condition. The traffic just couldn't wait for our offensive program to take care of this 1,000 miles, so we inaugurated a stopgap salvaging program which might be termed our defense in this highway game. It was decided we would resurface with 3 inches of hot mix bituminous concrete the entire 1,000 miles of suffering concrete as fast as contracts could be let. This stop-gap resurfacing did not include any widening, any grade reduction, or any alignment changes. It consisted simply of a patching of the old surface, the application of two 1½ inch courses of hot mix bituminous material, and the building up of the shoulders to the new grade. On much of the mileage to be resurfaced we have a sloping curb section 3 inches high. It was decided on such sections to simply fill in between the curbs and carry the drainage in shallow auxiliary side ditches. This program required no surveys in the usual sense and very little in the way of plans. We placed under contract during the summer 541.6 miles of this type of surfacing, and 130 miles were completed before the work had to be shut down for the winter. We anticipated we might have some difficulty getting enough contractors to undertake this program but such was not the case—we have had good competition on every project. In some areas the material producers were loaded up to the extent that we had to shift our activities to other parts of the state where materials were more readily available. This was not a serious handicap. We expect in 1952 to complete about 500 miles of this type of improvement.

This stop-gap resurfacing is relatively cheap but it does produce a good smooth satisfactory surface in a minimum period of time. Our average costs in 1951 were

Patching, per mile	$ 1,137
Bituminous Concrete, per mile	13,728
Shoulders, per mile	425
Total, per mile	$15,290

It should be kept in mind that we do not consider these roads finished roads. This is a defense measure only. We feel however, that this work fits in nicely with our offensive program. While on one hand we are waging an offensive program by building well but relatively slowly a comprehensive road system, we are on the other hand meeting the current emergency with a well organized fast

moving defense. We expect to complete the surfacing of this 1,000 miles of critical pavement by the end of 1953, thus producing in three years a good usable surface on pavements which otherwise might very well fail entirely. Except for this defense program ten to fifteen years would have no doubt been required to solve the problem by a complete modernization program.