

WAR'S CHALLENGE TO HIGHWAY ADMINISTRATORS

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One of the fine experiences of the past year was the time spent on the Alaska Highway. There one met on every hand a spirit of determination, courage and cooperation, without which the amazing results already secured would have been utterly impossible. The officers and men of the Army Engineer troops, contractors with their extensive organizations, and the Public Roads personnel were working toward a definite objective in which they believe. Long hours, bad weather and handicaps of many kinds, particularly transportation, did not and could not stop the project from going forward. The weeks there were productive of faith -- faith in the earnest attitudes, in the ability of our people to accomplish important objectives and in the serious desire to serve, which is characteristic of the large majority of our people now.

Even though there have seemed to be more disappointments than assurances, more stop lights than go-ahead signals, and many impositions that can not be justified, is it not time to count those things which are right, rather than to be discouraged to the point of frustration by what is wrong? Is it not time to appreciate the real value of the things we have? The conditions under which the highway organizations, State and Federal, are working today, are infinitely better than the conditions which confronted us at the time of the last war. It is by comparison between two such separated periods that we obtain a measure of the true advance. Among those elements that are important are these:

There is now a highway organization composed of State and Federal units, which on the whole have reached an adjustment of mutual relations and jointly demonstrated a capacity to carry on large programs of highway improvement. These adjustments have required the sacrifice of neither State sovereignty nor Federal objectives.

We are fortified in making administrative decisions by the results of the State-wide highway planning surveys. There has been a steady advance in highway engineering knowledge that in recent years has provided at an accelerated rate a scientific approach to problems in place of what was formerly little more than guesswork.

The development of efficient equipment for road building has led all other fields of construction. One of the major contributions to solving the woes of the road builder, or preventing them, is the universal use of pneumatic tires, in contrast to the destructive solid rubber tires used for heavy loads during the last war and immediately thereafter.

These are only a few of the major resources and changes that the highway engineers and administrators have available now as tools of a major character to help them in their work. Moreover, there have been more than two decades of nation-wide road building which has been carried forward at a high rate in good times and in depressions. No other business has been carried on as consistently year after year unless it be that of providing the motor vehicles to run over the highways -- a combination of the two making up highway transport. This, then, is no time to complain or to criticize. Unquestionably this amazing continuity of operations produced within itself an inertia of movement that has produced severe and uncomfortable dislocations and reactions when it has been necessary to slow the speed or change the direction of effort.

An analysis of the operations through the pre-war period, or the interval since the last war, indicates changes of greatest importance in our administrative plan and routine of operations. The change from local to State control of all major highways; the establishment of the State highway system; the designation of the Federal-aid system, and later the careful studies that led to a much more carefully planned secondary system; the operations with the War Department to select in conformity with the needs of the nation a strategic network important to the military establishments; have been steps in the coming of age of highway policies and administrative practices which, in the light of our existing situation, I am satisfied have been more nearly productive of useful results than any other policy that could have been adopted.

Perhaps this may seem to be a prejudiced opinion from one who has been a member of the Federal organization engaged with the State highway departments in this development. It is not so intended.

The growth in the number and the use of motor vehicles on the highways of the United States has been in such amazing proportions and so universal, that the figures represent magnitudes which can

not be understood by any individual. However, it can be understood that because of the distribution and penetration of the use of the motor vehicle to every hamlet of the country, a policy of building perfect highways, or highways of the super character of which we have heard so much, could not possibly have taken the place of the very large mileage of not so perfect roads but which nevertheless extend throughout the length and breadth of the United States.

So much misinformation has been broadcast, even from sources presumed to be authoritative, as to the German autobahnen, promulgated as a part of Herr Hitler's preparation for world conquests, that I am proposing a repetition of a part of a paper written and delivered before this group in Seattle in 1940.

"With important construction stopped less than midway of completion of the first planned network of approximately 4,200 miles, the Germans do not have a national system of autobahnen for either military or civil highway transport. They do have certain highly adequate completed routes. With the drastic rationing of gasoline, the previously existing but relatively heavier civil traffic has very largely disappeared. With the German nation engaged in a desperate offensive those operations are largely outside the country itself, how can any national evaluation of the autobahnen as defense utilities be formed? Finally, pre-war Germany is relatively so small it could be superimposed ten times or more upon the great expanse of the United States with ample margin. Most decidedly what has been done in Germany does not provide the pattern for us."

The war program of highway improvement has necessarily been limited. After war became imminent it is too late to build a system of roads. While, as pointed out in the report HIGHWAYS FOR THE NATIONAL DEFENSE ^{1/}, serious inadequacies existed on our main road system when measured by fixed standards, up to the present time there has been no widespread breakdown of the highway transport system because of road failures, but we are now approaching a critical time that may become a crisis in highway transport. Since December 2, 1941, no projects involving Federal funds have been approved which were not certified as essential to the war effort by an appropriate Federal defense agency. Since these certifications come from outside the road forces, many projects which highway officials believe highly necessary for the national defense have not been certified, and many of those certified have been delayed by the involved process in obtaining priorities.

About two thousand miles of completed superhighways from 1932 to 1938, a five-year period, is the record of the Hitler regime, and only a few stretches were connected as through highways. By

^{1/} A report by the Public Roads Administration to the Administrator, Federal Works Agency, on February 1, 1941.

far the larger number of the chief industrial centers were still unconnected by this system, and less than half of the projected system to tie these industrial centers together was put into service at the end of that year when he started his war operations. Notwithstanding these facts, only a few days ago an advertisement appeared in a national periodical, sponsored by a leading railroad of this country, stating definitely that because the Hitler regime had depended upon the system of superhighways and had neglected the railroads, his internal transportation arrangements were rapidly proving inadequate. Based upon the actual accomplishments in improved highways and railways, the transportation facilities of Germany were not ready, and judged by this standard, without any claimed knowledge of other conditions, it appears that the Hitler regime was forced into war by both internal and external conditions long before he was ready with adequate transport within his country. Any conception that the railroads of this country could do the work that the highways are doing today is as fundamentally wrong as that the highways could do the work that the railroads are doing, and it would be only reasonably fair on the part of the railroads to accept the fact that one of the reasons that the railroads are doing the magnificent job that they are today is that the highways are taking over the part of the task which bogged them down in the last war, - that is, the short haul and terminal distribution. At some of our points of embarkation, as high as 70 per cent of the local distribution to transports is being carried by motor vehicles. In this war and in all its generated activities there is a tremendous transportation job. It easily becomes one of the major bottlenecks internally. There are two types of overland transport, - one the long-distance mass transportation of men, materials and all characters of supplies, for which the railroads are pre-eminently fitted to supply the necessary transportation services. But there is an equally tremendous amount of local, short-haul movements of persons, materials and finished products, which can only be accomplished by highway transport. The sooner this fact is recognized and highway transport given its place in the sun, the more surely will we provide against transportation becoming a real bottleneck.

From the angle of the highway administrator, then, what is the most important problem to meet? In order to examine this, there must be a look backward over what has already been done. A fundamentally unsound premise has existed to the effect that our annual program of construction which has been carried forward on the main roads of the Federal-aid and State highway systems, consists only of new roads. The misunderstanding leads to the conclusion that the mileage constructed each year adds to the number of miles of roads in service, and ignores the true fact that the program over a long period has been the reconstruction, replacement and modernization in accordance with the traffic demands of roads that are already in service. Once the wrong premise is adopted, the conclusions which

emanate are wrong. In order to understand what has been happening since the last war, it is necessary to obtain a correct visualization of the annual program of highway construction as it actually is.

For many years predominantly, and in recent years exclusively, the program of highway building has been a program of replacement and reconstruction.

The main roads of the nation, inclusive of the Federal-aid highways, consist of designated systems known as State highways. We need go no further back than 1923 to establish the facts relative to the development of these State systems.

In the 18 years between 1923 and 1942, for which complete records are available, the primary systems of rural state highways increased in length from 251,610 miles to 331,567 miles, a net addition of approximately 80,000 miles, or 32 per cent of the length in 1923. In the same period, construction on these primary systems totalled 501,192 miles, an excess over the finally existing systems in 1942 of 169,625 miles. In other words, the entire enlarged system has been, in effect, reconstructed or replaced one and one-half times in an 18-year period.

In order to establish the trend of replacements, reconstruction and modernization on the integrated State systems in terms of the mileage built annually, we need only to divide the total period into three 6-year periods. From 1924 to 1929, inclusive, the initial system increased by 62,553 miles, but a total of 161,365 miles were built on the system. In the next 6-year period, from 1930 to 1935 inclusive, the system increased by only 17,704 miles, but more than 200,000 miles were constructed. The system decreased in net length by 300 miles in the final 6-year period from 1936 to 1941, but nearly 140,000 miles of replacements and reconstructions were built.

The State highway departments were created to construct, maintain and operate the system of designated highways for the use of the traveling public. Expenditures by the departments are made to improve and maintain the existing mileage and to guarantee the safe and efficient use of the facilities so provided. The replacements on the primary system of State or main roads have been made in response to the growing demands of an expanding traffic volume. They represent changes in highway types and standards adapted to the existing traffic volume. When such highway sections have become overcrowded, obsolete as to condition or uneconomical as to maintenance, these have been reconstructed or replaced to forestall a continued uneconomic use. Because funds available for such capital outlays have always lagged behind the requirements of traffic, needed replacements to correct inadequacies have also lagged and

have generally been made only after public protest against existing conditions. All such activities have been attended by constant maintenance to extract the maximum of utility from the existing mileage prior to replacement.

The mounting gains in overall traffic volumes, which have made necessary the raising of highway types and standards represented in the trend in road replacement, may be illustrated by a review of the increase in the number of motor vehicles in operation and their total motor fuel consumption during the 18-year period under consideration. Whereas the system of main roads increased in net length during this period by approximately 30,000 miles, or 32 per cent, the number of vehicles increased from some 15 million to more than 34 million, or by 127 per cent. In the same period the number of trucks in operation increased by 214 per cent and the number of passenger cars by 118 per cent.

The increases in motor fuel consumption between 1923 and 1942 not only further emphasize the constant and growing need for the highway replacements which have been made, but testify also to the establishment of highway transportation as an indispensable factor in the total distribution process. In 1923, the 15 million odd vehicles consumed 2,365 million gallons of motor fuel. For the year 1941, more than 24 billion gallons were consumed, the increase being 918 per cent.

Estimates of the total ton-mileage of carried loads transported by trucks on our main roads are not available for the entire period under consideration. However, between 1929 and 1940, the total carried load on rural main roads rose from approximately 14 billion ton-miles to more than 47 billion ton-miles. These figures show that nearly three and one-half times the freight load carried on the main roads in 1929 was carried in 1940 on a system of roads only 6 per cent greater in length. This has been possible only through a steadfast State and national policy of essential replacement and intensive maintenance.

Highway transportation, which has grown to maturity as an essential element of our complex system of distribution, has not been without its reverses. It has been definitely tied to the general welfare in periods of prosperity and in times of stress. In the period from 1923 to 1929, when the national income increased by 21 per cent, motor fuel consumption increased by 467 per cent. From 1929 to 1935, the national income receded by 29 per cent, and the volume of highway transportation, as measured by motor fuel consumption, increased only 21 per cent. In the last period, from 1935 to 1941, the growth in national income is indicated as 67 per cent, and highway use of motor fuel indicated a corresponding increase of 48 per cent in highway transportation activity.

It is already apparent that the mounting industrial activity attendant on the war effort has imposed steadily increasing demands on most phases of highway transportation. In view of the virtual cessation of replacements, both of rolling stock and the roadbed, and in consideration of other restrictions and limitations, the elimination of all nonessential highway activity will fall far short of compensating for the demands being placed upon essential highway transportation.

The emergency curtailment and subsequent elimination of such replacements of essential trucks, trailers, busses and other commercial and industrial highway vehicles, as are normally made to offset scrappage and retirements, render necessary the increased and extraordinary maintenance and repair of the vehicles remaining in service. It is precisely so with our system of main roads. If we examine the record of disbursements made by the highway departments in the 18-year period referred to, we can evaluate the relative requirements for maintenance, coincidentally with those for accomplishing the constant procession of replacements made on our main road system, without which the highway service rendered during this period would not have been possible.

Again considering the three 6-year periods, we observe that during the first period from 1924 to 1929, capital outlay for construction, which was predominantly replacement, amounted to \$2,626 million dollars. The existing system of main roads, relatively low in type, standard and traffic volume as compared with those in the present period of stress, still require \$1,105 million dollars of expenditure for maintenance and operation. From 1930 to 1935, the total construction expenditure of \$3,262 million dollars was made on the main roads essentially to elevate types and standards to accommodate the increased traffic volumes. Although this was the period of depression which retarded the rate of traffic increase, funds for necessary improvements still lagged behind traffic needs as evidenced by an increase in debt service from \$368 million dollars in the first period to \$730 million dollars in the second. In this second 6-year period we produced the greatest volume of improvements ever made on the primary system of State highways but a maintenance and operation expenditure of \$1,140 million dollars was still required.

The third period, from 1936 to 1941, was marked by a resumption in the rate of traffic increase consistent with the improvement in the general welfare. The adaptation of the system of main roads to the increased traffic requirements, to the extent possible, resulted in a construction outlay of \$2,774 million dollars accompanied by an increase in debt service to \$1,183 million dollars for the period. The reduction of Federal emergency highway expenditures typical of the previous depression period was largely responsible for the reduction in capital outlay and the increase in borrowing, although

the latter was to some extent affected by the State assumption of local governmental obligations. The 48 per cent increase in highway transportation activity in this period, together with a decreased rate of replacement and adaptation of the main road system, made necessary an increased expenditure for operation and maintenance of the system amounting to \$1,504 million dollars.

In the setup of the State highway departments, economy and appropriateness have indicated that the construction operations incident to replacement, reconstruction and modernization be let to private contract. Uniformly such work has been almost wholly accomplished by private contractors with private labor, equipment and material facilities under public supervision and in accordance with standard plans and specifications. Similar considerations have indicated the appropriateness of the conduct of operational and maintenance activities, not well adapted to itemized specification, directly by the State forces of the highway departments. For these purposes the departments have established and consolidated the public organizations and equipment and material facilities necessary to carry on this essential activity as a concomitant of the construction program accomplished through private facilities.

Other essential war construction has heavily tapped the reservoir of private construction facilities ordinarily required to carry on the annual program of highway replacement apparently to an extent greater than the emergency reduction in the volume of such work. Shortages in manpower, equipment, materials and in highway revenues have all combined to drastically limit and curtail the volume of needed replacement and reconstruction which may be declared essential in this period of expanded war activity.

A cursory review of the mileage and cost of wartime highway construction, limited to the provision of essential military and industrial access and to certified improvements on a strategic network of highways, reveals the extent to which the war-imposed restrictions have curtailed the normal replacements on the main road system. During the year 1942, the use of all Federal highway funds has been restricted to projects certified as essential to the national defense by an appropriate war agency.

Total obligations of Federal-aid funds on such certified projects during the first ten months of the calendar year 1942 amounted to \$65,625,685 for the construction of 513 projects totalling 1,057.3 miles on the Federal-aid highway and Federal-aid secondary systems. In addition, other emergency funds to the extent of \$451,536 were expended from remaining balances. Access road funds obligated totalled \$195,448,651 for 1,006 projects on 4,249.4 miles of road, principally off the systems and designed to provide access from military, industrial and raw material sites to such main road systems. Obligations for

work on the strategic network of highways, largely included in the primary system of State highways, amounted to \$10,695,533 for 106 projects on 156.9 miles of road. The total 1942 obligations to October 31, inclusive of the off-the-system access roads therefore provide for the construction of 1,623 projects totalling 5,463.6 miles in length at a total estimated cost of \$272,221,605.

Obligations during 1941 made without the restraints imposed by wartime restrictions amounted to \$282,672,479 for the improvement of 3,835 projects totalling 8,962.6 miles. This compares with the 1942 obligations other than access roads, amounting in ten months to \$76,772,754 for 615 projects on 1,214.2 miles of improvement, principally on main roads.

State data for 1942 are not available to permit a corresponding comparison of the non-Federal construction on the primary system of State highways. However, comparative employment data on State and Federal construction by private contractors are available for 1941 and for nine months of 1942. These data indicate that contract construction is off 38 per cent in the nine months of 1942 from the corresponding period of 1941. Data for recent months show that this situation is progressively aggravated with an indicated reduction of 49 per cent in contract construction activity. The latter comparison covers the period when such activity is usually at its peak.

From 1924 to 1941, the Federal-aid system was increased in length by 66,826 miles, but 193,318 miles were improved with Federal funds, at a total cost of \$4,256 million dollars. These improvements, aggregating 82 per cent of the system length in 1941 reveal the scope of replacements during this period exclusive of the non-Federal State improvements on the Federal-aid system.

Between 1923 and 1929, a total of 61,227 miles were built but the initial system had increased by only 20,846 miles. In the second 6-year period, 76,972 miles were constructed with an increase in the system of only 30,016 miles. The third period from 1936 to 1941 accounted for an increase in the Federal-aid system mileage of only 15,964 but 55,119 miles were built.

In the three periods, construction, reconstruction and replacement cost of projects involving Federal funds on the Federal-aid system may be compared with total expenditures of similar nature on the primary system of State highways, including the cost of both State and Federal-aid projects:

Total Cost (Million dollars)

	Federal-aid projects	State and Federal-aid projects	Cost of Federal-aid projects as a per- centage of cost of combined State and Federal-aid projects
1924 - 1929	\$1,222	\$2,526	46
1930 - 1935	1,501	3,262	46
1936 - 1941	1,533	2,774	55
1924 - 1941	\$4,256	\$8,662	49

In the whole period, Federal-aid projects accounted for approximately half of the cost of projects on the main roads, rising to a slightly larger proportion in recent years. It is assumed that the decline in the volume of construction involving Federal funds on the Federal-aid system will therefore be representative of the trend in the State activity on the main roads.

Based on the first ten months of 1942, the mileage of projects on the Federal-aid system completed with Federal funds will be less than 72 per cent of the mileage completed in 1941. This low rate of completions, however, does not accurately measure the real trend. It is estimated that the mileage to be under construction at the end of 1942 will be only 30 per cent of that in progress at the end of 1941. This conclusion is based on the rather alarming reduction in the rate at which improvements are currently being placed under construction.

In the calendar year 1941, some 7,235 miles of replacement and reconstruction projects were placed under construction. For the calendar year 1942, the total will be approximately 1,536 miles or but 22 per cent of the previous year. Based on the monthly trend in the decline of projects placed under construction, it is estimated that less than 375 miles will be possible in 1943 unless drastic revisions are made in policies presently restricting such improvements. Continuation of the recent trend in placing projects under construction, together with the currently low volume of work under way will curtail the mileage completed next year to less than one-third of normal requirements.

Practically all current highway transportation is war transportation and virtually all main roads are necessary to essential transportation. The elimination of nonessential passenger car operation is almost an accomplished fact. The increased demands imposed on truck transportation have resulted in its more intensive use and in a general increase in average carried loads. While some State tabulations reveal reductions in average traffic on main roads, they do not reveal that increases have developed on many particular roads. The tremendous migrations of military, industrial and manufacturing activity occasioned by our active participation in the war and involving shifts of workers, material and supplies, have imposed burdens on highway systems which were never constructed or improved to handle either the traffic volumes or gross weights to which they are now subjected. The provision of some 4,200 miles of access roads to camps, cantonments, naval bases, and manufacturing and industrial sites, frequently in virgin areas, has likewise imposed burdens on main roads to which the access roads connect. Numerous dangerous and unprotected highway-railway grade crossings still exist in vital areas and the condition of many bridges and structures bodes ill for the safety of essential highway transport in the event of a prolonged continuance of the war.

The overwhelming evidence of the entire record of highway administration which lies behind us indicates but one solution to the enforced reduction in the rate of highway replacement by new construction. That solution is more expedient than sound. It is not economical but it is mandatory. It consists of extraordinary maintenance, both more extensive and more intensive. It will require not only the absolute retention of all existing personnel, equipment, and material facilities of the organized State highway departments, but also the pooling and efficient cooperative use of those facilities of the minor highway administrative agencies. In addition to the retention of operating maintenance equipment by the departments, it will be necessary for them to have access to essential repair parts and to be authorized to make replacements of such essential equipment as can no longer be kept in operation, and to speed up the procedure for obtaining them.

The state highway departments will also require a considerable volume of repair and patching materials and quantities of the less critical materials such as bitumens and stress timber for the repair and strengthening of faltering structures. It will be imperative that these departments set up and maintain inventories of current and prospective material requirements in order that these may be given joint consideration with other war material needs.

Any main road today is an existing or a potential military road. The alternative to the provision of necessary replacement and reconstruction is extraordinary maintenance. The alternative to the failure to retain the full facilities for the provision of such maintenance is a gradual but creeping paralysis of transport upon that road. These facts are contained in the record of the past, but the final evidence may be no further ahead of us than the next spring thaw.