

## HIGHWAY DESIGN ITS RELATION TO LANDSCAPE OBJECTIVES

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## SYNOPSIS

Highway design has been concerned essentially with engineering objectives in the scientific solution of grading, paving, alignment, profile, cross section, drainage and maintenance problems. These were prerequisites of good construction but were incomplete in their relation to the proper blending of the construction into the natural landscape. Highway design in its broadest application will not only meet the requirements of safety and utility but will aim for ideals in the realm of landscape objectives and incorporate beauty in the completed structure. The landscape objectives may be summarized as follows:

- 1 The utilization of existing scenic advantages in the determination of a proposed route intended largely for pleasure traffic
- 2 The harmonizing of construction with natural topography by coordinating the work of the engineer with the landscape architect in all stages of reconnaissance, planning and construction
- 3 The conservation of existing vegetation and trees as far as is consistent with utilitarian requirements
- 4 The planting of new material primarily as a contributing agent to control erosion and to accomplish a natural transition between construction and nature
- 5 The creation of featural developments such as outlooks, concourses, parking spaces, picnic areas, historical marker sites and similar strategic areas where the public can stop for rest and enjoyment
- 6 The promotion of liberal right of way for the elimination of old scars on existing roads, the greater ease of blending construction into the natural topography on both old and new roads and for the protection of the roadside in case of future widening
- 7 The encouragement of separation of commercial from pleasure motor traffic, thus permitting parkway emphasis and greater latitude in the design of the pleasure route
- 8 The attainment of zoning for the better control, regulation and restriction of billboards and commercial structures along the highway

Such objectives logically go hand in hand with engineering objectives and will reduce drastic departures from the natural lay of the land and automatically reduce the problems of erosion and of maintenance. The total of all objectives is a balance of safety, good construction, economical maintenance and natural beauty.

Every human activity has certain definite objectives. These objectives may be casual and incidental, or they may be specific and fundamental. They may be limited in their scope or they may be broad and comprehensive in their influence. In every case, the higher the ideals of achievement, the broader have been the objectives that have directed the mind and the hand in the process.

The engineering profession has much to be proud of in the accomplishment of objectives essential to the program of

highway development. It is natural that the objectives have been largely utilitarian as creations serving the needs of man have always been the main purpose of the engineer. The coming of the automobile in an age closely following the development and expansion of our railway system resulted in the application of the general principles of railway engineering to the design of our highways. The requirements for road conditions adapted to the automobile were so pressing that the immediate and laudable ob-

jective of design was to furnish the public a better means of travel and communication

The engineering objectives, therefore, were logically the scientific solutions of the problems of grading, paving, alignment, profile, cross section, drainage and maintenance. These were the essential prerequisites of good construction. Tremendous achievements were made and the later recognition of additional objectives in design cannot in any way belittle the credit due the engineer in his attainment of the basic objectives. Good roads were provided, increased speed made possible and a definite contribution made to commerce as well as to convenience of access.

The program progressed rapidly, and with the completed work there developed problems related to the roadside which temporarily had seemed incidental. Construction scars, ugly fills and backslopes and the destruction of natural vegetation, however, created problems of erosion and of maintenance as well as marring the beauty of the roadside. The general results all over the country were sufficient evidence that the previously determined objectives were inadequate to a complete fulfillment of a satisfying design. There had been lacking any definite landscape objectives in the program that considered sufficiently the roadside problems in their practical and esthetic bearing upon construction and maintenance. It became apparent that the two objectives, the fulfillment of utilitarian requirements and the attainment of esthetic values were not divergent but in reality were closely related, and that the landscape design must be an integral part of the road design in all its phases.

It is important, therefore, that the objectives be studied in order that a clearer understanding may be had of the basic principles and that coordination of effort may lead to a broad and comprehensive solution of a problem.

#### RESTRICTED OBJECTIVES

Due to the large amount of follow up work necessary on old routes and a recognition that these routes were ugly in their unnatural sloping and resulting erosion, the landscape objective was at first thought of as a dressing up and correction of old scars. This suggested the unfortunate term "Roadside Beautification" which is fundamentally at variance with the true purpose of highway design. Even the later term "Roadside Development" while expressing a more logical objective, infers a restricted scope of treatment subsequent to construction, and in a defined area between the paved road and the right of way lines. Such an objective is one of "Applied Art" rather than one of "Landscape Design."

There has been too great a tendency in all our states to consider that the landscape objectives lie within a fixed right of way. From a strictly construction and maintenance point of view this is correct, and roadside development has a most important field of endeavor to remodel and improve the roadsides of the older routes.

#### BROADER LANDSCAPE OBJECTIVES

Highway design, in its broadest terms, however, has landscape objectives that are definitely related to the proper alignment, gradient and cross section—thus partly determining the right of way itself and its relation to the area lying beyond the limits of right of way. It is the recognition of beauty in the country beyond the right of way that makes the lasting impression upon the traveler. He sees the method of treatment of the roadside, but the vision carries beyond to the larger aspect of the landscape. Landscape design is more concerned with the cooperative endeavor of fitting construction into this larger picture than it is with the remedial work within pre-determined limits of right of way.

Highway design should, therefore, include certain definite landscape objectives which would bring construction more closely into harmony with the total terrain and which would contribute to a development more complete, more satisfying and more far-reaching in its service to the use and enjoyment of the public. The question immediately arises. First, what are these landscape objectives? Second, how can the highway design bring about their realization?

#### UTILIZE SCENIC BEAUTY

Our country abounds in a wealth of magnificent scenery of great variety. The public is giving increased attention to these natural assets, and it is essentially a part of the highway program to plan for convenient access to points of interest and areas of recreation. The present development and popularity of our state parks and the rapidly growing tourist interests of the country have tremendously increased the amount of pleasure traffic on our highways. Already reaching huge proportions, I believe that the pleasure traffic will continue to grow especially in consideration of the shorter working hours and the increase in leisure time made available to the public at large. The lure of the woods and mountains, the lakes and the seashore, the meadow and pasture, is common to all. It is highway design that not only determines the means of access to these places of human enjoyment, but also determines whether that route of traverse shall be attractive or unattractive. It should be one of the definite objectives in highway design to take every advantage of scenic beauty and accentuate its importance in every possible way. This objective immediately involves a careful coordination of work of the engineer and the landscape architect during preliminary reconnaissance, in order that the most practical general route may be

determined, taking advantage of the specific scenic factors that would enhance the ultimate solution. The utilitarian objective might logically influence the design to determine a route somewhat shorter in distance or possibly of less difficult construction. However, the landscape objective might justify a somewhat longer route or a more difficult construction, if the scenic values seemed to the engineer and the landscape architect to offset the financial difference. This objective dictates a careful study of such opportunities as locating the route so as to skirt some beautiful lakeshore or rising to some elevation where a commanding view would make a lasting impression upon the traveling public. It must be borne in mind also that these scenic values are virtually permanent values, whereas the structural values in time may diminish.

To fully utilize existing scenic values in the initial stages of reconnaissance and highway design is the first and most important landscape objective.

#### HARMONIZE CONSTRUCTION WITH NATURAL TOPOGRAPHY

The second landscape objective is that of "Harmonizing Construction with Natural Topography." It is this objective that is dependent upon the principles of landscape design as the construction itself is dependent upon road design. Again, the objectives should not be divergent, for if there is proper coordination of effort, the best construction in its broadest application will embody beauty in its achievement and ultimate economy of maintenance. Adequate right of way may assist in partially correcting constructional departures from natural topography, but if the most satisfactory transition from construction to natural landscape is to be accomplished, it must be definitely provided for in the highway design. The objective should be to pre-

STATE OF MINNESOTA  
 DEPARTMENT OF HIGHWAYS  
 CROSS SECTION SHOWING A TYPICAL PLAN  
 FOR  
 PRESENT AND FUTURE DEVELOPMENT

SCALE: 1" = 40'-0"

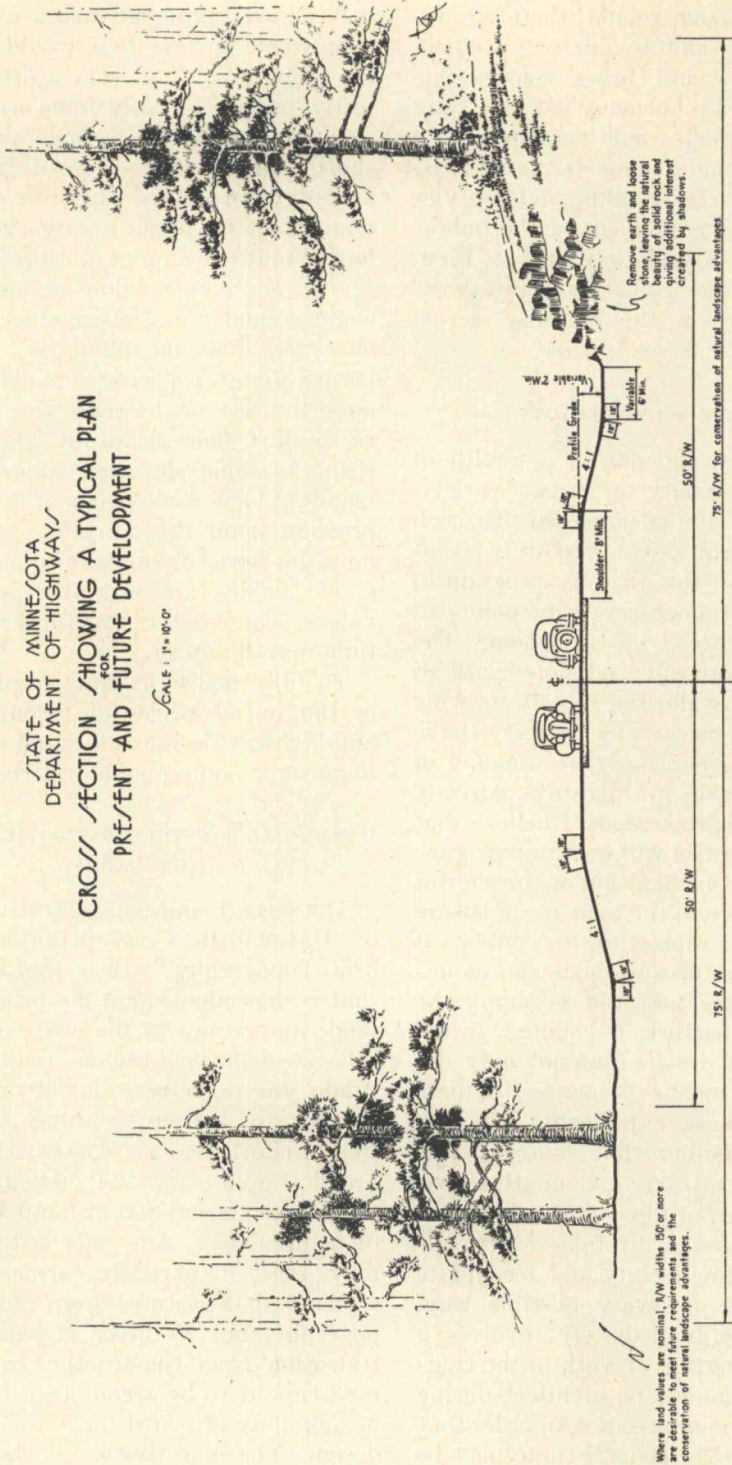


Figure 1



serve and restore the natural conditions by means of as simple and as graceful a grading and planting program as is possible. This simplicity and naturalness comes only when the original alignment and gradient has been studied and planned with this landscape value as a definite objective.

Mr. Thomas H. MacDonald, Chief of the Bureau of Public Roads, in a recent, "Review of Progress," makes the following statement: "For harmony of line, roadways should follow the regular lay of the land as far as is consistent with safety and utilitarian requirements." Here is a statement, in my opinion, that implies the underlying reason for many mistakes of the past and points to the ideal objectives in highway design. I believe you will all agree with me that the most glaring examples of artificiality in highway construction can be attributed to the fact that the alignment and profile were not sufficiently closely related to the regular lay of the land. The safety and utilitarian requirements were carefully planned, but the study of how closely the line and profile might have followed the lay of the land was somewhat neglected. The inevitable result has been that of ugly cuts, high fills and an increased area of destruction of natural vegetation. Landscape design objectives must be combined with engineering objectives in the determination of alignment, profile and cross section. Here is where "Design for Safety and Utility" can logically harmonize with "Design for Beauty" in studying the principles of perspective as applying to horizontal curvature, vertical profile, and proportional relation of tangent and curvature.

In the *design of the cross section*, the engineering objectives and the landscape objectives should easily be harmonized for the satisfactory accomplishment of the ideals of safety and economical maintenance which will automatically fulfill

certain landscape objectives. The last five or six years have witnessed a marked change in the grading of fillslopes, ditches, and backslopes, largely due to the continued emphasis placed by the Bureau of Public Roads upon the relation of these features to safety and maintenance. The wider shoulders, the flatter fillslopes and backslopes have demonstrated their value with respect to erosion control by the greater facility of restoring natural ground cover. There is still, however, the tendency in original construction design and supervision to neglect the essential factor of fullest conservation of topsoil and its utilization

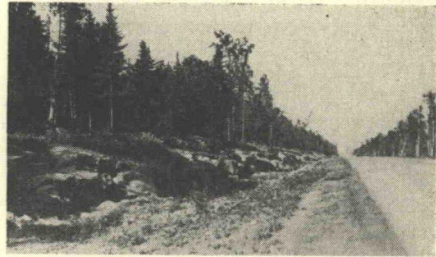


Figure 2. Photograph of Section Depicted in Figure 1

on the newly graded slopes. The report of the sub-committee on erosion of the Joint Committee on Roadside Development makes the following important statement:

"On shoulders, ditch areas and slopes a sterile subsoil has usually resulted from grading construction or maintenance operations where no thought was given to the saving of topsoil. Satisfactory vegetative cover cannot be established by natural or artificial methods without a deep soil capable of supporting plant growth." This committee offers, therefore, as a basic objective of both roadside development and soil erosion research that "on highway lands, design must be improved to provide a satisfactory surface upon which vegetation can be es-



tablished as a final stage of controlling erosion."

All of these practical considerations in the design of the cross section have a definite bearing upon the esthetic objective. The grading of fillslopes and backslopes not steeper than three to one and the rounding of the tops and toes of slopes and the restoration of ground cover not only assist materially in accomplishing the control of erosion and more economical maintenance, but also brings the construction more closely into harmony with the natural surroundings.

#### PLANTING; A CONTRIBUTING AGENT

The utilitarian objectives, particularly those of erosion control and economy of

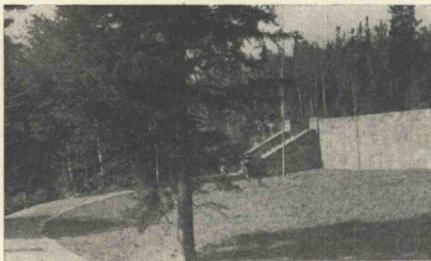


Figure 3

maintenance, are greatly aided in their accomplishment by the use of plant material properly selected and arranged. It is self evident that if we are to bring about the landscape objective of harmony with nature, this material must be studied in the light of the climate of the locality, the existing soil conditions, and the natural habitat of the plants as well as their adaptability and suitability to highway use. Planting design aims to stabilize the regraded surface of the construction area and to restore a natural blending of the structural elements with the undisturbed environment. However, planting is merely a means to an end and should not be considered in itself as a landscape objective. It may

be to give shade to a barren waste, it may be to screen objectionable views or to frame an attractive vista. It may be to assist in the control of erosion on a slope or it may be to restore a natural background. However, in any case, it must be as a means or contributing agent toward the main objective of *harmonizing the construction with natural surroundings*. For this reason, planting can only function properly when applied to a naturally graded area. Too often, we have considered planting as the real landscape objective with the result that confusion and discord have been the outcome instead of harmony. Fundamental design in the determination of location, the proper alignment, profile and section is the real governing factor, with planting as an embellishment and refinement to the more essential agencies.

#### CREATIVE DESIGN AT POINTS OF SCENIC INTEREST

It is not sufficient in the entire development merely to "Utilize the Natural Scenery" in its application to proposed alignment and profile and to "Harmonize the Construction with Natural Topography." These are the most essential objectives but to fully accomplish their purpose there must be added definite development of architectural, engineering and horticultural accessories.

Closely linked with the design of the roadway is the desirability of taking advantage of the outstanding opportunities for the creation of concourses, outlooks, picnic areas and parking spaces wherever such development is justified by scenic interest and public use. Up to the present time, the city or the town has been the individual point or focus toward which we have directed our line of traffic. Highway planning has been solely concerned with the utilitarian objective of the facility and speed connecting these individual centers. With the increasing tourist



travel and the importance of the scenic values, we should recognize as a desirable part of the highway design, the landscape objective of providing stopping places for full appreciation of areas of commanding view, and for suitable rest and recreation. No longer is the problem merely one of getting from "here" to "there." It is rather what points of interest can be developed that will add to the enjoyment of the public in traveling between "here" and "there." Wherever emphasis has been given to this type of work and architectural simplicity has dominated the design of outlooks, concourses and parking spaces adjacent to picnic areas and historical markers, there has been invariably most favorable comment by the public. Such featural development relieves the monotony of the continuous travel, adds interest to the total development program and contributes to the broader application of design in its landscape objective. Additional right of way to make possible these developments permits cars to swing off the main traveled road thus increasing safety at these strategic points. Much of this structural work in the building of retaining walls for outlooks and concourses has been accomplished in many states through the cooperation of the National Park Service and through the various Relief Agencies. I urge the enlargement of this field of study as a definite landscape objective in the complete highway design aiming to give to the public the fullest degree of use and enjoyment.

#### OBJECTIVES RELATED TO RIGHT OF WAY

The ideals of practically every landscape objective are often defeated by an existing narrow right of way or by a right of way on a proposed route which has not been determined as to its description and its width by a careful study of the esthetic requirements as well as

the safety and utilitarian requirements. Artificiality and ugly scars leading to erosion problems and high maintenance costs might well be said to be synonymous with narrow right of way. It is my opinion, that *all attempts at erosion control and landscape development under the limitations of a narrow right of way are, at best, merely a partial and inadequate attainment of the landscape objective.* These attempts do not reach the underlying cause of the trouble and are, therefore, not fundamental in character. Upon the open road, it is far more essential and fundamental to correct an artificial cut or fill by flattening the slopes than to sod or plant the steep slopes. Wherever possible on old align-

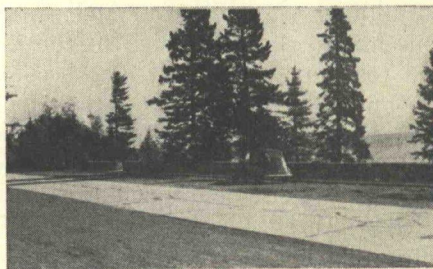


Figure 4

ment, the design for roadside development should direct its attention to the fundamental principle involved of proper grading, rather than perpetuate artificiality by superficial methods. This involves adequate right of way for a satisfactory solution of the desired landscape objective. Acquisition of added width or the procurement of slope easement should be urged, if we are to attain the landscape objective of harmonizing construction with natural topography.

#### PARKWAY EMPHASIS

One of the most encouraging factors in the attainment of many of these landscape objectives is the present trend to-

ward a separation of heavy commercial traffic from the pleasure motor traffic. It must be admitted that many of the ideals desired in alignment, profile and cross section have not the same flexibility, when applied to the commercial route as when applied to the pleasure traffic route. There is a vast opportunity for landscape development on the parkways or scenic routes, the divided roadways, the free-ways and all the other forms of highways which give greater breadth of development to the handling of traffic. The Mt Vernon Memorial Highway, The Westchester County Parkway, The Virginia Skyline Drive, and the Blue Ridge Parkway are all examples of the recognition of the importance of landscape objectives in meeting the needs of pleasure traffic, yet fulfilling the utilitarian and safety requirements. In the design of the divided roadway which will now become more and more in evidence, the landscape objectives must conform to those same principles already enunciated and make the entire structure one of natural unified appearance rather than two distinct developments divided by an island of unrelated height or depth. The total cross section must be such that both roadways seem to fit the natural setting. This can be accomplished only when the island treatment which divides traffic in reality unites the development of the entire right of way. Simplicity of grading and simplicity of planting should dominate the island treatment.

#### ZONING

A paper dealing with highway design and its relation to landscape objectives would be incomplete without reference to that most important field—highway zoning. Other attainments from objectives in the esthetic program can be completely marred by the conspicuous presence of billboards, signs and undesirable types of industries. Much study, research and

determination of policy lies ahead of us, with respect to this part of highway growth and development. The subject of zoning is too large to more than mention in this discussion. It reaches into the problems of regulation of highway uses and restrictions in the interest of safety and protection of values as well as into the question of roadside appearance. These considerations are not essentially those pertaining to highway design but rather to state planning and county zoning with all the intricate questions of legality of discretionary powers based upon esthetic considerations. Nevertheless, the ultimate elimination of billboards, snipe signs and the control, regulation and restriction of commercial structures along the highway is a very definite landscape objective. One of the best examples in the partial attainment of this objective is that of California, where highway zoning as a part of county zoning has enabled the State in some eight or more counties to limit outdoor advertising to the business centers of built up communities and to establish small business districts at properly located intervals along the highway, through the rural districts. No outdoor advertising is permitted between these small business districts. New Jersey through its State Planning Board, Massachusetts and many other States are making constant advance toward the goal of highway zoning.

#### SUMMARY

May we, therefore, summarize these landscape objectives as follows:

- 1 The utilization of existing scenic advantages in the determination of a proposed route intended largely for pleasure traffic
- 2 The harmonizing of construction with natural topography by coordinating the work of the engineer with the



landscape architect in all stages of reconnaissance, planning and construction

- 3 The conservation of existing vegetation and trees as far as is consistent with utilitarian requirements
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- 5 The creation of featural development such as outlooks, concourses, parking spaces, picnic areas, historical marker sites and similar strategic areas where the public can stop for rest and enjoyment
- 6 The promotion of liberal right of way for the elimination of old scars on existing roads, the greater ease of blending construction into the natural topography on both old and new roads and for the protection of the roadside in case of future widening
- 7 The encouragement of separation of commercial from pleasure motor traffic, thus permitting parkway emphasis and greater latitude in the design of the pleasure route
- 8 The attainment of zoning for the better control, regulation and restriction of billboards and commercial structures along the highway

The landscape objectives, thus, are those which will unite logically with the engineering objectives in giving to the complete work a beauty of structural achievement in a natural setting. Such objectives will reduce drastic departures from the natural lay of the land and will

automatically reduce the problems of erosion and of maintenance

#### CONCLUSION

Objectives determine the direction in which we are progressing. Design should progress as a smoothly organized piece of machinery carried forward on four well balanced wheels. The first of these wheels is Safety, the second is Good Construction, the third is Economical Maintenance, and the fourth is Natural Beauty. Each wheel has its individual function to perform and must fulfill a balanced relationship with every other wheel. Unified progress cannot result, if there is an unequal brake action or improper freedom for each wheel to function in balance with the others.

The Highway Research Board is giving careful study to all the essential factors involved in a complete highway structure. Such completeness is now recognized as resultant from design that not only fulfills the utilitarian and safety requirements, but that also aims for ideals in the realm of landscape objectives and incorporates beauty in its structure. May there be a closer cooperation of engineer and landscape architect in the study of all the objectives of highway design, in order that there will be continual progress toward the ideals of complete perfection.

Mr Daniel H Burnham has well said

"Make no little plans, they have no magic to stir men's blood. Make big plans, aim high in hope and in work remembering that a noble, logical diagram once recorded will never die, but long after we are gone will be a living thing asserting itself with ever growing insistence. Let your watch word be Order and your beacon Beauty."

## DISCUSSION ON DESIGN AND LANDSCAPE OBJECTIVES

MR O L KIPP, *Minnesota Highway Department* While there is no question about the desirability of roadside development projects to correct mistakes previously made on construction where such projects will not be changed by demands for further improvement to accommodate increasing traffic needs, yet the greatest benefit can be obtained by carrying out the principles which Mr Nichols has outlined on all new construction. It is possible, of course, on new construction to obtain much more pleasing effects with little if any increased cost than can be obtained in attempts to correct or embellish previous construction.

MR FRED LAVIS, *Consulting Engineer* One phase of this which occurs to me is this. A little while ago I was driving over a highway in an extremely hilly country. It has been located for miles and miles on a straight line, and it occurred to me in driving over it that probably it would have been a better, safer and more attractive road if some curvature had been

introduced into it. It may be heresy to say, with some curvature, when a straight line is possible, but I am not so sure about that. I am an old-time engineer but I believe in that particular case a fair amount of light curvature would have made it a better road to drive over with very little difference in gradients. Also a certain amount of curvature would have saved on construction cost.

MR W H SIMONSON, *U S Bureau of Public Roads* In analyzing the construction of a highway the engineer cannot limit his analysis to just the construction point of view alone in cold facts and figures. He must also relate the elements of construction to the use or function that the road will serve. If the human element is the largest factor in the safety triangle, the more necessary it is that we approach our construction and design problems from the standpoint of the human equation. We will never have a complete and safe highway until that is done.