

# Classification and Evaluation of Indiana Rural County Highways

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“We want better roads,” plead the taxpayers and motor vehicle users, and highway administrators are forced to counter with pleas for more funds and better management tools with which to fulfill this demand. Political favoritism, incompetence, extravagance, and similar charges against highway administrators are answered by counter charges of selfishness, ignorance, and others. Thus, a state of distrust and disgust may exist between the various levels of government and their respective citizens.

Much of this chaos can be attributed directly to the inadequate understanding by administrators as well as by taxpayers and motor vehicle users. The use of opinions instead of facts is common to both groups. It should be apparent to all that practical procedures for the collection, evaluation, and utilization of facts to facilitate the programming of highway expenditures are needed.

This paper presents a progress report of the Joint Highway Research Project’s development of rational procedures for the classification and evaluation of Indiana rural county highways. Many of these procedures have been field-tested in a study conducted at the request of the Commissioners of Allen County, Indiana.

## COUNTY HIGHWAYS ARE BIG BUSINESS

The various Indiana county highway departments, which are responsible for 76,093 miles of road, may well be described as “big business” enterprises as evidenced by the fact that they received a total of more than \$26 million from the Motor Vehicle Highway Account during the 1954 calendar year. The amounts received by the individual counties ranged from a high value of \$1,402,907 received by Marion County to a low value of \$62,043 in Ohio County. If the available funds per county are divided by their respective 1954 county road mileages, the available per mile of county road ranges from approximately

\$994 to \$232 per mile, representing \$2.72 (Marion County) and 64 cents (Spencer County) per mile per day respectively. Allen County, with the largest county road mileage of 1,512 miles, received approximately \$480 per mile while Ohio County, with the smallest mileage of 180 miles, received about \$345 per mile. The statewide average was \$342 per mile or 94 cents per mile per day.

### THE NEED FOR FACTS

A brief glance at these figures quickly reveals that the available funds are inadequate if each mile of county highway is to be developed and maintained to adequately satisfy the desires of each taxpayer and motor vehicle operator. In fact, if each mile of county highway had a hightype surface, present road funds would not be sufficient to properly maintain these surfaces. Thus it is imperative, as in any successful business operation, that the available funds be spent where the greatest benefit will result.

It has often been said that the most important roads in the world to an individual are those roads that are used by that individual. However true this may be, one of the keystones of democratic government is that government funds be expended in the public interest. Proper and unbiased evaluation of what constitutes the public interest has been of great concern to county road officials, who must establish a proper balance between increasing traffic volumes and service requirements on certain highways and the also increasing demand for more and better expenditures on all roads.

Inadequate funds have made it impossible for many counties to develop and maintain a competent work force to carry out an adequate county highway program. Wholesale hirings and firings, following a change in administration, have also contributed to the shortage of adequately trained county highway personnel.

Changes in administration have often resulted in a complete absence of programming and long range planning for an efficient county highway system. While certain roads are developed during one year, entirely unrelated projects may be initiated in the next year with little or no concern for the completion of the previous year's projects. After several years of such helter-skelter programming, a county may find itself with a non-integrated system of several pavement types in various stages of construction and repair, ranging from sections of narrow, thin gravel roads used by several hundred vehicles a day, to a wide, high-type pavement nearby serving less than fifty vehicles a day.

Most of this waste of highway funds cannot be attributed directly to malicious county officials, but rather to the failure to provide factual

information to honest officials. It is also recognized that these county officials could improve their conditions by insisting upon facts. All-too-often the basic criteria in establishing road projects has been upon the basis of who can shout the loudest or who can bring in the greatest number of petitions requesting the expenditure of highway funds.

### BENEFITS DERIVED FROM RATIONAL PROCEDURES

Rational procedures for classifying and evaluating county highways should provide county officials with an administrative tool which serves the following purposes:

1. Relevant facts are assembled in an orderly manner to aid in the establishment of priorities for the construction and reconstruction of highway sections which are unable, according to certain prescribed standards, to safely, rapidly, and economically serve the demands of traffic, abutting property, and the public interest.
2. Personal judgment is minimized or eliminated in the assignment of priorities.
3. Community and political pressure is held to a minimum in highway planning and construction.
4. Administrators, councilmen, and legislators are provided with an average measure of the existing county highways plant and progress of the highway program. This progress, indicated by increased or decreased highway adequacy through periodic evaluations, provides a means of measuring the sufficiency of road funds.
5. The public's investment in the highway system is protected because funds are budgeted according to the order of relative need.

### BASIC PROCEDURE CRITERIA

Before procedures for the classification and evaluation of rural county highways can be accepted, they must satisfy certain basic criteria of simplicity, practicality, flexibility, and economy, all in the proper balance. Involved calculations must be avoided, but an over-simplification of procedures will result in inadequate data. Design standards and mileages of high-type highway classifications must be practical for if set too high, their attainment will be made prohibitive, but, when standards and mileages are minimized, the only result becomes a definite loss in efficiency and safety. Flexibility in procedures is desirable to enable a wide application without a loss of validity and reliability due to too

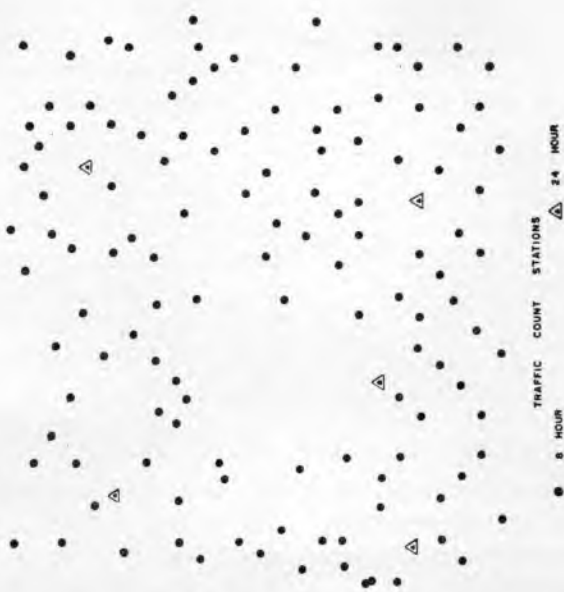
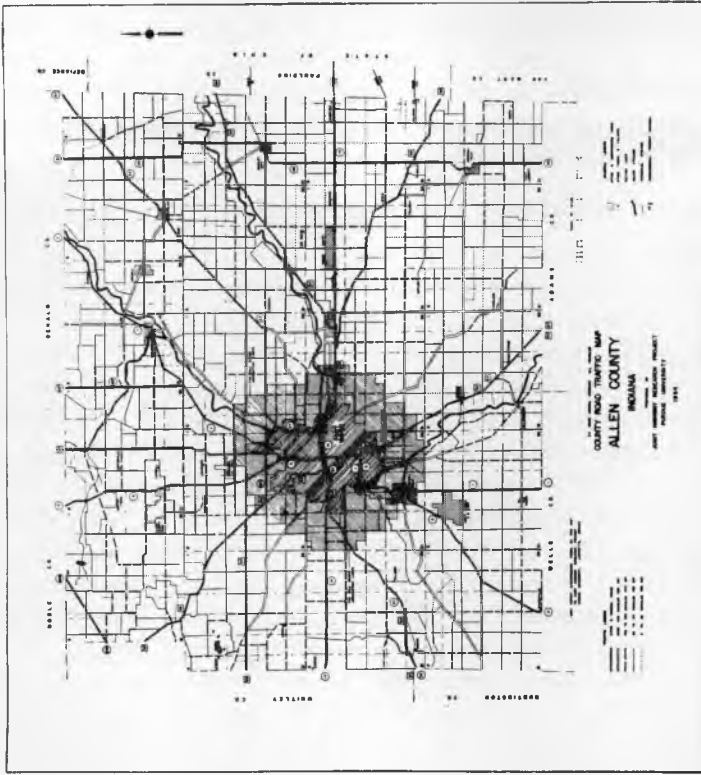


Fig. 1. Allen County, Indiana, traffic volume map and traffic count stations.

much flexibility. Because economy is ever the highway administrator's watchword, these other criteria must balance with economy of operation. Perhaps it would be better to say that these criteria must be tempered with economy because the most economical procedures may be far from being the best and most reliable.

### BASIC TRAFFIC INFORMATION IS ESSENTIAL

Before a county highway can be classified or evaluated, it is essential that information be available concerning volumes and character of traffic using the road. In 1937, the Indiana State Highway Planning Survey published traffic volume maps showing the daily volume for all county roads in each county. Current maps may be developed by collecting appropriate data from properly selected field stations (manned for at least eight hours, except for a few control stations which should be utilized for 24 hours or more) and applying proper expansion factors to obtain pertinent information for all rural roads. In Allen County, for example, 125 eight-hour stations and five 24-hour stations were used as shown in Figure 1. A uniform and understandable system of rural road identification is necessary to facilitate the location of these stations both in the field and during the analysis of the data.

It is of interest to observe the changes in traffic volumes on Allen County rural roads as indicated in Table 1. Of special importance is the fact that 400 or more vehicles per day were carried by 4.2 percent and 12.2 percent of the rural county highway mileage in 1937 and 1954 respectively.

TABLE 1  
PERCENTAGE OF RURAL ALLEN COUNTY ROAD MILEAGE  
CARRYING VARIOUS DAILY TRAFFIC VOLUMES  
IN 1937 AND 1954

Average Daily Traffic Volume (Vehicles per day)	1937 (Percent)	1954 (Percent)
0-25	19.7%	12.8%
26-99	52.1	48.7
100-399	24.0	26.3
400-999	3.9	9.2
Over 1000	0.3	3.0

### CLASSIFICATION PROCEDURES

The primary purpose of county roads is to serve local traffic, abutting property, and the community. The degree to which a highway fulfills this purpose is used in classifying the road as a County Primary, County Secondary, or Local Service Road. The ultimate objective of

any classification system is to provide a coordinated arrangement of State, County Primary, County Secondary, and Local Service Highways which will adequately serve the various sections of the county.

Traffic volume and character of use should play a major part in the classification of county highways because nearly all Indiana county highway revenues are derived from highway user imposts. On the other hand, the effect of abutting property cannot be completely ignored because of the direct relationship between land use and traffic generation.

#### *The County Primary System*

Certain highways, because of their location in the county and method of construction, may have average daily traffic volumes in excess of 400 vehicles a day while others may carry several thousand vehicles a day. These roads may serve to connect a large city with a smaller rural community or they may serve as a vital connecting link between two state highways or to connect highly productive areas.

#### *The County Secondary System*

Traffic volumes generally ranging from 100 to 400 vehicles a day are an important indication of a possible Secondary System Road. The service provided by the road, such as connecting less important communities with each other and/or with higher classification roads or highways, must also be considered.

#### *The Local Service System*

All remaining rural roads, which, as the designation implies, carry low daily volumes of less than 100 vehicles per day and tend to serve only the immediate area, should be classed as Local Service Roads. These roads do not serve as many people nor as much of the county and consequently require lower design standards.

As indicated by the legend in Figure 2, only 150 miles of the 1,224 total rural highway mileage in Allen County has been placed in the County Primary System. An additional 138 miles have been placed in the County Secondary System. It may also be observed that a combination of State Highways, County Primary Roads, and County Secondary Roads has resulted in two access or belt lines fairly near and farther away from Fort Wayne. Various system roads connect these belt lines with the remainder of the county.

### ROAD INVENTORY PROCEDURES

An accepted and valuable business practice is that of conducting periodic inventories in order to determine the current status of the business. The highway administrator, like his commercial counterpart, should have a vital interest in knowing the present status of his business—the county road system. Every citizen has very definite

opinions concerning what is wrong with the county roads and how these faults are to be corrected. Consequently, when county road administrators are forced to allocate funds on the basis of opinions rather than facts, they can usually expect varied amounts of criticism from disappointed petitioners.

Generally, records describing the existing physical condition of the county road system are woefully inadequate and often inaccurate. It is therefore essential that the initial inventory be as complete and precise as possible. All pertinent information—such as highway number or name; right-of-way, shoulder, and roadway widths; roadside culture; type and condition of the pavement or other surface; topography;

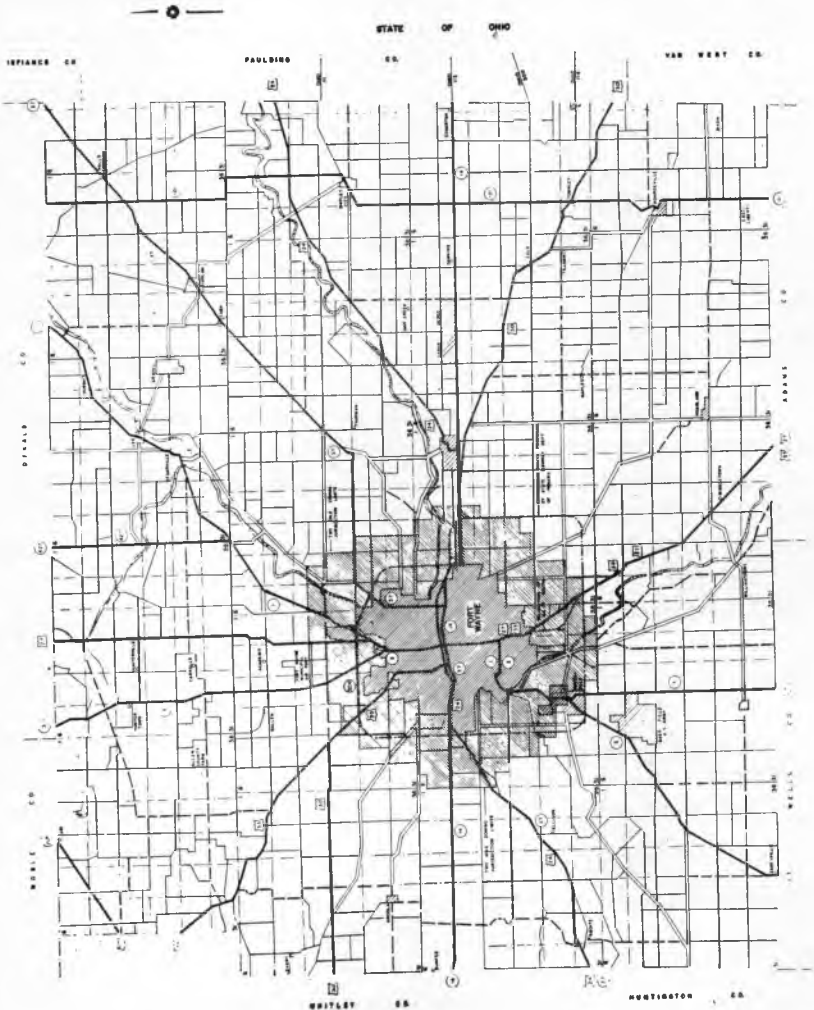


Fig. 2. Allen County, Indiana, highway classification map.

horizontal alignment; vertical sight distance; passing opportunity; safe driving speed; and gradient—is recorded for each tenth of a mile. This record will not only provide county road administrators with a factual record of essential road information, but the location and extent of critical conditions are readily evident. It is imperative, therefore, that the county highways be well identified through an accepted rural road identification system.

## EVALUATION PROCEDURES

Although an adequate inventory record can provide the highway administrators with facts about the county road network, there still may be considerable question as to what conditions are necessary to provide reasonably satisfactory service. Thus, the administrators are faced with the need for a set of scales with which to measure the ability of a section of highway to provide satisfactory service.

These scales, or design standards, have been developed to serve two purposes. The first is to provide, through the use of tolerable standards, a listing of modern highway design practices, every element of which is listed at the lowest possible value permissible under current motor transportation requirements. These minimum standards are not determined by the funds available to a job, but rather they are determined to identify and isolate those sections of the various county road systems which are so far below design standards that there is no question concerning their need for improvement. The second purpose of design standards is to provide, through the use of desirable standards, a listing of modern highway design practices which should be used for all new construction or reconstruction on the several road classifications.

Recommended, desirable, and tolerable design standards for Indiana rural county roads are shown in Figure 3. Some county officials may hesitate to approve the adoption of standards such as these because they may appear to be too high. It must be remembered, however, that much of the present congestion on county roads can be attributed to similar arguments of years ago, with the end result that funds were expended on the basis of design standards which the county officials "thought" they could afford. Consequently, the cost of providing an adequate highway is now much greater. The multiple costs of delay and lack of safety which resulted each year after the insufficient standards were utilized must also be considered.

## SERVICE RATINGS

As stated previously, the primary purpose of county highways is to serve local traffic, abutting property, and the community. Information



concerning the volume and character of traffic is available from the traffic count and knowledge of the land use of abutting property can be obtained from the road inventory. Community service is indicated by the use of certain roads for rural mail routes, school bus routes, and other public services. With the daily traffic volume carrying the most weight,

1954

ROAD CLASSIFICATION		LOCAL SERVICE		COUNTY SECONDARY		COUNTY PRIMARY		
HOURLY TRAFFIC VOLUME (VEHICLES/30th HIGHEST HR)		0 - 15		16 - 62		63 - 159		
AVERAGE DAILY TRAFFIC VOLUME (VEHICLES/DAY)		0 - 99		100-399		400 - 999		
		MINIMUM	DESIRABLE	MINIMUM	DESIRABLE	MINIMUM	DESIRABLE	
DESIGN SPEED (MILES / HOUR)	LEVEL	35	50	40	60	50	65	
	ROLLING	30	45	35	50	45	55	
	HILLY	25	35	30	40	40	45	
PAVEMENT TYPE		MINIMUM 5" CRUSHED STONE OR GRAVEL	MINIMUM 8" CRUSHED STONE OR GRAVEL	MINIMUM 8" CRUSHED STONE OR GRAVEL	MINIMUM 12" CR. ST OR GR. (STABILIZED WHERE OVER 200 VPD)	PAVEMENT ON STABILIZED BASE	PAVEMENT ON STABILIZED BASE	
MINIMUM WIDTH (FEET)	RT. OF WAY	40	60	50	80	60	100	
	SHOULDER	4	5	5	6	6	8	
	SURFACE	16	18	18	20	22	24	
MINIMUM SIGHT DISTANCE (FEET)	NONPASSING	LEVEL	240	350	275	475	350	540
		ROLLING	200	315	240	350	315	415
		HILLY	165	240	200	275	275	315
	PASSING	LEVEL	700	1400	900	2100	1400	2500
		ROLLING	500	1150	700	1400	1150	1750
		HILLY	300	700	500	900	900	1150
DEGREE AND RADIUS OF SHARPEST CURVE ( FEET )	LEVEL	18° 318	9° 637	14° 409	6° 955	9° 637	5° 1146	
	ROLLING	25° 229	11° 521	18° 318	9° 637	11° 521	7° 819	
	HILLY	36° 159	18° 318	25° 229	14° 409	14° 409	11° 521	
MAXIMUM GRADIENT (PERCENT)	LEVEL	10	7	8	6	7	6	
	ROLLING	10	8	10	7	8	7	
	HILLY	12	10	10	8	8	8	
STRUCTURES	WIDTH (FEET)	18	22	20	24	24	28	
	LOADING	10 T	15 T	10 T	15 T	15 T	20 T	

Fig. 3. Design policies for Indiana rural county roads.

it seems obvious that the more of these other elements that exist along a given section of highway, the more critical is the urgency for providing a satisfactory highway to serve this demand. If two road sections have identical unsatisfactory design features, but one road carries a high daily traffic volume through a region of concentrated roadside development, while the other carries a relatively low traffic volume through undeveloped lands, there seems to be no doubt that the former should have priority.

### ROAD RATINGS

The ability of a highway section to satisfy service demands can be measured when the various elements of the three main categories of structural adequacy, geometric design, and safety are compared with design standards. The most important of these categories is structural adequacy which includes such elements as pavement type, pavement condition, roadside drainage, structures, and railroad grade crossings. If these elements are in critical condition, especially pavement condition and structures, the ability of that section of road to provide satisfactory service is definitely limited.

Geometric design elements include right-of-way, pavement, and shoulder widths; gradient; and alignment. The most important of these elements is pavement width, and consequently, it is weighted higher in the rating process.

The safety category includes such elements as vertical sight distance, surface condition, safe driving speed, passing opportunity, and shoulder condition.

### A PRIORITY RATING FOR HIGHWAY IMPROVEMENT

The Service Rating factor provides a measure of the service to be provided by a given section of highway while the Road Rating factor provides a measure of the physical condition of the highway section. The critical requirement still remains to relate these two factors to each other in order to establish a numerical priority for improvement. This priority value must be impartial and actually portray the relative needs of the various road sections.

Certain mathematical properties seem desirable in any formula to express priority through a relationship between the Service Rating and the Condition Rating. These mathematical properties are:

1. Roads which provide a minimum service should have a priority rating which approaches a minimum value regardless of condition.

2. Roads which are ranked near the maximum as to condition (i.e., high road rating) should have a priority value rating which also approaches a minimum value regardless of the service provided by that road.
3. For a constant service rating, the rate of change of the priority rating should increase as the road rating decreases.
4. For a constant road rating, the rate of change of the priority rating should increase as the service rating increases.

The exact method for determining this Priority Rating is now being studied and should be determined later this year.

The priority rating cannot be regarded as a panacea by county highway administrators and used blindly as such. It should be considered as a guide, or an engineering tool, which has been developed to assist the administrator in doing a better job. It is neither desirable nor practical to improve only those sections having the lowest cost. From a public relations standpoint, it is impossible to expend all improvement funds on one highway or in any particular area of the county simply because the highways have a high priority rating. The administrators are concerned with a county-wide network of highways, critically in need of improvement funds, and consequently all sections of the county must receive consideration.

### GENERAL SUMMARY AND RECOMMENDATIONS

With the increasing need for the proper allocation of county highway funds, it is imperative that county administrators adopt techniques which are being developed to replace opinions with facts, and political expediency with sound judgment. Certain basic information is necessary in order to properly determine how and what county highways are utilized and what highways should receive priority in the allocation of improvement funds. The basic techniques now being developed by the Joint Highway Research Project and described in this paper are intended to guide county administrators.

Pending final refinement of these techniques, the respective counties should adopt uniform highway identification methods and begin to accumulate accurate and complete records which will facilitate the adoption of these classification and evaluation procedures. What are the current traffic volumes on every section of our county highways? What is the character of these traffic volumes? What are the maintenance costs for each highway sector? Answers to these and similar questions will be necessary when county highway classification and evaluation procedures are initiated in Indiana.