

# Prioritization of Road Networks for Rural Road Improvement with Analytical Hierarchy Process

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## Abstract

A methodology is developed in this study for prioritization of rural road for their improvement. Rural road are tertiary system in any road network, but connect largest habitation to big cities. As we know that largest population of India is living in rural area, and maximum of them are dependent on agriculture. It is mandatory for better development of any country to built rural roads to connect people of this area to urban area. This study gives a list of factors which affect rural road and their relative weightage. This weightage are carried out with the help of analytical hierarchy process. Analytical hierarchy process is a mathematical tool to determine relative weights of factors. Actual condition rating of these factors is multiplied with weightage of factors and rural road improvement index (RRII) is determined. Lower the value of rural road improvement index indicates good condition of road.

**Keywords:** Rural Road Improvement, PMGSY, RRII

## I. INTRODUCTION

Agriculture is dominating parameter in budget of India. Rural road affects economy of Indian government, Hence improvement of rural road is needed. This process of improvement is based on financial condition of government, although it is well known that budget is not always available at desired amount. So it is required to prioritize rural roads for improvement on basis of their present conditions. A road is classified in three sections like; straight section, curve section and intersection. Factors which affect rural road improvement are identified in each road sections. Total seven factors are identified in each road sections, and it resulted into total twenty one factors which affect rural road improvement in any entire road network. Following four stages are carried out in development of methodology. First is identification of Factors, second is determination of relative weights to this identified factors, third is assign rating to actual condition of factors and last stage is calculation of rural road improvement index (RRII).

## II. METHODOLOGY

In this study total twenty one factors are identified which affect rural road improvement. Firstly road is categorized into three section like straight section, curve section and intersection. Further it is categorized into different seven conditions like geometrical, surface, shoulder, drainage, road marking, road sign and street light. These seven conditions affect straight section, curve section and intersection. Next stage of this work is to determine weightage of these twenty one factors by analytical hierarchy process. Analytical hierarchy process is a tool to determine the weightage of several factors in any hierarchy. The Analytic Hierarchy Process (AHP) has been developed by T. Saaty and is one of the best known and most widely used. It allows users to assess the relative weight of multiple criteria or multiple options against given criteria in an intuitive manner. Following table presented weightage of factors.

Table – 1  
 Weightage of Factors

S.No.	Identified Factors at all sections	Weightage of factors (WF) at different sections		
		Straight	Curve	Intersection
1.	Geometrical Condition	0.0653	0.077376	0.099138
2.	Surface Condition	0.1021	0.121024	0.155062
3.	Shoulder Condition	0.0170	0.03744	0.04797
4.	Drainage Condition	0.0316	0.02016	0.02583
5.	Street light Condition	0.02430	0.02880	0.03690
6.	Road Marking Condition	0.00972	0.01152	0.01476
7.	Road Sign Condition	0.01998	0.02368	0.03034
	Total	0.270	0.320	0.410

### III. ACTUAL CONDITION RATING OF FACTORS (CF)

Again it is suggested to give actual value to identify factors on the basis of visible survey by a technical person. Assign: 0 values to excellent condition of factors, 0.1 to 0.24 to good condition of factors, 0.25 to 0.49 to satisfactory condition, 0.5 to 0.74 to poor condition and 0.75 to 1 to very poor condition of factors.

### IV. DEVELOPMENT OF RURAL ROAD IMPROVEMENT INDEX (RRII)

For rural road improvement, evaluation of rural road improvement index is used at straight sections, curve sections and intersections for these four formulae are developed.

#### A. Rural Road Improvement Index at Straight Section is Product of Weight and Actual Condition Rating of Safety Factors at Straight Section

$$RRII_S = \sum WF_S \times CF_S$$

Where,

$RRII_S$  = Rural road improvement index at Straight Section

$WF_S$  = Weight of Factors at Straight Section

$CF_S$  = Actual Condition Rating of Factors at Straight Section

#### B. Rural Road Improvement Index for Curve Section

Rural road improvement index at curve section is product of weight and condition rating of factors at curve section.

$$RRII_C = \sum WF_C \times CF_C$$

Where,

$RRII_C$  = Rural road improvement index at Curve Section

$WF_C$  = Weight of Factors at Curve Section

$CF_C$  = Condition Rating of Factors at Curve Section

#### C. Rural Road Improvement Index for Intersection

Rural road improvement index at intersection is product of weight and condition rating of factors at intersection.

$$RRII_I = \sum WF_I \times CF_I$$

Where,

$RRII_I$  = Rural road improvement index at Intersection

$WF_I$  = Weight of Factors at Intersection

$CF_I$  = Condition Rating of Safety Factors at Intersection

#### D. Rural Road Improvement Index for Road Section

Rural road improvement index for entire Road is determined by summation of equation rural road improvement index at straight, curve and intersection.

$$RRII_R = \sum RRII_S + RRII_C + RRII_I$$

Where,

$RRII_R$  = Rural road improvement index for entire Road

$RRII_S$  = Rural road improvement index at Straight Section

$RRII_C$  = Rural road improvement index at Curve Section

$RRII_I$  = Rural road improvement index at Intersection

Higher the value of rural road improvement index indicates higher need of improvement in road network.

### V. CONCLUSION

The weighted sum of the condition rating and weight of factor is used to calculate a rural road improvement index (RRII) for a rural road section. Road sections with the highest values of rural road improvement index (RRII) are identified as the road network which requires first priority for improvement. Road sections with the lowest values of rural road improvement index (RRII) are identified as the road network which requires least priority for improvement that means it is in good condition among all the roads. The outcome of this study is Rural road improvement index (RRII) and identification of factors which affect rural road improvement. Thus, it is expected that this study will be beneficial in improvement of rural road network on the available budget for rural road improvement.

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