

# A Preliminary Study on the Determination of Road Maintenance for Each Region Using Multiple Regression Analysis

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**Abstract:** The costs due to the maintenance and its method of national road have increased every year, and the maintenance costs have become higher due to the maintenance method without considering the characteristics of each region. This study is a preliminary study regarding the determination of maintenance method according to the characteristics of each region by applying variables (e.g. serviced time, traffic volume, average temperature, maximum temperature, minimum temperature, rainfall, and snowfall) to decide the maintenance and its method through the correlation analysis of road maintenance and repair period for each regional agency using the maintenance history data of national road management agency.

**Keywords:** Maintenance Cost, Rainfall, Traffic Volume, Regression Model

## 1. INTRODUCTION

The costs due to the maintenance and its method of national road have increased every year, and the maintenance costs have become higher due to the maintenance method without considering the characteristics of each region.

This study is a preliminary study regarding the determination of maintenance method according to the characteristics of each region by applying variables (e.g. serviced time, traffic volume, average temperature, maximum temperature, minimum temperature, rainfall, and snowfall) to decide the maintenance and its method through the correlation analysis of road maintenance and repair period for each regional agency using the maintenance history data of national road management agency.

## 2. RESEARCH METHODOLOGY

A total of 7 cities and counties targeting 5 road management agencies were set with variables influencing the serviced time including traffic volume, average temperature, maximum temperature, minimum temperature, rainfall and snowfall, and 3 groups were set for the traffic volume.

TABLE I  
TRAFFIC VOLUME GROUP (AADT)

| LOW<br>(<1000) | MIDDLE<br>(1000<=5000) | HIGH<br>(5000<) |
|----------------|------------------------|-----------------|
| 6              | 21                     | 70              |

In this study, the multiple regression analysis was carried out with 97 zones and 6 independent variables including traffic volume, average temperature, maximum temperature, minimum temperature, rainfall and snowfall using the maintenance history data to verify the influence on the serviced time which was the dependent variable.

Among 6 variables, the rainfall was entered first and the traffic volume was entered last according to the stage procedure. The summary of regression model established with selected variables is as shown in TABLE.2. The rainfall is 51.3% of total variables of dependent variables and the traffic volume which is the second item is 17.9%. These 2 variables accounted for 69.3% of total variables. The goodness-of-fit test result of model was very significant as P=0.000.

The variance analysis table shown in TABLE.3 shows that the ratio of regression variance (=471.636) among the total (=680.816) is 69.27%. Therefore, rainfall and traffic volume account for 69.27% of the variables of serviced time in 7 cities and countries, leading to the significant result.

Therefore, the ratio variable of maintenance zones in 7 cities and counties was 69.27%, indicating that the influence of rainfall and traffic volume was high at the time of maintenance.

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TABLE II  
 SUMMARY OF REGRESSION MODEL

| Model | R     | R square | Modified R square | Standard error of estimate | Statistic variation |             |                     |                     |                                      |
|-------|-------|----------|-------------------|----------------------------|---------------------|-------------|---------------------|---------------------|--------------------------------------|
|       |       |          |                   |                            | R square variation  | F variation | Degree of freedom 1 | Degree of freedom 2 | Significance probability F variation |
| 1     | .716a | .513     | .508              | 1.8578                     | .513                | 101.259     | 1                   | 96                  | .000                                 |
| 2     | .832b | .693     | .686              | 1.4839                     | .179                | 55.476      | 1                   | 95                  | .000                                 |

A. PREDICTOR : RAINFALL

B. PREDICTOR : RAINFALL, TRAFFIC VOLUME GROUP

TABLE III  
 VARIANCE ANALYSIS

| Model |            | Sum of square | Degree of freedom | Mean square | f       | Significance probability |
|-------|------------|---------------|-------------------|-------------|---------|--------------------------|
| 1     | Regression | 349.483       | 1                 | 349.483     | 101.259 | .000b                    |
|       | Residual   | 331.333       | 96                | 3.451       |         |                          |
|       | Total      | 680.816       | 97                |             |         |                          |
| 2     | Regression | 471.636       | 2                 | 235.818     | 107.097 | .000c                    |
|       | Residual   | 209.181       | 95                | 2.202       |         |                          |
|       | Total      | 680.816       | 97                |             |         |                          |

B.PREDICTOR: RAINFALL

C.PREDICTOR: RAINFALL, TRAFFIC VOLUME GROUP

### 3. CONCLUSION

This study is a preliminary study aiming to determine the repair method for each type according to the characteristics of each region by setting variables influencing the serviced time including traffic volume, average temperature, maximum temperature, minimum temperature, rainfall and snowfall using the maintenance history data of national road management agency and applying a different maintenance according to the characteristics each region. A total of 7 cities and counties targeting 5 road management agencies were set with the serviced time divided into 97 zones and variables influencing the serviced time including traffic volume, average temperature, maximum temperature, minimum temperature, rainfall and snowfall, and 3 groups were set for the traffic volume, and the result was drawn using the multiple regression analysis technique.

It is expected that it would be possible to determine a model with high reliability and repair method for each

reason based on a better regression analysis through the accumulation of monitoring data of weather data and repair zones in future studies.

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