DEVELOPING A MODEL FOR ESTIMATING THE CONSTRUCTION PERIOD OF A ROAD PROJECT: A SURVEY OF ROAD CONSTRUCTION PROJECTS IN KENYA FROM YEAR 2002 TO YEAR 2011

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Developing a model for estimating the construction period of a road project: A survey of road construction projects in Kenya from year 2002 to year 2011

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other university.

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DEDICATION

To my dear wife Thaara, daughter Wanjiru, sons Muoria and Mureithi for giving me home comfort and encouragement throughout the time of my study.

To my Lord God almighty be the glory and praise for making this seemingly impossible task humanly achievable.

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LIST OF ABBREVIATIONS

KeNHA Kenya National Highways Authority

KERRA Kenya Rural Roads Authority

KURA Kenya Urban Roads Authority

KIPPRA Kenya Institute of Public Policy and Research Analysis

MOR Ministry of Roads

MONM Ministry of Nairobi Metropolitan

FDOT Florida Department of Transport

VDOT Virginia Department of Transport

KNBS Kenya National Bureau of Statistics

CDF Constituency Development Fund

ABSTRACT

This study developed a model for estimating the construction period of a road project. The model was developed after a survey of road construction projects implemented in Kenya between the year 2002 and 2011.

The estimation of construction period of road projects in Kenya remains largely undeveloped. In practice, the estimation is based on an unclear combination of cost of project, history of implementation of similar projects and the intuition of the estimator who is normally the client's representative. This estimation process is subjective and inconsistent and is therefore likely to give spurious estimates because it does not adequately take account of many of the factors that may influence the construction speed of road projects. This error is likely to give contract periods that are unrealistic in that they may be too short or too long. Additionally, the error may lead to wrong assessments of project performance reflecting time overruns that are not real.

The objectives of this study were to identify the factors that influence construction period in road projects in Kenya and develop a statistical model for estimating this period. Quantitative data were collected using a survey questionnaire and analysis carried out using the Statistical Programme for Social Sciences (SPSS for Windows, version 16). The statistical procedures included descriptives (Measures of Central tendency, dispersion and distribution), correlation analysis and multiple linear regression. These procedures were chosen because they were considered most

appropriate to test the research hypothesis identified and hence achieve the aim and objectives of the study.

The factors that were found to be significantly correlated to the construction period at 95% confidence level were the scope of the project, adequacy of client's preconstruction planning and the contractor's capacity each of which was represented by one or more surrogates. The surrogates of the significant factors are as follows:

1) Construction cost in Billions of Kenya shillings, at 2010 prices
2) Presence or absence of feasibility study, a dichotomous variable.
3) Degree of design completion at tender stage measured on a seven point scale
4) Classifications of contractors in the ministry of roads register as indicated on a seven point scale.

An intervening variable, construction rate was defined. This intervening variable was regressed on all the four surrogates found to be significant. The four significant surrogates were entered into the regression model and by backward elimination method, the least significant ones were removed from the regression model which finally left only two of them in the equation as follows:

$$\textbf{Log CR} = \textbf{0.044 + 0.321Log C + 0.108D} \quad \textbf{and} \quad \textbf{T} = \frac{\textbf{L}}{\textbf{CR}}$$

Where;

CR is the construction rate in lane kilometers per month.

T is the construction period in months.

L is the length of standard lanes to be constructed in kilometres.

C is the estimated cost of the road works in Billions of Kenya shillings at 2010 prices.

D is the number of design documents completed at the time of tender out of a possible list of 7.

This model has a coefficient of determination (R^2) value of 0.753. This means that the model explains 75.3% of the variation of the construction period (T) of a road project in Kenya. Other unknown explanatory variables not considered in this research which need to be explored explain the remaining 24.7% of the variation in T.

It is recommended that the model be used to estimate construction periods to be included in the construction contract documents and also when evaluating applications for extension of time from contractors. The model should also be used in estimating the construction period when formulating time based road construction contracts where incentives are offered for early completion and penalties effected for late delivery.

Finally, further research needs to be conducted in order to (i) develop similar models for other types of road works not considered here (ii) establish other explanatory variables in order to increase the coefficient of determination from the achieved 0.753 and hence the percentage of the variation in T explained by the model from the 75.3% obtained here.