Analysis of NCDOT 'S Funding and Reasons for Hindrance in the Klang Valley

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Abstract
Malaysia, for instance, is a developing nation heavily dependent on the construction industry. Additionally, highway development is essential because it facilitates people's movement between locations. When it comes to a building project, delays are difficult to avoid in the construction industry. When a project is delayed, both its cost and its quality are affected. This study aims to determine which of the numerous factors that could lead to delays in a highway construction project are the most crucial to the project as a whole. Data are gathered through a pilot survey and questionnaire. Utilizing the Relative Importance Index method to rank and evaluate the degree of relevance was the next step. Poor planning, bad weather, poor site management, poor site inspection, and buried utilities made up the top five reasons, according to the RII rating. Both the highest and lowest factors had figures of 0.851/0.671.

1. INTRODUCTION

The most crucial aspect of a highway construction job's success is timing. There have been a number of investigations into the factors that lead to construction delays. According to [4], the project's delays are the result of poor planning, particularly when it comes to highway construction, which involves numerous parties and departments. Modifications to the design were identified as the third most significant of the twenty factors that influence highway construction projects [5]. Additionally, a significant factor in project delays is the presence of underground utilities. Some of Malaysia's most important underground utilities include lines for power distribution, telecommunications, water and sewage pipes, and natural gas pipelines. Highway construction may run afoul of buried utilities. The process of getting permission and moving can typically take a long time and require a lot of time off from work. One of the least appealing aspects of building projects is rework or additional work [6].

The second most common cause of construction delays was a lack of materials [7]. The quality of the materials used in highway construction is very important. For instance, if the asphalt does not meet the requirements, it takes some time for new asphalt from the quarry to arrive [8, 9], 10]. Proper management of these aspects is essential because equipment and machinery breakdowns increase the amount of time required to fix problems. According to previous research conducted in India [11, 12], poor communication in the construction industry is a major obstacle to achieving excellent cost and time performance. In addition, it was discovered that the project's late start was in large part due to a lack of skilled workers in Norway. It was discovered that the weather in Surabaya is the most important factor in determining a building project's success. Inclement weather caused electrical machinery and equipment to malfunction. Damage to equipment,

according to reports, led to numerous delays and expenses for the highway construction effort.
Poor building practices have emerged as a significant obstacle to the construction project in Palestine, which may delay its completion beyond what was initially anticipated. The lack of experience of the contractors is another important factor, as they may not be able to keep up with the project's progress if they lack the necessary knowledge. One of the most common causes of project failure in the Indian highway construction industry is thought to be inadequate site research. Financial worries were found to be a major cause of building delays in the past, according to studies. Due to financial constraints, infrastructure development projects in India have experienced prolonged delays, particularly with highway projects.
An obvious factor in the project's delaying is the inability to reach a site. Heavy equipment delivery in road construction projects necessitates a large area for the entry and exit of a long trailer, but a lack of space will result in a delay in the delivery process and a reduction in project completion time. Poor decision-making also contributes to construction delays in Malaysia. In many instances, poor site management and oversight are to blame for construction delays. A project's success depends on competent on-site monitoring and effective construction site management. Everyone on the jobsite is seriously at risk from accidents that happen there. Safety and accidents on the job site play a significant role in the construction industry, particularly in highway construction. Land is the most valuable asset in any building project, no matter how big or small, in this industry. According to the city, land acquisition is the most common and significant cause of project delays in Mecca

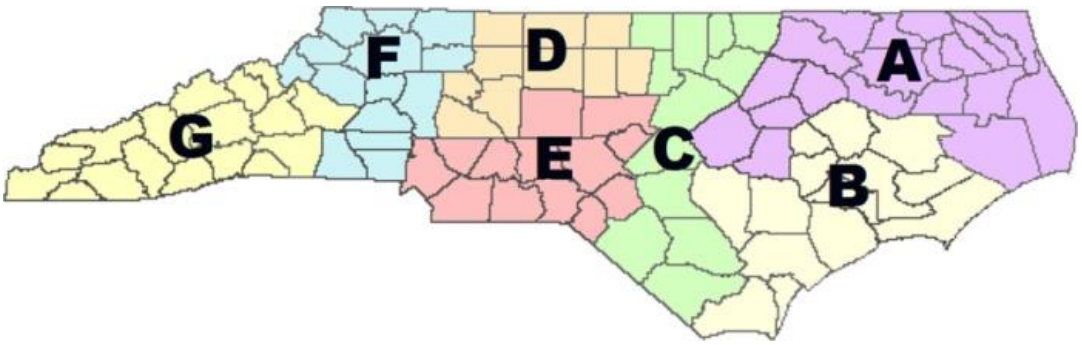

Fig.1 SevenregionsofNorthCarolina[18].”

2. LITERATURE REVIEW

This study discusses a financial scenario analysis for altering the release schedule of significant highway construction projects. Putting a project up for bid means making it available to a wider range of potential suppliers. Although North Carolina's Department of Transportation (NCDOT) is the focus of this article, the idea could easily be applied to other states. The Transportation Improvement Program (TIP) in the city's master plan includes numerous costly construction projects. Governments used the obligation basis before awarding construction contracts, which required a certain amount of money to be available to obligate against anticipated spending. The NCDOT has been using cash basis accounting to manage its total cash balance rather than project-specific expenditures since its inception in 2001 [1]. This is the new standard for managing total cash balances.
The state highway trust fund and the state highway fund receive almost all of their funding from pump fees [3]. Even though TIP construction project revenues can significantly diverge from anticipated amounts due to current economic concerns, this ambiguity regarding financing is one of

the primary risk factors that could result in inadequate funding allocation and delays. Consequently, despite the fact that cash-based management enables maximum spending on TIP development projects, this strategy has increased the risk of overdraft due to a small cash reserve maintained. A target cash balance of 12% of the anticipated annual revenue was established in an effort to improve financial management in North Carolina [4]. To be more specific, this means that the monthly cash balance of the NC DOT must be at least 5% larger than the total obligation for all transportation project contracts.

When anticipated financial flows indicate a potential overdraft or an exhaustion of available funds, respectively, the North Carolina Department of Transportation (NCDOT) must take the necessary action. In order to meet the required cash level, the NCDOT, for instance, may delay the leasing of certain building projects for a number of months. On the other hand, in order to reduce an unmanageable cash flow, certain projects may be expedited. These measures have been debated and ultimately chosen by a group of NCDOT departmental representatives. By presenting an ideal release schedule under a new financing scenario, this research aims to provide quantitative guidance for the committee's decision-making process. The best leasing schedule that minimizes overall performance impact while maintaining a reasonable cash balance can be determined with the help of an optimization model. We will illustrate as an added bonus because it is hard to find other studies that have looked at this topic because it is unique. In Section II of this study, we provide a brief literature review for highway construction planning issues. In Section III, a mathematical programming model is shown to figure out the best let schedule for a given funding situation. A forecasting model that is capable of accurately anticipating the costs of particular projects is necessary for the implementation of this strategy. The NCDOT case study in Section IV demonstrates the construction of payment forecasting models and the application of optimization models for rolling-horizon-based let scheduling, assessing the impact of funding shifts and identifying high-risk projects in the face of funding changes. To the best of the authors' knowledge, there are a number of studies of quantitative methods for transportation project planning in the literature, but none of them are directly applicable to the circumstance that is presented here. As a result, the publications analyzed in this section are included in a broader group of transportation program management issues.

Benjamin [5] employed a linear goal-programming approach to simultaneously implement multiple public sector programs. He chooses a group of projects from a list of possible options in the beginning. The multi-criteria strategy that Taplin and Qiu [6] proposed for a budget allocation problem in Australian public road construction is similar. Once the projects have been chosen, they are analyzed in terms of social, economic, and political objectives within resource constraints. This study goes beyond the standard cost-benefit analysis to evaluate a project. They have developed a number of criteria, all of which are rated from 0 to 10, including the state and national economies, tourism, time savings for individual and business travelers, and savings on vehicle operating costs.

Niemeier et al. present the following models for selecting transportation projects: [7). putting the projects in order of importance without taking into account trade-offs between project costs and a ranking model that makes it easier to choose between costs and ranks;

establishing a specific goal for each purpose in order to achieve policy goals; budget models requiring each project to meet or exceed the policy goal; a model that takes into account the project's budget as well as its relative importance. Gao and others 8] a mixed-integer nonlinear bilevel optimization strategy was used to select construction projects for expanding infrastructure

and maintaining roads. Vehicle speed is affected when the cost of road construction and upkeep is taken into account. An extended version of Bender's decomposition is used to solve the optimization problem.

A member of the Highway and Transportation Research Council in Virginia, Jensen [9], claims that other states were prioritizing projects in this manner at the time: The research determines the subjective descriptors that apply to the various parts of the rating scale, and each criterion is graded on a scale of 100 points. Patidar and co. Based on the incremental utility-cost ratio (IUC), Lagrangian relaxation, and pivot and complement approaches, 10] recommends placing bridge repairs first. In that study, there is a weighted utility scale for each bridge performance requirement. When it came to agency-wide bridge management, the IUC consistently outperformed the competition in terms of computational effort, accuracy, simplicity, and durability. Shang et al. [] offer a method for selecting transportation projects. 11] that takes into account dependence and feedback across a variety of decision levels and criteria. A nine-member advisory committee divides the criteria into four primary categories using the so-called Nominal Group Technique: opportunities (at costs), risks (at costs), and advantages. Comparative analysis is used to determine the relative relevance of a number of categories and the ancillary criteria to the overall goal. To account for the interrelationships between projects and criteria, our integrated approach to selecting transportation projects makes use of fuzzy Delphi, analytical process concepts, and 0–1 goal programming. 12].

3. PROPOSED SYSTEM

Despite the fact that the TIP typically consists of three stages—preliminary engineering, right-of-way, and construction—the majority of project costs are incurred during the construction phase. The construction phase begins with a bidding process. If a construction project is awarded a contract, the DOT will pay it until it is finished. DOT may alter and regulate cash flows to some extent on awarded projects, but monthly expenditures are distributed in accordance with development speed. Despite this, the cyclical nature of cost components makes it possible for real spending to change in unexpected ways.

Instead of limiting the costs of current construction projects, there are alternative strategies for dealing with funding changes for the Department of Transportation. One such strategy is to modify the timetable for future building projects. One of the many factors that could influence the decision to modify the lease schedule is the significance of the projects. Using a method known as priority rating, the North Carolina Department of Transportation (NCDOT) can rank the importance of each and every construction project. Keep in mind that the priority score of a project could be interpreted as a measure of how important the project is. As a result, the priority score ought to be taken into consideration when coming up with the lease schedule.

(3) xk0,1 fori = 1,2,...,N+1 and k = 1,2,...,K. (4) The goal in is the total penalties incurred during the planning period. Each project can only be allowed once throughout the planning horizon to meet the restrictions in (2) and the binary constraints in (4). B).

The LRP is a finitely many-solution binary integer programming problem. Negative penalties are imposed if a significant delay occurs, zero penalties are imposed if a significant delay occurs, and positive penalties are imposed in the event of a major delay in the lease date. Then, let's say that project k was originally scheduled to be awarded in period j. If this is the case, let d and a "denote

acceptable delays and advancements in the let date, respectively. Thus, the following is the definition of the penalty for a new lease date I:

pk>0, ifi>j +d pk=0, ifja ij+d, where a negative penalty is used to represent a reward.

Once a project has been awarded, the costs of construction are frequently divided. Assume that project k has been given term I. At the end of the planning horizon, we can estimate its total construction cost (N). The constant ck shows the total cost of building project k during period N when it is leased during period I, assuming that I is 1, 2,...,N and k is 1, 2,...,K. If the number of years N is 36, the total cost of Project 6 at period 36, when it is allowed in the 12th year, is c6. C6 is only used for 24 times, not the 365 times that were previously reported. For I = 1, 2,...,N + 1 and k = 1, 2,...,K, the integer programming problem xk can be solved with any ready-made solution. We will devise a timetable that minimizes penalties while making room for the financing adjustment. However, before drafting the LRP, the DOT must first determine parameter values such as pk and ck. You must fully comprehend the DOT's cash management system and the data you have access to in order to complete this assignment. In the North Carolina Department of Transportation case study, parameter values will be discussed in greater detail. (NCDOT).

TABLE 1:PARAMETER VALUES FOR INDIVIDUALCONSTRUCTION COSTESTIMATIONMODELS

Type	No. of Projects	State Funded	Federal Funded	Total Estimated Cost ($million)
B	6	0	6	125.4
I	13	0	13	648.6
R	24	10	14	1,097.2
U	23	2	21	734.2
Overall	66	12	54	2,605.4”

LRPs are automatically updated to the next time period when they are successfully solved in a new period.This decision assistance tool is also useful when the NCDOT is dealing with changes in financing. Committees are formed when the NCDOT anticipates a change in financing, and these committees are made up of NCDOT staff members from several departments. In the committee, it has been common practice for some time to make quality judgments regarding delaying the start dates of construction projects. The committee's own response or a starting point for discussion could be LRP rescheduled let dates. This article uses an example of a three-year NCDOT lease schedule from September 2014 to August 2017. Federal and state funds are expected to be allocated to 54 projects during this time period for 66 distinct species of whales, all of which fall into one of four categories. Bids are open for these projects during this time period. See Table VII for an estimate of the project's total costs. This estimated cost represents the total amount that would be

paid out in the event that all 66 projects are selected. If all projects are completed on time as planned, as shown in Table V, using the individual cost estimates model and the parameter values in Table V, construction costs will total $1,345,370,903. Let's say that the NCDOT needs to cut construction costs by $100 million for the project. To avoid violating confidentiality, we used fictional priority ratings for those projects in this analysis. Real priority rankings would have violated confidentiality. An open-source solver called GLPK [14], which performed well in a recent evaluation of open-source solvers, was used to solve the problem after the LRP was constructed. pk. As shown in Table VIII, the start dates of ten projects need to be changed in order to get the right result. Keep in mind that the priority ratings for this investigation were chosen at random. Consequently, the actual outcome would differ significantly from this one. to ensure that no unanticipated outcomes occur.

TABLE II: RESCHEDULED LET DATES UNDER A DEFICIT OF $100 MILLION

Project ID	Old Let Date	New Let Date	Schedule Difference	Funding Source
I-28xx	11/1/2016	1/1/2017	2	Federal
I-54xx	10/1/2014	9/1/2014	-1	Federal
I-55xx	6/1/2017	7/1/2017	1	Federal
R-25xxA	12/1/2015	6/1/2016	6	State
R-25xxB	10/1/2015	6/1/2016	8	State
R-25xxC	3/1/2016	4/1/2016	1	State
U-25xx	10/1/2014	6/1/2015	8	State
U-33xx	11/1/2014	9/1/2014	-2	Federal
U-34xx	11/1/2014	9/1/2014	-2	Federal
U-28xx	5/1/2016	9/1/2016	4	Federal”

Projects on four cities, three interstates, and three rural roads have been put off. The "schedule difference" column displays negative and positive figures for ad-vacating and delaying the lease dates, respectively. The completion dates for I-54, U-33, and U-34 have been extended, but the remaining seven projects have been put off. We have a window of opportunity to move forward with those three priority initiatives by delaying these seven initiatives. October marks the beginning of the federal fiscal year (FY) and the state fiscal year (FY) for North Carolina. As a consequence of this, the three projects that are supported by the federal government have been rescheduled for

September in order to take advantage of the opportunity to advance into the subsequent fiscal year. Projects delayed and not completed during the current fiscal year will incur a greater penalty. However, seven of these projects are still scheduled to be released this fiscal year. Four state-funded projects have experienced delays: A and B of R-25; U-25; and U-25; while the September of the same fiscal year has been chosen for the federally funded U-28.

If construction costs are adhered to in accordance with the revised let schedule, there will be a savings of $100 002 481 compared to the anticipated cost of $1 345 370 903 in the previous schedule. We might investigate how to deal with shifts in the committee's funding by starting with the LRP's lease schedule. The LRP and the FPRM can be used together to complete the picture. The FPRM is used to identify, evaluate, and prioritize risks related to project financing (Teng et al. 2013). To reduce or eliminate the impact of undesirable outcomes, it is essential to identify and monitor the initiatives that are most susceptible to funding changes. Finding such ventures may be made easier by simulating various financing scenarios. Let's say that we were able to show our financing change as a percentage of the amount of misinformation that was originally predicted by replacing the last two digits of the TIP numbers with "xx." If they yield the same masked numbers as before, we can differentiate them by adding capital letters in alphabetical order. Take into consideration the three TIP numbers in Table VIII, all of which start with the same two digits: R-25. In order to differentiate the TIP numbers, we added the suffixes A, B, and C after "xx." B is the same as rB0, where r is the percentage of the construction cost. When we change the value of r, we can see which programs are more susceptible to changes in funding. The case study looks at possible financing deviations from B0 of 5%, 4%,..., 1%, –1%, –2%, –9%, and 10%. In the first five scenarios, funding is sufficient, while in the last ten, funding is inadequate.

4.CONCLUSION

An LRP is taken into consideration for highway construction projects in this article due to the anticipated shift in financing. The Department of Transportation's large-scale construction projects frequently require state and federal funding. State and local governments must be able to deal with sudden changes in income resulting from a variety of taxes and levies that are subject to dramatic economic fluctuations in order to avoid overdrafts or excessive cash holdings. In addition, there is a connection between the LRP and FPRM in that program managers use the LRP to identify projects that might see their funding changed and take the necessary action. We developed a mathematical programming method for determining the optimal time to release a film in light of shifting financial resources. The case study by the North Carolina Department of Transportation includes projects in rural and urban areas as well as bridges and interstates. We only look at large-scale projects with construction costs of $10 million or more because of the significant impact they have on cash flows. In this case study, we predict the costs of construction for specific projects using a formula and a constrained logistic model. Consider the following three ideas to make the most of this brand-new LRP: Implement planning that evaluates the risk associated with potential funding shifts as a means of raising funds for construction projects. It is simple to apply DOT research on highway construction projects to other large-scale project management organizations, such as the military.

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