Metropolitan Transportation Planning and Contingency Planning of Highway Projects

[1]Dr. Bundi Arun Kumar

[1]Professor, Department of Civil Engineering, Ashoka Women's Engineering College, Kurnool, Andhra Pradesh, India

Article Info
Page Number: 395 - 404
Publication Issue:
Vol 69 No. 1 (2020)

Abstract
Previous research has highlighted the significance of risk assessment in construction projects, and a variety of approaches to addressing potential hazards have been advocated for each phase of the project. One way to deal with risk is to allocate funds for contingencies appropriately. The purpose of this research is to ascertain how much of an impact the aforementioned risk factors are thought to have on costs and schedules, as well as how relevant they are to the cost contingency amounts. The pre-identified risk factors were evaluated using survey responses from experts working on highway transportation projects. The relationship between expert risk ratings and predetermined cost contingency levels in these projects was investigated using regression modeling. The research found that poor constructability evaluations had a significant impact on the owner's contingency amount, while modifications requested by the owner had a significant impact on a project's timeline. During the planning phase of similar highway building projects, using these models and methods to estimate risk-appropriate contingency percentages might be helpful.

Article Received: *12 September 2020*
Revised: *16 October 2020*
Accepted: *20 November 2020*
Publication: *25 December 2020*

1. INTRODUCTION

In a metro area, over 50,000 people live. On the MPO board, which gives final approval to regionally important and federally funded transportation upgrades, government leaders from the city and county, state, regional, and municipal transportation agencies are all represented. MPOs spend more than a billion dollars annually, but many outside transportation providers and the people they serve are unaware of what MPOs are or how they operate.

Academics and planners emphasize the significance of metropolitan areas as economic entities and as the appropriate scale for addressing serious issues like transportation. The three Cs of continuous, cooperative, and comprehensive operations are frequently adhered to by MPOs. State Departments of Transportation (DOTs), local governments, and providers of public transportation set long-term goals and place a high priority on them. Despite this, modern MPOs face numerous

challenges in their day-to-day operations. Regional plans and investments that are contingent on their collective approval must be approved by a number of agencies and local governments. However, MPOs have little influence over the decisions that must be made regarding land use in order to achieve this goal, despite their growing advocacy for more bicycle- and pedestrian-friendly neighborhoods.

MPOs may become a more significant driver of regional development in the twenty-first century. Understanding the purpose and history of MPOs, as well as transportation planning prior to the majority of MPOs' establishment, is essential before addressing the issue of MPOs. A critical meta-review of the research on MPOs and regional transportation planning is carried out in this paper. I have three objectives: The practice of urban planning in the United States dates back to the 1960s and continues to this day. To the best of my knowledge, no one has connected the dots. Second, I'm curious about how these past and current MPO issues are connected. The third objective of this essay is to investigate various strategies for improving urban transportation planning.

The modern equivalent of an MPO for regional transportation planning is a reasonably well-developed organization. Their limitations, on the other hand, are real and range from dated membership structures to a lack of technological capability. Without strong leadership, knowledgeable and enthusiastic staff, the capacity to maximize limited resources, and the active participation of member jurisdictions, few MPOs are able to overcome these challenges (Transportation for America, 2014). In this study, I discover some long-buried causes of regional transportation planning issues. Despite its flaws, current planning provides regional transportation planners with significantly more direction than before federal law mandated 3C planning. Metro transportation planning is governed by legislation and administrative procedures that have changed over time and may serve as a foundation for future changes to MPO representation and regional transportation funding.

Continue reading this article to learn more about modern MPOs' operations and responsibilities. After that, I'll talk about how regional transportation planning has developed in the United States. When I talk about transportation planning in the early 20th century, I talk about the circumstances that prompted Congress to approve the Highway Act of 1962, which made 3C planning mandatory in metropolitan areas. I'll start by talking about the worries that policymakers have about modern MPOs, like the lack of a strong regional voice on investments. Last but not least, I'll talk about possible changes to MPO representation and finance.

What exactly are MPOs and how do they operate?

An umbrella organization that is in charge of transportation planning and decision-making in metropolitan areas across the United States and its territories is known as an MPO. On the other

hand, most people outside of the transportation industry don't know much about MPOs, so very little research has been done on them. The measures that have shaped modern MPOs were enacted as part of the Highway Act of 1962. A goal of the bill was to get cities involved in regional transportation decisions over federal highway funds, which are mostly controlled by state highway departments. For federal assistance in metropolitan areas, a continuous, collaborative, and comprehensive planning process (the 3Cs) was required.

The expansion of cities is governed by a number of federal and city-specific rules and regulations. Nevertheless, the governor of the state and the local governments that account for at least 75% of the region's population agree on the formation of each MPO. Under federal law, all MPO memberships, voting rights, decision-making procedures, and advisory committees must be implemented before MPO board rules can be implemented. Numerous MPOs are located in a single town or county. In addition to transportation, other MPOs are members of councils of government (COGs) that address regional issues like land use and economic development. It was difficult to plan transportation and other needs for metropolitan America in the early 20th century because there were no strong regional organizations to help with the process. Some MPOs that focus on transportation are independent organizations.

A structural flaw prevented linking the regional total to its constituent parts. Water management, traffic congestion, and other issues were addressed by regional planners like Patrick Geddes and Lewis Mumford. For instance, they established the Regional Planning Association of America to advocate for industrial metropolis-specific regional surveys and plans. There was a strong push for a government that was more metropolitan, which included annexing and merging cities with their suburbs.

The same issues that plagued early regional organizations—economic competition among jurisdictions, opposition to centralized planning, and resource limitations—still limit regional planning today. When the Port of New York Authority was established in 1921 to bring the facilities that were previously separated from one another in New York Harbor together, their ability to fully realize their goals for a publicly managed freight system was hampered by competing regional freight interests. During this time, the Board of Estimate, which represented the mayor, comptroller, five borough presidents, and the president of the city council, was in charge of the New York (NY) subway tunnel and trackage rights. The board's suspicions of central planning and competition prevented subway operators and planners from collaborating. Large-scale regional planning was difficult to carry out during the Depression and World War II due to a lack of funding from regional organizations like Chicago's Metropolitan Housing & Planning Council (MHPPC)

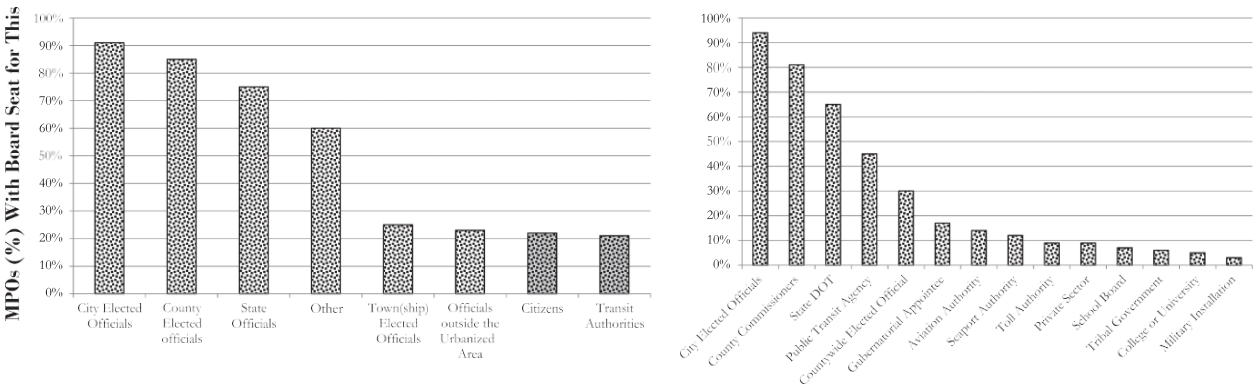

Fig.1 Development of MPO

2. LITERATURE REVIEW

According to previous research, professionals working in transportation are more concerned about the financial and time implications of risk. A lot of research led to the development of a three-tier risk analysis and contingency estimates for highway projects. These include identifying risks, qualitatively examining hazards, determining probable difficulties, and then carrying out quantitative risk evaluations. This method also includes active risk management. Reilly and Brown's (2004) risk and uncertainty methodologies are used to estimate the project's cost and provide a range of possible expenditures. This method, which goes by the name CEVP, is being used to check the costs that were estimated. Olumide et al. say that the Delphi method (2010), was used to create contingency graphs with sliding scales for three highway construction stages. A Love et al.-developed best-fit probability distribution function can be used to predict road construction contingency costs. Lhee (2009) says that artificial neural networks can be used to estimate how improvements to transportation infrastructure will affect costs. Gurgun and coworkers (2013) suggested a method for estimating the amount of schedule contingency required at various stages of project development. The completion rate ranges from 25% to 50%. Based on the most significant risk indicators, El-Touny and colleagues (2014) used the analytical hierarchy approach to model cost contingency. That was discovered (AHP). Chou and others Using real data from the Texas Department of Transportation (TxDOT), Bhargava's model-based economics can be used to predict the probabilistic cost of highway bridge replacement projects using a cumulative probability distribution function that was created in 2009. Ashley and others 2006) utilized risk management techniques to develop a policy for assessing risk in highway projects, including a quantitative risk analysis to anticipate unanticipated costs. The construction industry has been exposed to a number of risks. As a result, little research has been done on how risk drivers affect the cost of emergency plans. Published research articles did not indicate a connection between construction risks and project contingencies. We conducted this research to fill in the gaps in our understanding of the risk

factors associated with transportation construction and their connection to project contingencies. 31 potential risk factors were identified through a review of the scientific literature (listed in Table 1). The primary causes of risk events are referred to as risk drivers. This study was able to identify programmatic and project-specific construction risk indicators through extensive literature reviews and in-depth interviews with construction industry professionals. The Project Management Institute (PMI) has defined this term. According to the AACE Total Cost Management Framework's definition of contingency, this amount is added to the estimate to account for any unknown items, circumstances, or events. A cost contingency is a reserve budget set aside to deal with the monetary consequences of project risk and uncertainty, despite the fact that there are various methods for determining it. Project managers use contingency plans in the schedule to prevent delays, omissions, and other unanticipated occurrences and provide a safety net in the event that time estimates are incorrect. Anderson et al. claim that When it comes to creating contingency plans, "the conventional state highway agency strategy for allocating contingency has been to either follow a predetermined proportion for the changing phases of project development or to completely depend on the project estimator's expertise," as stated in 2007, Risk and uncertainty should be taken into account when determining a project's cost, and if necessary, contingency costs should be added. According to Table 1, a total of 31 risk factors were discovered and sorted into five major groups. This is because transportation agencies tend to focus on project risks rather than identifying and evaluating the individual hazards that contribute to a project's overall risk profile. In addition, respondents gave accurate figures for how much owner and/or tractor cost contingency was used in the projects that were reported. The majority of respondents stated that their contingency percentages were either 5% or 10%, according to the findings. Hypotheses testing was therefore carried out using two sets of contingency values for risk levels: high (more than 5%) and low (less than 5%). Hypotheses 1 and 2, which utilized these two levels of contingency in addition to evaluations of RI, CI, and SI, examined a total of 31 potential sources of risk. There was no correlation found between the contingencies of the owner or contractor and any of the 31 risk drivers' ratings. As a result, stepwise regression analysis was also conducted, which will be discussed in the following sections.

There are 31 potential danger spots. The model included all drivers' risk rating scores (such as CI and SI) as independent variables. We compared the ratings to the dependent or response variable, y, to see if they accurately reflected the owner or contractor's stated contingency percentage. SAS was used to perform a multicollinearity test, and the results showed that there was no multicollinearity in the cost contingency percentage. Because they are both network-based methods, CPM and the Program Evaluation and Review Technique (PERT) are frequently used in highway project

planning. Planners have a lot of animosity toward these approaches (Herbsman, 1987; NCHRP 2000). The difficulty of maintaining crew continuity, the difficulty of employing various crew strategies, and the fact that task production rates are unavailable at any given time during the project execution are some of the primary limitations of these methods.

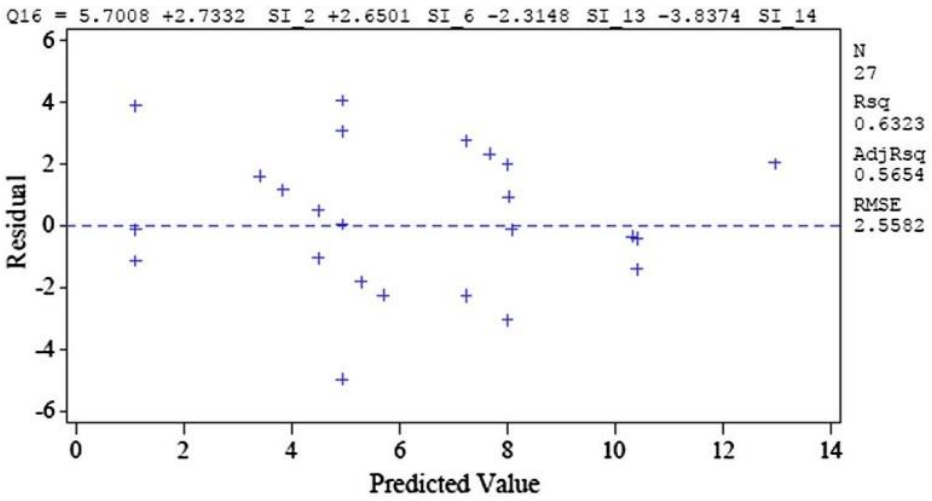

Fig.2 Stepwiseregressionofowners'contingencieswithSIratings

3. PROPOSED SYSTEM

In the early 20th century, there were no strong regional organizations to help with the planning of transportation and other needs for metropolitan America. A structural flaw prevented linking the regional total to its constituent parts. Water management, traffic congestion, and other issues were addressed by regional planners like Patrick Geddes and Lewis Mumford. For instance, they established the Regional Planning Association of America to advocate for industrial metropolis-specific regional surveys and plans. There was a strong push for a government that was more metropolitan, which included annexing and merging cities with their suburbs.

The same issues that plagued early regional organizations—economic competition among jurisdictions, opposition to centralized planning, and resource limitations—still limit regional planning today. When the Port of New York Authority was established in 1921 to bring the facilities that were previously separated from one another in New York Harbor together, their ability to fully realize their goals for a publicly managed freight system was hampered by competing regional freight interests. During this time, the Board of Estimate, which represented the mayor, comptroller, five borough presidents, and the president of the city council, was in charge of the New York (NY) subway tunnel and trackage rights. The board's suspicions of central planning and competition prevented subway operators and planners from collaborating. Large-scale regional

planning was difficult to carry out during the Depression and World War II due to a lack of funding from regional organizations like the Metropolitan Housing & Planning Council (MHPPC) in Chicago.

“These early laws encouraged federalist tendencies in US highway finance and established state highway departments as rural road-building agencies. State transportation agencies would own, place, and construct roads in accordance with federal standards as part of the process. Federal funds may also not be used to pay for planning, surveys, and economic analyses that are not directly related to building new roads. The 1934 Highway Act finally gave states permission to use 1.5% of their annual construction funding for planning, but these efforts remained focused on transportation in rural areas. “These measures increased the number of automobiles that entered American cities, but they did little to improve the flow of traffic within the cities themselves.

On the other hand, transportation issues were unique to American cities. With an increasing number of automobiles, congested downtown streets become even more congested. Potential solutions were discussed by architects, engineers, planners, officials from the state and local governments, as well as chambers of commerce. Boston (MA) stakeholders debated whether parking restrictions or a circular roadway would be preferable to "stran- gling" traffic congestion. The city issued bonds to pay for street improvements, and it was a joint effort by municipal engineers and corporate interests to create traffic planning and parking laws that would improve vehicle flow. There were plans for a transportation network and regional expressway that would be funded by Los Angeles' civic leaders. Many of the ambitious rehabilitation plans developed in cities across the nation in the late 1930s and early 1940s were hampered by a lack of state and federal funding. As the number of car owners and travelers increased, so did the number of city transportation services. It was a fundamental institutional issue to connect the regional total to its constituent parts when transit began to develop in the 1920s. Water management, traffic congestion, and other issues were addressed by regional planners like Patrick Geddes and Lewis Mumford. For instance, they established the Regional Planning Association of America to advocate for industrial metropolis-specific regional surveys and plans. There was a strong push for a government that was more metropolitan, which included annexing and merging cities with their suburbs.

The same issues that plagued early regional organizations—economic competition among jurisdictions, opposition to centralized planning, and resource limitations—still limit regional planning today. The Port of New York Authority, which was established in 1921 to create a publicly run freight system by bringing together New York Harbor's numerous port facilities, was unable to fulfill its full potential because there were too many competing freight interests in the region (Doig, 1993; 2003, Revell) During this time, the Board of Estimate, which represented the

mayor, comptroller, five borough presidents, and the president of the city council, was in charge of the New York (NY) subway tunnel and trackage rights. The board's suspicions of central planning and competition prevented subway operators and planners from cooperating. Large-scale regional planning was difficult to carry out during the Depression and World War II due to a lack of funding from regional organizations like the Metropolitan Housing & Planning Council (MHPPC) in Chicago.

Georeferenced data can be retrieved and managed with the help of a geodatabase, which is a relational database management system (RDBMS). A lot of visual data is stored in feature classes. Utilizing feature classes, features are grouped according to their nature and function (point, line, or polygon). Culverts were represented by simple points in the point feature class, whereas pavement layers, side drains, and breast walls were all represented by lines. The properties of each and every graphic element are linked dynamically and stored in tables. A feature table is immediately generated whenever new features are added to a feature class. A unique object identification number, which can be found in each row of the feature table, is how objects are identified.

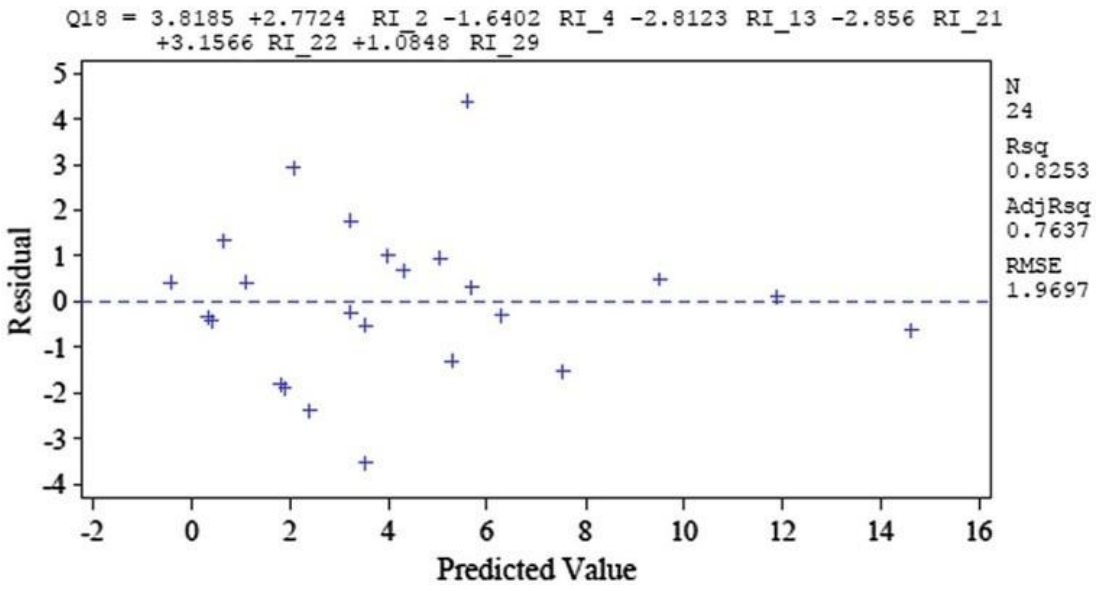

Fig.3 Proposed Methodology

4.CONCLUSION

The purpose of the study was to determine how risk factors affected the amount of money set aside by the owner of the project and/or the contractor for unexpected expenses. A regression model that rated the possible risk drivers was used to predict the contingency amounts. Using the methods presented in this study, the appropriate contingency percentages for highway construction projects can be determined using risk factors like RI, CI, and SI. It is essential to keep in mind that the models cannot be applied in a general way until the boundaries are established. These three risk

factors ought to be taken into consideration when developing the contingency plans of the owners and/or contractors:

Because it may have a significant impact on the cost contingency levels of the owner and contractor, this risk should be taken into consideration when developing the baseline timetable for each party. Contractors must also consider the impact of this risk factor on other risk factors when designing and executing highway projects. In order to avoid a significant risk driver, it is essential that the owner's contingency be calculated with sufficient resources allocated to handle the constructability assessment task. Other risk factors are significantly influenced by structural design errors, which may also have an effect on the project's total cost and the contractor's contingency budget.

When the stated risk drivers have a high likelihood of occurring during the construction phase of the project, all three models (RI, CI, and SI models) can be used to anticipate construction contingency amounts from the perspective of contractors. Risk rating parameters can be assigned levels based on the three values that were calculated in this research and evaluated by experts' assessments, and contingency plans can be tailored to the specific requirements of each company. The construction cost estimate for the project's contingency plan can be calculated using these values. Even if not all information about risk drivers is accessible in the majority of projects, models should be updated frequently to reflect any new risk information.

REFERENCES

1. Adler, S. (1993). The evolution of federal transit policy. Journal of Policy History, 5(1), 69–99. doi:10.1017/S0898030600006618
2. Advisory Commission on Intergovernmental Relations. (1968). Advisory Commission on Intergovernmental Relations, report M-17. Retrieved from http://www.library.unt.edu/gpo/acir/Reports/ information/m-17-1968.pdf
3. Allred, D., & Chakraborty, A. (2015). Do local development outcomes follow voluntary regional plans? Evidence from Sacramento region’s blueprint plan. Journal of the American Planning Association, 81(2), 104–120. doi:10.1080/01944363.2015.1067574
4. Altshuler, A. A., & Luberoff, D. E. (2003). Mega-projects: The changing politics of urban public investment. Washington, DC: Brookings Institution. Association of Metropolitan Planning Organizations. (2004). AMPO survey results: Institutional survey. Retrieved from http://www.ampo.org/ assets/55_institutionalsurveyresult.doc

5. Barbour, E., & Deakin, E. (2012). Smart growth planning for climate protection: Evaluating California's Senate Bill 375. Journal of the American Planning Association, 78(1), 70–86. doi:10.1080/01944363.20
6. 11.645272
7. Barrett, P. (1975). Public policy and private choice: Mass transit and the automobile in Chicago between the wars. The Business History Review, 49(4), 473–497. doi:10.2307/3113171
8. Benjamin, S. B., Kincaid, J., & McDowell, B. (1994). MPOs and weighted voting. Intergovernmental Perspective, 20(2), 31–35. Retrieved from http://www.library.unt.edu/gpo/acir/ACIRbib/acir_serial_publica- tions.htm
9. Bloom, M. S., & Bennett, N. (1998). U.S. highway financing: Histori- cal perspective and national priorities. TR News, 198, 3–7, 43. Retrieved from http://www.trb.org/Publications/PubsTRNewsMagazine.aspx Bond, A., & Kramer, J. (2010). Governance of metropolitan planning organizations: Board size, composition, and voting rights. Transportation Research Record, 2174, 19–24. doi:10.3141/2174-03
10. Bond, A., Kramer, J., & Seggerman, K. (2010). Staffing and adminis- trative capacity of metropolitan planning organizations (MPOs). Retrieved from https://www.planning.dot.gov/documents/Staffing_Administra- tive_Capacity_MPOs.pdf