Critical Factors of Performance of Highway Projects

Subjects: Regional & Urban Planning

Contributor: Shumank Deep , Shankar Banerjee , Saurav Dixit , Nikolai Ivanovich Vatin

Highway construction projects have always suffered from cost overruns due to extended project delivery, causing a loss of public funds. Highway projects have had unsatisfactory performance due to time and expense overruns. Also, prompt completion, minimal cost overruns, no on-site dangers, and a sufficient quality standard have all been identified as indicators of a successful project .

highway projects execution constraints construction projects

1. Introduction

Highway projects are the backbone of and a significant contributor to the growth of a nation's economy by ensuring seamless transportation for all. In the present scenario, the government of India prefers to execute highway construction projects using PPP modes in which "Built operate and transfer (BOT)" and "Design-build finance operate and transfer (DBFOT)" are predominant approaches for the execution of various national highway projects [1]. Construction and infrastructure projects in India are vital components of the countries' productive capacity and efficiency. With the recent slowdown in economic activities, the pace of highway construction is also declining; in the current financial year, it has slowed down to 27 km per day as compared to the previous year's 30 km per day. This has resulted in a reduction in highway completion targets by the government to 6000 km for the current financial year.

Leigland [2] has stated that the private sector's interest in public–private partnerships (PPPs) has dramatically fallen since 2012. Losses incurred as a result of cost overruns, disputes, and claim settlements are the major cause of conflicts, and interruptions can be the reason for this [3]. This is due to a lack of correct information visibility, which contributes to the industry's tendency toward decreased profit margins and poorer productivity [4]. As a result, highway construction projects have been vulnerable to a variety of delay-causing issues such as pollution on the job site, supplier insolvency during construction, logistic failure, and community opposition, to name a few [5]. In addition, the lack of transparency and information exchange in this industry has had an impact on productivity [6][7][8].

2. Theoretical Background about Critical Factors of Performance of Highway Projects

Overruns have been a regular and redundant phenomenon impacting the performance and overall project delivery of highway projects [9]. Currently, the major challenge in Indian road construction projects is an encroachment on the right of way, acquisition of land, and disputes between contracting parties, though the scope of such conflicts was limited to the maintenance and relaying of village road projects. The procurement selection for strategic construction, e.g., major highways and expressways, are handled through the use of the built, operate, and transfer method [5][10]. However, from the information received through the Right to Information Act, 2005 (RTI), over 35% of road/highway construction projects were delayed due to claims and counter claims, and approximately 10% were subjected to arbitration. **Figure 1** provides a summary of disputes reported in various State Highway, Other District Roads (ODR) and Major District Roads (MDR) for the financial year 2015–2019; this information was obtained through RTI.

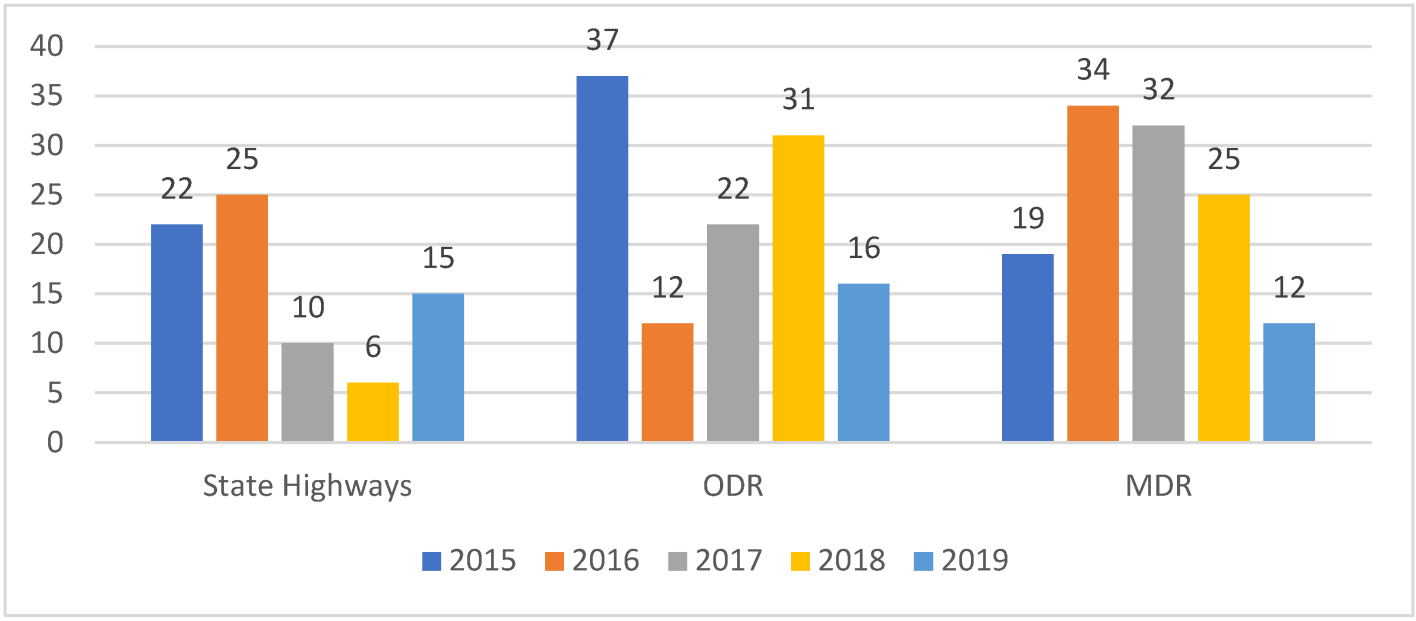

Figure 1. Delayed highway/road construction projects (Source: Information through RTI).

As per RTI application (information obtained through RTI application reference no MORTH/R/2019/50050 and CPWDN/R/2019/50005), the major reasons identified for causing delays are mentioned as follows:

- Incomplete works;
- Disruption due to encroachments in right of way;
- Socio-political reasons;
- Delayed payments;
- Work not conforming to the desired quality

The aforesaid identified reason creates risks that negatively impact project progression. Therefore, there was a need to explore the global scenario and identify the critical factors through the analysis of recent literature. The construction industry is mostly dependent on a several number of variables and participants, and because of this, to achieve the expected level of performance, an appropriate management technique for procurement planning and project execution is vital [11]. The selection of correct procurement has a direct influence on project performance [12][13][14][15][16][17]. Fulfilling the end user's requirements, achieving optimal performance and sustainability are prime requirements of PPP projects because of their direct impact on public infrastructure projects. To achieve the objective above, a public–private–people partnership (4P) procurement strategy was proposed which integrated "people," with a target of improving value for money and to promote sustainability in infrastructure [18]. Furthermore, some of the common risks that prevail throughout the life cycle of a highway construction project are:

- Loophole in site safety leading to accidents and injuries [19][20];
- Constraints due to managing change orders [21][22];
- Unknown site conditions [21];
- Poorly written contracts [8];
- Unpredictable prices of raw materials [23];
- Seasonal shortage of laborers [24];
- Damage to or breakdown of equipment and tools [25][26];
- Disagreement with the sub-contractors [27];
- Lack of efficient project management skills [28]

Besides the aforesaid factors, the highway project in itself has a very complex nature, and lack of trust and coordination happens to impact productivity; hence, managing risks efficiently becomes a vital task [18][29][30][31][32]. The execution of the highway projects is a very exhaustive task when it comes to managing a project site located over a vast chunk of land. Efficient project management skills become vital, as they influence decision making it terms of procurement design and contractor selection [18][32]. In the current scenario, the Indian construction industry places a heavy emphasis on price-based supplier selection rather than trust-building measures such as early contractor involvement approaches, leading to the perception that favoritism and opportunism are still prevalent approaches to project awarding [33]. As a result, there are project delays to claims and counter claims due to dissatisfied subcontractors. This tendency is caused by a focus on project specific requirements, i.e., there is an ever-changing group of suppliers or subcontractors at the lower level of hierarchy varying through different projects, constraining the development of a cohesive and lasting relationship [34][35]. Furthermore, the observations

from responses received in RTI application also indicated that the highway projects are also to a greater extent influenced by political favoritism specifically on the Indian subcontinent which indicates the impact of the current socio-political scenario, as indicated by researchers [36][37][38][39]. Furthermore, it was also observed that the local bodies tend to influence the contractors to lease their equipment which is ill maintained; however, this problem was limited to small scale works and mostly maintenance of the service roads and so on. However, the major problem that the contractors/subcontractors were concerned about was the theft of their equipment and the lack of a local availability of servicing facilities, ultimately resulting in the breakdown of machinery [25][27][28]. Thus, the exhaustive review leads to the identification of the following factors: delay from the clients; unprecedented price in raw materials; frequent modification from the client side; delay in land acquisition; inadequate and incomplete design; encroachment in the right of way; disputes between laborers; changing sequences in construction activity; change in quantities of work; adequate equipment; service for damaged equipment; impact of weather conditions on a project; pressure from any political party; local bodies compelling to use their resources; chances of sub-contractor walk out; delay in work execution of sub-contractor; revision of price. Hence, implications of these factors should be explored in the Indian Scenario.

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