

Figure 3. Graph showing the ranking of major delay causes for all the locations studied

In case of Bangalore, the most important delay factor is found to be related to obtaining permits from government. The second and third most important factors are related to the labour related issues which is justified by the paucity of labour in and around the location. Uniquely, site accidents due to negligence features ninth among the most important delay causes identified.

As can be seen from Table III, the top 3 factors in Kolkata are related to government related issues, which is synonymous to the local scenario and which is one agenda that is rarely in the hands of the project stakeholders. Two issues pertaining to labour related issues rank 4 and 6, which is agreeable to the views of the respondents, many of whom have expressed their concern that though the region has sufficient number of construction labour, but they prefer to migrate to other favourable locations for better opportunities.

According to the discussions with the respondents in Mumbai, it was pointed out that the building by-laws changed time to time and obtaining relevant permissions from the concerned authorities was a tough task. It is synonymous with the observations from the survey as delay factors related to obtaining permits from government is the most important cause. Factors like skilled labour availability and labour productivity are primarily important as well, as according to discussion with project managers, there is a paucity of local labour in and around Mumbai. It must be noted that the observations are similar to the ones observed for Bangalore.

It must be noted that the obtaining permits from the government (GV1) features as one of the top delay factors in all the cities studied, though it is rather lowly ranked at 9 for NCR. This delay cause seems to affect construction schedule almost everywhere in the country.

Delay factors labour productivity (LA1), skilled labour availability (LA3) and financial difficulties to parties involved (PR2) are ranked 2, 3 and 4 in the overall ranking and their ranking ranges from ranks 2-7 for all the other locations as well. Concerns regarding labour productivity and skill availability had been aptly raised by respondents during the

interviews also. Addressing this problem in the initial phase can help in reducing construction delay. Proper training of skilled labour can help in increasing the productivity, which in turn can reduce schedule overrun. It should also be noted that factors from delays categories like material related, equipment related, site related and external related issues do not feature in the highly ranked delay causes at the overall level. The ground for this could be due to these causes are local issues and can be rectified before the commencement of the project.

At the overall level, obtaining permits from government (GV1), labour productivity (LA1), skilled labour availability (LA3), financial difficulties to parties involved in project (PR2) and site management and supervision by contractor (EX1) feature as the top 5 problems affecting construction schedule. It is also noticeable that the top 15 factors listed in the table feature from 7 categories originally identified, namely, 4 from execution related, 3 from project related whereas 2 each from government related, scheduling and control related, labour related, and contract related causes.

As can be observed that most of the delay factors that affect schedule in the across metropolitan cities in India generally feature in the individual cities studied as well, there are still a few delay causes that are particular to certain locations. These causes are listed in Table IV. These causes need to be addressed at the local level to earn better benefits in the construction.

TABLE VI. DELAY FACTORS IN THE FOUR LOCATIONS DISTINCT FROM OVERALL CAUSES

Bangalore	Kolkata	Mumbai	NCR
Site accidents due to negligence/lack of safety measures (EX5)	Political Condition (GV2)	Political Condition (GV2)	Rework due to mistakes in construction (EX8)
Problems with Neighbours (ET1)	Availability of professional project management	Effectiveness of construction management	Design related issues (PR12)

Bangalore	Kolkata	Mumbai	NCR
	(CN6)	(CN10)	
Effectiveness of construction management (CN10)	Effectiveness of construction management (CN10)		Project schedule monitoring during construction (SH3)
	Public Holidays/Festivals (ET2)		
	Material Quality (MA4)		

VI. DISCUSSION – MAJOR CATEGORIES OF CONSTRUCTION DELAY IN INDIA

Table V illustrates the ranking of the delay categories for the four locations studied and the overall ranking of the delay categories. The delay causes have been arranged according to the ascending order of ranking for the overall rating.

TABLE VII. RANKING OF DELAY CATEGORIES ACROSS THE LOCATIONS STUDIED

Delay Constructs	Bangalore	Kolkata	Mumbai	NCR	Overall
Scheduling and Control Related Causes (SCH)	1	4	2	1	1
Government Related Causes (GOVN)	3	1	1	4	2
Execution Related Causes (EXE)	2	2	5	2	3
Labour Related Causes (LAB)	6	5	3	5	4
Contract Related Causes (CONT)	5	7	6	3	5
Project Related Causes (PRJ)	7	8	8	6	6
Site Related Causes (SITE)	8	10	7	9	7
External Related Causes (EXT)	4	3	4	7	8
Equipment Related Causes (EQP)	10	9	9	8	9
Material Related Causes (MAT)	9	6	10	10	10

The observations listed in Table V have been displayed

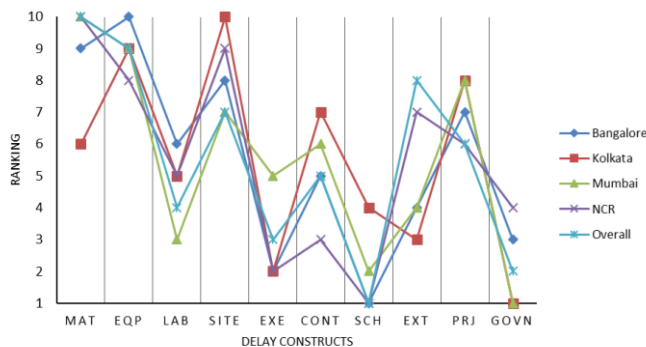


Figure 4. Graph comparing the overall ranking of delay categories against the locations

graphically in Fig. 4.

Scheduling and control related category features at the top for overall delay category and ranks as the top priority for both Bangalore and NCR, whereas it ranks at 4th for Kolkata and 2nd for Mumbai. Scheduling is an important task in any construction and more so in case of high-rise construction projects. Though in Kolkata it does not rank right at the top, it still is an important aspect to be looked into

Delay categories such as government related (overall rank 2) and execution related (overall rank 3) feature as top priority for all the locations with rankings varying between 1-4 for government related and rankings 2-5 for execution related. According to discussions with the respondents, it was observed that many privately owned construction projects get delayed due to changes in government related issues and this reflects in the observations from the study. Execution is an important part of a building construction project and needs to be looked into at appropriate times during the construction process.

Equipment related causes rank 9 overall and, ranks almost at the same level for the other locations. It can be inferred that present day projects are rather well versed in the modern construction techniques using construction equipment and is not of much concern for any of the locations.

Material related delay category ranks lowest overall and ranks near the bottom for most of the locations except Kolkata. According to discussions with the respondents, the material supplies in Kolkata are controlled by local business monopoly groups and creates a major hindrance in the process. A better coordination in material supply can help in achieving proposed schedule in projects.

VII. CONCLUSION AND RECOMMENDATIONS

A questionnaire consisting of 67 delay causes categorised under 10 groups was used to probe the most significant factors causing delay in real estate high-rise projects in a few major cities across India. Responses were taken on a 5-point scale from various professionals working with real estate developers, contractors, consultants and project management consultants (PMC). Around 100 responses were received from each of the locations. The importance of the various delay causes and delay categories was calculated.

Overall it can be observed that though the most important delay appear similar, there is difference in the individual ranking of the delay causes. There are a few delay causes which are unique to specific locations. Overall, the most important delay category has been identified to scheduling and control related and it features among the five most important cause for all the locations as well. In case of a high-rise construction, scheduling plays an important role. It should be noted that the observations of this research have a regional focus.

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