ANALYSING THE EFFECTIVENESS OF PUBLIC-PRIVATE PARTNERSHIPS (PPPS) IN NATIONAL HIGHWAYS (NH) IN INDIA

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ABSTRACT

Public-Private Partnerships (PPPs) are a tried-and-true method by which the government may quicken infrastructure construction. The government may increase the funds it receives for infrastructure projects like hospitals, bridges, and highways by collaborating with private groups. Faster completion times and more investment have been attained using this strategy. PPPs also provide many societal benefits, such as effective planning and execution, that raise national productivity. They also foster a mutually beneficial connection between the public and private sectors, which makes them vital to India's economic transformation into a $5 trillion economy. The government can effectively and efficiently support the development of infrastructure through PPPs. Through PPPs, infrastructure development reaches its maximum potential and encourages progress for everyone. The prosperity and development of India depend heavily on this approach. The average completion rate for Public-Private Partnership (PPP) projects in India is around 65%, showcasing a slight improvement compared to the 2021 figure of 63%. Financial investment in infrastructure projects by the private sector via public-private partnerships (PPPs) has increased in recent years, suggesting a boost in investor confidence. With an emphasis on cost-effectiveness, infrastructure quality, and completion time, this study aims to comprehensively analyze the National Highway Development in India from 2016 to 2023, focusing on Public-Private Partnerships (PPPs) dynamics. This analysis includes examining the PPP projects undertaken by selected Private Limited Companies, evaluating the contribution and impact of Build-Operate-Transfer (BOT) models within the PPP framework for infrastructure development, studying the growth trend of FASTag implementation from 2016 to 2023, and assessing the financial sustainability of road development projects in India. Through these analyses, the study seeks to provide insights into PPPs' effectiveness, challenges, and potential improvements in facilitating infrastructure development, particularly in the context of national highways and road projects in India.
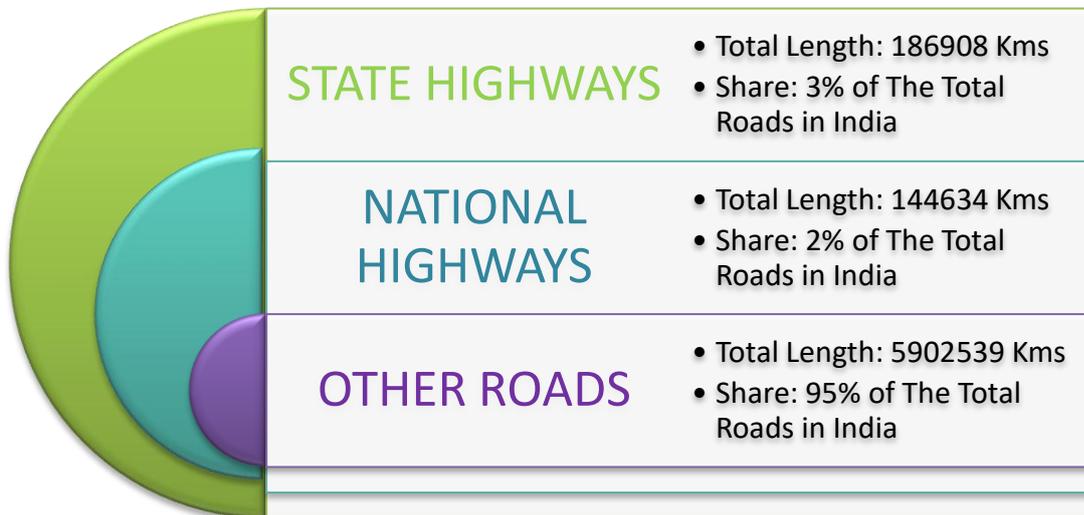
KEYWORDS: Public-Private Partnerships (PPPs), Funding, Infrastructure Development, PPP

projects, Indian National Highways

1. INTRODUCTION

Public Private Partnerships (PPPs) are crucial for global infrastructure development, particularly in India, where rapid urbanisation, economic growth, and population expansion necessitate solid transportation infrastructure. PPPs involve a cooperative effort between government and private entities to construct, fund, manage, and preserve infrastructure assets. They offer a viable approach to utilise the private sector's expertise, innovation, and financial capabilities to address infrastructure shortages, enhance service delivery, and achieve socio-economic objectives within national roadways. The efficacy of PPPs in the context of National Highways (NH) is influenced by factors such as the justification for embracing Public Private Partnership (PPP) models, potential advantages and obstacles, and the importance of solid governance frameworks and risk allocation mechanisms. Policymakers should assess PPP initiatives in the broader context of national transportation infrastructure targets, economic development aims, and stakeholder concerns.

FIGURE 1 – THE ROAD NETWORK IN INDIA IS SUB-DIVIDED INTO THREE CATEGORIES

STATE HIGHWAYS
- Total Length: 186908 Kms
- Share: 3% of The Total Roads in India

NATIONAL HIGHWAYS
- Total Length: 144634 Kms
- Share: 2% of The Total Roads in India

OTHER ROADS
- Total Length: 5902539 Kms
- Share: 95% of The Total Roads in India

Source: - PIB, November 2022

In India, the construction of national roads has seen various initiatives and projects that foster cooperation between public and private sectors. These partnerships aim to use the advantages and assets of both sectors to complete infrastructure projects effectively and punctually while guaranteeing high standards and long-term viability. Advocates argue that PPPs facilitate introducing innovation, experience, and financial resources from the private sector, while detractors' express concerns about

transparency, accountability, and potential private sector hegemony. India has implemented two models for PPPs in constructing and administrating national roads: Build Operate Transfer (BOT) toll and annuity. The BOT model involves realising the concessionaire's investment by imposing tolls on road users, while the annuity model allows the concessionaire to receive early toll or supplementary annuity payments.

FIGURE 2 – MAP OF NATIONAL HIGHWAYS

Source: - unsuccess

Most of the country's freight travels on roads, while most passengers also go on them. Most of India's vital national roads are constructed, upgraded, or maintained by the National Roads Authority of India (NHAI), the central organisation in charge of these tasks. It is controlled by the Ministry of Highways and Road Transport. Roads in India may be grouped into five primary types: expressways, national highways, state highways, and rural roads. Just 1 lakh kilometers are part of the national highway system, whereas 1.60 lakh km are part of the state highway system. Most people use "other" routes. Therefore, the total length of roads designated as NH in India is just over 2%.

1.1 PM GATI SHAKTI

The project launched by Prime Minister Narendra Modi, known as PM Gati Shakti, aims to expand the nation's infrastructure in a comprehensive and coordinated manner, using several modes of transportation. Roads, trains, airports, rivers, and electricity are just a few of the infrastructure sectors for which this program hopes to improve connection. It stresses the need for coordinated strategy,

execution, and evaluation to boost logistics and transportation efficiency and speed up infrastructure development.

Government officials under Prime Minister Gati Shakti are working to improve coordination amongst the many parties interested in infrastructure development and expedite decision-making within and across sectors. This endeavour is essential to promote economic growth, increase trade and commerce, and enhance general connectedness throughout the nation. This scheme will merge Bharatmala, Sagarmala, inland waterways, dry/land ports, UDAN, and other infrastructure plans from different ministries and state governments. Various economic zones, including those for textiles, pharmaceuticals, defence, electronics, industry, fishing, and agriculture, would be covered to boost connectivity and the competitiveness of Indian businesses. Technical assets, such as spatial planning tools created in tandem with the Indian Space Research Organization (ISRO), will also be heavily used.

The six pillars upon which PM Gati Shakti rests are as follows: transportation networks, logistics, ports, airports, and roadways. But in her 2023–24 budget address, Finance Minister Nirmala Sitharaman said that PM Gati Shakti is propelled by seven engines, one of which is waterways.

1.2 ADVANTAGES OF PPP

FIGURE 2 – ADVANTAGE OF PPP
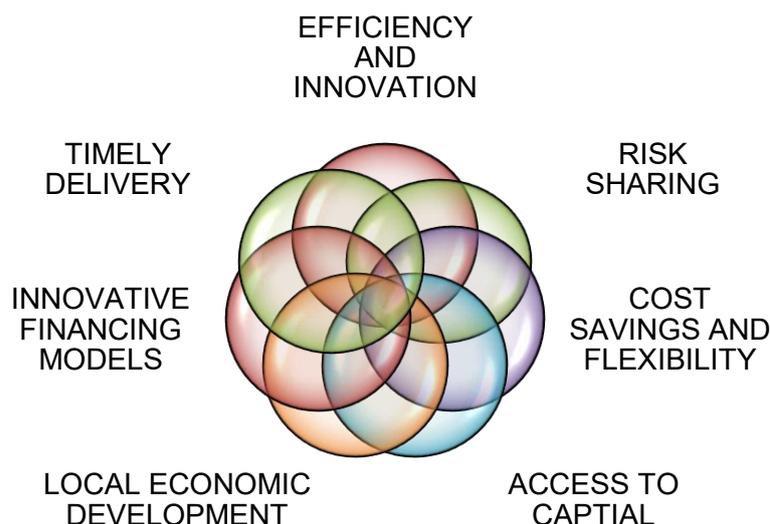
Source: Visualised from Researchers Perspective

Government agencies and private corporations work together in PPPs to fund, build, run, and maintain

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public services and infrastructure. PPP has several benefits, such as fostering innovation, sharing risks, cutting costs, increasing access to finance, taking a lifecycle approach, improving quality and performance, using new financing mechanisms, ensuring timely delivery, being flexible, and fostering local economic growth. With an eye on sustainability and long-term performance, they enlist the help of the private sector throughout building and operation. Innovative finance mechanisms, such as revenue-sharing agreements and user fees, may reduce the need for public support, while performance-based contracts ensure that private sector partners satisfy service standards. In addition to guaranteeing that infrastructure is relevant and functional throughout time, PPPs provide flexibility in reacting to changing conditions and developing public requirements.

2. REVIEW OF LITERATURE

Nayyer & Mukkai (2022) evaluated how transparency laws affect the length of the development phase of PPP projects, highlighting the significance of comprehending elements that influence timely project completion. Implementing transparency legislation prolonged the time required to reach financial closure and the length of the development phase. The transparency rule significantly improved the size of the development period, demonstrating its ability to increase openness and promote well-informed decision-making in PPP projects. Implementing robust transparency legislation is essential for fostering openness and minimising information asymmetry. The study used descriptive analysis, OLS regression modelling, and t-test comparison. It included the treatment variable RTI to evaluate transparency's influence on the development phase's length. The enactment of transparency legislation, particularly the Right to Information (RTI) Act in India in 2013, included PPP projects within its scope.

Garg (2020) investigated the efficacy of PPP in India, specifically emphasising 29 significant highway PPP initiatives that have incurred over \$4 billion. The research used fs/QCA, a configurational technique based on set theory, to examine the causal complexity, equi-finality, and ambiguity of outcome and predictor conditions. Comprehensive contextual knowledge is derived from collecting surveys, interviews, and archival data for seven years. This research examined the unequal circumstances and factors contributing to the success and failure of PPPs, drawing from many academic fields and literature. The study revealed that several factors, including project planning, resource availability, contractual maturity, the construction expertise of the private sector, and a focus on social interactions, influence the timely completion of projects. This method questioned the conventional one-sided perspective on PPP performance.

Garg and Dayal (2020) examined the progression of PPPs in India over thirty years, specifically emphasising enhancing road projects. The research findings indicate that crucial success determinants influence early and late phases. India's first road PPP initiative underwent a significant overhaul 25 years later, exposing disparities in motives, the level of regulatory framework development, and

performance views. The research further identified notable disparities in implementing PPP models over the two phases, which may be attributed to the government's inclination to assume higher financial and economic risks. This implies that several factors influence the transformation of business models in developing economies.

Singh (2018) analysed the incentive structures created by PPPs and traditional procurement contracts for infrastructure development. It compares construction costs and quality outcomes, concluding that despite higher construction costs, PPPs promote a life-cycle perspective on project expenses and lead to higher-quality roads than traditional highways. The methodology includes analysing incentive structures created by PPPs and conventional contracts, making predictions, validating these predictions with data from 313 NH projects in India, and performing empirical analysis to compare costs and quality between PPPs and traditional contracts.

Krishna & Karnam (2015) examined the effectiveness of PPPs for national roads in Karnataka, focusing on the projects' positive Value for Money (VfM) for the government and road users alike. It also offers solutions to strengthen PPP policies in India. The study evaluated Karnataka's NH PPP projects and found that the government and road users received good value for their money. The study used a methodology that included time overruns analysis, risk responsibility matrix, and quantitative and qualitative VfM evaluation to assess the performance of four NH PPP projects in Karnataka.

3. OBJECTIVES OF THE STUDY
3.1. PRIMARY OBJECTIVE
- To analyse National Highway Development in India through Public-Private Partnerships (PPPs) from 2016-2023

3.2. SECONDARY OBJECTIVES
- To study the contribution of Build-Operate-Transfer (BOT) in PPP projects for infrastructure development in India
- To analyse the FASTag Growth Trend between 2016-2023
- To evaluate the financial sustainability of road development projects in India.

4. METHODOLOGY OF THE STUDY
This study will use a quantitative methodology, including analysing secondary data from government publications, surveys, IBEF reports and Annual Reports of IRB Infrastructure Developer Ltd, Ashoka Buildcon Limited, Hindustan Construction Company Limited, and Reliance Infrastructure Limited. This research aims to examine the efficacy of PPPs in the context of the NH. The objectives will be substantiated using statistical methods such as descriptive analysis, inferential testing, and regression analysis. Software tools such as SPSS and Microsoft Excel will be used for data analysis.

5. PPP PROJECTS UNDERTAKEN BY SELECTED PRIVATE LIMITED COMPANIES.

5.1 RELIANCE INFRASTRUCTURE LIMITED (RINFRA)

As one of the leading infrastructure businesses, Reliance Infrastructure Limited develops projects via several Special Purpose Vehicles (SPVs) in a number of fast-growing industries, including the electricity, roadways, metro rail, airport, and defence sectors.

- 11 road projects
- Total length of 970 km under build, operate and transfer (BOT) scheme
- Total income of Rs. 4,159.27 crore in FY23.
- RINFRA is the largest National Highways Authority of India (NHAI) concessionaire under the BOT scheme

5.2 HINDUSTAN CONSTRUCTION COMPANY (HCC) LIMITED

Multi-use roads and highways with integrated features, including tunnels, bridges (large and small), cross-drainage works, and toll plazas, are constructed by HCC, a supplier of comprehensive transportation infrastructure solutions.

- HCC has constructed cross-country highway networks in addition to roads in densely populated metropolitan areas, relatively isolated regions with harsh climates, and other similarly difficult environments.
- As a network of expressways, national highways, state highways, and port approach systems, HCC's highway construction in India spans over 4036 lane kilometres.
- HCC has carried out the construction of roads under a variety of contract types, including PPP, BOT, and EPC. Additionally, HCC has experience executing design-build projects, including elevated road corridors and bridges.

5.3 IRB INFRASTRUCTURE DEVELOPERS LIMITED

A road BOT operator is IRB Infrastructure Developers Limited. Road building and maintenance is the core business of the organisation. A few examples of its business divisions include real estate (including the development of real estate), road infrastructure projects (including the construction and operation of highways), windmills (including the sale of energy produced by windmills), hotels, and airport infrastructure.

- Its construction business augments its BOT vertical by handling the engineering, procurement, and construction (EPC) and operation and maintenance (O&M) components of BOT concessions.

- Twenty-two BOT and hybrid annuity model (HAM) projects are currently in various stages of development.
- Earnings of 6,703 crore in the fiscal year 2023
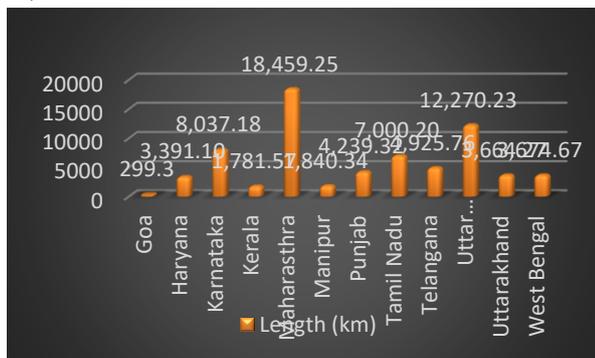
5.4 ASHOKA BUILDCON LIMITED

As a top highway developer in India, Ashoka Buildcon Limited is a Fortune 500 firm. The business is simultaneously involved in EPC, BOT, and HAM projects.

- Epic Media's Best Company in Roads & Highways Award 2023 offers the CIA World Infrastructure Awards.
- EPC World Media Group presents the Eight Lane Vadodara Kim Expressway (Ankaleshwar to Manubar segment) with the Outstanding Contribution in Roads & Highways award for 2023.
- The Roopnarayan Bridge project by Ashoka Buildcon Ltd. was honoured with the Silver Award in the National Highways Awards for Excellence by the Ministry of Road Transport & Highways.
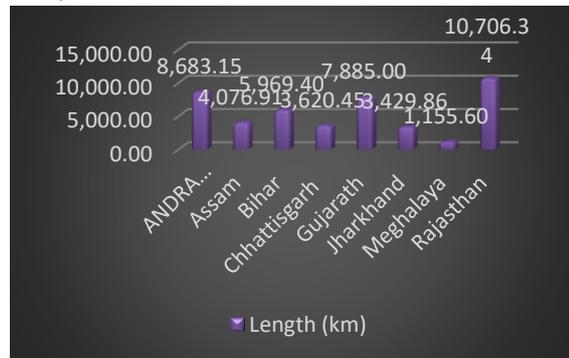
6   RESULTS AND DISCUSSION

CHART 1 - LENGTH OF NH AMONG VARIOUS STATES IN INDIA
#### A) MOST DEVELOPED STATES   B) LESS DEVELOPED STATES

C) LEAST DEVELOPED STATES

Source: Ministry of Road Transport and Highways; PRS India 2022

Chart 1 states that India's states exhibit varying levels of road network development, with the least developed states, like Arunachal Pradesh, Himachal Pradesh, and Mizoram, having shorter road lengths ranging from around 700 to 9,100 km. In contrast, more developed states such as Maharashtra, Uttar Pradesh, and Karnataka boast extensive road networks exceeding 10,000 km, showcasing robust infrastructure and connectivity. States like Goa, Kerala, and Haryana fall in between, demonstrating moderate development in terms of road infrastructure.

CHART 2 - UTILISATION OF FUNDS BY THE MINISTRY OF ROAD TRANSPORT AND HIGHWAYS (in Rs Crore)
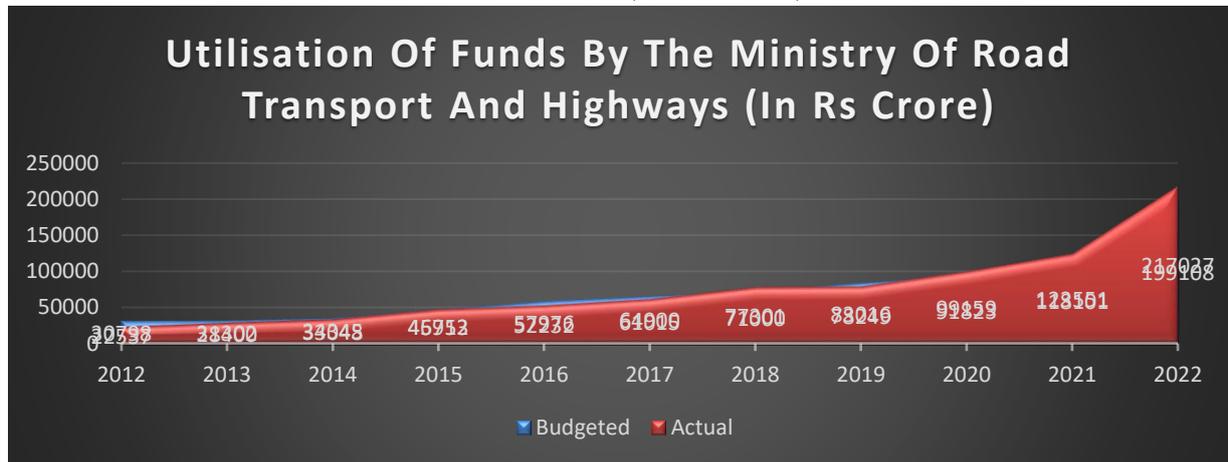
Source: Ministry of Road Transport & Highways, Year End Review 2023

Chart 2 presents budgeted and actual expenditure data for 2012 to 2022 and the utilisation percentage for each year. In 2012, the budgeted amount was 30,798 units, but the actual expenditure was lower at 22,537 units, resulting in a utilisation rate of 73 per cent. The trend continues with varying degrees of utilisation over the following years: 91 per cent in 2013, 96 per cent in 2014, 103 per cent in 2015, 90 per cent in 2016, 94 per cent in 2017 and 2019, 109 per cent in 2018 and 2022, 108 per cent in 2020, and 105 per cent in 2021.

TABLE 1 - USE OF NHAI FUNDS AMONG VARIOUS EXPENDITURE (in Rs Crore)

YEAR	LAND ACQUISITION	PROJECT EXPENDITURE	LOAN PAYMENT	OTHERS	TOTAL
2016-17	17,823	20,843	5,130	7,010	**50,806**
2017-18	32,143	30,648	14,612	8,946	**86,349**
2018-19	36,048	40,380	14,612	6,685	**97,726**
2019-20	28,542	49,785	19,420	6,319	**1,04,065**
2020-21	35,858	61,484	25,633	2,375	**1,25,350**

Source: Ministry of Road Transport and Highways

Table 1 shows the expenditures on infrastructure projects from 2016-17 to 2020-21. In 2016-17, the total expenditures were 50,806 units for land acquisition, 20,843 units for project expenditure, 5,130 units for loan repayment and interest payment, and 7,010 units for other expenses. In 2017-18, the expenditures increased to 86,349 units, and in 2018-19, they continued to rise to 97,726 units. The trend of growing expenditures continued in 2019-20 and 2020-21, reaching 1,04,065 units and 1,25,350 units, respectively, with varying allocations across land acquisition, project expenditure, loan repayment and interest payment, and other expenses each year.

CHART 3 - TOTAL PPP PROJECTS IN INDIA (AS OF NOVEMBER 2023)
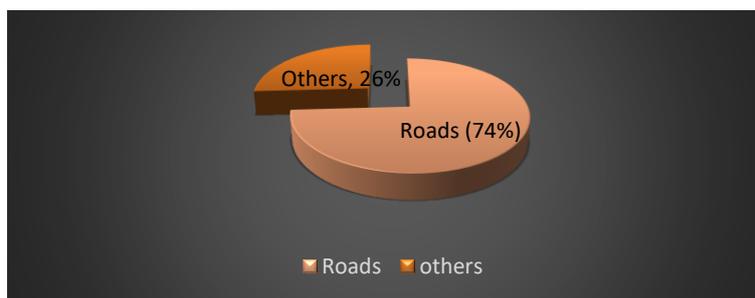
Source: Indian Brand Equity Foundation, December 2023

Chart 3 indicates the distribution of total PPP projects in the infrastructure sector. Among these projects, 74 per cent are related to roads, while the remaining 26 per cent encompass other infrastructure projects. This breakdown highlights the substantial focus on road development within the PPP framework compared to other infrastructure sectors. such as Railways, Ports , Telecom, and Airports.

CHART 4 - PROJECTS AWARDED TO BOT PRIVATE PLAYERS

Source: Indian Brand Equity Foundation, December 2023

Chart 4 presents data on the number of projects awarded to BOT (Build-Operate-Transfer) private players in various years. In 2016, 873 projects were awarded, followed by a decrease to 422 projects in 2017 and a further decline to 209 projects in 2018. However, there was an increase in 2019, with 505 projects awarded. In 2022, where 450 projects were awarded, and in 2023, the number increased significantly to 650 projects. The target for 2024 is set at awarding 1000 projects to private BOT players.

TABLE 2 – NUMBER OF PROJECTS TAKEN BY PRIVATE COMPANIES

STATE / COMPANY	NO OF PROJECTS			
	IRB Infrastructure Developer Ltd	Ashoka Buildcon Limited	HCC Limited	RInfra Limited
Andhra Pradesh	0	1	0	0
Chhattisgarh	0	1	0	0
Delhi	0	0	0	1
Gujarat	4	1	0	1
Haryana	1	0	0	1
Himachal Pradesh	1	0	0	0
Jaipur	0	0	0	1
Jammu & Kashmir	0	0	2	0
Jharkhand	0	0	0	0
Karnataka	2	10	0	0
Kerala	0	0	1	0
Madhya Pradesh	0	2	0	0

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Maharashtra	3	1	2	1
Mumbai	0	0	1	0
Orissa	0	1	0	0
Punjab	1	1	0	0
Rajasthan	5	0	1	0
Tamil Nadu	2	1	1	6
Telangana	1	1	0	0
Uttar Pradesh	3	0	4	0
West Bengal	1	1	3	0
Total	24	21	15	11

Source: Computed using data from Annual Reports of IRB Infrastructure Developer Ltd, Ashoka Buildcon Limited, Hindustan Construction Company Limited, and Reliance Infrastructure Limited.

Table 2 provides the number of projects undertaken by different infrastructure development companies across various states in India, along with a total count. IRB Infrastructure Developer Ltd has completed 24 projects, Ashoka Buildcon Limited has completed 21 projects, Hindustan Construction Company Limited has completed 15, and Reliance Infrastructure Limited has completed 11. These projects are distributed across states, with significant activity in states like Gujarat, Maharashtra, Tamil Nadu, and Uttar Pradesh. This data offers insight into the regional distribution and scale of infrastructure development projects undertaken by these companies.

CHART 5 – FASTag GROWTH TREND (2016-2023)
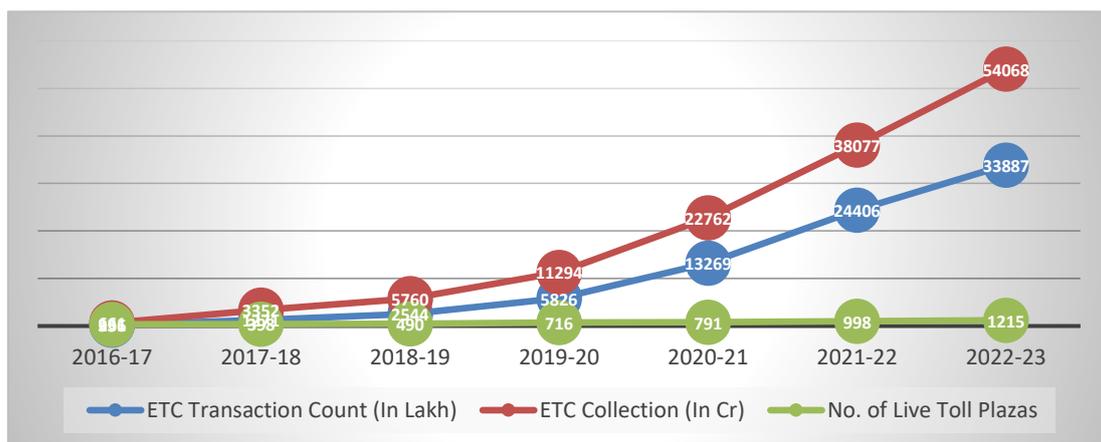
Source: Indian Highways Management Company Limited Annual Report 2022-23

Chart 5 shows the Electronic Toll Collection (ETC) transaction count in lakhs, ETC collection in crores, and the number of live toll plazas for each financial year from 2016-17 to 2022-23. The trend

indicates a significant increase in ETC transactions and collections over the years, reflecting the adoption and utilisation of electronic tolling systems across India's road networks. In 2016-17, 236 lakh ETC transactions amounting to 661 crore collections across 351 live toll plazas. By 2022-23, these figures surged to 33,887 lakh transactions, 54,068 crore collections, and 1,215 live toll plazas, demonstrating a substantial growth in electronic tolling infrastructure and usage.

REGRESSION ANALYSIS FOR THE RELATIONSHIP BETWEEN PROJECT LENGTH (kms) AND COST (Rs. Cr)

H_0: There is no significant linear relationship between project length and project cost.

H_1: There is a significant linear relationship between project length and project cost.

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.9332	0.87102	0.83877	20.08015
a. Predictors: (Constant), Cost				

ANOVA b						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	10892.082	1	10892.082	27.0132	0.00652
	Residual	1612.850	4	403.2126		
	Total	12504.933	5			
a. Predictors: (Constant), Cost						
b. Dependent Variable: Length						

Coefficients a						
Model		Unstandardized Coefficients	Std. Error	Standardized Coefficients	T	Sig.
1	(Constant)	14.60269	11.5286		1.2666	0.2740
	Cost	0.03669	0.0071	0.9332	5.1974	0.0065
a. Dependent Variable: Length						

From the above table,

Y represents the length of the NH constructed as a Dependent variable

X represents the cost of constructing NH as an Independent variable

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Therefore,

The regression equation takes the form as

$$Y = 14.60269 + 0.03669\ (X)$$

The regression analysis shows a strong and statistically significant relationship between the predictor variable "Cost" and the dependent variable "Length," with an R-squared value of 0.871, indicating that about 87.1% of the variation in Length can be explained by Cost. The model's ANOVA results further support its significance ($F = 27.013$, $p = 0.0065$), and the coefficients reveal that for every unit increase in Cost, Length is expected to increase by approximately 0.0367 units. This suggests that Cost substantially impacts Length, making the regression model reliable for predicting Length based on Cost.

7. SUGGESTIONS AND RECOMMENDATIONS:

- A comprehensive data-gathering strategy is recommended to get comprehensive information about all facets of PPP projects on national roads. The data should include project dates, prices, infrastructure quality, traffic flow enhancements, and economic ramifications.
- Cultivate stakeholder engagement by involving all relevant parties in PPP initiatives, including governmental entities, private investors, contractors, and local communities. Gather input, apprehensions, and recommendations to comprehend the many viewpoints and encounters.
- Assess the relative efficacy of PPP projects in terms of cost-efficiency, timeliness, and quality of infrastructure delivery compared to conventionally financed projects.
- Undertake a thorough risk evaluation to ascertain possible hazards linked to PPP projects, including financial, regulatory, and construction risks.
- Create and implement measures to reduce these risks and improve the efficiency of the project.
- Transparency and accountability should be maintained throughout all PPP initiatives, including procurement, implementation, and operation. It is essential to implement procedures that facilitate public monitoring and supervision to mitigate corruption and promote the optimal allocation of resources.

8. CONCLUSION

Therefore, assessing the efficacy of PPPs on national roads requires a comprehensive strategy that includes evaluating data, engaging stakeholders, developing performance indicators, doing comparative research, assessing risks, and implementing transparency measures. Policymakers may enhance their understanding of the merits and drawbacks of PPP projects by applying these recommendations. This would empower individuals to make educated judgments and improve infrastructure development's overall efficiency and efficacy on national roadways.

In the 2023–24 budget, Nirmala Sitharaman, the finance minister, said that the PM Gati Shakti National Master Plan is a game-changing strategy for sustainable development and economic prosperity. The seven pillars of the PM Gati Shakti National Master Plan include the following: transportation networks (roads, trains, airports, ports), logistical infrastructure, waterways, and mass transit. To expedite the transportation of people and commodities, the PM Gati Shakti Master Plan for Expressways will be developed in 2023-24. According to the Minister of Finance, the nation's road network will be expanded by 25,000 kilometres in fiscal years 2023-24.

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