



Assam PIDP

Pre-feasibility studies for
Road Project (Amingaon to
Chapaguri)

8th March, 2015

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1. Executive Summary

The Government of Assam has initiated an endeavour to bring about a uniform and inclusive socio economic development of the state by harnessing its potential.

Assam blessed with rich natural resources, human resources, river systems and a geographical location which positions the state as a gateway to India’s eastern neighbours, presents an opportunity to develop into a growth centre which will fuel the growth in the north-eastern states of India. This available potential needs to be exploited by developing the necessary infrastructure supported by holistic policies and institutions with provisions for social inclusiveness and environmental sustainability

For a holistic and inclusive socio-economic development of a state, comprehensive infrastructure development is essential.

The **20 Years Perspective Infrastructure Development (PIDP) for Assam** is an attempt to formulate an infrastructure development plan for the key infrastructure sectors in an integrated manner to support one another and thereby facilitate a holistic and inclusive socio-economic development uniformly across the state

To fulfil that the PIDP was prepared based on the 4 core sectors finalized by the Government of Assam

Figure 1: Sectors covered in PIDP



The PIDP is a culmination of two years of extensive effort

As part of this engagement, PwC has conducted in-depth as-is situation and gap analysis for the sectors under consideration (Road & IWT, Industry Infra, Urban Infra and Power) and has identified the issues and key challenges associated with each sector, formulated long term integrated infrastructure visions for the state as well as sectoral visions for each of the sectors aligned with the integrated vision, worked out the necessary interventions required to achieve the envisaged vision in terms of – physical intervention as well as institutional and policy level interventions, developed a financing strategy to fund the envisaged infrastructure development, identify key projects and **conducted a pre-feasibility studies for 40 of the identified projects across the sectors under consideration**

Driven by a philosophy to attain integrated development that is symbiotic to each sector, a long term integrated infrastructure vision has been envisaged for the state as a part of this PIDP

- **Development of multi-modal Transport Corridors with adequate feeder networks that provides seamless movement of traffic with minimum transshipment cost in connecting the state to its neighbours**

- **Development of Growth Centres along the transport Corridors by aligning urban development and industrial development**
- **Augmentation and strengthening of power infrastructure to drive the envisaged development**

Assam with a road network of 55,684 Km¹ plays an important role in the integration of the north east India region with the rest of the country.

It also shares international borders with Bhutan, Myanmar and Bangladesh and has the potential to act as a gateway to these countries.

The road network of the state carries a significant 74% of the total cargo traffic in the state (including interstate traffic) highlighting its importance, and makes its development and maintenance all more vital

The geographical isolation of Assam and the overall north east region makes it more imperative to develop the road network and other transportation modes to promote economic development of the region and establish the region as a gateway to India's eastern neighbours and the ASEAN countries

Overall it has been estimated that currently the sector requires significant augmentation in terms of length, capacity (lanes) and quality

It has been observed that in terms of length, the National Highways (NHs) are adequate for the existing traffic; however a gap of 60% and more than 100% has been observed for State Highways (SHs) and Major District Roads (MDRs) respectively

Table 1: Status of National Highways, State Highways and MDRs

	Existing Length	Required Length	Gap
State Highways	2,622 km	5,000 km	60%
MDR	4,365 km	12,000 km	More than 100%
National Highways	3,717 km	Adequate	Negligible

Source: PwD Roads, Government of Assam

It has been estimated that as per the existing traffic 70% of the length of State Highways in the state should be double lane, whereas at present only 6% of the length is double lane. Again for MDRs, 36% of the total length should have been Intermediate or double lane, but at present only 9% is either intermediate or double

Table 2: Status of Capacity of SHs and MDRs

	Existing %	Required % as per existing traffic
SH Double Lane	6%	70%
SH Intermediate Lane	20%	23%
MDR Intermediate & Double Lane	9%	36%

Source: PwD Roads, Government of Assam

As discussed earlier, ~ 50% of the roads in the state are unsurfaced and requires immediate attention

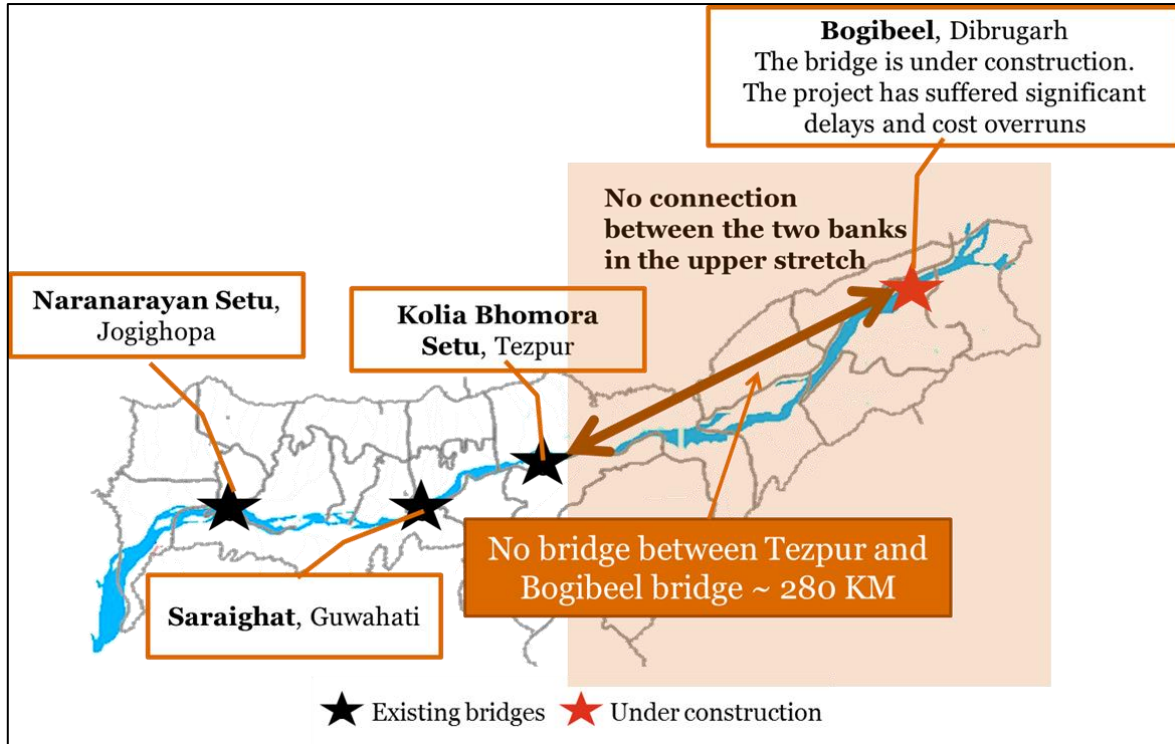
¹ Including non-PwD roads such as Panchayat and non PwD road and Urban Road under Town Committee, Municipalities, etc.

Apart from the above points, there is a need to improve the connectivity between the north bank and south bank of the river Brahmaputra, and between Brahmaputra and Barak Valley

1. Connectivity between North and South Bank of river Brahmaputra

There are bridges only at three points along the entire stretch of Brahmaputra - a length of 891 km in Assam

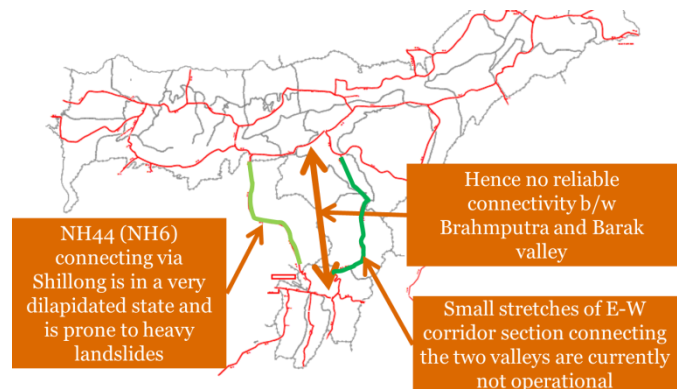
Figure 2: Bridges on river Brahmaputra



2. Connectivity between Brahmaputra valley and Barak valley

Currently NH-44 (renamed NH-6) provides connectivity from Guwahati to Silchar region via Meghalaya. The condition of the road is poor at certain stretches. The distance between Guwahati and Silchar is around 320 km, however due to poor condition of road it takes around 10-12 hours to travel the distance by road. Further the road is not operational for a few days during heavy rainfall. Hence an alternate connectivity is urgently required. Once the following two linkages are operational trade flow between Brahmaputra and Barak valley will improve significantly

Figure 3: Status of connectivity between Guwahati and Silchar



Aligned with the overall infrastructure vision for the state, and considering the infrastructure development that is required for the sector a long term vision for developing the IWT infra in the state has been envisaged

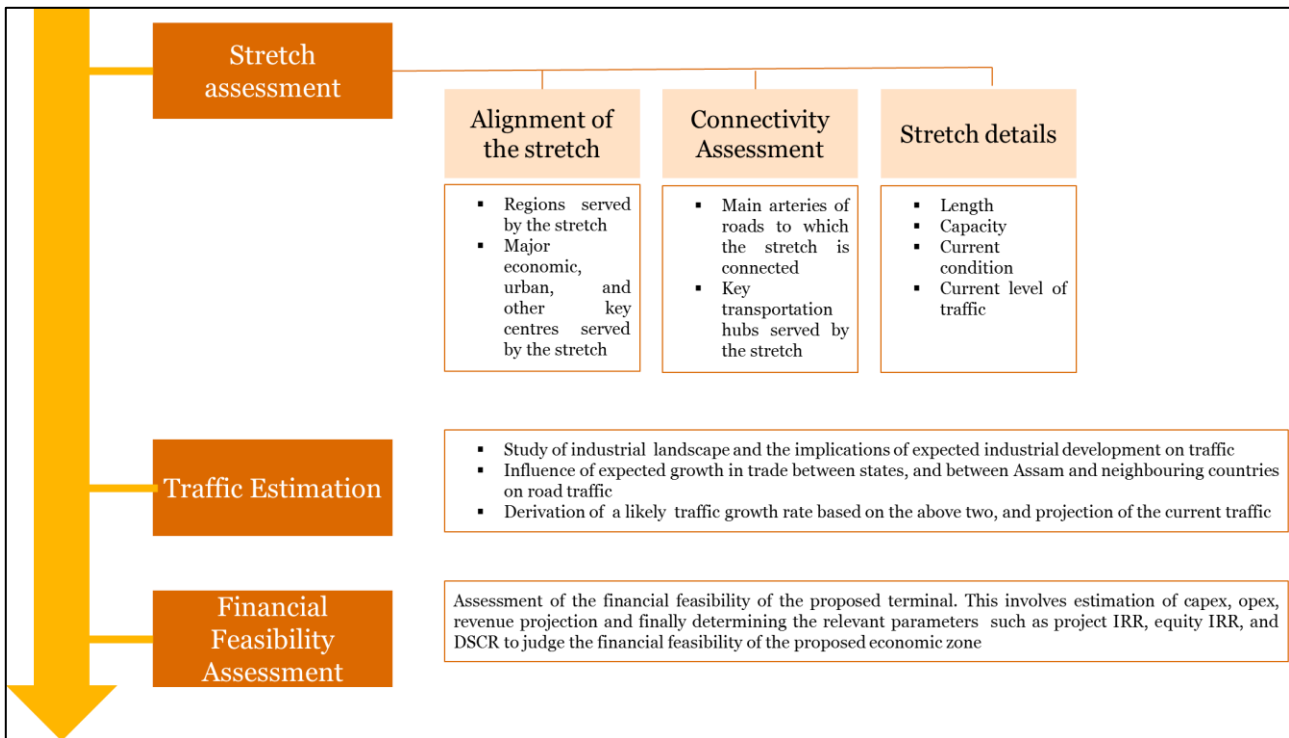
- Creation of a strong road network providing connectivity to all habitation and key centres (Industry Centres, Tourism Centres and growing Urban Centres) of the state
- Develop and strengthen connectivity to neighbouring states

- Make Assam the preferred gateway to neighbouring countries

As a part of the 20 years PIDP for Road infra in Assam in Assam, 5 road projects have been identified based on interactions with relevant stakeholders for conducting pre-feasibility studies

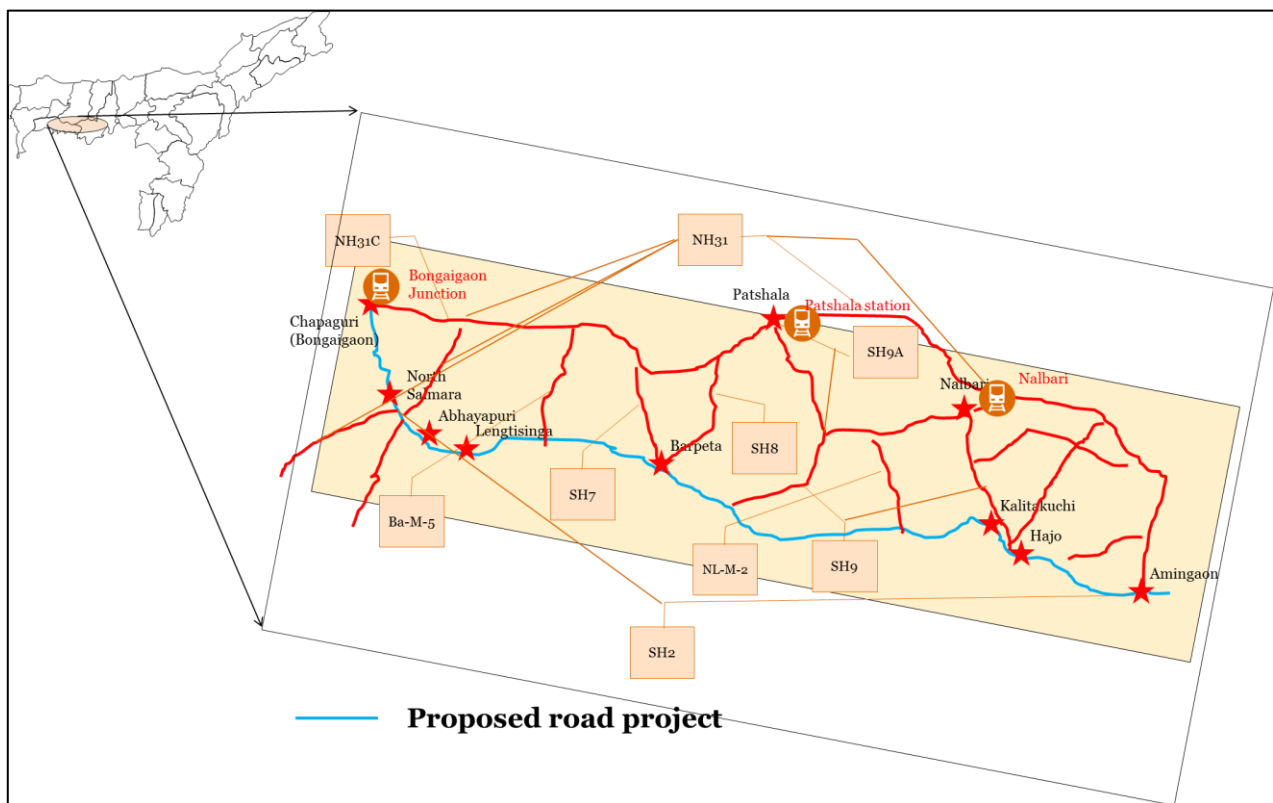
A modular approach that relies on a comprehensive assessment of all relevant factors vital to determine the feasibility of the proposed road project has been adopted

Figure 4: Our Approach and Methodology



The alignment of the proposed project can be stated as – Amingaon-Hajo-Kalitakuchi-Barpeta-Lengtisinga-Abhayapuri-North Salmara-Chapaguri (Bongaigaon).

Figure 5: Alignment of the proposed road project



The proposed road project runs parallel to NH31 and can serve as an alternative to NH31 thereby easing the stress on NH31. The proposed project almost connects most of the major urban areas in lower Assam.

As part of the PIDP, Bongaigaon and Guwahati has been envisaged as two of the development nodes, where an integrated urban and industrial development will take place, and which will drive the development in its surrounding areas. The proposed road project will go a long way in ensuring that the envisaged development in Bongaigaon and Guwahati will have its positive impacts on the regions in its vicinity such as the districts of Barpeta and Nalbari.

The proposed road project is in alignment with the envisaged vision as part of the PIDP, which is to provide 100% connectivity to all population in the state, and to bring development to under developed areas.

The Government of Assam intends to involve the private sector significantly in this endeavor. Private sector in addition to reducing the financial burden of the Government in developing such infrastructure also brings in the necessary best practices from across the world and imparts efficiency in completion of such endeavors.

A financial assessment has been undertaken from the point of view of the potential Developer to assess the financial viability of the project to the Developer

The analysis is based on the expected traffic that the road project is likely to handle. Assumptions on the project timeline, construction cost, operation and maintenance (O&M) costs and capital structure are presented in later sections. The model developed proceeds to analyze revenues generating sources and consequently IRR & NPV to the developer. Later parts of this chapter undertake sensitivity analysis for various critical parameters and assumptions to assess the volatility of the results of the Base Case.

In the financial analysis, while estimating the IRR, the terminal value of cash flow is not being considered.

It has been assessed that in a pure PPP model where the developer will financed the entire project and will earn 100% revenues through tolls, the project may not be feasible

Table 3; Summary of Feasibility Analysis under BOT (Toll) and BOT (VGF) Models

Target EIRR	EIRR under BOT (Toll)		EIRR under BOT (VGF)		Result
	18 years	30 years	18 years	30 years	
18%	-4.78%	7.40%	2.92%	12.15%	Not Feasible

Since, the project is not viable under BOT Toll/VGF, PPP annuity format may be considered as a preferable model

Within PPP annuity, two forms of models are available:

- *Pure annuity – where the entire construction cost is to be financed by private sector.*
- *Hybrid annuity – where 50% grant may be provided to concessionaire during construction period and balance through annuity.*

However, some of the notable aspects to be considered in deciding between pure and hybrid annuity are:

- The liquidity crunch in the current market is significant and private sector may find it difficult to mobilize equity for the entire project. Hybrid annuity can substantially alleviate this issue.
- Pure annuity model can also lead to higher annuity commitments as compared to hybrid annuity thereby constraining the budget.
- Hybrid annuity allows for taking advantage of both lower cost of capital of government to an extent as well as bringing private sector efficiency from the PPP model.

Therefore, it may be useful to use Hybrid Annuity model for the projects. However, the quantum of projects that can be taken up under annuity should be seen through the lens of public finance implications as well.

Table 4: Summary of Feasibility Analysis under BOT (Annuity):

Estimated Bid project cost (INR crore) for 10 years	Estimated Bid project cost (INR crore) for 15 years	EIRR (%)	Result
1375	1450	18	Feasible

As indicated above, the project will be feasible at the given estimated bid project cost. O&M cost is estimated at 1.5 % of the estimated bid project cost in the first year and escalated going forward.

2. Background

2.1. About PIDP

Assam blessed with rich natural resources, human resources, river systems and a geographical location which positions the state as a gateway to India’s eastern neighbors, presents an opportunity to develop into a growth centre which will fuel the growth in the north-eastern states of India.

This available potential needs to be exploited by developing the necessary infrastructure supported by holistic policies and institutions with provisions for social inclusiveness and environmental sustainability

For a holistic and inclusive socio-economic development of a state, comprehensive infrastructure development is essential. **The Government of Assam has embarked on a journey to develop the infrastructure of the state over the next 20 years.** To serve that purpose the **Planning and Development Department of Assam has prepared a 20 Years Perspective Infrastructure Development Plan for Assam with PwC’s assistance**

The **20 Years Perspective Infrastructure Development (PIDP) for Assam** is an attempt to formulate an infrastructure development plan for the key infrastructure sectors in an integrated manner to support one another and thereby facilitate a holistic and inclusive socio-economic development uniformly across the state

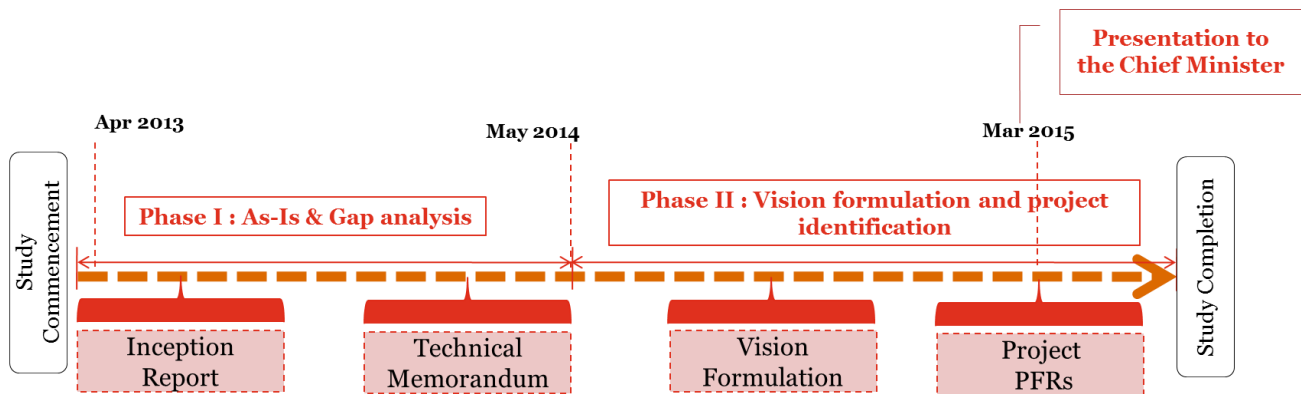
The PIDP was prepared **based on the 4 core sectors finalized by the Government of Assam** and was executed in an inclusive fashion with constant and active interactions with all relevant stakeholders

Figure 6: Sectors and Stakeholders (20 years PIDP for Assam)



The PIDP is a culmination of two years of extensive effort

Figure 7: PIDP Timeline



As part of this engagement, PwC has conducted in-depth as-is situation and gap analysis for the sectors under consideration (Road & IWT, Industry Infra, Urban Infra and Power) and has identified the issues and key challenges associated with each sector, formulated long term integrated infrastructure visions for the state as well as sectoral visions for each of the sectors aligned with the integrated vision, worked out the necessary interventions required to achieve the envisaged vision in terms of – physical intervention as well as institutional and policy level interventions, developed a financing strategy to fund the envisaged infrastructure development, identify key projects and conducted a pre-feasibility studies for 40 of the identified projects across the sectors under consideration

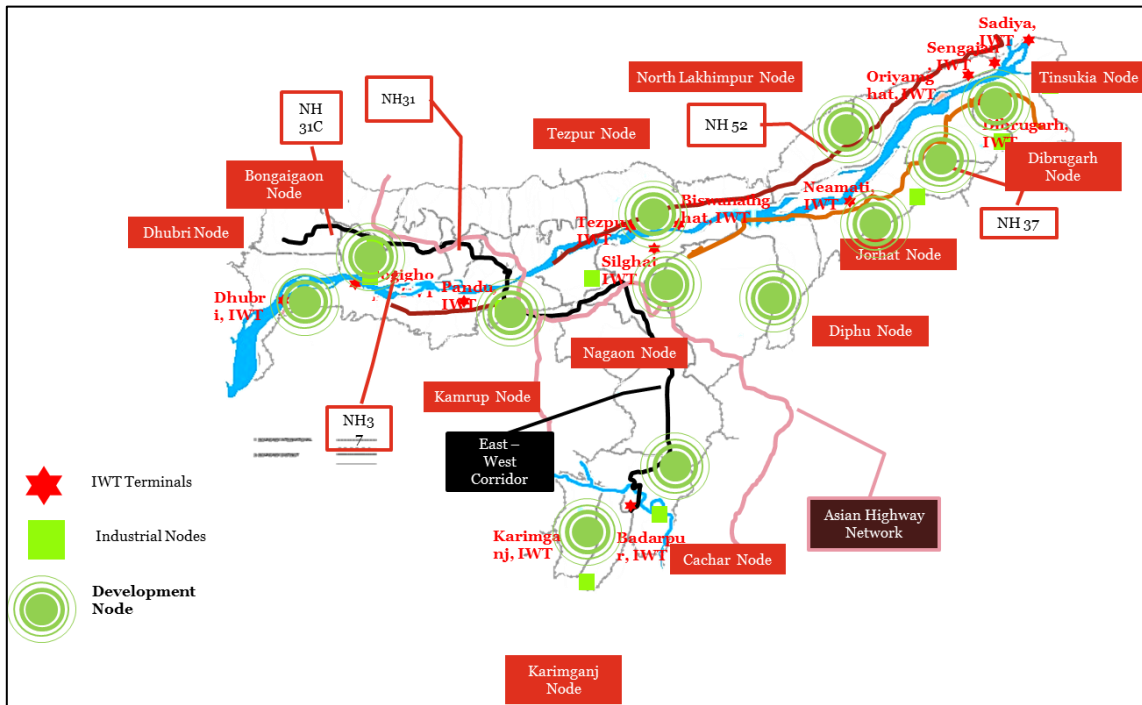
2.2. Overall 20 Years PIDP for Assam

For development of sustainable infrastructure where various infrastructure sectors works in tandem with and support one another, infrastructure development needs to be plan in an integrated manner taking into consideration the aspects of social inclusiveness and environmental sustainability

Driven by a philosophy to attain integrated development that is symbiotic to each sector, a long term integrated infrastructure vision has been envisaged for the state

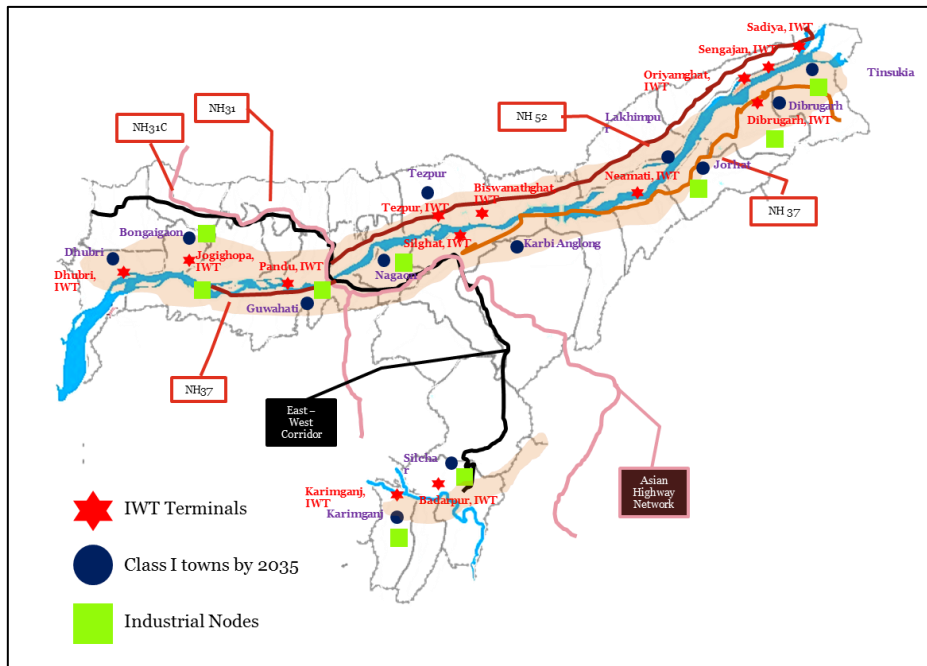
- ***Development of multi-modal Transport Corridors*** with adequate feeder networks that provides seamless movement of traffic with minimum transshipment cost in connecting the state to its neighbours
- ***Development of Growth Centres*** along the transport Corridors by aligning urban development and industrial development
- ***Augmentation and strengthening of power infrastructure*** to drive the envisaged development

Figure 8: PIDP for Assam



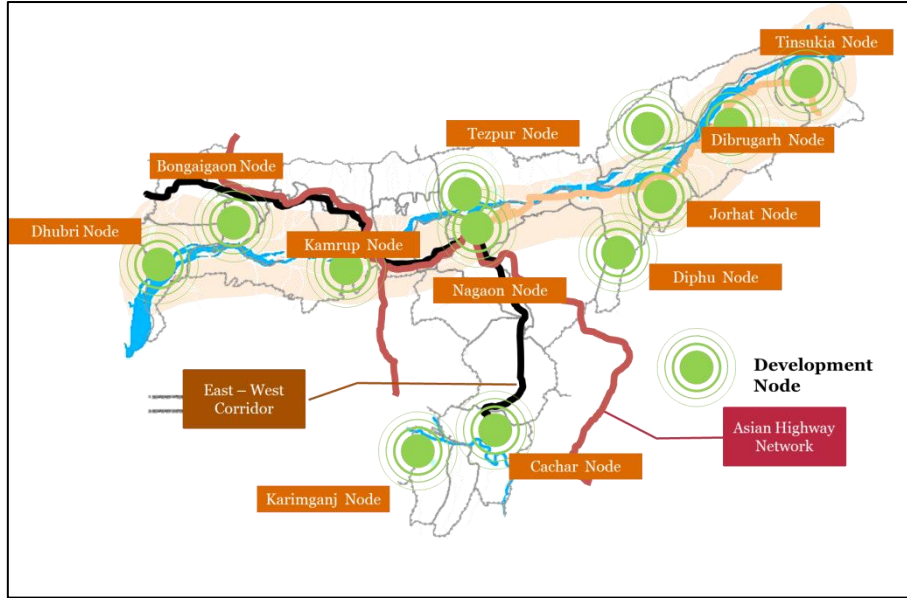
The PIDP proposes development of a multi-modal transport corridor comprising of a robust road network and a highly developed Inland Waterways mode among others; to ensure connectivity to all habitation and key areas, facilitate seamless movement of goods and positioned Assam and the north-east region of India as the preferred gateway to the neighbouring countries and the ASEAN

Figure 9: Envisaged development



The transport corridors will connect all the existing and upcoming Class I towns along with other key industrial and tourism centres. Aligning industrial and urban development will lead to the creation on 12 development nodes along the transport corridor. These development nodes will influence the development in their influence zone thereby bringing about a uniform socio-economic development across the state

Figure 10: Envisaged development node in Assam

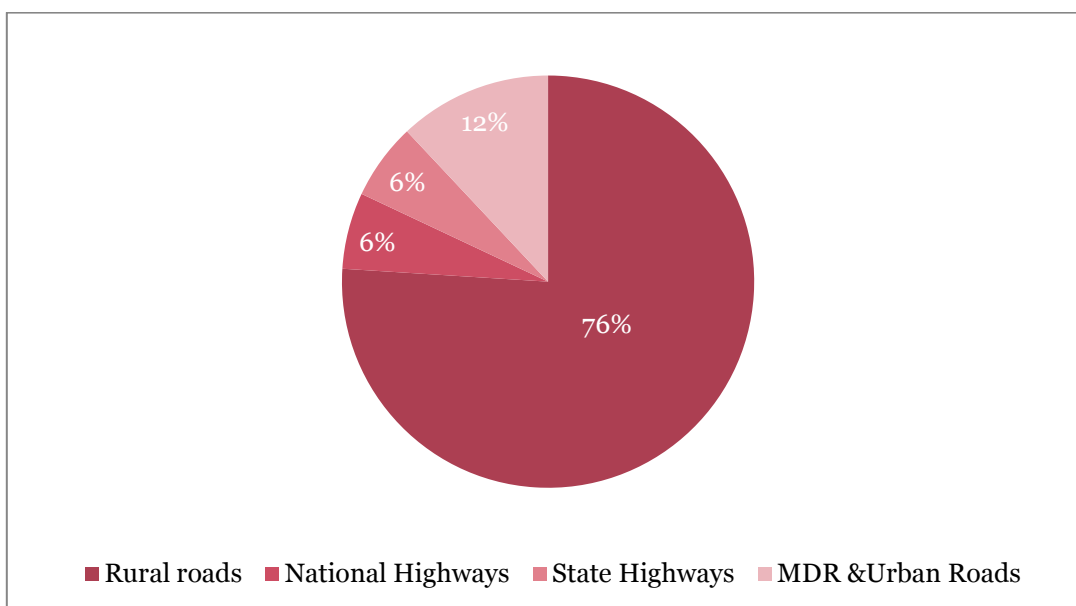


This developments needs to be supported by augmentation and strengthening of the power infrastructure. ***In the next 20 years, 11.5x Load Growth is expected in Assam. With Class I cities like Guwahati, Silchar , Nagaon & Dibrugarh expected to rapidly industrialise and urbanise in the next 20 years, around 13x Load Growth is expected in Class I towns and around 11x Load Growth is projected for upcoming Class I towns.***

2.3. Overview of Road Sector in Assam

At present, current road network in Assam aggregates to 48,358 km comprising National Highways (NH), State Highways (SH), Major District Roads (MDR), Urban and Rural Roads.

Figure 11: Distribution of Roads network (2012-13)



In comparison to the national average of 24%, Assam currently has around 11% of the roads in the state as National Highways.

Some of the important National Highways in the state are NH31C, NH 31B, NH37 and NH52.

State Highways constitute the secondary system of road transportation. State Highways connect the State capital with the various district centres, other important cities, towns and minor ports within a State. The State Highways also provide connectivity to the National Highways and the highways of the neighbouring States. There are a total of 53 SH in the state with a total length of 3,134 km.

Major District Roads (MDR) are high significance roads within a district connecting key centres to places of importance or with the State Highways & National Highways. These roads also connect Taluka headquarters and rural areas to District headquarters within the state. MDRs are critical for long term sustainable development of the state. Total length of MDR in Assam is 4,413 km

Rural roads are critical for providing connectivity to rural habitations and areas, thereby enabling generation of higher agricultural incomes. These roads are also critical for promoting access to economic and social services.

Total length of rural roads in Assam is 36,544 km. Most of these roads are being developed under the PMGSY scheme

3. Length

It has been observed that in terms of length, the National Highways (NHs) are adequate for the existing traffic; however a gap of 60% and more than 100% has been observed for State Highways (SHs) and Major District Roads (MDRs) respectively

Table 5: Status of National Highways, State Highways and MDRs

	Existing Length	Required Length	Gap
State Highways	2,622 km	5,000 km	60%
MDR	4,365 km	12,000 km	More than 100%
National Highways	3,717 km	Adequate	Negligible

Source: PwD Roads, Government of Assam

4. Number of lanes

It has been estimated that as per the existing traffic 70% of the length of State Highways in the state should be double lane, whereas at present only 6% of the length is double lane. Again for MDRs, 36% of the total length should have been Intermediate or double lane, but at present only 9% is either intermediate or double

Table 6: Status of Capacity of SHs and MDRs

	Existing %	Required % as per existing traffic
SH Double Lane	6%	70%
SH Intermediate Lane	20%	23%
MDR Intermediate & Double Lane	9%	36%

Source: PwD Roads, Government of Assam

5. Surfacing

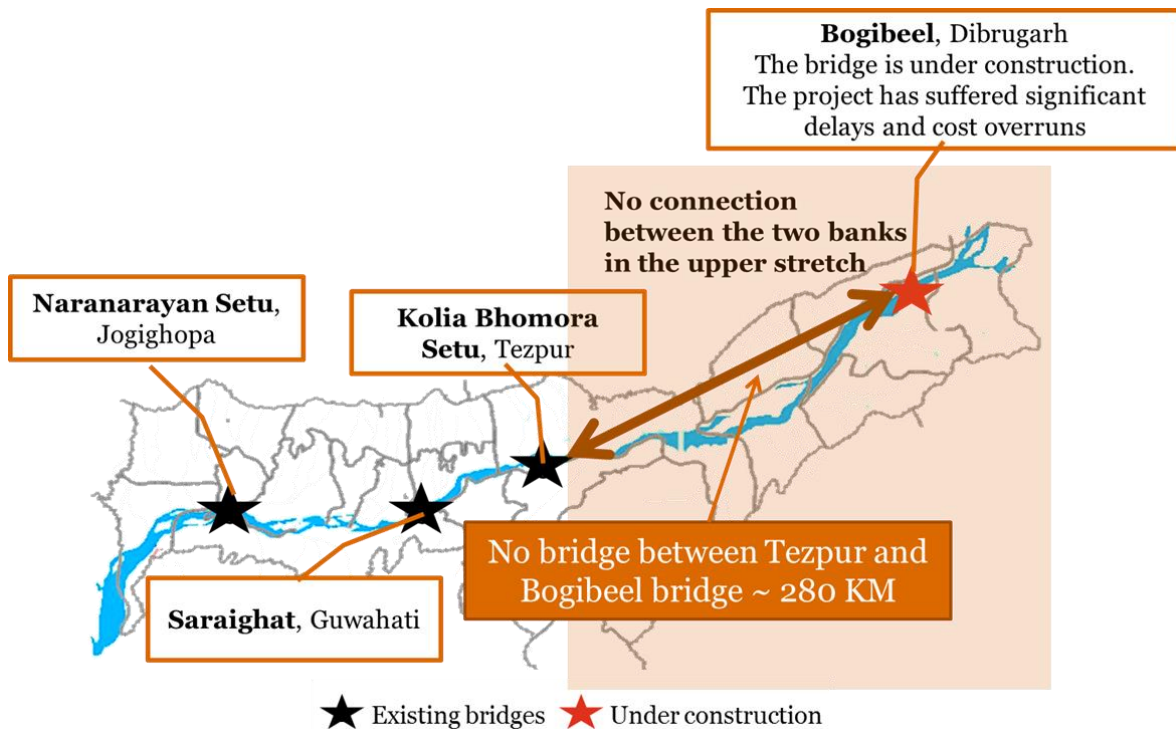
~ 50% of the roads in the state are unsurfaced and requires immediate attention

Apart from the above points, there is a need to improve the connectivity between the north bank and south bank of the river Brahmaputra, and between Brahmaputra and Barak Valley

6. Connectivity between North and South Bank of river Brahmaputra

There are bridges only at three points along the entire stretch of Brahmaputra - a length of 891 km in Assam

Figure 12: Bridges on river Brahmaputra

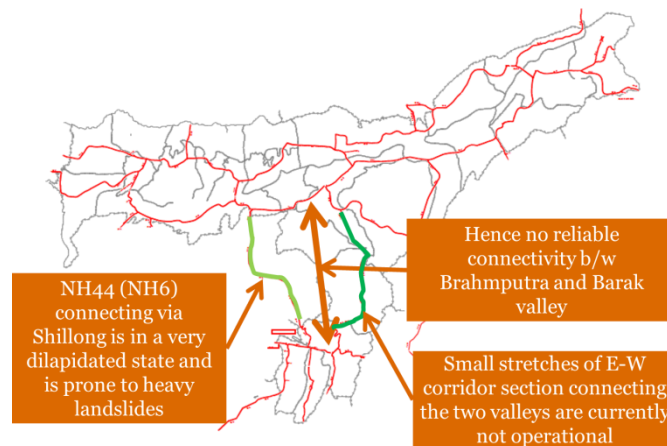


7. Connectivity between Brahmaputra valley and Barak valley

Currently NH-44 (renamed NH-6) provides connectivity from Guwahati to Silchar region via Meghalaya. The condition of the road is poor at certain stretches. The distance between Guwahati and Silchar is around 320 km, however due to poor condition of road it takes around 10-12 hours to travel the distance by road. Further the road is not operational for a few days during heavy rainfall. Hence an alternate connectivity is urgently

required. Once the following two linkages are operational trade flow between Brahmaputra and Barak valley will improve significantly

Figure 13: Status of connectivity between Guwahati and Silchar



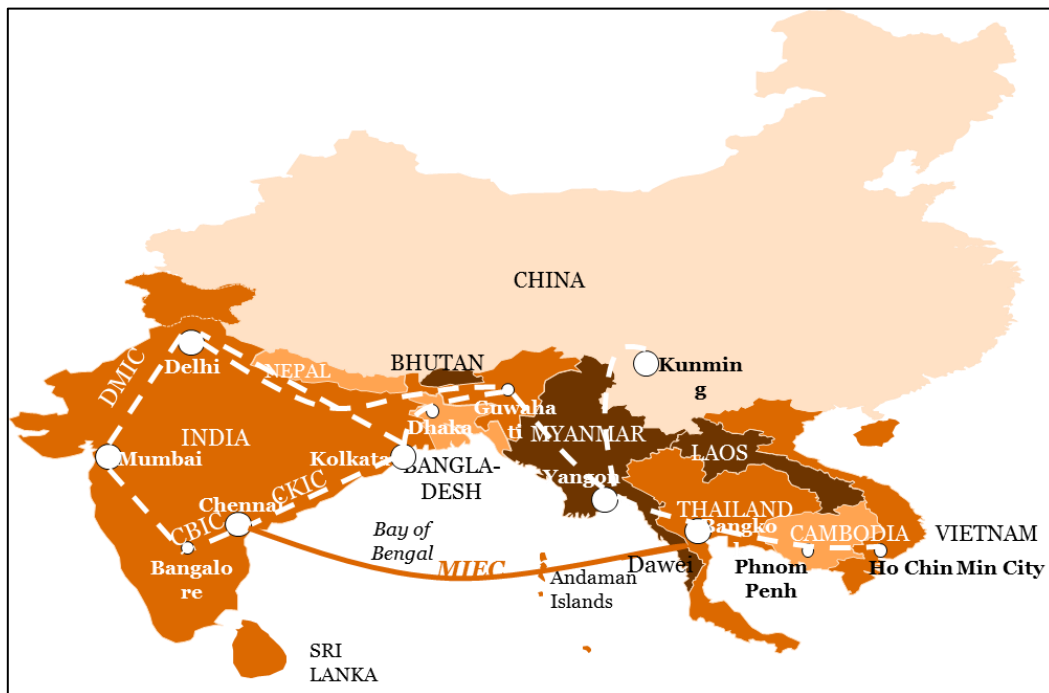
2.4. Importance of the Sector

Assam with a road network of 48,358 Km plays an important role in the integration of the north east India region with the rest of the country. It also shares international borders with Bhutan, Myanmar and Bangladesh and has the potential to act as a gateway to these countries.

The road network of the state carries a significant 74% of the total cargo traffic in the state (including interstate traffic) highlighting its importance, and makes its development and maintenance all more vital

The geographical isolation of Assam and the overall north east region makes it more imperative to develop the road network and other transportation modes to promote economic development of the region and establish the region as a gateway to India's eastern neighbours and the ASEAN countries

Figure 14: Indian ASEAN connectivity



2.5. 20 Years PIDP for Road Sector Assam

The geographical isolation of Assam and the overall north east region makes it more imperative to develop the road network and other transportation modes to promote economic development of the region and establish the region as a gateway to India’s eastern neighbours and the ASEAN countries

In order to bring about an overall development of the sector to drive the social and economic growth of the state and the region as whole, a holistic vision for the sector is required:

Vision for the next 20 years

- *Creation of a strong road network providing connectivity to all habitation and key centres (Industry Centres, Tourism Centres and growing Urban Centres) of the state*
- *Develop and strengthen connectivity to neighbouring states*
- *Make Assam the preferred gateway to neighbouring countries*

The implications of the vision are

- 1. The overall length of Road Network of the State to increase by ~ 30% (~ 55,435 Km to ~ 71,000 Km) in the next 20 years for providing better and seamless connectivity**

Table 7: Envisaged status of road network in the state of Assam by 2034 - 35

Categories of Road	Total Length (Km)	% of 6 Lane (by 2034-35)	% of 4 Lane (by 2034-35)	% of 2 Lane (by 2034-35)	% Single Lane (by 2034-35)
NH	5000	4%	96%		
SH	10,000		60%	40%	0%
MDR	12,000		5%	95%	
Rural Roads	~44000			20%	80%

2. Development of Core Road Network encapsulating connectivity to neighbouring states, countries and key growth centres

Achieving the envisaged vision will require physical interventions, institutional interventions and policy interventions

- **Physical interventions** – It will involve augmentation of the existing network and development of new roads.
- **Institutional interventions** – It will involve development of necessary institutions to formulate policies, master plan and implement the same
- **Policy interventions** – It will involve formulation of necessary policies to provide guidelines and drive sectoral development

Physical interventions should focus on development of core road networks which will form the backbone of the road transport in the state

The core road networks should encapsulate

- Enhancement of interstate connectivity
- Enhancement of international connectivity
- Improving connectivity between North and South Bank of River Brahmaputra
- Improving connectivity between Brahmaputra Valley and Barak Valley
- Connectivity to Tourist Centres, Industrial Centres and urban centres
- Coverage of more and more habitation centres

Basis the above objectives 6 Core Road Networks across the state has been identified

- 1. Core road network 1** – This network is spread across the entire state and comprises of vital arteries such as NH31C, NH31, NH37, NH52, and also the stretches of Trans Asian Highway and the East West Corridor running through Assam.

Development of this core road network coupled with development of industrial, urban and power infra will establish Assam as the center piece in developing north east India as an economic hub of the region and will enable Assam to influence a significant portion of the trade potential of north east India which has been estimated at a maximum value of 180,000 crore INR

- 2. Core road network 2** – This network will connect most of the key tourism centres in the State and also in the neighbouring state of Arunachal Pradesh such as the three national parks (Kaziranga, Manas and Orang), two wildlife sanctuaries (Barnadi and Sonai Rupai) in the state of Assam and Tawang in Arunachal Pradesh

Tourist traffic to Kaziranga has grown to ~ 1.25 Lakhs (6,922 Foreign Tourist) in the last seven years at a CAGR of 13%. The tourism network can facilitate the flow of this traffic to other tourism centres in

the state as well and has the potential of generating an employment of ~ 3.75 lakhs in the influence zone of each of the tourist centres in the state

- 3. Core road network 3** – This network connects all the state capitals of Arunachal Pradesh, Nagaland, Manipur, Mizoram and Tripura via Assam; thereby making Assam as the gateway for interstate connectivity

It reduces the travel time between north bank and south bank of river Brahmaputra in upper Assam and also connects the urban centres of Jorhat and Sibsagar in Brahmaputra valley to Silchar in Barak valley. Moreover it also provides international connectivity to Bangladesh via Karimganj

- 4. Core road network 4** – This network will connect Bhutan to the IWT Terminal at Dhubri and beyond to Bangladesh and Kolkata via river Brahmaputra. The IWT terminal at Dhubri is strategically located to capture all the cargo moving to and from Bhutan.

Trade between India and Bhutan stood at ~ INR 3,046 Crores in 2013 – 14, and this network has the potential of influencing a portion of this trade movement as well as trade between Bhutan and Bangladesh, with the IWT Terminal at Dhubri as the key node in the trade path to Bhutan

- 5. Core road network 5** – This network provides international and interstate connectivity by providing a direct connection between Bhutan and Meghalaya via. Barpeta. It reduces the travel time between Goalpara and Barpeta and between Barpeta and Chaygaon.

This network will result in direct savings of INR 392/tonne of cargo movement in fuel cost and a time saving of average 2 hours. Other indirect benefits include more traffic and trade movement between Bhutan and Meghalaya via- Assam

- 6. Core road network 6** – This network will provide two alternate connections between Brahmaputra valley and Barak valley.

It reduces the travel time from Nagaon to Barak valley by 5 – 6 hours resulting in a direct saving in fuel cost of INR 880/ tonne. At present, around 74 MTPA of cargo is transported through road. If one assumes, that 10% of this cargo movement happens between Brahmaputra and Barak valley, the above savings in fuel translates to INR 650 crore of aggregate savings per annum

In addition to the 5 Networks, key roads/stretchers have been identified across the State which requires capacity augmentation to handle the expected traffic over the next 20 years

- 5 Key National Highway Stretches with a total length of ~ 1497 km have been identified for capacity augmentation
- 5 Key State Highway Stretches with a total length of ~ 643 Km have been identified for capacity augmentation
- ~ 4415 Km of MDR across 26 Districts have been studied and identified for capacity augmentation
- 14 interstate stretches have been identified for capacity augmentation
- 13 stretches which connects Assam to Myanmar, Bhutan and Bangladesh have been identified for capacity augmentation
- 5 connections between the north and south bank of river Brahmaputra

To execute the envisaged physical development, key institutions will have to be developed and strengthened

- **Assam State Road Board** – The existing Assam State Road Board should be developed into an apex body which is mandated with policy planning, regulation and overseeing of implementing agencies as was envisaged during its conceptualization stage.

An act should be formulated that will provide the necessary authority to the Road Board to pass policy directives (maintenance benchmarks/targets, use of technology, network development targets) to and monitor the activities of the implementing agencies

- **Core Road Fund** – A Core Road Fund should be formed through an Act, which fixed its sources of funds and restrict its usage to road sector development specific use. The act should also ensure that the fund is non-lapsable, so that the funds are not redirected to other areas.

Formation of a core road fund will ensure steady flow of funds into the sector thereby making planning for the sector easier and will also build confidence among financial institutions, private developers, multilateral agencies, etc. to invest in the sector

The core road fund should be operationalized under ASRB. Since ASRB is expected to be the institution that will pass the policy directives to the implementing agencies, control of funds will enable ASRB to ensure accountability of the implementing agencies and thereby ensure that the targets set are met

- **Assam Road Development Corporation** – An Assam Road Development Corporation should be incorporated under the Companies Act. With an ability to raise funds on its own. This will reduce dependence on budgetary allocations which has been volatile and inadequate. Moreover being a corporation, the corporation will have more degree of freedom in terms of human resource management.

Govt. of Assam will have equity in the Corporation and it will also receive funds from the Core Road fund of the ASRB. The board members of the corporation should comprise of senior representatives from relevant departments such as Forest and Environment Ministry, Revenue Department, Finance Department, Industry; and also ex-officio of private banks and other private institutions

Holistic policies will have to be formulated to facilitate the envisaged physical development

A holistic sectoral policy should be formulated covering all aspects of the sector to provide the necessary guidelines for carrying out the required infrastructure development

- **Promote integrated road network development** - a holistic master plan for the sector which identifies core road networks, key stretches with provisions for adequate environmental safeguards and disaster management should be formulated
- **Focus on road maintenance** – The policy should have provisions for ensuring dedicated funds for road maintenance and ASRB should defined the service levels for each category of roads
- **Introduce tolling on key stretches by 2020** – Tolling policies should be formulated and introduced in the state by 2020. The policy should fixed the toll tariffs, fines for overloading vehicles, should identify the types of vehicles to be toll, guidelines for prosecution of vehicles which are not paying the tolls, guidelines for compensation of toll collecting agencies in case of occurrence of any loss. An act needs to be passed that will empower the state government to collect tolls
- **Capacity building of the implementing agencies** – Modern construction technology and IT systems should be adopted. Human Capital should be trained in project management and PPP procurement
- **Road safety and security** – ASRB will be responsible for providing design guidelines to ensured adequate safety in roads and ensure that the guidelines are followed by the implementing agencies
- **Facilitate PPP in the sector** – Necessary steps should be taken to promote PPP in the sector such as introduction of tolling, formation of core road fund, formation of dedicated PPP cell for the sector considering the quantum of investment and the complexity involved in the sector as compared to other sectors, PPP capacity building, standardization of contracts and resolution of execution issues such as land acquisition and acquiring of environmental clearances

While it will take time to develop the necessary policies and create the necessary institutions, it is also imperative to act on certain action points which are achievable in the current conditions and are vital for the overall development

1. The State Government an assist the PWD NH & Buildings or any other agency such as NHA involved in developing the recently declared National Highway networks, by assisting them in land acquisition and in getting environmental clearances

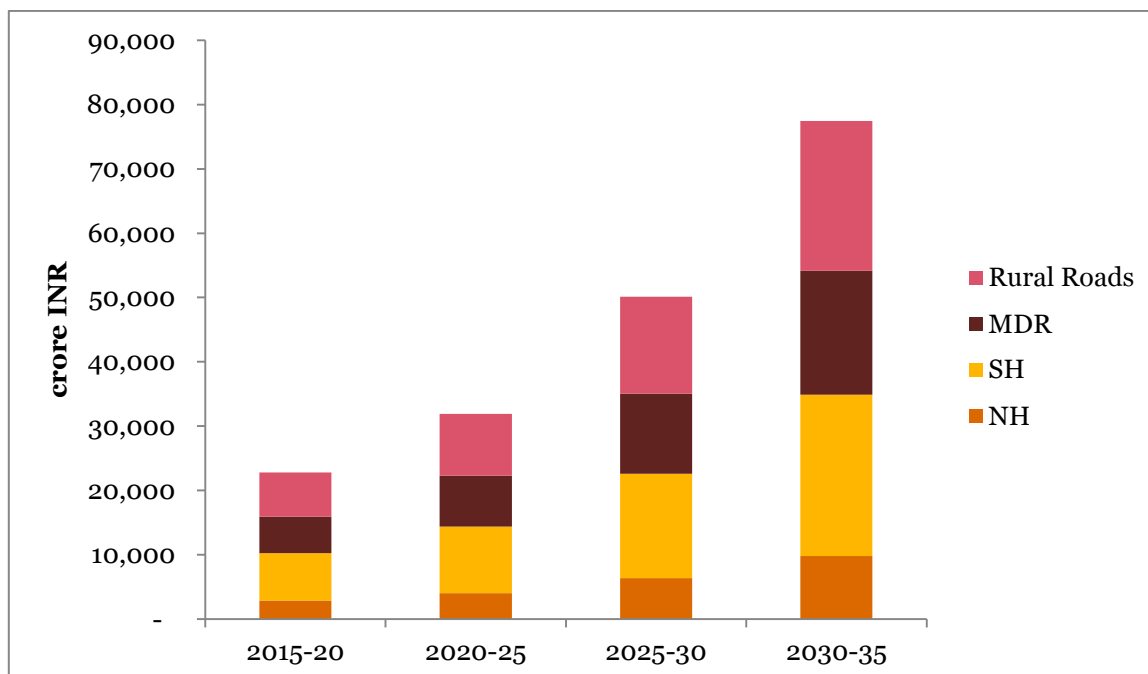
2. Project preparation for augmentation of NH 31B, NH 31 C and NH31 and NH37. The proposal should be placed before MoRTH highlighting the importance of these highways and the requirement for augmentation.
3. Identify State Highways and MDRs that can be converted into National Highways. As PIDP, we have identified five core networks and suggested SH and MDRs that would form part of such core networks. We have further suggested the capacity augmentation plans for each of the key stretches on the core network. The same should be considered and the identified stretches of SH and MDRs should be converted to NH to strengthened the overall core network.
4. Preparation of Model Concession agreements for PPP and EPC contracts

A total capital investment of ~ 183,000 crore INR has been estimated for the envisaged physical infrastructure development over the next 20 years.

Table 8: Envisaged capital investment for the sector

Categories of Road	Total investment (crore INR)
NH	23,151
SH	59,007
MDR	45,314
Rural Roads	54,778

Figure 15: Capex phasing for the next 20 years (as 5 year block period)



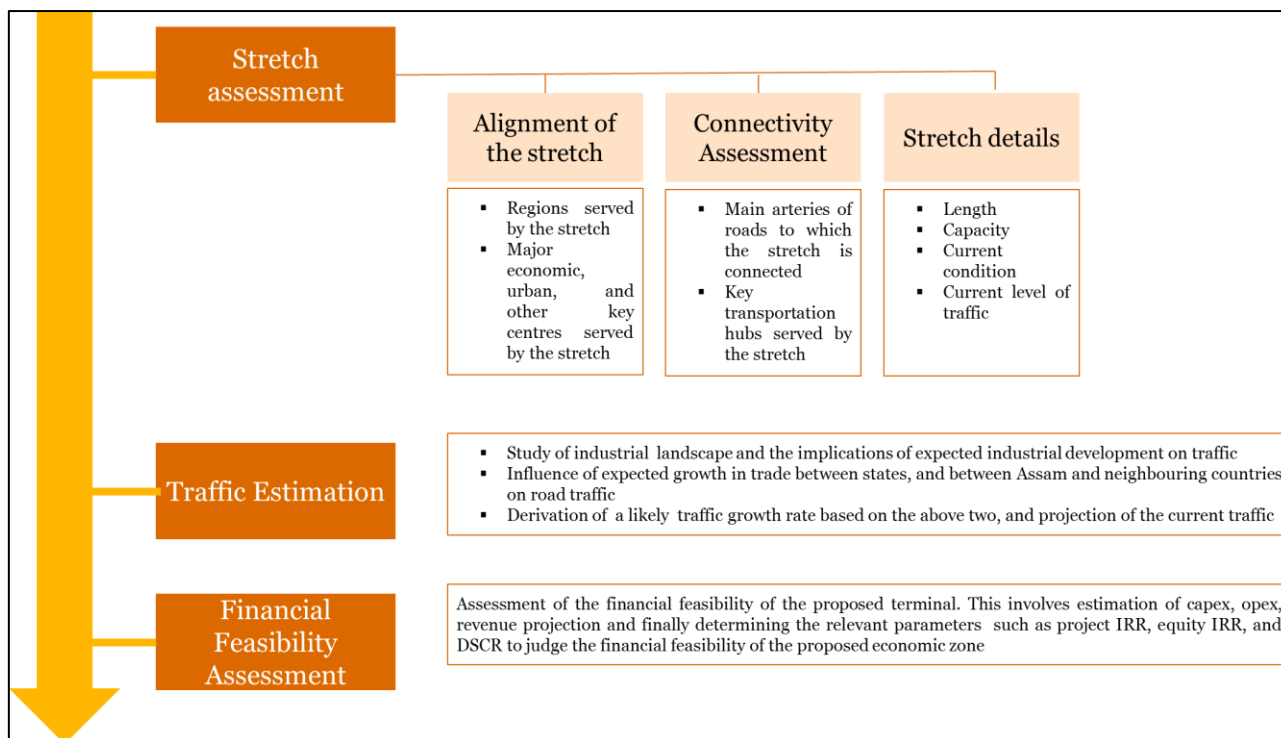
In line with the infrastructure development plan, the road stretch from Amingaon -Harjo-Kalitakuchi-Barpeta-Lengtisinga-Abhayapuri-North Salmara-Chapaguri (Bongaigaon) will be developed. Based on preliminary investigations and the envisaged integrated development the stretch has been chosen for the following reasons

-
- ***Connect major urban centres in lower Assam on the north bank of river Brahmaputra***
 - ***Provide alternate connectivity to NH31***
 - ***Align with the road sector vision of providing connectivity to 100% of the population***
 - ***To create the basic infrastructure that is necessary to initiate the process of development in an area, which has remained underdeveloped so far***

A pre-feasibility study will be conducted for the proposed road project has been conducted

3. Our approach for Pre-Feasibility study

Figure 16: Approach and Methodology



To achieve the objectives of this study, a modular approach is proposed that relies on a comprehensive assessment of all relevant factors vital to determine the feasibility of the proposed road project.

Step 1 – Assessment of the stretches in the proposed project

The study begins with an overall high level assessment of the proposed projects. This is done with the objective of understanding and establishing the significance of the project in terms of the number of people served by the project, connectivity to key urban and economic centres; and also to determine the likely implications of the development in the regions along the alignment of the proposed road project on the traffic on the road. The module culminates with the determination of a traffic growth rate

This module includes

- **Assessment of the regions along the alignment of the proposed road projects**

This is done with the objective of determining the socio-economic importance of the proposed road projects, and also to understand the future traffic dynamics of the proposed projects. This involves identification of major economic centres, urban centres, and population centres served by the road, and their implications on the traffic on the road

- **Connectivity assessment**

This involves identification of the key arteries which are connected to the proposed road project, and identification of key transport hubs such as railway stations, airports, and IWT terminals served by the proposed road project.

- **Determination of stretch details**

This involves identification of the current condition of the stretches in the project projects on parameters such as – length, capacity (no. of lanes), current condition (surface road – non surfaced road), and also determining the current traffic on the stretches in the proposed road project

Based on the stretch assessment conducted above, a conservative traffic growth rate is determined.

The stretches in the proposed road projects are evaluated according to three parameters

- Importance from tourism perspectives
- Importance from industry perspectives
- Importance due to other strategic factors.

If the stretch is important from the perspective of all the three parameters, the growth rate is 10%, if it is important from the perspective of any two parameters it is 9%, and it is important from the perspective of any one parameter it is 8%, if non important from the perspective of all the three parameters it is 7%².

Step 2 – Traffic estimation.

The study then moves on to traffic estimation for the proposed road project.

This step involves two sub-steps

1. Determination of traffic level for which the proposed project should be designed
2. Determination of the tollable traffic, so as to determine the revenue potential

1. Determination of traffic level for which the proposed project should be designed

Based on the traffic growth rate determined in step 1, the current traffic in the proposed road project is projected to determine the traffic level, for which the proposed project should be designed.

2. Determination of the tollable traffic, so as to determine the revenue potential

Determination of tollable traffic involves the following

- Segregation of the current traffic according to the various categories of vehicles, and determination of PCU equivalent.
- Based on the segregation of the traffic, the tollable categories are identified, and % of tollable traffic is determined
- Based on the PCU equivalent and percentage determined above, the tollable PCU equivalent is determined

^{2 2} The growth rates have been taken from the study “Advisory consultancy services for updating existing strategic options study (SOS)”, Assam State Road Projects.

- This tollable PCU equivalent is then projected using the conservative rate determined in step 1, to get the year on year tollable PCU equivalent
- A leakage of 20% is applied on the year on year PCU equivalent, to determine the tollable PCU equivalent from which revenues can be expected

Table 9: PCU equivalent

Type of Vehicle	PCU Equivalent
2-Wheelers	0.5
3-Wheelers	1
Car	1
LCV	1.5
Bus	3
2-axle Truck	3
3-axle Truck	3
MAV	4.5
Agr Tractor	1.5
Cycle	0.5
Cycle Rickshaw	2
Animal and Hand cart	3

Step 3 – Financial viability assessment

This is followed by financial viability assessment.

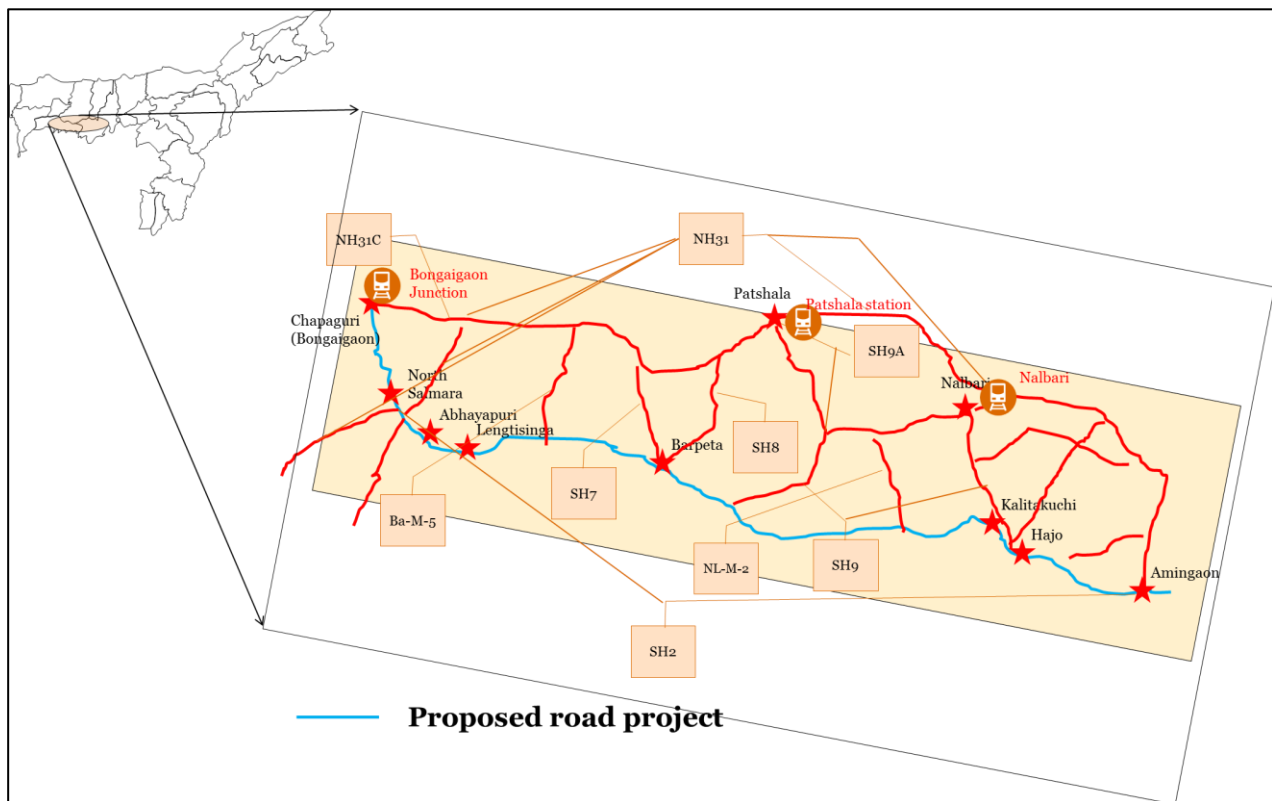
Based on the estimated traffic that is the proposed road project is likely to handle, the capacity to be developed is determined. This is subsequently followed by an estimation of capital expenditure and operating expenditure needed for the implementation. These expenditure figures have been used in the detailed financial modelling exercise undertaken for the proposed road project. Revenue side assessments have been done considering the toll-able traffic and the existing toll rates in India. Financial modelling quantifies the feasibility of the economic zone in terms of the Internal Rate of Return (IRR) that may be reasonably expected for the proposed economic zone project.

The processes mentioned above, and the corresponding assumptions are explained in more details in the following chapters.

4. About the stretch

4.1. Assessment of the stretches in the proposed road projects

Figure 17: Proposed road project



The alignment of the proposed project can be stated as – Amingaon-Hajo-Kalitakuchi-Barpeta-Lengtisinga-Abhayapuri-North Salmara-Chapaguri (Bongaigaon). The proposed road project runs from Amingaon in north Guwahati to Chapaguri in Bongaigaon, almost parallel to NH31. The proposed road project is on the northern Bank of river Brahmaputra in lower Assam. The proposed road project spans through the districts of - Kamrup, Nalbari, Barpeta, and Bongaigaon.

The proposed road project consists of the following stretches

Table 10: Stretches in the proposed road projects

Serial No.	Stretches	Road	Type
1.	Amingaon - Hajo	SH2	SH
2.	Hajo - Kalitakuchi	SH2	SH
3.	Kalitakuchi - Barpeta	SH2	SH
4.	Barpeta - Lengtisinga	SH2	SH
5.	Lengtisinga - Abhayapuri	SH2	SH
6.	Abhayapuri - North Salmara	SH2	SH
7.	North Salmara - Chapaguri	SH2	SH

- **Assessment of the regions along the alignment of the proposed road project.**

The regions along the alignment of the proposed road project are – Amingaon (north Guwahati), Hajo, Kalitakuchi, Barpeta, Lengtisinga, Abhayapuri, north Salmara, and Bongaigaon. The regions together are estimated to have a total population of ~ 0.5 million which will be directly influenced by the proposed road project.

The key urban centres along the alignment of the proposed road project are north Guwahati, Barpeta, Abhayapuri, and Bongaigaon. North Guwahati is slowly evolving into a satellite town of Guwahati. North Guwahati with a population of 19,172 (2011 census) is currently a Class IV town and was expected to transform into a Class III town by 2013, and is expected to have a population of 34,880. Barpeta is a Class III town currently with a population of 42,663 (2011 census). Barpeta town is expected to transform into Class II town by 2018, and is expected to have a population of ~ 77,000 by 2035.

Abhayapuri is currently a Class IV town and is expected to transform to Class III town by 2022, and is expected to have a population of 28,338 by 2035. Bongaigaon is a Class II town with a current population of 68,934. Bongaigaon is expected to transform into a Class I town by 2027 and is expected to have a population of 126,394 by 2035.

The proposed road project runs parallel to NH31 and can serve as an alternative to NH31 thereby easing the stress on NH31. The proposed project almost connects most of the major urban areas in lower Assam.

At present, Bongaigaon is one of the major economic centres in the regions where a refinery is located. There are 4 industrial areas in Bongaigaon. Also as part of the PIDP a multi sector economic zone is also envisaged in Bongaigaon. The proposed road project will directly or indirectly will serve these industrial areas/economic zones.

Table 11: Industrial areas in Bongaigaon

Industrial Areas	Distance from the proposed site (Kms)	Acres	Products produced
Industrial Growth Centre, Kharija Dolaigaon, Chirang	1	2	Aluminium utensil, ceramic tiles
Industrial Growth Centre, Baladmari, Goalpara	60	8.5	Food processing
Industrial Estate Bengtol gate	17	2	TMT bars, Petroleum Coke & Carbon paste, Aroma oil, Fly Ash bricks
Industrial Estate New Bongaigaon	4	9.5	Plastic based fabrication

As part of the PIDP, Bongaigaon and Guwahati has been envisaged as two of the development nodes, where an integrated urban and industrial development will take place, and which will drive the development in its surrounding areas. The proposed road project will go a long way in ensuring that the envisaged development in Bongaigaon and Guwahati will have its positive impacts on the regions in its vicinity such as the districts of Barpeta and Nalbari.

The proposed road project is in alignment with the envisaged vision as part of the PIDP, which is to provide 100% connectivity to all population in the state, and to bring development to under developed areas.

The proposed road project will go a long way in spawning socio and economic development in its region of influence

- **Connectivity assessment**

The proposed road project is connected to NH31 at Amingaon, and at Ghilaguri near Abhayapuri. Various roads such as SH7, SH8, SH9, SH9A, Ba-M-5, Km-M-11, and Km-M-2 connect NH31 with the proposed road project, and the areas between the proposed road project and NH31. Also MDRs such as - Ba-M-1, Ba-M-2, Ba-M-4, Km-M-12, and Km-M-15 connect the areas on the banks of river Brahmaputra to the proposed road project.

Various roads intersecting the proposed road projects signify that the proposed road project will act as the major artery in providing an overall connectivity to the region. The proposed road project is in alignment with the envisaged vision as part of the PIDP, which is to provide 100% connectivity to all population in the state, and to bring development to under developed areas. This makes a strong case for the overall development of the proposed road project for improving the overall connectivity in the region.

The proposed road project will serve the Bongaigaon railway station directly, and Patshala railway station and Nalbari railway station indirectly

- **Determination of stretch details**

Table 12: Details of stretches in the proposed road project

Stretches	Road	Type	Length (Kms)	Traffic (2013) PCU's	Capacity (No. of lanes)	Surfacing
Amingaon - Hajo	SH2	SH	18	23,327	Intermediate lane	Black top
Hajo - Kalitakuchi	SH2	SH	4	23,327	Intermediate lane	Black top
Kalitakuchi - Barpeta	SH2	SH	56	23,327	Intermediate lane	Black top
Barpeta - Lengtisinga	SH2	SH	28	23,327	Single lane	71% black top, 25% gravel, 4% earthen
Lengtisinga - Abhayapuri	SH2	SH	14	23,327	Single lane	71% black top, 25% gravel, 4% earthen
Abhayapuri - North Salmara	SH2	SH	6	23,327	Single lane	47% black top, 34% gravel, 19% earthen
North Salmara - Chapaguri	SH2	SH	18	23,327	Single lane	47% black top, 34% gravel, 19% earthen

Source: PWD Roads Dept., Assam

Given the stretch assessment conducted above a conservative traffic growth is determined.

Table 13: Expected traffic growth rate (stretch wise)³

Stretches	Road	Importance from tourism perspectives	Importance from industry perspectives	Importance due to other strategic factors.	Growth Rate till (2020)	Growth Rate till (beyond 2020)
Amingaon - Hajo	SH2	No	Yes	Yes	9%	5%
Hajo - Kalitakuchi	SH2	No	Yes	Yes	9%	5%
Kalitakuchi - Barpeta	SH2	No	Yes	Yes	9%	5%
Barpeta - Lengtisinga	SH2	No	Yes	Yes	9%	5%
Lengtisinga - Abhayapuri	SH2	No	Yes	Yes	9%	5%
Abhayapuri - North Salmara	SH2	No	Yes	Yes	9%	5%
North Salmara - Chapaguri	SH2	No	Yes	Yes	9%	5%

Based on the above rates, the current traffic in the stretches is projected, and then a weighted average traffic is determined for the entire proposed road project, for the subsequent years. Based on this a CAGR for traffic is estimated for the entire proposed road project. The rate for this particular road project has come out to be as follows-

Table 14: Expected traffic growth rate for the proposed road project

Growth Rate till (2020)	Growth Rate till (beyond 2020)
9%	5%

4.2. Traffic estimation

Based on the traffic growth rate deduced above, the traffic in each of the stretch is projected to arrive at the traffic level for which the road is to be designed.

Table 15: Expected traffic stretch-wise (in no. of PCUs)

Stretches	Traffic (2013) in no. of PCU's	Traffic (2020) in no. of PCU's	Traffic (2030) in no. of PCU's
Amingaon - Hajo	23327	42643	69460
Hajo - Kalitakuchi	23327	42643	69460
Kalitakuchi - Barpeta	23327	42643	69460
Barpeta - Lengtisinga	23327	42643	69460
Lengtisinga - Abhayapuri	23327	42643	69460
Abhayapuri - North Salmara	23327	42643	69460
North Salmara - Chapaguri	23327	42643	69460

³ The growth rates have been taken from the study "Advisory consultancy services for updating existing strategic options study (SOS)", Assam State Road Projects.

The average traffic expected on the entire proposed road project is the weighted average of the expected traffic in the stretches making up the proposed road project, the average traffic is given in the table below

Table 16: Expected total traffic (in no. of PCU's) for the entire proposed road project

Time lines	2013	2020	2030
Average traffic (no. of PCUs)	23327	42643	69460

From the traffic projected above, the % of tollable PCU has been determined which comes to be 33%. To this a traffic leak of 20% is applied, to arrive at the PCU numbers from which revenue can be expected.

Table 17: Total no. of tollable traffic (in no. of PCUs)

Time lines	2013	2020	2030
Average traffic (no. of PCUs)	7585	13866	22585

The tollable PCU's after 20% leakage are

Table 18: Total no. of tollable traffic after applying 20% leakage (in no. of PCU's)

Time lines	2013	2020	2030
Average traffic (no. of PCUs)	6068	11093	18068

Out of the above estimated traffic, 85% is expected to be outside traffic and the rest 15% Local non-commercial traffic.

5. Financial Feasibility Assessment

5.1. Financial Analysis

The Government of Assam is on a mission to overhaul the road infrastructure in the state to provide connectivity to 100% of the population, improve interstate and international connectivity, improve connectivity to key urban, industrial, tourism and cultural centres. Connectivity is the primary infrastructure that is required for the industrial development of the state. By improving the connectivity infrastructure the Government of Assam wants to achieve its objective of bringing a uniform socio-economic development in the state.

PIDP is an attempt to create the necessary infrastructure and necessary institutions and policies that are necessary for the overall socio economic development of the state. Road infrastructure is one of the key infrastructure sectors, which is vital for the development of the state.

The Government of Assam intends to involve the private sector significantly in this endeavor. Private sector in addition to reducing the financial burden of the Government in developing such infrastructure also brings in the necessary best practices from across the world and imparts efficiency in completion of such endeavors.

The financial analysis is carried out from the perspective of the developer with the objective of analyzing the financial implications resulting from the investment in the said project. The analysis is based on the expected traffic that the proposed road project is likely to handle. Assumptions on the project timeline, construction cost, operation and maintenance (O&M) costs and capital structure are presented in later sections. The model developed proceeds to analyze revenues generating sources and consequently IRR & NPV to the developer. Later parts of this chapter undertake sensitivity analysis for various critical parameters and assumptions to assess the volatility of the results of the Base Case.

In the financial analysis, while estimating the IRR, the terminal value of cash flow is not being considered.

5.2. Methodology

This financial assessment has been undertaken from the point of view of the potential Developer. In other words, this exercise intends to assess the financial viability of the proposed project to the Developer.

Financial assessment along with the financial viability of the project will largely depend upon the traffic, toll rates that can be charged, and capex and opex requirements. To have a robust model in place an exhaustive input sheet has been developed which broadly indicates all the assumptions. Further with help of these matrices/assumptions the model calculates projected revenue streams, capital and O&M costs. The model enables the testing of a number of parameters for their probable impacts on the finances of the proposed project.

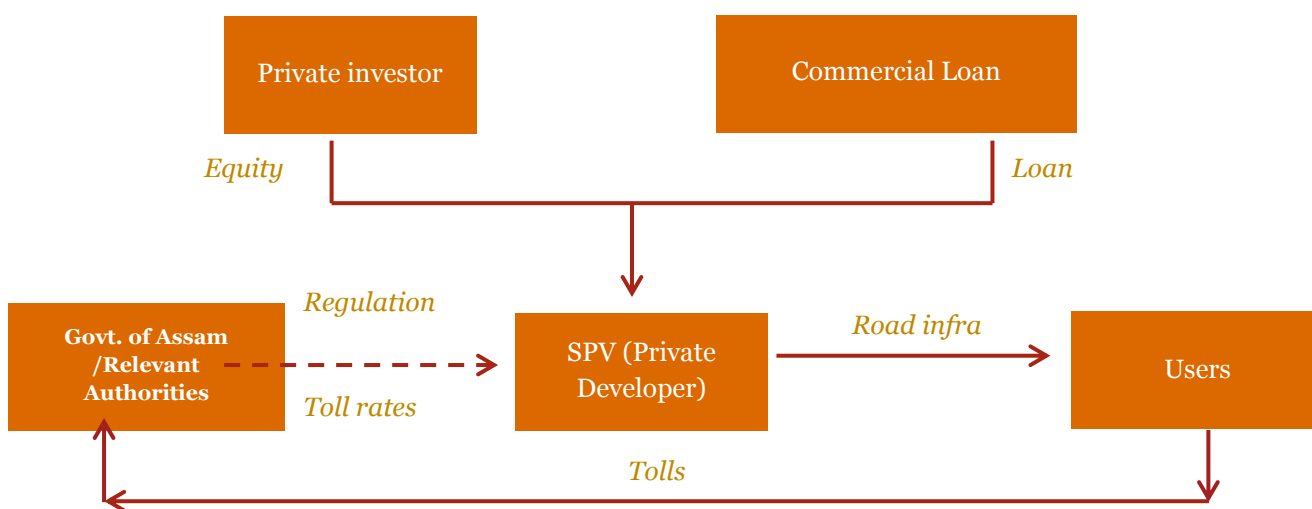
The primary outputs of the model are estimates of Equity Internal Rate of Return (IRR) and Project Internal Rate of Return (IRR) to the Developer under different scenarios.

The broad level assumptions considered while developing this model are –

- Govt. of Assam/PWD Roads/PWD NH & Buildings/Envisaged Assam Road Development Corporation/Relevant Authorities will carry out bid process for the proposed project and award the project to the successful bidder at the end of bid transaction process.
- A Development Agreement will be signed between Authority and successful developer for concession period of 20 years.

- Govt. of Assam/PWD Roads/PWD NH & Buildings/Envisaged Assam Road Development Corporation/Relevant Authorities for all the regulations relating to the development of the project.
- The Developer will be responsible for financing, development, and O&M.
- Financing for any development will be handled by the Private developer.
- Govt. of Assam/PWD Roads/PWD NH & Buildings/Envisaged Assam Road Development Corporation/Relevant Authorities will be responsible for providing the land that will be required for the project.
- The private developer will charge users as per the tolls agreed upon with the Govt. of Assam/PWD Roads/PWD NH & Buildings/Envisaged Assam Road Development Corporation/Relevant Authorities. For the following financial assessment, the toll revenue is calculated based on the NHAI Toll Notification, 2008

Figure 18: Base case PPP arrangement



The financial viability of the proposed project is assessed based on the following estimations:

1. Capital Costs of developing the infrastructure
2. O&M costs of operating and maintaining the infrastructure
3. Revenues accruing to the developer

Finally, it has been assumed that the Developer will expect at-least an EIRR of ~ 18% or above for the project to be a financial viable proposition.

The following section delves in greater detail regarding the key assumptions used in this financial assessment:

5.3. Inputs and Assumptions

The key inputs and assumptions used for the modelling of the projects are indicated below:

- The capital structure for private fund under PPP will involve 70% debt and 30% equity. Interest during Construction has been capitalized.
- The toll revenue is calculated based on the NHAI Toll Notification, 2008.

- It has been assumed that PPP project will be delivered on time. Any delay in PPP project attributable to private sector will only have economic impact on the benefits. However, there will be no financial impact as the risk has been transferred to private sector.
- Future Inflation has been assumed @ 5.5% per annum based on Survey of Professional Forecasters on Macroeconomic Indicators (a survey conducted by RBI on quarterly basis).
- The grant to be paid to the concessionaire during construction period has been considered to be 40% under BOT (VGF) and 0% under BOT (Toll).
- In case of BoT (Toll), no revenue share or upfront premium has been considered to get threshold viability.
- The analysis for BOT (Toll)/BOT (VGF) has been carried out for concession periods of – 15 years, and 30 years.
- The construction period has been assumed to be 3 years.
- Other relevant assumptions are shown in the table below.

Table 19: Inputs and Assumptions

Project Cost Estimation	BOT (Toll)/BOT (VGF)/ Hybrid Annuity	Explanation
Other pre-operative expenses	5% of Road Construction Cost	
Contingency	5% of the total EPC Cost	
Inflation	5.5%	As per long term projection in RBI Survey of professional forecasters
O&M Cost Assumptions for 2 lane	BOT (Toll)/BOT (VGF)	Explanation
Routine Maintenance	60% of base rate INR 7 lacs/per Km/per lane for 2010-11	As per NHAI Guidelines
Periodic Maintenance	Every 7 years; 60% of base rate INR 45 lacs/per Km/per lane for 2010-11	As per NHAI Guidelines
Management and Administrative expenses	Base rate of INR 2.5 Lacs per Km	As per NHAI Guidelines
O&M Cost Assumptions for 4 lane	BOT (Toll)/BOT (VGF)	Explanation
Routine Maintenance	INR 7 lacs/per Km/per lane for 2010-11	As per NHAI Guidelines
Periodic Maintenance	Every 7 years; INR 45 lacs/per Km/per lane for 2010-11	As per NHAI Guidelines
Management and Administrative expenses	Base rate of INR 2.5 Lacs per Km	As per NHAI Guidelines
Tax Assumptions	BOT (Toll)/BOT (VGF)	Explanation
Corporate Tax rate	33.99%	
MAT	20.01%	As per GoI guidelines

Table 20: Timing Assumptions

Project Timelines - Development and Construction		
Bid date		01-Jan-16
Time for Signing of Concession		45 days
Signing of Concession		15-Feb-16

Time for Financial Close	150 days	
Appointed Date	14-Jul-16	
than	13.00	
Construction start	14-Jul-16	
Construction period	1095 days	
Construction End	14-Jul-19	
End of Month	Date	FYE
Construction start	31-Jul-16	31-Mar-17
Construction end	31-Jul-19	31-Mar-20
Operations		
Start of Operations period	15-Jul-19	31-Mar-20
Operations period	10 years	Choose 27 for BOT project Only
End of Concession	14-Jul-29	31-Mar-30
First Month of Operation	31-Jul-19	
First year of Operation	261	days
Last year of Operation	105	days

5.4. Summary of Financial Feasibility Analysis

5.4.1. BOT Toll/VGF

Based on the above mentioned parameters, financial assessment of project packages is carried out for viability under Toll revenue i.e. BOT (Toll)/BOT (VGF). The analysis and results are summarized below.

Table 21; Summary of Feasibility Analysis under BOT (Toll) and BOT (VGF) Models

Target EIRR	EIRR under BOT (Toll)		EIRR under BOT (VGF)		Result
	18 years	30 years	18 years	30 years	
18%	-4.78%	7.40%	2.92%	12.15%	Not Feasible

As indicated, please note that the project is not viable under Toll based PPP models, and hence, PPP annuity format may be considered as a preferable model.

5.5. BOT Annuity

Within PPP annuity, two forms of models are available:

- **Pure annuity – where the entire construction cost is to be financed by private sector.**
- **Hybrid annuity – where 50% grant may be provided to concessionaire during construction period and balance through annuity.**

However, some of the notable aspects to be considered in deciding between pure and hybrid annuity are:

- The liquidity crunch in the current market is significant and private sector may find it difficult to mobilize equity for the entire project. Hybrid annuity can substantially alleviate this issue.
- Pure annuity model can also lead to higher annuity commitments as compared to hybrid annuity thereby constraining the budget.
- Hybrid annuity allows for taking advantage of both lower cost of capital of government to an extent as well as bringing private sector efficiency from the PPP model.

Therefore, it may be useful to use Hybrid Annuity model for the projects. However, the quantum of projects that can be taken up under annuity should be seen through the lens of public finance implications as well.

Table 22: Summary of Feasibility Analysis under BOT (Annuity):

Estimated Bid project cost (INR crore) for 10 years	Estimated Bid project cost (INR crore) for 15 years	EIRR (%)	Result
1375	1450	18	Feasible

As indicated above, the project will be feasible at the given estimated bid project cost. O&M cost is estimated at 1.5 % of the estimated bid project cost in the first year and escalated going forward.

Appendix A - Annuity payment for 15 years concession period

Annuity Number	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Annuity Component	18.68	20.38	22.30	24.34	26.60	28.98	31.70	34.53	37.70	41.21	44.95	49.13	53.66	58.87	63.96
Interest Component	31.05	30.51	29.03	28.09	26.27	25.20	23.18	21.76	19.48	17.67	15.17	12.79	9.84	6.96	3.57
Total Annuity payable	49.73	50.89	51.34	52.43	52.88	54.18	54.88	56.29	57.18	58.88	60.11	61.92	63.50	65.83	67.53
O&M Payment	15.41	15.83	16.26	16.70	17.15	17.62	18.10	18.59	19.09	19.61	20.14	20.69	21.25	21.83	22.42

