ANNEXE

DATA AND METHODOLOGY

This chapter focuses on the short-term benefits of investing in the three alternatives analysed in the Policy Brief based on two indicators:

1. **Direct employment likely to be generated through the investments**
2. **Number for people benefited through improved access to mobility**

It is acknowledged that infrastructure investments have a 20 to 30-year lock-in and estimating benefits and societal impacts over the lifecycle of the project would provide a holistic perspective. However, given the immediate term focus of an economic stimulus package other second order and longer term impacts such as suburbanisation, user costs of public vs private transport, energy consumption, emissions, safety and security of users etc. are beyond the scope of this Policy Brief.

The estimated employment and mobility benefit of a stimulus of INR 10,000 Cr (~1.3b USD) for each of these sub-sectors. The jobs and mobility impacts for each of the choices was derived through a wide range of secondary data sources. In each sub-sector, the man-days of employment provided and the number of trips made per unit investment of INR 1 Crore (~$1.3m) were derived considering FY 2016-17 as the reference year for analysis, based on data availability across sources. The analysis only focuses on passenger mobility and excludes analysis of the freight sector. Public transport is seen through the lens of buses, which are the preferred choice for users. Metro rail systems and informal and paratransit services in the form of three-wheelers and taxis aren't considered. The sub-sector wise methodology to derive employment and mobility benefits is explained below:

EMPLOYMENT AND MOBILITY BENEFITS OF ROAD INFRASTRUCTURE DEVELOPMENT

The formulae used for employment and mobility benefits assessment is shown below:

$$\textbf{Mandays of employment generated per unit investment in road infra development} = (Investment) \times (Cost\ per\ km\ of\ national\ highway\ development) \times (Mandays\ of\ employment\ created\ per\ km)$$

$$\textbf{Passenger trips (per year) per unit investment in road infra development} = \frac{(Investment) \times (km\ of\ roads\ built\ per\ unit\ investment) \times (daily\ service\ volume\ of\ vehicles) \times (Average\ occupancy\ of\ the\ vehicle) \times 365}{(Average\ trip\ length\ per\ trip)}$$

Cost per km of National-Highway (NH) development for 2016-17 was derived from progress reports from the Ministry of Road Transport and Highways (MoRTH)[1], while employment generation benefits of highways developed under the Bharatmala project of MoRTH were used to estimate the mandays of employment to be generated for an investment of INR 10,000 Cr (~1.3b USD)[2].

The underlying assumption here is that the stimulus by the government investments will be used as viability gap funding. In other words, the financial support or subsidy granted by the government to cover for the revenue gap between return on investments needed to encourage private sector investments for highway development and the likely revenue to be collected through road user charges such as toll fees. Hence, the government investments will only support the private investors and won't generate any financial returns.

The mobility benefits for the highways built were derived assuming a conservative scenario that the entire road will be used for passenger mobility. The actual benefits are likely to be lesser than this as freight accounts for a substantial share of highway traffic. The passenger car units (PCUs) of daily service volumes proposed by the Indian Highway Capacity Manual (Indo-HCM), for a four-lane highway under Level of Service (LoS) C category traffic along with the average trip length and occupancy of cars for a typical Indian highway were used to estimate the passenger trips of capacity to be generated for an investment of INR 10,000 Cr (~1.3b USD)[3][4].

EMPLOYMENT AND MOBILITY BENEFITS FROM INVESTMENTS IN THE AUTOMOBILE MANUFACTURING SECTOR

The formulae used for the employment and mobility estimates are given below:

$$\textbf{Mandays of employment generated per unit investment in automobile manufacturing} = \frac{(Investment) \times (People\ employed\ in\ manufacturing, sales\ and\ repair\ in\ FY\ 2016-17) \times 365}{(Gross\ turnover\ in\ FY\ 2016-17)}$$

[1] MORTH, 2019. *Holistic Development of Road Infrastructure*
[2] MORTH. 2019. *Holistic Development of Road Infrastructure*; MEHTA. 2018. *India's Road Sector to Boost Employment Opportunities*.
[3] CSIR, 2017. Indian Highway Capacity Manual.
[4] MORTH, 2019. *Environmental Impact Assessment & Environmental Management Plan*.

$$\textbf{Passenger trips (per year) per unit investment in automobile manufacturing} = \frac{(Investment) \times (Cars - sold \times Car\ occupancy + 2 - Wheelers\ sold \times 2 - Wheeler\ ocupancy) \times Trips\ per\ day \times 365}{(Gross\ turnover\ in\ \ FY\ 2016 - 17\ )}$$

The gross turnover of the automobile industry[5] for FY 2016-17 and the total number of people employed in the automobile sector including manufacturing, sales, dealerships and repair of motor vehicles were used to estimate the man-days of employment that can be generated per unit investment in the automobile sector[6]. This investment is assumed to benefit personal vehicles like cars and two-wheelers, since the benefits to the public transport services are estimated separately. The number of cars and two-wheelers sold in FY 2016-17 and the gross turnover for the same year were used to estimate the likely number of cars and two-wheelers to enter the market per unit investment stimulus to the automobile sector. These cars and two-wheelers are assumed to operate on all days of the year and make at least one round trip per day at their average occupancy levels to estimate the number of person-trips of mobility to be made possible through the investment.

EMPLOYMENT AND MOBILITY BENEFITS OF INVESTMENTS IN BUS SERVICE IMPROVEMENTS

The following were the formulae was used:

$$\textbf{Mandays of employment generated per unit investment in public bus services} = \frac{(Investment) \times (People\ employed\ in\ STUs) \times 365}{(Total\ cost\ of\ operations - Total\ revenue\ excluding\ subsidies)}$$

$$\textbf{Passenger trips (per year) per unit investment in public bus services} = \frac{(Investment) \times (Total\ bus\ trips\ made\ in\ STUs\ in\ FY\ 2016 - 17)}{(Total\ cost\ of\ operations - Total\ revenue\ excluding\ subsidies)}$$

The aggregated performance of the State Transport Undertakings (STUs) for FY 2016-17 published by the Central Institute of Road Transport (CIRT) were used as the benchmark to estimate the employment and mobility benefits of bus service improvements per unit investment[7]. The number of employees and passengers transport by all the buses owned by STUs are already captured in the report. The difference between the total cost of operating the buses and the total revenue i.e. both fare and non-fare revenue (excluding

[5] SIAM. 2016-17. *Performance of Auto Industry in 2016-17*.
[6] RUPE INDIA, 2019. *Is the auto industry really 49% of India's manufacturing sector? Does it employ 37 million?*.
[7] CIRT. 2017. Profile and Performance of *State Transport Undertakings. Key statistics 2016-17*

subsidies) were used to derive the cost at which these employment and mobility benefits are collected. These unit estimates were used to derive the employment and mobility benefits of investing INR 10,000 Cr (~1.33b USD) in the public bus sector.