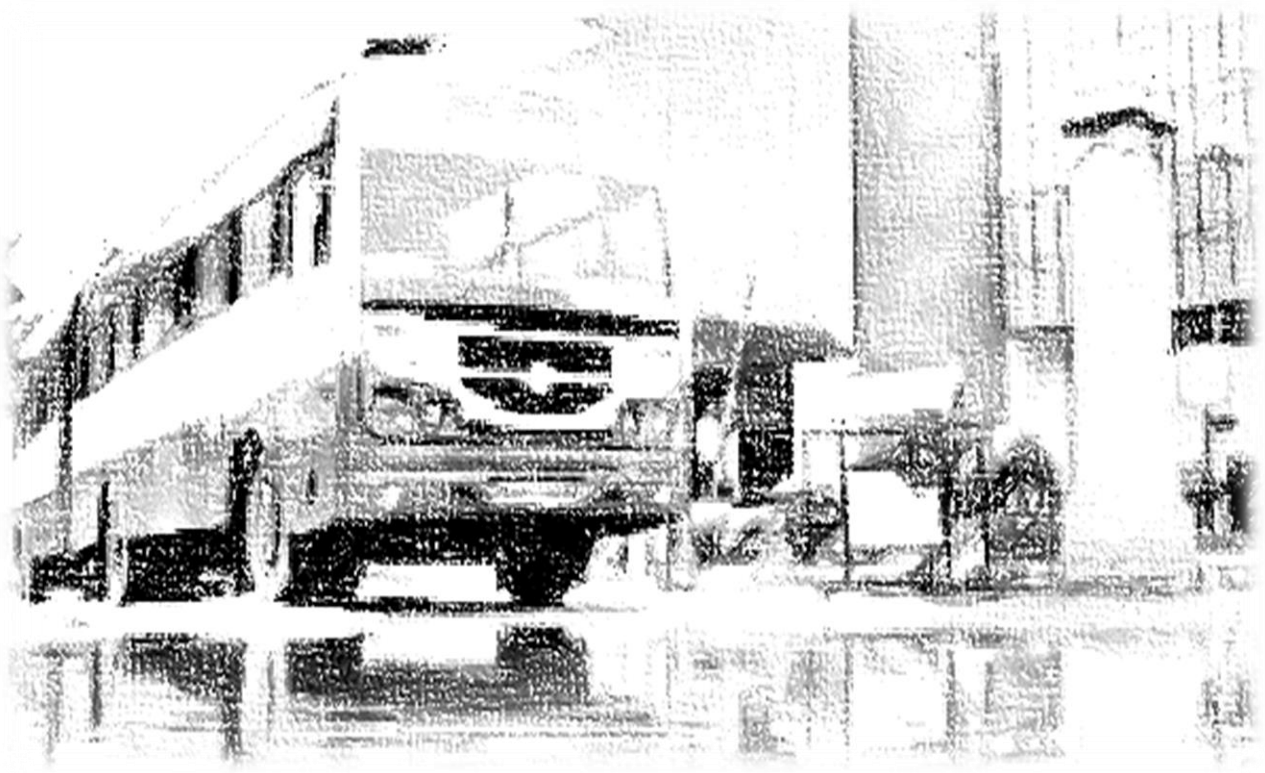
# Road- Map for Bus Fleet and Infrastructure Development for Bengaluru Metropolitan Transport Corporation (BMTC) using Long-range planning and Fleet estimation toolkit (FLEET).

January 2020



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# 1 Study Background

Public bus companies form the backbone of bus-based mobility in India. These are under the control of State Transport Departments with an objective to serve the mobility needs of the residents of that State, a region or a City, and are known as State Transport Undertakings (STUs) or City Transport Corporations. However, the current state of affairs is that many STUs are currently only serving a small fraction of passenger trips in the State, Region or City under their operational control. For example, Jammu and Kashmir State Road Transport Corporation (JKSRTC) is serving less than 1% of total daily trips in the State, whereas this number for progressive STUs such as Maharashtra State Road Transport Corporation (MSRTC) or Andhra Pradesh State Road Transport Corporation (APSRTC) is between 15% and 20%. On the other hand, even larger STUs and Transport Corporations, such as APSRTC and MSRTC, do not yet cater to a large chunk of potential bus trips and thus have scope of further expansion of operations. It is estimated that this expansion can result in capturing between 5% and 10% additional trips in these States/regions.

Evidently India is sitting on a large untapped demand of bus trips, and an untapped potential to significantly improve bus operations and services. The risk of not tapping into this demand is not only grave today but has more severe repercussions in the future. If STUs (and other private operators) are unable to provide affordable bus service to this huge potential commuter base, they will not only hamper the access to opportunities and essential services for a large segment of the population - stunting economic growth, but also risk the capturing of new mobility trips by inefficient modes of transport such as motor cycles and cars, leading to higher emissions, increased carbon footprint, accidents and congestion.

One of the major challenges that most STU's and transport corporations currently face is their inability to recover operational costs through their current revenue sources. This is in part, due to current financial and operational inefficiencies. Hence, these STUs may be completely dependent on government funding to overcome operational losses, maintaining and expanding their fleet strength and developing bus infrastructure. In this scenario, the State budgetary machinery and State Transport Department view each additional bus in the fleet as a liability, and each penny pledged to the STU (or the transport corporation) as sunk cost. This generates a resistance within the government, for investing in these bodies. This is a major bottleneck for any expansion and revival plans of STUs and transport corporations. In a scenario where, financial support from State is hard to come by, these organizations enter a deteriorating spiral.

It has been established that a well-defined road map with annual actions and achievable targets leading to achievement of overall reduced losses and increased profitability in a planned timeframe, can be useful to convince decision makers to commit the necessary investments in STUs. On the other hand, STUs will be able to effectively plan the utilization of sought resources, leading improved financial as well operational efficiency and expansion of operations into untapped markets resulting in augmentation of patronage. Recent studies on developing long range plans for MSRTC and APSRTC have shown that STUs focusing on intercity and mofussil operations can have the potential to be profitable and financially independent of State support. This can be achieved in a time period of 5 to 15 years, provided these STUs adopt a strategic road map to achieve this objective. It is shown that with improved efficiencies and investments, augmentation of patronage is possible, resulting in a significant increase in mode share for the STUs and 'transport corporations. The actions required as a part of this road map focus on improved optimization (of service value and resources) and increased patronage, through improved planning, better training as well strategically tapping Government and private investments and/or resources.

A spread- sheet based model with a VBA based user interface has been developed to allow STUs and other stakeholders and supporting organizations to develop a long-range road map for public bus

companies. This model has been developed, tested and applied (in various stages of its development) for a number of public bus companies such as Himachal Road Transport Corporation (HRTC), JKSRTC, MSRTC and APSRTC. This model uses variables such as fleet size, number of trips in the State (or the region served by STU), mode share, total route length operated, vehicle utilization, operational efficiency, occupancy, passenger trip length, route length, current per passenger revenue, operating cost per km, fleet procurement cost, bus infrastructure development cost, etc. This spreadsheet however is not in a format where it can be used for wide scale application by multiple STUs without the help of expert support. Additionally, this spread sheet has not been tested for urban only STUs.
Therefore, STUs desire to model the impact of inclusion of a predetermined number of e-buses in their fleet and their impact on the STUs annual budgetary requirement, operational costs, earning, operational efficiency, fleet utilization, staff requirement etc. The existing spread sheet-based model allows estimation based on a predetermined cost and operational lifespan of internal combustion engine (ICE) and e-buses. It however does not account for specific contribution of e-buses to operational cost and earnings, nor does it account for service or vehicle specific operational characteristics. It also currently does not account for e-bus specific infrastructure cost, especially depots, charging infrastructure, substation requirement, etc.
To ensure that the proposed tool is user friendly and meets all the requirements of public bus companies, SGA partnered with BMTC in July 2019, for development and testing of the tool, as a part of a project funded by Shakti Sustainable Energy Foundation (Shakti) starting May 2019. SGA has developed a beta version of the long-range planning tool (named as FlEET), using the data provided by BMTC. As a part of this partnership the project team consulted with BMTC officials, and used the BMTC operational data from October 2019, to develop a long range plan for the same. Long-range plan for BMTC with five different scenarios has been developed in FlEET. This report contains the details of this long-range plan. Like many public bus companies in India, BMTC has shown keen interest in converting their current 'internal combustion engine' (ICE) fleet to electric buses (e-buses), encouraged by different, central government flagship schemes. There is, however, little or no experience in the country with the use of a fleet of e-buses, or their impact on the operational, infrastructural and budgetary (both capital and operational cost) requirements. Therefore, this long-range plan, models the scenario for transition of 100% of current BMTC ICE fleet to e-buses by 2030.

Section one, of the report highlights the background and context of study followed by the objectives and methodology in section 2 and 3 respectively. Section 4 focusses about the development of the FLEET tool, architecture and components and its functionality and interaction and meetings conducted for the tool and Section 6 presents the scenario building comprised of 5 scenarios and their outcome obtained through the tool generated for BMTC followed with the annexures.

# 2 Bengaluru City and BMTC

Bangalore, officially known as Bengaluru is the capital of the Indian state of Karnataka. With a population of 8,443,675 in the city and 10,456,000 in the urban agglomeration, up from 8.5 million as per the 2011 census, Bengaluru is a megacity, and the third-most-populous city in India and the 18th-most-populous city in the world. The topology of Bengaluru is generally flat, though the western parts of the city are hilly. The city is well connected by air, by train and by road. (Figure 1).


**Figure 1: Bengaluru Map**

Commuting in and around the city by bus is perhaps the cheapest and one of the most convenient ways of transport. This is because Bengaluru has a comprehensive local bus network, operated by BMTC - a sole government agency that operates and serves urban public transport bus service in the core as well sub-urban and rural areas of the city. Buses operated by BMTC are an important and reliable means of public transport in the city. While commuters can buy tickets on boarding these buses, BMTC also provides an option of a bus pass to frequent users. BMTC runs air-conditioned luxury

buses on major routes, and also operates shuttle services from various parts of the city to Kempegowda International Airport. BMTC and KSRTC were the first operators in India to introduce Volvo city buses and intracity coaches in India. It has the highest number of Volvo buses operated by a public transport company in India. BMTC also has a mobile app that provides real-time location of a bus using the global positioning system of the user's mobile device.

BMTC has fleet strength of over 6000 buses covering around 11.94 lakhs kilometers making 69660 trips daily. The agency constitutes around 33575 employees and 54 bus stations and 45 depots across the city. Additionally, to control the these, BMTC has also set up 10 travel and transit Management centers (TTMCs) located at various part of the city. (Source: mybmtc.karnataka.gov.in)


**Figure 2: Shantinagar TTMC – BMTC**

BMTC has a comprehensive route network that covers every nook and corner of the city, making public transport an accessible and attractive travel choice for everyone. It is committed to provide quality, safe, reliable, clean and affordable travel for the residents of the city. The testimony of its success lies in increasing passenger trips everyday by a wide range of customer base. In an effort to modernize its services for commuter comfort, BMTC strives to strengthen information systems and improve processes through introduction of intelligent technology solution, make capacity enhancement through infrastructure development, user-friendly interchange facilities, fleet upgradation and augmentation, apart from its core activities, which includes fare structuring, route network optimization, planning and monitoring.

# 3 The Need for Developing FLEET, Long Range Planning Tool

The objectives of this Shakti funded study for developing the STU long range planning tool 'FLEET' is to develop and influence adoption (by public bus companies in India) of a user-friendly, spreadsheet based, long-range planning toolkit (for STUs), which can define different contexts and can be applied strategically to improve the effectiveness, efficiency and profitability of public bus companies in India. As a part of this development process a long-range plan for BMTC which is one of the biggest urban transport corporation in India, has been undertaken, for testing and validating the tool performance. The toolkit development was to be based on the learnings from the development of this long-range plan (for BMTC) as well long-range plan development exercise for non-urban STUs, undertaken earlier. Additionally, it incorporates findings of an expert review, to ensure that any shortcomings are addressed, and a more accurate assessment of fleet, infrastructure and financial requirements of STUs is achieved.

To fulfil these requirements, it is required that the toolkit achieve two broad objectives - usability and applicability. These have been achieved as following:

### 1. Usability

- **Minimizing input requirements specific to user type** - The tool needs to provide a user-friendly interface with minimal input requirements. The tool has staged level of complexity for different users. Thus, for day to day use or for operations by senior officials such as chief General Manager Statistics, the tool requires limited (easy to understand) inputs, which allow relatability to outputs. These include the planned fleet composition, planned mode share, expected/planned improvements in efficiency, occupancy etc., planned staff to bus ratio, horizon year for outputs, etc. For use by consultants and/or experts, the tool allows an additional level of intervention in default values. Thus, input requirements can be custom developed for different user types in the STU. Additionally, inputs such as those related to fleet and service can be disaggregated to allow evaluation of impact of new fleet type (such as e-buses) and new service models.
- **A user-friendly interface** – The interface takes in to account the expected user requirement and training level. Thus, language and presentation of the interface accounts for these requirements.
- **Capacity building and training** – Passive means of capacity building and training have been achieved through the development of a user manual for the tool.

### 2. Applicability

- **Ease the availability and usability of the information generated by the tool -** This has been achieved by including functionality which allows generation of tool outputs as tables and graphs for their use in documents, reports and plans that can or will be developed by the public bus companies.
- **Awareness building -** Awareness building influences applicability of the tool. This can be achieved at the following two levels:
    - By spreading awareness about the functionality and potential of the tool - This has been achieved through meetings with STUs (such as OSRTC), collaborating with CSOs and NGOs (such as SUMNET) which are engaging with State Transport Department, by participating/presenting in workshops (where tool outcomes and potential can be

discussed) and by partnering with 2 public bus companies (to develop a long-range plan for the same).

- By influencing an acceptability, need and requirement for such long-range plans with the State Transport Department - This can be demonstrated through advocacy with one selected State Transport Department in association with NGOs/CSOs.

# 4 Fleet Estimation and Evaluation Tool – FLEET

The FLEET tool is designed to assist STUs or transport corporations in forecasting fleet, passenger trips, infrastructure, staffing and budgetary requirement in different scenarios to allow long range planning (business and operational) for addressing the projected demand including an associated infrastructural, fleet and financial requirement.

## 4.1 Tool Architecture

The tool architecture is based on an annual projection/estimation basis and it generates annual outputs for a 33-year period from the date of input based on growth rates as well trajectory of change, provided/selected by the user. The tool is designed to provide macro or state/city/region level outputs (for both inter and intra city operations).

The tool was initially developed as an excel based spread sheet model, which has been upgraded into VBA (Visual Basic for Applications) based model as a part of the current Shakti funded study. For this purpose, the first version of the VBA based forms have been developed and presented in Annexure - 7.6


**Figure 3: Fleet Estimation and Evaluation tool – Cover**

## 4.2 Working and Methodology

Based on the different services operated by the STU and trajectory of growth/change (linear, logarithmic or exponential) envisioned by the user, the tool estimates a total of 33 outputs (ranging from annual budgetary requirements for fleet and infrastructure to new buses to be purchased, budgets required, etc.) separately for urban and regional operations, and separate for up to 24 different defined services in each operation type, using 72inputs (for each service type – Annexure-7.5) and 37 default values (Annexure - 7.4). The user is required to insert the data in input user forms and can save the outputs or results as a separate excel file.

The user input forms appear on a sequential basis. The first form allows the user to select the STU for which long range planning needs to be estimated. The tool has secondary data on the region/city/state

where the STU operates such as total trips undertaken, population, population growth rates, etc., saved in the tool, and the same a retrieved and displayed in the first form basis the selection of the STU name. The user can then define the number of different services operated by the STU. A maximum of 24 different services can be defined. The user may choose to define two different services in case one service uses two completely different fleet/bus types, with different operational and service parameters. For example, if an STU operates an AC bus service, and uses two buses such as Volvo low floor AC bus and Tata standard floor AC bus, the user may define the services as Volvo AC and Tata AC, and then go ahead and input separate data for the two services in subsequent forms. This allows the users the flexibility to evaluate the impact of change in composition of different fleet type within a service.

Subsequent forms allow users to input details for each of the defined services including name (classification), fleet size, fleet age, cost of buses uses, cost per km (CPK), earning per km (EPK), staff to bus ratio, occupancy, vehicle utilization, fleet utilization, etc. The vision form presents the current status and requires the users to input a vision for each of these parameters. These parameters include, fleet utilization, vehicle utilization, staff to bus ratio, earning per km (EPK), cost per km (CPK), cost of bus, composition of different services (by fleet or passenger trips catered) in the overall fleet size or passenger trips catered, occupancy or load factor, etc. This vision also includes the mode share of the STU buses, other buses and intermediate public transport (IPT) in terms of share of passenger trips carried in the area/region under the operational control of the public bus company. Additionally, the users are required to define the number of years in which the vision is expected to be achieved and the trajectory of change (for each of the vision inputs for each service).

The default form includes a list of (editable by the user) default values or assumptions used in estimating the output values. These includes fleet and infrastructure development cost, etc. The tool uses a series of validated algorithms to input values and the default values to generate output for each successive year. Each year estimates form the input for successive year outputs, thereby generating annual output values for 33 successive years, which are then presented as a table and graph for each of the outputs. Figure 4, presents a graphical representation of working of the FLEET tool.

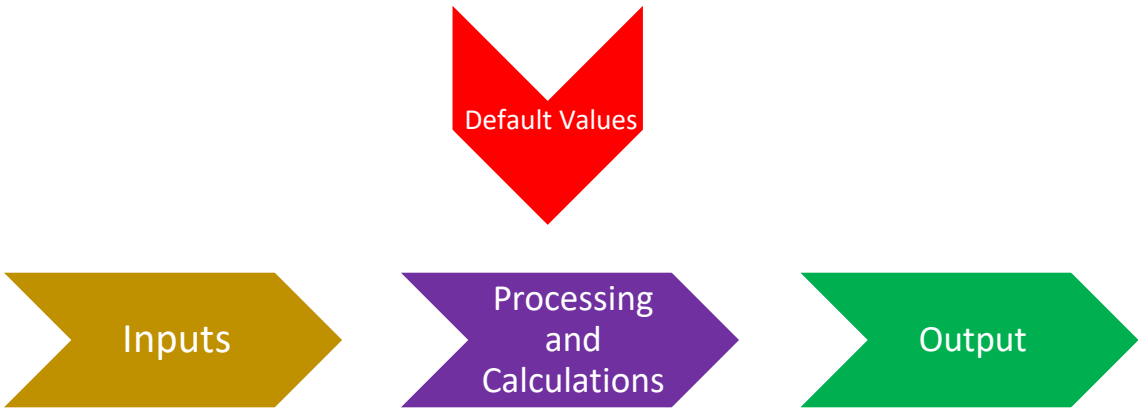



**Figure 4: Fleet Estimation and Evaluation tool – Functional Flowchart**

## 4.3 Inputs

To generate the outputs, the model requires a list of data inputs along with assumptions (such as expected/desired mode share or efficiency) which define a scenario. The data input in dashboard has been designed keeping in mind the easy availability of data with the STU's and from other sources such as census. The user defines the current year and the data year. The model then projects the data

from the data year (data such as census data is typically a historic data) to the current year and this is used in all output estimates. A total of 72 data inputs (presented in annexure 7.3) under the following 8 categories is required. These 72 data inputs are categorized service wise and distributed in the different web forms (Annexure -7.6) .Table 1 lists the eight categories and the respective components under which the data is inserted by the user.

**Table 1: Fleet estimation tool – Input data Categories**

| S.no | Input Category | Components | Source |
|---|---|---|---|
| 1 | Service wise Fleet Detail and Average Seating Capacity | Intercity and Intra city | STU/public bus company |
| 2 | Service wise Fleet utilization and Operational efficiency and % Load factor | Intercity and Intra city | STU/public bus company |
| 3 | Fleet Age | Intercity and Intra city | STU/public bus company |
| 4 | Trip and Profile Data | Population (Urban and rural), Mode share (Bus and IPT), work, non-work (Bus and IPT) Education trips, Trip-lengths, Nature of tourist trips- *applicable separately for less than and more than 10 km Inter and Intracity* | Census (is pre fed in the tool, but users have the option to edit it) |
| 5 | STU data – Service wise | Daily STU passenger trips, daily operated routes, Number of one-way Bus trips on the routes, Average route length and %load factor- *applicable separately for Inter and Intracity* | STU/public bus company |
| 6 | Growth Rates | Urban, Rural and Tourist | Web -Reports and Studies, tourism reports (is pre fed in the tool, but users have the option to edit it) |
| 7 | Staff to Bus Ratio | Intercity and Intra city | STU/public bus company |
| 8 | Cost and Earnings – Service wise | Earning per Km, Cost per Km, operating cost, Ticket price per km, earning per passenger, average trip length per passenger - *applicable separately for Inter and Intracity* | STU/ public bus company |

## 4.4 Default Values

The default values are the values of various parameters to be used in the tool for analysis and for defining different scenarios. These values are based on standard accepted norms but represent a level of assumption in the estimation process. These include values against the expected share of trips from outside State/city or region served by the STU, percent share of trips by purpose served by the STU, etc. These values are editable and if required the user can change these values in the defaults form. A total of 44 default values are used by the tool and have been listed in Annexure-7.4.

## 4.5 Outputs

A total of 33 outputs present results under the following three broad categories:

1. Future (annual) fleet size requirement categorized by service type and by vehicle type.
2. Future (annual) land requirement for depots and terminal classified by service type
3. Future annual budget requirement i.e. cost of fleet acquisition and infrastructure development classified by service type.

In addition, outputs are presented as rate of change, depicting growth/decline in different public transport mode share, staff requirement, efficiency, etc. A list of all outputs has been presented in Annexure-7.5. The output sheet also includes a listing of all input values. This sheet is included in the separate output file saved by the user after completing the last form. The user has the option to continue from his last work by selecting continue button in the first form (or the splash page), or he/she can start a 'new' form by clicking on the 'New study' button.

## 4.6 Data collection

The tool requires a series of secondary data inputs. Based on this data the tool computes the projected scenarios. The two broad categories of data required for the tool and their use in output estimation has been described below.

1. Census and tourist trip data (pre stored in the tool for different STUs) – This includes latest census based demographic data from the State/city or region served by the STU. This data is used to project demographic profile of the state (such as population data, urbanization) over the next 33 years. This helps generate the overall demand in terms of daily trips. This is further bifurcated as inter district and intra city trips, trips by different modes, trips by purpose and trips by length. Such bifurcation allows application of trip characteristic specific growth rates to generate more realistic projections. This data is pre-stored in the tool and is presented to the user when he/she selects the desired STU for which analysis needs to be undertaken (the tool includes data base for 56 STUs). In case the STU is not pre-defined in the tool, the user has the choice select a 'create new STU' from the selection and then input data for the same. The user can also edit the pre-fed data of any pre-defined STU (selected for analysis).

2. Data for current bus fleet being operated by the STU - This includes details on fleet size, fleet age, percentage load factor, efficiency, fleet utilization, etc. Current fleet data (STU) is used to estimate expected fleet size for the state over the next 33 years in different defined scenarios. This STU data is collected through the checklist developed by the design team. The checklist is presented in annexure- 7.1

## 4.7 Basis Of estimation and Scenario Building Factors

The tool uses the vision data input by the user to generate estimate of fleet size required in each projected year based on expected bus trips, average passenger trip length, expected percentage load factor (also known as occupancy), average run by each bus (per day), expected fleet utilization, etc. All other service specific (as well aggregated) outputs are generated based on this projected fleet size. This includes staff requirements, Infrastructure requirements, land and budget. Average daily bus trips are estimated based on population (urban and rural) of the state, growth rate trend applied (urban rural and tourist) and the total trips (non- work, work and education) catered. Figure 5 presents basis of the fleet estimation and the components and data inputs involved in the process.

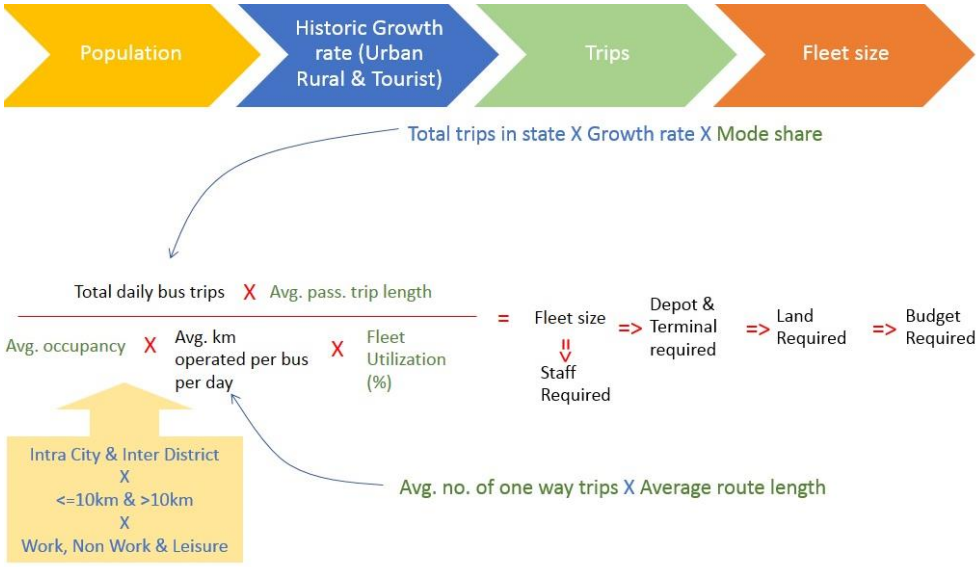



**Figure 5: Fleet estimation Tool- Basis of estimation**

The objective of the long-range planning exercise is to estimate the fleet requirement in each year up to the horizon year along with associated investment and infrastructure development requirement. Infrastructure requirement is dependent on the fleet size and infrastructure development needed. Thus, if fleet size requirement is known, we can determine the annual investment and infrastructure development requirement.

Fleet size requirement is dependent on demand in terms of passenger trips that needs to be catered and number of kilometers that the buses cover in a day. There are several parameters that effect the total passenger trips that need to be catered, average passenger trip length, fleet utilization, vehicle utilization, occupancy, etc. These parameters are dynamic in nature and change over time (or as a result of planned or unplanned interventions) therefore a sound understanding of their change characteristics, including rate as well trajectory of change and expected (or envisioned) value in the horizon year, is important to correctly project fleet requirement and associated factors. These parameters are:

- Population growth rate by trip type
- Fleet utilization
- Occupancy or load factor
- Efficiency (or vehicle utilization)
- Average passenger trip length
- Average number of seats per bus
- Average route length
- Mode share of the STU (by trip type)

Similarly, several factors determine the investment requirement projection, given a set of fleet and infrastructure requirement. These factors relate to operational profit/loss for the STU. These are:

- Cost per bus (for purchase)
- Per bus depot and terminal development cost
- Scrap cost of aged buses
- Staff to bus ratio
- Average per staff cost to STU
- Average ticket price

- Operating cost per kilometer, etc.

The projected fleet requirement for a given year values for the above parameters need to be known for that year. Thus, understanding the relationship between fleet and investment requirement and the above parameters is critical. This relationship has been explained through formulas presented below. Also, the value of each of these parameters in the current year is required to be known for the projection to be achieved. Many of the parameters are not reported by STUs, however, their values can be extracted using the relationship they have with other reported parameters. The relationships, or formulas used to estimate some of these values has been presented in the Figure 6.

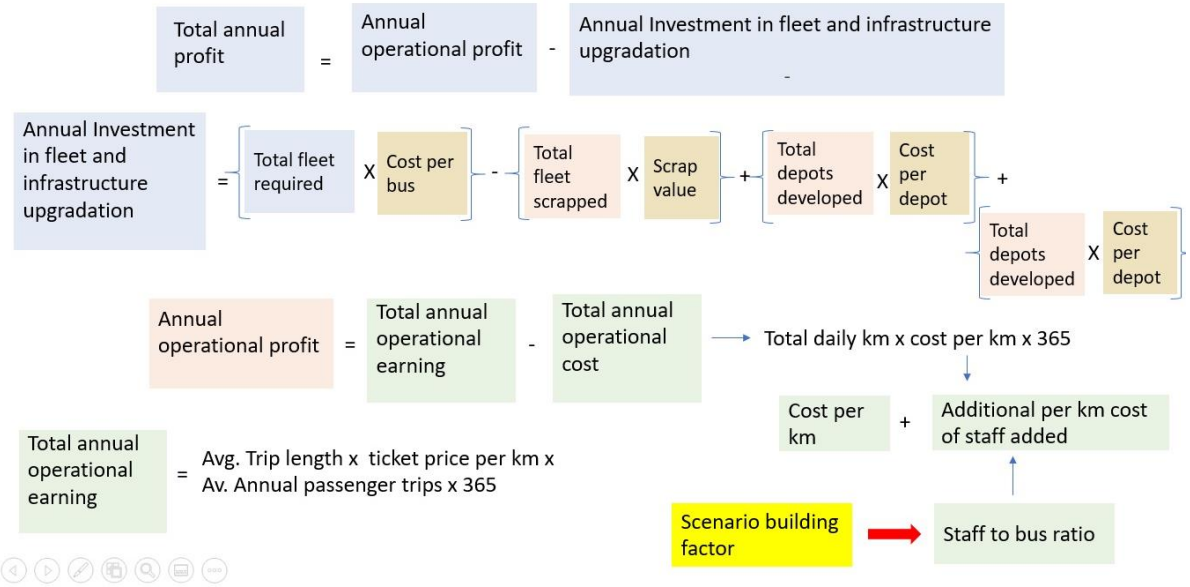



**Figure 6 Cost and earning assessment**

The estimation of fleet requirement and other associated factors is undertaken service wise, because data input in the tool is disaggregated at the service level (however, outputs do also present the cumulative values). Therefore, another critical piece of information that is required to generate scenarios is the composition by fleet size of, or passenger trips catered by different services. So, the tool uses the vision input on fleet composition (including the number of years required for the vision to be achieved and the trajectory of change) to plot the composition of fleet in each year (up to the horizon year). The user has a choice to define the future composition by the trips catered by each service (per day) or the percentage of vehicles operated under each service (of the total fleet size). These are representations of passenger side requirement and operator side requirements. The tool allows the users to specify whether they would want all estimations to be based on passenger side requirements or operator side requirements, in the estimation methodology form (Annexure 7.6, form 6).

# 5 BMTC Data Collection for Long Range Planning

In order to develop a long-range plan for BMTC, operational, financial and service data was collected from BMTC Shanti Nagar, Bangalore office. This data was collected over four visits to the BMTC office, the first of which was an introductory meeting. The details of these visits have been presented below.

The first site visit was held on 25th June 2019 to 26th June 2019 at TTMC – BMTC Shantinagar office, Bengaluru – Karnataka. Mr. Sandeep Gandhi and Mr. Satyajit Ganguly from SGA conducted the site visit and interacted with the BMTC concerned officials. The meeting was initiated with introduction of the team by Shakti and mediated by UITP team. During this visit several BMTC officials respective to various departments (Operations, Maintenance, Statistics and Traffic) were met. The agenda of this visit was to introduce the team, present the objectives, methodology and timelines of the project. Additionally, the data requirement for the project was a presented to the concerned officials (Figure 7). A working mechanism agreed upon with the BMTC during the visit. The idea behind such a working mechanism was to allow close co-ordination for data collection and ensuring an active feedback mechanism. Additionally, as part of applicability SGA team also met the outreaching partners such as C-STEP and UITP.

**Figure 7: Interaction with BMTC officials during first visit**

The second site visit was held on 19th August 2019 to 21st August 2019 at TTMC – BMTC Shanti Nagar office, Bengaluru – Karnataka. Mr. Sandeep Gandhi and Mr. Satyajit Ganguly from SGA conducted the site visit and interacted with the BMTC concerned officials for the data collection. During this meeting SGA team also interacted with officials of Directorate of Urban Land Transport (DULT) for technical Support and capacity building of public bus companies in Karnataka.

The third site visit was held on 24th September 2019 at TTMC – BMTC Shantinagar office, Bengaluru – Karnataka. Mr. Sandeep Gandhi from SGArchitects conducted the site visit and interacted with the BMTC officials to update the progress and collect the missing data provided by BMTC (after the second visit). The detailed minutes of meetings held during all the three site visits are presented in the annexure - 7.2.

BMTC supported the project team by providing more than 90% of the STU data requirement (over these three meetings) based on the checklist provided (Annexure- 7.1). The remaining data was provided within a week through mail or through telephonic discussions. A data collection form/check list was prepared for the study (Annexure -7.1 ) and the same was presented to the coordinating team for further. This data collected, broadly comprised of the following:

1. Service wise and overall BMTC Current bus fleet Size.
2. Type/ Categorisation of Bus fleet (Service wise).
3. Service wise current year fleet utilization.
4. Current year operational efficiency (Service wise)
5. Percent of fleet size – Age wise (Service wise)
6. Total STU trips on daily basis (Service wise)
7. Percentage Load factor (percentage of seating capacity) for each service.
8. Service wise - Average route length
9. Service wise- Average trip length
10. Total vehicle kilometres covered per day - Service wise
11. Current bus ridership
12. Average speed of buses
13. Route Length data of the various routes-Service wise
14. Current average staff per bus for the STU- Service wise
15. Annual operational cost breakup -Service wise
16. Annual revenue generation (Service wise) breakup, EPK, CPK, etc.

As discussed in previous sections, the FlEET tool uses State and STU specific data to generate outputs which can be used for developing long range planning by a STU. Since the data is input at service level, one of the first input requirements in the tool is to define the number of different services operated by the STU. For BMTC this number is 3. These services include regular (non-AC) bus service, AC service and airport service. An outline of the data collected has been presented in Table 2 and Table 3.

**Table 2: Collected Data**

| Data Collection | BMTC | Service 1 | Service 2 | Service 3 | Source |
|---|---|---|---|---|---|
| Fleet strength | 6482 | 5632 | 742 | 108 | BMTC |
| Fleet utilization | - | 89.23% | 77.8% | 77.8% | BMTC |
| Vehicle utilization | - | 89.80% | 82.77% | 82.77% | BMTC |
| Trips catered per day | 69 Lakhs | 6345600 | 550300 | 7500 | BMTC |
| % Load factor | - | 65% | 53.9% | 53.9% | BMTC |
| Vehicle to staff ratio | 5.47 | 5.32 | 4.25 | 4.25 | BMTC |

**Table 3: Growth rate and demographic data for Bengaluru**

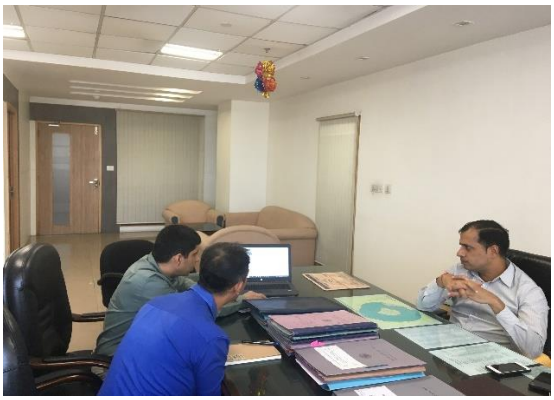
| Data Collection | Online source & reports | Source |
|---|---|---|
| Population | 8,443,675 | Census 2011 |
| Mode share | 19.77 % | Estimated from census 2011 and STU data |
| Urban population growth rate | 2.12% | Census 2011 and Karnataka – Tourism Survey report |
| Rural population growth rate | 0.99% | |
| Tourist growth rate | 2.50% | |

City data with reference to populations and number of overall daily trips in the City was collected through literature review, research papers, reports and studies available in the web. This included City demographics – population (urban and rural), work trips from Census data, urban rural and tourist applied growth rates etc. In The documents that were referred to for literature studies and secondary data collection are as following:

1. Comprehensive Traffic and Transportation Plan for Bengaluru (June 2011) - Rites Ltd.
2. Bengaluru Mobility Indicators (2010- 2011) – UMTC Ltd.
3. Collection of Domestic Tourism Statistics for the State of Karnataka.
4. State Transport Undertakings: Profile and Performance (2009 -10) Central Institute of Road Transport (CIRT) 2011.
5. State Transport Undertakings: Profile and Performance (2010 -11) Central Institute of Road Transport (CIRT) 2012.
6. State Transport Undertakings: Profile and Performance (2011 -12) Central Institute of Road Transport (CIRT) 2013.
7. State Transport Undertakings: Profile and Performance (2012 -13) Central Institute of Road Transport (CIRT) 2014.

Even though significant data was available from multiple sources, critical information was missing. This included mode share bifurcation between private and BMTC buses operating in Bengaluru. This information was generated by contrasting census data with BMTC data. For example, census provides data on total bus trips, while BMTC data included daily ticket sales (representing BMTC trips). The difference of the two was used to generate data for relating to private bus trips in the state.
Subsequently, SGA team developed a draft (test case scenario) long range plan for BMTC using FlEET tool. The objective of developing this plan was to test the complete functionalities of the tool and to check if the same was aligned with the input data available with the STUs in India. To assess, the usability of the tool outputs, a fourth site visit was held on 9$^{th}$ to 11$^{th}$ December 2019 at TTMC – BMTC Shantinagar office, Bengaluru – Karnataka. Mr. Sandeep Gandhi, Mr. Satyajit Ganguly and Mr. Kartikey Kochhar represented SGArchitects. In this meeting, BMTC was informed about tool upgradation and the test scenario outputs generated by the FlEET tool. Additionally, the data inputs considered for the test scenario was validated by BMTC officials as well the vision data was also discussed with the STU officials and out reaching partners- UITP. The detailed minutes of meetings held during all the four site visits are presented in the annexure - 7.2.

**Meeting with Outreaching Partners – UITP**



**Meeting with STU officials – BMTC**

**Validating tool inputs with STU officials – BMTC**

**Figure 8: Interaction with BMTC officials and outreaching partners during fourth visit**

# 6 Tool Based Estimations and Projections for BMTC

This chapter presents the long-range plan for BMTC developed for different scenarios. These scenarios have been defined based on the data collected (including vision data) for different types of services and understanding of expected envisioned scenarios, achieved based on meetings with BMTC officials. These scenarios are estimated based on the fleet composition that needs to be achieved in the defined year (as per vision composition and trajectory of change inputs). The estimation method is based on strict achievement of planned fleet composition which also results in premature retirement of a fraction of the fleet. Although the FlEET tool generates projections over a period of 33 years from the base year with different trajectories (Linear, Exponential and Logarithmic), BMTC expressed their interest for the estimation up to 2030. For the purpose all the scenarios are projected with linear trajectory and targeted time of 10 years (as the period to achieve the defined vision). The following sections presents the parameters (and their values) used for scenario building, the outputs of projections for the defined scenario and their comparisons.

## 6.1 Scenario Building

BMTC currently operates three different services. Through the series of discussion and meetings held with the BMTC officials, it is gathered that BMTC wishes to gradually replace (in the next 10 years) the three current services with a single AC city bus service, with 100% electric buses. This and envisioned service and operational parameters (as gathered from BMTC officials) formed the basis of scenario building. For comparison purposes a scenario with a single AC city bus service with 100% Bharat 6 Diesel buses has been developed. Service wise operational parameters values were agreed upon between the project team and BMTC officials. Table 4 presents base values for existing services and desired future services.

**Table 4: Service wise operational Parameters and base values**

| **Operational Parameters** | Current - Service 1 | Current - Service 2 | Current - Service 3 | **Future Service options** | |
|---|---|---|---|---|---|
| Service Name/ Type | Regular - high floor standard bus | Vajra-AC low floor | Vayu vajra AC express low floor | **Electric AC Bus** | **Euro 6 AC Diesel bus** |
| Fleet Composition | 86.89% | 11.45% | 1.67% | **0.00%** | **0.00%** |
| Fleet utilization | 89.23 | 77.89 | 77.89 | **89.23** | **89.23** |
| Scheduled Kilometers | 221.6 | 240.4 | 240.4 | **221.6** | **221.6** |
| Achieved Kilometers | 199 | 199 | 199 | **190** | **170** |
| Vehicle utilization | 89.80% | 82.77% | 82.77% | **85.74 %** | **76.71 %** |
| % Load factor | 65% | 53.9% | 53.9% | **65%** | **65%** |
| Vehicle to staff ratio | 5.32 | 4.25 | 4.25 | **5.32** | **5.32** |
| EPK | 42.74 | 57.35 | 79.68 | **42.74** | **42.74** |
| CPK | 58.45 | 78.7 | 78.7 | **85.00** | **70.00** |
| Cost of vehicle | 32,73,000 | 85,74,000 | 85,74,000 | **1,80,00,000** | **37,63,950** |
| Current BMTC Mode share | | | | | 19.77% |

The project team initially developed two scenarios which comprised of inclusion of electric bus service as fourth service with different % load factor values – 79.30% as suggested by BMTC officials and

65.00% suggested by outreaching partner – UITP. These scenarios and their outputs are elaborated in the following sections respectively.

### 6.1.1 Scenario 1: Business as Usual (BAU) 1

In this scenario, it is proposed that in next 10 years BMTC shall replace its existing bus fleet with electric bus fleet retaining the current mode share of 19.77 % with percentage load factor of 79.30%, remaining unchanged over this period. For this, the daily kilometres achieved in case of electric bus is considered as 190 km which remains unchanged in the future[1]. This leads to vehicle utilization of 85.74% (based on the scheduled kilometres of 232km as provided by BMTC). CPK for electric buses is estimated to be Rs. 85.00 in the current year and is expected to reduce to Rs. 70.00 by 2030.

This scenario projections are based on the estimates that in the next 10 years cost of electric vehicle will reduce from 1.8 Crore to 1.0 Crore and staff to bus ratio will reduce from 5.32 to 5.29. All other operational parameters for electric bus service are assumed to be same as that of the regular bus service. Table 5 presents service wise base and envisioned values considered for this scenario.

**Table 5: Service wise operational Parameters, base values and envisioned values – Scenario 1**

| Operational Parameters | Current - Service 1 | Envisioned values: Service 1 | Current - Service 2 | Envisioned values: Service 2 | Current - Service 3 | Envisioned values: Service 3 | Service 4 Base values | Service 4 Envisioned values |
|---|---|---|---|---|---|---|---|---|
| Service name | Regular -high floor standard bus | | Vajra-AC low floor | | Vayu vajra AC express low floor | | Electric bus | |
| Fleet Composition | 86.89% | 0.00% | 11.45% | 0.00% | 1.67% | 0.00% | 0.00% | 100% |
| Fleet utilization | 89.23% | 89.23% | 77.89% | 80.00% | 77.89% | 80.00% | 89.23 | 89.23 |
| Scheduled Kilometers | 221.6 | 221.6 | 240.4 | 240.4 | 240.4 | 240.4 | 221.6 | 221.6 |
| Achieved Kilometers | 199 | 199 | 199 | 199 | 199 | 199 | 190 | 190 |
| Vehicle utilization | 89.80% | 89.80% | 82.77% | 89.80% | 82.77% | 89.80% | 85.74 % | 85.74 % |
| Percentage Load factor | 79.30% | 79.3% | 53.9% | 54.1% | 53.9% | 54.1% | 79.30% | 79.30% |
| Vehicle to staff ratio | 5.32 | 5.32 | 4.25 | 4.25 | 4.25 | 4.25 | 5.32 | 5.29 |
| EPK | 42.74 | 43 | 57.35 | 57 | 79.68 | 80 | 42.74 | 42.74 |
| CPK | 58.45 | 58.45 | 78.7 | 78.7 | 78.7 | 78.7 | 85.00 | 70.00 |
| Cost of vehicle | 32,73,000 | 32,73,000 | 85,74,000 | 85,74,000 | 85,74,000 | 85,74,000 | 1,80,00,000 | 1,00,00,000 |
| Average Route Length in km | 50.48 | 50.48 | 33.7 | 33.7 | 53.4 | 53.4 | 50.48 | 50.48 |
| **BMTC current mode share** | | | | | | | | **19.77%** |
| **BMTC envisioned/ targeted mode share (Scenario 1)** | | | | | | | | **19.77%** |

Based on inputs of current and future values of parameters, FIEET tool generates service wise as well overall results for BMTC till the year 2053.

[1] It is assumed that the average effective range with the current bus technology shall be 190 km. However, this range will improve with additional more modern and upgraded battery buses inducted over the next 10 years, though the urban speeds are likely to reduce because of increased congestion. Because of this the vehicle utilization for electric buses shall remain unchanged over the next 10 years.

The critical service wise outputs generated by the tool for the defined scenario have been presented in Table 6

**Table 6: Service wise outputs – Scenario 1**

| S. No | Scenario 1 | 2019 | 2030 | 2053 |
|---|---|---|---|---|
| **Service 1 – Regular** | | | | |
| 1 | Fleet Composition | 86.89% | 0.00% | 0.00% |
| 2 | Fleet Strength | 5632 | 0 | 0 |
| 3 | Fleet Utilization | 89.23% | 89.23% | 89.23% |
| 4 | Vehicle utilization | 89.80 % | 89.80% | 89.80% |
| 5 | % Load factor | 79.30% | 79.30% | 79.30% |
| **Service 2 – Vajra** | | | | |
| 1 | Fleet Composition | 11.45% | 0.00% | 0.00% |
| 2 | Fleet Strength | 742 | 0 | 0 |
| 3 | Fleet Utilization | 77.89% | 80.00% | 80.00% |
| 4 | Vehicle utilization | 82.78% | 87.34% | 87.34% |
| 5 | %Load factor | 53.90% | 54.10% | 54.10% |
| **Service 3 – Vayu Vajra** | | | | |
| 1 | Fleet Composition | 1.67% | 0.00% | 0.00% |
| 2 | Fleet Strength | 108 | 0 | 0 |
| 3 | Fleet Utilization | 77.89% | 80.00% | 80.00% |
| 4 | Vehicle utilization | 82.78% | 87.34% | 87.34% |
| 5 | % Load factor | 53.90% | 54.10% | 54.10% |
| **Service 4 - Electric bus** | | | | |
| 1 | Fleet Composition | 0.00% | 100% | 100% |
| 2 | Fleet Strength | 0 | 8344 | 13723 |
| 3 | Fleet Utilization | 89.23% | 89.23% | 89.23% |
| 4 | Vehicle utilization | 85.74% | 85.74% | 85.74% |
| 5 | % Load factor | 79.30% | 79.30% | 79.30% |

In this scenario the mode share of passenger trips by BMTC is expected to remain same as 19.77% till 2053. The fleet size increase to cater to increased demand of the trips in the city (with constant mode share). Service wise outputs in this scenario suggest that after inducing electric buses, BMTC will attain 100% electric bus fleet in 10 years with 8344 electric buses in 2030 and by 13723 electric buses in 2053. In this scenario the other operational parameters were envisioned constant for electric buses and regular buses and remain same. However, for the other two services - Vajra and Vayu vajra, fleet utilization, vehicle utilization and percentage load factor are envisioned to increase. The fleet utilization is envisioned to increase from 77.89% to 80%, the vehicle utilization increases from 82.78% to 87.34% and the percentage load factor increases from 53.90% to 54.10% (in the next 10 years in a linear trajectory). Since, the projections are worked out for next 10 years, these three parameters remain constant from 2030 till 2053. The overall outputs for BMTC generated by the tool are presented in the section below. Table 7 presents the details of overall projected requirements for BMTC up to 2053.

Inputs presented in Table 6 are projected with linear trajectory to estimate the desired outputs for Scenario 1. The tool projections suggest that by 2030, BMTC is expected to cater to about 54.21 lakhs trips per day and this figure for 2053 is estimated as 89.10 lakhs trips per day. Currently 44.5 lakh passenger trips are catered by BMTC every day. The projection estimates the overall fleet strength which is 6,482 currently (in 2019) will need to increase to 8344 in 2030 and to 13723 in 2053. The staff strength will increase from current 33575 employees to 42328 by 2030.

As envisaged the total routes operated will be all most constant to 2264 in 2030 and 2053 from 2263 routes operated presently. In this scenario BMTC annual State support requirement (including operational losses, fleet procurement requirement, infrastructure development cost, etc.) shall increase to 1581.49 Crore in 2030 and 3539.72 Crore in 2053 from 664 .1 Crore in the current year. The total financial support required by BMTC (including fleet procurement, infrastructure development and operational losses) for the period 2020 to 2030 is estimated as Rs. 25,590.7 Crore. Table 7 presents the overall projections for scenario 1 for 2019, 2030 and 2053.

**Table 7: Overall outputs – Scenario 1**

| S.no | Outputs - Scenario 1 | 2019 | 2030 | 2053 |
|---|---|---|---|---|
| 1 | BMTC total trips per day | 4455151 | 5421708 | 8917349 |
| 2 | Total fleet strength | 6482 | 8344 | 13723 |
| 3 | Total operational routes | 2663 | 2264 | 2264 |
| 4 | Total staff strength | 33575 | 44138 | 72595 |
| 5 | Viability gap or total annual losses that need to be covered by State support[2] | -664.18 | -1581.49 | -3539.72 |

The infrastructure outputs generated by the tool in this scenario reveals, BMTC will require to develop 175 bus terminals and 83 bus depots by 2030. For the same the STU needs 194.8 Ha of land by 2030 with a budget of 174.2 Cr. Similarly, by 2050, BMTC will require to develop 288 bus terminals and 137 bus depots with land requirement of 320.4 Ha and a budget of 1224.79Cr. Table 8 presents cumulative infrastructure outputs for scenario 1 for 2019, 2030 and 2053.

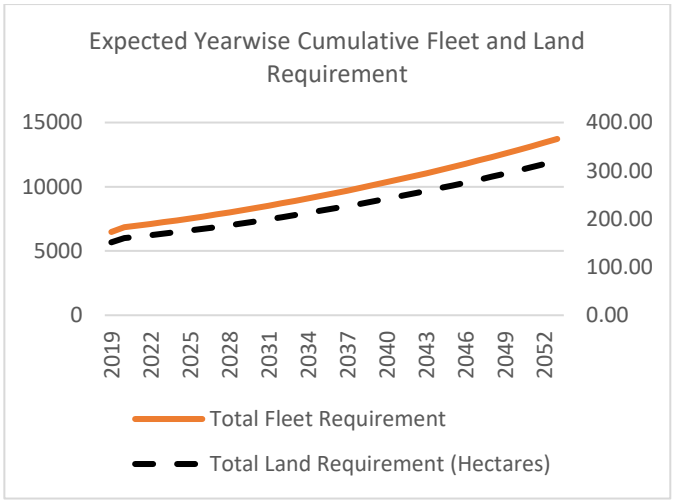
**Table 8: Infrastructural outputs – Scenario 1**

| S.no | Outputs - Scenario 1 | 2019 | 2030 | 2053 |
|---|---|---|---|---|
| 1 | Cumulative number Terminals required to be developed by year | 136 | 175 | 288 |
| 2 | Cumulative number of Depots required to be developed by year | 65 | 83 | 137 |
| 3 | Cumulative land requirement in Hectares by the year | 151.35 | 194.82 | 320.44.2 |
| 4 | Annual budget in Crores for Fleet and infrastructure in crores | 0 | 174.2 | 1224.791 |

The graphical representation of critical outputs for Scenario 1, as generated by the tool are presented in the Figure 9. These includes – (a) Cumulative Fleet and land requirement, (b) Projected total staff strength, (c) Expected Annual operating cost, earning and profit/loss and (d)Projected numbers of routes.

**Figure 9: Scenario 1 – Tool output graphs**

[2] Negative value indicates annual loss or viability gap, that needs to be covered by State support

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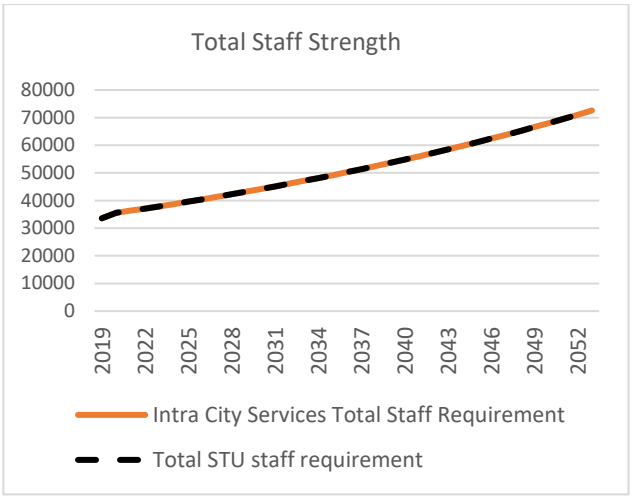


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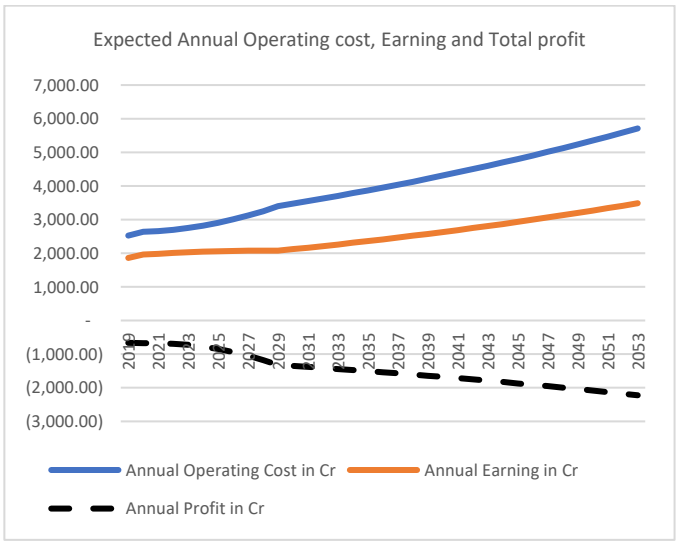


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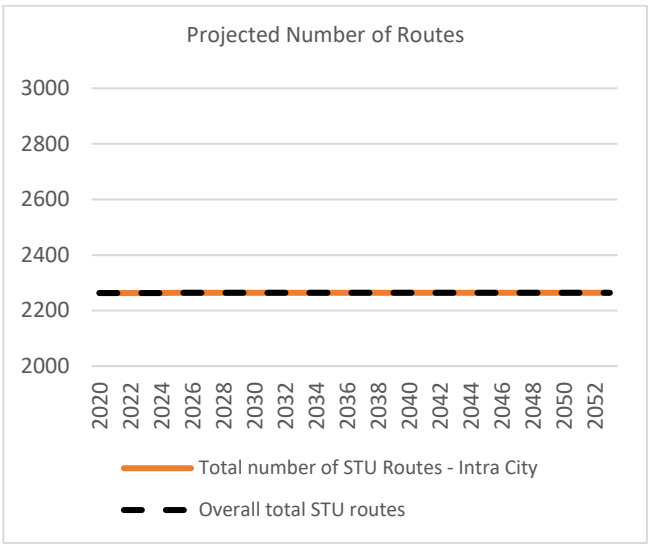


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### 6.1.2 Scenario 2: Business as Usual (BAU) 2

The percentage load factor value for October 2019 have been estimated as 79.30%, by BMTC officials. This value is considered on the higher side and may not be the true representation of average annual load factor. Therefore, a scenario with an estimate of 65% load factor in the current year has been developed in consultation with BMTC officials. Additionally, it was also suggested that the average route length should is likely to be reduced to 25 km for electric bus services as a shorter route length is preferred for urban bus operations.

In this scenario the project team projected the outputs with a percentage load factor of 65% (for regular and electric bus service) and reduced average route length of 25 km for the AC Electric Bus service (service 4). Additionally, the daily kilometres achieved for electric bus in this scenario is assumed to be 170 km[3] in 2030, from 190 km in the current year. This leads to further reduced vehicle utilization of 76.71% in 2030. However, the CPK value is envisioned to be kept same i.e. Rs. 85.00 in the current year, reducing to Rs. 70.00 in the 2030 (i.e. the same as in Scenario 1). Other operational parameters were taken identical to that considered for scenario 1. Table 9 presents service wise base and envisioned values considered for this scenario.

[3] A high congestion and no reserved lanes for bus scenario.

**Table 9: Service wise operational Parameters, base values and envisioned values – Scenario 2**

| Operational Parameters | Service 1 | Envisioned values: Service 1 | Service 2 | Envisioned values: Service 2 | Service 3 | Envisioned values: Service 3 | Service 4 Base values | Service 4 Envisioned values |
|---|---|---|---|---|---|---|---|---|
| Service name | Regular -high floor standard bus | | Vajra-AC low floor | | Vayu vajra AC express low floor | | Electric AC bus | |
| Fleet Composition | 86.89% | 0.00% | 11.45% | 0.00% | 1.67% | 0.00% | 0.00% | 100% |
| Fleet utilization | 89.23% | 89.23% | 77.89% | 80.00% | 77.89% | 80.00% | 89.23 | 89.23 |
| Scheduled Kilometers | 221.6 | 221.6 | 240.4 | 240.4 | 240.4 | 240.4 | 221.6 | 221.6 |
| Achieved Kilometers | 199 | 199 | 199 | 199 | 199 | 199 | 190 | 170 |
| Vehicle utilization | 89.80% | 89.80% | 82.77% | 89.80% | 82.77% | 89.80% | 76.71 % | 76.71 % |
| % Load factor | 65% | 65% | 53.9% | 54.1% | 53.9% | 54.1% | 65% | 65% |
| Vehicle to staff ratio | 5.32 | 5.32 | 4.25 | 4.25 | 4.25 | 4.25 | 5.32 | 5.29 |
| EPK | 42.74 | 43 | 57.35 | 57 | 79.68 | 80 | 42.74 | 42.74 |
| CPK | 58.45 | 58.45 | 78.7 | 78.7 | 78.7 | 78.7 | 85.00 | 70.00 |
| Cost of vehicle | 32,73,000 | 32,73,000 | 85,74,000 | 85,74,000 | 85,74,000 | 85,74,000 | 1,80,00,000 | 1,00,00,000 |
| Average Route Length in km | 50.48 | 50.48 | 33.7 | 33.7 | 53.4 | 53.4 | 50.48 | 25 |
| **BMTC mode share** | | | | | | | | **19.77%** |
| **BMTC envisioned/ targeted mode share (Scenario 2)** | | | | | | | | **19.77%** |

The critical service wise outputs generated by the tool for the defined scenario have been presented in Table 10

**Table 10: Service wise outputs – Scenario 2**

| S. No | Scenario 2 | 2019 | 2030 | 2053 |
|---|---|---|---|---|
| **Service 1 – Regular** | | | | |
| 1 | Fleet Composition | 86.89% | 0.00% | 0.00% |
| 2 | Fleet Strength | 5632 | 0 | 0 |
| 3 | Fleet Utilization | 89.23% | 89.23% | 89.23% |
| 4 | Vehicle utilization | 89.80 % | 89.80% | 89.80% |
| 5 | Percentage Load factor | 65% | 65% | 65% |
| **Service 2 – Vajra** | | | | |
| 1 | Fleet Composition | 11.45% | 0.00% | 0.00% |
| 2 | Fleet Strength | 742 | 0 | 0 |
| 3 | Fleet Utilization | 77.89% | 80.00% | 80.00% |
| 4 | Vehicle utilization | 82.78% | 87.34% | 87.34% |
| 5 | Percentage Load factor | 53.90% | 54.10% | 54.10% |
| **Service 3 – Vayu Vajra** | | | | |
| 1 | Fleet Composition | 1.67% | 0.00% | 0.00% |
| 2 | Fleet Strength | 108 | 0 | 0 |

| | | | | |
|---|---|---|---|---|
| 3 | Fleet Utilization | 77.89% | 80.00% | 80.00% |
| 4 | Vehicle utilization | 82.78% | 87.34% | 87.34% |
| 5 | Percentage Load factor | 53.90% | 54.10% | 54.10% |
| **Service 4 - Electric bus** | | | | |
| 1 | Fleet Composition | 0.00% | 100% | 100% |
| 2 | Fleet Strength | 0 | 11377 | 18713 |
| 3 | Fleet Utilization | 89.23% | 89.23% | 89.23% |
| 4 | Vehicle utilization | 76.71% | 76.71%% | 76.71% |
| 5 | Percentage Load factor | 65% | 65% | 65% |

Service wise outputs reveal that after inducting electric buses, BMTC will be able to attain 100% electric bus fleet by 2030 with 11,377 electric buses and by 2053 the fleet size will rise to 18713 electric buses. In this scenario the other operational parameters remain same for electric buses and regular buses, except for increase in the fleet utilization, vehicle utilization and percentage load factor of the vajra and Vayu vajra services. The fleet utilization is envisioned to increase from 77.89% to 80%, the vehicle utilization shall increase from 82.78% to 87.34% and the percentage load factor shall increase from 53.90% to 54.10%. All these three parameters remain constant from 2030 till 2053. The overall outputs for BMTC generated by the tool are presented in the below section

The inputs presented in the above table are projected with linear trajectory to estimate the desired outputs for Scenario 2. The tool projections suggest that by 2030, BMTC is expected to cater near about 54.21 lakhs trips per day by 2030 and 89.10 lakhs trips by 2053 compared to present days 44.5 lakh trips. The projection reveals the overall fleet strength which is 6,482 currently (in 2019) will need to increase to 11377 in 2030 and to 18713 in 2053, in order to achieve the inputted targets (with the operational parameters input for this scenario). The staff strength will need to increase from current 33575 employees to 60187 by 2030.

Number of routes estimated will be all most constant as envisaged for this scenario to 2264 in 2030 and 2053 from 2263 routes operated presently. In this scenario BMTC losses shall increase up to 1963.0 Cr in 2030 and 4318.4 Crore in 2053 from today's 664.1 Crore loss. The total financial support required by BMTC (including fleet procurement, infrastructure development and operational losses) for the period 2020 to 2030 is estimated as Rs. 32,255.0 crore. Table 11 presents the overall projections for scenario 2 for 2019, 2030 and 2053.

**Table 11: Overall outputs – Scenario 2**

| S.no | Outputs - Scenario 2 | 2019 | 2030 | 2053 |
|---|---|---|---|---|
| 1 | BMTC total trips per day | 44,55,151 | 54,21,708 | 89,17,349 |
| 2 | Total fleet strength | 6482 | 11377 | 18713 |
| 3 | Total operational routes | 2263 | 2264 | 2264 |
| 4 | Total staff strength | 33,575 | 60,187 | 98,992 |
| 5 | Viability gap or total annual losses that need to be covered by State support | -664.18 | -1963.00 | -4318.4 |

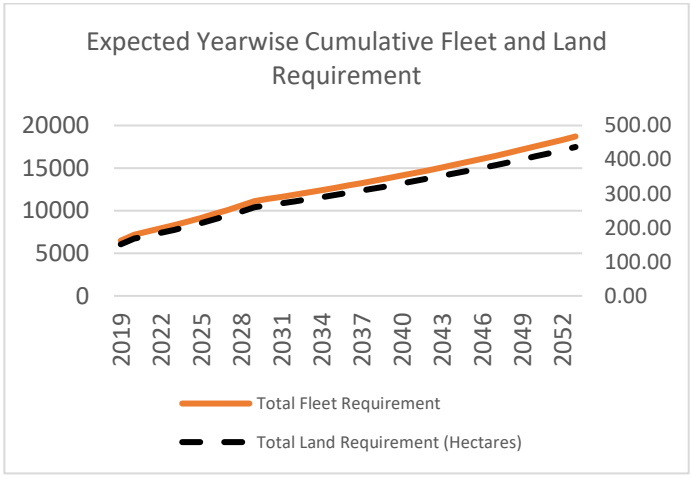
The infrastructure outputs generated by the tool in this scenario reveals, BMTC will require to develop 239 bus terminals and 114 bus depots by 2030. For the same the STU needs 265.66 Ha of land by 2030 with a budget of 245.89Cr. Similarly, by 2050, BMTC will require to develop 393 bus terminals and 187 bus depots with land requirement of 436.95 Ha and a budget of 1494.23 Cr. Table 12 presents cumulative infrastructure outputs for scenario 2 for 2019, 2030 and 2053.

**Table 12: Infrastructural outputs – Scenario 2**

| S.no | Outputs - Scenario 2 | 2019 | 2030 | 2053 |
|---|---|---|---|---|
| 1 | Cumulative number Terminals required to be developed by the year | 136 | 239 | 393 |
| 2 | Cumulative number of Depots required to be developed by the year | 65 | 114 | 187 |
| 3 | Cumulative land requirement in Hectares (by the year) | 151.35 | 265.6 | 436.955 |
| 4 | Annual budget in Crores for fleet procurement and infrastructure development in crores | 0 | 245.89 | 1494.232 |

The graphical representation of critical outputs for Scenario 2, as generated by the tool are presented in the Figure 9. These includes – (a) Cumulative Fleet and land requirement, (b) Projected total staff strength, (c) Expected Annual operating cost, earning and profit/loss and (d) Projected numbers of routes.

**Figure 10: Scenario 2 – Tool output graphs**

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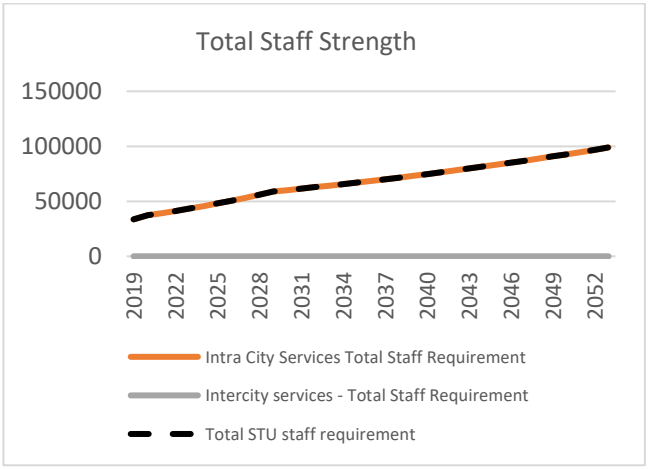


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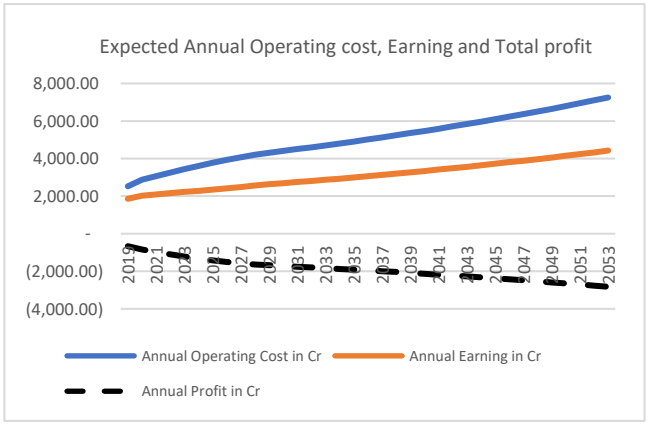


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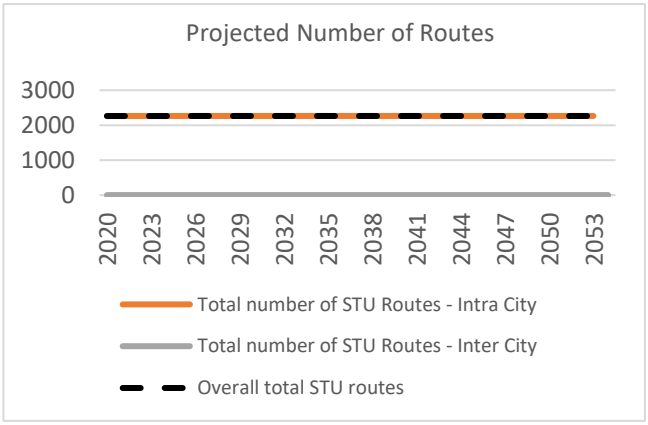


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### 6.1.3 Comparison – Scenario 1 and 2

When the financial outputs generated by the tool for both the scenarios were compared against each other it was observed that in scenario 1, BMTC would require a State financial support of 1518.49 Cr in 2030, and a total of Rs 25590.7 crore as the financial support from State between 2020 and 2030. Whereas in Scenario 2, at the same point of time BMTC will require a state support of 1963 Cr. and a total of Rs.32,255.02 crore as the financial support from State between 2020 and 2030. Similarly, in

2050, BMTC will require State financial support of 3439.7 Cr in scenario 1 and 4318.43 Cr in scenario 2. Table 13 presents viability gap comparison for scenario 1 and Scenario 2.

**Table 13: Financial outputs comparison – Scenario 1 and 2**

| S.no | Comparison Scenario 1 & 2 | Current | Scenario 1 | | Scenario 2 | |
|---|---|---|---|---|---|---|
| 1 | Year | 2019 | 2030 | 2053 | 2030 | 2053 |
| **2** | Fleet Strength | **6482** | **8344** | **13723** | **11377** | **18713** |
| 3 | Operating Cost | 2524.3 | 3471.8 | 5710.29 | 4409.2 | 7572.8 |
| 4 | Infrastructure development and fleet procurement cost | 0.00 | 166.46 | 1211.95 | 245.89 | 1494.23 |
| 5 | Revenue | 1860.15 | 2119.80 | 3486.54 | 2692.19 | 4427.97 |
| 6 | Viability Gap /State support Cr | -664.18 | -1518.49 | -3539.70 | -1963.0 | -4318.43 |

Figure 11 present viability gap graph generated for scenario 2 and Figure 12 present viability gap graph generated for scenario 1

**Figure 11: Scenario 1 –Viability gap / state support graph**

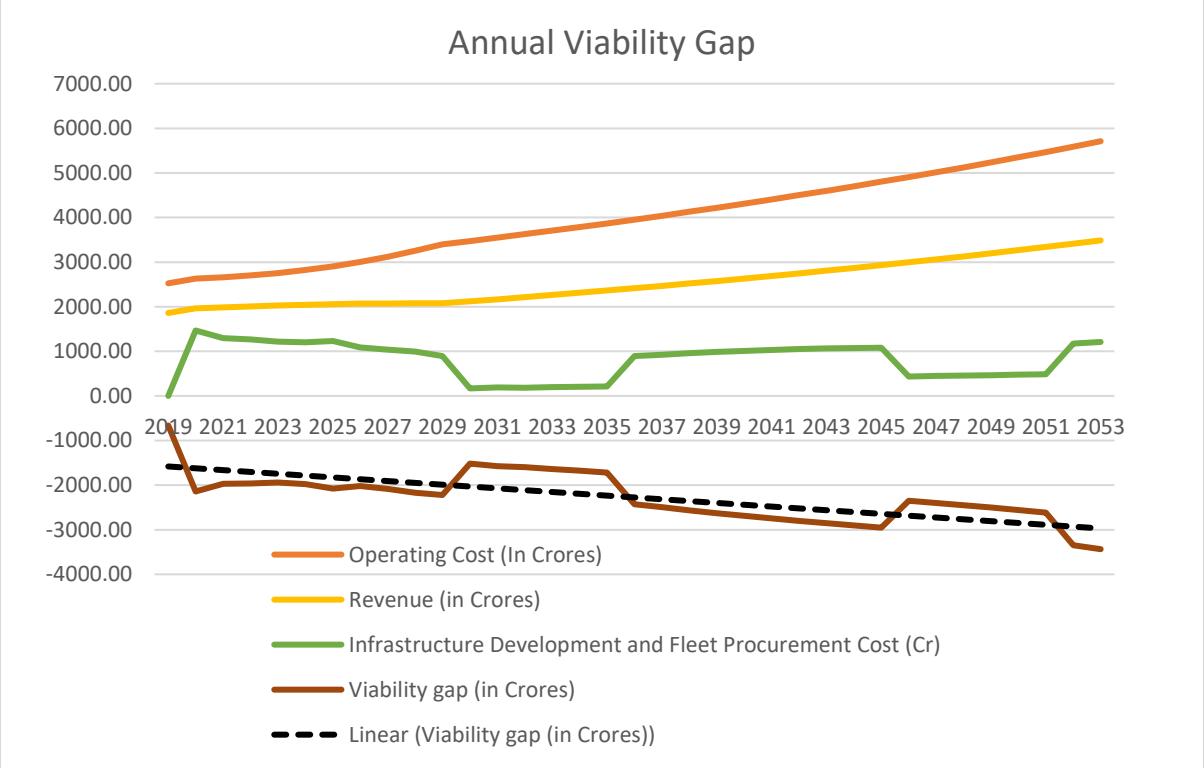
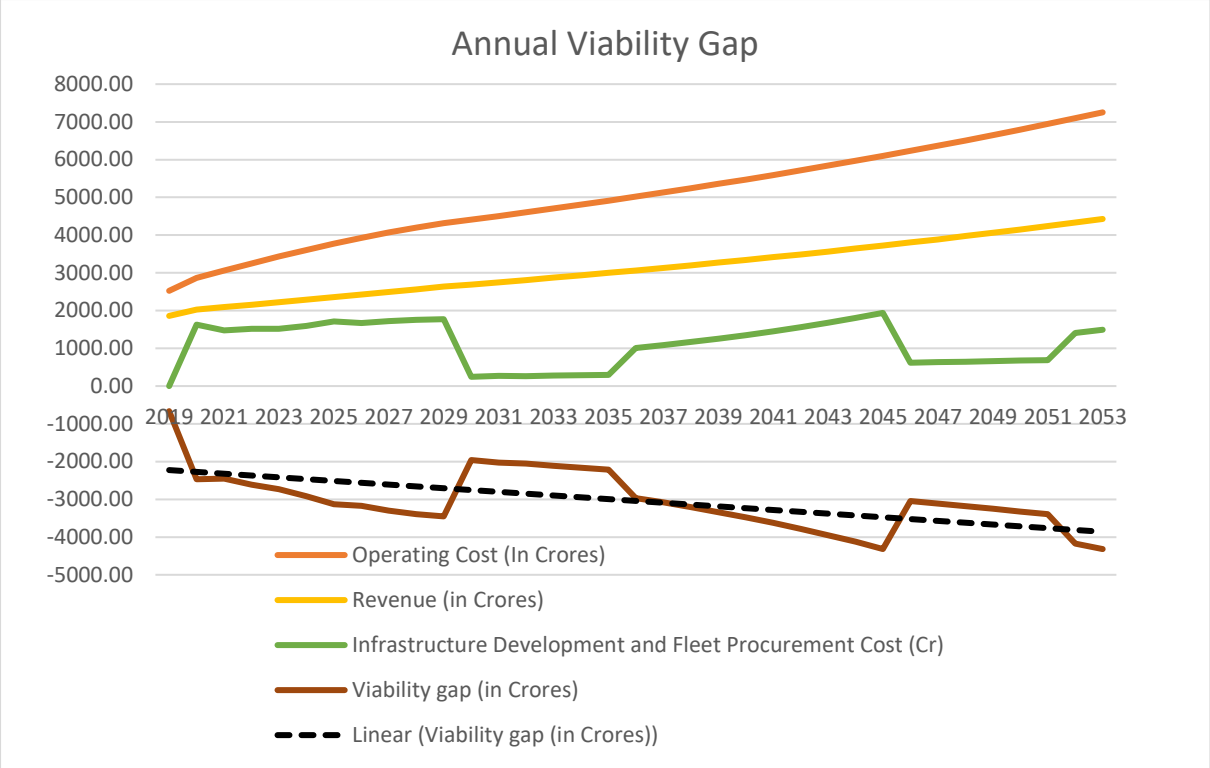



**Figure 12: Scenario 2 –Viability gap / state support graph**




According to outputs generated in scenario 1, it can be assessed that total BMTC fleet size by 2030 will be 8344 electric buses, while in scenario 2; the requirement is of 11377 buses. The difference in fleet requirement for BMTC in 2030 between the two scenarios is mainly on account of the difference in percentage load factor (79.3% in scenario 1 and 65.0% in scenario 2). The difference in vehicle utilization (85.74% in scenario 1 and 76.71% in scenario 2) also contributes to higher fleet size requirement in scenario 2.

After concluding the BAU scenario, the project team developed 3 more scenarios by inputting different envisioned operational parameters for different service types such as vehicle utilization, % load factor, cost and type of vehicle, mode share, EPK, CPK etc. (as discussed in the above chapter). For example, the BMTC mode share computed by the FIEET tool for horizon year 2019 is around 19.77%. Based on discussions with BMTC the project team generated a set of three scenarios where the mode share is envisioned to increase to 28% by 2030. These scenarios and their outputs have been presented in the following below.

### 6.1.4 Scenario 3: 100% electric bus fleet with 28% mode share

In this scenario, it is envisioned that BMTC shall replace its existing bus fleet with electric bus fleet and achieve mode share of 28.00% (up from 19.77% today) in next 10 years. This mode share is envisioned for BMTC in the city mobility plan for BMTC (CMP scenario 1). The envisioned average route length for all services is proposed to be 25 km in 2030. The other operational parameters in this scenario are retained identical to the values considered in the BAU scenario 2. For example, the daily kilometres achieved is considered as 170 km with vehicle utilization of 76.71%. The CPK value is envisioned to be Rs. 70.00 for electric buses (service 4) in 2030 from current Rs. 85.00. Cost of electric vehicle is estimated to be Rs. 1.8 Cr in 2019-20 which is expected to reduce (linearly) to Rs. 1.0 Cr in 2030. Staff to bus ratio will reduce from present 5.32 to 5.29 in 2030. The trajectory of change for all these transitions in operational and mode share parameters is selected as linear. Table 14 presents service wise base and envisioned values considered for this scenario.

**Table 14: Service wise operational Parameters, base values and envisioned values – Scenario 3**

| Operational Parameters | Service 1 | Envisioned values: Service 1 | Service 2 | Envisioned values: Service 2 | Service 3 | Envisioned values: Service 3 | Service 4 Base values | Service 4 Envisioned values |
|---|---|---|---|---|---|---|---|---|
| Service name | Regular -high floor standard bus | | Vajra-AC low floor | | Vayu vajra AC express low floor | | AC - Electric bus | |
| Fleet Composition | 86.89% | 0.00% | 11.45% | 0.00% | 1.67% | 0.00% | 0.00% | 100% |
| Fleet utilization | 89.23% | 89.23% | 77.89% | 80.00% | 77.89% | 80.00% | 89.23 | 89.23 |
| Scheduled Kilometers | 221.6 | 221.6 | 240.4 | 240.4 | 240.4 | 240.4 | 221.6 | 221.6 |
| Achieved Kilometers | 199 | 199 | 199 | 199 | 199 | 199 | 170 | 170 |
| Vehicle utilization | 89.80% | 89.80% | 82.77% | 89.80% | 82.77% | 89.80% | 76.71 % | 76.71 % |
| % Load factor | 65% | 65% | 53.9% | 54.1% | 53.9% | 54.1% | 65% | 65% |
| Vehicle to staff ratio | 5.32 | 5.32 | 4.25 | 4.25 | 4.25 | 4.25 | 5.32 | 5.29 |
| EPK | 42.74 | 43 | 57.35 | 57 | 79.68 | 80 | 42.74 | 42.74 |
| CPK | 58.45 | 58.45 | 78.7 | 78.7 | 78.7 | 78.7 | 85.00 | 70 |
| Cost of vehicle | 32,73,000 | 32,73,000 | 85,74,000 | 85,74,000 | 85,74,000 | 85,74,000 | 1,80,00,000 | 1,00,00,000 |
| Average Route Length | 50.48 | 25 | 33.7 | 25 | 53.4 | 25 | 50.48 | 25 |
| **BMTC mode share** | | | | | | | | **19.77%** |
| **BMTC envisioned/ targeted mode share (Scenario 3)** | | | | | | | | **28.00%** |

The critical service wise outputs generated by the tool for the defined scenario have been presented in Table 15

**Table 15: Service wise outputs – Scenario 3**

| S. No | Scenario 3 | 2019 | 2030 | 2053 |
|---|---|---|---|---|
| **Service 1 – Regular** | | | | |
| 1 | Fleet Composition | 86.89% | 0.00% | 0.00% |
| 2 | Fleet Strength | 5632 | 0 | 0 |
| 3 | Fleet Utilization | 89.23% | 89.23% | 89.23% |
| 4 | Vehicle utilization | 89.80 % | 89.80% | 89.80% |
| 5 | % Load factor | 65.00% | 65.00% | 65.00% |
| **Service 2 – Vajra** | | | | |
| 1 | Fleet Composition | 11.45% | 0.00% | 0.00% |
| 2 | Fleet Strength | 742 | 0 | 0 |
| 3 | Fleet Utilization | 77.89% | 80.00% | 80.00% |
| 4 | Vehicle utilization | 82.78% | 87.34% | 87.34% |
| 5 | %Load factor | 53.90% | 54.10% | 54.10% |
| **Service 3 – Vayu Vajra** | | | | |
| 1 | Fleet Composition | 1.67% | 0.00% | 0.00% |
| 2 | Fleet Strength | 108 | 0 | 0 |
| 3 | Fleet Utilization | 77.89% | 80.00% | 80.00% |

| | | | | |
|---|---|---|---|---|
| 4 | Vehicle utilization | 82.78% | 87.34% | 87.34% |
| 5 | % Load factor | 53.90% | 54.10% | 54.10% |
| **Service 4 - Electric bus** | | | | |
| 1 | Fleet Composition | 0.00% | 100% | 100% |
| 2 | Fleet Strength | 0 | 16171 | 26597 |
| 3 | Fleet Utilization | 89.23% | 89.23% | 89.23% |
| 4 | Vehicle utilization | 76.71% | 76.71% | 76.71% |
| 5 | % Load factor | 65.00% | 65.00% | 65.00% |

Service wise outputs produced by the tool for this scenario suggest that by 2030 BMTC will achieve mode share of 28.08% with 100% electric bus fleet comprising of 16171 buses. Eventually this fleet requirement will rise to 26597 buses with a mode share of 28.25% by 2053. In this scenario the other operational parameters were envisioned constant for electric buses and regular buses and remain unchanged till 2030. However, for the other two services - Vajra and Vayu vajra, fleet utilization, vehicle utilization and percentage load factor are envisioned to increase. The fleet utilization is targeted to rise from 77.89% to 80%, the vehicle utilization rises from 82.78% to 87.34% and the percentage load factor increases from 53.90% to 54.10%. Since, the transition (in a linear trajectory) is planned for next 10 years, these three parameters remain constant from 2030 till 2053. The overall outputs for BMTC generated by the tool are presented below. Table 16 presents the details of overall projected requirements for BMTC up to 2053.

The inputs presented in Table 15 have been included in the tool to estimate the desired outputs for Scenario 3. The tool projections suggest that by 2030, BMTC is expected to 72.96 lakhs trips per day by 2030 and 1.2Cr trips by 2053 compared to 44.5 lakh trips per day in the current year. The projection suggests the overall fleet strength which is 6,482 currently (in 2019) will need to increase to 16171 in 2030 and to 26597 in 2053, in order to achieve the target mode share (28.00%). The staff strength will need to increase from current 33575 employees to 85545 by 2030 and 140699 employees by 2053.

Desired, number routes operated will be all most constant at 2264 in 2030 and 2053 from 2263 routes operated presently. In this scenario BMTC annual losses (or total annual State financial support requirement) shall increase up to 2799.69 Crore in 2030 and 5906.53 Crore in 2053 from 664 .1 Crore in the current year. The total financial support required by BMTC (including fleet procurement, infrastructure development and operational losses) for the period 2020 to 2030 is estimated as Rs. 43240.93 crore. Table 16 presents the overall projections for scenario 3 for 2019, 2030 and 2053.

**Table 16: Overall outputs – Scenario 3**

| S.no | Outputs - Scenario 3 | 2019 | 2030 | 2053 |
|---|---|---|---|---|
| 1 | BMTC total trips per day | 4455151 | 7296714 | 12001261 |
| 2 | Total fleet strength | 6482 | 16171 | 26597 |
| 3 | Total operational routes | 2263 | 2264 | 2264 |
| 4 | Total staff strength | 33575 | 85545 | 140699 |
| 5 | Viability gap or total annual losses that need to be covered by State support | -664.18 | -2799.69 | -5906.53 |

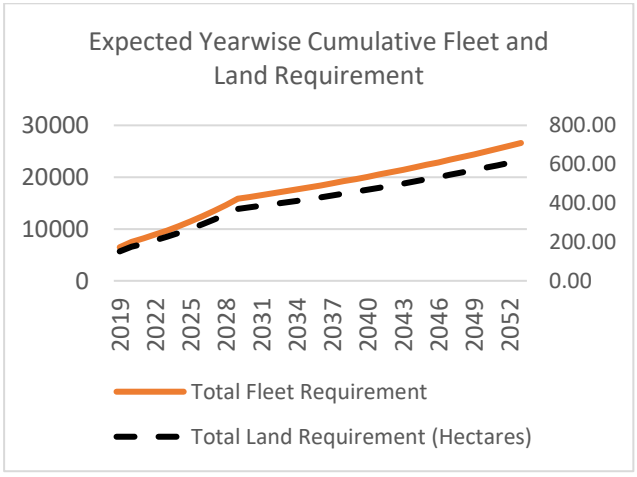
The infrastructure related outputs generated by the tool in this scenario suggest that BMTC will need to develop 340 bus terminals and 162 bus depots by 2030. For the same the STU needs 377.59 Ha of land by 2030 with a budget of 359.13 Cr. Similarly, by 2050, BMTC will require to develop 599 bus terminals and 266 bus depots with land requirement of 621.05 Ha and a budget of 1892.43 Crore. Table 17 presents cumulative infrastructure outputs for scenario 3 for 2019, 2030 and 2053.

**Table 17: Infrastructural outputs – Scenario 3**

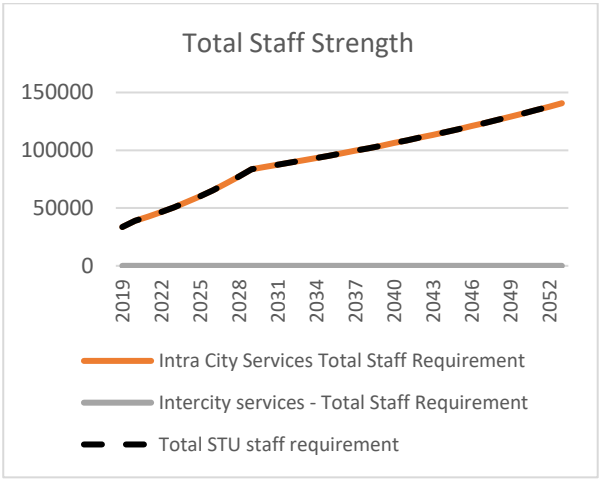
| S.no | Outputs - Scenario 1 | 2019 | 2030 | 2053 |
|---|---|---|---|---|
| 1 | Cumulative number Terminals required to be developed by year | 136 | 340 | 599 |
| 2 | Cumulative number of Depots required to be developed by year | 65 | 162 | 266 |
| 3 | Cumulative land requirement in Hectares | 151.35 | 377.59 | 621.05 |
| 4 | Cumulative annual budget in Crores for fleet procurement and infrastructure development (in crores) | 0 | 359.13 | 1892.43 |

The graphical representation of critical outputs for Scenario 3, as generated by the tool are presented in the Figure 13. These includes – (a) Cumulative Fleet and land requirement, (b) Projected total staff strength, (c) Expected Annual operating cost, earning and Profit/loss and (d) projected numbers of routes.

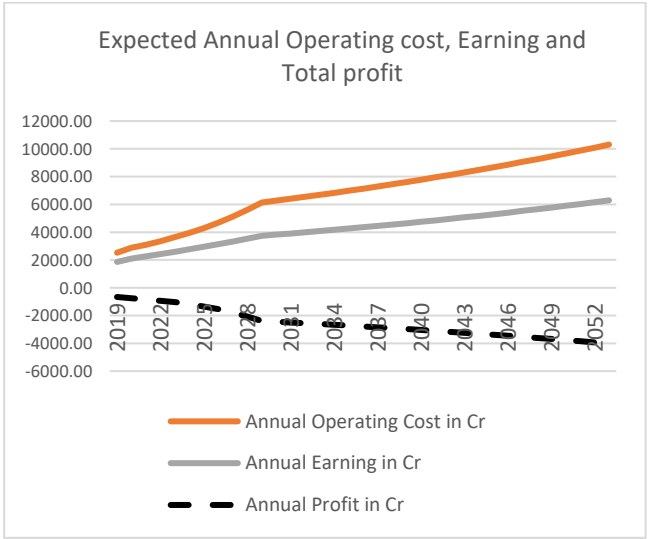
**Figure 13: Scenario 3 – Tool output graphs**



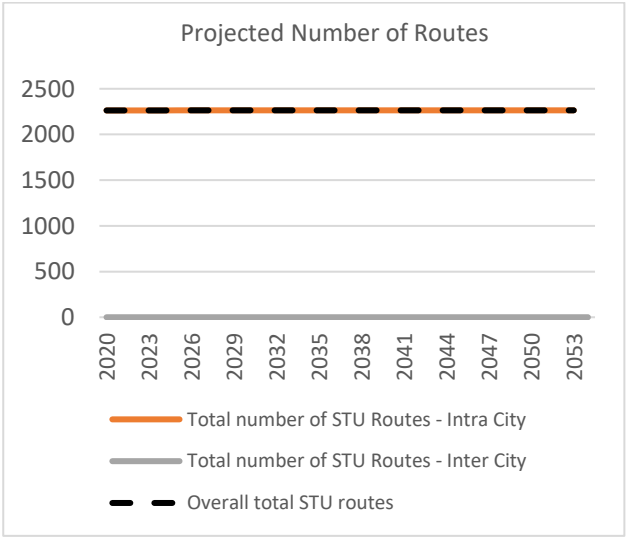

a




b




c




d

### 6.1.5 Scenario 4: 100% Euro 6 diesel bus fleet with 28% mode share

In this scenario, BMTC shall replace 100% of its existing bus fleet with fleet of Euro 6 diesel bus with targeted mode share of 28.00 % in next 10 years. The operational parameters values in this scenario are retained identical to the values considered for scenario 3, except for the cost of euro diesel buses

and CPK for the same. The cost of bus in his scenario is estimated to be 37.63 lakhs (both currently and in 2030 at current value of money) and CPK is taken as Rs. 58.45, both currently and in 2030 (at current value of money). Table 18 presents service wise base and envisioned values considered for this scenario.

**Table 18: Service wise operational Parameters, base values and envisioned values – Scenario 4**

| Operational Parameters | Service 1 | Envisioned values: Service 1 | Service 2 | Envisioned values: Service 2 | Service 3 | Envisioned values: Service 3 | Service 4 Base values | Service 4 Envisioned values |
|---|---|---|---|---|---|---|---|---|
| Service name | Regular -high floor standard bus | | Vajra-AC low floor | | Vayu vajra AC express low floor | | AC - EURO 6 Diesel bus | |
| Fleet Composition | 86.89% | 0.00% | 11.45% | 0.00% | 1.67% | 0.00% | 0.00% | 100% |
| Fleet utilization | 89.23% | 89.23% | 77.89% | 80.00% | 77.89% | 80.00% | 89.23 | 89.23 |
| Scheduled Kilometers | 221.6 | 221.6 | 240.4 | 240.4 | 240.4 | 240.4 | 221.6 | 221.6 |
| Achieved Kilometers | 199 | 199 | 199 | 199 | 199 | 199 | 170 | 170 |
| Vehicle utilization | 89.80% | 89.80% | 82.77% | 89.80% | 82.77% | 89.80% | 76.71 % | 76.71 % |
| % Load factor | 65% | 65% | 53.9% | 54.1% | 53.9% | 54.1% | 65% | 65% |
| Vehicle to staff ratio | 5.32 | 5.32 | 4.25 | 4.25 | 4.25 | 4.25 | 5.32 | 5.29 |
| EPK | 42.74 | 43 | 57.35 | 57 | 79.68 | 80 | 42.74 | 42.74 |
| CPK | 58.45 | 58.45 | 78.7 | 78.7 | 78.7 | 78.7 | 58.45 | 58.45 |
| Cost of vehicle | 32,73,000 | 32,73,000 | 85,74,000 | 85,74,000 | 85,74,000 | 85,74,000 | 37,63,950 | 37,63,950 |
| Average Route Length in Km | 50.48 | 25 | 33.7 | 25 | 53.4 | 25 | 50.48 | 25 |
| **BMTC mode share** | | | | | | | | **19.77%** |
| **BMTC envisioned/ targeted mode share (Scenario 4)** | | | | | | | | **28.00%** |

Based on current and future values of parameters presented in the above table, the FIEET tool generated service wise as well overall outputs for the current year, 2030 and 2053. It is observed that all the outputs generated for scenario 4 were same as the outputs derived for scenario 3, except for financial parameter. Due to much lower capital and operational cost of Euro 6 Diesel buses, the annual State financial support requirement is lower in this scenario, than in scenario 3. The critical service wise outputs generated by the tool for scenario 4 have been presented in Table 19

**Table 19: Service wise outputs – Scenario 4**

| S. No | Scenario 4 | 2019 | 2030 | 2053 |
|---|---|---|---|---|
| **Service 1 – Regular** | | | | |
| 1 | Fleet Composition | 86.89% | 0.00% | 0.00% |
| 2 | Fleet Strength | 5632 | 0 | 0 |
| 3 | Fleet Utilization | 89.23% | 89.23% | 89.23% |
| 4 | Vehicle utilization | 89.80 % | 89.80% | 89.80% |
| 5 | Percentage Load factor | 65.00% | 65.00% | 65.00% |

| | | | | |
|---|---|---|---|---|
| **Service 2 – Vajra** | | | | |
| 1 | Fleet Composition | 11.45% | 0.00% | 0.00% |
| 2 | Fleet Strength | 742 | 0 | 0 |
| 3 | Fleet Utilization | 77.89% | 80.00% | 80.00% |
| 4 | Vehicle utilization | 82.78% | 87.34% | 87.34% |
| 5 | Percentage Load factor | 53.90% | 54.10% | 54.10% |
| **Service 3 – Vayu Vajra** | | | | |
| 1 | Fleet Composition | 1.67% | 0.00% | 0.00% |
| 2 | Fleet Strength | 108 | 0 | 0 |
| 3 | Fleet Utilization | 77.89% | 80.00% | 80.00% |
| 4 | Vehicle utilization | 82.78% | 87.34% | 87.34% |
| 5 | Percentage Load factor | 53.90% | 54.10% | 54.10% |
| **Service 4 – EURO 6 diesel bus** | | | | |
| 1 | Fleet Composition | 0.00% | 100% | 100% |
| 2 | Fleet Strength | 0 | 16171 | 26597 |
| 3 | Fleet Utilization | 89.23% | 89.23% | 89.23% |
| 4 | Vehicle utilization | 76.71% | 76.71% | 76.71% |
| 5 | % Load factor | 65.00% | 65.00% | 65.00% |

The overall outputs generated for scenario 4 were also observed identical to that of the outputs generated for the previous scenario 3. The projections revealed similar results in terms of:

- Passenger trips catered - 72.96 lakhs trips per day by 2030 and 1.2Cr trips by 2053,
- Fleet strength required - 6,482 currently in 2019) to 16171 in 2030 and to 26597 in 2053,
- Staff strength required - from current 33575 employees to 85545 by 2030 and 140699 employees by 2053,
- Estimated number of routes - 2264 in 2030 and 2053 from 2263 routes operated presently.

In terms of financial output, BMTC shall require a total annual State financial support of Rs. 1550.04 Crore in 2030 and Rs. 3046.8 Crore in 2053. In comparison the total State financial support for BMTC in 2019 is estimated to be 664.1 Crore. The total financial support required by BMTC (including fleet procurement, infrastructure development and operational losses) for the period 2020 to 2030 is estimated as Rs. 20354.48 crore. Table 20 presents the overall outputs for scenario 4 for 2019, 2030 and 2053.

**Table 20: Overall outputs – Scenario 4**

| S.no | Outputs - Scenario 4 | 2019 | 2030 | 2053 |
|---|---|---|---|---|
| 1 | BMTC total trips per day | 44,55,151 | 72,96,714 | 1,20,01,261 |
| 2 | Total fleet strength | 6482 | 16171 | 26597 |
| 3 | Total operational routes | 2263 | 2264 | 2264 |
| 4 | Total staff strength | 33575 | 85545 | 140699 |
| 5 | Viability gap or total annual losses that need to be covered by State support | -664.18 | -1550.04 | -3046.8 |

The infrastructure related outputs estimated for scenario 4 are the same as those derived in scenario 3 (above) in terms of number of terminal and depots required and the cumulative requirement of land for the same. Table 21 presents annual infrastructure related outputs for scenario 4 for the years 2019, 2030 and 2053.

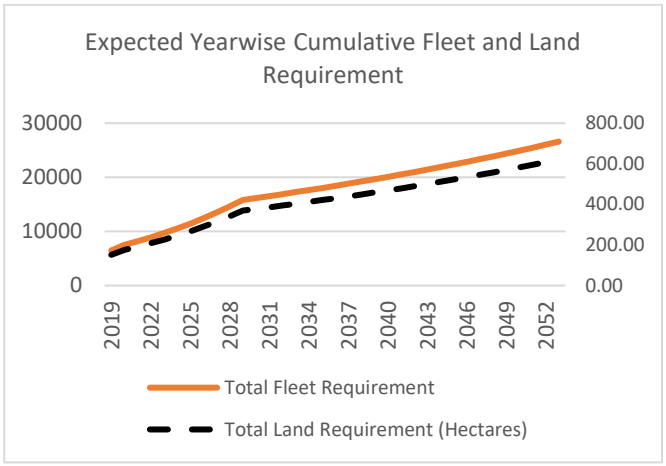
**Table 21: Infrastructural outputs – Scenario 4**

| S.no | Outputs - Scenario 4 | 2019 | 2030 | 2053 |
|---|---|---|---|---|

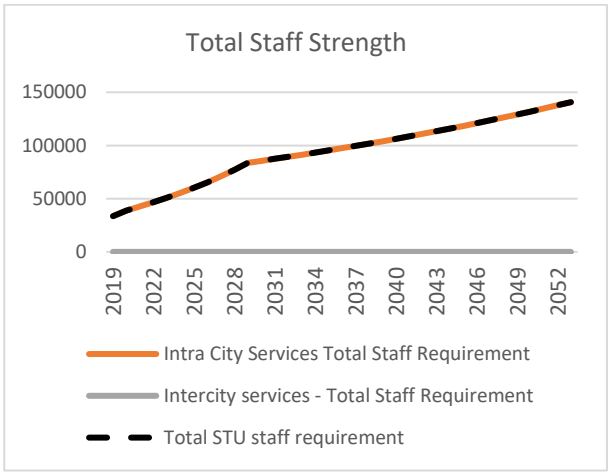
| | | | | |
|---|---|---|---|---|
| 1 | Cumulative number Terminals required to be developed by the year | 136 | 340 | 599 |
| 2 | Cumulative number of Depots required to be developed by the year | 65 | 162 | 266 |
| 3 | Cumulative land requirement in Hectares by the year | 151.35 | 377.59 | 621.05 |
| 4 | Annual budget in Crores for Fleet procurement and infrastructure development in crores | 0 | 143.54 | 733.54 |

The graphical representation of critical outputs for Scenario 4, as generated by the tool are presented in the Figure 14. These includes – (a) Cumulative Fleet and land requirement, (b) Projected total staff strength, (c) Expected Annual operating cost, earning and profit/loss and(d) Projected numbers of routes.

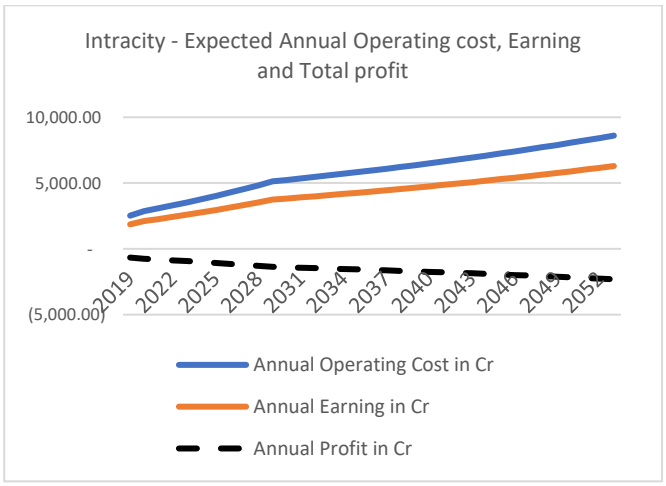
**Figure 14: Scenario 4 – Tool output graphs**



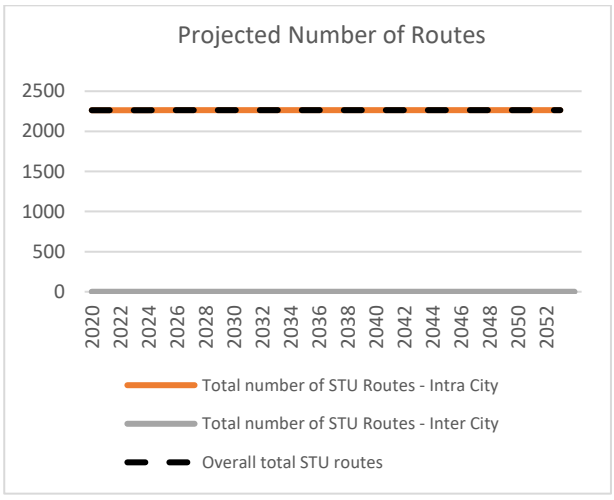

a




b




c




d

### 6.1.6 Comparison – Scenario 3 and 4

When the financial outputs generated by the tool for both the scenarios were compared against each other it was observed that although the fleet strength required was same in both cases but in scenario 3 (with electric bus fleet), BMTC would require a cumulative state financial support of Rs.43240.93. Cr between 2020 and 2030 whereas in Scenario 4 (with Euro 6 Diesel bus fleet), for the same period BMTC will require a state financial support of Rs. 20354.48 Cr. The outputs suggest that with Euro 6 diesel bus fleet BMTC may be financially more sustainable for the State however they will have a

significant negative impact on local air pollution, which can be mitigated by a 100% electric bus fleet. Table 22 presents annual viability gap comparison generated for scenario 3 and scenario 4 (for years 2019, 2030 and 2053).

**Table 22: Financial outputs (in crores) comparison – Scenario 3 and 4**

| S.no | Comparison Scenario 3 & 4 | Current | Scenario 3 | | Scenario 4 | |
|---|---|---|---|---|---|---|
| 1 | Year | 2019 | 2030 | 2053 | 2030 | 2053 |
| **2** | Fleet Strength | 6482 | 16171 | 26597 | 16171 | 26597 |
| 3 | Operating Cost | 2524.3 | 6267.02 | 10307.66 | 5232.9 | 8606.9 |
| 4 | Infrastructure development and fleet procurement cost | 0.00 | 359.13 | 1892.43 | 143.54 | 733.54 |
| 5 | Revenue | 1860.15 | 3826.46 | 6293.56 | 3826.46 | 6293.56 |
| 6 | Viability gap or total annual losses that need to be covered by State support | -664.18 | -2799.6 | -5906 | -1550.04 | -3046.64 |

Figure 15 presents viability gap graph generated for scenario 3 and Figure 16 presents viability gap graph generated for scenario 4

**Figure 15: Scenario 3 –Viability gap / state support graph**

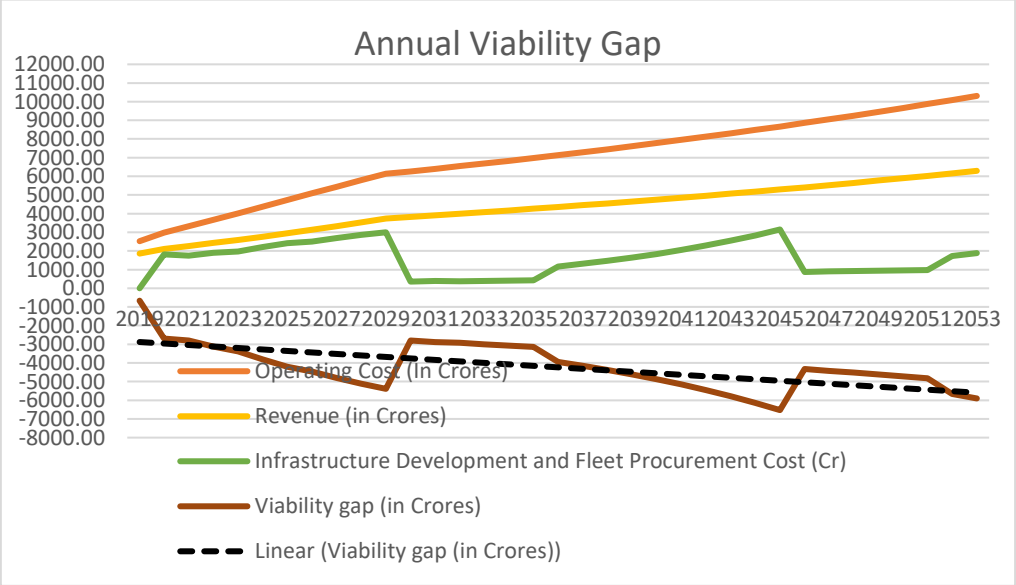
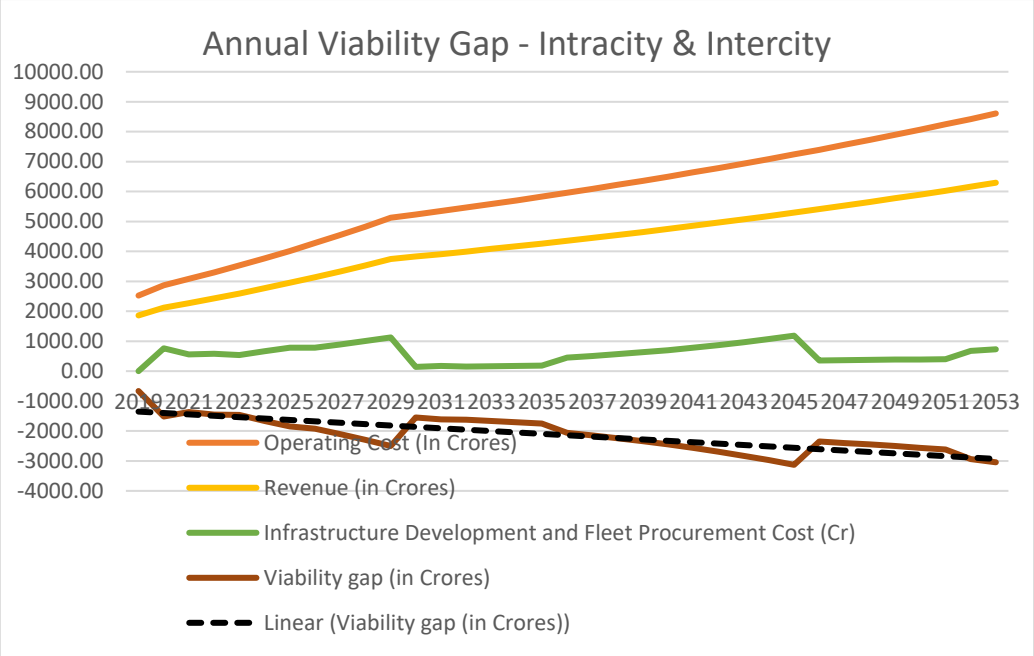



**Figure 16: Scenario 4 –Viability gap / state support graph**




### 6.1.7 Scenario 5: 100% Electric Bus Fleet with 33% mode share

This scenario is based – "Comprehensive Mobility Plan (CMP)– Bengaluru, Scenario 2", and assumes in future the Bengaluru city shall develop a vast network of bus priority lanes covering most of the BMTC route network and shall electric-bus charging points at terminals. In this scenario BMTC is expected to attain a higher mode share and vehicle utilization. Scenario 5 assumes that in next 10 years BMTC shall replace its existing bus fleet with electric bus fleet and attain a mode share of 33% (from the current 19.77%). Additionally, reserved bus lanes, shall ensure a high vehicle utilization of 90.25%. Table 23 presents service wise base and envisioned values considered for this scenario.

**Table 23: Service wise operational Parameters, base values and envisioned values – Scenario 5**

| Operational Parameters | Service 1 | Envisioned values: Service 1 | Service 2 | Envisioned values: Service 2 | Service 3 | Envisioned values: Service 3 | Service 4 Base values | Service 4 Envisioned values |
|---|---|---|---|---|---|---|---|---|
| Service name | Regular -high floor standard bus | | Vajra-AC low floor | | Vayu vajra AC express low floor | | AC - Electric bus | |
| Fleet Composition | 86.89% | 0.00% | 11.45% | 0.00% | 1.67% | 0.00% | 0.00% | 100% |
| Fleet utilization | 89.23% | 89.23% | 77.89% | 80.00% | 77.89% | 80.00% | 89.23 | 89.23 |
| Scheduled Kilometers | 221.6 | 221.6 | 240.4 | 240.4 | 240.4 | 240.4 | 221.6 | 221.6 |
| Achieved Kilometers | 199 | 199 | 199 | 199 | 199 | 199 | 200 | 200 |
| Vehicle utilization | 89.80% | 89.80% | 82.77% | 89.80% | 82.77% | 89.80% | 90.25 % | 90.25 % |
| % Load factor | 65% | 65% | 53.9% | 54.1% | 53.9% | 54.1% | 65% | 65% |
| Vehicle to staff ratio | 5.32 | 5.32 | 4.25 | 4.25 | 4.25 | 4.25 | 5.32 | 5.29 |
| EPK | 42.74 | 43 | 57.35 | 57 | 79.68 | 80 | 42.74 | 42.74 |
| CPK | 58.45 | 58.45 | 78.7 | 78.7 | 78.7 | 78.7 | 85.0 | 70.0 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Cost of vehicle | 3273000 | 3273000 | 8574000 | 8574000 | 8574000 | 8574000 | 18000000 | 10000000 |
| Average Route Length in Km | 50.48 | 25 | 33.7 | 25 | 53.4 | 25 | 50.48 | 25 |
| **BMTC mode share** | | | | | | | | **19.77%** |
| **BMTC envisioned/ targeted mode share (Scenario 5)** | | | | | | | | **33.07%** |

In this scenario, the daily kilometres achieved is considered as 200 km leading to relatively high vehicle utilization. CPK value for all services remains the same as in scenario 3. Cost of electric vehicle is 1.8 Crore, which is envisioned to reduce to 1.0 Crore and staff to bus ratio will reduce from present 5.32 to 5.29 (for current standard bus and the electric bus service). the envisioned average route length for all services is desired to be 25 km. It is modelled to reduce from current more than 50km length to 25km route length in a linear trajectory over the next 10 years. The other operational parameters in this scenario are retained identical to the values considered in the previous scenarios, as discussed above. The critical service wise outputs generated by the tool for the defined scenario have been presented in Table 24

**Table 24: Service wise outputs – Scenario 5**

| S. No | Scenario 5 | 2019 | 2030 | 2053 |
|---|---|---|---|---|
| **Service 1 – Regular** | | | | |
| 1 | Fleet Composition | 86.89% | 0.00% | 0.00% |
| 2 | Fleet Strength | 5632 | 0 | 0 |
| 3 | Fleet Utilization | 89.23% | 89.23% | 89.23% |
| 4 | Vehicle utilization | 89.80 % | 89.80% | 89.80% |
| 5 | Percentage Load factor | 65.00% | 65.00% | 65.00% |
| **Service 2 – Vajra** | | | | |
| 1 | Fleet Composition | 11.45% | 0.00% | 0.00% |
| 2 | Fleet Strength | 742 | 0 | 0 |
| 3 | Fleet Utilization | 77.89% | 80.00% | 80.00% |
| 4 | Vehicle utilization | 82.78% | 87.34% | 87.34% |
| 5 | Percentage Load factor | 53.90% | 54.10% | 54.10% |
| **Service 3 – Vayu Vajra** | | | | |
| 1 | Fleet Composition | 1.67% | 0.00% | 0.00% |
| 2 | Fleet Strength | 108 | 0 | 0 |
| 3 | Fleet Utilization | 77.89% | 80.00% | 80.00% |
| 4 | Vehicle utilization | 82.78% | 87.34% | 87.34% |
| 5 | Percentage Load factor | 53.90% | 54.10% | 54.10% |
| **Service 4 - Electric bus** | | | | |
| 1 | Fleet Composition | 0.00% | 100% | 100% |
| 2 | Fleet Strength | 0 | 16199 | 26644 |
| 3 | Fleet Utilization | 89.23% | 89.23% | 89.23% |
| 4 | Vehicle utilization | 90.25% | 90.25% | 90.25% |
| 5 | Percentage Load factor | 65.00% | 65.00% | 65.00% |

The service specific outputs in this scenario suggest that by 2030 BMTC will achieve mode share of 33 % with 100% electric bus fleet comprising of 16199 buses. Eventually this fleet requirement will rise to 26644 buses with same mode share (33%) by 2053. Since, the projections are worked out for next 10 years, fleet utilization, vehicle utilization and percentage load factor and other operational parameters remain constant from 2030 till 2053. Table presents the details of overall projected requirements for BMTC up to 2053.

The inputs presented in the above (table) are projected with linear trajectory to estimate the desired outputs for Scenario 5. The tool projections suggest that by 2030, BMTC is expected to cater to about 84.26 lakhs passenger trips per day by 2030 and 1.3Cr passenger trips by 2053 compared to 44.5 passenger lakh trips estimated for 2019. The staff strength will increase from current 33575 employees to 85695 employees by 2030 and 140946 employees by 2053.
As envisioned the total routes operated will be all most constant at 2264 in 2030 and 2053 from 2263 routes operated presently. In this scenario BMTC will require annual State financial support of Rs. 3236.176 Crore in 2030 and 6643 Crore in 2053, up from 664 .1 Crore estimated for 2020. Table 25 presents the overall projections for scenario 3 for 2020, 2030 and 2053.

**Table 25: Overall outputs – Scenario 5**

| S.no | Outputs - Scenario 5 | 2019 | 2030 | 2053 |
|---|---|---|---|---|
| 1 | BMTC total trips per day | 44,55,151 | 84,26,236 | 1,38,59,040 |
| 2 | Total fleet strength | 6482 | 16199 | 26644 |
| 3 | Total operational routes | 2263 | 2264 | 2264 |
| 4 | Total staff strength | 33,575 | 85,695 | 1,40,946 |
| 5 | Viability gap or total annual losses that need to be covered by State support | -664.18 | -3236.1 | -6643 |

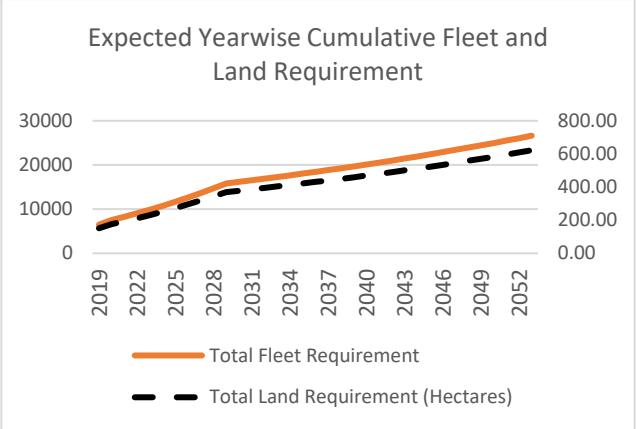
The infrastructure outputs generated by the tool in this scenario reveals, BMTC will require to develop 340 bus terminals and 162 bus depots by 2030. For the same the STU needs 378.269 Ha of land by 2030 with a budget of 359.80Cr. Similarly, by 2050, BMTC will require to develop 560 bus terminals and 266 bus depots with land requirement of 622.13 Ha and a budget of 1912.106Cr. Table 26 presents cumulative infrastructure outputs for scenario 3 for 2019, 2030 and 2053.

**Table 26: Infrastructural outputs – Scenario 5**

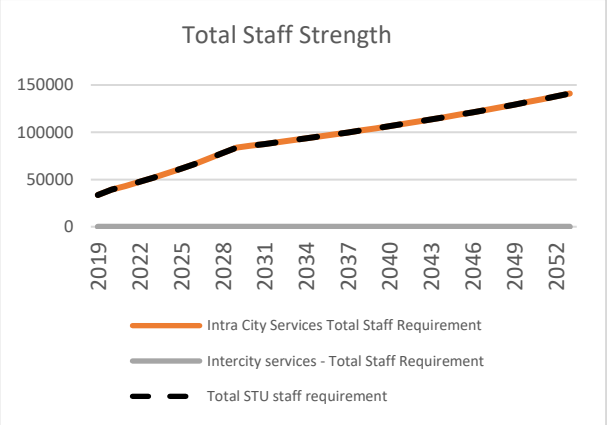
| S.no | Outputs - Scenario 5 | 2019 | 2030 | 2053 |
|---|---|---|---|---|
| 1 | Cumulative number Terminals required to be developed by year | 136 | 340 | 560 |
| 2 | Cumulative number of Depots required to be developed by year | 65 | 162 | 266 |
| 3 | Cumulative land requirement in Hectares | 151.35 | 378.26 | 622.13 |
| 4 | Cumulative annual budget in Crores for Fleet and infrastructure in crores | 0 | 359.80 | 1912.10 |

The graphical representation of critical outputs for Scenario 5, as generated by the tool are presented in Figure 17. These includes – (a) Cumulative Fleet and land requirement, (b) Projected total staff strength, (c) Expected Annual operating cost, earning and profit/loss and(d) Projected numbers of routes.

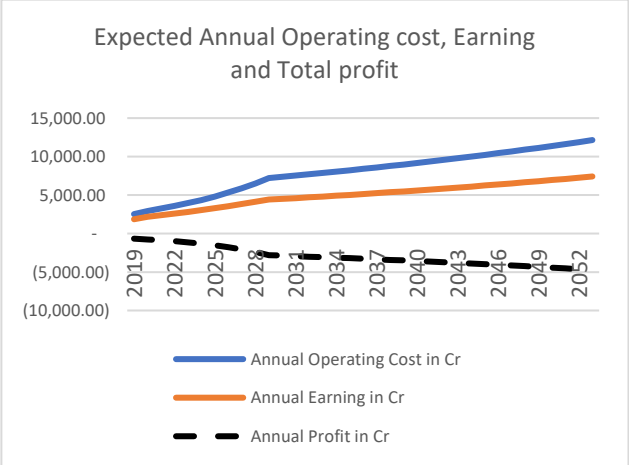
**Figure 17: Scenario 5 – Tool output graphs**



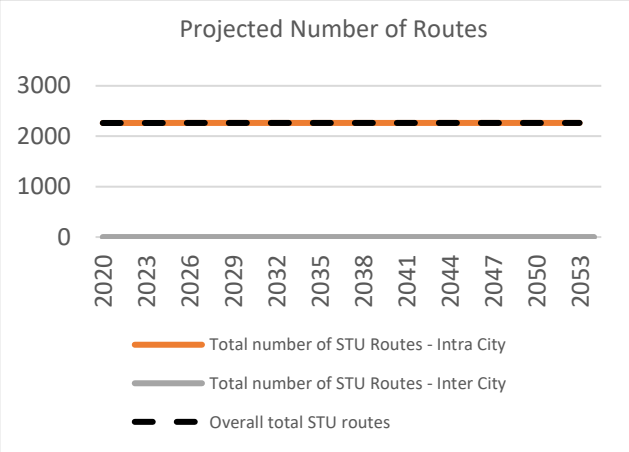

a




b




c



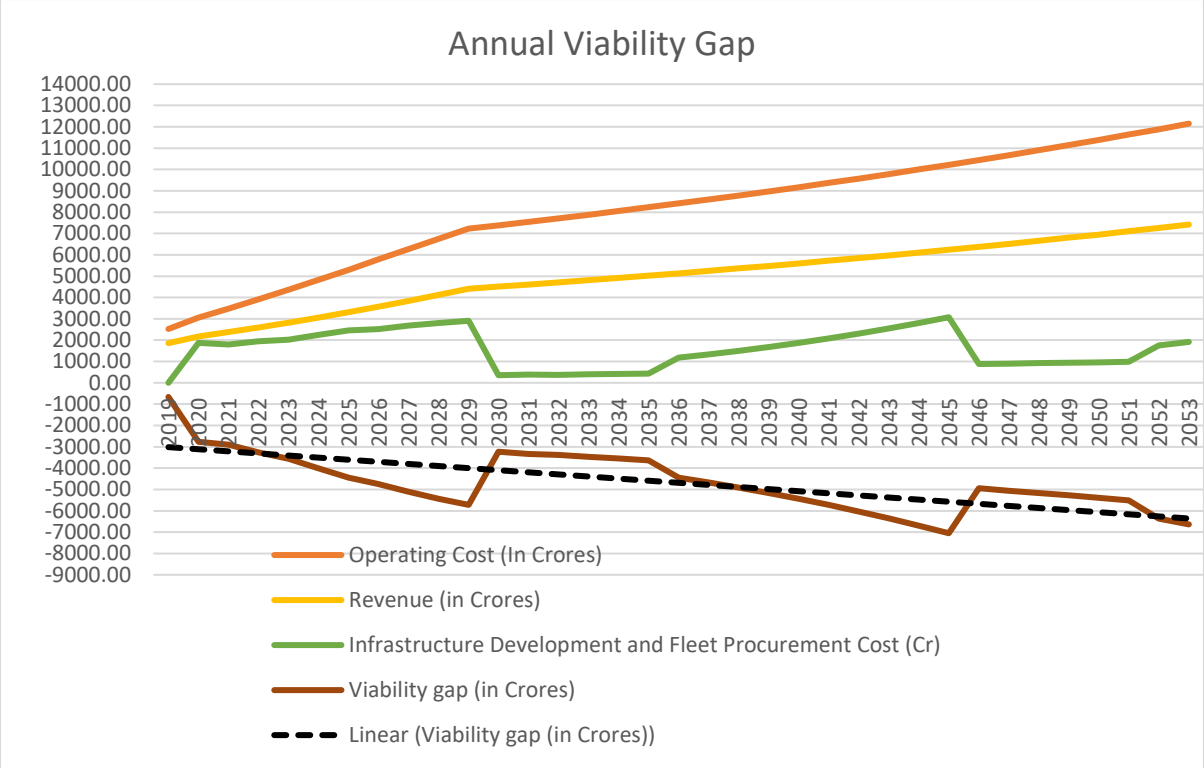

d

For this scenario the financial outputs generated by the tool reveals that BMTC would require a State financial support of 3160.86 Crore in 2030 and in 2050, BMTC will require additional state support of 6472.48 Crore. In comparison the State financial support estimated for 2020 for BMTC is 664.1 Crore. The total financial support required by BMTC (including fleet procurement, infrastructure development and operational losses) for the period 2020 to 2030 is estimated as Rs. 45853.21 crore. Table 27 presents financial outputs generated for scenario 5 and Figure 18 presents viability gap graph generated for this scenario.

**Table 27: Financial outputs – Scenario 5**

| S.no | Financial Outputs – Scenario 5 | Current | Scenario 5 | |
|---|---|---|---|---|
| 1 | Year | 2020 | 2030 | 2053 |
| **2** | Fleet Strength | 6482 | 161991 | 26644 |
| 3 | Annual Operating Cost | 2524.3 | 7836.13 | 12148.32 |
| 4 | Infrastructure development and fleet procurement cost | 0.00 | 359.80 | 1912.10 |
| 5 | Annual Revenue | 1860.15 | 4509.76 | 7417.42 |
| 6 | Viability gap or total annual losses that need to be covered by State support | -664.18 | -3236.17 | -6643.008 |

**Figure 18: Scenario 5 – Viability gap / state support graph**




The detailed outputs for this scenario have been presented in Annexure 7.1

### 6.1.8 Comparison All Scenarios – 2019 verses 2030

Table 28 presents a comparison of critical outputs generated by the tool for the base year and 2030 for each of the five-scenario discussed above.

**Table 28: 2030 outputs – all Scenarios**

| S.no | Projected Outputs for the year 2030 | Current | Scenario 1 2030 | Scenario 2 2030 | Scenario 3 2030 | Scenario 4 2030 | Scenario 5 2030 |
|---|---|---|---|---|---|---|---|
| 1 | Service - type | 4 | 4 | 4 | 4 | 4 | 4 |
| 2 | Mode share | 19.77% | 19.77% | 19.77% | 28.08% | 28.08% | 33.09% |
| 3 | Fleet Strength | 6482 | 8344 | 11377 | 16171 | 16171 | 16199 |
| 4 | Routes | 2263 | 2264 | 2264 | 2264 | 2264 | 2264 |
| 5 | BMTC total trips per day in lakhs | 44.55 | 54.21 | 54.21 | 72.96 | 72.96 | 84.26 |
| 6 | Annual-Staff requirement | 33575 | 44138 | 60187 | 85545 | 85545 | 85695 |
| 7 | Annual Land to be developed in Hectares | 151.35 | 194.82 | 265.66 | 377.59 | 377.59 | 378.26 |
| 8 | Annual Budget in Crores | 0.00 | 174.22 | 245.89 | 359.13 | 143.54 | 359.80 |
| 9 | State financial support required in Crores | 664.18 | 1581.69 | 1963.00 | 2799.69 | 1550.04 | 3236.17 |
| 10 | Total State financial support requirement for the period 2020-2030 in Crores | 664.18 | 25590.7 | 32,255.0 | 43240.93 | 20354.48 | 45853.21 |

# 7 Annexure

## 7.1 Checklist for STU data collection

**STU Data Collection Checklist**

**A. *Basic Info:***

Name of STU _____ Data year _____ Operation Type **Urban** or **Non Urban** or **Both**

Service type _____ in Nos Fleet Size _____ in Nos

STU Mode share _____ % Fleet Comp _____ % Avg. Route Length _____ km Avg Passenger Trip Length _____ km

**STU Data Collection Checklist**

**A. *Basic Info:***

Name of STU _____ Data year _____ Operation Type **Urban** or **Non Urban** or **Both**

Service type _____ in Nos Fleet Size _____ in Nos

**B. *Infrastructure Info :***

Number of bus terminals _____ Total area _____ Ha Total land area allocated including developed and Undeveloped bus terminals in Ha

Number of bus depots _____ Total area _____ Ha Total land area allocated including developed and Undeveloped bus depots in Ha

**C. *Service Info:***

Service name _____ Cost of bus _____ Age limit _____ years Seating Capacity _____ %

Number of Buses by age :

| 1yr | 2yr | 3yr | 4yr | 5yr | 6yr | 7yr | 8yr | Total Fleet |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

| 9yr | 10yr | 11yr | 12yr | 13yr | 14yr | 15yr | > 15 year |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

Fleet Utilization _____ % % Load Factor _____ % Daily Passenger trips _____

Daily Scheduled Km _____ Km Avg.Daily Km Achived _____ km Operational Routes _____

EPK _____ Rs CPK _____ Rs Staff to Bus ratio _____

Total Operational Hours _____ Hrs Share of Pass holders _____ % Avg Dead Kilometers _____

**D. *Vision Data (Service Specific) :***

STU Mode share _____ % Fleet Compostion _____ % Cost of vehicle _____ Rs

Fleet Utilization _____ % Load Factor _____ % Vehicle Utilization _____ %

Avg Passenger Trip Length _____ Km Avg.Route Length _____ km Operational Routes _____ No.s

EPK _____ Rs CPK _____ Rs Staff to Bus ratio _____

## 7.2 Meeting Minutes

### 7.2.1 Meeting :1

# Building a Long-Range Planning Toolkit for State Transport Undertaking's (STUs)

**Meeting minutes**

25th and 26th June 2019

**Meeting Agenda:** To discuss the working and methodology of long-range planning toolkit with the State Transport Undertakings (Bangalore Metropolitan Transport Corporation - BMTC and Karnataka State Road Transport Corporation – KSRTC) and outreaching partners (Union Internationale des transports publics -UITP and Centre for Study of Science, Technology and Policy - CSTEP).

For the purpose, a series of meetings were held in Bangalore – Karnataka, where there were representatives from Shakti, SGArchitects and BMTC, KSRTC, UITP and CSTEP. The section below presents the minutes of meetings held.

**Meeting 1: 25th June 2019, Tuesday**

**Attended by:**

**Mr. Sandeep Gandhi – SGArchitects.**

**Mr. Satyajit Ganguly – SGArchitects.**

**Ms. Christy Ann Cheriyan – Research consultant UITP.**

**Venue:** BMTC Shanti Nagar Bus station complex, 2nd Floor, UITP India.

**Minutes:**

- Meeting started with the design explanation of the K.R. Pura electric bus depot proposal developed by SGArchitects (SGA).
- In this regard, and introduction to the Bus depot guidelines developed by SGArchitects for ASRTU was presented to UITP team by SGA. This was to explain the planning and design standards followed in the depot design.
- UITP team mentioned the design proposal was helpful though she mentioned if the existing infrastructure on the site may be required to be retained or not
- SGA team explained that, for efficient utilization of land and resources, the existing infrastructure may require to be re-organized.

- UITP team mentioned that they have visited the site with BMTC official and what the current suggestion is to provide all chargers at one place along the wall erected along the depot periphery.
- SGA team explained that more efficient operational planning may include providing chargers at bus parking bays so as one charger can at a time be accessed by 2 to 4 buses. This will not require bus movement inside the depot and will also save time and manpower cost. Additionally, the estimated 50 charging points may not be accommodating in the available wall length.
- UITP team suggested that the provided proposal will put up the before MD BMTC for discussion.
- After concluding the depot discussion Mr Sandeep gave a brief introduction of the Long-Range Planning Toolkit for State Transport Undertaking's (STUs). He briefly explained the context of the project and its development till date.
- To this Ms Christy suggested to discuss this with Mr. Anupam Aggarwal – Director security and vigilance, BMTC.

**Meeting 2: 25th June 2019, Tuesday**

**Attended by:**

**Mr. Anupam Aggarwal - Director security and vigilance, BMTC.**

**Mr. M. N Srinivasa- Chief Mechanical Engineer (Maintenance) BMTC.**

**Mr. Vishwanath.K.R. R - Chief Traffic Manager (Operations). BMTC**

**Mr. Vivek Chandran - Shakti**

**Mr. Sandeep Gandhi – SGArchitects.**

**Mr. Satyajit Ganguly – SGArchitects.**

**Ms. Christy Ann Cheriyan – Research consultant UITP.**

**Venue:** BMTC Shanti Nagar Bus station complex, Central office, Bangalore, India.

**Minutes:**

- The meeting was initiated with introduction of the team by Shakti.
- Followed by this Shakti team briefly presented the background of the project to the Director BMTC.
- UITP team added that SGA is also providing hand holding in development of Electric bus depot design at K.R Pura.
- SGA team explained the functionality of tool and highlighted the tool outcomes and benefits.

- SGA team explained that during the previous engagements with other STUs, the tool produced aggregated outputs for Intercity and intracity operations. But in this phase emphasis shall be on city operations separately and thus the team seeks to partner with BMTC. It was also explained that the objective of this partnership would be to work closely with the BMTC team in order to ensure that the toolkit developed is user friendly and user responsive. Additionally, the outcome would be a long-range plan for BMTC.
- Mr. Agarwal expressed his keenness in partnering on the study. He mentioned that the tool outputs shall be very beneficial for BMTC. He said that BMTC is already planning to develop a long-range plan and that the proposed tool will be helpful in that endeavour.
- Mr. Aggarwal introduced Mr. M. N Srinivasa- Chief Mechanical Engineer (Maintenance) BMTC and Mr. Vishwanath.K.R. R - Chief Traffic Manager (Operations) and asked SGArchitects to interact with them for seeking further to explain the specifics of the involvement required along with details of the tools and the long range plans developed for other STUs, using the same.
- The meeting was concluded with Mr. Aggarwal suggesting that SGA and Shakti team share a concept note, which he will discuss with MD BMTC.

**Meeting 3: 25th June 2019, Tuesday**

**Attended by:**

**Mr. Vivek Chandran - Shakti**

**Mr. Vivek Vaidyanathan, Research Scientist, Domain Lead (transport) – CSTEP.**

**Mr. Sandeep Gandhi – SGArchitects.**

**Mr. Satyajit Ganguly – SGArchitects.**

**Ms. Christy Ann Cheriyan – Research consultant UITP.**

**Venue:** BMTC Shanti Nagar Bus station complex, 2nd Floor, UITP India.

**Minutes:**

- SGA team introduced the long-range roadmap developed for Maharashtra State Road Transport Corporation (MSRTC), Andhra Pradesh State Road Transport Corporation (APSRTC) and Jammu and Kashmir State Road Transport Corporation (JKSRTC) and updated CSTEP and UITP team with the development of the tool so far.
- SGA team made a presentation highlighting the outputs derived from long range planning undertaken for APSRTC and MSRTC.

- It was explained that the team is currently upgrading the tool to allow inputs disaggregated by different inter and intracity services.
- SGA team also presented the VBA based input forms designed for the tool.
- CSTEP team appreciated the work done so far and requested SGArchitects for another meeting at the CSTEP office, so as the transport team at their office could be brought up to speed with tool.
- SGA team also shared the technical reports developed for MSRTC and APSRTC with the participants.
- The meeting concluded with an understanding that SGA team will be meeting at CSTEP office with Mr. Vaidyanathan and his technical team and explain the working of the tool in detail.

**Meeting 4: 25th June 2019, Tuesday**

**Attended by:**

**Mr. Vishwanath.K.R. R - Chief Traffic Manager (Operations). BMTC**

**Mr. Vivek Chandran - Shakti**

**Mr. Sandeep Gandhi – SGArchitects.**

**Mr. Satyajit Ganguly – SGArchitects.**

**Venue:** BMTC Shanti Nagar Bus station complex, 2nd Floor – Central Building.

**Minutes:**

- As agreed in meeting with Director security and vigilance, BMTC, representatives from SGArchitects approached Mr. Vishwanath. K.R - CTM (Operations) office for discussion.
- The Shakti team initiated the meeting with introduction of the team members and brief background of the work done so far under development of long-range roadmap development project with other STU's.
- SGA team made a presentation highlighting the outputs derived from long range planning undertaken for APSRTC and MSRTC.
- SGA team explained the functionality of tool and highlighted the tool outcomes and benefits.
- SGA team also explained that the prior exercises done for APSRTC and MSRTC generated aggregated outputs for Intercity and Intracity. But in this phase, the focus will be to upgrade the tool in order to generate disaggregated outputs for Intracity operations and thus seeks to partner with BMTC, to better understand and respond to user requirements.
- Mr. Vishwanath understood the idea and invited his staff to ask any queries they had regarding the tool outputs.

- To this, office staff of Mr. Vishwanath. K.R - CTM (Operations) questioned SGA that the benefits showed are presently are theoretical and how they can be applied practically.
- SGA team explained that the tool generates outputs based on the vision of STU. It is a scenario building tool, allowing the public bus operators to evaluate the impact of different planned intervention on their growth trajectories. The interventions that may need to be planned to achieve higher utilization, efficiency and patronage are not listed in the tool but is already a subject of many other studies.
- The meeting ended on the note that BMTC will be happy to support as partner to the development of the tool and shall aid wherever required. Mr. Vishwanath asked Mr. Gandhi to share the details so that he can discuss the proposal to partner with senior management.

**Meeting 5: 25th June 2019, Tuesday**

**Attended by:**

**Mr. Mr. M. N Srinivasa- Chief Mechanical Engineer (Maintenance) BMTC.**

**Mr. Vivek Chandran - Shakti**

**Mr. Sandeep Gandhi – SGArchitects.**

**Mr. Satyajit Ganguly – SGArchitects.**

**Ms. Christy Ann Cheriyan – Research consultant UITP.**

**Venue:** BMTC Shanti Nagar Bus station complex, 4th Floor – Central Building.

**Minutes:**

- Shakti team initiated the meeting with introduction of the team members and brief background of the work undertaken so far on the development of long-range roadmap development project with other STU's.
- SGA team presented the outputs derived from long range planning undertaken for APSRTC and MSRTC.
- SGA team explained the functionality of tool along with highlights of the tool outcomes and benefits.
- SGA team added that the tool allows scenario development and generates outputs based on the vision of STU. It was explained that at present the tool is in the shape of an excel file, while in the current phase of the project the same is being developed as a toolkit for independent use by STUs. It is also proposed that in this phase additional functionality will be added to the tool allowing it to include service level disaggregated in inputs.

- Mr. Srinivasa found the tool outcomes very beneficial and the meeting ended with an assurance from Mr. Srinivasa and his team will look forward to partnering in the development of the toolkit.

**Meeting 6: 25th June 2019, Tuesday**

**Attended by:**

**Dr K. Rama Murthy, Chief Mechanical Engineer. (KSRTC)**

**Mr. Sandeep Gandhi – SGArchitects.**

**Mr. Satyajit Ganguly – SGArchitects.**

**Venue:** KSRTC Central office, K.H road, Shantinagar, Bengaluru

**Minutes:**

- Dr Rama Murthy - Chief Mechanical Engineer. (KSRTC) requested SGA team to brief about the agenda of the meeting.
- SGA team explained the project context, and the reason for the meeting. It was explained that Shakti has funded the development of long-range plans for four STUs. These plans have proved to be of great interest and utility to these STUs. These long-range plans have been developed using a spread sheet-based model. Shakti is currently funding towards the development of this model into a user-friendly toolkit which can be used by STUs, without any external support. In this endeavour it is considered important to partner with STUs to ensure that the toolkit is user friendly and user responsive. It was explained that in this endeavour, SGA is in talks with BMTC to partner to allow inputs specific to urban only operations, while it seeks to partner with KSRTC and seek inputs for use on both urban and non-urban operations. It was also explained that as an outcome a long-range plan will be developed for KSRTC using this tool.
- SGA team shared the technical summary report developed based on the work undertaken for JKSRTC, APSRTC and MSRTC.
- Dr Murthy had a quick go through the report shared. He found it interesting and understood the project intentions.
- Dr Murthy suggested Mr. Gandhi to share the project details and concept note with him. He suggested that he will discuss the concept note with his MD, basis which the discussion on collaboration can be taken forward.
- The meeting concluded on the note that he shall revert back with a concept note on the study and collaboration sought from KSRTC.

**Meeting 7: 26th June 2019, Tuesday**

**Attended by:**

**Mr. Mr. Vivek Vaidyanathan, Research Scientist, Domain Lead (transport) – CSTEP.**

**CSTEP - Transport team**

**Mr. Sandeep Gandhi – SGArchitects.**

**Mr. Satyajit Ganguly – SGArchitects.**

**Venue:** CSTEP Office, Bengaluru

**Minutes:**

- The meeting started with a round of introduction.
- A discussion on the description of previous projects undertaken were shared by both the teams. During this discussion SGArchitects shared their recently developed Bus terminal and depot guidelines for ASRTU with the CSTEP team.
- CSTEP team enquired if SGA project reports were available in public domain.
- SGA team informed that these reports can be accessed from SGA or shakti website.
- SGA team initiated the meeting with an introduction to Long Range Planning Toolkit Development project context and revealed the task undertaken so far for the different STU's as a follow up to the current project. This included a presentation on various details regarding the inception of the long-range plan development, spread sheet model development, different scenario building and the outcomes generated.
- SGA team explained the expected outcomes of the current project.
- CSTEP team enquired on the source of the data for the proposed toolkit.
- SGA team explained that the trips and mode share were calculated based on the census data whereas key operational parameters like average occupancy, fleet utilization, operation efficiency etc were extracted from the data provided by each STU. He also added the mode share determined for the STU form the basis of scenario building and other projections.
- CSTEP team understood the functionality of the tool but enquired if the tool can be advanced further to estimate demand. They explained that in cities competing transport projects effect demand, and it would be appropriate if the tool can account for these factors and estimate future demand, in addition to estimating outputs in different scenarios in response to that demand.
- SGA team explained that estimating demand requires and accurate assessment of coefficients and elasticity of different parameters such as travel distance cost, comfort, etc. To estimate these parameters is not easy and different set of data is required apart from classification of population by travel distance income levels, mode access, etc. The current project assumes

that such disaggregated outputs will be the subject of additional detailed studies. However, the possibility is open that future version of the tool may allow this functionality. It was explained that the intended tool is an aggregated vision and scenario building model. It allows modelling of impacts of different interventions on the growth trajectory and financial health of a STU. Here the demand data relates to policy direction and city vision, or outcome of other studies. Therefore, the demand input is defined as expected/desired mode share. It was also explained that the tool provides flexibility to the user for building profitability scenario triggering the vital operational parameters.

- While presenting the graphs SGA team was also questioned about the particular pattern found in cost and revenue graphs. To this it was explained that the tool also incorporates the fleet age, and that effect the pattern of budgetary requirement. In years when a large number of buses reach their service life, a large number of new buses need to be purchased to replace them, which reflects in a spike in budgetary requirement for that year.
- SGA team also presented VBA based input forms designed to capture data for the tool.
- The meeting was concluded with both SGA and CSTEP teams agreeing to collaborate further on the use and development of the tool.

### 7.2.2 Meeting :2

# Building a Long-Range Planning Toolkit for State Transport Undertaking's (STUs)

**Meeting minutes**

19th 20th and 21st August 2019

**Meeting Agenda:** To collect STU data from Bangalore Metropolitan Transport Corporation - BMTC for long-range planning toolkit, to initiate discussion with Karnataka State Road Transport Corporation – KSRTC as non-urban state transport undertaking (STU) partner for the project and seeking outreaching partners such as UITP and Directorate of Urban Land Transport (DULT) for for technical Support and capacity building of public bus companies in Karnataka. For the purpose, a series of meetings were held in Bangalore – Karnataka, where there were representatives from SGArchitects and BMTC, KSRTC, UITP and DULT.

The section below presents the minutes of meetings held.

**Meeting 1: 19th August 2019, Monday**

**Attended by:**

**Mr. Sandeep Gandhi – SGArchitects.**

**Mr. Satyajit Ganguly – SGArchitects.**

**Mr. Ravi Gadepalli - Consultant UITP**

**Ms. Christy Ann Cheriyan – Research consultant UITP.**

**Venue: BMTC Shanti Nagar Bus station complex, 2nd Floor, UITP India.**

**Minutes:**

- Meeting started with the update over the work taken forward for the development of the long-range planning tool kit after the last visit.
- In this regard, SGA informed Mr. Ravi about the checklist developed for data collection.
- UITP team mentioned that along with the long-range planning tool kit, assistance on micro planning exercises like development of sample design templates for terminals and depots, review of the existing infrastructure design layouts along with the costing and financial implications will also be beneficial for BMTC.
- To this SGA team explained that, they will be happy to provide such help if it is asked for and will also convey the suggestion to Shakti for consideration of including the same as part of scope of work under the mentioned project.
- Mr. Ravi suggested SGA, DULT can provided detailed insights on the works undertaken for mobility and Bus transportation in the city. For the purpose Mr. Ravi, scheduled a meeting with DULT and concluded the meeting.

**Meeting 2: 19th August 2019, Monday**

**Attended by:**

**Ms. Veena - Joint Director, DULT.**

**Mr. Shamanth Kuchangi - DULT.**

**Mr. Sandeep Gandhi – SGArchitects.**

**Mr. Satyajit Ganguly – SGArchitects.**

**Mr. Ravi Gadepalli - Consultant UITP**

**Venue: DULT office, BMTC Shanti Nagar Bus station complex, 4$^{th}$ Floor B- Block, Bangalore, India.**

**Minutes:**

- The meeting initiated with introduction of the SGA team to DULT officials by Mr. Ravi.
- Followed by this SGA briefly presented the background of the project to the DULT team.
- Mr Ravi (UITP) added the need and usability of the long-range plan to DULT team.
- DULT team appreciated the initiative.
- Mr. Shamanth from DULT mentioned that presently they are working public transport infrastructure and street development.
- During the discussion DULT highlighted that presently the projects undertaken are only focussed on infrastructural issues and not for the need of the bus and people.

- DULT team explained that the solutions outwards to inwards is completely missing. Ms. Veena joint director DULT said that long range planning will be more suitable for the agencies and while Integrated mobility solutions are more needed.
- To this, SGA informed the DULT team that they have worked on design development of terminals and depots for Andhra Pradesh and Himachal Pradesh. Under this they developed some demonstrative plans giving priority to demand and mobility rather than architecture and aesthetics. SGA team explained that the long-range plan will assure the phase wise requirement and budget of these facilities and accordingly the micro planning exercise can be phased out.
- Mr. Ravi added that along with this SGA can also review the existing plans.
- To this DULT suggested SGA to submit a proposal with concept note so that MOU can be signed in order to take work further.
- SGA team ensured to share the concept note with DULT. It was also conveyed to the DULT team that SGA will ask Shakti to include the micro exercises as a complimentary to the present work.
- Mr. Gandhi suggested for internal capacity building with two or three workshops arranged across the departments and training sessions for the officials regarding planning and designing of the bus infrastructure based on the bus terminal and depot design guidelines.
- DULT team appreciated the idea and agreed upon to incentivise the innovative design solutions developed based on the training given.
- The meeting concluded with SGA sharing the hardcopies of the bus terminal and depot design guidelines with DLTU.

**Meeting 3: 20th August 2019, Tuesday**

**Attended by:**

**Mr. Vishwanath.K.R. R - Chief Traffic Manager (Operations). BMTC**

**Mr. Sandeep Gandhi – SGArchitects.**

**Mr. Satyajit Ganguly – SGArchitects.**

**Mr. Ravi Gadepalli - Consultant UITP**

**Venue: BMTC Shanti Nagar Bus station complex, 2nd Floor, UITP India.**

**Minutes:**

- During the last visit to BMTC, SGA team already had an interaction and introduction of the long-range roadmap with Mr. Viswanath, so the meeting initiated with the work undertaken for the project so far.
- Following this, SGA team presented the data collection checklist to Mr. Vishwanath and explained that the prior work done was for intercity as well intracity services but for this phase

the focus shall be on urban services. SGA team also clarified that the prior work done was in spreadsheet model which will be upgraded as a VBA based Long range planning tool.

- Mr. Viswanath understood the need and gave a go-ahead for the project and promised to support SGA team in developing the tool and provide the required STU data.
- Mr. Vishwanath mentioned that long term plan is good but BMTC would a require shorter or medium phase wise outputs for E.g. fleet estimate for next 5 or 10 years. He explained that this shall be more beneficial for the STU to take up the outputs to execution level.
- SGA team explained that the tool generates output for each individual year for next 33 years and so phase wise results can be generated. SGA illustrated the outputs with help of the MSRTC report.
- To this, Mr Ravi (UITP) added that along with the long-range plan, bus infrastructure development strategies can also be developed as the part of this project.
- Further, for the ease of data collection, Mr. Vishwanath appointed Ms Soumya (BMTC) as the nodal person and asked SGA team to contact with her for required data.
- Mr. Vishwanath asked SGA team to keep him well informed about the development of the long-range tool.
- The meeting concluded with assurance of SGA team to keep BMTC informed about the development of the long-range tool.

**Meeting 4: 20th June 2019, Tuesday**

**Attended by:**

**Mr. Sandeep Gandhi – SGArchitects.**

**Mr. Satyajit Ganguly – SGArchitects.**

**Ms. Soumya (Operations). BMTC**

**Venue: BMTC Shanti Nagar Bus station complex, 2nd Floor – Central Building.**

**Minutes:**

- As agreed in meeting with Mr. Vishwanath. K.R - CTM (Operations) SGA team met Ms Soumya for discussion.
- The SGA team initiated the meeting with introduction of the team members and brief background of the work done so far under development of long-range roadmap development project with other STU's.
- SGA team made a presentation highlighting the outputs derived from long range planning undertaken for APSRTC and MSRTC.
- SGA team explained the functionality of tool and highlighted the tool outcomes and benefits.
- SGA team also explained that the prior exercises done for APSRTC and MSRTC generated aggregated outputs for Intercity and Intracity. But in this phase, the focus will be to upgrade

the tool in order to generate disaggregated outputs for Intracity operations and thus seeks to partner with BMTC, to better understand and respond to user requirements.

- Ms. Soumya understood the idea and enquired how loss reduction can be achieved.
- To this, SGA team explained that the loss reduction strategies are been provided as a separate section in the prior work done for MSRTC and APSRTC.
- SGA team shared the data collection checklist with Ms Soumya.
- Ms Soumya studied the checklist and stated that she will provide the required data. She also mentioned that some of the data inputs are to be collected from statistical department.
- While discussing the checklist SGA team realised that the checklist can be modified for the ease of data collection. For this SGA team informed Ms Soumya that they will revise and modify the checklist and will share them on same day. Later on, SGA team modified the checklist and shared them.
- During the discussion, Ms. Soumya informed about the service distribution of BMTC which SGA team categorised accordingly.
- For the statistical data, Ms Soumya introduced SGA team with Ms Shailaja, Assistant statistical officer BMTC.

**Meeting 5: 20th June 2019, Tuesday**

**Attended by:**

**Ms. Shailaja -Assistant statistical officer BMTC.**

**Ms. Soumya (Operations). BMTC**

**Mr. Sandeep Gandhi – SGArchitects.**

**Mr. Satyajit Ganguly – SGArchitects.**

**Venue: BMTC Shanti Nagar Bus station complex, 4th Floor – Central Building.**

**Minutes:**

- Ms Soumya took SGA team to Ms Shailaja's office where SGA team briefed her about the project and asked for help regarding provision of data for the project.
- SGA team presented the data collection checklists to Ms Shailaja.
- Ms. Shailaja understood the need and said SGA team that she will help in providing the required data but firstly she will review and discuss the forms with chief Statistical officer.
- Ms. Shailaja said that she will require some time for the purpose but gave assurance to SGA team for the data provision and concluded the meeting.

**Meeting 6: 21st August 2019, Wednesday**

**Attended by:**

**Mr. Srinivas – Chief Statistical Officer (BMTC)**

**Mr. Prasanna Kumar -Operations (BMTC)**

**Ms. Shailaja -Assistant statistical officer BMTC.**

**Ms. Soumya (Operations). BMTC**

**Mr. Sandeep Gandhi – SGArchitects.**

**Mr. Satyajit Ganguly – SGArchitects.**

**Venue: BMTC Shanti Nagar Bus station complex, 4th Floor – Central Building.**

**Minutes:**

- As agreed in the prior meeting SGA team approached Ms. Soumya for the required data.
- Ms. Soumya informed SGA team that she got the revised checklist format and it may take some time to process the data.
- She assured SGA team that she will provide the data through mail or Telephonic conversation as soon as the data gets compiled according to the required format.
- For the statistical data, SGA team approached Ms Shailaja accompanied by Ms Soumya.
- Ms Shailaja Introduced SGA team to Mr. Srinivas – Chief Statistical Officer BMTC.
- SGA team presented a brief introduction to the BMTC officials and expressed their interest in data collection.
- To this Mr. Prasanna assured the provision of required data after reviewing the checklist and discussion with statistical department officials.
- The meeting concluded on the note that after reviewing the checklist the data will be provided to SGA team through mails as soon as possible.

**Meeting 7: 21st August 2019, Wednesday**

**Attended by:**

**Dr K. Rama Murthy, Chief Mechanical Engineer. (KSRTC)**

**Mr. Sandeep Gandhi – SGArchitects.**

**Mr. Satyajit Ganguly – SGArchitects.**

**Venue: KSRTC Central office, K.H road, Shantinagar, Bengaluru**

**Minutes:**

- Dr Rama Murthy - Chief Mechanical Engineer. (KSRTC) requested SGA team to brief about the project status.
- SGA team explained the project context, and the reason for the meeting. It was explained that Shakti has funded the development of long-range plans for four STUs. These plans have proved to be of great interest and utility to these STUs. These long-range plans have been developed using a spread sheet-based model. Shakti is currently funding towards the development of this model into a user-friendly toolkit which can be used by STUs, without any external support. In this endeavour it is considered important to partner with STUs to ensure that the toolkit is user friendly and user responsive. It was explained that in this endeavour,

SGA has already partnered BMTC to allow inputs specific to urban only operations, while it seeks to partner with KSRTC and seek inputs for use on both urban and non-urban operations. It was also explained that as an outcome a long-range plan will be developed for KSRTC using this tool.

- For reference SGA team shared the detailed technical report developed based on the work undertaken for MSRTC.
- Dr Murthy had a quick go through the report shared. He found it interesting and understood the project intentions.
- Dr Murthy suggested Mr. Gandhi to share the project details and concept note with the Manging Director M.D. KSRTC. He said that as soon as MD gives approval, discussion on collaboration can be taken forward.
- The meeting concluded on the note that SGA will share a concept note on the study and collaboration sought from KSRTC.

### 7.2.3 Meeting :3

## Building a Long-Range Planning Toolkit for State Transport Undertaking's (STUs)

**Meeting minutes**

24th September 2019

**Meeting Agenda:** To discuss and update the progress of long-range planning toolkit with Bangalore Metropolitan Transport Corporation – BMTC and to collect the missing data provided in checklist shared by SGArchitects. For the purpose, a meeting was held in Bangalore – Karnataka, where representative from SGArchitects and BMTC participated. The section below presents the minutes of meetings held.

**Attended by:**

**Mr. Sandeep Gandhi – SGArchitects.**

**Ms. Shailaja -Assistant statistical officer BMTC.**

**Venue: BMTC Shanti Nagar Bus station complex, 2nd Floor, UITP India.**

**Minutes:**

- Mr Gandhi met Ms Shailaja's at her office where he briefed her about the project proceedings so far.
- Mr. Gandhi informed her that he has received the data required but some statistical data points are to be re -confirmed such as service wise EPK, CPK etc.
- To this, Ms Shailaja's provided the required data to Mr Gandhi and meeting concluded.

- After the meeting, Mr. Gandhi met Mr. Anupam Aggarwal - Director security and vigilance, BMTC and updated him about the progress of the tool. He also asked if he can get some vision data for testing the tool.
- To this Mr. Aggarwal asked Mr. Gandhi to seek insights from Mr. Ravi (UITP).
- Mr. Gandhi met Mr. Ravi and asked for the vision insights.
- Due to time constraints Mr. Ravi told Mr. Gandhi that he shall provide the insights over conference call, which was later conveyed to Mr. Satyajit Ganguly.
- The meeting concluded on the note that SGA team will test the tool with the data provided and will discuss further with BMTC officials.

### 7.2.4 Meeting :4

## Building a Long-Range Planning Toolkit for State Transport Undertaking's (STUs)

**Meeting minutes**

9th to 11th December 2019

**Meeting Agenda:** To update BMTC about tool upgradation, displaying the test scenario outputs generated by the FLEET tool, to validate the data inputs considered for the test scenario and discuss the vision data in order to develop further scenarios with the STU officials and out reaching partners- UITP. For the purpose a series of meetings were held at BMTC office Shantinagar- Bangalore, India, where there were representatives from BMTC, UITP and SGArchitects. The section below presents the minutes of meetings held.

**Meeting 1: 9th December 2019, Monday**

**Attended by:**

**Mr. Ravi Gadepalli – UITP.**

**Ms. Christy – UITP.**

**Mr. Sandeep Gandhi – SGArchitects.**

**Mr. Satyajit Ganguly – SGArchitects.**

**Mr. Kartikay Kochhar – SGArchitects.**

**Venue:** UITP Office,2nd Floor, BMTC Building, Shantinagar, Bengaluru, India.

**Minutes:**

- SGA team presented the VBA based FLEET tool to the UITP representatives. Inputs inserted in each of the user forms where explained.

- UITP liked the tool and appreciated the work.
- UITP suggested that the tool should have mentions of terminal and depot guidelines, in the infrastructure form as the base calculations were based on the standards and the norms suggested asper these guidelines.
- UITP representatives desired that the tool should be able to communicate the user about input required to be filled i.e. information boxes against the input boxes were suggested to be added in the forms.
- UITP also recommended that the vision forms should display the base year values for each parameter so that it will be more helpful inserting the vision data.

**Meeting 2: 9th December 2019, Monday**

**Attended by:**

**Mr. Vishwanath.K.R. R - Chief Traffic Manager (Operations). BMTC**

**Mr. Ravi Gadepalli – UITP.**

**Mr. Sandeep Gandhi – SGArchitects.**

**Mr. Satyajit Ganguly – SGArchitects.**

**Mr. Kartikay Kochhar – SGArchitects.**

**Venue:** BMTC Office,2nd Floor, BMTC Building, Shantinagar, Bengaluru, India.

**Minutes:**

- SGA team updated Mr. Vishwanath about the tool upgradation and expressed their desire to discuss the outputs generated by the tool for the test case scenario.
- Mr. Vishwanath agreed to the SGA request but mentioned that this shall require presence of the heads from all concerned departments – Traffic, statistics, operations and accounts.
- For this purpose, it was suggested to mobilize an official letter to all concerned departments of BMTC so that the meeting could be held in presence of all.

**Meeting 3: 10th December 2019, Tuesday**

**Attended by:**

**Mr. Anupam Aggarwal – Director S&V, BMTC.**

**Mr. Prasanna – Statistical Dept. BMTC**

**Mr. Ravi Gadepalli – UITP.**

**Mr. Sandeep Gandhi – SGArchitects.**

**Mr. Satyajit Ganguly – SGArchitects.**

**Mr. Kartikay Kochhar – SGArchitects.**

**Venue:** BMTC Office, 4th Floor, BMTC Building, Shantinagar, Bengaluru, India.

**Minutes:**

- SGA team and UITP representative met Mr. Aggarwal and explained the agenda of the visit.
- Mr. Aggarwal expressed his interest to see the VBA based fleet tool and the outputs generated.
- Team SGA presented the VBA based FLEET tool to BMTC officials.
- BMTC officials appreciated the work and showed their keen interest at the outputs generated by the tool.
- BMTC officials advised SGA if they can include a separate form with the specific data inputs like number of staff, fleet( Held as well on road) ,routes, scheduled km , trip length etc so that the derivatives like bus to staff ratio, fleet utilization , vehicle utilization, load factor etc can be generated by the tool automatically. Mr. Aggarwal mentioned that doing this will be beneficial to generate précised outputs. SGA agreed to the suggestion.
- Regarding output generated, BMTC suggested SGA to limit outcomes till 2030 to which SGA agreed.
- SGA requested BMTC if their officials can sit together and scrutinize the input values considered in the test scenario and subsequently discuss the vision inputs for scenario building.
- BMTC agreed to the proposed request and appointed BMTC representatives the statistical department to scrutinize the tool inputs and discuss the vision data. Additionally, Mr. Aggarwal also asked the BMTC officials to review the tool and flag their suggestion as part of the process. He also asked SGA team to share the VBA version of the FLEET tool so that he can also have some detailed understanding of the tool and accordingly provide his inputs.

**Meeting 4: 10th December 2019, Tuesday**

**Attended by:**

**Mr. Srinidhi – Statistical Department BMTC**

**Mr. Krishna.M.S. – Statistical Department BMTC**

**Mr. Sandeep Gandhi – SGArchitects.**

**Mr. Satyajit Ganguly – SGArchitects.**

**Mr. Kartikay Kochhar – SGArchitects.**

**Venue:** BMTC Office, 5th Floor, BMTC Building, Shantinagar, Bengaluru, India.

**Minutes:**

- Team SGA presented the VBA based FLEET tool to BMTC officials.
- Each form was elaborated in detail and the input values were discussed with BMTC officials.
- During the process correction in the base year values suggested by BMTC officials were incorporated by SGA team.
- Desired inputs for vision forms were also discussed during the meeting.
- For traffic data such as daily ticket sale, number of routes and route lengths the officials asked SGA team to refer traffic and operations department.
- The meeting concluded freezing the base values and vision data for scenario building. Subsequently the traffic data was also collected from traffic and operations department.

**Meeting 5: 10th December 2019, Tuesday**

**Attended by:**

**Mr. Ravi Gadepalli – UITP.**

**Mr. Sandeep Gandhi – SGArchitects.**

**Mr. Satyajit Ganguly – SGArchitects.**

**Mr. Kartikay Kochhar – SGArchitects.**

**Venue:** UITP Office, 2nd Floor, BMTC Building, Shantinagar, Bengaluru, India.

**Minutes:**

- SGA team reverted to UITP in order to overview the corrected data for scenario building in the tool for BMTC.
- UITP reviewed the revised input data and suggested additional inputs to SGA team. These suggested modifications were based on the UITP projections worked out for BMTC.
- UITP also suggested SGA team to review and compare the input data with the comprehensive mobility plan - Bengaluru. (CMP) data.
- SGA team and UITP mutually agreed upon to develop scenarios based on the inputs suggested by BMTC, UITP projections and CMP data.

**Meeting 6: 11th December 2019, Wednesday**

**Attended by:**

**Mr. Ravi Gadepalli – UITP.**

**Mr. Sandeep Gandhi – SGArchitects.**

**Mr. Satyajit Ganguly – SGArchitects.**

**Mr. Kartikay Kochhar – SGArchitects.**

**Venue:** UITP Office, 2nd Floor, BMTC Building, Shantinagar, Bengaluru, India.

**Minutes:**

- As decided SGA team worked out a comparative analysis based on inputs suggested by BMTC, UITP projections and CMP data and developed a scenario and presented it to UITP representative.
- The critical outcomes like fleet, cost and budgetary requirements were discussed mutually agreed upon between SGA team and UITP.
- It was further decided that SGA will develop various other scenarios based on inputs collected from BMTC, UITP projections as well CMP data.
- UITP advised SGA team to assemble a crisp and concise two pager based on the outputs generated according to the decided scenarios and share it with BMTC and UITP as way forward.

**Meeting 6: 11th December 2019, Wednesday**

**Attended by:**

**Mr. Anupam Aggarwal – Director S&V, BMTC.**

**Mr. Sandeep Gandhi – SGArchitects.**

**Mr. Kartikay Kochhar – SGArchitects.**

**Venue:** UITP Office, 4th Floor, BMTC Building, Shantinagar, Bengaluru, India.

**Minutes:**

- Subsequently SGA team presented the scenario developed based on the modifications suggested by BMTC and UITP with the Director S&V, BMTC.
- SGA conveyed that they would develop more scenarios and will share the same with BMTC for review.

## 7.3 List of inputs

| S. No. | List of Inputs – Fleet estimation Tool |
|---|---|
| | **STU specific Input Data** |
| 1 | STU Name |
| 2 | Data year |
| 3 | Operation type (Intercity/Intracity /Both) |
| 4 | Type of Buses |
| 5 | Type of Services |
| 6 | Tourist Data year |
| 7 | Mode share specific by Fleet or Trips |
| 8 | Bus type Name for each Service type - Intercity and Intracity |
| 9 | Seating Capacity for each Service type - Intercity and Intracity |

| | |
|---|---|
| 10 | Percent of fleet size with age <=1 year for each Service type - Intercity and Intracity |
| 11 | Percent of fleet size with age >1 to 2 years for each Service type- Intercity and Intracity |
| 12 | Percent of fleet size with age >2 to 3 years for each Service type- Intercity and Intracity |
| 13 | Percent of fleet size with age >3 to 4 years for each Service type- Intercity and Intracity |
| 14 | Percent of fleet size with age >4 to 5 years for each Service type - Intercity and Intracity |
| 15 | Percent of fleet size with age >5 to 6 years for each Service type- Intercity and Intracity |
| 16 | Percent of fleet size with age >6 to 7 years for each Service type- Intercity and Intracity |
| 17 | Percent of fleet size with age >7 to 8 years for each Service type- Intercity and Intracity |
| 18 | Percent of fleet size with age > 8 to 9 years for each Service type- Intercity and Intracity |
| 19 | Percent of fleet size with age > 9 to 10 Years for each Service type- Intercity and Intracity |
| 20 | Percent of fleet size with age >10 to 11 years for each Service type- Intercity and Intracity |
| 21 | Percent of fleet size with age >11 to 12 years for each Service type- Intercity and Intracity |
| 22 | Percent of fleet size with age >12 to 13years for each Service type- Intercity and Intracity |
| 23 | Percent of fleet size with age >13 to 14 years for each Service type- Intercity and Intracity |
| 24 | Percent of fleet size with age >14 to 15 years for each Service type- Intercity and Intracity |
| 25 | Percent of fleet size with age > 15 years for each Service type- Intercity and Intracity |
| 26 | Cost of Buses for each Service type- Intercity and Intracity |
| 27 | Age limit for the buses for each Service type- Intercity and Intracity |
| 28 | Fleet Strength for each Service type- Intercity and Intracity |
| 29 | Fleet Utilization for each Service type- Intercity and Intracity |
| 30 | Earning Per Kilometer for each Service type- Intercity and Intracity |
| 31 | Cost per Kilometer for each Service type- Intercity and Intracity |
| 32 | Average Daily Kilometers (scheduled) for each Service type- Intercity and Intracity |
| 33 | Average Route Length for each Service type- Intercity and Intracity |
| 34 | Daily Passenger Trip or Daily ticket sales for each Service type- Intercity and Intracity |
| 35 | Annual Passes held for each Service type- Intercity and Intracity |
| 36 | Vehicle Utilization for each Service type- Intercity and Intracity |
| 37 | % Load factor for each Service type- Intercity and Intracity |
| 38 | Staff to Bus ratio for each Service type- Intercity and Intracity |
| 39 | Total Operational routes for each Service type- Intercity and Intracity |
| 40 | Total Operational hours for each Service type- Intercity and Intracity |
| 41 | Average Daily Dead Kilometers Total Operational routes for each Service type- Intercity and Intracity |
| | **Infrastructure Input Data** |
| 42 | Total number of developed depot sites |
| 43 | Total number of developed terminal sites |
| 44 | Area Under depots -existing |
| 45 | Area Under terminal -existing |
| 46 | Land area allocated for depots |

| | |
|---|---|
| 47 | Land area allocated for terminals |
| | **Vision Input Data** |
| 48 | Desired Fleet Composition for each Service type- Intercity and Intracity |
| a | Desired Projection Trajectory – Linear/Logarithmic/ exponential |
| b | Desired Rate of Change |
| 49 | Desired Fleet Utilization for each Service type- Intercity and Intracity |
| a | Desired Projection Trajectory – Linear/Logarithmic/ exponential |
| b | Desired Rate of Change |
| 50 | Desired Vehicle Utilization for each Service type- Intercity and Intracity |
| a | Desired Projection Trajectory – Linear/Logarithmic/ exponential |
| b | Desired Rate of Change |
| 52 | Desired average occupancy for each Service type- Intercity and Intracity |
| a | Desired Projection Trajectory – Linear/Logarithmic/ exponential |
| b | Desired Rate of Change |
| 53 | Desired earning per Kilometer for each Service type- Intercity and Intracity |
| a | Desired Projection Trajectory – Linear/Logarithmic/ exponential |
| b | Desired Rate of Change |
| 54 | Desired cost per kilometer for each Service type- Intercity and Intracity |
| a | Desired Projection Trajectory – Linear/Logarithmic/ exponential |
| b | Desired Rate of Change |
| 55 | Desired Staff ratio for each Service type- Intercity and Intracity |
| a | Desired Projection Trajectory – Linear/Logarithmic/ exponential |
| b | Desired Rate of Change |
| 56 | Desired operation routes for each Service type- Intercity and Intracity |
| a | Desired Projection Trajectory – Linear/Logarithmic/ exponential |
| b | Desired Rate of Change |
| 57 | Desired average route length for each Service type- Intercity and Intracity |
| a | Desired Projection Trajectory – Linear/Logarithmic/ exponential |
| b | Desired Rate of Change |
| 58 | Desired Mode share of the STU buses - Intercity and Intracity less than 10 km |
| a | Desired Projection Trajectory – Linear/Logarithmic/ exponential |
| b | Desired Rate of Change |
| 59 | Desired Mode share of the STU buses - Intercity and Intracity more than 10 km |
| a | Desired Projection Trajectory – Linear/Logarithmic/ exponential |
| b | Desired Rate of Change |
| 60 | Desired Mode share of the other buses - Intercity and Intracity less than 10 km |
| a | Desired Projection Trajectory – Linear/Logarithmic/ exponential |
| b | Desired Rate of Change |
| 61 | Desired Mode share of the other buses - Intercity and Intracity more than 10 km |
| a | Desired Projection Trajectory – Linear/Logarithmic/ exponential |
| b | Desired Rate of Change |
| 62 | Desired Mode share of the IPT - Intercity and Intracity less than 10 km |
| a | Desired Projection Trajectory – Linear/Logarithmic/ exponential |
| b | Desired Rate of Change |

| | |
|---|---|
| 63 | Desired Mode share of the IPT - Intercity and Intracity more than 10 km |
| a | Desired Projection Trajectory – Linear/Logarithmic/ exponential |
| b | Desired Rate of Change |
| | **General Input Data** |
| 64 | Urban Population |
| 65 | Rural Population |
| 66 | Urban Population Growth rate |
| 67 | Rural Population Growth rate |
| 68 | Tourist Population Growth rate |
| 69 | Work trips by all modes – Intercity and Intracity (Less than 10 km and more than 10 kms respectively) |
| 70 | Educational Trips – Intercity and Intracity |
| 71 | Tourist Trips by all modes (Bus, IPT) – Intercity and Intracity (Less than 10 km and more than 10 kms respectively) |
| 72 | STU daily Passenger trips – Intercity and Intracity |

## 7.4 List of default values

| S.no | List of Default Values: |
|---|---|
| 1 | > 10km Work Bus trips origin from other states (travelling to state) as percent of work bus trips in state |
| 2 | > 10km Education Bus trips origin from other states (travelling to state) as percent of work bus trips in state |
| 3 | > 10km Non work (and non-tourist) trips bus trips origin from other states (travelling to state) as percent of work bus trips in state |
| 4 | Percent of education trips less than 10km in urban areas |
| 5 | Percent of education trips less than 10km in rural areas |
| 6 | Percent of intercity work trips >10km originating from urban area |
| 7 | Percent of intercity education trips >10km originating from urban area |
| 8 | Percent of intercity non-work trips >10km originating from urban area |
| 9 | Non-Work bus trips origin from State (travelling outside state) as percent of non-work bus trips in state |
| 10 | Percent of education trips less than 10km by buses in urban area |
| 11 | Intra city non work trips <10km by bus |
| 12 | Percent of same day non work trips by city bus |
| 13 | Percent of overnight non work trips less than 10km |
| 14 | Percent of overnight non work trips by city bus |
| 15 | Percent of same day education trips less than 10km by public buses in rural areas |
| 16 | Percent of same day education trips more than 10km by public buses in urban areas |
| 17 | Percent of same day education trips more than 10km by public buses in rural areas |
| 18 | Intercity non work trips <10km by bus |
| 19 | Intercity non work trips >10km by bus |
| 20 | Percent of STU Intra city trips <10km as percent of total intra city trips by bus |
| 21 | Percent of STU Intercity trips <10km as percent of total intercity trips by bus |
| 22 | Percent of STU Intra city trips >10km as percent of total intra city trips by bus |

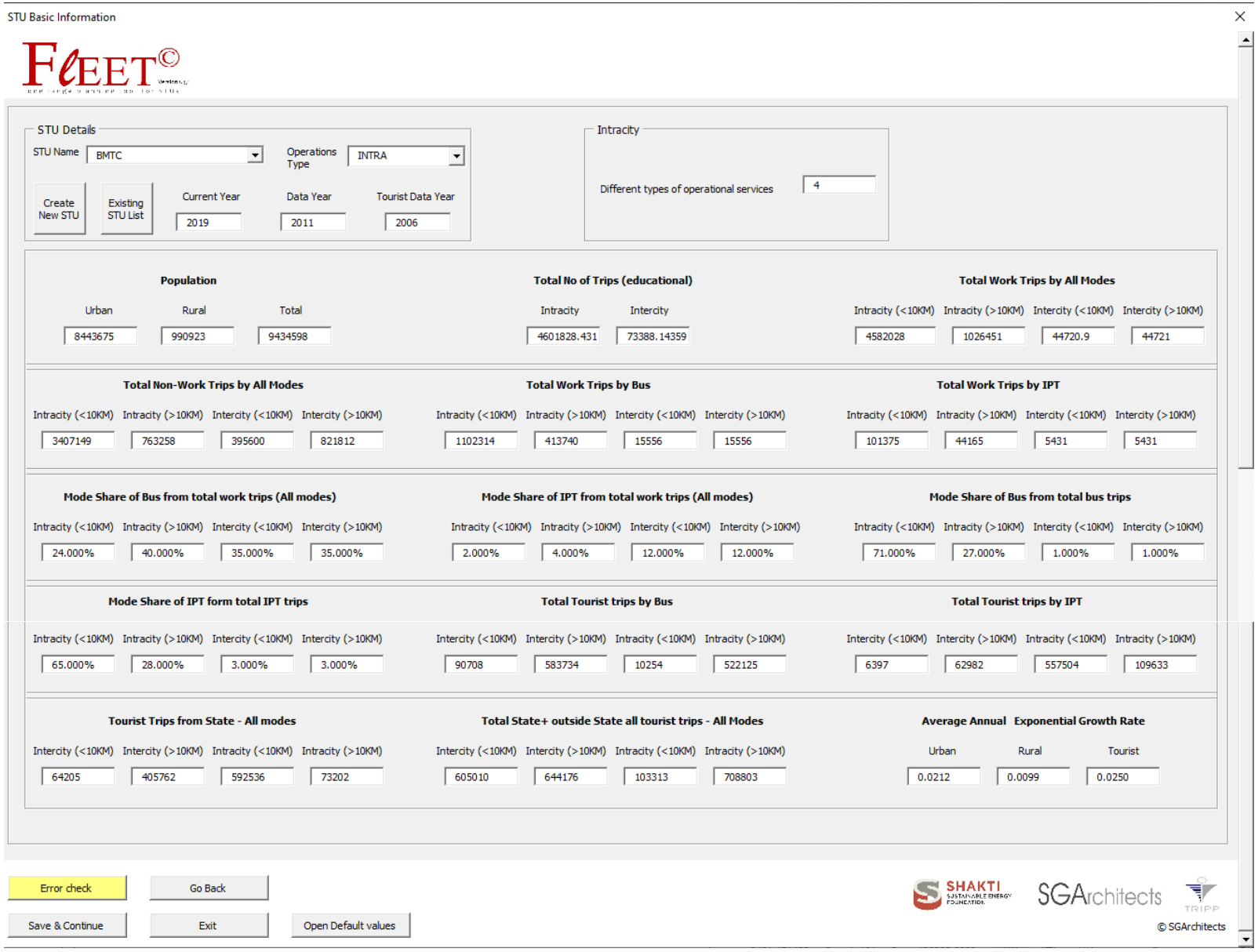
| | |
|---|---|
| 23 | Percent of STU Intercity trips >10km as percent of total intercity trips by bus |
| 24 | Work IPT trips origin from outside state (travelling to state) as percent of work IPT trips in state |
| 25 | Percent of same day education trips less than 10km by IPT in urban areas |
| 26 | Intra city non work trips <10km by IPT |
| 27 | Percent of same day education trips less than 10km by IPT in rural areas |
| 28 | Intercity non work trips <10km by IPT |
| 29 | Percent of same day education trips more than 10km by IPT in urban areas |
| 30 | Intra city non work trips >10km by IPT |
| 31 | Percent of same day education trips more than 10km by IPT in rural areas |
| 32 | Intercity non work trips >10km by IPT |
| 33 | Land Required per bus for intercity depot development (sqm) |
| 34 | Average Inter City Depot Capacity (buses) |
| 35 | Land Required per bus for intercity terminal development |
| 36 | % of non-local STU buses using intercity terminal (as % of STU buses) |
| 37 | Average Intercity terminal capacity |

## 7.5 List of outputs

| S no | List of Outputs: FlEET Tool |
|---|---|
| **1** | Year wise Budgetary Requirement (Crores) for Fleet and Infrastructure |
| **2** | Year Wise Budgetary Requirement for intercity and Intra city Services |
| **3** | Expected Year wise Land (Hectares) and Fleet Acquisition Requirement |
| **4** | Expected Year wise Growth in Seat Requirement |
| **5** | Expected Year wise Depot and Terminal Development Requirement |
| **6** | Year wise Bus Fleet Procurement Requirement |
| **7** | Expected Year wise Fleet Growth |
| **8** | Expected Year wise Cumulative Land Requirement for Fleet |
| **9** | Expected Year wise Cumulative Fleet and Land Requirement |
| **10** | Expected Year wise Growth in Number of Trips |
| **11** | Expected Year wise Growth in Bus Trips |
| **12** | Expected Year wise Growth in daily passenger PT Trips |
| **13** | Year wise Bus Trips by Purpose |
| **14** | Year wise Trips by Distance |
| **15** | Year wise PT mode share (<=10km) |
| **16** | Year wise PT mode share (>10km) |
| **17** | Expected/Planned Annual Services Efficiency Improvement |
| **18** | Expected/Planned Annual Services Occupancy Improvement |
| **19** | Expected/Planned Annual Services Fleet Utilization Improvement |
| **20** | Annual Additional Staff Recruitment Requirement |
| **21** | Total Staff Strength |
| **22** | Expected Staff to Vehicle Ratio |
| **23** | Projected Number of Routes |
| **24** | Projected Headway (Minutes) |

| | |
|---|---|
| **25** | Expected Trip lengths Intracity and intercity |
| **26** | Expected Operating cost Intra and Intercity |
| **27** | Expected Annual Operating cost, Earning and Total profit -Intercity and Intracity |
| **28** | Total Expected Annual Operating cost, Earning and Total profit |
| **29** | Average Route Length -Intercity and Intracity |
| **30** | Average Fleet Composition -Intercity and Intracity |
| **31** | Year wise Unutilized fleet -Intercity and Intracity |
| **32** | Year wise Mode share - Intercity and Intracity |
| **33** | Year wise annual viability gap -Intercity and Intracity |

## 7.6 Tool inputs Forms


STU Basic Information
FLEET©
STU Details
STU Name
BMTC
Operations Type
INTRA
Create New STU
Existing STU List
Current Year
2019
Data Year
2011
Tourist Data Year
2006
Intracity
Different types of operational services
4
Population
Urban
Rural
Total
8443675
990923
9434598
Total No of Trips (educational)
Intracity
Intercity
4601828.431
73388.14359
Total Work Trips by All Modes
Intracity (<10KM)
Intracity (>10KM)
Intercity (<10KM)
Intercity (>10KM)
4582028
1026451
44720.9
44721
Total Non-Work Trips by All Modes
3407149
763258
395600
821812
Total Work Trips by Bus
1102314
413740
15556
15556
Total Work Trips by IPT
101375
44165
5431
5431
Mode Share of Bus from total work trips (All modes)
24.000%
40.000%
35.000%
35.000%
Mode Share of IPT from total work trips (All modes)
2.000%
4.000%
12.000%
12.000%
Mode Share of Bus from total bus trips
71.000%
27.000%
1.000%
1.000%
Mode Share of IPT form total IPT trips
65.000%
28.000%
3.000%
3.000%
Total Tourist trips by Bus
90708
583734
10254
522125
Total Tourist trips by IPT
6397
62982
557504
109633
Tourist Trips from State - All modes
64205
405762
592536
73202
Total State+ outside State all tourist trips - All Modes
605010
644176
103313
708803
Average Annual Exponential Growth Rate
Urban
Rural
Tourist
0.0212
0.0099
0.0250
Error check
Go Back
Save & Continue
Exit
Open Default values
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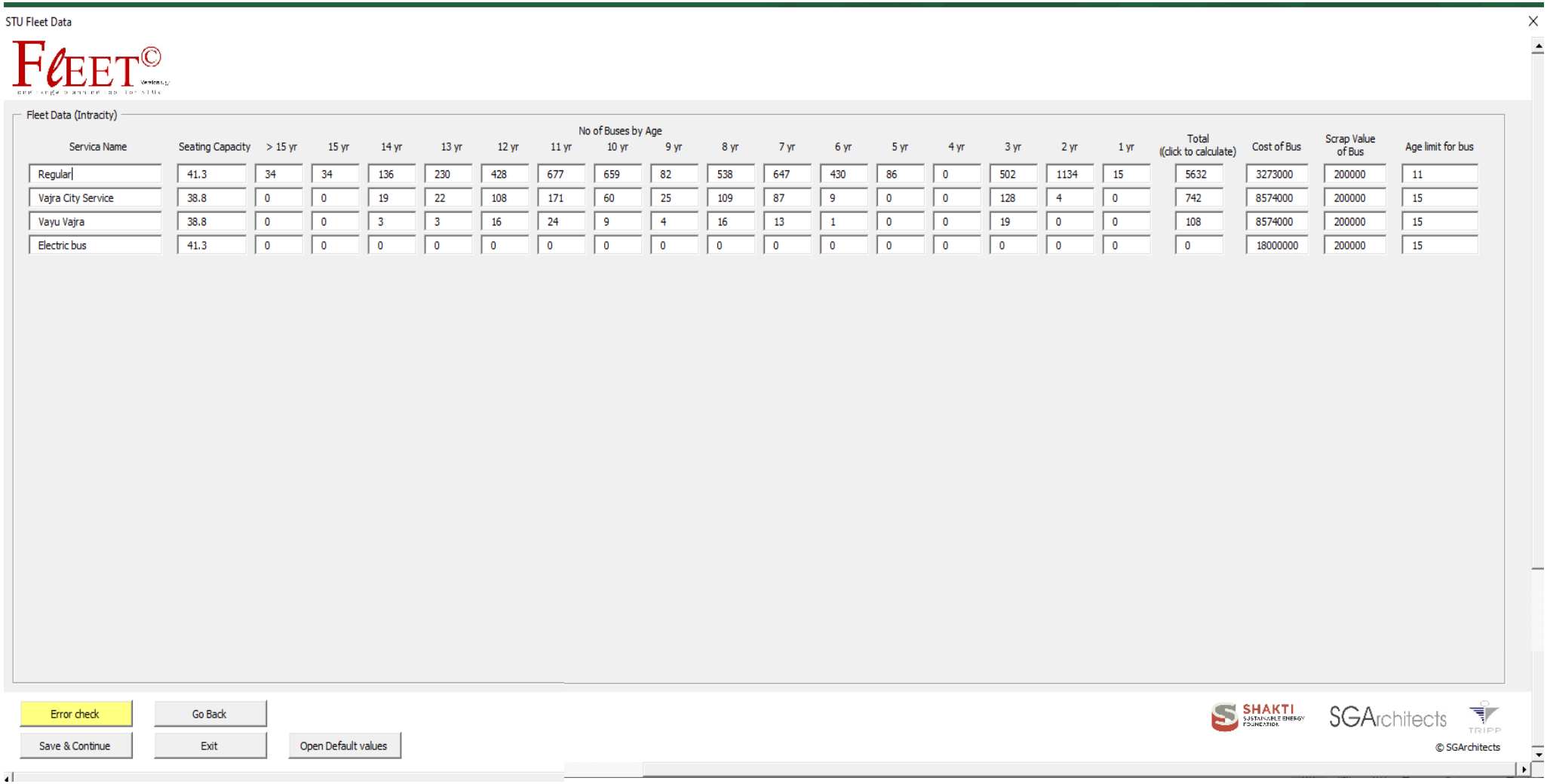
STU Fleet Data
FLEET©
Fleet Data (Intracity)
No of Buses by Age
Servica Name
Seating Capacity
> 15 yr
15 yr
14 yr
13 yr
12 yr
11 yr
10 yr
9 yr
8 yr
7 yr
6 yr
5 yr
4 yr
3 yr
2 yr
1 yr
Total ((click to calculate)
Cost of Bus
Scrap Value of Bus
Age limit for bus
Regular 41.3 34 34 136 230 428 677 659 82 538 647 430 86 0 502 1134 15 5632 3273000 200000 11
Vajra City Service 38.8 0 0 19 22 108 171 60 25 109 87 9 0 0 128 4 0 742 8574000 200000 15
Vayu Vajra 38.8 0 0 3 3 16 24 9 4 16 13 1 0 0 19 0 0 108 8574000 200000 15
Electric bus 41.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 18000000 200000 15
Error check
Go Back
Save & Continue
Exit
Open Default values
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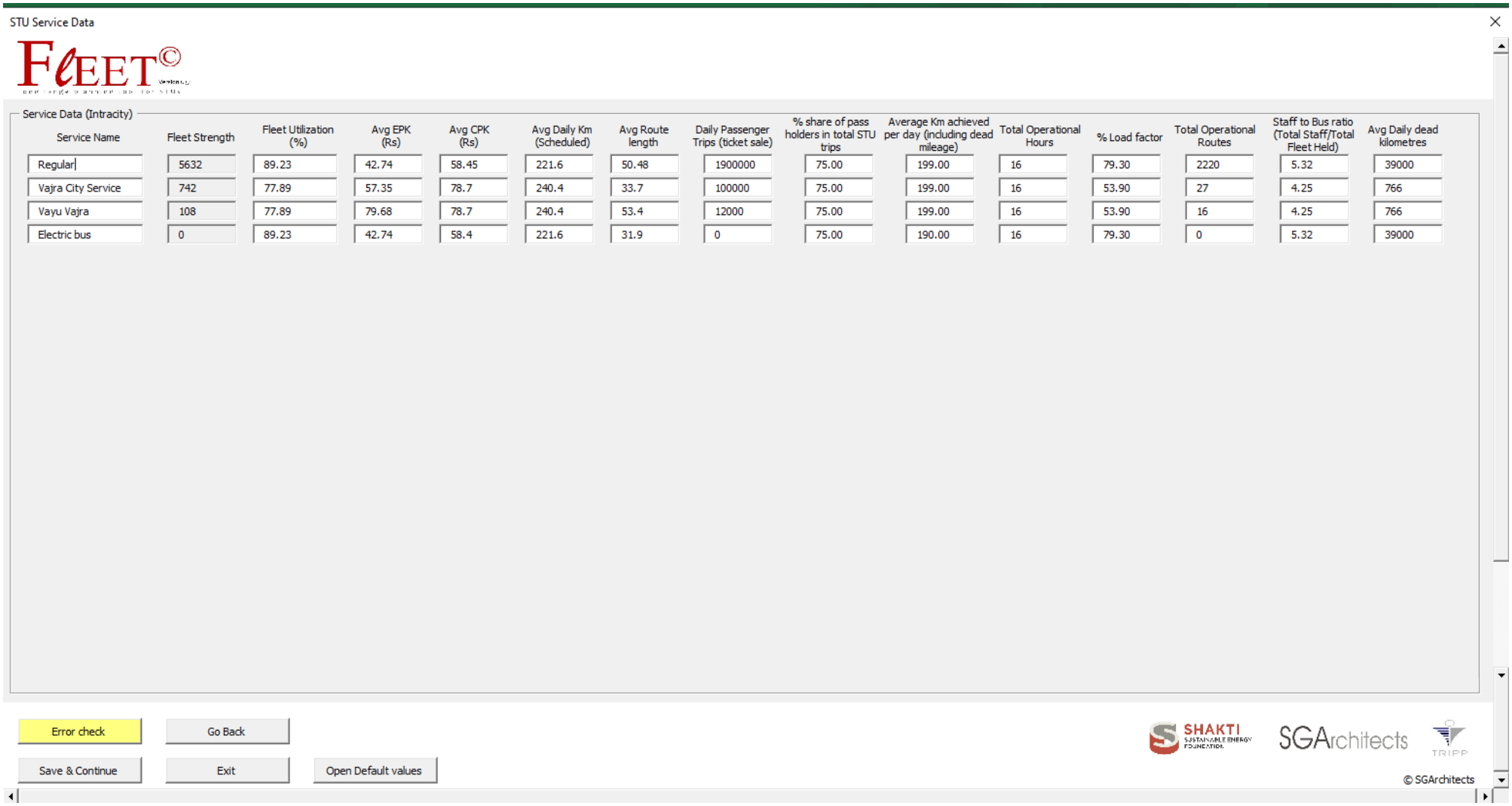
STU Service Data
FLEET©
Service Data (Intracity)
Service Name
Fleet Strength
Fleet Utilization (%)
Avg EPK (Rs)
Avg CPK (Rs)
Avg Daily Km (Scheduled)
Avg Route length
Daily Passenger Trips (ticket sale)
% share of pass holders in total STU trips
Average Km achieved per day (including dead mileage)
Total Operational Hours
% Load factor
Total Operational Routes
Staff to Bus ratio (Total Staff/Total Fleet Held)
Avg Daily dead kilometres
Regular 5632 89.23 42.74 58.45 221.6 50.48 1900000 75.00 199.00 16 79.30 2220 5.32 39000
Vajra City Service 742 77.89 57.35 78.7 240.4 33.7 100000 75.00 199.00 16 53.90 27 4.25 766
Vayu Vajra 108 77.89 79.68 78.7 240.4 53.4 12000 75.00 199.00 16 53.90 16 4.25 766
Electric bus 0 89.23 42.74 58.4 221.6 31.9 0 75.00 190.00 16 79.30 0 5.32 39000
Error check
Go Back
Save & Continue
Exit
Open Default values
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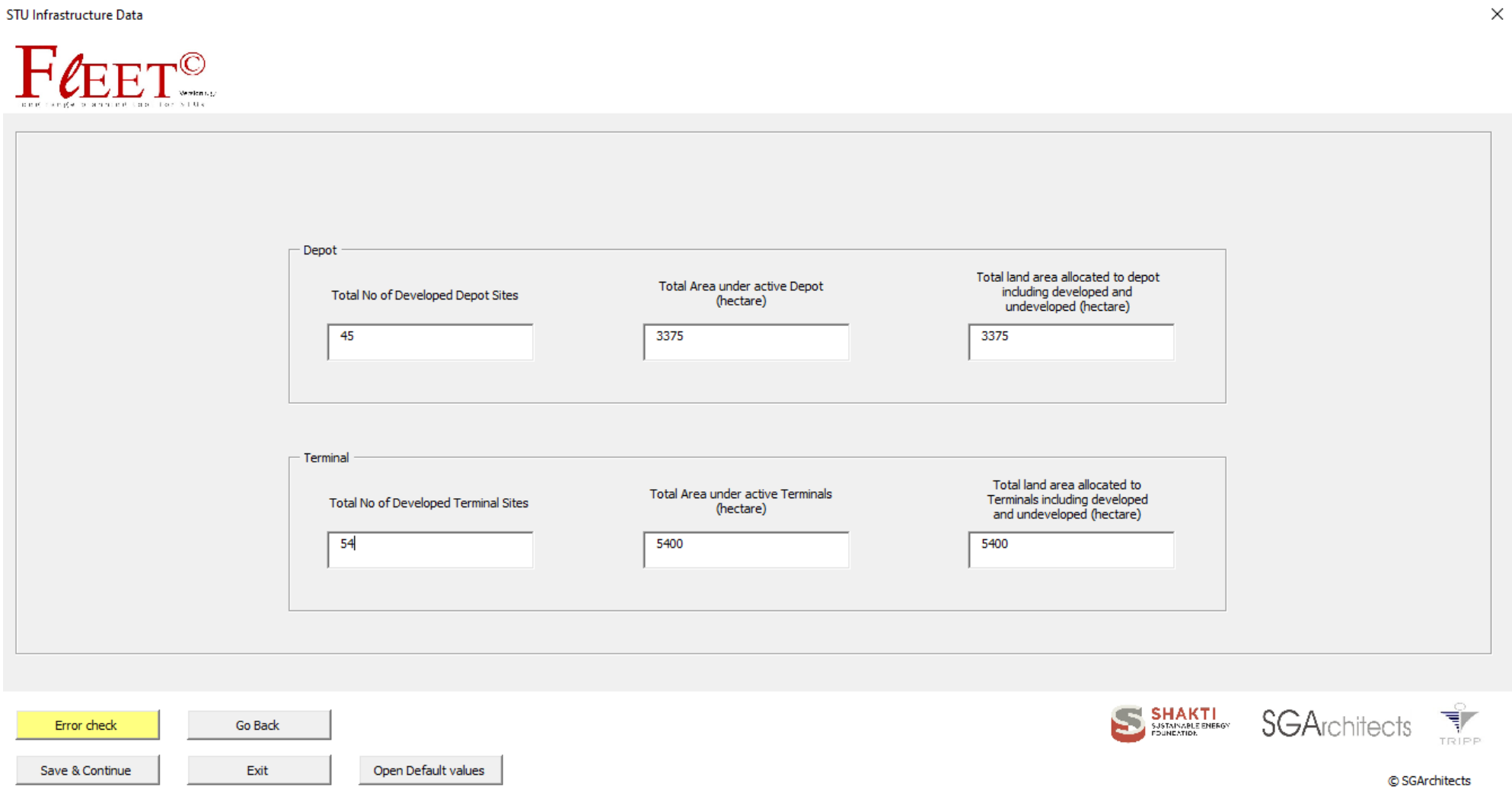
STU Infrastructure Data
FLEET©
Depot
Total No of Developed Depot Sites
45
Total Area under active Depot (hectare)
3375
Total land area allocated to depot including developed and undeveloped (hectare)
3375
Terminal
Total No of Developed Terminal Sites
54
Total Area under active Terminals (hectare)
5400
Total land area allocated to Terminals including developed and undeveloped (hectare)
5400
Error check
Go Back
Save & Continue
Exit
Open Default values
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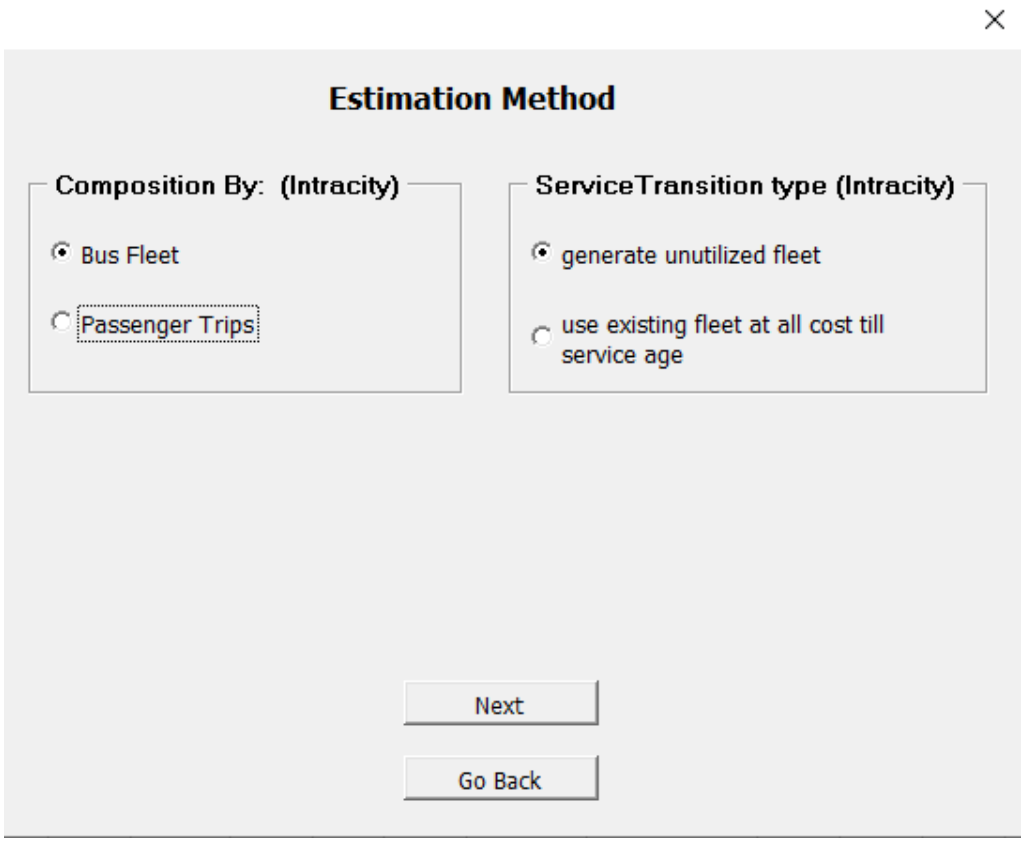

Estimation Method
Composition By: (Intracity)
Bus Fleet
Passenger Trips
ServiceTransition type (Intracity)
generate unutilized fleet
use existing fleet at all cost till service age
Next
Go Back

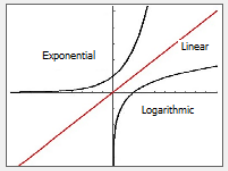
STU Vision Data (Intracity)-1

FLEET©

Service Composition (Intracity)

| Service Name | Current Fleet Composition (%) | Desired Fleet Composition (%) | Years to acheive target | Trajectory of Change | Current Fleet Utilization (%) | Desired Fleet Utilization (%) | Years to acheive target | Trajectory of Change | Current Avg Vehicle Utilization (%) | Desired Avg Vehicle Utilization (%) | Years to acheive target | Trajectory of Change | Current Avg Occupancy (%) | Desired Avg Occupancy (%) | Years to acheive target | Trajectory of Change |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Regular | 86.89% | 0.00 | 10 | linear | 89.23 | 89.23 | 10 | Linear | 89.80 | 85.74 | 10 | Linear | 79.30 | 79.30 | 10 | Linear |
| Vajra City Service | 11.45% | 0.00 | | | 77.89 | 80.00 | 10 | Linear | 82.78 | 87.34 | 10 | Linear | 53.90 | 54.10 | 10 | Linear |
| Vayu Vajra | 1.67% | 0.00 | | | 77.89 | 80.00 | 10 | Linear | 82.78 | 87.34 | 10 | Linear | 53.90 | 54.10 | 10 | Linear |
| Electric bus | 0.00% | 100.00 | | | 89.23 | 89.23 | 10 | Linear | 85.74 | 85.74 | 10 | Linear | 79.30 | 79.30 | 10 | Linear |

*( Same for all services )*




Indicative figure differentiating the different growth curves
Linear - Rate of change remains same over growth period
Exponential - Rate of change steadily increases over growth period
Logrithmic - Rate of change steadily reduces over growth period

Error check | Go Back | Save & Continue | Exit | Open Default values

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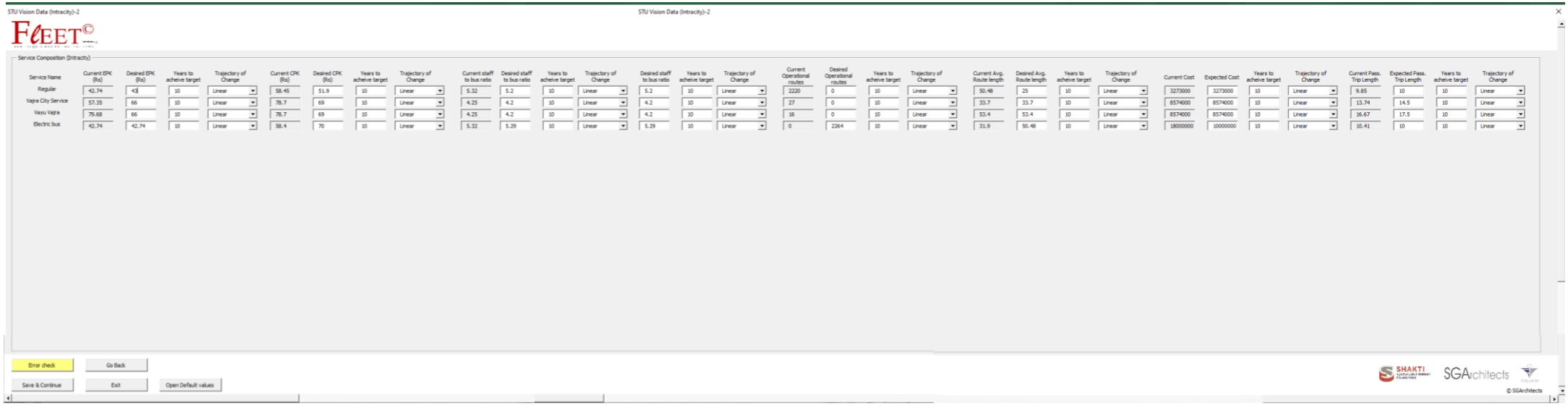
STU Vision Data (Intracity)-2
STU Vision Data (Intracity)-2
FLEET©
Service Composition (Intracity)
Service Name
Current EPK (Rs)
Desired EPK (Rs)
Years to acheive target
Trajectory of Change
Current CPK (Rs)
Desired CPK (Rs)
Years to acheive target
Trajectory of Change
Current staff to bus ratio
Desired staff to bus ratio
Years to acheive target
Trajectory of Change
Desired staff to bus ratio
Years to acheive target
Trajectory of Change
Current Operational routes
Desired Operational routes
Years to acheive target
Trajectory of Change
Current Avg. Route length
Desired Avg. Route length
Years to acheive target
Trajectory of Change
Current Cost
Expected Cost
Years to acheive target
Trajectory of Change
Current Pass. Trip Length
Expected Pass. Trip Length
Years to acheive target
Trajectory of Change
Regular
42.74
43
10
Linear
58.45
51.9
10
Linear
5.32
5.2
10
Linear
5.2
10
Linear
2220
0
10
Linear
50.48
25
10
Linear
3273000
3273000
10
Linear
9.85
10
10
Linear
Vajra City Service
57.35
66
10
Linear
78.7
69
10
Linear
4.25
4.2
10
Linear
4.2
10
Linear
27
0
10
Linear
33.7
33.7
10
Linear
8574000
8574000
10
Linear
13.74
14.5
10
Linear
Vayu Vajra
79.68
66
10
Linear
78.7
69
10
Linear
4.25
4.2
10
Linear
4.2
10
Linear
16
0
10
Linear
53.4
53.4
10
Linear
8574000
8574000
10
Linear
16.67
17.5
10
Linear
Electric bus
42.74
42.74
10
Linear
58.4
70
10
Linear
5.32
5.29
10
Linear
5.29
10
Linear
0
2264
10
Linear
31.9
50.48
10
Linear
18000000
10000000
10
Linear
10.41
10
10
Linear
Error check
Go Back
Save & Continue
Exit
Open Default values
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STU Vision Data (Mode Share)
FLEET©
Mode Share
Mode Share By STU Bus
Mode Share By Other Bus
Mode Share By IPT
Current
Desired
Years to acheive target
Trajectory of Change
Intracity
19.77%
19.70 %
10
Linear
5.24%
4.30 %
10
Linear
8.31%
5.40 %
10
Linear
Intercity
0.00%
0.00 %
10
Linear
36.22%
38.84 %
10
Linear
11.73%
11.66 %
10
Linear
Error check
Go Back
Save & Exit
Exit
Open Default values
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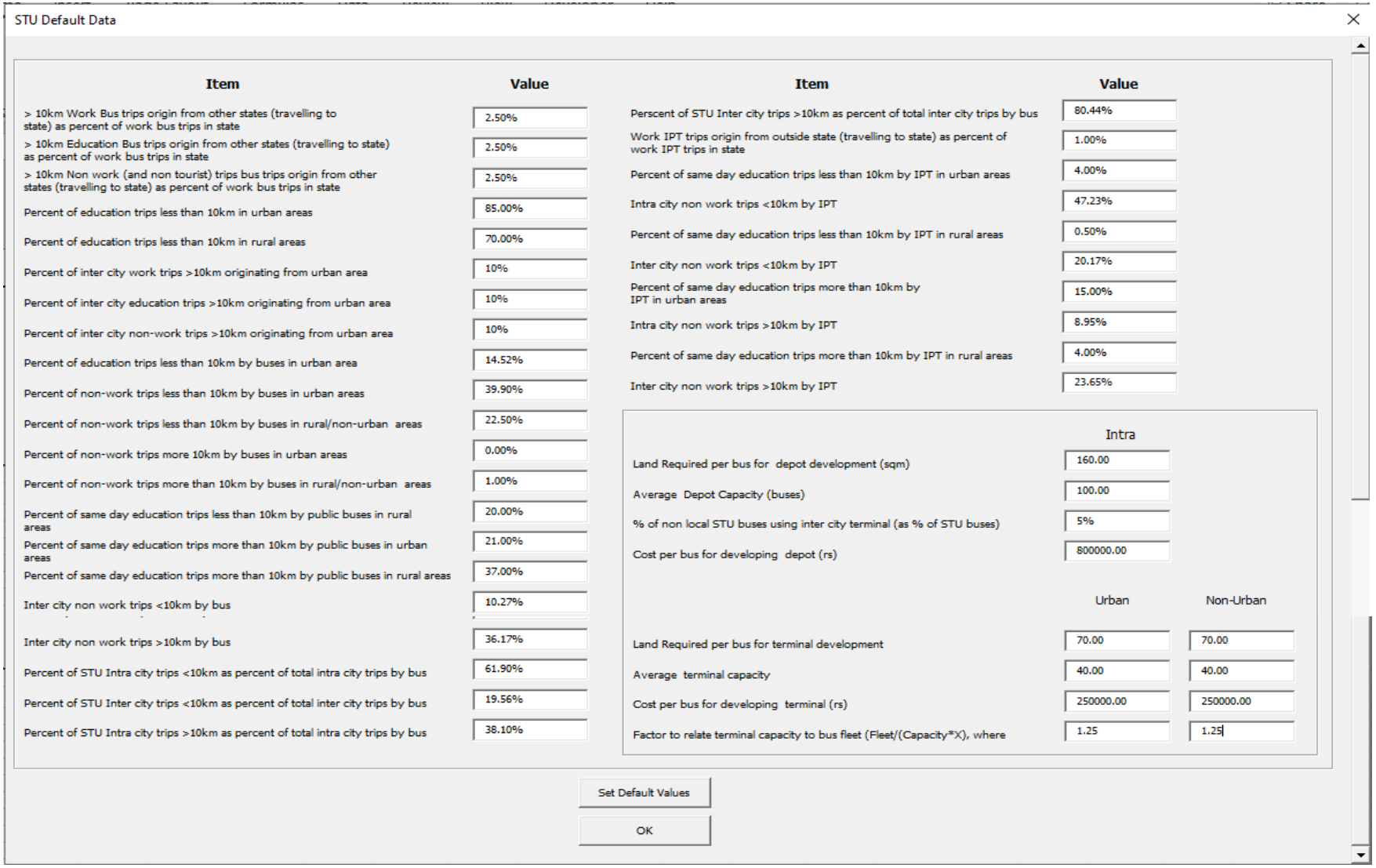
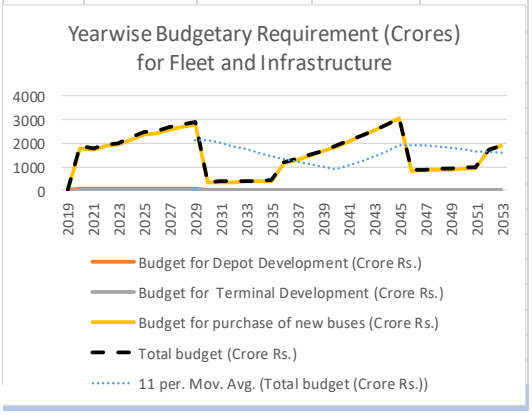

STU Default Data
Item
Value
> 10km Work Bus trips origin from other states (travelling to state) as percent of work bus trips in state
2.50%
> 10km Education Bus trips origin from other states (travelling to state) as percent of work bus trips in state
2.50%
> 10km Non work (and non tourist) trips bus trips origin from other states (travelling to state) as percent of work bus trips in state
2.50%
Percent of education trips less than 10km in urban areas
85.00%
Percent of education trips less than 10km in rural areas
70.00%
Percent of inter city work trips >10km originating from urban area
10%
Percent of inter city education trips >10km originating from urban area
10%
Percent of inter city non-work trips >10km originating from urban area
10%
Percent of education trips less than 10km by buses in urban area
14.52%
Percent of non-work trips less than 10km by buses in urban areas
39.90%
Percent of non-work trips less than 10km by buses in rural/non-urban areas
22.50%
Percent of non-work trips more 10km by buses in urban areas
0.00%
Percent of non-work trips more than 10km by buses in rural/non-urban areas
1.00%
Percent of same day education trips less than 10km by public buses in rural areas
20.00%
Percent of same day education trips more than 10km by public buses in urban areas
21.00%
Percent of same day education trips more than 10km by public buses in rural areas
37.00%
Inter city non work trips <10km by bus
10.27%
Inter city non work trips >10km by bus
36.17%
Percent of STU Intra city trips <10km as percent of total intra city trips by bus
61.90%
Percent of STU Inter city trips <10km as percent of total inter city trips by bus
19.56%
Percent of STU Intra city trips >10km as percent of total intra city trips by bus
38.10%
Item
Value
Percent of STU Inter city trips >10km as percent of total inter city trips by bus
80.44%
Work IPT trips origin from outside state (travelling to state) as percent of work IPT trips in state
1.00%
Percent of same day education trips less than 10km by IPT in urban areas
4.00%
Intra city non work trips <10km by IPT
47.23%
Percent of same day education trips less than 10km by IPT in rural areas
0.50%
Inter city non work trips <10km by IPT
20.17%
Percent of same day education trips more than 10km by IPT in urban areas
15.00%
Intra city non work trips >10km by IPT
8.95%
Percent of same day education trips more than 10km by IPT in rural areas
4.00%
Inter city non work trips >10km by IPT
23.65%
Intra
Land Required per bus for depot development (sqm)
160.00
Average Depot Capacity (buses)
100.00
% of non local STU buses using inter city terminal (as % of STU buses)
5%
Cost per bus for developing depot (rs)
800000.00
Urban
Non-Urban
Land Required per bus for terminal development
70.00
70.00
Average terminal capacity
40.00
40.00
Cost per bus for developing terminal (rs)
250000.00
250000.00
Factor to relate terminal capacity to bus fleet (Fleet/(Capacity*X), where
1.25
1.25
Set Default Values
OK

## 7.1 Scenario 5 - BMTC outputs generated with the tool

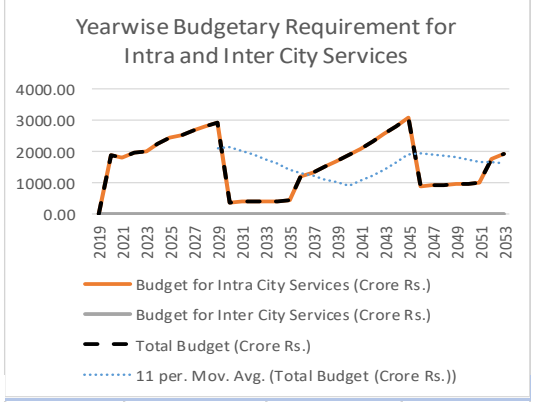
The below section presents detailed outputs generated by the FIEET tool for scenario 5. For better understanding of the user, the outputs generated are differently colored (as presented in the figure below) to distinguish intracity outputs, Intercity outputs and combined outputs.

| Legend | |
|---|---|
| | Intra |
| | Inter |
| | Both Combined |

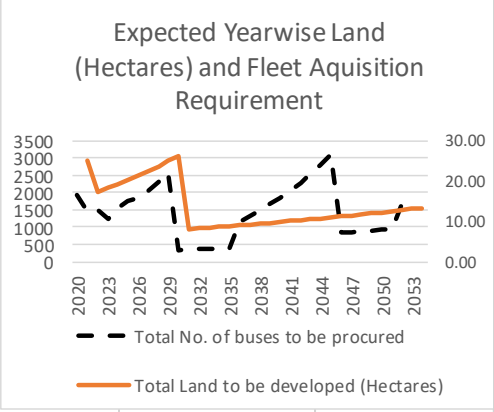
| Yearwise Budgetary Requirement (Crores) for Fleet and Infrastructure | | | | |
|---|---|---|---|---|
| Both Inter and Intra combined | | | | |
| Year | Budget for Depot Development (Crore Rs.) | Budget for Terminal Development (Crore Rs.) | Budget for purchase of new buses (Crore Rs.) | Total budget (Crore Rs.) |
| 2019 | 0 | 0 | 0.00 | 0.00 |
| 2020 | 86 | 27 | 1771.45 | 1867.55 |
| 2021 | 59 | 19 | 1730.63 | 1794.90 |
| 2022 | 63 | 20 | 1881.22 | 1949.66 |
| 2023 | 66 | 21 | 1931.08 | 2015.43 |
| 2024 | 69 | 22 | 2170.02 | 2247.91 |
| 2025 | 73 | 23 | 2372.90 | 2452.05 |
| 2026 | 77 | 24 | 2432.39 | 2523.47 |
| 2027 | 81 | 25 | 2573.90 | 2677.98 |
| 2028 | 85 | 27 | 2698.23 | 2807.67 |
| 2029 | 90 | 28 | 2802.35 | 2908.08 |
| 2030 | 28 | 9 | 346.32 | 359.80 |
| 2031 | 28 | 9 | 353.92 | 390.78 |
| 2032 | 29 | 9 | 361.68 | 376.80 |
| 2033 | 30 | 9 | 369.62 | 394.79 |
| 2034 | 30 | 9 | 377.73 | 409.05 |
| 2035 | 31 | 10 | 386.02 | 426.55 |
| 2036 | 32 | 10 | 1150.63 | 1175.00 |
| 2037 | 32 | 10 | 1307.50 | 1331.18 |
| 2038 | 33 | 10 | 1476.69 | 1498.65 |
| 2039 | 34 | 11 | 1658.92 | 1678.37 |
| 2040 | 34 | 11 | 1855.00 | 1870.67 |
| 2041 | 35 | 11 | 2065.77 | 2077.39 |
| 2042 | 36 | 11 | 2292.12 | 2302.46 |
| 2043 | 37 | 11 | 2535.00 | 2541.71 |
| 2044 | 38 | 12 | 2795.42 | 2798.18 |
| 2045 | 38 | 12 | 3074.45 | 3072.92 |
| 2046 | 39 | 12 | 836.54 | 881.08 |
| 2047 | 40 | 13 | 854.91 | 900.43 |
| 2048 | 41 | 13 | 873.68 | 920.21 |
| 2049 | 42 | 13 | 892.87 | 940.42 |
| 2050 | 43 | 13 | 912.49 | 961.08 |
| 2051 | 44 | 14 | 932.53 | 982.20 |
| 2052 | 45 | 14 | 1709.16 | 1744.79 |
| 2053 | 46 | 14 | 1878.31 | 1912.10 |



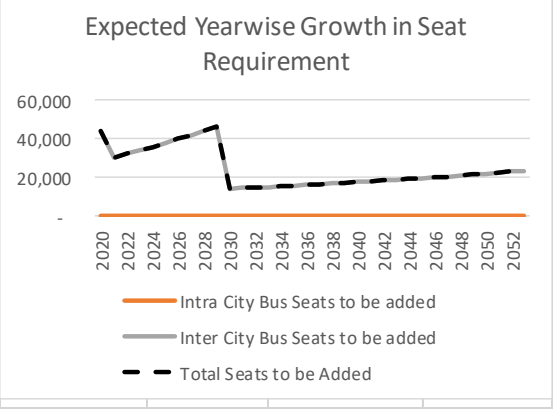

| Year Wise Budgetary Requirement for Intra and Inter City Services | | | |
|---|---|---|---|
| Year | Budget for Intra City Services (Crore Rs.) | Budget for Inter City Services (Crore Rs.) | Total Budget (Crore Rs.) |
| 2019 | 0.00 | 0.00 | 0.00 |
| 2020 | 1867.55 | 0.00 | 1867.55 |
| 2021 | 1794.90 | 0.00 | 1794.90 |
| 2022 | 1949.66 | 0.00 | 1949.66 |
| 2023 | 2015.43 | 0.00 | 2015.43 |
| 2024 | 2247.91 | 0.00 | 2247.91 |
| 2025 | 2452.05 | 0.00 | 2452.05 |
| 2026 | 2523.47 | 0.00 | 2523.47 |
| 2027 | 2677.98 | 0.00 | 2677.98 |
| 2028 | 2807.67 | 0.00 | 2807.67 |
| 2029 | 2908.08 | 0.00 | 2908.08 |
| 2030 | 359.80 | 0.00 | 359.80 |
| 2031 | 390.78 | 0.00 | 390.78 |
| 2032 | 376.80 | 0.00 | 376.80 |
| 2033 | 394.79 | 0.00 | 394.79 |
| 2034 | 409.05 | 0.00 | 409.05 |
| 2035 | 426.55 | 0.00 | 426.55 |
| 2036 | 1175.00 | 0.00 | 1175.00 |
| 2037 | 1331.18 | 0.00 | 1331.18 |
| 2038 | 1498.65 | 0.00 | 1498.65 |
| 2039 | 1678.37 | 0.00 | 1678.37 |
| 2040 | 1870.67 | 0.00 | 1870.67 |
| 2041 | 2077.39 | 0.00 | 2077.39 |
| 2042 | 2302.46 | 0.00 | 2302.46 |
| 2043 | 2541.71 | 0.00 | 2541.71 |
| 2044 | 2798.18 | 0.00 | 2798.18 |
| 2045 | 3072.92 | 0.00 | 3072.92 |
| 2046 | 881.08 | 0.00 | 881.08 |
| 2047 | 900.43 | 0.00 | 900.43 |
| 2048 | 920.21 | 0.00 | 920.21 |
| 2049 | 940.42 | 0.00 | 940.42 |
| 2050 | 961.08 | 0.00 | 961.08 |
| 2051 | 982.20 | 0.00 | 982.20 |
| 2052 | 1744.79 | 0.00 | 1744.79 |
| 2053 | 1912.10 | 0.00 | 1912.10 |



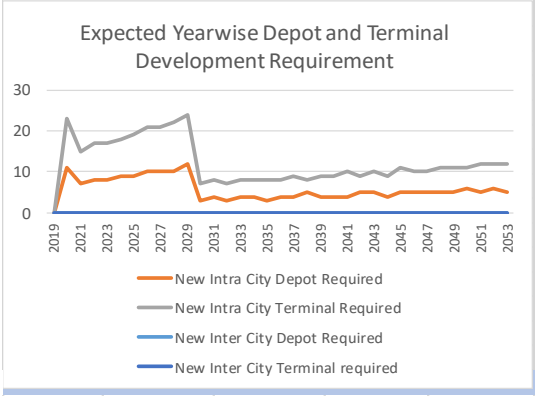
| Expected Yearwise Land (Hectares) and Fleet Aquisition Requirement | | |
|---|---|---|
| Both Inter and Intra combined | | |
| Year | Total Land to be developed (Hectares) | Total No. of buses to be procured |
| 2019 | | |
| 2020 | 25.20 | 1941 |
| 2021 | 17.30 | 1439 |
| 2022 | 18.25 | 1478 |
| 2023 | 19.23 | 1238 |
| 2024 | 20.27 | 1530 |
| 2025 | 21.34 | 1756 |
| 2026 | 22.47 | 1843 |
| 2027 | 23.66 | 2076 |
| 2028 | 24.89 | 2326 |
| 2029 | 26.19 | 2595 |
| 2030 | 8.09 | 346 |
| 2031 | 8.26 | 354 |
| 2032 | 8.45 | 362 |
| 2033 | 8.63 | 370 |
| 2034 | 8.82 | 378 |
| 2035 | 9.01 | 386 |
| 2036 | 9.21 | 1151 |
| 2037 | 9.41 | 1308 |
| 2038 | 9.62 | 1477 |
| 2039 | 9.83 | 1659 |
| 2040 | 10.05 | 1855 |
| 2041 | 10.27 | 2066 |
| 2042 | 10.49 | 2292 |
| 2043 | 10.72 | 2535 |
| 2044 | 10.96 | 2795 |
| 2045 | 11.20 | 3074 |
| 2046 | 11.45 | 837 |
| 2047 | 11.70 | 855 |
| 2048 | 11.96 | 874 |
| 2049 | 12.22 | 893 |
| 2050 | 12.49 | 912 |
| 2051 | 12.76 | 933 |
| 2052 | 13.04 | 1709 |
| 2053 | 13.33 | 1878 |



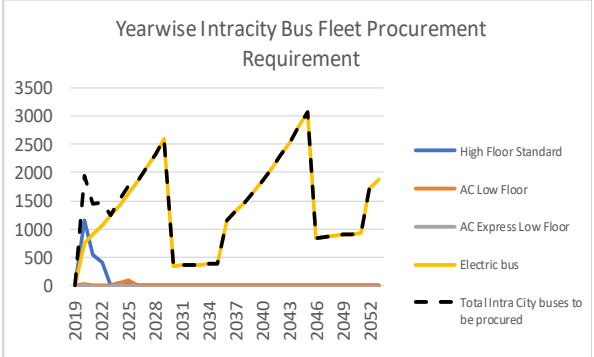

| Annual Seats to be added | | | |
|---|---|---|---|
| Year | Intra City Bus Seats to be added | Inter City Bus Seats to be added | Total Seats to be Added |
| 2019 | - | - | - |
| 2020 | - | 44,473 | 44,473 |
| 2021 | - | 30,659 | 30,659 |
| 2022 | - | 32,367 | 32,367 |
| 2023 | - | 34,155 | 34,155 |
| 2024 | - | 36,027 | 36,027 |
| 2025 | - | 37,987 | 37,987 |
| 2026 | - | 40,040 | 40,040 |
| 2027 | - | 42,191 | 42,191 |
| 2028 | - | 44,445 | 44,445 |
| 2029 | - | 46,806 | 46,806 |
| 2030 | - | 14,303 | 14,303 |
| 2031 | - | 14,617 | 14,617 |
| 2032 | - | 14,937 | 14,937 |
| 2033 | - | 15,265 | 15,265 |
| 2034 | - | 15,600 | 15,600 |
| 2035 | - | 15,943 | 15,943 |
| 2036 | - | 16,293 | 16,293 |
| 2037 | - | 16,650 | 16,650 |
| 2038 | - | 17,016 | 17,016 |
| 2039 | - | 17,389 | 17,389 |
| 2040 | - | 17,771 | 17,771 |
| 2041 | - | 18,162 | 18,162 |
| 2042 | - | 18,560 | 18,560 |
| 2043 | - | 18,968 | 18,968 |
| 2044 | - | 19,385 | 19,385 |
| 2045 | - | 19,811 | 19,811 |
| 2046 | - | 20,246 | 20,246 |
| 2047 | - | 20,691 | 20,691 |
| 2048 | - | 21,146 | 21,146 |
| 2049 | - | 21,610 | 21,610 |
| 2050 | - | 22,085 | 22,085 |
| 2051 | - | 22,571 | 22,571 |
| 2052 | - | 23,067 | 23,067 |
| 2053 | - | 23,574 | 23,574 |



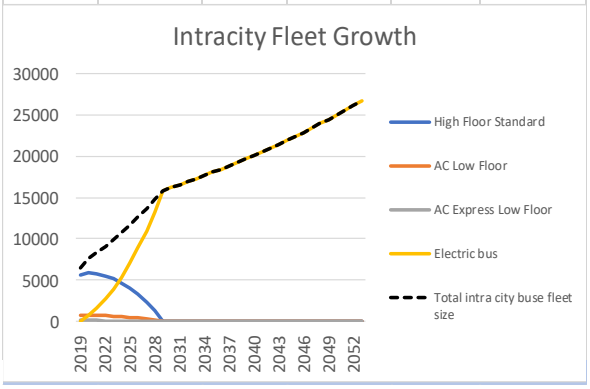
| Expected Yearwise Depot and Terminal Development Requirement | | | | |
|---|---|---|---|---|
| Year | New Intra City Depot Required | New Intra City Terminal Required | New Inter City Depot Required | New Inter City Terminal required |
| 2019 | 0 | 0 | 0 | 0 |
| 2020 | 11 | 23 | 0 | 0 |
| 2021 | 7 | 15 | 0 | 0 |
| 2022 | 8 | 17 | 0 | 0 |
| 2023 | 8 | 17 | 0 | 0 |
| 2024 | 9 | 18 | 0 | 0 |
| 2025 | 9 | 19 | 0 | 0 |
| 2026 | 10 | 21 | 0 | 0 |
| 2027 | 10 | 21 | 0 | 0 |
| 2028 | 10 | 22 | 0 | 0 |
| 2029 | 12 | 24 | 0 | 0 |
| 2030 | 3 | 7 | 0 | 0 |
| 2031 | 4 | 8 | 0 | 0 |
| 2032 | 3 | 7 | 0 | 0 |
| 2033 | 4 | 8 | 0 | 0 |
| 2034 | 4 | 8 | 0 | 0 |
| 2035 | 3 | 8 | 0 | 0 |
| 2036 | 4 | 8 | 0 | 0 |
| 2037 | 4 | 9 | 0 | 0 |
| 2038 | 5 | 8 | 0 | 0 |
| 2039 | 4 | 9 | 0 | 0 |
| 2040 | 4 | 9 | 0 | 0 |
| 2041 | 4 | 10 | 0 | 0 |
| 2042 | 5 | 9 | 0 | 0 |
| 2043 | 5 | 10 | 0 | 0 |
| 2044 | 4 | 9 | 0 | 0 |
| 2045 | 5 | 11 | 0 | 0 |
| 2046 | 5 | 10 | 0 | 0 |
| 2047 | 5 | 10 | 0 | 0 |
| 2048 | 5 | 11 | 0 | 0 |
| 2049 | 5 | 11 | 0 | 0 |
| 2050 | 6 | 11 | 0 | 0 |
| 2051 | 5 | 12 | 0 | 0 |
| 2052 | 6 | 12 | 0 | 0 |
| 2053 | 5 | 12 | 0 | 0 |



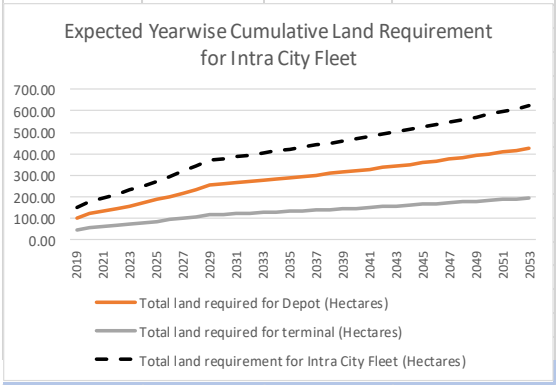

| Yearwise Intracity Bus Fleet Procurement Requirement | | | | | |
|---|---|---|---|---|---|
| Year | High Floor Standard | AC Low Floor | AC Express Low Floor | Electric bus | Total Intra City buses to be procured |
| 2019 | 15 | 0 | 0 | 0 | 15 |
| 2020 | 1143 | 37 | 5 | 756 | 1941 |
| 2021 | 535 | 0 | 0 | 904 | 1439 |
| 2022 | 413 | 0 | 0 | 1065 | 1478 |
| 2023 | 0 | 0 | 0 | 1238 | 1238 |
| 2024 | 54 | 44 | 7 | 1425 | 1530 |
| 2025 | 28 | 90 | 12 | 1626 | 1756 |
| 2026 | 0 | 0 | 0 | 1843 | 1843 |
| 2027 | 0 | 0 | 0 | 2076 | 2076 |
| 2028 | 0 | 0 | 0 | 2326 | 2326 |
| 2029 | 0 | 0 | 0 | 2595 | 2595 |
| 2030 | 0 | 0 | 0 | 346 | 346 |
| 2031 | 0 | 0 | 0 | 354 | 354 |
| 2032 | 0 | 0 | 0 | 362 | 362 |
| 2033 | 0 | 0 | 0 | 370 | 370 |
| 2034 | 0 | 0 | 0 | 378 | 378 |
| 2035 | 0 | 0 | 0 | 386 | 386 |
| 2036 | 0 | 0 | 0 | 1151 | 1151 |
| 2037 | 0 | 0 | 0 | 1308 | 1308 |
| 2038 | 0 | 0 | 0 | 1477 | 1477 |
| 2039 | 0 | 0 | 0 | 1659 | 1659 |
| 2040 | 0 | 0 | 0 | 1855 | 1855 |
| 2041 | 0 | 0 | 0 | 2066 | 2066 |
| 2042 | 0 | 0 | 0 | 2292 | 2292 |
| 2043 | 0 | 0 | 0 | 2535 | 2535 |
| 2044 | 0 | 0 | 0 | 2795 | 2795 |
| 2045 | 0 | 0 | 0 | 3074 | 3074 |
| 2046 | 0 | 0 | 0 | 837 | 837 |
| 2047 | 0 | 0 | 0 | 855 | 855 |
| 2048 | 0 | 0 | 0 | 874 | 874 |
| 2049 | 0 | 0 | 0 | 893 | 893 |
| 2050 | 0 | 0 | 0 | 912 | 912 |
| 2051 | 0 | 0 | 0 | 933 | 933 |
| 2052 | 0 | 0 | 0 | 1709 | 1709 |
| 2053 | 0 | 0 | 0 | 1878 | 1878 |



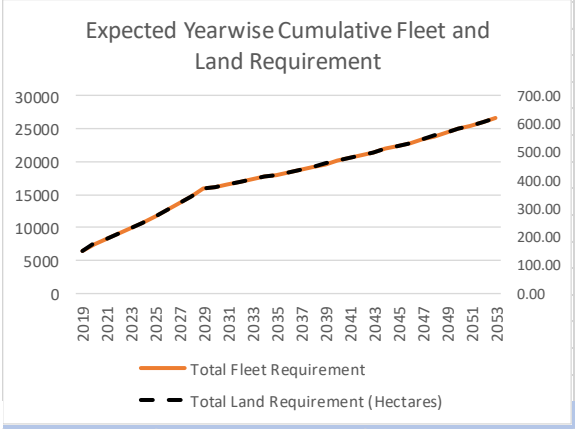
| Expected Yearwise Intracity Fleet Growth | | | | | |
|---|---|---|---|---|---|
| Year | High Floor Standard | AC Low Floor | AC Express Low Floor | Electric bus | Total intra city buse fleet size |
| 2019 | 5632 | 742 | 108 | 0 | 6482 |
| 2020 | 5913 | 779 | 113 | 756 | 7561 |
| 2021 | 5771 | 760 | 111 | 1660 | 8302 |
| 2022 | 5525 | 728 | 106 | 2725 | 9084 |
| 2023 | 5165 | 680 | 99 | 3963 | 9908 |
| 2024 | 4681 | 617 | 90 | 5388 | 10775 |
| 2025 | 4063 | 535 | 78 | 7014 | 11690 |
| 2026 | 3298 | 434 | 63 | 8856 | 12652 |
| 2027 | 2375 | 313 | 46 | 10932 | 13665 |
| 2028 | 1280 | 169 | 25 | 13258 | 14731 |
| 2029 | 0 | 0 | 0 | 15853 | 15853 |
| 2030 | 0 | 0 | 0 | 16199 | 16199 |
| 2031 | 0 | 0 | 0 | 16553 | 16553 |
| 2032 | 0 | 0 | 0 | 16915 | 16915 |
| 2033 | 0 | 0 | 0 | 17285 | 17285 |
| 2034 | 0 | 0 | 0 | 17662 | 17662 |
| 2035 | 0 | 0 | 0 | 18048 | 18048 |
| 2036 | 0 | 0 | 0 | 18443 | 18443 |
| 2037 | 0 | 0 | 0 | 18846 | 18846 |
| 2038 | 0 | 0 | 0 | 19258 | 19258 |
| 2039 | 0 | 0 | 0 | 19679 | 19679 |
| 2040 | 0 | 0 | 0 | 20109 | 20109 |
| 2041 | 0 | 0 | 0 | 20549 | 20549 |
| 2042 | 0 | 0 | 0 | 20998 | 20998 |
| 2043 | 0 | 0 | 0 | 21458 | 21458 |
| 2044 | 0 | 0 | 0 | 21927 | 21927 |
| 2045 | 0 | 0 | 0 | 22407 | 22407 |
| 2046 | 0 | 0 | 0 | 22897 | 22897 |
| 2047 | 0 | 0 | 0 | 23398 | 23398 |
| 2048 | 0 | 0 | 0 | 23910 | 23910 |
| 2049 | 0 | 0 | 0 | 24433 | 24433 |
| 2050 | 0 | 0 | 0 | 24968 | 24968 |
| 2051 | 0 | 0 | 0 | 25515 | 25515 |
| 2052 | 0 | 0 | 0 | 26073 | 26073 |
| 2053 | 0 | 0 | 0 | 26644 | 26644 |



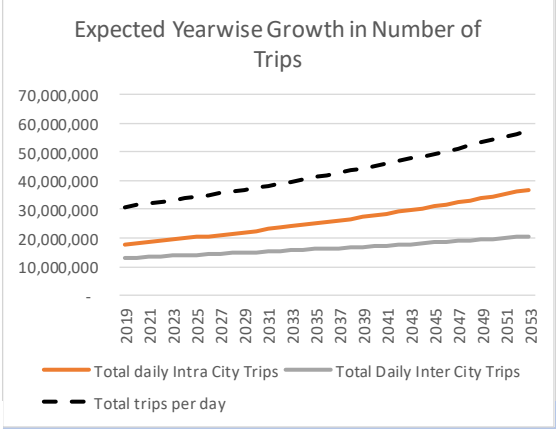

| Expected Yearwise Cumulative Land Requirement for Intra City Fleet | | | |
|---|---|---|---|
| Year | Total land required for Depot (Hectares) | Total land required for terminal (Hectares) | Total land requirement for Intra City Fleet (Hectares) |
| 2019 | 103.71 | 47.64 | 151.35 |
| 2020 | 120.98 | 55.58 | 176.56 |
| 2021 | 132.84 | 61.02 | 193.86 |
| 2022 | 145.34 | 66.77 | 212.11 |
| 2023 | 158.52 | 72.82 | 231.34 |
| 2024 | 172.41 | 79.20 | 251.61 |
| 2025 | 187.03 | 85.92 | 272.95 |
| 2026 | 202.43 | 92.99 | 295.43 |
| 2027 | 218.64 | 100.44 | 319.08 |
| 2028 | 235.70 | 108.28 | 343.98 |
| 2029 | 253.65 | 116.52 | 370.17 |
| 2030 | 259.19 | 119.07 | 378.26 |
| 2031 | 264.85 | 121.67 | 386.52 |
| 2032 | 270.64 | 124.33 | 394.96 |
| 2033 | 276.55 | 127.04 | 403.60 |
| 2034 | 282.60 | 129.82 | 412.42 |
| 2035 | 288.77 | 132.66 | 421.43 |
| 2036 | 295.09 | 135.55 | 430.64 |
| 2037 | 301.54 | 138.52 | 440.05 |
| 2038 | 308.13 | 141.55 | 449.67 |
| 2039 | 314.86 | 144.64 | 459.51 |
| 2040 | 321.75 | 147.80 | 469.55 |
| 2041 | 328.79 | 151.04 | 479.82 |
| 2042 | 335.98 | 154.34 | 490.31 |
| 2043 | 343.32 | 157.71 | 501.04 |
| 2044 | 350.83 | 161.16 | 512.00 |
| 2045 | 358.51 | 164.69 | 523.20 |
| 2046 | 366.35 | 168.29 | 534.65 |
| 2047 | 374.37 | 171.98 | 546.34 |
| 2048 | 382.56 | 175.74 | 558.30 |
| 2049 | 390.93 | 179.58 | 570.52 |
| 2050 | 399.49 | 183.51 | 583.00 |
| 2051 | 408.23 | 187.53 | 595.76 |
| 2052 | 417.17 | 191.64 | 608.81 |
| 2053 | 426.30 | 195.83 | 622.13 |



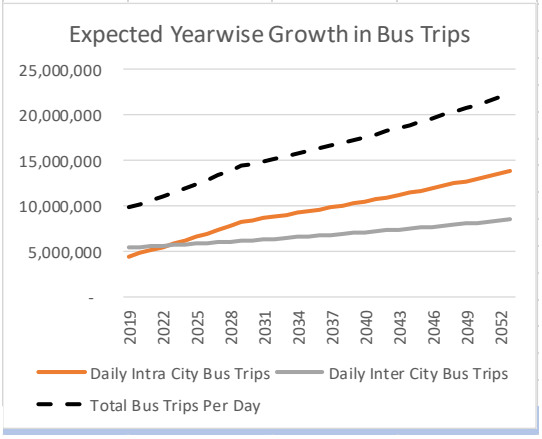
| Expected Yearwise Cumulative Fleet and Land Requirement | | |
|---|---|---|
| Both Inter and Intra combined | | |
| Year | Total Fleet Requirement | Total Land Requirement (Hectares) |
| 2019 | 6482 | 151.35 |
| 2020 | 7561 | 176.56 |
| 2021 | 8302 | 193.86 |
| 2022 | 9084 | 212.11 |
| 2023 | 9908 | 231.34 |
| 2024 | 10775 | 251.61 |
| 2025 | 11690 | 272.95 |
| 2026 | 12652 | 295.43 |
| 2027 | 13665 | 319.08 |
| 2028 | 14731 | 343.98 |
| 2029 | 15853 | 370.17 |
| 2030 | 16199 | 378.26 |
| 2031 | 16553 | 386.52 |
| 2032 | 16915 | 394.96 |
| 2033 | 17285 | 403.60 |
| 2034 | 17662 | 412.42 |
| 2035 | 18048 | 421.43 |
| 2036 | 18443 | 430.64 |
| 2037 | 18846 | 440.05 |
| 2038 | 19258 | 449.67 |
| 2039 | 19679 | 459.51 |
| 2040 | 20109 | 469.55 |
| 2041 | 20549 | 479.82 |
| 2042 | 20998 | 490.31 |
| 2043 | 21458 | 501.04 |
| 2044 | 21927 | 512.00 |
| 2045 | 22407 | 523.20 |
| 2046 | 22897 | 534.65 |
| 2047 | 23398 | 546.34 |
| 2048 | 23910 | 558.30 |
| 2049 | 24433 | 570.52 |
| 2050 | 24968 | 583.00 |
| 2051 | 25515 | 595.76 |
| 2052 | 26073 | 608.81 |
| 2053 | 26644 | 622.13 |



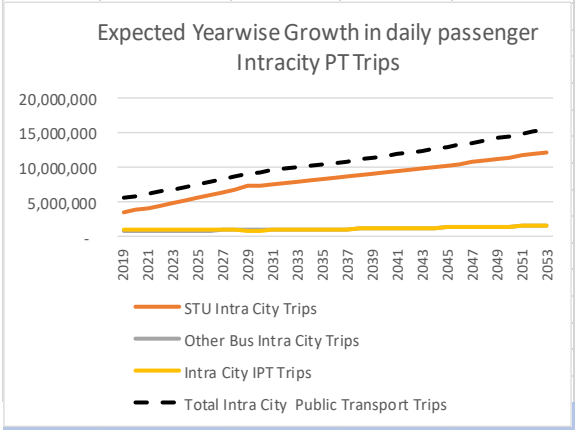

| Expected Yearwise Growth in Number of Trips | | | |
|---|---|---|---|
| Year | Total daily Intra City Trips | Total Daily Inter City Trips | Total trips per day |
| 2019 | 17,812,825 | 13,054,295 | 30,867,120 |
| 2020 | 18,196,725 | 13,222,465 | 31,419,190 |
| 2021 | 18,588,921 | 13,393,183 | 31,982,104 |
| 2022 | 18,989,592 | 13,566,495 | 32,556,087 |
| 2023 | 19,398,922 | 13,742,447 | 33,141,369 |
| 2024 | 19,817,098 | 13,921,090 | 33,738,188 |
| 2025 | 20,244,313 | 14,102,471 | 34,346,784 |
| 2026 | 20,680,762 | 14,286,641 | 34,967,403 |
| 2027 | 21,126,646 | 14,473,651 | 35,600,297 |
| 2028 | 21,582,168 | 14,663,555 | 36,245,723 |
| 2029 | 22,047,539 | 14,856,405 | 36,903,944 |
| 2030 | 22,522,971 | 15,052,256 | 37,575,227 |
| 2031 | 23,008,683 | 15,251,165 | 38,259,848 |
| 2032 | 23,504,897 | 15,453,188 | 38,958,085 |
| 2033 | 24,011,843 | 15,658,383 | 39,670,226 |
| 2034 | 24,529,751 | 15,866,811 | 40,396,562 |
| 2035 | 25,058,860 | 16,078,531 | 41,137,391 |
| 2036 | 25,599,414 | 16,293,607 | 41,893,021 |
| 2037 | 26,151,660 | 16,512,102 | 42,663,762 |
| 2038 | 26,715,852 | 16,734,081 | 43,449,933 |
| 2039 | 27,292,249 | 16,959,609 | 44,251,858 |
| 2040 | 27,881,117 | 17,188,755 | 45,069,872 |
| 2041 | 28,482,725 | 17,421,589 | 45,904,314 |
| 2042 | 29,097,350 | 17,658,179 | 46,755,529 |
| 2043 | 29,725,276 | 17,898,600 | 47,623,876 |
| 2044 | 30,366,790 | 18,142,924 | 48,509,714 |
| 2045 | 31,022,187 | 18,391,228 | 49,413,415 |
| 2046 | 31,691,770 | 18,643,588 | 50,335,358 |
| 2047 | 32,375,845 | 18,900,083 | 51,275,928 |
| 2048 | 33,074,728 | 19,160,793 | 52,235,521 |
| 2049 | 33,788,741 | 19,425,802 | 53,214,543 |
| 2050 | 34,518,211 | 19,695,192 | 54,213,403 |
| 2051 | 35,263,474 | 19,969,051 | 55,232,525 |
| 2052 | 36,024,874 | 20,247,465 | 56,272,339 |
| 2053 | 36,802,761 | 20,530,525 | 57,333,286 |



| Expected Yearwise Growth in Bus Trips | | | |
|---|---|---|---|
| Year | Daily Intra City Bus Trips | Daily Inter City Bus Trips | Total Bus Trips Per Day |
| 2019 | 4,455,151 | 5,362,531 | 9,817,681 |
| 2020 | 4,776,070 | 5,432,550 | 10,208,620 |
| 2021 | 5,108,885 | 5,503,646 | 10,612,531 |
| 2022 | 5,453,964 | 5,575,838 | 11,029,802 |
| 2023 | 5,811,686 | 5,649,146 | 11,460,831 |
| 2024 | 6,182,439 | 5,723,590 | 11,906,029 |
| 2025 | 6,566,625 | 5,799,192 | 12,365,817 |
| 2026 | 6,964,654 | 5,875,973 | 12,840,627 |
| 2027 | 7,376,950 | 5,953,956 | 13,330,906 |
| 2028 | 7,803,948 | 6,033,162 | 13,837,110 |
| 2029 | 8,246,095 | 6,113,615 | 14,359,710 |
| 2030 | 8,426,236 | 6,195,338 | 14,621,574 |
| 2031 | 8,610,329 | 6,278,355 | 14,888,684 |
| 2032 | 8,798,461 | 6,362,690 | 15,161,151 |
| 2033 | 8,990,722 | 6,448,368 | 15,439,090 |
| 2034 | 9,187,201 | 6,535,415 | 15,722,617 |
| 2035 | 9,387,993 | 6,623,858 | 16,011,851 |
| 2036 | 9,593,193 | 6,713,721 | 16,306,914 |
| 2037 | 9,802,897 | 6,805,033 | 16,607,930 |
| 2038 | 10,017,205 | 6,897,822 | 16,915,027 |
| 2039 | 10,236,218 | 6,992,116 | 17,228,334 |
| 2040 | 10,460,041 | 7,087,943 | 17,547,984 |
| 2041 | 10,688,779 | 7,185,334 | 17,874,113 |
| 2042 | 10,922,541 | 7,284,319 | 18,206,860 |
| 2043 | 11,161,438 | 7,384,929 | 18,546,366 |
| 2044 | 11,405,582 | 7,487,195 | 18,892,777 |
| 2045 | 11,655,091 | 7,591,150 | 19,246,241 |
| 2046 | 11,910,082 | 7,696,826 | 19,606,909 |
| 2047 | 12,170,677 | 7,804,258 | 19,974,935 |
| 2048 | 12,436,998 | 7,913,481 | 20,350,479 |
| 2049 | 12,709,174 | 8,024,528 | 20,733,702 |
| 2050 | 12,987,332 | 8,137,437 | 21,124,769 |
| 2051 | 13,271,605 | 8,252,245 | 21,523,850 |
| 2052 | 13,562,128 | 8,368,988 | 21,931,116 |
| 2053 | 13,859,040 | 8,487,706 | 22,346,746 |

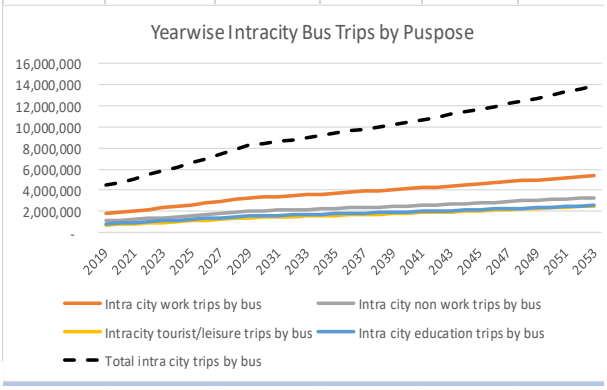



| Expected Yearwise Growth in daiy Intracity passenger PT Trips | | | | |
|---|---|---|---|---|
| Year | STU Intra City Trips | Other Bus Intra City Trips | Intra City IPT Trips | Total Intra City Public Transport Trips |
| 2019 | 3,521,000 | 934,151 | 1,126,223 | 5,581,374 |
| 2020 | 3,838,717 | 937,352 | 1,112,633 | 5,888,702 |
| 2021 | 4,168,634 | 940,251 | 1,097,761 | 6,206,646 |
| 2022 | 4,511,133 | 942,831 | 1,081,555 | 6,535,519 |
| 2023 | 4,866,608 | 945,078 | 1,063,959 | 6,875,645 |
| 2024 | 5,235,465 | 946,975 | 1,044,916 | 7,227,355 |
| 2025 | 5,618,119 | 948,506 | 1,024,366 | 7,590,991 |
| 2026 | 6,015,000 | 949,654 | 1,002,248 | 7,966,902 |
| 2027 | 6,426,548 | 950,402 | 978,500 | 8,355,449 |
| 2028 | 6,853,216 | 950,732 | 953,054 | 8,757,002 |
| 2029 | 7,295,471 | 950,624 | 925,844 | 9,171,939 |
| 2030 | 7,454,845 | 971,391 | 947,901 | 9,374,137 |
| 2031 | 7,617,715 | 992,614 | 970,486 | 9,580,815 |
| 2032 | 7,784,159 | 1,014,302 | 993,612 | 9,792,073 |
| 2033 | 7,954,255 | 1,036,467 | 1,017,292 | 10,008,014 |
| 2034 | 8,128,084 | 1,059,117 | 1,041,540 | 10,228,741 |
| 2035 | 8,305,728 | 1,082,265 | 1,066,369 | 10,454,362 |
| 2036 | 8,487,272 | 1,105,921 | 1,091,793 | 10,684,985 |
| 2037 | 8,672,800 | 1,130,096 | 1,117,826 | 10,920,723 |
| 2038 | 8,862,402 | 1,154,802 | 1,144,483 | 11,161,688 |
| 2039 | 9,056,167 | 1,180,051 | 1,171,780 | 11,407,998 |
| 2040 | 9,254,187 | 1,205,854 | 1,199,731 | 11,659,771 |
| 2041 | 9,456,555 | 1,232,224 | 1,228,352 | 11,917,131 |
| 2042 | 9,663,369 | 1,259,172 | 1,257,660 | 12,180,200 |
| 2043 | 9,874,725 | 1,286,713 | 1,287,670 | 12,449,108 |
| 2044 | 10,090,724 | 1,314,859 | 1,318,401 | 12,723,983 |
| 2045 | 10,311,468 | 1,343,623 | 1,349,869 | 13,004,960 |
| 2046 | 10,537,063 | 1,373,019 | 1,382,092 | 13,292,174 |
| 2047 | 10,767,615 | 1,403,061 | 1,415,088 | 13,585,765 |
| 2048 | 11,003,235 | 1,433,764 | 1,448,876 | 13,885,874 |
| 2049 | 11,244,033 | 1,465,141 | 1,483,475 | 14,192,649 |
| 2050 | 11,490,124 | 1,497,208 | 1,518,905 | 14,506,237 |
| 2051 | 11,741,625 | 1,529,980 | 1,555,185 | 14,826,790 |
| 2052 | 11,998,656 | 1,563,472 | 1,592,337 | 15,154,465 |
| 2053 | 12,261,338 | 1,597,701 | 1,630,380 | 15,489,420 |



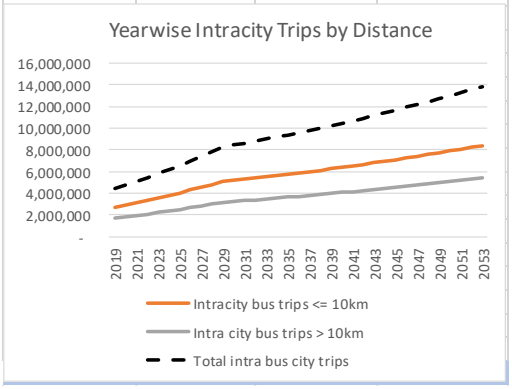
**Yearwise Intracity Bus Trips by Puspose**

| Year | Intra city work trips by bus | Intra city non work trips by bus | Intracity tourist/leisure trips by bus | Intra city education trips by bus | Total intra city trips by bus |
|---|---|---|---|---|---|
| 2019 | 1,786,242 | 1,091,831 | 733,890 | 843188 | 4,455,1 |
| 2020 | 1,913,739 | 1,169,763 | 789,195 | 903373 | 4,776,0 |
| 2021 | 2,045,839 | 1,250,508 | 846,807 | 965731 | 5,108,8 |
| 2022 | 2,182,681 | 1,334,151 | 906,805 | 1030327 | 5,453,9 |
| 2023 | 2,324,405 | 1,420,779 | 969,275 | 1097227 | 5,811,6 |
| 2024 | 2,471,157 | 1,510,480 | 1,034,301 | 1166502 | 6,182,4 |
| 2025 | 2,623,086 | 1,603,346 | 1,101,972 | 1238220 | 6,566,6 |
| 2026 | 2,780,347 | 1,699,471 | 1,172,381 | 1312455 | 6,964,6 |
| 2027 | 2,943,097 | 1,798,951 | 1,245,621 | 1389281 | 7,376,9 |
| 2028 | 3,111,498 | 1,901,884 | 1,321,791 | 1468774 | 7,803,9 |
| 2029 | 3,285,716 | 2,008,374 | 1,400,991 | 1551014 | 8,246,0 |
| 2030 | 3,355,373 | 2,050,952 | 1,436,016 | 1583896 | 8,426,2 |
| 2031 | 3,426,507 | 2,094,432 | 1,471,916 | 1617474 | 8,610,3 |
| 2032 | 3,499,149 | 2,138,834 | 1,508,714 | 1651765 | 8,798,4 |
| 2033 | 3,573,331 | 2,184,177 | 1,546,432 | 1686782 | 8,990,7 |
| 2034 | 3,649,086 | 2,230,482 | 1,585,092 | 1722542 | 9,187,2 |
| 2035 | 3,726,446 | 2,277,768 | 1,624,720 | 1759060 | 9,387,9 |
| 2036 | 3,805,447 | 2,326,056 | 1,665,338 | 1796352 | 9,593,1 |
| 2037 | 3,886,122 | 2,375,369 | 1,706,971 | 1834434 | 9,802,8 |
| 2038 | 3,968,508 | 2,425,727 | 1,749,646 | 1873324 | 10,017,2 |
| 2039 | 4,052,641 | 2,477,152 | 1,793,387 | 1913039 | 10,236,2 |
| 2040 | 4,138,557 | 2,529,668 | 1,838,221 | 1953595 | 10,460,0 |
| 2041 | 4,226,294 | 2,583,297 | 1,884,177 | 1995012 | 10,688,7 |
| 2042 | 4,315,891 | 2,638,062 | 1,931,281 | 2037306 | 10,922,5 |
| 2043 | 4,407,388 | 2,693,989 | 1,979,563 | 2080497 | 11,161,4 |
| 2044 | 4,500,825 | 2,751,102 | 2,029,052 | 2124603 | 11,405,5 |
| 2045 | 4,596,242 | 2,809,425 | 2,079,779 | 2169645 | 11,655,0 |
| 2046 | 4,693,683 | 2,868,985 | 2,131,773 | 2215641 | 11,910,0 |
| 2047 | 4,793,189 | 2,929,808 | 2,185,067 | 2262613 | 12,170,6 |
| 2048 | 4,894,804 | 2,991,920 | 2,239,694 | 2310580 | 12,436,9 |
| 2049 | 4,998,574 | 3,055,348 | 2,295,687 | 2359565 | 12,709,1 |
| 2050 | 5,104,544 | 3,120,122 | 2,353,079 | 2409587 | 12,987,3 |
| 2051 | 5,212,760 | 3,186,268 | 2,411,906 | 2460671 | 13,271,6 |
| 2052 | 5,323,271 | 3,253,817 | 2,472,203 | 2512837 | 13,562,1 |
| 2053 | 5,436,124 | 3,322,798 | 2,534,008 | 2566109 | 13,859,0 |

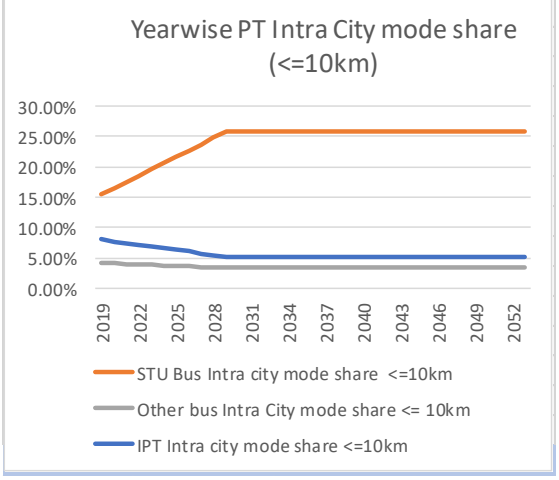



**Yearwise Intracity Trips by Distance**

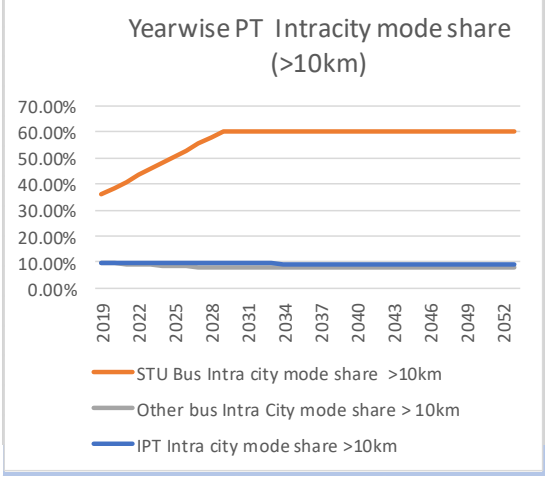
| Year | Intracity bus trips <= 10km | Intra city bus trips > 10km | Total intra bus city trips |
|---|---|---|---|
| 2019 | 2,757,615 | 1,697,536 | 4,455,151 |
| 2020 | 2,954,509 | 1,821,561 | 4,776,070 |
| 2021 | 3,158,517 | 1,950,368 | 5,108,885 |
| 2022 | 3,369,853 | 2,084,111 | 5,453,964 |
| 2023 | 3,588,736 | 2,222,950 | 5,811,686 |
| 2024 | 3,815,392 | 2,367,048 | 6,182,439 |
| 2025 | 4,050,051 | 2,516,574 | 6,566,625 |
| 2026 | 4,292,951 | 2,671,703 | 6,964,654 |
| 2027 | 4,544,336 | 2,832,614 | 7,376,950 |
| 2028 | 4,804,457 | 2,999,490 | 7,803,948 |
| 2029 | 5,073,573 | 3,172,522 | 8,246,095 |
| 2030 | 5,181,235 | 3,245,001 | 8,426,236 |
| 2031 | 5,291,182 | 3,319,147 | 8,610,329 |
| 2032 | 5,403,463 | 3,394,998 | 8,798,461 |
| 2033 | 5,518,127 | 3,472,595 | 8,990,722 |
| 2034 | 5,635,224 | 3,551,977 | 9,187,201 |
| 2035 | 5,754,807 | 3,633,186 | 9,387,993 |
| 2036 | 5,876,928 | 3,716,265 | 9,593,193 |
| 2037 | 6,001,641 | 3,801,256 | 9,802,897 |
| 2038 | 6,129,000 | 3,888,204 | 10,017,205 |
| 2039 | 6,259,063 | 3,977,155 | 10,236,218 |
| 2040 | 6,391,887 | 4,068,154 | 10,460,041 |
| 2041 | 6,527,529 | 4,161,250 | 10,688,779 |
| 2042 | 6,666,051 | 4,256,490 | 10,922,541 |
| 2043 | 6,807,512 | 4,353,925 | 11,161,438 |
| 2044 | 6,951,976 | 4,453,606 | 11,405,582 |
| 2045 | 7,099,507 | 4,555,584 | 11,655,091 |
| 2046 | 7,250,169 | 4,659,914 | 11,910,082 |
| 2047 | 7,404,028 | 4,766,649 | 12,170,677 |
| 2048 | 7,561,154 | 4,875,845 | 12,436,998 |
| 2049 | 7,721,614 | 4,987,560 | 12,709,174 |
| 2050 | 7,885,480 | 5,101,851 | 12,987,332 |
| 2051 | 8,052,825 | 5,218,780 | 13,271,605 |
| 2052 | 8,223,721 | 5,338,407 | 13,562,128 |
| 2053 | 8,398,245 | 5,460,795 | 13,859,040 |



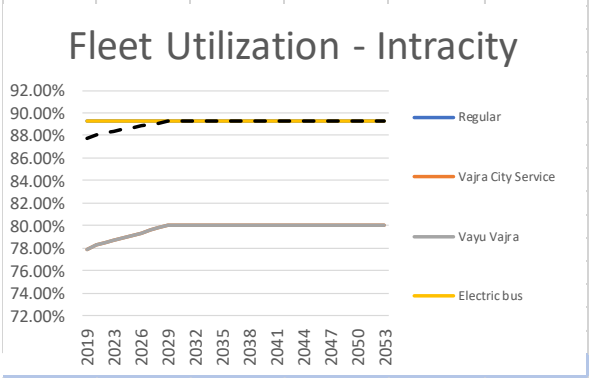
| Yearwise PT Intra City mode share (<=10km) | | | |
|---|---|---|---|
| Year | STU Bus Intra city mode share <=10km | Other bus Intra City mode share <= 10km | IPT Intra city mode share <=10km |
| 2019 | 15.47% | 4.10% | 7.99% |
| 2020 | 16.50% | 4.03% | 7.71% |
| 2021 | 17.54% | 3.95% | 7.43% |
| 2022 | 18.57% | 3.88% | 7.15% |
| 2023 | 19.61% | 3.81% | 6.87% |
| 2024 | 20.64% | 3.73% | 6.59% |
| 2025 | 21.68% | 3.66% | 6.31% |
| 2026 | 22.71% | 3.59% | 6.03% |
| 2027 | 23.75% | 3.51% | 5.75% |
| 2028 | 24.78% | 3.44% | 5.47% |
| 2029 | 25.82% | 3.36% | 5.19% |
| 2030 | 25.82% | 3.36% | 5.19% |
| 2031 | 25.82% | 3.36% | 5.19% |
| 2032 | 25.82% | 3.36% | 5.19% |
| 2033 | 25.82% | 3.36% | 5.19% |
| 2034 | 25.82% | 3.36% | 5.19% |
| 2035 | 25.82% | 3.36% | 5.19% |
| 2036 | 25.82% | 3.36% | 5.19% |
| 2037 | 25.82% | 3.36% | 5.19% |
| 2038 | 25.82% | 3.36% | 5.19% |
| 2039 | 25.82% | 3.36% | 5.19% |
| 2040 | 25.82% | 3.36% | 5.19% |
| 2041 | 25.82% | 3.36% | 5.19% |
| 2042 | 25.82% | 3.36% | 5.19% |
| 2043 | 25.82% | 3.36% | 5.19% |
| 2044 | 25.82% | 3.36% | 5.19% |
| 2045 | 25.82% | 3.36% | 5.19% |
| 2046 | 25.82% | 3.36% | 5.19% |
| 2047 | 25.82% | 3.36% | 5.19% |
| 2048 | 25.82% | 3.36% | 5.19% |
| 2049 | 25.82% | 3.36% | 5.19% |
| 2050 | 25.82% | 3.36% | 5.19% |
| 2051 | 25.82% | 3.36% | 5.19% |
| 2052 | 25.82% | 3.36% | 5.19% |
| 2053 | 25.82% | 3.36% | 5.19% |



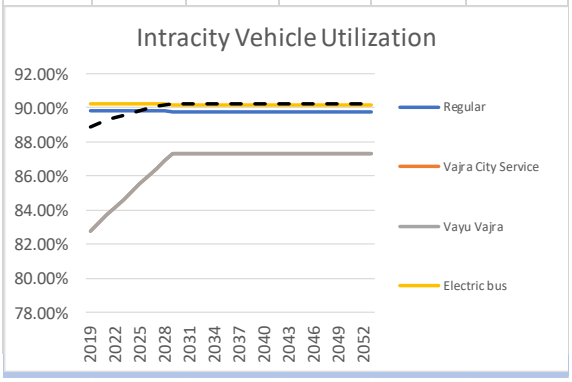

| Yearwise PT Intracity mode share (>10km) | | | |
|---|---|---|---|
| Year | STU Bus Intra city mode share >10km | Other bus Intra City mode share > 10km | IPT Intra city mode share >10km |
| 2019 | 36.06% | 9.57% | 9.52% |
| 2020 | 38.47% | 9.40% | 9.52% |
| 2021 | 40.89% | 9.23% | 9.52% |
| 2022 | 43.30% | 9.05% | 9.52% |
| 2023 | 45.72% | 8.88% | 9.52% |
| 2024 | 48.13% | 8.71% | 9.52% |
| 2025 | 50.54% | 8.54% | 9.52% |
| 2026 | 52.96% | 8.36% | 9.52% |
| 2027 | 55.37% | 8.19% | 9.52% |
| 2028 | 57.79% | 8.02% | 9.52% |
| 2029 | 60.20% | 7.85% | 9.52% |
| 2030 | 60.20% | 7.85% | 9.52% |
| 2031 | 60.20% | 7.85% | 9.52% |
| 2032 | 60.20% | 7.85% | 9.52% |
| 2033 | 60.20% | 7.85% | 9.52% |
| 2034 | 60.20% | 7.85% | 9.52% |
| 2035 | 60.20% | 7.85% | 9.52% |
| 2036 | 60.20% | 7.85% | 9.52% |
| 2037 | 60.20% | 7.85% | 9.52% |
| 2038 | 60.20% | 7.85% | 9.52% |
| 2039 | 60.20% | 7.85% | 9.52% |
| 2040 | 60.20% | 7.85% | 9.52% |
| 2041 | 60.20% | 7.85% | 9.52% |
| 2042 | 60.20% | 7.85% | 9.52% |
| 2043 | 60.20% | 7.85% | 9.52% |
| 2044 | 60.20% | 7.85% | 9.52% |
| 2045 | 60.20% | 7.85% | 9.52% |
| 2046 | 60.20% | 7.85% | 9.52% |
| 2047 | 60.20% | 7.85% | 9.52% |
| 2048 | 60.20% | 7.85% | 9.52% |
| 2049 | 60.20% | 7.85% | 9.52% |
| 2050 | 60.20% | 7.85% | 9.52% |
| 2051 | 60.20% | 7.85% | 9.52% |
| 2052 | 60.20% | 7.85% | 9.52% |
| 2053 | 60.20% | 7.85% | 9.52% |



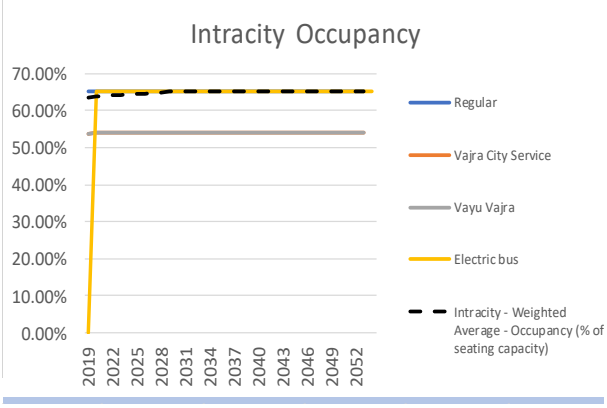
| Intracity Fleet Utilization | | | | | |
|---|---|---|---|---|---|
| Year | Regular | Vajra City Service | Vayu Vajra | Electric bus | Intracity - Weighted Average - Fleet Utilization (%) |
| 2019 | 89.23% | 77.89% | 77.89% | 89.23% | 87.74% |
| 2020 | 89.23% | 78.10% | 78.10% | 89.23% | 87.92% |
| 2021 | 89.23% | 78.31% | 78.31% | 89.23% | 88.08% |
| 2022 | 89.23% | 78.52% | 78.52% | 89.23% | 88.25% |
| 2023 | 89.23% | 78.73% | 78.73% | 89.23% | 88.40% |
| 2024 | 89.23% | 78.95% | 78.95% | 89.23% | 88.56% |
| 2025 | 89.23% | 79.16% | 79.16% | 89.23% | 88.70% |
| 2026 | 89.23% | 79.37% | 79.37% | 89.23% | 88.84% |
| 2027 | 89.23% | 79.58% | 79.58% | 89.23% | 88.98% |
| 2028 | 89.23% | 79.79% | 79.79% | 89.23% | 89.11% |
| 2029 | 89.23% | 80.00% | 80.00% | 89.23% | 89.23% |
| 2030 | 89.23% | 80.00% | 80.00% | 89.23% | 89.23% |
| 2031 | 89.23% | 80.00% | 80.00% | 89.23% | 89.23% |
| 2032 | 89.23% | 80.00% | 80.00% | 89.23% | 89.23% |
| 2033 | 89.23% | 80.00% | 80.00% | 89.23% | 89.23% |
| 2034 | 89.23% | 80.00% | 80.00% | 89.23% | 89.23% |
| 2035 | 89.23% | 80.00% | 80.00% | 89.23% | 89.23% |
| 2036 | 89.23% | 80.00% | 80.00% | 89.23% | 89.23% |
| 2037 | 89.23% | 80.00% | 80.00% | 89.23% | 89.23% |
| 2038 | 89.23% | 80.00% | 80.00% | 89.23% | 89.23% |
| 2039 | 89.23% | 80.00% | 80.00% | 89.23% | 89.23% |
| 2040 | 89.23% | 80.00% | 80.00% | 89.23% | 89.23% |
| 2041 | 89.23% | 80.00% | 80.00% | 89.23% | 89.23% |
| 2042 | 89.23% | 80.00% | 80.00% | 89.23% | 89.23% |
| 2043 | 89.23% | 80.00% | 80.00% | 89.23% | 89.23% |
| 2044 | 89.23% | 80.00% | 80.00% | 89.23% | 89.23% |
| 2045 | 89.23% | 80.00% | 80.00% | 89.23% | 89.23% |
| 2046 | 89.23% | 80.00% | 80.00% | 89.23% | 89.23% |
| 2047 | 89.23% | 80.00% | 80.00% | 89.23% | 89.23% |
| 2048 | 89.23% | 80.00% | 80.00% | 89.23% | 89.23% |
| 2049 | 89.23% | 80.00% | 80.00% | 89.23% | 89.23% |
| 2050 | 89.23% | 80.00% | 80.00% | 89.23% | 89.23% |
| 2051 | 89.23% | 80.00% | 80.00% | 89.23% | 89.23% |
| 2052 | 89.23% | 80.00% | 80.00% | 89.23% | 89.23% |
| 2053 | 89.23% | 80.00% | 80.00% | 89.23% | 89.23% |



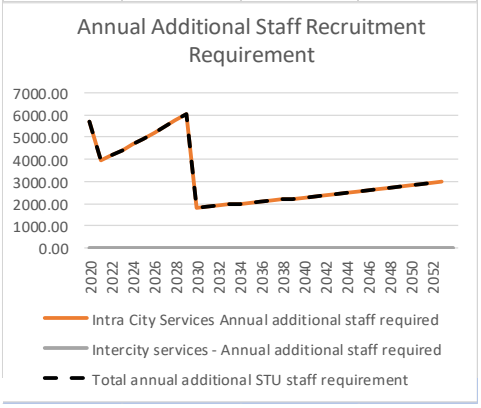

| Intracity Vehicle Utilization | | | | | |
|---|---|---|---|---|---|
| Year | Regular | Vajra City Service | Vayu Vajra | Electric bus | Intracity - Weighted Average - Vehicle Utilization(%) |
| 2019 | 89.80% | 82.78% | 82.78% | 90.25% | 88.88% |
| 2020 | 89.80% | 83.23% | 83.23% | 90.25% | 89.07% |
| 2021 | 89.80% | 83.69% | 83.69% | 90.25% | 89.25% |
| 2022 | 89.80% | 84.15% | 84.15% | 90.25% | 89.42% |
| 2023 | 89.80% | 84.60% | 84.60% | 90.25% | 89.57% |
| 2024 | 89.80% | 85.06% | 85.06% | 90.25% | 89.72% |
| 2025 | 89.80% | 85.52% | 85.52% | 90.25% | 89.85% |
| 2026 | 89.80% | 85.97% | 85.97% | 90.25% | 89.97% |
| 2027 | 89.80% | 86.43% | 86.43% | 90.25% | 90.07% |
| 2028 | 89.80% | 86.88% | 86.88% | 90.25% | 90.17% |
| 2029 | 89.80% | 87.34% | 87.34% | 90.25% | 90.25% |
| 2030 | 89.80% | 87.34% | 87.34% | 90.25% | 90.25% |
| 2031 | 89.80% | 87.34% | 87.34% | 90.25% | 90.25% |
| 2032 | 89.80% | 87.34% | 87.34% | 90.25% | 90.25% |
| 2033 | 89.80% | 87.34% | 87.34% | 90.25% | 90.25% |
| 2034 | 89.80% | 87.34% | 87.34% | 90.25% | 90.25% |
| 2035 | 89.80% | 87.34% | 87.34% | 90.25% | 90.25% |
| 2036 | 89.80% | 87.34% | 87.34% | 90.25% | 90.25% |
| 2037 | 89.80% | 87.34% | 87.34% | 90.25% | 90.25% |
| 2038 | 89.80% | 87.34% | 87.34% | 90.25% | 90.25% |
| 2039 | 89.80% | 87.34% | 87.34% | 90.25% | 90.25% |
| 2040 | 89.80% | 87.34% | 87.34% | 90.25% | 90.25% |
| 2041 | 89.80% | 87.34% | 87.34% | 90.25% | 90.25% |
| 2042 | 89.80% | 87.34% | 87.34% | 90.25% | 90.25% |
| 2043 | 89.80% | 87.34% | 87.34% | 90.25% | 90.25% |
| 2044 | 89.80% | 87.34% | 87.34% | 90.25% | 90.25% |
| 2045 | 89.80% | 87.34% | 87.34% | 90.25% | 90.25% |
| 2046 | 89.80% | 87.34% | 87.34% | 90.25% | 90.25% |
| 2047 | 89.80% | 87.34% | 87.34% | 90.25% | 90.25% |
| 2048 | 89.80% | 87.34% | 87.34% | 90.25% | 90.25% |
| 2049 | 89.80% | 87.34% | 87.34% | 90.25% | 90.25% |
| 2050 | 89.80% | 87.34% | 87.34% | 90.25% | 90.25% |
| 2051 | 89.80% | 87.34% | 87.34% | 90.25% | 90.25% |
| 2052 | 89.80% | 87.34% | 87.34% | 90.25% | 90.25% |
| 2053 | 89.80% | 87.34% | 87.34% | 90.25% | 90.25% |



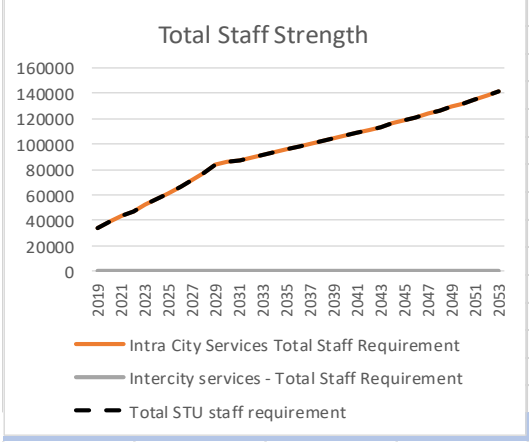
| Intracity - Occupancy | | | | | |
|---|---|---|---|---|---|
| Year | Regular | Vajra City Service | Vayu Vajra | Electric bus | Intracity - Weighted Average - Occupancy (% of seating capacity) |
| 2019 | 65.00% | 53.90% | 53.90% | 65.00% | 63.54% |
| 2020 | 65.00% | 53.92% | 53.92% | 65.00% | 63.69% |
| 2021 | 65.00% | 53.94% | 53.94% | 65.00% | 63.84% |
| 2022 | 65.00% | 53.96% | 53.96% | 65.00% | 63.99% |
| 2023 | 65.00% | 53.98% | 53.98% | 65.00% | 64.13% |
| 2024 | 65.00% | 54.00% | 54.00% | 65.00% | 64.28% |
| 2025 | 65.00% | 54.02% | 54.02% | 65.00% | 64.42% |
| 2026 | 65.00% | 54.04% | 54.04% | 65.00% | 64.57% |
| 2027 | 65.00% | 54.06% | 54.06% | 65.00% | 64.71% |
| 2028 | 65.00% | 54.08% | 54.08% | 65.00% | 64.86% |
| 2029 | 65.00% | 54.10% | 54.10% | 65.00% | 65.00% |
| 2030 | 65.00% | 54.10% | 54.10% | 65.00% | 65.00% |
| 2031 | 65.00% | 54.10% | 54.10% | 65.00% | 65.00% |
| 2032 | 65.00% | 54.10% | 54.10% | 65.00% | 65.00% |
| 2033 | 65.00% | 54.10% | 54.10% | 65.00% | 65.00% |
| 2034 | 65.00% | 54.10% | 54.10% | 65.00% | 65.00% |
| 2035 | 65.00% | 54.10% | 54.10% | 65.00% | 65.00% |
| 2036 | 65.00% | 54.10% | 54.10% | 65.00% | 65.00% |
| 2037 | 65.00% | 54.10% | 54.10% | 65.00% | 65.00% |
| 2038 | 65.00% | 54.10% | 54.10% | 65.00% | 65.00% |
| 2039 | 65.00% | 54.10% | 54.10% | 65.00% | 65.00% |
| 2040 | 65.00% | 54.10% | 54.10% | 65.00% | 65.00% |
| 2041 | 65.00% | 54.10% | 54.10% | 65.00% | 65.00% |
| 2042 | 65.00% | 54.10% | 54.10% | 65.00% | 65.00% |
| 2043 | 65.00% | 54.10% | 54.10% | 65.00% | 65.00% |
| 2044 | 65.00% | 54.10% | 54.10% | 65.00% | 65.00% |
| 2045 | 65.00% | 54.10% | 54.10% | 65.00% | 65.00% |
| 2046 | 65.00% | 54.10% | 54.10% | 65.00% | 65.00% |
| 2047 | 65.00% | 54.10% | 54.10% | 65.00% | 65.00% |
| 2048 | 65.00% | 54.10% | 54.10% | 65.00% | 65.00% |
| 2049 | 65.00% | 54.10% | 54.10% | 65.00% | 65.00% |
| 2050 | 65.00% | 54.10% | 54.10% | 65.00% | 65.00% |
| 2051 | 65.00% | 54.10% | 54.10% | 65.00% | 65.00% |
| 2052 | 65.00% | 54.10% | 54.10% | 65.00% | 65.00% |
| 2053 | 65.00% | 54.10% | 54.10% | 65.00% | 65.00% |



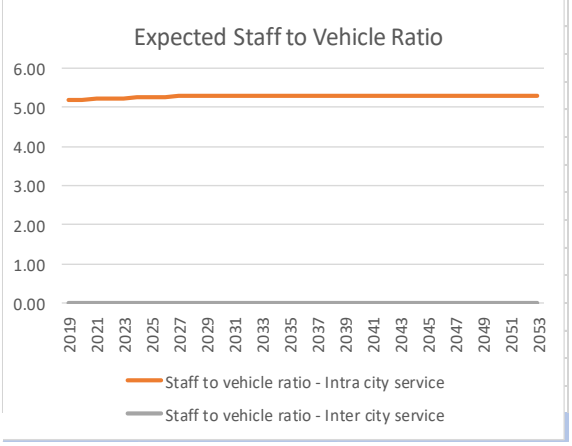

| Annual Additional Staff Recruitment Requirement | | | |
|---|---|---|---|
| Year | Intra City Services Annual additional staff required | Intercity services - Annual additional staff required | Total annual additional STU staff requirement |
| 2019 | 0.00 | 0.00 | 0.00 |
| 2020 | 5694.00 | 0.00 | 5694.00 |
| 2021 | 3958.00 | 0.00 | 3958.00 |
| 2022 | 4183.00 | 0.00 | 4183.00 |
| 2023 | 4417.00 | 0.00 | 4417.00 |
| 2024 | 4662.00 | 0.00 | 4662.00 |
| 2025 | 4917.00 | 0.00 | 4917.00 |
| 2026 | 5185.00 | 0.00 | 5185.00 |
| 2027 | 5462.00 | 0.00 | 5462.00 |
| 2028 | 5753.00 | 0.00 | 5753.00 |
| 2029 | 6057.00 | 0.00 | 6057.00 |
| 2030 | 1832.00 | 0.00 | 1832.00 |
| 2031 | 1872.00 | 0.00 | 1872.00 |
| 2032 | 1913.00 | 0.00 | 1913.00 |
| 2033 | 1955.00 | 0.00 | 1955.00 |
| 2034 | 1999.00 | 0.00 | 1999.00 |
| 2035 | 2042.00 | 0.00 | 2042.00 |
| 2036 | 2087.00 | 0.00 | 2087.00 |
| 2037 | 2132.00 | 0.00 | 2132.00 |
| 2038 | 2180.00 | 0.00 | 2180.00 |
| 2039 | 2227.00 | 0.00 | 2227.00 |
| 2040 | 2276.00 | 0.00 | 2276.00 |
| 2041 | 2327.00 | 0.00 | 2327.00 |
| 2042 | 2377.00 | 0.00 | 2377.00 |
| 2043 | 2430.00 | 0.00 | 2430.00 |
| 2044 | 2483.00 | 0.00 | 2483.00 |
| 2045 | 2537.00 | 0.00 | 2537.00 |
| 2046 | 2593.00 | 0.00 | 2593.00 |
| 2047 | 2650.00 | 0.00 | 2650.00 |
| 2048 | 2709.00 | 0.00 | 2709.00 |
| 2049 | 2768.00 | 0.00 | 2768.00 |
| 2050 | 2829.00 | 0.00 | 2829.00 |
| 2051 | 2891.00 | 0.00 | 2891.00 |
| 2052 | 2955.00 | 0.00 | 2955.00 |
| 2053 | 3019.00 | 0.00 | 3019.00 |



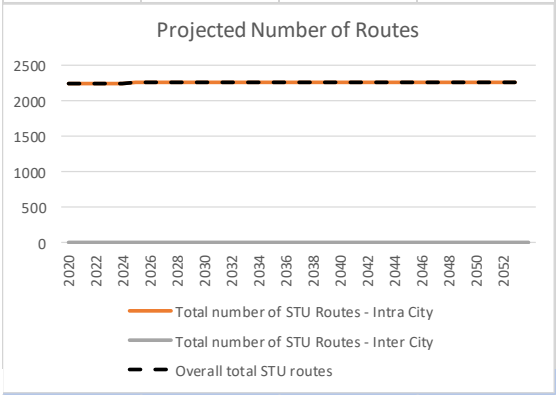
| Total Staff Strength | | | |
|---|---|---|---|
| Year | Intra City Services Total Staff Requirement | Intercity services - Total Staff Requirement | Total STU staff requirement |
| 2019 | 33575 | 0 | 33575 |
| 2020 | 39269 | 0 | 39269 |
| 2021 | 43227 | 0 | 43227 |
| 2022 | 47410 | 0 | 47410 |
| 2023 | 51827 | 0 | 51827 |
| 2024 | 56489 | 0 | 56489 |
| 2025 | 61406 | 0 | 61406 |
| 2026 | 66591 | 0 | 66591 |
| 2027 | 72053 | 0 | 72053 |
| 2028 | 77806 | 0 | 77806 |
| 2029 | 83863 | 0 | 83863 |
| 2030 | 85695 | 0 | 85695 |
| 2031 | 87567 | 0 | 87567 |
| 2032 | 89480 | 0 | 89480 |
| 2033 | 91435 | 0 | 91435 |
| 2034 | 93434 | 0 | 93434 |
| 2035 | 95476 | 0 | 95476 |
| 2036 | 97563 | 0 | 97563 |
| 2037 | 99695 | 0 | 99695 |
| 2038 | 101875 | 0 | 101875 |
| 2039 | 104102 | 0 | 104102 |
| 2040 | 106378 | 0 | 106378 |
| 2041 | 108705 | 0 | 108705 |
| 2042 | 111082 | 0 | 111082 |
| 2043 | 113512 | 0 | 113512 |
| 2044 | 115995 | 0 | 115995 |
| 2045 | 118532 | 0 | 118532 |
| 2046 | 121125 | 0 | 121125 |
| 2047 | 123775 | 0 | 123775 |
| 2048 | 126484 | 0 | 126484 |
| 2049 | 129252 | 0 | 129252 |
| 2050 | 132081 | 0 | 132081 |
| 2051 | 134972 | 0 | 134972 |
| 2052 | 137927 | 0 | 137927 |
| 2053 | 140946 | 0 | 140946 |



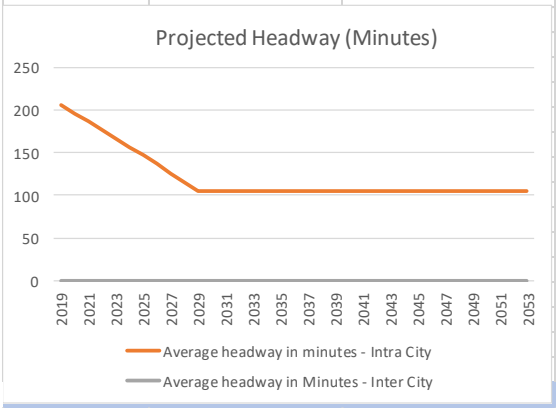

| Expected Staff to Vehicle Ratio | | |
|---|---|---|
| Year | Staff to vehicle ratio - Intra city service | Staff to vehicle ratio - Inter city service |
| 2019 | 5.18 | 0.00 |
| 2020 | 5.19 | 0.00 |
| 2021 | 5.21 | 0.00 |
| 2022 | 5.22 | 0.00 |
| 2023 | 5.23 | 0.00 |
| 2024 | 5.24 | 0.00 |
| 2025 | 5.25 | 0.00 |
| 2026 | 5.26 | 0.00 |
| 2027 | 5.27 | 0.00 |
| 2028 | 5.28 | 0.00 |
| 2029 | 5.29 | 0.00 |
| 2030 | 5.29 | 0.00 |
| 2031 | 5.29 | 0.00 |
| 2032 | 5.29 | 0.00 |
| 2033 | 5.29 | 0.00 |
| 2034 | 5.29 | 0.00 |
| 2035 | 5.29 | 0.00 |
| 2036 | 5.29 | 0.00 |
| 2037 | 5.29 | 0.00 |
| 2038 | 5.29 | 0.00 |
| 2039 | 5.29 | 0.00 |
| 2040 | 5.29 | 0.00 |
| 2041 | 5.29 | 0.00 |
| 2042 | 5.29 | 0.00 |
| 2043 | 5.29 | 0.00 |
| 2044 | 5.29 | 0.00 |
| 2045 | 5.29 | 0.00 |
| 2046 | 5.29 | 0.00 |
| 2047 | 5.29 | 0.00 |
| 2048 | 5.29 | 0.00 |
| 2049 | 5.29 | 0.00 |
| 2050 | 5.29 | 0.00 |
| 2051 | 5.29 | 0.00 |
| 2052 | 5.29 | 0.00 |
| 2053 | 5.29 | 0.00 |



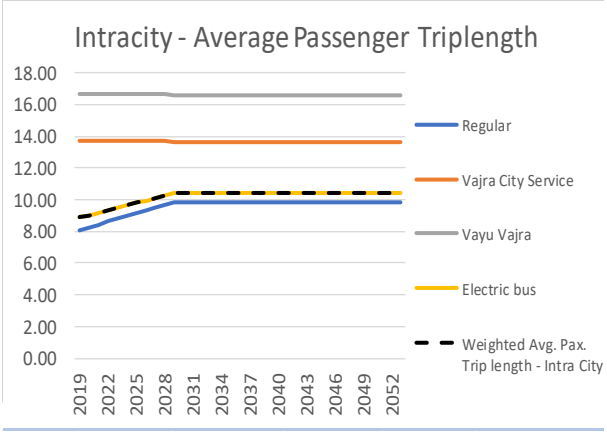
| Projected Number of Routes | | | |
|---|---|---|---|
| Year | Total number of STU Routes - Intra City | Total number of STU Routes - Inter City | Overall total STU routes |
| 2019 | 2263 | 0 | 2263 |
| 2020 | 2263 | 0 | 2263 |
| 2021 | 2263 | 0 | 2263 |
| 2022 | 2263 | 0 | 2263 |
| 2023 | 2263 | 0 | 2263 |
| 2024 | 2263 | 0 | 2263 |
| 2025 | 2264 | 0 | 2264 |
| 2026 | 2264 | 0 | 2264 |
| 2027 | 2264 | 0 | 2264 |
| 2028 | 2264 | 0 | 2264 |
| 2029 | 2264 | 0 | 2264 |
| 2030 | 2264 | 0 | 2264 |
| 2031 | 2264 | 0 | 2264 |
| 2032 | 2264 | 0 | 2264 |
| 2033 | 2264 | 0 | 2264 |
| 2034 | 2264 | 0 | 2264 |
| 2035 | 2264 | 0 | 2264 |
| 2036 | 2264 | 0 | 2264 |
| 2037 | 2264 | 0 | 2264 |
| 2038 | 2264 | 0 | 2264 |
| 2039 | 2264 | 0 | 2264 |
| 2040 | 2264 | 0 | 2264 |
| 2041 | 2264 | 0 | 2264 |
| 2042 | 2264 | 0 | 2264 |
| 2043 | 2264 | 0 | 2264 |
| 2044 | 2264 | 0 | 2264 |
| 2045 | 2264 | 0 | 2264 |
| 2046 | 2264 | 0 | 2264 |
| 2047 | 2264 | 0 | 2264 |
| 2048 | 2264 | 0 | 2264 |
| 2049 | 2264 | 0 | 2264 |
| 2050 | 2264 | 0 | 2264 |
| 2051 | 2264 | 0 | 2264 |
| 2052 | 2264 | 0 | 2264 |
| 2053 | 2264 | 0 | 2264 |



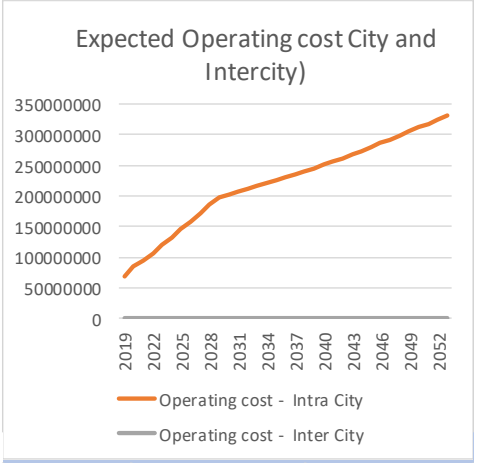

| Projected Headway (Minutes) | | |
|---|---|---|
| Year | Average headway in minutes - Intra City | Average headway in Minutes - Inter City |
| 2019 | 205 | 0 |
| 2020 | 196 | 0 |
| 2021 | 186 | 0 |
| 2022 | 176 | 0 |
| 2023 | 167 | 0 |
| 2024 | 157 | 0 |
| 2025 | 147 | 0 |
| 2026 | 136 | 0 |
| 2027 | 126 | 0 |
| 2028 | 116 | 0 |
| 2029 | 105 | 0 |
| 2030 | 105 | 0 |
| 2031 | 105 | 0 |
| 2032 | 105 | 0 |
| 2033 | 105 | 0 |
| 2034 | 105 | 0 |
| 2035 | 105 | 0 |
| 2036 | 105 | 0 |
| 2037 | 105 | 0 |
| 2038 | 105 | 0 |
| 2039 | 105 | 0 |
| 2040 | 105 | 0 |
| 2041 | 105 | 0 |
| 2042 | 105 | 0 |
| 2043 | 105 | 0 |
| 2044 | 105 | 0 |
| 2045 | 105 | 0 |
| 2046 | 105 | 0 |
| 2047 | 105 | 0 |
| 2048 | 105 | 0 |
| 2049 | 105 | 0 |
| 2050 | 105 | 0 |
| 2051 | 105 | 0 |
| 2052 | 105 | 0 |
| 2053 | 105 | 0 |



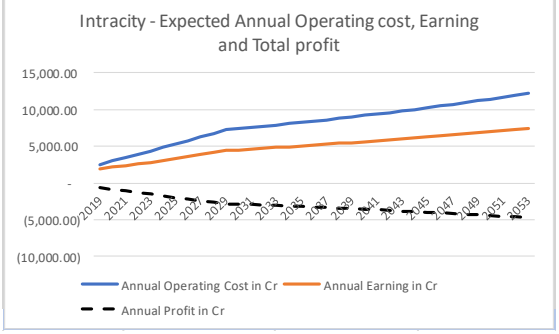
| Intracity - Avg Pax Triplength | | | | | |
|---|---|---|---|---|---|
| Year | Regular | Vajra City Service | Vayu Vajra | Electric bus | Weighted Avg. Pax. Trip length - Intra City |
| 2019 | 8.07 | 13.74 | 16.67 | 8.87 | 8.87 |
| 2020 | 8.25 | 13.74 | 16.67 | 9.02 | 9.02 |
| 2021 | 8.43 | 13.74 | 16.67 | 9.18 | 9.18 |
| 2022 | 8.61 | 13.74 | 16.67 | 9.33 | 9.33 |
| 2023 | 8.78 | 13.74 | 16.67 | 9.48 | 9.48 |
| 2024 | 8.96 | 13.74 | 16.67 | 9.64 | 9.64 |
| 2025 | 9.14 | 13.74 | 16.67 | 9.79 | 9.79 |
| 2026 | 9.32 | 13.74 | 16.67 | 9.95 | 9.95 |
| 2027 | 9.49 | 13.74 | 16.67 | 10.10 | 10.10 |
| 2028 | 9.67 | 13.74 | 16.67 | 10.26 | 10.26 |
| 2029 | 9.85 | 13.74 | 16.67 | 10.41 | 10.41 |
| 2030 | 9.85 | 13.74 | 16.67 | 10.41 | 10.41 |
| 2031 | 9.85 | 13.74 | 16.67 | 10.41 | 10.41 |
| 2032 | 9.85 | 13.74 | 16.67 | 10.41 | 10.41 |
| 2033 | 9.85 | 13.74 | 16.67 | 10.41 | 10.41 |
| 2034 | 9.85 | 13.74 | 16.67 | 10.41 | 10.41 |
| 2035 | 9.85 | 13.74 | 16.67 | 10.41 | 10.41 |
| 2036 | 9.85 | 13.74 | 16.67 | 10.41 | 10.41 |
| 2037 | 9.85 | 13.74 | 16.67 | 10.41 | 10.41 |
| 2038 | 9.85 | 13.74 | 16.67 | 10.41 | 10.41 |
| 2039 | 9.85 | 13.74 | 16.67 | 10.41 | 10.41 |
| 2040 | 9.85 | 13.74 | 16.67 | 10.41 | 10.41 |
| 2041 | 9.85 | 13.74 | 16.67 | 10.41 | 10.41 |
| 2042 | 9.85 | 13.74 | 16.67 | 10.41 | 10.41 |
| 2043 | 9.85 | 13.74 | 16.67 | 10.41 | 10.41 |
| 2044 | 9.85 | 13.74 | 16.67 | 10.41 | 10.41 |
| 2045 | 9.85 | 13.74 | 16.67 | 10.41 | 10.41 |
| 2046 | 9.85 | 13.74 | 16.67 | 10.41 | 10.41 |
| 2047 | 9.85 | 13.74 | 16.67 | 10.41 | 10.41 |
| 2048 | 9.85 | 13.74 | 16.67 | 10.41 | 10.41 |
| 2049 | 9.85 | 13.74 | 16.67 | 10.41 | 10.41 |
| 2050 | 9.85 | 13.74 | 16.67 | 10.41 | 10.41 |
| 2051 | 9.85 | 13.74 | 16.67 | 10.41 | 10.41 |
| 2052 | 9.85 | 13.74 | 16.67 | 10.41 | 10.41 |
| 2053 | 9.85 | 13.74 | 16.67 | 10.41 | 10.41 |



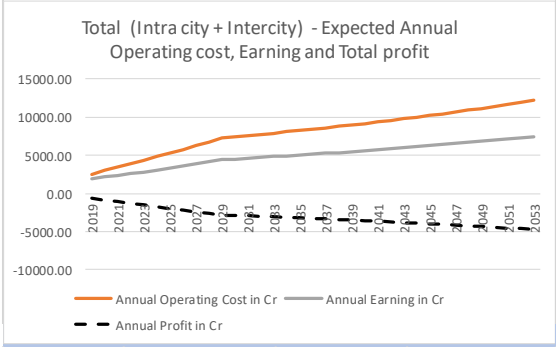

| Expected Operating cost Intra and Intercity | | |
|---|---|---|
| Year | Operating cost - Intra City | Operating cost - Inter City |
| 2019 | 69159873 | 0 |
| 2020 | 83895082 | 0 |
| 2021 | 95214796 | 0 |
| 2022 | 107081916 | 0 |
| 2023 | 119426563 | 0 |
| 2024 | 132167221 | 0 |
| 2025 | 145209896 | 0 |
| 2026 | 158447236 | 0 |
| 2027 | 171757603 | 0 |
| 2028 | 185004093 | 0 |
| 2029 | 198033514 | 0 |
| 2030 | 202359672 | 0 |
| 2031 | 206780741 | 0 |
| 2032 | 211298813 | 0 |
| 2033 | 215916025 | 0 |
| 2034 | 220634565 | 0 |
| 2035 | 225456666 | 0 |
| 2036 | 230384611 | 0 |
| 2037 | 235420735 | 0 |
| 2038 | 240567425 | 0 |
| 2039 | 245827118 | 0 |
| 2040 | 251202309 | 0 |
| 2041 | 256695545 | 0 |
| 2042 | 262309431 | 0 |
| 2043 | 268046630 | 0 |
| 2044 | 273909864 | 0 |
| 2045 | 279901915 | 0 |
| 2046 | 286025626 | 0 |
| 2047 | 292283904 | 0 |
| 2048 | 298679722 | 0 |
| 2049 | 305216115 | 0 |
| 2050 | 311896190 | 0 |
| 2051 | 318723120 | 0 |
| 2052 | 325700149 | 0 |
| 2053 | 332830593 | 0 |



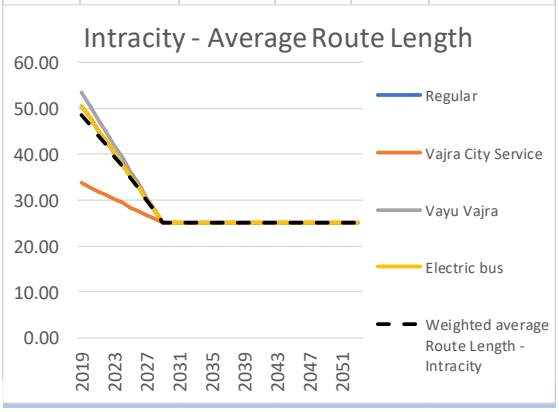
| Intra city - Expected Annual Operating Cost, Earning and Total Profit | | | |
|---|---|---|---|
| Year | Annual Operating Cost in Cr | Annual Earning in Cr | Annual Profit in Cr |
| 2019 | 2,524.34 | 1,860.15 | -664.18 |
| 2020 | 3,062.17 | 2,166.48 | -895.69 |
| 2021 | 3,475.34 | 2,374.28 | -1101.06 |
| 2022 | 3,908.49 | 2,591.98 | -1316.51 |
| 2023 | 4,359.07 | 2,819.83 | -1539.24 |
| 2024 | 4,824.10 | 3,058.05 | -1766.05 |
| 2025 | 5,300.16 | 3,306.90 | -1993.26 |
| 2026 | 5,783.32 | 3,566.62 | -2216.71 |
| 2027 | 6,269.15 | 3,837.44 | -2431.72 |
| 2028 | 6,752.65 | 4,119.60 | -2633.05 |
| 2029 | 7,228.22 | 4,413.35 | -2814.88 |
| 2030 | 7,386.13 | 4,509.76 | -2876.37 |
| 2031 | 7,547.50 | 4,608.29 | -2939.21 |
| 2032 | 7,712.41 | 4,708.98 | -3003.43 |
| 2033 | 7,880.93 | 4,811.87 | -3069.06 |
| 2034 | 8,053.16 | 4,917.03 | -3136.13 |
| 2035 | 8,229.17 | 5,024.50 | -3204.67 |
| 2036 | 8,409.04 | 5,134.32 | -3274.72 |
| 2037 | 8,592.86 | 5,246.55 | -3346.30 |
| 2038 | 8,780.71 | 5,361.25 | -3419.46 |
| 2039 | 8,972.69 | 5,478.47 | -3494.22 |
| 2040 | 9,168.88 | 5,598.26 | -3570.63 |
| 2041 | 9,369.39 | 5,720.68 | -3648.71 |
| 2042 | 9,574.29 | 5,845.79 | -3728.50 |
| 2043 | 9,783.70 | 5,973.65 | -3810.05 |
| 2044 | 9,997.71 | 6,104.32 | -3893.39 |
| 2045 | 10,216.42 | 6,237.85 | -3978.57 |
| 2046 | 10,439.94 | 6,374.33 | -4065.61 |
| 2047 | 10,668.36 | 6,513.80 | -4154.57 |
| 2048 | 10,901.81 | 6,656.33 | -4245.48 |
| 2049 | 11,140.39 | 6,802.00 | -4338.39 |
| 2050 | 11,384.21 | 6,950.87 | -4433.34 |
| 2051 | 11,633.39 | 7,103.02 | -4530.38 |
| 2052 | 11,888.06 | 7,258.51 | -4629.55 |
| 2053 | 12,148.32 | 7,417.42 | -4730.90 |



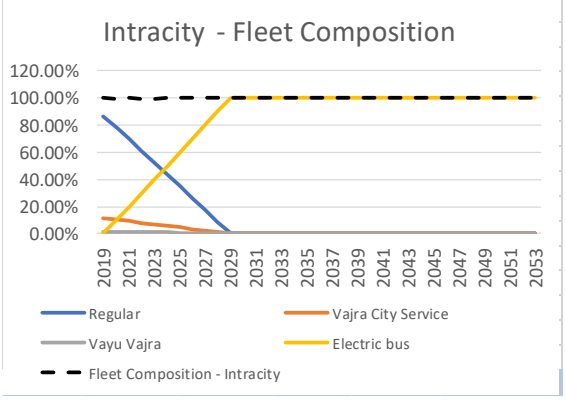

| Total (Inter city + Intercity) - Expected Annual Operating cost, Earning and Total profit | | | |
|---|---|---|---|
| Year | Annual Operating Cost in Cr | Annual Earning in Cr | Annual Profit in Cr |
| 2019 | 2524.34 | 1860.15 | -664.18 |
| 2020 | 3062.17 | 2166.48 | -895.69 |
| 2021 | 3475.34 | 2374.28 | -1101.06 |
| 2022 | 3908.49 | 2591.98 | -1316.51 |
| 2023 | 4359.07 | 2819.83 | -1539.24 |
| 2024 | 4824.10 | 3058.05 | -1766.05 |
| 2025 | 5300.16 | 3306.90 | -1993.26 |
| 2026 | 5783.32 | 3566.62 | -2216.71 |
| 2027 | 6269.15 | 3837.44 | -2431.72 |
| 2028 | 6752.65 | 4119.60 | -2633.05 |
| 2029 | 7228.22 | 4413.35 | -2814.88 |
| 2030 | 7386.13 | 4509.76 | -2876.37 |
| 2031 | 7547.50 | 4608.29 | -2939.21 |
| 2032 | 7712.41 | 4708.98 | -3003.43 |
| 2033 | 7880.93 | 4811.87 | -3069.06 |
| 2034 | 8053.16 | 4917.03 | -3136.13 |
| 2035 | 8229.17 | 5024.50 | -3204.67 |
| 2036 | 8409.04 | 5134.32 | -3274.72 |
| 2037 | 8592.86 | 5246.55 | -3346.30 |
| 2038 | 8780.71 | 5361.25 | -3419.46 |
| 2039 | 8972.69 | 5478.47 | -3494.22 |
| 2040 | 9168.88 | 5598.26 | -3570.63 |
| 2041 | 9369.39 | 5720.68 | -3648.71 |
| 2042 | 9574.29 | 5845.79 | -3728.50 |
| 2043 | 9783.70 | 5973.65 | -3810.05 |
| 2044 | 9997.71 | 6104.32 | -3893.39 |
| 2045 | 10216.42 | 6237.85 | -3978.57 |
| 2046 | 10439.94 | 6374.33 | -4065.61 |
| 2047 | 10668.36 | 6513.80 | -4154.57 |
| 2048 | 10901.81 | 6656.33 | -4245.48 |
| 2049 | 11140.39 | 6802.00 | -4338.39 |
| 2050 | 11384.21 | 6950.87 | -4433.34 |
| 2051 | 11633.39 | 7103.02 | -4530.38 |
| 2052 | 11888.06 | 7258.51 | -4629.55 |
| 2053 | 12148.32 | 7417.42 | -4730.90 |



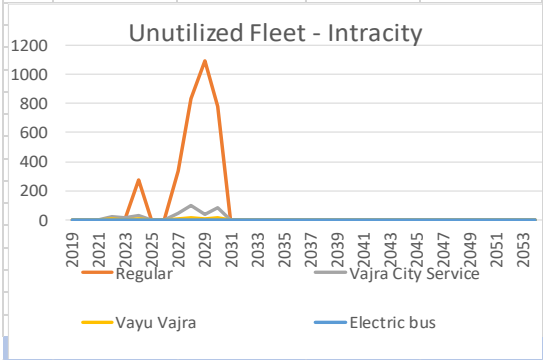
| Average Route Length - Intracity | | | | | |
|---|---|---|---|---|---|
| Year | Regular | Vajra City Service | Vayu Vajra | Electric bus | Weighted average Route Length - Intracity |
| 2019 | 50.48 | 33.70 | 53.40 | 50.48 | 48.61 |
| 2020 | 47.93 | 32.83 | 50.56 | 47.93 | 46.42 |
| 2021 | 45.38 | 31.96 | 47.72 | 45.38 | 44.19 |
| 2022 | 42.84 | 31.09 | 44.88 | 42.84 | 41.92 |
| 2023 | 40.29 | 30.22 | 42.04 | 40.29 | 39.61 |
| 2024 | 37.74 | 29.35 | 39.20 | 37.74 | 37.27 |
| 2025 | 35.19 | 28.48 | 36.36 | 35.19 | 34.89 |
| 2026 | 32.64 | 27.61 | 33.52 | 32.64 | 32.48 |
| 2027 | 30.10 | 26.74 | 30.68 | 30.10 | 30.02 |
| 2028 | 27.55 | 25.87 | 27.84 | 27.55 | 27.53 |
| 2029 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 |
| 2030 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 |
| 2031 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 |
| 2032 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 |
| 2033 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 |
| 2034 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 |
| 2035 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 |
| 2036 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 |
| 2037 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 |
| 2038 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 |
| 2039 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 |
| 2040 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 |
| 2041 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 |
| 2042 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 |
| 2043 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 |
| 2044 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 |
| 2045 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 |
| 2046 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 |
| 2047 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 |
| 2048 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 |
| 2049 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 |
| 2050 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 |
| 2051 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 |
| 2052 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 |
| 2053 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 |



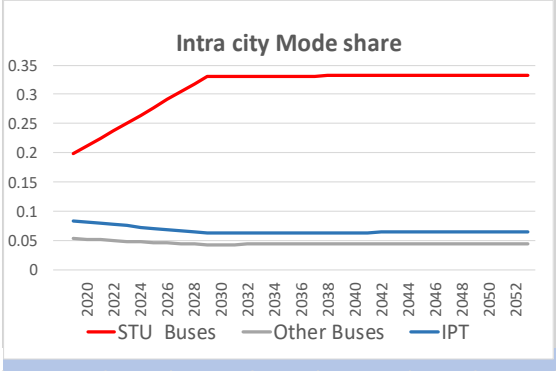

| Average Fleet Composition - Intracity | | | | | |
|---|---|---|---|---|---|
| Year | Regular | Vajra City Service | Vayu Vajra | Electric bus | Fleet Composition - Intracity |
| 2019 | 86.89% | 11.45% | 1.67% | 0.00% | 100.00% |
| 2020 | 78.20% | 10.30% | 1.50% | 10.00% | 100.00% |
| 2021 | 69.51% | 9.16% | 1.33% | 20.00% | 100.00% |
| 2022 | 60.82% | 8.01% | 1.17% | 30.00% | 100.00% |
| 2023 | 52.13% | 6.87% | 1.00% | 40.00% | 100.00% |
| 2024 | 43.44% | 5.72% | 0.83% | 50.00% | 100.00% |
| 2025 | 34.75% | 4.58% | 0.67% | 60.00% | 100.00% |
| 2026 | 26.07% | 3.43% | 0.50% | 70.00% | 100.00% |
| 2027 | 17.38% | 2.29% | 0.33% | 80.00% | 100.00% |
| 2028 | 8.69% | 1.14% | 0.17% | 90.00% | 100.00% |
| 2029 | 0.00% | 0.00% | 0.00% | 100.00% | 100.00% |
| 2030 | 0.00% | 0.00% | 0.00% | 100.00% | 100.00% |
| 2031 | 0.00% | 0.00% | 0.00% | 100.00% | 100.00% |
| 2032 | 0.00% | 0.00% | 0.00% | 100.00% | 100.00% |
| 2033 | 0.00% | 0.00% | 0.00% | 100.00% | 100.00% |
| 2034 | 0.00% | 0.00% | 0.00% | 100.00% | 100.00% |
| 2035 | 0.00% | 0.00% | 0.00% | 100.00% | 100.00% |
| 2036 | 0.00% | 0.00% | 0.00% | 100.00% | 100.00% |
| 2037 | 0.00% | 0.00% | 0.00% | 100.00% | 100.00% |
| 2038 | 0.00% | 0.00% | 0.00% | 100.00% | 100.00% |
| 2039 | 0.00% | 0.00% | 0.00% | 100.00% | 100.00% |
| 2040 | 0.00% | 0.00% | 0.00% | 100.00% | 100.00% |
| 2041 | 0.00% | 0.00% | 0.00% | 100.00% | 100.00% |
| 2042 | 0.00% | 0.00% | 0.00% | 100.00% | 100.00% |
| 2043 | 0.00% | 0.00% | 0.00% | 100.00% | 100.00% |
| 2044 | 0.00% | 0.00% | 0.00% | 100.00% | 100.00% |
| 2045 | 0.00% | 0.00% | 0.00% | 100.00% | 100.00% |
| 2046 | 0.00% | 0.00% | 0.00% | 100.00% | 100.00% |
| 2047 | 0.00% | 0.00% | 0.00% | 100.00% | 100.00% |
| 2048 | 0.00% | 0.00% | 0.00% | 100.00% | 100.00% |
| 2049 | 0.00% | 0.00% | 0.00% | 100.00% | 100.00% |
| 2050 | 0.00% | 0.00% | 0.00% | 100.00% | 100.00% |
| 2051 | 0.00% | 0.00% | 0.00% | 100.00% | 100.00% |
| 2052 | 0.00% | 0.00% | 0.00% | 100.00% | 100.00% |
| 2053 | 0.00% | 0.00% | 0.00% | 100.00% | 100.00% |



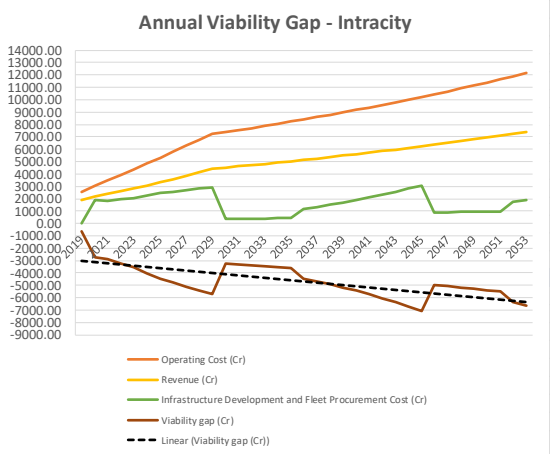
| Unutilized Fleet - Intracity | | | | |
|---|---|---|---|---|
| Year | Regular | Vajra City Service | Vayu Vajra | Electric bus |
| 2019 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2020 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2021 | 0.000 | 18.692 | 2.721 | 0.000 |
| 2022 | 0.000 | 13.421 | 1.719 | 0.000 |
| 2023 | 277.858 | 25.410 | 3.901 | 0.000 |
| 2024 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2025 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2026 | 334.785 | 40.758 | 5.666 | 0.000 |
| 2027 | 837.246 | 96.635 | 13.704 | 0.000 |
| 2028 | 1094.698 | 35.223 | 4.992 | 0.000 |
| 2029 | 777.966 | 81.632 | 11.545 | 0.000 |
| 2030 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2031 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2032 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2033 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2034 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2035 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2036 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2037 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2038 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2039 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2040 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2041 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2042 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2043 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2044 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2045 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2046 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2047 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2048 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2049 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2050 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2051 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2052 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2053 | 0.000 | 0.000 | 0.000 | 0.000 |




| Intra city Mode share | | | |
|---|---|---|---|
| Year | STU Buses | Other Buses | IPT |
| 2019 | 19.77% | 5.2443% | 8.3111% |
| 2020 | 21.10% | 5.1511% | 8.1054% |
| 2021 | 22.42% | 5.0580% | 7.8988% |
| 2022 | 23.75% | 4.9648% | 7.6912% |
| 2023 | 25.09% | 4.8715% | 7.4827% |
| 2024 | 26.42% | 4.7782% | 7.2733% |
| 2025 | 27.75% | 4.6849% | 7.0629% |
| 2026 | 29.08% | 4.5915% | 6.8516% |
| 2027 | 30.42% | 4.4980% | 6.6394% |
| 2028 | 31.75% | 4.4046% | 6.4262% |
| 2029 | 33.08% | 4.3110% | 6.2120% |
| 2030 | 33.09% | 4.3122% | 6.2237% |
| 2031 | 33.10% | 4.3133% | 6.2355% |
| 2032 | 33.11% | 4.3144% | 6.2473% |
| 2033 | 33.12% | 4.3155% | 6.2592% |
| 2034 | 33.13% | 4.3167% | 6.2710% |
| 2035 | 33.14% | 4.3178% | 6.2829% |
| 2036 | 33.15% | 4.3190% | 6.2949% |
| 2037 | 33.15% | 4.3201% | 6.3069% |
| 2038 | 33.16% | 4.3213% | 6.3189% |
| 2039 | 33.17% | 4.3224% | 6.3309% |
| 2040 | 33.18% | 4.3236% | 6.3430% |
| 2041 | 33.19% | 4.3247% | 6.3551% |
| 2042 | 33.20% | 4.3259% | 6.3673% |
| 2043 | 33.21% | 4.3271% | 6.3795% |
| 2044 | 33.22% | 4.3282% | 6.3917% |
| 2045 | 33.23% | 4.3294% | 6.4040% |
| 2046 | 33.23% | 4.3306% | 6.4163% |
| 2047 | 33.24% | 4.3318% | 6.4286% |
| 2048 | 33.25% | 4.3329% | 6.4410% |
| 2049 | 33.26% | 4.3341% | 6.4534% |
| 2050 | 33.27% | 4.3353% | 6.4659% |
| 2051 | 33.28% | 4.3365% | 6.4784% |
| 2052 | 33.29% | 4.3377% | 6.4909% |
| 2053 | 33.30% | 4.3389% | 6.5034% |



| Annual Viability Gap - Intracity | | | | |
|---|---|---|---|---|
| Year | Operating Cost (Cr) | Revenue (Cr) | Infrastructure Development and Fleet Procurement Cost (Cr) | Viability gap (Cr) |
| 2019 | 2524.34 | 1860.15 | 0.00 | -664.18 |
| 2020 | 3062.17 | 2166.48 | 1867.55 | -2763.24 |
| 2021 | 3475.34 | 2374.28 | 1794.90 | -2895.96 |
| 2022 | 3908.49 | 2591.98 | 1949.66 | -3266.16 |
| 2023 | 4359.07 | 2819.83 | 2015.43 | -3554.67 |
| 2024 | 4824.10 | 3058.05 | 2247.91 | -4013.96 |
| 2025 | 5300.16 | 3306.90 | 2452.05 | -4445.31 |
| 2026 | 5783.32 | 3566.62 | 2523.47 | -4740.18 |
| 2027 | 6269.15 | 3837.44 | 2677.98 | -5109.70 |
| 2028 | 6752.65 | 4119.60 | 2807.67 | -5440.72 |
| 2029 | 7228.22 | 4413.35 | 2908.08 | -5722.96 |
| 2030 | 7386.13 | 4509.76 | 359.80 | -3236.17 |
| 2031 | 7547.50 | 4608.29 | 390.78 | -3329.99 |
| 2032 | 7712.41 | 4708.98 | 376.80 | -3380.23 |
| 2033 | 7880.93 | 4811.87 | 394.79 | -3463.85 |
| 2034 | 8053.16 | 4917.03 | 409.05 | -3545.18 |
| 2035 | 8229.17 | 5024.50 | 426.55 | -3631.23 |
| 2036 | 8409.04 | 5134.32 | 1175.00 | -4449.72 |
| 2037 | 8592.86 | 5246.55 | 1331.18 | -4677.48 |
| 2038 | 8780.71 | 5361.25 | 1498.65 | -4918.11 |
| 2039 | 8972.69 | 5478.47 | 1678.37 | -5172.60 |
| 2040 | 9168.88 | 5598.26 | 1870.67 | -5441.30 |
| 2041 | 9369.39 | 5720.68 | 2077.39 | -5726.10 |
| 2042 | 9574.29 | 5845.79 | 2302.46 | -6030.96 |
| 2043 | 9783.70 | 5973.65 | 2541.71 | -6351.77 |
| 2044 | 9997.71 | 6104.32 | 2798.18 | -6691.58 |
| 2045 | 10216.42 | 6237.85 | 3072.92 | -7051.48 |
| 2046 | 10439.94 | 6374.33 | 881.08 | -4946.69 |
| 2047 | 10668.36 | 6513.80 | 900.43 | -5055.00 |
| 2048 | 10901.81 | 6656.33 | 920.21 | -5165.69 |
| 2049 | 11140.39 | 6802.00 | 940.42 | -5278.81 |
| 2050 | 11384.21 | 6950.87 | 961.08 | -5394.42 |
| 2051 | 11633.39 | 7103.02 | 982.20 | -5512.57 |
| 2052 | 11888.06 | 7258.51 | 1744.79 | -6374.34 |
| 2053 | 12148.32 | 7417.42 | 1912.10 | -6643.00 |




| Annual Viability Gap - (Intracity + Intercity) | | | | |
|---|---|---|---|---|
| Year | Operating Cost (In Crores) | Revenue (in Crores) | Infrastructure Development and Fleet Procurement Cost (Cr) | Viability gap (in Crores) |
| 2019 | 2524.34 | 1860.15 | 0.00 | -664.18 |
| 2020 | 3062.17 | 2166.48 | 1867.55 | -2763.24 |
| 2021 | 3475.34 | 2374.28 | 1794.90 | -2895.96 |
| 2022 | 3908.49 | 2591.98 | 1949.66 | -3266.16 |
| 2023 | 4359.07 | 2819.83 | 2015.43 | -3554.67 |
| 2024 | 4824.10 | 3058.05 | 2247.91 | -4013.96 |
| 2025 | 5300.16 | 3306.90 | 2452.05 | -4445.31 |
| 2026 | 5783.32 | 3566.62 | 2523.47 | -4740.18 |
| 2027 | 6269.15 | 3837.44 | 2677.98 | -5109.70 |
| 2028 | 6752.65 | 4119.60 | 2807.67 | -5440.72 |
| 2029 | 7228.22 | 4413.35 | 2908.08 | -5722.96 |
| 2030 | 7386.13 | 4509.76 | 359.80 | -3236.17 |
| 2031 | 7547.50 | 4608.29 | 390.78 | -3329.99 |
| 2032 | 7712.41 | 4708.98 | 376.80 | -3380.23 |
| 2033 | 7880.93 | 4811.87 | 394.79 | -3463.85 |
| 2034 | 8053.16 | 4917.03 | 409.05 | -3545.18 |
| 2035 | 8229.17 | 5024.50 | 426.55 | -3631.23 |
| 2036 | 8409.04 | 5134.32 | 1175.00 | -4449.72 |
| 2037 | 8592.86 | 5246.55 | 1331.18 | -4677.48 |
| 2038 | 8780.71 | 5361.25 | 1498.65 | -4918.11 |
| 2039 | 8972.69 | 5478.47 | 1678.37 | -5172.60 |
| 2040 | 9168.88 | 5598.26 | 1870.67 | -5441.30 |
| 2041 | 9369.39 | 5720.68 | 2077.39 | -5726.10 |
| 2042 | 9574.29 | 5845.79 | 2302.46 | -6030.96 |
| 2043 | 9783.70 | 5973.65 | 2541.71 | -6351.77 |
| 2044 | 9997.71 | 6104.32 | 2798.18 | -6691.58 |
| 2045 | 10216.42 | 6237.85 | 3072.92 | -7051.48 |
| 2046 | 10439.94 | 6374.33 | 881.08 | -4946.69 |
| 2047 | 10668.36 | 6513.80 | 900.43 | -5055.00 |
| 2048 | 10901.81 | 6656.33 | 920.21 | -5165.69 |
| 2049 | 11140.39 | 6802.00 | 940.42 | -5278.81 |
| 2050 | 11384.21 | 6950.87 | 961.08 | -5394.42 |
| 2051 | 11633.39 | 7103.02 | 982.20 | -5512.57 |
| 2052 | 11888.06 | 7258.51 | 1744.79 | -6374.34 |
| 2053 | 12148.32 | 7417.42 | 1912.10 | -6643.00 |