

FLEET[©]

long range planning tool for STUs



Tool User - Manual

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1 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 and are known as State Transport Undertakings (STUs). However, the current state of affairs is that many STUs are currently only serving a small fraction of passenger trips in their region of operation. 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 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.

Evidently India is sitting on a large untapped demand of bus trips in general and public bus trips in particular, 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 currently face is their inability to recover operational costs through their current revenue sources. This is in part, due to the nature of their business (and thus cannot be addressed beyond a point) and in part due to current financial and operational inefficiencies. Hence, these STUs are completely dependent on government funding to overcome any 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 as sunk cost. This generates a resistance within the government, for investing in the STUs. This is a major bottleneck for any expansion and revival plans of STUs. In a scenario where, financial support from State is hard to come by, these organizations enter a deteriorating spiral.

1.1 About Fleet

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, especially for non-urban operations. 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, investments in augmentation of patronage is possible, resulting in a significant increase in mode share for the STUs. 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.

Additionally, several STUs have shown keen interest in using e-buses, encouraged by different, central government flagship schemes. There is, however, little or no experience 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, 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.

SGArchitects (SGA) has developed a toolkit known as FLEET, under funding from Shakti Sustainable Energy Foundation (Shakti). This is a spreadsheet-based toolkit with a VBA based user friendly interface. The toolkit is designed to allow estimation of long-range requirements as well interventions for the STU based on current and projected service types as well service specific fleet and operational characteristics (fleet utilization, load factor, vehicle utilization, staff to bus ratio, etc.). The long-range requirements estimated by the tool include annual budgetary requirements, service specific fleet procurement requirement, bus infrastructure (depot and terminal) development requirement, staffing requirement, etc. This tool is designed for use by STU officials as well as their consultants. It is also of use to researchers, advocacy groups and funding agencies.

It is expected that with a wide scale use of this toolkit, a number of STUs will be able to initiate an informed transition to a more efficient and profitable organization. As STUs turn more efficient and profitable, they will expand to currently untapped regions (or markets) leading to overall increased patronage of bus services in general and STUs in particular. This will contribute to checking the increase in trips by non-sustainable, carbon intensive private transport modes, and will help promote public transport in the country.

1.2 About this User Manual

In order to give assistance to target users (STU officials and bus operators), the FLEET tool is supported with a user guide or manual. The document is developed by the project team for guiding the user regarding usability and functionality of the FLEET tool. The User manual explains step by step data inputs for each of user forms. It explains the functionality of the tool, data requirement, range of data that can be input and types of outputs that can be derived.

2 FLEET Tool - Approach and Methodology

2.1 Approach

The broad objective or the rationale behind FLEET Tool is to provide STUs with an easy to use calculator of annual, fleet, budgetary and infrastructure requirements which are sensitive to a variety of parameters that exist in the Bus service and operations environment. The base of the calculation is annual requirement for each consecutive year over a period of 33 years. Here the requirements are derived from estimated or projected trips that will need to be catered in each year basis the operational environment and service requirements that have been projected for that year. Further these operational and service parameters are specific to different services as defined to be operated by the STU. Services may be defined by difference in both operational and vehicle characteristic.

Thus, the tool includes functionality to project (over a 33-year time period in future) and estimate the operational and service requirement or parameters for each service type operated by the STU. It allows STUs to project the trajectory of change of operational and service requirements annually over the next 33 years. The annual requirements for each defined service are estimated based on the values of these parameters (such as fleet utilization, vehicle utilization, load factor, EPK, CPK, etc.) estimated for each year (basis the trajectory defined). It is thus sensitive to all factors that influence projections of STUs requirements over a long term. It allows the user to define multiple scenarios for these projections and compare the outputs in all scenarios.

Thus the scenarios are defined by specifying operational and service requirements, which are expected to change over the course of the projection period, based on an intended policy and/or planning action (such as reduced/increased fares, provision of reserved bus lanes, disincentivising private modes in terms of parking restrictions, congestion charges, etc.).

2.2 Methodology

The FLEET Tool has three broad components. These are:

- Data input interface
- Calculation engine
- Outputs

There are two sources of input data in the tool. The first source - the overall number of current trips in the region under the operational zone of the STU are derived from the database in the tool. This data base which can be edited by the user, has been created from all 56 STUs in India using Census data, tourist data reports, CMP, etc. The tool presents that data along with the year in which the data is collected in the first form, when a STU is selected (from the drop-down menu). The growth factors for population and tourist trips is also presented on this page. Trips in the region are presented as work, education, non-work and tourist trips, each broken into trips less 10km and more than 10km in length. The tool estimates the current year trips, population etc. by applying the growth factors from the data year to the current year. The second source is the current STU operational, fleet and service-related data (such as load factor, fleet distribution by service type and age, vehicle utilization, CPK, EPK, etc.). This needs to be input by the user in multiple forms. The kind of data required for use in the tool by the user has been presented as data collection forms in this manual (Annexure 6). Additionally users are required to input the vision or the expected value of all parameters that shall be achieved in the future (through different forms

in the tool), the number of years to achieve the change and the trajectory of the change (linear, logarithmic or exponential).

The tool, estimates fleet size requirements (overall or for a given service) using the equation:

$$\text{Total fleet} = \frac{\text{Trips in region per day} \times \text{Mode share by STU} \times \text{Avg. pass trip length}}{\text{Fleet utilization} \times \text{Avg. km per bus per day} \times \text{Avg. occupancy}} \dots\dots\dots [1]$$

Here [daily trips in the region X mode share = daily trips to be catered by STU]. Average passenger trip length is not recorded by most STUs but can be estimated based on other data collected through the following equation:

$$\text{Avg. pass. Trip length} = \frac{\text{Average route length}}{\left[\frac{\text{Average daily per bus passenger trips}}{\text{Average Occupancy}} \right]} \dots\dots\dots [2]$$

Here average route length and average occupancy (or load factor) is reported by STUs in percentage and needs to be converted into passengers by multiplying with the average number of seats in Bus. Average daily per bus passenger trips is derived by total daily passenger trips (including pass holders and day tickets)/ (total fleet held X fleet utilization%). Other parameters in equation [1] include trips in region per day. This is derived from the data base for the STU being evaluated (as discussed above). Fleet utilization is reported by the STUs as - total daily average operational fleet/divided by total fleet held. Average kilometre achieved (including dead mileage) is reported by the STUs. This is also used to derive average vehicle utilization (per service or overall) as - scheduled average km per bus per day/actual average operated km per bus per day. Both the factors are reported by STU and both include dead mileage. Average occupancy is derived by multiplying average number of seats (for each service or overall weighted average) by the percentage load factor as reported by the STUs.

Each of the factors included in equation [1] are projected for each year over the next 33 years, using the vision data provided by the user (as discussed above), and these projected value for each year are used in the equation [1] and [2] for that respective year.

Based on the estimate of overall and disaggregated (service wise) fleet estimates for each of the next 33 years in the future, financial requirements (such as overall operational cost, revenues, state support required, etc.), infrastructure requirements (such as number of depots and terminals to be built, total land required, investment required for depot and terminal development, etc.) and staffing requirement (total staff required), is estimated for each of the next 33 years. These estimates are based on the default values such as the cost of vehicle for each service type, CPK and EPK of each service type, per sqm land required for depot and terminal for per bus in the fleet, per sqm development cost of depot and terminals, etc. The per bus land and cost requirement for development of depot and terminals, has been derived from ASRTU Bus Terminal and Depot design guidelines (SGArchitects, 2015) (SGArchitects, 2017), but can be edited in the default values form. Similarly values such as cost of bus needs to be an input value from the user, while the scrap value of the bus is included in the default values and can be edited in the default values form. Additionally, these parameters that effect the financial requirements can have a defined vision

value for future (to be specified by the user). Hence EPK, CPK, purchase price of different bus types, etc. can be defined in the future, along with the years to achieve the target and the expected trajectory of change.

Based on the annual projected fleet requirement, the additional requirement of buses that need to be purchased for each service type is generated based on the difference with the fleet held in the previous year after excluding the number of buses that will reach their end of life or retirement age in that year. For example if the number of buses estimated to be required for a particular service in the year 2020 is estimated as 1000 through equation [1], and the fleet strength in 2019 (either by STU data or as estimate by equation [1]) is 900, and the number of buses that will reach retirement age at the beginning of 2020 is 100, then the number of buses required to be purchased/acquired is $1000 - (900 - 100) = 200$. To estimate for each year the number of buses achieving retirement age, the users are required to input the operational age of vehicles and current fleet strength disaggregated age wise, for each service type. The tool uses this information and estimates in which year how many buses shall be scrapped, and thus may need to be replaced.

The tool takes in service specific inputs and provides outputs disaggregated by service type. The characteristics of the service are defined apart from other factors, by number of buses (operated under each service) and number of passengers carried. These two factors may not necessarily be correlated between services, because different services can have different occupancy or load factor (for example more expensive services such as AC or limited stop services usually have a lower load factor). The tool allows users to specify a different composition of services (in the total volume for the STU) in the future, along with allowing the users to define the number of years for the change of composition to be achieved as well the trajectory of change. For example - an STU is running 2 services today - a diesel regular service with 50% fleet strength and 60% trips (for the entire STU) and a diesel AC service with 50% fleet strength and 40% of all passenger trips today, and it plans to replace all these buses in next 10 years by 40% Electric AC buses carrying 30% of passenger trips and 60% regular electric buses with 70% of all passenger trips. This transition can be plotted by the tool as change in percentage of passengers carried (of the total passengers carried) or change in percentage of buses under each service. Thus if change in percentage of passenger carried is selected as the method of estimation (in the tool) and the trajectory selected is logarithmic, the tool will estimate fleet strength in each of the next year so as both the passenger trips by diesel buses comes down to 0 in next 10 years, while trips carried by electric buses increase to 30% and 70% respectively for AC and non-AC services as a logarithmic curve. The composition calculated for each year is used to estimate the number of trips by each service which is used to estimate the fleet requirement for that service (using equation [1]). Whereas if the method of estimation selected was 'composition by buses under each service' the tool will estimate all parameters (for equation [1]) in each year as weighted average, use that to estimate the total fleet requirement and then divide the total buses as per the composition plotted in each year over the next 10 yearsⁱ.

In the above example, there are additional two approaches to estimation. These are based on whether to prioritise retaining existing buses in the STU fleet till the end of their life even if it means postponing complete transition to a different technology or service type, or to discard buses prematurely in order to achieve transition to a new technology and service type in a pre-determined fixed time period. When the former is selected, the tool only estimates the fleet strength of all services after accounting for the current strength, while matching the overall requirement (of vehicles to be operated or passenger trips to be served) for the STU in that year as per trajectory and vision inputs. If the latter is selected, the tool estimates the requirement for each service type based on the composition that needs to be achieved in each year (as per vision composition and trajectory of change inputs), leading to possible premature retirement of fleet.

The number of buses that shall be retired prematurely in each year is presented as a separate chart in the output sheets. The four cases that are possible because of selection of these two types of estimation methodology have been presented in Figure 1.

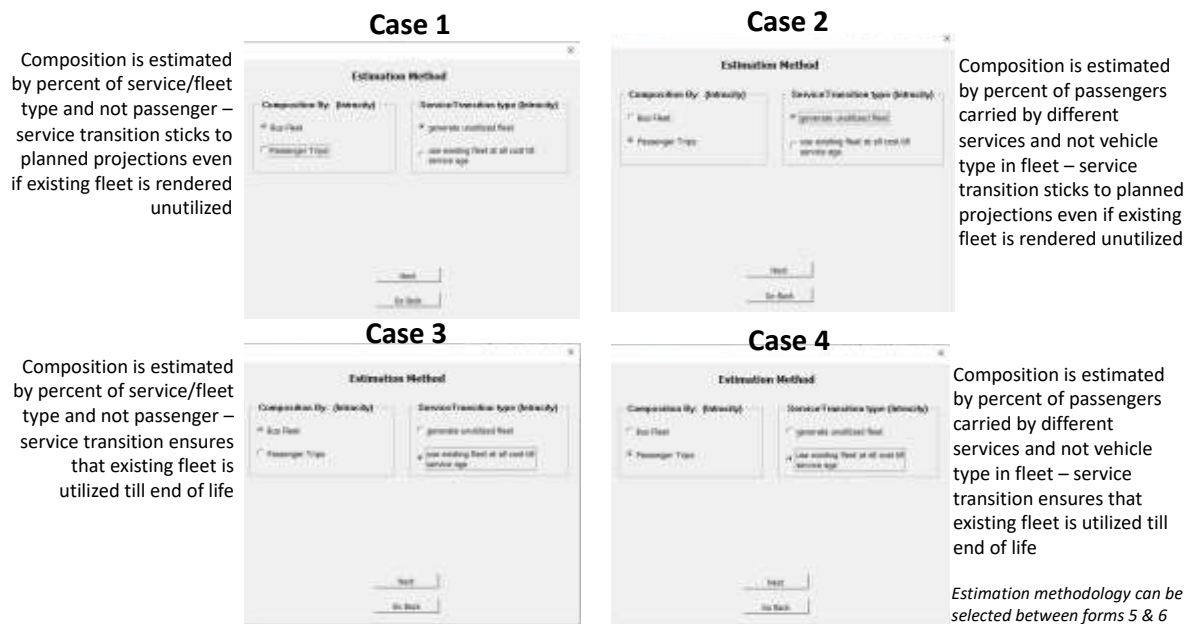


Figure 1: 4 possible cases for estimation when estimation methodologies are selected between two choices under two heads.

3 Guidelines for Use of FLEET Outputs by City Officials

STU officers can use the FLEET outputs to plan their operational and service strategies as well long-term budgetary requirements (based on revenue gaps), land requirements, etc. They can use this data to initiate in advance application for State monitory support, additional land acquisition, participation in central or bank (such as World Bank, ADB, etc.) sponsored programs, etc. The outputs from the tool that will be of use in decision making and long-term planning for STU officials are:

- Annual estimated operational cost and revenue (including operational losses/profit)
- Annual requirement of land that needs to be developed as depot and terminal
- Annual number of depot and terminals that need to be developed and the associated estimate of cost required
- Annual estimated operational characteristics of each service – load factor, vehicle utilization and fleet utilization
- Annual estimate financial characteristics of each service – EPK, CPK and Bus Cost
- Annual estimate of overall viability gap subject to composition of fleet or passenger trips by service in each year.

To arrive at these outputs, the tool requires the users to define the current and future scenario. Current scenario is established by the available data of the STU, including both operational, economic and infrastructure as well fleet characteristics. The future scenario is defined as vision and includes expected operational, fleet and economic characteristics for the STU. This vision value for a number of factors (such as CPK, EPK, vehicle utilization, fleet utilization, mode share, etc. to be achieved) can only be achieved as an outcome of certain planning, policy and financing actions. **In other words, the vision that can be achieved can be estimated through an assessment of what policy, planning and financial interventions are planned, and this in turn provides an estimate of STUs operational, financial, service and infrastructure characteristics or requirements over 33 years in to the future.** A total of 11 factors have been identified which shall be defined as an outcome of such policy & planning actions. These factors (dependent variables) which are used in the tool and require an input from user in the vision forms are:

- Expected EPK (y_a)
- Expected occupancy/load factor (y_b)
- Expected vehicle utilization (y_c)
- Expected fleet utilization (y_d)
- Expected number of routes (y_e)
- Expected CPK (y_f)
- Expected mode share of STU buses (y_g)
- Expected mode share of other buses (y_h)
- Expected mode share of IPT (y_i)
- Expected average passenger trip length (y_j)
- Expected average route length (y_k)

A total of nine factors (or independent variables) that influence one or more of the above dependent variables have been identified. These factors are:

- Change in STU bus fare (x_1)
- Change in quality of pedestrian environment in the stop catchment area (x_2)
- Change in average headway or passenger wait time at bus stop (x_3)
- Level of investment in improving bus/vehicle technology and service planning (x_4)
- Parking policy including paid parking and restrictions on private vehicle parking (x_5)
- Congestion charges or other monitory disincentives for private vehicle use (x_6)
- Provision of reserved bus lanes (x_7)

- Investment in depot infrastructure (x_8)
- Investments in bus terminal/station infrastructure (x_9)

In addition to the dependent variables being affected by independent variables, many dependent variables are also influenced by other dependent variables. For example, an increasing load factor (y_b) will contribute to increasing EPK (y_a). The effect of each independent and other dependent variable on each dependent variable has been presented in Figure 2.

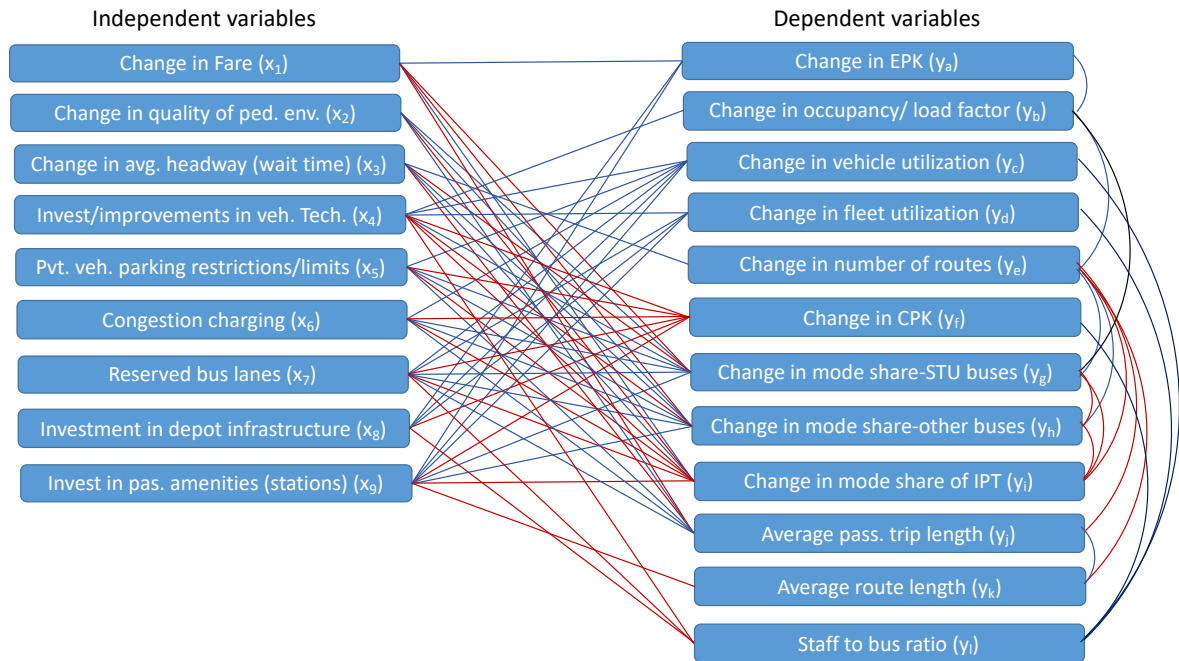


Figure 2: The effect of independent variables or policy factors on dependent variables or STU operational characteristics

In the above figure, blue lines represent a direct effect (i.e. when x is increased y will also increase) and the red line represents an inverse effect (i.e. when x is increased, y will reduce).

The following sections present an explanation of the effect of different variables on each dependent variable. Decision makers can use this understanding to finalise the expected or projected values of the operational characteristics of the STU in the future. **Additionally, the decision makers can use this understanding to finalise policy and planning actions, in order to ensure a planned performance of the STU.**

3.1 Expected EPK (y_a)

The expected EPK of a STU consists of fare box and non-fare box revenues. However, it is observed that nearly 90-95% of all STU earnings are through fare box revenues and contribution of other sources of revenue (such as advertisement, rentals, parking, freight, etc.) is not very significant. However, these non-fare box revenue sources can mostly be tapped through only the development of bus depot and terminal infrastructure. Most advertisement, rental and other non-fare box earning opportunities are tied to the development of bus infrastructure. Hence committing investments in the development of both depot and bus terminal can contribute to increasing the non-fare box revenue, thereby increasing the EPK by up to 3% of the current EPK.

However, increasing fares will have a more direct impact on EPK, and between 85% to 95% of the amount of increase in fare can be attributed to the amount of increase in EPK. However, the fallout is that increasing EPK, will decrease the total number of trips by buses (or the load factor), thereby reducing the current EPK significantly. Nevertheless, if load factor of current buses were to increase without making any other changes, EPK. It is expected that between 85% to 95% of the increase in the load factor will translate to an increase in EPK.

The relationship of these factors with the dependent variable, i.e. EPK can be defined through the following equation:

$$y_a = \beta_{a1}x_1 + \beta_{a8}x_8 + \beta_{a9}x_9 + \beta_{ab}y_b$$

Here β represents the parameter value of the indicators. This parameter value defines the contribution of changes in each of the independent variable to the overall change in the dependent variables. Following is the list of factors presented in the equation above, which will help improve EPK. The arrow adjacent to the factors suggests if these factors need to increase or reduce in order to increase EPK for the STU.

- Change in fare \uparrow
- Investment in depot infrastructure \uparrow
- Investment in passenger amenities (stations) \uparrow
- Changes in load factor \uparrow

3.2 Expected occupancy/load factor (y_b)

Load factor or occupancy of buses is a measure of how full the STU buses (or a particular STU service) are throughout the day. It is defined by the average factor measured by dividing the average number of passengers in a bus during the day by the total seats in the bus. Bus services are designed to cater to all passengers travelling during peak hours even at a very low level of service (overcrowding) especially for urban services. However, during non-peak hours many services will be running at much lower demand than even seating capacity. Additionally, even during peak hours not the entire route of each service will witness high demand. Services though cannot always be flexible to this kind of demand variation. This inevitable variation in demand throughout the day and along the route implies that even for high demand services the average load factor for most services cannot be higher than 65% to 75%. However, where STUs deploy modern techniques to ensure higher degree of demand responsiveness, and decision makers ensure additional policy and planning measures, the average load factor may be increased to between 80% to 95%.

Clearly, the load factor or occupancy is expected to increase (given all other factors including the number of buses is constant) when more trips are attracted towards STU buses. This implies that the use of STU buses should become more attractive while the use of other travel modes (primarily private transport and competing public transport modes such as private operators) should become less attractive. This is represented by a dependent variable, i.e. increase in STU mode share (y_g). Clearly when mode share increases but the number of buses does not increase proportionately, this will result in an increase in mode share.

Investment in improving vehicle technology will indirectly improve load factor by attracting more passengers, thereby improving mode share. However, it can also directly affect load factor by improving capacity (revised seating layout). Additionally, investments in improving service planning can result in more efficient service and operational plan which will result in a higher average load factor. It is also true that increased load factor on already overcrowded buses (say during peak hours or on high demand routes) may lead to reduced attractiveness of buses, thus a reduced mode share. This requires a fine balance between demand, fleet size (supply) and density (load factor).

The relationship of these factors with the dependent variable, i.e. load factor can be defined through the following equation:

$$Y_b = \beta_{b4}x_4 + \beta_{bg}y_g$$

Following is the list of factors presented in the equation above, which will help improve load factor. The arrow adjacent to the factors suggests if these factors need to increase or reduce in order to increase load factor for the STU.

- Investment in improvement of vehicle technology and service planning \uparrow
- Change in mode share of STU buses \uparrow

3.3 Expected vehicle utilization (y_c)

Vehicle utilization is defined by the ratio of average daily actual kilometre achieved (or covered by the bus in a day including dead miles) to average daily scheduled kilometre per bus for a service (including dead miles). This factor represents the level of inefficiency in operating buses, both due to internal and external factors. Internal factors could include staff unavailability or missed schedules, while the most common external factor is vehicular congestion. Therefore, planning or policy decisions that reduce the risk of buses being stuck in congestion contribute to increasing vehicle utilization. The most promising of these factors in development of reserved bus lanes on congested corridor (applicable to urban STUs). Additionally, congestion caused by friction from parked vehicles can be addressed by notification of parking policy or parking rules, and by increasing parking charges.

Congestion can also be checked through other private vehicle disincentivising measures which penalise their use. This may include congestion pricing or other monetary or physical disincentives. Investment in bus infrastructure in conjunction with route rationalization and service planning can contribute in improving vehicle utilization, by minimising dead mileage, thereby increasing effective kilometres achieved by a bus in a day. Dead mileage can be reduced if planning new depot and terminal facilities in conjunction so as buses minimise the distance, they run empty from the depot to the start point of their routes which is at a bus terminal. It is observed that in India actual kilometre achieved by buses operating urban services is in the range of 190 to 230km. This is higher on rural or other non-urban routes. Modern electric buses currently may fall short of this range due to technological limitations related to battery. Even where this range is achievable it comes at a cost – both the price of the buses and the axle load is high. It is understood that since electric vehicle technology has not yet fully evolved. A promise of additional investments in this industry will result in more efficient technology which will ensure longer range without the burden of additional cost and/or weight. A longer range can have a direct impact on vehicle utilization in case of electric buses. A very low staff to bus ratio (lower than 4 to 4.5) can be indicative of lack of crew to operate the buses for say average 16 hours in a day. This can result in lower vehicle utilization. However, a very high staff to bus ratio, say higher than 5.2 to 5.5 may not necessarily improve vehicle utilization.

The relationship of these factors with the dependent variable, i.e. vehicle utilization can be defined through the following equation:

$$Y_c = \beta_{c4}X_4 + \beta_{c5}X_5 + \beta_{c6}X_6 + \beta_{c7}X_7 + \beta_{c8}X_8 + \beta_{c9}X_9 + \beta_{c10}Y_1$$

Following is the list of factors presented in the equation above, which will help improve vehicle utilization. The arrow adjacent to the factors suggests if these factors need to increase or reduce in order to increase vehicle utilization for the STU.

- Investment in improvement of vehicle technology and service planning ↑
- Parking policy including paid parking and restrictions on private vehicle parking ↑
- Congestion charges or other monetary disincentives for private vehicle use ↑
- Provision of reserved bus lanes ↑
- Investment in depot infrastructure ↑
- Investment in passenger amenities (stations) ↑
- Changes in staff to bus ratio ↑

3.4 Expected fleet utilization (y_d)

Fleet utilization is explained by the ratio of average fleet on road (in active use) and the total fleet held. Most STUs (especially) urban STUs keep a reserve fleet of buses, to replace a bus in case of a breakdown. This number is usually around 5% of an STUs fleet size (depending on the average age and maintenance level of the fleet, etc.). Additionally, these include buses which need to be off the service for any scheduled maintenance. Therefore most STUs manage to maintain a fleet utilization of between 93% to 95%, while for some STUs (especially non-urban STUs) it can be as high as 97% to 99% (where they decide to maintain a lower reserve fleet as the

overall fleet size is large and replacement of a breakdown bus is not always possible because of long route length).

An increase in fleet utilization can lead to reduced fleet size requirements, leading to lower requirement of capital investment in procurement and replacement of buses. The fleet utilization can be increase by improvement in vehicle technology (which ensures lower breakdowns), investment in reserved bus lanes (for urban STUs) to ensure lower crash rate, investments in improving bus depot infrastructure to ensure higher maintenance of buses and investments in bus terminals/stations to provided (larger stations) with mini, bus maintenance yards (which can take care of minor breakdown issues faster and without the need of a depot visit). A very low staff to bus ratio (lower than 4 to 4.5) can be indicative of lack of staff to maintain the buses for, leading to an increased down time of buses. This can result in lower fleet utilization. However, a very high staff to bus ratio, say higher than 5.2 to 5.5 may not necessarily improve fleet utilization and optimum staff levels need to be maintained.

The relationship of these factors with the dependent variable, i.e. fleet utilization can be defined through the following equation:

$$Y_d = \beta_{d4}X_4 + \beta_{d7}X_7 + \beta_{d8}X_8 + \beta_{d9}X_9 + \beta_{d1}Y_1$$

Following is the list of factors presented in the equation above, which will help improve fleet utilization. The arrow adjacent to the factors suggests if these factors need to increase or reduce in order to increase fleet utilization for the STU.

- Investment in improvement of vehicle technology and service planning ↑
- Provision of reserved bus lanes ↑
- Investment in depot infrastructure ↑
- Investment in passenger amenities (stations) ↑
- Changes in staff to bus ratio ↑

3.5 Expected number of routes (y_e)

STUs need to cater to demand changes in the city by revising and adding routes on a regular basis. Fleet size usually increases in response to growing number of trips (in the city or region catered by the STU). An increase in the number of routes when other factors such as number of buses per route are constant, usually results in a higher accessibility and thus an increased patronage for the STU services. It also ensures that more passengers can get direct services between their origin destination, thereby leading to a reduced journey time and increased patronage.

To increase the number of routes additional buses are required in the system (so that they are available to be deployed on additional routes). This can be achieved either by an increase in fleet size or by re-deployment of current fleet on additional routes by reducing the number of buses deployed on existing routes. Thus, and increasing mode share of STU buses will result in higher fleet size (to cater to the increased trips) while a reduction in current average headway (with constant mode share) will make additional buses available for deployment on new routes. Similarly, increased vehicle and fleet utilization, will make additional buses available in the system (with constant mode share and headway) for deployment on new routes.

The relationship of these factors with the dependent variable, i.e. ‘number of routes’ can be defined through the following equation:

$$Y_e = \beta_{e3}X_3 + \beta_{e5}Y_5 + \beta_{e6}Y_6 + \beta_{e7}Y_7$$

Following is the list of factors presented in the equation above, which will help increase the number of routes operated by the STU. The arrow adjacent to the factors suggests if these factors need to increase or reduce in order to increase the number of routes operated by the STU.

- Change in average passenger wait time at bus stop¹ ↑
- Expected vehicle utilization ↑

¹ A reduced bus frequency on a route leads to an increase in wait time

- Expected fleet utilization ↑
- Change in mode share of STU buses ↑

3.6 Expected CPK (y_f)

The average cost per km (CPK) for operating a service depends on the cost of fuel/energy cost, the manpower (crew, maintenance staff and other STU staff), spare parts for buses, depot and other infrastructure maintenance cost, etc. A reduced CPK ensures higher profitability for STUs and reflects the level of financial efficiency of the STU. Since better and more planned maintenance results in lower fuel consumptions, lower requirement of spare part replacement, lower staff requirement, etc., it leads to low CPK. Thus, investments in depots will lead to lower CPK. Similarly, investments in bus terminals, i.e. existing ones planned with min depots and new ones developed along with depots, should result in both better maintenance and lower dead miles (thereby leading to lower per km fuel cost). Parking restrictions and financial disincentives on private modes (such as congestion charging) along with provision of reserved bus lanes (for urban STUs) should lead to improved average fuel efficiency thus a lower CPK for buses. Alongside, investments in improving bus technology should also result in reduced energy charges, and thus a lower CPK. Staff requirement in depots is represented by a parameter called staff to bus ratio, and this is effected by external factors or independent variables. But a lower staff to bus ratio, suggests a lower staff requirement which also leads to reduced CPK.

The relationship of these factors with the dependent variable, i.e. ‘number of routes’ can be defined through the following equation:

$$Y_f = \beta_{f4}X_4 + \beta_{f5}X_5 + \beta_{f6}X_6 + \beta_{f7}X_7 + \beta_{f8}X_8 + \beta_{f9}X_9 + \beta_{f1}Y_1$$

Following is the list of factors presented in the equation above, which will help reduce the CPK for STUs. The arrow adjacent to the factors suggests if these factors need to increase or reduce in order to reduce the CPK for a STU.

- Investment in improvement of vehicle technology and service planning ↑
- Parking policy including paid parking and restrictions on private vehicle parking ↑
- Congestion charges or other monetary disincentives for private vehicle use ↑
- Provision of reserved bus lanes ↑
- Investment in depot infrastructure ↑
- Investment in passenger amenities (stations) ↑
- Changes in staff to bus ratio ↓

3.7 Expected mode share of STU buses (y_g)

The percentage of passenger trips by STU buses, of all passenger trips (including walk trips) in the region (covered by or under the STU operations) is referred to as the mode share by STU buses. The passenger mode share by STU buses is currently observed anywhere between 0.5% to 20% for non-urban services and up to 28% for urban services. However, it is expected that this mode share can be increased to between 24% to 30% for non-urban services and up to 40% to 42% for urban services². The expected change or improvement in mode share by STU buses (assuming other variables such as load factor are constant) can be an outcome of change in mode share by other modes. For example, in case of deterioration in service level by other buses or by IPT, some of the trips by these modes will shift to STU buses, thereby leading to increase in mode share by STU buses and decrease in mode share by other buses as well IPT. Another key dependent variable that effects attractiveness of STU bus use is the load factor. An average increase in load factor suggests an increase in crowding (on parts of the routes for the service or during peak time). This will lead to reduced attractiveness, and thus a reduced number of trips, leading to a reduced mode share.

² Based on historic assessment of mode share

Similarly, an increase in fare is likely to discourage the use of STU buses, thereby resulting in a reduced mode share. An improved quality of pedestrian environment in the vicinity of bus stops/stations (especially in case of urban services), reduced wait time, investments in improving vehicles/buses, provision of reserved bus lanes which will lead to reduced passenger journey time and improved passenger amenities (at stations) will improve accessibility and attractiveness of bus services, thereby leading to an improved patronage resulting in an increased mode share. Private vehicle use disincentivising measures such as parking restrictions and congestion charging will shift private vehicle passenger trips in favour of public transport modes, leading to an improvement in STU mode share.

The relationship of these factors with the dependent variable, i.e. ‘STU mode share’ can be defined through the following equation:

$$Y_g = \beta_{g1}X_1 + \beta_{g2}X_2 + \beta_{g3}X_3 + \beta_{g4}X_4 + \beta_{g5}X_5 + \beta_{g6}X_6 + \beta_{g7}X_7 + \beta_{g9}X_9 + \beta_{gb}Y_b + \beta_{gh}Y_h + \beta_{gi}Y_i$$

Following is the list of factors presented in the equation above, which will help increase the mode share of STU buses. The arrow adjacent to the factors suggests if these factors need to increase or reduce in order to increase mode share of STU buses.

- Change in STU bus fare ↓
- Change in quality of pedestrian environment in the stop catchment area ↑
- Change in average passenger wait time at bus stop ↓
- Level of investment in improving bus/vehicle technology and service planning ↑
- Parking policy including paid parking and restrictions on private vehicle parking ↑
- Congestion charges or other monetary disincentives for private vehicle use ↑
- Provision of reserved bus lanes ↑
- Investments in bus terminal/station infrastructure ↑
- Change in load factor ↓
- Change in other bus mode share ↓
- Change in IPT mode share ↓

3.8 Expected mode share of other buses (y_h)

The percentage of passenger trips by other (non STU, other STU or private) buses, of all passenger trips (including walk trips) in the region (covered by or under the STU operations) is referred to as the mode share by other buses. These other buses are considered competition to STU buses, and thus a higher mode share of other buses as compared to STU buses is a reflection of poor health of the STU. However, both IPT and other/private bus services contribute to strengthening public transport, along with STU bus services. Hence, while reduction in mode share of other buses and IPT may contribute to an increase in mode share by STU buses, not all passenger trips are likely to shift from one green mode to the other, and a significant component of this reduced share may contribute to increasing private transport passenger trips. Hence reduction of other bus and IPT mode share may be in the interest of the STU but may not entirely be in the interest of the passengers or the city/region served by the STU.

The factors that affect the mode share of STU buses also affect the change in mode share of other buses, though the direction of the effect may not be the same. Hence while an investment in improving the technology of STU buses helps improve mode share by STU, it may reduce the mode share by other buses, as these trips may be attracted from less comfortable and attractive other/private buses. Similarly increase in fare by STUs, will increase the mode share of other buses as passengers may shift from STU buses to other/private buses. Whereas private transport disincentivising measures such as parking restrictions and congestion charging will contribute to increasing both the mode share of STU and other/private buses. Similarly, an improved pedestrian environment and provision of reserved bus lanes (which are used by all bus services) will also contribute to increasing the mode share of both STU and other bus services. However, investment in STU bus stations and reduction in STU bus service load factor will increase its attractiveness over other/private buses and thus the mode share of other/private buses may see

a decline. Additionally, an increase in mode share by STU buses and IPT, will lead to decline in mode share of other/private buses as these passenger trips are likely to be lost to these modes by other/private bus services.

The relationship of these factors with the dependent variable, i.e. ‘other bus mode share’ can be defined through the following equation:

$$Y_h = \beta_{h1}X_1 + \beta_{h2}X_2 + \beta_{h3}X_3 + \beta_{h4}X_4 + \beta_{h5}X_5 + \beta_{h6}X_6 + \beta_{h7}X_7 + \beta_{h9}X_9 + \beta_{hb}Y_b + \beta_{hg}Y_h + \beta_{hi}Y_i$$

Following is the list of factors presented in the equation above, which will help increase the mode share of other buses (some at the cost of mode share of STU buses). The arrow adjacent to the factors suggests if these factors need to increase or reduce in order to increase mode share of other buses. Red coloured arrows indicate changes that will lead to reduced mode share for STU buses.

- Change in STU bus fare ↑
- Change in quality of pedestrian environment in the stop catchment area ↑
- Change in average passenger wait time at bus stop (for STU buses) ↑
- Level of investment in improving (STU) bus/vehicle technology and service planning ↓
- Parking policy including paid parking and restrictions on private vehicle parking ↑
- Congestion charges or other monetary disincentives for private vehicle use ↑
- Provision of reserved bus lanes ↑
- Investments in bus terminal/station infrastructure ↓
- Change in load factor ↑
- Change in STU bus mode share ↓
- Change in IPT mode share ↓

3.9 Expected mode share of IPT (y_i)

The percentage of passenger trips by IPT, of all passenger trips (including walk trips) in the region (covered by or under the STU operations) is referred to as the mode share by other buses. IPT is considered competition to STU buses, and thus a higher mode share of IPT as compared to STU buses is a reflection of poor health of the STU. However, both IPT and other/private bus services contribute to strengthening public transport, along with STU bus services. Hence, while reduction in mode share of other buses and IPT may contribute to an increase in mode share by STU buses, not all passenger trips are likely to shift from one green mode to the other, and a significant component of this reduced share may contribute to increasing private transport passenger trips. Hence reduction of other bus and IPT mode share may be in the interest of the STU but may not entirely be in the interest of the passengers or the city/region served by the STU.

The factors that affect the mode share of STU buses also affect the change in mode share of IPT, though the direction of the effect may not be the same. Hence while an investment in improving the technology of STU buses helps improve mode share by STU, it may reduce the mode share by IPT, as these trips may be attracted from less comfortable and more expensive IPT. Similarly increase in fare by STUs, will increase the mode share of other buses as passengers may shift from STU buses to more accessible IPT. Whereas private transport disincentivising measures such as parking restrictions and congestion charging will contribute to increasing both the mode share of STU and IPT. Similarly, an improved pedestrian environment will also contribute to increasing the mode share of both STU and other bus services. However, provision of reserved bus lanes (which are generally not used by IPT), investment in STU bus stations and reduction in STU bus service load factor will increase the attractiveness of STU services over IPT and thus the mode share of IPT may see a decline. Additionally, an increase in mode share by STU buses and other buses, will lead to decline in mode share of IPT as these passenger trips are likely to be lost to these modes.

The relationship of these factors with the dependent variable, i.e. ‘IPT mode share’ can be defined through the following equation:

$$Y_i = \beta_{i1}X_1 + \beta_{i2}X_2 + \beta_{i3}X_3 + \beta_{i4}X_4 + \beta_{i5}X_5 + \beta_{i6}X_6 + \beta_{i7}X_7 + \beta_{i9}X_9 + \beta_{ib}Y_b + \beta_{ig}Y_h + \beta_{ih}Y_i$$

Following is the list of factors presented in the equation above, which will help increase the mode share of IPT (some at the cost of mode share of STU buses). The arrow adjacent to the factors suggests if these factors need to increase or reduce in order to increase mode share of IPT. Red coloured arrows indicate changes that will lead to reduced mode share for STU buses.

- Change in STU bus fare ↑
- Change in quality of pedestrian environment in the stop catchment area ↑
- Change in average passenger wait time at bus stop (for STU buses) ↑
- Level of investment in improving (STU) bus/vehicle technology and service planning ↓
- Parking policy including paid parking and restrictions on private vehicle parking ↑
- Congestion charges or other monetary disincentives for private vehicle use ↑
- Provision of reserved bus lanes ↓
- Investments in bus terminal/station infrastructure ↓
- Change in load factor ↑
- Change in STU bus mode share ↓
- Change in IPT mode share ↓

3.10 Expected average passenger trip length (y_j)

Current average passenger trip length is calculated for each service type based on the data collected by the STU. It is a factor of average route length, average number of passengers carried bus trip and load factor (or average occupancy) for each service. It is derived using the following formula:

$$r_j / [p_i / (l_i \times s_i)]$$

Here j denotes each service type, while r is average route length, p is number of passengers per bus trip, l is the average load factor and s is the average seating capacity of the fleet (operated under service i). p is the ratio of average km operated by each bus/vehicle under a service (also derived by multiplying vehicle utilization with scheduled kilometres per day for the service) and average passengers carried by each bus in the service (total passenger trips – including pass holders/total operational buses per day).

Current observations show that average passenger trip length for non-urban services can vary between 25 to 40km, while that for urban service can vary between 8 to 13km. This is expected to increase by up to 20%, if the vehicle speeds increase and also with the increase in average household income levels.

Since average trip length is governed by both financial budget and time budget limitations (as both travel time and travel cost are directly related to travel distance) changes in journey speed or cost can influence a change average passenger trip length. Thus, a reduction in bus fare will allow commuters to travel longer distance on the same budget, thereby increasing average passenger trip length. Similarly improved quality of pedestrian environment contributes to increased journey speed because walk speeds in such environment are observed to increase from 1m/s to 1.4m/s leading to 20% journey time saving in a 10km trip length (Gandhi, 2013). This will allow commuters to travel further in the same time budget, hence contributing to an increase in average passenger trip length.

Similarly parking restrictions and congestion pricing can free up road space, allowing buses to move faster in traffic. Also reserved bus lanes can allow faster movement of buses. All these measures allow passengers to travel longer distances on the same time budget, thereby contributing to an increase in average passenger trip length. Although there is no desirable average passenger trip length, generally a shorter trip length indicates a lower carbon footprint from mobility, while a longer trip length indicates that people are able to travel farther to avail employment and education opportunities. However, an understanding of factors that influence changes in trip length allows decision makers to be aware of side effects (such as changes in average trip length) of measures taken to influence other dependent factors.

The relationship of these factors with the dependent variable, i.e. ‘average passenger trip length’ can be defined through the following equation:

$$Y_j = \beta_{j1}X_1 + \beta_{j2}X_2 + \beta_{j3}X_3 + \beta_{j5}X_5 + \beta_{j6}X_6 + \beta_{j7}X_7$$

Following is the list of factors presented in the equation above, which will lead to an increase in the average passenger trip length. The arrow adjacent to the factors suggests if these factors need to increase or reduce in order to increase average passenger trip length.

- Change in STU bus fare ↓
- Change in quality of pedestrian environment in the stop catchment area ↑
- Change in average passenger wait time at bus stop (for STU buses) ↓
- Parking policy including paid parking and restrictions on private vehicle parking ↑
- Congestion charges or other monetary disincentives for private vehicle use ↑
- Provision of reserved bus lanes ↑

3.11 Expected average route length (y_k)

The average of all different route lengths operated under each service is referred to as the average route length of that service. Services running on shorter route lengths are generally more reliable, while longer route lengths help reduce journey time as it provides more direct options and thus less time is lost in changeover (between routes). Current observed average route lengths for urban services is observed to be anywhere between 12 and 50km, while that for non-urban services is between 30 to 600km.

Since routes terminate at a station or a bus terminal at both ends, the length bus routes tends to be longer with fewer bus terminals³. Similarly, if number of routes increase, while other factors including fleet size and average headway remain constant, the average route length will tend to decrease. However, since route length is also a function of demand, it is unlikely that these changes can contribute to a change in average route length in excess of 10 to 30%.

The relationship of independent factors with the dependent variable, i.e. ‘average route length’ can be defined through the following equation:

$$Y_k = \beta_{k9}X_9 + \beta_{ke}y_e$$

Following is the list of factors presented in the equation above, which will lead to a reduction in the ‘average route length’ (for a service). The arrow adjacent to the factors suggests if these factors need to increase or reduce in order to reduce the average route length of a service.

- Investment in passenger amenities/stations ↑
- Change in number of routes ↑

3.12 Staff to Bus Ratio (y_l)

The ratio of overall staff requirement for a service including both on roll and contractual (or say private operator) staff (including all crew, maintenance, admin, management staff etc. working for the service or the STU) and the total buses held by or under a service (or the STU) is referred to as the staff to bus ratio. This dependent variable is a reflection of financial and operational efficiency of a service (or a STU) and a lower staff to bus ratio (indicated lower staff requirement per bus) suggests higher efficiency and thus a lower operating cost. However very low staff to bus ratio can be an indicator of lack of staff to adequately service the bus (thus leading to lower fleet and vehicle utilization). Staff to bus ratio in India is typically observed to be between 2.5 to 6.5, with a value around 5 to 5.2 being in the desirable range.

Investments in newer buses as well better bus technology, investment in service planning, staff training etc., is likely to reduce the requirement of maintenance staff and bus crew required per bus. Similarly, better operational planning, investments in staff training etc. may increase efficiency of administrative and management staff, thereby reducing the per bus requirement. Investments in

³ Number of terminals will tend to increase due to a natural increase in trips even if the mode share is constant

existing depot infrastructure can help improve depot operational efficiency and reduce down time of buses, thereby reducing maintenance manpower requirement per bus. And lastly, development of reserved bus lanes is known to significantly reduce bus crashes and improve driving cycle (thereby reducing engine wear and tear and its maintenance requirement). Thus, more routes operating in reserved bus lanes (especially for urban operations), will result in lower maintenance requirement, thereby reducing the staff to bus ratio.

The relationship of independent factors with the dependent variable, i.e. ‘staff to bus ratio’ can be defined through the following equation:

$$Y_1 = \beta_{14}X_4 + \beta_{17}X_7 + \beta_{18}X_8$$

Following is the list of factors presented in the equation above, which will lead to a reduction in the ‘staff to bus ratio’ (for a service). The arrow adjacent to the factors suggests if these factors need to increase or reduce in order to reduce the ‘staff to bus ratio’ of a service.

- Level of investment in improving (STU) bus/vehicle technology and service planning ↑
- Provision of reserved bus lanes ↑
- Investments in depot infrastructure ↑

4 Getting Started with FLEET

FLEET Tool is a Visual Basic (VBA) based tool developed in Microsoft Excel 365. This tool is compatible with any Windows 10 based Microsoft Excel version 13 or 365 (2019) and above. The tool is in the form of a downloadable *.xlsb file which is less than 20mb in size. This file can be downloaded at www.sgarchitects.in, www.shaktifoundation.in and other web sites.

Space: The FLEET tool requires 3 MB of storage. If hard drive space is limited, one can use the FLEET tool from a USB memory stick with at least 10 MB of free space.

Screen Resolution: The FLEET tool will automatically adjust to most screen resolutions. In cases in which FLEET scroll bars and buttons are not visible, the user must exit FLEET and enter Windows Control Panel to change the screen resolution. One should select 1280 x 800 dpi or 1024 x 768 dpi. If the forms are bigger than the screen, the users may use the scroll bar at the bottom and right of the form to access all input boxes. In case these are not visible, the user should try and move the form on the screen by clicking on the top part of the form and moving (while keeping it clicked) the form to view the scroll bars

4.1 Terms of Use

The usage and distribution of the Tool is free, and the outputs of the Tool is free for usage, as long as the Tool and its developers are appropriately cited. This user manual may be reproduced and quoted in entirely or part thereof with due accreditation to the project team and SGArchitects.

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4.2 Enable Macros in Excel

Because this is a VBA based tool, it uses macros and thus the users may be prompted to enable macros when the downloaded FLEET file is opened. Users can also enable the Macros before they open the file using the following step by step process in Windows based Microsoft Excel 365 (2019/20 update).

4.3 Password

FLEET tool makes use of VBA script and macros in Excel. The FLEET tool requires an opening password which is 'FLEET2019'. User are prompted to enter this password before the tool user interface opens.



Figure 3: Password prompt window for FLEET

4.4 FLEET User Interface

The user interface of the tool utilizes VBA based input forms for an MS Excel based model. The user is asked to input parameters related to various bus operation components and STU requirements. The inputs required for the tool to generate results have been categorized and grouped in respective user forms. The forms have been divided in the following category and sequencing.

1. User form 1: Cover page

2. User form 2: STU basic information
3. User form 3: Fleet Data Form
4. User form 4: STU service data form
5. User form 5: Infrastructure Data form
6. User form 6: Estimation Method form
7. User form 7: Vision data form 1
8. User form 8: Vision data form 2
9. User form 9: Vision data form 3 (expected mode share)
10. User form 10: Default data form

4.5 Navigation Buttons

The user is presented with five separate navigation buttons displayed at the bottom of each user form (from 1 to 9) excluding form 1 or the splash page (which has a different set of toggle buttons). These buttons are: 'Save & Continue', 'Go Back', 'Default Values' and 'Exit'. Figure 4 presents the image of these buttons in the user form. The functionality of these buttons has been explained below.

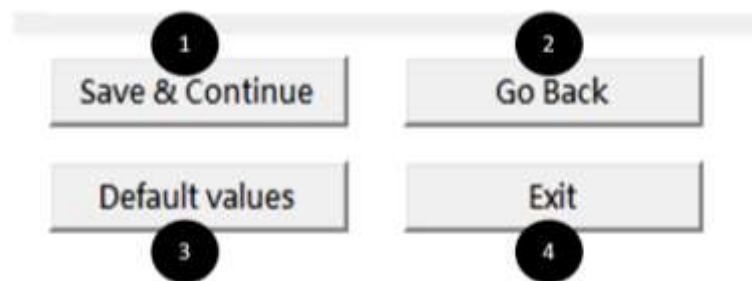


Figure 4: Navigation buttons on each user form

1. **'Save and Continue' Button** - This button allows user to save the data inserted by the user and proceed to the next user form. In case of an error in the form including empty cells, the tool will display a dialogue box and user will be returned to the original form. User will be required to correct all input errors before proceeding to the next form.



Figure 5: Error message dialogue box

2. **'Go Back' Button** – This button allows the user to go back to the previous page which displays previously entered inputs which can be modified or retained.
3. **'Open Default Values' Button** - This is an independent button provided in all user forms and can be clicked at any time (on any form) to access the default values form (opens in a pop-up window). The default data form includes description of all values along with

additional calculated values used by the tool in various processes. These default values have been discussed later in this chapter. After making changes in the default value form, the user is directed back to the original form when 'Save and Continue' button or 'Set Defaults' button is pressed on this form.

4. **'Exit' Button** - This button allows the user to exit the tool at any point of time. After pressing the button, the Tool will close but will retain data from all saved forms. This data will be displayed if the user presses 'Continue' button on the splash page when the tool is opened next.

4.6 Data Requirement

The FLEET Tool uses two different data sets. One set of data (referred to as 'Data Set 1') is the regional data and relates to population, trips etc. of the region under the operational scope of the STU. This data is already included in the tool for 56 existing Indian STUs. The users will require to collect this data for STUs other than those listed/included in the tool. The second data set (referred to as 'Data Set 2') requires comprises of STU service, operational, infrastructure, fleet and financial details. This data needs to be sourced from the STU officials before initiating input in the tool.

Annexure 6.1 and Annexure 6.2 include forms that can be used to record the data for 'Data Set 1' and 'Data Set 2' respectively. It is recommended that these forms be printed and used in interview with STUs and other stakeholders for recording data, before the use of the tool for long range planning is initiated. The data fields in these forms relate to the fields in the forms included in FLEET Tool. For ease of use the data labels and form numbers in these physical forms are the same as those used to explain input fields for the tool in the subsequent sections of this manual.

5 FLEET User forms

Following section presents an explanation of inputs required in each of the 10 user forms (listed above), used in the tool.

5.1 User form 1 – Splash/Cover Page

This form also referred to as the ‘splash page’ is the first page that the user views when application opens. The user is presented with four choices: NEW, CONTINUE, DEVELOPER and EXIT. Figure 6 shows the image of the first user form. The function of buttons in this form have been explained below.



Figure 6: Form 1 or the Splash page

- A. **NEW** – This button allows a user to start a new analysis. Here the user is directed to the FLEET tool Form 2; however, all boxes are blank for a new set of data entry.
- B. **CONTINUE** – This button allows the user to proceed from where he/she last exited FLEET. All data and inputs till last entry (before closing of the file in a previous session) are retained and the user is directed to the FLEET input forms (starting with Form 2), which (and subsequent pages) display previously entered inputs which can be modified or retained.
- C. **DEVELOPER**- This button allows a proper specialist to enter the tool's spreadsheet mode for modification purposes. This mode is for use by the developer of this tool only and is password enabled. Regular tool users are not required to use this function.
- D. **EXIT**- This button allows the user to exit the tool, without going further.

5.2 User form 2- STU basic Information

Figure 7, shows the image of the second user form – STU basic information. This form is designed to capture the required demographic context related information, such as population number of trips, etc., of the region under STU operations. For example, this will include data for Andhra Pradesh State when Andhra Pradesh State Road Transport Corporation (APSRTC) is being evaluated. The Tool has a data base of this basic information for 56 Indian STUs and the same can be recalled by the user as an alternative to seeking and filling these details herself.

As shown in Figure 7, this form has two data input parts, A and B respectively. Part A, includes STU details, while B includes input requirements related to region specific data such as population, number of trips, etc.

STU Details

STU Name: Operations Type:

Create New STU Existing STU List

Current Year: Data Year: Tourist Data Year:

Input Requirements

Population

Urban	Rural	Total
<input type="text" value="7005467"/>	<input type="text" value="34666721"/>	<input type="text" value="41674218"/>

Total No of Trips (educational)

Intracity	Intercity
<input type="text" value="263569"/>	<input type="text" value="6715767.836"/>

Total Work Trips by All Modes

Intracity (<1000)	Intracity (>1000)	Intercity (<1000)	Intercity (>1000)
<input type="text" value="2919671"/>	<input type="text" value="262482"/>	<input type="text" value="5990895"/>	<input type="text" value="238121.63"/>

Total Non-Work Trips by All Modes

Intracity (<1000)	Intracity (>1000)	Intercity (<1000)	Intercity (>1000)
<input type="text" value="2171260"/>	<input type="text" value="217487"/>	<input type="text" value="4380409"/>	<input type="text" value="1723880"/>

Total Work Trips by Bus

Intracity (<1000)	Intracity (>1000)	Intercity (<1000)	Intercity (>1000)
<input type="text" value="79930"/>	<input type="text" value="53660"/>	<input type="text" value="148915"/>	<input type="text" value="648572"/>

Total Work Trips by IPT

Intracity (<1000)	Intracity (>1000)	Intercity (<1000)	Intercity (>1000)
<input type="text" value="68028"/>	<input type="text" value="15380"/>	<input type="text" value="60878"/>	<input type="text" value="63274"/>

Mode Share of Bus from total work trips (All modes)

Intracity (<1000)	Intracity (>1000)	Intercity (<1000)	Intercity (>1000)
<input type="text" value="2.000%"/>	<input type="text" value="18.000%"/>	<input type="text" value="3.000%"/>	<input type="text" value="28.000%"/>

Mode Share of IPT from total work trips (All modes)

Intracity (<1000)	Intracity (>1000)	Intercity (<1000)	Intercity (>1000)
<input type="text" value="2.000%"/>	<input type="text" value="7.000%"/>	<input type="text" value="3.000%"/>	<input type="text" value="3.000%"/>

Mode Share of Bus from total bus trips

Intracity (<1000)	Intracity (>1000)	Intercity (<1000)	Intercity (>1000)
<input type="text" value="8.000%"/>	<input type="text" value="4.000%"/>	<input type="text" value="15.000%"/>	<input type="text" value="70.000%"/>

Mode Share of IPT from total IPT trips

Intracity (<1000)	Intracity (>1000)	Intercity (<1000)	Intercity (>1000)
<input type="text" value="32.000%"/>	<input type="text" value="9.000%"/>	<input type="text" value="29.000%"/>	<input type="text" value="30.000%"/>

Total Tourist trips by Bus

Intracity (<1000)	Intracity (>1000)	Intercity (<1000)	Intercity (>1000)
<input type="text" value="15897"/>	<input type="text" value="79957"/>	<input type="text" value="1462"/>	<input type="text" value="64666"/>

Total Tourist trips by IPT

Intracity (<1000)	Intracity (>1000)	Intercity (<1000)	Intercity (>1000)
<input type="text" value="1086"/>	<input type="text" value="6300"/>	<input type="text" value="66483"/>	<input type="text" value="14345"/>

Tourist Trips from State - All modes

Intracity (<1000)	Intracity (>1000)	Intercity (<1000)	Intercity (>1000)
<input type="text" value="694"/>	<input type="text" value="3516"/>	<input type="text" value="5141"/>	<input type="text" value="666"/>

Total State+ outside State all tourist trips - All Modes

Intracity (<1000)	Intracity (>1000)	Intercity (<1000)	Intercity (>1000)
<input type="text" value="71552"/>	<input type="text" value="80104"/>	<input type="text" value="17579"/>	<input type="text" value="92220"/>

Average Annual Exponential Growth Rate

Urban	Rural	Tourist
<input type="text" value="2.3790"/>	<input type="text" value="1.1100"/>	<input type="text" value="0.0250"/>

Figure 7: FLEET form 2, basic information form

The following sub sections explain the input requirements in the form. The inputs boxes are coded in alphabetical order and the buttons provided in the user form are coded with numerical values. The data required in this form and the functions of the buttons has been explained below.

5.2.1 Data set part A: User form 2

Figure 8: image of the Data Input Set part A. The inputs required in this have been explained below.

STU toggle Buttons (1 & 2): Two separate buttons (Figure 9) are provided to assist the user to make a choice between defining a new STU or working with data of a predefined (in the Tool) STU. When this form opens, as a default the 'Existing STU List' mode is active. The function of these two buttons is explained below

Figure 9: FLEET User form 2 – STU details

5. Create New STU – Clicking this button the user can update a new STU which is not listed by the tool. The user will be required to enter data for all parameters both in Part A and Part B. These values will be available to the user the next time the user opens the Tool and selects 'continue' in Form 1.
6. Existing STU List - Clicking this button the user can view the listed STU's in the tool and can select the STU to be analysed (from drop down menu – a). As a default setting, the form opens in this mode.
 - a. Name of the STU (Figure 10) – The user can select the name of STU from list of STU already included in the tool data base through the drop-down menu provided in the box. On selecting the STU from the list values corresponding to the selected STU is derived from the data base and displayed in all input boxes in Part A (except 'f' and 'g') and Part B.

Figure 10: Form 2 Part A – STU selection drop- down menu

- b. Type of operation (Figure 11) – The user is required to select the bus operation type through the drop-down menu provided in the box. The choices are 'Intra + Inter' city operations, 'Intra City' operation and 'Inter' city operations. Here, Intercity refers to regional and mofussil operations and intra city refers to urban or city bound operations. The user will not be able to toggle with this drop-down menu when the form is in 'Existing STU List' mode, and an appropriate option will be displayed with reference to the selected STU, as derived from the data base included in the Tool.

Figure 11: Form 2, Part A – Operation type drop down menu

- c. Current Data Year (Figure 12) - The user is required to input (in 'Create New STU' mode) or may need to edit the (in 'Existing STU List' mode) the current year or evaluation year in this input box. This input informs the tool of the year starting which the outputs need to be generated. The usual input here would be the current year. However, for the purpose of generating historic trends or for validation exercises, a past year may be input. Similarly, where the users seek to forecast drastic changes in a future year, they may need to generate separate projections for different time periods (with outputs of one period used as inputs in the subsequent period) and hence an evaluation year into the future may need to be defined. A user can input current year as anywhere between 2001 to 2050. However current year should be equal to or greater than 'Data Year' and 'Tourist Data Year' inputs ('d' and 'e'). If a value is input outside this range, the tool displays an error message when 'Error Check' is initiated before going to the next form. An error message is also displayed if the user tries to type inputs in characters other than numbers.

Figure 12: Form 2, Part A – Current (evaluation) and data year details

- d. Year of the data inserted by the user (Figure 12) - The user is required to input (in 'Create New STU' mode) or may need to edit (in 'Existing STU List' mode) the data year or the year for which the data is available, in this input box. For e.g. population data is derived from census 2011. The tool uses input growth rates to project the population or number of trips in the

current year/evaluation year, from the data provided for the data year. The value entered in this input box should be less than or equal to the value of 'Current Year' (c) and should be between 2000 and present year. If a value is input outside this range, the tool displays an error message when 'Error Check' is initiated before going to the next form. An error message is also displayed if the user tries to type inputs in characters other than numbers.

- e. Tourist Data year (Figure 12) – The user is required to input (in 'Create New STU' mode) or may need to edit (in 'Existing STU List' mode) the data year or the year for which the tourist data is available, in this input box. The tool uses input growth rates to project the population or number of trips in the current year/evaluation year, from the data provided for the data year. The value entered in this input box should be less than or equal to the value of 'Current Year' (c) and should be between 2000 and present year. If a value is input outside this range, the tool displays an error message when 'Error Check' is initiated before going to the next form. An error message is also displayed if the user tries to type inputs in characters other than numbers.

Number of Operational Services f & g (Figure 13) - Based on the type of bus operations by the STU (as derived from the data base or input by the user) the form displays input boxes (f) and (g). The user is required to input the number of services operated by the selected STU. The tool allows up to 24 different types of services to be evaluated for each operation type (intercity and intra city), and hence the user must input a value between 1 and 24. Different services may be defined not just basis different types of services (example, Ac, non-Ac, express, etc.) operated by the STU but these may be defined as separate services if any of the service, operational and financial criteria differ. For example, a regular bus service may be operated by electric minibuses and diesel low floor urban buses. This means that for the same service (i.e. regular non-AC), two different operational and financial characteristics exist because of two different types of buses used. Thus, both vehicle types may yield different load factor, will have different seating capacity, vehicle utilization, fleet utilization, earning per km (EPK), cost per km (CPK), etc. In such a condition a user can define the services as separate (say as electric regular minibus and diesel regular urban bus) and input sperate data for these re-defined services. This allows the tool to yield more accurate projections and allows the users to develop scenarios for transfer to different technology, fleet type, etc. **Please note, that the user may define services that are planned to be initiated/operated and are not yet operational. For example, users can define an electric bus service, which does not exist today, but has defined operational and service characteristics that can be input (with current fleet size as '0', but future fleet size as per plan).** The services can be characterised based on the parameters such as:

- EPK
- CPK
- Load factor/occupancy
- Vehicle utilization/ efficiency
- Fleet utilization
- Type of bus (AC, Non-AC mini, High floor, Low floor),
- Fuel type (Petrol, diesel or Electric)
- Nature of trips (Shuttle Service, Religious service or General route wise service).

Both the input boxes 'f' and 'g' will appear on the user form if the STU operates intra as well intercity services else the form shall display only one of the input field. For e.g. in case STU like KSRTC, which operates regional as well city services, both the input boxes (f) and (g) will appear as shown in the figure. But for STU like BMTC which is an urban STU, only input box (f) will appear on the form.

Figure 13: Form 2, Part A – number of operational services

- f. Number of Intra services – The user must insert number of city/urban services operated by STU. In case If the STU operates only Intracity operations, the form will show only input box (f). Input value must be between 1 and 24.
- g. Number of Intercity services - The user must insert number of regional and mofussil services operated by STU. In case If the STU operates only Intercity operations, the form will show only input box (g). Input value must be between 1 and 24.

Input aggregated data Button (3):

One separate button (Figure 14) is provided to assist the user to make a choice between defining different services operated by the STU or working with aggregated data as a single service (in the Tool). The function of this button is explained below

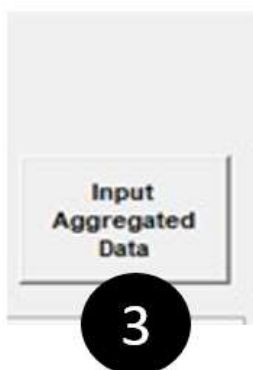


Figure 14: Form 2, Part A– Input Aggregated Data Button

Clicking this button, the user can insert aggregated data as a single service. The user will be required to enter data for all parameters based on the operational type of the STU. These values will be available to the user the next time the user opens the Tool and selects 'continue' in Form 1. **Please note, that the user may enter aggregated data separately for Intercity as well intracity operation type. In such case the tool shall presume the service as 1 in the data field. Additionally, the user has the flexibility to enter service wise data and aggregated data in case the STU operates intercity + Intracity service. For example, users can define an aggregated data for intracity as a single service and different service data for intercity service. In case wants to enter aggregated data for both type of operations, he/she is required to fill type of service as 1 under both operation types.**

5.2.2 Data set part B: User form 2

a Population

Urban	Rural	Total
6963438	29113819	36077258

b Total No of Trips (educational)

Intracity	Intercity
7237431.385	3934510.031

c Total Work Trips by All Modes

Intracity (<1000)	Intracity (>1000)	Intercity (<1000)	Intercity (>1000)
7449432	1371187.65	4101372.85	3131311.25

d Total Non-Work Trips by All Modes

Intracity (<1000)	Intracity (>1000)	Intercity (<1000)	Intercity (>1000)
5532391	1019601	3049739	2548211

e Total Work Trips by Bus

Intracity (<1000)	Intracity (>1000)	Intercity (<1000)	Intercity (>1000)
1655947	613891	874373	1870464

f Total Work Trips by BPT

Intracity (<1000)	Intracity (>1000)	Intercity (<1000)	Intercity (>1000)
226048	65229	184309	236618

g Mode Share of Bus from total work trips (All modes)

Intracity (<1000)	Intracity (>1000)	Intercity (<1000)	Intercity (>1000)
22%	43%	21%	60%

h Mode Share of BPT from total work trips (All modes)

Intracity (<1000)	Intracity (>1000)	Intercity (<1000)	Intercity (>1000)
3%	5%	4%	7%

i Mode Share of Bus from total bus trips

Intracity (<1000)	Intracity (>1000)	Intercity (<1000)	Intercity (>1000)
33%	12%	17%	37%

j Mode Share of BPT from total BPT trips

Intracity (<1000)	Intracity (>1000)	Intercity (<1000)	Intercity (>1000)
33%	9%	27%	31%

k Total Tourist trips by Bus

Intracity (<1000)	Intracity (>1000)	Intercity (<1000)	Intercity (>1000)
	8994	1677	77079

l Total Tourist trips by BPT

Intracity (<1000)	Intracity (>1000)	Intercity (<1000)	Intercity (>1000)
1023	7637	80333	16181

m Tourist Trips from State - All modes

Intracity (<1000)	Intracity (>1000)	Intercity (<1000)	Intercity (>1000)
983	5999	9239	1122

n Total State+ outside State all tourist trips - All Modes

Intracity (<1000)	Intracity (>1000)	Intercity (<1000)	Intercity (>1000)
86352	94775	16458	105471

o Average Annual Exponential Growth Rate

Urban	Rural	Tourist
0.0212	0.0099	0.0280

Figure 15: Form 2, Part B

Figure 15 shows the image of the Data Input Part B of user form 1. This part of the form displays 15 input boxes. These boxes are blank in the 'Create New STU' mode, while in the 'Existing STU List' mode it is populated with relevant data derived from the inbuilt data base, based on the STU name selected from the drop-down list. The users can edit the displayed data in this mode, and the edited data is saved for use in the tool and the same is displayed when the Tool is re-opened in the 'Continue' mode. The tool displays the following data derived from the secondary data sets available such as census, published reports (such as tourist statistics), Comprehensive Mobility Plans (CMP) and City Development Plans (CDP), etc. in the 'Existing STU List' mode. The given list also presents the acceptable value ranges when data is required to be input by users in these boxes in the 'Create New STU' mode. **Please note that inter-city operations in this document and the Tool refer to all non-urban operations. Also note that the data in this part of the form needs to be input for the region under the operational and administrative control of the STU selected/defined.**

- Population in the region – 'Urban', 'Rural' and 'Total'. Acceptable data range is between 20,000 and 200,00,00,000 for all data input boxes. The input in 'Total' input box should be exactly the sum of 'Urban' and 'Rural' input values.
- Number of all work passenger trips by all modes – Intra city > 10km, Intra city <= 10 Km, Intercity > 10km, Intercity <= 10 Km. These correspond to all work trips by character and by distance. Hence the input is required separately in terms of number of all Intra and intercity (or non-urban) trips (including walk) less than or equal to 10km and more than 10km in length. Acceptable data range is between 10,000 and 400,00,00,000 for all data boxes.
- Total number of all non-work passenger trips (i.e. all passenger trips excluding work and education trips and including tourist passenger trips) by all modes (including walk) – Intra

city > 10km, Intra city <= 10 Km, Intercity > 10km, Intercity <= 10 Km. These correspond to the number of non-work trips by character and by distance. Hence the input is required separately in terms of number of all intra and intercity (or non-urban) trips (including walk) less than or equal to 10km and more than 10km in length. Acceptable data range is between 10,000 and 400,00,00,000 for all data boxes.

- d) Total Number of work passenger trips by bus (all buses including STU and private buses) – intracity > 10km, intra city <= 10 Km, Intercity > 10km, Intercity <= 10 Km. These correspond to the number of bus-based work trips by character and by distance. Hence the input is required separately in terms of number of intra and intercity (or non-urban) bus trips less than or equal to 10km and more than 10km in length. Acceptable data range is between 10,000 and 400,00,00,000 for all data boxes.
- e) Number of work passenger trips by IPT⁴ – Intra city > 10km, Intra city <= 10 Km, Intercity > 10km, Intercity <= 10 Km. These correspond to the number of IPT-based work trips by character and by distance. Hence the input is required separately in terms of number of intra and intercity (or non-urban) IPT trips less than or equal to 10km and more than 10km in length. Acceptable data range is between 10,000 and 400,00,00,000 for all data boxes.
- f) Total number of all educational trips - Intra city and Intercity. These correspond to all urban and non-urban education trips by all modes (including walk). Acceptable data range is between 10,000 and 400,00,00,000 for all data boxes.
- g) Total tourist (passenger) trips by Bus (both from within the region and to/from the region) – Intra city > 10km, Intra city <= 10 Km, Intercity > 10km, Intercity <= 10 Km. These correspond to the number and classification of bus-based tourist trips by character and by distance (in the region). Hence the input is required separately in terms of number of bus based intra and intercity (or non-urban) tourist trips less than or equal to 10km and more than 10km in length. Acceptable data range is between 1,000 and 400,00,00,000 for all data boxes.
- h) Total tourist(passenger) trips by IPT (both from within the region and to/from the region) – Intra city > 10km, Intra city <= 10 Km, Intercity > 10km, Intercity <= 10 Km. These correspond to the number and classification of IPT-based tourist trips by character and by distance (in the region). Hence the input is required separately in terms of number of IPT based intra and intercity (or non-urban) tourist trips less than or equal to 10km and more than 10km in length. Acceptable data range is between 1,000 and 400,00,00,000 for all data boxes.
- i) Tourist (passenger) trips from state/region only for all modes (including walk) – Intra city > 10km, Intra city <= 10 Km, Intercity > 10km, Intercity <= 10 Km. These correspond to the number and classification of all tourist trips (generated by the region only) by character and by distance (in the region). Hence the input is required separately in terms of number of regions specific (including walk) intra and intercity (or non-urban) tourist trips less than or equal to 10km and more than 10km in length. Acceptable data range is between 1,000 and 400,00,00,000 for all data boxes.
- j) Total state and outside state tourist (passenger) trips for all modes (including walk) – Intra city > 10km, Intra city <= 10 Km, Intercity > 10km, Intercity <= 10 Km. These correspond to the number and classification of all tourist trips (including both travelling with the region and those travelling from outside the region to the region) by character and by distance (in the region). Hence the input is required separately in terms of number of all (including walk) intra and intercity (or non-urban) tourist trips less than or equal to 10km and more than 10km in length. Acceptable data range is between 1,000 and 400,00,00,000 for all data boxes.

⁴ IPT refers to intermediate public transport and includes travel modes such as taxis, auto rickshaw, cycle rickshaw, shared transport modes, etc.

- k) Mode share (percentage share) of bus from total trips by all modes (including walk) – Intra city > 10km, Intra city <= 10 Km, Intercity > 10km, Intercity <= 10 Km. These correspond to the number and classification of bus mode share percentage by character and by distance. Hence the input is required separately in terms of percentage share of intra and intercity (or non-urban) bus passenger trips (of all trips with which are) less than or equal to 10km and more than 10km in length. For example, if intercity bus trips more than 10km are 2,00,000 per day, and the number of passenger trips in the region by all modes (including bus and walk) which are intercity and more than 10km in distance is 10,00,000, then the mode share of intercity bus trips > 10km is 20%. Acceptable data range is between 1% and 80% for all data boxes.
- l) Mode share of IPT from total all work trips all modes – Intra city > 10km, Intra city < 10 Km, Intercity > 10km, Intercity < 10 Km. These correspond to the number and classification of IPT mode share percentage by character and by distance. Hence the input is required separately in terms of percentage share of intra and intercity (or non-urban) IPT passenger trips (of all trips with which are) less than or equal to 10km and more than 10km in length. For example, if intercity IPT trips more than 10km are 1,00,000 per day, and the number of trips in the region by all modes (including IPT and walk) which are intercity and more than 10km in distance is 4,00,000, then the mode share of intercity IPT trips > 10km is 25%. Acceptable data range is between 1% and 80% for all data boxes.
- m) Mode share (percentage share) of bus passenger trips which are intracity > 10km, intracity <= 10 Km, intercity > 10km, intercity <= 10 Km of the total bus trips in the region. The inputs comprise of percentage breakup of all bus passenger trips in the region (by all types of buses including STU buses) in terms of character and distance. Hence percentage of inter and intracity bus passenger trips with passenger trip length less than or equal to 10 km and more than 10km of the total bus passenger trips in the region are input here. The sum total of these percentages (in all four input boxes) should be 100% and the input range for each box is between 1% and 80%.
- n) Mode share of IPT from total IPT passenger trips which are intracity > 10km, intracity <= 10 Km, intercity > 10km, intercity <= 10 Km of the total IPT trips in the region. The inputs comprise of percentage breakup of all IPT passenger trips in the region in terms of character and distance. Hence percentage of inter and intracity IPT passenger trips with passenger trip length less than or equal to 10 km and more than 10km of the total IPT passenger trips in the region are input here. The sum total of these percentages (in all four input boxes) should be 100% and the input range for each box is between 1% and 80%.
- o) Average annual exponential growth rates - Urban, Rural and Tourist (population and trips). Growth rate of urban and rural trips is considered the same as the growth rate in the population. The growth rate is input as a fraction value and the acceptable input range for each of the three growth rates is between -0.15 and 0.15 (which translates to -15% to 15% growth rate).

5.3 User form 3- Fleet Data Form

Depending on the type of operations, i.e. intra city, intercity or both, undertaken by a STU, decides how the user forms from 3 to 9 are presented to the user. For example, if the operations are only intercity or only intra city, a single set of user forms 3 to 9, i.e. either for intra or intercity operations are presented. In case the operations are both intra and intercity, the user is first presented with a set of intercity user form (forms 3 to 9) followed by a set of intra city user forms (forms 3 to 9). For simplicity, the sections explaining forms 3 to 9 refer to intracity operations only. However, the forms and the requirements for filling them are same for intercity operations. Figure 16 shows the image of

the third user form – Fleet Data form. Here the user is required to input data related to STU bus fleet details.

Figure 16: User form 3 – Fleet Data

The input required are the types of buses operated by STU, seating capacity, age wise distribution of the fleet for each bus type, cost, scrap value and age limit for each bus type. For better understanding the provided data fields are grouped in three parts – A, B and C (Figure 17). The inputs boxes are coded in numerical values (1,2,3,4,5,6, 7and 8) under respective parts (A, B and C). The data input requirement has been detailed in the following sub sections.

Figure 17: User form 3 – Fleet Data

5.3.1 Data set part A: User form 3

1. **Service Name** – Number of rows corresponding to number of different service types input in form 2 are displayed on this form. The user is required to define and input a name of each service types (as explained for form no. 2) operated by the STU (Figure 18). The user is required to insert specific name of the bus type in alphanumeric characters (no decimal or special characters) with a maximum length of 40 characters. Here the user may also define a new/proposed (currently non-operational) service

Figure 18: Form 3, part A – Defining service type

2. **Seating Capacity** - The user is required to input the average seating capacities for the different bus/service types (Figure 19). Seating capacity is an indicator of the sizes of buses in use thus, seating capacities can range considerably, from around 10 passengers to 90. A high figure for average bus capacity, say 40 or more, will usually indicate that a high proportion of buses are conventional 12m buses. A figure of below 20 will indicate that the majority of buses are minibuses. For a new/proposed service, average seating capacity or planned average seating capacity is inserted. Input can be an absolute or average numerical or decimal value and the input range is between 1 to 90.

Service Name	Seating Capacity
Regular	41.3
Vajra City Service	38.8
Vayu Vajra	38.8
Electric bus	41.3

Figure 19: Form 3, part A – seating capacity

5.3.2 Data set part B: User form 3

3. **Age wise fleet distribution-** The data set part B of the form includes 16 age specific columns of input boxes for each service type (Figure 20). The user is required to age and service was fleet size in these boxes. Thus, number of buses operated under each defined service type are specified and input basis their age – i.e. up to 1 year old (under column titled ‘1 yr’), more than 1 year to up to 2 year old (under column ‘2 yr’), >2 to 3 (under column titled ‘3 yr’) and so on till greater than 15 year old (under the column titles ‘>15 yr’). Thus, the users enter in each column number of buses on that age group (column) operated by that service (row). For e.g. out of the total bus fleet of the selected STU, 15 ‘Regular’ buses are up to 1 year old. Here ‘Regular’ is the defined service name is the typology and age criteria are 1 year, so the user must input value (15) under ‘1 yr’ data field against this service type (Figure 20). The input range is 0 to 20,000 and the user needs to enter only whole numbers, no decimals are allowed. For a proposed (not yet operational) service number of buses for all age categories will be zero (refer row 4 Figure 20).

[illegible]

Figure 20: Form 3, part B – number of buses by age

5.3.3 Data set part C: User form 3

The data set part C of the form displays 4 different input boxes for each type of bus mentioned in as pervious data input.

4. **Total fleet size** – The user is required to click on the data field for under these columns for each service type in order to view the total number of buses (total of all age groups) for each service type, as calculated by the tool (Figure 21). If the user does not click on these cells, they will not autofill and the tool will prevent transition to the next form. It is thus imperative that the users click on each cell in this column, in order to auto fill the same. Total fleet size for a new/proposed service will be zero.

Total (click to calculate)	Cost of Bus	Scrap Value of Bus	Age limit for bus	Depot to be Developed by STU
5632	3273000	200000	11	<input type="radio"/> Y <input type="radio"/> N
742	8574000	200000	15	<input type="radio"/> Y <input type="radio"/> N
108	8574000	200000	15	<input type="radio"/> Y <input type="radio"/> N
0	18000000	200000	15	<input type="radio"/> Y <input type="radio"/> N

Figure 21: Form 3, part C – total fleet size

5. **Cost of Bus** – The user is required to insert the cost of the bus used for each defined service type (Figure 22). The figure below presents the specimen data inputs for data field (5). The input range is between 0⁵ and 9,00,00,000. For a new service known or estimated/expected cost of the bus on the date of first order shall be inserted.

Total (click to calculate)	Cost of Bus	Scrap Value of Bus	Age limit for bus	Depot to be Developed by STU
5632	3273000	200000	11	<input type="radio"/> Y <input type="radio"/> N
742	8574000	200000	15	<input type="radio"/> Y <input type="radio"/> N
108	8574000	200000	15	<input type="radio"/> Y <input type="radio"/> N
0	18000000	200000	15	<input type="radio"/> Y <input type="radio"/> N

Figure 22: Form 3, part C – cost of bus

6. **Scrap value of bus** - Scrap value is the worth of the vehicle (sale cost in scrap) when the asset itself is deemed no longer usable/operable. The user is required to insert the estimated average scrap value for buses in each defined service type. For a new/proposed service, estimated scrap value shall be inserted. The user is required to insert numerical value (no decimal value) between a range varying from 1 to 10,00,000. Figure 23 shows the specimen data inputs for data field (6).

⁵ The cost of the bus may be defined as zero in case the bus is operated under a service contract where the STUs do not bear the capital cost of the bus but pay a per km operational cost to the operator.

Total (click to calculate)	Cost of Bus	Scrap Value of Bus	Age limit for bus	Depot to be Developed by STU
5632	3273000	200000	11	<input checked="" type="radio"/> Y <input type="radio"/> N
742	8574000	200000	15	<input checked="" type="radio"/> Y <input type="radio"/> N
108	8574000	200000	15	<input checked="" type="radio"/> Y <input type="radio"/> N
0	18000000	200000	15	<input checked="" type="radio"/> Y <input type="radio"/> N

Figure 23: Form 3, part C – scrap cost of bus

7. **Age of bus-** Here the user is required to provide the currently established or expected operational age for each service type. The user is required to insert numerical value (no decimal value) ranging from 1 to 50. Figure 24 shows the specimen data inputs for data field (7). For a new/proposed service, expected operational age of the bus shall be inserted.

Total (click to calculate)	Cost of Bus	Scrap Value of Bus	Age limit for bus	Depot to be Developed by STU
5632	3273000	200000	11	<input checked="" type="radio"/> Y <input type="radio"/> N
742	8574000	200000	15	<input checked="" type="radio"/> Y <input type="radio"/> N
108	8574000	200000	15	<input checked="" type="radio"/> Y <input type="radio"/> N
0	18000000	200000	15	<input checked="" type="radio"/> Y <input type="radio"/> N

Figure 24: Form 3, part C – age limit of bus

8. **Depot to be developed by STU** – Here the user is required to mention (if any) depots are developed by STU for each service type. Here the user must click yes/no options based on the availability of depots operated by STU. Figure 25 shows the specimen data inputs for data field (8).

Total (click to calculate)	Cost of Bus	Scrap Value of Bus	Age limit for bus	Depot to be Developed by STU
5632	3273000	200000	11	<input checked="" type="radio"/> Y <input type="radio"/> N
742	8574000	200000	15	<input checked="" type="radio"/> Y <input type="radio"/> N
108	8574000	200000	15	<input checked="" type="radio"/> Y <input type="radio"/> N
0	18000000	200000	15	<input checked="" type="radio"/> Y <input type="radio"/> N

Figure 25: Form 3, part C – Depot to be developed by STU

5.4 User form 4- STU Service Data Form

Figure 26 presents the image of the fourth user form i.e. STU Service Data form.

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 size)	Avg Daily dead kilometres
Regular	9032	89.23	42.74	58.46	221.6	30.46	1880000	75.00	289.00	18	79.30	2229	5.32	28000
Upper City Service	742	77.89	57.55	76.7	240.4	23.7	100000	75.00	289.00	18	53.90	27	4.25	768
Lower City	388	77.89	76.68	76.7	240.4	23.4	12000	75.00	289.00	18	53.90	18	4.25	768
Electric bus	0	89.23	42.74	58.4	221.6	31.8	0	75.00	289.00	18	79.30	0	5.32	28000

Figure 26: Form 4 – STU service data form

In this form, the user is required to input the existing bus operational parameters of the STU for the base (usually current) year (as defined in user form 1) for each defined service type. These parameters are represented by 15 data fields (in one row for each service type). These are as following, in order from left to right (Figure 27):

1. Service name
2. Fleet Strength
3. Fleet Utilization:
4. Average earning per kilometre (EPK)
5. Average cost per kilometre (CPK)
6. Average daily kilometre (Scheduled)
7. Average route length
8. Daily Passenger trips/ticket sale
9. Percentage of pass holders
10. Average kilometres achieved per day
11. Total operational hours
12. % Load factor
13. Total operational routes
14. Staff to bus ratio
15. Average daily dead kilometres

For better understanding the 15 data fields are grouped in three parts – A, B and C (Figure 27). The inputs boxes are coded in alphabetical order (a, b, c, d, e, f, g, h, i, j, k, l, m, n and o.) under respective parts (A, B and C). The data input requirement has been detailed in the following sub sections.

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 size)	Avg Daily dead kilometres
Regular	9032	89.23	42.74	58.46	221.6	30.46	1880000	75.00	289.00	18	79.30	2229	5.32	28000
Upper City Service	742	77.89	57.55	76.7	240.4	23.7	100000	75.00	289.00	18	53.90	27	4.25	768
Lower City	388	77.89	76.68	76.7	240.4	23.4	12000	75.00	289.00	18	53.90	18	4.25	768
Electric bus	0	89.23	42.74	58.4	221.6	31.8	0	75.00	289.00	18	79.30	0	5.32	28000

Figure 27: Form 4 – Service data entry column labels

5.4.1 Data set part A: User form 4

The input requirements for these parameters has been explained below.

STU Service Data

FLEET

Service Data (unit/entry)

Service Name	Fleet Strength	Fleet Utilization (%)	Avg EPK (Rs)	Avg CPK (Rs)
Regular	5632	89.23	42.74	58.45
Vajra City Service	742	77.89	57.35	78.7
Vayu Vajra	108	77.89	79.68	78.7
Electric bus	0	89.23	42.74	58.4

Callouts: a (Service Name), b (Fleet Strength), c (Fleet Utilization (%)), d (Avg EPK (Rs)), e (Avg CPK (Rs))

Figure 28: Form 4 – Part A

- Service Name** – This field cannot be edited. All service names defined in last form (form number 3) shall be displayed.
- Fleet Strength:** Based on the data inserted by the user in the previous form under - age wise fleet data for each service, the tool self generates the fleet strength data field and the same cannot be edited here.
- Fleet utilization:** Fleet utilization is defined as percentage as the ratio of average number of operational buses on road to the total number of buses held (in the fleet). The user is required to insert (for each service type) in this data box, the existing service fleet utilization in numerical/decimal values ranging from 1 to 100. This value inserted represents and has the unit as 'percentage' and is used accordingly in the tool. For a new/proposed service the user is required to input a value corresponding to expected or estimated fleet utilization.
- Average earning per kilometre (EPK)⁶:** Average EPK is defined as the per km revenue for each service type. It includes both fare box and non-fare box revenue (total fare and non-fare box revenue divided by total kilometers operated by the service in unit time). Here the user must insert for each service type, the average earning per kilometre for respective services in numerical/ decimal values ranging from 1 to 200. For a new/proposed service the user is required to input the expected or estimated EPK on the day/month, when the service first becomes operational.
- Average cost per kilometre (CPK):** CPK is defined as the average expenditure per kilometre for operating buses for each service. It includes the fuel, maintenance, manpower cost etc. The user is required to insert the average earning per kilometre for each service type in numerical/ decimal values ranging from 1 to 300. For a new/proposed service the user is required to input the expected or estimated CPK on the day/month, when the service first becomes operational.

5.4.2 Data set part B: User form 4

⁶ Please note that all costs and financial numbers input or generated by the tool are without adjusting for inflation or at the current value of money.

B

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)
221.6	50.48	1900000	75.00	199.00
240.4	33.7	100000	75.00	199.00
240.4	53.4	12000	75.00	199.00
221.6	31.9	0	75.00	190.00

f
g
h
i
j

Figure 29: Form 4 – Part B

- f. **Average daily Scheduled Kilometre:** The user is required to insert average daily scheduled kilometre per bus for each service type. 'Scheduled kilometres' are the average number of kilometres that each bus (operated under a service type) is estimated to cover or operate in a day. This includes the 'dead miles' or the distance operated to access the bus terminal over which no passengers are accepted. For example, typically average daily scheduled kilometres for urban services is in the range of 200km. The user must enter data in numerical/ decimal values ranging from 1 to 999. For a new/proposed service the user is required to input the planned or expected average daily scheduled kilometres per bus.
- g. **Average route length:** Average route length is the sum of the lengths of all routes divided by total number of routes. The user is required to input data in numerical/ decimal values ranging from 1 to 999 specific to each service type. For a new/proposed service the user is required to input the planned or expected average route length.
- h. **Daily Passenger trips/ticket sale:** This data is generally derived by the STUs from annual/daily ticket sales, usually from electronic ticketing machines. Average daily number of tickets purchasing passengers, represents average daily passenger trips (excluding pass holders) for each defined service type. The user must enter data in numerical/ decimal values ranging from 1 to 9000000. **For a new/proposed (not yet operational) service this value must be zero.**
- i. **Percentage of pass holders:** This data is derived by the STUs from the 'ticket checkers' or through other surveys. It represents the average share of pass holders in each bus for each service type as percentage value of daily ticket sale, based trips. For example, if the total number of daily tickets purchase based trips on a bus service is 100000, and the number of trips by pass holders in a day is estimated to be 10000 then the percentage pass holders are $10000/100000 = 10\%$. Individual value for is required to be input for each service type. The user must enter data in numerical/ decimal values ranging from 1 to 100. The unit of this value is percentage and hence the value inserted is used as percentage value in the tool. For example, value entered 50, would be used as 50% in the tool. For a new/proposed service the user is required to input expected percentage of pass holders.

5.4.3 Data set part C: User form 4

C

Total Operational Hours	% Load factor	Total Operational Routes	Staff to Bus ratio (Total Staff/Total Fleet Held)	Avg Daily dead kilometres
16	79.30	2220	5.32	39000
16	53.90	27	4.25	766
16	53.90	16	4.25	766
16	79.30	0	5.32	39000

k
l
m
n
o

Figure 30: Form 4 – Part C

- j. **Average Kilometres achieved per day:** In this field the user is required to input the number of kilometres achieved/covered (including dead mileage) by each bus out of the total kilometres of service scheduled/targeted by the STU buses for each defined service. For example, typically daily per bus achieved kilometres for urban buses is usually in the range of 200 km. The user required to provide the input in numerical/decimal values and the input range is between 0 and 999. The ratio of this value and 'average daily scheduled km' (g), for each service, yields the vehicle utilization for that service (in percentage), and the same is estimated by the tool and presented in subsequent forms. For a new/proposed service the user is required to input expected or estimated average service kilometres (including dead mileage) that will be achieved by each bus (when the service becomes operational).
- k. **Total operational hours:** The user is required to input the number of operational hours for each service in a day. For example, typically bus services are operational 16 hours in a day. The input is required in numerical values and the input range is between 1 to 24. For a new/proposed service the expected number of operational hours shall be input.
- l. **% Load factor:** This parameter determines the carrying capacity of the bus and is defined in percentage as the ratio of average (of the whole day and different legs of the journey) number of passengers in the bus (at any point in time) to the seating capacity provided for each service. For example, a load factor of 100% in a 50-seater bus would mean that on an average 50 people will be using the bus at any point in time. The input is required in numerical/decimal values ranging from 1 to 100. The unit of this value is percentage and hence the value inserted is used as percentage value in the tool. For example, value entered 60, would be used as 60% in the tool. For a new/proposed service the user is required to input expected load factor for the service.
- m. **Total operational routes:** The user is required to input the number of operational routes serviced by each defined service. Here routes which overlap for more than 90% of the length should be treated as same and not different (while making a count of total number of operational routes). The input is required in whole numbers between 1 and 9999. **For a new/proposed (not yet operational) service the total operational routes are to be defined as zero.** The tool calculates the number of operational routes in each successive year based on the projected trend and target number of routes (included in later forms) to be achieved.
- n. **Staff to bus ratio:** The user is required to input the ratio of total staff including all on roll and contractual crew, maintenance staff, administrative and management staff, etc., used by the service, to the total fleet held by/under the service (including both operational and non-operational buses). The user is required to input data in numerical/ decimal values ranging between 1 and 100. For a new/proposed service the user is required to input expected staff to bus ratio for the service.

- o. **Average daily dead kilometres:** Dead kilometres refers to non-revenue Kilometres covered when trips are not scheduled/open for boarding and alighting of passengers. The user is required to input the total dead kilometres per day for all buses used for each defined service type. The user is required to input data in numerical/ decimal values between 0 and 99999. For a new/proposed service the user is required to input expected total dead kilometres per day for the service.

5.5 User form 5 – Infrastructure Data Form

Figure shows the image of the fifth user form i.e. STU Infrastructure data form (Figure 31). This form captures the details of bus infrastructure owned and operated by the STU (total for all services). This includes bus terminals, depots and any additional land for use in developing these facilities in the future.

Figure 31: Form 5 – Depot and terminal infrastructure details

The data field in this form are divided in two parts for explanation. Part A is dedicated to depot infrastructure related data while part B is dedicated to terminal infrastructure related data as presented in Figure 32

Figure 32: User form 5 – input data field labels

The details and requirements of input fields for user form 5 have been presented below.

5.5.1 Data set part A: User form 5

- a) Total number of developed depot sites - The user is required to provide (in each specific form for each operation type, i.e. inter and intra) the current total number (total for all services) of operational depots owned/operated by the STU. The input range for number of depots operated by a STU is between 1 and 9999 (inputs must be in integers) (Figure 32).
- b) Total area under active depot sites – The user is required to provide an assessment of the sum area (in hectares) currently under use as operational depots (total for all services). The input range is between 1 and 99999 (Figure 32).
- c) Total area allocated to depots including developed and undeveloped – In this field the user is required to input the total (including all services) land under the control of the STU as on date (in hectares) for use in the development of depots. This includes the land that is already under use by bus depots and currently vacant land dedicated for development of depot facility. Input range is 1 to 99999 (Figure 32).

5.5.2 Data set part B: User form 5

- a) Total number of developed terminal sites - The user is required to provide (in each specific form for each operation type, i.e. inter and intra) the current total number (total for all services) of operational bus terminals owned/operated by the STU. The input range for number of terminals owned and operated by a STU is between 1 and 9999 (inputs must be in integers) (Figure 32).
- b) Total area under active bus terminal sites – The user is required to provide an assessment of the sum total area (in hectares) currently under use as operational bus terminals (total for all services). The input range is between 1 and 99999 (Figure 32).
- c) Total area allocated to terminal including active and undeveloped - In this field the user is required to input the total (including all services) land under the control of the STU as on date (in hectares) for use in the development of bus terminals. This includes the land that is already under use by bus terminals and currently vacant land dedicated for development of terminal facility. Input range is 1 to 99999 (Figure 32).

5.6 Estimation Method Form 6

After user form 5, an Estimation method form is presented to the user. In this form the users make a choice between two types of estimation methods in two criteria or dimensions. Thus two options each on how the service wise composition of the STU needs to be defined and how the estimation of fleet size needs to be undertaken are presented and a choice needs to be made (Figure 33).

Estimation Method

a

Composition By:

☒ Bus Fleet

☐ Passenger Trips

b

Service Transition type

☒ generate unutilized fleet

☐ use existing fleet at all cost till service age

Next

Go Back

Figure 33: User form 6 - Estimation method selection

- a) Total fleet size requirement for a STU in each year is estimated by the tool based on the mode share and other parameters. This overall demand (in either passenger trips or in buses required to address the total demand) is divided into different services as per a defined composition based on projected transition (in composition) using the inputs provided by the user. The user is required to make a choice on weather estimation of service wise composition for a STU is to be based on the number of buses i.e. fleet held/dedicated to each service ('Bus Fleet') or on the basis of number of daily passenger trips undertaken by each service ('Passenger Trips'). This input is used by the tool to estimate future/projected composition and fleet size etc., i.e. either on the basis of number of buses assigned (or estimated to be assigned) to each service or on the basis number of passenger trips undertaken (or estimated to be undertaken) by each service. Thus, the user is required to select one of the two options, i.e. 'Bus Fleet' or 'Passenger Trips'. Depending on the selected option, all base and horizon year (future projections) are based on either overall STU composition based on buses in different services or passenger trips by different services.
- b) The service wise composition of STU (either based on number of buses or number of passenger trips) tomorrow can be different from today. A service type operating 50% of buses or carrying 60% of passenger trips today may be desired to be reduced to operating 25% of fleet or carrying 30% of passengers in the future. Similarly, the fleet size of the second service may be projected to increase from 50% to 75% (or passenger trips carried from 40% to 70%). This transition in fleet size for the two services can be projected theoretically but may not be achievable practically because the service which is to reduce its composition, in terms of buses or passenger trips (and thus likely reduce the fleet size) may not be able to reduce the existing number of buses without prematurely retiring some of them before they reach their defined age limit. If strict transition as per estimated composition in each year was to be enforced then the STU would most likely generate what can be defined as redundant or negative fleet inventory, i.e. buses in the inventory which will not be operated even though they have not reached the end of their life. Therefore, the tool allows users to choose how

they want to estimate and achieve this transition, i.e. by generating redundant fleet ('generate unutilized fleet') or by holding the number of buses which have not yet reached the retirement age in operational inventory till the time they reach retirement age ('use existing fleet at all cost till retirement age') – thus modifying the transition process based on the age of the fleet held. Thus, user is required to select one of the two options, i.e. 'generate unutilized fleet' or 'use existing fleet at all cost till retirement age'.

5.7 User form 7 – Vision data Form 1

Forms 7, 8, and 9 are referred to as the vision data form as they allow the users to define different future scenarios for a STU based on the vision for the same. Data from the outputs in each scenario can be used to develop a scenario specific long-range plan or generate comparative findings between scenarios. Figure 34 presents the image of the seventh user form i.e. vision data form 1. This form consists of a total of 17 fields which are designed to capture an expected scenario or a vision for the STU in terms of different service type specific target values of service and operational parameters such as load factor, fleet utilization, staff to bus ratio, etc. This form displays base/current year data and seeks inputs on target value of parameters, their trajectory of change and the time period (number of years) in which the change/transition is desired to be achieved.

Figure 34: User form 7 – vision data form 1

For explanation of all input fields, this form has been divided in to three parts, i.e. parts A, B and C (Figure 35). Each part is discussed separately below.

Figure 35: User form 7 – part A, B and C

5.7.1 Data set part A: User form 7

Figure 36 presents the image of the input fields in part A of the vision data form 1. In this form, the data on intended or desired composition are sought

The screenshot shows a form titled 'Form 7, part A' with the following sections:

- Service Name:** A list of services: Regular, Vajra City Service, Vayu Vajra, and Electric bus.
- Current Fleet Composition (%):** A column of input fields showing values: 86.89%, 11.45%, 1.67%, and 0.00%.
- Desired Fleet Composition (%):** A column of input fields showing values: 0.00, 0.00, 0.00, and 100.00.
- Years to achieve target:** An input field with the value 10.
- Trajectory of Change:** A dropdown menu set to 'linear'.
- Indicative figure:** A graph showing three curves: Exponential (increasing), Linear (straight), and Logarithmic (decreasing).

Labels A, d, and e are placed above the Service Name, Years to achieve target, and Trajectory of Change fields respectively. Labels a, b, and c are placed below the Current Fleet Composition, Desired Fleet Composition, and Years to achieve target fields respectively. A note below the graph states: '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. Logarithmic - Rate of change steadily reduces over growth period.'

Figure 36: Form 7, part A

- Service Name:** In these fields for each defined service type, the tool displays the name of all service type as defined in form number 3. These fields cannot be edited by the user and is for reference purpose in this form.
- Current fleet composition:** In this field the tool presents estimate of (for each service) percentage share of fleet dedicated to each service (of the total fleet) or the percentage share of average per day passenger trips undertaken by each service (of the total daily passenger trips) depending on weather estimation type is by 'Bus Fleet' or by 'Passenger Trips' as selected in Form 6. These fields cannot be edited by the user and is for reference purpose in this form.
- Desired fleet composition:** In these fields' user is required to input the desired or targeted composition for each defined service type, by fleet or passenger trips (depending on the selection in form 6) in percentage share. The user must input numerical/decimal value ranging between 0 to 100. Additionally, the user should ensure that the sum of 'desired composition' values for all services is 100. If this is not the case the tool will return an error on the error check stage. Please note that the unit of this value/input is percentage and hence the value inserted is used as percentage value in the tool. For example, value entered 50, would be used as 50% in the tool.
- Years to achieve the target:** In this field, the user is required to input the desired or targeted time frame (in number of years) to achieve the transition in (fleet or passenger trip) composition from current/base year to desired/target inputs. The user must input numerical, integer value ranging between 1 to 50. The target time frame input is common for all the services, and the tool applies the same time frame for transition in composition for all defined services.
- Trajectory of change:** The trajectory of transition between the base year and the targeted composition can be either linear (i.e. rate of change is constant throughout the defined time period of transition), logarithmic (i.e. rate of change gradually reduces throughout the time period of transition) or exponential (i.e. rate of change increases gradually throughout the time period of transition). The user can select one of these three transition types from the drop-down menu, and the tool will use the selected input in the estimates. The trajectory input is common for all the services, and the tool applies the same trajectory for transition in composition for all defined services.

Figure 37 presents the image of the data fields in part B of form 7 or vision data form 1. The part B includes 8 data fields (for each defined service type), 4 each for fleet and vehicle utilization. These have been labelled from (f) to (m). Input requirements for each of these fields has been explained below:

Current Fleet Utilization (%)	Desired Fleet Utilization (%)	Years to achieve target	Trajectory of Change	Current Avg Vehicle Utilization (%)	Desired Avg Vehicle Utilization (%)	Years to achieve target	Trajectory of Change
89.23	99.23	10	Linear	89.80	85.74	10	Linear
77.89	80.00	10	Linear	82.78	87.34	10	Linear
77.89	80.00	10	Linear	82.78	87.34	10	Linear
89.23	89.23	10	Linear	85.74	85.74	10	Linear

Labels below the form: f, g, h, i, j, k, l, m

Figure 37: Form 7, part B

- f. **Current Fleet Utilization:** In this field the tool presents current or base year ‘fleet utilization’ for each service type as input by the user in ‘form 4’. These fields cannot be edited by the user and is for reference purpose in this form.
- g. **Desired/target Fleet Utilization:** In this field the user is required to input the desired or targeted percentage ‘fleet utilization’ for all defined services. The user must input numerical/ decimal value ranging between 1 to 100. Please note that the unit of this value/input is percentage and hence the value inserted is used as percentage value in the tool. For example, value entered 50, would be used as 50% in the tool.
It is important to note that changes (positive or negative) in fleet utilization can be an effect of policy, financing and planning interventions. Therefore, users should be able to relate the expected change in ‘fleet utilization’ to an expected change in policy, financing and planning related to bus services and operations in the future. Section 3.4 of this manual discusses these policy, financing and planning interventions which will effect ‘fleet utilization’ and users are encouraged to refer to the same before finalizing an expected future value for this parameter in a defined scenario (for input in this field). Additionally, it is suggested that users record and report these interventions (in relation to the input value) when reporting the outcomes of this tool.
- h. **Years to achieve the target:** In this field, the user is required to input (for each defined service type) the desired or targeted time frame (in number of years) to achieve the transition in ‘fleet utilization’ from current/base year to desired/target inputs. The user must input numerical, integer value ranging between 1 to 50. The target time frame input is service specific, and the tool applies individually defined time frame for transition in ‘fleet utilization’ for all services.
- i. **Trajectory of change:** The trajectory of transition between the base year and the targeted ‘fleet utilization’ can be either linear (i.e. rate of change is constant throughout the defined time period of transition), logarithmic (i.e. rate of change gradually reduces throughout the time period of transition) or exponential (i.e. rate of change increases gradually throughout the time period of transition). The user must select one of these three transition types from the drop-down menu, individually for each service (each service can have a different defined trajectory of change in ‘fleet utilization’).
- j. **Current Vehicle Utilization:** In this field the tool presents an estimate of current or base year ‘vehicle utilization’ for each service type based on inputs (average scheduled, and actual kilometers achieved for each service) by the user in ‘form 4’. These fields cannot be edited by the user and is for reference purpose in this form.

- k. **Desired Vehicle Utilization:** In this field the user is required to input the desired or targeted percentage ‘vehicle utilization’ for all defined services. The user must input numerical/ decimal value ranging between 1 to 999. Please note that the unit of this value/input is percentage and hence the value inserted is used as percentage value in the tool. For example, value entered 120, would be used as 120% in the tool. The percentage value inserted is used to calculate desired/targeted average actual achieved kilometres at the end of defined time period of transition (for each service) by multiplying percentage vehicle utilization with average scheduled km (for each service) as input in ‘form 4’. Since vehicle utilization into the future may be higher than current defined scheduled kilometres, this input value can be higher than 100%. *It is important to note that changes (positive or negative) in ‘vehicle utilization’ can be an effect of policy, financing and planning interventions. Therefore, users should be able to relate the expected change in ‘vehicle utilization’ to an expected change in policy, financing and planning related to bus services and operations in the future. Section 3.3 of this manual discusses these policy, financing and planning interventions which will effect ‘vehicle utilization’ and users are encouraged to refer to the same before finalizing an expected future value for this parameter in a defined scenario (for input in this field). Additionally, it is suggested that users record and report these interventions (in relation to the input value) when reporting the outcomes of this tool.*
- l. **Years to achieve the target:** In this field, the user is required to input (for each defined service type) the desired or targeted time frame (in number of years) to achieve the transition in ‘vehicle utilization’ from current/base year to desired/target inputs. The user must input numerical, integer value ranging between 1 to 50. The target time frame input is service specific, and the tool applies individually defined time frame for transition in ‘vehicle utilization’ for all services.
- m. **Trajectory of change:** The trajectory of transition between the base year and the targeted ‘vehicle utilization’ can be either linear (i.e. rate of change is constant throughout the defined time period of transition), logarithmic (i.e. rate of change gradually reduces throughout the time period of transition) or exponential (i.e. rate of change increases gradually throughout the time period of transition). The user must select one of these three transition types from the drop-down menu, individually for each service (each service can have a different defined trajectory of change in ‘vehicle utilization’).

5.7.3 Data set part C: User form 7

Figure 38 presents the image of the data fields in part C of form 7 or vision data form 1. The part C includes 4 data fields. These have been labelled from (n) to (q). Input requirements for each of these fields has been explained below:

Current Avg Occupancy (%)	Desired Avg Occupancy (%)	Years to achieve target	Trajectory of Change
79.30	79.30	10	Linear
53.90	54.10	10	Linear
53.90	54.10	10	Linear
79.30	79.30	10	Linear

Callouts: n (Current Avg Occupancy), o (Desired Avg Occupancy), p (Years to achieve target), q (Trajectory of Change)

Figure 38: Form 7, part C

- n. **Current Average Occupancy:** In this field the tool presents an estimate of current or base year ‘average occupancy’ (also known as ‘load factor’) for each service type based on inputs by the user in ‘form 4’. These fields cannot be edited by the user and is for reference purpose in this form.
- o. **Desired/targeted Average Occupancy:** In this field the user is required to input the desired or targeted percentage ‘average occupancy’ or ‘load factor’ for all defined services. The user must input numerical/ decimal value ranging between 1 to 999. Please note that the unit of this value/input is percentage and hence the value inserted is used as percentage value in the tool. For example, value entered 120, would be used as 120% in the tool. The percentage value inserted is used to calculate desired/targeted average number of commuters in the bus at the end of defined time period of transition (for each service) by multiplying average occupancy with average seating capacity (for each service) as input in ‘form 3’ and ‘form 4’. Since average number of people in the bus can be higher than the seating capacity, this input value can be higher than 100%.
- It is important to note that changes (positive or negative) in ‘average occupancy’ can be an effect of policy, financing and planning interventions. Therefore, users should be able to relate the expected change in ‘average occupancy’ to an expected change in policy, financing and planning related to bus services and operations in the future. Section 3.3 of this manual discusses these policy, financing and planning interventions which will effect ‘average occupancy’ and users are encouraged to refer to the same before finalizing an expected future value for this parameter in a defined scenario (for input in this field). Additionally, it is suggested that users record and report these interventions (in relation to the input value) when reporting the outcomes of this tool.*
- p. **Years to achieve the target:** In this field, the user is required to input (for each defined service type) the desired or targeted time frame (in number of years) to achieve the transition in ‘average occupancy’ from current/base year to desired/target inputs. The user must input numerical, integer value ranging between 1 to 50. The target time frame input is service specific, and the tool applies individually defined time frame for transition in ‘average occupancy’ for all services.
- q. **Trajectory of change:** The trajectory of transition between the base year and the targeted ‘average occupancy’ can be either linear (i.e. rate of change is constant throughout the defined time period of transition), logarithmic (i.e. rate of change gradually reduces throughout the time period of transition) or exponential (i.e. rate of change increases gradually throughout the time period of transition). The user must

select one of these three transition types from the drop-down menu, individually for each service (each service can have a different defined trajectory of change in 'average occupancy').

5.8 User form 8 – Vision data Form 2

Figure 39 presents the image of the eighth user form i.e. vision data form 2. This form consists of a total of 29 fields which are designed to capture an expected scenario or a vision for the STU in terms of different service type specific target values of financial and passenger as well bus trip parameters such EPK, CPK, bus cost, passenger trip length, total route length, etc. This form displays base/current year data and seeks inputs on target value of parameters, their trajectory of change and the time period (number of years) in which the change/transition is desired to be achieved.

STU Vision Data (Intracity)-2

FLEET FOR YOUR BUDGET AND YOUR TIME

Service Composition (Intracity)

Service Name	Current EPK (Rs)	Desired EPK (Rs)	Years to achieve target	Trajectory of Change	Current CPK (Rs)	Desired CPK (Rs)	Years to achieve target	Trajectory of Change	Current staff to bus ratio	Desired staff to bus ratio	Years to achieve target	Trajectory of Change
Regular	42.74	43	10	Linear	58.45	51.9	10	Linear	5.32	5.2	10	Linear
Vajra City Service	57.35	66	10	Linear	78.7	69	10	Linear	4.25	4.2	10	Linear
Vayu Vajra	79.68	66	10	Linear	78.7	69	10	Linear	4.25	4.2	10	Linear
Electric bus	42.74	42.74	10	Linear	58.4	70	10	Linear	5.32	5.29	10	Linear

Current Operational routes	Desired Operational routes	Years to achieve target	Trajectory of Change	Current Avg. Route length	Desired Avg. Route length	Years to achieve target	Trajectory of Change	Current Cost	Expected Cost	Years to achieve target	Trajectory of Change
2220	0	10	Linear	50.48	25	10	Linear	3273000	3273000	10	Linear
27	0	10	Linear	33.7	33.7	10	Linear	8574000	8574000	10	Linear
15	0	10	Linear	53.4	53.4	10	Linear	8574000	8574000	10	Linear
0	2264	10	Linear	31.9	50.48	10	Linear	18000000	10000000	10	Linear

Current Pass. Trip Length	Expected Pass. Trip Length	Years to achieve target	Trajectory of Change
9.85	10	10	Linear
13.74	14.5	10	Linear
16.67	17.5	10	Linear
10.41	10	10	Linear

Figure 39: User form 8 – vision data form 2

For explanation of all input fields, this form has been divided in to six parts, i.e. parts A, B,C,D,E,F and G (Figure 40). Each part is discussed separately below.

Service Composition (Intracity)

Service Name	Current EPK (Rs)	Desired EPK (Rs)	Years to achieve target	Trajectory of Change
Regular	42.74	43	10	Linear
Vajra City Service	57.35	66	10	Linear
Vayu Vajra	79.68	66	10	Linear
Electric bus	42.74	42.74	10	Linear

Current EPK (Rs)

Current EPK (Rs)	Desired EPK (Rs)	Years to achieve target	Trajectory of Change
58.45	51.9	10	Linear
78.7	69	10	Linear
78.7	69	10	Linear
58.4	70	10	Linear

Desired EPK (Rs)

Current staff to bus ratio	Desired staff to bus ratio	Years to achieve target	Trajectory of Change
5.32	5.2	10	Linear
4.25	4.2	10	Linear
4.25	4.2	10	Linear
5.32	5.29	10	Linear

Current Operational routes

Current Operational routes	Desired Operational routes	Years to achieve target	Trajectory of Change
2220	0	10	Linear
27	0	10	Linear
16	0	10	Linear
0	2264	10	Linear

Current Avg. Route length

Current Avg. Route length	Desired Avg. Route length	Years to achieve target	Trajectory of Change
50.48	25	10	Linear
33.7	33.7	10	Linear
53.4	53.4	10	Linear
31.9	50.48	10	Linear

Current Cost

Current Cost	Expected Cost	Years to achieve target	Trajectory of Change
3273000	3273000	10	Linear
8574000	8574000	10	Linear
8574000	8574000	10	Linear
18000000	10000000	10	Linear

Current Pass. Trip Length

Current Pass. Trip Length	Expected Pass. Trip Length	Years to achieve target	Trajectory of Change
9.85	10	10	Linear
13.74	14.5	10	Linear
16.67	17.5	10	Linear
10.41	10	10	Linear

Buttons: Error check, Go Back, Save & Continue, Exit, Open Default values

Logos: SHAKTI, SGA Architects, © SGA Architects

Figure 40: User form 8, part A and B

5.8.1 Data set part A: User form 8

Figure 41 presents the image of the input fields in part A of the vision data form 2. In this form, the data on intended or desired EPK is sought for all defined services.

Service Composition

Service Name	Current EPK (Rs)	Desired EPK (Rs)	Years to achieve target	Trajectory of Change
Regular	42.74	43	10	Linear
Vajra City Service	57.35	66	10	Linear
Vayu Vajra	79.68	66	10	Linear
Electric bus	42.74	42.74	10	Linear

Labels: a, b, c, d, e

Figure 41: Form 8, part A

- Service name:** In these fields for each defined service type, the tool displays the name of all service type as defined in form number 3. These fields cannot be edited by the user and is for reference purpose in this form.
- Current EPK:** In this field the tool presents current or base year 'EPK' for each service type as input by the user in 'form 4'. These fields cannot be edited by the user and is for reference purpose in this form.

- c. **Desired EPK:** In this field the user is required to input the desired or targeted ‘EPK’ (unit is currency, i.e. Indian Rupees) individually, for all defined services. The user must input numerical/ decimal value ranging between 1 to 999.
It is important to note that changes (positive or negative) in ‘EPK’ can be an effect of policy, financing and planning interventions. Therefore, users should be able to relate the expected change in ‘EPK’ to an expected change in policy, financing and planning related to bus services and operations in the future. Section 3.1 of this manual discusses these policy, financing and planning interventions which will effect ‘EPK’ and users are encouraged to refer to the same before finalizing an expected future value for this parameter in a defined scenario (for input in this field). Additionally, it is suggested that users record and report these interventions (in relation to the input value) when reporting the outcomes of this tool.
- d. **Years to achieve the target:** In this field, the user is required to input (for each defined service type) the desired or targeted time frame (in number of years) to achieve the transition in ‘EPK’ from current/base year to desired/target inputs. The user must input numerical, integer value ranging between 1 to 50. The target time frame input is service specific, and the tool applies individually defined time frame for transition in ‘EPK’ for all services.
- e. **Trajectory of change:** The trajectory of transition between the base year and the targeted ‘EPK’ can be either linear (i.e. rate of change is constant throughout the defined time period of transition), logarithmic (i.e. rate of change gradually reduces throughout the time period of transition) or exponential (i.e. rate of change increases gradually throughout the time period of transition). The user must select one of these three transition types from the drop-down menu, individually for each service (each service can have a different defined trajectory of change in ‘EPK’).

5.8.2 Data set part B: User form 8

Figure 51,presents the image of the input fields in part B of the vision data form 2. In this form, the data on intended or desired CPK is sought for all defined services.

The screenshot shows a table with four columns: Current CPK (Rs), Desired CPK (Rs), Years to achieve target, and Trajectory of Change. There are four rows of data. A callout 'B' points to the top of the table. Callouts 'a', 'b', 'c', and 'd' point to the four columns respectively.

Current CPK (Rs)	Desired CPK (Rs)	Years to achieve target	Trajectory of Change
58.45	51.9	10	Linear
78.7	69	10	Linear
78.7	69	10	Linear
58.4	70	10	Linear

Figure 42: Form 8, part B

- a. **Current CPK:** In this field the tool presents current or base year ‘CPK’ for each service type as input by the user in ‘form 4’. These fields cannot be edited by the user and is for reference purpose in this form.
- b. **Desired CPK:** In this field the user is required to input the desired or targeted ‘CPK’ (unit is currency, i.e. Indian Rupees) individually, for all defined services. The user must input numerical/ decimal value ranging between 1 to 999.

It is important to note that changes (positive or negative) in 'CPK' can be an effect of policy, financing and planning interventions. Therefore, users should be able to relate the expected change in 'CPK' to an expected change in policy, financing and planning related to bus services and operations in the future. Section 3.6 of this manual discusses these policy, financing and planning interventions which will effect 'CPK' and users are encouraged to refer to the same before finalizing an expected future value for this parameter in a defined scenario (for input in this field). Additionally, it is suggested that users record and report these interventions (in relation to the input value) when reporting the outcomes of this tool.

- c. **Years to achieve the target:** In this field, the user is required to input (for each defined service type) the desired or targeted time frame (in number of years) to achieve the transition in 'CPK' from current/base year to desired/target inputs. The user must input numerical, integer value ranging between 1 to 50. The target time frame input is service specific, and the tool applies individually defined time frame for transition in 'CPK' for all services.
- d. **Trajectory of change:** The trajectory of transition between the base year and the targeted 'CPK' can be either linear (i.e. rate of change is constant throughout the defined time period of transition), logarithmic (i.e. rate of change gradually reduces throughout the time period of transition) or exponential (i.e. rate of change increases gradually throughout the time period of transition). The user must select one of these three transition types from the drop-down menu, individually for each service (each service can have a different defined trajectory of change in 'CPK').

5.8.3 Data set part C: User form 8

Figure 43, presents the image of the input fields in part C of the vision data form 2. In this form, the data on intended or desired staff to bus ratio is sought for all defined services.

The screenshot shows a table with four columns: 'Current staff to bus ratio', 'Desired staff to bus ratio', 'Years to achieve target', and 'Trajectory of Change'. There are four rows of data. A large black circle with the letter 'C' is in the top left corner. Below the table, four black circles labeled 'a', 'b', 'c', and 'd' point to the respective columns.

Current staff to bus ratio	Desired staff to bus ratio	Years to achieve target	Trajectory of Change
5.32	5.2	10	Linear
4.25	4.2	10	Linear
4.25	4.2	10	Linear
5.32	5.29	10	Linear

Figure 43: Form 8, part C

- a. **Current Staff to bus ratio:** In this field the tool presents current or base year 'staff to bus ratio' for each service type as input by the user in 'form 4'. These fields cannot be edited by the user and is for reference purpose in this form.
- b. **Desired Staff to bus ratio:** In this field the user is required to input the desired or targeted 'staff to bus ratio' individually, for all defined services. The user must input numerical/decimal value ranging between 1 to 100.

It is important to note that changes (positive or negative) in 'staff to bus ratio' can be an effect of policy, financing and planning interventions. Therefore, users should be able to relate the expected change in 'staff to bus ratio' to an expected change in policy, financing and planning related to bus services and operations in the future. Section 3.12 of this manual

discusses these policy, financing and planning interventions which will effect ‘staff to bus ratio’ and users are encouraged to refer to the same before finalizing an expected future value for this parameter in a defined scenario (for input in this field). Additionally, it is suggested that users record and report these interventions (in relation to the input value) when reporting the outcomes of this tool.

- c. **Years to achieve the target:** In this field, the user is required to input (for each defined service type) the desired or targeted time frame (in number of years) to achieve the transition in ‘staff to bus ratio’ from current/base year to desired/target inputs. The user must input numerical, integer value ranging between 1 to 50. The target time frame input is service specific, and the tool applies individually defined time frame for transition in ‘staff to bus ratio’ for all services.
- d. **Trajectory of change:** The trajectory of transition between the base year and the targeted ‘staff to bus ratio’ can be either linear (i.e. rate of change is constant throughout the defined time period of transition), logarithmic (i.e. rate of change gradually reduces throughout the time period of transition) or exponential (i.e. rate of change increases gradually throughout the time period of transition). The user must select one of these three transition types from the drop-down menu, individually for each service (each service can have a different defined trajectory of change in ‘staff to bus ratio’).

5.8.4 Data set part D: User form 8

Figure 44, presents the image of the input fields in part D of the vision data form 2. In this form, the data on intended or desired operational is sought for all defined services.

Current Operational routes	Desired Operational routes	Years to achieve target	Trajectory of Change
2220	0	10	Linear
27	0	10	Linear
16	0	10	Linear
0	2264	10	Linear

Figure 44: Form 8, part D

- a. **Current total operational routes:** In this field the tool presents current or base year ‘current total operational routes’ for each service type as input by the user in ‘form 4’. These fields cannot be edited by the user and is for reference purpose in this form.
- b. **Desired number of total operational routes:** In this field the user is required to input the desired or targeted desired ‘number of operational routes’ individually, for all defined services. The user must input numerical/ decimal value ranging between 1 to 9999. *It is important to note that changes (positive or negative) in ‘number of operational routes’ can be an effect of policy, financing and planning interventions. Therefore, users should be able to relate the expected change in ‘number of operational routes’ to an expected change in policy, financing and planning related to bus services and operations in the future. Section 3.5 of this manual discusses these policy, financing and planning interventions which will effect ‘number of operational routes’ and users are encouraged to refer to the same before finalizing an expected future value for this parameter in a defined scenario (for input in this*

field). Additionally, it is suggested that users record and report these interventions (in relation to the input value) when reporting the outcomes of this tool.

- c. **Years to achieve the target:** In this field, the user is required to input (for each defined service type) the desired or targeted time frame (in number of years) to achieve the transition in 'number of operational routes' from current/base year to desired/target inputs. The user must input numerical, integer value ranging between 1 to 50. The target time frame input is service specific, and the tool applies individually defined time frame for transition in 'number of operational routes' for all services.
- d. **Trajectory of change:** The trajectory of transition between the base year and the targeted 'number of operational routes' can be either linear (i.e. rate of change is constant throughout the defined time period of transition), logarithmic (i.e. rate of change gradually reduces throughout the time period of transition) or exponential (i.e. rate of change increases gradually throughout the time period of transition). The user must select one of these three transition types from the drop-down menu, individually for each service (each service can have a different defined trajectory of change in 'number of operational routes').

5.8.5 Data set part E: User form 8

Figure 45, presents the image of the input fields in part E of the vision data form 2. In this form, the data on intended or desired average route length is sought for all defined services.

Current Avg. Route length	Desired Avg. Route length	Years to achieve target	Trajectory of Change
50.48	25	10	Linear
33.7	33.7	10	Linear
53.4	53.4	10	Linear
31.9	50.48	10	Linear

Figure 45: User form 8, Part E

- a. **Current average route length:** In this field the tool presents the value of current or base year 'average route length' for each service type as input by the user in 'form 4'. These fields cannot be edited by the user and is for reference purpose in this form.
- b. **Desired average route length:** In this field the user is required to input the desired or targeted desired 'average route length' (in kilometers) individually, for all defined services. The user must input numerical/ decimal value ranging between 1 to 999.
It is important to note that changes (positive or negative) in 'average route length' can be an effect of policy, financing and planning interventions. Therefore, users should be able to relate the expected change in 'average route length' to an expected change in policy, financing and planning related to bus services and operations in the future. Section 3.11 of this manual discusses these policy, financing and planning interventions which will effect 'average route length' and users are encouraged to refer to the same before finalizing an expected future value for this parameter in a defined scenario (for input in this field). Additionally, it is suggested that users record and report these interventions (in relation to the input value) when reporting the outcomes of this tool.

- c. **Years to achieve the target:** In this field, the user is required to input (for each defined service type) the desired or targeted time frame (in number of years) to achieve the transition in 'average route length' from current/base year to desired/target inputs. The user must input numerical, integer value ranging between 1 to 50. The target time frame input is service specific, and the tool applies individually defined time frame for transition in 'average route length' for all services.
- d. **Trajectory of change:** The trajectory of transition between the base year and the targeted 'average route length' can be either linear (i.e. rate of change is constant throughout the defined time period of transition), logarithmic (i.e. rate of change gradually reduces throughout the time period of transition) or exponential (i.e. rate of change increases gradually throughout the time period of transition). The user must select one of these three transition types from the drop-down menu, individually for each service (each service can have a different defined trajectory of change in 'average route length').

5.8.6 Data set part F: User form 8

Figure 46, presents the image of the input fields in part E of the vision data form 2. In this form, the data on intended or desired cost of the vehicle (Bus) is sought for all defined services.

Current Cost	Expected Cost	Years to achieve target	Trajectory of Change
3273000	3273000	10	Linear
8574000	8574000	10	Linear
8574000	8574000	10	Linear
18000000	10000000	10	Linear

a b c d

Figure 46: User form 8, Part F

- a. **Current average cost of the bus:** In this field the tool presents the value of current or base year 'average current cost per bus' for each service type as input by the user in 'form 4'. These fields cannot be edited by the user and is for reference purpose in this form.
- b. **Desired cost of the bus:** Here the user must input the expected 'average cost per bus' (or the purchase cost) in the horizon year (or in the time period defined). If a scenario defines that the STU shall move to contracting an external/private operator and not investing in buses, then the cost of the bus shall be zero. Therefore, the input range for this field is a whole number between 0 and 99999999. Please note that all cost is before accounting for inflation or at current value for money and the input unit is Indian Rupees (INR).
- c. **Years to achieve the target:** In this field, the user is required to input (for each defined service type) the desired or targeted time frame (in number of years) to achieve the transition in 'average cost per bus' from current/base year to desired/target inputs. The user must input numerical, integer value ranging between 1 to 50. The target time frame input is service specific, and the tool applies individually defined time frame for transition in 'average cost per bus' for all services.

- d. **Trajectory of change:** The trajectory of transition between the base year and the targeted ‘average cost per bus’ can be either linear (i.e. rate of change is constant throughout the defined time period of transition), logarithmic (i.e. rate of change gradually reduces throughout the time period of transition) or exponential (i.e. rate of change increases gradually throughout the time period of transition). The user must select one of these three transition types from the drop-down menu, individually for each service (each service can have a different defined trajectory of change in ‘average cost per bus’).

5.8.7 Data set part F: User form 8

Figure 47,presents the image of the input fields in part E of the vision data form 2. In this form, the data on intended or desired average passenger trip length is sought for all defined services.

Current Pass. Trip Length	Expected Pass. Trip Length	Years to achieve target	Trajectory of Change
9.85	10	10	Linear
13.74	14.5	10	Linear
16.67	17.5	10	Linear
10.41	10	10	Linear

a b c d

Figure 47: User form 8, Part G

- a. **Current average passenger trip length:** In this field the tool presents the value of current or base year ‘average passenger trip length’ for each service type as input by the user in ‘form 4’. These fields cannot be edited by the user and is for reference purpose in this form.
- b. **Desired average passenger trip length:** In this field the user is required to input the desired or targeted desired ‘average passenger trip length’ (in kilometers) individually, for all defined services. The user must input numerical/ decimal value ranging between 1 to 500. *It is important to note that changes (positive or negative) in ‘average passenger trip length’ can be an effect of policy, financing and planning interventions. Therefore, users should be able to relate the expected change in ‘average passenger trip length’ to an expected change in policy, financing and planning related to bus services and operations in the future. Section 3.10 of this manual discusses these policy, financing and planning interventions which will effect ‘average passenger trip length’ and users are encouraged to refer to the same before finalizing an expected future value for this parameter in a defined scenario (for input in this field). Additionally, it is suggested that users record and report these interventions (in relation to the input value) when reporting the outcomes of this tool.*
- c. **Years to achieve the target:** In this field, the user is required to input (for each defined service type) the desired or targeted time frame (in number of years) to achieve the transition in ‘average passenger trip length’ from current/base year to desired/target inputs. The user must input numerical, integer value ranging between 1 to 50. The target

time frame input is service specific, and the tool applies individually defined time frame for transition in ‘average passenger trip length’ for all services.

- d. **Trajectory of change:** The trajectory of transition between the base year and the targeted ‘average passenger trip length’ can be either linear (i.e. rate of change is constant throughout the defined time period of transition), logarithmic (i.e. rate of change gradually reduces throughout the time period of transition) or exponential (i.e. rate of change increases gradually throughout the time period of transition). The user must select one of these three transition types from the drop-down menu, individually for each service (each service can have a different defined trajectory of change in ‘average passenger trip length’).

5.9 User form 9 – Vision data Form 3 (Mode share)

Figure 48, presents the image of the user form 9 – vision data form 3. In this form, the user is required provide the intercity and Intra city targeted/expected or envisioned mode share data separately for - STU bus, other buses and intermediate public transport (IPT). This form consists of a total of 24 inputs. **A good/desirable benchmark for mode share of intracity passenger trips would be 40 to 45% total combined mode share of trips by ‘all buses and IPT’, with 45% to 55% as the mode share by non-motorized modes (including walk) and not more than 5% to 15% by private motorized modes. The share of all bus-based passenger trips should be 85% to 90% of all one-way passenger trips longer than 7 to 8 km in the city. For intercity or non-urban passenger trips a good benchmark for mode share would be 40% to 50% of total trips by all bus and IPT, less than 5% to 10% by non-motorized modes, 35% to 45% by rail, air and water transport and less than 10% to 15% by private motorized modes.**

Mode Share By STU Bus				Mode Share By Other Bus				Mode Share By IPT						
	Current	Desired	Years to achieve target	Trajectory of Change		Current	Desired	Years to achieve target	Trajectory of Change		Current	Desired	Years to achieve target	Trajectory of Change
Intracity	19.77%	24.00 %	10	Linear		5.24%	4.10 %	10	Linear		8.33%	5.40 %	10	Linear
Intercity	0.00%	0.00 %	10	Linear		36.32%	36.34 %	10	Linear		11.70%	11.66 %	10	Linear

Figure 48: User form 9

This form has the same set of buttons at the bottom as rest of the forms, i.e. forms 2 to 8; except the ‘Save & Continue’ button is replaced by ‘Save & Exit’ button. This is the last of the standard input forms, and by pressing ‘Save & Exit’ the user exits the tool and is prompted to save the output *.xlsx file under a specified name and in a folder of choice. For explanation of input fields in this form, the form has been divided in to two parts, i.e. parts A and B (Figure 49). Each part is discussed separately below.

Figure 49: User form 9, parts A and B

5.9.1 Data set part A: Intra city mode share

Figure 50: User form 9, part A

Figure 50 presents the image of the input fields in part A of the vision data form 3. In this form, the data on desired/targeted/envisioned or expected mode share of STU buses, other buses and IPT in intracity operations is captured along with inputs on number of years to achieve the target and the trajectory of transition.

- Current STU bus mode share (intracity operations):** The tool estimates and presents the mode share of STU buses i.e. percentage share of passenger trips by STU buses out of all intracity passenger trips (including walk) by all travel modes in the region (under the operational area/scope of the STU). This is estimated from population and trip data captured in form 2 of the tool. This value cannot be edited and is for reference purpose only in this form.
- Desired STU mode share (intracity operations):** In this field the user is required to input the desired/targeted/envisioned or expected 'STU (bus) mode share (intracity)' (including walk) in kilometers (this is common input for the overall STU intracity operations). The user must input numerical/ decimal value ranging between 1 to 80. Please note that the unit of this value/input is percentage and hence the value inserted is used as percentage value in the tool. For example, value entered 40, would be used as 40% in the tool.

It is important to note that changes (positive or negative) in 'STU mode share (intracity)' can be an effect of policy, financing and planning interventions. Therefore, users should be able to relate the expected change in 'STU mode share (intracity)' to an expected change in policy, financing and planning related to bus services and operations in the future. Section 3.7 of this manual discusses these policy, financing and planning interventions which will effect 'STU mode share (intracity)' and users are encouraged to refer to the same before finalizing an expected future value for this parameter in a

defined scenario (for input in this field). Additionally, it is suggested that users record and report these interventions (in relation to the input value) when reporting the outcomes of this tool.

- c. **Number of years to achieve the target (for STU mode share in intracity operations):** In this field, the user is required to input the desired or targeted time frame (in number of years) to achieve the transition in 'STU (bus) mode share' from current/base year to desired/target inputs. The user must input numerical, integer value ranging between 1 to 50. The target time frame input is a single input for overall STU (intracity operations).
- d. **Trajectory of Change to achieve the target (for STU mode share in intracity operations):** The trajectory of transition between the base year and the targeted 'STU (bus) mode share' can be either linear (i.e. rate of change is constant throughout the defined time period of transition), logarithmic (i.e. rate of change gradually reduces throughout the time period of transition) or exponential (i.e. rate of change increases gradually throughout the time period of transition). The user must select one of these three transition types from the drop-down menu (this is a single input for overall STU intracity operations).
- e. **Current all other (other than STU) bus mode share (intracity operations):** The tool estimates and presents the mode share of all other buses (other than STU buses) i.e. percentage share of passenger trips by other buses out of all intracity passenger trips (including walk) by all travel modes (including STU buses) in the region (under the operational area/scope of the STU). This is estimated from population and trip data captured in form 2 of the tool. This value cannot be edited and is for reference purpose only in this form.
- f. **Desired all other (other than STU) bus mode share (intracity operations):** In this field the user is required to input the desired/targeted/envisioned or expected 'all other (other than STU) bus mode share (intracity)' (including walk) in kilometers. The user must input numerical/ decimal value ranging between 1 to 80. Please note that the unit of this value/input is percentage and hence the value inserted is used as percentage value in the tool. For example, value entered 40, would be used as 40% in the tool.
It is important to note that changes (positive or negative) in 'all other (other than STU) bus mode share (intracity)' can be an effect of policy, financing and planning interventions. Therefore, users should be able to relate the expected change in 'all other (other than STU) bus mode share (intracity)' to an expected change in policy, financing and planning related to bus services and operations in the future. Section 3.8 of this manual discusses these policy, financing and planning interventions which will effect 'all other (other than STU) bus mode share (intracity)' and users are encouraged to refer to the same before finalizing an expected future value for this parameter in a defined scenario (for input in this field). Additionally, it is suggested that users record and report these interventions (in relation to the input value) when reporting the outcomes of this tool.
- g. **Number of years to achieve the target (for all other bus mode share in intracity operations):** In this field, the user is required to input the desired or targeted time frame (in number of years) to achieve the transition in 'all other bus mode share' from current/base year to desired/target inputs. The user must input numerical, integer value ranging between 1 to 50.
- h. **Trajectory of Change to achieve the target (for all other bus mode share in intracity operations):** The trajectory of transition between the base year and the targeted 'all other bus mode share' can be either linear (i.e. rate of change is constant throughout the defined time period of transition), logarithmic (i.e. rate of change gradually reduces throughout the time period of transition) or exponential (i.e. rate of change

increases gradually throughout the time period of transition). The user must select one of these three transition types from the drop-down menu.

- i. **Current IPT mode share (intracity operations):** The tool estimates and presents the mode share of IPT i.e. percentage share of passenger trips by IPT out of all intracity passenger trips (including walk) by all travel modes (including STU buses) in the region (under the operational area/scope of the STU). This is estimated from population and trip data captured in form 2 of the tool. This value cannot be edited and is for reference purpose only in this form.
- j. **Desired IPT mode share (intracity operations):** In this field the user is required to input the desired/targeted/envisioned or expected 'IPT mode share (intracity)' (including walk) in kilometers. The user must input numerical/ decimal value ranging between 1 to 80. Please note that the unit of this value/input is percentage and hence the value inserted is used as percentage value in the tool. For example, value entered 40, would be used as 40% in the tool.
It is important to note that changes (positive or negative) in 'IPT mode share (intracity)' can be an effect of policy, financing and planning interventions. Therefore, users should be able to relate the expected change in 'IPT mode share (intracity)' to an expected change in policy, financing and planning related to bus services and operations in the future. Section 3.9 of this manual discusses these policy, financing and planning interventions which will effect 'IPT mode share (intracity)' and users are encouraged to refer to the same before finalizing an expected future value for this parameter in a defined scenario (for input in this field). Additionally, it is suggested that users record and report these interventions (in relation to the input value) when reporting the outcomes of this tool.
- k. **Number of years to achieve the target (for IPT mode share in intracity operations):** In this field, the user is required to input the desired or targeted time frame (in number of years) to achieve the transition in 'IPT mode share' from current/base year to desired/target inputs. The user must input numerical, integer value ranging between 1 to 50.
- l. **Trajectory of Change to achieve the target (for IPT mode share in intracity operations):** The trajectory of transition between the base year and the targeted 'IPT mode share' can be either linear (i.e. rate of change is constant throughout the defined time period of transition), logarithmic (i.e. rate of change gradually reduces throughout the time period of transition) or exponential (i.e. rate of change increases gradually throughout the time period of transition). The user must select one of these three transition types from the drop-down menu.

Please note that the sum total of mode share input field for intracity operations by STU bus, all other bus and IPT should not exceed 90 (or 90%).

5.9.2 Data set part A: Intercity mode share

The screenshot shows a form titled 'Intercity' with a circular icon containing the letter 'B'. The form is organized into three groups of input fields, each with a header row and four input fields below it. The first group has a header of '0.00%' and a dropdown menu set to 'Linear'. The second group has a header of '36.22%' and a dropdown menu set to 'Linear'. The third group has a header of '11.73%' and a dropdown menu set to 'Linear'. The input fields are labeled with letters a through l.

Group	Header	a	b	c	d	Header	e	f	g	h	Header	i	j	k	l
1	0.00%					36.22%					11.73%				
2	0.00 %					38.84 %					11.66 %				
3	10					10					10				
4	Linear					Linear					Linear				

Figure 51: Form 9, part B

Figure 51 presents the image of the input fields in part B of the vision data form 3. In this form, the data on desired/targeted/envisioned or expected mode share of STU buses, other buses and IPT in intercity operations is captured along with inputs on number of years to achieve the target and the trajectory of transition.

- a. **Current STU bus mode share (intercity/non-urban operations):** The tool estimates and presents the mode share of STU buses i.e. percentage share of passenger trips by STU buses out of all intercity passenger trips (including walk) by all travel modes in the region (under the operational area/scope of the STU). This is estimated from population and trip data captured in form 2 of the tool. This value cannot be edited and is for reference purpose only in this form.
- b. **Desired STU mode share (intercity/non-urban operations):** In this field the user is required to input the desired/targeted/envisioned or expected 'STU (bus) mode share (intercity)' (including walk) in kilometers (this is common input for the overall STU intercity operations). The user must input numerical/ decimal value ranging between 1 to 80. Please note that the unit of this value/input is percentage and hence the value inserted is used as percentage value in the tool. For example, value entered 40, would be used as 40% in the tool.
It is important to note that changes (positive or negative) in 'STU mode share (intercity)' can be an effect of policy, financing and planning interventions. Therefore, users should be able to relate the expected change in 'STU mode share (intercity)' to an expected change in policy, financing and planning related to bus services and operations in the future. Section 3.7 of this manual discusses these policy, financing and planning interventions which will effect 'STU mode share (intercity)' and users are encouraged to refer to the same before finalizing an expected future value for this parameter in a defined scenario (for input in this field). Additionally, it is suggested that users record and report these interventions (in relation to the input value) when reporting the outcomes of this tool.
- c. **Number of years to achieve the target (for STU mode share in intercity/non-urban operations):** In this field, the user is required to input the desired or targeted time frame (in number of years) to achieve the transition in 'STU (bus) mode share' from current/base year to desired/target inputs. The user must input numerical, integer value ranging between 1 to 50. The target time frame input is a single input for overall STU (intercity operations).
- d. **Trajectory of Change to achieve the target (for STU mode share in intercity/non-urban operations):** The trajectory of transition between the base year and the targeted 'STU (bus) mode share' can be either linear (i.e. rate of change is constant throughout the defined time period of transition), logarithmic (i.e. rate of change gradually reduces throughout the time period of transition) or exponential (i.e. rate of change increases gradually throughout the time period of transition). The user must select one of these three transition types from the drop-down menu (this is a single input for overall STU intercity operations).
- e. **Current all other (other than STU) bus mode share (intercity/non-urban operations):** The tool estimates and presents the mode share of all other buses (other than STU buses) i.e. percentage share of passenger trips by other buses out of all intracity passenger trips (including walk) by all travel modes (including STU buses) in the region (under the operational area/scope of the STU). This is estimated from population and trip data captured in form 2 of the tool. This value cannot be edited and is for reference purpose only in this form.
- f. **Desired all other (other than STU) bus mode share (intercity/non-urban operations):** In this field the user is required to input the desired/targeted/envisioned or expected

‘all other (other than STU) bus mode share (intercity)’ (including walk) in kilometers. The user must input numerical/ decimal value ranging between 1 to 80. Please note that the unit of this value/input is percentage and hence the value inserted is used as percentage value in the tool. For example, value entered 40, would be used as 40% in the tool.

It is important to note that changes (positive or negative) in ‘all other (other than STU) bus mode share (intercity)’ can be an effect of policy, financing and planning interventions. Therefore, users should be able to relate the expected change in ‘all other (other than STU) bus mode share (intercity)’ to an expected change in policy, financing and planning related to bus services and operations in the future. Section 3.8 of this manual discusses these policy, financing and planning interventions which will effect ‘all other (other than STU) bus mode share (intercity)’ and users are encouraged to refer to the same before finalizing an expected future value for this parameter in a defined scenario (for input in this field). Additionally, it is suggested that users record and report these interventions (in relation to the input value) when reporting the outcomes of this tool.

- g. **Number of years to achieve the target (for all other bus mode share in intercity/non-urban operations):** In this field, the user is required to input the desired or targeted time frame (in number of years) to achieve the transition in ‘all other bus mode share’ from current/base year to desired/target inputs. The user must input numerical, integer value ranging between 1 to 50.
- h. **Trajectory of Change to achieve the target (for all other bus mode share in intercity/non-urban operations):** The trajectory of transition between the base year and the targeted ‘all other bus mode share’ can be either linear (i.e. rate of change is constant throughout the defined time period of transition), logarithmic (i.e. rate of change gradually reduces throughout the time period of transition) or exponential (i.e. rate of change increases gradually throughout the time period of transition). The user must select one of these three transition types from the drop-down menu.
- i. **Current IPT mode share (intercity/non-urban operations):** The tool estimates and presents the mode share of IPT i.e. percentage share of passenger trips by IPT out of all intercity passenger trips (including walk) by all travel modes (including STU buses) in the region (under the operational area/scope of the STU). This is estimated from population and trip data captured in form 2 of the tool. This value cannot be edited and is for reference purpose only in this form.
- j. **Desired IPT mode share (intercity/non-urban operations):** In this field the user is required to input the desired/targeted/envisioned or expected ‘IPT mode share (intercity)’ (including walk) in kilometers. The user must input numerical/ decimal value ranging between 1 to 80. Please note that the unit of this value/input is percentage and hence the value inserted is used as percentage value in the tool. For example, value entered 40, would be used as 40% in the tool.

It is important to note that changes (positive or negative) in ‘IPT mode share (intercity)’ can be an effect of policy, financing and planning interventions. Therefore, users should be able to relate the expected change in ‘IPT mode share (intercity)’ to an expected change in policy, financing and planning related to bus services and operations in the future. Section 3.9 of this manual discusses these policy, financing and planning interventions which will effect ‘IPT mode share (intercity)’ and users are encouraged to refer to the same before finalizing an expected future value for this parameter in a defined scenario (for input in this field). Additionally, it is suggested that users record and report these interventions (in relation to the input value) when reporting the outcomes of this tool.

- k. **Number of years to achieve the target (for IPT mode share in intercity/non-urban operations):** In this field, the user is required to input the desired or targeted time frame (in number of years) to achieve the transition in 'IPT mode share' from current/base year to desired/target inputs. The user must input numerical, integer value ranging between 1 to 50.
- l. **Trajectory of Change to achieve the target (for IPT mode share in intercity/non-urban operations):** The trajectory of transition between the base year and the targeted 'IPT mode share' can be either linear (i.e. rate of change is constant throughout the defined time period of transition), logarithmic (i.e. rate of change gradually reduces throughout the time period of transition) or exponential (i.e. rate of change increases gradually throughout the time period of transition). The user must select one of these three transition types from the drop-down menu.

Please note that the sum total of mode share input fields for intercity/non-urban operations by STU bus, all other bus and IPT should not exceed 90 (or 90%).

5.10 Default Values Form

Figure 52 presents the image of the default user form. The fields on this form represent the assumed/expected/commonly accepted or estimated value of various parameters to be used in the calculations/working of the tool, in generating the outputs.

STU Default Data

Item	Value	Item	Value
> 10km Work Bus trips origin from other states (travelling to state) as percent of work bus trips in state	2.50%	Percent of STU Inter city trips >10km as percent of total inter city trips by bus	80.44%
> 10km Education Bus trips origin from other states (travelling to state) as percent of work bus trips in state	2.50%	Work IPT trips origin from outside state (travelling to state) as percent of work IPT trips in state	1.00%
> 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 same day education trips less than 10km by IPT in urban areas	4.00%
Percent of education trips less than 10km in urban areas	85.00%	Intra city non work trips <10km by IPT	47.23%
Percent of education trips less than 10km in rural areas	70.00%	Percent of same day education trips less than 10km by IPT in rural areas	0.50%
Percent of inter city work trips >10km originating from urban area	10%	Inter city non work trips <10km by IPT	20.17%
Percent of inter city education trips >10km originating from urban area	10%	Percent of same day education trips more than 10km by IPT in urban areas	15.00%
Percent of inter city non-work trips >10km originating from urban area	10%	Intra city non work trips >10km by IPT	8.95%
Percent of education trips less than 10km by buses in urban areas	14.52%	Percent of same day education trips more than 10km by IPT in rural areas	4.00%
Percent of non-work trips less than 10km by buses in urban areas	39.90%	Inter city non work trips >10km by IPT	23.65%
Percent of non-work trips less than 10km by buses in rural/non-urban areas	22.50%		
Percent of non-work trips more than 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	Urban	Non-Urban
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		
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

Figure 52: Form 10, default values page

The tool uses 38 editable default parameters. These parameters have an assigned value each in the tool, and the same is known as the default values. Users can edit these values based on their understanding. The edited values are saved in the tool and are available when the tool file is opened

again in the 'CONTINUE' mode. To edit these values users', need to access the 'default values form' by clicking on the 'open default values' button on forms 2 to 9 (except form 6). After making the changes the users can press 'Ok' button to return to the last form (they were working on). Alternately users may choose to restore system defaults by clicking on 'Set Default Values' button. Although all users can edit default values, changes to the same are not recommended, unless required for research and academic applications. The default values form has been divided in to four parts (A, B,C and D) for ease of explanation. Figure 53 presents the image of default values form indicating the four parts of the form.

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	25.00%
Percent of non-work trips less than 10km by buses in rural/non-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	19.54%
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	23.63%

Item	Value
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

Item	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

Figure 53: Form 10, default values page with labelled parts

5.10.1.1 Default Values Form – Part A

Figure 54,presents the image of the input fields in part A of the default data form. In this form, the data fields are labelled in alphabetical order sought for all defined services. Each of the labelled input fields in the figure have been explained below.

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	25.00%

Figure 54: Form 10, default values -Part A

- a. **>10km work Bus trips origin from other region/state (travelling to region/state) as percent of work bus trips in state:** This is an assumed value referring to the (percent of) work passenger trips as percent of total work trips in the region/State served by the STU, that are greater than 10km in length but originate from outside the region or State. The tool adds these trips to its estimate of total trips that need to be accounted for. The default value for this field is **2.50%**.
- b. **>10km education Bus trips origin from other region/States (travelling to region/State) as percent of work bus trips in state:** This is an assumed value referring to the (percent of) education passenger trips as percent of total education trips in the region/State served by the STU, that are greater than 10km in length but originate from outside the region or State. The tool adds these trips to its estimate of total trips that need to be accounted for. The default value for this field is **2.50%**.
- c. **>10km non work (and non-tourist) trips bus trips origin from other region/State (travelling to region/State) as percent of work bus trips in state:** This is an assumed value referring to the (percent of) passenger trips other than work, education and tourist trips as percent of total such trips in the region/State served by the STU, that are greater than 10km in length but originate from outside the region or State. The tool adds these trips to its estimate of total trips that need to be accounted for. The default value for this field is **2.50%**.
- d. **Percent of education trips less than 10km in urban areas:** This field refers the percent of intracity education (passenger) trips that are less than or equal to 10km in length out of total education trips in the urban area under the operational scope of the STU. The default value for this field is **85.00%**. This implies that 15.00% of education trips will be more than 10km in length in urban areas. This default value has been based on the census data of work trips.
- e. **Percent of education trips less than 10km in rural areas:** This field refers the percent of intercity or non-urban education (passenger) trips that are less than or equal to 10km in length out of total education trips in non-urban areas under the operational scope of the STU. The default value for this field is **70.00%**. This implies that 30.00% of education trips will be more than 10km in length in non-urban areas. This default value has been based on the census data of work trips.
- f. **Percent of intercity work trips >10km originating from urban areas:** This field refers the percent of intercity or non-urban work (passenger) trips that are more than 10km in length but originate from or are destined to an urban area, out of the total work trips in non-urban areas under the operational scope of the STU. The default value for this field is **10.00%**.
- g. **Percent of intercity education trips >10km originating from urban areas:** This field refers the percent of intercity or non-urban education (passenger) trips that are more than 10km in length but originate from or are destined to an urban area, out of the total education trips in non-urban areas under the operational scope of the STU. The default value for this field is **10.00%**.
- h. **Percent of intercity non-work trips >10km originating from urban areas:** This field refers the percent of intercity or non-urban non-work and non-education (passenger) trips (but including tourist trips) that are more than 10km in length but originate from or are destined to an urban area, out of the total non-work and non-education trips in non-urban areas under the operational scope of the STU. The default value for this field is **10.00%**.
- i. **Percent of education trips less than 10km by buses in urban areas:** This field refers the percent of intracity education (passenger) trips by all buses that are less than or equal to 10km in length, out of the total intracity (or sum of all urban area under the

operational scope of the STU) education trips that are less than or equal to 10km in length. The default value for this field is **14.52%**.

- j. **Percent of non-work trips less than 10km by buses in urban areas:** This field refers the percent of intracity ‘other than work, education and tourist (passenger) trips’ by all buses, that are less than or equal to 10km in length, out of the total intracity (or sum of all urban area under the operational scope of the STU) ‘other than work, education and tourist (passenger) trips’ that are less than or equal to 10km in length. As a default, the tool uses the same value as the percent of intracity work trips by ‘all buses less than or equal to 10km out of all intracity work trips less than or equal to 10km’. This value is derived from census and included in the tool data base for a listed STU or specified by the user in ‘Form 2’ for a new STU. If user accesses the default form before inputting values on Form 2, then the default value of **25.00%** shall be displayed in this field.

5.10.1.2 Default Values Form – Part B

Figure 55, presents the image of the input fields in part B of the default data form. In this form, the data fields are labelled in alphabetical order sought for all defined services. Each of the labelled input fields in the figure have been explained below.

Percent of non-work trips less than 10km by buses in rural/non-urban areas	40.00%	k
Percent of non-work trips more 10km by buses in urban areas	35.00%	l
Percent of non-work trips more than 10km by buses in rural/non-urban areas	35.00%	m
Percent of same day education trips less than 10km by public buses in rural areas	20.00%	n
Percent of same day education trips more than 10km by public buses in urban areas	21.00%	o
Percent of same day education trips more than 10km by public buses in rural areas	37.00%	p
Inter city non work trips <10km by bus	66.57%	q
Inter city non work trips >10km by bus	33.43%	r
Percent of STU Intra city trips <10km as percent of total intra city trips by bus	33.47%	s
Percent of STU Inter city trips <10km as percent of total inter city trips by bus	71.63%	t
Percent of STU Intra city trips >10km as percent of total intra city trips by bus	28.37	u

Figure 55: Form 10, default values Part B

- k. **Percent of non-work trips less than 10km by buses in rural/non-urban areas:** This field refers the percent of rural/nonurban ‘other than work, education and tourist (passenger) trips’ by all buses that are less than or equal to 10km in length, out of the total rural/non-urban ‘other than work, education and tourist (passenger) trips’ (in the region under the operational scope of the STU) that are less than or equal to 10km in length. As a default, the tool uses the **same value as the percent of rural/non-urban work trips by all buses less than or equal to 10km out of all rural/non-urban (passenger) work trips less than or equal to 10km**. This value is derived from census and included in the tool data base for a listed STU or specified by the user in ‘Form 2’ for a new STU. If user accesses the default form before inputting values on form 2, then the default value of 40.00% shall be displayed in this field.

- l. **Percent of non-work trips more 10km by buses in urban areas:** This field refers the percent of intracity ‘other than work, education and tourist (passenger) trips’ by all buses that are more than 10km in length, out of the total intracity (or sum of all urban area under the operational scope of the STU) ‘other than work, education and tourist (passenger) trips’ that are more than 10km in length. As a default, the tool uses the **same value as the percent of intracity work trips by all buses more than 10km out of all intracity work trips more than 10km**. This value is derived from census and included in the tool data base for a listed STU or specified by the user in ‘Form 2’ for a new STU. If user accesses the default form before inputting values on form 2, then the default value of 35.00% shall be displayed in this field.
- m. **Percent of non-work trips more than 10km by buses in rural/non-urban areas:** This field refers the percent of rural/nonurban ‘other than work, education and tourist (passenger) trips’ by all buses that are more than 10km in length, out of the total rural/nonurban ‘other than work, education and tourist (passenger) trips’ (in the region under the operational scope of the STU) that are more than 10km in length. As a default, the tool uses the **same value as the percent of rural/non-urban work trips by all buses more than 10km out of all rural/non-urban (passenger) work trips more than 10km**. This value is derived from census and included in the tool data base for a listed STU, or specified by the user in ‘Form 2’ for a new STU. If user accesses the default form before inputting values on form 2, then the default value of 35.00% shall be displayed in this field.
- n. **Percent of education trips less than 10km by buses in rural/non-urban areas:** This field refers the percent of intercity or non-urban education (passenger) trips by all buses that are less than or equal to 10km in length, out of the total intercity or non-urban education trips (in the region under the operational scope of the STU) that are less than or equal to 10km in length. The default value for this field is 20.00%.
- o. **Percent of education trips more 10km by buses in urban areas:** This field refers the percent of intracity education (passenger) trips by all buses that are more than 10km in length, out of the total intracity (or sum of all urban area under the operational scope of the STU) education trips that are more than 10km in length. The default value for this field is 21.00%.
- p. **Percent of education trips more than 10km by buses in rural/non-urban areas:** This field refers the percent of intercity or non-urban education (passenger) trips by all buses that more tan 10km in length, out of the total intercity or non-urban education trips (in the region under the operational scope of the STU) that are more than 10km in length. The default value for this field is 37.00%.
- q. **Intercity non work trips < 10km by bus:** This field refers to the percent share of intercity/non-urban STU Bus based passenger trips that are more than 10km in length out of total (all trip length) intercity/non-urban STU Bus based passenger trips in the region/ area under the scope of operations of the STU. **This value is derived (and presented in this field) from tool estimated values on all bus trips (for all purposes), i.e. percent of all intercity/non-urban bus trips more than 10km in length out of all intercity/non-urban bus trips; as a part of working of this tool.** It is assumed that this share is the same for trips made by STU buses for all purposes (work, education, tourist, non-work) in the region/area. Therefore, value is calculated by the tool and presented as default value in the default form. Users can edit this value and that modification applies to estimation of all STU bus trips. This modification will also affect the value/number of ‘other bus’ trips as the same is calculated by subtracting STU bus trips by purpose from all bus trips (not affected by this modification) by purpose. If user accesses the default form before inputting values on form 2, then the default value of 66.57% shall be displayed in

this field. In case the field is edited, **user must ensure that the sum of this field and that explained in 'r' above should be 100%.**

- r. **Intercity non work trips >10km by bus:** This field refers to the percent share of intercity/non-urban STU Bus based passenger trips that are less than or equal to 10km in length out of total (all trip length) intercity/non-urban STU Bus based passenger trips in the region/ area under the scope of operations of the STU. **This value is derived (and presented in this field) from tool estimated values on all bus trips (for all purposes), i.e. percent of all intercity/non-urban bus trips more than 10km in length out of all intercity/non-urban bus trips; as a part of working of this tool.** It is assumed that this share is the same for trips made by STU buses for all purposes (work, education, tourist, non-work) in the region/area. Therefore, value is calculated by the tool and presented as default value in the default form. Users can edit this value and that modification applies to estimation of all STU bus trips. This modification will also affect the value/number of 'other bus' trips as the same is calculated by subtracting STU bus trips by purpose from all bus trips (not affected by this modification) by purpose. If user accesses the default form before inputting values on form 2, then the default value of 33.43% shall be displayed in this field. In case the field is edited, **user must ensure that the sum of this field and that explained in 'r' above should be 100%.**
- s. **Percent of STU Intracity trips <10km as percent of total intracity trips by bus:** This field refers to the percent share of intracity/urban STU Bus based passenger trips that are less than or equal to 10km in length out of total (all trip length) intercity/non-urban STU Bus based passenger trips in the region/ area under the scope of operations of the STU. **This value is derived (and presented in this field) from tool estimated values on all bus trips (for all purposes), i.e. percent of all intracity/urban bus trips less than or equal to 10km in length out of all intracity/urban bus trips; as a part of working of this tool.** It is assumed that this share is the same for trips made by STU buses for all purposes (work, education, tourist, non-work) in the region/area. Therefore, value is calculated by the tool and presented as default value in the default form. Users can edit this value and that modification applies to estimation of all STU bus trips. This modification will also affect the value/number of 'other bus' trips as the same is calculated by subtracting STU bus trips by purpose from all bus trips (not affected by this modification) by purpose. If user accesses the default form before inputting values on form 2, then the default value of 33.43% shall be displayed in this field.
- t. **Percent of STU Intercity trips <10km as percent of total intercity trips by bus:** This field refers to the percent share of intercity STU Bus based passenger trips that are more than 10km in length out of total (all trip length) intercity STU Bus based passenger trips in the nonurban area under the scope of operations of the STU. **This value is derived (and presented in this field) from tool estimated values on all bus trips (for all purposes), i.e. percent of all intercity bus trips more than 10km in length out of all intercity bus trips; as a part of the working of this tool.** It is assumed that this share is the same for trips made by STU buses for all purposes (work, education, tourist, non-work) outside city/urban area. Therefore, value is calculated by the tool and presented as default value in the default form. Users can edit this value and that modification applies to estimation of all STU bus trips. This modification will also affect the value/number of 'other bus' trips as the same is calculated by subtracting STU bus trips by purpose from all bus trips (not affected by this modification) by purpose. If user accesses the default form before inputting values on form 2, then the default value of 71.63% shall be displayed in this field.

- u. **Percent of STU Intracity trips >10km as percent of total intra city trips by bus:** This field refers to the percent share of intracity STU Bus based passenger trips that are more than 10km in length out of total (all trip length) intracity STU Bus based passenger trips in the city/urban area under the scope of operations of the STU. **This value is derived (and presented in this field) from tool estimated values on all bus trips (for all purposes), i.e. percent of all intracity bus trips more than 10km in length out of all intracity bus trips; as a part of working of this tool.** It is assumed that this share is the same for trips made by STU buses for all purposes (work, education, tourist, non-work) in the city/urban area. Therefore, value is calculated by the tool and presented as default value in the default form. Users can edit this value and that modification applies to estimation of all STU bus trips. This modification will also affect the value/number of 'other bus' trips as the same is calculated by subtracting STU bus trips by purpose from all bus trips (not affected by this modification) by purpose. If user accesses the default form before inputting values on form 2, then the default value of 28.37% shall be displayed in this field. In case the field is edited, **user must ensure that the sum of this field and that explained in 'p' above should be 100%.**

5.10.1.3 Default Values Form – Part C

Figure 56, presents the image of the input fields in part C of the default data form. In this form, the data fields are labelled in alphabetical order sought for all defined services. Each of the labelled input fields in the figure have been explained below.

Item	Value	
Percent of STU Inter city trips >10km as percent of total inter city trips by bus	80.44%	V
Percent of same day education trips less than 10km by IPT in urban areas	4.00%	W
Intra city non work trips <10km by IPT	47.23%	X
Percent of same day education trips less than 10km by IPT in rural areas	0.50%	Y
Inter city non work trips <10km by IPT	20.17%	Z
Percent of same day education trips more than 10km by IPT in urban areas	15.00%	aa
Intra city non work trips >10km by IPT	8.95%	bb
Percent of same day education trips more than 10km by IPT in rural areas	4.00%	cc
Inter city non work trips >10km by IPT	23.65%	dd

Figure 56: Form 10, default values Part C

- v. **Percent of STU Intercity trips ≥10km as percent of total intercity trips by bus:** This field refers to the percent share of intercity/non-urban STU Bus based passenger trips that are more than 10km in length out of total (all trip length) intercity/non-urban STU Bus based passenger trips in the region/ area under the scope of operations of the STU. **This value is derived (and presented in this field) from tool estimated values on all bus trips (for all purposes), i.e. percent of all intercity/non-urban bus trips more than 10km in length out of all intercity/non-urban bus trips; as a part of working of this tool.** It is assumed that this share is the same for trips

made by STU buses for all purposes (work, education, tourist, non-work) in the region/area. Therefore, value is calculated by the tool and presented as default value in the default form. Users can edit this value and that modification applies to estimation of all STU bus trips. This modification will also affect the value/number of ‘other bus’ trips as the same is calculated by subtracting STU bus trips by purpose from all bus trips (not affected by this modification) by purpose. If user accesses the default form before inputting values on form 2, then the default value of 66.57% shall be displayed in this field. In case the field is edited, **user must ensure that the sum of this field and that explained in ‘r’ above should be 100%.**

- w. **Percent of education trips less than 10km by IPT in urban areas:** The tool estimates total number of intracity education trips less than or equal to 10km in length (by all modes) in the region under the operational scope of the STU, from the data provided in Form 2. Mode share of these trips by IPT is an assumed value based on the understanding developed from mode share of IPT trips in all intracity work trips less than or equal to 10km in length (known from the census data). The default value for this field is **4.00%**.
- x. **Percent of non-work trips less than 10km by IPT in urban areas:** The tool estimates total number of intracity non-work trips less than or equal to 10km in length (by all modes) in the region under the operational scope of the STU, from the data provided in Form 2. **Mode share of these intracity trips by IPT (in all intracity non-work trips less than or equal to 10km) is considered to be the same as that of work trips.** The mode share of intracity work trips by IPT (in all intracity work trips less than or equal to 10km) is known from the census data and is included in the data base of listed STUs. The same is available in Form 2 when working in ‘Existing STU List’ mode or is input by the user in ‘New STU’ mode. This value is presented as the default value in this field. If user accesses the default form before inputting values on form 2, then the default value of 47.23% shall be displayed in this field.
- y. **Percent of education trips less than 10km by IPT in rural/non-urban areas:** The tool estimates total number of intercity/non-urban education trips less than or equal to 10km in length (by all modes) in the region under the operational scope of the STU, from the data provided in Form 2. Mode share of these trips by IPT is an assumed value based on the understanding developed from mode share of IPT trips in all intercity/non-urban work trips less than or equal to 10km in length (known from the census data). The default value for this field is **0.50%**.
- z. **Percent of non-work trips less than 10km by IPT in rural/non-urban areas:** The tool estimates total number of intercity/non-urban non-work trips less than or equal to 10km in length (by all modes) in the region under the operational scope of the STU, from the data provided in Form 2. **Mode share of these trips by IPT (in all non-work trips less than or equal to 10km) is considered to be the same as that of intercity/non-urban work trips.** The mode share of intercity/non-urban work trips by IPT (in all intercity/non-urban work trips less than or equal to 10km) is known from the census data and is included in the data base of listed STUs. The same is available in Form 2 when working in ‘Existing STU List’ mode or is input by the user in ‘New STU’ mode. This value is presented as the default value in this field. If user accesses the default form before inputting values on form 2, then the default value of 20.17% shall be displayed in this field.
- aa. **Percent of education trips more than 10km by IPT in urban areas:** The tool estimates total number of intracity education trips more than 10km in length (by all modes) in the region under the operational scope of the STU, from the data provided in Form 2. Mode share of these trips by IPT is an assumed value based on the understanding developed from mode share of IPT trips in all intracity work trips

more than 10km in length (known from the census data). The default value for this field is **15.00%**.

- bb. **Percent of non-work trips more than 10km by IPT in urban areas:** The tool estimates total number of intracity non-work trips more than 10km in length (by all modes) in the region under the operational scope of the STU, from the data provided in Form 2. **Mode share of these intracity trips by IPT (in all intracity non-work trips more than 10km) is the same as that of work trips.** The mode share of intracity work trips by IPT (in all intracity work trips more than 10km) is known from the census data and is included in the data base of listed STUs. The same is available in Form 2 when working in 'Existing STU List' mode or is input by the user in 'New STU' mode. This value is presented as the default value in this field. If user accesses the default form before inputting values on form 2, then the default value of 8.95% shall be displayed in this field.
- cc. **Percent of education trips more than 10km by IPT in rural/non-urban areas:** The tool estimates total number of intercity/non-urban education trips more than 10km in length (by all modes) in the region under the operational scope of the STU, from the data provided in Form 2. Mode share of these trips by IPT is an assumed value based on the understanding developed from mode share of IPT trips in all intercity/non-urban work trips more than 10km in length (known from the census data). The default value for this field is **4.00%**.
- dd. **Percent of non-work trips more than 10km by IPT in rural/non-urban areas:** The tool estimates total number of intercity/non-urban non-work trips more than 10km in length (by all modes) in the region under the operational scope of the STU, from the data provided in Form 2. **Mode share of these trips by IPT (in all non-work trips more than 10km) is considered to be the same as that of intercity/non-urban work trips.** The mode share of intercity/non-urban work trips by IPT (in all intercity/non-urban work trips more than 10km) is known from the census data and is included in the data base of listed STUs. The same is available in Form 2 when working in 'Existing STU List' mode or is input by the user in 'New STU' mode. This value is presented as the default value in this field. If user accesses the default form before inputting values on form 2, then the default value of 26.65% shall be displayed in this field.

5.10.1.4 Default Values Form – Part D

Figure 57, presents the image of the input fields in part D of the default data form. In this form, the data fields are labelled in alphabetical order sought for all defined services. Each of the labelled input fields in the figure have been explained below.

D

	Intra	Inter	
Land Required per bus for depot development (sqm)	160.00	160.00	ee
Average Depot Capacity (buses)	100.00	100.00	ff
% of non local STU buses using inter city terminal (as % of STU buses)	5%	5%	gg
Cost per bus for developing depot (rs)	800000.00	800000	hh
	Urban	Non-Urban	
Land Required per bus for terminal development	70.00		ii
Average terminal capacity	40.00		jj
Cost per bus for developing terminal (rs)	250000.00		kk
Factor to relate terminal capacity to bus fleet (Fleet/(Capacity*X)), where	1.25		ll

Figure 57: Form 10, default values Part D

- ee. **Land required per bus for bus depot development (sqm):** This field includes the default value of per bus land requirement of depot with a capacity of 100 buses. This value is derived from the ASRTU Depot Design Guidelines (SGArchitects, 2017). This default value is **160 sq.m**
- ff. **Average bus depot capacity (buses):** This field includes the default value of depot capacity considered per depot proposed for development. This value is derived from the ASRTU Depot Design Guidelines, as the ideal depot size (SGArchitects, 2017). This default value is **100 buses**.
- gg. **Land required per bus for terminal development:** This field includes the default value of per bus land requirement of depot with a capacity to handle 40 buses per hour at average 20minute dwell time. This value is derived from the ASRTU Terminal Design Guidelines (SGArchitects, 2015). This default value is **70 sq.m.** and relates to the total buses in the fleet and not buses that are accommodated in the terminal at a given time.
- hh. **Percent of non-local STU buses using intercity terminal (as % of STU buses):** This value relates to the number of non (current STU) buses using the terminals operated by STU as a percent of (current) STU buses and is specific to intercity STUs. This default value is assumed to be **5%**.
- ii. **Average terminal capacity:** This value relates to the handling capacity of bus terminals considered or estimated for development. The default value is **40** buses per hour at average 20-minute dwell time each.
- jj. **Cost per bus for developing depot in Indian Rupees:** This field includes the default value of per bus cost for developing a depot. It is based on a depot land area development of 160sq.m. per bus as the size requirement for 100bus capacity depot, based on ASRTU Depot Design Guidelines (SGArchitects, 2017). This default value is Indian Rupees **8,00,000**
- kk. **Cost per bus for developing terminal in Indian Rupees:** This field includes the default value of per bus cost for developing a bus terminal. It is based on a terminal land area development of 70sq.m. per bus as the size requirement for 40bus per hour capacity terminal, based on ASRTU Bus Terminal Design Guidelines (SGArchitects, 2015). This default value is Indian Rupees **2,50,000**
- ll. **Factor to relate terminal capacity to bus fleet (fleet/(capacity*X)):** **1.25** is assumed default value as factor to relate terminal capacity to bus fleet.

5.11 Output

After filling the last user input form, the FLEET tool generates an excel based output file (compatible with MS Excel 2007 and above versions). Figure 58, presents the output form generated by the tool.

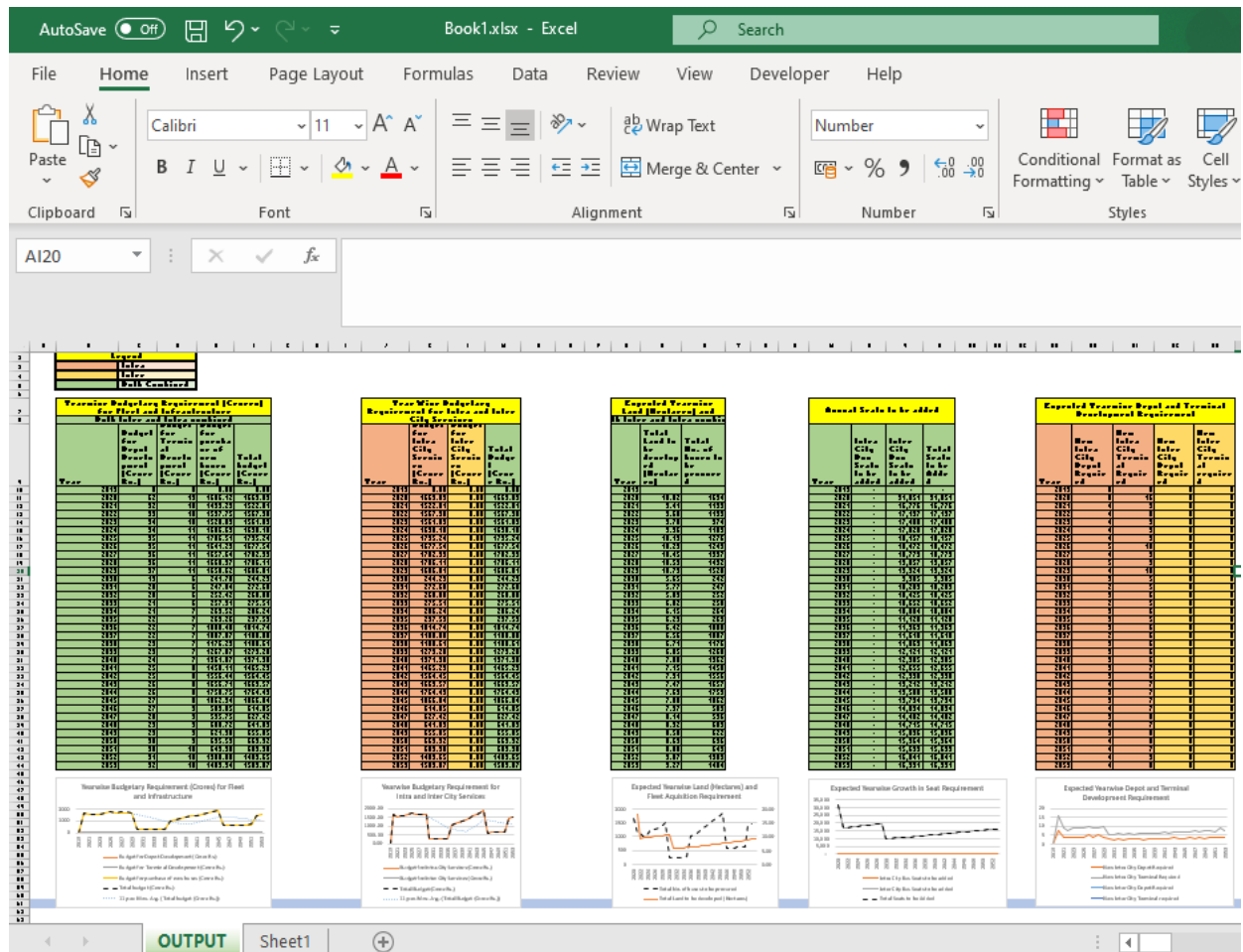


Figure 58: Output Form

The file includes password protected single worksheet, named 'Output' - containing a compilation of output results in forms of year wise charts supported by mathematical graphs. The user must enter the password – "FLEET2019", to open this worksheet. The work sheet includes a total of 33 outputs which 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.
- 4) In addition, outputs are presented as rate of change, depicting growth/decline in different public transport mode share, staff requirement, efficiency, etc.

For better understanding of the user, the outputs generated are differently coloured as shown in Figure 59 to distinguish intracity outputs, Intercity outputs and combined outputs

	Intracity outputs
	Intercity outputs
	Both Combined outputs

Figure 59: Output Colour Coding

The same file also contains the input data so that the user can view the inputs inserted against the generated results including any unedited values, such as values derived from census or default values. Any changes to these sheets are not recommended, but one can copy it and then analyse the same against results for other STU's outputs generated by the tool. A list of all outputs and their respective cell number has been presented in in the Table 1

Table 1: List of Outputs

no	List of Outputs: FLEET Tool	Cell number
1	Year wise Budgetary Requirement (Crores) for Fleet and Infrastructure	C9-F9
2	Year Wise Budgetary Requirement for intercity and Intra city Services	K9-M9
3	Expected Year wise Land (Hectares) and Fleet Acquisition Requirement	R9-S9
4	Expected Year wise Growth in Seat Requirement	X9-Z9
5	Expected Year wise Depot and Terminal Development Requirement	AE9-AH9
6a	Year wise Bus Fleet Procurement Requirement (Intracity)	AM9-BK9
6b	Year wise Bus Fleet Procurement Requirement (Intercity)	BP9-CN9
7a	Expected Year wise Fleet Growth (Intracity)	CS9-DQ9
7b	Expected Year wise Fleet Growth (Intercity)	DV9-ET9
8a	Expected Year wise Cumulative Land Requirement for Fleet (Intracity)	EY9-FA9
8b	Expected Year wise Cumulative Land Requirement for Fleet (Intercity)	FF9-FH9
9	Expected Year wise Cumulative Fleet and Land Requirement	FM9-FN9
10	Expected Year wise Growth in Number of Trips	FS9-FU9
11	Expected Year wise Growth in Bus Trips	FZ9-GB9
12a	Expected Year wise Growth in daily passenger PT Trips (Intracity)	GG9-GJ9
12b	Expected Year wise Growth in daily passenger PT Trips (Intercity)	GO9-GR9
13a	Year wise Bus Trips by Purpose (Intracity)	GW9-HA9
13b	Year wise Bus Trips by Purpose (Intercity)	HE9-HI9
14a	Year wise Trips by Distance (Intracity)	HM9-HO9
14b	Year wise Trips by Distance (Intercity)	HV9-HT9
15a	Year wise PT mode share (<=10km) (Intracity)	IA9-IC9
16a	Year wise PT mode share (>10km) (Intracity)	IH9-IJ9
15b	Year wise PT mode share (<=10km) (Intercity)	IO9-IQ9
16b	Year wise PT mode share (>10km) (Intercity)	IV9-IX9
17a	Expected/Planned Annual Services Fleet Utilization (Intracity)	JB9-JZ9
18a	Expected/Planned Annual Services Vehicle Utilization (Intracity)	KC9-LB9
19a	Expected/Planned Annual Services Occupancy (Intracity)	LE9-MD9
17b	Expected/Planned Annual Services Fleet Utilization (Intercity)	MI9-NH9
18b	Expected/Planned Annual Services Vehicle Utilization (Intercity)	NK9-OJ9

19b	Expected/Planned Annual Services Occupancy (Intercity)	OM9-PL9
20	Annual Additional Staff Recruitment Requirement	PQ9-PS9
21	Total Staff Strength	PX9-PZ9
22	Expected Staff to Vehicle Ratio	QE9-QF9
23	Projected Number of Routes	QK9-QM9
24	Projected Headway (Minutes)	QR9-QS9
25a	Expected Trip lengths (Intracity)	QX9-RW9
25b	Expected Trip lengths (Intercity)	QX9-RW9
26	Expected Operating cost Intra and Intercity	RZ9-SY9
27	Expected Annual Operating cost, Earning and Total profit -Intercity and Intracity	TC9-TD9
28a	Total Expected Annual Operating cost, Earning and Total profit (Intracity)	TJ9-TL9
28b	Total Expected Annual Operating cost, Earning and Total profit (Intercity)	TQ9-TS9
28c	Total Expected Annual Operating cost, Earning and Total profit (Total)	TY9-UA9
29a	Average Route Length (Intracity)	UF9-VD9
29b	Average Route Length (Intercity)	VG9-WE9
30a	Average Fleet Composition (Intracity)	WJ9-XH9
30b	Average Fleet Composition (Intercity)	XK9-YI9
31a	Year wise Unutilized fleet (Intracity)	YL9-ZI9
31b	Year wise Unutilized fleet (Intercity)	ZM9-AAJ9
32a	Year wise Mode share (Intracity)	AAM9-AAQ9
32b	Year wise Mode share (Intercity)	AAW9-ABA9
33a	Year wise annual viability gap (Intracity)	ABG9-ABM9
33b	Year wise annual viability gap (Intracity)	ABR9-ABU9
33c	Year wise annual viability gap (Intracity + Intercity)	ABZ9-ACC9

6 Annexure

6.1 Checklist – Data set 1

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

6.2 Checklist – Data set 2

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 Composition _____ %		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 _____					

