

# Request for Qualification and Proposal for Selection of Private Operator for City Bus Operations in Faridabad

**RFQP – Part III**

**Bus specifications – 650 mm floor height CNG fuelled Air  
Conditioned (AC) and Non Air-conditioned (Non AC) Midi buses**

**Tender Reference No. – FSCL/2019/740**

**Date –01.08.2019**

**Faridabad Smart City Limited**

**PART III**

**Bus specifications – 650 mm floor height CNG fuelled Air Conditioned and Non Air-conditioned Midi buses**



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# Specifications for AC & Non-AC CNG fuelled 650 mm floor height Midi Buses

## PART I – GENERAL REQUIREMENTS

### 1. INTRODUCTION AND SCOPE:

End-use requirement oriented specifications, with maximum make / model neutrality, for fully built CNG fuelled Bharat Stage IV (BS IV) compliant air-conditioned (AC) and Non air-conditioned (Non AC) 650 mm floor height Midi buses for Public Transport (PT) System in urban areas of Faridabad. Non AC Midi buses are proposed to be deployed for intra-city PT services and air-conditioned (AC) buses are planned to operate as feeder services to Metro rail system operating between Ballabhgarh in Faridabad to Kashmere gate in Delhi. Manufacturer/Bodybuilder/ Private Operator (PO) would furnish technical details for assemblies / sub-assemblies/ systems/ equipment as per Technical Specification of this Section in appropriate formats.

The specifications cover end use based design, evaluation, fabrication & testing features of CNG fuelled AC and Non AC Midi buses for PT operations for transportation of passengers mainly in Faridabad. The bus design should be energy efficient, environment friendly, safe, efficient and reliable besides meeting all statutory, legal and other requirements, as also those related to easy passenger accessibility including for Persons with Disabilities (PwDs), passenger comfort, driver's work place, internal and external aesthetics, ease of repair and maintenance etc.

Specifications would comply with all applicable Central, State and local laws (including Acts, Rules & Regulations). These would include, but not be limited to, the provisions of Disability Act 1995 as amended till date as well as state and local accessibility, safety, emission and other requirements. The bus would meet or exceed the Central Motor Vehicles Rules (CMVR) of India / Safety Norms, Emission, Noise & other norms applicable at the time of supply. In the event of any conflict between requirements emanating from these specification and those as per any statutory/legal, etc. in force, the superior/ higher requirements/Standards would prevail.

The word "Bus" or "Buses" wherever used in the specification means the "9200±200 mm long CNG fuelled BS IV compliant air-conditioned and Non-air conditioned Midi bus with 650 mm ± 10 mm floor height" as per specifications given in this document. The urban buses would have right hand drive.

For PT operations in urban areas of Faridabad, a fully built / custom built bus as per specs detailed in this document and those of AIS 052 / UBS II is envisaged.

### 2. GENERAL DESIGN FEATURES OF THE MIDI BUSES:

- 2.1. Buses would generally be designed and manufactured in accordance with the UBS II specifications & 'Code of Practice for Bus Body Design and Approval' (AIS 052 and amendments applicable to CNG buses)-- hereinafter referred to as Bus Code--; as applicable to buses in India/CMVR rules/Haryana motor vehicle rules whichever is superior. Details of relevant standard followed would be indicated against each item.
- 2.2. Bus body design would consider all other aspects / provisions to be made on proposed bus body facilitating ease of its mounting / erection on the acquired chassis without causing any damage / defect to chassis / its aggregates etc. and further facilitating ease of repair and maintenance of all other fitments / aggregates provided on bus chassis, etc.
- 2.3. Bus would be designed to carry commuters in Faridabad with ease of boarding and alighting especially for ladies, senior citizens and PwDs. Buses would be provided with wheel chaired disabled persons friendly access and anchorage system.
- 2.4. Bus design would be suitable for daily operation of 16 to 20 hours in FSCL with peak loading of about 42 passengers in Midi buses (each passenger weighing 68 Kgs on an average and carrying a load of 7kgs each), average journey speed of about 25 Kms per hour with frequent starts/stops, say, after every 500 to 1000 mtrs. The max attainable speed of the bus would be in range of 75kmph with cruising speeds of 40-50 kms.
- 2.5. Bus design would be eco-friendly, energy efficient, safe, and comfortable meeting specified exhaust emissions norms (Bharat Stage IV or Euro-IV or latest as amended up to date of supply).
- 2.6. Bus must be of proven design suitably modified to climatic & operational conditions, infrastructure and road conditions as obtaining in urban Faridabad.

- 2.7. Bus design should meet all statutory requirements applicable Faridabad in all respects.
- 2.8. The bus structure would meet requirements of structural strength, stability, deflection, vibration, crashworthiness, roll over protection etc. amongst others for at least the following main loads including those as per annexure 3 of UBS II:
- i. Static loads
  - ii. Dynamic loads
  - iii. Single wheel bump loads
  - iv. Double wheel bump (diagonally opposite) loads
  - v. Braking and acceleration loads
  - vi. Front impact loads
  - vii. Roll over loads
  - viii. Speed breaker induced loads
- 2.9. Bus/ bus-body design would be a proved design duly evaluated by agencies authorized as per CMVR using Finite Element Analysis for above loads/performance requirements for values for above loads/ conditions /performance parameters as given in subsequent paragraphs.
- 2.10. Minimum required performance values/ data for above load conditions may be considered as follows:
- i. Strength (Factor of safety): minimum of 1.35 (tolerance  $\pm 10\%$ ) i.e. design stress would be  $1/1.35^{\text{th}}$  of yield stress.
  - ii. Stiffness (Deflection): 5mm.
  - iii. Vibrations (Lowest Natural Frequency):5Hz
  - iv. Frontal Impact:  
(Velocity = 56 Kmph against fixed rigid barrier)
    - Head Injury Criterion(HIC) = 1000
    - Crumbled Zone = 132mm
    - No part of structure would intrude into residual space.
    - (HIC= Head Injury Criterion calculation is based on acceleration level at the head of driver/ passenger & time duration during which maximum value of above acceleration is build up. Typical acceleration at the head should not exceed 80g continuously for 3 milliseconds to avoid head cracks).
  - v. Roll over (as per bus code – AIS 052) tests with modifications of making the bus roll from ground level instead of the raised platform:
    - (i) Bus tilted to its unstable position
    - (ii) Bus allowed to fall freely under gravity from this position.
    - (iii) Gross vehicle weight of the bus is to be considered
    - (iv) The Energy absorbed by the structure =0.75 ER  
{ $E_R$  =Reference energy-- the Potential energy of the bus in its (unstable) equilibrium position}.

$E_R = M.g.h$ , Where M= Effective weight of the bus; g = Acceleration due to gravity;  
h= Height of C.G. above ground level in (unstable) equilibrium position.}

    - (a) Angular velocity should not exceed 5 deg/sec.
    - (b) The unstable position should not occur before 35 deg.
    - (c) No part of structure intrudes into residual space.)
  - vi. Buckling Factor would be equal to or more than four.
  - vii. Various loads:

- Normal Loads (Static) = No. of Passengers x wt. of passengers (68 Kgs.) + passenger luggage weight (7 Kgs). (Besides the vehicle related loads).
- Bump Loads:
  - Bump height = as per relevant BIS/Indian Road Congress Guidelines.
  - Case I: Single Wheel on Bump/Pot hole.
  - Case II: Diagonally opposite wheels on Bump/Pot hole.
  - Case III: Both wheels (Front & Rear) on Bump/Pot hole.
- Braking Loads:0.6g

Horizontal = 0.6g load, Vertical = 1g load, (Applied together)

- 2.11. The bus, loaded to Gross Vehicle Weight (GVW), with crush load and under static conditions, would not exhibit deflection or deformation that impairs the operation of steering mechanism, doors, windows, passenger escape mechanisms and service doors, etc.
- 2.12. Manufacturer's certificate supported by testing and type approval agency's certificates along with the bus as also technical specifications/drawings required for inspection, performance assessment as above to be supplied along with the bus. Besides meeting the statutory requirements the bus would be designed with respect to its body and different aggregates/systems /sub systems to operate satisfactorily in urban transport service for at least 10 years or 8, 00,000Kms whichever is later.
- 2.13. Detailed schematic drawings of bus structure, seats, interior/ exterior fittings, electrical systems, wiring looms / harness, photometric items and other accessories along with complete details of materials used, their specification, manufacturing tolerances etc. would be provided by the bus manufacturer/ Bodybuilder/PO. Additionally, details / drawings of mounting / fastening bus body to chassis to be provided along with the bid specifically bringing out whether bus body would be welded and integrated to chassis or fastened using fasteners along with applicable mechanism system /arrangement. Detailed Circuit diagrams for electricals be also provided by the bidder/bus manufacturer.
- 2.14. Details of general appearance, seating layout and structural of roof, floor, sides, front & rear show and driver's cab, etc. would be supplied. Main dimensions of the fully built bus i.e., overall length, overall width, overall height, saloon height, pillar to pillar distance, seat pitch, number of seats (excluding seat for the driver), entry/exit gates, wheel chair locations/fastening arrangement and the accessibility mechanism, etc. would be supplied along with the schematic diagrams/printed literature of the bus.
- 2.15. Material used in construction of buses would be as per Bureau of Indian Standards (BIS)/ Automotive Industry Standards (AIS)/ specifications and/or other international specifications meeting/ surpassing performance & other requirements as given in the Bus Code. In absence of above specifications, Association of State Road Transport Undertakings (ASRTU) specifications could be followed. Wherever Indian Standards are not available, internationally acceptable Standards may be referred. Specifications/ Standards followed would conform to Specification/Standards as amended /up dated/ or the latest published by the concerned agencies. Wherever no specifications of any item have been notified as International/ National Standards etc. actual specifications of that item used be mentioned. Guaranteed life of the bus and its other aggregates be indicated item by item. Periodical maintenance schedule for obtaining the said life of the bus be also indicated.
- 2.16. BIS Standards are normally available from Bureau of Indian Standards, Manank Bhawan, 9-Bahadur Shah Zafar Marg, New Delhi-110 002. Web site: <http://www.bis.org.in>. Similarly, AIS Standards are available from Automotive Research Association of India, Post Box No.832, Pune-411 004. Web site: <http://www.araiindia.com>. ASRTU Specifications are available from Association of State Road Transport Undertakings, Sector 12, Dwarka, New Delhi. Web site: <http://www.asrtu.org>.
- 2.17. Suitable traps/openings with appropriate sealing and covers would be provided for repair and maintenance of various aggregate/systems/sub systems / chassis / body/ their components, etc. of the bus.
- 2.18. Any restriction in design, manufacture and mounting of bus body on chassis, as provided by chassis manufacture, as a part of detailed instructions for this purpose, be meticulously followed while mounting / joining / integrating bus body to bus chassis.
- 2.19. The bus would be so designed as to maintain operational stability requirement as per Bus Code. Interior noise and pass by noise of the vehicle would conform to BIS: 12832:1989 or latest and BIS: 3028:1998, 10399: 1998 or latest respectively.

- 2.20. It would be ensured that the design, manufacture, certification(wherever called for) & installation of major bus sub-components and systems are compliant with all such sub-component vendors' requirements & recommendations within the frame work of any statutory, legal and or any other lawful/functional requirements. A certificate of compliance would be shown on demand. Components used in the vehicle would be of heavy-duty design.
- 2.21. Any other provisions/fitments required for safe and efficient operation and or for fulfilling statutory requirements be provided in the offered bus.

### 3. ENGINE:

- 3.1. CNG fuelled engine would have adequate horse power to obtain desired performance in respect of its adequacy of power, acceleration levels, emission norms, specific fuel consumption etc. The engine to have adequate horsepower not only to propel the bus at its GVW but also to operate efficiently all other auxiliary devices, and the air conditioning systems fitted to bus, simultaneously, etc. As the bus is required for operation in urban services, engines of adequate horse power at lower Revolutions per minute (RPM ) levels with a high torque over a larger RPM range (on the lower side of the RPM range) be considered for use. The Horse Power and torque at defined rpm levels of the Engine be indicated by the bidder in his bid along with other details called for in the annexure
- 3.2. **Performance data/curves and other details of the engine have to be supplied. A detailed set of calculations indicating adequacy of said engine for proposed urban bus be provided along with all performance parameters of selected engine.**
- 3.3. The engine and its accessories would be easily replaceable. Engine mounting would be such as to minimize transmission of vibrations to bus structure. Engine foundation & mounting would be so located as to facilitate easy accessibility & replacement. Engine design would be such that it would not be overheated during normal operating conditions of vehicle. An arrangement for audio-visual signal would be provided in the event of engine getting overheated **excessively. The temperature at which signal operates would be indicated. Similar arrangement for other sub-system of engine with their monitorable indicators is made on dashboard. The engine would be equipped with electronic engine management and on-board diagnostic system.**
- 3.4. Engine compartment would be insulated to avoid transmission of heat and noise to saloon area. This firewall would preclude or retard propagation of an engine compartment fire into passenger compartment. Only necessary openings would be allowed in the firewall, and these would be fireproofed. Wiring may pass through only if connectors or other means are provided to prevent or retard fire propagation through the firewall. Engine access panels in the firewall would be fabricated of fireproof material and secured with fireproof fasteners. These panels, their fasteners, and the firewall would be constructed and reinforced to minimize warping of panels during a fire that will compromise integrity of the firewall. Bus manufacturer would provide relevant details to FSCL.
- 3.5. The engine would be suitably designed to operate optimally under Faridabad's peak summer heat and dust.
- 3.6. Engine noise and emission levels must conform to the Central Motor Vehicle Rules (CMVR)/ UBSII /AIS 052 any other Indian Standards, adopting the most superior one.
- 3.7. Specific fuel consumption of CNG per KW hour at Standard conditions would be indicated along with guaranteed fuel consumption level (kilometres per kg of CNG) under GVW and the standard urban operational conditions / cycle.
- 3.8. For sound-proofing & for protection against fire risk in engine compartment, no flammable material or material liable to soak fuel, lubricant or any combustible material would be used in engine compartment unless the material is clad by an impermeable fireproof sheet. A partition of heat-resistant material would be fitted between the engine compartment & any other source of heat.
- 3.9. The vehicles would have air intake design / location in a manner as to provide adequate quantity of dust free, restriction free air so as to avoid any operational problem of the engine.
- 3.10. Details of make / model etc. of various items of engine system and its subsystems would be provided as part of bid.

### 4. COOLING SYSTEM:

- 4.1. Heavy-duty radiator and other subsystems of cooling system would efficiently dissipate heat from the engine system. De-aeration tank and pressurized radiator cap would be provided. It would be easy for



filling and level checking of coolant. Replacement/ maintenance of radiator and its items be also easily carried out. Details of radiator specifications, cooling capacity, coolant, repair and maintenance procedures etc. would be supplied.

**5. TRANSMISSION SYSTEM:**

- 5.1. Heavy duty automatic transmission system having minimum 5 forward and one reverse gear would be provided. All operational controls/buttons/switches etc. be conveniently located within easy reach of the driver. The transmission system and the control/operational sub systems be easily accessible for repairs and also be easily replaceable. Complete system details need to be supplied with the bus.
- 5.2. Transmission system be fitted with a mechanism which makes it possible to engage reverse gear only when vehicle is stationary.
- 5.3. Details of make / model etc. of various items of transmission system would be provided as part of bid.

**6. SUSPENSION:**

- 6.1. The bus would be fitted with air suspension system at front and at rear axles. The suspension system would be fitted with shock absorbers, suitable for trouble free operation and jerk free comfortable ride in existing road conditions of Faridabad municipal area.

**7. STEERING SYSTEM:**

- 7.1. Hydraulic re-circulating ball type power steering would be provided.

**8. BRAKING SYSTEM:**

- 8.1. The braking system would be full pneumatic type with fail-safe dual circuit having four-way protection valve, auto slack adjuster, disc brakes in front and at rear, with non-asbestos brake pads having temperature and wear characteristics suitable for harsh urban operations. Brake squeal would be absent under normal conditions of operation. An air compressor/dryer which minimizes oil carry over would be fitted. Braking system would be fitted with air dryer and oil/ water separator system. Buses would also be provided with hand operated pneumatic flick valve type parking brakes at rear wheels. Air pressure line would be treated for corrosion resistance.
- 8.2. In the event of failure of engine and or loss of air in system, adequate provision be made for obtaining effectiveness of service brake system and or for deactivating the spring actuated brakes.

## **9. WHEELS AND TYRES:**

- 9.1. The bus would be fitted with steel radial tubeless tyres of optimal size and design conforming to AIS-044 Part I with wheel rims of corresponding size conforming to AIS/ BIS: 10694 (part 3)-1991 or latest. The bus would be supplied with 7 sets of tyres (two on front and four on rear wheels) fitted on the bus plus one set as spare Stepney.
- 9.2. Details of type, specifications, capacity, make, model etc. of tyres/wheel rims would be provided as part of the bid.
- 9.3. Suitable guards be provided near wheels to prevent damage/ for obtaining safety from stones hurled from tyres.
- 9.4. Splash aprons of minimum 6.50mm thickness composed of rubberized fabric would be installed behind the wheels as needed to reduce road splash and protect under floor components. Splash aprons would extend downward to within 100mm of road surface at static conditions. Apron widths would be no less than tyre widths, except for the front apron, which may extend across the width of the bus. Splash aprons would be bolted to the bus under structure. Splash aprons and their attachments would be inherently weaker than the structure to which they are attached. The flexible portions of splash aprons would not be included in road clearance measurements. Other splash aprons would be installed where necessary to protect bus equipment.

## **10. AXLES:**

- 10.1. Solid beam front axle & grease type front bearings & seals of reliable & proven design of adequate capacity to take care of maximum Gross Vehicle Weight (GVW) & crush loading expected during life span of the bus of minimum 10 years or 8,00,000 Kms. whichever is later
- 10.2. The bus would be driven by a single heavy-duty rear axle of proven design, adequate capacity to take care of maximum GVW & crush loading expected during life span of bus of minimum 10 years or 8,00,000 Kms whichever is later. Transfer of gear noise to bus interior would be minimized. Lubricant drain plug would be magnetic type, external hex head. If a planetary gear design is employed, oil level in the planetary gears would be easily checked through plug or sight gauge.
- 10.3. The drive shaft would be guarded to prevent it striking floor of the coach or the ground in the event of a tube or universal joint failure.
- 10.4. Details of type, specifications, capacity, make, model etc. of Front& Rear Axles would be provided at in the bid.

## **11. CNG FUELCYLINDERS:**

- 11.1. CNG fuelled vehicles must meet and satisfy all requirements of “code of practice for CNG fuel in internal combustion engine vehicles”, safety and other requirements as per AIS 052, safety and type approval as per AIS 024 and 028, and as per any other applicable standard and procedures; regulatory requirements as per CMVR / Haryana Motor Vehicle Rules (HMVR) and any other applicable regulations for operation in the State of Haryana.
- 11.2. CNG cylinders of requisite capacity would be appropriately mounted on to the bus keeping in mind convenience of CNG filling, safety of system and its maintainability, operation in the urban areas.
- 11.3. Capacity of the CNG cylinders be adequate for over 300 kms of bus running without refilling.
- 11.4. CNG cylinders and other components of CNG fuelled vehicles should conform to applicable AIS / BIS standards or International Specs / standards in absence of AIS /BIS specs. Cylinders and other components / units of CNG system be tested and certified to conform to said standards not more than one year prior to delivery of buses to the Authority. Detailed drawing indicating location and mounting details of CNG cylinders / its sub-systems be provided along with the bid
- 11.5. Make, model, capacity, etc. of each cylinder and the number of such cylinders fitted, be submitted along with the bid. Similar details be also submitted for regulator and other subsystems of the CNG system.
- 11.6. All requirements of AIS / BIS / CMVR/HMVR etc. for CNG cylinders, CNG sub-systems and components, etc. be fully met and test certificate for the same be provided.

## **12. UNDER FRAME & STRUCTURE:**

- 12.1. The under frame and super structure would be suitably designed to carry dense crush load **of about 42 passengers in Midi buses (each passenger weighing 68 Kgs on an average and carrying a load of**

**7kgs each**) consisting of seated and standee passengers, the superstructure of steel tubing, bus tare weight, all other fitments such as AC system, etc. and meet performance requirements under various loads indicated earlier. The structure would be designed to withstand the transit service conditions of operation throughout its service life.

- 12.2. Bus would be of integral construction / fastened to chassis frame depending upon the chassis design, with the super structure fabricated using steel tubing (ERW– Rectangular / Square Sections) conforming to BIS 4923-1985 or latest, of grade Yst –240.
- 12.3. A comprehensive multi-stage anti-rust treatment would be provided to bus flooring, sides, roof, under-structure, axle suspension components etc. for resistance to corrosion or deterioration from atmospheric conditions & road salts so as to enable them & the bus frame to last for at least 10 years or 8, 00,000Kms whichever is later.
- 12.4. Samples of all materials & connections would withstand a two weeks (336 hours) Salt Spray test in accordance with ASTM procedure B117 with no structural detrimental effect to normally visible surfaces & no weight loss of over 1%. Details of treatment provided with relevant specification details be indicated along with suitable calculations to reflect that the corrosion prevention treatment meets the requirements of minimum 10 years life in Faridabad's operational environment. Details of the system followed for corrosion prevention of internal surfaces of structural tubing would be supplied. A certificate of testing from an authorised test lab be provided.
- 12.5. Front and rear structure design would be energy absorption type to reduce impact stresses into under frame/side structures/ other areas of the vehicle. Damaged area of the vehicle would be easily repairable and or replaceable in the event of any major damage at normally available workshop facilities and without any need for specialised tools / fixtures and equipment.
- 12.6. Entire surface of bus under floor and sides exposed to ground would be covered with appropriate corrosion prevention & flame retardant paint coating for protection against harmful effects of water, mud etc. and to retard flames, if any. Wheel housings would be constructed to contain tyre bursts during operation and be flame retardant in case of tyre fire.
- 12.7. Sufficient clearance & air circulation would be provided around the tyres, wheels & brakes to preclude over-heating when the bus is operating
- 12.8. MIG welding would be used for steel structural member's fabrication.
- 12.9. All structural members would be MIG welded besides suitable gussets/ brackets of adequate size & thickness be provided on floor, side, front, rear & roof structure to ensure structure rigidity & integrity. Material, shape size and specs of such gussets / brackets would be provided by the bus supplier in their supplied drawings.
- 12.10. After anti corrosive treatment, structural members would be coated with red oxide/ Zinc Chromate primer & superior quality black paint.
- 12.11. During structural assembly operations, a number of holes are drilled and or weldments made after the corrosion prevention treatment of components/structural items/members causing loss of such treatment and exposing these items to corrosion. Manufacturer would take sufficient care to carry out corrosion prevention of items so exposed to effectively prevent corrosion.
- 12.12. Under floor to sidewalls would be sealed to prevent dust ingress.

### **13. PANELLING:**

- 13.1. Bus exterior side panels would be fitted with stretched steel sheet at waist level. The exterior front-end panelling would be of steel sheet while roof, rear, sides & skirt panelling would be of aluminium. All interior panelling would be of Acrylonitrile Butadiene Styrene (ABS) conforming to relevant National or International Standards.
- 13.2. Wherever aluminium is joined with steel or with/ any dissimilar metals together, the involved joints would be treated with thick layer of approved quality dielectric paint conforming to relevant Indian/ International Standards, before assembly. Adequate treatment be also provided to avoid any incidence of galvanic corrosion between dissimilar metals.
- 13.3. Panels would not have any waviness & would be so mounted as to present smart aesthetic exteriors. Details of the above said panelling including specifications / thickness/ sizes of panels, fittings, rivet/ bolt pitch etc. would be supplied.

- 13.4. All side skirt panels below stretch panel be of such design as would facilitate quick replacement of any damaged panel(s) with pre-painted panels. The side skirt would be able to withstand side impact as per provisions of BIS: 14682-1999 or latest. Similarly rear end would be able to withstand rear impact as per the provisions of BIS: 14812-2000 or latest
- 13.5. Anti-drumming compound would be applied on inner side (enclosed surfaces) of entire panelling.
- 13.6. Roof structure would be thermally insulated with flame retardant Polyurethane or glass wool of minimum 40 kgs/m<sup>3</sup> density. The specifications/ BIS Standards for aforesaid insulating material would be supplied. Insulation would also be provided at other locations for improved performance of air conditioning system.
- 13.7. MIG welding for fabrication of aluminium components would be used.
- 13.8. Rain gutters would be provided to prevent water flowing from the roof onto the passenger doors, driver's side window, and exterior mirrors. When the bus is decelerated, gutters would not drain onto windshield, or driver's side window, or into the door boarding area. Cross sections of the gutters would be adequate for proper operation.
- 13.9. Entire front end of the bus would be sealed to prevent debris accumulation behind the dashboard and to prevent driver's feet from kicking or fouling wiring and other equipment. Front end would be free of protrusions that are hazardous to passengers standing or walking in front of the bus during rapid acceleration.
- 13.10. Interior panels would be attached so that there are no exposed unfinished or rough edges or rough surfaces. Panels & fasteners would not be easily removable by passengers.

#### **14. PAINTS:**

- 14.1. All structural members of the bus would be treated for corrosion prevention internally as well as externally and painted wherever required. Polyurethane (PU) painting base spray paint of standard companies conforming to latest/ international Standards as applicable would be used for exteriors painting of bus including interiors wherever required. Colour shade would match to the shades as per BIS: 5-1978 or latest. Details of paints used, surface treatment & preparation, corrosion prevention treatment, base primer coatings, number of paint coats to be applied etc. would be supplied.
- 14.2. All exterior surfaces would be smooth & free of wrinkles & dents. Exterior surface to be painted would be properly prepared as required by paint system supplier, prior to application of paint to ensure a proper bond between the basic surface and succession coat of original paint for stipulated service life of the bus. Paint would be applied smoothly and evenly with the finished surface free of dirt and following other imperfections:
  - i. Blisters or bubbles appearing in the topcoat film.
  - ii. Chips, scratches, or gouges of the surface finish.
  - iii. Cracks in the paint film.
  - iv. Craters where paint failed to cover due to surface contamination.
  - v. Overspray.
  - vi. Peeling.
  - vii. Runs or sags from excessive flow and failure to adhere uniformly to the surface.
  - viii. Chemical stains and water spots.

#### **15. COLOUR SCHEMES:**

- 15.1. Exterior, interior colour schemes and logo/ graphics would be painted as directed by FSCL / Municipal Corporation Faridabad (MCF). Information, on seats, for reservation for persons with disabilities, ladies, senior citizens would be marked as per the details provided by the FSCL.

#### **16. SERVICE DOORS:**

- 16.1 Two service doors (passenger entrance / exit) with steps, one ahead of the front axle and the other behind rear axle as indicated in summarised specs in part II, would be provided on near side (on kerb side wall)
- 16.1. Layout of passenger service gates on near side is given at Appendix 'A' to part II.
- 16.2. Doors would be jack-knife type.

- 16.3. Operation of entrance and exit doors would be electro-pneumatically controlled by driver with internal and external emergency operational controls. In an event of an emergency, it would be possible to open doors manually from inside the bus by using a force no more than about 10 Kg. after actuating and unlocking device at each door. Unlocking devices would be clearly marked as an emergency device & would require two distinct actions to actuate.
- 16.4. Doors, operating mechanisms, door hinges and locks would comply with safety requirements as per Indian/ International Standards (to be specified and supplied by the bus manufacturer). Overall dimensions and construction of entrance and exit doors would be identical so that doors and door operating mechanisms are interchangeable. Closing and opening time of doors should be in the range of 4 seconds each. There would be maximum opening area in longitudinal & vertical directions in fully open condition. Door operating mechanisms, brackets etc. would be maintenance free and designed with lifetime durability of minimum 10 years or 8, 00,000Kms. whichever is later.
- 16.5. A pilot lamp on the driver's dashboard would be provided to warn that the door is 'Open' or not fully closed.
- 16.6. Entrance and Exit doors would be provided with suitable support in form of grab handles for boarding/ alighting passengers on JK door flaps. Electronic / other suitable sensors would be installed at all entrance and exit doors to retract door automatically if any obstruction to door occurs during door closing. It must be effective until door is fully closed.
- 16.7. Colour shade would match to the shades as per BIS: 5-1978 or latest.
- 16.8. A red "Door Closing" sign would be installed above exit doors. The sign will blink when doors are closing.
- 16.9. A suitable device to prevent doors from opening as long as bus is in motion would be provided.
- 16.10. Service Doors' operation would be controlled with help of separate push buttons and one switch for each door mounted over the partition between the doors. One red master button to close all entrance and exit doors at same time would also be provided
- 16.11. All button and switches would be labelled on a panel to right side of the driver.
- 16.12. Heavy-duty prominent nosing of bright yellow colour would be used to protect edge at entrance/exit.
- 16.13. Access door would be provided with heavy-duty sealing to avoid ingress of dust into passenger compartment. Upper & lower section of both front & rear doors would be glassed for not less than 45% of the respective door opening area of each section. Glazing material & glass in doors would be same as in side windows.
- 16.14. Details of above service doors including electro-pneumatically controlled door closing system with complete circuit diagram would be supplied Photo-cell controlled opening / closing functions of doors and a "sensitive edge" made for safe entry exit be fitted.
- 16.15. Doors would be fitted with heavy-duty hinges as per bus code.
- 16.16. Doors would be fitted with heavy-duty locks with &/ without lock & key depending upon their use. Striker plate would be fitted at the closing end of locks.
- 16.17. All handles would match to décor of its fitment location or would be chrome plated.
- 16.18. Doors would open or close completely in about 4 seconds from the time of control actuation and would be subject to closing force requirements and adjustment requirements. Front door would remain in commanded state position even if power is removed or lost. Operation of & power to, passenger door would be completely controlled by driver. A control or valve in driver's compartment would shut off power to, and/or dump the power from, front door mechanism to permit manual operation of front door with bus shut down.

## **17. GUARD / GUARD RAILS:**

- 17.1. Suitable guard would be provided in areas such as service doors entrance/exit area where seated passengers are likely to be thrown into as a result of heavy braking, Guard height would be minimum 800mm from bus floor, and guard would extend inward from the wall at least 100mm more than the centre line of the seating position of the passengers who are prone to this risk.

## **18. WINDOWS:**

- 18.1. Windows would of large size for panoramic view. They would be in single piece window glasses. Toughened glass wherever used in bus body would be 4.8 mm to 5.3 mm thick for midi buses– each aesthetically installed. Size and shape of the glasses would enable even the standees to have maximum outside view without kneeling. General requirements of windows would be as per the provisions of bus code (AIS 052).
- 18.2. Windows would have provision of suitable sealing to avoid ingress of dust and water and would have proper/ efficient drainage system /UBS II.
- 18.3. Details of window design; fitment etc. would be supplied by the bidder along with the bid.

#### **19. WINDOW GUARDRAIL:**

- 19.1. Not required for AC Buses. In Non AC Buses window guard rails as specified in bus code (AIS 052) shall be provided.

#### **20. EMERGENCY EXIT:**

- 20.1. Emergency exits would be provided in bus as per the provisions of Bus Code – AIS 052 / CMVR. Possibility of using passenger entry/exit gates on near side for said purpose would be explored by manufacturer and confirmed. Details of Emergency exits including their numbers, locations, sizes, markings etc. would be supplied.

#### **21. ESCAPE HATCH:**

- 21.1. In addition to emergency exits, at least one escape hatch would be provided in roof as per bus code. A number of additional hatches may also be provided for facilitating ventilation inside bus in the unlikely event of air-conditioner failure.

#### **22. STEPS:**

- 22.1. There would be steps provided at the entrance / exit gates on the near side.

#### **23. FLOOR:**

- 23.1. Bus floor design would be without internal steps in floor area. There would be steps in gates located on near side wall, that is, at left-hand side wall of the bus.
- 23.2. Floor height of the bus would be 650 ±10mm from ground level.
- 23.3. Internal saloon height would be 1900 mm minimum.
- 23.4. Floor design would allow easy cleaning including that of sweeping & drainage of water.
- 23.5. Floor would be fitted with fire retardant 12mm thickness phenolic resin bonded densified laminated compressed wooden floor board (both side plain surface) having density of 1.2 gms/cc conforming to IS 3513(Part-3): type VI 1989 or latest. The flooring should also be boiling water resistant as for marine board BIS:710-1976/ latest and fire retardant as per BIS:5509-2000 (IS15061:2002)
- 23.6. The said floor would be covered with anti-skid type silicon grain material of minimum 3mm thickness meeting Indian/ International Standards (to be indicated by the bus manufacturer in the bid), ISO 877/76 for colour, IS5509 for fire retardancy. Adequate sealing would be provided in the floor to prevent ingress of dust, gases, water etc. Provision of draining of water if any on bus floor would be made.

#### **24. GANGWAYS:**

- 24.1. Gangway-from entry/exit gate walls through the entire bus length, would have clear space of minimum 600 mm for passenger movement and would be generally as per the provisions of the Bus Code (AIS 052)/ UBS II and meet statutory requirements.

#### **25. HANDRAILS AND HANDHOLDS**

- 25.1. Handrails and Handholds would be provided as per provision of bus code (AIS 052) / UBS II. The surface of handrails & handholds would be colour contrasting and slip-resistant.
- 25.2. All handrails would be of aluminium tubing of 32 mm dia and 3 mm thick. Depending upon the size of the bay (i.e. between two consecutive roof hand rail brackets), minimum 2 to 4 numbers handholds per bay would be provided so that every standee passenger even during crush load is able to grab a hand hold.
- 25.3. Hand holds be made of transparent polycarbonates with provision for display of advertisements. Hand holds be appropriately fastened to the hand grab rails so as to prevent their axial sliding and or rotation. Details of the handrails & handholds fitted would be supplied.

## **26. STANCHIONS**

- 26.1. Vertical stanchions would be so positioned to facilitate access to seats for those standing. Stanchions would be of 40.0 mm dia and 3.15 mm thick aluminium tubing with surface of colour contrasting and slip resistant.
- 26.2. Stanchion pipes and the handrails would be painted in cannerly yellow colour while the joining brackets be painted in grey colour generally matching with inner panelling.
- 26.3. A suitable device, such as high visibility bell pushes, for convenience of passengers to request for stopping bus be provided at appropriate locations.

## **27. PASSENGER SEATS:**

- 27.1. Passenger seats would be front facing in intra city buses and side facing in metro feeder buses (similar to those in Metro), comfortable, durable & maintenance free of 'PPLD/LDPE' (Polypropylene Low Density) moulded construction meeting performance requirements of AIS023 and other requirements as per the Bus Code (AIS 052). The 'PPLD/LDPE' moulded seat would be fitted.
- 27.2. Similarly, 'PPLD/LDPE' moulded seat backrest would be appropriately fitted. Suitable integral type seat hand grab rails would be provided one on top of backrest & one at the back of backrest for seated passengers.
- 27.3. Seat pitch would be maintained at 750 mm (minimum) as per AIS 052 for AC / Non AC buses.
- 27.4. Details of seat design, material, specifications, pitch and other relevant data and the seating layout would be supplied by the manufacturer for approval of FSCL.
- 27.5. Details of seating lay out, accommodating maximum number of seats in 2x2 layouts in midi buses for intra-city operations and bench type lay out along bus walls in low floor (650mm) area & 2\*2 in high floor (if any) area for feeder midi buses meeting requirements of the bus code would be supplied. Seating capacity would be 23-26 for midi buses with provision for seat belt as required, etc. Standee capacity of bus worked out as per system given in bus code (AIS 052) would be indicated by manufacturer. Seating and standee capacity of bus would be minimum 42 for midi bus (as worked out as per AIS 052).
- 27.6. Construction/ fitting of the seat would be such as to be easily replaceable and repairable.

## **28. SEAT BELTS AND ITS ANCHORAGES:**

- 28.1. Seat belts would be provided for the seats as per the provisions of CMVR & Bus Code (AIS 052). Any seats provided at rear end of bus, seats in centre (facing the gangway) would necessarily be provided with seat belts. Seat belts and its anchorages would conform to the requirements of AIS 005 and AIS 015

## **29. DRIVER'S WORK AREA:**

- 29.1. A driver door of not less than 1600 mm height and 650 mm width and with requisite steps would be provided for entry and exit to driver's work area. Proper hand holds and steps would be provided for easy access to driver's cabin. All other requirements of driver's work area would be as per the provisions of Bus Code -AIS 052. Driver's work area would have lighting arrangement to provide general illumination and it would illuminate half of the steering wheel nearest to the driver. Brake Pedal Angle would be determined from a horizontal plane regardless of slope of cab floor. Driver entrance-cum-exit door would be provided as per Bus Code (AIS 052) with a provision of maximum width of sliding window using material like glazing & glass as used in other side window glasses. Driver work area would be equipped with a 24V DC, 200mm diameter fan mounted at proper height on side structure. Colour of fan would match the interior decor of the bus.
- 29.2. Driver's visibility in front of the bus, seated on driver seat, be as per bus code (AIS 052) / CMVR
- 29.3. Driver's seat would meet the requirements of AIS 023.
- 29.4. Driver partition would be provided as per AIS 052.
- 29.5. A barrier of bulkhead between driver and front passenger seat would be provided. The barrier would minimize glare & reflection in windscreen directly in front of barrier from interior light during night time operation.
- 29.6. Dashboard Instrumentation and Control System

Bus would have ergonomically designed moulded type dash board and instrument panels made out of FRP material. Details of materials used their specifications etc. of dashboard and instrument panel would be provided by the manufacturer.

Bus would have dash board with full instrumentation panel containing meters and gauges to indicate important parameters like air pressure, coolant temperature, battery charging current, fuel level, side indicators, head lights, hand brakes engagement, engine oil pressure etc. In addition warning lights for low engine oil pressure, high cooling system temperature & low coolant level, low pressure and high temperature of transmission oil, low fuel level, if any, low air pressure and battery weak would be provided at the driver's dash board. All the dashboard controls and instrumentation system would be as per the bus code.

On board electronic diagnostics system would be provided as per UBS II.

### **30. REAR-VIEW MIRRORS- INTERIOR AND EXTERIOR:**

- 30.1. Rear-view mirrors would be provided on both sides of bus to enable driver to have clear side/rear views. One interior rear-view mirror would also be fitted for viewing saloon area by driver. Installation and performance requirements of rear-view mirrors would conform to AIS 001 and AIS 002. Exterior rear-view mirrors would also enable the driver to view object near bumper area.

### **31. SUN VISOR:**

- 31.1. Adjustable sun visors would be provided for windshield & driver's side window. Visors would be shaped to minimize light leakage between visors & windshield. Adjustment of visors would be made easily by hand with positive locking & releasing devices and would not be subject to damage by over-tightening. Sun visor construction & material would be strong enough to resist breakage during adjustment. Visors may be transparent but would not allow a visible light transmittance in excess of 10%. Visors where deployed would be effective in driver's field of view at angles more than 5° above horizontal.
- 31.2. An electric horn conforming to BIS: 1884-1993 or latest and installation requirements conforming to AIS 014 would be fitted in bus and further conforming to the provisions of CMVR.

### **32 Intelligent Transport System(ITS) and the ITS DEVICES:**

The sections provides general end-use specifications of ITS systems and the devices to ensure that body building shall be done in a way as to provide for raceways/conduits for wiring (Data and Power) for these devices during bus body building. The devices shall also need mounting surfaces/ structures provisions for which shall be made as part of body building. FSCL proposes to get ITS items fitted / installed in the bus, as per detailed specs provided herein. The bus supplier would acquire the entire ITS / devices / system, hardware, software, and any other item to make the system functional, install and commission the same on-board in a manner as to deliver the end use requirements simultaneously being fully compatible and synchronized with the back-end systems. The bus ITS would have, among other items, SCU (Single Control Unit) and Bus Driver Console (BDC), PIS Boards, GPS system, Panic Button, Security Camera Network, router, etc.

#### **32.1. Destination boards and the general end-use requirements:**

- i. Design of PIS including destination boards etc. as per UBS II and generally comprising of following amongst others would be provided. Route details and other inputs for Electronic Destination Display system as well as audio system would be provided by FSCL. Bus manufacturer would provide facilities for all PIS and ITS devices on bus, as decided by FSCL and as provided for in ITS section of UBS II.
- ii. Route details of all routes i.e. route number, route origin, destination, stops en-route, etc shall be pre-stored in SCU on-board. Required audio messages duly synchronised with route / stop displays as above would also be pre-stored along with. On selection of any route by the driver at the start of the route, necessary route details would be displayed at all PIS boards along with simultaneous audio messages announcing the displayed details.
- iii. The system would be compatible with on-board GPS which would identify the approaching bus stops on the route under operation and trigger simultaneous display of the desired information on all PIS boards duly synchronised with audio messaging pre-stored in the SCU. The system would have inbuilt mechanism to enable the driver to change destination at any / every bus stop in the event of the GPS System failing to trigger as above.



- iv. The system would have a programming for up to 100 numbers of routes and 200 numbers of destinations. Further system would also have a programming for minimum of up to 60 nos. of bus stops on each route. The system would be GPS/any other ITS device compatible and as per provisions of UBS II. There would be provision for feeding more destination options against any route number. Periodic operational interventions of the system by driver would be made through touch type/or any other input device located on the dashboard/near it in the event of failure of GPS based triggering. There would be single point near dashboard for changing programme.
  - v. Details of memory, circuit, wiring, diagram, power consumption etc. would be supplied by bus manufacturer who would impart detailed training to officials / drivers of operators with respect to programming, operation/ maintenance etc. of display system. The system would be of rugged construction, vibration proof, and water proof and would be able to operate efficiently at ambient temperatures of approximately 0 to 50 degree Celsius, humidity level 5% to 100% and dusty conditions of Faridabad urban area.
  - vi. Provision for fitment of antenna preferably inside the bus (for safety and security hazards) or at roof of the bus - front and rear, if so desired, be made for connecting to GPS system / VMUs without any disturbance to bus panelling system.
- 32.2. Alphanumeric Dual Display Technology coloured LED based electronic route display system of high intensity illumination with automatic brightness control along with audio-video display system in English and Hindi would be installed at front, rear and side of bus as per the following details.

### **32.3. Front Destination Board**

There would be display of destination with options in Hindi & English along with route number in Arabic numerals. The display system would be accommodated within size specified in the bus code / UBS II. Display should be fixed type. Pitch of the LED would be optimised to cover the maximum possible area along the length for displaying maximum number of letters. Display would be clearly visible in all weathers upto a distance of up to 50 metres.

### **32.4. Side Destination Board**

There would be scrolling display of destination in Hindi & English alternatively along with fixed route number in Arabic numerals. The system would simultaneously announce route number and destination so as to be audible to passengers waiting on bus stops. Loudspeakers integrated and synchronised with display system be fitted one each at service gates. Display system be accommodated within minimum size specified in the bus code / UBS II. Pitch of LEDs would be optimized to cover maximum possible area along the length for displaying maximum number of letters. Audio messages and video display would be clearly audible/ visible in all weathers at a distance of up to 5 metres.

Side destination system as above would be made available on near side gates.

### **32.5. Rear Destination Board**

There would be display of destination with options in Hindi & English along with route number in Arabic numerals. Display system would be accommodated within minimum size specified in bus code/ UBS II. The display would be fixed type. Pitch of LED would be optimised to cover the maximum possible area along the length for displaying maximum number of letters. The display would be clearly visible in all weathers at a distance of up to 15 metres. There would be one loud speaker fitted at rear of the bus (inside the bus – rear right side). The display boards shall be so fitted as to allow for cleaning of the display board as also the rear wind screen glass facing the display.

### **32.6. Inside Display Boards (behind driver partition)**

There would be display of name of approaching bus stops in Hindi & English alternatively duly synchronised with audio announcement system. The system would be operated with inbuilt software and the trigger system on approaching a bus stop. The system should be able to store on board up to a minimum of 100 messages of 50 characters each on an average. The messages should be capable of rolling, flashing (fully or selectively) in Hindi /English/symbols as per pre-programmed system. The message would be visible to all the

passengers standing/sitting up to last seat of bus. Names and Badge numbers of crew (driver & conductor) would be displayed once after every two stops. Micro-processor based audio announcement would be made for both current and next bus stop/destination synchronized with display alternatively in Hindi and English. Illumination system will be of module display type. Display size of one row would be 800 mm x 100 mm. Display panel would have multiple rows for higher coverage. Display would be mounted behind driver at an appropriate height for clear visibility to all passengers in bus from all angles. Present and next stops details would be highlighted with flashing in modern commuter-friendly colours. It should also be possible to display advertisements with graphic images on display boards. Display time, frequency and sequencing of advertisements/messages would be programme controlled. Display system would have provision of flashing/highlighting information in pre-programmed mode and through an intervention by driver/conductor and or GPS.

### **32.7. Integrated voice announcement system**

A noise free integrated voice announcement system of adequate volume (which could be heard by all bus commuters (4 watt, 3 nos.)) be fitted one at front (behind driver along with LED display) and one at the rear side-inside. one more speaker for exclusive use of passengers outside the bus (on bus stops), especially for persons with disabilities along with LED display be fitted / mounted on/near the gates on near- side (kerb side) of bus.

Synchronisation of voice messages / announcements with visual displays is essential.

### **32.8. Control Panels**

- Control Panels would have following features and those provided in UBS II–
  - i. Easily operable, robust, water & dust proof, control switches/keys/touch type within easy reach of driver.
  - ii. Control Panel layout and content would be simple and easily comprehensible by crew who is not highly educated. Displays should have all weather visibility.
  - iii. Crew access to requisite information by operating least no. of robust buttons / switches / keys.
  - iv. Console to have over-riding provision to jump information operation sequence like skipping a particular stop, etc.
  - v. Mechanism/port etc. be provided to load/amend/upgrade on-board stored data from PC at workshop office complete with any related software interfacing hardware required.

### **32.9. Memory entourage**

Memory storage, retrieval, amendments, additions, deletions etc.

- i. A microprocessor / controller with adequate memory to store minimum 100 numbers of routes (alphanumeric characters) and 200 numbers of destinations with upto 60 stops each on an average.
- ii. The memory should also be capable of storing badge no. and names of at least 250 each drivers and conductors etc.
- iii. Easy and quick irretrievability of the all memory contents whenever required.
- iv. Easy accessibility to microprocessor / controller by driver / conductor from his seat inside the bus.
- v. Provision for upgrading / modifying existing information as well as additions and deletions.
- vi. Size, quality, robustness etc. of microprocessor / controller be such as to accommodate entire information required for this system including that required in flashing advertisement messages.
- vii. All information pre-programmable and loaded on to micro-controller through PC.
- viii. Ability to retain entire data in memory in the event of power failure or any other kind of failure in the system be provided.

### **32.10. General Requirements**

- 32.10.1. All ITS / PIS related design / specs / construction / protocols etc. would be as per ITS / Electricals details available in UBS II.
  - i. The system be designed such that data can be fed on-board using add on devices like pen drive etc.

- ii. The system hardware should be able to withstand fluctuations in climatic conditions, battery power, noise and vehicle vibrations, etc.
- iii. All items / sub-systems be leak proof and would have water / dust ingress protection as per IP Protection No. 55/65 or latest Standards.
- iv. Mounting of system should be robust and vibration absorbing type.
- v. The system hardware should be durable and vandal-proof from inside as well as outside the bus (proper protection with locking system be provided).
- vi. Excellent visibility from all sides during day, twilight and night in all weathers.
- vii. Ability to withstand acceleration up to 10g.
- viii. Ability to withstand variation in natural frequencies in the range of 5 to 50 Hz.

32.10.2. The system should have PC interface facility.

- i. It would be operable on 24 Volt DC power obtained from vehicle battery. The system would have adequate measures to ensure appropriate quality of power supply even during battery output fluctuations.
- ii. All components, circuitry, cards, microprocessors, switches / keys should have ISI marks and be of internationally reputed makes / brands.
- iii. All components would carry ISI mark as far as possible.
- iv. The system should have easy maintainability / repair-ability.
- v. It should be damage proof on account of power fluctuation and should continue to operate smoothly even during such fluctuations.
- vi. Any other precaution / measures required for smooth and efficient trouble-free functioning of the system year after year for up to the life of the vehicle be incorporated.
- vii. The above systems have provision to be upgraded as and when required in future.

32.10.3. Other requirements:

- i. The buses are planned to be equipped with a modern digital payment system that would enable passengers to pay using plastic cards, cash and mobile phone based apps. To start with, the buses would ply with Conductors / CSAs (Customer Service Agents) who would be equipped with ETVMs (Electronic Ticketing Vending / Verification Machines) and would allow passengers to pay for the journeys with cash or plastic cards (Closed Loop to start with and then Open Loop as well). The ETVMs would be equipped with card, cash, mobile app based payment for ticketing as also QR code readers.
- ii. The latter devices may need to communicate with other electronic control systems on the bus (such as SCU) and also systems off the bus (such as bank Host computers). The system shall also have provision for triggering approaching bus stop of the operational route for displaying stop on ETVM to facilitate printing of same on tickets issued there from and for other usage through the ETVMs. The concessionaire needs to make provision for GPS compatibility with the ETVMs.
- iii. Concessionaire may choose to offer better alternative solutions/ equipment specifications, in consultation with FSCL, without diluting the proposed functionalities.

32.11. Other ITS devices on board:

- i. **Panic Buttons**  
Panic Buttons should be placed inside the bus within reach of passengers, and when pressed, should result in a message sent to the central Command & Control Centre. This is for security and safety of passengers, especially of women and children. Number and position of Panic Buttons should be as per the AIS 140 specification.
- ii. **Security Camera Network**  
One rear camera for bus reversing and two cameras in the passenger cabin area as per the specifications listed in UBS-II shall be provided in the bus.
- iii. **Vehicle Health Monitoring and Diagnostics (VHMD)**  
As per standard CAN bus protocol (J1939) and DTC codes published as per UBS II specifications shall be provided in the bus.

iv. Router

This device would enable the communication among the different internal systems as well as between the ITS components and central back-end system and Automatic Vehicle Location (AVL) system. The router must come with 3G/ LTE based WAN and at least 4 LAN ports and WiFi.

- 32.12. Concessionaire shall be responsible to supply Buses meeting the ITS specifications outlined in this clause and compatible with off-board / control items and the communication systems. The ITS service provider of the concessionaire hence needs to coordinate with various vendors/suppliers including but not limited to those responsible for supply of buses, ETVMs, routers, SCUs, display boards, cameras, GPS and other ITS equipment.

**33. STOP REQUESTS:**

- 33.1. A suitable device for the convenience of passengers to request for stopping bus be provided at appropriate locations inside the bus on stanchions.

**34. BUMPERS:**

- 34.1. Bus would be provided with front and rear bumpers of Steel or impact resistant polymer or combination of both meeting requirement of an energy absorbing system. The bumper would be easily repairable/ replaceable. Bumpers would conform to the requirements of CMVR, AIS (069), and Bus Code/any other international Standards (to be specified by the manufacturer). Details of above bumpers along with drawings including thickness of bumpers, section, profile etc would be supplied by the Successful bidder.
- 34.2. Bus manufacturer would provide details of materials used, their specifications and process followed for their repair and maintenance along with material required.

**35. TOWING DEVICE:**

- 35.1. Heavy-duty ring type towing devices would be provided in front and rear bumper area with load transfer to bus structural members. Capacity of each towing device would be 1.2 times (minimum) the kerb weight of the bus within 30 degrees of longitudinal axis of the bus. The manufacturer would supply a copy of the test certificate of the towing devices

**36. WIND SCREENS:**

- 36.1. Front wind screen in the bus would be in single piece design, plain/ flat with curved corners, intervening PVB film laminated safety glass of minimum thickness of 8.0 mm. Rear windscreen would also be in single piece design, flat in centre and curved on corners toughened glass of thickness of 5.5 mm ( $\pm$  0.3mm). Windscreen glasses would meet the requirements of BIS 2553: Part II-1992 or latest and that of CMVR and Bus code(AIS 052). The glazing used for fitment of glasses would be Ethylene Propylene Dien Monomer (EPDM) rubber of black colour or pasted with adhesive material conforming to Indian/ International Standards to be specified by the manufacturer. A grab handle and suitable handles on the outside of windshield centre at waist level would be provided to facilitate manual cleaning of the windscreens.

**37. WIND SCREEN WIPERS:**

- 37.1. Electrically operated windscreen wiper system having two wiper arms with blades would be provided. Wiper motor would be heavy-duty steel body for minimum of two-speed operations. Wiper arms would rest horizontally when not in use. The sweep angle would be sufficiently wide for clear view during rainy days. Windscreen wiping system would be 24V, having variable speed, with fitment of time delay relay. Windshield washer system would spray washing fluid on windshield & when used with the wipers, would evenly & completely wet the entire wiped area. Windshield washer system would have a minimum of 2.5 litres capacity tank suitably located for easy refilling from inside the bus and two nozzles at suitable location for proper spray of fluid. Reservoir pumps, lines & fittings would be corrosion resistant & reservoir itself would be translucent for easy determination of fluid level. The windscreen wiping system would be in accordance with CMVR/ BIS: 7827 Part1, 2, 3 (section 1, 2) or latest.

**38. FIRE EXTINGUISHERS:**

- 38.1. Multipurpose fire extinguishers would be ISI marked conforming to BIS: 13849-1993 or latest, dry powder type (Stored pressure) duly filled, of capacity and quantity as per the provisions of GSR-853 (E) dated 19.11.2001 notification of Government of India, Bus Code, UBS II. Fire extinguishers would be

encased & fitted with proper reinforcement. The enclosure box would have transparent breakable glass at front cover.

### **39. FIRST AID KIT:**

- 39.1. First aid kit complete with items, medicines, bandages etc. would be provided as per provisions of CMVR fitted near driver seat at appropriate position and level on side with proper reinforcement.

### **40. PROVISIONS FOR PERSONS WITH DISABILITIES:**

- 40.1. The manufacturer would provide for ease of accessibility, guidance, positioning of aids etc. system for PwDs that meets the requirements as given in the Bus Code and CMVR.

### **41. BATTERY:**

- 41.1. Battery system would be 24V of minimum 180 Amps-hour capacity, low maintenance type lead acid batteries. Batteries would be well secured to a hinged/ pivoted or slide out type carrier for ease of access for repair & maintenance, replacement and suitably ventilated for escape of fumes but insulated against ingress of dust and moisture. Battery box would be mounted near/ next to engine compartment and would be well secured, easily accessible & ventilated. Performance requirements of batteries would conform to BIS: 7372-1995 (or latest).
- 41.2. Battery terminals with positive locking system (e.g. angle type terminal with provision for double bolting) duly protected against all possible short circuit risk would be provided.
- 41.3. Each battery cable would be covered with flame retardant Grey colour corrugated flexible pipe and would be properly encased & clamped.
- 41.4. A relay controlled Heavy-duty type battery cut-off switch (isolator switch) capable of carrying & interrupting total circuit load would be provided 1 each near battery / driver on side panelling at appropriate level for disconnecting all battery positives except for safety devices such as fire suppression system & other systems as specified. Two points of battery cut off switch would be connected with battery and two points would be connected with self-starter. The battery Cut-off switch with power plant operating, would not damage any components of electrical system in off position. The battery Cut-off switch would be capable of carrying & interrupting the total circuit load.

### **42. ELECTRICAL EQUIPMENT AND WIRING:**

As per details given in UBS II and generally as under:

- 42.1. The bus would have 24 Volt D.C with multiplex wiring system for all its electrical equipment except in unavoidable circumstances to avoid sparking in buses. A separate system/ mechanism would be provided for discharge of electro static charge induced during the operation of vehicle. Adequate precaution would be taken in case of single pole wiring to avoid spark in items such as self, alternator etc.
- 42.2. An adequate capacity alternator of 24V DC, minimum 150Ah rating with consistent output to take care of high idling periods of city operation would be provided and so located as to minimise ingress of oil or rain water into it. The Manufacturer may, if so required, have to install two separate Alternators each for Air Conditioning System and Auxiliary systems.
- 42.3. A pre-engaged type 24V DC Self-starter of adequate capacity(over minimum 80Ah) with relay would be fitted in bus and so located as to minimise ingress of oil or rain water into it.
- 42.4. Details of specifications of Battery, Alternator and Self-starter along with circuit diagrams would be furnished by the manufacture along with their bids.
- 42.5. Electrical equipment and wiring would conform to Indian/ international Standards, bus code and UBS II. All cabling would be as per provisions of Bus code / UBS II. The wiring would be multiplex system, flame proof, ISI marked conforming to BIS: 2465-1984 or latest. As far as possible electrical system would be 24V double pole multiplex wiring system except in unavoidable condition. However, in case of single pole wiring all power & ground wiring would have double electrical insulation, which would be waterproof conforming to the Indian/ International Standards. Wiring would be grouped, numbered & colour coded. Wiring harnesses would not contain wires of different voltage classes unless all wires within the harness or insulated for highest voltage present in harness. Kinking, grounding at multiple points, stretching & exceeding minimum bend radius would be prevented.
- 42.6. Wiring looms/ harness for electrical system of bus would be properly routed, encased/ concealed type so mounted to eliminate chances of any spark. Details of above wiring loom including circuit diagram; layout of controls etc. would be supplied by the bidder along with the bid wiring support would be

protective & non-conducting at areas of wire contact & would not be damaged by heat, water, solvents or chafing.

- 42.7. All electrical fittings and lights would be fully wired up, running in flame retardant black colour PVC sleeves as per applicable Indian Standards (to be specified by the manufacturer) and installed in a manner to facilitate easy inspection/ rectification/ replacement etc. as & when required without disturbing internal finish/ décor of the bus. Whenever any wire or cable or PVC sleeve carrying cable etc. passes through holes in sheet metals/ structural member, suitable rubber grommets/ Bakelite inserts would be provided in these holes to avoid direct contact between cables and sheet metal causing damage to insulation coating.
- 42.8. Bus manufacturer would furnish details of above wires/cables and battery cables.
- 42.9. Design of electrical, electronic & data communication systems would be modular so that each major component, apparatus panel or wiring bundle is easily separable with Standard hand tools or by means of connectors. Each module except main body wiring harness would be removable & replaceable. Power Plant wiring would be an independent wiring module. Replacement of engine compartment wiring module would not require pulling wires through any bulkhead or removing any terminals from the wires.
- 42.10. Electrical system & its electronic components would be capable of operating in area of the vehicle in which they will be installed. Electrical & electronic equipment would not be located in an environment that will reduce performance or shorten life of the component or electrical system. No vehicle component would generate or be affected by electro-magnetic interference or radio frequency interference (EMI/RFI) that can disturb performance of electrical / electronic equipment.
- 42.11. Bus manufacturer would furnish recommendations regarding methods to prevent damage from voltage spikes generated from welding, jumps start shorts etc.
- 42.12. All electrical & electronics hardware would be accessible & replaceable easily. It would be mounted on an insulating panel to facilitate replacement. Mounting of hardware would not be used to provide sole source ground and all hardware would be isolated from potential EMI/ RFI.
- 42.13. All electrical/ electronic hardware mounted in interior of bus would be inaccessible to passengers & hidden from view unless intended to be viewed.
- 42.14. All electrical/ electronic hardware mounted on exterior of bus i.e. not designed to be installed in an exposed environment would be mounted in a sealed enclosure.
- 42.15. All electrical/ electronic hardware & its mountings would comply with shock & vibration requirements.
- 42.16. Bus manufacturer would provide a certificate of testing/estimation of electrical load for each system.
- 42.17. Alternator over voltage output protection would be provided.
- 42.18. All branch circuits except battery to starting motor & battery to generator/ alternator circuits would be protected by circuit breakers or fuses sized to requirements of the load. Circuit breakers or fuses would be sized to larger than total circuit load current as per UBS II. Current rating for wire used for each circuit must exceed size of circuit protection being used.
- 42.19. Electronic Circuit protection for cranking motor would be provided to prevent engaging of motor for long time/to prevent overheating.
- 42.20. To the extent practicable, wiring would not be located in environmentally exposed locations under the vehicle. Wiring & electrical equipment necessarily located under the vehicle would be insulated from water, heat, corrosion & mechanical damage. Where feasible front to rear electrical harnesses should be installed above the window line of vehicle.
- 42.21. All electrical motors would be easily accessible for servicing.
- 42.22. Separate additional outlets, as required in UBS II, are to be provided with appropriate relays & fuses in wiring harness for fitment of electrical auxiliary devices/ systems to be added later on in buses, if required.
- 42.23. AC (Alternating Current) out-let of 220V, as required in UBS II if any, be provided at suitable location for charging of electrical/electronic equipment, etc.
- 42.24. If any electronic components have an internal clock, it would be provided with its own battery back up to monitor time when battery power is disconnected.

- 42.25. All electronic components/equipment would have self-protecting capability in event of shorts in cabling and also in over voltage and reverse polarity conditions. If an electronic component is required to interface with other components it would not require external pull up and/ or pull down resistors.
- 42.26. RF components such as global positioning system (GPS) etc. whenever provided would use coaxial cable to carry the signal. The RF systems require special design consideration for losses along the cable. Connectors would be minimized, since each connector & crimp has a loss, which will attribute to attenuation of signal. Cabling should allow for removal of antennas or attached electronics without removing the installed cable between them.

### **43. LIGHTS AND LIGHTING SYSTEM:**

- 43.1. Interior saloon lighting would be sunken type light assembly fitted with LED lights and mounted in staggered formation for uniform lighting in two separate circuits. First row of lamps provided in driver's cabin should be fitted with amber internal filter to reduce glare to driver at night.
- 43.2. Modern rectangular type headlamps with relay and side light etc. would be suitably styled into front-end construction.
- 43.3. White and Red marker lights of 5 Watt each would be fitted at both top side corners of the front and rear panel of the bus respectively.
- 43.4. Identical signal lights of 15 Watts would be fitted for inter-changeability in each side i.e.; front, rear and side respectively
- 43.5. Brake lights (15 W) and taillights (10W) would be two separate lights to reduce heat generation.
- 43.6. Reverse light of 25W, square lamps with white covers would be provided.
- 43.7. Side markers would be provided on both sides as per bus code/ AIS 008
- 43.8. Rear signal lights, brake lights, taillights and reverse lights would be arranged vertically.
- 43.9. Light wattages given above are indicative, however, all the lights and lighting systems would conform to requirements of Bus code, CMVR/Haryana MVR / UBS II and other relevant AIS Standards.
- 43.10. Following lights would be actuated when the headlight are 'ON' and the doors are 'Open':
- i Lights provided for illuminating exit/entrance door area, lights would illuminate outside area up to at least one meter when door/doors is/are opened. Lights for exit/entrance door areas would be flushed as far as possible to avoid tripping of passengers, protrusions if any would conform to relevant CMVR/ AIS Standards.
  - ii Exterior door lights
  - iii Lights would be automatically switched off when the door is closed.
- 43.11. A well-lighted bus registration number plate would be fitted at rear as per provisions of CMVR duly complying with directives/ regulations regarding high security number plates as notified by Government of India / Government of Haryana if any.
- 43.12. No Electrical fittings would be mounted on front and rear bumpers.
- 43.13. Switches would be fitted on right hand side of instrument panel through evenly loaded circuits & fuses as per bus code.
- 43.14. A reverse buzzer would be installed at the rear of bus to sound intermittently when reverse gear is engaged.
- 43.15. A suitable light would also be provided in engine compartment for ease of maintenance/ emergency repairing.
- 43.16. Following circuit diagrams would be supplied along with buses:
- i) Complete circuit drawings for exit/entrance door control system, door mechanism.
  - ii) Complete door sensor electrical circuit drawing.
  - iii) Complete circuit drawing for sensitive door edge system.
  - iv) A layout drawing for all door control switches, gauges, warning lights on driver's dashboard.
  - v) A layout drawing for all lighting and wiring circuits, control switches fuses and fitment details and diagrams along with item specs and types in each case.

### **44. PERFORMANCE STATEMENT:**

- 44.1. Bus manufacturers would furnish following information for performance evaluation of bus chassis and/ or complete buses supplied to other customers and now in service for at least 3 years. The information should be furnished separately order wise:
- a) Type/Model
  - b) Name and address of the bus operating agencies where this model is operating
  - c) Number of the buses supplied
  - d) Order no. against which buses have been supplied.
  - e) Date of supply and date from which in service
  - f) Maximum/minimum turning radius.
  - g) Maximum climbing ability/ gradeability
  - h) Type of bus body
  - i) Engine HP @ RPM
  - j) Engine Max Torque @ RPM, and RPM range for max torque
  - k) Specific fuel consumption
  - l) GVW of buses
  - m) Emission Norms
  - n) Type of suspension
  - o) Dimensions- Length, width, height, floor height, wheel base,
  - p) Angle of approach, departure and ramp over
  - q) Axle –rear and front
  - r) Passenger carrying capacity
  - s) Any other performance data.

#### **45. TECHNICAL INFORMATION**

- 45.1. Technical information required to be furnished by bus manufacturers along with Bid wrt the following amongst others:
- 45.2. Bus manufacturer's technical information of the bus i.e. General Drawings comprising of elevations – sides, front & rear ends along-with main dimensions i.e. overall length, overall width, overall height, saloon height, pillar to pillar distance, isometric views, exterior & interior details, seating layouts, no. of seats (excluding seat for driver), environmental friendly colour scheme as per FSCL etc. would submit same along-with the Bid.
- 45.3. General appearance & structural details of roof, floor, sides, front & rear show and driver's cab would be provided by the bidder along with their bids. Details of main structural members, material specifications, shape, size, thickness, etc. be indicated on the above drawings.
- 45.4. Power Point presentation material on a DVD for offered design of bus (indicative) duly furnished/ painted in environmental friendly colour scheme as given by FSCL would be submitted along-with the bid. The presentation will cover elevations –sides, front & rear ends along-with main dimensions, isometric views, exterior & interior details, seating layouts, colour scheme etc.

#### **46. TOOLS, GAUGES AND TESTING INSTRUMENTS:**

- 46.1. Bus manufacturers would furnish a list of special tools, gauges and testing instruments for inspection, repair and maintenance of buses along with a complete list of spare parts recommended for:
- Normal wear and tear; and
  - Emergency requirements for any breakdowns, damages etc.

#### **47. OPERATION AND MAINTENANCE MANUAL:**

- 47.1. At least 2 hard bound copies, for every 25 buses or part thereof, of operation and maintenance manual containing essential technical information required for satisfactory operation, inspection and maintenance would be supplied by bus manufacturers.
- i. One set of Coloured wall charts of following units would also be provided for every ten buses or part thereof showing assembly details:
  - ii. Chassis lubrication and brake system.
  - i. One set of Coloured wall charts of following units amongst others for every 25 buses showing assembly details:



- Engine
- Transmission system
- Drive line and Rear axle
- Front axle
- Steering system, alternator, starter, fuel injection system etc.
- Brake system, ABS etc.
- Bus AC System
- Any other necessary for skill development of operator staff

#### **48. TRAINING**

- 48.1. For each lot of up to 25 buses or part thereof, bus manufacturer would arrange orientation training at Faridabad for two days for 60-70 drivers in batches of 20-25 (up to a total of 150 man days) besides similar orientation training at Faridabad for 3 days for 50 technicians/ supervisors/ engineers in batches of 25 (Total 75 man-days).
- 48.2. Bus/ fuel/ available facilities will be provided by Bus Operator and course materials will be provided by bus manufacturer on free of cost basis. This training will be provided free of cost, as and when required by FSCL/ Bus Operator within one year of purchase of buses.

#### **49. TOOL KIT**

- 49.1. Bus manufacturer would provide a suitable tool kit and other mandatory items as per CMVR 138 (4)/ other applicable rules comprising of common tools and other essential items required. Complete list of tools in tool kit to be supplied with every bus would be supplied by the manufacturer. One Hydraulic Jack per bus of a capacity of at least 10 Ton as per design of bus would also be supplied.

#### **50. INSPECTION AND TESTING:**

- 50.1. Bus may be inspected at various stages of fabrication by FSCL's representative at manufacturer works. Inspection would comprise of ensuring that all materials, components, items, accessories and assemblies used in fabrication of buses conform to contractual specifications. Wherever required to ensure this, laboratory test would be carried out at bus manufacturer's cost.
- 50.2. The inspection may be undertaken at any and or all stages such as component fabrication stage, chemical pre-treatment stage, fabrication of assembly, sub assembly stage, structure, panelling and equipping stage and Pre-dispatch inspection.
- 50.3. Final Inspection of buses would be carried out at manufacturer's facilities and or at a place finalised by FSCL. After the bus is finally inspected, it would be subjected to test run and trials as required by FSCL
- 50.4. The bus would be taken over by FSCL after satisfactory final inspection, testing and trials in Faridabad.

#### **51. MAINTENANCE SPARES AND MATERIALS**

- 51.1. Bus manufacturer would provide details of components/spares required for maintenance of vehicle for twelve months' operation taking daily utilisation of bus of up to 300 Kms.
- 51.2. Manufacturer would also provide complete details of vendors, for every component/ spares for complete bus and the spare parts catalogue in 2 sets for every 25 buses or part thereof.
- 51.3. Manufacturer would ensure that during service life of 10 years or 8,00,000 Kms. (whichever is later) of service, adequate spare parts in kit form/ individual components are made available in time to FSCL on demand along with other essential items required.
- 51.4. All spare parts availability would be more than 95% at any time.

#### **52. MAINTAINABILITY**

- 52.1. Design and fabrication of bus would be such as facilitates easy access for repair & maintenance, removal, replacement of various bus components/ assemblies/ sub-assemblies/ systems by providing suitable traps/ flaps etc. Also removal and re-fitment of engine, transmission, differential, radiator, door closing

mechanism, PIS etc. would be easy for repair & maintenance purpose. Enough space would be provided between wind screen glasses and PIS boards for facilitating cleaning of glasses.

- 52.2. Radiator coolant/water filling and CNG filling inlets would be easily accessible with suitable closing devices complete with locking arrangement/-holding arrangement.
- 52.3. Also an access would be provided for attending to air cleaner assemblies mounted in the vehicle.

### **53. WARRANTY/ GUARANTEE**

- 53.1. Fully built bus would be covered under Warranty/ Guarantee for up to 1, 50,000Kms or 24 months whichever is later from the date of putting bus into operation after registration. All assemblies, sub-assemblies, fitments, components would be covered under Warranty Period as per commitment of bus manufacturer at the time of supply of bus.

### **54. GENERAL REQUIREMENTS:**

- 54.1. FSCL reserves the right to alter, modify, change specifications as per requirement to suit the latest provisions of CMVR/ any other Notifications, safety aspects, emission aspects besides any practical/ operational difficulties etc. faced/likely to be faced by FSCL. Vehicle Manufacturer would ensure that all alterations, changes or modifications in specifications, if necessary, as mentioned above would be carried out in buses built by them as per the advice of FSCL without attributing any additional cost.
- 54.2. Ministry of Road Transport & Highways, Government of India (MORT&H) vide Notification No.GSR-853 (E) dated 19.11.2001 in the Gazette of India, inter-alia stipulated the following measures which need to be complied with for enhancement of safety by the Vehicle Manufacturers as per the statutory requirement for registration of vehicles
  - (i) While registering every bus, Vehicle Manufacturers & transport authority would jointly examine the bus prior to registration. The registration of such a vehicle be done only after signing the report jointly by all concerned along with the transport authority.
  - (ii) For electrical installations, flameproof cables would be used, especially positive terminals would be locked firmly with all cables & pipes with proper looming to take care of vibrations, fire retardant material would be used for seats, roof & sidewalls. Safety instructions about fire hazards would be displayed.
  - (iii) Details of structural members, their material specifications & dimensions i.e. cab & saloon flooring, cross bearers, various angles, floor longitude, main body pillars, dummy/stump pillars, cant rail, vent rail, waist rail, skirt rail, wheel arch section, sole bar, seat rail, roof sticks & roof longitudes, diagonal bracing, Rub rail tube, stretch & body panel stiffeners, gussets etc. would be provided by bus manufacturers.
  - (iv) Similarly, details of aluminium sheets/sections & their alloys/specifications, aluminium sheet, rub rail, decorative mouldings, wire cover, wearing strips, footsteps edging, various panel beadings, window frames and its sections, finishers, water gutter channel, roof grab rail brackets would be provided by bus manufacturers.
  - (v) All edges would be rounded off and would not cause injury to bus occupants.
  - (vi) Complete bus would be rattle-free.
  - (vii) All the rivet and bolt holes would be jig drilled as far as possible. The rivet holes should be drilled before the corrosion treatment. Holes drilled after the corrosion treatment be suitably treated with anti-corrosion materials. Rivet heads neatly formed and each bolt/ rivet would be tightened after full mating of the surfaces to be fastened.
  - (viii) All safety aspects should be considered while designing and fabricating the bus.
  - (ix) Continuous length piano type hinges and tower bolts of stainless steel would be used as per relevant Indian Standards.
  - (x) Similarly Aluminium extruded sections wherever not painted would be anodized.
  - (xi) All flaps wherever provided should have heavy-duty support to keep it open for ease of maintenance.
  - (xii) All miscellaneous M.S pipes would be phosphated with the coating of 2.16 to 2.70 gm/m<sup>2</sup> or by any other pre-treatment process conforming to Indian/ international Standards (to be specified by the manufacturer). Samples of all materials & components would withstand a two weeks (336 hours) Salt

Spray test in accordance with ASTM procedure B117 with no structural detrimental effect to normally visible surfaces & no weight loss of over 1%.

- (xiii) Anodized decorative aluminium mouldings/ beadings etc. would be used.
- (xiv) All M.S pipes used in the bus would be ERW conforming to BIS 3601:1984 or latest, of grade WT –160.
- (xv) All rubber items used on the bus body would be made of Ethylene Propylene Dien Monomer (EPDM) rubber of black colour conforming to the Indian/ International Standards to be specified by the Manufacturer.
- (xvi) EPDM rub rail of aesthetic profile would be fitted in anodized extruded aluminium channel between stretch panel and skirt rail longitudinally at the widest portion of the bus. The quality of EPDM material would be as per the Indian/ International Standards to be specified by the Bidder.
- (xvii) Every trap/-opening flap would be secured in a manner that the vibrations can't dislodge it. Lifting devices must not protrude above the flap.
- (xviii) Ease of accessibility to engine & other aggregates for easy maintenance would be ensured. Assemblies / units would be so mounted that they are easily accessible & can be removed without disturbing other components / assemblies.
- (xix) All structure, body, and panel-bending mode frequencies, including vertical, lateral, and torsional modes, would be sufficiently removed from all primary excitation frequencies to minimize audible, visible, or sensible resonant vibrations during normal service.
- (xx) Exterior protrusions if any would conform to the provisions of relevant CMVR/ AIS/ Bus Code. The exterior rear-view mirrors and required lights and reflectors are exempted from the protrusion requirement. Advertising frames would protrude no more than 22mm from the body surface and would have the exposed edges and corners rounded to the extent practicable. Grilles, doors, bumpers and other features on the sides and rear of the bus would be designed to minimize the ability of unauthorized riders to secure footholds or handholds. The exterior body features would be shaped to allow complete & easy cleaning by automatic bus washers without snagging washer brushes or retaining water & dirt.
- (xxi) Hydraulic Grease Nipples would be provided for ease of proper lubrication & maintenance.
- (xxii) Front panels, bumpers and grill should be designed such that there are no pointed or sharp protrusions to minimise injuries to vulnerable road users in case of impact.

## **55. QUALITY ASSURANCE**

- 55.1. Bus manufacturer would use materials including fasteners conforming to relevant Indian/ International Standards and would get the same tested before use, meeting requirements of all specified parameters to ensure quality of material specified. However, random sample of materials picked up and duly sealed by representative of FSCL in presence of bus manufacturer, out of purchased lot at works of the manufacturer or out of the bus under fabrication/ completed bus and be sent for testing quality of components at CIRT, Pune/ARAI/BIS approved testing laboratories having testing facilities for testing all parameters of specifications of materials/ items. In the event of failure of samples in lab tests, testing would be conducted in same way again from fresh lot. The bidder would replace failed materials by those duly passed in lab tests.
- 55.2. In the event of failure of material/ items in laboratory test, failure of material/ items (removed from completed bus) in laboratory test, acceptance decision about bus be taken by FSCL after obtaining compensation/ recoveries of liquidated damages from bus supplier as per system decided by FSCL. Wherever, failure of material on one parameter or more than one parameter, recoveries for complete lot of materials used in bus would be made from manufacturer plus 20% damages thereof.
- 55.3. Completed bus would be subjected to water leakage test conforming to BIS: 11865-1986 or latest.
- 55.4. Add list of items to be tested for bus bodies as had been given earlier

## **56. STATUTORY REQUIREMENT**

- 56.1. Bus manufacturer would ensure that all statutory requirements in respect of each and every item of bus are fully met. Manufacturer would also obtain type approval certificates etc. for bus & any other items from testing agencies specified in the CMVR namely Vehicle Research & Development Establishment, Ahmednagar of the Ministry of Defence of Government of India or Automotive Research Association of

India, Pune or Indian Institute of Petroleum, Dehradun and or any other agencies as specified by the Central Government on date of testing/ type approval or any other agency specified by competent authority. A certificate showing details of make/type/model of various units like engine, gear box/transmission system, clutch assembly, propeller shafts, rear axle, radiator, alternator, starter, regulator, batteries, tyres, steering, instruments on the panel, air compressor, shock absorbers, suspension system items, etc. would be furnished.

- 56.2. Bus Manufacture/ Bodybuilder must make sure that the Fully built bus complies with standards and regulations for CNG fuelled vehicle provided in the AIS-052, AIS 024, AIS 028, any other applicable standard; CMVR 1989 as amended till date, CMVR 1989 and Haryana MVR 1989 and all amendments thereto.

#### **57. MANUFACTURER'S NAMEPLATE**

- 57.1. Manufacturer's nameplate may be fixed as per approval of FSCL.

#### **58. POLLUTION UNDER CONTROL (PUC) CERTIFICATE HOLDER**

- 58.1. A suitable holder with clear acrylic sheet cover would be provided in driver cab near driver seat at appropriate level for fixing of PUC certificate.

#### **59. DELETED:**

#### **60. BUS AIR CONDITIONING SYSTEM**

- 60.1. Air conditioning system capable of maintaining prescribed cabin temperature while operating even in harsh ambient conditions of 45 – 48 degree C ambient temperature, dusty and humid conditions in Faridabad.
- 60.2. Power required for air conditioning system operation should not adversely affect operational performance of bus particularly wrt its acceleration, Gradeability, load pulling capability, etc. even when the bus is loaded to capacity and the air conditioning is on.
- 60.3. Bus entry exit doors are assessed to operate (Open, dwell, close for an average period of 45 seconds each time)at headways of about 2 minutes, for boarding/ alighting etc. of passengers,
- 60.4. Estimated Peak hour load in bus may be considered as at 1.5 times bus capacity
- 60.5. Air conditioning system's test reports as provided in UBS II / as given in this doc be submitted. On site testing may be undertaken by FSCL at their discretion and Bus supplier would make all arrangements for the same at their cost.

#### **61. ANY OTHER PROVISIONS TO MAKE THE BUS FULLY FUNCTIONAL**

- 61.1. Notes indicated in this doc form part of the specs / bus body building requirements. Should however there be any conflict details contained in notes would over-ride others.

#### **62. Fire Detection and Alarm System (FDAS):**

##### **General Requirements**

- 62.1. Vehicles shall be equipped with fire detection & alarm system detecting fires in the engine compartment based on sensors that senses either abnormally high temperature or rate of temperature rise, or both.
- 62.2. Upon detection in engine compartment, the system referred in clause no 62.1, shall provide the driver with both an audio and a visual signal, and activate the hazard warning signal. The placement of the visual alarm shall be such that it is visible unobstructed while viewed from the driver seat.
- 62.3. The detection & alarm system shall be operational irrespective of whether engine has been started and the vehicle's altitude.
- 62.4. The installation of the fire detection & alarm system shall comply with the following requirements;
- 62.5. The fire detection & alarm system shall be installed according to the system manufacturer's installation manual.
- 62.6. An analysis shall be conducted prior to the installation in order to determine the location of fire detectors and alarm system. Potential fire hazards within the engine compartment shall be identified such that the fire detectors shall be positioned to cover the fire hazard. The system shall also be ensured to work properly regardless of the vehicle's altitude, road conditions etc.,

- 62.7. Fire hazards to be taken into account in the analysis shall at least consist of the following: Components whose surface may reach temperatures above the auto-ignition temperature for fluids, gases or substances that are present within the compartment and electrical components and cables with a current or voltage high enough for an ignition to occur as well as hoses and containers with flammable liquid or gas (in particular if those are pressurized). The analysis shall be fully documented.
- 62.8. The Fire Detection and Alarm System (FDAS) installed in the buses shall comply with the requirement of AIS 135, UBS II as applicable, CMVR and other relevant standards as well as best market practices.
- 62.9. Make, model, specs etc. of various components / sub-systems / system of FDAS be clearly indicated for each item as part of the offer. A detailed drawing of the system details / specs be also provided for.

**PART II – SPECIFICATIONS OF CNG FUELLED AC AND NON AC 650 MM FLOOR HEIGHT BS IV COMPLIANT MIDI BUSES FOR URBAN OPERATIONS BY FSCL – GENERALLY AS PER UBS II AND BUS CODE (AIS 052)**

| S. No. | Description   | Specifications   | Bidder to confirm and provide details  |
|--------|---|--|--|
|        |   | Midi buses   |  |
| A      | B   | C  | D  |
| 1      | Bus Floor heights in mm   | 650±10 mm, shall be uniform inside the Bus at least upto 60% of bus floor area as per AIS 052  | Confirm  |
| 2      | Propulsion System   | CNG fuelled Internal Combustion Engine (ICE);  | Confirm  |
| 2.1    | Emission norm and Fuel  | BS-IV - CNG  | Confirm  |
| 3      | Engine  | CNG Fuelled engine, water cooled, , with intercooler and conforming to BS IV emission norms  | Confirm  |
| 3.1    | Engine HP sufficient to provide:                                      |  | Make & model of engine---<br>--<br>HP -----at Rpm---<br>Max torque -----NM at rpm-----& rpm range-----         |
| a      | Rated performance at GVW in a stop/start urban operations             | Attain Geared maximum speed of 75 kmph (without speed limiter) at GVW load and air conditioning system operational   | Max speed ---- kmph  |
| b      | Acceleration (meter/sec <sup>2</sup> )                                | ≥ 0.8  | Confirm  |
| c      | Attain Bus speed of 0-30 kmph in seconds                              | ≤ 10.5   | Confirm  |
| d      | Maximum speed   | Geared maximum speed without speed limiter to be 75 kmph as at 3.1.a   | Confirm  |
| e      | Grade ability from stop at GVW and air conditioning system operating. | 17%  | Confirm  |
| f      | Rated HP / torque preferably at lower rpm range                       | Rated HP at low rpm and Maximum engine torque required at lower range of RPM and spread over a wider range of RPM  | Engine HP ---- at ----rpm & Engine peak torque ---- NM at ---- rpm;<br>Range of rpm---- to---- for peak torque |
| g      | Power requirements for Air conditioning system, ITS, etc.             | Required to be provided by bus engine  | Confirm and indicate power in terms of HP  |
| 3.2    | Emission norms  | BS IV/latest as applicable   | Confirm  |
| 3.3    | Engine management   | Engine oil pressure, engine coolant temperature, engine speed in RPM, vehicle speed, engine % load (torque), diagnostic message (engine specific) generally as per UBS II      | Confirm  |
| 3.4    | Engine operational requirements                                       | Engine should be able to operate efficiently at ambient temperatures / environmental conditions of Faridabad generally operating in the semi-arid zone prevailing in the area. | Confirm  |
| 3.5    | Engine location   | Front or rear(optional)  | specify  |
| 3.6    | Transmission  | Automatic transmission with minimum 5 forward and one reverse speed.<br>Neutral during stops   | 1. Make --- model ----- of Transmission system<br>2.No. of forward speeds and their details                    |
| 4      | Operational safety  | Transmission system to be fitted with a mechanism which makes it possible to engage reverse gear only when vehicle is stationary.  | Confirm  |
| 5      | Clutch  | Not required.  |  |

| S. No. | Description                               | Specifications  | Bidder to confirm and provide details   |
|--------|---|---|---|
|        |   | Midi buses  |   |
| 5.1    | Rear axle                                 | Single reduction, hypoid gears, full floating axle shafts with optimal gear ratios suitable for urban operations  | Make --- model ----- of Rear Axle<br>Type --<br>Gear ratio ----   |
| 5.2    | Front axle                                | Heavy duty reverse Elliot type axle suitable for bus floor height   | Make --- model ----- of Front Axle<br>Type --   |
| 6      | Steering system                           | Hydraulic power steering  | Make --- model ----- of Steering system<br>Type --  |
| 7      | Suspension system                         | Air suspension at front and air suspension at rear axle   | Confirm<br>Indicate make and model of air suspension system<br>Indicate no. of air bellows  |
| 7.1    | Front                                     | Air suspension system   | Make --- model -----,<br>Type – specs ---size---  |
| 7.2    | Rear                                      | Air suspension system   | Confirm<br>Indicate make n model of air suspension system<br>Indicate no. of air bellows  |
| 7.3    | Kneeling (mm)                             | deleted   |   |
| 7.4    | Anti-roll bars/stabilizers                | Both front and rear   | Confirm   |
| 7.5    | Shock absorbers                           | Hydraulic double acting minimum 2 each at front & rear  | Make --- model -----, of shock absorbers<br>Type – specs ---<br>Confirm   |
| 7.6    | Controls (optional)                       | Deleted   |   |
| 8      | Braking system                            | Disc Brakes in front and at rear wheels. Graduated hand controlled, spring actuated parking brakes acting on rear wheels. Asbestos free brake Pads at all places. | Confirm :<br>i. fitment of disc brakes at Rear<br>ii. Disc brakes at front<br>iii. Hand brakes<br>iv. Asbestos free pads<br>Provide Make -----, model-----, specs--- of brake system and its subsystems |
| 8.1    | Anti-skid anti brake locking system (ABS) | Required  | Provide Make -----, model---, specs--- of ABS   |
| 8.2    | Electronic controls (optional)            | Deleted   |   |
| 9      | Electrical system                         | 24 volt DC  | Confirm   |
| 9.1    | Batteries:                                | Low maintenance type lead acid batteries for 24 V system- performances as per BIS: 14257-1995(latest). 2*12V maintenance free batteries of 180Ah rating.          | Confirm<br>Make --- model -----, of Batteries<br>Type – specs ---<br>Rating ---- Ah   |
| 9.2    | Self-starter                              | 24V, 80 Ah  | Make --- model -----, of Self starter<br>Type – specs ---<br>Rating ---- Ah   |
| 9.3    | Alternator                                | 24V, 180 Ah.<br>If required two separate alternator to be installed for AC requirement and Auxiliary support in AC buses.   | Make --- model -----, of Alternator<br>Type – specs ---   |
| 9.4    | Electrical wiring & controls –type        | Multiplexing type -- As specified separately under ITS specifications   | Confirm and provide details.  |

| S. No. | Description   | Specifications   | Bidder to confirm and provide details  |
|--------|---|--|--|
|        |   | Midi buses   |  |
|        |   |  | Provide details of certifying agencies who had certified the multiplexing system design.                         |
| 10     | Speed limiting device                               | Electronic type duly approved/certified as per AIS – 018/2001 or latest, tamper proof and be adjusted to applicable speed limit                            | Make --- model -----, of speed limiting device<br>Type – specs ---   |
| 11     | Tyres   | Steel radial tube-less tyres– size and ply rating for urban operations as per CMVR Standards   | Make --- model -----, of tyres<br>Type –Size---, specs ---<br>Tread pattern for front----<br>& for rear tyres--- |
| 12     | CNG Cylinders                                       | Capacity of CNG cylinders be adequate to enable bus operation of up to 300 km between consecutive fillings   | Confirm details of CNG cylinders:<br>- No. of cylinders<br>- Capacity of ea cylinder—<br>Specification -         |
|        | CNG Cylinders location                              | Optional. However CNG filling nozzle system should not create any Safety Hazard and/or hurdle for Bus door locations and any other related specifications. | Confirm location of CNG Cylinders  |
|        | Other CNG system aggregates                         |  | Provide details of specs, make, model of each of the main items such regulator, etc.                             |
| 13     | Bus characteristics                                 |  |  |
| 13.1   | Bus dimensions in mm                                |  |  |
| A      | Overall length (over body excluding bumper)         | 9200 ± 200 mm  | Confirm and provide dimensional details  |
| B      | Overall width (sole bar/floor level-extreme points) | 2450 ± 100 mm  | Confirm and provide dimensional details  |
| C      | Overall height (unladen-at extreme point)           | 3800 mm max  | Confirm and provide dimensional details  |
| D      | Wheel-base  | 5000±200mm   | Confirm and provide dimensional details  |
| I      | Front overhang                                      | 45% of wheel base limited to 2000mm  | Confirm and provide dimensional details  |
| Ii     | Rear overhang                                       | < 60% of wheel base limited to 2400mm  | Confirm and provide dimensional details  |
| 13.2   | Turning circle radius (mm) - minimum                | As per CMVR  |  |
| 13.3   | Floor height above ground (mm)                      | 650 ± 10   | Confirm and provide dimensional details  |
| 13.4   | Clearances (mm)                                     |  |  |
| A      | Axle clearance(mm)                                  | Minimum 190 mm   | Confirm and provide dimensional details  |
| B      | Wheel area clearance(mm)                            | > 220 mm for parts fixed to bus body &> 170 mm for the parts moving vertically with axle.  | Confirm and provide dimensional details  |
| C      | Minimum ground clearance at GVW                     | Within the wheelbase not less than 240mm.  | Confirm and provide dimensional details  |
| 13.5   | Angles (degrees)                                    |  |  |
| A      | Angle of approach (unladen)                         | Not less than 8.0°   | Confirm and provide dimensional details  |
| B      | Angle of departure                                  | Not less than 8.5°   | Confirm and provide  |



| S. No. | Description   | Specifications   | Bidder to confirm and provide details   |
|--------|---|--|---|
|        |   | Midi buses   |   |
|        | (unladen)   |  | dimensional details   |
| C      | Ramp over angle (half of break-over angle)unladen                           | Minimum 4.8°   | Confirm and provide dimensional details                                       |
| 14     | Bus Gates/Doors   |  |   |
| 14.1   | Entry exit gates with doors   |  |   |
| A      | Operating mechanism   | Electro pneumatically controlled   | Confirm<br>Make ----, model ---- type --- & specs ---- of operating mechanism |
| B      | Maximum opening / closing time in seconds per operation                     | 4  | Confirm and indicate closing / operational time                               |
| C      | Positions of door controls  | As per AIS 052   | Confirm   |
| D      | Passenger safety system - allowing bus motion only on doors closing         | √  | Confirm and indicate type of system provided                                  |
| 14.2   | Entry/Exit door – between wheels ( <b>near side/non driver side</b> );      | Options:<br>Option I: Front gate ahead of front axle and rear gate behind rear axle<br>Option II: Front gate between axles & rear gate behind rear axle.<br><br>Preferred option I |   |
| A      | Door aperture in mm   | 850 mm as per AIS 052  | Confirm and provide dimensional details                                       |
| B      | Clear door width (fully opened)   | ≥700mm as per AIS 052  | Confirm and provide dimensional details                                       |
| C      | Door height   | 1900 mm as per AIS 052   | Confirm and provide dimensional details                                       |
| D      | Fixed partition between gates - full height                                 | Deleted  |   |
|        | Width of partition in mm  | Deleted  | Confirm and provide dimensional details                                       |
|        | Location of partition   | Deleted  |   |
| E      | Positioning doors with respect to partition.                                | Deleted  |   |
| F      | Number of gates   | 2  | confirm   |
| G      | Positioning doors   | As at 14.2 above   |   |
| 14.3   | Location of Entry / exit gates on driver side (off-side)– between wheels    | Deleted  |   |
| 14.4   | Maximum first step height (mm) from ground – unladenposition in buses with: |  |   |
| A      | Stepped type entry on near side doors                                       | 400 mm   | Confirm and indicate first step ht.----- mm                                   |
| B      | Deleted   |  |   |
| 14.5   | Maximum height (mm) of other steps  | 250 mm -- In no case, bus floor height should go beyond the maximum floor height.  | Confirm   |

| S. No. | Description  | Specifications  | Bidder to confirm and provide details  |
|--------|--|---|--|
|        |  | Midi buses  |  |
|        | on near side gates   |   |  |
| A      | Front door – ahead of front axle   | 250 mm  | Confirm and provide dimensional details---mm   |
| B      | Rear door – behind rear axle   | 250 mm  |  |
| 14.6   | Ramp / suitable mechanism for wheel chair access at the near side gates,   | Required AIS 052 / UBS II<br>Sunken type wrap over (manually operated) ramp, for wheel chair of PwDs, fitted on floor at gate in front of PwD seat anchorage. | Confirm<br>Type--- size----<br>Dimensions<br>Material ---- specs----<br>Load carrying capacity --<br>--- kgs m |
| A      | Dimensions   | Minimum width 900 mm  | Confirm  |
| B      | Material   | Aluminium alloy with anti-slip coating  |  |
| C      | Load carrying capacity   | > 300   |  |
| D      | Device to prevent the wheel chair roll off the sides when the length exceeds 1200mm  | Required AIS 052 / UBS II   |  |
| E      | Device to lock wrapped up ramp   | Required AIS 052 / UBS II   |  |
| F      | Kneel ramp control:  | Deleted   | confirm  |
| G      | Requirement for passenger with limited mobility  | √   | Confirm  |
| I      | Wheel chair anchoring - minimum for one wheel chair  | √   | Confirm  |
| Ii     | Priority seats - minimum 2 seats   | √   | Confirm  |
| Iii    | Stop request- on pillars-- selected for operational convenience  | √   | Confirm  |
| H      | Emergency doors/exits or apertures (numbers)   | As per AIS 052  | Confirm<br>Emergency door details--<br>--, type-----, size-----,<br>locations----, nos---<br>Confirm           |
|        | Dimensions in mm   | As per AIS 052  |  |
| I      | Passenger safety system - allowing bus motion on doors closing and doors opening only when the bus is stopped  | Mandatory   | Confirm and provide details of mechanism   |
| J      | Power operated service door - construction & control system of a power operated service door be such that a Passenger is unlikely to be injured/trapped between the doors while closing. | As per AIS 052  | Confirm and provide details of mechanism   |

| S. No. | Description                                     | Specifications  | Bidder to confirm and provide details   |
|--------|---|---|---|
|        |   | Midi buses  |   |
| K      | Door components                                 | As per AIS 052  | Confirm   |
| L      | Door locks/locking systems/door retention items | As per AIS 052  | Confirm   |
| M      | Door hinges                                     | As per AIS 052  | Confirm   |
| 15     | Bus body  |   |   |
| 15.1   | Design type approval                            | As per Annexure-3 of UBS II   | Confirm and provide details   |
| 15.2   | Bus structure - materials specifications etc.   | Material to be decided by the manufacturer. Other requirements as per bus body code. Material should fulfill strength etc. requirements indicated under Annexure-3 of UBS II and those in Part I above.   | Details of Structural materials fulfilling strength etc. requirements indicated under Annexure-3 of UBS II and those in part I of specs to be provided as a separate annexure / drawing with complete dimensional, materials and other details of specs at bidding stage. |
| 15.3   | Insulation                                      |   |   |
| A      | Roof structure/body                             | Material to be decided by the manufacturer. Other requirements as per bus body code. Material should fulfill strength etc. requirements indicated under Annexure-3 to UBS II and part I above.  | Confirm and provide details of materials specs---<br>---, size-----,shape----etc  |
| B      | Engine compartment                              |   | Confirm   |
| 15.4   | Aluminium extruded sections for:                |   |   |
| A      | Rub rail  | Aluminium extrusion IS 733/1983 or better   | Confirm and provide details of specs, sizes, make etc.at bidding stage.   |
| B      | Decorative moulding                             |   |   |
| C      | Wire cover                                      |   |   |
| D      | Wearing strip                                   |   |   |
| E      | Foot step edging                                |   |   |
| F      | Panel beading                                   |   |   |
| G      | Window frame                                    |   |   |
| H      | Roof grab rail brackets                         |   |   |
| 15.5   | Floor type / materials etc.                     |   |   |
| A      | Type of floor                                   | Uniform floor inside bus without steps at least up to 60% of bus floor length   | Confirm   |
| B      | Steps on floor                                  | As above.   | Confirm   |
| C      | Maximum floor slope                             | As per AIS 052  | Confirm   |
| D      | Floor surface material                          | 12mm thickness phenolic resin bonded densified laminated compressed wooden floor board (both side plain surface) having density of 1.2 gms/cc conforming to IS 3513(Part-3): type VI 1989 or latest. The flooring should also be boiling water resistant as for marine board BIS:710-1976/ latest and fire retardant as per BIS:5509-2000(IS15061:2002) | Confirm and provide details   |
| E      | Anti – skid material                            | 3 mm thick anti-skid type silicon grains ISO 877/76 for colour, IS5509 for fire retardancy  | Confirm and provide details of material, specs, thickness, make etc.at bidding stage.   |
| 15.6   | Safety glasses and fittings:                    |   |   |

| S. No. | Description  | Specifications  | Bidder to confirm and provide details   |
|--------|--|---|---|
|        |  | Midi buses  |   |
| A      | Front windscreen (laminated) glass:  | Single piece laminated safety glass, plain, flat / curved with curved corners with intervening PVB film IS 2553 (Part-2)-1992 / latest. Standard designs for MIDI buses to be followed (Refer Annexure 1 to UBS II) | Confirm and provide dimensional and specs details at bidding stage.               |
|        | Size:  | Standard designs for midi buses to be followed. (Refer Annexure 1 to UBS II)  | Confirm and provide dimensional and specs details, drawing etc. at bidding stage. |
| B      | Rear windscreen:   | Single piece flat/curved toughened glass-plain/flat/curved at centre & curved at corners IS 2553(Part-2)-1992/latest  | Confirm and provide dimensional and specs details, drawing etc. at bidding stage. |
|        | Size:  | Standard designs for midi buses to be followed. (Refer Annexure 1 to UBS II)  | Confirm and provide dimensional and specs details, drawing etc. at bidding stage. |
| C      | Side windows:  | Flat, 2-piece design-top fixed toughened glass IS 2553 (Part-2)-1992/latest.  | Confirm and provide dimensional and specs details                                 |
| D      | Glass specifications   | Toughened glass IS2553(Part-2)-1992/latest  | Confirm and provide dimensional and specs details, etc.at bidding stage.          |
|        | Glass thickness:   | 4.8-5.3mm   |   |
| E      | Window & other glasses - material specifications, thickness etc                            | Toughened as per IS 2553(Part-2)-1992/latest of 4.8-5.3 mm thickness  | Confirm and provide dimensional and specs details, etc. at bidding stage.         |
| F      | Safety glass   | As per AIS 052/CMVR   | Confirm and provide dimensional and specs details                                 |
| G      | Rear view mirrors  | As per AIS 052  | Confirm and provide dimensional and specs details                                 |
| 15.7   | Seating and gangway etc.   |   |   |
| 15.7.1 | Passenger seating for AC deluxetype-1 buses  | As per AIS 052  | Confirm   |
| A      | Seat layout – Intra city bus operations  | 2*2; As per AIS 052   | Confirm and provide dimensional details   |
| B      | Seat layout – Feeder bus operations  | Bench type seats, as in Delhi Metro, in low floor area laid out along bus walls & 2*2 in other areas if any; As per AIS 052   | Confirm and provide dimensional details   |
| C      | Seat area/seat space per Passenger (width*depth) mm  | 400*350   | Confirm and provide dimensional details   |
| D      | Seat pitch - minimum in mm   | 686 mm in non AC buses and 750 in Ac buses As per AIS 052   | Confirm and provide dimensional details   |
| E      | Minimum backrest height-from floor to top of seat/headrest                                 | As per AIS 052  | Confirm and provide dimensional details   |
|        | Seat base height-distance from floor to horizontal front upper surface of seat cushion mm. | As per AIS 052  | Confirm and provide dimensional details   |
|        | Seat back rest height in mm  | 375   | Confirm dimensions  |
| F      | Torso angle (degrees)  | Minimum 12  | Confirm   |

| S. No. | Description   | Specifications   | Bidder to confirm and provide details                               |
|--------|---|--|---|
|        |   | Midi buses   |   |
| G      | Seat materials  | 'PPLD/LDPE' moulded AIS:023 & bus code for performance   | Confirm and provide dimensional and specs details                   |
| H      | Seat frame structure material where required:   | Frame Structure of ERW steel tube  | Confirm and provide dimensional and specs details                   |
| I      | Free height over seating position in mm   | More than 800  | Confirm dimensions  |
|        | Seat base height:   | As per AIS 052   | Confirm dimensions  |
| J      | Clearance space for seated Passenger facing partition mm  | AIS 052  | Confirm dimensions  |
| K      | Seat back/Pad material/Thickness: (optional)  | Not required.  |   |
|        | Type:   | MDI moulded IS 5509  | Confirm and provide dimensional and specs details                   |
|        | Upholstery:   | Not Required   |   |
| L      | Area for seated passengers (sq.mm.):  | 400*350  | Confirm dimensions  |
| M      | Area for standee passengers (sq.mm.):   | As per AIS 052   | Confirm dimensions  |
| N      | Number of seats including one for wheel chair   | 23-26  | Confirm and provide no. of passenger seats and wheel chair position |
| O      | Number of standees (calculation as per AIS 052)   | As per AIS 052   | Confirm and provide no. of standees                                 |
| P      | Seats side facing location  | Optional In this case seat belts provision as per AIS 052 / any other standard                         | Confirm   |
| Q      | Seat back rest  | Fixed  | Confirm   |
| r      | Seat belts & their anchorage  | Not necessary except diver seat & wheel chair and those facing aisle (performance etc. as per AIS 052) | Confirm   |
| s      | Performance & strength requirements of:   | √  |   |
| i      | Driver seat   | As per AIS 023   | Confirm and provide dimensional and specs details                   |
| ii     | Passenger seats   | As per AIS 023   | As per AIS 023  |
| 15.7.2 | Gangway:  |  |   |
| a      | Minimum interior head room (centre line of gangway) in mm   | 1900 mm including that in the rear overhang area.  | Confirm and provide dimensions                                      |
| i      | At front axle:  | As per AIS 052   | Confirm and provide dimensions                                      |
| ii     | At rear axle:   |  |   |
| iii    | Other areas   |  |   |
| b      | Gangway Width (mm) from gates to longitudinal space between rows of seats (Access to service doors) | (Refer figure-1 of UBS II) minimum 600 mm  | Confirm and provide dimensions                                      |
| c      | Gangway Width   | (Refer figure-1 in UBS II) minimum 600 mm excluding  | Confirm and provide   |

| S. No. | Description   | Specifications  | Bidder to confirm and provide details  |
|--------|---|---|--|
|        |   | Midi buses  |  |
|        | (mm) in longitudinal space between rows of seats  | armrests (armrests are not required) and including stanchions- will be measured from seat edge to seat edge.  | dimensions   |
| D      | Driver's working space  | As per AIS 052  | Confirm and provide dimensions   |
|        | Driver's seat   | As per AIS 023 & AIS 052  | Confirm and provide dimensional and specs details                            |
| 15.8   | Corrosion prevention & painting   | As per clause 3.17 of AIS 052   | Confirm  |
| a      | Corrosion prevention treatment  | As per clause 3.17 of AIS 052   | Confirm  |
|        | Internal surfaces of structural members   |   | Confirm and provide process followed   |
|        | External surfaces of structural members   |   | Confirm and provide process followed   |
|        | After drilling holes/welding  |   | Confirm and provide process followed   |
|        | Inter metallic galvanic corrosion prevention  |   | Confirm and provide process followed   |
| b      | Primer coating  |   | Confirm and provide process followed and specs of primer coating used        |
| c      | Painting:   |   | Confirm and provide process followed and specs of primer coating used        |
| 16     | Electricals   | Multiplexing provision for electrical circuitry   | Confirm, type. Provide details and the drawings                              |
| 16.1   | Electrical cables:  | BIS marked, copper conductors with fire retardant as per IS/ISO: 6722:2006 as per appropriate class. Conductor cross-section varying as per circuit requirements, minimum cross-section 0.5 sq mm. Quality marking may also be as per equivalent or better European, Japanese, US standards | Confirm and provide details of specs, sizes, make etc. of each type of cable |
| 16.2   | Conductor cross section   | As above and suitable to carry rated current (Japanese auto Standard JASO D0609-75 AV)  | Confirm and provide details of specs, sizes, make etc. of each type of cable |
| 16.3   | Safety requirements of electrical   | As per AIS 052  | Confirm  |
| a      | Fuse  | As per AIS 052 - fuse of rated current 1.5 times the load current of electrical equipment. Necessary in every electrical circuit  | Confirm and provide details of specs, sizes, make etc.                       |
| b      | Isolation switches for electrical circuits where RMS value of voltage exceeds 100 volts | As per AIS 052- Isolation switch required for each such circuit   | Confirm and provide details of specs, sizes, make etc.                       |
| c      | Location of cables away from heat sources   | As per AIS 052- Required for each such circuit  | Confirm  |
| d      | Type approval of circuit diagram as per standards related to electric equipment/wiring  | As per AIS 052 - Required for all items   | Confirm and provide details along with relevant certificates                 |

| S. No. | Description  | Specifications   | Bidder to confirm and provide details   |
|--------|--|--|---|
|        |  | Midi buses   |   |
| e      | Cable insulation with respect to heat  | As per AIS 052   | Confirm and provide details etc.  |
| f      | Battery cut - off switch (isolator switch):                                      | Heavy-duty type capable of carrying & interrupting total circuit load.1 each near battery/driver   | Confirm and provide details of specs, make etc.                                       |
| 16.4   | Wind screen wiper:   | Electrically operated with two wiper arms & blades, wiper motor heavy duty steel body with minimum 2-Speed operation wiping system as per CMVR/BIS 7827 part-1, 2, 3(Sec.1 & 2)/latest. As per AIS 011 | Confirm.<br>Provide Make -----, model---, specs--- of wiper motors and its subsystems |
| a      | Wiper motor:   | Variable speed with time delay relay as per AIS11.   | Confirm.<br>Provide Make -----, model---, specs--- of wiper motors and its subsystems |
| b      | Wiper arm/blade:   | AIS 019/AIS011   | As above wrt arms / blade   |
| 16.5   | Driver cabin fan   | 1 number, 24 volts, 200mmdia fan as per provision of CMVR, matching interiors  | Provide Make -----, model---, specs--- of fan   |
| 16.6   | Lighting - internal & external and illumination                                  | As per AIS 052.  | Confirm and provide details of lighting / illumination                                |
| 16.7   | Illumination requirements/performance of:  |  |   |
| a      | Dash Board Tell-tale lighting/control lighting                                   | As per AIS 052 & bulbs tested for photometry as per IS 1606:1996   | Confirm and provide details of specs, wattage, make etc.                              |
| b      | Cabin Lighting - luminous flux of all lamps for cabin lighting                   | As per AIS 052 with illumination level of $\geq 100$ lux & $\leq 200$ lux  | Confirm and provide details of specs, wattage, make etc.                              |
| c      | Passenger area lighting - luminous flux of all lamps for Passenger area lighting | As per AIS 052 with illumination level of $\geq 100$ lux and $\leq 150$ lux  | Confirm and provide details of specs, wattage, make etc.                              |
| 17     | ITS enabled bus  | As specified separately under ITS chapter of UBS II specifications   |   |
| 18     | Safety related items:  |  |   |
| 18.1   | Driver seat belt & anchorage duly type approved.                                 | ELR recoil type, 3 point mounting as per CMVR & AIS 052 conforming to AIS: 005&015.  | Confirm and provide details of specs, type, make etc. of seat belt and anchorage      |
| 18.2   | Passengers seat belt:  | Not necessary except diver seat, for seats facing gangway if any.& wheel chair (performance etc. as per AIS 052)   | Confirm   |
|        | Number:  |  |   |
| 18.3   | Driver/Passenger/wheelchair Seat Belt Anchorage                                  |  |   |
| 18.4   | Fire extinguisher:   | As per AIS 052   | Provide Make -----, model---, specs--- of fire extinguishers                          |
| 18.5   | First aid box:   | 1 number, as per provision of CMVR   | Provide Make -----, model---, specs--- of first aid box and its contents.             |
| 18.6   | Handrails Minimum length*diameter* height above floor in mm                      | Colour contrasting and slip resistant of aluminium tubing 32 mm dia, 3 mm thick.   | Confirm and provide details of specs, size make etc.                                  |
| 18.7   | Handholds:   | Colour contrasting and slip resistant. 2 to 4 Numbers. hand holds per bay of poly-bicarbonate transparent with   | Confirm and provide details of specs, sizes,  |



| S. No. | Description   | Specifications  | Bidder to confirm and provide details   |
|--------|---|---|---|
|        |   | Midi buses  |   |
|        |   | provision for advertisements  | make etc.   |
| 18.8   | Stanchions:   | Vertically fitted, aluminium tubing with Colour contrasting and slip resistant. 40 mm dia& 3.15 mm thick. Rest As per AIS 052.  | Confirm and provide details of specs, sizes, make etc.  |
| 18.9   | Bells for Passenger convenience                     | High visibility bell pushes shall be fitted at a suitable height ( $\geq 1.2$ meter on all/ alternate/convenient stanchions keeping in view convenience of passengers and avoidance of un-necessary/ inadvertent operation by passengers. These would assist PwDs | Confirm and provide details of specs, sizes, make etc.  |
| 18.10  | Left blank  |   |   |
| 18.11  | Window Guardrails:                                  | As per AIS 052.   | Confirm and provide details of specs, sizes, make etc. where provided   |
| a      | In all school buses - minimum numbers.              |   |   |
| b      | In all other buses - minimum numbers.               |   |   |
| c      | In AC super deluxe buses                            |   |   |
| d      | Other details:                                      |   |   |
| i      | First guard rail at a height from window sill in mm |   |   |
| ii     | The distance between two guard rails in mm          |   |   |
| 18.12  | Entrance/Exit Guard/Step well guard:                | 800 mm minimum height extending $\geq 100$ mm more than centre line of sitting position of the Passenger.   | Confirm and provide details of specs, sizes, etc.   |
| 18.13  | Emergency exit doors, warning devices etc.          | As per AIS 052/CMVR   | Confirm and provide details of specs, make etc.   |
| 18.14  | Front/rear door, stepwell lights, door open sign    | Incandescent bulb/LED as per AIS 008  | Confirm and provide details of specs, wattage, make etc.  |
| 18.15  | Mirrors right/left side exterior/interior:          | Convex as per AIS 001 & 002. Interior with double curvature   | Provide Make -----, model---, specs--- of rear view mirrors   |
| 18.16  | Towing device front and rear                        | Heavy duty for loads of 1.2 times (minimum) the kerb weight of the bus within 30° of the longitudinal axis of the bus. As per CMVR & IS 9760 - ring type  | Confirm and provide dimensional and specs details   |
| 18.17  | Warning triangle                                    | As per AIS 052/CMVR   | Provide Make -----, model---, specs--- of warning triangle  |
| 18.18  | Fog Lighting  | As per AIS 052/CMVR   | Confirm and provide details of specs, wattage, make etc.  |
| 18.19  | Bumpers - front and rear                            | Both made of Steel or impact resistant polymer or combination of both meeting requirement of an energy absorbing system   | Confirm and provide details of specs, sizes, make etc.  |
|        | Impact strength for bumpers                         | Meet requirements of Para 6.3.1 of AIS 052  | Confirm and provide details of impact strength etc.<br>Para 6.3.1 of AIS 052 does not give any values, test standard and or test procedure. VM would hence be required to provide above details at the time of pre-bid meeting. |
| 19     | Miscellaneous                                       |   |   |



| S. No. | Description  | Specifications   | Bidder to confirm and provide details  |
|--------|--|--|--|
|        |  | Midi buses   |  |
|        | items/requirements   |  |  |
| 19.1   | Windows  |  |  |
| a      | Type of window   | Fixed windows in AC buses and two piece in non AC buses. In the latter case top portion be fixed and bottom portion to have sliding glasses. | Confirm and provide details of specs, sizes, make etc.   |
| b      | Minimum height of window aperture (clear vision)   | ≥ 950 mm   | Confirm and provide dimensions   |
| c      | Minimum height of upper edge of window aperture from bus floor                             | As per AIS 052   | Confirm and provide dimensions   |
| d      | Minimum width of windows (clear vision zone)   | As per AIS 052   | Confirm and provide dimensions   |
| 19.2   | Cabin luggage carrier  | Not required   |  |
| 19.3   | Life cycle requirements of bus (whichever is later)  | 10 years or 8,00,000 km  | Confirm and provide details of mechanism of assessing life of buses  |
| 20     | Air conditioning system - test procedure for type approval -- applicable only for AC buses |  |  |
| 20.1   | Specifications   | <p>a) For up to 42°C of saloon temperature and</p> <p>b) For &gt; 42°C of saloon temperature</p>   | <p>Provide details as under:</p> <p>i. Heat loss / heat load in terms of KWs, from each of the sub-systems of the bus and the total bus system.</p> <p>ii. Air conditioner size and capacity requirement</p> <p>iii. Engine power required for efficient and effective operation of air conditioning system.</p> <p>iv. Total power consumption for 12 hrs of operation maintaining saloon temperature of 230 C under continuous operation of vehicle with doors opening / closing as indicated and bus operating at design loads, etc.</p> <p>v. Type, size, make, model, capacity of the air-conditioning system and its subsystems like compressor, condenser, evaporator etc.,</p> <p>vi. Type of insulation provided in the bus along with its detailed specifications, BIS No. and the details thereof,</p> <p>vii. Ducting layout for uniform circulation of conditioned air in the Saloon,</p> <p>viii. Ventilation and air circulation system for the saloon when AC fails to function,</p> |

| S. No. | Description   | Specifications  | Bidder to confirm and provide details   |
|--------|---|---|---|
|        |   | Midi buses  |   |
|        |   |   | ix. Tools / system of objective measurement of saloon temperature<br>x. Rate of cooling and time required for obtaining saloon temperature of 20 degrees C when outside temperature is 45°C and the bus is un-laden with all doors closed.<br>xi. Type of air curtains at entry exit gates, specs, capacity, air supply source, power consumption, etc.<br>xii. Similar details for heating system, |
| 20.2   | Target results  | a) 24+/- 4°C (Up to 42°C )<br>b) Temperature Gradient of 15° ( > 42°C of saloon temperature) e.g. If the saloon temperature is 45°, then the target temperature inside the bus is 45°-15°= 30°<br>c) Min avg. air velocity at air vent is 4.5 m/s   | a. Confirm and provide details of temperature range provided.<br>b. Confirm and provide details of temperature range provided<br>Confirm and provide average air velocity at air vent   |
| 20.3   | Apparatus   | Lab condition and heating chamber   | Confirm and provide details   |
| 20.4   | Procedure   | 1. Soak for 1 hour<br>2. At 2000 rpm<br>3. Upto 42°C: pull down time 30 minutes (maximum)(for more than 42°C of saloon temperature, pull down time within 40 min (maximum))<br>4. Thermocouple to be placed over place minimum 20 numbers. at nose level  | Confirm and provide details against each head.  |
| 21     | Additional requirements   |   | Additional requirements   |
| 21.1   | Air circulations and ventilation in driver's area   | An air passage/duct/roof hatch to be provided in driver area at a suitable location for proper inflow of air inside the driver cab  |   |
|        |   | Drivers work area to be provided with blower or suitable device (200 mm diameter 24 V fan) to ensure proper ventilation. These devices may be capable of 3 – speed adjustment   | Confirm and provide details of make, model and rating of fan.   |
| 21.2   | Maximum noise levels inside the saloon (irrespective of AC, non-AC/fuel type/engine location)-test procedure as per AIS 020 | 81dba   | Confirm and provide details   |
| 22     | Fire Detection and Alarm System (FDAS)  | An automatic fire detection & alarm system be essentially provided for engine and other fire sensitive areas of the bus. Possibility of provision of FDAS for entire bus including but not limited to engine area, drive line, fuel tanks, fuel filling point and fuel distribution lines / cluster, wheel wells, electrical systems etc. | FDAS provided for: - Name all systems, sub-subsystems; Indicate type, make & model of provisions in each case   |
| A      | Fire Condition Monitoring device  | Pneumatic Electronic Linear fire detector with stainless steel tube with suitable diameter  | Make and model of the fire detector; Dia. and specs of SS tubing;   |
| B      | Components for  |   |   |

| S. No. | Description   | Specifications  | Bidder to confirm and provide details             |
|--------|---|---|---|
|        |   | Midi buses  |   |
|        | Fire Condition Monitoring Device  |   |   |
| I      | Generally as per UBS II, AIS 135, CMVR  | Detector operating on rate of rise with Advanced Built in Test Module.  | Make, model & specs;                              |
| II     |   | Stainless steel Tube sensor with suitable diameter and should be rodent free  | Specifications and relevant documents be provided |
| C      | Detector Specification/ requirements: Generally as per UBS II, AIS 135, CMVR (if any) | Detector should operate with Rate of Rise along with advanced Built-in Test Module that indicates failure in the event of reduced performance over the entire range of sensor tube. |   |
| I      | IP Rating   | IP67  |   |
| II     | Enclosure   | Aluminium   |   |
| III    | Operational Temperature Range   | -40°C to +125°C   |   |
| IV     | Shock & Vibration:  | Should comply to<br>BS EN 61373, Table 1,2,3<br>MIL STD- 810:501.4, 516.5.4.  |   |
| V      | Sensor Tube   | 1 Mtr. to 100 Mtr. in length. Stainless steel material with suitable diameter.  |   |
| VI     | Operating Voltage:  | 18 - 32 V DC  |   |
| VII    | Alarm Current:  | 40mA  |   |

**NOTES:**

- All cross and or T or X-joints of structural elements of bus body structure (Front, rear, sides, roof, floor, etc.) be provided with MS gussets of min 2.5mm thickness. All Weldments / structural sub elements be properly cleaned and treated for corrosion prevention
- Service / inspection hatches with covers be provided for servicing of various aggregates / sub-systems of bus.
- Width of wheel arches frame be maintained as per chassis manufacturer specs for providing adequate ventilation to tyres amongst fulfilling other needs.
- Stanchion pipes and grab rails to be of Aluminum tubing of appropriate specs, size / wall thickness etc. Handholds supporting hand rails and the stanchion pipes be painted in cannery yellow color, Brackets be grey matching the colour of the inner paneling. Brackets however need to be of proper size and shape to ensure perfect fittings. No redundant fastening holes be provided on brackets
- Hand holds be of polycarbonate material, transparent and provision for space for advertisements
- No Spare-wheel carrier and spare-wheel hatch need be provided on the bus. As the same need not be carried on-board during urban operations. Spare wheel would be retained in bus depot as float.
- Stop buzzers may be provided as one in frontal area, one in middle and one in the rear area on stanchions at reasonable height ensuring easy accessibility as well as preventing unnecessary usage. Design of buzzer switch be sturdy, long lasting and sunk-in type to avoid undesirable / inadvertent operation.
- LED illumination provided in saloon area of the bus be covered with ground glasses to prevent glare.
- Mounting of bus body cross bearers on chassis be as per design / instructions of the chassis manufacturer.
- Tail lamps be covered with metallic grill in a manner that not only protects the tail lamps but also facilitates lamp replacement etc.
- Front and rear facia of the bus body may be fabricated out of FRP suitably designed, ensuring its strength, finish and ease of repair / replacements at par or better than the metallic ones asked for in the specs.
- Where type approval, of any of the bus body items including full bus body / bus is a mandatory requirement Type approval be undertaken by test agencies authorized under CMVR. In other cases approval of selection of testing agency be obtained from FSCL.

13. Design approval of multiplexing wiring in bus body / bus be obtained from test agencies authorised under CMVR or any other agency accredited for the purpose subject to approval of FSCL .

Bus supplier / bus body builder / PO to provide detailed drawings / specifications / make / model etc. as called for in specs for all items as generally indicated in RFP specs including but not limited to electrical Circuit diagrams of electrical subsystems in the bus.

**Appendix ‘A’ to part II above –Passenger entry / exit gates, doors size and locations – Midi bus for FSCL**

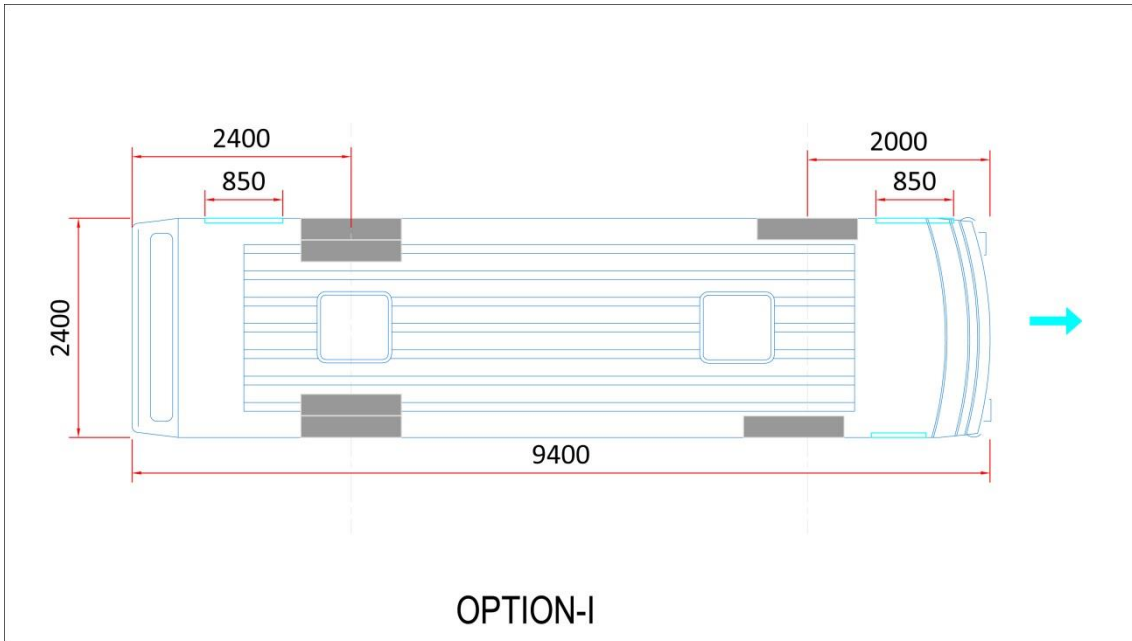


Figure 1: Passenger entry / exit doors size and locations for provision in BS-IV Compliant CNG Fuelled 9200±200mm Long AC Midi Buses for Faridabad – Option-I

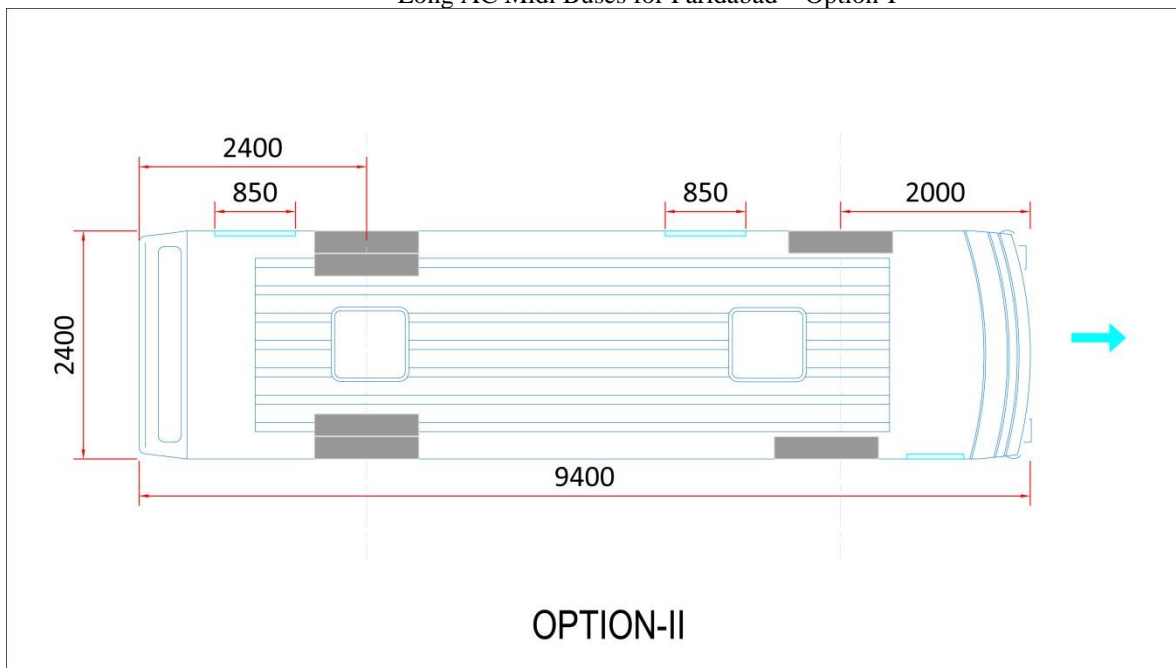


Figure 2: Passenger entry / exit doors size and locations for provision in BS-IV Compliant CNG Fuelled 9200±200mm Long AC Midi Buses for Faridabad– Option-II

**Preferred option is Option 1**

