

7.2.1. TYPOLOGY

7.2.1.1. ARTICULATED BUS

- It must be driven by dedicated engines that fulfill all the requirements from current regulations on technologies, emission standards and clean fuels defined by the relevant authority.
- It must have central engine between axles under the passenger platform
- It must be equipped with an automatic transmission with incorporated delay
- The vehicle must have enough power, torque and transmission ratio to allow reaching a 40Km/h speed at full loading capacity in less than 22 seconds on a flat surface in the city of Bogotá.
- It must have an automatic suspension system; mixed suspensions or any other types are not accepted.
- It must have a speed regulation system so that the maximum speed allowed by the current National Code of Traffic in urban roads is not exceeded (60Km/h).
- It must have fuel storage tanks that allow autonomy and quick filling up, under conditions that allow providing services continuously all day long.

In case the selected bidder considers using electric bi-articulated buses, the contracting party shall evaluate –during the Concession validity term- the possibility of adjusting the useful life and/or reposition term of transport units pursuant to a technical study including but not limited to the perspective of both the manufacturers and the Transport operators who employ this kind of technology¹.

7.2.1.1.1. SPECIFIC DESIGN FEATURES

In order to operate in the Integrated System of Public Transportation (SITP) trunk, the vehicles shall have to fulfill at least the NTC-4901-1 Colombian technical standard, and the following specific technical features:

- The seat distribution for these vehicles may be 2-2, 2-1, 1-1, 1-0, 0-0 face to face and along the perimeter of the vehicle's body. The vehicle must have 10 seats available for preferential use by the elderly, physically challenged, children and pregnant women. It must have a maximum capacity of 260 passengers.

- The driver's seat must be located in a way that allows:

¹ A paragraph was added after the "bi-articulated bus typology" bullets of the Operation Manual through Addendum No. 7.



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- Upper vision angle: to allow the driver to observe objects located 15000 millimeters ahead and 4500 millimeters from the ground.

- Lower vision angle: to allow driver to observe objects located 800 millimeters ahead and 1400 millimeters from the ground.

- The entire road area at the vehicle's front end which is not directly seen by the driver must be viewable through mirrors.

All the interior finishing of the vehicle must be made of washable, wear-resistant, flame-retardant, self-extinguishable and non-toxic material, without prejudice to the fulfillment of safety specifications by the latest version of the NTC-3586 Colombian Technical Standard, or the FMVSS 302 Standard, or its international equivalent.

Passenger seats must have individual sitting position, ergonomic design, lumbar support and must have no holes on the back side, except for those required for children grip-handles; they must have no padding, upholstery; they must have anti-slip texture, technical tests certificates that guarantee color prevalence for at least 5 years, free of blades, edges or any sharp element which may cause injuries to passengers.

Passenger seats next to the central hall must have handrails or lateral grip-handles to facilitate children's firm and safe grip. These handrails or grip-handles must not affect the free wide space of the hall defined in the clause about internal vehicle measurements.

The driver's seat must be padded, with adjustable-strength hydraulic or pneumatic suspension and head rest. The horizontal, vertical and back adjustment must allow as least a horizontal movement of about 150 millimeters on the longitudinal axis, a vertical movement of about 100 millimeters on the vertical axis and a back inclination angle from 0 to 20 degrees measured with respect to the vertical one. The horizontal, vertical and back adjustment must be hydraulic or pneumatic. The materials must comply with the safety provisions specified in this manual without prejudice to the fulfillment of safety standards provided by the relevant authorities.

The interior finishing of the vehicle must be in plastic rolled melanimic material or any other wear-resistant washable material pursuant to the safety requirements of this specification. Under no circumstances may the interior finishing and covering be covered in metal sheets. The seat anchoring may connect directly to the vehicle platform or the lateral panel of the body. In any case, the method to fasten seats must provide them with enough strength in case of accidents or abrupt movements so as to avoid passenger injuries. All the seat metalwork and other fastening elements must comply with the latest version of the NTC-3638 Colombian Technical Standard or its international equivalent. The following must be fulfilled without prejudice to the aforementioned:

- The seat fastening system must be resistant to breaking or crashing with longitudinal-horizontal strength of 3000N applied in two 1500N strengths each on the central axis of the upper back in each seat. For single seats, the fastening system must be resistant to breaking or crashing under total longitudinal-horizontal strength of 1500 N in the central axis of their upper back.

- The handrails and grip-handles must be resistant enough so that passengers can be standing during vehicle



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movement, even in case of emergency braking.

➤The handrail surface must be free of edges and sharp corners and their ends must be curved, so as to avoid the hazard of user injury.

➤The handrails must be continuous elements and must not have joints in places other than the intersections anchoring to the vehicle's body.

➤The surface of all the bars and grip-handles must offer anti-slip handling without obstacles.

➤The bars and grip-handles must have a section to allow passengers easy grip and tight holding. Every bar-handle shall be at least 150 millimeters long to place a hand, in case there are grip-beams with grip-bars, the minimum length of such bar would be 100 millimeters.

➤The grip-bars must be circular or oval having a diameter from 30 to 45 millimeters. In case of oval section bars, the diameter shall be calculated as the arithmetic average from the higher to lower diameter.

➤All the grip-bars must be made of stainless steel tubes in polished aluminum or steel covered by PVC encased plastic material.

➤The horizontal grip-bars shall be located at a height from 1750 to 1900 millimeters, measured from the vehicle platform.

➤The horizontal grip-bars next to each service door must be located at a height from 1850 to 1900 millimeters, measured from the vehicle platform. They must not block the access to hatchways or emergency exits located on the vehicle ceiling.

➤In case there were seats in the area where horizontal grip-bars were located, they cannot be farther than 150 millimeters measured from the seat edge to the hall in direction to the windows.

➤At least two (2) vertical grip-bars must be available, one at each side of the service doors and spaces reserved for wheel-chair passengers.

➤There must be a vertical 1500-millimeter handrail every (2) seats, accordingly. The handrails may be fastened directly to the tube structure of seats, guaranteeing the safety conditions in any case.

➤The seats must have a horizontal grip-bar in the upper back, which under no circumstances should protrude over 150 millimeters from the back. The passenger seats cannot have lateral arms.

The floor or platform and the emergency-door steps of the vehicle must be covered in synthetic anti-slip material pursuant to the safety and material provisions herein. The use of metal sheets as covering for the internal floor of the vehicle shall be absolutely forbidden.

The material covering the vehicle floor must last at least 10 years under the SITP operating conditions. This material must avoid liquid filtering, guaranteeing watertightness inside the vehicle.

The windows must comply with the material and safety conditions pursuant to the latest version of the NTC-1467 standard or its international equivalent. The side windows shall be divided horizontally in two independent



modules. The lower module shall be fixed and fastened to the body structure by means of glues. The upper module must be available to open; it can be fastened through the framing and packing system. The minimum height of the upper module shall be 30% of the window height, and the maximum height of the upper module shall be 50% of the window height.

The use of framing and packing system shall be allowed to fasten the windows to the body when used to fasten the front windshield window and rear windshield window, the driver's window and other upper modules of side windows. In all cases, the fastening frame must be in black anodized aluminum.

All the SITP articulated buses must have 7 double-doors of service and 1.10 meter-wide free space.

The service doors must be located to the left side of the vehicle, having two doors among the axles of the first body, one door at the second body in front of the axle and four doors on the third body, two doors to each side of the axle.²

The service doors must have a trigger mechanism to guarantee adequate evacuation and a 2-second maximum opening time.

The emergency doors must have a trigger mechanism to ensure adequate evacuation and a 5-second maximum opening time.

The service doors must have at least 40% of its surface in glass.

The vehicles shall have a system that allows opening both service and emergency doors from the inside or outside of the vehicle in case of an emergency. This system shall have at least one spot for triggering the doors from the outside, which must be duly marked for easy triggering. The internal emergency triggering system must be clearly marked and protected with translucent red polycarbonate enclosures. Likewise, service doors must have an optical or audio signal easily identified by the driver sitting at his seat, under any lighting conditions, in order to alert when a door is not completely closed. This sign must light up or sound every time the door structure is ajar.

The vehicles shall have an audio and illuminated system at each service and emergency door to allow passengers noticing that the doors are going to open or close.

The vehicles shall have a system that prevents opening doors while the vehicle is moving and impedes starting the vehicle while any door is still open.

The opening and closing controls of service and emergency doors must allow the driver to invert the door movement at all times during the closing or opening action. The opening system of service doors must prevent passenger injuries by being trapped by the door when triggered.

The vehicle must have a radio control to control the opening and closing of the automatic door system installed at the single stations, together with the opening and closing system of the vehicle's service doors. This control must be compatible with the system currently installed at Caracas, Calle80, AutopistaNorte, Eje Ambiental,

² Paragraph six (6) was modified through Addendum No. 7, after the second group of bullets for specific design features of the Operation Manual



Avenida de las Américas, Norte-Quito-Sur, Autopista S 26, Carrera 10 and Carrera 7 trunks, or at future expansion trunks of the system. The necessary wiring and electric protection must be considered for this purpose.

The vehicles for Massive Public Transportation of Passengers must have internal fluorescent lighting and/or new efficient-energy-use technologies with a minimum lighting of 200lux measured at a 1200 millimeter height over the vehicle platform in a dark room, including the following areas:

Passenger and driver's compartment, access to any exit or entrance and the articulated section of the vehicle.³

The driving area must have a lighting system independent from the interior bus lighting, so that no light is reflected on the front windshield and safe driving is not blocked.

The door area must have an automatic lighting system that lights the vehicle floor. This lighting system must activate while the doors are open, provided that the interior lighting system is on.

7.2.1.1.2. Internal Measurements (in millimeters):

Dimensions	Minimum	Maximum
Free internal height	2100	
Upper visibility height	1750	
Lower visibility height	600	1000
Hall width	600	
Seat Separation	650	
Space between face-to-face seats	1300	
Seat depth	350	430
Seat width	400	
Seat height	350	450
Back Height	500	600
Free height of service doors	1900	
Free height of emergency doors	1800	
Free width of emergency doors	600	

³ Paragraph fifteen (15) was modified through Addendum No. 7 after the second bullet group with specific design features of the Operation Manual

		
Free width of service doors	ALCALDÍA MAYOR BOGOTÁ D.C. TRANSMILENIO S.A.	

For vehicles with rear engines, the minimum free-width of service doors shall be 1000 millimeters. Similarly, the lower visibility of windows may decrease up to 500mm measured from the area where passenger feet are placed to the lower window line, provided that it has a protection device up to 650mm height in order to avoid the chance of passengers falling off the bus.

The measurement of seat height for those seats located on the wheel arch or the steering gear box is performed from the floor where passengers place their feet.

7.2.1.1.3. SPECIFIC TECHNICAL FEATURES OF THE BODY

The typology of the initial fleet must comply with the following minimal technical features in terms of vehicle body:

The SITP vehicles may be built as a bodied chassis or as an integral self-supporting body vehicle. In any case, the vehicle configuration must comply with the accessibility provisions for passengers stated in the previous clause.

In the case of bodied vehicles and integral-body vehicles, the body must be made equivalent by the chassis manufacturer; therefore, the AUTHORIZED DEALER shall be subject to obtain from the vehicle manufacturer and enforce all the conditions for the design and construction of the body with regard to safety, accessibility, comfort and economy criteria. Under no circumstances may the vehicle be acquired through separate components, and the AUTHORIZED DEALER is subject to guarantee that the chassis and body are acquired jointly; and obtain the certificate from the chassis manufacturer stating that the body integrated to it is technically and operationally compatible.

The body structure must comply with the provisions from number 5 of the “*Regulation No.66 Uniform Provisions concerning the approval of Large Passenger Vehicles with regard to the Strength of their Superstructure*” document by the United Nations.

The chassis design criteria shall consider the optimization of surfaces available for passengers in order to place the elements.

The chassis or body structure shall not be modified, except with express approval from manufacturer authorized by TRANSMILENIO S.A. A modification shall be any change of dimensions and relocation of structural chassis or body components, relocation of engine, transmission and steering gear box.

In the case of self-supporting body vehicles, the modification of body elements or relocation of mechanical or structural parts is absolutely forbidden to any agents other than the structure manufacturer.

The SITP buses shall not use chassis designed and made to be used in loading and traction vehicles (tractors, trucks, trailers and semi-trailers).



The body structure must incorporate metal materials or steel or light metals. Without prejudice to the aforementioned, mixed structures may be built employing other materials whose features offer strength, lasting and safety equal or higher than that of metal materials.

The joints of elements comprising the body and those attached to it must be firmly joined to one another, minimizing the level of vibrations and noise inside the passenger space.

The body structure must be designed to support a static load on the roof equivalent to 50% of the maximum weight supported by the vehicle, evenly distributed along the area, for 5 minutes, without experiencing deformation over 70 millimeters at all points. In order to verify compliance with this condition, the manufacturer must submit a certificate evidencing –through structural design, physical tests or computer modeling- that the design fulfills the required strength and deformation parameters.

Additionally, it must have a fastening metal sheet for grounding of devices to be installed in the upper body parts (radio antennas, communications, GPS, etc.).

The vehicle must have thermal flameproof set-up in the engine area and other areas near high-heat sources in order to guarantee that the temperature inside the passenger space at areas near heat sources, measured in a 100 millimeter radius, is not higher than 28°C (maximum temperature in the passenger and driver compartments).

The vehicle must have acoustic isolation so that the maximum noise level allowed inside the vehicle is 90dB (A), at any point for a maximum 30-minute exposition period.

The passenger space and its ventilation system must not allow flows of water, dust, smoke and any other damaging agent that annoys passengers. Every vehicle must have an instrument board, with at least the following instruments: speed indicator, engine revolution indicator, fuel level and oil pressure, temperature, voltage, lights on, manometer for the air-pressure of the braking system, with a red led, and a space suitable to install the logic unit display and audio alarm indicating low pressure of the pneumatic braking system under 5050N/cm². In addition, it must have a visible indicator for the driver, which alerts every time there is a variation from normal operation conditions of the braking system and weight control. The signals of abnormalities in normal operation conditions must be compatible with the vehicle's logic unit.

Every vehicle for the SITP must have a digital tachograph to record and store the following information: speed, running time and stop time, and traveled distance. This equipment must have the capacity to record and store the information generated for at least 24 hours, during this period all speed variations occurred from 0 to 120Km/h must be recorded. This equipment in each vehicle must be calibrated and certified by the tachograph provider; likewise, it must be connected to the logic unit through a digital input signal.

All vehicles must have minimum space of 270 millimeter width by 180 millimeter height in each vehicle body in order to place the internal numbering assigned by TRANSMILENIO S.A.

All vehicles must have a user information system (LED, plasma, LCD or other similar type) depending on the bus body. It must not fog up and must inform passengers visually and with sound about the service provided, the current stop station, the next two stops, and the final destination. This system must extract and display the information stored in the logic unit onboard, and must be able to communicate to the control center of the System. The connection to the logic unit onboard is through an RS232 port. The minimum dimensions for these boards are 85mm height by 500 mm length and one must be placed per bus wagon in areas that allow the greatest visibility for users without impacting passenger accessibility or



safety. All SITP vehicles must have the following electronic indicators of destination since their manufacturing:

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- Frontal indicator of destination: it will show information about the service currently provided by the vehicle. It must be located to the front on the upper windshield section. The frontal indicator of destination will be 1750 millimeters length by 250 millimeter height, without prejudice to having a system that allows reading a minimum distance of 100 meters during both day and night. This indicator must have a system to prevent fog up of information shown under any adverse weather conditions.
- Lateral Indicators of Destination: it must have at least the destination number of the service provided on each body of the bus, there must be at least one indicator and it will be located on top or at upper sections next to the access doors. It will have minimum dimensions of 450 millimeter length by 250 millimeter height.
- Rear indicator of destination: It must contain at least the service number and shall be located at the right upper section of the rear windshield. It will have a minimum dimension of 450 millimeters length x 250 millimeters high.

7.2.1.1.4. VEHICLE WEIGHT

The vehicle weight must comply with the following limits:

AXLE	MAXIMUM LOAD ALLOWED
First axle	7.5Ton
Second axle	12.5Ton
Third axle	12.5Ton
Fourth axle	12.5Ton

The following will be considered to calculate the SITP bus weight: a 68kg mass per passenger, the maximum vehicle capacity, the seat distribution and the free areas available for standing passengers.

The maximum limits per axle defined by manufacturer shall not be exceeded under any circumstances. In order to calculate the maximum vehicle load, the standing passengers and sitting passengers will be added up.

The gross vehicle weight must be less than 40 tons in any case.

7.2.1.1.5. EXTERNAL DIMENSIONS



The external dimensions of SITP vehicles must comply with the standards issued by the relevant authority. Notwithstanding the standards, vehicles will fulfill at least the following conditions.

Vehicle width: 2600 maximum. Under no circumstances the width between the external sides of the rear axle wheels may exceed 150 millimeters on each side, and the external mirrors will not exceed the total vehicle width over 250 millimeters on each side.

Vehicle height: The total vehicle height may be exceeded in 4100 millimeters

Vehicle length: the maximum length allowed is 30000 millimeters, pursuant to the NTC 4901-1 standard. The minimum length allowed is 25000 millimeters.

Height from the ground to the height point of the body: it must be 280 millimeters or over

Height from the ground to the platform: The actual height to load and unload passengers, measured from the road level to the vehicle platform shall be 880 millimeters minimum and 920 millimeters maximum.

Turning radius: The vehicle must comply with the provisions of the NTC4901-1 standard

7.2.1.1.6. EMERGENCY AND SAFETY SYSTEMS

The vehicles for the SITP trunk operation must be equipped with the following emergency and safety systems:

A switch to request driver's help and the corresponding alarm on the instrument board, easily accessible to passengers located at the wheelchair area.

Two (2) single emergency doors on the right side of the vehicle. The emergency doors may open from the inside out by pushing manually in case of an emergency. Similarly, they must have an external mechanism to allow triggering in case they cannot be open from the inside. The emergency doors must have the corresponding access stair and an element that covers the area occupied by the stairs, which must have an automatic triggering mechanism to allow using the stair in case of emergency.

One (1) skylight with an ejection system per every thirty (30) passengers capacity, located on the vehicle ceiling and distributed evenly pursuant to the passenger location in each vehicle body. The skylights must have a minimum free area of 3000cm² so that it is possible to make a 500mm x 600mm rectangle in this area. In case of vehicles using compressed natural gas as fuel that require placing bottles on the roof, the ceiling will include as many skylights as possible. Those that cannot be placed must be replaced in like number with additional emergency windows.



The emergency windows must have fragmentation mechanisms pursuant to the NTC-1467 standard. The windows must be easy and quick to trigger from the inside of the vehicle at any time during operation.

Each emergency window must have a minimum free area of four thousand (4000) square centimeters, so that a 500mm x 700mm rectangle can pass through it.

All vehicles must have green safety glasses pursuant to the technical specifications provided by the latest version of the NTC-1467 Colombian Technical Standard, which must be fulfilled for this purpose as follows:

Back and Side Window(s)	Tempered Glass(es)
Frontal Windshield	Laminated Glass(es)

Glasses must be transparent and free from every commercial, advertising or sticker that blocks visibility except for stickers indicating emergency exits or legal requirements such as technical revisions provided by the National Code of Traffic.

All SITP buses must comply with the provisions of the National Code of Land Traffic in terms of braking systems. Without prejudice to this condition, they must have a pneumatic anti-lock ABS braking system with an independent double-circuit.

Vehicles must have a mechanical forced ventilation system that ensures air renewal at least every thirty (30) times per hour by using fans and extractors evenly distributed along the body, with a minimum 330m³/hr. capacity per fan. The air renewal produced by opening doors and/or windows and/or hatches of the vehicle shall not be taken into account.

The driver seat must have a three-speed mechanical ventilation system with adjustable grilles for face, body and feet.

The frontal windshield must have a de-misting system able to remove air condensation from the entire glass, under any operating condition of the vehicle, which must be certified through manufacturer's measurements on the de-misting system (the minimum capacity of this system must be 1200m³/hour).

The vehicle must be equipped with fixed dividing panels from 700mm to 800 mm high in the following cases:

In front of seats located at emergency stair areas

At the back of the driver's seat, complemented by a transparent panel reaching a maximum height of 1800 millimeters

The vehicle's battery must be located outside the passenger space and must have an available device located within driver's reach that allows cutting the power coming from the battery.

All vehicles must have three point retractable seat-belts at the driver's seat pursuant to NTC1570, NTC2037 standards or their international equivalent as applicable. Likewise, they must have a visual and



audio alarm that activates in case the driver starts moving the vehicle not using the safety-belt.

The vehicle will have (2) spaces for the physically challenged in wheel chairs, they must be distributed as follows: the first one at the vehicle body, the second one at the vehicle body as close as possible to the access door. These spaces must be duly marked for physically challenged people. The minimum space must be 900mm x 1400mm and the symmetry axis of seats must be parallel to the longitudinal bus axis. There must also be a handrail in each space to facilitate entry and exit of the aforementioned users. The physically challenged in wheel chairs must travel held tight by means of a mechanism anchored to a structural element of the vehicle. The fastening mechanism must have a simple and quick-operation system that allows using the area as a free space when not in used by physically challenged in wheel-chairs.

Fuel tanks must be either enclosed inside a metal structure for protection in case of crashing or rollover or located between the two chassis frames. These structures must be installed by the vehicle's chassis assembler.

The piping of the fuel-feeding system must never go through the passenger space. They must be protected and kept free of leaks or escapes, abnormal torsional stress, bending, friction and vibration.

The fuel piping path must be designed so that a possible leaking has no chance to drop on the exhaust system or any other heat source.

There must be a fuel-cut valve as close as possible to the fuel tank that can be handled from the driver's control board.

The electric system must be sealed and protected from moist. Under no circumstances can the electric system be located inside the passenger cabin.

Every electric cable going through a hole must be fastened to prevent movement and the hole must have proper protection to avoid cable damage by cut or friction.

The entire external lighting system and brake lights, emergency lights and turn signals shall comply with the NTC4901-1 standard.

The rear brake lights must have a minimum dimension to cover a 140mm-diameter circle and must have a third brake light located on the upper middle section of the body with the same aforementioned dimensions. They must be visible from a 100-meter distance under any weather condition. The rear brake lights, position lamps, reversing lamps, and turn signals must comply with the European regulations of European Standards No. 6, 7 and 23 related to international illumination levels.

The front lamps must comply with the specifications from Standard No 87 "*Uniform Provisions concerning the approval of daytime running lamps for power driven vehicles*" by the United Nations related to the capacity and tests in order to be used as daytime lamps.

Each vehicle must be equipped with four (4) ABC extinguishers. One is to be located next to the driver's seat with a minimum 10lb capacity, the second in the first articulation area at least 1.20 meters high from the floor, the third in the second articulation area at least 1.20 meters high from the floor, and the fourth extinguisher at the third body. They must be duly marked.

Vehicles driven by Vehicular Compressed Natural Gas and their components (hoses, pipes, pressure relief valves, air-gas mixer, excess flow valves, gas relief devices, hermetic cover, gas injectors, rigid pipe lines, filter, gas flow adjusting device, accessories and flexible pipe lines) must comply with the Colombian Technical Standards NTC3561, NTC-4300, 4830-2, 4830-3, 4830-4, 4830-5, 4830-6, 4830-7, 4830-8, 4830-9, 4830-10, 4830-11, 4830-12, 4830-13, 4830-14, 4830-15, 4830-16 and 4830-17.

Vehicles driven by Vehicular Compressed Natural Gas must comply with the provisions of Colombian Technical Standards NTC3847 and NTC4828 related to the tests and requirements to be fulfilled by cylinders used to store this type of fuel.

Vehicles driven by other type of clean fuel pursuant to those defined by law must comply with the provisions of the Technical Standards defined by the relevant authority for this purpose.

7.2.1.1.7. TECHNICAL SPECIFICATIONS TO INSTALL LOGIC CONTROL UNITS

The vehicle to be incorporated into the SITP trunk operation must be equipped with the following elements as a pre-installation of the logic unit for voice and data localization, processing and transmission.

Odometer System of the Vehicle: we require the odometer system of the vehicle to have a pulse output other than that used for the instrument board's speedometer, by using a signal source with a TTL level under 500 pulses per mile at 2500 pulses per second at the vehicle's max speed, with a spacing between pulses over 125 microseconds. This connection to the odometer must use a 20 AWG (pair) black and white signal cable. This cable must have a 4-meter maximum length.

➤Location of the Logic Unit: the vehicle must have a space in the driver assigned area where the logic unit and other communication equipment and systems are to be installed. The space assigned to the logic unit must fulfill the following minimum requirements:

➤Be located at less than 5 meters from the driver's seat, where the logic unit and control display will be installed.



- It must be free from dust and moist
- It must allow ventilation
- It must be vibration-free
- It must be located out of passenger reach
- The space assigned to install the equipment must house equipment with the following dimensions: 70cmX 50cmX 20cm and a 3.5kg weight.

7.2.1.1.8. Location of Antennas:

- The vehicle must have a place on the roof with support sheets to install the GPS antenna, and the radio communication and data transmission antennas.
- The GPS and communication antennas must be located to a minimum distance of (3) meters from one another.
- The GPS antenna location must allow connecting to a logic unit through a 4-millimeter coaxial cable, less than 5-meter length. The vehicle must have holes and other devices required for wiring and installing the GPS antenna, rubber edge protection and corners of said holes. The purpose is to protect the aforementioned wiring.
- The GPS antenna shall have maximum diameter of 12 centimeters and a maximum height of 3.5 centimeters
- The communication antenna location must allow connecting to the Logic-Unit installation location through a cable less than 20-meter long. The vehicle must have holes and other devices required for wiring and installing communication antennas and rubber edge protectors, and the corners of such holes in order to provide wiring protection.
- In any case, the place where antennas are installed must have access from the inside of the vehicle for installation and maintenance purposes.
- In case the roof material is non-conductive, the vehicle manufacturer must place a metal sheet on the roof of at least 0.4 square for fastening and grounding, which is to be used to install the GPS antenna.
- The installation area on the roof for the antennas cannot have a horizontal tilt over 10 degrees.
- In order to wire the coaxial cable required there must be a pipe with a minimum $\frac{3}{4}$ " diameter between the antenna installation point and the place defined for the logic units and other equipment required by the Operation Control System. This pipe must have no angles so that cables can be installed.
- The vehicle manufacturer must have all the seals and mechanisms to avoid water entry into the vehicle.

Vehicle wiring:



The installation area of the logic units must have a DC supply cable and its corresponding fuse or protection system. This will be a two-way cable with at least 10 AWG for a 24DVC voltage and 20 amps

The installation area of logic units must have a power supply cable from the vehicle's on switch and its corresponding fuse or protection system. This will be a two-way cable, at least 10 AWG for a 24DVC voltage and 20amps.

The installation area of logic units must have a grounded cable. This cable must be at least 20AWG.

7.2.1.1.9 VEHICLE ENVIRONMENTAL PERFORMANCE

The engine and vehicle control systems must certify and keep an environmental performance that complies with the current environmental standards related to technologies, clean fuels, emission levels and controls defined by the relevant authority.

For all purposes and permanently during the concession validity term, all vehicles provided by the AUTHORIZED DEALER to the trunk operation shall fulfill the following minimum environmental performance provisions:

- All the vehicles must comply with the standards and maximum limits of emission permitted by Resolution 2604 from 2009 or any modifying, adding or substituting standard. All vehicles must have a catalytic converter or emission control system with capacity and features compatible with the engine, technology and clean fuel used,
- Pursuant to the regulation or standard adopted by the relevant ruling authority. In the case of gas or diesel vehicles complying with emission standards equivalent to EURO IV or higher, based on the emission levels defined in resolution 2604 from 2009 or its modifying, adding or substituting standards, they must have an emission control device or onboard diagnostic system OBD (OnBoard Diagnosis) (or DAB in Spanish) pursuant to standards of directives 2005/55/EC and 2005/78/EC.⁴

➤After the vehicles are placed in Bogotá and duly adjusted or calibrated and acclimatized, it must be guaranteed that they fulfill current standards on maximum emission levels of mobile sources issued by the relevant authority (such as the Secretaria Distrital de Ambiente, Ministerio de Ambiente, Vivienda y Desarrollo Territorial, Ministerio de Transporte, among other). Under no circumstance or time during the concession validity term may vehicles have external noise emission levels over 90dB (A), pursuant to the measurement procedure established in standard 70/157/EEC.

7.2.1.1.10. OPERATION CONTROL SYSTEMS

The SITP trunk buses must be equipped with a logic unit of voice and data localization, procedure and transmission that fulfills the technical features required to interact with the control system of TRANSMILENIO S.A.'s operation, keep effective communication with TRANSMILENIO S.A. control center, receive signals sent by the control center to communicate with each operating vehicle, allowing TRANSMILENIO S.A. to give orders and supervise activities inside the SITP vehicle permanently and continuously. The fulfillment of these

⁴The first bullet of paragraph 2, number **7.2.1.1.9 (Articulated Bus) Vehicle Environmental Performance** of the Operation Manual was modified by means of Addendum No. 4.



specifications is subject to prior, express and written approval of TRANSMILENIO S.A.

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Additionally, the AUTHORIZED DEALER shall be subject to perform any improvement or modification on equipment required for appropriate system operation, whenever required by TRANSMILENIO S.A. This shall be a permanent obligation for the AUTHORIZED DEALER during the agreement validity term. The AUTHORIZED DEALER must acquire the licenses needed to use the software installed on the equipment.

In order to incorporate the fleet to the regular SITP operation, the logic unit and monitor must comply with the following basic technical specifications, with no restriction for TRANSMILENIO S.A. to require introducing changes in the following specifications or the software related to the logic unit due to technical and operational needs:

7.2.1.1.11. GPS signal reception

➤Accuracy of GPS reception of at least 25m without differential techniques in 50% of the cases and less than 10 meters with differential techniques in 95% or more cases.

➤"Hard Mounted" GPS reception antenna with security seal of at least 25dB, with an operation temperature range from -30°C to 85°C and a connection cable with the required length.

➤The minimum number of satellite channels for "Selective Availability" is 8

7.2.1.1.12. Processing component:

➤Microprocessor of operating technology lower than PentiumDX2 at 133MHZ.

➤Enough memory capacity to store and exchange service data and services with the Control Center. Coordinates of stations and service reference points, Start date of each service to be performed by the bus ("offset"), Route time between points for each service to be performed by the bus, Standing time at route points per service, Medium speed based on service section and per service, Announce the next stop depending on the service being provided, Confirm service exit and/or line change one station before the exit point, Display the travel type to be performed on screen.

➤Differential correction parameters for GPS reception coming in transmissions from the control center.

➤Codes to display messages sent from the Control Center to driver on the interaction monitor

➤Codes to identify pre-programmed messages on onboard monitors to inform the passenger. They are activated based on resident rules from the program memory, such as the arrival to a station

➤Enough memory capacity to store programs and package transmission rules with the Control Center and compatibility with other commands such as: mistime arrival to stations or points pre-defined in the services, bus diversion from the defined route over 100 meters, Bus start and end, Sudden switching-off of the Logic Unit, Unauthorized omission of a mandatory stop station, Bus stopping at an unauthorized station, Stops not



included in the itinerary, Panic alarm activation by the driver, Instant speed higher than the speed allowed in a route section of the service, Waiting at main stations, Inability to provide the next service, Excessive time without moving or standing at a station, Delay or advance in service route due to one or several buses covering a service route, Bus saturation at a station, Queue-length controls and blocking at intersections, Traffic jam at intersections, Transmission of locations pursuant to default time frequency and the corresponding exchange of information to generate all the operation reports in the Control Center.

➤ Easy way to store packages when they cannot be transmitted, and transmit them when having access to the transmission means

➤ Modem with proper power for the required functionality with at least 0-6watts output RF and a Hard-mounted GPS transmission antenna with at least 5dB (Absolute Gain at Zenith), provided that they are technologically compatible with the Control Center and the Operation Control System used in the SITP, in which case TRANSMILENIO S.A. shall establish the technical conditions to be observed by the AUTHORIZED DEALER for that purpose.

7.2.1.1.13. Entrances and exits:

➤ Manual buttons.

➤ Maximum panic button with contacts normally open and installed on the floor, hidden and at driver's reach, with an high-gain ambient microphone activated by driver for the control center to listen to conversations in the bus.

➤ Switch buttons with normally open contacts installed in the monitor of driver's interaction.

➤ At least six (6) serial communication ports for RS232, RS485 or TTL interfaces.

➤ At least one (1) parallel port.

➤ Incoming and outgoing communication port for the driver's interaction monitor.

7.2.1.1.14. Logic unit configuration

➤ Reception and configuration of bus route lines from the Control Center through data sending, specifying the service, service routine and service start.

➤ Reception of differential correction of services (new "offset" or service start time) and GPS sent by the control center through the online transmission means, which will be based on the functionality and detailed designed of the installed system.

➤ Compatibility with the software installed in the Control Center by receiving the package-transmission activation command from the Control Center by means of online communication.

➤ Receive itinerary corrections sent by the Control Center through the online communication means, in case of bus

delay or advance for buses in the same service.



7.2.1.1.15. Logic unit power supply:

- The power supply must be chassis negative.
- The voltage must be regulated from 0 to 24DCV, with short-circuit and overvoltage protection and capacity to supply 10 amps.
- Ground connection directly from the vehicle's main power source.
- Main supply from the bus electric system.
- Alternate intelligent power through rechargeable battery is activated when the main power supply is interrupted.

7.2.1.1.16. List of functional requirements of driver interaction monitors:

- Keyboard to enter codes to the logic unit.
- Alphanumeric screen of at least 80 characters.
- Internal acoustic notice for message reception in the unit.
- Alarm push button.
- Input and output interface to the logic unit.

7.2.1.1.17. Operation Specifications.

- Certificate issued by an official institution on standards EIA RS152/RS204 for environmental specifications in both the exterior box and exterior connectors protecting against:
 - 8g pic rom vibration, 100 to 1000Hz.
 - 30g impact during 6 milliseconds.
 - Dust pursuant to standard SAEJ1455 or equivalent
 - 98% Humidity at to 66°C.
- Mean Time Between Failures (MTBF) of the Logic Unit of at least 50.000 hours, submitting the relevant written certificate issued by an official bureau of specifications.

7.2.1.1.18. Functional specifications of the voice communication system.

- Radio communication equipment to communicate through the Trunking system compatible with the communication server of the system installed at the Control Center and it must be interfaced to the Logic unit for self-service of calls to that center.
- An input port for microphone including the microphone.

- A port for speaker outputs.
- Button to request communication with the Control Center incorporated to the radio and/or microphone.

7.2.1.1.19. PASSENGER ACCESSIBILITY

Vehicles must have direct access to the platform level for the system trunk operation. Each vehicle must have two (2) spaces reserved for wheel-chair passengers, as well as handrails and other means necessary for proper wheel-chair passenger fastening. Also, it must have ten (10) preferential use seats for physically challenged, elderly and pregnant passengers, located in special places and painted in blue.

7.2.1.2. ARTICULATED BUS TYPOLOGY

- It must be driven by dedicated engines that fulfill the requirements defined in current standards about technologies, clean fuels and emission standards defined by the relevant authority.
- It must have a rear central engine between axles under the passenger platform.
- It must be equipped with automatic transmission with built-in retarder.
- The vehicle must have the power, torque and transmission ratio to allow reaching a 40Km/h speed at full loading capacity in less than 22 seconds on a flat surface in the city of Bogotá.
- It must have an automatic suspension system; mixed suspensions or any other types are not accepted.
- It must have a speed regulation system so that the maximum speed allowed by the current National Code of Traffic in urban roads is not exceeded (60Km/h).
- It must have fuel storage tanks that allow autonomy and quick filling up, under conditions that allow providing services continuously all day long.

In case the selected bidder considers using electric bi-articulated buses, the contracting party shall evaluate –during the Concession validity term- the possibility of adjusting the useful life and/or reposition term of transport units pursuant to a technical study including but not limited to the perspective of both the manufacturers and the Transport operators who employ this kind of technology.⁵

⁵ A paragraph was added after the articulated bus typology bullets of the Operation Manual through Addendum No. 7

7.2.1.2.1. SPECIFIC DESIGN FEATURES

In order to operate in the SITP trunk system, the vehicles shall have to fulfill at least the NTC-4901-1 Colombian technical standard, and the following specific technical features:

- The seat distribution for these vehicles may be 2-2, 2-1, 1-1, 1-0, 0-0 face to face and along the perimeter of the vehicle's body. The vehicle must have 8 seats available for preferential use by the elderly, physically challenged, children and pregnant women. It must have a maximum capacity of 190 passengers.
- The driver's seat must be located in a way that allows:
 - Upper vision angle: to allow the driver to observe objects located 15000 millimeters ahead and 4500 millimeters from the ground.
 - Lower vision angle: to allow driver to observe objects located 800 millimeters ahead and 1400 millimeters from the ground.
- The entire road area at the vehicle's front end which is not directly seen by the driver must be viewable through mirrors.

All the interior finishing of the vehicle must be made of washable, wear-resistant, flame-retardant, self-extinguishable and non-toxic material, without prejudice to the fulfillment of safety specifications by the latest version of the NTC-3586 Colombian Technical Standard, or the FMVSS 302 Standard, or its international equivalent.

Passenger seats must have individual sitting position, ergonomic design, lumbar support and must have no holes on the back side, except for those required for children grip-handles; they must have no padding, upholstery; they must have anti-slip texture, technical tests certificates that guarantee color prevalence for at least 5 years, free of blades, edges or any sharp element which may cause injuries to passengers.

Passenger seats next to the central hall must have handrails or lateral grip-handles to facilitate children's firm and safe grip. These handrails or grip-handles must not affect the free wide space of the hall defined in the clause about internal vehicle measurements.

The driver's seat must be padded, with adjustable-strength hydraulic or pneumatic suspension and head rest. The horizontal, vertical and back adjustment must allow as least a horizontal movement of about 150 millimeters on the longitudinal axis, a vertical movement of about 100 millimeters on the vertical axis and a back inclination angle from 0 to 20 degrees measured with respect to the vertical one. The horizontal, vertical and back adjustment must be hydraulic or pneumatic. The materials must comply with the safety provisions specified in this manual without prejudice to the fulfillment of safety standards provided by the relevant authorities.

The interior finishing of the vehicle must be in plastic rolled melanimic material or any other wear-resistant washable material pursuant to the safety requirements of this specification. Under no circumstances may the



interior finishing and covering be covered in metal sheet. The seat anchoring may connect directly to the vehicle platform or the lateral panel of the body. In any case, the method to fasten seats must provide them with enough strength in case of accidents or abrupt movements so as to avoid passenger injuries. All the seat metalwork and other fastening elements must comply with the latest version of the NTC-3638 Colombian Technical Standard or its international equivalent. The following must be fulfilled without prejudice to the aforementioned:

- The seat fastening system must be resistant to breaking or crashing with longitudinal-horizontal strength of 3000N applied in two 1500N strengths each on the central axis of the upper back in each seat. For single seats, the fastening system must be resistant to breaking or crashing under total longitudinal-horizontal strength of 1500 N in the central axis of their upper back.
- The handrails and grip-handles must be resistant enough so that passengers can be standing during vehicle movement, even in case of emergency braking.
- The handrail surface must be free of edges and sharp corners and their ends must be curved, so as to avoid the hazard of user injury.
- The handrails must be continuous elements and must not have joints in places other than the intersections anchoring to the vehicle's body.
- The surface of all the bars and grip-handles must offer anti-slip handling without obstacles.
- The bars and grip-handles must have a section to allow passengers easy grip and tight holding. Every bar-handle shall be at least 150 millimeters long to place a hand, in case there are grip-beams with grip-bars, the minimum length of such bar would be 100 millimeters.
- The grip-bars must be circular or oval having a diameter from 30 to 45 millimeters. In case of oval section bars, the diameter shall be calculated as the arithmetic average from the higher to lower diameter.
- All the grip-bars must be made of stainless steel tubes in polished aluminum or steel covered by PVC encased plastic material.
- The horizontal grip-bars shall be located at a height from 1750 to 1900 millimeters, measured from the vehicle platform.
- The horizontal grip-bars next to each service door must be located at a height from 1850 to 1900 millimeters, measured from the vehicle platform. They must not block the access to hatchways or emergency exits located on the vehicle ceiling.
- In case there were seats in the area where horizontal grip-bars were located, they cannot be farther than 150 millimeters measured from the seat edge to the wall in direction to the windows.
- At least two (2) vertical grip-bars must be available, one at each side of the service doors and spaces reserved for wheel-chair passengers.
- There must be a vertical 1500-millimeter handrail every (2) seats, accordingly. The handrails may be fastened directly to the tube structure of seats, guaranteeing the safety conditions in any case.



➤ The seats must have a horizontal grip-bar in the upper back which under no circumstances should protrude over 150 millimeters from the back. The passenger seats cannot have lateral arms.

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The floor or platform and the emergency-door steps of the vehicle must be covered in synthetic anti-slip material pursuant to the safety and material provisions herein. The use of metal sheets as covering for the internal floor of the vehicle shall be absolutely forbidden.

The material covering the vehicle floor must last at least 10 years under the SITP operating conditions. This material must avoid liquid filtering, guaranteeing watertightness inside the vehicle.

The windows must comply with the material and safety conditions pursuant to the latest version of the NTC-1467 standard or its international equivalent. The side windows shall be divided horizontally in two independent modules. The lower module shall be fixed and fastened directly to the body structure by means of glues. The upper module must be available to open; it can be fastened through the framing and packing system. The minimum height of the upper module shall be 30% of the window height, and the maximum height of the upper module shall be 50% of the window height.

The use of framing and packing system shall be allowed to fasten the windows to the body when used to fasten the front windshield window and rear windshield window, the driver's window and upper modules of side windows. In all cases, the fastening frame must be in black anodized aluminum.

All the SITP articulated buses must have 4 double-doors of service and 1.10 meter-wide free space.

The service doors must be located to the left side of the vehicle, having two doors among the axles of the first body and one door at each side of the axle of the second body.

The service doors must have a trigger mechanism to guarantee adequate evacuation and a 2-second maximum opening time.

The emergency doors must have a trigger mechanism to ensure adequate evacuation and a 5-second maximum opening time.

The service doors must have at least 40% of its surface in glass.

The vehicles shall have a system that allows opening both service and emergency doors from the inside or outside of the vehicle in case of an emergency. This system shall have at least one spot for triggering the doors from the outside, which must be duly marked for easy triggering. The internal emergency triggering system must be clearly marked and protected with translucent red polycarbonate enclosures. Likewise, service doors must have an optical or audio signal easily identified by the driver sitting at his seat, under any lighting conditions, in order to alert when a door is not completely closed. This sign must light up or sound every time the door structure is ajar.

The vehicles shall have an audio and illuminated system at each service and emergency door to allow passengers noticing that the doors are going to open or close.

The vehicles shall have a system that prevents opening doors while the vehicle is moving and impedes starting the vehicle while any door is still open.



The opening and closing controls of service and emergency doors must allow the driver to invert the door movement at all times during the closing or opening action. The opening system of service doors must prevent passenger injuries by being trapped by the door when triggered.

The vehicle must have a radio control to control the opening and closing of the automatic door system installed at the single stations, together with the opening and closing system of the vehicle's service doors. This control must be compatible with the system currently installed at Caracas, Calle80, AutopistaNorte, Eje Ambiental, Avenida de las Américas, Norte-Quito-Sur, Autopista Sur, Calle26, Carrera10 and Carrera7 trunks, or at future expansion trunks of the system. The necessary wiring and electric protection must be considered for this purpose.

The vehicles for Massive Public Transportation of Passengers must have internal fluorescent lighting and/or new efficient-energy-use technologies with a minimum lighting of 200lux measured at a 1200 millimeter height over the vehicle platform in a dark room, including the following areas: Passenger and driver's compartment, access to any exit or entrance and the articulated section of the vehicle.⁶

The driving area must have a lighting system independent from the interior bus lighting, so that no light is reflected on the front windshield and safe driving is not blocked.

The door area must have an automatic lighting system that lights the vehicle floor. This lighting system must activate while the doors are open, provided that the interior lighting system is on.

7.2.1.2.2. Internal Measurements (in millimeters):

Dimensions	Minimum	Maximum
Free internal height	2100	

Dimensions	Minimum	Maximum
Upper visibility height	1750	
Lower visibility height	600	1000
Hall width	600	
Seat Separation	650	
Space between face-to-face seats	1300	
Seat depth	350	430
Seat width	400	

⁶ Paragraph fifteen (15) was modified after the second group of bullets from the specific design features of the Operation Manual through Addendum No.7



Seat height	350	450
Back Height	500	600
Free height of service doors	1900	
Free height of emergency doors	1800	
Free width of emergency doors	600	
Free width of service doors	1100	

For vehicles with rear engines, the minimum free-width of service doors shall be 1000 millimeters. Similarly, the lower visibility of windows may decrease up to 500mm measured from the area where passenger feet are placed to the lower window line, provided that it has a protection device up to 650mm height in order to avoid the chance of passengers falling off the bus.

The measurement of seat height for those seats located on the wheel arch or the steering gear box is performed from the floor where passengers place their feet.

7.2.1.2.3. SPECIFIC TECHNICAL FEATURES OF THE BODY

The typology of the initial fleet must comply with the following minimal technical features in terms of vehicle body:

The system vehicles may be built as a bodied chassis or as an integral self-supporting body vehicle. In any case, the vehicle configuration must comply with the accessibility provisions for passengers stated in the previous clause.

In the case of bodied vehicles and integral-body vehicles, the body must be made equivalent by the chassis manufacturer; therefore, the AUTHORIZED DEALER shall be subject to obtain from the vehicle manufacturer and enforce all the conditions for the design and construction of the body with regard to safety, accessibility, comfort and economy criteria. Under no circumstances may the vehicle be acquired through separate components, and the AUTHORIZED DEALER is subject to guarantee that the chassis and body are acquired jointly; and obtain the certificate from the chassis manufacturer stating that the body integrated to it is technically and operationally compatible.

The body structure must comply with the provisions from number 5 of the "*Regulation No.66 Uniform Provisions concerning the approval of Large Passenger Vehicles with regard to the Strength of their Superstructure*" document by the United Nations.

The chassis design criteria shall consider the optimization of surfaces available for passengers in order to place the elements.

The chassis or body structure shall not be modified, except with express approval from manufacturer authorized by TRANSMILENIO S.A. A modification shall be any change of dimensions and relocation of structural chassis or body components, relocation of engine, transmission and steering gear box.

In the case of self-supporting body vehicles, the modification of body elements or relocation of mechanical or structural parts is absolutely forbidden to any agents other than the structure manufacturer.



The system buses shall not use chassis designed and made to be used in loading and traction vehicles (tractors, trucks, trailers and semi-trailers).

The body structure must incorporate metal materials such as steel or light metals. Without prejudice to the aforementioned, mixed structures may be built employing other materials whose features offer strength, lasting and safety equal or higher than that of metal materials.

The joints of elements comprising the body and those attached to it must be firmly joined to one another, minimizing the level of vibrations and noise inside the passenger space.

The body structure must be designed to support a static load on the roof equivalent to 50% of the maximum weight supported by the vehicle, evenly distributed along the area, for 5 minutes, without experiencing deformation over 70 millimeters at all points. In order to verify compliance with this condition, the manufacturer must submit a certificate evidencing –through structural design, physical tests or computer modeling- that the design fulfills the required strength and deformation parameters.

Additionally, it must have a fastening metal sheet for grounding of devices to be installed in the upper body parts (radio antennas, communications, GPS, etc.).

The vehicle must have thermal flameproof set-up in the engine area and other areas near high-heat sources in order to guarantee that the temperature inside the passenger space at areas near heat sources, measured in a 100 millimeter radius, is not higher than 28°C (maximum temperature in the passenger and driver compartments).

The vehicle must have acoustic isolation so that the maximum noise level allowed inside the vehicle is 90dB (A), at any point for a maximum 30-minute exposition period.

The passenger space and its ventilation system must not allow flows of water, dust, smoke and any other damaging agent that annoys passengers. Every vehicle must have an instrument board, with at least the following instruments: speed indicator, engine revolution indicator, fuel level and oil pressure, temperature, voltage, lights on, manometer for the air-pressure of the braking system, with a red led, and a space suitable to install the logic unit display and audio alarm indicating low pressure of the pneumatic braking system under 50N/cm². In addition, it must have a visible indicator for the driver, which alerts every time there is a variation from normal operation conditions of the braking system and weight control. The signals of abnormalities in normal operation conditions must be compatible with the vehicle's logic unit.

Every vehicle for the SITP must have a digital tachograph to record and store the following information: speed, running time and stop time, and traveled distance. This equipment must have the capacity to record and store the information generated for at least 24 hours, during this period all speed variations occurred from 0 to 120Km/h must be recorded. This equipment in each vehicle must be calibrated and certified by the tachograph provider; likewise, it must be connected to the logic unit through a digital input signal.



All vehicles must have minimum space of 270 millimeter width by 180 millimeter height in each vehicle body in order to place the internal numbering assigned by TRANSMILENIO S.A.

All vehicles must have a user information system (LED, plasma, LCD or other similar type) depending on the bus body. It must not fog up and must inform passengers visually and with sound about the service provided, the current stop station, the next two stops, and the final destination. This system must extract and display the information stored in the logic unit onboard, and must be able to communicate to the control center of the SITP. The connection to the logic unit onboard is through an RS232 port. The minimum dimensions for these boards are 85mm height by 500 mm length and one must be placed per bus wagon in areas that allow the greatest visibility for users without impacting passenger accessibility or safety. All SITP vehicles must have the following factory-made electronic indicators of destination:

- Frontal indicator of destination: it will show information about the service currently provided by the vehicle. It must be located to the front on the upper windshield section. The frontal indicator of destination will be 1750 millimeters length by 250 millimeter height, without prejudice to having a system that allows reading a minimum distance of 100 meters during both day and night. This indicator must have a system to prevent fog up of information shown under any adverse weather conditions.
- Lateral Indicators of Destination: it must have at least the destination number of the service provided on each body of the bus, there must be at least one indicator and it will be located on top or at upper sections next to the access doors. It will have minimum dimensions of 450 millimeter length by 250 millimeter height.
- Rear indicator of destination: It must contain at least the service number and shall be located at the right upper section of the rear windshield. It will have a minimum dimension of 450 millimeters length x 250 millimeters high.

7.2.1.2.4. VEHICLE WEIGHT

The vehicle weight must comply with the following limits:

AXLE	MAXIMUM LOAD ALLOWED
First axle	7.5Ton
Second axle	12.5Ton
Third axle	12.5Ton

The following will be considered to calculate the SITP bus weight: a 68kg mass per passenger, the maximum vehicle capacity, the seat distribution and the free areas available for standing passengers.

The maximum limits per axle defined by manufacturer shall not be exceeded under any circumstances. In order to calculate the maximum vehicle load, the standing passengers and sitting passengers will be added up.

The gross vehicle weight must be less than 30 tons in any case.

7.2.1.2.5. EXTERNAL DIMENSIONS

The external dimensions of SITP vehicles must comply with the standards issued by the relevant authority.



Notwithstanding the standards, vehicles will fulfill at least the following conditions.

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Vehicle width: 2600 maximum. Under no circumstances the width between the external sides of the rear axle wheels may exceed 150 millimeters on each side, and the external mirrors will not exceed the total vehicle width over 250 millimeters on each side.

Vehicle height: The total vehicle height may be exceeded in 4100 millimeters

Vehicle length: the maximum length allowed is 23000 millimeters; the minimum length allowed is 17000 millimeters.

Height from the ground to the height point of the body: it must be 280 millimeters or over.

Height from the ground to the platform: The actual height to load and unload passengers, measured from the road level to the vehicle platform shall be 880 millimeters minimum and 920 millimeters maximum.

Turning radius: The vehicle must comply with the provisions of the NTC4901-1 standard.

7.2.1.2.6. EMERGENCY AND SAFETY SYSTEMS

The vehicles for the SITP trunk operation must be equipped with the following emergency and safety systems:

A switch to request driver's help and the corresponding alarm on the instrument board, easily accessible to passengers located at the wheelchair area.

Two (2) single emergency doors on the right side of the vehicle. The emergency doors may open from the inside out by pushing manually in case of an emergency. Similarly, they must have an external mechanism to allow triggering in case they cannot be open from the inside. The emergency doors must have the corresponding access stair and an element that covers the area occupied by the stairs, which must have an automatic triggering mechanism to allow using the stair in case of emergency.

One (1) skylight with an ejection system per every thirty (30) passengers capacity, located on the vehicle ceiling and distributed evenly pursuant to the passenger location in each vehicle body. The skylights must have a minimum free area of 3000cm² so that it is possible to make a 500mm x 600mm rectangle in this area. In case of vehicles using compressed natural gas as fuel that require placing bottles on the roof, the ceiling will include as many skylights as possible. Those that cannot be placed must be replaced in like number with additional emergency windows.

The emergency windows must have fragmentation mechanisms pursuant to the NTC-1467 standard. The windows must be easy and quick to trigger from the inside of the vehicle at any time during operation.

Each emergency window must have a minimum free area of four thousand (4000) square centimeters, so that a 500mm x 700mm rectangle can pass through it.



All vehicles must have green safety glasses pursuant to the technical specifications provided by the latest version of the NTC-1467 Colombian Technical Standard, which must be fulfilled for this purpose as follows:

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Back and Side Window(s)	Tempered Glass(es)
Frontal Windshield	Laminated Glass(es)

Glasses must be transparent and free from every commercial, advertising or sticker that blocks visibility except for stickers indicating emergency exits or legal requirements such as technical revisions provided by the National Code of Traffic.

All SITP buses must comply with the provisions of the National Code of Land Traffic in terms of braking systems. Without prejudice to this condition, they must have a pneumatic anti-lock ABS braking system with an independent double-circuit.

Vehicles must have a mechanical forced ventilation system that ensures air renewal at least every thirty (30) times per hour by using fans and extractors evenly distributed along the body, with a minimum 330m³/hr. capacity per fan. The air renewal produced by opening doors and/or windows and/or hatches of the vehicle shall not be taken into account.

The driver seat must have a three-speed mechanical ventilation system with adjustable grilles for face, body and feet.

The frontal windshield must have a de-misting system able to remove air condensation from the entire glass, under any operating condition of the vehicle, which must be certified through manufacturer's measurements on the de-misting system (the minimum capacity of this system must be 1200m³/hour).

The vehicle must be equipped with fixed dividing panels from 700mm to 800 mm high in the following cases:

In front of seats located at emergency stair areas

At the back of the driver's seat, complemented by a transparent panel reaching a maximum height of 1800 millimeters

The vehicle's battery must be located outside the passenger space and must have an available device located within driver's reach that allows cutting the power coming from the battery.

All vehicles must have three point retractable seat-belts at the driver's seat pursuant to NTC1570, NTC2037 standards or their international equivalent as applicable. Likewise, they must have a visual and audio alarm that activates in case the driver starts moving the vehicle not using the safety-belt.



The space for the physically challenged in wheel chairs must be located at the first body of the vehicle as close as possible to an access door. This space must be duly marked for wheelchair users. The minimum space must be 900mm x 1400mm and the symmetry axis of seats must be parallel to the longitudinal bus axis. There must also be a handrail in each space to facilitate entry and exit of the aforementioned users. The physically challenged in wheel chairs must travel held tight by means of a mechanism anchored to a structural element of the vehicle. The fastening mechanism must have a simple and quick-operation system that allows using the area as a free space when not in used by physically challenged in wheel-chairs.

Fuel tanks must be either enclosed inside a metal structure for protection in case of crashing or rollover or located between the two chassis frames. These structures must be installed by the vehicle's chassis assembler.

The piping of the fuel-feeding system must never go through the passenger space. They must be protected and kept free of leaks or escapes, abnormal torsional stress, bending, friction and vibration.

The fuel piping path must be designed so that a possible leaking has no chance to drop on the exhaust system or any other heat source.

There must be a fuel-cut valve as close as possible to the fuel tank that can be handled from the driver's control board.

The electric system must be sealed and protected from moist. Under no circumstances can the electric system be located inside the passenger cabin.

Every electric cable going through a hole must be fastened to prevent movement and the hole must have proper protection to avoid cable damage by cut or friction.

The entire external lighting system and brake lights, emergency lights and turn signals shall comply with the NTC4901-1 standard.

The rear brake lights must have a minimum dimension to cover a 140mm-diameter circle and must have a third brake light located on the upper middle section of the body with the same aforementioned dimensions. They must be visible from a 100-meter distance under any weather condition. The rear brake lights, position lamps, reversing lamps, and turn signals must comply with the European regulations of European Standards No. 6, 7 and 23 related to international illumination levels.

The front lamps must comply with the specifications from Standard No 87 *"Uniform Provisions concerning the approval of daytime running lamps for power driven vehicles"* by the United Nations related to the capacity and tests in order to be used as daytime lamps.



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Each vehicle must be equipped with three ABC extinguishers. One is to be located next to the driver's seat with a minimum 10lb capacity, the second in the articulation area at least 1.20 meters high from the floor, and the third extinguisher in the second body. They must be duly marked.

Vehicles driven by Vehicular Compressed Natural Gas and their components (hoses, pipes, pressure relief valves, air-gas mixer, excess flow valves, gas relief devices, hermetic cover, gas injectors, rigid pipe lines, filter, gas flow adjusting device, accessories and flexible pipe lines) must comply with the Colombian Technical Standards NTC3561, NTC-4300, 4830-2, 4830-3, 4830-4, 4830-5, 4830-6, 4830-7, 4830-8, 4830-9, 4830-10, 4830-11, 4830-12, 4830-13, 4830-14, 4830-15, 4830-16 and 4830-17.

Vehicles driven by Vehicular Compressed Natural Gas must comply with the provisions of Colombian Technical Standards NTC3847 and NTC4828 related to the tests and requirements to be fulfilled by cylinders used to store this type of fuel.

Vehicles driven by other type of clean fuel pursuant to those defined by law must comply with the provisions of the Technical Standards defined by the relevant authority for this purpose.

7.2.1.2.7. TECHNICAL SPECIFICATIONS TO INSTALL LOGIC CONTROL UNITS

The vehicle to be incorporated into the SITP trunk operation must be equipped with the following elements as a pre-installation of the logic unit for voice and data localization, processing and transmission.

Odometer System of the Vehicle: we require the odometer system of the vehicle to have a pulse output other than that used for the instrument board's speedometer, by using a signal source with a TTL level under 500 pulses per mile at 2500 pulses per second at the vehicle's max speed, with a spacing between pulses over 125 microseconds. This connection to the odometer must use a 20 AWG (pair) black and white signal cable. This cable must have a 4-meter maximum length.

Location of the Logic Unit: the vehicle must have a space in the driver assigned area where the logic unit and other communication equipment and systems are to be installed. The space assigned to the logic unit must fulfill the following minimum requirements:

- Be located at less than 5 meters from the driver's seat, where the logic unit and control display will be installed.
- It must be free from dust and moist
- It must allow ventilation
- It must be vibration-free
- It must be located out of passenger reach
- The space assigned to install the equipment must house equipment with the following dimensions: 70cmX 50cmX 20cm and a 3.5kg weight.

7.2.1.2.8. Location of Antennas:



➤The vehicle must have a place on the roof with support sheets to install the GPS antenna, and the radio communication and data transmission antennas.

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➤The GPS and communication antennas must be located to a minimum distance of (3) meters from one another.

➤The GPS antenna location must allow connecting to a logic unit through a 4-millimeter coaxial cable, less than 5-meter length. The vehicle must have holes and other devices required for wiring and installing the GPS antenna, rubber edge protection and corners of said holes. The purpose is to protect the aforementioned wiring.

➤The GPS antenna shall have maximum diameter of 12 centimeters and a maximum height of 3.5 centimeters.

➤The communication antenna location must allow connecting to the Logic-Unit installation location through a cable less than 20-meter long. The vehicle must have holes and other devices required for wiring and installing communication antennas and rubber edge protectors, and the corners of such holes in order to provide wiring protection.

➤In any case, the place where antennas are installed must have access from the inside of the vehicle for installation and maintenance purposes.

➤In case the roof material is non-conductive, the vehicle manufacturer must place a metal sheet on the roof of at least 0.4 square for fastening and grounding, which is to be used to install the GPS antenna.

➤The installation area on the roof for the antennas cannot have a horizontal tilt over 10 degrees.

➤ In order to wire the coaxial cable required there must be a pipe with a minimum 3/4" diameter between the antenna installation point and the place defined for the logic units and other equipment required by the Operation Control System. This pipe must have no angles so that cables can be installed.

➤ The vehicle manufacturer must have all the seals and mechanisms to avoid water entry into the vehicle.

7.2.1.2.9. Vehicle wiring:

The installation area of the logic units must have a DC supply cable and its corresponding fuse or protection system. This will be a two-way cable with at least 10 AWG for a 24DVC voltage and 20 amps

The installation area of logic units must have a power supply cable from the vehicle's on switch and its corresponding fuse or protection system. This will be a two-way cable, at least 10 AWG for a 24DVC voltage and 20amps.

The installation area of logic units must have a grounded cable. This cable must be at least 20AWG.

7.2.1.2.10. VEHICLE ENVIRONMENTAL PERFORMANCE

The engine and vehicle control systems must certify and keep an environmental performance that complies with the current environmental standards related to technologies, clean fuels, emission levels and controls defined by the relevant authority.

For all purposes and permanently during the concession validity term, all vehicles provided by the AUTHORIZED DEALER to the trunk operation shall fulfill the following minimum environmental performance provisions:

- All vehicles must have a catalytic converter or emission control system with capacity and features compatible with the engine, technology and clean fuel used, pursuant to the regulation or standard adopted by the relevant ruling authority.

- After the vehicles are placed in Bogotá and duly adjusted or calibrated and acclimatized, it must be guaranteed that they fulfill current standards on maximum emission levels of mobile sources issued by the relevant authority (such as the Secretaria Distrital de Ambiente, Ministerio de Ambiente, Vivienda y Desarrollo Territorial, Ministerio de Transporte, among other).

- Under no circumstance or time during the concession validity term may vehicles have

external noise emission levels over 90dB (A), to the measurement procedure established in standard 70/157/EEC.



All the vehicles must comply with the standards and maximum limits of emission permitted by Resolution 2604 from 2009 or any modifying, adding or substituting standard. All vehicles must have a catalytic converter or emission control system with capacity and features compatible with the engine, technology and clean fuel used, pursuant to the regulation or standard adopted by the relevant ruling authority. In the case of gas or diesel vehicles complying with emission standards equivalent to EURO IV or higher, based on the emission levels defined in resolution 2604 from 2009 or its modifying, adding or substituting standards, they must have an emission control device or onboard diagnostic system OBD (OnBoard Diagnosis) (or DAB in Spanish) pursuant to standards of directives 2005/55/EC and 2005/78/EC⁷

7.2.1.2.11. OPERATION CONTROL SYSTEMS

The SITP trunk buses must be equipped with a logic unit of voice and data localization, procedure and transmission that fulfills the technical features required to interact with the control system of TRANSMILENIO S.A.'s operation, keep effective communication with TRANSMILENIO S.A. control center, receive signals sent by the control center to communicate with each operating vehicle, allowing TRANSMILENIO S.A. to give orders and supervise activities inside the SITP vehicle permanently and continuously. The fulfillment of these specifications is subject to prior, express and written approval by TRANSMILENIO S.A.

Additionally, the AUTHORIZED DEALER shall be subject to perform any improvement or modification on equipment required for appropriate system operation, whenever required by TRANSMILENIO S.A. This shall be a permanent obligation for the AUTHORIZED DEALER during the agreement validity term. The AUTHORIZED DEALER must acquire the licenses needed to use the software installed on the equipment.

In order to incorporate the fleet to the regular SITP operation, the logic unit and monitor must comply with the following basic technical specifications, with no restriction for TRANSMILENIO S.A. to require introducing changes in the following specifications or the software related to the logic unit due to technical and operational needs:

7.2.1.2.12. GPS signal reception

➤ Accuracy of GPS reception of at least 25m without differential techniques in 50% of the

⁷ A fourth paragraph was added to Number 7.2.1.2.10- Vehicle Environmental Performance (Articulated Bus) of the Operation Manual through Addendum No. 4.



cases and less than 10 meters with differential technology in 95% or more cases.

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➤➤"Hard Mounted" GPS reception antenna with security seal of at least 25dB, with an operation temperature range from -30°C to 85°C and a connection cable with the required length.

➤The minimum number of satellite channels for "Selective Availability" is 8

7.2.1.2.13. Processing component:

➤Microprocessor of operating technology lower than PentiumDX2 at 133MHZ.

➤Enough memory capacity to store and exchange service data and services with the Control Center. Coordinates of stations and service reference points, Start date of each service to be performed by the bus ("offset"), Route time between points for each service to be performed by the bus, Standing time at route points per service, Medium speed based on service section and per service, Announce the next stop depending on the service being provided, Confirm service exit and/or line change one station before the exit point, Display the travel type to be performed on screen.

➤Differential correction parameters for GPS reception coming in transmissions from the control center.

➤Codes to display messages sent from the Control Center to driver on the interaction monitor

➤Codes to identify pre-programmed messages on onboard monitors to inform the passenger. They are activated based on resident rules from the program memory, such as the arrival to a station

➤Enough memory capacity to store programs and package transmission rules with the Control Center and compatibility with other commands such as: mistime arrival to stations or points pre-defined in the services, bus diversion from the defined route over 100 meters, Bus start and end, Sudden switching-off of the Logic Unit, Unauthorized omission of a mandatory stop station, Bus stopping at an unauthorized station, Stops not included in the itinerary, Panic alarm activation by trunk-bus driver, Instant speed higher than the speed allowed in a route section of the service, Waiting at main stations, Inability to provide the next service, Excessive time without moving or standing at a station, Delay or advance in service route due to one or several buses covering a service route, Bus saturation at a station, Queue-length controls and blocking at intersections, Traffic jam at intersections,



Transmission of locations pursuant to default time and frequency and the corresponding exchange of information to generate all the operation in the Control Center

➤ Easy way to store packages when they cannot be transmitted, and transmit them when having access to the transmission means

➤ Modem with proper power for the required functionality with at least 0-6watts output RF and a Hard-mounted GPS transmission antenna with at least 5dB (Absolute Gain at Zenith), provided that they are technologically compatible with the Control Center and the Operation Control System used in the SITP, in which case TRANSMILENIO S.A. shall establish the technical conditions to be observed by the AUTHORIZED DEALER for that purpose.

7.2.1.2.14. Entrances and exits:

➤ Manual buttons:

➤ Maximum panic button with contacts normally open and installed on the floor, hidden and at driver's reach, with an high-gain ambient microphone activated by driver for the control center to listen to conversations in the bus.

➤ Switch buttons with normally open contacts installed in the monitor of driver's interaction.

➤ At least six (6) serial communication ports for RS232, RS485 or TTL interfaces.

➤ At least one (1) parallel port.

➤ Incoming and outgoing communication port for the driver's interaction monitor.

7.2.1.2.15. Logic unit configuration

➤ Reception and configuration of bus route lines from the Control Center through data sending, specifying the service, service routine and service start.

➤ Reception of differential correction of services (new "offset" or service start time) and GPS sent by the control center through the online transmission means, which will be based on the functionality and detailed designed of the installed system.

➤ Compatibility with the software installed in the Control Center by receiving the package-transmission activation command from the Control Center by means of online communication.



- Receive itinerary corrections sent by the Control Center through the online communication means, in case of bus delay or advance for bus arrival service.

7.2.1.2.16. Logic unit power supply:

- The power supply must be chassis negative.
- The voltage must be regulated from 0 to 24DCV, with short-circuit and overvoltage protection and capacity to supply 10 amps.
- Ground connection directly from the vehicle's main power source.
- Main supply from the bus electric system.
- Alternate intelligent power through rechargeable battery is activated when the main power supply is interrupted.

7.2.1.2.17. List of functional requirements of driver interaction monitors:

- Keyboard to enter codes to the logic unit.
- Alphanumeric screen of at least 80 characters.
- Internal acoustic notice for message reception in the unit.
- Alarm push button.
- Input and output interface to the logic unit.

7.2.1.2.18. Operation Specifications.

- Certificate issued by an official institution on standards EIA RS152/RS204 for environmental specifications in both the exterior box and exterior connectors protecting against:
 - 8g pic rom vibration, 100 to 1000Hz.
 - 30g impact during 6 milliseconds.
 - Dust pursuant to standard SAEJ1455 or equivalent
 - 98% Humidity at to 66°C.
- Mean Time Between Failures (MTBF) of the Logic Unit of at least 50.000 hours, submitting the relevant written certificate issued by an official bureau of specifications.



7.2.1.2.19. Functional specifications of the communication system.

- Radio communication equipment to communicate through the Trunking system compatible with the communication server of the system installed at the Control Center and it must be interfaced to the Logic unit for self-service of calls to that center
- An input port for microphone including the microphone.
- A port for speaker outputs
- Button to request communication with the Control Center incorporated to the radio and/or microphone.

7.2.1.2.20. PASSENGER ACCESSIBILITY

Vehicles must have direct access to the platform level for the SITP trunk operation. Each vehicle must have a space reserved for wheel-chair passengers, as well as handrails and other means necessary for proper wheel-chair passenger fastening. Also, it must have eight (8) preferential use seats for physically challenged, elderly and pregnant passengers, located in special places and painted in blue.

7.2.1.3. FEEDER BUS AND TRANSIT BUS TYPOLOGY

- It must be a single body vehicle.
- The new buses to be incorporated must be latest models
- It must have enough power, torque and transmission ratio to allow reaching a 40Km/h speed at full loading capacity in less than 22 seconds on a flat surface in the city of Bogota
- The vehicle engine and control system must certify and maintain an environmental performance complying with the current standards on technologies, clean fuels, emission levels and control defined by the relevant authority.
- For all purposes and permanently during the concession validity term, all vehicles provided by the AUTHORIZED DEALER to the trunk operation shall fulfill the following minimum environmental performance provisions:
 - All vehicles must have a catalytic converter or emission control system with capacity and features compatible with the engine, technology and clean fuel used, pursuant to the regulation or standard adopted by the relevant ruling authority.
 - After the vehicles are placed in Bogota and duly adjusted or calibrated and acclimatized, it must be guaranteed that they fulfill current standards on maximum emission levels of mobile sources issued by the relevant authority (such as the Secretaria Distrital de Ambiente,

Ministerio de Ambiente, Vivienda y Desarrollo Territorial, Ministerio de Transporte, among other)



- The bus ascending capacity must be at least 20% higher than that required to climb the steepest slope in the operation area.
- It must have a speed regulation system so that the maximum speed allowed by the current National Code of Traffic in urban roads is not exceeded (60Km/h).
- It must have fuel storage tanks that allow 260Km autonomy and quick filling up.

In case the selected bidder considers using electric bi-articulated buses, the contracting party shall evaluate –during the Concession validity term- the possibility of adjusting the useful life and/or reposition term of transport units pursuant to a technical study including but not limited to the perspective of both the manufacturers and the Transport operators who employ this kind of technology.⁸

When the vehicle typology provided establishes accurate dimensions for the different vehicle features, or in case maximum and minimum ranges are set for vehicle features, or if specific features are indicated; any modification on these features or the use of variations on these ranges shall be accepted only through prior express and written consent by TRANSMILENIO S.A., which may be provided upon request from the AUTHORIZED DEALER, and provided that they are supported by technical studies fully justifying such modification.

Likewise TRANSMILENIO S.A. may add or remove elements from the vehicle typology in order to improve the System operation due to the infrastructure's technological features, in mutual agreement with the authorized dealers. The cost for implementing this changes or modifications will be in charge of the AUTHORIZE DEALER.

7.2.1.3.1. SPECIFIC DESIGN FEATURES

The typology of vehicles with 80 to 120 passenger capacity intended for SITP route operation must comply at least with Colombian Technical Standard NTC4901-3 and the following specific technical features:

It must have a minimum total capacity of 80 passengers (standing and sitting passengers).

The seat distribution for these vehicles may be 2-2, 2-0, 2-1, 1-1, 1-0, 0-0 face to face or along the perimeter of the vehicle's body. The vehicle must have 6 seats available for preferential use by the elderly, physically challenged, children and pregnant women. Only

⁸ A paragraph was added after the bullets of the Feeder Bus and Transit Bus Typology section of the Operation Manual through Addenda No. 7.



one row of seats can be located on the left side in front of the vehicle doors. .⁹

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All the interior finishing of the vehicle must be made of washable, wear-resistant, flame-retardant, self-extinguishable and non-toxic material, without prejudice to the fulfillment of safety specifications by the latest version of the NTC-3586 Colombian Technical Standard, or the FMVSS 302 Standard, or its international equivalent.

All SITP buses must comply with the provisions of the National Code of Land Traffic in terms of braking systems. Without prejudice to this condition, they must have a pneumatic anti-lock ABS braking system with an independent double-circuit.

➤ The driver's seat must be located in a way that allows:

➤ Upper vision angle: to allow the driver to observe objects located 15000 millimeters ahead and 4500 millimeters from the ground.

➤ Lower vision angle: to allow driver to observe objects located 800 millimeters ahead and 1400 millimeters from the ground.

➤ The entire road area at the vehicle's front end which is not directly seen by the driver must be viewable through mirrors.

Passenger seats must have individual sitting position, ergonomic design, lumbar support and must have no holes on the back side, except for those required for children grip-handles; they must have no padding or upholstery. They must have anti-slip texture, technical tests certificates that guarantee color prevalence, namely, E=1 in the first year, E=2 being the color variation. If E exceeds the maximum values defined, the seats shall be changed. These seats must be free from edges, corners or any sharp element that may cause passenger injury.

The seats must have a horizontal grip-bar in the upper back, which under no circumstances should protrude over 150 millimeters from the back. These handrails or grip-handles must not affect the free wide space of the hall defined in the number about internal vehicle measurements.

The driver's seat must be padded, with adjustable-strength hydraulic or pneumatic suspension and head rest. The horizontal, vertical and back adjustment must allow as least a horizontal movement of about 150 millimeters on the longitudinal axis, a vertical movement of

⁹The third paragraph of Specific Design Features of the Operation Manual was modified through Addenda No. 7



about 100 millimeters on the vertical axis and a back inclination angle from 0 to 20 degrees measured with respect to the vertical one. The horizontal, vertical and back adjustment must be hydraulic or pneumatic. The materials must comply with the safety provisions specified in this manual without prejudice to the fulfillment of safety standards provided by the relevant authorities.

The interior finishing of the vehicle must be in plastic rolled melanimic material or any other wear-resistant washable material pursuant to the safety requirements of this specification. Under no circumstances may the interior finishing and covering be covered in metal sheets. The seat anchoring may connect directly to the vehicle platform or the lateral panel of the body. In any case, the method to fasten seats must provide them with enough strength in case of accidents or abrupt movements so as to avoid passenger injuries. All the seat metalwork and other fastening elements must comply with the latest version of the NTC–3638 Colombian Technical Standard or its international equivalent. The following must be fulfilled without prejudice to the aforementioned:

- The seat fastening system must be resistant to breaking or crashing with longitudinal-horizontal strength of 3000N applied in two 1500N strengths each on the central axis of the upper back in each seat. For single seats, the fastening system must be resistant to breaking or crashing under total longitudinal-horizontal strength of 1500 N in the central axis of their upper back.
- The handrails and grip-handles must be resistant enough so that passengers can be standing during vehicle movement, even in case of emergency braking.
- The handrail surface must be free of edges and sharp corners and their ends must be curved, so as to avoid the hazard of user injury.
- The handrails must be continuous elements and must not have joints in places other than the intersections anchoring to the vehicle's body.
- The surface of all the bars and grip-handles must offer anti-slip handling without obstacles.
- The bars and grip-handles must have a section to allow passengers easy grip and tight holding. Every bar-handle shall be at least 150 millimeters long to place a hand, in case there are grip-beams with grip-bars, the minimum length of such bar would be 100 millimeters.
- The grip-bars must be circular or oval having a diameter from 30 to 45 millimeters. In case of oval section bars, the diameter shall be calculated as the arithmetic average from the higher to lower diameter.



➤All the grip-bars must be made of stainless steel tubes or polished aluminum or steel covered by PVC encased plastic material.

➤The horizontal grip-bars shall be located at a height from 1750 to 1900 millimeters, measured from the vehicle platform.

➤The horizontal grip-bars next to each service door must be located at a height from 1850 to 1900 millimeters, measured from the vehicle platform. They must not block the access to hatchways or emergency exits located on the vehicle ceiling.

➤In case there were seats in the area where horizontal grip-bars were located, they cannot be farther than 150 millimeters measured from the seat edge to the hall in direction to the windows.

➤At least two (2) vertical grip-bars must be available, one at each side of the service doors and spaces reserved for wheel-chair passengers.

➤There must be a vertical 1500-millimeter handrail every (2) seats, accordingly. The handrails may be fastened directly to the tube structure of seats, guaranteeing in any case the safety conditions set forth herein.

➤ The floor or platform and the emergency-door steps of the vehicle must be covered in synthetic anti-slip material pursuant to the safety and material provisions in this agreement. The use of metal sheets (checkered plate) as covering for the internal floor of the vehicle shall be absolutely forbidden.

The material covering the vehicle floor must last at least 12 years under the SITP operating conditions. This material must avoid liquid filtering, guaranteeing watertightness inside the vehicle.

The windows must comply with the material and safety conditions pursuant to the latest version of the NTC-1467 standard or its international equivalent. The side windows shall be divided horizontally in two independent modules. The lower module shall be fixed and may be fastened by means of the framing and packing system. The upper module must be available to open; it can be fastened through the framing and packing system. The minimum height of the upper module shall be 40% of the window height, and the maximum height of the upper module shall be 50% of the window height.

The use of framing and packing system shall be allowed to fasten the windows to the body when used to fasten the front windshield window and rear windshield window and the



modules of side windows. In all cases, the fastening frame must be in black electrostatic paint.

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All the new vehicles for the SITP feeding operation must have 3 double-doors of service and 1.10 meter-wide free space. In exceptional cases, whenever the situation warrants, 2 doors shall be accepted upon approval by TRANSMILENIO S.A.

The service doors must be located to the right side of the vehicle.

The service doors must have a trigger mechanism to guarantee adequate evacuation and a 3-second maximum opening time.

In case emergency doors are used, they must have a trigger mechanism to ensure adequate evacuation and a 5-second maximum opening time.

The service doors must have at least 45% of its surface in glass pursuant to the safety provisions of the latest version of NTC-1467 standard.

The vehicles shall have a system that allows opening the doors from the inside or outside of the vehicle in case of an emergency. This system shall have at least one spot for triggering the doors from the outside, which must be duly marked for easy triggering. The internal emergency triggering system must be clearly marked and protected with translucent red polycarbonate enclosures. Likewise, service doors must have an optical or audio signal easily identified by the driver sitting at his seat, under any lighting conditions, in order to alert when a door is not completely closed. This sign must light up or sound every time the door structure is ajar.

The vehicles shall have an audio and illuminated system at each service and emergency door to allow passengers noticing that the doors are going to open or close.

The vehicles shall have a system that prevents opening doors while the vehicle is moving and impedes starting the vehicle while any door or emergency door is still open.

The opening and closing controls of service and emergency doors must allow the driver to invert the door movement at all times during the closing or opening action. The opening system of service doors must prevent passenger injuries by being trapped by the door when triggered.

The feeding operation vehicles for the Massive Public Passenger Transportation System must have internal fluorescent lighting and/or new efficient-energy-use technologies with a minimum lighting of 200lux measured at a 1200 millimeter height over the vehicle platform in



a dark room, including the following areas: Passenger and driver's compartment, access to any exit.¹⁰

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The driving area must have a lighting system independent from the interior bus lighting, so that no light is reflected on the front windshield and safe driving is not blocked.

The door area must have an automatic lighting system that lights the vehicle floor. This lighting system must activate while the doors are open, provided that the interior lighting system is on.

Internal Measurements (in millimeters):

Dimensions	Minimum	Maximum
Free internal height	2100	
Upper visibility height	1750	
Lower visibility height	600	1000
Hall width	600	
Seat Separation	700	750
Space between face-to-face seats	1300	
Seat depth	350	430
Seat width	400	
Seat height	350	450
Back Height	500	600
Free height of service doors	1900	
Free height of emergency doors	1800	
Free width of emergency doors	600	
Free width of service doors*	1100	

For vehicles with rear engines, the minimum free-width of service doors shall be 1000 millimeters. Similarly, the lower visibility of windows may decrease up to 500mm measured from the area where passenger feet are placed to the lower window line, provided that it has a protection device up to 650mm height in order to avoid the chance of passengers falling off

¹⁰ Paragraph fifteen (15) was modified after the second bullet group of Specific Design Features of the Operation Manual through Addendum No. 7.



the bus.

The measurement of seat height for those seats located on the wheel arch or the steering gear box is performed from the floor where passengers place their feet.

7.2.1.3.2. TECHNICAL BODY FEATURES

The fleet typology for the feeding fleet operation must comply always with the following minimum technical features related to the vehicle body:

- The SITP vehicles may be built as a bodied chassis or as an integral self-supporting body vehicle. In any case, the vehicle configuration must comply with the accessibility provisions for passengers.

- In the case of bodied vehicles and integral-body vehicles, the body must be made equivalent by the chassis manufacturer; therefore, the AUTHORIZED DEALER shall be subject to obtain from the vehicle manufacturer and enforce all the conditions for the design and construction of the body with regard to safety, accessibility, comfort and economy criteria. Under no circumstances may the vehicle be acquired through separate components, and the AUTHORIZED DEALER is subject to guarantee that the chassis and body are acquired jointly; and obtain the certificate from the chassis manufacturer stating that the body integrated to it is technically and operationally compatible.

- The body structure must comply with the provisions from number 5 of the "*Regulation No.66 Uniform Provisions concerning the approval of Large Passenger Vehicles with regard to the Strength of their Superstructure*" document by the United Nations.

- The chassis design criteria shall consider the optimization of surfaces available for passengers in order to place the elements.

- The chassis or body structure shall not be modified, except with express approval from manufacturer authorized by TRANSMILENIO S.A. A modification shall be any change of dimensions and relocation of structural chassis or body components, relocation of engine, transmission and steering gear box.



➤ In the case of self-supporting body vehicles, the modification of body elements or relocation of mechanical or structural parts is absolutely forbidden to any agents other than the structure manufacturer.

➤ The SITP buses shall not use chassis designed and made to be used in loading and traction vehicles (tractors, trucks, trailers and semi-trailers).

➤ The body structure must incorporate metal materials such as steel or light metals. Without prejudice to the aforementioned, mixed structures may be built employing other materials whose features offer strength, lasting and safety equal or higher than that of metal materials.

➤ The joints of elements comprising the body and those attached to it must be firmly joined to one another, minimizing the level of vibrations and noise inside the passenger space.

➤ The body structure must be designed to support a static load on the roof equivalent to 50% of the maximum weight supported by the vehicle, evenly distributed along the area, for 5 minutes, without experiencing deformation over 70 millimeters at all points. In order to verify compliance with this condition, the manufacturer must submit a certificate evidencing – through structural design, physical tests or computer modeling- that the design fulfills the required strength and deformation parameters.

Additionally, it must have a fastening metal sheet for grounding of devices to be installed in the upper body parts (radio antennas, communications, GPS, etc.).

➤ The vehicle must have thermal flameproof set-up in the engine area and other areas near high-heat sources in order to guarantee that the temperature inside the passenger space at areas near heat sources, measured in a 100 millimeter radius, is not higher than 10°C compared to the maximum temperature in the passenger and driver compartments (28°C).

➤ The vehicle must have acoustic isolation so that the maximum noise level allowed inside the vehicle is 90dB (A), at any point for a maximum 30-minute exposition period.

➤ The passenger space and its ventilation system must not allow flows of water, dust, smoke and any other damaging agent that annoys passengers.



➤ Every vehicle must have an instrument board with at least the following instruments: speed indicator, engine revolution indicator, fuel level and oil pressure, temperature, voltage, lights on, manometer for the air-pressure of the braking system, with a red led, and a space suitable to install the logic unit display and audio alarm indicating low pressure of the pneumatic braking system under 13.7N/cm^2 . In addition, it must have a visible indicator for the driver, which alerts every time there is a variation from normal operation conditions of the braking system.

➤ All SITP vehicles must have minimum space of 270 millimeter width by 180 millimeter height in the vehicle in order to place the internal numbering assigned by TRANSMILENIO S.A.

➤ All SITP vehicles must have the following factory-made electronic indicators of destination:

➤ Frontal indicator of destination: it will show information about the service currently provided by the vehicle. It must be located to the front on the upper windshield section. The frontal indicator of destination will be 1750 millimeters length by 250 millimeter height, without prejudice to having a system that allows reading a minimum distance of 100 meters during both day and night. This indicator must have a system to prevent fog up of information shown under any adverse weather conditions.

➤ Lateral Indicators of Destination: it must have at least the number and destination of the service provided and shall be located next to the first service door. It will have minimum dimensions of 450 millimeter length by 150 millimeter height.

➤ Rear indicator of destination: It must contain at least the service number and shall be located at the right upper section of the rear windshield. It will have a minimum dimension of 450 millimeters length x 250 millimeters high.

➤ The frontal, lateral and rear route indicators must be duly incorporated to the vehicle's body, together with the corresponding lighting system.

7.2.1.3.3. VEHICLE WEIGHT

The vehicle weight must comply with the following limits:



AXLE	MAXIMUM LOAD ALLOWED
First axle	7.5Ton
Second axle	12.5Ton

The following will be considered to calculate the SITP bus weight: a 68kg mass per passenger, the maximum vehicle capacity, the seat distribution and the free areas available for standing passengers.

The maximum limits per axle defined by manufacturer shall not be exceeded under any circumstances. In order to calculate the maximum vehicle load, the standing passengers and sitting passengers will be added up.

The gross vehicle weight must be less than 20 tons in any case

7.2.1.3.4. EXTERNAL DIMENSIONS

The external dimensions of SITP vehicles must comply with the standards issued by the relevant authority. Notwithstanding the standards, vehicles will fulfill at least the following conditions:

- Vehicle width: Maximum 2600 millimeters. Under no circumstances the width between the external sides of the rear axle wheels may exceed 150 millimeters on each side, and the external mirrors will not exceed the total vehicle width over 250 millimeters on each side.
- Vehicle height: The total vehicle height may be exceeded in 4100 millimeters
- Vehicle length: the maximum length allowed is 13500 millimeters; the minimum length allowed is 10750 millimeters.
- Rear overhang: must not exceed 3000 millimeters.
- Front overhang: must not exceed 3500 millimeters.
- Height from the ground to the height point of the body: it must be 280 millimeters or over

7.2.1.3.5. TURNING RADIUS

The vehicle shall comply with the following turning radius:

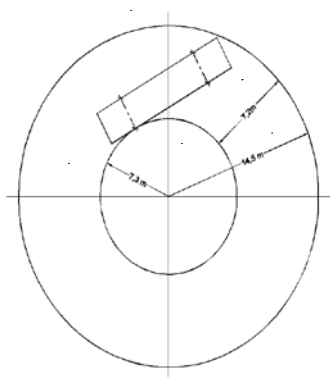
- The vehicle must draw its trajectory in an external-radius (distance between walls) and internal-radius (distance between sidewalks) annulus pursuant to the following table:



Vehicle Configuration	Annulus diameter	
	Inside diameter	Outside diameter
Conventional	5,3	12,5

➤ They must be able to maneuver in any turning angle of the steering wheels within a circle with the radius from the previous Table, and none of its outermost points shall exceed the area covered by both circumferences.

➤ When the vehicle's outermost points move in any wheel turning angle in the radius circle defined in the Table, the vehicle must be able to move within the limits of a 7,2m-wide circular trajectory as shown in the following figure:



7.2.1.3.6. EMERGENCY AND SAFETY SYSTEMS

The vehicles for the SITP feeding operation must be equipped with the following emergency and safety systems:

➤ The vehicles must have audio and visual signaling elements to inform all passengers about each arrival at each stop point duly in advance depending on the service route. Decree 1160 from June 16, 2003, Article 19, Number 1.

➤ A switch to request driver's help easily accessible to the passenger at the wheelchair seat and its corresponding alarm on the instrument board.

➤ A bus for each feeding service must be equipped with the elements needed to allow access to wheelchair users. There must be a free area inside these buses for wheelchair physically challenged people, located near the middle access door, with 900mm x 1400mm minimum dimensions, so that the symmetry axis of seats is parallel to the longitudinal bus axis. There must be a fastening mechanism anchored to a structural element of the vehicle in this area for wheelchair passenger safety. The fastening mechanism must be simple and



easy to operate in both passenger fastening and release which must be performed quickly in case of emergency. The area must become a free space when not in use by physically challenged users.

➤ It must have adequate spaces to place aids such as walking sticks, crutches, wheelchairs and any other device or mechanism deemed a technical aid for a physically challenged person; and it must not represent any additional cost for them. Decree 1660 from June 16, 2003, Article 19, Number 2.

➤ One (1) skylight with an ejection system per every thirty (30) passengers capacity, located on the vehicle ceiling and distributed evenly pursuant to the passenger location in each vehicle body. The skylights must have a minimum free area of 3000cm² so that it is possible to make a 500mm x 600mm rectangle in this area. In case of vehicles using compressed natural gas as fuel that require placing bottles on the roof, the ceiling will include as many skylights as possible. Those that cannot be placed must be replaced in like number with additional emergency windows.

➤ The minimum number of emergency exits must be that defined in the following table.

➤ Minimum Number of Emergency Exits

Number of passengers and crew	Total minimum number of emergency exits
60	6
60 to 100	9
Greater than 100	1 additional exit per every 30 passengers

➤ The emergency exits must not be located on a single side of the vehicle.

➤ Emergency exits, emergency hatches, emergency doors and serviced doors adequate for this purpose must be calculated in the minimum number of emergency exits

➤ The emergency windows must have fragmentation mechanisms pursuant to the NTC-1467 standard. The windows must be easy and quick to trigger from the inside of the vehicle at any time during operation

➤ Each emergency window must have a minimum free area of four thousand (4000) square



centimeters, so that a 500mm x 700mm rectangle can pass through it.

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➤ All vehicles must have green safety glasses pursuant to the technical specifications provided by the latest version of the NTC-1467 Colombian Technical Standard, which must be fulfilled for this purpose as follows:

Back and Side Window(s)	Tempered Glass(es)
Frontal Windshield	Laminated Glass(es)

➤ Glasses must be transparent and free from every commercial, advertising or sticker that blocks visibility except for stickers indicating emergency exits or legal requirements such as technical revisions provided by the National Code of Traffic.

➤ All SITP buses must comply with the provisions of the National Code of Land Traffic in terms of braking systems.

➤ All the braking systems must comply with the latest version of Colombian technical standards NTC-1884 and NTC-2042 or their international equivalents.

➤ All the vehicles must use wheels that comply with Colombian Technical Standards number NTC-1256 and NTC-1304. And a minimum 2mm depth must be guaranteed during their operation.

➤ Vehicles must have a mechanical forced ventilation system that ensures air renewal at least every thirty (30) times per hour by using fans and extractors evenly distributed along the body, with a minimum 330m³/hr. capacity per fan. The air renewal produced by opening doors and/or windows and/or hatches of the vehicle shall not be taken into account.

➤ The driver seat must have a three-speed mechanical ventilation system with adjustable grilles for face, body and feet.

➤ The frontal windshield must have a de-misting system able to remove air condensation from the entire glass, under any operating condition of the vehicle, which must be certified through manufacturer's measurements on the de-misting system (the minimum capacity of

this system must be 1200m³/hour).



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- The vehicle must be equipped with fixed dividing panels from 700mm to 800 mm high in the following cases: (i) in front of seats located at emergency stair areas; (ii) at the back of the driver's seat, complemented by a transparent panel reaching a maximum height of 1800 millimeters.
- The vehicle's battery must be located outside the passenger space and must have an available device located within driver's reach that allows cutting the power coming from the battery.
- All vehicles must have three point retractable seat-belts at the driver's seat pursuant to standard NTC1570 or its international equivalent as applicable. Likewise, they must have a visual and audio alarm that activates in case the driver starts moving the vehicle not using the safety-belt.
- Fuel tanks must be either enclosed inside a metal structure for protection in case of crashing or rollover or located between the two chassis frames. These structures must be installed by the vehicle's chassis assembler.
- The piping of the fuel-feeding system must never go through the passenger space. They must be protected and kept free of leaks or escapes, abnormal torsional stress, bending, friction and vibration.
- The fuel piping path must be designed so that a possible leaking has no chance to drop on the exhaust system or any other heat source.
- There must be a fuel-cut valve as close as possible to the fuel tank that can be handled from the driver's control board.
- The electric system must be sealed and protected from moist. Under no circumstances can the electric system be located inside the passenger cabin.
- Every electric cable going through a hole must be fastened to prevent movement and the hole must have proper protection to avoid cable damage by cut or friction.
- The entire external lighting system and brake lights, emergency lights and turn signals shall comply with the ISO-303/63E standard.



➤ The rear brake lights must have a minimum diameter to cover a 140mm-diameter circle and must have a third brake light located on the upper middle section of the body with the same aforementioned dimensions. They must be visible from a 100-meter distance under any weather condition. The rear brake lights, position lamps, reversing lamps, and turn signals must comply with the European regulations of European Standards No. 6, 7 and 23 related to international illumination levels.

➤ The front lamps must comply with the specifications from Standard No 87 *“Uniform Provisions concerning the approval of daytime running lamps for power driven vehicles”* by the United Nations related to the capacity and tests in order to be used as daytime lamps.

➤ Each vehicle must be equipped with two ABC extinguishers with a minimum 10lb capacity as follows: One is to be located next to the driver's seat, the second in area next to the third door. These extinguishers must be duly marked.

➤ Vehicles driven by Vehicular Compressed Natural Gas and their components (hoses, pipes, pressure relief valves, air-gas mixer, excess flow valves, gas relief devices, hermetic cover, gas injectors, rigid pipe lines, filter, gas flow adjusting device, accessories and flexible pipe lines) must comply with the Colombian Technical Standards NTC3561, NTC-4300, 4830-2, 4830-3, 4830-4, 4830-5, 4830-6, 4830-7, 4830-8, 4830-9, 4830-10, 4830-11, 4830-12, 4830-13, 4830-14, 4830-15, 4830-16 and 4830-17.

➤ Vehicles driven by Vehicular Compressed Natural Gas must comply with the provisions of Colombian Technical Standards NTC3847 and NTC4828 related to the tests and requirements to be fulfilled by cylinders used to store this type of fuel.

➤ Vehicles driven by other type of clean fuel pursuant to those defined by law must comply with the provisions of the Technical Standards defined by the relevant authority for this purpose.

7.2.1.3.7. VEHICLE ENVIRONMENTAL PERFORMANCE

Vehicles operating pursuant to the concession granted by means of this agreement must comply with the following environmental performance standards:

- All the vehicles must comply with the standards and maximum limits of emission permitted by Resolution 2604 from 2009 or any modifying, adding or substituting standard. All vehicles must have a catalytic converter or emission control system with capacity and features compatible with the engine, technology and clean fuel used, pursuant to the regulation or standard adopted by the relevant ruling authority. In the



case of gas or diesel vehicles complying with emission standards equivalent to EURO IV or higher, based on the emission level defined in Resolution 2604 from 2009 or its modifying, adding or substituting standards, they must have an emission control device or onboard diagnostic system OBD (OnBoard Diagnosis) (or DAB in Spanish) pursuant to standards of directives 2005/55/EC and 2005/78/EC.¹¹

Without prejudice to the aforementioned, the AUTHORIZED DEALER shall consider the fulfillment of requirements defined for importing this type of vehicles with regard to their environmental impact conditions. And particularly the obtainment of the emission certificate guarantee issued by the Ministerio de Medio Ambiente (nowadays Ministerio de Ambiente, Vivienda y Desarrollo Territorial – MAVDT) for the dynamic test required in Colombia prior to import, pursuant to the legal procedures provided by Resolution 237 from 1999 by the Ministerio del Medio Ambiente and/or by any other current provisions that may complement, modify, or substitute it in the future.

For vehicles incorporated to the SITP as new (model 2001 or later), which comply with all the typologies provided, which had been already defined for feeding the Calle 80, Avenida Caracas and Autopista Norte SITP trunks, the following documents must be attached when they are going to be incorporated to the service:

- Legible and clear copy of the emission certificate of dynamic test issued by the Ministerio del Medio Ambiente, previously used to obtain the permit to import the chassis.
- Legible and clear copy of the opacity emission certificate issued by a Registered Diagnosis Center authorized for these purposes by the relevant authority. It must allow verifying the fulfillment of maximum allowed levels of emissions defined in the current environmental standards.

For all purposes and permanently during the concession validity term, all vehicles provided by the AUTHORIZED DEALER to the feeding operation shall fulfill the following minimum environmental performance provisions:

All vehicles must have a catalytic converter or emission control system with capacity and features compatible with the engine, technology and clean fuel used, pursuant to the regulation or standard adopted by the relevant ruling authority.

After the vehicles are placed in Bogotá and duly adjusted or calibrated and acclimatized, it

¹¹ The Bullet from Paragraph 1 of Number 7.2.1.3.7 – Vehicle Environmental Performance (Feeder Bus and 80-Passenger Bus) of the Operation Manual was modified through Addendum No. 4



must be guaranteed that they fulfill current standards of maximum emission levels of mobile sources issued by the relevant authority (such as the Secretaría Distrital de Ambiente, Ministerio de Ambiente, Vivienda y Desarrollo Territorial, Ministerio de Transporte, among other). Under no circumstance or time during the concession validity term may vehicles have external noise emission levels over 90dB (A), pursuant to the measurement procedure established in the standard.

If there is a need to change the type or brand of any emission control elements of the engine components in order to improve the automobile performance, upon finishing the vehicle acclimatization process under the terms and conditions set forth by TRANSMILENIO S.A. for this purpose; the operator shall request the express consent of TRANSMILENIO S.A. by technically supporting the reason for change. Under no circumstances can modifications be performed on the engine if they imply breach of environmental standards.

Said authorizations shall not wavier the AUTHORIZED DEALER'S responsibility to comply with the contractual requirements provided in this clause and the national or district environmental standards. The environmental performance control may be performed by TRANSMILENIO S.A. or any other appointed institution.

7.2.1.4 DUAL TRANSIT BUS TYPOLOGY

In addition to the transit bus typology, the dual transit bus must have the following:

- Two (2) double doors of service pursuant to NTC 4901-3 on the left side with 1.1mts free-width (at platform level). These doors must be in line with the stop station doors. The left-side service doors must be located as follows: one door between axles and one door at the rear overhang. For rear engine vehicles, 1000mm free-width shall be allowed in the last service door.
- Height from the ground to the platform: the actual height for the passenger loading and unloading operation through the left side, measured from the road level to the vehicle platform level shall be 880 millimeters minimum and 920 millimeters maximum.
- It must have a total pneumatic suspension system. Mixed suspensions or any other types are not accepted.
- Lateral indicators of destination: it must have at least the destination number of the service provided on each body of the bus, there must be two indicators and they will be located on top or at upper sections next to the left-side access doors. They will have minimum dimensions of 450 millimeter length by 250 millimeter height.



- All the vehicles must comply with the standards and maximum limits of emission permitted by Resolution 2604 from 2009 or any modifying, adding or substituting standard. All vehicles must have a catalytic converter or emission control system with capacity and features compatible with the engine, technology and clean fuel used, pursuant to the regulation or standard adopted by the relevant ruling authority. In the case of gas or diesel vehicles complying with emission standards equivalent to EURO IV or higher, based on the emission levels defined in resolution 2604 from 2009 or its modifying, adding or substituting standards, they must have an emission control device or onboard diagnostic system OBD (OnBoard Diagnosis) (or DAB in Spanish) pursuant to standards of directives 2005/55/EC and 2005/78/EC.¹²

7.2.1.5. 10-TO-79 PASSENGER CONVENTIONAL BUS TYPOLOGY

Conventional buses must comply at least with Colombian technical standard NTC-5206 (first update on July 2009), including the following special technical features:

- It must be a single body vehicle.
- New buses to be incorporated must be latest models.
- It must have enough power, torque and transmission ratio to allow accessing any route specified in Bogotá's SITP at full loading capacity.
- The bus ascending capacity must be at least 20% higher than that required to climb the steepest slope in the operation area.
 - The vehicle engine and control systems must certify, have and maintain an environmental performance complying with the current standards on technologies, clean fuels, emission levels and control defined by the relevant authority. All the vehicles must comply with the standards and maximum limits of emission permitted by Resolution 2604 from 2009 or any modifying, adding or substituting standard. All vehicles must have a catalytic converter or emission control system with capacity and features compatible with the engine, technology and clean fuel used, pursuant to the regulation or standard adopted by the relevant ruling authority. In the case of gas or diesel vehicles complying with emission standards equivalent to EURO IV or higher, based on the emission levels defined in resolution 2604 from 2009 or its modifying, adding or substituting standards, they must have an emission control device or

¹² Bullet number 5 was added to Number 7.2.1.4 – Dual 80-Passenger Bus Typology of the Operation Manual through Addendum No. 4.



onboard diagnostic system OBD (OnBoard Diagnostics) (or DAB in Spanish) pursuant to standards of directives 2005/55/EC and 2005/78/EC¹³

- It must have a speed regulation system so that the maximum speed allowed by the current National Code of Traffic in urban roads is not exceeded (60Km/h).
- It must have fuel storage tanks that allow autonomy and quick filling up, under conditions that allow providing services continuously all day long.

When the vehicle typology provided establishes accurate dimensions for the different vehicle features, or in case maximum and minimum ranges are set for vehicle features, or if specific features are indicated; any modification on these features or the use of variations on these ranges shall be accepted only through prior express and written consent by TRANSMILENIO S.A., which may be provided upon request from the AUTHORIZED DEALER, and provided that they are supported by technical studies fully justifying such modification.

Likewise TRANSMILENIO S.A. may add or remove elements from the vehicle typology in order to improve the System operation due to the infrastructure's technological features, in mutual agreement with the authorized dealers. The cost for implementing this changes or modifications will be in charge of the AUTHORIZED DEALER.

7.2.1.5.1. SPECIFIC DESIGN FEATURES

The typology of vehicles intended for SITP feeding operation must comply at least with Colombian Technical Standard NTC5206 and the following specific technical features:

The seat distribution for these vehicles may be 2-2, 2-0, 2-1, 1-1, 1-0, 0-0 face to face or along the perimeter of the vehicle's body. The vehicle must have 6 seats available for preferential use by the elderly, physically challenged, children and pregnant women. Only one row of seats can be located on the left side in front of the vehicle doors.¹⁴

All the interior finishing of the vehicle must be made of washable, wear-resistant, flame-retardant, self-extinguishable and non-toxic material, without prejudice to the fulfillment of safety specifications by the latest version of the NTC-3586 Colombian Technical Standard, or the FMVSS 302 Standard, or its international equivalent.

Passenger seats must have individual sitting position, ergonomic design, lumbar support and must have no holes on the back side, except for those required for children grip-

¹³The sixth bullet of paragraph 1 from number 7.2.1.5 – 10-to-79 Passenger Conventional Bus Typology of the Operation Manual was modified through Addendum No. 4.

¹⁴The second (2nd) paragraph above the “specific design features” bullets of the Operation Manual was modified through Addendum No.7.



handles; they must have no padding, upholstery, and must have anti-slip texture, technical tests certificates that guarantee color prevalence $E=1$ in the first year, $E=2$ being the color variation. If E exceeds the maximum values defined, the seats shall be changed. These seats must be free from edges, corners or any sharp element which may cause injuries to passengers.

The seats must have a horizontal grip-bar in the upper back, which under no circumstances should protrude over 150 millimeters from the back. These handrails or grip-handles must not affect the free wide space of the hall defined in the number about internal vehicle measurements.

The driver's seat must be padded, with adjustable-strength hydraulic or pneumatic suspension and head rest. The horizontal, vertical and back adjustment must allow as least a horizontal movement of about 130 millimeters on the longitudinal axis, a vertical movement of about 100 millimeters on the vertical axis and a back inclination angle from 10 to 25 degrees measured with respect to the vertical one. The horizontal back adjustment must be mechanical and the vertical¹⁵ adjustment must be hydraulic or pneumatic. The materials must comply with the safety provisions specified in this agreement without prejudice to the fulfillment of safety standards provided by the relevant authorities.

The interior finishing of the vehicle must be in plastic, rolled melanimic material or any other wear-resistant washable material pursuant to the safety requirements of this specification. Under no circumstances may the interior finishing and covering be covered in metal sheets. The seat anchoring may connect directly to the vehicle platform or the lateral panel of the body. In any case, the method to fasten seats must provide them with enough strength in case of accidents or abrupt movements so as to avoid passenger injuries. All the seat metalwork and other fastening elements must comply with the latest version of the NTC–5206 Colombian Technical Standard or its international equivalent, checking the provisions and test procedures defined in Appendix 5 of Rule No. 80 by the United Nations, without prejudice to fulfilling the following:¹⁶

➤The handrails and grip-handles must be resistant enough so that passengers can be standing during vehicle movement, even in case of emergency braking.

¹⁵ Paragraph six (6) above the “specific design features” bullets of the Operation Manual was modified through Addendum No.7

¹⁶ Paragraph seven (7) above the “specific design features” bullets of the Operation Manual was modified through Addendum No.7



- The handrail surface must be free of edges and corners and their ends must be curved, so as to avoid the hazard of user injury.
- The handrails must be continuous elements and must not have joints in places other than the intersections anchoring to the vehicle's body.
- The surface of all the bars and grip-handles must offer anti-slip handling without obstacles.
- The bars and grip-handles must have a section to allow passengers easy grip and tight holding. Every bar-handle shall be at least 150 millimeters long to place a hand, in case there are grip-beams with grip-bars, the minimum length of such bar would be 100 millimeters.
- The grip-bars must be circular or oval having a diameter from 30 to 45 millimeters. In case of oval section bars, the diameter shall be calculated as the arithmetic average from the higher to lower diameter.
- All the grip-bars must be made of stainless steel tubes in polished aluminum or steel covered by PVC encased plastic material.
- In case there were seats in the area where horizontal grip-bars were located, they cannot be farther than 150 millimeters measured from the seat edge to the wall in direction to the windows.

At least two (2) vertical grip-bars must be available, one at each side of the service doors and spaces reserved for wheel-chair passengers.

There must be a vertical 1500-millimeter handrail every (2) seats, accordingly. The handrails may be fastened directly to the tube structure of seats, guaranteeing in any case the safety conditions set forth herein.

The floor or platform and the emergency-door steps of the vehicle must be covered in synthetic anti-slip material pursuant to the safety and material provisions in this agreement. The use of metal sheets (checkered plate) as covering for the internal floor of the vehicle shall be absolutely forbidden.

The material covering the vehicle floor must last at least 10 years under the SITP operating conditions. This material must avoid liquid filtering, guaranteeing watertightness inside the vehicle.

The windows must comply with the material and safety conditions pursuant to the latest version of the NTC-1467 standard or its international equivalent. The side windows shall be divided horizontally in two independent modules. The lower module shall be fixed and may be fastened by means of the



framing and packing system. The upper module must be available to open; it can be fastened through the framing and packing system. The minimum height of the upper module shall be 40% of the window height, and the maximum height of the upper module shall be 50% of the window height.

The use of framing and packing system shall be allowed to fasten the windows to the body when used to fasten the front windshield window and rear windshield window and the modules of side windows. In all cases, the fastening frame must be in black electrostatic paint.

All the new vehicles for the SITP operation must have 2 double-doors of service. Vehicles with 19-passenger capacity or lower may have single doors. The service doors must be located at the right side of the vehicle.¹⁷

The service doors must have a trigger mechanism to guarantee adequate evacuation and a 3-second maximum opening time. For vehicles without factory-made compressed air supply, the maximum opening time allowed is 5 seconds.¹⁸

The service doors must have at least 45% of its surface in glass pursuant to the safety provisions of the latest version of NTC-1467 standard.

The vehicles shall have a system that allows opening the doors from the inside or outside of the vehicle in case of an emergency. This system shall have at least one spot for triggering the doors from the outside, which must be duly marked for easy triggering. The internal emergency triggering system must be clearly marked and protected with translucent red polycarbonate enclosures. Likewise, service doors must have an optical or audio signal easily identified by the driver sitting at his seat, under any lighting conditions, in order to alert when a door is not completely closed. This sign must light up or sound every time the door structure is ajar.

The vehicles shall have an audio (less than 75dB(A)) and illuminated system at each service and emergency door to allow passengers noticing that the doors are going to open or close.¹⁹

The vehicles shall have a system that prevents opening doors while the vehicle is moving and impedes starting the vehicle while any service door or emergency door is still open.

The opening and closing controls of service and emergency doors must allow the driver to invert the door movement at all times during the closing or opening action. The opening

¹⁷ Paragraph five (5) after the “specific design features” bullets of the Operation Manual was modified through Addendum No. 7.

¹⁸ Paragraph six (6) after the “specific design features” bullets of the Operation Manual was modified through Addendum No. 7.

¹⁹ Paragraph ten (10) after the “specific design features” bullets of the Operation Manual was modified through Addendum No. 7.



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system of service doors must prevent passenger from being trapped by the door when triggered.

The operation vehicles for the Massive Public Passenger Transportation System must have internal fluorescent lighting and/or new efficient-energy-use technologies with a minimum lighting of 80lux measured at a 1200 millimeter height over the vehicle platform in a dark room, including the following areas: Passenger and driver's compartment, access to any exit or entrance.²⁰

The driving area must have a lighting system independent from the interior bus lighting, so that no light is reflected on the front windshield and safe driving is not blocked.

The door area must have an automatic lighting system that lights the vehicle floor. This lighting system must activate while the doors are open, provided that the interior lighting system is on.

7.2.1.5.2. TECHNICAL BODY FEATURES

The typology must comply always with the following minimum technical features related to the vehicle body:

The System vehicles may be built as a bodied chassis or as an integral self-supporting body vehicle. In any case, the vehicle configuration must comply with the accessibility provisions for passengers. In the case of bodied vehicles and integral-body vehicles, the body must be made equivalent by the chassis manufacturer; therefore, the AUTHORIZED DEALER shall be subject to obtain from the vehicle manufacturer and enforce all the conditions for the proper design and construction of the body with regard to safety, accessibility, comfort and economy criteria. Under no circumstances may the vehicle be acquired through separate components, and the AUTHORIZED DEALER is subject to guarantee that the chassis and body are acquired jointly; and obtain the certificate from the chassis manufacturer stating that the body integrated to it is technically and operationally compatible.

➤ The body structure must comply with the provisions from number 5 of the "*Regulation No.66 Uniform Provisions concerning the approval of Large Passenger Vehicles with regard to the Strength of their Superstructure*" document by the United Nations.

➤ The chassis design criteria shall consider the optimization of surfaces available for passengers in order to place the elements.

➤ The chassis or body structure shall not be modified, except with express approval from manufacturer authorized by TRANSMILENIO S.A. A modification shall be any change of dimensions and relocation of structural chassis or body components, relocation of engine,

²⁰ Paragraph thirteen (13) after the "specific design features" bullets of the Operation Manual was modified through Addendum No. 7.



transmission and steering gear box.

➤ In the case of self-supporting body vehicles, the modification of body elements or relocation of mechanical or structural parts is absolutely forbidden to any agents other than the structure manufacturer.

➤ The body structure must incorporate metal materials such as steel or light metals. Without prejudice to the aforementioned, mixed structures may be built employing other materials whose features offer strength, lasting and safety equal or higher than that of metal materials.

➤ The joints of elements comprising the body and those attached to it must be firmly joined to one another, minimizing the level of vibrations and noise inside the passenger space.

➤ The body structure must be designed to support a static load on the roof equivalent to 50% of the maximum weight supported by the vehicle, evenly distributed along the area, for 5 minutes, without experiencing deformation over 70 millimeters at all points. In order to verify compliance with this condition, the manufacturer must submit a certificate evidencing – through structural design, physical tests or computer modeling- that the design fulfills the required strength and deformation parameters. Additionally, it must have a fastening metal sheet for grounding of devices to be installed in the upper body parts (radio antennas, communications, GPS, etc.).

➤➤ The vehicle must have thermal flameproof set-up in the engine area and other areas near high-heat sources in order to guarantee that the temperature inside the passenger space at areas near heat sources, measured in a 50 millimeter radius, is not higher than 10°C compared to the maximum temperature in the passenger and driver compartments (28°C). ²¹

➤ The passenger space and its ventilation system must not allow flows of water, dust, smoke and any other damaging agent that annoys passengers.

➤ Every vehicle must have an instrument board, with at least the following instruments: speed indicator, engine revolution indicator, fuel level and oil pressure, temperature, voltage, lights on, manometer for the air-pressure of the braking system, with a red led, and a space suitable to install the logic unit display and audio alarm indicating low pressure of the pneumatic braking system under 13.7N/cm². In addition, it must have a visible indicator for the driver, which alerts every time there is a variation from normal operation conditions of the braking system.

²¹ Bullet nine (9) of the “specific design features” of the Operation Manual was modified through Addendum No. 7.



➤ All vehicles must have minimum space of 270 millimeter width by 180 millimeter height in the vehicle in order to place the internal number assigned by TRANSMILENIO S.A.

➤ All SITP vehicles must have the following factory-made electronic indicators of destination:

➤ Frontal indicator of destination: it will show information about the service currently provided by the vehicle. It must be located to the front on the upper windshield section. The frontal indicator of destination will be 1750 millimeters length by 250 millimeter height, without prejudice to having a system that allows reading a minimum distance of 100 meters during both day and night. This indicator must have a system to prevent fog up of information shown under any adverse weather conditions.

➤ Lateral Indicators of Destination: it must have at least the number and destination of the service provided and shall be located next to the first service door. It will have minimum dimensions of 450 millimeter length by 150 millimeter height.

➤ Rear indicator of destination: It must contain at least the service number and shall be located at the right upper section of the rear windshield. It will have a minimum dimension of 450 millimeters length x 250 millimeters high.

➤ The frontal, lateral and rear route indicators must be duly incorporated to the vehicle's body, together with the corresponding lighting system.

7.2.1.5.3. EXTERNAL DIMENSIONS

The external dimensions of SITP vehicles must comply with the standards issued by the relevant authority. Notwithstanding the standards, vehicles will fulfill at least the following conditions:

➤ Vehicle width: Maximum 2600 millimeters. Under no circumstances the width between the external sides of the rear axle wheels may exceed 150 millimeters on each side, and the external mirrors will not exceed the total vehicle width over 250 millimeters on each side.

➤ Vehicle length: the maximum length allowed is 10000 millimeters.

7.2.1.5.4. TURNING RADIUS

The vehicle shall comply with the following turning radius:

➤ The vehicle must draw its trajectory in an external-radius (distance between walls) and internal-



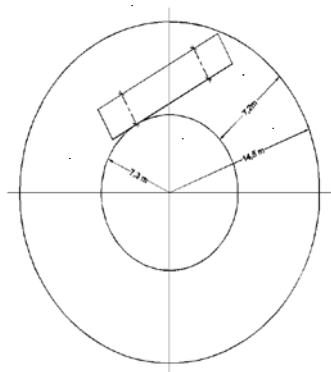
radius (distance between sidewalks) annulus pursuant to the following table:

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Vehicle Configuration	Annulus diameter	
	Inside diameter	Outside diameter
Conventional	5,3	12,5

➤ They must be able to maneuver in any turning angle of the steering wheels within a circle with the radius from the previous Table, and none of its outermost points shall exceed the area covered by both circumferences.

➤ When the vehicle's outermost points move in any wheel turning angle in the radius circle defined in the Table, the vehicle must be able to move within the limits of a 7,2m-wide circular trajectory as shown in the following figure:



7.2.1.5.5 EMERGENCY AND SAFETY SYSTEMS

All SITP buses must comply with the provisions of the National Code of Land Traffic in terms of braking systems. Without prejudice to this condition, they must have a pneumatic anti-lock ABS braking system with an independent double-circuit. Vehicles with 19-passenger capacity or lower may have a hydraulic braking system, together with an anti-lock ABS system.²²

(I, PASCUAL ORDUZ HIDALGO, Sworn Official Translator and Interpreter for the English-Spanish, Spanish-English languages, appointed pursuant to Resolution No. 1117 by the Ministry of Justice of Colombia, do hereby certify that the above translation fully corresponds to the original document written in Spanish. In witness whereof, I hereunto set my hand and Official seal on this 23rd day of October, 2013. Translator's contact Information: (571) 6135182, (57) 3002683504, traducciones@angloservicios.com, www.angloservicios.com)

²² Number 7.2.1.5.5 of the "emergency and security system" of the Operation Manual was added through Addendum No. 7