

Special Provision for related Works (SP):

For those items of works not covered by Standard Specifications for Road and Bridge works 2073 (Amendment 2078) refer Technical Requirement for Traffic Light System (TLS)

Signal Lamps Items

- Size of vehicular signal: 300mm dia. ± 10
- Size of 3 digits Vehicular Counter :- Led Screen 640*480mm display Size
- 3 digits Pedestrian Counter: P8 Led Screen 320*320mm display Size
- Size of pedestrian Signal : 300mm dia. ± 10 mm
- Viewing angle minimum 30 degrees
- Vandal proof, rain proof PV UC resistant casing.

Specifications	Red Lamp	Amber Lamp	Green Lamp	Green Arrow	Pedestrian Red man	Pedestrian Green man	Count Down Iron or steel or polycarbonate housing	
							3 digits Pedestrian Counter	3 digits Vehicular Counter
LED Lens	Water Clear	Water Clear	Water Clear	Water Clear	Water Clear	Water Clear	Water Clear	
No. of Led	168 $\pm$ 5	168 $\pm$ 5	168 $\pm$ 5	69 $\pm$ 5	80 $\pm$ 5	129 $\pm$ 5	P8 Led Screen size 320*320mm	P8 Led Screen 640*480mm
Intensity	≥ 400 Cd	≥ 400 Cd	≥ 600 Cd	≥ 600 Cd	≥ 400 cd/m ²	≥ 600 cd/m ²	≥ 5000 cd/m ²	≥ 5000 cd/m ²
Wavelength	625 $\pm$ 5nm	590 $\pm$ 5nm	505 $\pm$ 5nm	505 $\pm$ 5nm	625 $\pm$ 5nm	505 $\pm$ 5nm	625 $\pm$ 5nm	625 $\pm$ 5nm
Operating Voltage	230 VAC / 24 VDC	230 VAC / 24 VDC	230 VAC / 24 VDC	230 VAC / 24 VDC	230 VAC / 24 VDC	230 VAC / 24 VDC	5 VDC	5 VDC
Power Consumption	≤ 11 W	≤ 11 W	≤ 11 W	≤ 11 W	≤ 8 W	≤ 7 W	≤ 100 W	≤ 200 W
Operating Temperature	-10°C to +70°C	-10°C to +70°C	-10°C to +70°C	-10°C to +70°C	-10°C to +70°C	-10°C to +70°C	-10°C to +70°C	-10°C to +70°C
Protection	IP65	IP65	IP65	IP65	IP65	IP65	IP55	IP55

Note: Each product shall be supplied including necessary accessories like: - Left/right/top visor, Bracket, Screw, Nut, Gasket, Manual and Quality Certificate.

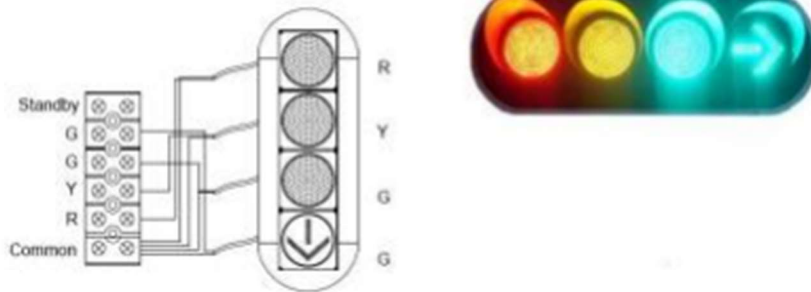


fig: wiring diagram of traffic lights (reference only)

1.1. Vehicular Signal Lamp

(A) Scope:

The work covers supply, installation, fixing, testing and commissioning of Vehicular Signal Lamp (Red, Green, Amber and Green Arrow (a complete set)) to be fixed on the horizontal arms as per instruction.

(B) Materials:

The requirement for Vehicular Signal Lamp shall be as per **Table 1.1: Requirements for Vehicular Signal Lamp**

Particulars	Requirement
Certification	At least Global Standard
LED Lens	Water Clear
Lamp Types	• Red • Yellow/Amber • Green • Green Arrow
Red Lamp	No of LED: Min 180
Yellow/Amber Lamp	No of LED: Min 180
Green Lamp	No of LED: Min 180
Green Arrow Lamp	No of LED: Min 65
Signal Lamp Diameter	300mm dia. $\pm$ 10mm. or better
Intensity	$\geq 400\text{Cd}$ for Red and Amber $\geq 600\text{Cd}$ for Green and Green Arrow
Operating Voltage	In Case of AC Lamp 220V $\pm$ 20% In case of DC Lamp Convert to AC lamps
Power Consumption	$\leq 15\text{W}$
Operating Temperature	-10°C to +70°C
Protection	Min.IP65
Accessories	Left/right/top visor, Bracket, Screw, Nut, Gasket, Manual, Quality Certificate and other needed supporting accessories all complete.

Other Specifications	Lightning protection circuit should be implemented Rain proof, PV UC resistant casing.
Warranty	Minimum 2 years.

(C) Description of Works:

The set of Vehicular Signal Lamp for required intersection must be supplied by the contractor. The Contractor shall be responsible to ensure that requirement of the Vehicular Signal Lamp is met as mentioned in **Table 1.1: Requirements for Vehicular Signal Lamp.**

The Contractor shall be responsible for storage of supplied instruments/ parts. Before installation, the surface must be clean and proper safety measures must be maintained during installation. The Contractor shall be responsible to manage any accessories/equipment that is required during fixing of lamp.

(D) Measurement and Payment:

The measurement of vehicular signal lamps shall be in numbers of each lamp (Red, Green, Amber and Arrow). The installation, fixing, testing, commissioning charge and other accessories of lamps are deemed included in the measurement of the lamps. Accessories and equipment charges for fixing are also deemed included in the measurement of the lamps.

The quantities measured as above shall be paid at the respective contract unit rates which shall be full and final compensation to the contractor for installation, fixing in position, testing, commissioning and all other incidental cost to complete the work specified.

1.2. Counter Display

(A) Scope:

The work covers supply, installation, fixing, testing and commissioning of Vehicular Counter Display to be fixed on the horizontal arms as per instruction.

(B) Material:

The requirement for Vehicular Counter Display shall be as per **Table 1.2 Requirements for Vehicular Counter Display**

Table 1.2 Requirements for Vehicular Counter Display

Certification	At least Global Standard
Support clear viewing Display Digit	At least 3 digit eg.999 (also alphabet must be displayed if required)
Types of Display	P8 standard or better
Display Dimension	640*480mm $\pm$ 5%. or better for Vehicular 320*320 mm 5% for Pedestrian Counter.
Intensity	$\geq$ 5000cd/m ²

Operating Volatage (DC)	5V
Power Consumption	≤100W
Operating Temperature	-10°C to +70°C
Housing	Aluminium or Polycarbonate or steel
Protection	Min.IP65
Accessories	Left/right/top visor, Bracket, Screw, Nut, Gasket, Manual, Quality Certificate and other needed supporting accessories all complete.
Other Specifications	Lightning protection circuit should be implemented Rain proof, PV UC resistant casing.
Warranty	At least 2 years.

(C) Description of Works:

The set of Vehicular Counter Display for required intersection must be supplied by the contractor. Working from the same core of the lamp and not needed extra core from the controller. The Contractor shall be responsible to ensure that requirement of the Vehicular Counter Display is met as mentioned in **Table 1.2 Requirements for Vehicular Counter Display**. The counter display must be able to show STOP and GO during operation. The Contractor shall be responsible for storage of supplied instruments/ parts. Before installation, the surface must be clean and proper safety measures must be maintained during installation.

The Contractor shall be responsible to manage any accessories/equipment that is required during fixing.

(D) Measurement and Payment

The measurement of Vehicular Counter Display shall be in numbers. The installation, fixing, testing, commissioning charge and other accessories of Display are deemed included in the measurement of the counter display. Accessories and equipment charges for fixing are also deemed included in the measurement of the counter display. The quantities measured as above shall be paid at the respective contract unit rates which shall be full and final compensation to the contractor for installation, fixing in position, testing, commissioning and all other incidental cost to complete the work specified.

1.3. Pedestrian Signal Lamp

(A) Scope

The work covers supply, installation, fixing, testing and commissioning of Pedestrian Signal Lamp (Red Man and Green Walking Man) to be fixed on the Pedestrian pole as per instruction.

(B) Material

The requirement of Pedestrian Signal Lamp shall be as per **Table 1.3 Requirements for Pedestrian Signal Lamp**

Table 1.3 Requirements for Pedestrian Signal Lamp

Certification	At least Global Standard
LED Lens	Water Clear
Lamp Types	• Red Man • Green Walking Man
Red Man Lamp	No of LED: Min 75
Green Walking Man Lamp	No of LED: Min 125
Signal Lamp Diameter	300mm dia. $\pm$ 10mm. or better
Intensity	$\geq$ 400Cd for Red and Amber $\geq$ 600Cd for Green and Green Arrow
Operating Voltage	In case of AC lamp 220V $\pm$ 20% In case of DC lamp Convert it to AC lamp.
Power Consumption	$\leq$ 10W for Red Man $\leq$ 15W for Green Man
Operating Temperature	-10°C to +70°C
Protection	Min.IP65
Accessories	Left/right/top visor, Bracket, Screw, Nut, Gasket, Manual, Quality Certificate and other needed supporting accessories all complete.
Other Specifications	Lightning protection circuit should be implemented Rain proof, PV UC resistant casing.
Warranty	At least 2 years.



Fig: Ø300mm led red and Green Walk man pedestrian Traffic signal light 220VAC.

(C) Description of Works:

The set of Pedestrian Signal Lamp for required intersection must be supplied by the contractor. The Contractor shall be responsible to ensure that requirement of the Pedestrian Signal Lamp is met as mentioned in **Table 1.3 Requirements for Pedestrian Signal Lamp.**

The Contractor shall be responsible to manage any accessories/equipment that is required during fixing. The Contractor shall be responsible for storage of supplied instruments/parts. Before installation, the surface must be clean and proper safety measures must be maintained during installation.

(D) Measurement and Payment:

The measurement of Pedestrian Signal Lamp shall be in numbers. The installation, fixing, testing, commissioning charge and other accessories of Pedestrian Signal Lamp are deemed included in the measurement of the lamps. Accessories and equipment charges for fixing are also deemed included in the measurement in Pedestrian Signal Lamp. The quantities measured as above shall be paid at the respective contract unit rates which shall be full and final compensation to the contractor for installation, fixing in position, testing, commissioning and all other incidental cost to complete the work specified.

2. Buzzer Items

(A) Scope

The work covers supply, installation, fixing, testing and commissioning of Buzzer (a complete set) to be fixed on the Pedestrian pole as per instruction.

(B) Material

The requirement of Buzzer shall be as per **Table 2.1 Requirements for Buzzer**

Table 2.1 Requirements for Buzzer

Certification	At least Global Standard
Operating Frequency	Human audible Frequency (20Hz <20KHz)
Operating Voltage	• 12 V(DC) • 24 V (DC) • 220VAC Voltage Will be as per requirement
Operating Temperature	-10°C to +70°C
Other Specifications	Buzzer should operate during pedestrian Green Signal only. Should have privilege of changing or insert custom sound of buzzer. Should have the option of changing the volume of buzzer. Should be compatible within Pedestrian Light
Warranty	At least 2 years.

(C) Description of Works:

The set of buzzers for required intersection must be supplied by the contractor. The Contractor shall be responsible to ensure that requirement of the Buzzer is met as mentioned in **Table 2.1 Requirements for Buzzer**.

The Contractor shall be responsible for storage of supplied instruments/ parts. Before installation, the surface must be clean and proper safety measures must be maintained during installation.

(D) Measurement and Payment:

The measurement of Buzzer shall be in numbers. The installation, fixing, testing, commissioning charge and other accessories of Buzzer are deemed included in the measurement of the buzzer. The quantities measured as above shall be paid at the respective contract unit rates which shall be full and final compensation to the contractor for installation, fixing in position, testing, commissioning and all other incidental cost to complete the work specified.

3. Controller Items:

3.1. Controller

(A) Scope

The work covers supply, installation, fixing, testing and commissioning of Controller (a complete set with Controller Casing) to be fixed on the pole or as per instruction.

Controller should be able to connect Existing Web Interface

- .DOR shall provide authenticate key *(API Key) of each intersections for connection of these intersection in DOR Ownership software.

- After completion of contract, the contractor shall handover all the login credentials and restrict himself out of the system.
- Traffic light system shall be compatible to the existing software.

Table Error! No text of specified style in document.3.1 Requirements Controller

Certification	At least Global Standard
Minimum independent output channels	40
Operating/Working Voltage (AC)	220VAC±50
Operating Temperature	-10°C to +70°C
Protection	Min.IP65
Accessories	All needed supporting accessories.
Mode of Operation	• Fully automatic (Isolated Intersection Controller) as per programmed work on “time of the day” and “day of the year” for the entire year • Manual Mode – Traffic Signals can be operated manually by Traffic Police or Traffic Personnel • Blinking mode – Flashing amber color traffic light of each post • Synchronization mode (Cable linking green synchronization / Cable less green synchronization)
Other Specifications	Wireless 4G-LTE and wired OFC/LAN modem interface for communication with web and other devices like slave controller and GPS based clock synchronization. Manual Phase assignment with wireless remote controller or by web application. Compatible with existing devices and controller and also support by web application.
CPU & Electronic Unit	• Core: Arm® 32-bit Cortex®-M4 CPU with FPU, Adaptive real-time accelerator (ART Accelerator) allowing 0-wait state execution from flash memory, frequency up to 168 MHz, memory protection unit, 210 DMIPS/ 1.25 DMIPS/MHz (Dhrystone 2.1), and DSP instructions. • Equipped with SSR/TRAIC/ Output Cards for lamp driving maximum load 5 Amp each output. • Expendable Output Interfaces, Each Output Card drive 10 lamp and configurable minimum 4 Output Card (40 lamp Outputs). • Industrial grade electronic components • Safety Features: - Self-diagnosis on power up and runtime, Green – Green Conflict Monitoring Lamp failure / Short

	circuit Monitoring, Fallback on AMBER flash in case of conflict or error condition.
User Interface	• SPI Display Screen. • Web Application / Window based Software Application
Police Control Panel	• Police Control panel with universal cam lock • Having buttons for following functions • Lamp ON/OFF • Manual mode • Force Blinking • Hurry Call from Web Application / Window based Software Application
Warranty	At least 2 years.

- The controller shall have ability to integrate with TLS system and perform all function of TLS.

(B) Material

The requirement of Master Controller shall be as per **Table Error! No text of specified style in document.3.1 Requirements Controller** and for Controller Casing shall be as per **Table 3.2 Requirement for Controller Casing**.



Fig: Controller box (for reference only.)

Table 3.2 Requirement for Controller Casing

Operating Temperature	-10°C to +70°C
-----------------------	----------------

Casing	Steel Casing (should protect from weather, and corrosion)
Protection	Min.IP65
Other Specifications	Provision for external antenna (at least water splash proof) if required. Rain proof, PV UC resistant casing.
Warranty	At least 2 years.

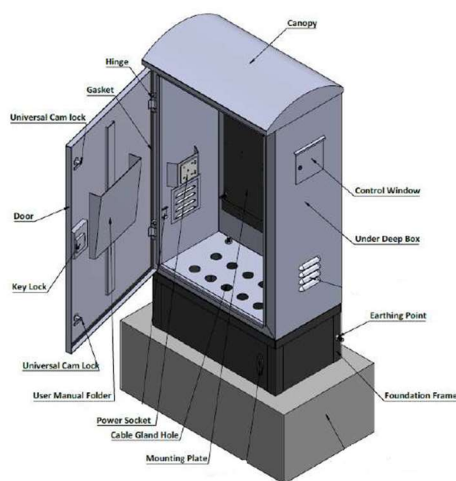


Fig:- Controller Casing (for reference only)

(C) Description of Works:

The set of Controller for required intersection must be supplied by the contractor. The Contractor shall be responsible to ensure that requirement of the Controller is met as mentioned in 3.2 below. The Controller must be protected by a Controller Cover as per the requirement mentioned in **Table 3.2 Requirement for Controller Casing** Contractor shall be responsible for storage of supplied instruments/ parts. Before installation the surface must be clean and proper safety measures must be maintained during installation. The product function and technical features of Controller shall be as mentioned in 3.2.

(D) Measurement and Payment:

The measurement of Master Controller shall be in numbers. The installation, fixing, testing, commissioning charge and other accessories of Controller are deemed included in the measurement of the controller. The quantities measured as above shall be paid at the respective contract unit rates which shall be full and final compensation to the contractor for installation, fixing in position, testing, commissioning and all other incidental cost to complete the work specified.

3.2. Product Functions and Technical Features Controller

- a. Built-in central control system to ensure work stability ;
- b. Should have dedicated RJ45/ Mode bus serial port for communication.

- c. Should have option of implementing code on microcontroller remotely.
- d. In case of interruption in communication with TLS web portal, the controller should operate automatically with existing store data.
- e. Yellow flashing or power off at night can be set manually from location and forcefully from web.
- f. Adopt RS-232/USB/Rj45/ISP for Programming Facility
- g. LAN/ 4G /OFC port to communicate with TLS web portal
- h. Manually forceful flashing should be supported
- i. If any light fails to operate, it should automatically set to yellow flash state.

Items	Traffic Light Controller	Pedestrian Light Controller
Vehicular operation sequence special timing state should be statement before production)	all Red (can setup) →green light green flash can setup) →yellow light red light	all Red (can setup) →green light green flash can setup) →yellow light red light
Pedestrian signal operation sequence	all Red (can setup) →green light Green flash (can setup)→Red light	all Red (can setup) →green light Green flash (can setup)→Red light

4. AC to DC Conversion

(A) Scope

The work covers supply, installation, fixing, testing and commissioning of AC to DC Conversion (a complete set) to be fixed on the pole or as per instruction.

(B) Material

The requirement of AC o DC Conversion shall be as per

Table 4.1 Requirements for AC to DC Conversion

Table 4.1 Requirements for AC to DC Conversion

Certification	At least Global Standard
Protection	Short Circuit Protection (SURGE Protection)
Input Voltage (AC)	AC 220V±20%
Output Voltage (DC)	Each device should provide at least 3 output voltage of 5V, 12 V and 24 V.
Operating Temperature	-10°C to +70°C
Power Supply type	Switched Mode Power Supply (SMPS)
Warranty	At least 2 years.

(C) Description of Works:

The set of AC o DC Conversion for required intersection must be supplied by the contractor. The Contractor shall be responsible to ensure that requirement of the AC to DC Conversion is met as mentioned in

Table 4.1 Requirements for AC to DC Conversion

The Contractor shall be responsible for storage of supplied instruments/ parts. Before installation, the surface must be clean and proper safety measures must be maintained during installation.

(D) Measurement and Payment:

The measurement of AC to DC Conversion shall be in numbers. The installation, fixing, testing, commissioning charge and other accessories of AC to DC Conversion are deemed included in the measurement of the item.

The quantities measured as above shall be paid at the respective contract unit rates which shall be full and final compensation to the contractor for installation, fixing in position, testing, commissioning and all other incidental cost to complete the work specified.

5. Double Pole (DP) MCB**(A) Scope**

The work covers supply, installation, fixing, testing and commissioning of Double Pole (DP) MCB (a complete set) to be fixed on the pole or as per instruction.

(B) Material

The requirement of Double Pole (DP) MCB shall be as per

Certification	At least Global Standard
Operating Voltage (AC)	AC110V/220V±20%
Operating Current	Support Maximum 32 A
MCB Type	Dual pole
Operating Temperature	-10°C to +70°C
Other Specifications	Must be enclosed with Electrical Switch Box and fuse all complete
Warranty	At least 2 years.

Certification	At least Global Standard
Operating Voltage (AC)	AC110V/220V±20%
Operating Current	Support Maximum 32 A
MCB Type	Dual pole

Operating Temperature	-10°C to +70°C
Other Specifications	Must be enclosed with Electrical Switch Box and fuse all complete
Warranty	At least 2 years.

(C) Description of Works:

The set of Double Pole (DP) MCB for required intersection must be supplied by the contractor. The Contractor shall be responsible to ensure that requirement of the Double Pole (DP) MCB is met as mentioned in

Certification	At least Global Standard
Operating Voltage (AC)	AC110V/220V±20%
Operating Current	Support Maximum 32 A
MCB Type	Dual pole
Operating Temperature	-10°C to +70°C
Other Specifications	Must be enclosed with Electrical Switch Box and fuse all complete
Warranty	At least 2 years.

The Contractor shall be responsible for storage of supplied instruments/ parts. Before installation, the surface must be clean and proper safety measures must be maintained during installation.

(D) Measurement and Payment:

The measurement of Double Pole (DP) MCB shall be in numbers. The installation, fixing, testing, commissioning charge and other accessories of Double Pole (DP) MCB are deemed included in the measurement of the item.

The quantities measured as above shall be paid at the respective contract unit rates which shall be full and final compensation to the contractor for installation, fixing in position, testing, commissioning and all other incidental cost to complete the work specified.

From controller	To Light	From Light to Counter	From controller to counter
Red	Red	Red	
Yellow	Yellow		
Green	Green	Green	
Arrow	Arrow		
Pedestrian Green	Pedestrian Green	Pedestrian Green	
Pedestrian Red	Pedestrian Red	Pedestrian Red	
Neutral 1	Neutral 1	Neutral 1	
Neutral 2			Neutral 2
Phase			Phase

Wring diagram

6. Vehicular Signal Post

(A) Scope

The work covers supply, installation, fixing of Vehicular Signal Post of required dimension as per instruction.

(B) Material

The requirement of Vehicular Signal Post shall be as mentioned below:

- Hot Dip Galvanized (Zinc coating: 80 micron)
- Length: 7m
- Thickness: 4 ± 0.3 mm

(C) Description of Works:

The Vehicular Signal Post shall be carefully adjusted prior to fixing in place to ensure matching at proper level. Holes shall be dug or drilled to indicated depth by approved method and equipment, provided these are erected in proper position and free from distortion and any other damage. Concrete and excavation for bedding shall confirm to SSRBW 2073 with amendment 2078. The Contractor shall be responsible to ensure that requirement of the Vehicular Signal Post is met as mentioned in (B)

The Contractor shall be responsible for storage of supplied instruments/ parts. Proper safety measures must be maintained during installation.

(D) Measurement and Payment:

The measurement of Vehicular Signal Post shall be in numbers. The installation, fixing, testing, and other accessories of Vehicular Signal Post are deemed included in the measurement of the item. The quantities measured as above shall be paid at the respective contract unit rates which shall be full and final compensation to the contractor for installation, fixing in position, testing, commissioning and all other incidental cost to complete the work specified.

7. Pedestrian Signal Post Items

(A) Scope

The work covers supply, installation, fixing of Pedestrian Signal Post of required dimension as per instruction.

(B) Material

The requirement of Pedestrian Signal Post shall be as mentioned below:

- Hot Dip Galvanized (Zinc coating: 80 micron)
- Length: 4m (4" for bottom 4m) for underground wiring
- Length: 7m (4" for bottom 7m) for Overhead wiring
- Thickness: 3 ± 0.3 mm

(C) Description of Works:

The Pedestrian Signal Post shall be carefully adjusted prior to fixing in place to ensure matching at proper level. Holes shall be dug or drilled to indicated depth by approved

method and equipment, provided these are erected in proper position and free from distortion and any other damage. Concrete and excavation for bedding shall conform to SSRBW 2073 with amendment 2078. The Contractor shall be responsible to ensure that requirement of the Pedestrian Signal Post is met as mentioned in (B)

The Contractor shall be responsible for storage of supplied instruments/ parts. Proper safety measures must be maintained during installation.

(D) Measurement and Payment:

The measurement of Pedestrian Signal Post shall be in numbers. The installation, fixing, testing, and other accessories of Pedestrian Signal Post are deemed included in the measurement of the item.

The quantities measured as above shall be paid at the respective contract unit rates which shall be full and final compensation to the contractor for installation, fixing in position, testing, commissioning and all other incidental cost to complete the work specified.

8. Horizontal Signal Arm

(A) Scope

The work covers supply, installation, fixing of Horizontal Signal Arm of required dimension as per instruction.

(B) Material

The requirement of Horizontal Signal Arm shall be as mentioned below:

- Hot Dip Galvanized (Zinc coating: 80 micron)
- Length: 3000-6000 mm
- diameter: 63 ± 5 mm
- Thickness: 3 ± 0.5 mm
- Including Brackets, Nuts, bolts etc. necessary to mount the post.

(C) Description of Works:

The Horizontal Signal Arm shall be carefully adjusted prior to fixing in place to ensure matching at proper line and level. Arm shall be fixed to signal post by approved method and equipment, provided these are fixed in proper position and free from distortion and any other damage. The Contractor shall be responsible to ensure that requirement of the Horizontal Signal Arm is met as mentioned in (B)

The Contractor shall be responsible for storage of supplied instruments/ parts. Proper safety measures must be maintained during installation.

(D) Measurement and Payment:

The measurement of Horizontal Signal Arm shall be in numbers. The installation, fixing, testing, and other accessories of Horizontal Signal Arm are deemed included in the measurement of the item. The quantities measured as above shall be paid at the respective contract unit rates which shall be full and final compensation to the contractor for installation, fixing in position, testing, commissioning and all other incidental cost to complete the work specified.

9. Operation and Reporting of Traffic Signal System

A. Operation and Maintenance Activities:

Traffic signal system shall be regularly maintained by the contractor within the DLP without any extra cost to the Employer. However, the contractor shall be paid for operation and reporting as per quoted rate in BoQ. For this purpose, the system need some of the additional works to be done. The Contractor shall make sure to generate report of current and previous status. The Contractor shall configure the Traffic light system with TLS application, server and database.

Existing , newly installed and operated controller(master and slave) should be maintained and the contractor should update changes in controller as per Engineer's instruction.

If any issue arises regarding installed hardware and software, the Contractor shall report to the client within 24 hour and the Contractor shall fix it within 24 hour after the client gives approval for change and update. The Contractor shall create and install patches for micro controller both master and slave and ensure that controller works on both Wireless and wired technology. The Controller should adopt API feature and should be able to indexing phase data fetch through API. In case of API changes the Contractor should assure the changes and implement on the controller.

The Contractor shall regularly maintain the system and ensure the system working smooth and efficiently. Every maintenance and operation done by the Contractor shall maintain log and shall submit it to the Employer through email and hard copy . The system provide by the Contractor should have the features of defect and fault detection on every installed traffic light system.

If any device of the traffic light system gets failure/not working to operate then the Contractor should repair including fitting /fixing/installation without extra cost to the Employer. If the device can't be repair then the Contractor should report to department as soon as possible. After approval from department the Contractor should supply the hardware part that are to be replaced and install without any extra cost to the Employer as per Engineer's instruction.

In case of changes or update in features; functionalities or modules of Traffic light system, the Contractor should assure quality control of the system. All the log (modification) of the controller system should be maintained , every phase raw source code should be submitted to the Employer.

Traffic light system should ensure the security and prevention at least of unauthorized access to controller and devices, scripting/attack prevention and the Contractor should daily monitor the system for the server connection and troubleshooting. The system should store the data information of last one changes if the connection fail with server and should operate at least upto 7 days. System should be able to replace old data with new one automatically if the new changes in data and phases are triggered.

The system should have to operate automatically through web app and manually through operation place.

For regular operation and maintenance of the Traffic Light System following activities should be performed:

- Regular operation of existing signals in Traffic Light System Software of DOR
- Signal Timing Re-Phasing and transfer of Knowledge to traffic police personals to set timing for phasing and rephrasing
- Regular inspection of intersections and repair of Traffic signal system if needed for smooth operation and maintenance
- Provide required technical support for regular operation and maintenance
- Regular cleaning, dusting of dust, debris and other unwanted materials on parts/components of traffic signal system at all intersections as per instruction
- Electrical Charges and data communication charges shall be due cleared on time (payment Will be under Provisional Sum of BOQ) by the Contractor. (Note: If any fine or charges are to be cleared due to delay in payment, the Contractor shall himself be liable).
- Prevention of Unauthorized access to controller and devices.
- The Contractor should store the data information of last one changes if the connection fail with server and should operate at least upto 7 days.
- Old data should be replaced with new one automatically if the new changes in data and phases are triggered.
- The Contractor shall maintain through trained, qualified traffic signal maintenance experts sufficient to perform the work required and described herein as per requirement
- The qualified expert shall be available to respond promptly after receiving the instruction from the engineer which may be received from time to time and to promptly make temporary and permanent repairs.

B. Report and Deliverables

Source code and content of upgraded site: The Contractor shall submit all credentials of all upgraded systems including the Source Code (RAW and HEX) and Database (if exist).

User manual document: The Contractor shall submit a user manual written in English language with proper documentation. Following Schedule of deliverables should be followed:

S. N	Deliverable	Description	Time of delivery
1	Inception report	In soft and hard copy	Within 15 days of sign of contract
2	Monthly Report during construction and DLP (should include task completed within that month)	In soft and hard copy.	First week of Nepali Month.

3	Detail System Design Report	In soft and hard copy.	Within 45 days of sign of contract
4	Job Completion Report	In soft and hard copy.	Handover Period.
5	Source code and content of upgraded system	In a flash media (Pen drive, HDD etc.), CD will not be preferred.	Handover Period.
6	Updated User, Operational, Programming manual document	In soft and hard copy	Handover Period.