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South Central Railway

Signal and Telecommunication Department

Feasibility Report

For

COMPREHENSIVE SIGNALLING AND TELECOMMUNICATION WORKS FOR PROVISION OF AUTOMATIC BLOCK SIGNALLING SYSTEM IN
NANDALUR - RENIGUNTA Jn SECTION OF GUNTAKAL
DIVISION IN
SOUTH CENTRAL RAILWAY

(TO BE INCLUDED AS ANNEX-I OF SCHEDULE-B OF DRAFT EPC AGREEMENT)

On
Engineering, Procurement and Construction (EPC) Mode

May - 2024

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Section 1

Abbreviations

In this Agreement, the following words and expressions shall, unless repugnant to the context or meaning thereof, have the meaning hereinafter respectively assigned to them.

ABS	Automatic Block Signalling	ACTM	AC Traction Manual
AT	Auxiliary Transformer	AWS	Approach Warning System
BIS	Bureau of Indian Standards	GTL	Guntakal
XLPE	Cross Linked Polyethylene	CRS	Commissioner of Railway Safety
CT	Cable Termination	CTC	Centralised Traffic Control
CTB	Cable Termination Box	DL	Data logger
DN line	Down Line	DP	Detection Point
DVD	Digital Versatile Disc	EI	Electronic Interlocking
ELD	Earth Leakage Detector	EOLB	Electrically Operated Lifting Barrier
FACS	Fuse Auto Changeover System	FAT	Factory Acceptance Test
FDMS	Fibre Distribution Management System	FN MUX	Fail Safe Network Multiplexer
GAD	General Arrangement Drawing	G&SR	General & Subsidiary Rules
GI	Galvanized Iron	HDPE	High Density Polyethylene
HDN	High Density Network	IRSTE	Institution of Railway Signal & Telecommunication Engineers
IIT	Indian Institute of Technology	IPS	Integrated Power Supply System
IRPWM	Indian Railways Permanent Way Manual	IRS	Indian Railway Specifications
IRSE	Institution of Railway Signal Engineers	IRSEM	Indian Railway Signal Engineering Manual
IRSOD	Indian Railway Schedule of Dimensions	IS	Indian Specification
KVA	Kilo Volt Ampere	LUX	Luminous Flux
LC	Level Crossing	LED	Light Emitting Diode

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LC	Level Crossing	LED	Light Emitting Diode
LTE	Long Term Evolution	MUX	Multiplexer
MSDAC	Multi Section Digital Axle Counter	NVR	Network Video Recorder
NI	Non-Interlocking	NP2	Non-Pressure 2
OFC	Optical Fibre Cable	OEM	Original Equipment Manufacturer
PI	Panel Interlocking	PA	Public Address
PCB	Printed Circuit Board	QAP	Quality Assurance Plan
RTU	Remote Terminal Unit	RCC	Reinforced Cement Concrete
RDSO	Research Designs and Standards Organization	RITES	Rail India Technical and Economic Services
RRI	Route Relay Interlocking	SWR	Station Working Rules
SAT	Site Acceptance Test	GTL	Guntakal
SCR	South Central Railway	SWRD	Station Working Rule Diagram
SIP	Signalling Interlocking Plan	SMPS	Switch Mode Power Supply
SMS	Short Messaging Service	TAN	Technical Advisory Note
TCAS	Train Collision Avoidance System (KAVACH)	TOC	Table of Control
TSAA	Technical System Application Approval	6Q	6 Quad
UP Line	UP Line	UFSBI	Universal Fail Safe Block Interface
VDU	Visual Display Unit	VRLA	Valve Regulated Lead Acid

Station Codes

NRE	Nandalur	KOU	Koduru
HAQ	Hastavaram	SF	Settigumta
RJP	Rajampet	BLPE	Balapalle
PMT	Pullampet	MRM	Mamanduru
OBVP	Obulavaripalle	RU	RENIGUNTA Jn
ANE	Anantarajupet		

Section 2
Introduction and Site Information

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2.0 Introduction

NANDALUR - RENIGUNTA Jn section of Guntakal division in SCR is on HDN-5 route. To increase the section capacity, Automatic Block Signalling is proposed in this section.

In Automatic Signalling, the section between two stations is divided into a series of Automatic Block Signalling sections and the entry into each Automatic Block Signalling section is controlled by an Automatic Stop signal. These signals are operated automatically by the passage of trains. Hence, in Automatic Block System more trains can be dealt with lesser manual involvement, thus increasing the section/Line capacity. It is envisaged that the Automatic block signalling work will result in enhancement of traffic throughput.

2.1 Objective

The main objective of the project is to improve the Line capacity in NRE-RU section to handle more traffic by utilising existing track infrastructure with optimal investment and minimal project gestation period.

2.2 Section Description

NANDALUR - RENIGUNTA JN section of Guntakal division is a Double line section. There are Ten block sections involving Eleven block stations in the NRE-RU section.

2.3. Section Details

Railway	South Central Railway
Name of Division	Guntakal
Name of Section	NANDALUR - RENIGUNTA Jn
Section Length	85.64 RKM
Max. Permissible Speed	130 KMPH
Number of Lines in the block section (existing)	Two lines

2.4. Infrastructure Details

2.4.1. NRE - RU section is in Guntakal Division of South Central Railway with maximum permissible speed of the section is 130 Kmph.

2.4.2. NRE - RU section is 25 KVA electrified section of South Central Railway consisting of Twelve Block sections controlled through Ten Block Stations. At all stations points and signals interlocked to Standard III (R)/ III. NRE, HAQ, RJP stations are equipped with EI of Hitachi (Microlok II) make, all other stations are with Relay Based Panel Interlocking.

2.4.3. Signalling Infrastructure

Station/ Block Section	Chainage at km	Railway/ Division	Std of Interlocking	Type of Interlocking	LC gates	Make of IPS/Battery Capacity	Major Bridges
NRE	220.427	SCR/GTL	III (R)	Centralized EI- Hitachi Make.	LC 111 T	STATCON 300AH	NIL
NRE-HAQ		SCR/GTL	NA	NA	NIL	NIL	Bridge no. 394
HAQ	214.16	SCR/GTL	III (R)	Centralized EI- Hitachi Make.	LC 110 T LC 108	STATCON 200AH	NIL
HAQ-RJP		SCR/GTL	NA	NA	NIL	NIL	NIL
RJP	209.03	SCR/GTL	III (R)	Centralized EI- Hitachi Make	LC 102 T	STATCON 200AH	NIL
RJP-PMT		SCR/GTL	NA	NA	LC 101 E	NIL	Bridge no. 347A
PMT	199.90	SCR/GTL	III (R)	Q style Relay Based PI	LC 99 T	AMARAJA 200AH	Bridge no. 330
PMT- OBVP		SCR/GTL	NA		LC 98, LC97, LC 95 LC94	NIL	NIL
OBVP	188.75	SCR/GTL	III (R)	EI Kyosan	LC 93	AMARAJA 300AH	NIL

Station/ Block Section	Chainage at km	Railway/ Division	Std of Interlocking	Type of Interlocking	LC gates	Make of IPS/Battery Capacity	Major Bridges
OBVP-ANE		SCR/GTL	NA	NA	NIL	NIL	Bridge no. 289
ANE	182.90	SCR/GT	III (R)	Q style Relay Based PI	LC 89 T, LC 88T	AMARAJA 200AH	NIL
ANE-KOU		SCR/GTL	NA	. NA	LC 86 , LC 85, LC 84	NIL	Bridge no. 274, 256
KOU	175.51	SCR/GTL	III (R)	Q style Relay Based PI	NIL	AMARAJA 200AH	NIL
KOU-SF		SCR/GTL	NA	NA	LC 83, LC 82, LC 81	NIL	Bridge no. 251
SF	165.84	SCR/GTL	III (R)	Q style Relay Based PI	LC 80	AMARAJA 200AH	NIL
SF-BLPE		SCR/GTL	NA	NA	NIL	NIL	NIL
BLPE	158.85	SCR/GTL	III (R)	Q style Relay Based PI	NIL	AMARAJA 200AH	NIL
BLPE-MRM		SCR/GTL	NA	NA	NIL	NIL	Bridge no. 231, 232
MRM	149.02	SCR/GTL	III (R)	Q style Relay Based PI	NIL	AMARAJA 200AH	NIL

Station/ Block Section	Chainage at km	Railway/ Division	Std of Interlocking	Type of Interlocking	LC gates	Make of IPS/Battery Capacity	Major Bridges
MRM-RU	NA	SCR/GTL	NA	NA	LC 73	NIL	Bridge no. 206, 211
RU	134.78	SCR/GTL	III (R)	Q style Relay Based PI	LC 72	STATCON 300AH	Bridge no. 200

2.4.4. Telecommunications Infrastructure:

Station	Control Communication	25W VHF Radio	Any other Communication	6Q Cable	OFC availability
NRE	Yes. on STM/PDMUX	Yes	Railway auto phone & CUG FCT	No Spare quads available.	RCIL OFC available. No spares
HAQ	Yes. on STM/PDMUX	Yes	Railway auto phone & CUG FCT	No Spare quads available	RCIL OFC available. No spares
RJP	Yes. on STM/PDMUX	Yes	Railway auto phone & CUG FCT	No Spare quads available	RCIL OFC available. No spares
PMT	Yes. on STM/PDMUX	Yes	Railway auto phone & CUG FCT	No Spare quads available	RCIL OFC available. No spares
OBVP	Yes. on STM/PDMUX	Yes	Railway auto phone & CUG FCT	No Spare quads available	RCIL OFC available. No spares
ANE	Yes.on STM/PDMUX	Yes	Railway auto phone & CUG FCT	No Spare quads available	RCIL OFC available. No spares
KOU	Yes. on STM/PDMUX	Yes	Railway auto phone & CUG FCT	No Spare quads available	RCIL OFC available. No spares
SF	Yes. On STM/PDMUX	Yes	Railway auto phone & CUG FCT	No Spare quads available	RCIL OFC available. No spares
BLPE	Yes. On STM/PDMUX	Yes	Railway auto phone & CUG FCT	No Spare quads available	RCIL OFC available. No spares
MRM	Yes. On STM/PDMUX	Yes	Railway auto phone & CUG FCT	No Spare quads available	RCIL OFC available. No spares
RU	Yes. On STM/PDMUX	Yes	Railway auto phone & CUG FCT	No Spare quads available	RCIL OFC available. No spares

2.4.5 Details of existing Data Loggers at Stations is given below:

S. No	Station / LC	Make	Capacity	
			Digital	Analog
1	NRE	Efftronics	512	32
2	HAQ	Efftronics	512	32
3	RJP	Efftronics	512	32
4	PMT	Efftronics	512	32
5	OBVP	Efftronics	512	32
6	ANE	Efftronics	512	32
7	KOU	Efftronics	512	32
8	SF	Efftronics	512	32
9	BLPE	Efftronics	512	32
10	MRM	Efftronics	512	32
11	RU/South Cabin	Efftronics	512	32

2.5 Project Scope:

(A) Works to be done by Contractor:

2.5.1 The entire NRE - RU section of 85.64 RKMs shall be provided with Automatic Block Signaling as per the approved system configuration attached as **Annexure-1** with Bid Document.

2.5.2 NRE-RU shall be provided with Automatic Signaling for both UP & DN lines

2.5.3 All the block stations shall have semi-Automatic Signaling with change over facility for converting main line signals of UP, DN lines to automatic signals whenever required. Scheme Plan in this regard is attached as Annexure 2 with Bid Document.

2.5.4 Required alterations in the existing interlocking infrastructure is part of the project and shall be carried out at block stations, LC gates as detailed in para 2.4.3.

2.5.5 The automatic block signaling shall be achieved through continuous track detection using MSDAC as per the approved system configuration attached as Annexure 1 with Bid Document.

2.5.6 The scope of project involves the following activities:

a) Design and Drawing for Automatic Signalling system in the entire section.

b) Preparation of all documents as listed in Annexure 3A & 3B required for processing of approvals, sanction and any other documentation required for commissioning of the project.

c) Supply of all material required for execution and completion of work as per the approved design.

d) Construction of ABS huts and their electrification as detailed in para 3.8 (attached as Annexure 4B with Bid Document).

e) Approach Warning System at all Mid-Section interlocked LC gates as per scheme attached as Annexure 9 with Bid Document.

f) Supply, installation, testing and commissioning of Power Supply arrangements required for Automatic Signalling work.

g) Complete Indoor and Outdoor design, supply, installation, wiring, alteration in existing EI/PI/RRI, testing, energisation and commissioning of Stations, ABS huts, LC gates and any other place required as per the approved design to make the installation functional.

h) Design, supply, installation, integration, testing and commissioning of Track detection system for Automatic Block Signalling using Multi Section digital axle counters (MSDAC) with dual detection as per RDSO/SPN/176/2013 Ver.3 or latest.

i) Design, supply, installation, integration, testing and commissioning of UFSBI as per IRS Spec. No. IRS:S-104/2012 Ver.0 with latest amendments or FN MUX as per RDSO specification RDSO/SPN/211/2022.

j) Supply, installation, integration, testing, validation, networking and commissioning of Data loggers. The work also involves augmentation, alteration and validation of existing Data Logger at stations, LC Gates and any other locations.

k) Design, supply, installation and wiring of earthing arrangements for all new equipment installed as per OEM recommendations, RDSO Code of Practice and Zonal Railway practice.

l) System Integration, Testing and commissioning of both indoor and outdoor installations of Automatic Block Signalling system along with all associated works.

m) Monitoring of the system after commissioning during the Defects Liability Period as detailed in Article 15 of Draft EPC Agreement.

n) Releasing of all non-functional equipment, systems and associated material after commissioning of Automatic Block Signalling system in the section and transportation to designated location.

o) Setting up of Project Store Depot at the nominated location for storage of material as detailed in Para 3.7.

p) Providing transportation and man power facilities required for inspection and supervision of work by the Authority Engineer and his representatives.Supply of furniture for ABS hut as detailed in Para 3.29.

q) Supply and installation of Telecom Equipment for communication between Station to ABS Huts and ABS Huts to ABS Huts as detailed in Para No.3.21.

r) Supply, Installation and commissioning of IP based day and night high resolution video surveillance system in the ABS huts.

s) Supply, installation and commissioning of LED based continuous Display of Automatic Signals and track occupation status at Station & ABS huts with the provision of dual NV MUX.

t) Submission of As Made documents within 2 months after commissioning of the Block Section as per **Annexure 3B**.

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(B) Works to be done by Railways:

a) Approval of all design and documentation as detailed in Para 2.5.6 (b).

b) Processing of CRS / GM/PCSTE / PCEE / PCOM / EIG sanctions and dispensations.

c) Automatic Signal Location Finalization

d) Provision of Auxiliary Transformer for 230 Volts AC supply.

e) Testing and Acceptance of equipment, systems and subsystems.

f) Arranging disconnection of existing signaling systems, power and traffic blocks, opening of existing relay rooms and location boxes as per Article 4 and 8 of Draft EPC Agreement.

g) Arranging required bandwidth for networking of MSDAC, Data Loggers etc.

h) Issue of approved NI Programmer for commissioning of Integrated Automatic Block Signaling.

Note: ***This Feasibility Report is included as Annexure-I of Schedule-B of Draft EPC Agreement. Bidders may please note that the Feasibility Report of the Project is being provided only as a preliminary reference document by way of assistance to the Bidders who are expected to carry out their own surveys, investigations and other detailed examination of the Project before submitting their Bids. Nothing contained in the Feasibility Report shall be binding on the Authority nor confer any right on the Bidders, and the Authority shall have no liability whatsoever in relation to or arising out of any or all contents of the Feasibility Report.***

Section 3
Technical Details

3.1 The scope of the work is **"Comprehensive Signaling & Telecommunication works in connection with Provision of Automatic Block Signaling system in NANDALUR-RENIGUNTA Jn section of Guntakal division of South Central Railway"** as per approved System Configuration and Scheme Plan. The scope of each sub work is detailed below under various heads.

3.2 The entire work is to be executed as per the provisions of the Rules for Opening of Railways, IRSOD, SCR G&SR, IRPWM, Indian Railways Bridge Manual, Indian Railway Signal Engineering Manual (IRSEM), Indian Railway Telecommunication Manual, Operating Manual, IRACTM, IRS/ RDSO specifications, RDSO TAN's, Policy and Technical Circulars of South Central Railway, Technical Manuals of OEM and the latest guidelines issued by Railway Board, RDSO and South Central Railway.

Note: Any document /drawing /manual /circular /guidelines, etc. which are not attached along with the bid document may be obtained from the Authority / Authority Engineer during office hours on any office working day.

3.3 ABS system configuration of the project is attached with the bid document as **Annexure 1**. Bidders shall submit their bids along with a detailed scheme proposed to be implemented in the work duly conducting detailed site survey. Any departure from the scheme should have sufficient justifications in terms of improved RAMS.

3.4 The technical details given below provide the description of the work to be executed. In case of conflict between any two clauses in this Feasibility Report, the decision of the Authority Engineer is final and binding.

3.5 **General requirements:** This chapter gives the general requirements of the work to be executed.

S. No	Description
3.5.1	**Supply of Material**
i	All materials required for completion of the project as per the scope for full functionality of the scheme and requirements of Automatic Block Signaling as per G&SR, IRSEM, IR Telecommunication Manual, Operating Manual and other reference documents as detailed in Para 3.2 above shall be supplied by the contractor.
ii	A list of specifications for supply of material is given in **Annexure 7A & Annexure 7B**. The material shall be supplied as per these specifications only. Wherever no specification is mentioned, procedure outlined in Schedule D, Part- II of Draft EPC Agreement shall be followed.
3.5.2	**Inspection of Material**
i	The material having value more than Rs. 5,50,000/- or critical items as per Railway Board letter No.74/RS(G)/379/2Pt. dated 4/3/91 and 18/6/91 shall be supplied duly inspected by RDSO/ RITES. The details of inspecting agencies are given in Annexure 7A & Annexure 7B. All the inspection charges shall be borne by the contractor. The inspection charges for material to be inspected by RITES will be as per Railway Board letter No.2022/RS(G)779/9 Dated.01.12.2022 or latest Railway Board guidelines. Normally, the inspecting agency shall not be changed. However, in case the nominated inspecting agency is not in a position to carry out inspection due to policy changes / or any other reason, the inspection shall be carried out as per Authority's decision. In such a case, cost of inspection charges as applicable for RDSO/RITES shall be deducted from the contractor's bills
ii	Material with RDSO specifications shall be procured from RDSO approved vendors only. If no RDSO approved vendor is available, material shall be procured from other sources as approved by Authority.
iii	Notwithstanding any approval which the inspecting officer may have given in respect of the stores or any materials or the work or workmanship involved in the performance of the contract (Whether with or without any test carried out by the contractor or the Inspecting officer or under the direction of the Inspecting officer) and notwithstanding delivery of the stores where so provided to the interim consignee, it shall be lawful for the consignee, on behalf of the purchaser, to reject the stores or any part, portion of consignment thereof within a reasonable time after actual delivery thereof to him at the place or destination specified in the contract if such stores or part, portion of consignment thereof is not in all respects in conformity with the terms and conditions of the contract whether on account of any loss, deterioration or damage before dispatch or delivery or during transit or otherwise whatsoever.

iv	Once materials with value more than Rs.10 Lakh are received at designated store depot, the contractor has to inform the Authority Engineer in writing within Seven days of receipt of such material along with copies of inspection certificates and other documents. Within Fifteen days of receipt of information, Authority engineer shall depute his representative to inspect the material. In order to facilitate Authority engineer's representative inspection, Contractor shall produce all certificates, e-way bills and invoices in original during inspection. Contractor will also facilitate the Authority Engineer's representative with tools, measuring instruments, labour and skilled staff for sample testing of the material. Material, irrespective of value, which is not in conformity with the specifications, loss, defective or damaged will be rejected summarily.
3.5.3	**Augmentation / Alterations and Interfacing with Existing Equipment**
i	The existing working equipment such as EI, IPS, Data loggers, etc. shall be augmented as per the requirement of project scope duly supported by technical details and calculation. The contractor shall arrange for all the necessary hardware, software, interfaces, alterations in the existing equipment viz EI, IPS, data logger etc. for commissioning of Automatic Block Signalling. The contractor shall arrange and coordinate with the OEMs of existing systems for interfacing with hardware / software with necessary alterations.
3.5.4	**Installation and Commissioning**
i	All the equipment shall be installed and commissioned by OEM's authorised Engineers. OEM Installation certificates, testing certificates, Pre-commissioning checklists etc., shall be arranged by the contractor. Procedures specified in the latest RDSO TAN shall be followed.
3.5.5	**Penalty Imposition**
i	Penalties as mentioned in **Annexure 12** will be imposed for various deficiencies and discrepancies in the work/ services executed.
3.5.6	**Transportation**
i	Loading, unloading and transportation of all materials with all lead and lift from one location to other shall be within the scope of the project.
ii	Transportation required for inspection, supervision, testing and commissioning of works by Authority / Authority Engineer and his representatives shall be within the scope of the project.
3.5.7	**Tools & Plants**
i	All tools & plants, measuring instruments etc. required for inspection, installation, testing & commissioning shall be arranged by the contractor and shall be the contractor's property.
ii	The contractor shall supply the tools & plants and measuring instruments as per **Annexure 11** for maintenance of the system along with test and warranty certificates.

3.5.8	**Project Monitoring**
i	The contractor shall deploy latest project monitoring tools such as MS Project / Primavera etc. as approved by Authority Engineer with five number of user licenses for the use of all concerned associated with the project. He shall also engage an experienced Planning Engineer for regular (daily / weekly) updating of progress and generating exception reports as required by Authority Engineer or his representatives.
3.5.9	**Record of ManPower**
i	The Contractor shall enter the details of all the manpower engaged by him for the entire project in Shramik Kalyan Portal.
ii	The record of ESIC details of manpower engaged by the contractor shall be made available for the inspection of Authority Engineer/his representative. The contractor shall fill the salient details of contract labours engaged in the contract and ensure updating of each wage payment to them on Shramik Kalyan portal on monthly basis and the record shall be made available for the inspection of Authority Engineer/his representative
3.5.9	**Safety & Security at Work Sites**
i	Contractor shall adhere to all safety instructions, circulars and norms issued by Railway when working close to the track to ensure safety of trains as well as staff working in the vicinity of the track. Contractor shall deploy adequate look out men while working on track with all necessary safety devices, tools and gadgets. Instructions laid down in 10.2.11 of Draft EPC Agreement shall be followed. PCE/SCR Engineering Standing Orders No. 89 dated 29.07.2020 and No. 65 dated 05.07.2010 or latest shall be the basis of the safety plan.
ii	Contractor shall arrange for security guards at the worksite during night at all locations where work is in progress. A record of details & attendance of security guards provided shall be maintained at site and this record shall be made available for the inspection of Authority Engineer/his representative.
3.5.10	**Discrepancies in Drawings and Documents:**
i	The contractor shall carry out at his expense any alteration of the work due to any discrepancies, errors or omissions in the drawings or other particulars submitted by him. Any approval given by the Railway for this purpose shall in no way absolve the contractor from any or all responsibilities for the correct function of the equipment and systems so integrated. In this regard, the sole responsibility rests with the contractor in all respects. Any fittings or accessories which may not be specifically mentioned in the specification or tender documents or the letter of acceptance of the tender or the agreement executed thereof but which are necessary as per the requirement of the system, Signal Engineering practice and good industry practice are to be provided by the contractor without extra charge so that the project is complete in all respects, functional and meets the requirements of G&SR, IRSEM, IR Telecommunication Manual, Operating Manual, IRSOD and IRACTM etc.
3.5.11	**Provisional and Final Completion Certificates.**
i	Completion certificate Provisional / Final shall be issued in accordance with the procedure laid down in Article 12 of Draft EPC Agreement

3.6. Design of the Automatic Signaling System:

3.6.1 Scope of the Design

Detailed design of Automatic Signaling System as per SCR Technical Circular No. TC 01/2022 or latest and approved system configuration for ABS

3.6.2. Technical Details:

S.No	Description
i	The Contractor shall appoint a design director (the "Design Director"), approved by Authority Engineer, who will head the Contractor's design unit and shall be responsible for surveys, investigations, collection of data, and preparation of preliminary and detailed designs. The Design Director shall be a Graduate Engineer with basic knowledge in Railway Signalling and AutoCAD.
ii	The contractor shall submit SIP, TOC and detailed design proposed for Automatic Block Signalling Block section wise for the approval of Authority. The scheme shall be as per approved system configuration for ABS (SCR Drawing No. 5760) attached as Annexure 1. SIP shall be prepared after the ground survey and shall indicate the following: a) Stations' SIPs as per SCR practice / RDSO standard practice as per existing SIP. b) Block section SIP as per SCR practice. c) Proposed new signals, replacement of existing signal / CLS unit and removal of existing signals required, if any in the station / block section shall be shown in the above SIPs. d) Besides, all other details required as per the detailed scheme plan attached as **Annexure 2** shall be indicated. The contractor shall submit ABS hut location, site layout plan and floor plans, indoor and outdoor circuits along with circuit alterations / changes / addition in software & hardware design in existing installations such as EI, data logger, existing Location boxes, relay room etc. (Refer **Annexure 3A**) as per SCR practice and typical circuits. SIP, TOC, indoor circuits along with circuit alterations / changes / addition in software & hardware design shall require the approval of Authority. All remaining documents and designs shall require the approval of Authority Engineer

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iii.	Design activities shall be in accordance with Article 10 of Draft EPC Agreement. The design and documents shall be produced and checked by IRSE/ IRSTELO design licence holders. List of competent designers shall be submitted by the contractor to the Authority to finalise the design team. The Design philosophy and process shall be as per guidelines issued vide Lr No. SCR-HQ0SNT (SGPC)/5/2019 dt. 05.01.2021. In order to have continuity in the design process, designers shall not normally be changed for the entire project duration.
iv	The proposed cable route path for trenching shall be prepared by carrying out a site survey. The survey report shall be prepared in a diagrammatic representation, showing the existing cable paths, distances of various cable paths from the nearest track centre, railway land boundary etc. for both main and redundant paths. Both Cable paths i.e. main & redundant shall be preferably planned at a distance of one metre inside the railway boundary.
v	Cable Route plan, Cable Core plan, Cable Termination details in relay room and location boxes, location wiring plan, Fuse particulars, Power supply scheme, equipment disposition / floor plan, indoor circuits both logic and interface, shall be designed and checked as per SCR practice / Typical circuits and submitted for approval.
vi	The signalling cables shall be planned in such a way that a minimum of 20% of working conductors are kept as spare. 1. In station yards, the cables shall be planned as per Drg no SK/P/SC/ABS/003 2. In the Block Section beyond the home signal of one station to the home signal of adjacent station, the cables shall be planned and laid as per SC.RLY. DRG.NO.C5760 Loading of functions in 6Q cables shall be planned in such a way that minimum two quads must be kept spare in each 6Q cable.
vii	The design and execution of outdoor works at NRE station shall be planned in such a way that full complement of work is executed at both stations for commissioning of ABS system in the station yard as per approved signalling plan.

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Nomination of fibres for various applications shall be as under.

S.No	**Function/ Equipment**	Main OFC (No of Fibres)	Redundant OFC (No of Fibres)
1	MSDAC Evaluators (Main and standby)	2	2
2	USFBI (Main & Stand by) / FN MUX	4/6	4/6
3	Non Vital MUX (if provided)	2	2
4	Telecom Equipment	2	2
5	CTC (Future)	2	2
6	TCAS (Future)	6	6
7	DL	2	2
8	Spare	4/2	4/2

viii

Testing of existing fibres and restoration of any defective fibres to achieve the availability of working and spare fibres as specified in para above is in the scope of the project.

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For ease of maintenance and cost effective inventory management, MSDAC, UFSBI / FNMUX, IPS, batteries, Data logger, Relays, ELD's, Changeover modems, Telecom equipment and other equipment of uniform make shall be used for the entire project.

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All the alterations required in existing EI/PI/RRI installations such as interface circuits, logic circuits or any other circuits shall be designed as per approved SIP & TOC and submitted for approval.

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Boolean equations of the modified logic shall be submitted for comparison and approval with the existing application logic by Authority. Similarly, I/O bits and port configuration shall be submitted for approval by Authority. Required Application Data Generation tools shall be made available to the Authority along with a comparative statement of modified logic with existing logic.

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All documents required for necessary approval and sanction as mentioned in table below shall be prepared and submitted by the contractor. Corrective actions and compliance of observations of approving / sanctioning authority, if any, shall be arranged by the contractor.

S.No	Document
1	CRS / GM/ PCSTE / PCEE / PCOM / EIG sanction application
2	Application for dispensation under Approved Special Instructions.

3	Application for dispensations under Special Instructions.
4	SWR & GWR
5	SWRD
6	TSAA
7	NI readiness document
8	Grade Condonation papers

3.7 Material Management:

3.7.1 Scope of the work: Supply, Storage, Account and Management of Material.

3.7.2 Technical Details

Sl.No.	Description
i	All materials required for completion of the project as per the scope for full functionality of the scheme and requirements of Automatic Block Signaling as per G&SR, IRSEM, IR Telecommunication Manual, Operating Manual, ACTM, IRSOD etc shall be supplied by the contractor. The list and quantity of material which are to be supplied as spares is given in **Annexure 10**. Rounding off shall be done as specified in Para 1.3 of Draft EPC Agreement.
ii	A list of specifications for supply of material is given in **Annexure 7A & 7B**. The material shall be supplied as per these specifications only. Wherever no specification is mentioned, procedure outlined in Schedule D, Draft EPC Agreement shall be followed.
iii	All the signalling, copper conductor Power and Telecommunication cables required as per the System Configuration shall be supplied by the contractor. All cables shall be procured from RDSO approved vendors with RDSO inspection except 35 sq mm, 2 Core XLPE copper cable which shall be procured with RITES inspection as per IS specification.
iv	The RCC duct shall be supplied as per SCR DRG No.5778 and 5778A. SCR DRG No.5778 is to be adopted for laying of Signalling, Telecom and 2X35 Sq.mm XLPE power cable. SCR DRG No. 5778A to be followed for laying of Signalling and Telecom Cables only.
v	All the materials required for the project shall be maintained in the custody of the contractor at the nominated store depot of the contractor. Location of Store depot shall have prior approval of Authority Engineer. The Contractor shall set up/lease a store depot with a covered shed of minimum size of 400 sqm with protection all around. The Contractor shall arrange security guard round the clock for the above store depot. A record of details & attendance of security guards provided shall be maintained at site and this record shall be made available for the inspection of Authority Engineer/his representative.

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vi	Site required for setting up of store depot shall be arranged by contractor and any payment towards rental charges, security, electricity, water etc. shall be borne by the contractor.
vii	Contractor shall take necessary insurance as detailed in Article 18 and indemnify all material as detailed in Article 23 of Draft EPC Agreement. The material in store shall be protected properly by the contractor by making necessary arrangements such as round the clock security, fencing, sheds, lighting, surveillance cameras, fire protection arrangements etc. The contractor is solely responsible for the safe custody of the material.
viii	The contractor shall neither divert the materials nor use for any other purposes than exclusively for execution of the project for which the materials are intended for. The store is subjected to inspection at any time without notice by the Authority Engineer or his representative.
ix	Proper record of daily material transactions shall be maintained in a register (DMTR Format). Gate passes, issues, receipts, stock on hand, inspection reports etc. shall be maintained by the contractor. Material transactions and Stock position may be digitized.
x	Stage payments shall be made as per the contract price weightage mentioned in Schedule- G of Draft EPC Agreement.

3.8. Construction of Automatic Block Signalling Huts (ABS Huts)

3.8.1. Scope of the work: Design of Automatic Block Signalling huts as per the layout plan attached as **Annexure 4A & 4B** with Bid document and construction as per the approved drawings at the specified location along with supply of all electrical fittings & carrying out necessary electrical wiring with all the related works as per approved designs and drawings.

3.8.2. Technical Details

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<table>
<tr><th>Sl. No</th><th>Description</th></tr>
<tr><td>i</td><td>ABS huts shall be precast RCC structures of approved design and from a reputed company having constructed precast RCC buildings of cumulative floor area not less than 2,00,000 Sq. feet in the government and/or corporate sector. The Pre-cast Manufacturer shall have its own manufacturing facility with ISO certification. The number of ABS huts to be constructed in the block sections and at stations is as follows:
<table>
<tr><th>S.No</th><th>Block section</th><th>No o f huts to be constructed</th></tr>
<tr><td>1</td><td>NRE-HAQ</td><td>1</td></tr>
<tr><td>2</td><td>HAQ</td><td>1</td></tr>
<tr><td>3</td><td>HAQ-RJP</td><td>1</td></tr>
<tr><td>4</td><td>RJP</td><td>1</td></tr>
<tr><td>5</td><td>RJP-PMT</td><td>2</td></tr>
<tr><td>6</td><td>PMT</td><td>1</td></tr>
<tr><td>7</td><td>PMT- OBVP</td><td>2</td></tr>
<tr><td>8</td><td>OBVP</td><td>1</td></tr>
<tr><td>9</td><td>OBVP-ANE</td><td>1</td></tr>
<tr><td>10</td><td>ANE</td><td>1</td></tr>
<tr><td>11</td><td>ANE-KOU</td><td>1</td></tr>
<tr><td>12</td><td>KOU</td><td>1</td></tr>
<tr><td>13</td><td>KOU-SF</td><td>2</td></tr>
<tr><td>14</td><td>SF</td><td>1</td></tr>
<tr><td>15</td><td>SF-BLPE</td><td>1</td></tr>
<tr><td>16</td><td>BLPE</td><td>1</td></tr>
<tr><td>17</td><td>BLPE-MRM</td><td>2</td></tr>
<tr><td>18</td><td>MRM</td><td>1</td></tr>
<tr><td>19</td><td>MRM-RU</td><td>2</td></tr>
<tr><td>20</td><td>RU</td><td>1</td></tr>
<tr><td>21</td><td>LC 81</td><td>1</td></tr>
<tr><td>22</td><td>LC 83</td><td>1</td></tr>
<tr><td></td><td>Total</td><td>27</td></tr>
</table>
</td></tr>
</table>

ii	Total no of ABS huts to be constructed will be 27 (Twenty Seven)nos.
iii	The size of the ABS huts shall be as per **Annexure 4**. While arriving at the size of the ABS hut, recommendations of OEM regarding the space to be maintained between different equipment racks and working space shall be kept in mind. Layout plan attached with this document indicates only the minimum distance to be maintained between equipment. If any deviation from the attached layout plan is required as per revised design considerations, the modified plan shall be submitted by the contractor for the approval of the Authority Engineer.
iv	All the materials used for construction shall be as per IS specifications. Design shall comply with latest IS codes. Loading standards shall be as per IS 875 or latest and relevant IS codes. Flooring shall be able to handle loading of 2000 kg/ sq mt in addition to live loads.

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v	Windows shall be made of UPVC with glazed glass doors, MS grill of approved type and integrated wire mesh. Door frames shall be made of MS. Outer door shall be made of MS and double door type. Inner door shall be of solid WPC (Wood Polymer Composite). Ventilators shall be of louvred Aluminium type with integrated wire mesh and provided as per layout plan attached.and relevant IS codes for Precast structures. Flooring shall be able to handle loading of 2000 kg/ sq mt in addition to live loads.
vi	Windows shall be made of UPVC with glazed glass doors, MS grill of approved type and integrated wire mesh. Door frames shall be made of MS. Outer door shall be made of MS and double door type. Inner door shall be of solid WPC (Wood Polymer Composite). Ventilators shall be of louvred Aluminium type with integrated wire mesh and provided as per layout plan attached.
vii	All doors and windows shall be painted with two coats of approved colour. Indoor and outdoor shall be painted with weather proof emulsion paints of minimum two coats of approved colours. The Paint shall be of approved brands such as Asian, Berger, Indigo, British, Dulux etc.
viii	The flooring shall be provided with double vitrified tiles of size not less than 600 mm x 600 mm.
ix	Cable duct of size 300 mm x 300 mm shall be provided as indicated in the layout plan. Arrangements shall be made inside the ABS hut to fix cable trays, supporting angles of cable termination racks, relay racks and supports for various equipment. After completion of cable laying, cable duct shall be provided with matching tiles.
x	Supervision of building and electrical construction activities, quality control shall be done by a qualified Civil Engineer having minimum five years of working experience in a reputed construction company/ organization as approved by Authority Engineer. The above mentioned Civil Engineer shall be available at site during the entire period of ABS Hut construction. The Contractor shall arrange for inspection of ABS Huts by RITES in different stages but not limited to ▪ Foundation Stage ▪ First slab stage ▪ Second slab stage ▪ Finished stage

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xi	Proper approach shall be provided from track formation to ABS hut. The width of the approach shall not be less than One meter.
xii	Arrangements shall be made on the roof of the ABS huts to erect Class A protection system as per SCR Drawing No. 5777. Base plate for installation of the mast for Class A protector as per the drawing shall be embedded in the roof while casting Slab. Hooks for connecting stay wires of class A protection mast shall be provided in the slab as per SCR Drawing No. 5777.
xiii	Provision for Cable entry shall be provided in ABS hut for not less than 60 cables as close as possible to CT rack and OFC rack as per layout plan.
xiv	Contractor is responsible for loading, unloading and transportation of all construction material of ABS hut to site.
xv	Fencing as per RDSO DRG No. ETI/C/0186 shall be provided around the hut leaving a minimum 1000 mm gap from the building. Earth work with protection shall be done to level the earth around the building inside the fencing.
xvi	All the materials used shall be as per the approved list issued by PCE vide Lr No. SCR-HQ0ENGG(SOR)/1/2020-Dy.CE/WORKS/SCR dt. 24.05.2022.
xvii	The roof of ABS huts shall be painted with one coat of silane Althatic, Urethane Resin Blend Solvent Based high technology Membrane radiant heat reflecting insulating Thermal barrier coating
xviii	Provision of electrical fitting as per approved design but not limited to ceiling fans (1400 mm sweep), exhaust fan and required number of Lights inside & outside (LUX shall be not less than 500) with MCB protection arrangements as per SCR Drawing No.5780 for triple line section and as per SCR drawing no 5780 for Double Line section. Electrical wiring shall be concealed. All materials used shall be energy efficient and of reputed make such as Havells, Phillips, Surya etc and as per PCEE spec SCR/PCEE/SPEC/BLDC-02/2022 & SCR/LED bulbs (ID/OD)/ 001-005/2017 or latest. Extension of AT supply from nearest AT transformer to the hut on 35 sq mm, 2 Core XLPE copper cable and termination on adequate capacity of CLS Panel (Including supply of cable & CLS Panel) is in the scope of work.
xix	All the new ABS huts both at stations and block sections shall be provided with double locking arrangements and door sensor arrangement. Closing/Opening of ABS hut door should be monitored through door sensor connected with Datalogger
xx	The ABS huts in mid sections should be located in such a way that there will be a proper road approach for the ABS huts. It shall be possible for a road vehicle such as a pickup van to go up to the ABS hut entrance for loading/unloading of material. Where required ,the tenderer shall lay approach road for the ABS hut. The road shall be Kachha nature with a minimum width of 3 mts.

3.9. Laying of Signalling, Power & Telecom Cables:

3.9.1. Scope of the work: Trenching and laying of cable ducts, signalling, power and telecom cables in the main and redundant paths (as far as possible on both sides of track), as per the approved cable route plan with all the necessary material supply and transportation to site, termination, jointing & wiring required for commissioning of the Automatic Block Signalling in the entire section and stations as detailed below.

3.9.2. Technical details:

Sl.No.	Description
3.9.2	**Cable Laying**
i	Trenching and laying of cable ducts, Signalling, telecommunication, Power cables, termination of cable on terminals with supply of all necessary fixtures and material, blowing of OFC, splicing, jointing, provision of joint chambers and loop chambers, termination of fibres on FDMS of OFC and testing of cables and fibres and associated works is in the scope of the work. Practices as specified in IR Telecom Manual, guidelines issued by RDSO for signal cable laying vide RDSO/SI/G/2010 Ver 1.1 or latest, SCR technical guidelines shall be followed. In the RE area special precautions laid down in RDSO guidelines shall be followed.
ii	Requirements of micro-tunnelling / trenchless laying, laying of RCC duct / HDPE pipe / RCC pipes / GI Pipe and protection arrangements etc. shall be assessed based on site survey and shall be indicated in the cable route plan and submitted for approval of Authority Engineer. Cable shall be laid as per approved cable route plan and cable core / distribution plan. An extra cable loop of 6 to 8 meters shall be kept at each end of the main cable / tail cable / power cables / 6Q cable, at apparatus cases, at signal foundations, ABS huts / Relay rooms, major bridges and culverts. If the cables are to be laid in the station area/ circulating area by breaking concrete/ road/ platform/ any other surface, the work area shall be brought back to its original state after completion of cable laying
iii	Trenching and cable laying shall be carried out in Two paths. One is called the main path and another one is called the redundant path. Main and Redundant path for cable laying shall be on the opposite side of tracks. If there is no space for cable laying on the opposite side of the track, then it can be laid in the same path with prior approval of the Authority Engineer. a) If for any reason, if the cable laying is done in only one path (with prior approval of authority engineer), that path shall be considered as the main path and RCC duct shall be laid. b) In the main path, the duct shall be laid at a depth not less than 600 mm. All signalling, Power, HDPE duct shall be drawn in the duct. The RCC duct shall be laid for the main cable path and also for the tail cables trench that is from main cable path up to the function. RCC duct shall be filled with River sand / Sieved quarry dust not less than 50 mm above the cable top. The joints of RCC duct covers shall be sealed with cement mortar. The trench shall be refilled after closing of the duct. c) Where power cables are to be taken through the RCC duct, the RCC duct (as per SCR drawing no 5778) shall be used.

	d) where no power cables are required to be taken in the RCC duct, RCC duct (as per SCR drawing no: 5778A) can be used. e) When cables are to be laid in rocky areas, in the path nominated for RCC duct, the rock shall be cut to a depth of not less than 400 mm, place the RCC duct and concrete the remaining portion up to ground level, with 1:3:6 concrete mix after laying of cables.. f) In areas where continuous sheet rock is encountered, the cables shall be laid in GI pipes of adequate diameter and complete length of the GI pipe shall be clamped and concreted with 1:3:6 concrete mix up to the height/width of 300 mm above /adjacent to the GI Pipe. g) In the redundant path, signalling, telecom and power cables shall be buried directly at a depth not less than 1.0 mtrs. Wherever the above-mentioned depth of 1.0 mts cannot be achieved due to site conditions, protection arrangements as per SCR Drawing No. 5771 shall be provided. A minimum depth of 600 mm shall be dug for the above protection arrangement. h) The trench path shall be straight as far as possible. The trenching shall be carried out without causing damage to the working cables. A qualified engineer shall be deployed at the work spot continuously. The guidelines issued vide Railway Board Lr No.2021/Tele/5(2)/3-Part(1)(3425647) dated 12.06.2023 for taking up digging activity near S&T cables shall be followed. Necessary bushes/trees/jungle shall be cleared before taking up the trenching. i) When rock is encountered, the cable laying shall be done as per Drawing Nos.15-D2 of IRSEM Sheet 1, 2 & 3. j) Trenching and cable laying shall be carried out in one path for short distance only, where it is not feasible to provide in two separate path duly taking approval from Authority Engineer.
iv	a) Track Crossings, Road crossings, Platform crossings, Trenching in Circulating area, shall be carried out by Micro tunneling / Polyofenil channel duct /Trench less digging to the extent possible. Micro tunneling / trenchless digging shall also be adopted in difficult terrains/marshy areas/water logged areas if it is found advantageous for quick delivery of the project but not envisaged during the survey shall be decided by the Authority Engineer. Micro tunnelling shall be carried out at a depth of not less than 1.5m from rail level. Micro tunneling / trenchless digging shall include supply and insertion of HDPE duct of Dia 110 mm, PE 80 (IS 4984). b) If micro tunnelling is not feasible for track crossings / Road crossings, horizontal boring method vide SCR Drawing No. 5770 shall be followed. For track crossings, micro tunnelling/ horizontal boring shall be done at a depth not less than 1.0 mts from the bottom of the sleeper. c) If both the above mentioned methods are not feasible, manual track crossing / road crossing shall be done as per SCR Drawing No. 5768 as decided by the Authority Engineer. d) RCC pipe used for manual crossing shall be of non-pressure NP2 class (light duty) of 150 mm dia. with collars joined with a stiff mixture of cement mortar in

	the proportion of 1:2 (1 cement : 2 fine sand) including testing of joints etc. e) The surface area shall be brought back to its original state after completion of cable laying. f) Wherever the above Two options are not feasible, cables shall be taken over the foot over bridge in lieu of track crossing as decided by the Authority Engineer. Cable shall be laid inside HDPE pipe of Dia 110 mm, PE 80 (IS 4984) of suitable diameter properly clamped to the FOB structure. g) A cable chamber as per SCR Drawing No. 5766 shall be constructed near the Relay room, ABS Hut, LC Gate and cable coil loops shall be kept in this chamber duly filled in with sand and sealed with RCC slab.
v	**Cable Laying on Bridges:** a) Cable laying on important/ major bridges having steel girders shall be either through GI trough vide DRG No.15-D6 of IRSEM (Supporting channels vide DRG No. S&T/RE/78/2/76 page 1, galvanized to Spec IS 2629-1985) or through Medium class GI pipe conforming to IS.1239 (part-I) 1990 and galvanized to specification IS.4736-1986 of adequate diameter supported by 'C' Channels of size not less than 100mm x 50mm x 1200 mm thickness 5mm galvanized to specification IS 2629-1985. GI Pipe shall be perforated at regular intervals. No drilling of holes on girders is permitted. b) Cable laying on important/ major Bridges with concrete girders and having built in duct shall be laid through HDPE pipe of Dia 110 mm, to specification PE 80 (IS 4984). Masonry brick blocks of size 500 x 500 mm (width X height) shall be provided at either end of the bridge to cover exposed HDPE pipe completely. c) Cable laying on important/ major Bridges with concrete girders without built in duct shall be done through GI pipes of adequate diameter. Concrete masonry of 300X300X300 mm above GI pipes shall be provided at every 2 mts .The GI pipes shall be clamped at every 1 mt. The GI pipes and concrete masonry shall not infringe as per IRSOD. Both ends of the GI pipes are to be closed with brick masonry. d) Cable laying on all minor bridges / culverts shall be as per DRG No. 15-D8 of IRSEM. Medium class GI Pipes of adequate diameter for laying cable on the culvert shall be used. When the cables are to be laid on the bed of culverts or under culvert, the laying shall be done as per IRSEM drawing no DRG No. 15-D7. This procedure shall be adopted for minor bridges/culverts where there is no perennial water flow. The pipe shall be of non-pressure NP2 class (light duty) of 150mm dia R.C.C. pipes with collars jointed with a stiff mixture of cement mortar in the proportion of 1:2 (1 cement : 2 fine sand).
vi	When the cables have to be taken inside a relay room / ABS hut / Dy. SS room / LC gate hut etc, the cables shall be laid & bunched over powder coated MS ladder of appropriate width made of angle of size 38mm X 38 mm X 3 mm and taken inside the relay room. The base of the ladder shall be properly concreted with 1:3:6 concrete. The above arrangement shall be protected by constructing a brick masonry block around the ladders.

vii	When the cables are required to be taken inside working location boxes / Signal Post, the cable shall be taken from underneath the location box foundation. Inside of the location box shall be sand filled, plastered after taking the cables inside. For working functions, the planning shall be such that it is possible to change over without disconnection of working function or with bare minimum disconnection. Wherever there is paucity of space in the existing locations, new wired location with foundation shall be done and existing cables shall be jumpered from the existing location to the new wired location and existing location shall be converted into Junction Box.
viii	6Q cable shall be jointed using jointing kits to specification IRS TC 77/2012 Rev 3 with latest amendments. These joints shall be kept in a separate new Full Location Box duly fixing with teak wood reapers on both ends of the joint without any sharp bends. 6Q cable shall be terminated on WAGO / Phoenix terminals which shall confirm to RDSO Specification No. 189/2004 or latest at location boxes near DPs of MSDAC. 6Q cable pairs shall be twisted before termination.

ix	**OFC Cable Laying:** a) Laying of HDPE duct and blowing of OFC Cable shall be done as per guidelines given in Section VIII of Chapter 13 of IR Telecom Manual. OFC cable shall be blown through HDPE duct confirming to specification RDSO/SPN/TC/45/2013. HDPE duct shall be laid in both main and redundant paths as required. Both Main & Redundant OFC cables shall be blown through HDPE duct using a blowing machine and no manual pulling is permitted. Before blowing of OFC cable, Duct Integrity test shall be carried out on HDPE duct as per procedure laid down in Para Annexure-I Chapter 13 of IR Telecom Manual and readings shall be recorded before blowing OFC cables. OFC cable shall be jointed as detailed in Section X Chapter 13 of IR Telecom Manual. After splicing OFC shall be tested and readings recorded as per format in Para 13.10.23 of IR Telecom Manual / South Central Railway formats. b) All the fibres of OFC shall be terminated in FDMS in LC Gates / ABS huts / Stations / Cabins as per system requirement. These FDMS shall be housed in a suitable standard make 42U rack such as Vero President / Rittal / AEW etc. at the ABS Huts / Stations and rack of suitable size in LC Gates. The rack shall have cooling fans, Power managers, cable managers, equipment trays of adequate numbers. OFC Patch cords of adequate length shall be provided to connect OFC cables to Equipment. c) In block sections two OFC cables of suitable capacity (minimum 48 Fiber), shall be laid in separate paths from station to station to meet the requirement of working functions and spares as specified in para 3.6. d) The existing OFC in the sections shall be terminated at all ABS huts / LC Gates, two numbers of 48F OFC cables shall be laid in HDPE duct and spliced at the nearest joint chamber and terminated at FDMS in ABS Huts / LC Gates. e) All materials required such as OFC joint closure, Joint chambers, FDMS etc. shall be within the scope of the work. Provision of FRP Loop chambers at every one Km, on both ends of track crossing, both ends of major bridges etc. are in the scope of work. RFID markers shall be of STANLEY/3M/LEGRAND or any other reputed make are to be provided as per approved specifications. RFID markers shall be programmed with details approved by Authority Engineer. It shall support web based/smart phone based viewing of cable path and other details.
x	Wherever power cables are required to take 230V AC power supply, it shall be laid in the separate partition of the RCC duct.

xi	The entire cable path (both main and redundant paths) shall be provided with cable route markers as per DRG. No. 15-D1 of IRSEM. The cube test reports of each sample of the concrete batch shall be submitted. The Cable markers shall be provided at an interval of 50 mtrs. Additional cable markers shall also be provided at every cable joint/cable diversion. Cable markers shall be painted with standard colour code. RFID Cable route markers shall be provided in both main and redundant trenches at every 100 mts and at the locations of Track crossing and OFC Loop Chamber.
xii	The complete trenching, cable laying activity shall be video recorded and submitted in CD / Pen drive along with stage payment certificate.
xiii	a) 6 Quad Cable for signalling applications available in the section shall be brought to the ABS Huts and terminated for emergency use.
	b) 6 Quad Cable used for block, BPAC, EC and LC Gates communication shall also be brought and terminated at ABS Huts.

3.10. Signal and Location Box/apparatus case

3.10.1. Scope of the work: Supply, transportation, casting foundation, installation, termination of cables and wiring, with all accessories and necessary materials, testing of wiring in location boxes and signals required for commissioning of the system.

3.10.2. Technical details:

Sl. No.	Description
3.10.2.1	**Location boxes**
i	The apparatus case of full size (GKP type) with 'E' type lock & key, fixed on one side of the door as per DRG. No. S&T/MFT/2378 (Single) shall be supplied by the contractor. E Type lock of Ward No. 32 / 31 as per RDSO DRG. No. SA 3376/M and Key to DRG. No. S.3377 shall be used.
ii	The apparatus case shall be installed as per cable core plan by Excavation of Pit, Casting foundation as per SCR Drawing No. 5781. The top surface of the foundation shall normally be at rail level in a plain area. For all location box foundations strengthening of foundation with stone pitching shall be done upto a height of 40 cm covering an area of one meter around the Location box foundation. The foundation shall be lime washed with two coats after completion of erection of location box.
iii	New separate location boxes shall be cast for each new signal location . Where two new signals of the same direction are located at a distance less than 10 mts , the same location box can be used for both signals . Separate Location Boxes shall be provided for each Home Signal. New separate location box shall be cast for each MSDAC DP location .Where MSDAC DPs are located at a distance more than 20 mts.
iv	The apparatus case shall be painted with one coat of primer after preparing the surfaces smooth by emery paper polishing. The apparatus case shall be painted with two coats of aluminium paint on outer surface and two coats of white paint inside. The paints shall be of make Berger / Asian / British / JSW etc.

v	Supply & Fixing of Teak wood Reapers / Teak wood Block / 10 mm hylam sheet, Cable termination, Supply and fixing of 1 Way / 6 Way terminal / WAGO Terminal, Supply and fixing of Fuse blocks and fuses, wire coils, relays, earthing and earth connections. All signalling cables shall be terminated on ARA terminals. For terminating the cables, a hylam sheet of 10 mm thickness / teak wood reapers of size 75mm x 20mm, 25mm x 20mm, 50mm x 50mm with two coats of wood primer as per requirement shall be provided inside the location box. The size of the hylam sheet shall be such that it covers the full open space below the relay frames in the location box. Gland Plate as per SCR Drawing no. 5774, earthing of Location Box / equipment, anti tilting arrangement for equipment and all other associated work required to complete the work is in the scope of work.
vi	All the underground cables shall be provided with punched name plates showing Drum No, total no. of cores, and from and to details etc. Cable termination particulars of location boxes shall be laser printed, laminated and fixed to the location box door using 2mm thick Perspex sheet cover.
vii	The apparatus case in which any equipment like MSDAC / DCDP / Charger need to be kept shall be provided with teak wood planks of size 940 X 470 X 20 mm neatly finished and applied with two coats of wood primer.
viii	The apparatus case in which any relays need to be fixed shall be provided and fixed with powder coated relay fixing frame of size 940mm x 150mm and made of MS angle of 25mm x 25mm x 3mm. the frame shall be painted with two coats of paint.
ix	A cable loop pit of size not less than 1mtr depth and 1.5 mtr diameter shall be made near every location box and a loop of 6 to 8 mtr of each cable shall be coiled and kept in the pit. Individual cable coils shall be tied with released cable pieces and kept in the pit on top of the other, if multiple cables are to be terminated in the same location box. The loop pit shall be refilled and rammed. In any case the depth of the top most cable shall not be less than 1 mtr.
x	Stone pitching around all location boxes, tie bar fencing in urban areas and miscreant activity prone areas as decided by authority engineer is in the scope of the project.
xi	The location box shall be painted and numbered as per the existing practice of SCR. To the extent possible, location Boxes shall be pre-wired at a central location and erected on foundations. For ease of maintenance, the wiring and terminations shall be uniform throughout the section. Infringement particulars, earth resistance particulars of Location box shall be painted on the track side of the location box.
3.10.2.2	**Signals**
i	Signals complete with all the accessories such as Signal Unit, Post, CLS Base, Ladder, Ladder Shoe, Offset Bracket, Junction / Stencil type route indicator, U Bolts & Nuts, Arrow marker for RHS signals, Universal Lock, Number Plates, C/A/G marker plates, Pinnacles, Calling ON Signal unit, Shunt Signal unit, all types of LED aspects as per Approved SIP, A/AG markers (LED lit type), all types of markers / indicators shown in SIP etc, with all wiring material and any other material required for commissioning of signals and to integrate with the ABS system shall be supplied, installed, wired and commissioned. Integrated LED signal lighting unit 110V AC, retro-fittable in CLS housing and compatible with AC LED ECR, as per SPN No. RDSO/SPN/199/2010/Rev1.1 or latest shall be used.

ii	New foundations shall be cast for all the new automatic/semi automatic signals , incudling existing 4 aspect signals .In addition to these,new foundations shall be cast for new 4 aspect manual signals at NRE station (as shown in scheme plan) .
iii	The signal foundation shall be casted as per SCR DRG No. 5772 for signal on one side of the track and as per DRG No. RDSO/M-00011/R4 for signals in between tracks which are likely to infringe as per IRSOD. The top surface of the signal foundation shall normally be at rail level. Strengthening of signal foundation shall be done for all those signals whose foundation is not surrounded by rammed earth on all four sides for at least 40 cms width.
iv	The complete signal unit with all accessories like ladder, stage, ladder shoe and signal hood etc., shall be erected duly taking all safety precautions and adhering to IRSOD. The signal unit shall be fixed with a “X” marker (signal not in use indication) made of hardwood of size 1000mm x 100mm x 20mm till it is commissioned. The cross bar shall be painted white as per IRSEM and fixed with suitable MS flat clamp.
v	The signal post shall be suitably plumbed to make it straight. The Gap between CLS Base and Signal Post shall be filled with glass wool and lead sealed.
vi	The complete signal shall be painted with two coats of Enamel / Aluminum paint after preparing the surfaces smooth by emery paper polishing. The signal infringement distance shall be painted on the signal surface base towards the track side. The paints shall be of make Berger / Asian / British / JSW etc
vii	Signal post height shall be 3.6 mtrs or higher as per site conditions to achieve required visibility. Necessary offset brackets shall be provided wherever required to achieve visibility as per IRSEM.
viii	A cable loop pit of size not less than 1mtr depth and 1.5 mtrs diameter shall be made near every signal and a loop of 6 to 8 mtrs of each cable shall be coiled and kept in the pit. Individual cable coils shall be tied with released cable pieces and kept in the pit on top of the other, if multiple cables are to be terminated in the same signal. The loop pit shall be refilled and rammed. In any case the depth of the top most cable shall not be less than 1 mtr. The tail cables shall be taken through the foundation, signal post and terminated in the signal unit using 6 way terminals. The wiring from 6 way terminal to signal LED shall be carried out using adequate dia. flexible PVC pipe and 28/0.3 mm copper wire with lugs of suitable size.

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ix	For the Colour Light signals in the RE area which are coming in the infringing zone, screening arrangement as per SCR Drawing No.5767 shall be provided. The screen shall be made of MS wire-mesh and shall be fixed on MS angles of size 25mm x 25mm x 6mm with suitable fixing clamps, bolts and nuts and painted with one coat of red oxide and two coats of black paint of make Berger / Asian / British / JSW etc.
x	All Route Indicators shall be mounted on the top of the signal post firmly. The tail cables for route indicators shall be taken through signal post without any damage to the insulation and armour, skinned and terminated on route indicators. Route indicators shall be wired with 28/0.3mm copper wire as per the approved circuit diagram. Hoods shall be fixed properly and examined during day time and if required extension of hoods shall be made to have proper visibility.
xi	Calling on signals/ 'A' marker/'AG' marker/ Shunt signals shall be fitted on the signal posts at required height using suitable off-set brackets. Suitable hole shall be drilled on the signal post to bring the cable/jumper wires with minimum outside exposure. The cable/ jumper wires shall be taken to calling on signal/ 'A' marker/'AG' marker/Shunt signal through suitable steel hose pipes and wired. The calling on signals shall be provided with 'C' marker and 'Automatic signals with 'A'/'AG' marker. Number plates to be fixed and painted as per the standard practice of South Central Railway.
xii	In Case of signals with horizontal clearance less than 2.36 mtrs from the nearest track centre, blanking arrangement shall be provided as per IRSOD. The ladder of the signal shall be blanked off to a height of 300 mm between 2060 mm and 2360 mm above rail level using MS plate not less than 8 mm thickness. The end portions of the plate shall be rounded off and no sharp edges shall be protring. The plate shall be painted with two coats of black colour. The signal post shall be painted as per Annexure 19-A1of IRSEM. The paints shall be Berger/ Asian/ British/ JSW make.
xiii	"Entering into Automatic Block Territory" & "Entering into Absolute Block Territory" boards of size 1000mm X 600mm X 3mm shall be provided as per SIP.

3.11. Level Crossing Gates

3.11.1. Scope of the work: Interlocking of manned mid-section level crossing gates with provision of Electrically Operated Lifting Barriers, integration of all interlocked level crossing gates of the section with automatic signalling as per approved SIP and provision of Approach Warning System for all level crossing gates.

3.11.2. Technical Details:

S. No.	Description
i	Manned non-interlocked gates shall be interlocked and provided with EOLB along with necessary power supply arrangements, road warning signals with hooter and flasher, sliding boom arrangements. Power supply for EOLB and sliding boom shall be separate. List of non-interlocked Manned LC gates are given below. LC 81,82,83, 86, 94, 97 & 101 E are to be interlocked along with ABS Works in this section.
ii	EOLB as per RDSO specification RDSO/SPN/208/2012/Ver.2.0 Amdt. 1 or latest shall be provided. Foundations of EOLB shall be as per DRG No. S&T/MFT/6099.
iii	All the signalling arrangements and related works for interlocking of non-interlocked gates / integration of interlocked LC gates with automatic block signalling is part of this work. This incles supply of all material such as cables, location boxes, panels, power supply equipment, batteries, wiring material, relays and any additional MSDAC detection points required for gate holding purposes as per approved SIP etc. Sliding boom arrangement, if not available, shall be provided at all interlocked LC gates. Sliding boom shall be as per DRG No. S&T/MFT/4709.
iv	Approach Warning System as per SCR Drawing No. 5784 (**Annexure 9)** shall be provided for all LC gates in the block section to warn the Gateman of the approaching trains. The AWS system shall be designed to give audio warning & visual indication of any approaching train to the Gateman. The AWS system shall be effective for all lines of the section in both UP & DN directions. System shall trigger an audio buzzer and indication at a distance of 4.0 Kms from the LC Gate. Additional cables and hardware required are in the scope of work.
v	All the interlocking arrangements for LC gates proposed to be interlocked shall be housed in ABS Hut / new location boxes.
vi	RTU of not less than 64 digital inputs and 16 Analog inputs shall be provided and integrated with the existing data logger network at LC gates proposed to be interlocked. The capacity of RTU installed at existing interlocked LC gates to be augmented as per the requirement.
vii	All metallic parts such as pedestal, meeting post etc. shall be connected to negative rail with MS Flat as prescribed in AC Traction Manual.
viii	Seven Non interlocked LC Gates are to be interlocked in NRE-RU section.

3.12. Power Supply

3.12.1. Scope of the work

Supply, installation, testing and commissioning of power supply arrangements at ABS huts, along with all associated works and necessary augmentation / alteration to existing power supply systems at stations & LC gates.

3.12.2. Technical Details

S.No	Description
i	The contractor shall submit the proposed power supply scheme along with termination details for the different equipment to be installed in ABS huts / Station / LC Gates along with load calculations & module ratings. The typical schematic diagram of IPS configuration for ABS Huts is enclosed as Annexure 15.
ii	SMPS based IPS system confirming to RDSO Specification No. RDSO/SPN/165/2012 or latest as per the approved configuration shall be provided at all new ABS huts constructed in the mid section and at stations. VRLA batteries as per RDSO Spec IRS S 93/96 Amd 1 or latest shall be used for IPS at ABS huts. Battery capacity shall be decided as per load calculation and shall provide not less than 6 hrs backup at full load. Power supply arrangements at LC gates proposed to be interlocked shall be as per SCR Drawing No.5764. LMLA batteries as per RDSO Spec IRS: S- 88/2004 or latest shall be used. Powder coated aluminium ladder as per SCR Drawing No. 5769 of required length shall be used for routing of cables and wires.
iii	The power supply systems at existing stations / LC gate huts shall be augmented if required, to cater for additional power supply requirements for commissioning of automatic block signalling by providing additional DC-DC converters of adequate rating of the same make. Supply of necessary material, its wiring, testing and preparation of Pre commissioning checklists is part of the work. Where required, temporary busbars need to be derived from existing IPS for testing and commissioning of new equipment such as MSDAC, UFSBI etc. After some of the existing signalling loads become redundant, the above mentioned temporary loads need to be made permanent. All the necessary equipment and wiring required for the above arrangements are part of the work.
iv	Various supplies associated with signalling viz., 110V AC, 110V DC, 60V DC, 24V DC and 12/24V DC are to be brought out to the relay/ equipment room from Power Rack using suitable gauge wires. The voltage drop from IPS to equipment / fuse block in the Relay room shall not be more than 1 Volt.
v	One 230/110V DC / 30 Amps charger shall be provided at every new IPS location as a standby for battery charging. The charger shall be wired, commissioned and manual changeover arrangement to be provided.
vi	Laminated boards of size 45 cm X 60 cm X 12mm thick with the various instruction for maintenance of signalling assets printed on them ,as per the instructions of authority engineer ,shall be provided in each new hut constructed for the following:

3.13. Indoor wiring

3.13.1 Scope of the work: Design, supply, installation, wiring, testing, energisation and commissioning of indoor circuits including supply of all required material for indoor wiring at Stations, ABS huts, LC gates and for alterations in existing relay rooms at stations /LC gates

3.13.2. Technical details:

S.No.	Description
i	The contractor shall submit equipment disposition plan / floor plan of the ABS hut, Relay room, LC gate hut indicating the position of various equipment and racks for the approval of Authority Engineer. Equipment layout, relay positioning, cable terminations, fuse positioning and wiring shall be identical in all ABS huts and location boxes throughout the project.
ii	All the contacts of relay shall not be used, at least one front contact and one back contact shall be kept as spare for future requirements.
iii	Relay bases of only the correct configuration shall be used. Under no circumstances, configuration of bases shall be disturbed. Penalty of Rs 10,000/- per relay will be imposed for use of wrong configuration relay base.
iv	All the material required for carrying out indoor wiring at ABS huts, Panels and existing relay rooms such as Q-style / metal to metal relays, wiring material, relay racks, cable termination racks, power Racks, ladders, 6 way / 1 way / WAGO terminals, wire coils, lugs, indoor cable, fuse blocks, fuse links, LVR etc. is in the scope of work.
v	Wiring shall be done as per approved circuits and practices adopted in South Central Railway. All the wiring should comply with the EI / ABS (equipment) OEM checklist, latest RDSO TANs. All wiring is to be properly bunched with lacing twine or cable ties.
vi	Newly laid outdoor signalling cables shall be terminated on cable termination racks as per SCR Drawing No. 5783 in the ABS huts / relay rooms / LC gates.
vii	Details of wires / cables to be used for various types of indoor wiring is listed below: a) Relay to relay, relay to cable termination rack, relay to fuse blocks: 16/0.2mm wire coils ATC as per IRS S76/89 Amendment No.2 or latest. b) Power supply wiring: 35 sq.mm (277/0.4 mm)/10 sq.mm wire coils (140/0.3 mm) as per IRS S76/89 Amendment No.3 or latest according to load calculations / OEM recommendation. c) Relay rack to panel: 60 core indoor cable as per IRS-S-76/89 Amendment-2 or latest / signalling cable as per specification IRS 63/2014 Rev 4 or latest. d) Earthing: Multistrand copper conductor of appropriate dia. shall be used for connection of equipment / earth bus bar as per RDSO code of practice for earthing. e) Data logger wiring: i) Tag Block to data logger: 60 core indoor cable as per IRS-S-76/89, Amendment-2 or latest. ii) Relay to Tag Block 16/0.2mm wire coils ATC as per IRS.S76/89 or latest. f) MSDAC, USFBI, FN MUX, EI: as per OEM recommendations.

viii	All the flexible wires shall be terminated using suitable size lugs. These lugs shall be crimped and soldered. Wire identification tags / sleeves / Ferrules of insulation material shall be provided at both ends of the wire with terminal particulars printed on it. Soldering shall be carried out as per Para 19.1.2 of IRSEM. At fuses i.e., on the busbar side, wiring shall be in ring fashion.
ix	Relay name and number shall be painted / printed on the relay racks as per the standard practice (both in front and rear side of each relay) and CT rack termination particulars, fuse particulars shall be painted / printed on the CT rack / power rack in addition to the details displayed on the nearby wall.
x	Relays flashing shall be done before plugging in the relays and flashing readings shall be recorded.
xi	Testing of wiring shall be in accordance with the IRSEM Para 19.8.5. First testing shall be carried out by the Competent Engineer of the contractor before offering for testing to railways. Testing shall be offered to railways at two stages: Stage 1: Wire to wire test with buzzer before soldering Stage 2: Wire to wire test with buzzer after soldering The wiring will be tested separately by SSE & Officer nominated by Authority Engineer at each stage. Different colour ink shall be used for marking during testing at different stages. Necessary manpower required for testing of circuits by SSE & Officer shall be arranged by the contractor.
xii	Earth Leakage Detectors as per RDSO specification RDSO/SPN/256/2002 or latest shall be provided at each ABS hut and all external power supplies shall be connected to Earth Leakage Detector. The power supplies of either side of the ABS hut shall be connected to different channels. Pre commissioning checklist and OEM installation certificate shall be prepared and submitted. All the power cables shall be in healthy condition as per earth leakage detector set values. Potential free contacts of Earth Leakage Detector shall be wired to data logger.
xiii	All the cable entries shall be closed properly using concrete / Silica Gel or any other compound to avoid entry of rodents or cable theft.
xiv	Arrangement shall be made by way of proximity switch or any other means to monitor the opening of ABS hut through data logger.
xv	Required alterations in the existing knob type panels / push button panels shall be carried out to suit Automatic Block Signalling in the section and in the scope of the work.
xvi	Powder coated Aluminum ladder as per SCR Drawing No. 5769 required for drawing different types of cables shall be supplied and installed by the contractor. In case of alterations at EI stations, the ladder shall match with the already available ladder in the relay room.
xvii	Suitable arrangements shall be made in the relay rack for fixing condenser and resistance units as per the circuit design requirement. Letter painting shall be made against each unit to identify the circuit for which it is used.

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3.14. Outdoor wiring

3.14.1: Scope: Design, installation, wiring, testing and energization of all outdoor circuits incling supply of all required materials to make the installation functional and to integrate with Automatic Block Signalling system.

3.14.2. Technical details:

S.No.	Description of the work
i	The contractor shall submit location box particulars with equipment disposition, fuse, termination details and outdoor wiring diagrams for the approval of Authority Engineer. Equipment layout, relay positioning, cable terminations, fuse positioning and wiring shall be identical in all location boxes throughout the project. Wiring shall be designed to improve the reliability by paralleling of contacts.
ii	The installation in location boxes and wiring shall be done as per the approved wiring diagrams. First testing shall be carried out by the Competent Engineer of the contractor before offering for testing to railways for final testing. The contractor has to arrange for necessary manpower for the testing of circuits / functional testing by railway officials.
iii	Wherever necessary, the existing tail cables of signals/Location Boxes shall be released from the existing signals / Location Boxes and new tail cables shall be drawn to the functions and terminated as per approved scheme. This work shall be planned in such a way that disconnection required is either nil or bare minimum. If felt advantageous, new foundations shall be casted for signals to eliminate the need for disconnections.
iv	a) All the flexible wires shall be terminated using suitable sized lugs. These lugs shall be crimped and soldered. Wire identification tags / sleeves / Ferrules of insulation material shall be provided at both ends of the wire with terminal particulars printed on it. Soldering shall be carried out as per Para 19.1.2 of IRSEM. b) At fuses i.e., on the busbar side, wiring shall be in ring fashion. c) All cables to be clamped properly using Cable Gland Plates.
v	Cable termination particulars of location boxes shall be laser printer, laminated and fixed to the location box door using 2mm thick Perspex sheet cover.
vi	Consequent to introduction of new circuits or alterations to existing circuits in apparatus cases / CTBs, new nomenclature should be painted on the cable sleeve. And also, the new particulars / corrections to existing particulars shall be painted / printed/ displayed on the inner side of the doors.

3.15 Alteration in existing Electronic Interlocking / RRI / PI:

3.15.1. Scope of work:

Design, supply of hardware & software, wiring, testing, energising of circuits and carrying out necessary alterations as per approved SIP and circuits required for commissioning of Automatic Block Signalling in stations with all associated works.

3.15.2. Technical Details

<table>
<tr><th>Sl. No.</th><th>Description</th></tr>
<tr><td>3.15.2.1</td><td>Electronic Interlocking</td></tr>
<tr><td>i</td><td>Supply of hardware, alteration of Interface Circuits / Application Logic / VDU layout duly certified by OEM, wiring, loading of the software, FAT, SAT and commissioning of alteration in EI system for Automatic Block Signalling. The logic and interface circuits of the alterations duly certified by OEM shall be submitted for approval.</td></tr>
<tr><td>ii</td><td>Design, wiring, testing, energisation, preparation of pre-commissioning checklists and commissioning involved in the alterations of EI shall be executed by Competent Engineers of OEM. Factory Acceptance Test and Site Acceptance Test shall be conducted as per RDSO guidelines and as per instructions of Authority Engineer. Contractor shall prepare and submit documentation for TSAA and NI readiness for the approval of competent authority.</td></tr>
<tr><td>iii</td><td>FAT and SAT shall be carried out as per Railway Board letter No. 2017/SIG/3/85th SSC dtd 04.12.2018. FAT, SAT and correspondence testing is to be first carried out by the OEM with Competent Engineers before offering to Railways. All the necessary arrangements for FAT, SAT such as wiring, interface equipment, simulation panel, manpower needed for testing shall be arranged by the contractor.</td></tr>
<tr><td>iv</td><td>The EI alteration shall be carried out in the working electronic interlocking system and these alterations need to be carried out in the Traffic blocks / Disconnection. The contractor has to arrange for sufficient manpower required to complete the work within the allotted time.</td></tr>
<tr><td>v</td><td>The work is planned to be commissioned in different phases. Phase alterations shall be required to be carried out in the Electronic Interlocking/Panel interlocking at following stations.
Alterations to be carried out in both the phases is part of the work. The following are the details of the station at which phase working is needed to be carried out.
<table>
<tr><td>S.No</td><td>Phase working to be done at</td><td>Remarks</td></tr>
<tr><td>1</td><td>Pullampet</td><td>Nil</td></tr>
<tr><td>2</td><td>Koduru</td><td>Nil</td></tr>
<tr><td>3</td><td>Mamanduru</td><td>Nil</td></tr>
</table>
</td></tr>
</table>

vi	Penalty of Rs. 2500/- shall be levied for each design mistake in interface and logic circuits submitted for approval and identified at any stage up to commissioning. All the design mistakes identified at any stage up to completion of Defect Liability Period shall be rectified by the contractor at his own cost.
3.15.2.2	**Panel Interlocking/Route Relay Interlocking**
i	The circuits shall be designed as per the practice of South Central Railway as indicated in the typical attached as Annexure 16 and submitted to Authority for approval. Work shall be carried out as per the approved design drawings. All materials such as relays, wire coils, terminals, ladder, relay racks, relay frames, fuse blocks, fuses, manpower etc. shall be arranged for installation, testing and commissioning.
ii	Penalty of Rs. 2,500/- shall be levied for each design mistake in the circuits submitted for approval and identified at any stage up to commissioning. All the design mistakes identified at any stage up to completion of Defect Liability Period shall be rectified by the contractor at his own cost.

3.16.Multi Section Digital Axle Counters (MSDAC):

3.16.1 Scope of the work

Design, supply, installation, testing and commissioning of Track Detection system for Automatic Block Signaling using Multi Section Digital Axle Counters (MSDAC) as per RDSO/SPN/176/2013 Ver. 3 or latest with dual detection along with all associated works as per approved signaling plan and ABS system configuration of SCR attached as **Annexure-1.**3.16.2. Technical details:

Sl. No.	Description
i	Detailed design showing system architecture with separate evaluators for main & redundant systems of UP and DN lines, showing the locations of evaluators, power supply arrangement, and placement of DPs shall be submitted by the contractor for approval of railways, which shall be based on the approved ABS System configuration attached as **Annexure-1.**
ii	Installation of Central Evaluator in the relay room / ABS hut and wiring from CT rack to Central Evaluator, installation of the reset box, LV box, power supply, all other materials and work required to make the system functional and to integrate with the ABS system is in the scope of work. Separate track clearance relay shall be picked up for each main and redundant track section. Evaluators shall be interconnected with main and redundant OFC with auto changeover facility. However, during emergencies it shall be possible to connect these evaluators on 6 Quad cable also. Necessary hardware required for auto changeover from OFC to OFC and for manual changeover from OFC to 6 Quad is in the scope of work.
iii	MSDAC Evaluators shall be networked to monitor from the divisional signal control room. All hardware & software required for networking shall be in the scope of the project.

Iv	The resetting provision for MSDAC shall be as per the approved design. It shall have both auto reset, supervisory reset & manual reset provision. All resets shall be of preparatory type only. Common reset box for all track sections kept at the dispatch station and a co-operation button kept in the reception station shall enable this operation.

	Supervisory Reset: a) Supervisory Reset shall be as per Annexure 20 -A1 of IRSEM and configured as per the Approved SIP. Successful bidders shall submit the scheme of supervisory reset and Circuits for the approval of Authority Engineer. b) Supervisory sections shall be configured for main and redundant DPs independently. c) Supervisory sections shall be configured independently for UP line and Down Line in case of Double line Sections and UP line, Down Line and U/D line for triple line sections. d) SUPR shall be picked up separately or can be programmed in the MSDAC Evaluator as per OEM requirements and SUPR relays (if picked externally) shall be proved in the datalogger. e) Two Automatic Block Sections shall be Configured as one Supervisory section after LSS and In the remaining Automatic Block Signalling Sections Maximum of Two Automatic Block Signalling sections shall be configured in one supervisory section for reset. f) There should be an overlap of one Automatic Block Signalling section in each supervisory section. g) LC gate holding DP's shall be covered in the concerned Supervisory section.
v	Separate quad cable shall be laid for Main & Redundant DPs, in UP line, DN Line and line as per system configuration attached as **Annexure-1.**
vi	Earthing arrangements for MSDAC Evaluators and DPs shall be as per OEM recommendations.
vii	Deflector plates are to be installed on both sides of detectors for protection.
viii	Event logger with diagnostic feature shall be provided at each station of the Project and signal control room of the division. Details of Event logger (In-Built) & portable diagnostic terminal with monitoring software shall be as below: a) Event logger Diagnostic software for each station / auto section. b) Event logger Diagnostic PC as per following specification: (i) Processor: Intel Core i7, 3.1GHz Processor or Higher (ii) RAM: 8 GB (iii) HDD: 1 TB SATA (Minimum) (iv) Ports: 2 USB-2, 2 PCI slot (v) Screen: 32" (1920 x 1080) LED or better. (vi) Network interface: Integrated 10/100/1000 Gb E LAN (vii) Wireless: 802.11a/b/g/n Wi-Fi and Bluetooth (viii) Keyboard & Optical mouse (ix) Built in camera and Bluetooth (x) RS-232 Compatible in-built Modem OS: Windows 11 or better

ix	Wiring, installation and commissioning shall be carried out by Competent Engineers of OEM. Pre-Commissioning checklists and OEM installation certificates shall be prepared and submitted.
x	Warning boards with Retro Reflective High intensity film (IS 9002 certified for consistent quality with minimum guarantee life of 5 years) of yellow background and Black letters of suitable size reading “Un insulated Trolleys & DIP Lorries Prohibited. TT Machine Driver! Beware of Axle Counter” in bilingual format of size 1000mm X 600mm X 3 mm shall be provided on either side of each MSDAC DP with concrete base of size 300mm X 300mm X 300mm. This board shall be made up of Aluminium alloy sheet of thickness 0.25 to 0.30mm with 3mm x 25mm M.S flat welded at the borders and fixed to MS angle of size 75mm x 75mm x 6mm of 3 mts length with nut and bolt. Minimum reflectivity of Retro Reflective High intensity film shall be 250 for black / yellow and must be able to withstand the climatic tests as per IS9000.
xi	**MSDAC Networking – Functional Requirements** 1. All MSDAC Evaluators shall be networked and shall be able to monitor from the Divisional test room. 2. A dash board with GUI shall be provided 3. There shall be a pop up window with audio and visual alarms for following failures a. Evaluators b. Detection Points c. Networking Devices d. Individual modules in evaluators 4. It shall be possible to extract following exception reports track section wise, block section wise or any combinations thereof a. Number of soft resets initiated b. Number of hard resets initiated c. Number of supervisory resets initiated d. Alarms generated in the evaluators e. Event logs

3.17.UFSBI/FN MUX

3.17.1. Scope of the work: Design, supply, installation, testing and commissioning of UFSBI as per IRS spec. No IRS:S:-104/2012 Ver.0 with latest Amendments or RDSO approved FN MUX as per RDSO spec RDSO/SPN/211/2022 Version .1 for exchange of Vital / non vital relay states as per system configuration of SCR attached as Annexure-1

3.17.2. Both the Vital and Non-Vital I/O exchange pertaining to Auto Signal aspect control and display of Auto section Track/ Signals when carried out through RDSO approved Mux conforming to UFSBI as per IRS: S- 104/2012, ver. 0 with latest amd. or FN MUX as per RDSO/SPN/211/2022 Version.1 must ensure media redundancy as per Cl. 3.17 of the Feasibility Report Document.

<table>
<tr><th>S.No.</th><th colspan="3">Description</th></tr>
<tr><td>i</td><td colspan="3">Supply and installation of dual redundant UFSBI equipment, as per the system configuration of SCR attached as Annexure 1, along with other required items conforming to IRS: S- 104/2012, ver. 0 with latest amendment or FN MUX as per RDSO specification RDSO/SPN/211/2022 Version.1 with Pre-wired cabinets, automatic media changeover system, secondary modem along with other accessories as Input/ Output gatherer for exchange of information of signal aspects, track occupancy information and any other Vital / Non-Vital information between ABS huts-Stations, ABS Huts- ABS huts and ABS huts-LC gates etc.</td></tr>
<tr><td>ii</td><td colspan="3">USFBI / FN MUX shall be wired, installed and commissioned by Competent Engineers of OEM. Pre commissioning check lists shall be prepared and signed by an authorised representative of OEM.</td></tr>
<tr><td>iii</td><td colspan="3">It is preferable to equip more than one USFBI / FN MUX equipment in one rack to optimise floor space.</td></tr>
<tr><td rowspan="10">iv</td><td colspan="3"></td></tr>
<tr><td colspan="3">ETHERNET Switch - Technical Specification</td></tr>
<tr><td colspan="2"></td><td rowspan="2">Industrial standard
8 RJ45 + 4 FO (or) Higher</td></tr>
<tr><td rowspan="2">Capacity</td><td>Port Quantity</td></tr>
<tr><td>Port Types</td><td>RJ45 : 10/100BASE-TX, SFP FO</td></tr>
<tr><td rowspan="2">Networking</td><td>Managed switch</td><td>Managed Layer 2 switch (or Higher)</td></tr>
<tr><td>Diagnostics</td><td>Signal Contact (for error), Device Status Indication, LEDs, Syslog, System Information</td></tr>
<tr><td>Power Requirements</td><td>Operating Voltage</td><td>24/48/60 VDC</td></tr>
<tr><td rowspan="2">Form Factor</td><td>Mounting Type</td><td>DIN-RAIL / RACK MOUNT</td></tr>
<tr><td>Protection class</td><td>IP20</td></tr>
<tr><td>Environment</td><td>Operating Temperature Range</td><td>(-40*c) to (+70*c)</td></tr>
<tr><td>Approvals</td><td>Transportation</td><td>EN 50121-4 (Conformity given)</td></tr>
</table>

3.17.3: Non Vital MUX - Non Vital MUX must be installed and commissioned at both stations and ABS Huts. These are to be configured, installed and connected with dual arrangements, one as Main and the Other one as Standby in order to achieve continuous display of ABS Sections status at stations.

3.18. Data Loggers:

3.18.1 Scope of the work: Supply, installation, testing, validation, networking and commissioning of data loggers, modification / augmentation of database, fault logics of existing data logger as per the technical details given below:

3.18.2.1. Technical Details:

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Sl.No.	Description
i	The data loggers of adequate capacity as per specification IRS: S 99-2006 Amd. 3 or latest shall be provided at each new ABS Hut, both at station and in block section. . All the materials such as tag blocks, cables, wire coils and interface equipment etc. required shall be supplied and installed. Data loggers shall be equipped and wired with not less than 20% spare capacity for both Analog and digital inputs to cater for future requirements. RTU of capacity not less than 64 digital inputs and 16 Analog inputs shall be provided at LC gates proposed for interlocking. Augmentation of existing data loggers / RTUs available at stations / interlocked LC gates shall be carried out to accommodate alll digital and Analog inputs (both new and existing).
ii	Modifications, up gradation, wiring, validation and updating database, fault logics of the new inputs related to Automatic Block Signalling work in existing data loggers at stations, LC gates, test room, central control etc. and any software / hardware upgradation in existing data loggers required for the functioning of the data logger network shall be arranged. This shall also include supply and installation of additional modems/ data concentrators required at stations / interlocked LC gates for networking of data loggers.
iii	Installation, wiring, validation, networking of data loggers shall be carried out by authorised Engineer of OEM. Pre-Commissioning checklists and OEM installation certificates shall be prepared and signed by OEM authorised engineers.
iv	Provision of FEP / MFEP, additional servers required, if any, to augment the data logger network at Divisional and HQ signal control is in the scope of work.
v	Potential free contacts of IPS, ELD, SPD, Fire alarm, MSDAC, USFBI / FN MUX, networking equipment, proximity switch, FACS etc. shall be wired to data logger and required fault logics shall be developed to generate alarms and SMS alerts.

3.19. Earthing, Lightning and Surge Protection

3.19.1.Scope of the work: Supply, installation and wiring of earthing, lightning and surge protection arrangements at ABS huts, for all the new equipment at LC gates, Stations and in the mid-section as per OEM recommendations and requirements specified in IRSEM / IR Telecom Manual.

3.19.2. Technical details:

Sl. No.	Description
i	All the equipment viz. apparatus cases, signal posts, MSDAC, UFSBI/ FN MUX, Power supply equipment, IPS, Power panels, outdoor cables, all indoor equipment and LC gate equipment etc. shall be earthed as per OEM recommendations, SCR practice, IRSEM, IR Telecom Manual and ACTM.

ii	**Earthing of Location boxes & Signals**
	a) Earths as per SCR Drawing No. 5775 shall be provided for all Signals, Location boxes. b) The MS flat connecting earth electrode and location box/signal post shall be welded on both sides. c) All nuts / bolts used to connect MS Flat to function/any other connection used for earthing shall be galvanised. d) The earth resistance achieved shall not be more than 10 Ohm. Additional Earths shall be provided and paralleled if required to achieve final earth resistance of less than 10 ohms. e) Earth Chamber shall be filled with River sand / Robo sand. f) Earth resistance value shall be painted on the function with date of measurement.
iii	**Earthing of Cables**
	a) All the signalling and telecommunication cable armours shall be earthed properly. Both Sheath & Armour of Main cables are to be earthed. All cable armours shall be soldered with released cable copper conductors of required length and the other end of the conductors shall be connected to Cable gland plate. Armour of OFC shall be earthed at both ends. b) 6Q cable armour, sheath and screen shall be earthed at both ends.
iv	**Earthing at ABS Huts**
	One ring earth, containing not less than four copper plate earthing units as per SCR Drawing No. 5776 and 5777 shall be provided at each ABS hut. All four earth pits shall be interconnected using 35 x 6 mm GI flat duly welded. The earth resistance of ring earth shall be less than 1 ohm. If the desired earth resistance is not achieved, additional earth pits shall be provided till earth resistance of less than one ohm is achieved. The distance between two earth pits shall not be less than 3 mtrs in any case. Internal and external connections to earth pits, earth bus bars and various equipment in ABS hut shall be as per SCR Drawing No. 5776 and 5777. All materials viz. wire coils, copper bus bar, copper strip, exothermic welding materials etc. is in the scope of the project.
v	**Class A Lightning Protection**
	Class A protection as per IEEE 998 standard working on Collection Volume Method principle (such as Erico 3000 or similar) along with counter, high voltage insulated down copper conductor (Dia 50 Sq.mm) of EN-62305-3 Standard to be supplied and installed as per SCR Drawing No. 5777 along with separate copper plate earthing (Minimum 2) at each ABS hut as per the SCR Drawing No. 5773,at all the new ABS huts constructed,both at stations and block sections.

vi	**Earthing at Stations and Interlocked LC gates.**
	All equipment installed at Stations, Interlocked LC gates shall be connected to the available earth bus bars in the relay room / equipment room along with required cables, lugs, PVC pipes etc. If the available earthing arrangement is found unsuitable as per OEM recommendations, new earthing arrangements as detailed above shall be provided
vii	**Telecom & Video surveillance Equipment**
	All telecom and video surveillance equipment shall be earthed as per OEM recommendations. Separate copper plate earth pits shall be provided for this purpose.
viii	**Electrical Earth**
	Separate earths for electrical wiring of ABS hut and ATs shall be provided as per code of earthing for electrical installations

3.20. LED Based Display system at Stations and ABS Huts.

3.20.1 **Scope**: Supply, installation & commissioning LED based display system for display of Signal & track Occupation status at stations and ABS huts.

3.20.2. Technical Details:

<table>
<tr><th>S. No</th><th>Description</th></tr>
<tr><td>i</td><td>Indications of signals aspects, track occupation, incoming and outgoing YR’s status of entire automatic block sections on both sides of the station ,shall be displayed on a separate VDU of size not less than 42” for each block section at station. VDU shall be a commercial grade LED screen of Sony / LG / Samsung / Toshiba / Panasonic make along with an industrial grade PC . VDU’s shall be fixed at a visible distance from the point of operation of signalling gears by making suitable fixing arrangements preferably by a floor mounted stand.

Contractor shall submit the scheme of such a display system for the approval of the Authority Engineer.</td></tr>
<tr><td>ii</td><td>Indication panel of adequate size shall be provided at each ABS hut for displaying the status of automatic signal aspects, track section occupation status controlled from the ABS hut. Indications of incoming YR’s and Outgoing YR’s shall be provided on the indication panel. Indications of supervisory sections shall be provided on the indication panel. Contractor shall submit the scheme of such a display system and indication panel top plate drawing for the approval of the Authority Engineer.
Indications at ABS Hut shall be provided as described below:
<table>
<tr><th>S.No</th><th>Indication required</th><th>Purpose</th></tr>
<tr><td>1</td><td>All The aspects of the signals controlled from the hut including A /AG markers</td><td>For the maintainer to have information during failure rectification.</td></tr>
<tr><td>2</td><td>Track sections(main & Redundant)</td><td>For the maintainer to have information about the track section failures</td></tr>
<tr><td>3</td><td>Resetting indications of main and redundant track sections</td><td>For maintenance</td></tr>
</table>
</td></tr>
</table>

iii	All software, hardware, networking equipment, cables, power supply etc. required to make the system functional and to integrate with the ABS system.

.

3.21. Telecom Facilities

3.21.1 Scope: Telecom equipment at ABS huts, stations and LC gates as mentioned below shall be provided for extending communication facilities and networking of various equipment.

3.21.2. TECHNICAL DETAILS

<table>
<tr><th>S.No</th><th>Description</th></tr>
<tr><td>i</td><td>Supply, installation, testing and commissioning of telecom equipment required for providing various telecom facilities at ABS huts, stations and LC gates along with power supply arrangement.</td></tr>
<tr><td>ii</td><td>The following telecom facilities shall be provided to enable:
a) Provision of Railway Auto phone to ABS Hut and Gumty from nearest station/exchange
b) Extension of data logger network to stations from ABS Huts / LC Gates.
c) Extension of IP based surveillance cameras' network to SSE depot / office.</td></tr>
<tr><td>iii</td><td>All equipment to extend the following minimum channel configuration between ABS Hut / LC Gate / Station to provide above telecom facilities shall be in the scope of the project.
<table>
<tr><th>S.No.</th><th>Type of Channel</th><th>No of Channels</th></tr>
<tr><td>1</td><td>2W/4W E&M channels</td><td>8</td></tr>
<tr><td>2</td><td>FXS channels</td><td>4</td></tr>
<tr><td>3</td><td>FXO channels</td><td>4</td></tr>
<tr><td>4</td><td>10/100 Mbps Ethernet ports</td><td>4</td></tr>
<tr><td>5</td><td>E1</td><td>4</td></tr>
</table></td></tr>
<tr><td>iv</td><td>All the telecom equipment shall be networked with Web based NMS at divisional test room and SSE/Tele of the section for monitoring and configuration required, if any. This equipment shall work on OFC with self-healing ring architecture and should be compatible with IP MPLS. Required hardware and software required for networking shall be provided.</td></tr>
<tr><td>v</td><td>The equipment shall have spare slots to add additional channels if required in future. One push button electronic telephone of make Beetel / Sanyo / BPL shall be provided at each ABS hut and station relay room.</td></tr>
</table>

3.22. IP based Surveillance Cameras:

3.22.1. Scope of the work:

Supply, Installation and commissioning of IP based Video surveillance system consisting of day and night high resolution bullet cameras, NVR, Switches, Server, media converters, power supply, display, software and hardware with required backup.

3.22.2. Technical Details:

S.No.	Description
i	Four numbers of HD bullet cameras shall be provided at all new ABS huts in the mid section locations as per approved Layout Plan. Fixing stands, cables required to connect to NVR, Power supply, monitors, networking equipment, media converters, connecting cables, hardware, software and other materials required to make the system functional shall be supplied and installed by the contractor. Monitor with required hardware and software shall be provided at SSE/Signal of the section for the ABS huts in their respective jurisdictions
ii	● IR LEDs: 4; ● Lens Type: Verifocal, 3.6mm to 12mm; ● Focal Length: 3.6mm (6mm optional) ; ● Compression: H.265+ /H.265/ H.264+/ H.264; ● Frame Rate: Main Stream: 4M(1~25/ 30fps); ● Bit Rate Control: CBR/VBR; ● Bit Rate: H.264: 24K ~ 10240Kbps; ● Day/ Night: Auto(ICR)/ Color/B/W; ● Video Standard: PAL or latest; ● Protocol: TCP IP or Latest; ● Streaming Method: Unicast / Multicast; ● Max. User Access:20 Users; ● Interoperability: ONVIF 2.4, CGI Conformant; ● Power Supply: DC12V, PoE (802.3af) (Class 0)

iii	ONVIF 16 channel Network Video Recorder (NVR) of Dahua/ Hikvision/ CP plus similar to Model No. 4416-4KS2 compatible to support the above mentioned cameras as per detailed specification below: ● NVR of similar of make ● Main Processor: Quad-core embedded processor; ● Interface: 1 HDMI, 1 VGA, ● Resolution: 1920 × 1080; ● Multi-screen Display:1/4/8/9/16; ● OSD: Camera title, Time, Video loss, Camera lock, Motion detection, Recording; ● Trigger Events: Recording, PTZ, Tour, Alarm Out, Video Push, Email, FTP, Snapshot, Buzzer and Screen Tips; Video Detection: Motion Detection, MD Zones: 396 (22 × 18),Video Loss and Camera Blank; ● Playback:16; ● Search Mode: Time /Date, Alarm, MD and Exact Search (accurate to second), Smart search; ● Playback Function: Play, Pause, Stop, Rewind, Fast play, Slow Play, Next File, Previous File, Next Camera, Previous Camera, Full Screen, Repeat, Shuffle, Backup Selection, Digital Zoom; ● Backup Mode: USB Device/ Network/ Internal SATA burner/ eSATA Device for a minimum period of 30 days; ● Internal HDD: 4 SATA III Ports, Up to 6 TB capacity for each HDD; ● USB: 2 USB Ports (1 USB 2.0 , 1 USB 3.0); ● RS232: 1 Port, for PC Communication and Keyboard; ● RS485: 1 Port, for PTZ Control; ● Compression: H.264+/H.264/MJPEG/JPEG; ● Resolution: 4MP or higher
iv	Monitor: HD LED Monitor of 19" consisting of inbuilt speakers, HDMI Ports; USB Ports; AVI Port; VGA Port; Make: HAIER/ Samsung/ Sony/ LG/ TCL.

3.23. Fire Alarm

3.23.1. Scope of the work:

Supply, Installation and commissioning of Fire Alarm & Detection System

3.23.2. Technical Details:

S.No	Description
i	The fire alarm and detection system must be supplied as per RDSO Spec. No. RDSO/SPN/217/2016, Ver. 2.0 or latest.
ii	Supply must be done through RDSO approved vender only. Inspection of materials to be done by RDSO.
iii	Firm must supply all sensors and equipment listed in para 2.1 of the RDSO specification. This incles Multi Sensor, Aspirating type smoke detector, Linear Heat Detector, manual call point, Control unit, GSM/cellular module, cables, relay, audio visual alarm etc. as per the specification. Ten nos of sensors must be installed in each ABS Hut constructed at stations and are to be networked through data loggers.

iv	The Fire alarm system shall be installed in New ABS huts constructed in the station section only.
v	10% spare for modules, detectors and cards, subject to a minimum of one quantity to be supplied. For CPU card and Power Supply card minimum one quantity to be supplied by the contractor.
vi	The installation of equipment is to be done by OEM or its authorised representative only. RDSO pre-commissioning Checklist to be prepared with the Railway Representative and is to be submitted before commissioning.
vii	All the accessories and material required for installation & commissioning of Fire Alarm System shall be arranged by contractor
viii	Two nos of Fire Extinguisher of CO2 type (Capacity Minimum 5 KG) shall be supplied and installed at all ABS Huts both at Station Section & Block Section.

3.24. Testing of the system:

3.24.1. Scope of the work: Testing of both indoor and outdoor installations of Automatic Block Signalling system along with all associated works individually and after integrating with the system for its full functionality to meet the requirements laid down in G&SR,IRSEM, IR Telecom Manual and Operating Manual.

3.24.2. Technical Details: The indoor and outdoor testing shall be carried out as per the details given below.

Sl.No.	Description
	Testing Strategy
i	Tests, as may be necessary to demonstrate to the satisfaction of the Authority Engineer that the apparatus and the system as installed are in accordance with the specification and meet the requirements of G&SR, IRSEM, IR Telecom manual and Operating manual.
ii	Test plan document indicating stage strategy, various types of tests and their schedule, location of manpower, tools and measuring instruments, equipment and transportation arrangements etc. shall be submitted for the approval of the Authority Engineer well in advance and not less than seven days prior to conducting such tests. Article 11 of Draft EPC Agreement shall be followed in this regard.
iii	The equipment such as EI, MSDAC, UFSBI / FN MUX, IPS, Data logger, Class A protection, telecom equipment, surveillance cameras etc. shall be installed, wired, tested and commissioned by OEM's authorised engineer only. Pre-commissioning checklists shall be signed and OEM certificates for satisfactory installation shall be issued for all equipment.
iv	Arranging tools, instruments and apparatus, required number of skilled staff, transportation to site for testing of equipment are in the scope of the project.
v	All the new gears installed need to be tested before commissioning to ensure that the gears are in proper working order.
	Cables: Signalling, Telecommunication, Power and OFC

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vi	Signalling, power and telecommunication cables shall be meggered once before laying and again after laying as per the procedure given in Chapter 15, Section 4 of IRSEM and Chapter 7 of IR Telecom Manual. The test results shall be recorded as per the format given in IRSEM and IR Telecom Manual and adopted in SCR. Joint cable testing shall be carried out along with maintenance staff and readings shall be recorded. Cables shall be tested again before commissioning if more than Two months' time is elapsed after joint cable testing. Sample testing of each cable shall be done before commissioning.
vii	Pairing of conductors shall be done. All the power cables shall be made through and power supply shall be extended to all locations. Dummy loads such as bulbs shall be connected at the far end to observe for sinking of voltage.
viii	6Q cables shall be tested as per para 7.2.8 of IR telecom manual and parameters shall be recorded on the format as per SCR practice. Joint cable testing shall be carried out along with maintenance staff and readings shall be recorded. Cables shall be tested again before commissioning if more than Two months' time is elapsed after joint cable testing. Sample testing of each cable shall be done before commissioning.
ix	Duct Integrity test shall be carried out on HDPE duct as per procedure laid down in Para Annexure-I Chapter 13 of IR Telecom Manual and in case of leakage, duct shall be attended before blowing. Joint OFC testing shall be carried out along with maintenance staff and readings shall be recorded. OFC shall be tested again before commissioning if more than Two months' time has elapsed after joint testing. Sample testing of each cable shall be done before commissioning.

	Signals:
x	a. Wire to Wire bell test will be carried out in Location Boxes by the supervisors and officer. b. All signal aspects shall be checked by giving 110V AC feed from Location Box and then the test shall be repeated by giving feed from the relay room CT rack. This test shall be done for each aspect, route, Calling ON, shunt signals, A/AG markers of Semi-Automatic Signals. c. Care shall be taken to ensure that no train is approaching during this test to avoid misleading information to drivers. d. Adjustment of orientation of signal units to achieve optimum visibility for signals, record the aspect voltages and ensure that it is within the permissible limit e. Check the aspect control sequence as per SIP and marking on the signal aspect control chart. f. Facilitating the conduct of signal sighting committee and preparation of report.
xi	All automatic signals shall be tested by a wiring simulation panel and simulating all conditions with switches as per approved SIP.
	Earthing
xii	All earth pits shall be tested individually as per procedure described in Para 19.11.7 of IRSEM. Measurement of ring earth shall be carried out first for individual earth pits and after interconnecting all earth pits.

	Indoor wiring
xiii	All the circuits shall be tested as per Section 8 Chapter 19 of IRSEM.
xiv	Field correspondence test shall be carried out as per the procedure given in para 19.8.8 (f) of IRSEM.
xv	Testing of relay interlocking and Indoor equipment consists of: 1. Wire to Wire bell test at the level of Supervisor and officer before and after soldering 2. Wire count test 3. Soldering integrity test with magnifying glass 4. Cross checking of contact analysis 5. Relay pin locking test 6. Energisation of relays by connecting the simulation panel. 7. Recording of End Voltages on relays 8. Clearing of signals on the simulation panel and carrying out the following tests (As per table of control)/OEM/South: (a) Negative tests (b) Dead/Approach locking tests (c) Route/Back locking tests (d) Testing of conflicting signals 9. Testing of MSDAC, UFSBI/ FN MUX as per RDSO/OEM/South Central Railway formats. 10. Data logger validation, Analog voltages calibration test and any other test as per RDSO/OEM/South Central Railway formats. 11. Indoor Cable Meggering 12. Bulb Test to check leakages at relay racks
	Electronic Interlocking
xvi	Internal FAT shall be carried out by the OEM as per approved SIP and TOC before offering the same to railways for FAT. Arrangement of necessary infrastructure for the same shall be in the scope of the project.
xvii	Wire to wire test, wire count test of interface wiring along with port verification and bit chart verification shall be done by the contractor before offering to railways for inspection of the same.
xviii	SAT as per para 21.5.2 of IRSEM. will be carried out by railway authorities. Arrangement of necessary infrastructure for the same shall be in the scope of the project. Comparative statement of Application Logic between SAT version and Service Version duly certified by OEM shall be submitted to Authority Engineer for scrutiny and approval.
	Power Supply System
xix	Capacity test of new batteries provided shall be carried out with dummy load at the rate of C/10.

xx	All modules of IPS viz. DC-DC converters, inverters, SMRs, transformers etc. shall be tested with dummy load at not less than 90% of rated capacity.
xxi	Bulb Test shall be carried out in IPS racks to check leakage. Voltage drop shall be measured from IPS to Relay room for various bus bars. The voltage drop shall not be more than 1.0 Volt.
	LC gates
xxii	LC gate wiring shall be tested as per para xi above.
xxiii	Operation of gate and Boom locking shall be tested for its effectiveness. Operating current of the EOLB shall not be more than OEM prescribed limit. Positive and negative tests shall be carried out on slots. Cancellation of slots shall be tested similar to that of any signal as per TOC.
xxiv	Road Signals, hooter and flasher shall be tested for their effectiveness and certified fit for the purpose. Communication arrangements at LC gate shall be tested.
	Miscellaneous Tests
xxv	Cube test for RCC Duct, Cable markers, ABS Huts etc. for each batch of casting as prescribed in relevant IS codes shall be carried out at NABL accredited laboratories. Slump tests for concrete shall be carried out and recorded as per approved QAP.
xxvi	Materials such as steel, cement, sand etc. used in RCC structures, RCC Duct, RCC Cable markers etc. shall be tested as per relevant IS codes and approved QAP.
xxvii	All tools, plants, measuring instruments used for testing and Commissioning of ABS system shall be properly calibrated at a government approved laboratory
xxviii	All the costs associated with the testing shall be in the scope of the project.
xxix	Pre-commissioning checklist and OEM installation certificate for equipment listed in Annexure 5 shall be submitted by the tenderer duly signed by OEM.

3.25. Commissioning of Automatic Signalling System:

3.25.1. Scope of the Work: Commissioning of Automatic Block Signalling system.

3.25.2. Technical details

S.No.	Description
i	The automatic block signalling shall be tested and commissioned, integrating all the related works to meet requirements of G&SR, IRSEM, IR Telecom Manual Operating Manual and ACTM.

ii	Commissioning shall be planned in Two phases: a) **Pre-NI Phase:** Integrated system testing shall be done to the extent possible. b) **NI Phase:** NI panel shall be provided to facilitate train movement during simulation testing. NI circuit shall be designed as per station layout and submitted for approval. NI circuit shall be tested before and after soldering by the supervisor and officer nominated by Authority Engineer. c) **Traffic Block:** Correspondence testing of all gears connected with the station incling Automatic Signalling Gears.
iii	The work needs to be commissioned as per commissioning plan outlined in Article 10 & Schedule I of Draft EPC Agreement.
iv	The work shall be commissioned in the permitted block given by railways duly adhering to all safety norms.
v	The non-interlocking arrangements as listed below but not limited to during the entire NI period as communicated by Authority Engineer shall be in scope of the project. a) Erection of required number of temporary NI goomties of approved design at specified locations b) Provision of minimum one table and Two chairs at each NI goomty. c) Adequate lighting and Fan arrangements shall be made. d) Arranging drinking water at NI goomties e) Arranging five unskilled labour per station for assisting operating staff during NI f) Communication and PA system arrangements at goomties. g) Arranging transportation for men and material at station and block section during pre-NI and NI period.
vi	Post commissioning defects shall be attended in accordance with Article 15 of Draft EPC Agreement.
vii	Various maintenance registers listed in Annexure 6 shall be prepared within one week duly entering various parameters.

3.26. Post Commissioning Maintenance

3.26.1. Scope of the work: To monitor and maintain the entire system commissioned.

3.26.2. Technical details

Sl. No.	Description
i	The contractor shall deploy one skilled and 2 unskilled staff round the clock per block section for attending any post commissioning defects, failures and for maintenance of the system starting from the date of commissioning upto a period of two months or till the date of issuance of Completion Certificate whichever is later
ii	All defects and failures which will interfere with safety and operations shall be attended duly following safety procedures within two hours under the supervision of Authority Engineer's representative as specified in Article 15 of Draft EPC Agreement.

iii	The contractor has to ensure that Competent Engineers of OEMs for MSDAC, UFSBI / FN MUX, EI etc. are available for attending teething troubles in SSE/Signal jurisdiction from the date of commissioning up to the completion of maintenance period

3.27. Documentation:

3.27.1 Scope of the Work: Preparation of various documents required for processing of statutory approvals, recording of measurements, as made documents, any other documentation work required for commissioning and maintenance of the ABS system.

3.27.2. Technical details:

Sl. No.	Description
i	All documentation shall be prepared as per the list in **Annexures 3A and 3B**
ii	All the documents listed in **Annexure 3B** (I) to be prepared in "AutoCAD" and to be submitted for approval of the Authority engineer. After getting the final approval, all documents are to be taken in tracing paper of thickness 75 GSM in A2 / A3 sizes as required and submitted for final approval. Six sets of final approved copies of **Annexure 3B** as per the existing practice of SCR in the form of booklet along with the AutoCAD soft copy and signed scanned copy of all approved drawings in DVD / Pen Drive / Hard drive (3 nos) shall be submitted to railways. For EI installations, application logic and VDU layout / logic in the format loaded and pre-loaded configuration along with Application Data Generation tools shall be provided in DVD / Pen Drive / Hard Drive.
iii	The contractor shall furnish six sets hard copies of the final As Made cable plan and integrated cable route path showing the old as well as newly laid cables, distance of cables from the nearest track centre at not less than every 30m intervals, distance of cables, protection arrangements, Cable Markers, LBs, Signals etc.
iv	Contractor shall get the As Made documentation thoroughly checked by Competent Designers and Verifiers before submission to Authority Engineer for final approval. Any mistakes detected in As Made documentation shall be viewed seriously. A penalty of Rs. 10,000/- (ten thousand only) per mistake shall be levied.
v	All test reports, pre commissioning checklists, OEM certificates etc. shall be submitted in Two sets in the form of a booklet neatly bound.
vi	Measurement records in bound registers shall be submitted in one set.
vii	A quality hand book, with contents as per **Annexure 3C**, ABS hut wise shall be prepared and submitted indicating details of all equipment installed RDSO / RITES/ Consignee Test Certificates etc and submitted in Two copies.

3.28. Releasing of Material:

3.28.1. Scope of work: All materials which are non-functional after commissioning of Automatic Block Signalling system shall be released and transported to designated location.

3.28.2. Technical Details

SL.No.	Description
i	The contractor shall prepare a list of all signalling and telecom equipment that will become non-functional after commissioning of the Automatic Block Signalling system jointly with Stock Verifier and Authority Engineer's representative. All released materials shall be Railway property.
ii	The material shall be released with utmost care. Items which have not completed their codal life and fit for re-use shall be released carefully and stacked at a secure place with proper packing. All packing materials shall be in the scope of the project.
iii	Signal posts, Location boxes etc. which are going to infringe after commissioning shall be released during NI/Disconnection only duly following safety precautions.
iv	All released material shall be stacked at a central location such as station / LC gate for proper accountal immediately after releasing.
v	All released material shall be transported to stores or scrap depots as instructed by the Authority Engineer. Loading, unloading and transportation shall be in the scope of the project.
vi	All concrete foundations of released signals, location boxes etc. shall be dismantled and earth shall be levelled.

3.29. Site Facilities

3.29.1. Transportation

3.29.1.1. Scope : Arrangement of transportation for inspection and supervision of works shall be in the scope of the project.

3.29.1.2. Technical Details

S. No.	Description
i	Provision of one Non-AC SUV such as Maruti Suzuki Ertiga / Mahindra TUV 300 / Tata Harrier or better for the entire period of the contract including extended periods, if any.
ii	Another AC vehicle shall be provided separately for SAG and above grade officers inspection as per the instructions of Authority Engineer for the total period of the contract including the extended periods either at site or at any other specified location.
iii	A log of vehicle movement shall be maintained to this end.
iv	Failure to make the vehicle available would invite a penalty as indicated in annexure 12

3.29.2. Skilled and semi-skilled Assistants for inspections and other activities

3.29.2.1. Scope: Skilled and semi-skilled manpower to assist authority engineer or his representatives to prepare inspection reports, for giving markings of various functions, and to carry out any other activity concerned with the project at office or field.

3.29.2.2 Technical Details

S.No.	Description
i	Skilled manpower: The contractor shall arrange Computer oriented technical manpower,two person/day, on all working days of the currency of the work incling extended periods of the contract at Authority Engineer's office to carry out works like Drawing, computation, write up etc., using computer, using software like AUTOCAD, MS Office etc., for 08.00 hrs in a day with all expenses of transportation, accommodation, food, consumables etc., with all ascents, descents, taxes, octroi, cess, fees, duties, duties with contractors cost etc., as per special conditions/ specifications/ regulations and as directed by Engineer-in-charge. Note: The person engaged for providing the services shall be convergent with computer working knowledge in above software.
ii	Skilled manpower shall be adequately qualified and experienced to discharge duties assigned to him to the satisfaction of authority engineer. They should have Computer literacy, knowledge of AutoCAD.
iii	The contractor shall arrange semi- skilled manpower ,minimum **two persons per day, on all working days** during the entire currency of the work incling extended periods of the contract, to assist authority engineer/his representative during inspections or for executing any other work assigned to him at site .
iv	The Contractor shall deploy a signal Design Expert,who shall be (a) a Graduate Engineer with minimum 5 yrs of experience /Diploma holder with minimum of 7 years of experience, in Designing, Drawing, Preparation and checking of Signalling drawings,signalling circuits and signalling Documents . (or) (b) a person having a total of at least 7 yrs experience in designing as JE(drg) and above in S&T department of railways or in the same grade in RITES/IRCON/RVNL//KRCL (or) (c) a person having a total of at least 5 yrs experience in designing as SE(drg) and above in S&T department of railways or in the same grade in RITES/IRCON/RVNL//KRCL The design expert shall be approved by the authority engineer.
v	The Contractor shall deploy Two nos of Draftsmen who shall be a Diploma holder /Graduate with a minimum of 3 yrs of experience in preparation of Signalling drawings & documents. The drafts men shall be approved by the authority engineer.

vi	Penalty as per Annexure 12 will be imposed if Design Expert/Draftsman / Unskilled man power are not deployed.

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3.30. Furniture:

3.30.1. Scope: The following furniture shall be provided at each new hut constructed ,both at station and in mid section.

3.30.2. Technical Details

S. No	Description	Qty
i	Godrej T-104 model table or similar	1
ii	Godrej PCH5d13R model chair or similar	1
iii	Godrej PCH 5002T chair model or similar	2
iv	Godrej shelf storage of 916 x 486 x 1981 mm or similar	1
v	Steel stools 18" height neatly finished and painted.	2

3.31. Project Monitoring and Supervisory Team

3.31.1. Scope: For effective management and supervision of project, the following staff but not limited to shall be deployed to carry out Project activities in the project office or field.

3.31.2. Requirement Details

<table>
<tr><th>S.No.</th><th>Description</th></tr>
<tr><td>i</td><td>Contractor may engage retired railway employees also as per the extant instructions issued from time to time.</td></tr>
<tr><td>(ii)</td><td>The following is the requirement of minimum staff to be deployed by contractor at site
<table>
<tr><th>Designation</th><th>Education and Experience</th><th>No of Persons</th></tr>
<tr><td>Project manager</td><td>Graduate Engineer; 10-12 years of experience in execution of Railway signalling projects.</td><td>1</td></tr>
<tr><td>Site Engineer</td><td>Diploma Engineer; 3-5 years of experience in execution of Railway signalling projects.</td><td>One per Block section.</td></tr>
</table>
</td></tr>
<tr><td>iii</td><td>Contractor shall submit the details of the project management and supervisory team along with their credentials within 15 days from the appointed date for the approval of Authority Engineer.</td></tr>
</table>

iv	A penalty of Rs. 40,000/- per month and Rs. 25,000/- per month respectively shall be imposed if Project Manager and Site Engineers are not deployed.

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SECTION 4
COST OF THE PROJECT

The estimated cost for the project is Rs. 123,42,17,917.24 Paise.
Break up of total cost for different components is as follow:

S. No	Description	Weightage (%)
i	Survey, Design and Documentation	0.60
ii	Provision of ABS system for entire project	86.35
iii	Integrated Testing and Commissioning	1.18
iv	Supply of Spares: Inventory	1.29
v	Construction of ABS huts, Modification / Augmentation of existing Relay Room / Construction of new Accommodation and Electrification thereof.	9.66
vi	Provision of AT supply at ABS hut	0.92
	Total:	100

SECTION 5
Reference Drawings

The following table gives a list of reference drawings to be followed for execution works. Any other drawings which are required shall be prepared and submitted by the contractor as per the standard practice followed in South Central Railway for the approval of Authority Engineer.

Sl.No.	Description	Drawing No.
1	Main Signal Foundation in between tracks	RDSO/M-00011/R4
2	Main Signal Foundation	SCR Drawing No.5772
3	Cable laying when rock faced at 300 mm depth from ground level	DRG 15-D2 of IRSEM Sheet 1
4	Cable laying when rock faced at 400 mm depth from ground level	DRG 15-D2 of IRSEM Sheet 2
5	Cable laying when rock faced at 600 mm depth from ground level	DRG 15-D2 of IRSEM Sheet 3
6	Cable laying on the bed of culverts or under culvert	DRG 15-D7 of IRSEM
7	C channel for Trough & GI Pipe	DRG No. S&T/RE/78/2/76
8	Gland Plate for full Location Box	SCR Drawing No. 5774
9	Class A Lightning Protection	SCR Drawing No. 5777
10	Copper plate earthing	SCR Drawing No. 5773
11	Earthing Arrangements for ABS Hut	SCR Drawing No. 5776
12	Earthing Arrangement for Signals and Location Boxes	SCR Drawing No. 5775
13	ABS hut Electrical layout plan (Triple line section)	SCR Drawing No. 5779
14	ABS hut Electrical layout plan (Double line section)	SCR Drawing No. 5780
15	EOLB foundations	S&T/MFT/6099 or latest
16	Full Location Box Foundation	SCR Drawing No.5781
17	Fencing of ABS Hut	RDSO DRG No. ETI/C/0186
18	Tie Bar Fencing for Location Box	S&T/MFT/7100
19	Horizontal boring / Micro Tunnelling	SCR Drawing No. 5770

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S. NO.	Description	Drawing No.
20	RCC Cable Duct	SCR Drawing No. 5778 & 5778A
21	RE Protection Screen	SCR Drawing No. 5767
22	Sliding Boom	S&T/MFT/4709
23	Track/ Road crossings	SCR Drawing No. 5768A
24	Typical Power Supply Arrangements at Mid-Section Interlocked LC Gate in Automatic Section	SCR Drawing No. 5764
25	Ladder for Indoor Wiring	SCR Drawing No. 5769
26	Protection Arrangement for cables at Less Depth	SCR Drawing No. 5771
27	Cable Trough for Metallic Bridge	IRSEM Drawing No.-15-D6
28	Cable laying on all minor bridges / culverts	DRG No. 15-D8 of IRSEM
29	Cabling scheme for station section	Drg no SK/P/SC/ABS/003

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SECTION 6
List of Annexures

Annexure No.	Description
1	System configuration for Automatic Signalling (SCR Drawing No. 5760: Attached with Bid Document). Note 12 of the Drawing may be read as 48 Fibres and must be laid in both main and redundant paths.
2	Automatic Signalling System Scheme Plan (Attached with Bid Document)
3A	List of Design and Documents
3B	List of As Made Documents
3C	List of documents to be submitted for Quality Hand Book
4A	Automatic Block Signalling Hut Layout Plan (SCR Drawing No. 5756 & 5757: Attached with Bid Document)
4B	Automatic Block Signalling Hut Electrical Layout Plan (SCR Drawing No. 5779 & 5780: Attached with Bid Document)
5	List of Pre-Commissioning Checklists and OEM Installation Certificate
6	List of Maintenance Registers to be supplied
7A	List of Specifications/Drawings and inspection agencies Signalling
7B	List of Specifications/Drawings and inspection agencies Telecommunication
8	List of Policy Letters / Circulars
9	AWS scheme of Mid-Section LC gates (SCR Drawing No. 5763: Attached with Bid Document)
10	List of Spares to be supplied
11	List of Tools and Measuring Instruments to be supplied
12	Details of Penalties
13	Typical IPS Scheme for ABS Hut

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Annexure 1

System configuration for Automatic Signalling

(Attached with Bid Document)

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Annexure 2

Automatic Signalling System Scheme Plan

(Attached with Bid Document)

Annexure 3A
List of Design and Documents

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Sl. No.	Description
1	Site Layout Plan of ABS Huts
2	SIP, TOC and SWRD
3	Station Working Rules
4	Dispensation Applications
5	CRS/PCSTE/PCOM/PCEE Application along with Enclosures
6	Sighting committee report
7	Circuit Diagrams of Stations and ABS Huts
8	Relay Index, Disposition Particulars and Relay Contact Analysis
9	K Rack Particulars: Cable Termination Particulars
10	P Rack Particulars
11	Fuse / Fuse Rack Particulars
11	Condenser and Resistors Particulars
12	Power Rack Termination Particulars
13	Datalogger Termination Particulars and Validation Report
14	Integrated Cable Path Diagram
15	Cable Distribution Diagram
16	Apparatus Case Wiring Diagram, Termination and Cable Particulars
17	Power Distribution Diagram
18	Floor Plans of Relay Room, Equipment Room & Earthing Diagrams
19	TSAA Documents
20	Quality Manual as per South Central Railway practice
21	MSDAC, USFBI/ FN MUX wiring diagrams
22	OFC Distribution plan and termination particulars
23	Telecom & Surveillance Camera Wiring diagrams
24	Pre-commissioning Checklist and OEM installation Certificate

Annexure 3B
List of As Made Documents

Sl. No.	Description
I	**Design Documents (Auto-Cad Drawings)**
1	SIP, TOC, SWRD
2	As made circuit diagrams of Stations & ABS huts
3	Relay Contact analysis
4	K rack particulars: Cable termination particulars
5	P rack particulars
6	Relay index, Disposition particulars and Relay Contact Analysis
7	Fuse rack particulars
8	Condenser and resistors particulars
9	Power rack termination particulars
10	Data logger termination particulars
11	Integrated Cable path diagram
12	Cable distribution diagram
13	Apparatus case wiring diagram, Termination and cable particulars
14	Power distribution diagram
15	Floor plans of relay room, equipment room, Earthing diagrams
16	MSDAC, USFBI/ FN MUX wiring diagrams
17	OFC Distribution plan and termination particulars
18	Telecom & Surveillance Camera Wiring diagrams
II	**Commissioning documents**
19	Copies of CRS/PCSTE/PCOM/PCEE/EIG sanctions and Dispensations
20	Copies of XR message and Safety certificate
21	Inspector work completion certificate
22	Sighting committee report
23	Copy of Technical system approval
24	Pre-commissioning Checklist and OEM installation Certificate
25	Data Logger validation report

Annexure 3C
List of documents to be submitted for Quality Hand Book

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Sl.No.	Description
1	Work Ready for Interlocking Certification for CSTE's approval
2	PRIME Compliance Status
3	Approved ESP
4	Latest SIP (Updated with Dispensations)
5	Latest TOC
6	FAT Tested TOC
7	SAT Tested TOC
8	FAT Certificate
9	Square Sheet
10	TSAA
11	SAT Certificate
12	Approved Floor Plan
13	Earthing Plan
14	Data Logger Validation Report
15	CRS Sanctions
16	CRS & COM Dispensations
17	SWRD
18	Cable Core Plan
19	Track Bonding Diagram
20	Cable Route Plan (With record of Depths) Record of depths
21	NI Program Day wise
22	Pre-commissioning OEM Checklist for EI, IPS, DL, MADAC, UFSBI/ FN MUX etc.,
23	RDSO Certificates EI, IPS, MSDAC, DATA LOGGER, ELD, UFSBI/ SIL4 MUX, Relays & Cables
24	Sighting Committee Report
25	Reading/ Parameters of Signals – incling distance from centre line of the track

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Sl. No.	Description
26	CRS Sanction / Authorization Letter
27	Cable Meggering Details copy duly signed by SSE/S
28	Earth Resistance register duly signed by SSE/S
29	Location particulars
30	Working Diagram or Key Diagram showing old and new layout
31	Training Details (for S & T) & (Optg)
32	Works to be done during Pre NI & NI
33	Supervisory Track Section Plan

Annexure 4A & 4B

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Annexure 4A - Automatic Block Signalling Hut Layout Plan &

Annexure 4B - Automatic Block Signalling Hut Electrical Layout Plan

(Attached with Bid Document)

Annexure 5

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Pre-Commissioning Checklists and OEM Installation Certificates

Sl. No.	Name of the equipment
1	Datalogger
2	Integrated Power Supply system
3	Electronic interlocking
4	Earth leakage detector
5	UFSBI/ FN MUX
6	MSDAC
7	Video Surveillance System
8	Class A Protection
9	Fire Alarm & Detection System

Annexure 6

Maintenance Registers

Sl. No.	Description
1	S&T HB- Signal History book
2	S&T/R-1- Station Asset Register
3	S&T/R-4- Work Site Orientation classes note book
4	S&T/R-6- Infringement measurement Register for Signalling gears
5	S&T/R-10- Cable Testing Summary
6	S&T/R-11- Signal Maintenance Record
7	S&T/R-12- Integrated Power supply System maintenance Record
8	S&T/R-13- Battery Set/Battery Charger Maintenance Record-110V
9	S&T/R-22- LC Gate Lifting Barrier Maintenance Record
10	S&T/R-25- Location box Maintenance Record
11	S&T/R-26- Earth testing and maintenance record
12	S&T/R-27- Cabin/Relay Room Maintenance Record
13	UFSBI Maintenance Register
14	DC-DC Converter- IPS Module maintenance Register
15	Data logger/ IPS/ LED failure Register
16	MSDAC Maintenance Register
17	Data logger Maintenance Register
18	Telecom Asset Maintenance Registers
19	Video Surveillance System Maintenance Register

Annexure 7A

Specification/ Drawings & Inspection Authority (Signalling)

(Note: All the specifications / Drawings referred shall be latest as on the date of opening of tender)

Sl.No.	Description	Specification/Drawing	Inspection
1	Signalling cables	IRS S 63-2014 Rev 4.0 with latest Amdt	RDSO
2	60C/40C Indoor cable	IRS S 76/89 Amdt 3 or latest	RDSO
3	COPPER CONDUCTOR POWER 2X35 Sq mm Copper cable	IS:7098(Part-1)/1988 with all amendments or latest.	RITES
4	Colour light Signal unit	IRS:S-26/64 DRG No:. SA-23840 with Amdt-1 or latest(Adv.)	RITES
5	Location box Full	S&T/MFT/2378 or latest	RITES
6	IPS	RDSO/SPN/165/2012 or latest	RDSO
7	EOLB	RDSO/SPN/208/2012/Ver.2.0 Amdt. 1 or latest	RDSO
8	MSDAC	RDSO/SPN/176/2013/Ver 3 or latest	RDSO
9	Data Logger	IRS S99-2006 or latest	RDSO
10	UFSBI	IRS:S-104/2012 ver 0 or latest	RDSO
11	FN-Mux	RDSO/SPN/211/2022 Version.1	RDSO
12	LED signal aspects	RDSO/SPN/153/2011 rev 4.1 or latest	RDSO
13	Electronic interlocking equipment / components	RDSO/SPN/192/2019, Ver.2 or latest	RDSO
14	DWC pipes	RDSO/SPN/204/2011/Ver.1.1 and Amdt 1 or latest	RITES
15	GI Pipe	IS.1239 (part-I) 1990 with galvanization as per IS.4736-1986 or latest	RITES
16	Hylam sheet	IS 2036- 1995 or latest	Consignee
17	Terminals & Fuse Blocks	IRS S75-2006 or latest	RDSO
18	Wago terminals	RDSO/SPN/189/2002 ver3 or latest	RDSO
19	Wire coils	IRS S76/89 Amendment No.3 or latest	RDSO

S.No.	Description	Specification/Drawing	Inspection
20	VRLA batteries	RDSO IRS S 93/96 Amd 1 or latest	RDSO
21	ELD	RDSO/SPN/256/2002 or latest	RDSO
22	HDPE Pipe	IS 4984 – 1995 or latest	RITES
23	Relays	BRS 930, 931A, IRS-S60, IRS-S34 and IRS-S23 (as applicable).	RDSO
24	Fuse all types	IRS S78-2006 or latest	RDSO
25	Calling on signal Unit	Drawing no.SA.24351 /Adv. Or latest	RITES
26	CLS post 3.6/4.6 mtrs	Specn.No.IRS-S6-81 or latest	RITES
27	Surface base	DRG.No.S-2011/M. or latest	RITES
28	CLS ladder 3.5/4.5 mtrs	DRG.no.SA.23153.SA 23150 or latest	RITES
29	CLS Ladder shoe	DRG No. S.2033 or latest	Consignee
30	Signal unit 4 Aspect	DRG.No.SA 23003/A/M with latest Amdt.	RITES
31	Route indicator Junction type	DRG no.SA.23402 with IRS - S 66/84 with amdt-1	RITES
32	Signal offset bracket 140 mm	DRG No. SA 23080 or latest	RITES
33	Transformer rectifier	IRS S 91-2014 or latest	RDSO
34	Tag block 200 way	IRS S71-87 or latest	Consignee
35	Fuse auto changeover system	RDSO/SPN/209/2012 ver 2.0 or latest	RDSO
36	Metal to metal relays	S 46 – 74 and Amdt 1	RDSO
37	RCC Pipes	IS 458-2003 or latest	RITES
38	Position light shunt signal	SA 23840 or latest	RITES
39	E Type Lock & Key	SA 3376/M & S 3377 or latest	RITES
40	LED ECR	STS/E/Relays/AC Lit LED Signal/09-2002 or latest	RDSO
41	Timer Relay Electronic fail safe	IRS: S -61 – 2000 with Amdt 3 or latest	RDSO
42	GI Wire	IS 280-2006 or latest	Consignee

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43	RCC duct	SCR Drawing No. 5778 & 5778A	RITES
44	RCC Cable Marker	DRG No.15-D1 of IRSEM	RITES
45	CT rack	SCR Drawing No. 5783	Consignee
46	Relay rack	SCR Drawing No. 5782	Consignee
47	Ladder for Indoor Wiring	SCR Drawing No. 5769	Consignee
48	A Marker Board	DRG. No. 19-D10 sheet 1 of IRSEM	Consignee
49	AG Marker Board	DRG. No. 19-D10 sheet 2 of IRSEM	Consignee
50	Arrow Board for RHS signals	DRG. No. 19-D10 Sheet 8 of IRSEM	Consignee
51	Signal Number Plate	RDSO DRG. No. S23149	Consignee
52	C Marker	DRG. No. 19-D10 Sheet 4 of IRSEM	Consignee
53	RFID type Cable Route Markers.	As per OEMs' specifications	Consignee
54	G Marker	DRG. No. 19-D10 Sheet 3 of IRSEM	Consignee
55	Integrated LED signal lighting unit	RDSO/SPN/199/2010/Rev1.1 or latest	RDSO
56	Cable Route Locator	As mentioned in Annexure 11	RITES
57	Fire Alarm & Detection System	RDSO/SPN/217/2016, Ver. 2.0 or latest	RDSO

Annexure 7B

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Specification/ Drawings & Inspection Authority (Telecommunication)

Sl. No.	Description	Specification/ Drawing	Inspection
1	OFC	TC 55-2006, Rev.1 with Amendment –1.1 or latest	RDSO
2	FDMS	RDSO/SPN/TC/37/2020 Revision- 4.0 or latest	Consignee
3	Optical fibre Joint closure	RDSO/SPN/TC/68/2014, Rev.1.0 Amdt -1 or latest	Consignee
4	OFC Joint chambers – FRP type	RAILTEL/SR/OFC/2010/1 or latest	Consignee
5	6Q cable	TC 30-05 Ver. 1 Amdt -5 or latest	RDSO
6	6Q jointing kit	IRSTC-77/2012, Revision-3 Or latest	RITES
7	Optical fibre patch cord and pigtails	RDSO/SPN/TC/69/2007, Rev.0 or latest	Consignee
8	Switch board cable	NO. GR/WIR-06/03. MAR 2002 or latest	Consignee
9	SMPS charger	RDSO/SPN/TC/23/1999 Ver.4 Amdt-1 or latest	RDSO
10	PL HDPE duct with all accessories	RDSO/SPN/TC/45/2013 Rev.2.0 Amdt -2 or latest	RDSO
11	Media Converter.	RDSO/SPN/TC/103/2013 Rev. 1.0 or latest	RDSO/Consignee
12	LAN Extender	RDSO/SPN/TC/82/2020/Rev. 2.0 or latest	RDSO/Consignee

Annexure 8

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List of Policy Letters / Circulars

(Note: The following documents can be obtained from Authority /Authority Engineer)

Sl. No.	Description	Letter No.
1	Basis of the safety plan issued by PCE/SCR	PCE/SCR Engineering Standing Order No. 89 dated 29.07.2020 and Engineering Standing Order No. 65 dated 05.07.2010 or latest
2	Approved list of Brands / Makes of items for the use in Civil Engineering works issued by PCE.	PCE/SCR's Lr No. SCR-HQ0ENGG(SOR)/1/2020-Dy.CE/WORKS /SCR Dt: 24.05.2022.
3	Procedure for undertaking digging work in the vicinity of Signalling, Electrical and Telecommunication cables.	Railway Board Lr No.2021/Tele/5(2)/3-Part(1)(3425647) dated 12.06.2023
4	Materials to be inspected by RDSO / RITES.	Railway Board Letter No. 74/RS(G)/ 379/ 2Pt. Dt: 04.03.1991 and 18.06.1991 and Railway Board Letter No.2022/RS(G)779/9 dated: 01.12.2022
5	Technical Circular on Scheme for Automatic Block Signalling	South Central Railway Technical Circular No. SCR TC 01/2022.
6	Design philosophy and process guidelines	SCR Letter No. SCR-HQ0SNT (SGPC)/5/2019 Dt: 05.01.2021.
7	RDSO Guidelines for signal cable laying	RDSO/SI/G/2010 Ver 1.1 or latest,
8	PCEE Specifications on Electrical Items	SCR/PCEE/SPEC/BLDC-02/2022 & SCR/LED bulbs(ID/OD)/001-005/2017 or latest
9	FAT & SAT Testing Procedure	Railway Board letter No. 2017/SIG/3/85th SSC dtd 04.12.2018 or latest

Annexure 9

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AWS scheme of Mid-Section LC gates

(Attached with Bid Document)

Annexure

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10 Spares

(Quantity of spares shall be calculated for the entire project. However, supply of spares shall be done for each stage commission as specified in Schedule - I of Draft EPC Agreement)

Sl. No.	Description of material	Quantity
1	MSDAC cards & Track side electronics	10% of working cards as spare for each type with minimum one card
2	MSDAC DPs assembly	10 % of working DPs as spare for each type
3	USFBI cards	10% of working cards as spare for each type with minimum one card
4	OFC Patch cords	10% of working cords as spare with minimum one cord of each type
6	AC lamp proving relays	10% of quantity used in the project with minimum one relay of each type
7	VRLA Batteries	5 Nos. per IPS
9	LED signals all aspects	10 % of Working LED signals
10	Relays All types except those mentioned in Sl. No. 6 above	5% of working relays
11	OFC Cable	2% of total cable used in the project subject to minimum one drum of standard length.
12	Signaling cables all types	2 % of total cable used in the project subject to minimum one drum of standard length.
13	Telecom cables	2 % cable used in the project subject to a minimum one drum of standard length.
14	COPPER CONDUCTOR POWER cable	10 % of the quantity utilized.
15	Telecom Equipment	10% of quantity utilized
16	Video surveillance Equipment	10 % of the quantity utilized.
a	IP based day and night high resolution camera	10 % of the quantity utilized.
b	8 Channel NVR	10 % of the quantity utilized.
c	Network 8 port switch	10 % of the quantity utilized.

Annexure 11

Tools & Plants and Measuring Instruments

Sl.No.	Description of Tools	Qty
1	Maintenance tool kit for signaling as per Item No 1018 of SCR SOR 2012	3
2	RIDGID Precision Pipe and Cable locator / Route tracer Brand : PIPE AND CABLE LOCATOR / ROUTE TRACER(Q3)SR-24 KIT903180001 or similar	1
3	Tool kit of MSDAC as per OEM recommendations	3
4	Optical fiber splicing tool kit consisting of precision clever and other required tools as per TEC Spec GR/OFT -01/03.APR 2006 or latest	2
5	Supply of mini Optical Time Domain Reflectometer as per TEC Spec TEC/GR/TX/OTD-002/04/AUG-19 Type A with built in power Source option of make Anritsu / HP / Fluke / Megger / Stanley / Fujikura or better	2
6	Supply of **Optical Power Meter**(850/1310/1490/1550 nm Calibrated wavelengths, Single & Multi mode operation, Measurement range +3 to 60dBm, 0.01 dB resolution, NIST Traceable, GERMANIUM, 0.01dB, Zero/SET Ref, CE Certified, 2KHz Tone identification)	2
7	Supply of Core Alignment Fusion Splicing Machine as per TEC spec TEC/GR/TX/OSM-001/04/SEP-12 or latest of Fujikura 88S / Stanlay / HP / Anritsu / Megger / Fluke or better.	1
8	Digital insulation tester suitable for testing of cables in AC traction area. Range: 50V -1000V DC. Make: Rishabh / Meco / Fluke	4
9	Supply of Digital earth tester along with test kit and leather case similar to RISH make. Inspection : Consignee	2
10	RFID Marker Locator, 8000 Marker records, Built in GPS Module, 1.5m Depth Range 4 X 20 Digit LCD Display for 101.4kHz Telecom Markers. RFID Marker locator provided complete with Marker Database software and clo data storage service facility (unlimited data storage) Make : Komplex or similar	1

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Annexure 12

Details of Penalties

S.No.	Nature of Discrepancy/ Deficiency	Penalty to be Imposed
1	Indoor/ outdoor relays with wrong coding pin configuration	Rs 10,000/- Per relay
2	Design mistake in the circuits submitted for approval	Rs 2,500/- for each mistake
3	Mistakes in as made documents	Rs 10,000/- per mistake
4	Non-Deployment of Project Manager	Rs. 1,500/- per day
5	Non-Deployment of Site Engineer	Rs. 1,000/- per day
6	Non-Deployment of Vehicle	Rs. 5,000/- per Occasion
7	Non -deployment of skilled manpower	Rs 1,000/ day
8	Non-deployment of semi skilled manpower	Rs 1,000/day
9	Non-Deployment of Proof Consultant	Rs. 1,500/- per day
10	Non-Deployment of Safety Consultant	Rs. 1,500/- per day
11	Non-Deployment of Civil Engineer during construction of ABS Hut	Rs. 4,000/- per day
12	Non-deployment of Design Expert	Rs.3000/day
13	Non-deployment of Draftsman	Rs.1500/day

Annexure 13

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Typical Schematic Diagram of IPS Configuration for ABS Huts

(Attached with Bid Document)