Revised Reasoned Document OF RDPMS:-25/07/2020

Spec. Cl. No.	Specification Clause	Railway / Vendor Comments	RDSO Remarks SSE suggestion on the basis of remark
1.0	**The Functional requirement of Centralized Traffic Control (CTC) is as under:-** **SCOPE:**		
1.1.3	Interfacing & real time data sharing with COA, Crew management system, PA system at station, ETCS L-2/TCAS etc	**M/s. Kyosan:** Technically Possible.	
		However the interface for all subsystem needs to be under open protocol. In case of OEM specific protocol additional development and integration testing is required.	Non proprietary protocol should be used
		We understand " COA, Crew management system, PA system at station " are interfaced with CTC server at OCC.	Yes
		We understand " ETCS L-2/TCAS " are interfaced with EI at Station. Further ETCS L-2 having some advance commands at Centralized place .It needs to be interface with CTC server. For TCAS we are envisaging that server level OCC interface is not required.	Sever may be required
1.1.4	This system should have facility of Automatic route setting (ARS), Long route setting, Route stacking command for	**M/s. Kyosan:** Need more clarity on Route Stacking Command	Is detailed in relevant clause

	avoiding repetitive operation by controller.		
1.2	The system shall enable interconnection with other TMS of adjacent Sections/ Backup control centre (BCC)/National control centre (NCC).	**M/s. Kyosan:** TMS of adjacent Sections - The interface for all adjacent TMS needs to be under open protocol. In case of OEM specific protocol additional development and integration testing is required.	Non proprietary protocol shall be used, mentioned in relevant paras.
		Backup control centre (BCC) - Planning of BCC shall be initiate along with the main tender so that BCC concept can be incepted at each functional level.	Not related to specification, may be taken care during tendering
		National control centre (NCC) - As per our understanding NCC is an extended vesrion of OCC/BCC. The Planning of NCC shall be more elaborate.	Yes
2.0	**BASIC REQUIREMENTS OF TMS:**		
2.1	**SYSTEM RESPONSE TIME:**		
2.1.3	The time taken between initiation of a query relating to data /result /report and its response on terminals shall be as fast as possible and be never more than 3 seconds for up to 2 page report.	**M/s. Kyosan:** The time taken between initiation of a query relating to data /result /report depends upon the volume of report we are looking for. If we tried to get report of monthly planned vs actual timetable . Definitely the time will exceed more than 3 seconds hence we cannot fix upper limit of 3 secs at least for reports.	Para is modified as suggested.

		M/s. HBL: The time taken between initiation of a query relating to data / result / report and its response on terminals shall be as fast as possible and be never more than 3 seconds for single page report.	
2.3 2.3.3	The disk space shall be sufficient to store 30 days of historical data and leave 50% of free space available	**M/s. Kyosan:** However, specifying requirement of the historical data shall be based on the number of event as it depends on the number of trains and operations per days which will vary section to section.	Disk space may be planned accordingly, no change in para required.
2.5	**Hardware and Operating Systems:**		
2.5.1	The TMS must be based on proven, non-proprietary and largely distributed hardware, software and communication protocols.	**M/s. Kyosan:** Non-proprietary and largely distributed hardware - Complied- Intel based servers/workstations are considered Software - Complied - Linux OS is considered Communication protocols - Complied- Inter TMS and other subsystem communication shall be through open protocols. However internal communication between TMS components will be based on proprietary protocols.	Protocol used for internal communication has to be shared with Railway for future uses.
		Remarks by HBL: TMS Software will be proprietary to each OEM.	

2.5.3	The specification of the server shall be based on latest configuration available at the time of supply.	**M/s. Kyosan:** IT hardware becomes obsolete very often hence the period of supply from the date of tender notice to be specified.	
2.5.5	Servers shall be a current product offering of a server manufacturer with at least 10% server market share at time of procurement.	**M/s. HBL:** Server shall be of reputed brand from one of the preferred brands suggested by purchaser. **Remarks by HBL:** Determination of which server manufacturer has at least 10% market share is a contentious issue and leads to execution delays.	In view of point raised by firm, this para may be modified as "Servers shall be a current product offering of a reputed server manufacturer, It should be approved by engineer in charge."
2.5.6	Servers' operating systems shall be either Windows or LINUX, in line with the leading server market distribution.	**M/s. HBL:** Servers' operating systems shall be either Windows or LINUX.	Nothing to add para is OK
2.5.7	Workstations shall be Windows-based, in line with the leading workstation market distribution.	**M/s. Kyosan:** Workstations shall be Windows/Linux-based, in line with the leading workstation market distribution. **M/s. Siemens:** We also suggest to incorporate other OS (e.g. Linux) to align with Open System Concept requirements (Clause 9.0). The Linux has some advantages like Security, reliability, Consuming fewer system resources & cost.	Clause may be modified as "Workstations shall be preferably Linux/Windows-based, current product offering of a reputed make, Type of work station shall be decided &approved by engineer in charge."

		DMRC: Operating system – Windows should not be defined: 1) Windows is Virus prone, 2) Operating system changes: Poses maintenance and obsolance challenges {Window XP, Windows 7, Windows 10 and frequent updates). Even hardware replacement require OEM support} Therefore OS requiring least support to be preferred.	
2.5.9	Data from individual sub system to be saved in common data base enabling different user to access the data on real time basis.	**DMRC:** Leave it to OEM – All users should be able to access it	In view of suggestion of DMRC, Clause is modified as " It should be possible to access Data from individual sub system by different user on real time basis."
2.6	**Environmental:**		
2.6.1	Design of OCC shall be as per ISO-11064 "Elements of Good Control Room Design". Environmental aspects should be as per ISO-11064 part 6.	**M/s. HBL:** Design of OCC shall be as per ISO11064 "Elements of Good Control Room Design". Environmental aspects should be as per ISO-11064 part 6. Purchaser Railway is responsible for making space available for the Control Room, according to the requirements of the standard.	Design of Building has already worked out and covered in subsequent section, space as per the design will be made available. No change in para needed.
2.6.2	The servers and workstations shall comply with operation at 0-45 deg C system inlet temperature range at sea level.	**M/s. HBL:** The servers and workstations shall comply with operation at ambient temperature range of 10 - 35 deg C at sea level.	No change in para needed.
2.6.3	The system shall be provided with A/C equipment with independent control of temperature as required depending on the	**M/s. HBL:** This clause may be deleted	Clause need to be there, it will be part of building and shall be taken care during tendering.

	equipments.		
2.7.2	Redundancy shall be built in the hardware both in the external equipment interface and also in the TMS network equipment interfaces/ link such that no single failure will lead to shut down of the TMS functioning.	**M/s. Kyosan:** We understand that redundancy of TMS hardware and its communication. Redundancy of external subsystem may depend on the configuration. **Comments from WR:** Also, Local Data Storage facility to be provided in FIU (Field interface Unit). This will avoid loss of critical data in case of Total Communication Failure.	Suggestion of M/s HBL will be added under FIU
2.8	**Interlocking Interface:**	**M/s. HBL:** Interface to other Signaling Systems. **Remarks by HBL:** Since Indian Railways is planning to install TCAS also in a big way across the network, it is better to consider interface between TMS, TCAS & Interlocking systems in an integrated manner, by the articulation of an Indian Railways Traffic Management System (IRTMS) architecture, with an illustration similar to this.	Suggestion is beyond the scope of this specification. May be planned in future.
2.8.1	Interlocking interface shall be based on open, non proprietary standards.	**M/s. Kyosan:** For interlocking-CTC interface , it is responsibility of EI vendor to deliver Protocol Converter (Embedded PC) with one side connected with interlocking and another side space shall be available to connect CTC-TMS with predefined standard protocol. However station specific application logic needs to be modify to fit CTC	Para may be modified as "Interlocking interface shall be based on open, non-proprietary standards. All details of interlocking interfaces including data structure, CRC, Checksum details, communication process & protocol shall be shared by the TMS vendor. TMS product shall develop necessary protocol converter for interfacing with

		requirement which will be carried out by respective EI vendor. **DMRC:** As an alternative all details of interlocking interfaces including data structure, CRC, Checksum details, communication process shall be shared as part of interlocking supply and product. TMS product shall develop necessary protocol converter for interfacing with different interlocking system This is most critical for TMS system to proliferate on IR	different interlocking system. Protocol of interlocking system shall be made available by Railway in liaison with interlocking vendors. Alternatively if Interlocking system is designed as per EULYNX standard then EULYNX's TCS-ILS interface document Baseline-3 release-7 or latest shall be followed.
2.8.2	The TMS interface to the Interlocking shall be developed and assessed according to CENEIEC 50128 SII 2 safety integrity.	**M/s. HBL:** The TMS interface to the Interlocking shall be developed and assessed according to CENELEC 50128 and 50129 SIL 2 safety integrity by an RDSO-empanelled ISA. **DMRC:** Generic TMS/CTC product certification by ISA to effect, that development process design, manufacture & validation is as per Safety Integrity Level 2 as defined in CENELEC Standard EN 50128 is mandatory. For deployment on a line / section / project, ISA certification is not mandatory being non vital system.	Clause may be modified as "TMS/CTC product certification by RDSO empanelled ISA to the effect that development process, design, manufacture & validation is as per Safety Integrity Level 2 as defined in CENELEC Standard EN 50128 & EN 50129. For deployment on a line / section / project, ISA certification is not mandatory and may be decided by engineer in charge."
2.8.3	2.8.3 Critical functions like operation of point/signal/level crossing with Interlocking shall be initiated by operator at OCC and	**Remarks by HBL:** Can Operator from OCC initiate operation of points and signals? This	No safety issue involved in this as it will be taken care by interlocking system at station.

	then only interlocking accepts it as a valid request.	may be a hazardous operation from a remote location. He should only be able to set or cancel routes.	
2.9	**Acquisition Protocols:**		
2.9.1	The acquisition protocols shall be event driven, with polling utilized only if necessary.	**M/s. Kyosan:** Acquisition protocol topic can be dealt while preparing a separate specification for EI	No change in para needed.
2.9.2	The acquisition protocols shall include time stamping and data quality coding. Quality coding shall be propagated to the data throughout the processing.	**Remarks by HBL:** CRC and checksum are widely understood terms compared to data quality coding.	As suggested clause may be modified as "The acquisition protocols shall include time stamping and CRC and checksum checking. CRC and checksum shall be propagated to the data throughout the processing."
2.10.1	TMS shall be designed and manufactured to achieve Safety Integrity level 2 as defined in the CENEIEC standard EN50128 in the context of a safety hazard analysis addressing safety functions of equipment blocking.	**M/s. Deltron:** Additionally, since Auto Route setting (ARS) and remote Signal / Point operation is a part of functional requirements, then SIL-3 hardware/software safety along with communication should be preferred. Third-party (Safety certified proven COTS) may be allowed to be used for achieving uniform operation and easy interoperability.	As suggested by DMRC para is modified as "Development process of TMS system shall be designed, manufactured and validated to Safety Integrity Level 2 as defined in the CENELEC standard, EN50128. All potentially unsafe effects of safety-related functions performed by TMS shall be mitigated by mandatory interaction with SIL4 subsystems such as Interlocking, TCAS, ETCS

		DMRC: Consider to change to "Development process of TMS system shall be designed, manufactured and validated to Safety Integrity Level 2 as defined in the CENELEC standard, EN50128". All potentially unsafe effects of safety-related functions performed by TMS shall be mitigated by mandatory interaction with SIL4 subsystems such as Interlocking, TCAS, ETCS etc.	etc."
2.10.2	Interlocking interfaces shall be based on open, non-proprietary standards.	**M/s. Kyosan:** For interlocking-CTC interface , it is responsibility of EI vendor to deliver Protocol Converter (Embedded PC) with one side connected with interlocking and another side space shall be available to connect CTC-TMS with predefined standard protocol. However station specific application logic needs to be modify to fit CTC requirement which will be carried out by respective EI vendor.	Covered in para 2.8.1, Duplicate clause, deleted.
		M/s. HBL: This clause is deleted.	
		Remarks by HBL: It is a repetition of clause 2.8.2	

		DMRC: Generic TMS/CTC product certification by ISA to effect, that development process design, manufacture & validation is as per Safety Integrity Level 2 as defined in CENELEC Standard EN 50128 is mandatory. For deployment on a line / section / project, ISA certification is not mandatory being non vital system.	
2.10.3	The TMS and its interface to the Interlocking shall assessed according to CENEIEC 50128 SIL- 2 safety integrity by Independent safety assessor (ISA).	**M/s. Alstom:** We understand that if the ISA certification already exists for the TMS solution provided, there is no need to assess/certify at project stage. Request to modify the clause accordingly	clause 2.8.2 modified as per feedback, this clause deleted being duplicate.
		M/s. HBL: This clause is deleted	
		Remarks by HBL: It is a repetition of clause 2.8.2	
		DMRC: Generic TMS/CTC product certification by ISA to effect, that development process design, manufacture & validation is as per Safety Integrity Level 2 as defined in CENELEC Standard EN 50128 is mandatory. For deployment on a line / section / project, ISA certification is not mandatory being non vital system.	
3.0	**FUNCTIONALITIES OF TMS:**		

	The system broadly envisages the functionality as described below:	**Remarks by HBL:** It is better if this section is made as Section 2.0, since it describes all the functions of TMS, after which current section 2.0 will make better sense in terms of flow	No change required.
3.1.1.2	The Mimic Indication Panel shall display all track circuited lines and all interlocked signal aspects of track layouts of station & auto sections of section monitored by TMS.	**DMRC:** " Suggest to include monitoring critical Power supply, all indications. Please list these display at one place as it is scattered now, "	Power supply monitoring is covered under TMS maintenance terminal. No change in this para.
3.1.1.6	It should be possible to update changes in yard layout through software from the maintenance terminals without any requirement of changing in hardware. The uploading time of software changes should be minimum (worst case change over time should be less than 60 minutes) and it should be possible without complete shutdown of the indication system.	**M/s. Kysan:** Incase of changes in the yard layout, first EI system needs to be upgrade in layout , application logic and TMS interface. These all activates shall be performed offline and tested with TMS offline tools. EI updation and TMS updation to be done parallely during the commissioning time. In such a case TMS change over time shall be less than 60 minutes.	Following may be added in para "In Complex situation when time needed is more than 60 minute, approval from Zonal railway as a special case may be taken."
		Remarks by HBL: Changes yard station layouts, like addition of new lines, signals etc., may need increasing the capacity of FIUs	
3.1.1.7	It shall be possible to show the temporary speed restriction by showing the track lines with different colors or by showing the Tag box or by any other means.	**Remarks by HBL:** A separate server for TSR implementation is being planned for TCAS. It is suggested to integrate the TSR requirements between the two systems, in order to avoid duplication of hardware and software.	Not much issue both servers will be connected, no change in para needed.

3.1.2.2	Section controller / Chief controller terminals (work stations) will consist of 4 LCD/LED (as specified by user- by default it should be 32" LED type) monitors operated by one computer with GPU . All the features required for efficient display and control of the section shall be available on these terminals.	**M/s. HBL:** Section controller / Chief controller terminals (work stations) will consist of 3/4 LCD/LED 24" /32" monitor (as specified by user- by default it should be 32" LED type) monitors operated by one computer with GPU. All the features required for efficient display and control of the section shall be available on these terminals.	Para may be modified as "Section controller / Chief controller terminals (work stations) will consist of 4 LCD/LED 32" monitor (or as specified by user) operated by one computer with GPU. All the features required for efficient display and control of the section shall be available on these terminals."
3.1.2.10	The train controller terminal shall be capable of running the Decision Support System (DSS) feature. Decision support system shall identify operational conflicts (like precedence, crossing etc.) in advance and suggest optimized control options to the controller.	**M/s. Kyosan:** In our understanding DSS module shall be operated by section controller as on need basis during train online condition.	yes
3.1.2.11	The crew details available in the system shall also be available on the terminals provided with Sr. DOM, CHC, Dy. CHC, etc. apart from being available on SCOR & ASM work stations.	**M/s. HBL:** CHC, Dy.CHC and SCOR abbreviations to be added.	Will be added.
3.1.3	Live Indications on terminals provided with staff at Important Junction stations /Car shed/ lobbies etc.:	**DMRC:** Limit Train displays on track layout – Indications of signal and points at all locations, only add to load on system beside unavoidable conflicts It should be purely on need basis"	**Para may be modified as "**Live Indications on terminals provided with staff at Important Junction stations/Car shed/ lobbies etc. as decided by engineer in charge":
3.1.3.5	It shall be possible to query the central control regarding details of trains, cancellation, rescheduling, delays, diversions etc, through menu driven commands.	**M/s. Kyosan:** We understand Central control is nothing but CTC central server	Yes
3.2.8	The train describer system shall be able to register & display abnormal conditions in the		

	Software such as following:		
	(i) Single track circuit failure		
	(ii) Faulty position of points	**M/s. Alstom:** We understand faulty position here refers to difference between controlled and detected positions, Please confirm	Yes
	(viii) Wrong marking of object/functions.(For example- A train with electric loco being marked onto non-electrified line, A passenger train marked to a goods line, A train being routed to wrong destination etc.)	**M/s. Alstom:** This depends on accurate classification of fleet and their types and availability of that data in TMS system. Request to include the condition in the clause.	Yes
	(ix) Abnormal disappearing of train describer tag shall generate an alarm and display in different colour	**M/s.HBL:** Abnormal disappearing of train describer tag shall generate an alarm.	yes
3.2.9	The train describer system shall be able to handle the commands for -	**M/s. Alstom:** WE understand the commands listed here are for the berth symbol indication and not for train identification, please confirm. (for ex: (iii) Renaming a train describer tag doesn't mean modifying the train identification)	
	(i) Insertion of a train describer tag on a track or at a signal, which shall be assigned automatically to the train occupying the track.		
	(ii) Moving a train describer tag to a different location		
	(iii) Renaming a train describer tag.		
	(iv) Exchanging one train describer tag with		

	another train describer tag		
	(v) Deleting a train describer tag.		
	(vi)Join/Split of Two Train Describer Tags.	**WR:** Join/Split of Two Train Describer Tags. (To be added)	added as suggested by W.rly
3.2.12	The train describer system shall send log records of the event logged including the following information to data base:		
	(i) Movement of train descriptions (track to track details with timing).		
	(ii) Operator's commands to the train describer system.		
	(iii) System will display crew details from the detailed link available in crew management software, on query from various terminals of controllers & lobbies.		
	(iv) Log Report of all Trains renamed by Specific Operator/Terminal.	**WR:** Log Report of all Trains Renamed by Specific Operator/Terminal. [To be added)	Added as suggested
3.2.13	In case of Link failure / Track circuit failure, If any Train loose TD, it shall automatically reassign same TD after failure is restored.		
3.2.12	The train describer system shall send log records of the event logged including the following information to data base:		
	(i) Movement of train descriptions (track to track details with timing).		
	(ii) Operator's commands to the train describer system.		
	(iii) System will display crew details from the detailed link available in crew management software, on query from various terminals of controllers & lobbies.		

3.3.1	After taking control of an area, the central controller will be able to send commands to the corresponding interlocking. The possible commands are,		
	(g) Setting / Releasing Slot, LC Gate, Crank Handle etc.	**WR:** Setting / Releasing Slot, LC Gate, Crank Handle etc. [To be added]	Added as suggested
	(h) Throw Signal to Danger	**WR:** Throw Signal to Danger [To be added]	Added as suggested
3.3.7	All emergency operation shall be done locally by ASM at station or can be done from CTC under exchange of private number, this aspect shall be approved by Railway at the time of design.	**M/s. Kyosan:** Kindly elaborate the method of operation for exchange of private number for the following, 1. EI VDU 2. ASM Terminal (CTC terminal at station) 3. Section Controller OCC 4. Dy. Chief Controller at OCC	Clause may be modified as under " All emergency operation shall be done locally by ASM at station or can be done from OCC under exchange of private number with ASM at station, this aspect shall be approved by Railway at the time of design."
3.3.13	In CTC mode, it should be possible to 'Throw any signal to Danger' from Local Panel as well to deal with emergency situation.	**WR:** In CTC mode, it should be possible to 'Throw any signal to Danger' from Local Panel as well. [To be added)	Added as suggested
3.3.14	Every operation of CTC mode should be logged and daily report to be prepared.	**WR:** Every operation of CTC mode should be logged and daily report to be prepared. [To be added]	Added as suggested
3.6	**Block Working Operation:**	**M/s. Alstom:** • For EI, we presume that, it will be automatic block working • RRI/PI, we presume that replacement of conventional block	Safety issue is not evolved as all interlocking related to block working will be there at station.

		instrument is done using digital block instruments and it shall have provision to transfer the data safely to CTC using safety protocol/gateway.	
3.7.2.2	Based on the events logged and the operator input, the system shall generate various traffic management reports including but not limited to those given below:		
	(xv) TD Report (Track circuit and Signal No.) - Actual occupying time of every track circuit by specified Train / Object in entire Section.	**WR:** TD Report (Track circuit and Signal No.) - Actual occupying time of every track circuit by specified Train / Object in entire Section. [To be added]	Added as suggested
	(xvi) Report of Actual Speed of Train.	**WR:** Report of Actual Speed of Train. [To be added]	Added as suggested
3.9.6	The system should be capable of simulating the existing time-table and compare it with actual running on periodic basis to create Management Information to identify any shortcomings in the system / time-table.	**M/s. Kyosan:** Since simulator is an offline system the actual running cannot be compared. However for comparison purpose actual train data can be collected and feed into the simulation system such that comparison between planned and actual can be done.	No manual feeding of data shall be required, clause is OK.
3.9.9	The simulation provides the following facilities:		
	(v) Scripting and running tests scenarios,	**M/s.HBL:** Test scenarios to be specified for other conditions other than mentioned in previous clauses.	
3.11	Interfacing of TDS with Crew Management System(CMS):	**M/s.HBL:** Methodology of Integration between	May be defined at Zonal railway level.

		CTC and CMS to be defined as is done for Methodology of Integration between CTC and COA Systems (Annexure-iv)	
3.12	Interfacing with OHE SCADA system (optional)	**M/s.HBL:** Methodology of interfacing between existing SCADA system and CTC to be defined. Protocol to be defined for SCADA interfacing.	May be defined at Zonal railway level.
3.13.7.1	The system shall have a standalone Windows based tool to do the timetable planning in the offline system.	**M/s. Kyosan:** The word "Windows" may be replaced with GUI (Graphical User Interface).	Para may be modified as Under: "The system shall have a standalone tool using GUI to do the timetable planning in the offline system."
3.13.7.4	A train service shall have following attributes:		
	(vii) Creating train Id if required.	**M/s.HBL:** To be replaced with Train number	Para is OK
4.1.2	The time span of log shall be minimum 30 days of events.	**M/s. Kyosan:** However, specifying requirement of the logs shall be based on the number of event as it depends on the number of trains and operations per days which will vary section to section.	No change needed.
4.3.1	Vital traffic operation related alarms should be -	**M/s. Alstom:** We find few repetitive requirements in sub-clause, please modify (for ex: iv &v, vi & vii)	Para's are Ok.
6.0	**Field Interface Unit (FIU):**		
6.2	The RRI/PI/ALH station's and independent	**M/s. Kyosan:**	Use of FIU can not be avoided in

	LC gates signaling field gear data shall be fetched through FIU using potential free contacts.	FIU to be used for collecting field inputs and transmit CTC command to RRI/PI/ALH however to avoid huge wiring modifications at relay room and SM Panel to facilitate parallel controls. It is suggested to RRI/PI/Auto section need to be converted into EI platform. For independent LC gates hut CTC contractor should put FIU and read the data through Potential free contact up to CTC.	case of PI/RRI installation. Para is OK.
6.3	System to be used for communication with interlocking shall be as per IEC 870-5-101 communication protocol.	**M/s. Siemens:** While IEC 870-5-101 is based on a serial communication of data (e.g. using RS-232 and FSK based modems), IEC 870-5-104 is packet oriented and is based on Ethernet (TCP/IP) transmission.	Both the option (Serial & Ethernet based) may be kept and para may be modified as " System to be used for communication with interlocking shall be as per IEC 870-5-104 or IEC 870-5-101 communication protocol."
6.4	The FIU system design shall ensure that SIL2 level is maintained during communication between CTC and FIU.	**M/s. HBL:** FIU, including communication from FIU to CTC, shall be compliant with CENELEC standards SIL 2.	No change in para.
6.6	For interfacing of EI with CTC, protocol converter shall designed by CTC vendors. Data protocol used for EI may be shared by EI vendors	**M/s. Siemens:** Currently, the protocol converter can be implemented if required for different make of EI interface with CTC. However, in future, the adaption of common EULYNX protocol can provide standard interface of CTC with EI of different make.	Para modified as under: "For interfacing of EI with CTC, protocol converter shall designed by CTC vendors. Data protocol used for EI may be shared by EI vendors. Protocol converter of each type of EI shall be planned at CTC location instead

		WR: **6.7** In case of EI (Electronic Interlocking) Installation, no interface shall be needed at way side stations. (Direct telegram from EI through protocol converter should be accepted by TMS Servers) [To be added	of at every station."
6.7		**M/s.HBL:** FIU shall have dual Ethernet ports for communication (New clause to be added)	Para 6.7 may be added as under: FIU hardware should have provision for two separate channels for different systems (OCC and BCC).
7.4	The communication channel from station to BCC shall be different from that of OCC as far as possible.	**M/s. Siemens:** In this regard, it is important is to ensure that the FIU hardware allows those two separate channels with different systems (OCC and BCC)	Para 6.7 added
9.1	All software shall be based on open system concept and shall be independent of type of processor or hardware platform.	**M/s. Kyosan:** The minimum hardware requirement as installed to be maintained	No change needed.
9.3	Following modification should be possible without modifying the source program:		
	(XV) Incorporation of additional infrastructure such as yards, sidings, new lines etc.	**M/s. Alstom:** Incorporation of additional infrastructure such as yards, sidings, new lines etc would require modification of configuration database in TMS as many functions use this. Hence, we do not recommend alteration in a system tested and validated for operation.	

10.0	**Technical Requirements of TMS:**		
	General:	**DMRC:** **Para 10.1.5, Para 10.1.6:** Workstations & Servers are Commercially off the Shelf products and diagnostic information such as LED indications or test points modifications are normally not done on such products. It is proposed that the clause may be replaced by COTS available servers & workstations which meet environmental &EMC requirements should be used and provided diagnostic support.	
10.1.1	All Servers and Terminals to be provided at OCC shall be of same type and make as approved by the Engineer.	**M/s. Kyosan:** Regarding server every manufacturer having their own type and make based on the utilization factor of the software hence uniformity cannot be maintained.	This clause is for same type of server & terminal at a particular OCC. Para may be modified as under: "All Servers and Terminals to be provided at a OCC shall be of same type and make as approved by the Engineer."
10.1.2	All Terminals to be provided at wayside locations shall be of same type and make as approved by the Engineer. The hardware installed at wayside locations shall be modular and rugged and of appropriate size, capability and capacity.	**M/s. Kyosan:** Regarding Terminal if RDSO recommended an uniform type and make that can be complied. However RDSO may rethink as it is almost impossible to maintain type and make for any CTC OEM due to regular up gradation in technology.	No change in para.
10.1.3	All Servers and Terminals at OCC & wayside locations shall be provided with printer slot and minimum 2 spare slots for future use.	**M/s. Kyosan:** For Server basically there is no printer slot is available nowadays. Current printers are based on network printing	No change in para.

		technology. The Printers are connected to the CTC LAN and accessible to all the terminals. Please elaborate the utility of 2 spare slots	
10.1.5	LED Indications and test points shall be available on various cards Modules for easy fault diagnostics by the maintenance personnel.	**M/s. Kyosan:** Equipments are COTS product available with basic indications.	No change in para needed.
10.1.7	The TMS shall support communication with neighboring TMS based on UIC 407-1 or similar standards.	**M/s. HBL:** Fields required for exchange of data between neighboring TMS shall be defined.	May be decided at design stage
10.2.7	It shall be connected via data channels with the entire station signal interlocking through a suitable interface. The OFC data channels for connectivity will be used.	**M/s. HBL:** It shall be connected via data channels with the entire station signal interlocking through a suitable interface. The available OFC data channels with Railways will be used for this connectivity.	Para is Ok
10.2.13	Central server equipment shall be redundant fault tolerant server. The FT Server eliminates single points of failure using replicated components that continue uninterrupted processing even in the event of a component malfunction. Hardware faults are handled automatically by the system, without the delay of a failover (as on a cluster) and without loss of data.	**M/s. HBL:** Central server equipment shall be redundant server. The dual active hot stand by Server eliminates single points of failure using replicated components that continue uninterrupted processing even in the event of a component malfunction. Hardware faults are handled automatically by the system, without the delay of a failover and without loss of data.	Para is ok

10.2.14	The proposed configuration of central server shall be discussed and got approved by engineer in charge of Railway. Typical configuration of central server for reference is given as under as under:		
	(i) Type: Redundant Fault Tolerant Server.	**M/s. HBL:** Type: Redundant Server	
	(xii) Supporting operating system - Red Hat Enterprise Linux 7.6.	**M/s. HBL:** Supporting operating system - Windows Server OS / Red Hat Enterprise Linux 7.6	Para may be modified to include windows OS as under "Supporting operating system - Windows Server OS / Red Hat Enterprise Linux 7.6"
10.2.17	Following data should be logged on Servers to be archived for subsequent use:		
	v. The storage shall be for a minimum period of 30 days. It shall be possible to take Incremental back up on hard disc, additional hardware for this purpose may be provided.	**M/s. Kyosan:** However, specifying requirement of the storage shall be based on the number of event as it depends on the number of trains and operations per days which will vary section to section.	Para is OK
10.4.1	All TMS terminals shall have similar hardware configuration. Typical Hardware configuration is given as under:		
	ii) Processor: 64 Bit Multi core Multi Processor.	**M/s. Kyosan:** For terminals multi-processor is not applicable. **M/s. HBL:** Processor: 64 Bit Dual Core Dual Processor OR 64 Bit Quad Core Dual Processor	Para is generic and OK
	v) Monitor: LED Back lit color monitor, high resolution 1920 X1200, and 32"	**M/s. HBL:** Monitor: LED backlit color monitor,	Para is Ok, as per feedback from TMS at Tundla bigger terminal are

	(minimum).	high resolution 1920 x1200, and 24"	better suited for continuous working.
10.4.2	Table below shows the various operational posts for which the TMS terminals are provided and the number and sizes of monitors with the controllers. Operational Post Monitor Size (inches) No. of monitors per position Chief controller 32" 4 Dy. Chief controller 32" 4 Assistant controller 32" 4 Section controller(s) 32" 4 CTC Maintenance Terminal at OCC 32" 1 Signal Fault controller 32" 1 Track controller 32" 1 Traction Power 32" 1 Station Master at Station 32" 1 Crew controller 32" 1 Signal Maintainer at Station, IMD and IMSD 32" 1 Miscellaneous User CTC Terminals 32" 1 In the OCC separate workstations for offline timetable management shall be provided having the same configuration as those for TMS terminals.	**M/s. HBL:** Number of tables and monitor size to be decided based on users requirement, in each project.	

11.1	**Video Wall Display:**		
11.1.1	Laser based rear projection system type video wall may be used. It shall consist of Display modules and Display controller which will integrate various display modules into a single logical Display Wall.	**M/s. Siemens:** The OEM of video wall suppliers can provide accurate comparisons between all video wall technologies. However, as per experience from one of our expert & discussion with various video wall suppliers, the LED based rear projection system has advantages in terms of durability, cost & maintainability. **M/s. HBL:** LED based rear projection system type video wall may be used. It shall consist of Display modules and Display Controller which will integrate various display modules into a single logical Display Wall.	Laser rear projection system is better in terms of performance & life. It being widely used technology for video wall across the industry. No change needed in para.
11.1.2	Display resolution of video wall should be minimum 1920X1080 pixel	**M/s. Delta:** Display resolution of each cube of video wall should be minimum 3840x2160 pixel	Para may be mofied as "Display resolution of video wall should be minimum Full HD i.e.1920X1080 pixels. Preferably display resolution of 4K i.e. 3940x2160 pixels to be used for higher clarity and reducing video wall size or to accommodate more number of stations on same size of video wall."
11.1.7	The placement of Video Wall Display Panels, seating arrangement of the controller's, viewing angle in vertical and horizontal plane etc. inside OCC shall be carefully planned. To ensure a user-friendly environment, an ergonomic study shall be	**M/s. Delta:** "Design of Video Display wall shall be as per ISO 11064 Part 5." to be removed	It is standard provision, need not to be removed.

	performed to guarantee uniformity and consistency. Design of Video Display wall shall be as per ISO 11064 Part 5.		
11.1.14	It shall be possible to increase or decrease the color intensity, contrast adjusting etc. screen wise through the system console. It shall be possible to memorize the parameters of one screen and use the same parameters for all the other screens	**M/s. Delta:** " It shall be possible to memorize the parameters of one screen and use the same parameters for all the other screens" to be removed	Para may be made generic and may be modified as "It shall be possible to increase or decrease the color intensity, contrast adjusting etc. screen wise through the system console. It shall be possible to maintain same parameters for all the other screens."
11.1.19	Video Display wall shall be designed as per ISO 11064 Part 5 to include all functionalities required for the section	**M/s. Delta:** Video Display wall shall be designed with depth not more than 600 mm as per ISO 11064 Part 5 to include all functionalities required for the section	Already covered in para 11.1.7, this para will be deleted. No need to add depth of display.
11.1.22	Technical specification of video wall shall be got approved by Railway engineer (Minimum technical requirement of laser based rear projection system is given in annexure-II for ready reference).	**M/s. HBL:** LED based RVPD systems are stable in the market and in use for 24X7X365 operation. It is advised to amend Specifications accordingly.	Same remark as in para 11.1.1
11.2.4	The display controller shall have following minimum configuration:		
	(i) The Display controller shall be housed in an industrial 19" rack mounted casing (6U) based on Intel Quad core CPU 2.66 GHz.	**M/s. HBL:** The Display Controller shall be housed in an industrial 19" rack mounted casing (maximum 8U) based on Intel Quad Core CPU 2.66 GHz.	6U size of rack will be sufficient,

		M/s. Delta: The Display controller shall be housed in an industrial 19" rack mounted casing (4U) based on Intel Quad core CPU 3.0 GHz.	
	(vii) The Display controller shall be based on 64 bit operating system.	**M/s. Delta:** The Display controller shall be Window based on 64 bit operating system.	It is kept generic, no need to add "window based'.
11.3.8	The software shall support control of brightness, contrast, saturation, hue, filtering, and crop and rotate function on the various displays connected to the display controller.	**M/s. Delta:** The software shall support control of brightness, contrast function on the various displays connected to the display controller.	Para is Ok, It shall be possible to control all parameter.
11.3.8	The software shall support control of brightness, contrast, saturation, hue, filtering, and crop and rotate function on the various displays connected to the display controller.		
	(iii)can be exported to EXCEL/HTMI; and Show internal patterns.	**M/s. Delta:** can be exported to CSV and Show internal patterns.	Para may be modified to have option of CSV as under " can be exported to EXCEL/HTMI/CSV; and Show internal patterns.
12.2.1	CTC Terminals for Controllers · Chief Controller, Dy. Chief Controller, Traffic Controller(s) and Assistant Traffic Controller:		
	(i) These CTC terminals with each of the controller shall have three monitors, one will show the overview, another detailed view and the third one would show the alarm/event view. There shall be full flexibility, however with regard to display of information on any of the 3 monitors.	**M/s. HBL:** Contradiction with table in 10.4.2 for number of monitors 3 vs 4. This needs to be corrected.	Para may be modified as " These CTC terminals with each of the controller shall have 4 monitors, to show the overview, detailed view, alarm/event and graph etc. There shall be full flexibility with regard to display of information on any of the 4 monitors.

12.2.2	**CTC Terminal for Signal Fault Controller at OCC:**		
	(i) Remote monitoring of status of Signalling equipment at stations and in Block Sections, shall be provided on these terminals. This shall include logging in of events in central system, generating alarms, alerts etc.	**M/s. Kyosan:** The clause shall be rephrased as " Status of Signalling system and field gears at stations and in Block Sections, shall be provided on these terminals. This shall include logging in of events in central system, generating alarms, alerts etc limited to Annexure "	Para is Ok, In Annexure indicative list of alarm is given.
12.2.4	**CTC Maintenance Terminal at OCC:**		
	(xvii) Fault Diagnostics:	**M/s. HBL:** ISMs abbreviation to be added	Will be added
13.0	**Various Interface Requirements:**		
13.1	Interface between CTC and SCADA system:		
	(e) SCADA will pick up failure of AT supply details from CTC.	**M/s. Kyosan:** This clause to be deleted.	
13.2	**Interface with Master Clock System:**		
	The system clock shall be synchronized with Master clock provided in OCC under PS (Telecommunications). A suitable synchronization system in the event of failure of the Master clock shall also be provided.	**M/s. HBL:** Protocol to be defined for interfacing with Master Clock System	Para may be modified as " The system clock shall be synchronized with Master clock provided in OCC under PS (Telecommunications).Master clock will take time reference from the IRNSS (Indian Regional Navigation Satellite System). A suitable synchronization system in the event of failure of the Master Clock shall also be provided.

13.4	**Interface with other CTC:**		
	(d) Interface specification shall be prepared according to requirement of CTC of adjacent sections detailing the information required to be shared with CTC of adjacent sections. One CTC will share all the required information of his CTC, including the data formats, protocols, physical / logical connectivity and limitations related to the interface, with the other CTC to enable them design their interface .	**M/s. HBL:** Data interface specifications between two CTC systems should be defined very clearly to ensure 100% interoperability. Without this, execution of projects will suffer significant delays and uncertainties.	Can not be defined in specification and it will be decided at Zonal railway level.
13.5.2.4	As far as possible, indicators shall be driven through station TDS terminals in addition to driven by existing PC.	**M/s. Kyosan:** We understand that ASM terminals will be used as TDS terminals. The "TDS terminal" name to be replaced as "ASM Terminal". **WR:** 13.5.2.5 EAIM of all stations should be available at Maintenance Terminal in central control for ease of analysis and it should be logged. [To be added]	Para is Ok, At present there is one PC connected to indicator. TDS should also get connected to indicator for controlling it through TMS.
13.5.5.12	It shall be possible to send message from TDS controller to ASM terminal and station VDUs.	**M/s. Kyosan:** We understand that ASM terminals will be used as TDS terminals. ASM terminals will not be connected to Local Station VDU. However CTC server will connect with Local VDU through EI for control transfer mechanism from CTC to Local VDU	TDS will be in addition to VDU of EI.
13.5.5.13	The system shall keep log of all the messages received from the TDS during last	**M/s. Kyosan:** We recommended all logs will be kept	As suggested it is changed to 15days.

	7 days.	at server level for 30 days. Necessary view can be done in controller/ASM terminal level. However, specifying requirement of the logs shall be based on the number of event as it depends on the number of trains and operations per days which will vary section to section.	
13.6	Interface with ETCS L-2/IRATP (TCAS):	**M/s. Siemens:** We have standard multiple protocols with our CTC system suitable to various RBCs. Also, the protocol converter can be implemented if required. However, in future, the adaption of common EULYNX protocol can provide standard interface for CTC with RBCs / TCAS.	Suggestion added in subsequent sub para.
13.6.1	CTC system shall have interface to share information with RBC of ETCS L-2 and TSRMS of IRATP (TCAS) if provided in the section.	**M/s. Kyosan:** We understand " ETCS L-2/TCAS " are interfaced with EI at Station. Further ETCS L-2 having some advance commands at Centralized place .It needs to be interface with CTC server. For TCAS we are envisaging that server level OCC interface is not required.	For TSRMS (temporary speed restriction management system) of TCAS needs to be interfaced with TMS.
13.6.2	Provision of accessing location data of trains from RBC in case of ETCS & stationary TCAS equipment housed at stations in case of IRATP shall be made in CTC.	**M/s. Kyosan:** We understand " ETCS L-2/TCAS " are interfaced with EI at Station. Further ETCS L-2 having some advance commands at Centralized place .It needs to be interface with CTC server. For TCAS we are envisaging that server level OCC	Content is duplicate, deleted.

		interface is not required.	
13.6.3	The scheme/protocol mentioned in RDSO/SPN/196/2012 version 4.0 or latest shall be followed for interfacing TSRMS system with the CTC system. In case of interfacing with ETCS L-2 system, necessary protocol of ETCS shall be made available.	**M/s. Kyosan:** We understand " ETCS L-2/TCAS " are interfaced with EI at Station. Further ETCS L-2 having some advance commands at Centralized place .It needs to be interface with CTC server. For TCAS we are envisaging that server level OCC interface is not required. **M/s. HBL:** As mentioned against clause # 2.8 above, it is suggested that a comprehensive view of how the various ATP systems will interface and interact with CTC / TMS system be developed and requirements included in the specification, in order to avoid duplications, conflicts, uncertainties and impossibilities.	Para may be modified as "The scheme/protocol mentioned in RDSO/SPN/196/2012 version 4.0 or latest shall be followed for interfacing TCAS TSRMS system with the CTC system. In case of interfacing with RBC of ETCS L-2 system, EULYNX's TCS-RBC interface document shall be followed"
14.1.10	It shall be possible to interface and transfer the circuits on to the backup communication on redundant OFC, wherever available.	**M/s. HBL:** Communication media / channels are not defined other than OFC in the specification. It may be desirable to consider options like E1 or LTE, based on their planned availability in the near future.	Provision of 4G/LTE may be added for redundancy.
15.3	It shall be possible to send the emergency caution order in the form of SMS through his TDS/MTRC terminal.	**M/s. HBL:** Scheme / protocol and information to exchange between TDS and MTRC shall be defined.	MTRC interface is optional and interfacing scheme may be decided at local level.
17.1	The equipment shall be suitably protected against atmospheric voltage surges both for common mode (voltage that appears	**M/s. Kyosan:** RDSO may recommend suitable earthling scheme for CTC-TMS at OCC	Details of protection arrangement is mentioned in Annexure-4

	between phase conductors and earth) and differential mode (voltage that appears between neutral & earth) in order to limit the harmful effects of lightning.	level however for station existing earthling scheme may prevail.	
18.1.2	For inspection of material, relevant clauses of IRS: S 23 and RDSO/SPN/144 shall apply.	**M/s. Kyosan:** Complete CTC-TMS system hardwares are COTS products hence international standards can be specified. Therefore this clause may not be applicable.	COT item has to comply RDSO/SPN/144.
		M/s. HBL: IRS: S 23 and RDSO/SPN/144 are not relevant and hence should be removed, as majority of items are Off the-shelf IT and communication products.	
18.2	**SAFETY PLAN:**		
18.2.1	Safety plan shall be prepared and submitted which shall include system description, safety Integrity level and safety case.	**M/s. Kyosan:** Not Applicable for IT Equipment (Server / Work station / terminals / Switches)	
18.2.2	Manufacturer shall check and verify that the system being offered meets the requirements of safety integrity laid down by railways.		
18.2.3	Routine test (which must be carried out on each equipment by the manufacturer) and acceptance test(which are to be carried out on each equipment in the firm's premises before delivery) formats with test procedures and its significance	**M/s. HBL:** Site Acceptance Test to be added for functionality tests as simulation tests can not cover the complete scope. OEM premises tests can be conducted for compliance to specs for each equipment.	No change in para needed.
18.3	**TEST PROCEDURE:**		

	The test procedure shall be based on the system design. The methodologies to be adopted for various tests shall be decided taking into account the system design/ configuration.	**M/s. Kyosan:** Not Applicable for IT Equipment (Server / Work station / terminals / Switches)	
18.4.2	**Card Level Checking:**	**M/s. Kyosan:** NA	
19.1	All markings/ indications shall be easily legible and durable. Where the marking is by use of labels, the labels shall be metallic and shall be firmly fixed and shall not be capable of being removed by hand. Durability of marking shall be checked by rubbing the marking by hand with a piece of cloth soaked with petroleum spirit. This requirement shall also be met after completion of climatic test.	**M/s. Kyosan:** NA	
19.2	All markings/ indications shall be placed in the vicinity of the components to which these refer and shall not be placed on removable parts, if these parts can be replaced in such a way that the marking/ indications can become misleading.	**M/s. Kyosan:** NA	
19.3	The words 'Indian Railway Property' shall be etched, engraved or embossed on the equipment at a conspicuous position. For it, the size of the letters shall be chosen depending upon the equipment but shall not be less than 20mm high in any case.	**M/s. Kyosan:** Stickering can be done after installation	
19.4	The anodized name plate shall be firmly attached to the equipment and shall show the following information:	**M/s. Kyosan:** NA	
20.0	DOCUMENTATION		
	c. Mechanical drawings of each sub-	**M/s. Kyosan:**	

	system/ rack.	Not Applicable for Sub system	
	e. Schematic block diagram showing mounting arrangement of various components & details of each type of assembled PCB.	**M/s. Kyosan:** NA	
	f. Trouble shooting procedures along with test voltages and waveforms at various test points in the PCBs.	**M/s. Kyosan:** NA	
	g. Details of software viz. Source code, algorithm, flow chart, machine code along with test/ validation procedure used and the results thereof.	**M/s. Kyosan:** NA **M/s. Alstom:** The core software used might be common over multiple projects/solutions and source code, algorithm etc. are not useful to the user. We recommend to limit this to application level software and test documents only	
	h. Details of Hardware e.g. schematic diagrams of the system circuits/ components, details for each type of assembled PCB and part-list.	**M/s. Kyosan:** NA	
21.0	**PACKING:**		
21.1	The equipment and its sub assemblies shall be wrapped in bubble sheet and then packed in thermocole boxes and the empty spaces shall be filled with suitable filling material. All PCBs shall be enclosed in anti-static shield cover. the equipment shall be finally packed in a wooden case of sufficient strength so that it can withstand bumps and jerks encountered in a road/ rail journey.	**M/s. Kyosan:** NA	

21.2	Each box shall be marked with code numbers, contents and name of manufacturer. The upside shall be indicated with an arrow. Boxes should have standard signages to indicate the correct position and precaution "Handle with Care" with necessary instructions.	**M/s. Kyosan:** NA	
21.3	Printed circuit boards shall be separately and individually packed to prevent damage.	**M/s. Kyosan:** NA	
22	**INFORMATION TO BE PROVIDED BY THE PURCHASER:**	**M/s. Kyosan:** In addition the following needs to be provided.	
		M/s. Alstom: We request to include Type of communication system /leased lines in case BCC/NCC are located in zonal railway HQ/Corporate office	
	i.Signaling details of stations in section.	**M/s. Kyosan:** Details of LC , ALH or IBH to be provided	Para may be modified as " Signaling details of stations, LC gate, IBH etc in section."
	ii. lf interface with ETCS/TCAS is needed.	**M/s. Kyosan:** Details of interlocking (PI/RRI/EI) to be provided	Is covered in para above, no change in this para.
	iii. Details of location where CTC terminal shall be required.	**M/s. Kyosan:** Details of existing system like PIDS/PAS/CA system etc,	Sub Para added as v
	iv. Location of OCC, BCC & NCC.	**M/s. Kyosan:** Details of source power supply, CRIS Interface information, adjacent CTC-TMS information	
	v. Details of PID/ PA system, CMS to be interfaced		

Annexure –II (minimum technical requirement of video wall) made generic and functional. Zonal Railway may prepare and approve Tech specification at the time tendering as per latest configuration of Laser based video wall.