General Bid Bulletin No. 24
09 September 2021

IFB No. 21-031-4

THE MALOLOS-CLARK RAILWAY PROJECT AND THE NORTH SOUTH RAILWAY PROJECT-SOUTH LINE (COMMUTER) PACKAGE CP NS-03: ROLLING STOCK-LIMITED EXPRESS TRAINSETS

This General Bid Bulletin is issued to amend/clarify certain provisions in the Bidding Documents for the abovementioned project. Please refer to the attached Annex of this General Bid Bulletin duly approved by the end-user and co-implementer.

1. **Annex "A"** –Answers to Queries from Prospective Bidders including clarifications to the Bidding Documents;

2. **Annex "B"**– Revisions to the Bidding Documents; and

3. **Annex "B – 1"** – Revised pages/amendments and final form as revised/amended.

All other portions of the Bidding Documents affected by these revisions, amendments and/or clarifications shall be made to conform to the same.

Revisions/amendments/clarifications made herein shall be considered an integral part ofthe Bidding Documents for this project.

For your information and guidance.

For the Bids and Awards Committee IV:

SIGNATURE REDACTED

PAUL JASPER V. DE GUZMAN
Vice-Chairperson

Annex A

PACKAGE CP NS-03: ROLLING STOCK - LIMITED EXPRESS TRAINSETS
General Bid Bulletin No. 24
Annex A

Item No.	Volume Section No. Page No. Clause No. / Title Reference Text	Clarification Request	Proposed Revised Text (if any)	Response
1.	Volume I of III, INVITAION FOR BIDS, SECTION II. BID DATA SHEET IFB-2 7 SECTION II. BID DATA SHEET BDS-10 ITB 27.1 General Bid Bulletin No.20 Annex A IFB-2 7	Bid must be delivered to the address above on or before 10:00 AM on 19 August 2021 and… The opening of the… Date: 19 August 2021 Time: 10:00 AM In accordance with General Bid Bulletin No.20 dated 28 July 2021, the Bidder noted that the due date of the submittal of the bid proposals has been extended from 29 July 2021 to 19 August 2021. However, as per the Bidder's request through the previous clarification, the extended due date is still not sufficient for the Bidder to review the Bidding Documents and conduct series of meetings and discussions with its potential suppliers. Additionally, responding to the Employer's reply for the clarifications provided via GBB No. 1 through 19, in particular, regarding the air-conditioning unit and the definition of Rolling Stock Gauge, the Bidder needs further reviews	Bid must be delivered to the address above on or before 10:00 AM on 15 October~~19 August~~ 2021 and… The opening of the… Date: 15 October~~19 August~~ 2021 Time: 10:00 AM	Please refer to further GBB 23 relating to IT 24.1-The deadline for Bid submission.

		and discussions with its potential suppliers to offer the best proposal to the Employer. Especially, the change of the Key Dates has considerable impact on the Bidder's prospective project schedule and costing and so, we need to carefully review these changes and evaluate our schedule and Price Proposal in cooperation with potential suppliers. In addition, it is understood that we are required to be quarantined for two (2) weeks after our arrival at Philippines due to COVID-19 and so, we must consider additional time to deliver the proposal from the outside of Philippines. As such, to assure sufficient time for proposal preparation is available, we respectfully request more extension of two (2) months for submittal of the bid proposals.		
2.	Volume II of III, SECTION VI General Bid Bulletin No.11 8.1.7 Air diffusers	The Bidder noted the Employer's response in General Bid Bulletin No.11 item No. 38 dated 9 June 2021. Although the response of above GBB describes "please refer to Annex B", we are not able to find the related contents in Annex B. Accordingly, please provide the related Annex B in next GBB.	N/A	Please see Annex B for the updated diffuser requirement.
3.	General Bid Bulletin No.16 Page 11 of 43 No.9	The Bidder noted the Employer's response in General Bid Bulletin No.16 dated 2 July 2021. Although the response of above GBB describes "please see Annex B on the updated clause 22.7.4.1", we are not able to find the related contents in Annex B.	N/A	Please see Annex B for the updated fleet defects requirements.

		Accordingly, please provide the related Annex B in next GBB.		
4.	General Bid Bulletin No.16 Page 11 of 43 No. 8	Responding to the Employer's reply in General Bid Bulletin No.16 dated 2 July 2021, the Bidder would like DOTr to further clarify if the delivery, testing, commissioning and warranty activities for the LE Trains will be conducted either Mabalacat Depot or Banlic Depot, or both Mabalacat Depot and Banlic Depot. Please be advised that, in the latter case, multiple delivery, testing, commissioning and warranty teams as well as associated facilities and/or tools are required, which brings significant additional costs. Therefore, the Bidder respectfully requests DOTr to specify one designated depot for the delivery, testing, commissioning and warranty activities.	N/A	For the delivery, testing and commissioning of LE trains, the bidder shall make the provision for Mabalacat Depot. As for warranty activities, since LE train will be as well stable and launch from the South, the requirement for warranty activities shall cover both depots i.e. Mabalacat and Banlic.
5.	General Bid Bulletin No.16 Page 13 of 43 No.13	The Bidder noted the Employer's response in General Bid Bulletin No.16 dated 2 July 2021, however, there is a discrepancy in the beginning date of the total DNP period. The Bidder believes that the total DNP period shall be up to four (4) years from the taking-over date for the first trainset, not from the date of commencement of the first train in-service operation. Please confirm the Bidder's understanding is correct.	N/A	Bidder understanding is correct.
6.	Volume II of III, SECTION VI ERT-34 ERT-134 2.8.1.6 21.2.9 Under-frame mounted equipment	The Bidder received the Employer's replies as per the General Bid Bulletin No.10 dated 25 May 2021 and the General Bid Bulletin No.11 dated 9 June 2021. Since "Hard Lock Nut" is service-proven in Japan	N/A	Please see annex B for the updated clause 21.2.9.

	General Bid Bulletin No.10 General Bid Bulletin No.11	and is adopted for other JICA projects, the Bidder requests the Employer to allow the Contractor to exempt ERT 21.2.9 on the precondition so that the Contractor can propose the adequate experienced design during the design stage.		
7.	General Bid Bulletin No.15 PC-8 Attachment 1 Summary of Key Dates ERG-49 8.6 Performance Reports 8.6.2	*KD5 Achievement: Completion of training and delivery of Operation and Maintenance Manual (55 months)* *The Rolling Stock TOC Performance report shall be issued for each trainset prior to operational acceptance and shall provide:* *11) Completion of Training program,* In accordance with General Bid Bulletin No.15 dated 25 June 2021, the Bidder noted that the Key Dates has been changed. However, it is impossible for the Bidder to complete the heavy maintenance training and to deliver the heavy maintenance manual within 55 months since we assume that the sufficient trainsets and the depot equipment which is necessary for the heavy maintenance training will not be available during such time period. Therefore, the Bidder requests the Employer to amend KD5 as provided. In addition, as per the aforementioned reason, the Bidder also requests the Employer to remove the completion of heavy maintenance training from the condition of TOC.	KD5 Achievement: Completion of training (excluding the heavy maintenance training) and delivery of Operation and Maintenance Manual (excluding the heavy maintenance manual) (55 months) The Rolling Stock TOC Performance report shall be issued for each trainset prior to operational acceptance and shall provide: 11) Completion of Training program (excluding the heavy maintenance training),	Requirement will not be changed. However, the heavy maintenance training delivery program may be discussed during design stage considering O&M CA benefit and which train will be used for heavy maintenance training.

8.	Volume II of III, SECTION VI ERT-153 25.7.1 Trainee Population	*25.7.1* *The number of staff to be trained shall not be less than as follows:* *1) Operation Staff – 12* *2) Maintenance Staff* *a) Supervisors – 8* *b) Mechanical Technicians – 10* *c) Electrical Technicians – 10* *d) Electronic Technicians – 10* *3) Engineering Staff – 4* The number of staff to be trained is excessive compared with the other experienced projects and the Bidder assumes that the number of staff is generally approx. 10 persons in total. The Bidder believes that the staff to be trained shall be the trainer for other staff and it is desired for the Employer to grow the trained trainer. The Bidder would like to evaluate and propose appropriate numbers of the staff to be trained as a part of the training plan to be submitted during the Contract execution stage, so that the Contractor can focus on the trainer and take the trainer's learning to a higher level. Thus, the Bidder requests the Employer to eliminate the numbers of the staff given in the current specification and revise the requirement as provided.	The number of staff to be trained shall not be <u>evaluated and proposed by the Contractor as a part of their training plan to be submitted during the Contract</u> less than as follows: 1) Operation Staff – 12 2) Maintenance Staff a) Supervisors – 8 b) Mechanical Technicians – 10 c) Electrical Technicians – 10 d) Electronic Technicians – 10 3) Engineering Staff – 4	The requirement will not be changed. This is going to be presented and discussed during the project implementation.
9.	General Bid Bulletin No.18 PC-8 Attachment 1 Summary of Key Dates	*KD6: Achievement:Issuance of taking over certificate on all 7 trainsets (57 months).* *KD8: Achievement: Completion of Trial Operation support and the whole of the Works (58 months)*	N/A	Please refer to ERG 10.2.4.2 (7); ERG 12.2.4(5); ERG 14.1.4, 14.1.5 and ERT 20.6.

		The Bidder noted the updated Key Dates in General Bid Bulletin No.18 dated 23 July 2021. Although the difference between KD6 and KD8 is only 1 month, the Bidder would like to clarify what the Contractor shall do for the completion of the whole of the Works. Thus, the Bidder requests the Employer to clarify the process for the completion of the whole of the Works.		To summarize, the completion of the whole of the Works is the successful completion of Trial Running during the Trial Operation phase of the project.
10.	General Bid Bulletin No.15 PC-8 Attachment 1 Summary of Key Dates Attachment 2 Time for Access to the Site	The Bidder noted the updated Key Dates and Access Dates in General Bid Bulletin No.15 dated 25 June 2021. The Bidder requests the Employer to provide the whole schedule to cover the entire projects of the Malolos-Clark Railway Project and the North South Railway Project-South Line including Depot and E&M related to this CP NS-03 so that the Bidder can evaluate the entire project schedule and establish their schedule appropriately.	N/A	The Employer will not be providing the requested schedule.
11.	Volume II Section VI General Bid Bulletin No.13 ERT-29 1.21.2 1.21.3 1.21.4 1.21.5 1.21.8	The Bidder understands that the vehicle and structural gauges shown in Appendix C of the ERT are defined in accordance with Chapter 8, Section 1, Article 64 of the Japanese Ministerial Ordinance, MLIT. And the definition of Rolling Stock Gauge in the above MLIT is as follows. Chapter 8, Section 1, Article 64 (Rolling stock gauge) (Basic Items)	N/A	Bidder understanding is correct. Referenced clauses by bidder were amended in GBB 18.

	Definition of Gauges	1. The railway operator shall establish the rolling stock gauge; the rolling stock shall not exceed the rolling stock gauge. <Omitted below > 2. The "rolling stock shall not exceed the rolling stock gauge" in 1 means the rolling stock shall not exceed the rolling stock gauge in the following conditions: (1) On a flat and straight track, the rolling stock (including the case with the worn wheels, etc.), is in the hold state with the center line of the carbody and bogie coincident with the center line of the track; (2) The loaded condition is between the empty condition and the maximum loaded condition; (3) The carbody and bogies are not tilting due to passengers or loaded cargo. Also, Construction Gauge is defined in Chapter 3, Section 3, Article 20 of the Japanese Ministerial Ordinance, MLIT is as follows. Construction gauge at a tangent line shall be set to provide an adequate distance from the car clearance not to impair train operations and the safety of passengers and crew, taking the vibration caused be car operation in consideration. <Omitted below > Based on the above definition in MLIT, the Bidder understands that the proposed rolling stock shall not exceed rolling stock gauge under the static condition and shall not exceed Construction gauge under the dynamic condition including abnormal condition in accordance with ERT Clause 3.2.1.2. The Bidder requests the Employer to confirm that the foregoing understanding is correct and also		

		requests the Employer to amend the referenced clauses accordingly.		
12.	Volume II of III, SECTION VI Employer's Requirements ERG-73 12.2.4 Inspection, Testing and Commissioning Plan ERG-76 14.1.4 Training Requirement ERT-130 20.6.2 Trial Operations	*5) Trial Operations: The Contractor shall undertake Trial Operations which shall take place at the completion of the testing and commissioning process. The Trial Operations shall be supported by the Engineer and other interested parties. It consists of operating the newly procured Rolling Stock, consideration simulating requirements of operating the trains for revenue service, but without active passengers.* *The Contractor shall recognize the dates for Trial Operations and shall ensure that all appropriate personnel have received adequate training to equip them for all of the tasks required during Trial Operations before the commencement of the Trial Operations.* *The Contractor shall support the Employer during the Trial Operations which shall take place at the completion of the Testing and Commissioning.* The Bidder assumes that the Trial Operation is conducted by the Employer to demonstrate revenue service with the trains in cooperation with interested parties including CP NS-03 Contractor after hanging over seven (7) trainsets. Please clarify the following items so that the Bidder can estimate associated costs adequately:	N/A	

		1) Detailed activities and required duration of each activity which the Contractor shall support during the Trial Operation. 2) The number of trainset. 3) The period of the Trial Operation.		1) Please refer to ERT clause 20.6. Please refer to Annex B. Clause 20.6.9 & 20.6.10 were deleted. Duration for trial operation is provided at -no. 3. 2) 3 Trainsets is required for trail operation which is from Buendia-CIA. 3) 3 months
13.	General Bid Bulletin No.16 ERT-152 24.2.1.1 Testing and Commissioning Spare Parts	*Testing and Commissioning Spare Parts:* *1) In addition to the O&M Spares, the Contractor shall keep on the Site throughout the installation, erection, and commissioning periods, sufficient stocks of Spare Parts to enable immediate replacement of any item in the Works found to be defective or in any way in non-conformance with the Specification prior to the issuance of TOC. ("Testing and Commissioning Spares");* *2) The Contractor shall use his best endeavour to supply and deliver the Testing and Commissioning Spares on or before the commencement of the on-site testing and commissioning;* *3) The Contractor shall submit to the Employer's for review a list of all Testing and Commissioning* In accordance with General Bid Bulletin No.16 dated 2 July 2021, the Bidder noted to add the new conditions of Testing and Commissioning Spare Parts.	N/A	Bidder understanding is correct.

		The Bidder understands that the Contractor are not required to replenish the Testing and Commissioning Spare Parts after the completion of on-site Testing Commissioning. Please confirm the Bidder's understanding is correct.		
14.	General Bid Bulletin No.16 ERT-152 24.2.1.2 O&M Spare Parts	*7) At the end of the Defects Notification Period, the stock of O&M spares shall be replenished and handed to the Employer to cover a further period of two (2) years of operation and maintenance beyond the DNP.* In accordance with General Bid Bulletin No.16 dated 2 July 2021, the Bidder noted that the new conditions of O&M Spare Parts are added. Although the Contractor is required to replenish the O&M Spare Parts at the end of the Defects Notification Period, the Bidder assumes that O&M after TOC is the Employer's responsibility, and it is impossible to predict the prospective items and q'ty required to replenish because the O&M is out of the Contractor's responsibility. Therefore, please amend the sentence as provide.	7) At the end of the Defects Notification Period, the stock of O&M spares shall be ~~replenished and~~ handed to the Employer ~~to cover a further period of two (2) years of operation and maintenance beyond the DNP.~~	Bidder request is rejected. The development of spare part list shall be in accordance with ERG 11.5. Based on the FMECA and proven service experience etc., the Contactor should have be able to calculate the spare part volume and the quantity in order to comply with the Employer requirements.
15.	Volume II Section VI ERT-17 Table 1 Basic Rolling Stock Maintenance Categories	*Table 1 Heavy Maintenance* *Semi overhaul: Within 4 years or Within 600,000 km* *Overhaul: Within 8 years or Within 1,200,000 km* *For purposes of defining the maintenance requirement of each consist, the yearly-accumulated*	N/A	Bidder understanding is not correct. Please refer to GBB No. 16 Annex B Item 3 - O&M Spare Parts shall comprise of the Operational Spares, Preventive Maintenance, Corrective Maintenance & Overhaul Spares;

	ERT-18 1.14.7	*kilometer run shall be about 280,000 km.* Depending on the project schedule and/or the extension of DNP period up to four (4) years from the taking-over date for the first trainset, there is the possibility to come the timing of implementation of Semi overhaul and Overhaul during DNP period. Even if the timing of implementation of Semi overhaul and Overhaul comes during DNP period, the Bidder understands that the Semi overhaul and Overhaul works including the arrangement of Overhaul Spares is the O&M Concessionaire or the Employer's responsibility. In other words, it is understood that any parts necessary for the Semi-Overhaul and Overhaul works shouldn't be included in the O&M Spare Parts to be supplied by the Contractor under this Contract. Please confirm the Bidder's understanding is correct.		
16.	Volume II Section VI ERT-4 1.2.12.2 Submission of meeting materials	As with CP NS-02:Rolling Stock–Commuter Trainsets, the Bidder requests the Employers to consider revising the submission date of meeting materials as provided.	If the meeting is to review or present design information or other material, such material shall be forwarded to the Engineer not less than 15 ~~working~~ calendar days prior to the meeting.	Please see Annex B.
17.	Volume II Section VI ERT-4 1.2.12.5	As with CP NS-02:Rolling Stock–Commuter Trainsets, the Bidder requests the Employers to consider revising the submission date of minutes of the meeting as provided.	The Contractor shall, within 15 ~~3 working~~ calendar days after the date of the meeting,	Please see Annex B.

	Minutes of the meeting		submit minutes of each such meeting to the Engineer, detailing all issues raised during the review, their resolutions or ongoing design status and due date for resolution.	
18.	Volume II Section VI ERT-20 1.16.5.2	In GBB 16 No. 23, although the description has been modified for "plated stud types or stainless steel studs with plated studs", the Bidder understands that both plated stud types and stainless steel stud types are allowed. In addition, the Bidder humbly requests the Employer to allow WAGO type terminal block to be applied, which is sufficiently service proven products, and widely applied in numerous railway projects for the purpose of improved maintainability and compactification of the space.	Terminal blocks including WAGO type, where used, shall be of a high quality, plated stud type or stainless stud type ~~with plated stud~~, wherever possible, with proper creepage and clearance provisions for the voltage used. Terminal blocks including WAGO type shall each be given a unique identification number, and each "point" on the block shall be numbered.	Bidder request to include a specified OEM name is rejected. The requirement has covered the stainless stud with plated stud.
19.	Volume II Section VI ERT-21 1.16.7.2 1.16.9.5 Current ratings of wires and cables	The Bidder notes the Employer's response in GBB No. 16 item 25, however, the Bidder notes that in considering all de-rating factors to define wire and cable current ratings, if the temperature condition is applied at an expected temperature of 45 °C instead of a maximum ambient temperature of 40 °C specified in the ERT clause 1.9.1 (GBB No.6), it will cause excessive current ratings of wire and cable and unnecessarily increase their size and weight.	ERT 1.16.7.2 All connectors shall have sufficient current ratings, with applied de-rating factors for expected operating temperatures of not less than 40 ~~45~~ ℃. ERT 1.16.9.5	Bidder request for amendment is rejected.

		Accordingly, the Bidder requests the Employer to amend the expected operating temperature to 40℃ which is the same condition as for CP NS-02:Rolling Stock–Commuter Trainsets.	All wires and cables shall have sufficient current ratings, with applied de-rating factors for expected operating temperature of not less than 40 ~~45~~ ℃.	
20.	Volume II Section VI ERT-21 1.16.9.4 Wire and Cable Installation ERT-135 21.4.8 Voltage Segregation	*The Contractor's attention is drawn to the requirements of Sub-Clause 21.4.8 regarding voltage segregation.* *Voltage Segregation* *Wires shall be segregated according to JIS or IEC standards.* Regarding the separation of electric wires and cables in rolling stock, not JIS but JRIS (Japan Association of Rolling Stock Industries Standards), which specifically stipulates the details of the wiring process, is used for rolling stock in Japan. Accordingly, the Bidder humbly requests to amend the sentence as proposed revised text.	ERT 21.4.8 Voltage Segregation Wires shall be segregated according to JRIS ~~JIS~~ or IEC standards.	Please see Annex B.
21.	Volume II Section VI ERT-35 2.8.2.4 Strength of the steps	To allow staff or passengers to safely exit from the vehicle, the Bidder will ergonomically design the steps and verify that there is no permanent deformation under the specified loading condition. Accordingly, the Bidder opines that the limitation of the maximum deflection is not necessary, and therefore requests the Employer to make the amendment as well as Commuter train for MCRP, NSCR and NSRP-S as proposed.	The stiffness and strength of the steps and their connections shall be designed and tested to allow use by a person exerting a force of 1.3 kN (load applied at a 45 degree angle), without permanent deformation~~, and with the maximum~~	Please see Annex B.

			~~deflection limited to 1 mm~~.	
22.	Volume II Section VI ERT-43 4.1.8 Cable hoses	The Bidder assumes that the cable hoses mean the hose and/or flexible conduit that put small wires or cables for inter-vehicle jumper cables for protection purpose. If the foregoing understanding is correct, PMA flexible conduits, which are more resistant for weather and abrasion, and sufficient service-proven design around the world for similar mass transit projects, are widely applied. Accordingly, the Bidder requests the Employer to make the amendment as proposed.	Cable hoses or flexible conduits shall be made out of high quality, weather and abrasion resistant insulated rubber or other materials, subject to approved by the Engineer.	Please see Annex B.
23.	Volume II Section VI ERT-47 5.7.3 5.7.6 Passenger Seat	The moquette fabric, which is a woven fabric, is a flexible, non-rigid surface that constantly displaces to give durability benefits. Therefore, it is practically not feasible to expect water-repellency and/or waterproof for the passenger seats. In addition, it is not feasible to eliminate the gap perfectly for the seats with reclining function. Accordingly, the Bidder requests the Employer to make the following amendment, so as to allow the seat materials as soft type with moquette, breathability and durability, which is commonly used for similar express trains in Japan.	ERT 5.7.3: The seats shall be ergonomically designed and the materials to be used in the seat design shall be soft type with moquette, ~~water-repellent~~, breathability, durability, fire and vandal resistant. Fire performance testing shall be undertaken by the Contractor with review by the Engineer. The seat design shall eliminate gaps as possible to allow easy cleaning. ~~that shall trap dirt or liquids and can be easily maintained.~~	Please see Annex B for updated requirement on clause 5.7.3 and 5.7.6.

			ERT 5.7.5: The seat design shall be ergonomically designed for passenger comfort, aesthetically pleasing, and eliminated gaps as possible to allow easy cleaning. ~~that will trap dirt or liquids.~~	
24.	Volume II Section VI ERT-49 5.10.3 Power supply outlet for vending machine	The Bidder understands that the adequate luggage racks for larger/heavier luggages shall be located at each end of the car within the passenger compartment rather than vestibule area as per ERT Clause 5.10.1 and GBB No.5 item 16. The Bidder also understands that providing adequate luggage space/capacity is important for the limited express trains used for airport access in this project. Accordingly, in order to install the vending machine without reducing the luggage racks for larger/heavier luggages placed in the passenger compartment in the future, the Bidder proposes to provide the power supply (AC220V, 1-phase, 60 Hz) outlet for the vending machine at the vestibule area along with the vending machine installation space instead of the luggage space. Therefore, the Bidder requests the Employer to amend the requirement as proposed.	The power supply (AC220V, 1-phase, 60 Hz) outlet shall be installed ~~at the baggage spaces~~ in the car for future provision of vending machines. The location shall be submitted to Engineer for review and given statement of No Objection. Four (4) vending machine spaces shall be provided per train, one spaces in each leading car, two spaces in the middle cars.	Please see Annex B.
25.	Volume II Section VI ERT-50 5.12.1 5.12.2 Drivers Cab Windshield	The cab front windshield will comply with JIS R 3213 in accordance with ERT 5.12.1. Also, since JIS R 3213 includes requirements for impact resistance, the Bidder is of the opinion that the strength requirements specified in ERT 5.12.2 are covered by complying with JIS R 3213 instead of	N/A	Bidder understanding is correct.

		UIC 651. Please confirm that the foregoing understanding is correct.		
26.	Volume II Section VI ERT-58 6.5.5 Head light	The Bidder is of the opinion that it is important to arrange the headlight so that it is easily accessible in consideration of maintainability. Accordingly, the Bidder requests the Employer to amend the requirement as proposed.	Headlight (LED) shall be able to be accessed either from outside or inside of the driver cab. The optical axis of head lamps shall capable of being easily adjusted.	Please see Annex B.
27.	Volume II Section VI ERT-59 6.5.10 Door indicator light	The Bidder notes the Employer's response in item #31 of GBB No. 16, however, we still believe that the required function of indication light in ERT 6.5.10 is the same as that of ERT 6.5.8 as follows. ERT 6.5.8: install on above each door - illuminated when the doors open while not lit up when the doors are closed. - blinking during opening and closing cycle of the door. - illuminated when the door is fault and/or isolated ERT 6.5.10: install on both side of car - illuminated when all doors which is installed on same side with indicating light are not closed ERT 6.5.11: install on both side of car - illuminated when emergency call is activated in the car ERT 7.3.19: install on both side of car - illuminated when one of the door which is installed on same side with indicating light are isolated Based on the above, the Bidder understands that the response in item no. 31 of GBB no.16 does not	N/A	Bidder request is rejected. Employer maintened the reponse in GBB No. 16. 6.5.8 is the requirement for each doors whilst 6.5.10 and 6.5.11 are the requirements for car side indication lights. 7.3.19 is the requirement on car side indicator lights. 6.5.8 is meant for passenger visual aid on door operation and status, whilst 6.5.10 and 6.5.11 are meant for the O&M personnel doors system status.

		match with the requirement, and still believes that the function of indicating light required in ERT 6.5.10, and also ERT 6.5.11 are duplicated with that of ERT 6.5.8. Therefore, we respectfully request the Employer to delete the requirement of ERT 6.5.10/6.5.11 or organize the function of them.		
28.	Volume II Section VI ERT-60 7.1.2 Side door	*ERT 7.1.2* *Two (2) electrically operated doors shall be provided on each side of every car.* With the acceptance in GBB 16 to apply single leaf pocket sliding doors, the Bidder respectfully requests the Employer that the use of pneumatic sliding pocket doors with air sealing actuator that applies pressure on the door from the interior side for airtight purpose, which is widely used in Japanese limited express trains including high speed trains such as Shinkansen (Bullet trains), is also applicable. Accordingly, the Bidder requests the Employer to amend the requirement as proposed.	ERT 7.1.2 Two (2) electrically or pneumatically operated doors shall be provided on each side of every car.	Please see Annex B.
29.	Volume II Section VI ERT-60 7.1.7 Crush loading	ERT 5.11.3 and 7.1.7 stipulate that the window and door shall be withstand under the crush loading condition. However, since the definition of crush loading condition is inconsistency as below, the Bidder requests the Employer to clarify it and amend the related clause accordingly. -ERT 9.6.14: Crush Loading conditions (W3) ERT 11.1.6: Crush loading condition W2	N/A	Please see Annex B.

30.	Volume II Section VI ERT-63 7.3.11 Door push back function	The Bidder opines that, in view of the industry practice widely applied around the world for similar mass transit projects, unlike commuter trains, where many passengers get on and off during short station stop time, generally pushback function is not prepared for limited express trains. Also, it is not practical to apply pushback functionality to both electrical or pneumatic plug-in sliding doors and the pneumatic sliding pocket door that applies pressure from inside the door. Accordingly, the Bidder requests the Employer to accept waiver the requirement of pushback function, if plug door will be applied	N/A	Bidder request is rejected.
31.	Volume II Section VI 7.3.21.1 Emergency handle	The Bidder considers that, in view of the industry practice widely adopted around the world for similar mass transit projects, in consideration of safety aspects, two doors on either one of the side, rather than both sides will be used for emergency evacuation. In general, each door will be able to manually open by using an emergency door opening handle, which mechanically links to the unlocking device via a Bowden cable, adjacent to each door in the event of an emergency. The Bidder considers that in the event of emergency, passenger should operate an emergency door opening handle adjacent to each door to evacuate from that door, and that unexpected opening of all doors, there is a risk for safety aspects such as passenger falling. Also, it is not practical to open manually all of the four doors in the car by one emergency door opening handle. Although it may possible to open all of the four doors in the car by one cock handle if pneumatic type door will be applied for this	Adjacent to each doorway in the car ~~passenger compartment~~ shall be installed an emergency door opening handle, (Emergency Egress Device) which may be used by passengers to open the one door in the event of an emergency. ~~There shall also be one (1) handle inside the car that can open all of the four doors in the car. The emergency door opening device which can open the several doors shall be included.~~ The position and function, numbers of emergency door opening	Please see Annex B.

		project, the Bidder do not recommend for the above reasons. Accordingly, since the requirements of ERT Clause 7.1.3 will be able to satisfy even if evacuating from two doors on one side, the Bidder requires the Employer to amend the requirements as proposed.	device shall be reviewed by the Engineer.	
32.	Volume II Section VI ERT-67 8.2.6 Air filters	*Air filters shall be washable/re-useable and shall be well supported to prevent passing air from dislodging them shall the filters become saturated. They shall seal well at all edges. The filters shall be easily replaced but shall be sized not to require replacement at intervals less than 3500 hours of operation.* Since the Bidder assumes that the timing of replacement is subject to change due to the size of mesh, dirty air, and train operation etc, it is advisable to be equivalent to the requirement for CP NS-02: Rolling Stock – Commuter Trainsets. Therefore, the Bidder respectfully requests the Employer to revise the sentence as provided.	Air filters shall be washable/re-useable and shall be well supported to prevent passing air from dislodging them shall the filters become saturated. They shall seal well at all edges. The filters shall be easily replaced but shall be sized such that they shall be serviced monthly. ~~not to require replacement at intervals less than 3500 hours of operation~~.	Please see Annex B.
33.	Volume II Section VI ERT-72 9.1.11 Sensors for brake system	Generally brake force will be controlled by bogie or car basis. In this case the Bidder believes there is not required to measure the pressure of each brake cylinder and each air suspensions. Actually WSP control will be provided as an axle basis, but it is controlled by the difference of axle speed, so brake cylinder pressure of each axle will not be used. In addition, we believe that installation of unnecessary sensors will increase the frequency of failure and decrease the availability of train.	Several sensors shall be incorporated to brake system. Adequate quantity of Sensors shall be equipped to ~~each~~ brake cylinders and ~~each~~ air suspensions, as a minimum. These data detected by sensors shall be transmitted to	Please see Annex B.

		Therefore, we respectfully request the Employer to modify the requirement of ERT 9.1.11 as proposed.	Brake control unit, and shall be utilized for control of propulsion, brake and ATO and etc.	
34.	Volume II Section VI ERT-77 10.2.7 Operation of air-compressor	The Bidder understands that what should we should be comply is "average each compressor's operation ratio". And we consider that operation ratio can be averaged by using Master/Slave configuration, since master/slave will be switched according to running direction or calendar information etc. Therefore we respectfully request the Employer to modify the requirement of ERT 10.2.7 as proposed.	~~All~~ The operation of air compressors shall be ~~started/stopped synchronously~~ managed to average each compressor's operation ratio. For this control, train line or transmission of TMS may be utilized.	Please see Annex B.
35.	Volume II Section VI ERT-82 11.1.16.2	The Bidder considers that if ATO contractor choose pattern a), "Same time constant with manual mode" through Interface meeting, propulsion has no necessary to prepare multiple jerk pattern. Please confirm that the foregoing understanding is correct.	N/A	The Contractor shall resolve the foregoing of propulsion multiple jerk pattern during the project implementation.
36.	Volume II Section VI ERT-82 11.1.17 Blending pattern	Since clause 9.3.1 of ERT requests "Regenerative braking shall be supplied and shall be fully effective down to 0.5~1km/h", it feels blending has no or less effect for braking rate or stopping accuracy. Please clarify the reason why TMS should have several blending pattern. And also please clarify the purpose of every 1km/h patterns test run.	N/A	The test of regenerative revocation at the speed shall be conducted to evaluate the influence against station stopping accuracy. The speed (of regenerative revocation) means every 1km/h.
37.	Volume II Section VI ERT-87	The Bidder notes that it is a common practice in the industry that except for high speed trains such as Shinkansen (Bullet trains), no pantograph	Pantograph cover shall be equipped for suppression of aerial	Please see Annex B.

	12.1.9 Pantograph cover	covers is equipped for commuter trains and limited express trains. Also, the bidder notes that it is practically not feasible to equip pantograph cover within the rolling stock gauge which is almost the same as CP NS-02 Rolling Stock–Commuter Trainsets, and even if a small cover to be installed, it hardly contributes to noise reduction. Since we will satisfy the in-vehicle and out-of-vehicle noise defined in Chapter 12 even without a pantograph cover, the Bidder requests the Employer to make amendment as proposed.	noise, in consideration of body oscillations, where required, to comply with the noise requirement in clause 1.12.	
38.	Volume II Section VI ERT-88 12.3.2 Carbody grounding	The Bidder understands that ERT Clause 12.3 "Current Return" is the requirement for high voltage equipment or circuit, and it is not applied to low voltage equipment or circuit. Please confirm the Bidder's understanding is correct.	N/A	Bidder understanding is correct.
39.	Volume II Section VI ERT-98 15.6.1 Electrical jumper wire	*Electrical jumper wire that is necessary for transmission between the vehicles shall be specified by TMS supplier and shall have a design life about 8 years. Couplings shall be HART type or similar.* The Bidder assumes that the jumper wire for TMS can be included in the jumper cable assembly designed by the car builder, as well as the jumper wires for other systems, if the jumper cable assembly meets the requirements specified by TMS supplier. Please confirm that the foregoing understanding is correct. Further, the Bidder requests the Employer to confirm whether "HART" means HARTING, a connector manufacturer.	N/A	Bidder understanding is correct. Please see Annex B for the updated requirement on Electrical jumper wire.

40.	Volume II Section VI ERT-99 16.2.1 16.2.2 ERT-102 16.5.5 GBB No.15 Human Machine Interface (HMI)	The Bidder is of the opinion that the quantity of monitor (HMI) shall be decided considering its function and operability. Therefore, the Bidder respectfully requests the Employer to make amendment the requirement of ERT 16.2.1, 16.2.2 and 16.5.5 as proposed to enable the Bidder to propose optimal configuration.	[ERT 16.2.1] The CP NS-03 Contractor shall equip each driver's cab with the necessary Human Machine Interface (HMI) facilities for the operation, control and monitoring by the driver of the on-board communications systems. The number of handsets required for driver use shall be rationalized and kept to a minimum. ~~In particular, the CP NS-03 Contractor shall utilize a dedicated monitor~~. [ERT 16.2.2] ~~Subject to any reliability constraints, both CP NS-03 and CP NS-01 Contractors shall consider the integration of all communication operator functions into a different single HMI.~~ [ERT 16.2.5] The destination sign shall be programmable from a dedicated PIS monitor or TMS in the driver's cab.	Please see Annex B.

41.	Volume II Section VI ERT-127 ERT-128 20.3.10 20.4.2.2 Off-site performance test	The function test such as BC pressure measurement will be conducted before transporting the Rolling Stock to Manila, however, the Bidder requests the Employer to permit dynamic test including brake performance test such as deceleration of service and emergency braking to be conducted on-site.	N/A	Tests that cannot be carried out at Bidder's test facility will be carried out on the main line after the vehicle has been delivered to Manila. Please see Annex B.
42.	Volume II Section VI ERT-135 21.4.2.2 Wire insulation	In accordance with ERT 21.4.2.1 revised in GBB No.16, the Bidder will apply cables that comply with the Japan Association of Rolling Stock Industries Standards (JRIS). JRIS specifies the wire insulation other than XLPO for high voltage and high current wiring, and JRIS standard wires larger than 6mm2 is sufficiently capable for “carbody wiring” and widely used for similar domestic and oversea mass transit projects. Accordingly, the Bidder requests the Employer to make the amendment of cable insulation as proposed, so as to allow other proven insulation materials in accordance with JRIS, can also be applied.	5) Wires 6 mm2 and smaller shall have the appropriate insulation material as defined above. Wires larger than 6 mm2 shall be insulated ~~only~~ with Cross-linked Polyolefin (XLPO), or JRIS standard insulation material.	Please see Annex B.
43.	Volume II Section VI ERT-135 21.4.5.1	The Bidder doesn't normally apply the pinch screw terminals and the solid conductors. However, as for the pinch screw terminals, the Bidder recognizes that wire connection with pinch screw terminals is recommended on some electrical components as their standard option, and the Bidder has applied this method per their standard in our numerous railway projects. Regarding the solid conductor, the Bidder recognizes that co-axial cable, which is typically applied for antenna line in signaling and	N/A	Bidder request is rejected.

		communication system, is the solid conductor, which is successfully functioning. Therefore, the Bidder requests the Employer to allow minimum use of pinch screw terminals and solid conductors when it is standard usage and service prove application.		
44.	Volume II Section VI ERT-137 21.9.4 Securing or locking the enclosure	*The enclosures must be secured or locked to prevent unauthorized or accidental entry.* The Bidders understands that the requirement of this clause is that the enclosure inside the car shall be locked by dedicated keys to prevent unauthorized personnel or passengers from inadvertently or using commonly available tools to access the cubicle/cabinet. On the other hand, in view of the industry practice widely adopted around the world for similar mass transit projects, the Bidder is of the opinion that the underfloor equipment enclosures, which is hardly accessible for passengers, are equipped with latches or locks to opened and closed without dedicated keys or special tools. Please confirm the foregoing understanding is correct.	N/A	Bidder understanding is not correct. Unauthorized and accidental entry will not be limited only to the passengers. Underfloor equipment enclosures shall able to prevent unauthorized personnel as well.
45.	Volume III of III, SECTION VII General Conditions (GC) GC-22 4.8 Safety Procedures General Bid Bulletin No. 16	*The Contractor shall:* *(a)* *comply with all applicable safety regulations,* *(b)* *take care for the safety of all persons entitled to be on the Site,* *(c)* *use reasonable efforts to keep the Site and*	The Contractor shall: (a) comply with all applicable safety regulations, (b) take care for the safety of all persons entitled to	Please refer to Employer response in General Bid Bulletin No.16 dated 2 July 2021.

		Works clear of unnecessary obstruction so as to avoid danger to these persons, *(d)* *provide fencing, lighting, guarding and watching of the Works until completion and taking over under Clause 10 [Employer's Taking Over], and* *(e)* *provide any Temporary Works (including roadways, footways, guards and fences) which may be necessary, because of the execution of the Works, for the use and protection of the public and of owners and occupiers of adjacent land.* The Bidder received the Employer's reply in accordance with General Bid Bulletin No.16 dated 2 July 2021. However, the Bidder assumes that the provision of the items described in 4.8 (d) and (e) is excessive and not applicable to the CP NS-03 Contractor because these provisions should be provided by the CP NS-01 Contractor and/or the Employer after the delivery of the trainsets to the Site. Please reconsider to delete the provisions concerning (d) and (e).	be on the Site, and (c) use reasonable efforts to keep the Site and Works clear of unnecessary obstruction so as to avoid danger to these persons.~~,~~ ~~(d)~~ ~~provide fencing, lighting, guarding and watching of the Works until completion and taking over under Clause 10 [Employer's Taking Over], and~~ ~~(e)~~ ~~provide any Temporary Works (including roadways, footways, guards and fences) which may be necessary, because of the execution of the Works, for the use and protection of the public and of owners and occupiers of adjacent land.~~	
46.	General Bid Bulletin No.15 PC-11 Attachment 2 TIME FOR ACCESS TO THE SITE	*AD3: Access to the mainline for On-Site Testing and Commissioning (34 months)* *AD4: Buendia-CIA Partial Operation (58 months)* *AD5: Access to the whole mainline from Calamba to CIA (74 months)*	N/A	

		1. In accordance with GBB No.15, the Bidder understands that all testing and commissioning including type tests, integrated testing & commissioning and 1,500 km of FFR of each trainset shall be conducted on the mainline after 34 months from NTP as per AD3.Please confirm the above Bidder's understanding is correct. In addition, please clearly specify which portion of the mainline shall be used for this testing and commissioning including integrated testing & commissioning and 1,500 km of FFR. 2. In accordance with GBB No.18, the Contractor is required to complete the Trial Operation support and the whole of the Works by 58 months from NTP. Also, in accordance with GBB No. 15, the partial operation between Buendia and CIA shall be commenced at 58 months from NTP. Under such circumstances, the Bidder understands that the mainline between Buendia and CIA will be available for the Trial Operation by 57 months from NTP. Please confirm the above Bidder's understanding is correct and also provide the specific date of access to the mainline between Buendia and CIA. 3. Additionally, the Bidder would like to clarify if the Contractor is required to conduct the testing and commissioning including type tests, integrated testing & commissioning and 1,500 km of FFR in the remaining mainline between Buendia and Alabang because the implementation of testing and commissioning including type tests, integrated testing & commissioning and 1,500 km of FFR divided into		1. Bidder understanding is not correct. AD3 stated that the Contractor will gained the access to the mainline between Malolos - CIA for testing and commissioning and FFR not shall be conducted. 2. Bidder understanding is correct. Access to Buendia – CIA is on month 56 of CP NS 03 Limited Express program. 3. Bidder will have to cost in the risk of having site testing activities at 2 different phase of mainline section in this bid for the employer evaluation. The Taking Over Certificate will be issued on each train which have completed the testing and commissioning including type tests, integrated

		two (2) phases has considerable cost impact. The Bidder humbly requests the Employer to clarify the aforementioned. Also, please confirm that Taking Over Certificate shall be issued once the Contractor successfully completes the testing and commissioning including type tests, integrated testing & commissioning and 1,500 km of FFR of each trainset at the 1st phase in the event that the Contractor is required to conduct the 2nd phase testing. 4. In connection with the above 3, the Bidder would like to clarify if the Trial Operation between Alabang and CIA shall be conducted by the Employer and the Contractor is required to support such activity once the whole mainline becomes available for revenue service.		testing & commissioning and 1,500 km of FFR. TOC will not be issued if the testing activites were not completed due to Contractor's phasing testing arrangement. 4. The Contractor is required to support the Employer on all sectional Trial Operation activities.
47.	Volume II Section VI ERT-72 9.2.4	*The parking brakes shall be with spring- applied park brake function, through air release brake actuators, and shall be capable of holding 10 cars train-set in W2 (7t payload)loading condition on a 3.5% grade under all track conditions indefinitely. Parking brakes shall be installed in each leading car and more cars if needed to meet the above performance requirement.* The Bidder requests the Employer to clarify the intention that "the parking brake shall be installed in each leading car and more cars if needed to meet the above performance requirement." Since the Bidder is of the opinion that the arrangement and the quantity of the parking brakes will not affect its performance, the Bidder would like to propose the optimal arrangement and the quantity of parking brakes, taking into account the safety factor to comply with the	Enough number of ~~P~~parking brakes shall be installed in any car ~~leading car and more cars if needed~~ to meet the above performance requirement.	Please see Annex B.

		required parking brake performance. Accordingly, the Bidder respectfully requests the Employer to make the amendment to the requirement as proposed to allow to propose optimal configuration.		
48.	Volume II Section VI ERT-20 1.16.4.1 Grounding point	*Safety grounding points shall be provided on all electrical equipment, unless otherwise reviewed by the Engineer. Grounding points shall be of tinned copper, clean, free from paint, and of a sufficient area to ensure proper electrical contact for the grounding cable fasteners. Un-tinned bronze grounding points and austenitic grade stainless steel grounding points are also considered acceptable. The area of any weld joining the grounding pad to a surface shall be at least equal to the cross-sectional area of the grounding cable.* The Bidder notes that welding joint of copper and aluminum alloy or stainless steel is generally difficult due to differences in thermal conductivity. For the reason set forth above, the Bidder requests the Employer, subject to acceptance by the Engineer during the design stage, to allow the Bidder to propose an alternative service-proven grounding material and method other than specified in this clause. Please confirm that the Bidder's request above is acceptable.	N/A	Bidder request is acceptable.
49.	Volume II Section VI ERT-56 5.19.2.6 5.19.2.7 Master Controller	*5.19.2.6* *The driver's key shall be removable when The Master Controller is not in the predetermined Emergency position. The Master Controller will be interlocked electrically or mechanically.*	ERT-55 5.19.2~~4-7~~ 5.19.2.4 The Master Controller shall be interlocked by the Driver's key.	We noted the numbering error in GBB no. 18. Please see Annex B on updated clause 5.19.2.6 and 5.19.2.7

	General Bid Bulletin No.18 Page 10 of 33 No.14	*5.19.2.7* *The driver's key shall be removable when The Reversing Switch is not in the predetermined OFF (Neutral) position. The Reversing Switchwill be interlocked electrically or mechanically.* Regarding the requirement for interlocking function of Master Controller, it was changed to opposite meaning in GBB No.18. The Bidder believes that original requirement is correct, i.e. driver's key shall not be removable when the Master Controller is not in the predetermined Emergency position or the Reversing Switch is not in the predetermined OFF (Neutral) position. Accordingly, the Bidder requests to amend the sentence as proposed revised text. In addition, the Bidder assumes that the Clause No. updated in the Annex B of GBB No.18 is not correct, please also amend the Clause No. as provided.	5.19.2.5 When the driver's key is in the ON position and Reversing Switch is in the forward or reverse position, the Master Controller shall be released. 5.19.2.6 The driver's key shall not be removable when The Master Controller is not in the predetermined Emergency position. The Master Controller will be interlocked electrically or mechanically 5.19.2.7 The driver's key shall not be removable when The Reversing Switch is not in the predetermined OFF (Neutral) position. The Reversing Switch will be interlocked electrically or mechanically.	
50.	Volume II Section VI ERT-58 6.5.1	*6.5.1* *The Contractor shall provide LED type headlights.* *6.5.4*	6.5.4 The light intensity of headlights shall comply with Table.7 in item 5.2.1	Please see Annex B.

	6.5.4 Head lights	*The light intensity of headlights shall comply with Table.7 in item 5.2.1 of JRIS R 1645 or any equivalent standard.* Although ERT 6.5.4 specifies that "The light intensity of headlights shall comply with Table.7 in item 5.2.1 of JRIS R 1645 or any equivalent standard.", the Bidder notes that JRIS R 1645 is a standard for HID type headlights. Since the Contractor shall provide LED type headlights in accordance with ERT 6.5.1, the Bidder assumes that JRIS R 1646 shall be applied for LED type headlights. Therefore, please amend the sentence as provided.	of JRIS R ~~1645~~ 1646 or any equivalent standard.	
51.	Volume II Section VI General Bid Bulletin No.18 ERT-67 8.1.1 Air-conditioning unit	*Each car shall be provided with two units of ventilation and air-conditioning (VAC) system complete with relative humidity control. The air-conditioning units (ACU) shall be controlled independently such that if there is a failure in one unit, the other units shall continue to operate normally. All system components must be service-proven, and must be tested to demonstrate compliance with the requirements of this ERT.* The Bidder would like to clarify the intention of the Clause 8.1.1 as updated in GBB No.18.The Bidder understands that the purpose of the updated Clause 8.1.1 is not to install two independent air-conditioning units on roof top in each car, but to realize redundancy of air conditioning system.	N/A	Bidder stated requirement is acceptable.

		The Bidder requests the Employer to accept the following so that the Bidder can propose the adequate design in consideration of the reduction of maintenance work such as the replacement work and running cost by reducing the number of roof top air-conditioning unit: - Two independent refrigerant cooling circuits shall be provided in one rooftop mounting air-conditioning unit. - Two independent control systems and electric circuits shall be provided. Please confirm that the Bidder's requirement above is acceptable.		
52.	Volume II Section VI ERT-92 14.7.3 Material of battery box	*Each leading car shall be equipped with a sintered electrode type nickel-cadmium-alkali storage battery contained in a steel battery box. The Contractor can propose Alternative battery type for Engineer review.* The Bidder understands that stainless steel, which is widely used for rolling stock as a material for battery boxes, is allowed to be used for the battery box. Even if it is made of stainless steel, the surface of the battery box will be painted appropriately such as propulsion inverter box, static inverter box, etc. Please confirm that the foregoing understanding is correct.	N/A	Bidder understanding is correct.
53.	Volume II Section VI ERT-136 21.7.1 Painting	*All surfaces shall be completely free of rust, scale, grease and other foreign material immediately before painting and shall be painted with at least two coats of primer and one finish coat of paint. Areas exposed to corrosive fluids or cleaning solutions shall be protected with*	N/A	Bidder understanding is acceptable.

		coatings resistant to those fluids. The finish coat shall match that of the equipment in quality and color. There shall be no paint applied to hoses and electrical *lines. The interior surfaces of equipment enclosures shall be primed and given one coat of insulating paint. There shall be no exposed, unpainted or untreated surfaces on the equipment supplied unless specifically reviewed and commented by the Engineer.* Although the type and number of painting are specified in this clause, various types of painting will be applied to each portion/area depending on the surface finish and exposure conditions, etc. Also, the composition of the paint will not only use the primer and/or finish coat, but depending on the portion, surfacer or putty will also be used. Accordingly, the Bidder is of the opinion that we can propose the optimum painting method including the type and number of painting during the design stage. Please confirm that our understanding above is acceptable.		
54.	Volume II Section VI ERT-129 ERT-130 20.4.3 On-site Testing and Commissioning 20.5	The Bidder understands the limited express train will be operated in the same line as the commuter train. In case that the commuter trains commence in-service operation before the conduction of On-site Testing and Commissioning and Integrated Testing and Commissioning for the limited express trains, it affects the project schedule for CP NS-03 due to the limitation on the use of mainline.	N/A	The mainline access will be provided to the Contractor on case by case basis. Utterly, the priority will be given to the commercial service operation than the testing and commissioning activites. In addition, the engineering downtime of 5 hours a day possibly be provided to the

	Integrated Testing and Commissioning	As such, the Bidder requests the Employer to clarify the number of hours per day for the said Testing and Commissioning in mainline.		Contractor depending on Operator approval for the mainline access.
55.	Volume I of III, INVITAION FOR BIDS, IFB-2 7 SECTION II. BID DATA SHEET BDS-10 ITB 27.1 General Bid Bulletin No.22 Annex A IFB-2 7	*Bid must be delivered to the address above on or before 10:00 AM on 2 September 2021 and…* *The opening of the…* *Date: 2 September 2021* *Time: 10:00 AM* In accordance with General Bid Bulletin No.22 dated 18 August 2021, the Bidder noted that the due date of the submittal of the bid proposals has been extended from 19 August 2021 to 2 September 2021. Since the Bidder has not received yet the Employer's reply for the Bidder's clarifications, which have impacts on the design, prospective project schedule, costing and so on, it is not possible to finalize our proposals by the said due date. Additionally, the extended due date is still not sufficient for the Bidder to finalize our technical reviews and discussions with its potential suppliers, and establish our technical proposal responding to the Employer's reply for the clarifications provided via GBB No.1 through 21, in particular, regarding the air-conditioning unit, the definition of Rolling Stock Gauge and the	Bid must be delivered to the address above on or before 10:00 AM on 15 October~~2 September~~ 2021 and… The opening of the… Date: 15 October~~2 September~~ 2021 Time: 10:00 AM	Please refer to further GBB 23 relating to IT 24.1-The deadline for Bid submission.

		coupler. As such, to assure sufficient time for proposal preparation is available, we respectfully request more extension of one and half (1.5) months for submittal of the bid proposals.		
56.	General Bid Bulletin No.21 Page 2 of 7 No.2 Volume II of III, SECTION VI ERT-43 4.1.4 Automatic coupler	The Bidder noted the Employer's response in General Bid Bulletin No.21 dated 16 August 2021, however, the Bidder would like to request to confirm again that it is not necessary to equip an electrical head on the automatic coupler for the limited express as follows. The Bidder is of the opinion that both leading cars shall have the following features for preparation of rescue operations under the emergency circumstances in accordance with ERT 4.1.5 and 4.1.6. □ To provide an electrical connecting plug* in both leading cars □ To provide an emergency connection cable and stored in the cabinet placed in the driving cab □ The emergency connection cable will be compatible with the commuter train*, and can be connected with two limited express trains or limited express train and commuter train for rescue operation under the emergency circumstances. □ To operate properly the required functions such as brake command, broadcasting, buzzer etc., under the rescue operation. * Details of the electrical connecting plug and the emergency connection cable will be designed in coordination with the relevant interface	The automatic coupler shall, in conjunction with the draft-gear automatically effect mechanical~~, electrical~~ and pneumatic coupling for two (2) Limited Express Train or identically coupling head. It shall also permit separation of units either by manually from the track side and/or remotely from the cab.	Please see Annex B.

		contractors such as CP NS-02 at the design stage. Based on the above, the Bidder requests to follow the design concept of commuter trains, i.e., unnecessary to equip an electrical head on the automatic coupler, in consideration of maintenance, procedure of emergency rescue operation, etc. Accordingly, the Bidder requests to make the amendment as proposed.		
57.	Volume II of III, SECTION VI ERG-43 7.10.2.1 Software framework ERG-48 8.1.12 (Newly added) SIL related requirement 8.8.4.4 (Newly added) 8.8.4.5 (Newly added)	*2nd RFC:* *The Bidder is required to use EN50128 or IEC62279 for Software Safety Integrity Level (Software SIL) 2. However, the Bidder cannot see any software SIL allocation for any subsystems, equipment and functions in the ERG and ERT. In addition, there is no requirement for performing Software SIL allocation and proposing appropriate Software SIL in ERG and ERT. Accordingly, the Bidder requests the Employer to clarify Software SIL allocation in appropriate clauses in ERG or ERT.* *GBB11 No.55* *Required SIL shall be determined by the Contractor for each safety related function which uses software for control and monitoring. The Contractor will set the SIL at the function level and functional module level and shall assign that SIL to all systems, subsystems or LRU's associated with that function. Please see annex B Clause 8.1.12.* The Bidder received the Employer's reply in General Bid Bulletin No.11 dated 9 June 2021.	N/A	The Bidder shall determine SIL requirements for any safety critical or safety related function where electrical/electronic/programmable electronic safety-critical items or softwares contributes to perform that safety related function in accordance with applicable standards like EN 50126, EN 50129, or IEC 61508. Please see Annex B for the updated requirement on SIL – Clause 8.2.2 As part of SIL Assessment, the Bidder can propose to demonstrate that the allocated SIL meets the requirement through service proven equipment for the Engineer and/or Employer for approval.

		However, the Bidder requests the Employer to deem the service-proven equipment to meet SIL requirement as equivalent if the Contractor can propose the adequate experience during design stage.		
58.	Volume II Section VI ERG-47 8.1.7 Fault Free Running (FFR) 8.5.2.2 In-service operation FFR	*2nd clarification No.59* *Please clarify whether the fault/failure includes only the failure which causes a delay greater than 5 minutes.* *Or does fault/failure in FFR means all failures?* *Response for GBB11 No.59* *Bidder understanding is not correct. The fault free is none fault registered in the TMS fault indication screen and subsystem event logger i.e PECE, APSE etc.* The Bidder's understanding for fault free (FFR) is as follows. Fault free is no faults occur by own causes in components. Not consider any faults occur by other factors such as line voltage low. Such condition causes low line voltage failure on APSE and registered in APSE and indicated on TMS fault indication screen.	N/A	Please see added clause 20.5.3 – 20.5.7 in annex B. The failure criteria during FFR shall be proposed by the Contractor for Engineer review and given notice of no objection.
59.	Volume II Section VI ERG-47 8.1.3	*GBB11 No.57* *System Assurance Plan* The Bidder requested the Employer to unify the term "System Assurance Plan" into System Assurance Management plan. In clause 8.1.3, the term "System Assurance Plan: SAP" still remains. System Assurance Plan: SAP should not remain any more in ER.	N/A	Please see Annex B on the updated system Assurance requirement.

60.	Volume II Section VI ERG-47 8.1.3	*GBB11 No.58* The Bidder requested the Employer to confirm that System Assurance Management shall only cover Reliability, (Availability), Maintainability and Safety (RAMS). However, in clause 8.1.3, activities other than RAMS (System assurance management) still remain such as EMC, Fire safety strategy. In addition, Project management (project organization, Role and Responsibilities), Software Management and Control, and Requirement Management are newly added in ERG clause 8.1.3 as System Assurance activities which is just changed term from System Assurance Plan. Referring to ERG clause 8.1.2, the Bidder can see that System assurance management plan contains all requirements within this ERG Section 8. However, there are no requirements for Requirement management, EMC, fire safety, Project management and so on under ERG Clause 8. Furthermore, does the Employer's person in charge of System Assurance review and approve above mentioned requirements, outputs and so on? Please clarify.	N/A	8.1.3 is general requirement of System Assurance and not limited to RAMS. Please see Annex B for updated System Assurance requirement. Yes, the Engineer and/ or Employer in charge of System Assurance will evaluate bidders's proposal submission.
61.	Volume II Section VI ERG-48 8.2.1 8.2.2	*GBB11 No.60* The Bidder confirmed that ERG Clause 8.2.1 has been revised according to the Bidder's request. However, some new requirements are added in this clause and ERG Clause 8.2.2 for Availability activity. Accordingly, the Bidder would like to confirm the following items. Quoted sentence from ER:	N/A	Please see Annex B on the updated system Assurance requirement. Please be informed that there is no change of requirement on train performance requirements.

		"Reliability and Availability will be assessed against specific targets laid out in this tender." Query 1. Is Availability requirement added newly? If so, please specify the availability target in ER. Query 2. What is the meaning of "specific targets laid out in this tender"? Does the Employer specify the Reliability and Availability targets according to the Bidder's proposal? Query 3. Is the Reliability target mentioned in ERG clause 8.5.3.1? Query 4. Is the Maintainability target mentioned in ERG clause 8.5.3.3? Query 5. Please specify System Availability target and definition required in this contract for Availability analysis. Usually, those should be included in ER and if not, the Bidder cannot implement Availability activities.		
62.	Volume II Section VI ERG-49 8.2.1	*GBB 11 No.60* Please specify the definition and requirement for "Performance measure" which is added newly in GBB 11 No.60.	N/A	Please see Annex B on the updated system Assurance requirement. The Performance is now defined in clause 8.10.10. There is no requirement change.
63.	Volume II Section VI ERG-49 8.5.3.2	*GBB 11 No.62* *The OMTTR measures the average effective time required to return the train to service after a service affecting failure.* *Example: Train 1 is a serviceable train and was having a propulsion (Capital component) fault that*	N/A	Yes, the OMTTR target is applicable to all kinds of failure of the capital components. Refer the example provided in GBB 11 No. 62.

		caused a motion obstruction, four times in one schedule day and you spend an hour repairing each of those instances of fault, the OMTTR would be 15 minutes (60 minutes / 4 = 15 minutes) Again the Bidder request the Employer to clarify whether rescue operation is included in OMTTR analysis. In addition, provided example for calculation formula of OMTTR is for the result of demonstration test. Accordingly, the Bidder requests the Employer to provide the calculation formula of OMTTR when the Bidder performs Maintainability analysis for OMTTR in design phase.		The Bidder shall be obligated to propose the calculation formula of OMTTR when the Bidder performs Maintainability analysis for OMTTR in in the RAMS demonstration plan documents for engineer review and given notice of no objection. Please see Annex B on the updated system Assurance requirement.
64.	Volume II Section VI ERG-49 8.5.3.3	*GBB 11 No.63* *The CMTTR is a measurement on the maintainability of equipment and repairable parts. It represents the average time needed to repair a failure until the equipment returns to a fully functional state.* *Example:* *Train 1 was take out from serviceable status to unserviceable and routed back to depot due to propulsion error. The scaled time between the train entered the pit line and declared serviceable by the maintenance / total number of affected capital components is CMTTR:* *Total train on pit = 8 hours.* *Total affected capital component = 1 Propulsion* *CMTTR= 8/1*	N/A	Please see reponse provided on item 52.

		Again the Bidder request the Employer to clarify whether rescue operation is included in OMTTR analysis. In addition, provided example for calculation formula of OMTTR is for the result of demonstration test. Accordingly, the Bidder requests the Employer to provide the calculation formula of OMTTR when the Bidder performs Maintainability analysis for OMTTR in design phase.		
65.	Volume II Section VI ERG-50 ERG-51 ERG-52 ERG-53 8.5.4 8.8.1.1 8.8.3.4 8.8.3.8	*GBB 11 No.64* *GBB 11 No.75* *GBB 11 No.79* *GBB 11 No.80* *GBB 11 No.82* *Safety criteria/target, Risk matric table etc. shall in general according to EN50126 or IEC62278 or any other equivalent international standard for Rolling Stock.* The Bidder understand that Safety criteria / Risk matrix etc. is in general according to EN50126 / IEC62278. Accordingly, the Bidder requests the Employer to specify and include Risk matrix etc into the ER for activities of Risk assessment / Safety analysis according to the consideration of safety principle under the Employer's duty.	N/A	Please see Annex B for the updated requirement on system assurance and appendix C for risk matrix. The matrix provided in Appendix C is a sample only.
66.	Volume II Section VI ERG-50 8.6.2.4 FTA	*GBB 11 No.65* The Bidder confirmed revised clause 8.6.2.4 and newly "critical subsystem equipment was added in this clause.	N/A	Please see Annex B for the updated requirement on system assurance.

		Accordingly, the Bidder requests the Employer to include the definition of Critical system equipment for identifying it. It appears that there is no definition for critical system equipment in this ER. In addition, new system is also added in this clause. As the Bidder said before, conducting FTA is enough when failure consequence is not solved in FMECA result. Accordingly, the Bidder also requests the Employer to remove “new” in this clause.		
67.	Volume II Section VI ERG-50 8.6.2.5 Reliability Critical Item List	*GBB 11 No.66* *The requested information shall be provided by the contractor during the project implementation.* The Bidder understands that Reliability Critical Item List shall be provided to the Employer.Accordingly, the Bidder requests the Employer to provide the criteria for identifying Reliability Critical Item. Usually this criteria is included in ER (Customer’ specification) according to their consideration for RAM activities.	N/A	Please see Annex B for the updated requirement on system assurance. Reliablity critical item list will be analysis through reliability analysis procedure. The Reliability, Availability, Maintainability and Safety Target were included in the ER.
68.	Volume II Section VI ERG-50 8.6 Performance report	*GBB 11 No.67* *Bidder understanding is correct. 7 sets performance report shall be submitted by the Contractor. Bidder proposal is accepted. This shall be outlined in the Contractor configuration management plan etc.* The Bidder’s proposal was accepted. Accordingly, the Bidder clarifies bound contents for Performance report as follows. Please note that contents after Clause 8.6.6 are clarified with other clarifications.	N/A	Please see Annex B for the updated system assurance requirement. Performance report has been replaced with RAM demonstration report in clause 8.4.29.2.

		Trainset 1: Documents for Clause 8.6.2.1 to 8.6.2.5 are bound. Trainset 2 to 7: No bound documents for Clause 8.6.2.1 to 8.6.2.5. (due to the same contents with Trainset 1.) Just reference documents number only included.		
69.	Volume II Section VI ERG-50 8.6.2.6 8.6.2.7 8.6.2.8 8.6.2.9 8.6.2.13 8.6.2.14	*GBB 11 No.68* *Bidder understanding is rejected. These certificates shall be in a binder submitted by the Contractor together in the Performance Report for TOC application.* The Bidder understood these certificates should be prepared according to relevant ER which stipulates requirements for these certificates. Accordingly, these certificates will be issued individually from appropriate department such as Quality department. Therefore above required certificates to be copied will be bound in Performance report and submitted to the Employer as the contents of Performance report.	N/A	Please see Annex B for the updated system assurance requirement. Item was moved ERT clause 20.5 Integrated Testing and Commissioning.
70.	Volume II Section VI ERG-50 8.6.6.11 As-built drawing in Performance report	*GBB 11 No.69* *Engineer Notice of No Objection of submitted list of As-built Drawing* The Bidder confirmed the Employer's amendment by GBB11 No.69 in Clause 8.6.2.11. As-built drawing list is applicable for all trainsets. Accordingly, the Bidder proposes that this list should be bound only in trainset 1. Performance report for other trainsets just refer to document number of As-built drawing list.	N/A	Please see Annex B for the updated system assurance requirement. Performance report has been replaced with RAM demonstration report in clause 8.4.29.2.
71.	Volume II Section VI	*GBB 11 No.71* *They are two different reports.*	N/A	This requirement has been removed. Please see Annex B for

	ERG-50 8.3.3 RAM demonstration report 8.6.3 Performance report for Performance certificate	*Clause 8.3.3 required the Contractor to provide the plan of assurance of reliability, for operational service. Reliability and availability will be assessed against specific targets laid out by Employer. The report shall provide evidence that the respective RAM targets have been achieved and shall include any supporting information and calculations. This report shall be prepared by the Contractor RAMS engineer.* *Clause 8.6.3 (Rolling Stock Performance report) is the prerequisite for the issuance of performance certificate which includes the works performance progress i.e. defect remedial, open items, modifications etc. This report shall be prepared by the Contractor PM.* *The contractor is allowed to make the RAM demonstration report as the annexes of the Rolling Stock Performance report.* The Bidder confirmed required plan and reports in clause 8.3.3 revised by GBB 11 No.71 and also confirmed that RAM demonstration report was the same/similar to Rolling Stock Performance report stipulated in clause 8.6.3 that is usually called as RAM demonstration report in other projects. Accordingly, the Bidder would like to clarify as follows. 1. Whether RAM demonstration report is also prepared monthly basis. It is because that this report is allowed to be annexes of Rolling stock performance report. 2. GBB 11 No. 71 mentioned that Contractor Project Management (PM) team shall prepare and submit Rolling stock Performance report. Accordingly, please specify this task for PM in		the updated system assurance requirement. 1.) Yes the interim RAMS report shall be submitted monthly; 2.) Reference to Rolling stock Performance report was removed from section 8 System Assurance. For PM task and responsibility please refer to ERG clause 10. 3.)Please refer to updated clause 8.10.11 in Annex B. 4.) The TOC performance report has been removed from the ERG Section 8.

		appropriate ERG clause. Contractor RAMS engineer will prepare RAM demonstration report and provide it to Contractor Project Management (PM) team for the submission of Rolling stock Performance report. 3. GBB 11 No. 71 mentioned that Availability target laid out by Employer. Accordingly, please specify Availability target in appropriate clause of ER. 4. Is TOC Performance report also submitted by the Contractor Project Management (PM) team? If so, please specify this task for PM in appropriate ERG clause like Rolling stock performance report.		
72.	Volume II Section VI ERG-52 8.8.3.1 8.8.3.2 Hazard analysis	*GBB 11 No.77* *Safety criteria / target, Risk matrix table etc. shall in general according to EN 50126 or IEC 62278 or any other equivalent international standard for the Rolling stock.* The Employer's response does not reply to the Bidder's request. The Bidder's request is to provide the template for performing Hazard analysis. Generally this template is included in ER to provide appropriate analysis result by Contractor with compatibility between the Employer and Contractor.	N/A	Please see Annex B for the updated system assurance requirement and SA template in Appendix C. The hazard analysis template provided in Appendix C is a sample only.
73.	Volume II Section VI ERG-52 8.3.3.3 Hazard log	*GBB 11 No.78* *Safety criteria / target, Risk matrix table etc. shall in general according to EN 50126 or IEC 62278 or any other equivalent international standard for the Rolling stock.*	N/A	Please see Annex B for the updated system assurance requirement and SA template in Appendix C. The hazard analysis template provided in Appendix C is a sample only.

		The Employer's response does not reply to the Bidder's request. The Bidder's request is to provide the template for performing Hazard log management. Generally this template is included in ER to provide appropriate hazard log management by Contractor with compatibility between the Employer and Contractor.		
74.	Volume II Section VI ERG-52 8.8.3 Safety Requirement 8.8.3.4 Safety Assessment	*GBB 11 No.79* *Safety criteria/target, Risk matric table etc. shall in general according to EN50126 or IEC62278 or any other equivalent international standard for Rolling Stock.* *The assessment is to determine the Design, Testing and Commissioning phase and shall also identify mods of operation that are critical to the safe operation of the system, including emergency modes, maintenance and day-to-day operations. The table provided an example only and it is the Contractor obligation under the Works defined in this contract to perform the safety assessment.* The Bidder would like to clarify that why/how the subsystems and functions in the table are provided as example. We believe that those are identified according to the judgement criterion such as safety criteria, risk matrix etc under the consideration of Employer. Accordingly, preventing discrepancy between the Employer and Bidder when the Bidder performs safety assessment, please provide, specify and include such criteria in ER. The requirements for safety stipulated in ERG Clause 8.8.3 are obviously added from original ER	N/A	Please see Annex B for the updated system assurance requirement. Please refer to amended clause 8.8 in annex B. 8.8.2 stated that the requirement stand only a as a guideline; the Contractor will remain responsible for performing extensive safety analysis and allocate Safety Integrity Level for any safety critical or safety related function.

		of NSCR. Accordingly, it appears that there are any discrepancies under SA requirements in ERG.		
75.	Volume II Section VI ERG-52 8.8.3.5 Safety Critical Item List	*GBB 11 No.80* *Safety critical item list and the criteria for identifying the items is the reference to relevant entry in Hazard Log for safety critical failure modes. Safety criteria / target, Risk matrix table etc. shall in general according to EN 50126 or IEC 62278 or any other equivalent international standard for the Rolling stock.* The Bidder understands that in any Rolling Stock projects the criteria/condition for identifying Safety Critical Item is clearly defined in ER. Risk matric table is also generally included in Employer Requirement according to EN 50126 / IEC 62278 requirement. Accordingly, the Bidder again requests the Employer to provide the criteria / condition for Safety Critical Item List. Template for Safety Critical Item List is also required to be provided by the Employer like any other Rolling Stock projects	N/A	Please see Annex B for the updated system assurance requirement. Safety critical item should be derived from the preliminary hazard assessment which list out the components/subsystem failure or operation failure will lead to hazardous condition.
76.	Volume II Section VI ERG-53 8.8.3.7 Quantitative Risk Assessment	*GBB 11 No.82* *Safety criteria / target, Risk matrix table etc. shall in general according to EN 50126 or IEC 62278 or any other equivalent international standard for the Rolling Stock.* The Bidder again requests the Employer to provide Safety criteria / target for demonstrating whether the result of Quantitative Risk Assessment meets such criteria / target. In any projects such criteria / targets are included in ER under the consideration of Employer's safety assessment.	N/A	Please see Annex B for the updated system assurance requirement. Global risk criteria was provided in clause 8.5.3.

77.	Volume II Section VI ERG-52 8.8.3.4 Safety assessment	*GBB 11 No.83* *The term in clause 8.8.3.7(original 8.8.3.8) was changed. Please see Annex B.* The Bidder confirmed that the term “Safety” was changed to “Hazard” in clause 8.8.3.7. However, the Bidder’s query is for ERG clause 8.8.3.4. Accordingly the Bidder would like to confirm that the intention of Safety assessment mentioned in ERG clause 8.8.3.4 is to perform hazard analysis for the functions listed in table of ERG clause 8.8.3.4.	N/A	Please see Annex B for the updated system assurance requirement. The safety assessment will required to be done to the safety functional requirement as per clause 8.8 in Annex B.
78.	Volume II Section VI ERG-52 8.8.4.2 (2)	*GBB 11 No.84* *8.8.4.2 (2) was updated. Please see Annex B.* *Updated sentence is as follows.* *Design Safety Requirement demonstrating the safety requirements are in compliant with Technical Requirements (ERT).* The Bidder confirmed updated sentence in ERG clause 8.8.4.2 (2) but we have still confusion about the requirement of this clause. What is the meaning of “Design Safety Requirement demonstrating the safety requirements”? Safety requirement in Design phase is safety requirement? Safety requirements stipulated in ERG clause 8.8.3 are activities related to safety analyses such as hazard analyses, Hazard log management etc. Accordingly should we show that we have performed activities related to safety analyses as Safety requirements?	N/A	Please see Annex B for the updated system assurance requirement. Please refer to clause 8.4.28 for the requirement of Deterministic Safety Assessment.

79.	Volume II Section VI ERG-52 8.8.4.2 (2)	*Design Safety Requirement demonstrating the safety requirements are in compliant with Technical Requirements (ERT).* The Bidder would like to clarify that what the intention of the sentence "safety requirement are in compliant with Technical Requirements (ERT) is. Quoting this sentence, we can understand that if we design Rolling stock to comply with ERT, safety requirements can be achieved accordingly. In addition, if identified safety requirements do not comply with ERT and there is a conflict between safety requirement and ERT, what should we do? Furthermore, if identified safety requirements cannot be found in ERT, what should we do? Please specify activities in those case.	N/A	Please see Annex B for the updated system assurance requirement. Please refer to clause 8.4.28 for the requirement of Deterministic Safety Assessment.
80.	Volume II Section VI ERG-52 8.8.4.2 (4)	*GBB 11 No.85* *The requirement was updated. Please see Annex B.* *Design Safety Case or Safety report to be submitted for Employer's given statement of No Objection.* The Bidder confirmed that Final Safety Case was deleted in ERG 8.8.4.2 (4). However, what the Bidder want to clarify is whether Safety Case is the same as Safety report. Safety Case is generally defined in EN50129 / IEC62245 but what the Employer's requirement as Safety report is the Safety Case defined in this standard? If Safety report is not Safety Case defined in this standard, please remove Safety case and clearly specify the contents for Safety report.	N/A	Please see Annex B for the revised system assurance requirement in particular to safety case report.

81.	Volume II Section VI ERG-52 8.8.4.2 (4)	*GBB 11 No.86* *The requirement was updated. Please see Annex B.* *Design safety case or Safety report is a report which shall be submitted at two stages in the project, which is at the Final Design and Testing and Commissioning.* *Correct. For TOC application, each train shall have individual binder of performance report as outlined in clause 8.6.2 of ERG.* The Bidder confirmed that Rolling Stock Operation Readiness Safety report "Final Safety Case" mentioned in original ERG Clause 8.8.4.4 was deleted and also "Design Safety case of Safety Report" was added in ERG clause 8.6.2 (10) as one of the contents of Performance report. Accordingly, the Bidder would like to clarify that in ERG clause 8.8.4.2 (4) and 8.8.4.6 Safety Case or Safety Report is required. Please clarify inconsistency between the two. In addition, Safety report or Safety Case is not the characteristic of preparation / submission for each trainset individually. Accordingly the Bidder will refer to document number of Safety report or Safety Case in each Performance Report mentioned in ERG Clause 8.6.2.	N/A	Please see Annex B for the updated system assurance requirement. Please see clause 8.4.24 for Safety Case for Design and Pre-Operation Safety Case requirement.
82.	Volume II Section VI ERG-53 8.8.4.3	*The Rolling Stock Design Safety report "Design Safety case"*	N/A	The term was unified. Please see Annex B for the updated system assurance requirement in particular to safety case report.

		Please unify the term between “Safety report or Safety case” and “Design safety report Design Safety case”.		
83.	Volume II Section VI ERG-54 8.8.4.7 (original 8.8.4.5 (1))	*GBB 11 No.89* *The requirement was updated. Please see Annex B.* *The safety performance and criteria of safety performance is the tracking down failures or incidents which have or may have an impact on safety.* Quoting the response by GBB 11 No.89, the Bidder would like to clarify that the definition of Safety Performance is that occurrence failures or incidents impacts on safety during DNP. And those shall be reported by Safety Monitoring report stipulated in ERG Clause 8.8.4.7 included in DRACAS report as one of contents for Rolling Stock Performance report stipulated in ERG clause 8.7.4.	N/A	Please see Annex B for the updated system assurance requirement. Safety monitoring report requirement was revoked. The monitoring of safety performance shall be within the safety case report issued by the Contractor to describe on how safety of the system is achieved and continuously to be achieved.
84.	Volume II Section VI ERG-49 8.3.4	*RAM Management plan shall include the strategy for management of RAM and safety issues and define the specific tasks to be performed throughout all the lifecycle of the project.* Safety issue should be handled in Safety management activities. Accordingly, the Bidder requests the Employer to remove “safety issue” in this clause and move it to appropriate clause in clause 8.8.	N/A	Safety issue had been moved. Please see Annex B for the updated system assurance requirement.
85.	Volume II Section VI ERG-48 ERG-49 8.2.1	*RAM Assurance plan* *RAM Management plan* The Bidder requests the Employer to clarify the differences between RAM (Performance)	N/A	Under RAMS management, Contracor shall provide RAM demonstration plan. RAM demonstration plan is part of

	8.3.3	Assurance Plan defined in ERG clause 8.2.1 and RAM Management Plan defined in ERG clause 8.3.3. Generally, RAM management should be included in RAM assurance plan if RAM assurance plan is required. Accordingly, the sentence “can be part of System Assurance Management plan” is not necessary in ERG Clause 8.3.3.		deliverable in the Assurance plan. Please see Annex B.
86.	Volume II Section VI ERG-49 8.3.3	*RAM Demonstration test, RAM Demonstration report, Maintainability Demonstration Test plan, FMECA Analysis report* The Bidder would like to clarify each document as follows. 1. RAM Demonstration test and RAM Demonstration report: Are these documents duplicated or separate documents? If so, please specify the differences between two. 2. Maintainability Demonstration test plan: If Maintainability demonstration test is required, please specify the requirement for this test. Currently it appears that preparation of this test plan is only required. 3. FMECA Analysis report: The term “Analysis” is not necessary. 4. RAM Demonstration (test) report: What is differences between RAMS demonstration (test) report and Rolling Stock Performance report defined in ERG Clause 8.7.4? RAMS demonstration (test) report includes DRACAS report but Performance report is also. Contents and characteristic for both reports seem to be the same.	N/A	This requirement has been revised. Please see Annex B for the updated system assurance requirement 1.) Please see requirement for RAM demonstration report on clause 8.4.29.2; 2.) The requirement of maintainability demo test plan is not required. The Contractor shall only prepare the RAM demonstaration report during the DNP. 3.) Noted. FMECA was removed. 4.) The Contractor shall only prepare the RAM demonstaration report during the DNP.

		Accordingly, please clarify.		
87.	Volume II Section VI ERG-54 8.8.4.4	*System Safety Demonstration plan* ERG Clause 8.8.4 is the requirement for Safety report but System Safety Demonstration Plan in ERG Clause 8.8.4.4 is included even though it is plan. We consider that contents of its plan should be included in System Safety Management Plan stipulated in ERG Clause 8.8.2. Accordingly, the Bidder requests the Employer to move contents mentioned in this demonstration plan to appropriate clause if this demonstration plan is applicable.	N/A	Please see Annex B for the revised system assurance requirement in parcular to Safety Case for Design and Pre-Operation Safety Case.
88.	Volume II Section VI ERG-54 8.8.4.4	*System Safety Demonstration plan and report.* *IEC 61508* For System safety demonstration, IEC 61508 is quoted. Generally this standard is used for activities, method, criteria etc related to SIL. If this is not the intention of requirement, please specify the safety target for showing demonstration results.	N/A	Please see Annex B for the revised system assurance requirement. Safety target is included in clause 8.5.3.
89.	Volume II Section VI ERG-83 ERG-51 18.1.6 8.7	*The Contractor shall Requirements Management software "ComplyPro" as the platform to implement the DRACAS process starting form Factory Acceptance Test,; continue during site Testing and Commissioning, Trial run until handover to O&M concessionaire.* Referring to ERG Clause 18.1.6, the Bidder can finish DRACAS at Handover (TOC). However,	N/A	18.1.6 is the requirement for using Complypro for the managing the DRACAS during the project implementation till handover to O&M Concessionaire. However, the DRACAS process shall continues until completion of DNP through CMMS tools. Please refer to clause 8.4.29.1 (3).

		referring to ERG 8.7, DRACAS should continue until end of DNP. Please clarify.		
90.	Volume II Section VI ERG-83 ERG-51 18.1.8	*A final output of "ComplyPro" shall be the demonstration of achievement of the safety requirements for the work under the contract and shall be used to support the final safety case or report.* According to GBB 11 No86, Final safety case or report was deleted. Please update the contents in ERG Clause 18.1.8.	N/A	18.1.1 is the requirement for ComplyPro tools. The requirement for Safety Case for Design and Pre-Operation Safety Case are now located to 8.4.24.
91.	Volume II Section VI ERG-49 8.5.2	*8.5.2* *2) In-service Operations - 10,000 km or two (2) months of continuous in-service operational FFR. ERG clause 8.5.2.2) defines the performance acceptance criteria as 10,000km or 2 months of continuous in-service operation FFR.* Quoting this clause, can the Bidder finish demonstration test for MDBF requirement when all trainsets finish 10,000km running or 2 months continuous running elapsed with achieving performance acceptance criteria? Please clarify the aforementioned.	N/A	The Contractor can demonstrate the test within the shorter timeframe, however, the performance certificate shall only be issue after the completion of DNP. During the DNP, the demonstration of reliability shall cover the achievement of 10,000 km or 2 months of FFR and the fleet (7 trainsets) shall achieve a Mean Distance Between Failures (MDBF) of 50,000 km causing a delay greater than 5 minutes.
92.	General Bid Bulletin No. 21 Page 2 of 7 Item No. 3	*The bidder's understanding is not correct. Reference to the R.A. 4566 as amended by P.D. No. 1746 provides that no Contractor (including sub-contractors and specialty contractors) shall engage in the business of contracting without first having secured a PCAB license to conduct*	N/A	Please be advised that the PCAB license is not a requirement for CP NS-03.

		business. It is an offence to engage in contracting business without a license first being obtained. Considering the nature of the project, which is Procurement of Rolling Stock, we would like to again clarify whether the Bidder needs to secure a PCAB license despite the facts and/or circumstances below. A. The Scope Of Works (SOW) consists of the following (Volume II of III Part 2 - Employer's Requirements, page 11): 1) Implementation planning for the provision of vehicles; 2) Technical design of vehicles; 3) Driver's Cab and Saloon Mock-Up; 4) Train Operation Simulator Parts; 5) Manufacturing; 6) Procurement of materials, components and subsystems; 7) Delivery of Rolling Stock and Simulator Parts to the Site; 8) Testing and Commissioning of the vehicles; 9) Provision for spare parts and special tools for the Rolling Stock maintenance; 10) Provision of Rolling Stock Operation and Maintenance (O&M) Manuals; 11) Training of personnel; 12) Providing "As-Built" documentation for the vehicles; and 13) Providing engineering service during the Defects Notification Period (DNP);		

		Yet the Contractors' License Law defines a "contractor" as (Section 9 (b) of Republic Act No. 4566): "'Contractor' is deemed synonymous with the term "builder" and, hence, any person who undertakes or offers to undertake or purports to have the capacity to undertake or submits a bid to, or does himself or by or through others, construct, alter, repair, add to, subtract from, improve, move, wreck or demolish any building, highway, road, railroad, excavation or other structure, project, development or improvement, or to do any part thereof, including the erection of scaffolding or other structures or works in connection therewith. The term contractor includes subcontractor and specialty contractor." We believe there is nothing in the SOW that fits in this definition. B: In a previous rail tender, LRT Line 6 Project, Presentation during the Pre-Qualification Conference (GBB2, page 20) https://dotr.gov.ph/images/PPP/2015/LRT6/GBB-02-2016_LRT6.pdf It was shown that PCAB License is not required for Rolling Stock activity as qualification document, even though infrastructure construction and systems construction are required. C. We understand the general rule requiring PCAB license in the bidding of Infrastructure Projects (23.4.2.3, The 2016 Revised Implementing Rules and Regulations (IRR) of the Government Procurement Act). However, the IRR states that it does not apply to the Procurement of Goods,		

		Infrastructure Projects and Consulting Services funded from Foreign Grants covered by the Official Development Assistance Act (RA 8182, as amended), unless the contract between the Philippines and the foreign grantor agree otherwise (4.4, the same IRR). In view of the reasons listed above, does the Bidder still need to secure a PCAB license? If PCAB license is still deemed necessary, • Please advise what would be the appropriate PCAB classification and category which we need to apply? • Please advise when should we acquire PCAB license? As per CP01 Tender GBB9, PCAB license is only required before commencing execution of work (and not during tender stage). We understand PCAB License is not required for bidding. Is our understanding correct?		

Annex B

PACKAGE CP NS-03: ROLLING STOCK - LIMITED EXPRESS TRAINSETS
General Bid Bulletin No. 24
Annex B

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
Volume I Part 1 – Bidding Procedures		
1	Volume I. Invitation for Bids (IFB) Page No. IFB-2 Item 7	Reference to the General Bid Bulletin No. 23, please refer to the amended pages in Attachment 1.
2	Section II. Bid Data Sheet D. Submission and Opening of Bids ITB 24.1 Page No. BDS-10	Reference to the General Bid Bulletin No. 23, please refer to the amended pages in Attachment 1.
3	Section II. Bid Data Sheet D. Submission and Opening of Bids ITB 27.1 Page No. BDS-10	Reference to the General Bid Bulletin No. 23, please refer to the amended pages in Attachment 1.
4	Section II. Bid Data Sheet E. Evaluation and Comparison of Bids ITB 37.1 Page No. BDS-11	The currency that shall be used for Bid evaluation and comparison purposes to convert all Bid Prices expressed in various currencies into a single currency is: Philippine Peso. The source of exchange rate shall be: Bangko Sentral ng Pilipinas (BSP, the Central Bank of the Philippines). The date for the exchange rate shall be: 21 August 2021. In the event of non-availability of exchange rate in the BSP website due to non-working days, the Bidder shall apply the exchange rate of the following working day.

PACKAGE CP NS-03: ROLLING STOCK - LIMITED EXPRESS TRAINSETS
General Bid Bulletin No. 24
Annex B

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
5	Section II. Bid Data Sheet E. Evaluation and Comparison of Bids ITB 38.2 (c) Page BDS-11	Replace ITB 38.2 (c) with the following: "price adjustment due to discounts offered in accordance with ITB 18.7 or ITB 18.8."
6	Section. II Bid Data Sheet E. Evaluation and Comparison of Bids ITB 38.3 Page BDS-11	Replace ITB 38.3 with the following: "If price adjustment is allowed in accordance with ITB 18.5, the estimated effect of the price adjustment provisions of the Conditions of Contract, applied over the period of execution of the Contract, shall not be taken into account in Bid evaluation."
Volume II Part 2 – Employer's Requirements		
7	ERT-67 8.1.7	<u>Revised clause 8.1.7 to 8.15:</u> <u>Updated clause 8.1.5:</u> Diffuser shall be arranged in consideration with the window seat side distribution and its accessibility for cleaning and maintenance.
8	ERT-114 22.7.4.1	<u>Updated clause 22.7.4.1:</u> The occurrence of independent failures with the same root cause of the same warranted item during the Defect Notification Period and within a six (6) month consecutive moving window, that exceeds

PACKAGE CP NS-03: ROLLING STOCK - LIMITED EXPRESS TRAINSETS
General Bid Bulletin No. 24
Annex B

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
		more than 10% percent, or at least three (3) of the total number of identical items supplied may be declared a fleet defect or pattern failure.
9	ERT-134 21.2.9	Updated clause 21.2.9: For equipment suspended from the underframe, the load of the equipment on each bolt shall not the clamp load of the bolt. Set screws shall not be used. Where practical, load on the bolts shall be no greater that that exerted when the bolt is tightened to its recommended torque. When practical loads shall be on structural cross beams etc. Huck bolts can be used according to their strength specification unless otherwise proposed by the Contractor.
10	ERT-131 20.6.9 & 20.6.10	Deleted clause 20.6.9 & 20.6.10
11	ERT-4 1.2.12.2, 1.2.12.5	Updated clause 1.2.12.2: If the meeting is to review or present design information or other material, such material shall be forwarded to the Engineer not less than 15 working/calendar days prior to the meeting. Updated clause 1.2.12.5: The Contractor shall, within 3 working/calendar days after the date of the meeting, submit minutes of each such meeting to the Engineer, detailing all issues raised during the review, their resolutions or ongoing design status and due date for resolution.

PACKAGE CP NS-03: ROLLING STOCK - LIMITED EXPRESS TRAINSETS
General Bid Bulletin No. 24
Annex B

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
12	ERT-135 21.4.8.1	Updated clause 21.4.8.1: Wires shall be segregated according to JRIS or IEC standards.
13	ERT-35 2.8.2.4	Updated clause 2.8.2.4: The stiffness and strength of the steps and their connections shall be designed and tested to allow use by a person exerting a force of 1.3 kN (load applied at angle of 45 degrees), without permanent deformation.
14	ERT-43 4.1.8	Updated clause 4.1.8: Cable hoses or flexible conduits shall be made out of high quality, weather and abrasion resistant insulated rubber or other materials, subject to approved by the Engineer.
15	ERT-47 – 48 5.7.3, 5.7.6	Updated clause 5.7.3: The seats shall be ergonomically designed and the materials to be used in the seat design shall be soft type with moquette, stain repellent, anti-microbial treated, and flame retardant treated. Fire performance testing shall be undertaken by the Contractor with review by the Engineer. The seat design shall eliminate gaps as possible to allow easy cleaning. Updated clause 5.76:

PACKAGE CP NS-03: ROLLING STOCK - LIMITED EXPRESS TRAINSETS
General Bid Bulletin No. 24
Annex B

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
		The seat design shall be ergonomically designed for passenger comfort, aesthetically pleasing, and eliminated gaps as possible to allow easy cleaning.
16	ERT-49 5.10.3	Updated clause 5.10.3: The power supply (AC220V, 1-phase, 60 Hz) outlet shall be installed in the car for future provision of vending machines. The location shall be submitted to Engineer for review and given statement of No Objection. Four (4) vending machine spaces shall be provided per train, one spaces in each leading car, two spaces in the middle cars.
17	ERT-58 6.5.5	Updated clause 6.5.5: Headlight (LED) shall be able to be accessed either from outside or inside of the driver cab. The optical axis of head lamps shall capable of being easily adjusted.
18	ERT-60 7.1.2	Updated clause 7.1.2: Two (2) electrically or pneumatically operated doors shall be provided on each side of every car. All doorways shall have a clear opening of 900 mm, as minimum, (1300mm is preferred as this allows 2 streams of passengers to alight/board simultaneously see TCRP report 13) and a clear height of 1850 mm.

PACKAGE CP NS-03: ROLLING STOCK - LIMITED EXPRESS TRAINSETS
General Bid Bulletin No. 24
Annex B

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
19	ERT-81 11.1.6	Updated clause 11.1.6: Load weighing shall be provided for all car weights up to crush loading condition W3. The failure of electric braking to provide the requested performance shall initiate supplemental friction braking.
20	ERT-64 7.3.21.1	Updated clause 7.3.21.1: Adjacent to each doorway in the car shall be installed an emergency door opening handle, (Emergency Egress Device) which may be used by passengers to open the one door in the event of an emergency. The position and function, numbers of emergency door opening device shall be reviewed by the Engineer.
21	ERT-67 8.2.6	Updated clause 8.2.6: Air filters shall be washable/re-useable and shall be well supported to prevent passing air from dislodging them shall the filters become saturated. They shall seal well at all edges. The filters shall be easily replaced and shall be sized such that they shall be serviced monthly.
22	ERT-72 9.1.11	Updated clause 9.1.11: Several sensors shall be incorporated to brake system. Adequate quantity of Sensors shall be equipped to brake cylinders and air suspensions, as a minimum. These data detected by sensors shall be transmitted to Brake control unit, and shall be utilized for control of propulsion, brake and ATO and etc.

PACKAGE CP NS-03: ROLLING STOCK - LIMITED EXPRESS TRAINSETS
General Bid Bulletin No. 24
Annex B

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
23	ERT-77 10.2.7	Updated clause 10.2.7: The operation of air compressors shall be managed to average each compressor's operation ratio. For this control, train line or transmission of TMS may be utilized.
24	ERT-87 12.1.9	Updated clause 12.1.9: Pantograph cover shall be equipped for suppression of aerial noise, in consideration of body oscillations where if required in order to comply with the noise requirement in clause 1.12.
25	ERT-98 15.6.1	Updated clause 15.6.1: Electrical jumper wire that is necessary for transmission between the vehicles shall be specified by TMS supplier and shall have a design life about 8 years
26	ERT-99 – 100 16.2.1, 16.2.2	Updated clause 16.2.1: The CP NS-03 Contractor shall equip each driver's cab with the necessary Human Machine Interface (HMI) facilities for the operation, control and monitoring by the driver of the on-board communications systems. The number of handsets required for driver use shall be rationalized and kept to a minimum. In particular, the CP NS-03 Contractor shall utilize a dedicated monitor or TMS monitor with respect to the display. Update clause 16.2.2:

PACKAGE CP NS-03: ROLLING STOCK - LIMITED EXPRESS TRAINSETS
General Bid Bulletin No. 24
Annex B

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
		Subject to any reliability constraints, both CP NS-03 and CP NS-01 Contractors shall consider the integration of all communication operator functions into a different or single HMI to optimize space requirements.
27	ERT-102 16.5.5	Updated clause 16.5.5: The destination sign shall be programmable from the a dedicated PIS monitor or the TMS in the driver's cab.
28	ERT-127 20.3.10, 20.4.2.1	Updated clause 20.3.10: Before transporting the Rolling Stock to Manila, the Contractor shall perform a test to demonstrate that the Emergency Braking and service requirements have been met each design deceleration. Tests that cannot be carried out at Bidder's test facility will be carried out on the main line after the vehicle has been delivered to Manila. Updated clause 20.4.2.1: The Contractor shall perform a FAT to ensure that the systems are functioning correctly before shipment of the trains. The Tests shall be conducted in the test track and other special test facilities of the Contractor. Tests that cannot be carried out at Bidder's test facility will be carried out on the main line after the vehicle has been delivered to Manila.

PACKAGE CP NS-03: ROLLING STOCK - LIMITED EXPRESS TRAINSETS
General Bid Bulletin No. 24
Annex B

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
29	ERT-135 21.4.2.2	Updated clause 21.4.2.2 (5): Wires 6 mm2 and smaller shall have the appropriate insulation material as defined above. Wires larger than 6 mm2 shall be insulated only with Cross-linked Polyolefin (XLPO) or JRIS standard insulation material.
30	ERT-72 9.2.4	Updated clause 9.2.4: The parking brakes shall be with spring- applied park brake function, through air release brake actuators, and shall be capable of holding 10 cars train-set in W2 (7t payload) loading condition on a 3.5% grade under all track conditions indefinitely. Parking brakes shall be installed in each leading car and more cars if needed to meet the above performance requirement unless otherwise proposed by the Contractor
31	ERT-55 5.19.2.6, 5.19.2.7	Updated clause 5.19.2.6: The driver's key shall be removable or not removable when The Master Controller is not in the predetermined Emergency position. The Master Controller will be interlocked electrically or mechanically. Updated clause 5.19.2.7: The driver's key shall be removable or not removable when The Reversing Switch is not in the predetermined OFF(Neutral) position. The Reversing Switch will be interlocked electrically or mechanically.

PACKAGE CP NS-03: ROLLING STOCK - LIMITED EXPRESS TRAINSETS
General Bid Bulletin No. 24
Annex B

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
32	ERT-58 6.5.4	Updated clause 6.5.4: The light intensity of headlights shall comply with Table.7 in item 5.2.1 of JRIS R 1646 or any equivalent standard.
33	ERT-43 4.1.4	Updated clause 4.1.4: The automatic coupler shall, in conjunction with the draft-gear automatically effect mechanical and pneumatic coupling for two (2) Limited Express Train or identically coupling head. It shall also permit separation of units either by manually from the track side and/or remotely from the cab.
34	ERT-130 20.5	Added clause 20.5.3: All trains shall undergo Fault Free Running during the integrated testing and commissioning. Each train is required to complete 1,500 km fault-free operation on the Main Line. Any issue occurred during trial running shall be fully resolved before restarting the trial run. Added clause 20.5.4: In the event major failure occurred during the trial running, the trial run mileage shall be re-started from zero after the rectification is completed. For minor failure, the trial run mileage shall be continued after the rectification is completed. Added clause 20.5.5:

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
		The Contractor shall propose the failure criteria in the Testing and Commissioning plan for review and given notice of no objection by the Engineer. Added clause 20.5.6: The Contractor shall ensure proper wheel profiling after the Trial Running completed and compensation on wheel to be profiled due to failure during TNC. Added clause 20.5.7: The Contractor may apply by notice to the Engineer for a Taking-Over Certificate not earlier than 14 days before the successful completion of FFR.
35	ERG-46-53 8-System Assurance	Updated clause 8.1.3: The System Assurance activities shall cover and not limited to the System Assurance Management, System Safety (including the Electromagnetic Compatibility (EMC), Fire Safety) strategy, Software Management and Control, Reliability, Availability, Maintainability (RAM), Hazard Log Management Procedures; System Risk Management Plan including Risk Assessment Methodology, Safety Critical Items List (SCIL), Reliability Critical Item List (RCIL), Design Safety Study Report, Safety Cases, RAM Demonstration Test Report, Failure Recording and Data Reporting and Corrective Action System reports. Updated clause 8.1.7:

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
		A Taking Over Certificate (TOC) will be issued for each trainset. In order to obtain a TOC for the Rolling Stock from the Employer/Engineer, it is required that each trainset achieves 1,500 km of Fault-Free Running (FFR) during the integrated testing and commissioning. Updated clause 8.1.8: A Performance Certificate will be issued by the Engineer for the total performance of the fleet. This Performance Certificate is required to be achieved by the end of the Defect Notification Period (DNP). Replaced clause 8.2: **Safety Integrity Level** The CENELEC standard specifies five Safety Integrity Levels (SILs). The required Safety Integrity Level shall be decided on the basis of the level ofrisks. The Contractor shall set a SIL at functional level and functional modules level. The Contractor shall assign to all Systems/Subsystems/Components a Safety Integrity Level when relevant. The Contractor shall propose design, implementation techniques and measures depending on the SIL of the function to be performed by each individual System, Subsystem or Component. Replaced clause 8.3: **Quality Assurance** The Contractor shall implement the relevant part of [ISO 9001] standard in accordance with EN 50126 standard. Verification activities conducted to ensure that design and development outputs meet the input

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
		requirements are included in these activities. The Contractor shall provide a Quality Assurance Plan covering all safety-related systems, whatever their SILs. In connection with its Quality Assurance Plan, the Contactor shall provide a System Development Plan covering all re-used, newly developed or modified systems. <u>Replaced clause 8.4:</u> **Risk Mitigation Strategy** According the level of their acceptability, the risks shall be managed in different ways. Acceptable and unacceptable risks *Unacceptable risks (R4) are those which have:* • Catastrophic consequences with a frequency greater than remote, • Critical consequences with a frequency greater than occasional. • Marginal consequences with a frequent frequency. *Acceptable risks (R1) are those which are:* • Of an incredible frequency, • Of an improbable frequency with consequences less than critical, • Of a remote frequency with insignificant consequences. Since no prevention / mitigation measures shall cover these risks, the allocation of risks to these two categories has to be thoroughly documented.

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
		Other risks *Other risks (R2 and R3) are those risks, which have:* • Insignificant consequences with frequent frequency, • Marginal or insignificant consequences with probable frequency, • Critical, Marginal or insignificant consequences with occasional frequency, • Catastrophic, Critical or Marginal consequences with remote frequency, • Catastrophic or Critical consequences with improbable frequency. These risks need to be discussed in writing and submitted to the Engineer for acceptance of both the risks and the corresponding prevention / mitigation measures. For the justification, discussion of the mitigation measure. The following shall be addressed: Residual risk, cost of the measure. Alternative measures will be proposed, The feasibility and cost of the measures is an important part of justification / discussion, Input data used in the assessment, justification, discussion shall be provided with reference of their origin and copy of the statements to be considered, Measures of SILs equal or greater than 2 shall be stated in the safety analysis. To demonstrate the risk has been reduced ALARP, the following criteria shall be used (in order of priority): show compliance with international standards use of product already accepted by internationally recognized railways agency perform a Cost Benefit Analysis The Cost Benefit Analysis should be used as less as possible; priority shall be given to technical argument.

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
		To conduct of the safety analysis, safety analysis(s) must be conducted which the following minimum requirements: The safety objective is reached when the level of risk has reached the "acceptable" area with acceptable justification, Every safety-related function shall be identified and assessed for its related hazards, Every safety-related constituent shall be identified and assessed for its related hazards, Every safety-related interface shall be identified and assessed for its related hazards. Link between safety objectives and SIL's shall be assessed regarding EN50126 requirements. The following links shall also be used as possible guidance. They have been issued by expert judgement: Functions which failure can lead to an unacceptable risk with catastrophic consequences shall be supported with SIL4 constituents, Functions which failure can lead to an unacceptable risk with critical consequences shall be supported with SIL3 constituents, Functions which failure can lead to an R3 or R2 risk shall be supported with SIL2 constituents, Functions which failure can lead to an R1 risk shall be supported with SIL1 constituents. Implementation of SIL constituents, equipment shall have a SIL at least equal to the functions it implements. As a minimum, SIL 4, SIL 3, SIL 2 and SIL 1 constituents shall comply with the following requirements: Compliance to standards referenced by the Contractor Quality assurance, Safety assurance.

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS

Recognized techniques used in the railway application for implementation of SIL 4 or 3 constituents are as follows:

"Fail safe" technique,

"Checked safety" technique,

"Probabilistic safety" technique,

"Safety concept" approach of the programmable electronic equipment,

Use of "safety software",

Use of "proven safety" techniques.

These main safety techniques are presented and developed in EN50128 and EN50129 standards.

SIL Safety Targets

For an eventual implementation of SILx functions by the means of "probabilistic safety", the Mean Time Between Hazardous Event could be given in the table below:

Safety Integrity Level	Frequency of dangerous failure per hour
4	$\geq 10^{-9}$ to $<10^{-8}$
3	$\geq 10^{-8}$ to $<10^{-7}$
2	$\geq 10^{-7}$ to $<10^{-6}$
1	$\geq 10^{-6}$ to $<10^{-5}$

Mean Time Between Hazardous Event

Systems Engineering Management

The Contractor shall apply a suitable Systems Engineering Process (SEP) in order to provide assurance that

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
		the final operating system shall achieve the conceptual design intent. The Contractor shall provide the Systems Engineering Management Plan, which describes the program's overall technical approach, including systems engineering processes, resources, and key technical tasks activities. These shall be integrated with the program management control efforts, including technical performance measures, Examples of suitable methodologies are: IEEE 1220 Standard for the Application and Management of the Systems Engineering Process EIA 632 Systems Engineering The Contractor with consent of the Engineer may propose an alternative methodology. Engineering Safety Management The Contractor shall apply a suitable Engineering Safety Management System. The Contractor with consent of the Engineer may propose an alternative methodology. RAM Management The Contractor shall apply a suitable RAM Management System Contractor shall provide a RAM demonstration plan. RAM Activities In order to provide confidence, that the final operating system shall achieve the requirements of the Performance Measures, Contractor shall undertake RAM assessments at appropriate stages of the project. The scope of RAM activities shall include: RAM requirements capture and definition; Preliminary RAM Analysis Derivation and Apportionment of RAM targets

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
		RAM requirements allocation; Integration of existing sub-system and lower level RAM requirements that contribute to the achievement of system level requirements; Management of RAM activities Collation, interpretation and presentation of RAM results RAM activities should include RAM Assessment, RAM Testing, RAM Demonstration and Failure Recording. The RAM activities during theproject shall be reported and copied to the Engineer. Design RAM Analysis The Contractor shall demonstrate that they are able to meet the RAM targets given, or the Contractor may opt to carry out a target apportionment analysis to work out their own targets and submit a target apportionment report thereafter for acceptance by the Engineer. Nonetheless, the Contractor shall lay down their intention in his RAM Demonstration Plan in the first place for acceptance by the Engineer. RAM analyses shall be conducted at equipment level, and shall be extended to a component level. The methodology (e.g. using reliability block diagram, Fault Tree Analysis (FTA) or Failure Modes, Effects and Criticality Analysis (FMECA)) shall be specified in the RAM Demonstration Plan and review and given notice of no objection by the Engineer. A RAM analysis report shall be submitted to the Engineer for review and acceptance to demonstrate the predicted RAM performance meets the RAM performance targets as stipulated in this Section. Assurance Management All assessments shall be reported in a format as agreed with the Engineer. Contractor shall submit monthly progress report describing the progress achieved, based on milestone schedule tasks identified in the SA Plan.

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
		The deliverables shall include but not be limited to: Systems Assurance Plan (including Safety); Systems Engineering Management Plan; Systems Assurance Quality Manual; Systems Assurance Management Procedures; RAM Demonstration Plan RAM Analysis Report RAM Testing/Commissioning Plan; Hazard Log; Safety Assessment Reports; RA Safety Critical Items List; RAM Demonstration Report; and Data Recording and Corrective Actions System (DRACAS). Systems Assurance Audits External Audits - The Contractor's Systems Assurance process shall be subject to audits conducted by the Engineer throughout the Contract. These audits shall involve support from the Contractor's system assurance team. The Contractor shall render support throughout and the Contractor's Project Manager and System Assurance Manager shall attend. The Contractor shall rectify any outstanding items identified at the RAMS audits and return to the Engineer by the dates agreed with the Engineer's RAMS auditors. The programme shall include, but not be limited to:

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
		Auditing for compliance with selected standards specified in the SA Plan; Checking that the RAMS requirements are adequately met; Internal Audits – The Contractor shall perform RAMS audits on the Contractor's organization, the Contractor's subcontractors and consultants and any parties who are involved in the Contractor's works and have RAMS responsibilities thereof. The Contractor shall identify in the Contractor's System Assurance Plan the Contractor RAMS audits with dates at which the Contractor shall conduct their RAMS Audits throughout. The Contractor shall notify the Engineer of the Contractor's RAMS audits at least 2 weeks in advance and invite the Engineer to take part at the discretion of the Engineer. The Contractor shall submit their internal RAMS audit reports to the Engineer for review. System Assurance Organization The Contractor shall establish a system assurance organizational structure that assumes the system assurance responsibilities and enables effective communication among all relevant parties during the system assurance process. The Contractor shall appoint a System Assurance Manager (SAM). The SAM shall be responsible for all system assurance tasks as well as hosting and facilitating the Hazard Identification Workshops. The SAM shall be the author or reviewer of every System Assurance submission. When the SAM is not available for a workshop or meeting, the SAM shall be represented by a delegate who is review and acceptance by the Engineer. The incumbents for the SAM and SAM delegates (if any) shall possess at least 8-year relevant experience and skills of system assurance in the railway industry. The Contractor shall submit the curriculum vitae of their SAMs and SAM delegates (if any) to the Engineer for acceptance prior to appointment(s). The Contractor shall write to the Engineer for acceptance in case of change of their SAMs or SAM delegates. All meetings and workshops specified thereof shall be hosted in Manila at venues arranged by the

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
		Contractor. All key participants from the Contractor and his sub- Contractors shall be physically present in the meetings and workshops thereof. Records of RAMS related meetings by way of meeting minutes or the like shall be produced by the Contractor, subject to review by the Engineer, regardless of whether the Engineer was present. The contractor shall attend RAMS related meetings called by the Engineer and will be notified accordingly. System Assurance Plan The Contractor shall prepare and submit a Systems Assurance (SA) Plan before any design begins. The SA Plan shall define all management and technical activities during each stage, which are necessary to ensure that safety related system, achieve and maintain the required systems assurance objectives. The SA Plan shall: Define all phases of the project from the planning to handover; Describe the Systems Assurance organization; Define the responsibilities and competencies of personnel responsible for implementing the Systems Assurance programme and undertaking the Systems Assurance activities; Outline the Contractor's approach, procedures and schedules for conduct of reliability, availability, maintainability and safety during all the above phases. The schedules shall detail all the systems assurance activities and associated milestones and deliverables; Procedures for monitoring and control of system assurance activities of the Contractor/Sub-contractors Internal audit programme Identify the interfaces with Subcontractors. All system assurance reports generated by the Contractor and the associated sub- contractors and suppliers shall be submitted for review and acceptance. The Programme of system assurance tasks for the Contactor

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
		shall include, but not be limited to the following: Theoretical system assurance analyses and their associated reports, which shall include, but not be limited to: Preliminary Hazard Analysis Report Deterministic Safety Assessment Report Interface Hazard Analysis Report System Hazard Analysis Report Operating and Support Hazard Analysis Report Safety Integrity Level Analysis Report Failure Mode, Effects and Criticality Analysis Report Quantified Risk Assessment/Fault Tree Analysis Report Safety Verification (Safety Critical Item) Report The deliverables shall include, in addition to those aforementioned, but not be limited to the following: Systems Assurance Plan (including Safety, RAM); Systems Engineering Management Plan; Systems Assurance Quality Manual; Systems Assurance Management Procedures; RAM Testing/Commissioning Plan; Hazard Log;

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
		Safety Assessment Reports; RAM Assessment Reports; Safety Critical Items List; RAM Demonstration Test Report; Data Recording and Corrective Actions System (DRACAS); Safety Case for Design; Operational Safety Case (draft); Operational Safety Case (Final); and; Any other submissions at the request of the Engineer RAMS and Design Safety Review The Contractor shall hold RAMS Review meetings periodically with a view to: Reviewing the progress of all SA activities against the System Assurance Plan, Reporting on status of compliance with the SA requirements, and; Confirming whether the RAMS analyses reflect the latest design to date. The Contractor shall evaluate any design changes arising as a result of the Contractor's RAMS analysis for any potential RAMS impacts. The Contractor shall update their RAMS analysis reports accordingly. Should a RAMS analysis necessitate a design change, the Contractor's design change request as a result shall be submitted with sufficient technical information to the Engineer for review and given notice of no objection. The Contactor shall invite the Engineer for any RAMS and Design Safety Review meetings and

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
		notify the Engineer thereof at least 2 weeks in advance. Safety Case for Design and Pre-Operation Safety Case The Contractor shall summarize in a Safety Case for Design and Operational Safety Case respectively for review and given notice of no objection by Engineer and the approval by ISA. The Contractor shall provide a Statement of Safety that the Works are fit for the purpose and safe for the revenue service in the Contractor's Safety Cases. The Contractor shall submit the Contractor's Design Safety Case by the end of the design phase as documented proof of safety for a Statement of No Objection by the Engineer. The Contractor shall submit the Contractor's Pre-Operational Safety Case (draft) two months prior to the commencement of the revenue service for review and the Contractor's final Pre-Operational Safety one month prior to the commencement of the Commercial Train Operation for a Statement of No Objection by the Engineer. The Contractor's safety cases shall include a summary for the following as a minimum: Introduction: The Contractor's scope of works Scope of the Safety Cases System Description: The key safety features and the interfaces of the Contractor's works Evidence of Quality Management: The Contractor's Quality Management System and their activities devoted towards the works Evidence of System Assurance Management: The Contractor's System Assurance Management System and their activities devoted towards the works Technical Safety Report: Risk assessments, hazard management, RAMS targets and their fulfilment, status and details, mitigation measures etc. Operations and Maintenance: Assumptions used for design, Operations and maintenance procedures related to the Contractor's works for normal, degraded and emergency conditions,

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
		plans/strategies for training, modification and operational changes. Recommendations and Restrictions: restrictions to be applied for the Contractor's works and recommendations for safety and efficiency improvement Conclusions: a statement of safety and description on how safety of the system is achieved and continuously to be achieved. References: a list of all the documents/standards referred by the Contractor. Safety Inspection On-site safety inspections may be conducted by the Engineer so as to identify any other potential hazards against the applicable safety requirements and the mitigation measures described in the Contractor's hazard log and the Deterministic Safety Assessment (DSA) report. The Contractor shall provide support and the Contractor's System Assurance Manager and Design Manager shall attend. The Contractor shall update the Contractor's SA deliverables accordingly as a result of the Safety Inspections. Operational Safety Requirements Hazard log The Contractor shall produce an operational hazard log with entries of hazards which may affect the safety and / or reliability of the Limited Express Train operations due to design, construction, installation, testing, commissioning, operations and maintenance of the Works. The design shall incorporate the safeguards identified in the hazard log where applicable. The format of the hazard log shall be provided by Contractor's and shall be submitted to the Engineer for Review and given notice of no objection. References to relevant information / analysis items shall be included in the hazard log to describe the source(s) of the operational hazards identified. Operational Hazard Identification

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
		The Contractor shall conduct formal operational hazard identification workshops and analyses to systematically identify relevant operational hazards which may affect the safety and / or reliability of Limited Express Train operations. The methods of analysis (e.g. hazard and operability study) shall be review and given notice of no objection by the Engineer. The operational hazard analysis shall cover system / equipment hazards, interface hazards and operations & support hazards. All protection measures identified which are designed to eliminate, control, or mitigate the effect of potential operational hazards shall be documented Operational hazard identification workshops shall be conducted by the Contractor during the early stage of the Works for which the Engineer shall be invited, to identify the operational hazards and propose appropriate mitigation measures. The scope, purpose and methodology to be applied of the workshops shall be detailed in the form of HAZOP guidance notes and a copy thereof shall be submitted to the Engineer for Review and given notice of no objection. Records of such workshops by way of meeting minutes and Hazard Log (Workshop) shall be produced for review by the Engineer. The Contractor shall make efforts to identify pertinent operational hazards with respect to the following areas, among other things: New and specific design functions or applications; Location specific design features or site restrictions; Different designs compared with the interfacing operating railway lines, if any, which may introduce compatibility and / or inter- operability issues; Changes in operating assumptions or design compared with the specified requirements, causing impacts on operation and interfacing systems; Requirements for the introduction of new operating procedures, temporary or permanent operating restrictions; and Human error prone activities due to complicated operation and maintenance, different equipment design principles, human machine interface or nomenclature within the same

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
		operating environment. Construction activities that may affect existing railway operations. The Contractor shall enter all the identified operational hazards into the Hazard log and a copy thereof shall be submitted to the Engineer for review thereafter. Operational Hazard Management All the operational hazards identified shall be assessed in accordance with the "Risk Matrix for Operational Hazard Management" which shall be provided by the Contractor and for the Engineer review and given notice of no objection. The Contractor shall also make every effort to ensure that there is no duplication of operational hazards. The Contractor shall review and resolve the operational hazards in the Operational Hazard Log in accordance with the following principles: Operational hazards with a residual risk rating of R3 or R4 are not acceptable. The Contractor shall propose safeguards to mitigate the risk to Level R1 or R2 timely to avoid last-minute changes. Unless the Contractor can demonstrate that design solutions have been duly explored but in vain, the use of other mitigation measures, such as operating / maintenance procedures or training of operating / maintenance staff, will not be accepted as suitable safeguards; and Should there be any operational hazards with a residual risk at R2 but of particular concern, The Engineer may request the Contractor to provide evidence to show that the risks of such operational hazards have been reduced to as low as reasonably practicable (ALARP). Should there be any operational hazards requiring more accurate risk evaluation, The Engineer may request the Contractor to carry out quantitative risk analysis, e.g. fault tree analysis and/or event tree analysis, to assess the risk levels of particular operational hazards. The Contractor shall at least review quarterly the progress of the operational hazard resolutions in the

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
		Hazard log and submit an updated Hazard log (in Microsoft Excel) to the Engineer until all the operational hazards are closed out. Should there be any operational hazards which arise from construction activities and may affect existing railway operations, monthly reviews shall be conducted thereto. For operational hazards requiring design safeguards to resolve, the Contractor shall provide sufficient close-out information and evidence to the Engineer for design change review and acceptance. All safeguards and method statements for controlling installation / construction hazards shall be in place before the installation / construction of the relevant part of works is allowed to commence. The close-out of operational hazards shall be done in a timely manner. O&M safeguards which are incorporated into the O&M manual shall be put in force prior to Trial Running. Operational hazards shall only be closed when the agreed safeguards and cross-references to back up relevant evidence such as design submissions, calculations, inspection records, testing and commissioning results, as-built drawings etc. are provided for review to the satisfaction of the Engineer. Deterministic Safety Assessment The Contractor shall perform a Deterministic Safety Assessment (DSA) to demonstrate that relevant safety requirements have been conformed to and safety principles applied in the Works. It forms the main qualitative, non- numerical, assessment of the safety of the Works supplied in this Contract. Purpose To assess the design in respect of the application of, and compliance / non-compliance with the current codes and standards; and To identify and assess any design safety principles associated with each aspect of the design, and confirm compliance / non- compliance with these principles. Procedure The DSA forms the main qualitative, non-numerical, assessment of design safety. The Contractor

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
		shall use the DSA to evaluate conformance of their design with current accepted practices. The DSA shall review the design against applicability and relevance with respect to the: i) Contract requirements; ii) Codes, regulations and standards; and iii) Design safety principles In the event that the DSA has identified any Contractor' submissions or designs which do not fulfil the system safety requirements such as accepted codes, standards and regulations, the Contractor shall justify themselves by way of operational hazard review / quantitative risk assessment. The relevance and applicability of the design safety principles specified shall be checked and confirmed against normal, degraded and emergency operations of the system. The results of the DSA shall be documented using the template provided by the Contractor. The Contractor shall submit a copy thereof in Microsoft Excel to the Engineer for Review and given notice of no objection prior to completion of the design and construction. The results of the DSA are used to demonstrate compliance with the accepted codes, regulations and standards, and design safety principles for safe operations of the system under normal and degraded operations and credible emergency situations. The Contractor shall provide cross-reference numbers to back up documentary evidence e.g. design submissions, drawings, calculations, etc. to prove compliance with all safety requirements stated therein. In case of non- compliance, full justification by way of operational hazard review / Quantitative Risk Assessment (QRA) shall be provided to the Engineer for review and given notice of no objection. RAM Demonstration

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
		RAM Demonstration Plan The Contractor shall submit a RAM Demonstration Plan at least 90 Days before the commencement of the DNP for Review and given notice of no objection by the Engineer. The RAM Demonstration Plan shall include: - i) organization, responsibility and key personnel of the system assurance demonstration; ii) Approach, including test methods, failure assessment, reliability calculation, etc., to demonstrate achievement of RAM target and; iii) a programme summarizing the key activities. The demonstration of compliance with the RAM targets shall be achieved within the DNP. The RAM Demonstration Plan shall describe the Data Reporting Analysis and Corrective Action System (DRACAS) and the procedures for collection, analysis, correction and documentation of data. DRACAS shall be used to ensure all incidents are accurately and consistently categorized as to cause, significance, frequency and chargeability. The DRACAS shall log data on integrated tests and trials, failures, performance and maintenance from the start of integrated testing up to and including the DNP. RAM Demonstration Report The Contractor shall submit a RAM Demonstration Report within 1 Month before expiry of DNP. Interim results, which include DRACAS records, RAM performance statistics and comparison of the RAM targets, shall be submitted to the Engineer monthly during the DNP. The report shall provide evidence that the respective RAM targets have been achieved and shall include any supporting information and calculations. The RAM performance presented in the RAM Demonstration Report and monthly interim results shall be calculated by taking the average of RAM performance for the period starting from the date of the train taking over certificate or a date to be agreed with the Engineer, to the Month during which the RAM Demonstration Report or the interim

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
		results are prepared. The Contractor shall describe the details of each failure case in the RAM Demonstration Report and interim reports. The details of each failure case shall include time, date, duration of train service disruption, response time, recovery time, cause of incident, symptom, alarm, and remedial action taken etc. Failure to Achieve RAM Targets Should any RAM targets cannot be achieved, The Contractor shall, subject to the Engineer's Review and given notice of no objection, take whatever prompt and effective action deemed necessary to meet the requirements. In the event that any RAM target is not achieved at the end of the DNP of the Work, the demonstration of the achievement of the targets shall be extended at least 1 Month and repeated at monthly intervals based upon the performance of the Works over the past 12-Month period, until the requirement is achieve. <u>Replaced clause 8.5:</u> **Reliability, Availability, Maintainability and Safety Targets** Overall System The overall system shall be developed in order to protect people and environment against the risks induced by the Malolos Clark Railway Project (MCRP) and the North South Railway Project-South Line (NSRP-S) system, and to protect this system against its environment. Most of identified hazards have been granted to systems composing the Malolos Clark Railway Project (MCRP) and the North South Railway Project-South Line (NSRP-S) overall system. However, the electric hazards and fire hazards shall be treated at overall system level: -

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS

Top Safety targets

The global Risk Criteria under normal and/or degraded mode operations shall be as specified in the following Table:

Classification on Individual	Individual Risk Design Safety Value (probability of death per year)	
	Limit of Tolerability (LOT)	Limit of Acceptability (LOA)
Passenger	10E-6	10E-8
Public	10E-6	10E-8
Employee	2x10E-5	10E-7

Global Risk Criteria

The top safety targets for the Works shall be equivalent to or better than these values.

At subsystem level, any wrong side failure of key safety critical subsystems must be shown to be better than 10^{-9} per hour and the specific safety targets that are identified for each subsystem in the following sections shall be achieved.

Where equipment is installed to provide safety critical function for multiple location the wrong side failure of equipment must be shown to be better than 10^{-10} per hour.

Replaced clause 8.6:

Electrical hazards

Electrical hazard is not only linked to the power supply subsystem. Electrical risk must be treated with a System level point of view, in order to protect people against electrocution, and to mitigate the consequences of stray currents and electrical disturbances due to:

Malolos Clark Railway Project (MCRP) and the North South Railway Project-South Line (NSRP-

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
		S) transportation system on its environment (EMC), Environment on the Malolos Clark Railway Project (MCRP) and the North South Railway Project-South Line (NSRP-S) transportation system (EMC), These following concept design documents will address these topics: Preliminary Earthing, Bonding, Lightning protection and Stray currents report [CD E&B] Preliminary EMI / EMC (Electromagnetic Interference / Electromagnetic Compatibility) plan [CD EMI/EMC] As a minimum, the following standard shall be applied within the development of the Malolos Clark Railway Project (MCRP) and the North South Railway Project-South Line (NSRP-S) Transportation System: EN 50121, EN 50122-1, EN 50122-2. Replaced clause 8.7: **Fire safety requirement** As for the electrical risk, fire safety of the system shall be treated with a system level point a view. Replaced clause 8.8: **Rolling Stock** The following Safety Functional Requirements have been identified. Safety Integrity Levels have been allocated to them regarding the gravity of consequences of hazards they are covering.

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS

This is only a guideline; the Contractor will remain responsible for performing extensive safety analysis and allocate Safety Integrity Level for any safety critical or safety related function.

In addition, the Limited Express Train shall comply with the requirement of the EN 45545 or equivalent standard regarding Fire Safety requirement.

Safety Functional Requirements	Safety Integrity Level (SIL) associated with
In case of loss of train integrity, emergency braking shall be triggered on each car of the consist.	4 (Safety critical)
In case of emergency braking, the braking performance shall be guaranteed.	4 (safety critical)
Any failure in the braking system shall not lead to a total loss of braking	4 (safety critical)
Parking brake on each car	3 (safety critical)
Unwanted opening of door shall trigger emergency braking	4 (safety critical)
Movement of train with open door shall be prevented	4 (safety critical)
Kinetic energy of doors shall be limited	3 (safety critical)
Obstacle shall be detected on door closure	3 (safety critical)
Manual opening of at least three quarters of the doors and the platform screen doors in each passenger car shall be possible when the train is immobilized.	4 (safety critical)
50% of air conditioning power shall be guaranteed	2 (safety related)

		SIL associated with Rolling Stock safety functional requirements Safety Integrity Level Analysis The Contractor shall be responsible for performing extensive safety analyses and allocate SIL levels for any safety critical or safety related functions in the Contract in accordance with the EN50126 and demonstrate the achievement of the SIL requirement specified in this Appendices of the for review and given notice of no objection by the Engineer. A Safety Integrity Level Analysis shall be carried out for all safety related system software. The Contractor shall allocate a Safety Integrity Level for each safety related system software. In determining Safety Integrity Level, all causes of failures (including random hardware failures, systematic failures and software errors) which lead to an unsafe state should be included. The Safety Integrity Levels defined in IEC 61508 shall be used. The software design and development process shall comply with the relevant requirements stipulated in EN50128 and EN50129 The Contractor shall demonstrate in the safety analysis that the SIL of software system shall be able to reduce the risk ALARP. The SIL requirement for software shall apply to all applicable system, sub-systems and its interfaces delivering the identified safety functions. The assessment methodology shall be submitted for approval by ISA before commencement of the work and for the PDP's review and acceptance. The Safety Integrity Level Analysis Report is part of the Safety Analysis Report. The Contractor shall submit SIL certification for ISA approval and Engineer's review. <u>Replaced clause 8.9:</u> **Operation and Maintenance** Safe procedures shall be written in order to ensure: A safe utilization of the line for every passenger (in station and trains), Safe working conditions for operator and maintenance staff within the Main line and the Depot area.

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
		These rules and procedures shall be consistent with mitigation requirements from the risks analyses. Added clause 8.10: **Reliability, Availability, Maintainability Targets** The Contractor shall demonstrate that they are able to meet the RAM targets given herein or elsewhere for a service life as defined herein or elsewhere, or the Contractor may opt to carry out a target apportionment analysis to work out their own targets and submit a target apportionment report thereafter for review and given notice of no objection by the Engineer. Nonetheless, the Contractor shall lay down their intention in his SAP in the first place for review and acceptance by the Contractor. The term "failure" shall apply to any event which gives rise to a partial or complete shutdown of the unit or system thereof rendering such a unit or system unable to perform its intended function (including hardware and software) or causes nuisance tripping, either in the form of shutdown or impaired performance which is not in accordance with the performance criteria, but shall exclude those incidents due to loss of external input (e.g. loss of external power supply) or failures due to external influences like flooding, incorrect operations and vandalism. Fleet Defects (Pattern Failures) are failures caused by design defects and are not caused by failure mechanisms such as component wear out. All Fleet Defects (Pattern Failures) shall be counted as failures for the demonstration of the reliability, availability and maintainability requirements during the DNP. Subject to the Engineer's review and Employer acceptance, they may be excluded from the demonstration when the failure mechanism, which is associated with a design defect, is identified and corrective action is satisfactorily retrofitted within a reasonable timeframe in the DNP. Any defects which effect on safety critical system shall be defined as Fleet Defects. Any defects which affect more than ten (10) percentage of the train fleet on non-safety critical system shall be defined as fleet defects and as per ERT clause 22.7.4.

PACKAGE CP NS-03: ROLLING STOCK - LIMITED EXPRESS TRAINSETS
General Bid Bulletin No. 24
Annex B

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
		The Contractor shall rectify such fleet defects, shall include but not limited to the following, in relation to all Limited Express Train: - Fleet wide replacement of all the parts/components Redesign of the concern system Recommission of the concern system The Mean Time Between Failures (MTBF) is the predicted elapsed time between failures of a system / a piece of equipment during operations. The MTBF shall be calculated as an arithmetic mean time between failures of a system / a piece of equipment. All failures shall be countable. The Contractor shall establish their MTBFs, for their systems / equipment of which failures may necessary a maintenance operation. The Mean Time To Repair (MTTR) is the mean active repair time required, on arrival of the maintenance team, to locate and isolate the fault, make repairs, and perform a functional checkout to verify that the equipment has restored to its intended operational status. The MTTR is the total active corrective maintenance repair time expended on the article during a specific period of time divided by the total number of failures requiring corrective maintenance during that same time period. MTTR, measuring System Maintainability, shall be established for systems of which failures may impact the operations of the systems concerned. 'Availability' is the ability of an item to perform its required function at a stated instant of time or over a stated period of time. It is influenced by the combined factors of reliability, maintainability and maintenance support. A system is defined as 'available' when it is operational, with all components fully serviceable to their designed specification. Mean Down Time (MDT) represents the average elapsed time between losing Mission Capable status and restoring the system to at least partially mission capable status. Calculated as the ratio of total downtime over the number of downing events–most often, the total maintenance time over the number of maintenance

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS

events. It is used as a substitute as appropriate MTTR.

Overall System

Failures of equipment may lead to more or less important disturbance on line operations and trains running. In order to provide assurance that the final operating systems shall comply with the high reliability standard to support service quality, Reliability indicators of each system works and their components shall be provided.

Specific reliability indicators

Service Availability and Reliability

For essential system works not limited to signalling, Rolling Stock, telecommunications and power supply system, sufficient system redundancy shall be provided to ensure no single failure shall result in severe service disruption. Apart from the redundancy architecture, periodic self-diagnostic functions should proactively detect problems within the system and send alarms to the operator in the OCC before more serious failure actual occurs. During DNP, the Train Service Availability performance of 100%

KPI	Calculation Formula	Value	Review Period
Train Service Availability	[(Actual Train Trips per Day)/ (Schedule Train Trips per Day)] x 100%	100%	Monthly
Service Reliability	Total operating hours less total system-related delays over total operating hours	99.90%	Monthly

The calculation of the service reliability does not include the failures that are not directly caused by technical failure (as vandalism, suicide, strike…). Moreover, it is also generally

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
		accepted to not take into account the failures that lead to an operational unavailability lower than 5 minutes. The Service Reliability shall be at least 99.90%. Reliability i) The Malolos Clark Railway Project (MCRP) and the North South Railway Project-South Line (NSRP-S) system shall be designed and constructed in such a way so as to guarantee a high degree of reliability in order to provide proper operating service. ii) For essential system works not limited to signalling, rolling stock, telecommunications and power supply system, sufficient system redundancy shall be provided to ensure no single failure shall result in severe service disruption. iii) Apart from the redundancy architecture, periodic self-diagnostic functions should proactively detect problems within the system and send alarms to the operator in the OCC before more serious failure actual occurs. Maintainability i) The maintainability of the train reflects its ability to be restored to its operation specification level within a stated period and under specific maintenance conditions. The aim is to reduce the costs and delays and to improve the availability of the Malolos Clark Railway Project (MCRP) and the North South Railway Project-South Line (NSRP-S) system. The Contractor shall submit the maintainability targets with benchmark other current operation railways for review and acceptance by the Engineer and with compliance to Clause 8.10.11(IV) . <u>Rolling Stock</u> Each consist shall be designed for a service life of 30 years. Each consist shall be able to operate for 19 hours a day, 7 days a week, with engineering downtime of 5 hours a day.

PACKAGE CP NS-03: ROLLING STOCK - LIMITED EXPRESS TRAINSETS
General Bid Bulletin No. 24
Annex B

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
		The availability target of one train shall be 99.99%. (but need to be reassessed in case of fleet sizing modification). It shall be calculated using the following formula: $$\frac{MTBSAF}{MTBSAF + MDT}$$ Where • MTBSAF is the Mean Time Between Service Affecting Failure, which cause service delay of, or over 5 minutes. • MDT shall be understood as the time required to restore normal operation (withdraw the disabled train and insertion of a stand-by train). Reliability targets for the Limited Express Train are set in term of Mean Distance Between Service Affecting Failures (MDBSAF): **Delay** / **Crossed distance** 0 to 5 min delay — 50,000 km 5 to 30 min delay — 100,000 km More than 30 min delay — 500,000 km Train rescue — 3,000,000 km **Reliability targets for Limited Express Train** Where the MDBSAF shall be calculated using the following formula: $$\frac{Total\ Accumulative\ distance\ in\ kilometres\ in\ a\ period}{Total\ No.of\ service\ Affecting\ Failures\ in\ that\ period}$$

PACKAGE CP NS-03: ROLLING STOCK - LIMITED EXPRESS TRAINSETS
General Bid Bulletin No. 24
Annex B

ITEM NO.	REFERENCE/CLAUSE/ SECTION	REVISIONS / AMENDMENTS
		Maintainability targets for the Limited Express Train shall be: **OMTTR** – Operational Mean Time To Restore (OMTTR) capital components; the trainsets shall be restored to operational order in an OMTTR of 15 minutes. **CMTTR** – Corrective Mean Time To Repair (CMTTR) capital components shall not be greater than 4 hours. Clause 8.9 is now 8.11:
36	ERG-110 Appendix C	Appendix C was added to the General Requirement. Please refer to Attachment 1.

Annex B – Attachment 1

Account Name: **Procurement Service – DBM**
Account No: **001442-1012-10**
Swift Code: **TLBPPHMMXX**

Important Notes:

i. Due to 72-hours standard wire transfer clearing process for online transfers, bidders are strictly advised to ensure transfer of the payment not later than 25 May 2021.

ii. Bidders who choose to transfer payments online shall ensure that the amount transferred shall be sufficient to cover the transfer fees of correspondent banks upon conversion of the original currency to Philippines Pesos.

iii. Bidder shall send proof of payment to the official BAC email on the same day of transfer.

iv. Please refer to Annex A-1 for the list of Depository Bank.

The Bidding Documents (without the General Conditions of Contract) may also be downloaded by the Bidders for free of charge from the website of PS, DOTr and PNR (indicated in the item 5 above), but Bidders must pay the said non-refundable fee for the Bidding Documents before the submission of their Bids.

7. Bids must be delivered to the address above on or before 10:00 AM on 20 September 2021~~19 August 2021~~ and must be accompanied by a Bid Security of Japanese Yen Four Hundred Forty Million Nine Hundred Eighty Thousand (JPY 440,980,000).

8. The Technical Bids will be opened in the presence of Bidders' representatives who choose to attend at the address given in item 5 above, immediately after the deadline for the submission of bids.

Joseph Conrad D Dueñas
Chairperson
Bids and Awards Committee IV

Account Name: **Procurement Service – DBM**
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Joseph Conrad D Dueñas
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<table>
<tr><td></td><td>in color with each copy of the Technical Bid.</td></tr>
<tr><td>ITB 22.2</td><td>The written confirmation of authorization to sign on behalf of the Bidder shall, corresponding to whether the Bidder is a Corporation, Partnership, Joint Venture (JV) or Sole Proprietorship, consist of the applicable documents, as follows:

<table>
<tr><th></th><th>TYPE OF ENTITY</th><th>DOCUMENT</th></tr>
<tr><td>1</td><td>Corporation</td><td>Board Resolution with Board Secretary Certificate</td></tr>
<tr><td>2</td><td>Partnership</td><td>Articles of Partnership</td></tr>
<tr><td>3</td><td>Sole Proprietorship</td><td>Special Power of Attorney (SPA)</td></tr>
</table>

For a Japanese Company bidding as a Corporation, a SPA may be substituted for a Board Resolution with Board Secretary Certificate.

However, in the case of a JV, evidence shall be provided to demonstrate that the person(s) signing the SPA is authorized to sign for and on behalf of each member of the JV.</td></tr>
<tr><td colspan="2">D. Submission and Opening of Bids</td></tr>
<tr><td>ITB 24.1</td><td>For <u>Bid submission purposes</u> only, and acting on behalf of the Employer, the Procuring Agent’s address is:
Attention: Joseph Conrad D Dueñas
The Chairperson
Bids and Awards Committee IV

Address: Procurement Service
RR Road, Cristobal Street,
Paco, Manila

The deadline for Bid submission is:
Date: <u>20 September 2021</u>~~19 August 2021~~
Time: 10:00 AM</td></tr>
<tr><td>ITB 27.1</td><td>The opening of the Technical Bids shall take place immediately after the deadline for submission of Bids in the presence of Bidders’ representatives who choose to attend at:
Address: Procurement Service
RR Road, Cristobal Street,
Paco, Manila

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RR Road, Cristobal Street,
Paco, Manila

Date: 20 September 2021</td></tr>
</table>

	Time: 10:00 AM
E. Evaluation and Comparison of Bids	
ITB 37.1	The currency that shall be used for Bid evaluation and comparison purposes to convert all Bid Prices expressed in various currencies into a single currency is: Philippine Peso. The source of exchange rate shall be: Bangko Sentral ng Pilipinas (BSP, the Central Bank of the Philippines). The date for the exchange rate shall be: 21 August 2021~~20 July 2021~~. In the event of non-availability of exchange rate in the BSP website due to non-working days, the Bidder shall apply the exchange rate of the following working day.
ITB 38.2(c)	Replace ITB 38.2 (c) with the following: "price adjustment due to discounts offered in accordance with ITB 18.7 or ITB 18.8."~~Replace the wording of ITB 38.2(c) with the following: "price adjustment due to any discount offered in accordance with ITB 18.6 and ITB 18.4."~~
ITB 38.3	Replace ITB 38.3 with the following: "If price adjustment is allowed in accordance with ITB 18.5, the estimated effect of the price adjustment provisions of the Conditions of Contract, applied over the period of execution of the Contract, shall not be taken into account in Bid evaluation."

	Time: 10:00 AM
E. Evaluation and Comparison of Bids	
ITB 37.1	The currency that shall be used for Bid evaluation and comparison purposes to convert all Bid Prices expressed in various currencies into a single currency is: Philippine Peso. The source of exchange rate shall be: Bangko Sentral ng Pilipinas (BSP, the Central Bank of the Philippines). The date for the exchange rate shall be: 21 August 2021. In the event of non-availability of exchange rate in the BSP website due to non-working days, the Bidder shall apply the exchange rate of the following working day.
ITB 38.2(c)	Replace ITB 38.2 (c) with the following: "price adjustment due to discounts offered in accordance with ITB 18.7 or ITB 18.8."
ITB 38.3	Replace ITB 38.3 with the following: "If price adjustment is allowed in accordance with ITB 18.5, the estimated effect of the price adjustment provisions of the Conditions of Contract, applied over the period of execution of the Contract, shall not be taken into account in Bid evaluation."

8 Ventilation and Air-Conditioning

8.1 General

8.1.1 ~~Each vehicle shall be provided with Ventilation and Air-Conditioning (VAC) system complete with relative humidity control. All system components shall be service-proven, and shall be tested to demonstrate compliance with the requirements of this ERT. Testing shall also be performed to determine the carbody heat transfer coefficient.~~Each car shall be provided with two units of ventilation and air-conditioning (VAC) system complete with relative humidity control. The air-conditioning units (ACU) shall be controlled independently such that if there is a failure in one unit, the other units shall continue to operate normally. All system components must be service-proven, and must be tested to demonstrate compliance with the requirements of this ERT.

8.1.2 ~~The Contractor shall submit a complete design of the air handling and diffusing system along with air flow and velocity calculation. Qualified testing of VAC system's air balancing shall be required to verify values. Upon installation on the vehicle, the complete air supply/diffusing system shall be measured and balanced and the air flow and velocity confirmed~~. The Contractor shall submit a complete design of the air handling and diffusing system along with air flow and velocity calculation for the Engineer to review. Upon installation on the car, the complete air supply/diffusing system shall be measured and balanced and the air flow and velocity confirmed. Air-balancing on each car shall be performed by a qualified VAC technician. Measurements shall be conducted in accordance with American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) requirements or equivalent.

8.1.3 The Contractor shall provide test and service equipment necessary for the maintenance and repair of the Ventilation and Air-Conditioning units. This shall include but not limited to off-board test bench, refrigerant recovery/recycling equipment and portable vacuum pump.

8.1.4 If air-conditioning stops to operate by any ~~serious~~minor failure i.e. Communication or link error etc., switch shall be installed to allow the driver to be able to reset from the driver's cab.

~~8.1.5 One outside unit of air conditioning system shall be mounted on the roof of carbody. The unit weight shall be below 800kg.~~

~~8.1.6 In case the compressors don't operate normally by serious failure, the operation of the other compressors shall not be affected by the failed compressor.~~

~~8.1.7~~8.1.5 Diffuser shall ~~be incorporated individually to window seats~~ be arranged in consideration with the window seat side distribution and its accessibility for cleaning and maintenance.~~.~~

8.2 Ventilation System

8.2.1 Blower fans supplied as part of the overhead evaporator units shall be capable to provide vehicle ventilation. Fresh air shall enter the vehicle through screened openings in the roof on each side, pass-through stainless-steel ducts (sloped downwards to drain), and pass through a filter into a plenum chamber adjacent to each overhead evaporator unit. The design shall prevent blown rain from entering the plenum and leaking into the vehicle interior.

8.2.2 It shall be possible to change by TMS monitor whether function of entering ambience air

8 Ventilation and Air-Conditioning

8.1 General

8.1.1 Each car shall be provided with two units of ventilation and air-conditioning (VAC) system complete with relative humidity control. The air-conditioning units (ACU) shall be controlled independently such that if there is a failure in one unit, the other units shall continue to operate normally. All system components must be service-proven, and must be tested to demonstrate compliance with the requirements of this ERT.

8.1.2 The Contractor shall submit a complete design of the air handling and diffusing system along with air flow and velocity calculation for the Engineer to review. Upon installation on the car, the complete air supply/diffusing system shall be measured and balanced and the air flow and velocity confirmed. Air-balancing on each car shall be performed by a qualified VAC technician. Measurements shall be conducted in accordance with American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) requirements or equivalent.

8.1.3 The Contractor shall provide test and service equipment necessary for the maintenance and repair of the Ventilation and Air-Conditioning units. This shall include but not limited to off-board test bench, refrigerant recovery/recycling equipment and portable vacuum pump.

8.1.4 If air-conditioning stops to operate by any minor failure i.e. Communication or link error etc., switch shall be installed to allow the driver to be able to reset from the driver's cab.

8.1.5 Diffuser shall be arranged in consideration with the window seat side distribution and its accessibility for cleaning and maintenance.

8.2 Ventilation System

8.2.1 Blower fans supplied as part of the overhead evaporator units shall be capable to provide vehicle ventilation. Fresh air shall enter the vehicle through screened openings in the roof on each side, pass-through stainless-steel ducts (sloped downwards to drain), and pass through a filter into a plenum chamber adjacent to each overhead evaporator unit. The design shall prevent blown rain from entering the plenum and leaking into the vehicle interior.

8.2.2 It shall be possible to change by TMS monitor whether function of entering ambience air is valid. Validity shall be changed as to section (tunnel/outside) as a minimum.

8.2.3 Re-circulated air shall be drawn through grilles in the ceiling and mix with the fresh air. This air mixture shall then pass through another filter into the evaporator unit, from where the blower shall force the air through the evaporator coils into the main air ducts.

8.2.4 Means shall be provided to adjust the volumes of fresh and re-circulated air. Approx. 1100 m3/h of fresh air per vehicle shall be provided when VAC system is operated.

8.2.5 The main air distribution duct shall be manufactured from anodized aluminum or the material that is enough service-proven and shall be constructed to ensure that the exiting air velocity is constant along its length. Ceiling panels may act as the lower side of the duct, provided adequately sealed.

8.2.6 Air filters shall be washable/re-useable and shall be well supported to prevent passing air from dislodging them shall the filters become saturated. They shall seal well at all edges. The filters shall be easily replaced and shall be sized such that they shall be serviced

Contractor shall be renewed for a period equal to the period of the original warranty/guaranty effective as of the day when such repaired/replaced part is installed. If the failure is found to affect any other component or apparatus, the renewal of the warranty/guaranty shall also be extended to cover the components or apparatus so affected and shall start as of the date the interrelated components and apparatus function is restored.

22.7.4 Fleet Defects (Pattern Failures)

22.7.4.1 The occurrence of independent failures with the same root cause of the same warranted item during the Defect Notification Period and within a six (6) month consecutive moving window, that exceeds more than 10% percent, ~~but~~or at least three (3) of the total number of identical items supplied may be declared a fleet defect or pattern failure. ~~The occurrence of independent failures of the same warranted item that exceeds more than 3 percent of the total number of identical items supplied may be declared a fleet defect or pattern failure.~~

22.7.4.2 On this basis, the Contractor shall be required to develop and implement an encompassing corrective action program to eliminate the pattern failure.

22.7.5 Computerized Maintenance Management System

22.7.5.1 The Contractor shall support the Computerized Maintenance Management System (CMMS) development by the CP NS-01 Contractor.

22.7.5.2 The Contractor shall coordinate and agree with the CP NS-01 Contractor and provide the necessary required data for the CMMS.

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21.2.6 The threads of stainless-steel fasteners shall be suitably treated to prevent galling upon installation.

21.2.7 All wire ties used shall be of the weather-resistant (black) variety.

21.2.8 Locking washers or other devices to prevent loosening of fasteners shall be used.

21.2.9 For equipment suspended from the underframe, the load of the equipment on each bolt shall not the clamp load of the bolt. Set screws shall not be used. Where practical, load on the bolts shall be no greater that that exerted when the bolt is tightened to its recommended torque. When practical loads shall be on structural cross beams etc. Huck bolts can be used according to their strength specification unless otherwise proposed by the Contractor.~~.~~

21.3 **Parts**

21.3.1 Components, plates, shields, or other parts, which may be removed for repair or maintained, shall be interchangeable with others identical item.

21.3.2 Non-maintained components shall be designed for a useful life of 30 years. If, during the warranty period, it is demonstrated that the extrapolated life of any component is less than 30 years, the component must be redesigned and replaced on every vehicle.

21.3.3 All parts shall be free from sharp edge and burrs that might injure persons or damage clothing.

21.4 **Electrical Components**

21.4.1 Terminals

21.4.1.1 Solderless terminals shall be submitted for the review of the Engineer and given the Statement of No Objection on equivalent and shall have sufficient current carrying capacity, de-rated to the anticipated maximum operating temperature.

21.4.1.2 The use of quick connect ("FASTON") terminals shall not be allowed, except subject to review by the Engineer. When allowed, quick connect terminals must be of brass or phosphor bronze.

21.4.1.3 Only ring tongue terminals shall be used, except as specifically reviewed and commented by the Engineer.

~~21.4.1.3~~21.4.1.4 Alternative forms of terminals will be considered where appropriate.

21.4.2 Wire Insulation

21.4.2.1 Cables shall comply with EN standards or Japanese regulations/standards.~~conform to EN50264 or other equivalent standards~~.

21.4.2.2 Unless otherwise specified, wire insulation shall be one of the following types, unless specifically reviewed and commented by the Engineer:

1) Ethylene Tetrafluoroethylene (ETFE) fluoropolymer having a continuous temperature rating of 150 ℃,

2) Abrasion resistant, filled Tetrafluoroethylene (TFE) with a temperature rating of 260 ℃

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2) Abrasion resistant, filled Tetrafluoroethylene (TFE) with a temperature rating of 260 ℃

3) Cross-linked Polyolefin (XLPO),

20.6 **Trial Operations**

20.6.1 The objective of Trial Operations, is that operational readiness is verified, meaning that full training of operational staff including drivers, emergency-service personnel and others, has taken place successfully, demonstrating that the required railway operational safety, together with the requisite performance criteria in the employer's requirements, has been achieved.

20.6.2 The Contractor shall support the Employer during the Trial Operations which shall take place at the completion of the Testing and Commissioning.

20.6.3 The Trial Operations consist of operating the newly procured trains, taking into consideration requirements of operating the trains for revenue service, but without passengers.

20.6.4 The objectives of the Trial Operations shall include, but is not limited to:

1) Validation of all interfaces with the on-board signaling system;
2) Validation of all interfaces with PSD controller system
3) Validation of train schedule running;
4) Station stops precision (including regenerative braking force fluctuation)
5) Training of drivers, OCC staff and line managers; and
6) Emergency exercises.

20.6.5 Different test cases shall be developed in normal operation (checking that new trains can achieve daily timetable without delays and incidents) and degraded modes (simulating different incidents) as follows:

1) Failure during pre-departure tests;
2) Traction mode failure;
3) Train doors fail to close;
4) On-board signaling defects; and
5) Rescue of Failed Train.

20.6.6 A detailed list of test cases shall be drafted by all interested parties prior to the commencement of the Trial Operations. Some of these tests may be an opportunity for close coordination with third parties such as the police and emergency services, to check any new features of the procured new trains.

20.6.7 As for station stop precision, improvement and trial operation must be continued until a certain standard is achieved. The required standard is for each passenger door to stop within the platform screen door opening. Regarding this improvement, coordination with equipment such as a propulsion system, a brake system, a TMS, a brake shoe, etc. shall be made when necessary.

20.6.8 All trains shall run the ~~entire~~ available line taking into consideration Revenue Service, without passengers and in accordance with commercial service pattern.

~~20.6.9 After completion of all the testing and commissioning, Taking Over Certificate will be issued by the Engineer/Employer.~~

~~20.6.10 Defect notification should start when trains have completed the acceptance process, and are signed off for commercial service.~~

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20.6.8 All trains shall run the available line taking into consideration Revenue Service, without passengers and in accordance with commercial service pattern.

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20.7 **Test Documentation**

20.7.1 All test documentation, procedures, reports and certifications shall be provided with a unique document number and properly controlled.

20.7.2 Test Procedures

20.7.2.1 The test procedure must state the purpose of the test, and reference the relevant portion

Unless otherwise specified, the presentation shall be conducted at the Engineer premises.

1.2.11 Design Submission and Acceptance

1.2.11.1 The Contractor shall submit a Submission Programme in accordance with the Design Submission programme in the General Requirement. In addition to these requirements, the Submission Program shall:

1) Identify all design, manufacturing, testing, operations and maintenance contract deliverables required by this ERT and the ERG;

2) Assign reference numbers to all submissions; and

3) Identify the planned submission date for each submission.

1.2.11.2 The Engineer will carry out review of the design submissions received and respond to the Contractor in accordance with the design review process.

1.2.12 Design Review Meetings

1.2.12.1 Design review meetings shall be held during each design stage to aid Engineer understanding and/or review of the design.

1.2.12.2 If the meeting is to review or present design information or other material, such material shall be forwarded to the Engineer not less than 15 working/calendar days prior to the meeting.

1.2.12.3 The Contractor shall ensure that participation in design review meetings includes representatives of all functions, disciplines and entities for the concerned equipment and/or system under review.

1.2.12.4 Meetings shall not be arranged to gain formal or informal oral statement of No Objection of designs. The Engineer shall give "Approved", or "Approved with Comment" only in writing through the design review process.

1.2.12.5 The Contractor shall, within 3 working/calendar days after the date of the meeting, submit minutes of each such meeting to the Engineer, detailing all issues raised during the review, their resolutions or ongoing design status and due date for resolution.

1.2.13 Design Audit

1.2.13.1 The Engineer will carry out design audits of the Contractor periodically throughout the duration of the Contract as deemed necessary for validation of the design. Such design audits will generally cover interfaces, integration, co-ordination, operation and detailed design issues so far as they are considered necessary by the Engineer.

1.2.13.2 The Contractor shall provide all documentation and personnel participation reasonably requested by the Engineer to enable design audits to be carried out.

1.2.13.3 The Contractor shall, within 15 working days of the date of each design audit, submit for review Design Audit Minutes detailing all issues raised during the audit, their resolutions or ongoing design status and due date for resolution.

1.2.14 Design Verification and Validation

1.2.14.1 The Contractor shall submit a Design Verification and Validation in the Requirement Management Plan in accordance with the ERG for given statement of No Objection by the Engineer.

1.3 Configuration Control

1.3.1 Control Processes

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3) Cross-linked Polyolefin (XLPO),

4) All wire insulation, except carbody wiring, shall be rated at 300/300V or 600 V minimum; unless otherwise specified or agreed to by the Engineer. Carbody wire insulation shall be rated at 2000 V minimum. Here "carbody wiring" shall be understood as the 1500 Volts DC traction wiring from Overhead catenary up to Variable Voltage Variable Frequency (VVVF) termination point and auxiliary power supply unit; and

5) Wires 6 mm^2 and smaller shall have the appropriate insulation material as defined above. Wires larger than 6 mm^2 shall be insulated only with Cross-linked Polyolefin (XLPO) or JRIS standard insulation material.

21.4.3 Wire Current Rating (Ampere Capacity)

21.4.3.1 The selection of wire sizes and insulation shall be based on the current carrying capacity, voltage drop, mechanical strength, expected maximum operating temperature and flexibility requirements in accordance with applicable Rail Industry approved standards.

21.4.3.2 Maximum wire current rating shall conform to applicable Rail Industry approved standards. Where conductors are routed in a raceway or cable, the current rating shall be suitably de-rated.

21.4.4 Wire Stranding

21.4.4.1 Wires stranding and conductor construction shall be appropriate for the application, taking into account wire size, flexing requirements, etc., and shall comply with appropriate Rail Industry approved standards.

21.4.5 Wiring Prohibition

21.4.5.1 Pinch screw terminals and solid conductors are specifically forbidden.

21.4.6 Creepage and Clearance

21.4.6.1 Electrical creepage and clearance shall be adequate for the voltage levels and environment.

21.4.7 Insulation Resistance

21.4.7.1 The insulation resistance of all wiring shall be designed and tested in accordance with Industry approved Insulation Resistance Test and High Potential Test procedure.

21.4.8 Voltage Segregation

21.4.9 Wires shall be segregated according to JRIS or IEC standards. Wires shall be segregated into separate bundles/harnesses and connectors according to the voltage ratings in the following classes.:

1) Line voltage DC wiring,

1) Low voltage AC wiring (Under 600V),

4) All wire insulation, except carbody wiring, shall be rated at 300/300V or 600 V minimum; unless otherwise specified or agreed to by the Engineer. Carbody wire insulation shall be rated at 2000 V minimum. Here "carbody wiring" shall be understood as the 1500 Volts DC traction wiring from Overhead catenary up to Variable Voltage Variable Frequency (VVVF) termination point and auxiliary power supply unit; and

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21.5 **Electronic Equipment**

21.5.1 As a minimum, all electronic equipment shall comply with JIS E 5006: Electronic Equipment used on Rail Vehicles (or other equivalent standards), for design, manufacture and testing and shall use components purchased against an internationally recognized

~~2.8.1.3~~2.8.1.2 All equipment mounts shall meet the requirements of Sub-Clauses 1.12 Noise Vibration and Aerodynamics and 1.14 Maintainability Requirements of this ERT and shall have a fatigue life of not less than 30 years.

~~2.8.1.4~~2.8.1.3 Equipment shall be logically grouped into enclosures, which shall meet the requirements of Clause 23 of this ERT. Care shall be taken to ensure that the equipment within the enclosures is readily maintainable, taking into consideration the required maintenance interval. Mounting of equipment enclosures/boxes shall be made to allow easy access and opening given the constraints of the maintenance pit/facility.

~~2.8.1.5~~2.8.1.4 All equipment and corresponding cases shall be mounted such that removal and replacement of each is possible without requiring the removal of other major equipment or cases. Similar but non-interchangeable parts shall have different mounting arrangements, to ensure against mistakes in fitting.

~~2.8.1.6~~2.8.1.5 The Contractor shall ensure that safety mounts are provided for all under-frame mounted equipment to prevent derailment risk in the event of main mounts failure in service. Similarly, equipment's enclosures shall have the doors securely attached to prevent falling off and cause derailment or other damage.

~~2.8.1.7~~2.8.1.6 The Contractor shall ensure that all fasteners are of the same material when attaching components to the carbody and be of the same grade appropriate to the load and position.

~~2.8.1.8~~2.8.1.7 The Contractor shall design equipment arrangement in consideration with signaling system and radio system adopted or planned to adopt in MCRP, NSCR and NSRP-S. Basically, space of under floor in leading cars shall be secured for signaling equipment, radio equipment, in addition, equipment desirable to be mounted to leading cars such as door controller and so on.

~~2.8.1.9~~2.8.1.8 The Contractor shall confirm equipment arrangement of rolling stock in MCRP, NSCR and NSRP-S, and equipment arrangement shall be unified as possible, paying attention to mounted side, mounted positions (especially test valves, valves and cocks used in emergency), and so on. Equipment arrangement shall be designed not to affect maintainability and emergency operation even if special operations are adopted. Example, equipment arrangement shall be designed in consideration with symmetry, when reversed train formation operation will be adopted.

~~2.8.1.10~~2.8.1.9 Equipment arrangement shall be reviewed by the Engineer.

2.8.2 Cabin and Saloon Access Handrails and Steps

2.8.2.1 The Contractor shall ensure that a set of steps with non-slip treads is provided under each driver's door; to warrant the Driver's safety when boarding and exiting the vehicle when not at platform level.

2.8.2.2 The Contractor shall ensure that easy access steps with non-slip treads and handrails fit for purpose will be provided at each passenger side entrance door on both sides, this will allow passengers to easily and safety exit the cars during evacuation circumstances when the car is not at platform level. Signage and instructions on how to alight from the train safely shall be provided for each passenger door.

2.8.2.3 The stiffness and strength of the handrails and their connections shall be designed and tested to ensure that they will withstand the rigors of use and the environment. They shall be designed and tested to withstand, without permanent deformation, a load of 1.3 kN applied at the midpoint of the span.

2.8.2.4 The stiffness and strength of the steps and their connections shall be designed and tested

to allow use by a person exerting a force of 1.3 kN (load applied at angle of 45 degrees), without permanent deformation~~, and with the maximum deflection limited to 1 mm.~~.

2.9 Stanchions, Handrails, Grab Handles, Door Screen

2.9.1 General

2.9.1.1 The interior will be equipped with sufficient stanchions and handrails to accommodate the safety of standee passengers. When normally loaded to W2 and onwards, capacity there shall be sufficient handholds for all passengers.

2.9.1.2 Stanchions and handrails shall be securely held at each end in fittings. Fittings shall be pressings or castings and the finish shall match that of the stanchions. All fittings shall provide a permanently tight and rattle proof fastening, and be free of burrs and sharp edges. All fastenings shall be concealed and proven to provide safety to the passengers.

2.9.2 Material

2.9.2.1 Stanchions and handrails shall be made from seamless, radial brush finish and satin finished stainless-steel tubing.

2.9.3 Grab Handles

2.9.3.1 Grab handles shall be provided for standee passenger. The grab handles shall be robust and use concealed fasteners. Colors and finishes shall match the stanchions and the passenger seat frame.

2.9.4 Glass screens

~~2.8.2.4~~2.9.4.1 Glass screens (windscreens or draught screens) shall be provided. Each screen shall incorporate a vertical curved stanchion and a clear laminated safety glass panel at least 6mm thick with polished edges.

between wheels in an axle shall be less than 10%.

2.8.1.2 All equipment mounts shall meet the requirements of Sub-Clauses 1.12 Noise Vibration and Aerodynamics and 1.14 Maintainability Requirements of this ERT and shall have a fatigue life of not less than 30 years.

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4 Coupler and Draft Gear

4.1 General

4.1.1 The end cars in each train shall be fitted with an automatic coupler. The coupler shall be placed in a readily accessible position under and from either side of the end vehicle. The position (right side or left side) of parts operated shall be consistent for all end vehicle. It shall be possible to connect with other commuter train of North-South Commuter Railway (NSCR), MCRP- and ~~North-South Railway Project-South, MMSP Line (~~NSRP-South~~)~~ ~~without any adapter~~ during train rescue or ~~-~~hauling.

4.1.2 The automatic coupler shall be able to couple with other types of rail vehicle with, if necessary, an adaptor. The adaptor, if required, shall be provided by the rolling stock supply Contractor.

4.1.3 The automatic coupler shall be able to connect a unit with the coupler of another unit on all curves in the depots and main line. The coupler height, measured from the center of the coupler to the top of rail, shall be within 880 mm +10/-15 mm.

4.1.4 The automatic coupler shall, in conjunction with the draft-gear automatically effect ~~mechanical, electrical and~~mechanical and pneumatic coupling for two (2) Limited Express Train or identically coupling head. It shall also permit separation of units either by manually from the track side and/or remotely from the cab.

4.1.5 In both leading cars, an electrical connecting plug which is necessary for relief operation by connecting train-sets shall be equipped. Also, an emergency connection cable that connects this electrical connection plug shall be equipped. By using this connecting cable, required functions such as brake command, broadcasting, buzzer etc. shall operate properly. Length and diagram of cable shall be also consistent with other commuter trains of NSCR, NSPR-South, MMSP. The position of this plug shall be consistent with other commuter trains of NSCR, NSRP-South, MMSP particularly length of cable shall be determined in consideration of the severest deviations during coupled with other train. Basically, utilization of adapter shall not be acceptable.

4.1.6 The Contractor shall provide the required cabinet for housing the emergency connection cable on the train. Alternatively, the Contractor shall provide proper mechanism for retaining the emergency connection cable when it is not in used.

4.1.7 All electrical connections shall be made to terminal blocks in junction boxes compliant with IP 65, via jumper cables, using quick connect/disconnect couplings securely locked with wire.

4.1.8 ~~Cable hoses shall be made out of high quality, weather and abrasion resistant insulated rubber.~~Cable hoses or flexible conduits shall be made out of high quality, weather and abrasion resistant insulated rubber or other materials, subject to approved by the Engineer.

4.1.9 The connectors for each cable, if of the same size, shall be keyed differently to prevent misconnection, and shall be color coded to enable connectors to be easily distinguished.

4.1.10 In all cases, care shall be taken to ensure that strain relief is provided for all cables leaving the junction boxes, and that all cables are properly supported in suitable cleats, and that no chafing of the cabling takes place under all possible movements of the coupler.

4.1.11 The arrangement shall prevent damage from coupling with misaligned couplers, and shall minimize damage to the carbody wiring, should excessive tension be applied to the cables in the event of an accident.

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4.1.12 The couplers shall be designed to prevent the coupler swinging transversely when it is not coupled.

4.1.13 Couplers and draft gear shall be capable of withstanding all coupling, buffing and draft

be the enough service-proven:

1) Slip resistance of 0.75 dry and 0.62 wet in accordance with JRIS J0745 or other equivalent standards,
2) Hardness of Shore A Hardness 85-90,
3) Resistance to chemicals in accordance with JIS A 1454 (or other equivalent standards) with noticeable variation, and
4) Tensile strength in accordance with JIS K6251 (or other equivalent standards) - 7.3MPa;

The Contractor can propose alternative to the above requirement value for the Engineer review.

5.4.11 The entire floor construction shall be required to comply with the fire safety requirement as per clause 218.8 of this ERT.

5.4.12 All floor penetrations (for piping, conduit, etc.) shall be suitably sealed against the elements, and be required to comply with the fire safety requirement as per clause 21.8 of this ERT.

5.5 Ceiling

~~5.5.1~~ The vehicle ceiling shall present an aesthetically pleasing smooth service, and shall incorporate lighting fixtures, conditioned air outlet grilles, public address speakers, etc. The ceiling panels and fixtures shall not vibrate, rattle or squeak during normal service conditions. Panels shall comply with fire regulations DIN 5510-2 or any equivalent standard which shall be reviewed and given notice of no objection by the Engineer.~~-~~

5.6 Entrance Room

5.6.1 At the end of passenger saloon, a vestibule shall be provided for the purpose of separating the door area from the passenger accommodation and keeping cooled air in the saloon. Between saloon and vestibule the partition with door shall be provided. That door shall be automatically opened and closed by floor based or button or sensor. Passenger get on and get off the train through vestibule.

5.6.2 Alternate arrangement can be suggested by the Contractor looking into optimum space utilization and carrying capacity in rush hours and will be subject to review and comments by the Engineer.

5.7 Passenger Seats

5.7.1 The Contractor shall propose a cross seating arrangement. Same needs to be submitted for Engineer's review and comments.

5.7.2 All seats with limited reclining function shall be automatically/manually changeable the direction with locking system and installed ~~to the floor by one stand~~ in ~~to~~order to facilitate cleaning of floors and storage of Passengers' belongings underneath.

5.7.3 The seats shall be ergonomically designed and the materials to be used in the seat design shall be soft type with moquette, ~~waterproof~~ stain repellent, anti-microbial treated, ~~fire~~

~~and vandal resistant~~and flame retardant treated. Fire performance testing shall be undertaken by the Contractor with review by the Engineer. The seat design shall eliminate gaps as possible to allow easy cleaning. ~~that shall trap dirt or liquids and can be easily maintained.~~

5.7.4 The seats shall be designed and manufactured as per fire safety requirement given in Clause 21.8 of this ERT. Details of the specification and testing requirements are to be supplied by the Contractor to the Engineer for review.

5.7.5 The electrical sockets (220V 60Hz) / USB ports shall be provided adequate position on the seats one socket per person. The sockets shall be protected by a low amp breaker. As there are three (3) designs of socket sed in the Philippines, types A, B and C the most popular type shall be provided.

5.7.6 The seat design shall be ergonomically designed for passenger comfort, aesthetically pleasing, and eliminated gaps as possible to allow easy cleaning.~~that will trap dirt or liquids.~~

5.7.7 The Contractor shall be required to supply documented evidence the proposed seats to have troubled-free service in a similar operating environment.

5.7.8 Specification of the seat shall be submitted by the Contractor for review by the Engineer.

5.8 Accommodation for Disadvantaged Passengers

5.8.1 The Contractor shall provide space on the leading vehicles to cater for people on wheelchairs, and people with prams. The prospective wheelchair space shall be prominently labeled on the floor with the appropriate standard sign. Additionally, ~~fully retractable and~~ a non-obstructive, ~~–~~self-aid ~~wheelchair tie downs~~ and a railway transportation proven wheelchair securement device with instruction decal shall be made available ~~for ready installation~~ for each wheelchair space.

5.8.2 Each car shall be equipped with one (1) wheelchair space per car and 6 priority seats per car. The disabled and elderly passenger seat's label shall be prominently displayed.

5.8.3 The wheelchair spaces shall be close to disabled type toilets.

~~5.8.3~~5.8.4 The priority seats location shall be nearest to the door as per Rule IV- Requirements for Public Transportation (BATAS PAMBANSA BILANG 344).

5.9 Toilet

5.9.1 The Contractor shall provide the two western type toilets per train. Both toilets must be designed for disabled Passengers and easy using with wheel chair.

5.9.2 The toilet system should have manure dirt tank and discharge it at depot and dispose. The capacity of waste tank shall be enough to store the toilet waste for three (3) days.

5.9.3 The fresh water tank at each toilet location, shall be sufficient for 3 days of usage.

5.9.4 Regarding the amount of waste per one person for the definition of tank-capacity, the Contractor shall be reviewed by the Engineer.

5.9.5 Regarding the direction of vent of waste tank, the Contractor shall discuss with CP N-05 Contractor and the Engineer.

5.9.6 The toilet system shall be vacuum flushing type.

1) Slip resistance of 0.75 dry and 0.62 wet in accordance with JRIS J0745 or other equivalent standards,
2) Hardness of Shore A Hardness 85-90,
3) Resistance to chemicals in accordance with JIS A 1454 (or other equivalent standards) with noticeable variation, and
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5.9.5 Regarding the direction of vent of waste tank, the Contractor shall discuss with CP N-05 Contractor and the Engineer.

5.9.6 The toilet system shall be vacuum flushing type.

5.9.7 In the toilet room shall be installed mirror, paper holder, hand wash corner and bidet shower (water hose with tap).

5.9.8 And shall be installed folding baby chair and folding baby bed on which the baby diaper can be changed.

5.9.9 There shall be waste bins in the toilet, one for common rubbish and one for diapers or

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5.9.9 There shall be waste bins in the toilet, one for common rubbish and one for diapers or sanitary products. They shall be clearly identified. The sanitary bin shall carry a Hazard Label.

5.9.10 The toilet room shall be easy to clean, and shall be completely watertight.

5.9.11 The toilet door shall be lockable from inside but can be unlocked from the aisle using a key.

5.9.12 In the toilet room, handrail, smoke detector, ventilation fan shall be installed.

5.9.13 In the washroom illumination shall be installed.

5.10 Baggage/Luggage Space

5.10.1 Baggage space shall be provided in the car, and rack above the passenger seats that the lighter baggage can be put on, shall be provided in the passenger compartment. Baggage spaces for larger/heavier luggage shall be located at each end of the car within the passenger compartment.

5.10.2 The rack in the passenger compartment must be enough space to put the large luggage on. If double racked, there must be restrain in the upper rack from bags falling out

5.10.3 The power supply (AC220V, 1-phase, 60 Hz) outlet shall be installed ~~at the baggage spaces~~ in the car for future provision of vending machines. The location shall be submitted to Engineer for review and given statement of No Objection. Four (4) vending machine spaces shall be provided per train, one spaces in each leading car, two spaces in the middle cars.

5.10.4 Security locks for baggage like dial combination locks shall be installed at baggage spaces.

5.11 Windows and Glazing

5.11.1 All side windows (except windows in the doors) shall be laminated glass to current railway industry standards. Windows shall be suitably mounted to the carbody window frame. The color and degree of tinting will be agreed with the Engineer during the design process.

5.11.2 The size of the passenger side windows will allow the maximum entry of natural light into the Passenger saloon and maintaining the structural integrity of the Carbody.

5.11.3 Windows shall be capable of withstanding the pressure differentials associated with head-on pressure, passing trains, prevailing winds, etc. The windows and mountings shall also be able to withstand the loads imposed by passengers leaning on them under crush loaded conditions.

5.11.4 The mounting of windows shall be able to absorb undue shock without breaking or cracking on the glass.

5.11.5 The side windows shall be the sealed type with double glass.

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5.11.5 The side windows shall be the sealed type with double glass.

5.11.6 Window design must allow all passengers (sitting and standing position) to have a good vision on the outside and especially on the station information.

5.11.7 The body-side and door windows shall be designed to minimize solar gain and provide a level of thermal insulation consistent with the requirements of the air conditioning system.

6.5.3 The Contractor shall ensure that a headlight fault detection system is provided for each train cab, providing Fault indication and status information to the driver by TMS monitor.

6.5.4 The light intensity of headlights shall comply with Table.7 in item 5.2.1 of JRIS R 16465 or any equivalent standard.

6.5.5 Headlight (LED) shall be able to be accessed either from outside orand inside of the driver cab. The optical axis of head lamps shall capable of being easily adjusted.

6.5.6 The Contractor shall ensure that the red tail-lights or white marker lights are automatically activated based upon the Cab activation status as follows:

1) Red taillights displayed - associated Cab is not activated, or non-activated Cab is at rear of the Train, or when both cabs in the train are inactive.

2) White marker light displayed - associated Cab has been activated, indicating this will be the front of the train. The white marker lights shall be lit when vehicles are driven in reverse direction.

6.5.7 LED type marker lights shall be provided, and combination red/white units may be proposed.

6.5.8 The Contractor shall ensure that two indicating lights are installed above each door, one inside and one outside. The lights shall be illuminated when the doors open while not lit up when the doors are closed. The lights shall be blinking during opening and closing cycle of the door. The light shall be illuminated together with an indication on the driver's panel or TMS monitor when the door is faulty and/or isolated.

~~6.5.9 The Contractor shall ensure that inspection lights are provided in the vicinity of the underframe mounted equipment. The inspection lights shall be push button activated from the cab and underframe and shall incorporate design features to ensure that the lights are not inadvertently left on when the train is in operation.~~

~~6.5.10~~6.5.9 The Contractor shall ensure that all exterior lights are powered from the low voltage DC power supply system. ~~All lights shall be powered by the batteries in the event of APSE failure.~~ The low batteries DC load analysis shall be presented during the design phase to simulate event of APSE failure

~~6.5.11~~6.5.10 The Contractor shall ensure that indicating lights are installed in both side of car. The light on the side where all the doors are not closed illuminates.

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7 Doors and Door Control

7.1 Passenger Side Entrance Doors, Gangway Doors and Saloon Separation Doors

7.1.1 The side entrance door operator design and functionality shall be based on a "fail-safe" principle and high standards of safety and security for passengers. Design, safety and testing of the passenger doors shall be compliant with MLIT Article 74 or other equivalent standards.

7.1.2 Two (2) electrically or pneumatically operated doors shall be provided on each side of every car. All doorways shall have a clear opening of 900 mm, as minimum, (1300mm is preferred as this allows 2 streams of passengers to alight/board simultaneously see TCRP report 13) and a clear height of 1850 mm.

7.1.3 The number of the doors and their dimensions shall allow the complete evacuation within three minutes by passengers in emergency. An emergency exit shall be able to be opened by a passenger from inside the train. All external passenger doors shall be equipped with emergency opening devices allowing them to be used as emergency exits

7.1.4 Side door number is two for each side, and position of the door must adjust to PSD door position. When express train stop at station, train door shall be inside the width of the PSD door, considering the accuracy of stopping ±350mm by ATO (Automatic Train Operation). The Contractor shall Interface with the PSD NS-01 Contractor on the requirement of door positioning between the Rolling Stock and PSD in accordance with section 7.8 of the ERT. The doors shall be ~~the sliding pocket~~ bi-parting or single leaf plug-in sliding doors or single leaf pocket sliding doors, constructed to prevent hands/finger pinning at the pocket section during operation. An airtight structure is preferred. If airtight structure is adopted, the mechanical door system must be fit to this system. The proposed door type shall be a proven solution to the constructability with the platform door under CP NS-01 contract, the maintainability, the safety and the performance of the rolling stock.

7.1.5 The Rolling Stock shall be a high-floor design, with level boarding from platforms. Wheelchair and mobility-impaired boarding shall not require the use of bridging or lifting devices. The horizontal distance of the passenger door thresholds shall be 1,475 +/- 25 mm from the track center unless otherwise proposed by the Contractor subject to the review by the engineer~~.~~

7.1.6 Doors shall be vibration free and sufficiently insulated against heat and sound transmission. Exterior and Interior surfaces of the door leaves shall be finished to match the adjacent surfaces of the car. The doors shall be free from dimples, warping, spot welding depression and any other blemish.

7.1.7 The closed-door leaves shall be capable of withstanding loads imposed by passengers leaning on them under crush loading conditions. The doors shall be designed and tested such that the door leaves sustain such pressure with no permanent deformation. The Contractor shall submit test procedure and results based on best international practices.

7.1.8 It shall be extremely improbable for a door to detached from the car under any operating conditions, including heavy side load from standing passengers or sudden pressure transients.

7.1.9 No single defect or failure of any part of any door system shall produce a situation capable of causing injury to the passenger and the employer personnel etc.

7.1.10 Door guides and supports shall be mounted within the section of doorway protected by the door seals and shall not allow ingress of dirt, debris, or any other foreign matter likely

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7.1.10 Door guides and supports shall be mounted within the section of doorway protected by the door seals and shall not allow ingress of dirt, debris, or any other foreign matter likely to result in excessive wear or incorrect operation of the door equipment.

11.1.5 An additional simulation is required for which the Contractor shall use an "Constant speed" operation for simulation purposes.

1) The Contractor will determine the travel time and average speed based on the provided track alignment data for an "Constant speed" simulation.

2) The data of radius of curves, curve lengths and speed limits at curves is available in Appendix K.

3) All other simulation parameters not included in the listed conditions shall in compliance with the Employer's Requirements.

11.1.6 Load weighing shall be provided for all car weights up to crush loading condition W32. The failure of electric braking to provide the requested performance shall initiate supplemental friction braking.

11.1.7 The traction power circuit shall be cut out if pressure of main reservoir is below the minimum required working pressure. In this case, the emergency brake shall be operated at the same time, and the line breaker (LB) shall be open when the emergency brake is operated.

11.1.8 The propulsion system design shall automatically compensate for wheel diameter variations between axles on the same car of no less than 6 mm. The Contractor shall incorporate the function that each car wheel diameter is input from the TMS. If this function is not used or incorrectly used, the propulsion system shall operate recognizing the wheel diameter as 820 mm.

11.1.9 The Contractor shall be required to perform a combined propulsion system test in accordance with a procedure which shall be reviewed by the Engineer. This test shall consist of the performance of the entire propulsion system, including the power conversion equipment (PCE), traction motors and associated cabling. The temperature of critical components, amongst other parameters, shall be monitored to gauge suitability for the intended service.

11.1.10 The equipment to be supplied shall require minimal maintenance, and any items requiring periodic attention shall not require such at intervals less than monthly.

11.1.11 The propulsion system shall be provided by a supplier having had a minimum of 5 years of demonstrable experience in supplying service-proven, considerably reliable 3-phase AC propulsion equipment in a similar operating environment to that in Manila.

11.1.12 The speed sensor-less control system shall be supplied. During initiation of acceleration or deceleration (regenerative braking), speed estimation shall be completed successfully within 200ms after motor current begins to flow. In particular, even in the case of the low-speed range and the recession started, speed estimation shall be completed successfully, to avoid unnecessary vibration, worsening of ride and protection operation for example, overcurrent of motor, frailer of speed estimation or detection of recession shall not be happened. Speed sensor for backup shall be incorporated in the train line, which may be used. During vehicle is traveling in the opposite direction to the command direction in the range of 0 to 5 km / h, the train shall be able to start normally without vibration and protection operation etc.

11.1.13 For the parts that shall be considered exothermic, thermal simulation shall be performed, e.g., switching device module, HSCB, LB, and main circuit wires. This simulation shall be performed based on the run curve at the most severe riding rate, taking into account the heat dissipation environment inside the box. Simulation results shall be validated during testing and commissioning with and without load.

speed" operation for simulation purposes.

1) The Contractor will determine the travel time and average speed based on the provided track alignment data for an "Constant speed" simulation.
2) The data of radius of curves, curve lengths and speed limits at curves is available in Appendix K.
3) All other simulation parameters not included in the listed conditions shall in compliance with the Employer's Requirements.

11.1.6 Load weighing shall be provided for all car weights up to crush loading condition W3. The failure of electric braking to provide the requested performance shall initiate supplemental friction braking.

11.1.7 The traction power circuit shall be cut out if pressure of main reservoir is below the minimum required working pressure. In this case, the emergency brake shall be operated at the same time, and the line breaker (LB) shall be open when the emergency brake is operated.

11.1.8 The propulsion system design shall automatically compensate for wheel diameter variations between axles on the same car of no less than 6 mm. The Contractor shall incorporate the function that each car wheel diameter is input from the TMS. If this function is not used or incorrectly used, the propulsion system shall operate recognizing the wheel diameter as 820 mm.

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11.1.14 The design life of the main circuit semiconductors shall be 30 years or more, PECE and

in the specified range.

7.3.13 The above gaps and timings are notional and shall be capable of being adjusted after experience in service has been gained. The initial settings shall be determined from an investigatory trial undertaken using the door mock-up, or the door test rig.

7.3.14 Time delay of door motion shall be adjustable from 0 second to 3 second.

7.3.15 Door warning shall be clearly audible to both internally and externally to the cars at all door passenger portals.

7.3.16 The volume of door warning tones shall be adjustable by Maintenance Staff only.

7.3.17 The opening and closing of doors shall only be possible from the operative cab, and it shall not be possible to energize the door open circuits if train speed is greater than 3 km/h. Door closing or opening time shall be adjustable between two and five seconds. The doors shall be able to be opened only when a certain amount of braking force is operating.

7.3.18 Propulsion power shall be inhibited until all doors have closed and are locked; the Contractor shall provide the function that does not enable brake release and train start if all doors are not closed and locked.

7.3.19 It shall be possible to isolate and mechanically lock a defective door on any car from the door open command, at which time the yellow fault lights on that side of the exterior of the car shall illuminate. The isolated door(s) of a car(s) shall be identified in the TMS and marked "X" to denote it has been isolated.

7.3.20 The driver must reset the device before the train can proceed or without a reset device depending on the system safety design of the rolling stock. The device shall be recessed and suitably sealed to prevent accidental actuation.

7.3.21 Emergency Egress Device

7.3.21.1 Adjacent to each doorway in the car ~~passenger compartment~~ shall be installed an emergency door opening handle, (Emergency Egress Device) which may be used by passengers to open the one door in the event of an emergency. ~~There shall also be one (1) handle inside the car that can open all of the four doors in the car. The emergency door opening device which can open the several doors shall be included.~~ The position and function, numbers of emergency door opening device shall be reviewed by the Engineer.

7.3.21.2 The device shall adjacent to the door and be recessed and suitably sealed to prevent accidental actuation and at a height compatible with passenger height.

7.3.21.3 The manual emergency release shall however be shielded from unintentional use by passengers, whilst still being available in an emergency. Seal or lift transparent flap to be fitted. Once the handle is operated, the driver loses power and the door can be manually opened if train speed drops sufficiently., it shall be indicated to the train operator as an open door. The driver will have an override button which will keep power for a short time so that the driver can move to a safer location to attend to the emergency. Only when the train comes to nominal zero speed, can the passenger open the door fully manually.

7.3.21.4 If these devices are operated, crews shall be alarmed by indicating through TMS monitor and sounds.

7.3.21.5 This Egress device, once activated, requires the driver to reset with a key.

investigatory trial undertaken using the door mock-up, or the door test rig.

7.3.14 Time delay of door motion shall be adjustable from 0 second to 3 second.

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7.3.18 Propulsion power shall be inhibited until all doors have closed and are locked; the Contractor shall provide the function that does not enable brake release and train start if all doors are not closed and locked.

7.3.19 It shall be possible to isolate and mechanically lock a defective door on any car from the door open command, at which time the yellow fault lights on that side of the exterior of the car shall illuminate. The isolated door(s) of a car(s) shall be identified in the TMS and marked "X" to denote it has been isolated.

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7.3.21 Emergency Egress Device

7.3.21.1 Adjacent to each doorway in the car shall be installed an emergency door opening handle, (Emergency Egress Device) which may be used by passengers to open the one door in the event of an emergency. The position and function, numbers of emergency door opening device shall be reviewed by the Engineer.

7.3.21.2 The device shall adjacent to the door and be recessed and suitably sealed to prevent accidental actuation and at a height compatible with passenger height.

7.3.21.3 The manual emergency release shall however be shielded from unintentional use by passengers, whilst still being available in an emergency. Seal or lift transparent flap to be fitted. Once the handle is operated, the driver loses power and the door can be manually opened if train speed drops sufficiently., it shall be indicated to the train operator as an open door. The driver will have an override button which will keep power for a short time so that the driver can move to a safer location to attend to the emergency. Only when the train comes to nominal zero speed, can the passenger open the door fully manually.

7.3.21.4 If these devices are operated, crews shall be alarmed by indicating through TMS monitor and sounds.

7.3.21.5 This Egress device, once activated, requires the driver to reset with a key.

7.3.22 Normal Door Opening

7.3.22.1 Normal door opening shall be possible to open passenger doors only when Door authorization/command is available from On Board Signaling System. This requires zero speed signal and driver button operation.

is valid. Validity shall be changed as to section (tunnel/outside) as a minimum.

8.2.3 Re-circulated air shall be drawn through grilles in the ceiling and mix with the fresh air. This air mixture shall then pass through another filter into the evaporator unit, from where the blower shall force the air through the evaporator coils into the main air ducts.

8.2.4 Means shall be provided to adjust the volumes of fresh and re-circulated air. Approx. 1100 m3/h of fresh air per vehicle shall be provided when VAC system is operated.

8.2.5 The main air distribution duct shall be manufactured from anodized aluminum or the material that is enough service-proven and shall be constructed to ensure that the exiting air velocity is constant along its length. Ceiling panels may act as the lower side of the duct, provided adequately sealed.

8.2.6 Air filters shall be washable/re-useable and shall be well supported to prevent passing air from dislodging them shall the filters become saturated. They shall seal well at all edges. ~~The filters shall be easily replaced but shall be sized not to require replacement at intervals less than 3500 hours of operation.~~ The filters shall be easily replaced and shall be sized such that they shall be serviced monthly.

8.2.7 In order to reduce the frequency of replacement of the filter, the roll filter can~~shall~~ be used unless otherwise proposed by the Contractor. ~~The roll filter is that the furnace material is wound around the core, and when the set time has elapsed, a new furnace material portion is automatically set. Setting time of the winding is able to be changed arbitrarily by maintenance people. The length of the roll filter shall be determined with the reviewed of the Engineer.~~ Filter details shall be presented during design stage which shall not limited to the filter element materials data sheet, drawings, lifecycle cost analysis etc. for engineer review.

~~8.2.8 Openings shall be closed automatically when running through tunnel to prevent pressure variation, and open automatically after running through tunnel. For above, information of position from TMS shall be used.~~

~~8.2.9~~8.2.8 Active-ventilation system actuated by the battery supply shall be necessary, according to the requirements of the Japanese Ministerial Ordinance, MLIT Chapter 8, Section 4, Article 73 (Structure of Saloon) or other equivalent standards. Active ventilation system shall be operated at least one (1) hour by the battery supply.

~~8.2.10~~8.2.9 The entire ventilation system shall be submitted to the Engineer for review and comments.

8.3 Cooling System

8.3.1 The air conditioning system shall be thermostatically controlled and shall be service-proven and shall automatically maintain the specified interior temperature conditions. Relative humidity in the vehicle shall not exceed 60% under stabilized conditions. The capacity of air conditioning system shall be calculated considering the maximum number of passengers compared the demand forecast and W2 load condition.

8.3.2 The calculated capacity shall be reviewed by the Engineer.

8.3.3 In order to lower the center of gravity, the weight of one outside unit should be as light as possible. And the Contractor should carry out the lighter weight as much as possible, for example using aluminum and selecting most adequate compressor, etc.

8.3.4 Air flow over the evaporator coils shall be sufficiently low to prevent any moisture in the air from entering the main air supply duct, but in no case shall exceed 2.5 m/s. Evaporator

8 Ventilation and Air-Conditioning

8.1 General

8.1.1 Each car shall be provided with two units of ventilation and air-conditioning (VAC) system complete with relative humidity control. The air-conditioning units (ACU) shall be controlled independently such that if there is a failure in one unit, the other units shall continue to operate normally. All system components must be service-proven, and must be tested to demonstrate compliance with the requirements of this ERT.

8.1.2 The Contractor shall submit a complete design of the air handling and diffusing system along with air flow and velocity calculation for the Engineer to review. Upon installation on the car, the complete air supply/diffusing system shall be measured and balanced and the air flow and velocity confirmed. Air-balancing on each car shall be performed by a qualified VAC technician. Measurements shall be conducted in accordance with American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) requirements or equivalent.

8.1.3 The Contractor shall provide test and service equipment necessary for the maintenance and repair of the Ventilation and Air-Conditioning units. This shall include but not limited to off-board test bench, refrigerant recovery/recycling equipment and portable vacuum pump.

8.1.4 If air-conditioning stops to operate by any minor failure i.e. Communication or link error etc., switch shall be installed to allow the driver to be able to reset from the driver's cab.

8.1.5 Diffuser shall be arranged in consideration with the window seat side distribution and its accessibility for cleaning and maintenance.

8.2 Ventilation System

8.2.1 Blower fans supplied as part of the overhead evaporator units shall be capable to provide vehicle ventilation. Fresh air shall enter the vehicle through screened openings in the roof on each side, pass-through stainless-steel ducts (sloped downwards to drain), and pass through a filter into a plenum chamber adjacent to each overhead evaporator unit. The design shall prevent blown rain from entering the plenum and leaking into the vehicle interior.

8.2.2 It shall be possible to change by TMS monitor whether function of entering ambience air is valid. Validity shall be changed as to section (tunnel/outside) as a minimum.

8.2.3 Re-circulated air shall be drawn through grilles in the ceiling and mix with the fresh air. This air mixture shall then pass through another filter into the evaporator unit, from where the blower shall force the air through the evaporator coils into the main air ducts.

8.2.4 Means shall be provided to adjust the volumes of fresh and re-circulated air. Approx. 1100 m3/h of fresh air per vehicle shall be provided when VAC system is operated.

8.2.5 The main air distribution duct shall be manufactured from anodized aluminum or the material that is enough service-proven and shall be constructed to ensure that the exiting air velocity is constant along its length. Ceiling panels may act as the lower side of the duct, provided adequately sealed.

8.2.6 Air filters shall be washable/re-useable and shall be well supported to prevent passing air from dislodging them shall the filters become saturated. They shall seal well at all edges. The filters shall be easily replaced and shall be sized such that they shall be serviced

monthly.

8.2.7 In order to reduce the frequency of replacement of the filter, the roll filter can be used unless otherwise proposed by the Contractor. Filter details shall be presented during design stage which shall not limited to the filter element materials data sheet, drawings, lifecycle cost analysis etc. for engineer review.

8.2.8 Active-ventilation system actuated by the battery supply shall be necessary, according to the requirements of the Japanese Ministerial Ordinance, MLIT Chapter 8, Section 4, Article 73 (Structure of Saloon) or other equivalent standards. Active ventilation system shall be operated at least one (1) hour by the battery supply.

8.2.9 The entire ventilation system shall be submitted to the Engineer for review and comments.

8.3 Cooling System

8.3.1 The air conditioning system shall be thermostatically controlled and shall be service-proven and shall automatically maintain the specified interior temperature conditions. Relative humidity in the vehicle shall not exceed 60% under stabilized conditions. The capacity of air conditioning system shall be calculated considering the maximum number of passengers compared the demand forecast and W2 load condition.

8.3.2 The calculated capacity shall be reviewed by the Engineer.

8.3.3 In order to lower the center of gravity, the weight of one outside unit should be as light as possible. And the Contractor should carry out the lighter weight as much as possible, for example using aluminum and selecting most adequate compressor, etc.

8.3.4 Air flow over the evaporator coils shall be sufficiently low to prevent any moisture in the air from entering the main air supply duct, but in no case shall exceed 2.5 m/s. Evaporator coils shall preferably be manufactured from copper, and shall have copper fins, however, aluminum elements is also acceptable provided they are sufficiently protected from the elements. A condensate pan shall be provided beneath the evaporator coil. The pan shall be made from stainless steel with suitable drain lines and shall realize easy cleaning. The condensate drain lines shall be insulated to prevent condensation.

8.3.5 The refrigerant used shall be environmentally friendly such as R407C or equivalent the use of refrigerant containing fluorocarbons is not allowed.

8.3.6 Because of preventing trouble of moisture and water, connectors in outside units shall be waterproof type.

8.3.7 The evaporator unit shall include all required components, such as the liquid line solenoid valve, modulating solenoid valve, thermal expansion valves, liquid line strainer, liquid line sight glass/moisture indicator, etc. Appropriate gauge ports for troubleshooting shall be provided.

8.3.8 Blowers shall be direct driven by the motor, which shall be powered by the 440 Vac auxiliary power supply system.

8.3.9 The compressor-condenser unit shall be heavy duty transportation grade, service-proven combined hermetic compressor/condensing unit. The compressor motor shall be powered by the 440 VAC auxiliary power supply system. Cylinder unloaders shall be easily adjusted and shall provide at least two stages of unloading for a total of not less than two-thirds unloading per one compressor.

9.1.9 For service brake, the loaded braking ratio shall be 70% or more or according to EN standards. For the security brake, the empty brake ratio shall be 70% or more or according to EN standards. The rolling stock shall comply with all relevant requirements in Japanese Ministerial Ordinance, MLIT Chapter 8, Article 69 (Brake unit related) or other equivalent standards.

9.1.10 In addition, the above, the balance of deceleration of regenerative and pneumatic shall be finally adjusted considering ATO station stop accuracy. Interface between BCU and ETCS or Running and stopping assistant system about service brake step (via TMS control transmission) shall be at least 31 steps.

9.1.11 ~~Several sensors shall be incorporated to brake system. Sensors shall be equipped to each brake cylinders and each air suspensions, as a minimum. These data detected by sensors shall be transmitted to Brake control unit, and shall be utilized for control of propulsion, brake and ATO and etc.~~ Several sensors shall be incorporated to brake system. Adequate quantity of Sensors shall be equipped to brake cylinders and air suspensions, as a minimum. These data detected by sensors shall be transmitted to Brake control unit, and shall be utilized for control of propulsion, brake and ATO and etc.

9.1.12 The calculation for emergency braking distances under dry and wet conditions shall be submitted during design phase for the Engineer review.

9.1.13 Braking distances for normal service braking with electric brake blending shall also be submitted during the design phase for the Engineer review.

9.2 Friction Brakes

9.2.1 All axles shall be equipped with a split type ventilated brake disc unless the lifetime of the disc brake exceeds the lifetime of the wheels. ~~and b~~Braking torque shall be applied to the disc by the air operated brake cylinder operating the caliper containing the brake pads equipped with tread cleaning and keeping proper condition of the pad. Each axle of motor mounted cars shall be equipped with the disk brake on wheel with tread cleaning.

9.2.2 The brake pads shall be an asbestos-free friction material or otherwise proposed by the Contractor, which has shown stable friction characteristics under a wide range of temperatures, humidity, and surface speed conditions. The friction material shall be compatible with the friction ring of the brake disc, and with consideration to Coefficient of Friction (COF) linearity, nominal performance, wear, noise, etc. The brake pad shall have a proven service history in railway operation.~~The brake pad shall be designed and manufactured not only with extremely small changing characteristics with respect to water, lubricating oil, fade, pressing pressure, speed and so on, but also with suppression of occurrence of spark caused by friction. The Contractor shall submit these bench test data and obtain statement of No Objection from the Engineer~~.

9.2.3 The friction brakes shall be fully capable of performing all braking duties, without the assistance of the electric brakes. The brake pads shall be retained by the brake actuator calipers or brake cylinder and shall be of the composite type. The pads shall not contain any asbestos or other cancer inducing materials, and the Contractor shall provide the Engineer with full details of the material composition for the health hazards assessment.

9.2.4 The parking brakes shall be with spring- applied park brake function, through air release brake actuators, and shall be capable of holding 10 cars train-set in W2 (7t payload) loading condition on a 3.5% grade under all track conditions indefinitely. Parking brakes shall be installed in each leading car and more cars if needed to meet the above performance requirement unless otherwise proposed by the Contractor~~.~~

9.1.9 For service brake, the loaded braking ratio shall be 70% or more or according to EN standards. For the security brake, the empty brake ratio shall be 70% or more or according to EN standards. The rolling stock shall comply with all relevant requirements in Japanese Ministerial Ordinance, MLIT Chapter 8, Article 69 (Brake unit related) or other equivalent standards.

9.1.10 In addition, the above, the balance of deceleration of regenerative and pneumatic shall be finally adjusted considering ATO station stop accuracy. Interface between BCU and ETCS or Running and stopping assistant system about service brake step (via TMS control transmission) shall be at least 31 steps.

9.1.11 Several sensors shall be incorporated to brake system. Adequate quantity of Sensors shall be equipped to brake cylinders and air suspensions, as a minimum. These data detected by sensors shall be transmitted to Brake control unit, and shall be utilized for control of propulsion, brake and ATO and etc.

9.1.12 The calculation for emergency braking distances under dry and wet conditions shall be submitted during design phase for the Engineer review.

9.1.13 Braking distances for normal service braking with electric brake blending shall also be submitted during the design phase for the Engineer review.

9.2 Friction Brakes

9.2.1 All axles shall be equipped with a split type ventilated brake disc unless the lifetime of the disc brake exceeds the lifetime of the wheels. Braking torque shall be applied to the disc by the air operated brake cylinder operating the caliper containing the brake pads equipped with tread cleaning and keeping proper condition of the pad. Each axle of motor mounted cars shall be equipped with the disk brake on wheel with tread cleaning.

9.2.2 The brake pads shall be an asbestos-free friction material or otherwise proposed by the Contractor, which has shown stable friction characteristics under a wide range of temperatures, humidity, and surface speed conditions. The friction material shall be compatible with the friction ring of the brake disc, and with consideration to Coefficient of Friction (COF) linearity, nominal performance, wear, noise, etc. The brake pad shall have a proven service history in railway operation..

9.2.3 The friction brakes shall be fully capable of performing all braking duties, without the assistance of the electric brakes. The brake pads shall be retained by the brake actuator calipers or brake cylinder and shall be of the composite type. The pads shall not contain any asbestos or other cancer inducing materials, and the Contractor shall provide the Engineer with full details of the material composition for the health hazards assessment.

9.2.4 The parking brakes shall be with spring- applied park brake function, through air release brake actuators, and shall be capable of holding 10 cars train-set in W2 (7t payload) loading condition on a 3.5% grade under all track conditions indefinitely. Parking brakes shall be installed in each leading car and more cars if needed to meet the above performance requirement unless otherwise proposed by the Contractor

9.2.5 The parking brakes shall be applied in the event of loss of the main compressed air supply. The parking brakes shall be capable of release from within the cab when the compressed air supply is present. With no compressed air supply available, it shall be possible to release individual parking brake actuators manually from track level. Application of parking brakes shall also be controllable from the cab.

9.2.6 The design shall be such that the parking brakes will take effect prior to fade off of service

10 Pneumatic Equipment

10.1 General

10.1.1 The trains shall be supplied with the equipment and functions specified herein, such that a complete, fully integrated and fully functioning friction brake and pneumatic system is provided.

10.1.2 The number and capacity of complete pneumatic system, which shall consist of an air compressor assembly and all associated piping, reservoirs, fittings, etc., to provide a fully functional system capable of supplying all air requirements for the friction braking system, air suspension system,), horns, etc., shall be provided.

10.1.3 Compressed air shall be produced by the air compressor assembly described in Sub-Clause 10.2 of this ERT. Compressed air shall be sufficiently filtered and dried prior to entering the pneumatic lines. All feeds from the main supply line shall be protected by check valves, to prevent the rapid loss of air shall a rupture of leakage in the line occur. Flexible connections from the air compressor to the main supply line shall be likewise protected by check valves.

10.1.4 The pneumatic equipment, including the compressor shall have a maximum operating pressure of 1MPa (10bars). The compressor shall be adequately protected, including from over pressure.

10.1.5 The Contractor shall submit the air system design document including the number and capacity of air compressor unit and air tank capacity and function, etc., It shall be reviewed by the Engineer. In the event of one compressor unit failure, the adjacent compressor shall be able to support the pressure level without degradation of the train operation performance.

10.2 Air Compressor Assembly

10.2.1 The train shall be equipped with require number of transit service-proven air compressor assembly, which shall consist of an air compressor unit directly driven by an electric motor, air filtration, air drier equipment, inter cooler, safety valves, etc.

10.2.2 The assembly shall be installed under the vehicle via resilient mounts, and care shall be taken to minimize the amount of noise and vibration transmitted into the carbody structure and to the wayside.

10.2.3 The air compressor shall be scroll type or better reliable than; and the maximum discharge pressure of air compressor shall be more than 1MPa ~~The air compressor shall be scroll type, and the maximum discharge pressure of air compressor shall be more than 1MPa.~~

10.2.4 The air compressor motor shall be powered from the 440 VAC, 60 Hz auxiliary power supply system.

10.2.5 ~~Each compressor assembly shall be capable of supplying all of the air requirements for an 8-cars train-set in the event of failure of one compressor unit.~~The design of the pneumatic system shall be capable of supplying all of the air requirements for a train consist in the event of failure of one compressor unit.

10.2.6 The capacity of air compressor shall have sufficient for the simultaneous operation of all pneumatic devices. Calculations for the capacity of air compressor shall be submitted for review by the Engineer.

10.2.7 ~~All air compressors shall be started/stopped synchronously to average each compressor's~~

~~operation ratio. For this control, train line or transmission of TMS may be utilized.~~The operation of air compressors shall be managed to average each compressor's operation ratio. For this control, train line or transmission of TMS may be utilized.

10.3 Pneumatic System

10.3.1 The Contractor shall submit details of stainless-steel pneumatic system piping or an equivalent service-proven material such as copper for ~~for Engineer~~the Engineer review. Joints shall be rail industry approved compression fittings. Joints shall not be made to connect straight runs of pipe work, unless reviewed and approved by the Engineer. Inaccessible runs of pipe work shall not utilize joints. All piping shall be installed to keep fittings to an absolute minimum.

10.3.2 Cut-out valve handles shall be installed so that in the open position they are parallel to the flow of air, and in the closed position they are perpendicular to the flow of air. Cut-out cock handles shall be readily accessible for use in an emergency. All cut-out cocks shall be of the vented type, unless the function prohibits their use. The function of all cut-out cocks shall be clearly identified by means of engraved stainless-steel plates riveted to structure adjacent to the valve, the lettering on which shall be filled with black epoxy paint and suitable color coded.

10.3.3 All pneumatic tanks or reservoirs shall have drain valve to remove condensates.

10.3.4 All pneumatic tanks shall be in accordance with EN286-C or EN286-4 or other equivalent standard.

10.3.5 A cut-off valve shall be provided at a place required for maintenance or abnormality.

10.3.6 Separate systems within the pneumatic system shall be supplied via a vented cut-out valve and a strainer, ~~and shall be provided with separate air reservoirs,~~ supplied through a check valve to protect against sudden loss of air pressure. The air brake reservoir shall be sized to provide at least three emergency brake operations under W2 loading conditions. Reservoirs shall be set to assist moisture collection and shall include automatic/manual drain valves.

10.3.7 The main air reservoir shall have sufficient capacity for the simultaneous operation of all pneumatic devices. Calculations for the capacity of all reservoirs shall be submitted to the Engineer for review.

10.3.8 All air reservoir structure shall comply with EN286-C or EN286-4. or other equivalent standards.

10.3.9 All flexible hoses shall be date stamped, and its full life indicated, unless otherwise proposed by the Contractor during the design stage and reviewed by the ~~.~~Engineer. All flexible hose connections on removable assemblies shall be of railway service proven, quick connect coupling or compatible to ISO 8434, unless otherwise proposed by the Contractor during the design stage and reviewed by the Engineer~~.~~

10.3.10 The device and air pipe from the last tank as the source of the braking force to brake cylinder used to service brake and emergency brake shall be placed within the width of bogie.

10.3.11 The device and air pipe from the last tank as the source of the braking force to brake cylinder used to security brake shall be placed within the width of bogie frame.

10.3.12 Pneumatic air supply distribution system shall be designed in such a way that any single point failure can be readily isolated to ensure that the affected train can be continued in

10 Pneumatic Equipment

10.1 General

10.1.1 The trains shall be supplied with the equipment and functions specified herein, such that a complete, fully integrated and fully functioning friction brake and pneumatic system is provided.

10.1.2 The number and capacity of complete pneumatic system, which shall consist of an air compressor assembly and all associated piping, reservoirs, fittings, etc., to provide a fully functional system capable of supplying all air requirements for the friction braking system, air suspension system,), horns, etc., shall be provided.

10.1.3 Compressed air shall be produced by the air compressor assembly described in Sub-Clause 10.2 of this ERT. Compressed air shall be sufficiently filtered and dried prior to entering the pneumatic lines. All feeds from the main supply line shall be protected by check valves, to prevent the rapid loss of air shall a rupture of leakage in the line occur. Flexible connections from the air compressor to the main supply line shall be likewise protected by check valves.

10.1.4 The pneumatic equipment, including the compressor shall have a maximum operating pressure of 1MPa (10bars). The compressor shall be adequately protected, including from over pressure.

10.1.5 The Contractor shall submit the air system design document including the number and capacity of air compressor unit and air tank capacity and function, etc., It shall be reviewed by the Engineer. In the event of one compressor unit failure, the adjacent compressor shall be able to support the pressure level without degradation of the train operation performance.

10.2 Air Compressor Assembly

10.2.1 The train shall be equipped with require number of transit service-proven air compressor assembly, which shall consist of an air compressor unit directly driven by an electric motor, air filtration, air drier equipment, inter cooler, safety valves, etc.

10.2.2 The assembly shall be installed under the vehicle via resilient mounts, and care shall be taken to minimize the amount of noise and vibration transmitted into the carbody structure and to the wayside.

10.2.3 The air compressor shall be scroll type or better reliable than; and the maximum discharge pressure of air compressor shall be more than 1MPa

10.2.4 The air compressor motor shall be powered from the 440 VAC, 60 Hz auxiliary power supply system.

10.2.5 The design of the pneumatic system shall be capable of supplying all of the air requirements for a train consist in the event of failure of one compressor unit.

10.2.6 The capacity of air compressor shall have sufficient for the simultaneous operation of all pneumatic devices. Calculations for the capacity of air compressor shall be submitted for review by the Engineer.

10.2.7 The operation of air compressors shall be managed to average each compressor's operation ratio. For this control, train line or transmission of TMS may be utilized.

logged fault related to the switching of element and behavior of instantaneous current and voltage, etc. shall be required to be available for fault diagnostic analysis.

11.4.3.3 Attention shall be provided to automatically discharge capacitors which the voltage might present a hazard to the maintenance personnel opening any enclosure. Discharge time shall not be more than 5 minutes.

12 Primary Power System

12.1 Current Collection

12.1.1 The 1500 VDC power shall be collected from the overhead line system using electrically operated pantographs. The pantograph assembly shall permit all necessary movement, taking into account the overhead line installation tolerances/clearances, vibration of rolling stock, deflation of suspension etc. and maintain the complete and effective collection of electrical power. Carbon or copper shall be used as the material of the contact strip.

12.1.2 The pantograph within the train-sets shall equip both the function to raise and lower at all pantographs on the train the same time and the function to raise or lower individually, and each pantograph shall be able to be raised by releasing the lock manually.

12.1.3 Each guide pipe for the two parts of the current collector shall be equipped with respectively in order to have higher guidance function for the shaking of the catenary than the single guide pipe between the two parts of the current collector.

12.1.4 A lightning arrester shall be installed on the appropriate position adjacent to the pantograph(s).

12.1.5 Pantograph shall be mounted on the roof with double insulation.

12.1.6 The spring structure to suppress detachment shall be equipped to suppress leaving overhead catenary at ~~180km/h,~~ the required train performance maximum design speed, as per clause 1.11.2.1 (Item2).~~.~~

12.1.7 A function shall be provided to judge whether the pantograph is rising or descending and shall be displayed in the TMS.

12.1.8 Number of pantographs shall be determined in consideration not over each acceptable value even when train current is maximum, the capacity calculation shall be reviewed by the Engineer. Also, consistency with multi-pantograph system, such as distance between pantographs, shall be taken into consideration.

12.1.9 Pantograph cover shall be equipped for suppression of aerial noise, in consideration of body oscillations where if required in order to comply with the noise requirement in clause 1.12.~~.~~

12.1.10 Wires of high voltage from pantographs shall be shielded adequately to suppress EMI and to weaken magnetic flux in the car.

12.2 Input Protection (HSCB)

12.2.1 The power supply shall be protected by a heavy duty, transit proven, ultra-high-speed circuit breaker, which shall be capable of handling the short circuit capacity of the Power Conversion Equipment. The High-Speed Circuit Breaker (HSCB) shall be installed in a dedicated explosion-proof enclosure. The Contractor shall select the HSCB so as to have sufficient capacity to break the short-circuit current. The set value to trip shall be

present a hazard to the maintenance personnel opening any enclosure. Discharge time shall not be more than 5 minutes.

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12.2.2 Tripping of the HSCB shall be enunciated in the Driver's Cab and shall be registered in

5) Traction motor current,
6) Main airline pressure / brake cylinder pressure,
7) Emergency brake status,
8) Brake events under manual operation.
9) Driver safety devise,
10) Status of doors and control,
11) ACU events,
12) Wheel Slip and slide,
13) Operation of safety related cut-out switches,
14) Overhead line Voltage,
15) Battery Voltage,
16) Date and Time, and
17) Location.
18) ATO condition
19) PSD condition
20) Battery Contactor status.

15.5 Master Clock

15.5.1 The TMS shall be able to communicate with the Communication or the on-board signaling systems to obtain the time and date details to provide the master clock information to other on-board systems. The accuracy of the clock shall be self-confirmed at the startup of the train.

15.6 Electrical jumper wire

15.6.1 Electrical jumper wire that is necessary for transmission between the vehicles shall be specified by TMS supplier and shall have a design life about 8 years ~~be achieved 1 million cycles of performance test. Couplings shall be HART type or similar.~~

11) ACU events,
12) Wheel Slip and slide,
13) Operation of safety related cut-out switches,
14) Overhead line Voltage,
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16 Communication System

16.1 General

16.1.1 The Rolling Stock shall be equipped with communications equipment to provide voice, video and data services. This Clause describes the requirements for the CP NS-01 (Communication System) Contractor, and the CP NS-03 (Rolling Stock) Contractor.

16.1.2 Both Contractors shall ensure that all requirements of the specification pertaining to interfaces are comprehensively fulfilled. Below is a brief outline of responsibilities between the CP NS-03 and CP NS-01 Contractors. Further details are specified in following Sub-Clauses:

Table 16.1 Responsibility Matrix

SOW	Item Description	By Contractor
1	Public Address (PA) System to broadcast speech messages to train passengers from the driver's cab. Facility to broadcast over the train PA System from the Operations Control Center (OCC) with the associated message content relayed to the train via the Train Radio System.	CP NS-03 CP NS-01
2	Guidance display for the customer shall be placed ~~above the door~~ under the ceiling in the passenger coaches (or saloons). Guidance display shall be digital signage to present on dedicated TV-style color monitors using ~~17-inch LCD~~ LCD displays which is 17-inch or bigger size~~displays~~, and it shall be possible to display the destination, the next station, the side of opening door, transit information, line map, time to arrive at each station, the guidance of the next station and attention, etc. One monitor shall be installed on one door. Securing space and supplying the wiring shall be prepared so that another screen can be added for advertisement. Advertisement display for the customer shall be placed ~~above the window between doors~~ in the passenger coaches (or saloons). Advertisement display shall be digital signage to present on dedicated TV-style color monitors using 21.5-inch or more LCD displays. (BG This may interfere with luggage racks)	CP NS-03
3	Passenger emergency intercom to provide audio communication between carriages and the driver's cab to enable passengers to alert the driver should an emergency situation occur within the train carriage. In case the driver does not pick up the passenger emergency intercom within a predefined time, it automatically connects to the OCC, using the Train ~~onboard~~ radio.	CP NS-03 CP NS-01
4	Driver's intercom system to allow full-duplex audio communication between driver's cabs.	CP NS-03
5	Train radio system to allow full-duplex audio communication between the driver and the OCC. Additional interfaces shall be provided within the OCC to relay to the trains PA audio messages. ~~Train Protection Radio~~	CP NS-01
6	Outdoor display (mounting on the train) consisting of a full color LED to display destination stations for the passengers on the platform.	CP NS-03

16.2 General Requirements

16.2.1 The CP NS-03 Contractor shall equip each driver's cab with the necessary Human Machine Interface (HMI) facilities for the operation, control and monitoring by the driver of the on-board communications systems. The number of handsets required for driver use

shall be rationalized and kept to a minimum. In particular, the CP NS-03 Contractor shall utilize a dedicated monitor or TMS monitor with respect to the display.

16.2.2 Subject to any reliability constraints, both CP NS-03 and CP NS-01 Contractors shall consider the integration of all communication operator functions into a different or single ~~single~~ HMI to optimize~~minimize~~ space requirements.

16.2.3 All of the cab-mounted equipment shall be fit for purpose and ergonomically designed taking account of human factor issues.

16.2.4 Unless otherwise stated, the equipment shall be controllable from the operational driver's cab and must be fully functional over a length of 10-car trains. The on-board communications equipment shall be fed via individual circuit breakers from a fully regulated low voltage power supply equipped with a battery back-up.

16.2.5 The design shall incorporate the latest proven technology, which shall be highly scalable and reliable, avoiding common mode failure.

16.2.6 The entire installation for each system shall include a comprehensive diagnostic and fault management facility and shall be interfaced to the TMS to log events/incidents and major fault data, to send and to receive a variety of information necessary for control.

16.2.7 Suitable security measures and firewalls shall be employed comprising standardized state-of-the-art authentication mechanisms to block unwanted data traffic and access to the on-board communication systems.

16.2.8 The equipment shall be robustly constructed and shall be resistant to tampering, vandalism and exposure to liquid spillages, etc.

16.2.9 The equipment devices within carriages shall in appearance be aesthetically pleasing and their fitment shall be flush mounted into the carriage body and installed in positions to minimize their exposure to vandalism.

16.2.10 The CP NS-03 Contractor shall perform a study to ensure that, within the train carriages all of the communications equipment is positioned, as appropriate, so as to achieve ease of passenger use and passenger viewing without creating an obstruction to passenger flow and without obscuring other facilities such as signs, notices and other displays, etc.

16.2.11 The CP NS-03 and CP NS-01 Contractors shall ensure that the required number of antennas be minimized and be positioned taking into account the following:

1) The effect of the geometry of the installation location on the radiation/reception performance of the antenna and without exceeding the rolling stock gauge;
2) The effect of any protrusions which might affect the radiation/reception performance of the antenna;
3) The effect of any adjacent aerials on the performance of the radio system;
4) The risk of being struck or otherwise damaged;
5) Electrical safety in relation to proximity to exposed HV lines; and
6) Diversity for improving reception sensitivity.

16.2.12 The systems shall, where appropriate, be interfaced to the TMS for provision of accurate time and date information.

16.2.13 Suitable automatic test routines shall be available to the driver in the active cab in order to check ~~that the operational integrity of~~ the operational status of the on-board communications equipment ~~is verified~~ prior to the train entering passenger service.

16 Communication System

16.1 General

16.1.1 The Rolling Stock shall be equipped with communications equipment to provide voice, video and data services. This Clause describes the requirements for the CP NS-01 (Communication System) Contractor, and the CP NS-03 (Rolling Stock) Contractor.

16.1.2 Both Contractors shall ensure that all requirements of the specification pertaining to interfaces are comprehensively fulfilled. Below is a brief outline of responsibilities between the CP NS-03 and CP NS-01 Contractors. Further details are specified in following Sub-Clauses:

Table 16.1 Responsibility Matrix

SOW	Item Description	By Contractor
1	Public Address (PA) System to broadcast speech messages to train passengers from the driver's cab. Facility to broadcast over the train PA System from the Operations Control Center (OCC) with the associated message content relayed to the train via the Train Radio System.	CP NS-03 CP NS-01
2	Guidance display for the customer shall be placed under the ceiling in the passenger coaches (or saloons). Guidance display shall be digital signage to present on dedicated TV-style color monitors using LCD displays which is 17-inch or bigger size, and it shall be possible to display the destination, the next station, the side of opening door, transit information, line map, time to arrive at each station, the guidance of the next station and attention, etc. One monitor shall be installed on one door. Securing space and supplying the wiring shall be prepared so that another screen can be added for advertisement. Advertisement display for the customer shall be placed in the passenger coaches (or saloons). Advertisement display shall be digital signage to present on dedicated TV-style color monitors using 21.5-inch or more LCD displays. (BG This may interfere with luggage racks)	CP NS-03
3	Passenger emergency intercom to provide audio communication between carriages and the driver's cab to enable passengers to alert the driver should an emergency situation occur within the train carriage. In case the driver does not pick up the passenger emergency intercom within a predefined time, it automatically connects to the OCC, using the Train radio.	CP NS-03 CP NS-01
4	Driver's intercom system to allow full-duplex audio communication between driver's cabs.	CP NS-03
5	Train radio system to allow full-duplex audio communication between the driver and the OCC. Additional interfaces shall be provided within the OCC to relay to the trains PA audio messages.	CP NS-01
6	Outdoor display (mounting on the train) consisting of a full color LED to display destination stations for the passengers on the platform.	CP NS-03

16.2 General Requirements

16.2.1 The CP NS-03 Contractor shall equip each driver's cab with the necessary Human Machine Interface (HMI) facilities for the operation, control and monitoring by the driver of the on-board communications systems. The number of handsets required for driver use

shall be rationalized and kept to a minimum. In particular, the CP NS-03 Contractor shall utilize a dedicated monitor or TMS monitor with respect to the display.

16.2.2 Subject to any reliability constraints, both CP NS-03 and CP NS-01 Contractors shall consider the integration of all communication operator functions into a different or single HMI to optimize space requirements.

16.2.3 All of the cab-mounted equipment shall be fit for purpose and ergonomically designed taking account of human factor issues.

16.2.4 Unless otherwise stated, the equipment shall be controllable from the operational driver's cab and must be fully functional over a length of 10-car trains. The on-board communications equipment shall be fed via individual circuit breakers from a fully regulated low voltage power supply equipped with a battery back-up.

16.2.5 The design shall incorporate the latest proven technology, which shall be highly scalable and reliable, avoiding common mode failure.

16.2.6 The entire installation for each system shall include a comprehensive diagnostic and fault management facility and shall be interfaced to the TMS to log events/incidents and major fault data, to send and to receive a variety of information necessary for control.

16.2.7 Suitable security measures and firewalls shall be employed comprising standardized state-of-the-art authentication mechanisms to block unwanted data traffic and access to the on-board communication systems.

16.2.8 The equipment shall be robustly constructed and shall be resistant to tampering, vandalism and exposure to liquid spillages, etc.

16.2.9 The equipment devices within carriages shall in appearance be aesthetically pleasing and their fitment shall be flush mounted into the carriage body and installed in positions to minimize their exposure to vandalism.

16.2.10 The CP NS-03 Contractor shall perform a study to ensure that, within the train carriages all of the communications equipment is positioned, as appropriate, so as to achieve ease of passenger use and passenger viewing without creating an obstruction to passenger flow and without obscuring other facilities such as signs, notices and other displays, etc.

16.2.11 The CP NS-03 and CP NS-01 Contractors shall ensure that the required number of antennas be minimized and be positioned taking into account the following:

1) The effect of the geometry of the installation location on the radiation/reception performance of the antenna and without exceeding the rolling stock gauge;
2) The effect of any protrusions which might affect the radiation/reception performance of the antenna;
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5) Electrical safety in relation to proximity to exposed HV lines; and
6) Diversity for improving reception sensitivity.

16.2.12 The systems shall, where appropriate, be interfaced to the TMS for provision of accurate time and date information.

16.2.13 Suitable automatic test routines shall be available to the driver in the active cab in order to check the operational status of the on-board communications equipment prior to the train entering passenger service.

16.3.14 PA broadcasts initiated by the train driver shall have priority over other broadcasts.

16.4 Internal Guidance Display

16.4.1 The guidance display shall be digital-signage to present on dedicated TV style color monitors, (17-inch LCD), a display to show typically, the destination, the next station, which side door opening, transit information, line map, time to arrive at each station, the guidance of the next station, etc.

16.4.2 The displays for advertisement (21.5-inch or more LCD) shall be installed at suitable locations in the saloon area. Advertisement contents shall be installed into this system directly. Also, it shall be prepared to be able to be installed remotely by interfacing with the wireless another system.

16.5 External Destination Sign System

16.5.1 The destination sign located at the end of the consist shall provide, as a minimum, information on the train running number along with the start and destination locations of the train service and any special information such as 'Not in Service', etc.

16.5.2 The destination sign shall be installed externally on each cab car above (or below dependent on the cab front design) the windshield and two units on each side of each car above the window.

16.5.3 A hinged panel shall be installed in the driver's cab to provide ready access to the destination sign unit by maintenance personnel.

16.5.4 The destination sign shall be suitably sized with text colors such that passengers waiting on platforms shall be able to see clearly the information displayed on the train approach to the platform under all conditions.

16.5.5 The destination sign shall be programmable from the a dedicated PIS monitor or the TMS in the driver's cab.

16.5.6 The destination signs in the non-active cab and on the side of the car shall automatically indicate the same destination as in the active cab.

16.5.7 The design of the destination sign shall allow manual override in the case of a defect in the electronics system.

16.5.8 The Contractor shall propose options for the electronic destination display sign system for the Engineer's review.

16.5.9 Choosing optimal colors according to train type, guidance content and display that is easy for the user to understand shall be implemented.

16.5.10 Display contents, colors, fonts, etc. shall be reviewed by the Engineer.

16.6 Digital Signage for Advertising

16.6.1 Space and power supply provision shall be made available within the train carriages to enable digital signage as described in Sub-Clauses 167.1.2 item 2 and 167.4 herein.

16.4 **Internal Guidance Display**

16.4.1 The guidance display shall be digital-signage to present on dedicated TV style color monitors, (17-inch LCD), a display to show typically, the destination, the next station, which side door opening, transit information, line map, time to arrive at each station, the guidance of the next station, etc.

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16.6 **Digital Signage for Advertising**

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16.7 **Passenger Emergency Intercom**

~~20.3.7~~

~~20.3.8~~20.3.9 The parking brake shall be tested to demonstrate its ability to hold a consist on the specified gradient. The test shall record the actual force required to overcome the parking brake in a failure recovery situation on both level track and a 3.5% gradient. ~~The test shall be undertaken at the time of handing over of Rolling Stock.~~ This shall be carried out with a number of parking brakes (20%) isolated.

~~20.3.9~~20.3.10 Before transporting the Rolling Stock to Manila, the Contractor shall perform a test to demonstrate that the Emergency Braking and service requirements have been met each design deceleration. Tests that cannot be carried out at Bidder's test facility will be carried out on the main line after the vehicle has been delivered to Manila.

~~20.3.10~~20.3.11 The Contractor shall prepare and conduct qualification tests to demonstrate that all other equipment to be supplied will operate properly within the limits of the environmental and/or physical parameters listed in this ERT. The test shall be undertaken at the time of handing over of Rolling Stock at Depot.

~~20.3.11~~20.3.12 Running resistance and Energy consumption test shall be conducted during type test.

~~20.3.12~~20.3.13 Any design changes, adjustments, etc., that are required to meet the performance requirements, shall be fully re-tested and documented. All Equipment design changes shall be subject to prior review by the Engineer.

~~20.3.13~~20.3.14 For any unit previously qualified, or with a railroad proven service history, the Contractor may request a waiver from performing the Qualification Test. However, the request for a waiver must be accompanied by a duplicate test report or certification for given statement of No Objection in order to satisfy qualification requirements. The waiver request must include justification of the claim that the equipment and test(s) are substantially the same as those in the current qualification requirements.

~~20.3.14~~20.3.15 Only with the written consent of the Engineer will Qualification Test or Certification requirements be waived.

20.4 Acceptance Testing

20.4.1 General

20.4.1.1 All cars, sets and consists shall undergo acceptance testing in accordance with the requirements of JIS E4041 or other equivalent standards like IEC 61133 as a minimum.

20.4.1.2 Acceptance tests shall be completed on every vehicle supplied under this Contract to prove that manufacturing and assembly of the trains have been carried out appropriately. A Type Test shall be conducted for the first 8-car train-set and a Routine Test shall be completed on every trainset after that, except for the first train.

20.4.1.3 The tests shall be completed at the Contractor's manufacturing facility as Factory Acceptance Test (FAT) and at on-site after delivery of the train as On-site Testing and Commissioning.

20.4.2 Factory Acceptance Test (FAT)

20.4.2.1 The Contractor shall perform a FAT to ensure that the systems are functioning correctly before shipment of the trains. The Tests shall be conducted in the test track and other special test facilities of the Contractor. Tests that cannot be carried out at Bidder's test

facility will be carried out on the main line after the vehicle has been delivered to Manila.

20.4.2.2 The following tests shall be carried out as a minimum but not limited to:

1) Type Test: These tests shall be performed on the 1st trainset:
   a) Dimension inspection;
   b) Weighing; and balancing the car weight over all eight (8) wheels on every vehicle in the consist.;
   c) Dielectric test;
   d) Brake system tests including Emergency Brake Distance and Service Brake Tests;
   e) Auxiliary power supply operation;
   f) Door system operation;
   g) Air conditioning operation;
   h) Water tightness test.
   i) Propulsion system test;
   j) Bogie car clearance test (one motor car and trailer car only);
   k) Carbody loading test (one car only);
   l) Jacking up test;
   m) Center of gravity measurement;
   n) Interior lights illumination test;
   o) Noise measurement (static);
   p) Vibration measurement; and
   q) On-board signaling function test.
2) Routine Test: These tests shall be performed on the 2nd to 7th trainset:
   a) Dimension inspection;
   b) Weighing; and balancing the car weight over all eight (8) wheels on every vehicle; in the train
   c) Dielectric test;
   d) Brake system test;
   e) Auxiliary power supply operation;
   f) Door system operation;
   g) Air conditioning operation;
   h) Water tightness test; and
   i) Propulsion system test.

3) Integrated Factory Acceptance Test:
   a) Integrated Factory Acceptance Test (IFAT) to verify the integration of the Rolling Stock

brake in a failure recovery situation on both level track and a 3.5% gradient. This shall be carried out with a number of parking brakes (20%) isolated.

20.3.10 Before transporting the Rolling Stock to Manila, the Contractor shall perform a test to demonstrate that the Emergency Braking and service requirements have been met each design deceleration. Tests that cannot be carried out at Bidder's test facility will be carried out on the main line after the vehicle has been delivered to Manila.

20.3.11 The Contractor shall prepare and conduct qualification tests to demonstrate that all other equipment to be supplied will operate properly within the limits of the environmental and/or physical parameters listed in this ERT. The test shall be undertaken at the time of handing over of Rolling Stock at Depot.

20.3.12 Running resistance and Energy consumption test shall be conducted during type test.

20.3.13 Any design changes, adjustments, etc., that are required to meet the performance requirements, shall be fully re-tested and documented. All Equipment design changes shall be subject to prior review by the Engineer.

20.3.14 For any unit previously qualified, or with a railroad proven service history, the Contractor may request a waiver from performing the Qualification Test. However, the request for a waiver must be accompanied by a duplicate test report or certification for given statement of No Objection in order to satisfy qualification requirements. The waiver request must include justification of the claim that the equipment and test(s) are substantially the same as those in the current qualification requirements.

20.3.15 Only with the written consent of the Engineer will Qualification Test or Certification requirements be waived.

20.4 **Acceptance Testing**

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20.4.1.2 Acceptance tests shall be completed on every vehicle supplied under this Contract to prove that manufacturing and assembly of the trains have been carried out appropriately. A Type Test shall be conducted for the first 8-car train-set and a Routine Test shall be completed on every trainset after that, except for the first train.

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20.4.2 Factory Acceptance Test (FAT)

20.4.2.1 The Contractor shall perform a FAT to ensure that the systems are functioning correctly before shipment of the trains. The Tests shall be conducted in the test track and other special test facilities of the Contractor. Tests that cannot be carried out at Bidder's test facility will be carried out on the main line after the vehicle has been delivered to Manila.

20.4.2.2 The following tests shall be carried out as a minimum but not limited to:

1) Type Test: These tests shall be performed on the 1st trainset:
    a) Dimension inspection;

21.2.6 The threads of stainless-steel fasteners shall be suitably treated to prevent galling upon installation.

21.2.7 All wire ties used shall be of the weather-resistant (black) variety.

21.2.8 Locking washers or other devices to prevent loosening of fasteners shall be used.

21.2.9 For equipment suspended from the underframe, the load of the equipment on each bolt shall not the clamp load of the bolt. Set screws shall not be used. Where practical, load on the bolts shall be no greater that that exerted when the bolt is tightened to its recommended torque. When practical loads shall be on structural cross beams etc. Huck bolts can be used according to their strength specification unless otherwise proposed by the Contractor.~~.~~

21.3 Parts

21.3.1 Components, plates, shields, or other parts, which may be removed for repair or maintained, shall be interchangeable with others identical item.

21.3.2 Non-maintained components shall be designed for a useful life of 30 years. If, during the warranty period, it is demonstrated that the extrapolated life of any component is less than 30 years, the component must be redesigned and replaced on every vehicle.

21.3.3 All parts shall be free from sharp edge and burrs that might injure persons or damage clothing.

21.4 Electrical Components

21.4.1 Terminals

21.4.1.1 Solderless terminals shall be submitted for the review of the Engineer and given the Statement of No Objection on equivalent and shall have sufficient current carrying capacity, de-rated to the anticipated maximum operating temperature.

21.4.1.2 The use of quick connect ("FASTON") terminals shall not be allowed, except subject to review by the Engineer. When allowed, quick connect terminals must be of brass or phosphor bronze.

21.4.1.3 Only ring tongue terminals shall be used, except as specifically reviewed and commented by the Engineer.

~~21.4.1.3~~21.4.1.4 Alternative forms of terminals will be considered where appropriate.

21.4.2 Wire Insulation

21.4.2.1 Cables shall comply with EN standards or Japanese regulations/standards.~~conform to EN50264 or other equivalent standards~~.

21.4.2.2 Unless otherwise specified, wire insulation shall be one of the following types, unless specifically reviewed and commented by the Engineer:

1) Ethylene Tetrafluoroethylene (ETFE) fluoropolymer having a continuous temperature rating of 150 ℃,

2) Abrasion resistant, filled Tetrafluoroethylene (TFE) with a temperature rating of 260 ℃

3) Cross-linked Polyolefin (XLPO),

4) All wire insulation, except carbody wiring, shall be rated at 300/300V or 600 V minimum; unless otherwise specified or agreed to by the Engineer. Carbody wire insulation shall be rated at 2000 V minimum. Here "carbody wiring" shall be understood as the 1500 Volts DC traction wiring from Overhead catenary up to Variable Voltage Variable Frequency (VVVF) termination point and auxiliary power supply unit; and

5) Wires 6 mm^2 and smaller shall have the appropriate insulation material as defined above. Wires larger than 6 mm^2 shall be insulated only with Cross-linked Polyolefin (XLPO) or JRIS standard insulation material.

21.4.3 Wire Current Rating (Ampere Capacity)

21.4.3.1 The selection of wire sizes and insulation shall be based on the current carrying capacity, voltage drop, mechanical strength, expected maximum operating temperature and flexibility requirements in accordance with applicable Rail Industry approved standards.

21.4.3.2 Maximum wire current rating shall conform to applicable Rail Industry approved standards. Where conductors are routed in a raceway or cable, the current rating shall be suitably de-rated.

21.4.4 Wire Stranding

21.4.4.1 Wires stranding and conductor construction shall be appropriate for the application, taking into account wire size, flexing requirements, etc., and shall comply with appropriate Rail Industry approved standards.

21.4.5 Wiring Prohibition

21.4.5.1 Pinch screw terminals and solid conductors are specifically forbidden.

21.4.6 Creepage and Clearance

21.4.6.1 Electrical creepage and clearance shall be adequate for the voltage levels and environment.

21.4.7 Insulation Resistance

21.4.7.1 The insulation resistance of all wiring shall be designed and tested in accordance with Industry approved Insulation Resistance Test and High Potential Test procedure.

21.4.8 Voltage Segregation

~~21.4.9~~ Wires shall be segregated according to JRIS or IEC standards. ~~Wires shall be segregated into separate bundles/harnesses and connectors according to the voltage ratings in the following classes.:~~

~~1) Line voltage DC wiring,~~

~~1) Low voltage AC wiring (Under 600V),~~

21.2.6 The threads of stainless-steel fasteners shall be suitably treated to prevent galling upon installation.

21.2.7 All wire ties used shall be of the weather-resistant (black) variety.

21.2.8 Locking washers or other devices to prevent loosening of fasteners shall be used.

21.2.9 For equipment suspended from the underframe, the load of the equipment on each bolt shall not the clamp load of the bolt. Set screws shall not be used. Where practical, load on the bolts shall be no greater that that exerted when the bolt is tightened to its recommended torque. When practical loads shall be on structural cross beams etc. Huck bolts can be used according to their strength specification unless otherwise proposed by the Contractor.

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21.4.8.1 Wires shall be segregated according to JRIS or IEC standards.

21.5 **Electronic Equipment**

21.5.1 As a minimum, all electronic equipment shall comply with JIS E 5006: Electronic Equipment used on Rail Vehicles (or other equivalent standards), for design, manufacture and testing and shall use components purchased against an internationally recognized

9.1.9 For service brake, the loaded braking ratio shall be 70% or more or according to EN standards. For the security brake, the empty brake ratio shall be 70% or more or according to EN standards. The rolling stock shall comply with all relevant requirements in Japanese Ministerial Ordinance, MLIT Chapter 8, Article 69 (Brake unit related) or other equivalent standards.

9.1.10 In addition, the above, the balance of deceleration of regenerative and pneumatic shall be finally adjusted considering ATO station stop accuracy. Interface between BCU and ETCS or Running and stopping assistant system about service brake step (via TMS control transmission) shall be at least 31 steps.

9.1.11 ~~Several sensors shall be incorporated to brake system. Sensors shall be equipped to each brake cylinders and each air suspensions, as a minimum. These data detected by sensors shall be transmitted to Brake control unit, and shall be utilized for control of propulsion, brake and ATO and etc.~~ Several sensors shall be incorporated to brake system. Adequate quantity of Sensors shall be equipped to brake cylinders and air suspensions, as a minimum. These data detected by sensors shall be transmitted to Brake control unit, and shall be utilized for control of propulsion, brake and ATO and etc.

9.1.12 The calculation for emergency braking distances under dry and wet conditions shall be submitted during design phase for the Engineer review.

9.1.13 Braking distances for normal service braking with electric brake blending shall also be submitted during the design phase for the Engineer review.

9.2 Friction Brakes

9.2.1 All axles shall be equipped with a split type ventilated brake disc unless the lifetime of the disc brake exceeds the lifetime of the wheels. ~~and b~~Braking torque shall be applied to the disc by the air operated brake cylinder operating the caliper containing the brake pads equipped with tread cleaning and keeping proper condition of the pad. Each axle of motor mounted cars shall be equipped with the disk brake on wheel with tread cleaning.

9.2.2 The brake pads shall be an asbestos-free friction material or otherwise proposed by the Contractor, which has shown stable friction characteristics under a wide range of temperatures, humidity, and surface speed conditions. The friction material shall be compatible with the friction ring of the brake disc, and with consideration to Coefficient of Friction (COF) linearity, nominal performance, wear, noise, etc. The brake pad shall have a proven service history in railway operation.~~The brake pad shall be designed and manufactured not only with extremely small changing characteristics with respect to water, lubricating oil, fade, pressing pressure, speed and so on, but also with suppression of occurrence of spark caused by friction. The Contractor shall submit these bench test data and obtain statement of No Objection from the Engineer~~.

9.2.3 The friction brakes shall be fully capable of performing all braking duties, without the assistance of the electric brakes. The brake pads shall be retained by the brake actuator calipers or brake cylinder and shall be of the composite type. The pads shall not contain any asbestos or other cancer inducing materials, and the Contractor shall provide the Engineer with full details of the material composition for the health hazards assessment.

9.2.4 The parking brakes shall be with spring- applied park brake function, through air release brake actuators, and shall be capable of holding 10 cars train-set in W2 (7t payload) loading condition on a 3.5% grade under all track conditions indefinitely. Parking brakes shall be installed in each leading car and more cars if needed to meet the above performance requirement unless otherwise proposed by the Contractor~~.~~

9.1.9 For service brake, the loaded braking ratio shall be 70% or more or according to EN standards. For the security brake, the empty brake ratio shall be 70% or more or according to EN standards. The rolling stock shall comply with all relevant requirements in Japanese Ministerial Ordinance, MLIT Chapter 8, Article 69 (Brake unit related) or other equivalent standards.

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9.2.4 The parking brakes shall be with spring- applied park brake function, through air release brake actuators, and shall be capable of holding 10 cars train-set in W2 (7t payload) loading condition on a 3.5% grade under all track conditions indefinitely. Parking brakes shall be installed in each leading car and more cars if needed to meet the above performance requirement unless otherwise proposed by the Contractor

9.2.5 The parking brakes shall be applied in the event of loss of the main compressed air supply. The parking brakes shall be capable of release from within the cab when the compressed air supply is present. With no compressed air supply available, it shall be possible to release individual parking brake actuators manually from track level. Application of parking brakes shall also be controllable from the cab.

9.2.6 The design shall be such that the parking brakes will take effect prior to fade off of service

~~Reversing Switch.~~

5.19.2.5 When the driver's key is in the ON position and Reversing Switch is in the forward or reverse position, the Master Controller shall be released.~~unlocked~~.

5.19.2.6 The driver's key shall be removable or not removable ~~itself be captive~~ when The Master Controller is not in the predetermined Emergency position. The Master Controller will be interlocked electrically or mechanically.

5.19.2.7 The driver's key shall be removable or not removable ~~itself be captive~~ when The Reversing Switch is not in the predetermined OFF(Neutral) position. The Reversing Switch will be interlocked electrically or mechanically.

5.19.2.8 Only one cab of 2 cabs on a trainset shall be able to be activated at any time.

5.19.3 Reversing Switch

5.19.3.1 The Reversing Switch has three (3) positions, as follows.

	Reversing Switch Position	**Direction of the train**
1.	Vertically upright	OFF position
2.	Forward from the vertical position	Forward
3.	Backwards from the vertical position	Reverse

5.19.3.2 When the Driver's key is in the ON position and The Master Controller is in the predetermined Emergency position, the Reversing Switch shall be unlocked.

5.19.3.3 The Driver`s key can be removed when Master Controller is in Emergency position and the Reversing Switch is in OFF(Neutral) position.

5.19.4 Driver's Vigilance System

5.19.4.1 The Master Controller handle or its vicinity shall incorporate a button which shall be pressed and released on a regular, predetermined basis, to prevent the application of emergency braking.

5.19.4.2 The feature shall be coordinated such that either action prevents brake application.

1) If within a certain period of time there is no master controller operation by the driver, the alarm sounds.

2) Within 5 seconds after the alarm sounds, if there is no operation of the confirmation button, or no master controller operation, emergency brake is operated.

5.19.4.3 The idling time limit for alarm shall be able to be adjusted by the maintainer. (=/- 50% only)

5.19.5 ATP Mode

5.19.5.1 The ATP mode shall be locked by the Driver's key and a sealed switch for ATP cut-out shall be provided.

5.19.5.2 The train shall be designed to make provision for an additional on-board signaling system.

5.19.5.3 Details of the signaling system will be provided by the CP NS-01 Contractor during the interface meeting as described in ERT Clause 17.

5.19.2.1 The master controller shall control accelerating and braking in several steps adjustable or stepless adjustable, linear manner. In case of a several steps adjustable, the master controller features will at minimum as follows:

	Handle Position	Function
1.	Vertically upright	OFF position
2.	Forward from the vertical position until the handle reaches its end position with a spring return device.	Propulsion, with acceleration increasing acoording 4 steps with handle movement.
3.	Backwards from the vertical position until the handle engages a a spring loaded detent.	Normal Braking, with the effort increasing acoording to 7 steps with handle movement.
4.	Backwards from the spring loaded detent in 3, until the handle reaches its end position.	Emergency braking.

In case of a stepless adjustable linear manner, the master controller features will at minimum:

a. Coasting / neutral position: The centre position is notched. Traction is not applied;
b. Traction: Push lever forwards 0...100% of the path proportionally sets desired tractive effort;
c. Braking: Pull lever backward, 0...100% of the path proportionally sets the braking effort;
d. Emergency brake: Notched to prevent accidental triggering by the driver.

5.19.2.2 The Master Controller shall be ergonomically designed to minimize unnecessary physical strain and fatigue to the driver.

5.19.2.3 The Master Controller shall have a control system for keeping the constant speed in case of powering.

5.19.2.4 The Master Controller shall be interlocked by the Driver's key.

5.19.2.5 When the driver's key is in the ON position and Reversing Switch is in the forward or reverse position, the Master Controller shall be released.

5.19.2.6 The driver's key shall be removable or not removable when The Master Controller is not in the predetermined Emergency position. The Master Controller will be interlocked electrically or mechanically.

5.19.2.7 The driver's key shall be removable or not removable when The Reversing Switch is not in the predetermined OFF(Neutral) position. The Reversing Switch will be interlocked electrically or mechanically.

5.19.2.8 Only one cab of 2 cabs on a trainset shall be able to be activated at any time.

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	Reversing Switch Position	Direction of the train
1.	Vertically upright	OFF position
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6.5.3 The Contractor shall ensure that a headlight fault detection system is provided for each train cab, providing Fault indication and status information to the driver by TMS monitor.

6.5.4 The light intensity of headlights shall comply with Table.7 in item 5.2.1 of JRIS R 16465 or any equivalent standard.

6.5.5 Headlight (LED) shall be able to be accessed either from outside or~~and~~ inside of the driver cab. The optical axis of head lamps shall capable of being easily adjusted.

6.5.6 The Contractor shall ensure that the red tail-lights or white marker lights are automatically activated based upon the Cab activation status as follows:

1) Red taillights displayed - associated Cab is not activated, or non-activated Cab is at rear of the Train, or when both cabs in the train are inactive.

2) White marker light displayed - associated Cab has been activated, indicating this will be the front of the train. The white marker lights shall be lit when vehicles are driven in reverse direction.

6.5.7 LED type marker lights shall be provided, and combination red/white units may be proposed.

6.5.8 The Contractor shall ensure that two indicating lights are installed above each door, one inside and one outside. The lights shall be illuminated when the doors open while not lit up when the doors are closed. The lights shall be blinking during opening and closing cycle of the door. The light shall be illuminated together with an indication on the driver's panel or TMS monitor when the door is faulty and/or isolated.

~~6.5.9 The Contractor shall ensure that inspection lights are provided in the vicinity of the underframe mounted equipment. The inspection lights shall be push button activated from the cab and underframe and shall incorporate design features to ensure that the lights are not inadvertently left on when the train is in operation.~~

~~6.5.10~~6.5.9 The Contractor shall ensure that all exterior lights are powered from the low voltage DC power supply system. ~~All lights shall be powered by the batteries in the event of APSE failure.~~ The low batteries DC load analysis shall be presented during the design phase to simulate event of APSE failure

~~6.5.11~~6.5.10 The Contractor shall ensure that indicating lights are installed in both side of car. The light on the side where all the doors are not closed illuminates.

~~6.5.12~~6.5.11 The Contractor shall ensure that indicating lights are installed in both side of car. The lights shall be illuminated when emergency call is activated in the car.

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4 Coupler and Draft Gear

4.1 General

4.1.1 The end cars in each train shall be fitted with an automatic coupler. The coupler shall be placed in a readily accessible position under and from either side of the end vehicle. The position (right side or left side) of parts operated shall be consistent for all end vehicle. It shall be possible to connect with other commuter train of North-South Commuter Railway (NSCR), MCRP- and ~~North-South Railway Project-South, MMSP Line (~~NSRP-South~~)~~ ~~without any adapter~~ during train rescue or ~~-~~hauling.

4.1.2 The automatic coupler shall be able to couple with other types of rail vehicle with, if necessary, an adaptor. The adaptor, if required, shall be provided by the rolling stock supply Contractor.

4.1.3 The automatic coupler shall be able to connect a unit with the coupler of another unit on all curves in the depots and main line. The coupler height, measured from the center of the coupler to the top of rail, shall be within 880 mm +10/-15 mm.

4.1.4 The automatic coupler shall, in conjunction with the draft-gear automatically effect ~~mechanical, electrical and~~mechanical and pneumatic coupling for two (2) Limited Express Train or identically coupling head. It shall also permit separation of units either by manually from the track side and/or remotely from the cab.

4.1.5 In both leading cars, an electrical connecting plug which is necessary for relief operation by connecting train-sets shall be equipped. Also, an emergency connection cable that connects this electrical connection plug shall be equipped. By using this connecting cable, required functions such as brake command, broadcasting, buzzer etc. shall operate properly. Length and diagram of cable shall be also consistent with other commuter trains of NSCR, NSPR-South, MMSP. The position of this plug shall be consistent with other commuter trains of NSCR, NSRP-South, MMSP particularly length of cable shall be determined in consideration of the severest deviations during coupled with other train. Basically, utilization of adapter shall not be acceptable.

4.1.6 The Contractor shall provide the required cabinet for housing the emergency connection cable on the train. Alternatively, the Contractor shall provide proper mechanism for retaining the emergency connection cable when it is not in used.

4.1.7 All electrical connections shall be made to terminal blocks in junction boxes compliant with IP 65, via jumper cables, using quick connect/disconnect couplings securely locked with wire.

4.1.8 ~~Cable hoses shall be made out of high quality, weather and abrasion resistant insulated rubber.~~Cable hoses or flexible conduits shall be made out of high quality, weather and abrasion resistant insulated rubber or other materials, subject to approved by the Engineer.

4.1.9 The connectors for each cable, if of the same size, shall be keyed differently to prevent misconnection, and shall be color coded to enable connectors to be easily distinguished.

4.1.10 In all cases, care shall be taken to ensure that strain relief is provided for all cables leaving the junction boxes, and that all cables are properly supported in suitable cleats, and that no chafing of the cabling takes place under all possible movements of the coupler.

4.1.11 The arrangement shall prevent damage from coupling with misaligned couplers, and shall minimize damage to the carbody wiring, should excessive tension be applied to the cables in the event of an accident.

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4.1.12 The couplers shall be designed to prevent the coupler swinging transversely when it is not coupled.

4.1.13 Couplers and draft gear shall be capable of withstanding all coupling, buffing and draft

14) Cab controls, functions and indications;

15) Door control and functionality, per door and all doors;

16) Signaling system operation;

17) Safety critical functions; and

18) Any other routine test demonstrating fulfilment of the requirements of the interface specifications.

20.4.3.2 Commissioning shall be carried out on all consists supplied under this Contract. For each consist delivered to the Site, the Contractor shall establish an open actions list. The open actions list shall record all actions to be carried out on the train consist and shall be supplemented as additional actions become known. These shall include:

1) Type, routine, integration and commissioning tests;

2) Fault correction and equipment repairs; and

3) Fleet modifications and defect rectification.

20.5 Integrated Testing and Commissioning

20.5.1 During Integrated Testing and Commission of the railway, the CP NS-01 is the lead Contractor responsible for the test's plans, monitoring and test reports, with all interfacing Contractors supporting these activities accordingly.

20.5.2 The CP NS-03 and the CP NS-01 Contractors shall coordinate and submit the following Integrated Testing and Commissioning (ITC) deliverables:

1) Production of an ITC plan, for inspection and testing of equipment that interfaces with other contracts;

2) Coordination with interfacing parties regarding the requirements relating to interface testing;

3) Production of a test schedule of tests, providing full details of all tests to be carried out under the Contract; and

4) Testing procedures to be presented to the Engineer for review.

20.5.3 All trains shall undergo Fault Free Running during the integrated testing and commissioning. Each train is required to complete 1,500 km fault-free operation on the Main Line. Any issue occurred during trial running shall be fully resolved before restarting the trial run.

20.5.4 In the event major failure occurred during the trial running, the trial run mileage shall be re-started from zero after the rectification is completed. For minor failure, the trial run mileage shall be continued after the rectification is completed.

20.5.5 The Contractor shall propose the failure criteria in the Testing and Commissioning plan for review and given notice of no objection by the Engineer.

20.5.6 The Contractor shall ensure proper wheel profiling after the Trial Running completed and compensation on wheel to be profiled due to failure during TNC.

20.5.7 The Contractor may apply by notice to the Engineer for a Taking-Over Certificate not earlier than 14 days before the successful completion of FFR.

~~4)~~

17) Safety critical functions; and

18) Any other routine test demonstrating fulfilment of the requirements of the interface specifications.

20.4.3.2 Commissioning shall be carried out on all consists supplied under this Contract. For each consist delivered to the Site, the Contractor shall establish an open actions list. The open actions list shall record all actions to be carried out on the train consist and shall be supplemented as additional actions become known. These shall include:

1) Type, routine, integration and commissioning tests;

2) Fault correction and equipment repairs; and

3) Fleet modifications and defect rectification.

20.5 Integrated Testing and Commissioning

20.5.1 During Integrated Testing and Commission of the railway, the CP NS-01 is the lead Contractor responsible for the test's plans, monitoring and test reports, with all interfacing Contractors supporting these activities accordingly.

20.5.2 The CP NS-03 and the CP NS-01 Contractors shall coordinate and submit the following Integrated Testing and Commissioning (ITC) deliverables:

1) Production of an ITC plan, for inspection and testing of equipment that interfaces with other contracts;

2) Coordination with interfacing parties regarding the requirements relating to interface testing;

3) Production of a test schedule of tests, providing full details of all tests to be carried out under the Contract; and

4) Testing procedures to be presented to the Engineer for review.

20.5.3 All trains shall undergo Fault Free Running during the integrated testing and commissioning. Each train is required to complete 1,500 km fault-free operation on the Main Line. Any issue occurred during trial running shall be fully resolved before restarting the trial run.

20.5.4 In the event major failure occurred during the trial running, the trial run mileage shall be re-started from zero after the rectification is completed. For minor failure, the trial run mileage shall be continued after the rectification is completed.

20.5.5 The Contractor shall propose the failure criteria in the Testing and Commissioning plan for review and given notice of no objection by the Engineer.

20.5.6 The Contractor shall ensure proper wheel profiling after the Trial Running completed and compensation on wheel to be profiled due to failure during TNC.

20.5.7 The Contractor may apply by notice to the Engineer for a Taking-Over Certificate not earlier than 14 days before the successful completion of FFR.

20.6 Trial Operations

20.6.1 The objective of Trial Operations, is that operational readiness is verified, meaning that full training of operational staff including drivers, emergency-service personnel and others, has taken place successfully, demonstrating that the required railway operational

8.1 General

8.1.1 System Assurance Management is applicable for all stages of the Rolling Stock development, including design, manufacture, testing, commissioning, systems integration, trial operations, and in-service operations.

8.1.2 The Contractor shall submit a comprehensive System Assurance Management Plan (SAMP) which contains all requirements within this ERG Section 8 of this document, for the Engineer's review. The SAMP shall include, but not limited to the Contractor's methodology to plan, manage and control the system assurance process, organization and roles/responsibilities of the key personnel for system assurance, tasks, program and procedures for system assurance, and an internal audit program.

8.1.3 The System Assurance activities~~Plan shall cover Reliability, Availability, Maintainability and Safety, Electromagnetic Compatibility (EMC), Fire Safety strategy and System Engineering.~~shall cover and not limited to the System Assurance Management, System Safety (including –the Electromagnetic Compatibility (EMC), Fire Safety strategy, Software Management and Control, Reliability, Availability, Maintainability (RAM), Hazard Log Management Procedures; System Risk Management Plan including Risk Assessment Methodology, Safety Critical Items List (SCIL), Reliability Critical Item List (RCIL), Design Safety Study Report, Safety Cases, RAM Demonstration Test Report, Failure Recording and Data Reporting and Corrective Action System reports.

8.1.4 The System Assurance Management Plan shall comprise a programme showing in detail the timing of each activity and the anticipated dates for submission of system assurance documentation. The programme will break down the planned activities into discrete stages of work as a minimum design, manufacturing, installation, testing and commissioning and RAM demonstrations.

8.1.5 ~~System Assurance~~The Plan shall clearly identify the reviews to be performed at the end of each stage of the programme. The Contractor shall convene formal System Assurance Review (SAR) meetings to review all SA activities and to ensure operational hazards are comprehensively identified within the scope of the Contract. The SAR meetings shall be held quarterly, or when there is any key system change, and meeting records shall be submitted by the Contractor to the Employer. The Employer and the Engineers may participate in the SAR .System Assurance Report shall be submitted at the end of each stage of the programme which covered all the subjects above.~~ The Subsystem Assurance Plans will be consistent in approach with the System Assurance Plan~~. The Contractor's subcontractor or supplier shall provide the SAMP which will be in consistent in approach with the Contractor SAMP.

8.1.6 The SAMP shall be certified by the Contractor's internal department or by a third-party independent engineer from the design and manufacturing section. The SAMP shall be specifically developed for this Contract. ~~The SAMP shall address the Performance (Reliability, Availability, Maintainability) and Safety of the Rolling Stock.~~

8.1.7 A Taking Over Certificate (TOC) will be issued for each trainset. In order to obtain a TOC for the Rolling Stock from the Employer/Engineer, it is required that each trainset achieves 1,500 km of Fault-Free Running (FFR) during the integrated testing and commissioning.

8.1.8 A Performance Certificate will be issued by the Engineer for the total performance of the fleet. This Performance Certificate is required to be achieved by the end of the Defect Notification Period (DNP). ~~Prerequisites to obtain the Performance Certificate includes: each trainset shall achieve 10,000 km or 2 months of FFR, the fleet (7 trainsets) shall achieve a Mean Distance Between Failures (MDBF) of 50,000 km causing a delay greater than 5 minutes, a fleet in-service Operational Mean Time To Restore (OMTTR) of 15~~

~~minutes, and the fleet maintainability of capital components a Corrective Mean Time To Repair (CMTTR) of 4 hours .~~

8.1.9 The Contractor shall provide sufficient documented information for review by the Engineer. It is expected that the design demonstration of the Rolling Stock performance shall be achieved through supplier-based material self-certification, including cross-references to proven and accredited in-service performance of Rolling Stock equipment supplied in a similar railway application.

8.1.10 With regard to Safety, it is expected that certification shall be achieved through supplier-based information via application of cross references to previously certified acceptances from a reputable body (e.g., train operators, national railways authorities, independent accredited safety bodies, etc.) of similarly supplied Rolling Stock equipment, with a product-generic safety case application to be made based on existing safety certification.

8.1.11 The Employer shall conduct compliance audits during design, development, manufacture and testing and commissioning phases to ensure that the Contractor has met all relevant System Assurance requirements. The Engineer shall give 7 days' notice to the Contractor about the audit arrangement. The Contractor shall provide all necessary assistance to enable the Employer or his representative complete the audit.

~~8.1.11~~8.1.12 The Contractor shall propose design, implementation techniques and measures, depending on the SIL of the function in line with the principles of EN50128 and EN50129 or other equivalent standard subject to the given notice of no objection by the Engineer.

8.2 Safety Integrity Level

8.2.1 The CENELEC standard specifies five Safety Integrity Levels (SILs). The required Safety Integrity Level shall be decided on the basis of the level of risks.

8.2.2 The Contractor shall set a SIL at functional level and functional modules level. The Contractor shall assign to all Systems/Subsystems/Components a Safety Integrity Level when relevant.

8.2.3 The Contractor shall propose design, implementation techniques and measures depending on the SIL of the function to be performed by each individual System, Subsystem or Component.

8.3 Quality Assurance

8.3.1 The Contractor shall implement the relevant part of [ISO 9001] standard in accordance with EN 50126 standard. Verification activities conducted to ensure that design and development outputs meet the input requirements are included in these activities.

8.3.2 The Contractor shall provide a Quality Assurance Plan covering all safety-related systems, whatever their SILs.

8.3.3 In connection with its Quality Assurance Plan, the Contactor shall provide a System Development Plan covering all re-used, newly developed or modified systems.

8.4 Risk Mitigation Strategy

8.4.1 According the level of their acceptability, the risks shall be managed in different ways.

Acceptable and unacceptable risks

Unacceptable risks (R4) are those which have:

- Catastrophic consequences with a frequency greater than remote,

- Critical consequences with a frequency greater than occasional.
- Marginal consequences with a frequent frequency.

Acceptable risks (R1) are those which are:

- Of an incredible frequency,
- Of an improbable frequency with consequences less than critical,
- Of a remote frequency with insignificant consequences.

8.4.2 Since no prevention / mitigation measures shall cover these risks, the allocation of risks to these two categories has to be thoroughly documented.

Other risks

Other risks (R2 and R3) are those risks, which have:

- Insignificant consequences with frequent frequency,
- Marginal or insignificant consequences with probable frequency,
- Critical, Marginal or insignificant consequences with occasional frequency,
- Catastrophic, Critical or Marginal consequences with remote frequency,
- Catastrophic or Critical consequences with improbable frequency.

8.4.3 These risks need to be discussed in writing and submitted to the Engineer for acceptance of both the risks and the corresponding prevention / mitigation measures.

8.4.4 For the justification, discussion of the mitigation measure. The following shall be addressed:

8.4.5 Residual risk, cost of the measure. Alternative measures will be proposed,

1) The feasibility and cost of the measures is an important part of justification / discussion,

2) Input data used in the assessment, justification, discussion shall be provided with reference of their origin and copy of the statements to be considered,

3) Measures of SILs equal or greater than 2 shall be stated in the safety analysis.

8.4.6 To demonstrate the risk has been reduced ALARP, the following criteria shall be used (in order of priority):

1) show compliance with international standards

2) use of product already accepted by internationally recognized railways agency

3) perform a Cost Benefit Analysis

8.4.7 The Cost Benefit Analysis should be used as less as possible; priority shall be given to technical argument.

8.4.8 To conduct of the safety analysis, safety analysis(s) must be conducted which the following minimum requirements:

1) The safety objective is reached when the level of risk has reached the "acceptable" area with acceptable justification,

2) Every safety-related function shall be identified and assessed for its related hazards,

3) Every safety-related constituent shall be identified and assessed for its related hazards,

4) Every safety-related interface shall be identified and assessed for its related hazards.

8.4.9 Link between safety objectives and SIL's shall be assessed regarding EN50126 requirements. The following links shall also be used as possible guidance. They have been issued by expert judgement:

1) Functions which failure can lead to an unacceptable risk with catastrophic consequences shall be supported with SIL4 constituents,

2) Functions which failure can lead to an unacceptable risk with critical consequences shall be supported with SIL3 constituents,

3) Functions which failure can lead to an R3 or R2 risk shall be supported with SIL2 constituents,

4) Functions which failure can lead to an R1 risk shall be supported with SIL1 constituents.

8.4.10 Implementation of SIL constituents, equipment shall have a SIL at least equal to the functions it implements. As a minimum, SIL 4, SIL 3, SIL 2 and SIL 1 constituents shall comply with the following requirements:

1) Compliance to standards referenced by the Contractor

2) Quality assurance,

3) Safety assurance.

8.4.11 Recognized techniques used in the railway application for implementation of SIL 4 or 3 constituents are as follows:

1) "Fail safe" technique,

2) "Checked safety" technique,

3) "Probabilistic safety" technique,

4) "Safety concept" approach of the programmable electronic equipment,

5) Use of "safety software",

6) Use of "proven safety" techniques.

These main safety techniques are presented and developed in EN50128 and EN50129 standards.

8.4.12 SIL Safety Targets

8.4.12.1 For an eventual implementation of SILx functions by the means of "probabilistic safety", the Mean Time Between Hazardous Event could be given in the table below:

Safety Integrity Level	Frequency of dangerous failure per hour
4	$\geq 10^{-9}$ to $<10^{-8}$
3	$\geq 10^{-8}$ to $<10^{-7}$
2	$\geq 10^{-7}$ to $<10^{-6}$
1	$\geq 10^{-6}$ to $<10^{-5}$

Mean Time Between Hazardous Event

8.4.13 Systems Engineering Management

8.4.13.1 The Contractor shall apply a suitable Systems Engineering Process (SEP) in order to provide assurance that the final operating system shall achieve the conceptual design intent. The Contractor shall provide the Systems Engineering Management Plan, which describes the program's overall technical approach, including systems engineering

processes, resources, and key technical tasks activities. These shall be integrated with the program management control efforts, including technical performance measures, Examples of suitable methodologies are:

1) IEEE 1220 Standard for the Application and Management of the Systems Engineering Process

2) EIA 632 Systems Engineering

The Contractor with consent of the Engineer may propose an alternative methodology.

8.4.14 Engineering Safety Management

8.4.14.1 The Contractor shall apply a suitable Engineering Safety Management System. The Contractor with consent of the Engineer may propose an alternative methodology.

8.4.15 RAM Management

8.4.15.1 The Contractor shall apply a suitable RAM Management System acceptable to the CP NS-03 project. Contractor shall provide a RAM demonstration plan.

8.4.16 RAM Activities

8.4.16.1 In order to provide confidence, that the final operating system shall achieve the requirements of the Performance Measures, Contractor shall undertake RAM assessments at appropriate stages of the project. The scope of RAM activities shall include:

1) RAM requirements capture and definition;

2) Preliminary RAM Analysis

3) Derivation and Apportionment of RAM targets

4) RAM requirements allocation;

5) Integration of existing sub-system and lower level RAM requirements that contribute to the achievement of system level requirements;

6) Management of RAM activities

7) Collation, interpretation and presentation of RAM results

8.4.16.2 RAM activities should include RAM Assessment, RAM Testing, RAM Demonstration and Failure Recording. The RAM activities during the project shall be reported and copied to the Engineer.

8.4.17 Design RAM Analysis

8.4.17.1 The Contractor shall demonstrate that they are able to meet the RAM targets given, or the Contractor may opt to carry out a target apportionment analysis to work out their own targets and submit a target apportionment report thereafter for acceptance by the Engineer. Nonetheless, the Contractor shall lay down their intention in his RAM Demonstration Plan in the first place for acceptance by the Engineer.

8.4.17.2 RAM analyses shall be conducted at equipment level, and shall be extended to a component level. The methodology (e.g. using reliability block diagram, Fault Tree Analysis (FTA) or Failure Modes, Effects and Criticality Analysis (FMECA)) shall be specified in the RAM Demonstration Plan and review and given notice of no objection by the Engineer.

8.4.17.3 A RAM analysis report shall be submitted to the Engineer for review and acceptance to demonstrate the predicted RAM performance meets the RAM performance targets as stipulated in this Section.

8.4.18 Assurance Management

8.4.18.1 All assessments shall be reported in a format as agreed with the Engineer. Contractor shall submit monthly progress report describing the progress achieved, based on milestone schedule tasks identified in the SA Plan.

8.4.18.2 The deliverables shall include but not be limited to:

1) Systems Assurance Plan (including Safety);
2) Systems Engineering Management Plan;
3) Systems Assurance Quality Manual;
4) Systems Assurance Management Procedures;
5) RAM Demonstration Plan
6) RAM Analysis Report
7) RAM Testing/Commissioning Plan;
8) Hazard Log;
9) Safety Assessment Reports;
10) RA Safety Critical Items List;
11) RAM Demonstration Report; and
12) Data Recording and Corrective Actions System (DRACAS).

8.4.19 Systems Assurance Audits

8.4.19.1 External Audits - The Contractor's Systems Assurance process shall be subject to audits conducted by the Engineer throughout the Contract. These audits shall involve support from the Contractor's system assurance team. The Contractor shall render support throughout and the Contractor's Project Manager and System Assurance Manager shall attend. The Contractor shall rectify any outstanding items identified at the RAMS audits and return to the Engineer by the dates agreed with the Engineer's RAMS auditors. The programme shall include, but not be limited to:

1) Auditing for compliance with selected standards specified in the SA Plan;
2) Checking that the RAMS requirements are adequately met;

8.4.19.2 Internal Audits – The Contractor shall perform RAMS audits on the Contractor's organization, the Contractor's subcontractors and consultants and any parties who are involved in the Contractor's works and have RAMS responsibilities thereof. The Contractor shall identify in the Contractor's System Assurance Plan the Contractor RAMS audits with dates at which the Contractor shall conduct their RAMS Audits throughout. The Contractor shall notify the Engineer of the Contractor's RAMS audits at least 2 weeks in advance and invite the Engineer to take part at the discretion of the Engineer. The Contractor shall submit their internal RAMS audit reports to the Engineer for review.

8.4.20 System Assurance Organization

8.4.20.1 The Contractor shall establish a system assurance organizational structure that assumes the system assurance responsibilities and enables effective communication among all relevant parties during the system assurance process.

8.4.20.2 The Contractor shall appoint a System Assurance Manager (SAM). The SAM shall be responsible for all system assurance tasks as well as hosting and facilitating the Hazard

Identification Workshops. The SAM shall be the author or reviewer of every System Assurance submission. When the SAM is not available for a workshop or meeting, the SAM shall be represented by a delegate who is review and acceptance by the Engineer.

8.4.20.3 The incumbents for the SAM and SAM delegates (if any) shall possess at least 8-year relevant experience and skills of system assurance in the railway industry. The Contractor shall submit the curriculum vitae of their SAMs and SAM delegates (if any) to the Engineer for acceptance prior to appointment(s).

8.4.20.4 The Contractor shall write to the Engineer for acceptance in case of change of their SAMs or SAM delegates.

8.4.20.5 All meetings and workshops specified thereof shall be hosted in Manila at venues arranged by the Contractor. All key participants from the Contractor and his sub-Contractors shall be physically present in the meetings and workshops thereof. Records of RAMS related meetings by way of meeting minutes or the like shall be produced by the Contractor, subject to review by the Engineer, regardless of whether the Engineer was present.

8.4.20.6 The contractor shall attend RAMS related meetings called by the Engineer and will be notified accordingly.

8.4.21 System Assurance Plan

8.4.21.1 The Contractor shall prepare and submit a Systems Assurance (SA) Plan before any design begins. The SA Plan shall define all management and technical activities during each stage, which are necessary to ensure that safety related system, achieve and maintain the required systems assurance objectives. The SA Plan shall:

1) Define all phases of the project from the planning to handover;

2) Describe the Systems Assurance organization;

3) Define the responsibilities and competencies of personnel responsible for implementing the Systems Assurance programme and undertaking the Systems Assurance activities;

4) Outline the Contractor's approach, procedures and schedules for conduct of reliability, availability, maintainability and safety during all the above phases. The schedules shall detail all the systems assurance activities and associated milestones and deliverables;

5) Procedures for monitoring and control of system assurance activities of the Contractor/Sub-contractors

6) Internal audit programme

7) Identify the interfaces with Subcontractors.

8.4.22 All system assurance reports generated by the Contractor and the associated sub-contractors and suppliers shall be submitted for review and acceptance. The Programme of system assurance tasks for the Contactor shall include, but not be limited to the following:

8.4.22.1 Theoretical system assurance analyses and their associated reports, which shall include, but not be limited to:

1) Preliminary Hazard Analysis Report

2) Deterministic Safety Assessment Report

3) Interface Hazard Analysis Report

4) System Hazard Analysis Report

5) Operating and Support Hazard Analysis Report

6) Safety Integrity Level Analysis Report

7) Failure Mode, Effects and Criticality Analysis Report

8) Quantified Risk Assessment/Fault Tree Analysis Report

9) Safety Verification (Safety Critical Item) Report

8.4.22.2 The deliverables shall include, in addition to those aforementioned, but not be limited to the following:

1) Systems Assurance Plan (including Safety, RAM);

2) Systems Engineering Management Plan;

3) Systems Assurance Quality Manual;

4) Systems Assurance Management Procedures;

5) RAM Testing/Commissioning Plan;

6) Hazard Log;

7) Safety Assessment Reports;

8) RAM Assessment Reports;

9) Safety Critical Items List;

10) RAM Demonstration Test Report;

11) Data Recording and Corrective Actions System (DRACAS);

12) Safety Case for Design;

13) Operational Safety Case (draft);

14) Operational Safety Case (Final); and;

15) Any other submissions at the request of the Engineer

8.4.23 RAMS and Design Safety Review

8.4.23.1 The Contractor shall hold RAMS Review meetings periodically with a view to:

1) Reviewing the progress of all SA activities against the System Assurance Plan,

2) Reporting on status of compliance with the SA requirements, and;

3) Confirming whether the RAMS analyses reflect the latest design to date.

4) The Contractor shall evaluate any design changes arising as a result of the Contractor's RAMS analysis for any potential RAMS impacts. The Contractor shall update their RAMS analysis reports accordingly. Should a RAMS analysis necessitate a design change, the Contractor's design change request as a result shall be submitted with sufficient technical information to the Engineer for review and given notice of no objection.

5) The Contactor shall invite the Engineer for any RAMS and Design Safety Review meetings and notify the Engineer thereof at least 2 weeks in advance.

8.4.24 Safety Case for Design and Pre-Operation Safety Case

8.4.24.1 The Contractor shall summarize in a Safety Case for Design and Operational Safety Case respectively for review and given notice of no objection by Engineer and the approval by

ISA. The Contractor shall provide a Statement of Safety that the Works are fit for the purpose and safe for the revenue service in the Contractor's Safety Cases. The Contractor shall submit the Contractor's Design Safety Case by the end of the design phase as documented proof of safety for a Statement of No Objection by the Engineer. The Contractor shall submit the Contractor's Pre-Operational Safety Case (draft) two months prior to the commencement of the revenue service for review and the Contractor's final Pre-Operational Safety one month prior to the commencement of the Commercial Train Operation for a Statement of No Objection by the Engineer.

8.4.24.2 The Contractor's safety cases shall include a summary for the following as a minimum:

1) Introduction: The Contractor's scope of works
2) Scope of the Safety Cases
3) System Description: The key safety features and the interfaces of the Contractor's works
4) Evidence of Quality Management: The Contractor's Quality Management System and their activities devoted towards the works
5) Evidence of System Assurance Management: The Contractor's System Assurance Management System and their activities devoted towards the works
6) Technical Safety Report: Risk assessments, hazard management, RAMS targets and their fulfilment, status and details, mitigation measures etc.
7) Operations and Maintenance: Assumptions used for design, Operations and maintenance procedures related to the Contractor's works for normal, degraded and emergency conditions, plans/strategies for training, modification and operational changes.
8) Recommendations and Restrictions: restrictions to be applied for the Contractor's works and recommendations for safety and efficiency improvement
9) Conclusions: a statement of safety and description on how safety of the system is achieved and continuously to be achieved.
10) References: a list of all the documents/standards referred by the Contractor.

8.4.25 Safety Inspection

8.4.25.1 On-site safety inspections may be conducted by the Engineer so as to identify any other potential hazards against the applicable safety requirements and the mitigation measures described in the Contractor's hazard log and the Deterministic Safety Assessment (DSA) report. The Contractor shall provide support and the Contractor's System Assurance Manager and Design Manager shall attend. The Contractor shall update the Contractor's SA deliverables accordingly as a result of the Safety Inspections.

8.4.26 Operational Safety Requirements

8.4.26.1 Hazard log

1) The Contractor shall produce an operational hazard log with entries of hazards which may affect the safety and / or reliability of the Limited Express Train operations due to design, construction, installation, testing, commissioning, operations and maintenance of the Works. The design shall incorporate the safeguards identified in the hazard log where applicable.
2) The format of the hazard log shall be provided by Contractor's and shall be submitted to the Engineer for Review and given notice of no objection. References to relevant information / analysis items shall be included in the hazard log to describe the

source(s) of the operational hazards identified.

8.4.26.2 Operational Hazard Identification

1) The Contractor shall conduct formal operational hazard identification workshops and analyses to systematically identify relevant operational hazards which may affect the safety and / or reliability of Limited Express Train operations. The methods of analysis (e.g. hazard and operability study) shall be review and given notice of no objection by the Engineer. The operational hazard analysis shall cover system / equipment hazards, interface hazards and operations & support hazards. All protection measures identified which are designed to eliminate, control, or mitigate the effect of potential operational hazards shall be documented

2) Operational hazard identification workshops shall be conducted by the Contractor during the early stage of the Works for which the Engineer shall be invited, to identify the operational hazards and propose appropriate mitigation measures.

3) The scope, purpose and methodology to be applied of the workshops shall be detailed in the form of HAZOP guidance notes and a copy thereof shall be submitted to the Engineer for Review and given notice of no objection. Records of such workshops by way of meeting minutes and Hazard Log (Workshop) shall be produced for review by the Engineer. The Contractor shall make efforts to identify pertinent operational hazards with respect to the following areas, among other things:

4) New and specific design functions or applications;

5) Location specific design features or site restrictions;

6) Different designs compared with the interfacing operating railway lines, if any, which may introduce compatibility and / or inter- operability issues;

7) Changes in operating assumptions or design compared with the specified requirements, causing impacts on operation and interfacing systems;

8) Requirements for the introduction of new operating procedures, temporary or permanent operating restrictions; and Human error prone activities due to complicated operation and maintenance, different equipment design principles, human machine interface or nomenclature within the same operating environment.

9) Construction activities that may affect existing railway operations.

10) The Contractor shall enter all the identified operational hazards into the Hazard log and a copy thereof shall be submitted to the Engineer for review thereafter.

8.4.27 Operational Hazard Management

8.4.27.1 All the operational hazards identified shall be assessed in accordance with the "Risk Matrix for Operational Hazard Management" which shall be provided by the Contractor and for the Engineer review and given notice of no objection.

8.4.27.2 The Contractor shall also make every effort to ensure that there is no duplication of operational hazards.

8.4.27.3 The Contractor shall review and resolve the operational hazards in the Operational Hazard Log in accordance with the following principles:

1) Operational hazards with a residual risk rating of R3 or R4 are not acceptable. The Contractor shall propose safeguards to mitigate the risk to Level R1 or R2 timely to avoid last-minute changes. Unless the Contractor can demonstrate that design solutions have been duly explored but in vain, the use of other mitigation measures, such as operating / maintenance procedures or training of operating / maintenance

staff, will not be accepted as suitable safeguards; and

2) Should there be any operational hazards with a residual risk at R2 but of particular concern, The Engineer may request the Contractor to provide evidence to show that the risks of such operational hazards have been reduced to as low as reasonably practicable (ALARP).

8.4.27.4 Should there be any operational hazards requiring more accurate risk evaluation, The Engineer may request the Contractor to carry out quantitative risk analysis, e.g. fault tree analysis and/or event tree analysis, to assess the risk levels of particular operational hazards.

8.4.27.5 The Contractor shall at least review quarterly the progress of the operational hazard resolutions in the Hazard log and submit an updated Hazard log (in Microsoft Excel) to the Engineer until all the operational hazards are closed out. Should there be any operational hazards which arise from construction activities and may affect existing railway operations, monthly reviews shall be conducted thereto.

8.4.27.6 For operational hazards requiring design safeguards to resolve, the Contractor shall provide sufficient close-out information and evidence to the Engineer for design change review and acceptance. All safeguards and method statements for controlling installation / construction hazards shall be in place before the installation / construction of the relevant part of works is allowed to commence. The close-out of operational hazards shall be done in a timely manner. O&M safeguards which are incorporated into the O&M manual shall be put in force prior to Trial Running.

8.4.27.7 Operational hazards shall only be closed when the agreed safeguards and cross-references to back up relevant evidence such as design submissions, calculations, inspection records, testing and commissioning results, as-built drawings etc. are provided for review to the satisfaction of the Engineer.

8.4.28 Deterministic Safety Assessment

8.4.28.1 The Contractor shall perform a Deterministic Safety Assessment (DSA) to demonstrate that relevant safety requirements have been conformed to and safety principles applied in the Works. It forms the main qualitative, non- numerical, assessment of the safety of the Works supplied in this Contract.

8.4.28.2 Purpose

1) To assess the design in respect of the application of, and compliance / non-compliance with the current codes and standards; and

2) To identify and assess any design safety principles associated with each aspect of the design, and confirm compliance / non- compliance with these principles.

8.4.28.3 Procedure

1) The DSA forms the main qualitative, non-numerical, assessment of design safety. The Contractor shall use the DSA to evaluate conformance of their design with current accepted practices.

2) The DSA shall review the design against applicability and relevance with respect to the:

i) Contract requirements;

ii) Codes, regulations and standards; and

iii) Design safety principles

3) In the event that the DSA has identified any Contractor' submissions or designs

which do not fulfil the system safety requirements such as accepted codes, standards and regulations, the Contractor shall justify themselves by way of operational hazard review / quantitative risk assessment.

4) The relevance and applicability of the design safety principles specified shall be checked and confirmed against normal, degraded and emergency operations of the system.

5) The results of the DSA shall be documented using the template provided by the Contractor. The Contractor shall submit a copy thereof in Microsoft Excel to the Engineer for Review and given notice of no objection prior to completion of the design and construction.

6) The results of the DSA are used to demonstrate compliance with the accepted codes, regulations and standards, and design safety principles for safe operations of the system under normal and degraded operations and credible emergency situations.

7) The Contractor shall provide cross-reference numbers to back up documentary evidence e.g. design submissions, drawings, calculations, etc. to prove compliance with all safety requirements stated therein. In case of non- compliance, full justification by way of operational hazard review / Quantitative Risk Assessment (QRA) shall be provided to the Engineer for review and given notice of no objection.

8.4.29 RAM Demonstration

8.4.29.1 RAM Demonstration Plan

1) The Contractor shall submit a RAM Demonstration Plan at least 90 Days before the commencement of the DNP for Review and given notice of no objection by the Engineer. The RAM Demonstration Plan shall include: -

i) organization, responsibility and key personnel of the system assurance demonstration;

ii) Approach, including test methods, failure assessment, reliability calculation, etc., to demonstrate achievement of RAM target and;

iii) a programme summarizing the key activities.

The demonstration of compliance with the RAM targets shall be achieved within the DNP.

2) The RAM Demonstration Plan shall describe the Data Reporting Analysis and Corrective Action System (DRACAS) and the procedures for collection, analysis, correction and documentation of data. DRACAS shall be used to ensure all incidents are accurately and consistently categorized as to cause, significance, frequency and chargeability. The DRACAS shall log data on integrated tests and trials, failures, performance and maintenance from the start of integrated testing up to and including the DNP.

3) DRACAS shall be managed through "ComplyPro" during project implementation and to be managed through CMMS by O&M Concessionaire and also the Contractor.

8.4.29.2 RAM Demonstration Report

1) The Contractor shall submit a RAM Demonstration Report within 1 Month before expiry of DNP. Interim results, which include DRACAS records, RAM performance statistics and comparison of the RAM targets, shall be submitted to the Engineer monthly during the DNP. The report shall provide evidence that the respective RAM targets have been achieved and shall include any supporting information and calculations. The RAM performance presented in the RAM Demonstration Report

and monthly interim results shall be calculated by taking the average of RAM performance for the period starting from the date of the train taking over certificate or a date to be agreed with the Engineer, to the Month during which the RAM Demonstration Report or the interim results are prepared.

2) The Contractor shall describe the details of each failure case in the RAM Demonstration Report and interim reports. The details of each failure case shall include time, date, duration of train service disruption, response time, recovery time, cause of incident, symptom, alarm, and remedial action taken etc.

8.4.29.3 Failure to Achieve RAM Targets

1) Should any RAM targets cannot be achieved, The Contractor shall, subject to the Engineer's Review and given notice of no objection, take whatever prompt and effective action deemed necessary to meet the requirements.

2) In the event that any RAM target is not achieved at the end of the DNP of the Work, the demonstration of the achievement of the targets shall be extended at least 1 Month and repeated at monthly intervals based upon the performance of the Works over the past 12-Month period, until the requirement is achieve.

8.5 Reliability, Availability, Maintainability and Safety Targets

8.5.1 Overall System

8.5.1.1 The overall system shall be developed in order to protect people and environment against the risks induced by the Malolos Clark Railway Project (MCRP) and the North South Railway Project-South Line (NSRP-S) system, and to protect this system against its environment.

8.5.2 Most of identified hazards have been granted to systems composing the Malolos Clark Railway Project (MCRP) and the North South Railway Project-South Line (NSRP-S) overall system. However, the electric hazards and fire hazards shall be treated at overall system level: -

8.5.3 Top Safety targets

The global Risk Criteria under normal and/or degraded mode operations shall be as specified in the following Table:

Classification on Individual	Individual Risk Design Safety Value (probability of death per year)	
	Limit of Tolerability (LOT)	Limit of Acceptability (LOA)
Passenger	10E-6	10E-8
Public	10E-6	10E-8
Employee	2x10E-5	10E-7

Global Risk Criteria

8.5.3.1 The top safety targets for the Works shall be equivalent to or better than these values.

8.5.3.2 At subsystem level, any wrong side failure of key safety critical subsystems must be shown to be better than 10^{-9} per hour and the specific safety targets that are identified for each subsystem in the following sections shall be achieved.

8.5.3.3 Where equipment is installed to provide safety critical function for multiple location the wrong side failure of equipment must be shown to be better than 10^{-10} per hour.

8.6 Electrical hazards

8.6.1 Electrical hazard is not only linked to the power supply subsystem. Electrical risk must be treated with a System level point of view, in order to protect people against electrocution, and to mitigate the consequences of stray currents and electrical disturbances due to:

1) Malolos Clark Railway Project (MCRP) and the North South Railway Project-South Line (NSRP-S) transportation system on its environment (EMC),

2) Environment on the Malolos Clark Railway Project (MCRP) and the North South Railway Project-South Line (NSRP-S) transportation system (EMC),

8.6.2 These following concept design documents will address these topics:

1) Preliminary Earthing, Bonding, Lightning protection and Stray currents report [CD E&B]

2) Preliminary EMI / EMC (Electromagnetic Interference / Electromagnetic Compatibility) plan [CD EMI/EMC]

8.6.3 As a minimum, the following standard shall be applied within the development of the Malolos Clark Railway Project (MCRP) and the North South Railway Project-South Line (NSRP-S) Transportation System:

1) EN 50121,

2) EN 50122-1,

3) EN 50122-2.

8.7 Fire safety requirement

8.7.1 As for the electrical risk, fire safety of the system shall be treated with a system level point a view.

8.8 Rolling Stock

8.8.1 The following Safety Functional Requirements have been identified. Safety Integrity Levels have been allocated to them regarding the gravity of consequences of hazards they are covering.

8.8.2 This is only a guideline; the Contractor will remain responsible for performing extensive safety analysis and allocate Safety Integrity Level for any safety critical or safety related function.

8.8.3 In addition, the Limited Express Train shall comply with the requirement of the EN 45545 or equivalent standard regarding Fire Safety requirement.

Safety Functional Requirements	Safety Integrity Level (SIL) associated with
In case of loss of train integrity, emergency braking shall be triggered on each car of the consist.	4 (Safety critical)
In case of emergency braking, the braking performance shall be guaranteed.	4 (safety critical)
Any failure in the braking system shall not lead to a total loss of braking	4 (safety critical)
Parking brake on each car	3 (safety critical)
Unwanted opening of door shall trigger emergency braking	4 (safety critical)

Movement of train with open door shall be prevented	4 (safety critical)
Kinetic energy of doors shall be limited	3 (safety critical)
Obstacle shall be detected on door closure	3 (safety critical)
Manual opening of at least three quarters of the doors and the platform screen doors in each passenger car shall be possible when the train is immobilized.	4 (safety critical)
50% of air conditioning power shall be guaranteed	2 (safety related)

SIL associated with Rolling Stock safety functional requirements

8.8.4 Safety Integrity Level Analysis

8.8.4.1 The Contractor shall be responsible for performing extensive safety analyses and allocate SIL levels for any safety critical or safety related functions in the Contract in accordance with the EN50126 and demonstrate the achievement of the SIL requirement specified in this Appendices of the for review and given notice of no objection by the Engineer.

8.8.4.2 A Safety Integrity Level Analysis shall be carried out for all safety related system software. The Contractor shall allocate a Safety Integrity Level for each safety related system software.

8.8.4.3 In determining Safety Integrity Level, all causes of failures (including random hardware failures, systematic failures and software errors) which lead to an unsafe state should be included.

8.8.4.4 The Safety Integrity Levels defined in IEC 61508 shall be used.

8.8.4.5 The software design and development process shall comply with the relevant requirements stipulated in EN50128 and EN50129

8.8.4.6 The Contractor shall demonstrate in the safety analysis that the SIL of software system shall be able to reduce the risk ALARP. The SIL requirement for software shall apply to all applicable system, sub-systems and its interfaces delivering the identified safety functions.

8.8.4.7 The assessment methodology shall be submitted for approval by ISA before commencement of the work and for the PDP's review and acceptance.

8.8.4.8 The Safety Integrity Level Analysis Report is part of the Safety Analysis Report.

8.8.4.9 The Contractor shall submit SIL certification for ISA approval and Engineer's review.

8.9 Operation and Maintenance

8.9.1 Safe procedures shall be written in order to ensure:

1) A safe utilization of the line for every passenger (in station and trains),

2) Safe working conditions for operator and maintenance staff within the Main line and the Depot area.

8.9.2 These rules and procedures shall be consistent with mitigation requirements from the risks analyses.

8.10 Reliability, Availability, Maintainability Targets

8.10.1 The Contractor shall demonstrate that they are able to meet the RAM targets given herein or elsewhere for a service life as defined herein or elsewhere, or the Contractor may opt

to carry out a target apportionment analysis to work out their own targets and submit a target apportionment report thereafter for review and given notice of no objection by the Engineer. Nonetheless, the Contractor shall lay down their intention in his SAP in the first place for review and acceptance by the Contractor.

8.10.2 The term "failure" shall apply to any event which gives rise to a partial or complete shutdown of the unit or system thereof rendering such a unit or system unable to perform its intended function (including hardware and software) or causes nuisance tripping, either in the form of shutdown or impaired performance which is not in accordance with the performance criteria, but shall exclude those incidents due to loss of external input (e.g. loss of external power supply) or failures due to external influences like flooding, incorrect operations and vandalism.

8.10.3 Fleet Defects (Pattern Failures) are failures caused by design defects and are not caused by failure mechanisms such as component wear out. All Fleet Defects (Pattern Failures) shall be counted as failures for the demonstration of the reliability, availability and maintainability requirements during the DNP. Subject to the Engineer's review and Employer acceptance, they may be excluded from the demonstration when the failure mechanism, which is associated with a design defect, is identified and corrective action is satisfactorily retrofitted within a reasonable timeframe in the DNP.

8.10.4 Any defects which effect on safety critical system shall be defined as Fleet Defects. Any defects which affect more than ten (10) percentage of the train fleet on non-safety critical system shall be defined as fleet defects and as per ERT clause 22.7.4.

8.10.5 The Contractor shall rectify such fleet defects, shall include but not limited to the following, in relation to all Limited Express Train: -

1) Fleet wide replacement of all the parts/components

2) Redesign of the concern system

3) Recommission of the concern system

8.10.6 The Mean Time Between Failures (MTBF) is the predicted elapsed time between failures of a system / a piece of equipment during operations. The MTBF shall be calculated as an arithmetic mean time between failures of a system / a piece of equipment. All failures shall be countable. The Contractor shall establish their MTBFs, for their systems / equipment of which failures may necessary a maintenance operation.

8.10.7 The Mean Time To Repair (MTTR) is the mean active repair time required, on arrival of the maintenance team, to locate and isolate the fault, make repairs, and perform a functional checkout to verify that the equipment has restored to its intended operational status. The MTTR is the total active corrective maintenance repair time expended on the article during a specific period of time divided by the total number of failures requiring corrective maintenance during that same time period. MTTR, measuring System Maintainability, shall be established for systems of which failures may impact the operations of the systems concerned.

8.10.8 'Availability' is the ability of an item to perform its required function at a stated instant of time or over a stated period of time. It is influenced by the combined factors of reliability, maintainability and maintenance support. A system is defined as 'available' when it is operational, with all components fully serviceable to their designed specification.

8.10.9 Mean Down Time (MDT) represents the average elapsed time between losing Mission Capable status and restoring the system to at least partially mission capable status. Calculated as the ratio of total downtime over the number of downing events–most often,

the total maintenance time over the number of maintenance events. It is used as a substitute as appropriate MTTR.

8.10.10 Overall System

8.10.10.1 Failures of equipment may lead to more or less important disturbance on line operations and trains running. In order to provide assurance that the final operating systems shall comply with the high reliability standard to support service quality, Reliability indicators of each system works and their components shall be provided.

Specific reliability indicators

1) Service Availability and Reliability

For essential system works not limited to signalling, Rolling Stock, telecommunications and power supply system, sufficient system redundancy shall be provided to ensure no single failure shall result in severe service disruption. Apart from the redundancy architecture, periodic self-diagnostic functions should proactively detect problems within the system and send alarms to the operator in the OCC before more serious failure actual occurs. During DNP, the Train Service Availability performance of 100%

KPI	Calculation Formula	Value	Review Period
Train Service Availability	[(Actual Train Trips per Day)/ (Schedule Train Trips per Day)] x 100%	100%	Monthly
Service Reliability	Total operating hours less total system-related delays over total operating hours	99.90%	Monthly

The calculation of the service reliability does not include the failures that are not directly caused by technical failure (as vandalism, suicide, strike…). Moreover, it is also generally accepted to not take into account the failures that lead to an operational unavailability lower than 5 minutes. The Service Reliability shall be at least 99.90%.

2) Reliability

i) The Malolos Clark Railway Project (MCRP) and the North South Railway Project-South Line (NSRP-S) system shall be designed and constructed in such a way so as to guarantee a high degree of reliability in order to provide proper operating service.

ii) For essential system works not limited to signalling, rolling stock, telecommunications and power supply system, sufficient system redundancy shall be provided to ensure no single failure shall result in severe service disruption.

iii) Apart from the redundancy architecture, periodic self-diagnostic functions should proactively detect problems within the system and send alarms to the operator in the OCC before more serious failure actual occurs.

3) Maintainability

i) The maintainability of the train reflects its ability to be restored to its operation specification level within a stated period and under specific maintenance conditions. The aim is to reduce the costs and delays and to improve the availability of the Malolos Clark Railway Project (MCRP) and the North South

Railway Project-South Line (NSRP-S) system. The Contractor shall submit the maintainability targets with benchmark other current operation railways for review and acceptance by the Engineer and with compliance to Clause 8.10.11(IV) .

8.10.11 Rolling Stock

8.10.11.1 Each consist shall be designed for a service life of 30 years. Each consist shall be able to operate for 19 hours a day, 7 days a week, with engineering downtime of 5 hours a day.

8.10.11.2 The availability target of one train shall be 99.99%. (but need to be reassessed in case of fleet sizing modification). It shall be calculated using the following formula:

$$\frac{MTBSAF}{MTBSAF + MDT}$$

Where

- MTBSAF is the Mean Time Between Service Affecting Failure, which cause service delay of, or over 5 minutes.
- MDT shall be understood as the time required to restore normal operation (withdraw the disabled train and insertion of a stand-by train).

8.10.11.3 The Limited Express train shall achieve 10,000 km or 2 months of FFR during the DNP period and;

8.10.11.4 Reliability targets for the Limited Express Train are set in term of Mean Distance Between Service Affecting Failures (MDBSAF):

Delay	Crossed distance
0 to 5 min delay	50,000 km
5 to 30 min delay	100,000 km
More than 30 min delay	500,000 km
Train rescue	3,000,000 km

Reliability targets for Limited Express Train

Where the MDBSAF shall be calculated using the following formula:

$$\frac{Total\ Accumulative\ distance\ in\ kilometres\ in\ a\ period}{Total\ No.\ of\ service\ Affecting\ Failures\ in\ that\ period}$$

8.10.11.5 Maintainability targets for the Limited Express Train shall be:

1) **OMTTR** – Operational Mean Time To Restore (OMTTR) capital components; the trainsets shall be restored to operational order in an OMTTR of 15 minutes.

2) **CMTTR** – Corrective Mean Time To Repair (CMTTR) capital components shall not be greater than 4 hours.

~~**8.2 Performance Assurance Plan (PAP)**~~

~~8.2.1 Within the SAMP, the Contractor shall submit a Performance Assurance Plan (PAP) or RAM Assurance Plan as per EN 50126 or IEC 62278 or any other equivalent international standard for the Rolling Stock to comply with the Employers Requirement (functional, performance and safety Requirements) and submitted for review by the~~

Employer/Engineer. The PAP shall describe the activities that the Contractor proposes to carry out during the life cycle of the design, implementation and operation of the Rolling Stock, and shall demonstrate compliance with the Employer's Requirements, achievement of a TOC for each train set, and a Performance Certificate for the total fleet (7 trainsets).

8.2.2 The Contractor shall implement a formal Maintainability Plan for Rolling stock any other applicable system to comply with the Technical Requirements (ERT).

8.3 Performance (RAM) Requirements

8.3.1 The Contractor shall submit the Performance or RAM (Reliability, Availability and Maintainability) Target Apportionment Report in the preliminary design stage.

8.3.2 The Contractor shall conduct a Preliminary RAM Analysis which shall give an initial indication of any RAM problems which may arise which might affect the performance of the rolling stock.

8.3.3 The Contractor shall provide RAM Demonstration Plan and RAM Demonstration report as necessary in the relevant stages of the project.

8.3.4 The Contractor shall establish a Data Reporting and Corrective Action System (DRACAS) to monitor the safety and RAM performance of the equipment, from the design, through testing and commissioning and into operation. The system shall be used to monitor the performance of components and to identify patterns of failures so that corrective action can be taken to improve both current and future systems.

8.3.5 The reliability of the trains shall be measured based on the number of train service disruption incidents, hereafter referred to as incidents, which are caused by train failures during operation. An incident is defined as any one of the following events which are caused by a train failure:

1) Train removed from Service;

2) Delay to Train Service (more than 5 minutes);

3) Failure to be Dispatched.

8.4

8.5 Performance Acceptance Criteria (PAC)

8.5.1 All RAM calculations shall use an annual operation of 19 hours a day, 7 days a week, with engineering downtime of 5 hours a day.

8.5.2 Each trainset shall achieve:

1) Trail Operation (selected trainset) – No major faults.

2) **In-service Operations** – 10,000 km or two (2) months of continuous in-service operational FFR.

8.5.3 The train fleet (7 trainsets) as a whole shall achieve:

1) **MDBF** – In service operational faults, MDBF no less than 50,000 km causing a delay greater than 5 minutes.

2) **OMTTR** – Operational Mean Time To Restore (OMTTR) capital components; the trainsets shall be restored to operational order in an OMTTR of 15 minutes.

3) **CMTTR** – Corrective Mean Time To Repair (CMTTR) capital components shall not be greater than 4 hours.

8.5.4 Where appropriate, the Contractor shall also specify RAM (Reliability, Availability and Maintainability) requirements for the design, operation and maintenance of subsystems where the failure mode, effects and criticality analysis (FMECA) identify failure modes that have a maintenance, operations or safety impact, using the risk assessment methodology.

8.5.5 The Contractor shall commence the use of the Data reporting analysis and corrective action system (DRACAS) prior to any factory or site acceptance tests and report to the Employer/Engineer on a regular basis.

8.5.6

8.6 Performance Reports

8.6.1 The Contractor shall provide Performance Reports to support the applications for Rolling Stock TOC for each trainset and the Performance Certificate for the fleet (7 trainsets).

8.6.2 The Rolling Stock TOC Performance report shall be issued for each trainset prior to operational acceptance and shall provide:

1) Technical design justification of performance;

2) Cross reference to Rolling Stock performance in a similar application;

3) The design prediction at LRU (Line replaceable unit) level (MDBF, OMTTR and CMTTR) of all capital components;

4) Failure mode, effect, & criticality analysis (FMECA) and Fault Tree Analysis (FTA)

5) Reliability Critical item list which might impact the operations of the train or train service,

6) Manufacturing Completion Certificate for each train,

7) Design Qualification Testing Completion Certificate,

8) Factory Acceptance Tests Completion Certificate,

9) Train Delivery to site completion Certificate,

10) As-built Drawing,

11) Completion of Training program,

12) On-site Testing and Commissioning Completion Certificate for each train, and

13) Train Operation Completion Certificate for each train 1500 km (FFR)

8.6.3 The Rolling Stock Performance report shall be issued progressively on a monthly basis, shall be finalized at the end of DNP, and shall provide:

1) In-service FFR operational performance of individual trainsets as per clause 8.3.3;

2) In-service operational performance of the fleet (7 trainsets) MDBF as per clause 8.3.3;

3) The in-service OMTTR and CMTTR of all capital components as per clause 8.3.3,

4) Completion of Defect Remedial,

5) Completion of Open Item,

6) Completion of Modification, and

7) Completion of Spare Part, Special Tools and Test Equipment delivery, and

8) DRACAS report

8.7 Performance Certificate

8.7.1 During the in-service Defects Notification Period (DNP), the fleet (all 7 trainsets) in total shall demonstrate successful achievement of the Performance Acceptance Criteria (PAC) which will be a prerequisite of the application for a Performance Certificate to be issued by the Engineer.

8.7.2 Failure to meet the PAC within the DNP shall mean that the DNP shall be extended until such time as the PAC of the total fleet has been met. All cost associated with the extension of the DNP shall be borne by the Contractor.

8.10.12 The DNP shall be up to a limit of 4 years from the date of commencement of the first train in-service operation.

8.7.3

8.8 Safety Assurance

8.8.1 Safety

8.8.1.1 Safety is defined as freedom from those conditions that can cause death, injury, occupational illness, or damage to or loss of equipment or property. All circumstances susceptible to cause injuries or fatalities of passengers, operation staff, and maintenance staff are considered as risks, and by extension, includes all events leading to a partial or total destruction of costly equipment. The objective of safety is expressed by the capability of the Rolling Stock to keep the physical integrity of the asset and to preserve the safety during railway operations and maintenance for passengers, staff and persons in general. The safety assurance program aims to reduce to a tolerable level the probability of occurrence of catastrophic or critical events causing damage to assets or harm to any person. The Contractor shall follow appropriate risk reduction principle such as ALARP (As Low as Reasonably Possible) to demonstrate the risk acceptance to the Employer.

8.8.1.2 The Contractor shall bear the duty of safety in design for the assurance of safety for the life cycle of operations for MCRP and NSRP-S. The Rolling Stock shall fulfil the safety requirements of all General Requirements and Technical Requirements and shall demonstrate that the train is fit for purpose to be operated and maintained in a safe manner for these projects.

8.8.2 Safety Assurance Plan (SAP)

8.8.2.1 Within the SAMP, the Contractor shall provide a Safety Assurance Plan (SAP) for review by the Engineer. The SAP shall cover the design, manufacture, testing, commissioning and integrated testing phases, and safety management for in-service passenger operations. The Plan shall further identify how the magnitude and seriousness of events or malfunctions which could result in harm to passengers or staff and damage to equipment or property will be minimized.

8.8.2.2 System Safety Assurance Management Plan shall detail, but not limited to, the following:

1) Organization of the Safety team

2) Management of Safety-related interfaces with other contractors.

3) Provisions and procedures for providing feedback to and interacting with other disciplines in the Contractor's team, e.g. design, manufacturing, testing and commissioning and maintenance etc.

4) Identified Safety requirements (including interfaces).

5) Safety methods to be used for the safety analysis.

6) Management of subcontractors' Safety requirements.

7) Safety related software management

8) Quality management

9) Configuration management

10) Verification and validation of assessments, including data.

11) Validation of Safety requirements during manufacture, installation, commissioning and maintenance.

12) Audits and Review activities.

13) Record keeping of Safety assessments/analysis.

14) Hazard Log Management.

15) List of deliverables, including interim items listed within this document.

16) High level schedule for deliverables.

8.8.3 Safety Requirements

8.8.3.1 The Contractor shall submit the Preliminary Hazard Analysis Report in early design stage.

8.8.3.2 The Interface Hazard Analysis (IHA), System Hazard Analysis (SHA), Operating & Support Hazard Analysis (OSHA) shall be conducted upon completion of the Preliminary Hazard Analysis.

8.8.3.3 Hazard log management shall be performed to ensure all the hazards are at an acceptable risk limits with suitable mitigation control measures.

8.8.3.4 Safety Assessment for the Safety functions to be performed, for example:

No.	Subsystem	Function
1	Propulsion	Speed controls including ATP/Brake interface
2	Brake	Emergency Brake application
3	Passenger doors	Emergency door release
4	HVAC	Smoke / Heat Detections
5	Driver Machine Interface	Manual coupling / uncoupling /Train Complete Interlocking
6	Train Management System	On-board control and monitoring functions

8.8.3.5 The Contractors shall prepare a Safety Critical Item List of equipment and LRUs classified by their impact on safety for Employer review.

8.8.3.6 The Contractor shall submit the Failure Modes, Effects and Criticality Analysis (FMECA) Report in design stage and subsequent stages.

8.8.3.7 In addition to the Hazard Log, the Contractor shall also set up and maintain a Register of Train Failures to document all scenarios which will result in a train failure. The causes, consequential effects and impact on train service shall be recorded for each entry in the Register.

8.8.3.8 The Contractor shall provide Quantitative Risk Assessment for the "top events" related to Safety; for example:

1) Train collision on main line

~~2) Train derailment on main line~~

~~3) Fire in Train~~

~~4) Smouldering / Smoke in train~~

~~5) Train separation on main line~~

~~6) Undemanded passenger door opening on main line~~

~~8.8.3.9 The Contractor shall provide Safety Verification evidences to demonstrate that safety functions / features which are an integral part of the design shall work as intended. The process shall be covered by type test and commissioning tests on items of equipment critical to safety.~~

~~8.8.3.10 Design Safety Case and Final Safety Case or Safety repot for CP NS-03 Rolling Stock to be submitted for ISA review and Employer's Notice of No Objection to get a Taking Over Certificate (TOC) from the Employer.~~

~~8.8.4 Safety Report~~

~~8.8.4.1 The Contractor shall carry out Safety Assurance and provide Safety Reports to the Engineer to support the Rolling Stock safety application, in coordination with the Operator, to gain a TOC from the Engineer, and a final in-service safety report to support the Performance Certificate application.~~

~~8.8.4.2 The Contractor shall provide the following, but not limited to:~~

~~1) The Hazard Analysis report shall evaluate and ensure that all the hazards are identified and satisfactorily resolved to an acceptable level.~~

~~2) Safety assessment report demonstrating Safety requirements are in compliant with Technical Requirements (ERT)~~

~~3) The Fire Safety Analysis report shall evaluate and ensure inter alia that the fire loadings of material proposed to be used, and the fire withstand ratings etc. are as per the requirements specified in the Employer's Requirements – Technical Requirements (ERT).~~

~~4) Design Safety Case and Final Safety Case or Safety report to be submitted for Employer's given statement of No Objection.~~

~~8.8.4.3 The Rolling Stock Design Safety report "Design Safety case" shall provide:~~

~~1) Technical Justification for Rolling Stock safety; and~~

~~2) Cross reference to a generic Rolling Stock safety application of similar product provided.~~

~~8.8.4.4 The Rolling Stock Operational Readiness Safety report "Final Safety case" provided for each trainset at their TOC shall provide:~~

~~1) The Safety application for in-service operations; and~~

~~2) The Safety Management System to be applied for in-service operations.~~

~~8.8.4.5 The Rolling Stock In-service Final Operational Safety reports shall be issued progressively on a monthly basis and finalized at the end of DNP; they shall provide:~~

~~1) Safety performance; and~~

~~2) Safety recommendations.~~

~~8.9~~8.11 Independent Assessment

8.1 General

8.1.1 System Assurance Management is applicable for all stages of the Rolling Stock development, including design, manufacture, testing, commissioning, systems integration, trial operations, and in-service operations.

8.1.2 The Contractor shall submit a comprehensive System Assurance Management Plan (SAMP) which contains all requirements within this ERG Section 8 of this document, for the Engineer's review. The SAMP shall include, but not limited to the Contractor's methodology to plan, manage and control the system assurance process, organization and roles/responsibilities of the key personnel for system assurance, tasks, program and procedures for system assurance, and an internal audit program.

8.1.3 The System Assurance activities shall cover and not limited to the System Assurance Management, System Safety (including the Electromagnetic Compatibility (EMC), Fire Safety strategy, Software Management and Control, Reliability, Availability, Maintainability (RAM), Hazard Log Management Procedures; System Risk Management Plan including Risk Assessment Methodology, Safety Critical Items List (SCIL), Reliability Critical Item List (RCIL), Design Safety Study Report, Safety Cases, RAM Demonstration Test Report, Failure Recording and Data Reporting and Corrective Action System reports.

8.1.4 The System Assurance Management Plan shall comprise a programme showing in detail the timing of each activity and the anticipated dates for submission of system assurance documentation. The programme will break down the planned activities into discrete stages of work as a minimum design, manufacturing, installation, testing and commissioning and RAM demonstrations.

8.1.5 The Plan shall clearly identify the reviews to be performed at the end of each stage of the programme. The Contractor shall convene formal System Assurance Review (SAR) meetings to review all SA activities and to ensure operational hazards are comprehensively identified within the scope of the Contract. The SAR meetings shall be held quarterly, or when there is any key system change, and meeting records shall be submitted by the Contractor to the Employer. The Employer and the Engineers may participate in the SAR. System Assurance Report shall be submitted at the end of each stage of the programme which covered all the subjects above. The Contractor's subcontractor or supplier shall provide the SAMP which will be in consistent in approach with the Contractor SAMP.

8.1.6 The SAMP shall be certified by the Contractor's internal department or by a third-party independent engineer from the design and manufacturing section. The SAMP shall be specifically developed for this Contract.

8.1.7 A Taking Over Certificate (TOC) will be issued for each trainset. In order to obtain a TOC for the Rolling Stock from the Employer/Engineer, it is required that each trainset achieves 1,500 km of Fault-Free Running (FFR) during the integrated testing and commissioning.

8.1.8 A Performance Certificate will be issued by the Engineer for the total performance of the fleet. This Performance Certificate is required to be achieved by the end of the Defect Notification Period (DNP).

8.1.9 The Contractor shall provide sufficient documented information for review by the Engineer. It is expected that the design demonstration of the Rolling Stock performance shall be achieved through supplier-based material self-certification, including cross-references to proven and accredited in-service performance of Rolling Stock equipment supplied in a similar railway application.

8.1.10 With regard to Safety, it is expected that certification shall be achieved through supplier-based information via application of cross references to previously certified acceptances from a reputable body (e.g., train operators, national railways authorities, independent accredited safety bodies, etc.) of similarly supplied Rolling Stock equipment, with a product-generic safety case application to be made based on existing safety certification.

8.1.11 The Employer shall conduct compliance audits during design, development, manufacture and testing and commissioning phases to ensure that the Contractor has met all relevant System Assurance requirements. The Engineer shall give 7 days' notice to the Contractor about the audit arrangement. The Contractor shall provide all necessary assistance to enable the Employer or his representative complete the audit.

8.1.12 The Contractor shall propose design, implementation techniques and measures, depending on the SIL of the function in line with the principles of EN50128 and EN50129 or other equivalent standard subject to the given notice of no objection by the Engineer.

8.2 Safety Integrity Level

8.2.1 The CENELEC standard specifies five Safety Integrity Levels (SILs). The required Safety Integrity Level shall be decided on the basis of the level of risks.

8.2.2 The Contractor shall set a SIL at functional level and functional modules level. The Contractor shall assign to all Systems/Subsystems/Components a Safety Integrity Level when relevant.

8.2.3 The Contractor shall propose design, implementation techniques and measures depending on the SIL of the function to be performed by each individual System, Subsystem or Component.

8.3 Quality Assurance

8.3.1 The Contractor shall implement the relevant part of [ISO 9001] standard in accordance with EN 50126 standard. Verification activities conducted to ensure that design and development outputs meet the input requirements are included in these activities.

8.3.2 The Contractor shall provide a Quality Assurance Plan covering all safety-related systems, whatever their SILs.

8.3.3 In connection with its Quality Assurance Plan, the Contactor shall provide a System Development Plan covering all re-used, newly developed or modified systems.

8.4 Risk Mitigation Strategy

8.4.1 According the level of their acceptability, the risks shall be managed in different ways.

Acceptable and unacceptable risks

Unacceptable risks (R4) are those which have:

- Catastrophic consequences with a frequency greater than remote,
- Critical consequences with a frequency greater than occasional.
- Marginal consequences with a frequent frequency.

Acceptable risks (R1) are those which are:

- Of an incredible frequency,
- Of an improbable frequency with consequences less than critical,
- Of a remote frequency with insignificant consequences.

8.4.2 Since no prevention / mitigation measures shall cover these risks, the allocation of risks to these two categories has to be thoroughly documented.

Other risks

Other risks (R2 and R3) are those risks, which have:

- Insignificant consequences with frequent frequency,
- Marginal or insignificant consequences with probable frequency,
- Critical, Marginal or insignificant consequences with occasional frequency,
- Catastrophic, Critical or Marginal consequences with remote frequency,
- Catastrophic or Critical consequences with improbable frequency.

8.4.3 These risks need to be discussed in writing and submitted to the Engineer for acceptance of both the risks and the corresponding prevention / mitigation measures.

8.4.4 For the justification, discussion of the mitigation measure. The following shall be addressed:

8.4.5 Residual risk, cost of the measure. Alternative measures will be proposed,

1) The feasibility and cost of the measures is an important part of justification / discussion,
2) Input data used in the assessment, justification, discussion shall be provided with reference of their origin and copy of the statements to be considered,
3) Measures of SILs equal or greater than 2 shall be stated in the safety analysis.

8.4.6 To demonstrate the risk has been reduced ALARP, the following criteria shall be used (in order of priority):

1) show compliance with international standards
2) use of product already accepted by internationally recognized railways agency
3) perform a Cost Benefit Analysis

8.4.7 The Cost Benefit Analysis should be used as less as possible; priority shall be given to technical argument.

8.4.8 To conduct of the safety analysis, safety analysis(s) must be conducted which the following minimum requirements:

1) The safety objective is reached when the level of risk has reached the "acceptable" area with acceptable justification,
2) Every safety-related function shall be identified and assessed for its related hazards,
3) Every safety-related constituent shall be identified and assessed for its related hazards,
4) Every safety-related interface shall be identified and assessed for its related hazards.

8.4.9 Link between safety objectives and SIL's shall be assessed regarding EN50126 requirements. The following links shall also be used as possible guidance. They have been issued by expert judgement:

1) Functions which failure can lead to an unacceptable risk with catastrophic consequences shall be supported with SIL4 constituents,
2) Functions which failure can lead to an unacceptable risk with critical consequences

shall be supported with SIL3 constituents,

3) Functions which failure can lead to an R3 or R2 risk shall be supported with SIL2 constituents,

4) Functions which failure can lead to an R1 risk shall be supported with SIL1 constituents.

8.4.10 Implementation of SIL constituents, equipment shall have a SIL at least equal to the functions it implements. As a minimum, SIL 4, SIL 3, SIL 2 and SIL 1 constituents shall comply with the following requirements:

1) Compliance to standards referenced by the Contractor

2) Quality assurance,

3) Safety assurance.

8.4.11 Recognized techniques used in the railway application for implementation of SIL 4 or 3 constituents are as follows:

1) "Fail safe" technique,

2) "Checked safety" technique,

3) "Probabilistic safety" technique,

4) "Safety concept" approach of the programmable electronic equipment,

5) Use of "safety software",

6) Use of "proven safety" techniques.

These main safety techniques are presented and developed in EN50128 and EN50129 standards.

8.4.12 SIL Safety Targets

8.4.12.1 For an eventual implementation of SILx functions by the means of "probabilistic safety", the Mean Time Between Hazardous Event could be given in the table below:

Safety Integrity Level	Frequency of dangerous failure per hour
4	$\geq 10^{-9}$ to $<10^{-8}$
3	$\geq 10^{-8}$ to $<10^{-7}$
2	$\geq 10^{-7}$ to $<10^{-6}$
1	$\geq 10^{-6}$ to $<10^{-5}$

Mean Time Between Hazardous Event

8.4.13 Systems Engineering Management

8.4.13.1 The Contractor shall apply a suitable Systems Engineering Process (SEP) in order to provide assurance that the final operating system shall achieve the conceptual design intent. The Contractor shall provide the Systems Engineering Management Plan, which describes the program's overall technical approach, including systems engineering processes, resources, and key technical tasks activities. These shall be integrated with the program management control efforts, including technical performance measures, Examples of suitable methodologies are:

1) IEEE 1220 Standard for the Application and Management of the Systems Engineering Process

2) EIA 632 Systems Engineering

The Contractor with consent of the Engineer may propose an alternative methodology.

8.4.14 Engineering Safety Management

8.4.14.1 The Contractor shall apply a suitable Engineering Safety Management System. The Contractor with consent of the Engineer may propose an alternative methodology.

8.4.15 RAM Management

8.4.15.1 The Contractor shall apply a suitable RAM Management System acceptable to the CP NS-03 project. Contractor shall provide a RAM demonstration plan.

8.4.16 RAM Activities

8.4.16.1 In order to provide confidence, that the final operating system shall achieve the requirements of the Performance Measures, Contractor shall undertake RAM assessments at appropriate stages of the project. The scope of RAM activities shall include:

1) RAM requirements capture and definition;
2) Preliminary RAM Analysis
3) Derivation and Apportionment of RAM targets
4) RAM requirements allocation;
5) Integration of existing sub-system and lower level RAM requirements that contribute to the achievement of system level requirements;
6) Management of RAM activities
7) Collation, interpretation and presentation of RAM results

8.4.16.2 RAM activities should include RAM Assessment, RAM Testing, RAM Demonstration and Failure Recording. The RAM activities during the project shall be reported and copied to the Engineer.

8.4.17 Design RAM Analysis

8.4.17.1 The Contractor shall demonstrate that they are able to meet the RAM targets given, or the Contractor may opt to carry out a target apportionment analysis to work out their own targets and submit a target apportionment report thereafter for acceptance by the Engineer. Nonetheless, the Contractor shall lay down their intention in his RAM Demonstration Plan in the first place for acceptance by the Engineer.

8.4.17.2 RAM analyses shall be conducted at equipment level, and shall be extended to a component level. The methodology (e.g. using reliability block diagram, Fault Tree Analysis (FTA) or Failure Modes, Effects and Criticality Analysis (FMECA)) shall be specified in the RAM Demonstration Plan and review and given notice of no objection by the Engineer.

8.4.17.3 A RAM analysis report shall be submitted to the Engineer for review and acceptance to demonstrate the predicted RAM performance meets the RAM performance targets as stipulated in this Section.

8.4.18 Assurance Management

8.4.18.1 All assessments shall be reported in a format as agreed with the Engineer. Contractor shall submit monthly progress report describing the progress achieved, based on milestone schedule tasks identified in the SA Plan.

8.4.18.2 The deliverables shall include but not be limited to:

1) Systems Assurance Plan (including Safety);
2) Systems Engineering Management Plan;
3) Systems Assurance Quality Manual;
4) Systems Assurance Management Procedures;
5) RAM Demonstration Plan
6) RAM Analysis Report
7) RAM Testing/Commissioning Plan;
8) Hazard Log;
9) Safety Assessment Reports;
10) RA Safety Critical Items List;
11) RAM Demonstration Report; and
12) Data Recording and Corrective Actions System (DRACAS).

8.4.19 Systems Assurance Audits

8.4.19.1 External Audits - The Contractor's Systems Assurance process shall be subject to audits conducted by the Engineer throughout the Contract. These audits shall involve support from the Contractor's system assurance team. The Contractor shall render support throughout and the Contractor's Project Manager and System Assurance Manager shall attend. The Contractor shall rectify any outstanding items identified at the RAMS audits and return to the Engineer by the dates agreed with the Engineer's RAMS auditors. The programme shall include, but not be limited to:

1) Auditing for compliance with selected standards specified in the SA Plan;
2) Checking that the RAMS requirements are adequately met;

8.4.19.2 Internal Audits – The Contractor shall perform RAMS audits on the Contractor's organization, the Contractor's subcontractors and consultants and any parties who are involved in the Contractor's works and have RAMS responsibilities thereof. The Contractor shall identify in the Contractor's System Assurance Plan the Contractor RAMS audits with dates at which the Contractor shall conduct their RAMS Audits throughout. The Contractor shall notify the Engineer of the Contractor's RAMS audits at least 2 weeks in advance and invite the Engineer to take part at the discretion of the Engineer. The Contractor shall submit their internal RAMS audit reports to the Engineer for review.

8.4.20 System Assurance Organization

8.4.20.1 The Contractor shall establish a system assurance organizational structure that assumes the system assurance responsibilities and enables effective communication among all relevant parties during the system assurance process.

8.4.20.2 The Contractor shall appoint a System Assurance Manager (SAM). The SAM shall be responsible for all system assurance tasks as well as hosting and facilitating the Hazard Identification Workshops. The SAM shall be the author or reviewer of every System Assurance submission. When the SAM is not available for a workshop or meeting, the SAM shall be represented by a delegate who is review and acceptance by the Engineer.

8.4.20.3 The incumbents for the SAM and SAM delegates (if any) shall possess at least 8-year relevant experience and skills of system assurance in the railway industry. The Contractor shall submit the curriculum vitae of their SAMs and SAM delegates (if any) to the

Engineer for acceptance prior to appointment(s).

8.4.20.4 The Contractor shall write to the Engineer for acceptance in case of change of their SAMs or SAM delegates.

8.4.20.5 All meetings and workshops specified thereof shall be hosted in Manila at venues arranged by the Contractor. All key participants from the Contractor and his sub-Contractors shall be physically present in the meetings and workshops thereof. Records of RAMS related meetings by way of meeting minutes or the like shall be produced by the Contractor, subject to review by the Engineer, regardless of whether the Engineer was present.

8.4.20.6 The contractor shall attend RAMS related meetings called by the Engineer and will be notified accordingly.

8.4.21 System Assurance Plan

8.4.21.1 The Contractor shall prepare and submit a Systems Assurance (SA) Plan before any design begins. The SA Plan shall define all management and technical activities during each stage, which are necessary to ensure that safety related system, achieve and maintain the required systems assurance objectives. The SA Plan shall:

1) Define all phases of the project from the planning to handover;
2) Describe the Systems Assurance organization;
3) Define the responsibilities and competencies of personnel responsible for implementing the Systems Assurance programme and undertaking the Systems Assurance activities;
4) Outline the Contractor's approach, procedures and schedules for conduct of reliability, availability, maintainability and safety during all the above phases. The schedules shall detail all the systems assurance activities and associated milestones and deliverables;
5) Procedures for monitoring and control of system assurance activities of the Contractor/Sub-contractors
6) Internal audit programme
7) Identify the interfaces with Subcontractors.

8.4.22 All system assurance reports generated by the Contractor and the associated sub-contractors and suppliers shall be submitted for review and acceptance. The Programme of system assurance tasks for the Contactor shall include, but not be limited to the following:

8.4.22.1 Theoretical system assurance analyses and their associated reports, which shall include, but not be limited to:

1) Preliminary Hazard Analysis Report
2) Deterministic Safety Assessment Report
3) Interface Hazard Analysis Report
4) System Hazard Analysis Report
5) Operating and Support Hazard Analysis Report
6) Safety Integrity Level Analysis Report
7) Failure Mode, Effects and Criticality Analysis Report

8) Quantified Risk Assessment/Fault Tree Analysis Report

9) Safety Verification (Safety Critical Item) Report

8.4.22.2 The deliverables shall include, in addition to those aforementioned, but not be limited to the following:

1) Systems Assurance Plan (including Safety, RAM);

2) Systems Engineering Management Plan;

3) Systems Assurance Quality Manual;

4) Systems Assurance Management Procedures;

5) RAM Testing/Commissioning Plan;

6) Hazard Log;

7) Safety Assessment Reports;

8) RAM Assessment Reports;

9) Safety Critical Items List;

10) RAM Demonstration Test Report;

11) Data Recording and Corrective Actions System (DRACAS);

12) Safety Case for Design;

13) Operational Safety Case (draft);

14) Operational Safety Case (Final); and;

15) Any other submissions at the request of the Engineer

8.4.23 RAMS and Design Safety Review

8.4.23.1 The Contractor shall hold RAMS Review meetings periodically with a view to:

1) Reviewing the progress of all SA activities against the System Assurance Plan,

2) Reporting on status of compliance with the SA requirements, and;

3) Confirming whether the RAMS analyses reflect the latest design to date.

4) The Contractor shall evaluate any design changes arising as a result of the Contractor's RAMS analysis for any potential RAMS impacts. The Contractor shall update their RAMS analysis reports accordingly. Should a RAMS analysis necessitate a design change, the Contractor's design change request as a result shall be submitted with sufficient technical information to the Engineer for review and given notice of no objection.

5) The Contactor shall invite the Engineer for any RAMS and Design Safety Review meetings and notify the Engineer thereof at least 2 weeks in advance.

8.4.24 Safety Case for Design and Pre-Operation Safety Case

8.4.24.1 The Contractor shall summarize in a Safety Case for Design and Operational Safety Case respectively for review and given notice of no objection by Engineer and the approval by ISA. The Contractor shall provide a Statement of Safety that the Works are fit for the purpose and safe for the revenue service in the Contractor's Safety Cases. The Contractor shall submit the Contractor's Design Safety Case by the end of the design phase as documented proof of safety for a Statement of No Objection by the Engineer. The Contractor shall submit the Contractor's Pre-Operational Safety Case (draft) two months prior to the commencement of the revenue service for review and the Contractor's final

Pre-Operational Safety one month prior to the commencement of the Commercial Train Operation for a Statement of No Objection by the Engineer.

8.4.24.2 The Contractor's safety cases shall include a summary for the following as a minimum:

1) Introduction: The Contractor's scope of works
2) Scope of the Safety Cases
3) System Description: The key safety features and the interfaces of the Contractor's works
4) Evidence of Quality Management: The Contractor's Quality Management System and their activities devoted towards the works
5) Evidence of System Assurance Management: The Contractor's System Assurance Management System and their activities devoted towards the works
6) Technical Safety Report: Risk assessments, hazard management, RAMS targets and their fulfilment, status and details, mitigation measures etc.
7) Operations and Maintenance: Assumptions used for design, Operations and maintenance procedures related to the Contractor's works for normal, degraded and emergency conditions, plans/strategies for training, modification and operational changes.
8) Recommendations and Restrictions: restrictions to be applied for the Contractor's works and recommendations for safety and efficiency improvement
9) Conclusions: a statement of safety and description on how safety of the system is achieved and continuously to be achieved.
10) References: a list of all the documents/standards referred by the Contractor.

8.4.25 Safety Inspection

8.4.25.1 On-site safety inspections may be conducted by the Engineer so as to identify any other potential hazards against the applicable safety requirements and the mitigation measures described in the Contractor's hazard log and the Deterministic Safety Assessment (DSA) report. The Contractor shall provide support and the Contractor's System Assurance Manager and Design Manager shall attend. The Contractor shall update the Contractor's SA deliverables accordingly as a result of the Safety Inspections.

8.4.26 Operational Safety Requirements

8.4.26.1 Hazard log

1) The Contractor shall produce an operational hazard log with entries of hazards which may affect the safety and / or reliability of the Limited Express Train operations due to design, construction, installation, testing, commissioning, operations and maintenance of the Works. The design shall incorporate the safeguards identified in the hazard log where applicable.
2) The format of the hazard log shall be provided by Contractor's and shall be submitted to the Engineer for Review and given notice of no objection. References to relevant information / analysis items shall be included in the hazard log to describe the source(s) of the operational hazards identified.

8.4.26.2 Operational Hazard Identification

1) The Contractor shall conduct formal operational hazard identification workshops and analyses to systematically identify relevant operational hazards which may affect the safety and / or reliability of Limited Express Train operations. The methods of

analysis (e.g. hazard and operability study) shall be review and given notice of no objection by the Engineer. The operational hazard analysis shall cover system / equipment hazards, interface hazards and operations & support hazards. All protection measures identified which are designed to eliminate, control, or mitigate the effect of potential operational hazards shall be documented

2) Operational hazard identification workshops shall be conducted by the Contractor during the early stage of the Works for which the Engineer shall be invited, to identify the operational hazards and propose appropriate mitigation measures.

3) The scope, purpose and methodology to be applied of the workshops shall be detailed in the form of HAZOP guidance notes and a copy thereof shall be submitted to the Engineer for Review and given notice of no objection. Records of such workshops by way of meeting minutes and Hazard Log (Workshop) shall be produced for review by the Engineer. The Contractor shall make efforts to identify pertinent operational hazards with respect to the following areas, among other things:

4) New and specific design functions or applications;

5) Location specific design features or site restrictions;

6) Different designs compared with the interfacing operating railway lines, if any, which may introduce compatibility and / or inter- operability issues;

7) Changes in operating assumptions or design compared with the specified requirements, causing impacts on operation and interfacing systems;

8) Requirements for the introduction of new operating procedures, temporary or permanent operating restrictions; and Human error prone activities due to complicated operation and maintenance, different equipment design principles, human machine interface or nomenclature within the same operating environment.

9) Construction activities that may affect existing railway operations.

10) The Contractor shall enter all the identified operational hazards into the Hazard log and a copy thereof shall be submitted to the Engineer for review thereafter.

8.4.27 Operational Hazard Management

8.4.27.1 All the operational hazards identified shall be assessed in accordance with the "Risk Matrix for Operational Hazard Management" which shall be provided by the Contractor and for the Engineer review and given notice of no objection.

8.4.27.2 The Contractor shall also make every effort to ensure that there is no duplication of operational hazards.

8.4.27.3 The Contractor shall review and resolve the operational hazards in the Operational Hazard Log in accordance with the following principles:

1) Operational hazards with a residual risk rating of R3 or R4 are not acceptable. The Contractor shall propose safeguards to mitigate the risk to Level R1 or R2 timely to avoid last-minute changes. Unless the Contractor can demonstrate that design solutions have been duly explored but in vain, the use of other mitigation measures, such as operating / maintenance procedures or training of operating / maintenance staff, will not be accepted as suitable safeguards; and

2) Should there be any operational hazards with a residual risk at R2 but of particular concern, The Engineer may request the Contractor to provide evidence to show that the risks of such operational hazards have been reduced to as low as reasonably practicable (ALARP).

8.4.27.4 Should there be any operational hazards requiring more accurate risk evaluation, The Engineer may request the Contractor to carry out quantitative risk analysis, e.g. fault tree analysis and/or event tree analysis, to assess the risk levels of particular operational hazards.

8.4.27.5 The Contractor shall at least review quarterly the progress of the operational hazard resolutions in the Hazard log and submit an updated Hazard log (in Microsoft Excel) to the Engineer until all the operational hazards are closed out. Should there be any operational hazards which arise from construction activities and may affect existing railway operations, monthly reviews shall be conducted thereto.

8.4.27.6 For operational hazards requiring design safeguards to resolve, the Contractor shall provide sufficient close-out information and evidence to the Engineer for design change review and acceptance. All safeguards and method statements for controlling installation / construction hazards shall be in place before the installation / construction of the relevant part of works is allowed to commence. The close-out of operational hazards shall be done in a timely manner. O&M safeguards which are incorporated into the O&M manual shall be put in force prior to Trial Running.

8.4.27.7 Operational hazards shall only be closed when the agreed safeguards and cross-references to back up relevant evidence such as design submissions, calculations, inspection records, testing and commissioning results, as-built drawings etc. are provided for review to the satisfaction of the Engineer.

8.4.28 Deterministic Safety Assessment

8.4.28.1 The Contractor shall perform a Deterministic Safety Assessment (DSA) to demonstrate that relevant safety requirements have been conformed to and safety principles applied in the Works. It forms the main qualitative, non- numerical, assessment of the safety of the Works supplied in this Contract.

8.4.28.2 Purpose

1) To assess the design in respect of the application of, and compliance / non-compliance with the current codes and standards; and

2) To identify and assess any design safety principles associated with each aspect of the design, and confirm compliance / non- compliance with these principles.

8.4.28.3 Procedure

1) The DSA forms the main qualitative, non-numerical, assessment of design safety. The Contractor shall use the DSA to evaluate conformance of their design with current accepted practices.

2) The DSA shall review the design against applicability and relevance with respect to the:

   i) Contract requirements;

   ii) Codes, regulations and standards; and

   iii) Design safety principles

3) In the event that the DSA has identified any Contractor' submissions or designs which do not fulfil the system safety requirements such as accepted codes, standards and regulations, the Contractor shall justify themselves by way of operational hazard review / quantitative risk assessment.

4) The relevance and applicability of the design safety principles specified shall be checked and confirmed against normal, degraded and emergency operations of the

system.

5) The results of the DSA shall be documented using the template provided by the Contractor. The Contractor shall submit a copy thereof in Microsoft Excel to the Engineer for Review and given notice of no objection prior to completion of the design and construction.

6) The results of the DSA are used to demonstrate compliance with the accepted codes, regulations and standards, and design safety principles for safe operations of the system under normal and degraded operations and credible emergency situations.

7) The Contractor shall provide cross-reference numbers to back up documentary evidence e.g. design submissions, drawings, calculations, etc. to prove compliance with all safety requirements stated therein. In case of non- compliance, full justification by way of operational hazard review / Quantitative Risk Assessment (QRA) shall be provided to the Engineer for review and given notice of no objection.

8.4.29 RAM Demonstration

8.4.29.1 RAM Demonstration Plan

1) The Contractor shall submit a RAM Demonstration Plan at least 90 Days before the commencement of the DNP for Review and given notice of no objection by the Engineer. The RAM Demonstration Plan shall include: -

i) organization, responsibility and key personnel of the system assurance demonstration;

ii) Approach, including test methods, failure assessment, reliability calculation, etc., to demonstrate achievement of RAM target and;

iii) a programme summarizing the key activities.

The demonstration of compliance with the RAM targets shall be achieved within the DNP.

2) The RAM Demonstration Plan shall describe the Data Reporting Analysis and Corrective Action System (DRACAS) and the procedures for collection, analysis, correction and documentation of data. DRACAS shall be used to ensure all incidents are accurately and consistently categorized as to cause, significance, frequency and chargeability. The DRACAS shall log data on integrated tests and trials, failures, performance and maintenance from the start of integrated testing up to and including the DNP.

3) DRACAS shall be managed through "ComplyPro" during project implementation and to be managed through CMMS by O&M Concessionaire and also the Contractor.

8.4.29.2 RAM Demonstration Report

1) The Contractor shall submit a RAM Demonstration Report within 1 Month before expiry of DNP. Interim results, which include DRACAS records, RAM performance statistics and comparison of the RAM targets, shall be submitted to the Engineer monthly during the DNP. The report shall provide evidence that the respective RAM targets have been achieved and shall include any supporting information and calculations. The RAM performance presented in the RAM Demonstration Report and monthly interim results shall be calculated by taking the average of RAM performance for the period starting from the date of the train taking over certificate or a date to be agreed with the Engineer, to the Month during which the RAM Demonstration Report or the interim results are prepared.

2) The Contractor shall describe the details of each failure case in the RAM

Demonstration Report and interim reports. The details of each failure case shall include time, date, duration of train service disruption, response time, recovery time, cause of incident, symptom, alarm, and remedial action taken etc.

8.4.29.3 Failure to Achieve RAM Targets

1) Should any RAM targets cannot be achieved, The Contractor shall, subject to the Engineer's Review and given notice of no objection, take whatever prompt and effective action deemed necessary to meet the requirements.

2) In the event that any RAM target is not achieved at the end of the DNP of the Work, the demonstration of the achievement of the targets shall be extended at least 1 Month and repeated at monthly intervals based upon the performance of the Works over the past 12-Month period, until the requirement is achieve.

8.5 Reliability, Availability, Maintainability and Safety Targets

8.5.1 Overall System

8.5.1.1 The overall system shall be developed in order to protect people and environment against the risks induced by the Malolos Clark Railway Project (MCRP) and the North South Railway Project-South Line (NSRP-S) system, and to protect this system against its environment.

8.5.2 Most of identified hazards have been granted to systems composing the Malolos Clark Railway Project (MCRP) and the North South Railway Project-South Line (NSRP-S) overall system. However, the electric hazards and fire hazards shall be treated at overall system level: -

8.5.3 Top Safety targets

The global Risk Criteria under normal and/or degraded mode operations shall be as specified in the following Table:

Classification on Individual	**Individual Risk Design Safety Value (probability of death per year)**	
	Limit of Tolerability (LOT)	Limit of Acceptability (LOA)
Passenger	10E-6	10E-8
Public	10E-6	10E-8
Employee	2x10E-5	10E-7

Global Risk Criteria

8.5.3.1 The top safety targets for the Works shall be equivalent to or better than these values.

8.5.3.2 At subsystem level, any wrong side failure of key safety critical subsystems must be shown to be better than 10^{-9} per hour and the specific safety targets that are identified for each subsystem in the following sections shall be achieved.

8.5.3.3 Where equipment is installed to provide safety critical function for multiple location the wrong side failure of equipment must be shown to be better than 10^{-10} per hour.

8.6 Electrical hazards

8.6.1 Electrical hazard is not only linked to the power supply subsystem. Electrical risk must be treated with a System level point of view, in order to protect people against electrocution, and to mitigate the consequences of stray currents and electrical disturbances due to:

1) Malolos Clark Railway Project (MCRP) and the North South Railway Project-South Line (NSRP-S) transportation system on its environment (EMC),

2) Environment on the Malolos Clark Railway Project (MCRP) and the North South Railway Project-South Line (NSRP-S) transportation system (EMC),

8.6.2 These following concept design documents will address these topics:

1) Preliminary Earthing, Bonding, Lightning protection and Stray currents report [CD E&B]

2) Preliminary EMI / EMC (Electromagnetic Interference / Electromagnetic Compatibility) plan [CD EMI/EMC]

8.6.3 As a minimum, the following standard shall be applied within the development of the Malolos Clark Railway Project (MCRP) and the North South Railway Project-South Line (NSRP-S) Transportation System:

1) EN 50121,

2) EN 50122-1,

3) EN 50122-2.

8.7 Fire safety requirement

8.7.1 As for the electrical risk, fire safety of the system shall be treated with a system level point a view.

8.8 Rolling Stock

8.8.1 The following Safety Functional Requirements have been identified. Safety Integrity Levels have been allocated to them regarding the gravity of consequences of hazards they are covering.

8.8.2 This is only a guideline; the Contractor will remain responsible for performing extensive safety analysis and allocate Safety Integrity Level for any safety critical or safety related function.

8.8.3 In addition, the Limited Express Train shall comply with the requirement of the EN 45545 or equivalent standard regarding Fire Safety requirement.

Safety Functional Requirements	Safety Integrity Level (SIL) associated with
In case of loss of train integrity, emergency braking shall be triggered on each car of the consist.	4 (Safety critical)
In case of emergency braking, the braking performance shall be guaranteed.	4 (safety critical)
Any failure in the braking system shall not lead to a total loss of braking	4 (safety critical)
Parking brake on each car	3 (safety critical)
Unwanted opening of door shall trigger emergency braking	4 (safety critical)
Movement of train with open door shall be prevented	4 (safety critical)
Kinetic energy of doors shall be limited	3 (safety critical)
Obstacle shall be detected on door closure	3 (safety critical)

Manual opening of at least three quarters of the doors and the platform screen doors in each passenger car shall be possible when the train is immobilized.	4 (safety critical)
50% of air conditioning power shall be guaranteed	2 (safety related)

SIL associated with Rolling Stock safety functional requirements

8.8.4 Safety Integrity Level Analysis

8.8.4.1 The Contractor shall be responsible for performing extensive safety analyses and allocate SIL levels for any safety critical or safety related functions in the Contract in accordance with the EN50126 and demonstrate the achievement of the SIL requirement specified in this Appendices of the for review and given notice of no objection by the Engineer.

8.8.4.2 A Safety Integrity Level Analysis shall be carried out for all safety related system software. The Contractor shall allocate a Safety Integrity Level for each safety related system software.

8.8.4.3 In determining Safety Integrity Level, all causes of failures (including random hardware failures, systematic failures and software errors) which lead to an unsafe state should be included.

8.8.4.4 The Safety Integrity Levels defined in IEC 61508 shall be used.

8.8.4.5 The software design and development process shall comply with the relevant requirements stipulated in EN50128 and EN50129

8.8.4.6 The Contractor shall demonstrate in the safety analysis that the SIL of software system shall be able to reduce the risk ALARP. The SIL requirement for software shall apply to all applicable system, sub-systems and its interfaces delivering the identified safety functions.

8.8.4.7 The assessment methodology shall be submitted for approval by ISA before commencement of the work and for the PDP's review and acceptance.

8.8.4.8 The Safety Integrity Level Analysis Report is part of the Safety Analysis Report.

8.8.4.9 The Contractor shall submit SIL certification for ISA approval and Engineer's review.

8.9 Operation and Maintenance

8.9.1 Safe procedures shall be written in order to ensure:

1) A safe utilization of the line for every passenger (in station and trains),
2) Safe working conditions for operator and maintenance staff within the Main line and the Depot area.

8.9.2 These rules and procedures shall be consistent with mitigation requirements from the risks analyses.

8.10 Reliability, Availability, Maintainability Targets

8.10.1 The Contractor shall demonstrate that they are able to meet the RAM targets given herein or elsewhere for a service life as defined herein or elsewhere, or the Contractor may opt to carry out a target apportionment analysis to work out their own targets and submit a target apportionment report thereafter for review and given notice of no objection by the Engineer. Nonetheless, the Contractor shall lay down their intention in his SAP in the first place for review and acceptance by the Contractor.

8.10.2 The term "failure" shall apply to any event which gives rise to a partial or complete shutdown of the unit or system thereof rendering such a unit or system unable to perform its intended function (including hardware and software) or causes nuisance tripping, either in the form of shutdown or impaired performance which is not in accordance with the performance criteria, but shall exclude those incidents due to loss of external input (e.g. loss of external power supply) or failures due to external influences like flooding, incorrect operations and vandalism.

8.10.3 Fleet Defects (Pattern Failures) are failures caused by design defects and are not caused by failure mechanisms such as component wear out. All Fleet Defects (Pattern Failures) shall be counted as failures for the demonstration of the reliability, availability and maintainability requirements during the DNP. Subject to the Engineer's review and Employer acceptance, they may be excluded from the demonstration when the failure mechanism, which is associated with a design defect, is identified and corrective action is satisfactorily retrofitted within a reasonable timeframe in the DNP.

8.10.4 Any defects which effect on safety critical system shall be defined as Fleet Defects. Any defects which affect more than ten (10) percentage of the train fleet on non-safety critical system shall be defined as fleet defects and as per ERT clause 22.7.4.

8.10.5 The Contractor shall rectify such fleet defects, shall include but not limited to the following, in relation to all Limited Express Train: -

1) Fleet wide replacement of all the parts/components
2) Redesign of the concern system
3) Recommission of the concern system

8.10.6 The Mean Time Between Failures (MTBF) is the predicted elapsed time between failures of a system / a piece of equipment during operations. The MTBF shall be calculated as an arithmetic mean time between failures of a system / a piece of equipment. All failures shall be countable. The Contractor shall establish their MTBFs, for their systems / equipment of which failures may necessary a maintenance operation.

8.10.7 The Mean Time To Repair (MTTR) is the mean active repair time required, on arrival of the maintenance team, to locate and isolate the fault, make repairs, and perform a functional checkout to verify that the equipment has restored to its intended operational status. The MTTR is the total active corrective maintenance repair time expended on the article during a specific period of time divided by the total number of failures requiring corrective maintenance during that same time period. MTTR, measuring System Maintainability, shall be established for systems of which failures may impact the operations of the systems concerned.

8.10.8 'Availability' is the ability of an item to perform its required function at a stated instant of time or over a stated period of time. It is influenced by the combined factors of reliability, maintainability and maintenance support. A system is defined as 'available' when it is operational, with all components fully serviceable to their designed specification.

8.10.9 Mean Down Time (MDT) represents the average elapsed time between losing Mission Capable status and restoring the system to at least partially mission capable status. Calculated as the ratio of total downtime over the number of downing events–most often, the total maintenance time over the number of maintenance events. It is used as a substitute as appropriate MTTR.

8.10.10 Overall System

8.10.10.1 Failures of equipment may lead to more or less important disturbance on line operations and trains running. In order to provide assurance that the final operating systems shall comply with the high reliability standard to support service quality, Reliability indicators of each system works and their components shall be provided.

Specific reliability indicators

1) Service Availability and Reliability

For essential system works not limited to signalling, Rolling Stock, telecommunications and power supply system, sufficient system redundancy shall be provided to ensure no single failure shall result in severe service disruption. Apart from the redundancy architecture, periodic self-diagnostic functions should proactively detect problems within the system and send alarms to the operator in the OCC before more serious failure actual occurs. During DNP, the Train Service Availability performance of 100%

KPI	Calculation Formula	Value	Review Period
Train Service Availability	[(Actual Train Trips per Day)/ (Schedule Train Trips per Day)] x 100%	100%	Monthly
Service Reliability	Total operating hours less total system-related delays over total operating hours	99.90%	Monthly

The calculation of the service reliability does not include the failures that are not directly caused by technical failure (as vandalism, suicide, strike…). Moreover, it is also generally accepted to not take into account the failures that lead to an operational unavailability lower than 5 minutes. The Service Reliability shall be at least 99.90%.

2) Reliability

i) The Malolos Clark Railway Project (MCRP) and the North South Railway Project-South Line (NSRP-S) system shall be designed and constructed in such a way so as to guarantee a high degree of reliability in order to provide proper operating service.

ii) For essential system works not limited to signalling, rolling stock, telecommunications and power supply system, sufficient system redundancy shall be provided to ensure no single failure shall result in severe service disruption.

iii) Apart from the redundancy architecture, periodic self-diagnostic functions should proactively detect problems within the system and send alarms to the operator in the OCC before more serious failure actual occurs.

3) Maintainability

i) The maintainability of the train reflects its ability to be restored to its operation specification level within a stated period and under specific maintenance conditions. The aim is to reduce the costs and delays and to improve the availability of the Malolos Clark Railway Project (MCRP) and the North South Railway Project-South Line (NSRP-S) system. The Contractor shall submit the maintainability targets with benchmark other current operation railways for review and acceptance by the Engineer and with compliance to Clause 8.10.11(IV) .

8.10.11 Rolling Stock

8.10.11.1 Each consist shall be designed for a service life of 30 years. Each consist shall be able to operate for 19 hours a day, 7 days a week, with engineering downtime of 5 hours a day.

8.10.11.2 The availability target of one train shall be 99.99%. (but need to be reassessed in case of fleet sizing modification). It shall be calculated using the following formula:

$$\frac{MTBSAF}{MTBSAF + MDT}$$

Where

- MTBSAF is the Mean Time Between Service Affecting Failure, which cause service delay of, or over 5 minutes.
- MDT shall be understood as the time required to restore normal operation (withdraw the disabled train and insertion of a stand-by train).

8.10.11.3 The Limited Express train shall achieve 10,000 km or 2 months of FFR during the DNP period and;

8.10.11.4 Reliability targets for the Limited Express Train are set in term of Mean Distance Between Service Affecting Failures (MDBSAF):

Delay	Crossed distance
0 to 5 min delay	50,000 km
5 to 30 min delay	100,000 km
More than 30 min delay	500,000 km
Train rescue	3,000,000 km

Reliability targets for Limited Express Train

Where the MDBSAF shall be calculated using the following formula:

$$\frac{Total\ Accumulative\ distance\ in\ kilometres\ in\ a\ period}{Total\ No.\ of\ service\ Affecting\ Failures\ in\ that\ period}$$

8.10.11.5 Maintainability targets for the Limited Express Train shall be:

1) **OMTTR** – Operational Mean Time To Restore (OMTTR) capital components; the trainsets shall be restored to operational order in an OMTTR of 15 minutes.
2) **CMTTR** – Corrective Mean Time To Repair (CMTTR) capital components shall not be greater than 4 hours.

8.11 Independent Assessment

8.11.1 The Employer may appoint independent engineers and/or Independent Safety Assessors (ISAs) to assess on compliance with contract requirements on System Assurance. The Contractor, subcontractors and suppliers shall provide assistance to the appointed engineers and assessors, as required.

8.11.2 The independent assessor may undertake the following:

1) Assess on compliance with contract requirements on System Assurance;
2) Safety audits;

Appendix C - Sample hazard log template

Hazard ID	System / Activity Category	Subsystem / Specific Activity	Hazard Description	Location	Potential Cause	Affects						Effects/ Consequence	Original Risk			Hazard Controller (Operations)	Hazard Controller (Projects)	Proposed Safeguards	Residual Risk			Remarks	Target Completion Date	Status Update			Closed	Rev.
						Public	Passenger	Staff	Contractor	Environment	Service Disruption		Frequency	Severity	Risk Index				Frequency	Severity	Risk Index			Evidence of hazard close-out (e.g.) Design Submission Test Report O&M Procedure Training etc	Individual O - Outstanding P - Partially C - Completed	Overall O - Outstanding P - Partially Completed C - All Completed		

Sample Risk Matrix

This matrix presents shows an example of risk evaluation and risk reduction/controls for risk acceptance.

		Hazard Severity Level			
		Insignificant	Marginal	Critical	Catastrophic
		4	3	2	1
Frequency of occurrence of a hazard	Frequent	R3	R4	R4	R4
	Probable	R2	R3	R4	R4
	Occasional	R2	R3	R3	R4
	Remote	R1	R2	R3	R3
	Improbable	R1	R1	R2	R2
	Incredible	R1	R1	R1	R1

Table A-4 Risk Matrix

Scaling for the frequency of occurrence of hazardous events will depend on the application under consideration where:

Risk	Risk evaluation	Definition
R1	Negligible	Acceptable without any agreement.
R2	Tolerable	Acceptable with adequate control and the agreement of the PDP/Railway Authority.
R3	Undesirable	Shall only be accepted when risk reduction is impracticable and with the agreement of the PDP/Railway Authority.
R4	Intolerable	Shall be eliminated.

As shown in the matrix below, **frequency of occurrence** and **severity of the consequences** are combined together in order to further process the risks:

Frequency of occurrence of hazards

The following categories shall be used to classify the frequency of occurrence of hazards:

Category	Frequency (per year)	Description
Frequent	F > 10	Likely to occur frequently. The hazard will be continually experienced.
Probable	1 < F < 10	Will occur several times. The hazard can be expected to occur often.
Occasional	0.1 < F < 1	Likely to occur several times during the system lifetime.
Remote	0.01 < F < 0.1	Could occur sometimes during the system lifetime. But the probability to happen during the lifetime of the system is very low.
Improbable	0.0001 < F < 0.01	Unlikely to occur but possible. It can be assumed that the hazard may exceptionally occur during the system lifetime.
Incredible	F < 0.0001	Extremely unlikely to occur. It can be assumed that the hazard may not occur.

Sample Classes of frequency of occurrence of hazards

Severity of hazards

The following levels shall be used to classify the severity of the consequences of the hazards. Consequences taken into account are consequences for people, system and environment.

Class	Severity level	Consequences for people or environment	Consequences for system
1	Catastrophic	Fatalities and / or multiple severe injuries and/or major damage to the environment.	
2	Critical	Single fatality and / or severe injury and / or significant damage to environment.	Loss of train or of a major system.
3	Marginal	Minor injury and / or significant threat to the environment.	Severe system(s) damage.
4	Insignificant	Possible minor injury.	Minor system damage.

Sample Classes of hazard severity

Sample DSA Template

Item No.	Sub-system /Equipment	Reference clauses of codes of practices / legislation / specification requirements	Relevant design / operations safety requirements and principles	Design		Construction		Relevant Operational Hazard ID (if any)	Remark
				Close-out Evidence (Document/ Drawing)	Compliance Status*	Close-out Evidence (Document / Drawing)	Compliance Status*		

* Key for Compliance Status Categories:

C Full compliant – no further action or monitoring required N/C Non-compliant – subject to rework, re-test etc.
I/C Inconclusive – review incomplete, awaiting testing, procedures under review or preparation

The date to which the safety requirements and principles are expected to close satisfactorily (i.e. from N/C or I/C to C), shall be provided for N/C and I/C item