

Technical Specification No. M- 04-215

For

Ballast Bogie Hopper Wagon
(90 ton Gross)

Approved by ISR professional committee date: _ _

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1. General

- 1.1. This technical specification establishes the criteria for hopper wagons type FACCS to be operated by Israel Railways Ltd. (ISR). The intended use of the bogie hopper wagons is to transport ballast and other materials of gravel character. The wagons shall be loaded with ballast in one of two ways – gravel silo continually or separately; by excavator from ground near the rail. Unloading of the wagon will be done from a moving train or stationary through manual operated discharge doors.
- 1.2. The wagon shall be of a proven design with ample field experience. Test data of the prototype wagon shall be provided with the proposal.
- 1.3. The hopper wagons shall be equipped with two bogies type Y25Lsd or similar for an axle load of 22.5 tons.
- 1.4. The hopper shall be open top type with a total capacity of at least 35 m³ fitted with 8 discharge tilting doors to enable quick unloading of the ballast material by gravity and self-cleaning.
- 1.5. The hopper wagons top shall be fitted for loading the ballast with excavator in order not to damage the upper body.
- 1.6. The wagons shall be fitted with compressed air brake, parking handbrake and with an empty/loaded changeover valve which shall be activated automatically.
- 1.7. During the evaluation of the proposal extra points will be granted to those Bidders who achieve the best pay load/tare ratio getting the minimum possible tare and the maximum possible pay load with minimum height of center of gravity when loaded and empty. Hopper geometry and design will enable the efficient loading of the wagon to its maximum capacity.
- 1.8. The wagons shall be designed and manufactured incorporating the standard of ISO 9001/9002 or an equivalent quality system. The Bidder shall submit with the proposal a detailed description of his internal QC (Quality Control) and QA (Quality Assurance) systems.
- 1.9. The Bidder shall clearly demonstrate in his offer, how he intends to fulfill the requirements of ISR. The Bidder shall submit as part of its proposal a full compliance list following the paragraphs of this specification. In case certain

proposed item or feature deviates from the specified requirement the fact must be clearly indicated, described and justified.

1.10. In this specification items marked with "*" are mandatory. Non-compliance of such items may totally disqualify the proposal.

2. Standards

The wagons shall be designed, manufactured and tested according to Technical Specification for Interoperability relating to the subsystem 'Rolling Stock - Freight Wagons' and to the most recent editions EN and UIC prevailing standards. The wagons shall be compatible according AVV and GCU - General Contract of Use for wagons.

See Annex H – non exhaustive list of applicable standards and regulations.

3. Prevailing climate conditions

- Temperature range – minus 5°C till + 47°C.
- 90% humidity.
- Dusty conditions.
- For more details see attached Annex E.

4. Track data

- Track gauge – 1435 mm
- Minimum curve radius (on main lines) - 141 meters
- Minimum curve radius (on secondary lines) - 120 meters
- Minimum curve radius (service branches) - 80 meters
- Maximum gradient – 3.5%
- Minimum vertical radius - 500 meters
- For more details – see attached Annex F
- Loading gauge - according to GC EN15273 see attached Annex G.

The wagon shall be able to negotiate curves with 90 m radius without interfering with the loading gauge.

5. Operational requirements

5.1. General

5.1.1. The design of the wagons shall be for an unrestricted circulation on the ISR network:

- S-shaped curves having a radius of 150 m to 150 m without straight in between (loaded).
- Curves with radius of up to 80 m (empty); with the screw coupling being completely undone.
- Vertical curves with radius of 500 m (empty and loaded).
- The wagon could be arranged into any consist of ISR wagons.

5.1.2. The design shall permit the wagon to operate on humps in gravity yards:

- The impact speed of the wagon: maximum 15 km/h for empty wagon; maximum 7 km/h for loaded wagon.
- The underframe and the connection of the bogies to the wagon should be designed to withstand the impact stresses when buffer forces are raised up to 3000 KN during dynamic tests.

5.2. Operating speed

The wagons shall be able to run unrestricted in "S" traffic (100 km/h operating speed) according to UIC 432, fully loaded up to 90 ton gross, or where the axle load of the most heavily loaded bogie does not exceed 22.5 ton, and in "SS" traffic (120 km/h operating speed) in empty condition.

5.3. Main characteristics

- Total length of wagon over buffers should be up to 16 m.
- Wagon capacity - as much as possible but not less than 35 m³. *
- Maximum height of wagon above rail - 3600 mm*
- Nominal height level of draw-gear above rail – 1040 ±5 mm
- Height of buffers above rail – 1060 ±5 mm (empty wagon, new condition of wheels)
- Maximum width of the body not to exceed - 3.200 mm *
- Number of discharge doors – 8
- Top opening – full opening lengthwise and widthwise
- Tare of wagon not more than - 25 ton *
- Maximum axle load - 22.5 ton *
- Wheel diameter (new) - 920 mm

The Bidder shall provide the values of the above dimensions for the proposed wagon.

5.4. Loading characteristics

5.4.1. The hopper wagon shall be designed to carry Gravel (Ballast) characteristics:

- a. Type of stone - dolomite
- b. Bulk density - 1,4 ÷ 1,6 Ton/M³
- c. Graduation – less than
 - 63 mm - 100%
 - " " 50 mm - 70-199%
 - " " 40 mm - 30-65%
 - " " 31.5 mm - 1-25%
 - " " 22.4 mm – 0-3%
 - " " 31.5-50 mm – ≥50%
- d. Abrasivity - extremely
- e. Corrosivity - none
- f. Cohesion - none

5.4.2. Loading/Unloading

5.4.3. Loading of the ballast into the hopper wagon shall be done from the top. The bidder shall consider the erection of partition walls inside the hopper.

5.4.4. The unloading of the ballast shall be done from 4 to 8 discharge doors, with option to discharge only one side. The design of the hopper must ensure complete discharge.

5.4.5. The wagon shall be designed to be operated with the same efficiency under an active high voltage electrical line, Overhead Contact System (OCS) with 25K V AC and on non-electrified track with Continuous Welded Rail (CWR) and jointed track.
An approving statement shall be submitted.

6. Structure

6.1. Running Safety

Constructional characteristics of the wagon shall be in accordance with the conditions laid out in UIC 530-2. The structural design and assessment of the wagon body shall comply with EN 12663-2 as well as with UIC loading requirements and regulations for hopper wagons.

6.2. Under-frame

6.2.1. The under-frame shall be built of hot rolled and bent profiles and steel sheets joined by welding as required by the UIC guidelines reserving the place stated in Annex 4 of the UIC leaflet 530-1 for future mounting of automatic couplers.

6.2.2. The supports between wear-plates of the wagon body and bogie shall be elastic. The wear-plates of the wagon body should be of sufficient size to ensure a complete support over all the surface of the wear-plates of the bogie under any condition of running.

6.3. Body structure

6.3.1. The container of the wagon shall be steel and consist of a rigid framework made from rolled and bent profiles to which the steel sheets of sides and end walls shall be welded.

6.3.2. The inclined parts of the end walls and the side walls shall be with an angle in order to prevent accumulation of ballast material. Determination of the exact angle must ensure effective and complete discharge.

6.3.3. The steel sheets in contact with the gravel shall be made of COR-TEN or equivalent.

6.3.4. Access to the platform shall be by stairs or ladder, equipped by handrails, from a platform located at one of the headstocks. The construction and positioning of the walkway, ladder and handrails shall be in accordance with ERA/TD/2012-04/INT and EN 16116-2.

- 6.3.5. The proposed hopper will be of a proven design with ample field experience showing excellent flow characteristics of the gravel during unloading operations.
- 6.3.6. The body will be provided with four discharge chutes, two on each side, which will enable discharging of ballast between and outside rails in different positions as shown in Annex C.

6.4. Discharge doors

- 6.4.1. Four discharge doors shall be of curved shapes to be held in closed position by the static pressure of the material conveyed and manual locking of the operating mechanism.
- 6.4.2. Opening of each door will be done manually by a mechanical mechanism activated by lever located on the wagon platform.
- 6.4.3. On this platform will be located all operator levers.
- 6.4.4. The operating mechanism must be able to stop the discharging of ballast at any time. Forces required to operate the lever, taking into consideration wear, tear and corrosion shall not exceed 15 kg.
- 6.4.5. All parts, especially those which may be in physical contact with the transported gravel shall be smooth and manufactured from corrosion resistant materials.
- 6.4.6. Casual opening of the discharge doors must be avoided. In closed and locked position, the doors shall positively prevent any possibility of release or spillage of ballast. Use of a double labyrinth should be considered. Proper protection of the opening/closing system against the infiltration of dust into the system must be ensured. Any accumulation of the materials on the discharge doors shall be avoided. All bearings shall be maintenance free.
- 6.4.7. As a separately priced option the Bidder can offer, in addition to the mechanical system, an alternative opening/closing system for operation of each of the discharge doors separately.
The control unit shall be located on the wagon.

7. Running gear

The running gear shall consist of two bogies Y25 Lsd or similar and adhere to the requirements of EN 15827. A separate Technical Specification for the bogies is attached in Annex B.

8. Braking system

8.1. General

The brake system of the wagon shall follow requirements of EN 14198.

8.2. Brake equipment

8.2.1. The wagon shall be equipped with compressed air brake KNORR KE-GP-A(K) *. Brake equipment shall be according to UIC 543.

8.2.2. The following brake equipment shall be made and supplied by KNORR:

- Distributor KE-2d SL- ALB
- Brake cylinder 16"-BG-16.
- Load brake valve, type RLV-11
- Two headstock cocks, type LH3 1¼"
- Weighing valve type WM10
- On-off device (Hebrew name plates-Knorr)

8.2.3. The slack adjuster in accordance with EN 16241 shall be SAB - WABCO type DRV-2A -600 -H2 or similar.

8.2.4. The main reservoir shall be of 125 liters.

8.2.5. Brake system equipment and all components shall be well protected from material spill and accumulation. Suitable protection covers shall be installed where necessary.

8.2.6. The brake shoes shall be of phosphorous cast iron P-14, in accordance with EN 16452 and UIC 832 specifically to Appendix C of the UIC standard (cognizant that this is in contrary to requirements of TSI regarding the brake block material).

8.2.7. The brake performance shall be in accordance with UIC 544-1.

- 8.2.8. The brake system distribution piping shall be of the heavy type steel tubes according to DIN 2441, 1¼" and ½". The fittings shall be of VEBO type.
- 8.2.9. The coupling hoses and headstocks, as well as their location shall be in accordance with UIC 541-1, with simple headstock installation. Hangers for the hoses when they are not in use shall be installed.
- 8.2.10. The brake rigging shall be central type located and designed to withstand the stresses for a brake regime S and according to UIC 542 Appendix E.
- 8.2.11. An automatic empty-loaded change-over device shall be provided. The device shall be supplied by Knorr. It shall be pneumatically operated by means of variation in the pressure in the brake cylinder through a KE - 2d SL type brake distributor and weighing valve, located on one of the bogies, proportionally to the load.

8.3. **Parking hand brake**

- 8.3.1. The wagon shall be according to EN 14531-6 and fitted with a hand brake which will enable safe parking on a slope of up to 35%. Operation shall be by means of hand-wheels located at end platform. Tightening of the brake shall be activated by rotating the hand-wheel clockwise and loosening by rotating it anti-clockwise.
- 8.3.2. The multiplication ratio of the hand brake gear box shall obtain the required brake effort percentage.
- 8.3.3. An indicator showing the state of the parking brake shall be provided on both sides on the outside of the vehicle.

9. **Buffers and draw-gear**

- 9.1. Buffers shall be in accordance with EN 15551 with a stroke of 105 mm. The dynamic energy absorption capacity of the buffer shall be at least 30 KJ (category "A").
- 9.2. Draw-hooks and screw couplings shall be in accordance with EN 15566 with breaking strength of 1350 KN for the screw coupling and 1500 KN for the draw-hook.

9.3. The draw-gear to be provided on the wagon shall be accordance with EN 15566.

10. Accessories

10.1. The wagon shall be earthed in accordance with UIC 533.

10.2. Four under-guard handles shall be fitted under the buffers.

10.3. The vehicle extremities shall bear clearances according to leaflet UIC 521.

10.4. The wagon shall be equipped with climbing steps and a platform with handrails in accordance with ERA/TD/2012-04/INT and EN16116.

The footsteps and platform shall be of grated steel, in order to prevent accumulation of gravel, and shall have raised edges to prevent skidding.

10.5. The wagon shall be equipped on each longitudinal side with one mail support in accordance with UIC 575.

10.6. Four signal brackets shall be placed on the both ends of wagon in accordance with UIC 532.

10.7. If necessary, spark-arresting shall be mounted on the under-frame in the wheelset area in accordance with UIC 543.

10.8. Four tow hooks shall be fitted per wagon in compliance with UIC 535-2.

10.9. The wagon shall be fitted with lifting points and re-railing support points in compliance with UIC 581.

11. Materials

All materials used in the production of the wagons shall meet the requirements of relevant standards and norms with the approved production drawings in terms of their composition, quality, processing and technical delivery conditions. Quality assurance certificates should be enclosed to each material delivery.

12. Welding

Welding shall be carried out in accordance with EN 15085-1-5 series standards.

13. Corrosion protection and finishing

- 13.1. All suitable materials shall be blasted according to ISO 8501, SIS 055900, SA 2 1/2.
- 13.2. All surfaces of all blasted materials shall receive a coat of weld able primer, at nominal dry film thickness of 25 micron.
- 13.3. All other materials shall be cleaned free of loose mill scale, loose foreign matters and grease using hand or power steel brushes and solvent.
- 13.4. After fabrication, damaged areas and welds on surface to be painted shall be cleaned with hand or power steel brushes. Oil or grease left by machining operations shall be cleaned off with suitable solvents or other means.
- 13.5. After fabrication, all surfaces shall be cleaned and receive a primer coating. Spray rates and coverage shall be regulated to a 60 - 70-micron dry film thickness.
- 13.6. The second layer shall be a full coat of protective paint which shall be applied to a thickness of 35-45 micron.
- 13.7. The final coat of paint at nominal thickness of 30-35-micron dry film shall be applied. Color of the final external coat shall be Ral 1018. The logo of ISR and the registration number shall be clearly displayed on both sides of the wagon.
- 13.8. Paint products shall be supplied in accordance with UIC 842-1. The paint products shall be tested in accordance with UIC 842-2. The painting system shall be inspected in accordance with UIC 842-6.
- 13.9. Anti-corrosion protective strip shall be provided where necessary in accordance with UIC 842-4 par. 4.
- 13.10. The covering of the steps, gangways etc. shall ensure prevention of slipping.

13.11. All signs, markings and labels on the wagon shall follow the requirements of EN 15877-1 and shall be written in both English and Hebrew.

13.12. All paint material shall be based on water and environmental proven.

13.13. As part of the detailed design the Bidder shall submit a detailed painting plan, including preparation and painting procedures, paint types and paint suppliers, to be approved in advance by ISR.

14. Testing

14.1. General

The Bidder shall detail in its proposal the tests to be carried out prior to delivery and shall provide an inspection and test plan (ITP) upon signing the Agreement. The ITP shall be approved by ISR. The plan shall include a sufficiently detailed manufacturing schedule with all expected dates of inspections and tests, a description of each inspection or test (including the test method) to be performed and the applicable standards. Where Bidder's acceptance standards are proposed, copies shall be provided for ISR's approval.

The ITP shall include the proposal of the Bidder regarding the participation of ISR or ISR's representative:

| Class of test | Representation |
|---------------|--|
| I | The must be present |
| II | ISR shall be invited; the Bidder however is entitled to perform the test as scheduled when ISR or his representative is not present |
| III | Routine test according the ITP; no invitation to ISR is necessary; Test Certificates shall be ready for inspection after test if required by ISR |

The inspection and test plan and the related schedule shall be updated by the Bidder at two-month intervals with clear indication of revised inspection and test dates.

Written notice of the exact date, time and place of inspections and tests as well as all other necessary information shall be sent to ISR in writing not later than thirty (30) days prior to the date of any such inspections and tests.

- 14.2. All materials and components shall be provided with test certificates which shall be presented before installation and shall be attached to the wagons test book.
- 14.3. All weld and paint work shall be tested as specified in the relevant section.
- 14.4. The prototype wagon shall be tested (or shall have been tested) in accordance with ORE B12/RP17 document.
- 14.5. Every frame shall meet the dimensions stated in the dimensional drawing. A dimensions sheet shall be filled out for every frame.
- 14.6. Every completed wagon shall meet the dimensions stated in the dimensional drawing. A dimensions sheet shall be filled out for every complete wagon.
- 14.7. Every wagon shall be inspected during construction and final certificate shall be issued after performance of the empty and loaded running test. Length of running test shall be at least:
 - Empty - 100 km
 - Loaded - 200 km
- 14.8. For the running test, 10 or more cars shall be connected. The running test shall be planned and performed in accordance with UIC 544-1 part 2.2 and in accordance with the requirements of EN 14363.
- 14.9. ISR will proceed to inspect the wagons and the production process, independently of the producer, through the **Inspection Body** .
The accredited Inspection Body undertakes construction inspections and vehicle acceptance according to requirements and quality standards of this Tech Spec .
- 14.10. Additional to the NoBo , ISA and Inspection Body statements , in order to apply for Serial Permit it is required :
 - a. The supplier's declaration of conformity: The supplier will declare the entire wagon series met all the requirements of the production planning and the acceptance tests of the prototype.
 - b. Confirmation by Inspection Body that the wagon series met all the production planning requirements and the acceptance tests in the same way as the prototype.
 - c. Confirmation of the ISR project manager on behalf that the wagon series met all the requirements and can travel and operate in commercial operation on the line.

15. RAMS (Reliability, Availability, Maintainability, Safety)

15.1. General

15.1.1. The Bidder shall perform the RAMS process according to EN 50126. The RAMS process includes both the definition of the requirements and the demonstration of compliance (see Annex D).

15.1.2. The detailed RAMS requirements shall be jointly defined between Israel Railways and the Bidder at the beginning of the project. The Bidder shall prepare a safety program plan to be submitted no later than 2 months after the Commencement Date.

15.2. Reliability

15.2.1. The reliability of the wagon shall be (under the condition, that the maintenance is performed in accordance with the maintenance manual) as an average over the fleet per 1'000'000 km:

- 1 complete failure of a wagon (unit must be towed to the workshop)
- 5 failures of part of the wagon systems, wagon can finish the duty cycle.

15.2.2. The Bidder shall fulfil the MDBSF (Mean Distance Between Sub-System Failures) data in km for the systems defined in Annex D, section 1.4.

15.3. Availability

15.3.1. The daily availability of the fleet shall be better than 94 %, the average, determined over one month shall be better than 96 %. The availability is calculated daily at 09:00 a.m as follows :

15.3.2. Availability (entire fleet in %):

$$A = \text{number of wagons in operation} / \text{total number of wagons} * 100$$

15.3.3. Number of wagons in operation:

All wagons, with exception of the wagons which are taken out of service for the following activities:

- taking out of service for repairs (including transition time to workshop)
- taking out of service to perform warranty (including transition time)
- taking out of service for preventive maintenance of more than 3.0 hours working time
- taking out of service for reprofiling of the wheels, inclusive of the transition time to the respective workshop.
- The Bidder shall indicate the average Km. between reprofiling

15.3.4. Taking out of service is calculated at 0.5 days minimum.

15.3.5. Transition to a workshop must be taken into account if the wagon must be specially transferred.

15.3.6. The respective work in the workshop starts within 1 day.

15.3.7. Service and maintenance requiring less than 3.0 hours are planned into the revenue service and to not have to be considered in the availability calculation.

15.4. Maintainability

15.4.1. The following general rules are to be followed:

- All components shall be designed in order to achieve a running distance of > 750.000 km without special maintenance. No component shall require maintenance below 50.000 running kilometers
- Components and wear-parts shall be installed easily accessible. Identical parts must be interchangeable, similar parts, which are not interchangeable must be keyed, so that they cannot be misplaced

- Functional units shall be designed as easily exchangeable modules

15.4.2. In addition to these maintainability requirements, the Bidder shall adhere to the following:

- Reduce the vehicle down-times by the "replacement" maintenance philosophy
- Design to minimize adjustment requirements
- Design to minimize maintenance personnel skills and training
- Design to minimize number of special tools
- Adjustment fittings, safety valves, etc. shall be easily accessible.
- Self-retaining fasteners shall be used
- Provide handles on heavy components or less accessible components for ease of handling
- Wherever possible, provide for visual inspection of equipment.
- Design to eliminate torque specifications for fasteners.

15.4.3. The maintainability figures for subsystems shall be indicated by the Bidder.

15.5. Safety

15.5.1. It must be possible to operate the wagon safely. All critical aspects of the operation of the wagon must be considered.

15.5.2. The following should be considered as a general philosophy

- a single order failure should not result in dangerous situation
- a second order failure should not result in a catastrophic situation

15.5.3. A safety analysis shall be performed by the Bidder (see Annex D, section 4.3).

16. Technical Data

- 16.1. The wagon's performance details, and evidence requested to ensure compliance with this technical specification, shall be provided to ISR as part of the Bidder's response.
- 16.2. The Bidder shall include with the proposal at least the following technical data:
 - 16.2.1. Full description of the proposed wagons including dimensions and weights, structure, loading and discharge doors, running gear, brake system, pneumatic system, painting plan, etc. The description shall include make and models of equipment, where applicable.
 - 16.2.2. Compliance list according to section 1.9.
 - 16.2.3. General arrangement drawings and system diagrams.
 - 16.2.4. Full details on the safety equipment.
 - 16.2.5. A detailed description of the internal QC (Quality Control) and QA (Quality Assurance) systems of the supplier.
 - 16.2.6. Name, profile, qualification and accreditation of the certification body which shall be carrying out the testing and the certification of the wagons.
 - 16.2.7. Full information regarding operators and maintenance personnel training programs.
 - 16.2.8. Preliminary Spare Parts List for 2000 operating hours.
- 16.3. Three months before the commencement of the delivery of wagons the chosen Bidder shall provide to ISR:
 - 16.3.1. A certificate or a declaration from an accredited and independent Notified Body (NoBo) regarding the Conformity Assessment and the Compliance with the Norms as required in the act of "putting" the wagon in the EU market.

The identity of the NoBo shall be agreed upon with Ministry of Transportation in Israel via ISR in advance.

The **NoBo** must have an accreditation for the Technical specification of interoperability (**TSI**) relating to the Rolling Stock and the subsystem 'rolling stock — freight' in one of the countries of the European Union and registered in the European Commission, having met the minimum criteria described in Annex VIII of Directive 2008/57/EC.

16.3.2. A table with the required data as outlined in “Rolling Stock register Requirements for the Freight Wagon Register – Annex H” of TSI “Freight Wagons”

16.4. The following technical data shall be provided concurrent with the supply of the first wagon:

16.4.1. The full and detailed technical specification and general arrangement drawings for wagon, bogies, brake and pneumatic systems, etc.

16.4.2. 3D digital media models of the complete wagon assembly and of the main sub-assemblies such as bogies, brake, doors, pneumatic systems, etc.

16.4.3. Binders with all the documents of calculations, measurements, tests results, signed acceptance forms, passports of components and full certification of the wagons.

16.4.4. The Bidder shall also provide the following:

- a certificate or a declaration from an accredited Notified Body (NoBo) regarding the Conformity Assessment and the Compliance with the Norms as required in the act of “putting” the wagon in the EU market. The identity of the NoBo shall be agreed upon with ISR in advance

16.4.5. Operation and maintenance manuals, safety instructions and spare parts catalogue:

- **Maintenance manual** shall include instructions and procedures for parts and components replacements, adjustments, disassembly, assembly, and testing.
- **Operating manual** shall include instructions for wagon operation.
- **Safety instructions** shall be included in these manuals.
- **Spare parts catalogue** shall include:
 - + B.O.M and full list of manufacturer spare parts codes

- + Parts breakdown with illustrated parts breakdown (Sub-Supplier items included) with a set of section drawings or axonometric / "blow-up" drawings and a list for each one of the drawings including: item number on the drawing, item's name, Sub-Supplier's part number, Sub-Supplier name, quantity per assembly.
- + Part numbers index with the following data as: part number, drawing number, drawing index number.
- + **Part list information include:** system level, component, producer OEM, material number, weight and volume of part incl. package, duration of technical life cycle, material information, description of function, potential failure mode, potential effect of failure, potential root cause of failure, types of vehicles where applicable.

Until the end of the warranty period, ISR may request an adaptation and amendment of the list free of charge.

- 16.5. Three duplicates of all these data shall be supplied on hard copy and two on Digital media. All documents shall be in English or Hebrew language.
- 16.6. At the beginning of the project the ISR and the Bidder shall define and agree on a training program for operators and maintenance staff. The basis for the program shall be the information submitted by chosen Bidder according section 16.2.7.

17. **Bidder Requirements**

- 17.1. Staff carrying out work related to the design, manufacture, inspection and testing of the system shall be appropriately trained and competent to carry out safety critical tasks *.
- 17.2. Upon signing the contract with ISR the Bidder shall employ an **Independent Safety Assessor (ISA)** - a professional body which is not part of planning, development and production of the project. Its role is to assess and manage the risks of the project and monitor that the safety level and safety requirements of the vehicle are maintained *. The ISR Project Manager could also be assisted with those services during all the stages of the project.

This independent body must have professional knowledge and at least five years of experience in safety control, processes, examination and delivery to a customer of one or more rolling stock projects.

ISA shall submit, during the project, periodical reports and its final report shall be submitted at the completion and delivery of the vehicles.

17.3. The ISA will comply to (EU) 402/2013 (CSM RA) ,Annex II requirements and will be certified to EN ISO/IEC 17020 "Inspection Body" .

17.4. The ISA will certify whether the Wagon design and manufacture are compliant with the safety requirements in accordance with CENELEC Standard EN50126.

17.5. Provision of documents as detailed in section 16.3.

17.6. Documentation Plan according phases see annex A.

18. **Warranty and post-delivery support**

18.1. Bidder shall be responsible to provide warranty services for two (2) years after each wagon acceptance *.

18.2. All costs associated with warranty repairs shall be at no cost to ISR.

18.3. Bidder shall provide technical support in the event of equipment failure.

18.4. Availability of spare parts shall be guaranteed for at least 12 years from date of order *.

19. **Acceptance Procedure**

19.1. ISR's acceptance of each wagon shall be based on the following:

- Tests in accordance with section 14 successfully completed.
- ISR's review and approval of the documentation provided as per section 16.4.
- Training in accordance with section 16.6 successfully completed.

19.2. A certificate of Acceptance shall be issued by ISR as confirmation of the wagon's acceptance. This will signify the start of the warranty period.

ANNEX "A"

Documentation Plan

| Document | Phase |
|--|--|
| <ul style="list-style-type: none"> • ISO 9001 certificate • Technical description of the wagon • List of proved experience • Technical specification compliance list • Prototype Test data • Homologation plan • Description of QC & QA • Notified Body (No-Bo) • Training programs | Bidding |
| <ul style="list-style-type: none"> • Safety plan • Interoperability plan • MDBSF report • Safety Analysis | 2 months after the Commencement |
| <ul style="list-style-type: none"> • Wagon drawing & systems diagram • Inspection and test plan (ITP) • Painting plan, external inscription & emblems | Final Design review |
| <ul style="list-style-type: none"> • Readiness for foreign acceptance | Prior to Foreign Acceptance |
| <ul style="list-style-type: none"> • Notified Body (No-Bo) certification • Rolling Stock register, TSI Freight Wagons Annex H • Operation and maintenance manuals, safety instructions and spare parts catalogue, B.O.M • Initial spare parts list | 3 month before Shipping |
| <ul style="list-style-type: none"> • Full technical documentation • 3d media model • Wagon book | First wagon Acceptance |
| <ul style="list-style-type: none"> • Hard copy of the technical documents | After wagons Delivery |
| <ul style="list-style-type: none"> • Final Acceptance Certificate | After Final Acceptance |

TP- AAP Type Permit Authority Approval Plan

| Phase | No. | Deliverables | Remark / Reference Document | Participation | | | | | | Due Date | Status | |
|--|-----|---|-----------------------------|---------------|---|-----|----------|----------|------|----------|--------|-----|
| | | | | O | S | S.s | NoB o | DeB o | PISA | | | ISA |
| Pre Tender Phase | | | | | | | | | | | | |
| 0 | 1 | *Project Initiation document | | | | | | | | | A | |
| 0 | 2 | *System Safety Plan | | | | | | | | | I | |
| 0 | 3 | Technical Specifications | | | | | | | | | A | |
| Phase 1 Concept | | | | | | | | | | | | |
| 1 | 4 | Type Approval Assessment Plan | | | | | | | | | A | |
| Phase 2 System Definition | | | | | | | | | | | | |
| 2 | 5 | Preliminary RS Safety Plan | | | | | | | | | I | |
| Phase 6 Design and implementation | | | | | | | | | | | | |
| 6 | 6 | RS Safety Plan at end of Detailed design | | | | | | | | | I | |
| 6 | 7 | Preliminary Safety Case at end of Detailed Design | | | | | | | | | I | |
| 6 | 8 | Testing and Commissioning Plan | | | | | | | | | I | |
| 6 | 9 | Drivers Certification Plan | | | | | | | | | A | |
| Phase 9 - Testing and Commissioning | | | | | | | | | | | | |
| 9 | 10 | T&C Acceptance Test Report | | | | | | | | | I | |
| | 11 | Final technical Safety Case | | | | | | | | | I | |
| Phase 10 - Final Acceptance | | | | | | | | | | | | |
| 10 | 12 | EC certificates of verification | | | | | | | | | I | |
| | | EC declarations of verification | | | | | | | | | I | |
| | | NTR certificate of conformity | | | | | | | | | I | |
| | | NTR declaration of conformity | | | | | | | | | I | |
| | | AsBo Safety assessment report | | | | | | | | | I | |
| | | Final Safety Assessment Report (SAR) | | | | | | | | | A | |
| 10 | 13 | Drivers Certificate | | | | | | | | | A | |
| 10 | 14 | Final Handover Acceptance, Issue TPTO request | | | | | | | | | A | |
| TaPTO | | | | | | | | | | | A | |

ANNEX "B"

Technical Specification for bogie type

Y25 Lsd / Y25 Lsdm

With 22.5 Tons axle load

Table of Content

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1. General

The bogie shall be a 2-axle bogie for use on freight wagons. Its design shall be unified in accordance with the most recent editions of EN standards and UIC leaflets and shall correspond to UIC 510-1.

It can be offered either in a welded construction according to the general drawing ERRI B12/RP44 A.2.

The design axle load for a speed of 100 km/h shall be 22.5 ton and the bogie shall be able to run under an empty wagon at a speed of 120 km/h.

The bogies shall be designed for an unrestricted circulation on the Israel Railways network.

2. Standards

The bogies shall be designed, manufactured and tested according to TSI Freight Wagons and to the most recent editions EN and UIC prevailing standards. See Annex S – a non-exhaustive list of applicable standards and regulations.

3. Prevailing Climate Conditions

- 3.1. Temperature range minus 5°C - 47°C
- 3.2. 90% humidity.
- 3.3. Dusty conditions.
- 3.4. For more details see Annex E.

4. Track Data

- 4.1. Track Gauge 1435 mm
- 4.2. Maximum gradient 3.5%
- 4.3. Minimum vertical radius 500 meters
- 4.4. Rail type mainly U 50 and UIC 54

5. Operating Requirements

- 5.1. Operating Speed

The bogie shall be able to run unrestricted in "S" traffic (100 km/h operating speed) according to UIC 432, fully loaded with an axle load of 22.5 metric ton and under empty wagon load - at a speed of 120 km/h.

5.2. Main Characteristics

| | |
|-----------------------------|----------|
| Track gauge | 1435 mm |
| Wheel diameter | 920 mm |
| Wheelbase | 1800 mm |
| Distance between slide bars | 1700 mm |
| Maximum axle load | 22.5 ton |
| Tare weight - not to exceed | 4,750 kg |

6. Structure

6.1. Running Safety

Constructional characteristics of the bogie shall be according to the conditions laid out in EN 13749 and UIC 530-2.

The bogie structure shall be designed to withstand the test criteria given in ERRI B12/R44.

The bidder shall provide with his proposal test certificates showing that the bogie passed the above listed tests.

6.2. Welded bogie frame

The frame shall be a welded unit consisting essentially of two solid bars receiving the primary suspension, a central fixed bolster which bears the pivot and bear-plates, two (2) longerons (stiffeners) to fix the brake and two (2) head-beams in U section.

The side members and pivot bolster shall be able to withstand the bending moments due the load.

6.3. Pivot bearing and side bearers

The wagon body shall rest via a spherical pivot bearing and elastic side bearers on the bogie. The lower pivot part of the bogie shall be welded into the cross girder, and shall be equipped with RAILKO type AL2 or NF21 slide bar according to UIC/ERRI 100 M 12500010 as well as the flexible slide bars, according to drawing (UIC/ERRI 100 M 1255023) or an equivalent material which shall take up lubrication and wear.

The rotary braking, which is necessary for safety and riding quality must be within the limits of UIC 510-1.

6.4. Suspension

6.4.1. The suspension shall be designed, manufactured and supplied according EN 13298 and UIC 822.

6.4.2. One of the spring groups in each axle-box shall be fitted with a damping device of LENOIR type.

7. **Wheelsets**

7.1. General

The wheelsets shall be according to UIC 813 and EN 13260. The electric resistance of the assembly shall comply with the requirements of UIC 512.

7.2. Wheels

The wheels shall be of the solid (Monoblock) type with a diameter of 920 mm drawing UIC/ERRI 200 M 1110001 and UIC 510-1 par. 1.1. The wheels shall be provided according to the requirements of EN 13262. The technical approval of the wheels shall be according to EN 13979-1 and UIC 510-5. The wheel material shall be in accordance with EN 13262, type ER7.

The wheel profile shall be in accordance with UIC 510-2 Appendix B1 and EN 13715 Annex C. The maximum wear of the wheel shall be 25 mm in radius. The wheels shall be provided with an oiling hole and plug, to allow pressing out easier.

7.3. Axles

The axles shall be provided according to the requirements of EN 13261. The axles shall be designed according to EN 13103 and shall be as indicated in UIC 510-1, "B" type, for journals of 130 X 191mm, (drawing UIC/ERRI 100 M 1114 0001). The grade of the steel shall be EA1N – normalized, according to EN 13261.

7.4. Axle-boxes

Axle-boxes, in cast steel, (E 300-52Mc 2 quality, drawing UIC/ERRI 100 M 115 00001) shall be fitted with lateral lugs, symmetrically arranged to accommodate the suspension coil spring. The axle-boxes shall be for journals of 130 X 191 mm.

The roller bearing shall be of the cylindrical rollers type manufactured by SKF or FAG.

Performance testing for the axle-boxes according to EN-12082.

8. Braking system

The brake rigging shall be designed for "S" service (100 km/h) for a loaded wagon and "SS" service (120 km/h) for an empty wagon. Braking power shall be in accordance with the directives given in UIC 544-1.

The brake triangles shall be according to drawing (UIC/ERRI 187 M3323) for a resistance of 120 KN in accordance with UIC 833.

The dimensions of pins and clearances shall be in accordance with UIC 542 Appendix F for "S" service.

ISR prefers for easy and quick pin removal the suitable pin locks type double spring cotter pin or a split pin.

The leverage shall be in multiplication of 4 and four (4) brake shoes per wheel, sixteen (16) per bogie.

The brake shoes shall be of phosphorous cast iron P-14, in accordance with UIC 832.

The bogie shall be provided with a weighing valve for the automatic empty-load change-over and its corresponding piping. The connection pipes between the valve and the wagon body shall be according to UIC 510-1 Appendix 7.

9. Materials

All materials used in the production of the wagons shall meet the requirements of relevant standards and norms with the approved production drawings in terms of their composition, quality, processing and technical delivery conditions. Quality assurance certificates should be enclosed to each material delivery.

10. Welding

Welding shall be carried out in accordance with EN 15085-1-5 series standards.

11. Corrosion protection

11.1. All suitable materials shall be blasted with malleable iron abrasive to ISO 8501, S.I.S. 055900, SA 2 1/2.

- 11.2. All surfaces of all blasted material shall immediately receive a coating of weld able primer, at nominal dry film thickness of 25 micron.
- 11.3. All other materials shall be cleaned free of loose mill scale, loose foreign matters and grease by the use of hand or power steel brushes and solvent.
- 11.4. After fabrication, damaged areas and welds on surface which is to be painted shall be cleaned with hand or power steel brushes. Oil or grease left by machining operations shall be cleaned off with suitable solvents or other means.
- 11.5. After fabrication, all surfaces shall be cleaned and receive a primer coating. Spray rates and coverage shall be regulated to a 60-70 micron dry film thickness.
- 11.6. The second layer shall be a full coat of protective paint which shall be applied to thickness of 35-45 micron.
- 11.7. The final coat of paint at nominal dry film thickness of 30-35 micron shall be applied. Color of the final coat shall be Ra1 8012.
- 11.8. Anti corrosion protective strip shall be provided where necessary in accordance with UIC 842-4 par. 4.
- 11.9. Paint products shall be supplied in accordance with UIC 842-1. The paint products shall be tested in accordance with UIC 842-2. The painting system shall be inspected in accordance with UIC 842-6.
- 11.10. All paint material shall be based on water and environmental proven.
- 11.11. The bogie shall be provided with inscriptions and emblems. Size, wording and location shall be decided during the detail design phase.

12. Testing

- 12.1. All materials and components shall be provided with a test certificate which shall be presented before installation and shall be attached to the bogie test book.
- 12.2. All weld and paint work shall be tested as specified in the relevant section.
- 12.3. Every frame shall meet the dimensions stated in the dimensional drawing. A dimensions sheet shall be filled out for every frame.
- 12.4. Every completed bogie shall meet the dimensions stated in the dimensional drawing. A dimensions sheet shall be filled out for every complete bogie.

Annex S
Technical Specification for bogie type
Y25 Lsd / Y25 Lsdm
List of Standards

EN Standards:

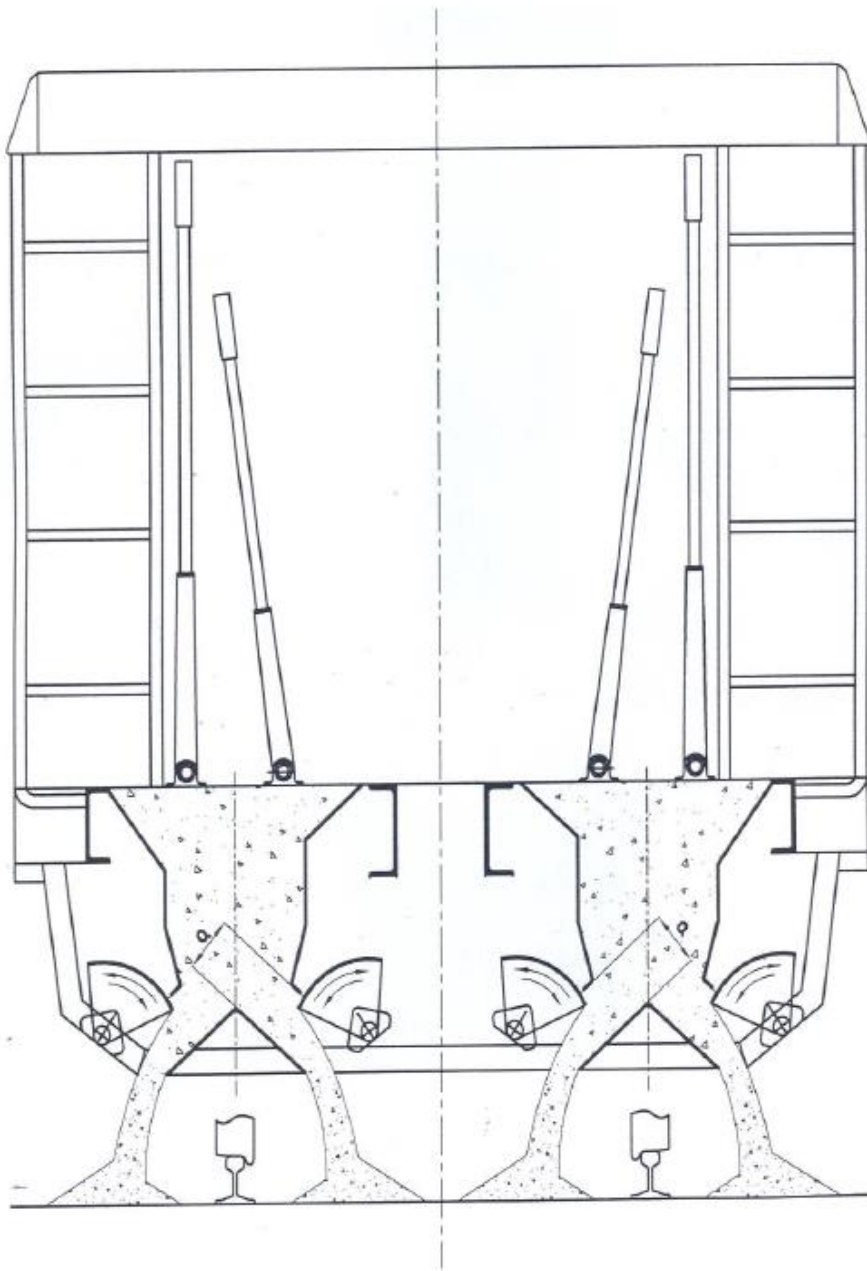
- EN 13103 Wheelsets and Bogies – Non powered Axles – Design Method
- EN 13260 Wheelsets and Bogies – Wheelsets – Products Requirements
- EN 13261 Wheelsets and Bogies – Axles – Product Requirements
- EN 13262 Wheelsets and Bogies – Wheels – Product Requirements
- EN 13298 Suspension Components – Helical Suspension Springs, steel
- EN 13715 Wheelsets and Bogies – Wheels – Wheels tread
- EN 13749 Wheelsets and Bogies – Methods of Specifying Structural Requirements of Bogie Frame
- EN 13979-1 Wheelsets and Bogies – Monobloc Wheels – Technical Approval Procedure

UIC Standards:

- UIC 432 Wagons - Running speed
- UIC 510-1 Wagons - Running Gear - Normalization
- UIC 510-2 Trailing Stock: Wheels and Wheelsets. Conditions Concerning the use of Wheels of Various Diameters
- UIC 510-5 Technical Approval of Monobloc Wheels, Application Document for Standard EN 13979-1
- UIC 512 Conditions in order to avoid difficulties with track circuits
- UIC 530-2 Wagons - Running Safety
- UIC 542 Brake Parts - Interchangeability
- UIC 544-1 Brakes - Braking Power
- UIC 813 Technical specification for the supply of Wheelsets
- UIC 822 Technical specification for the supply of helical compression springs
- UIC 832 Technical specification for Brake shoes of Phosphoric Iron
- UIC 833 Technical specification for Brake Triangles
- UIC 840-2 Technical specification for the supply of Steel Castings
- UIC 842-1 Technical specification for the supply of Paint Products
- UIC 842-2 Technical specification for Testing Paint Products
- UIC 842-4 Technical specification for Protection against Corrosion
- UIC 842-6 Technical specification for Inspection of Paint Systems
- UIC 897-9 Technical specification for preparation of the Edges
- UIC 897-11 Technical specification for the acceptance of Welders
- UIC 897-12 Technical specification for welding procedures
- UIC 897-13 Technical specification for the control of welded joints

ANNEX "C"

Distribution of Ballast on the track



ANNEX "D"

RAMS

1. Reliability

1.1. General

The vehicle shall conform to high reliability standards. In this section the standards to be achieved regarding endemic failure are defined and certain requirements are described regarding remedial measures, design procedures and monitoring of reliability.

1.2. Definitions

In this Section the following definitions shall apply:

- a) Service failure - a condition requiring unscheduled maintenance of a wagon or a component or a sub-assembly either in service or during the scheduled checks.
- b) Mean Distance between Sub-System Service Failures (MDBSF) - in regard to any sub-system which is listed in section 1.4 below and any continuous six-month period, the total number of kilometers travelled in scheduled revenue operation during that period divided by the number of Service Failures which occurred during that period and which are attributable to defects in that sub-system, save that any data in respect of a wagon which had not completed 5.000 km of operation by the commencement of that period shall be disregarded.

1.3. Calculation of MDBSF

As soon as possible after the beginning of the seventh month of revenue operation of the first supplied wagon, ISR will calculate the MDBSF for the previous six-month period for each of the sub-systems listed in Section 1.4 below. Each month thereafter ISR shall repeat this calculation in respect of the corresponding previous six-calendar-month period. On completion of the calculations each month ISR shall notify the Bidder of the respective MDBSF values. The calculations of the MDBSF values shall be based on logbooks and maintenance records, in both cases, kept properly, regularly and up-to-date and separately in respect of each wagon throughout the period during which the endemic failure provisions apply. Such books and records shall be available for inspection by the Bidder subject to his giving reasonable notice to ISR.

1.4. Reliability Requirements

The wagons and their sub-systems shall be designed and manufactured so that, for every successive continuous six-month period the MDBSF values, calculated as described above, equal or exceed the respective values shown for each sub-system in the following table:

| Sub-system | MDBSF in km |
|----------------------------------|-------------|
| Bogies | |
| Brake system | |
| Doors opening and closing system | |

The data as given by the Bidder in the data sheet will be filled in this table in order to make it part of the contractual specification.

1.5. Corrective Action

If the MDBSF value for any sub-system, calculated as described above at any month, does not achieve the value given in the table then:

- a) where this occurs during the 12-month period following the date of the Acceptance Certificate for the individual wagon, the Bidder shall analyze the cause and shall submit his proposals for suitable remedial measures to ISR who will decide, whether and to what extent, if at all, the Bidder shall be required to undertake these or other remedial measures. Where the Bidder is so required then he shall undertake the measures in accordance with the Quality Assurance practices.
- b) where this occurs during the 10-year period from acceptance and ISR is of the opinion that the MDBSF for the sub-assemblies or components not achieved or that more than 50 per cent of the associated instances of Service Failure are attributable to a particular sub-assembly or component having been defective then that sub-assembly or component shall be considered to have suffered endemic failure. In this case the relative provisions in the Agreement shall apply.

1.6. Design Procedures

The design of the vehicle, its sub-systems and components shall be carried out with careful regard to attaining reliability in service. From time to time, as the design proceeds, this matter shall be reviewed, and the results of the final review shall be incorporated in the recommendations for servicing that are included in the manuals. Such recommendations shall include, where appropriate, measure to reduce the likelihood of sub-assembly or component failure. The Bidder shall carefully consider, during the design stage, the need for reliability testing of components and sub-assemblies of the passenger vehicles. He shall discuss this with ISR, putting forward his proposals for such testing and his reasons for omitting this where he considers it is not

necessary, all as may be appropriate. Following such discussion, the Bidder shall submit his proposals for such tests for the approval of ISR, setting out their scope and form. The results of such tests shall be furnished to ISR and, where appropriate, shall be incorporated in the manuals. Should the results of any tests prove unsatisfactory, the design or method of manufacture of the component or sub-assembly shall be revised as ISR may approve or require and similar tests shall be repeated.

1.7. Reliability Monitoring Program

During the warranty period of the vehicles the Bidder shall keep records regarding remedial actions in respect of each wagon. In these records he shall record any failure of a type that would, during the operating life of a vehicle, fall within the definitions of a Service Failure, notwithstanding that these may occur during testing of the vehicle. Should any such failure indicate the possibility of non-reliability in operation the Bidder shall promptly notify ISR and submit his proposals for remedying the cause of the failure. During the period while they are in attendance, the field service engineers shall assist ISR in monitoring any Service Failures and shall advise him upon necessary or desirable to prevent or reduce the likelihood of their recurrence. As and when required by ISR, the Bidder shall provide further advice to augment that of the field service engineers. At the beginning of each month during the 12-month period following the date of the Acceptance Certificate for the individual vehicle, the Bidder shall submit to ISR, a report on the reliability of each vehicle during the preceding month.

2. Availability

The design should aim to achieve maximum availability and reliability. The relative objectives are given in section 15.3 of the Spec.

3. Maintainability

3.1. General

The primary objective of the Maintainability Program is to maximize vehicle availability. To achieve this objective, concentrated efforts shall be made to minimize maintenance downtime, reduce the possibility of human error when performing maintenance, and optimize overall accessibility of equipment for servicing, removal and repair. Maintainability considerations shall include features for minimizing maintenance costs and the need for highly skilled maintenance personnel guidance.

CLC/prTR50126-3 shall be used as guidance.

3.2. Maintainability Targets

The maintainability requirement for a vehicle is an MTTM_C of 1.5 hours. The maintainability figures for subsystems shall be indicated by the Bidder:

| Subsystem | MTTM _C | MTTM _P |
|---------------------|-------------------|-------------------|
| Air Brake system | | |
| Friction brakes | | |
| Doors Mechanisms | | |
| Bogies & Suspension | | |
| Car body | | |
| Miscellaneous | | |

The Bidder shall indicate the MTTM_P for the vehicle with the respective calculations.

4. Safety

4.1. General

The objectives of the system safety design shall be to ensure that no failure or deficiency shall result in a catastrophic or critical accident and that a hazard control program (as part as the system's operational procedures) will be maintained to ensure the optimum level of safety for:

- 1) ISR and/or ISR customers' personnel who are operating, maintaining or testing the vehicle.
- 2) The vehicle, its equipment and supporting facilities.
- 3) Wayside personnel, equipment and facilities.

The following accident categories shall be used in assessing hazard impacts on the system:

Category I - Catastrophic

May cause one or more fatalities and/or loss of major portions of the system.

Category II - Critical

May cause serious or multiple injuries and/or may require immediate corrective action to prevent fatalities or major system loss.

Category III - Marginal

May cause minor injury or system damage and/or may cause lengthy service interruption.

Category IV - Minor

Will not result in injury, system damage or lengthy service interruption, but may require nonroutine repair service and/or operational procedure.

4.2. Safety Requirements

The vehicle system shall be designed, so that a second order failure (i.e. two failures superimposed) does not cause a category I or II hazard.

4.3. Safety Analysis and Demonstration

The design of the vehicle, its subsystems and components shall be performed according to approved methods regarding systems safety. The safety analysis shall be performed by the Bidder on a regular basis and shall be presented to ISR at design review meetings. The safety analysis shall specifically include:

- a) identifying by analytical techniques the sources of functional failures in vehicle equipment, arrangements and operating controls which can result in catastrophic or critical accidents. Particular attention shall be given to accidents involving:
 - Collision or Derailment
 - Fire/Explosion
 - Entrapment/Crushing
 - Falls/Contusions
 - Safety of the operational and maintenance personnel
- b) demonstrating that sources of these functional failures are eliminated
- c) demonstrating how the consequences of these functional failures are controlled to attain the program objectives

Safety information and procedures shall be developed for inclusion in operations, training and publications. These shall include, but not be limited to, normal and emergency operations and the use of protective devices and emergency equipment by operating and maintenance personnel. The emergency procedures shall be demonstrated as part of the training program set out in 16.2.7.

ANNEX "E"

Environmental Conditions

| | |
|--------------------------------|---|
| Range of ambient temperatures: | -5°C to +45°C (with temperature changes of up to 20°C per hour) |
| Altitude of operations: | -400 m to +800 m above MSL |
| Cross winds: | 5 m/s with gusts of wind of 50 m/s in duration of 1s per gust of wind |
| Snowfall | no particular requirements |
| Rainfall | 400-800 mm/year |
| Relative humidity: | 10% to 90% |
| UV radiation | 360-600 MJ/m ² per year |
| Sunny hours per year: | 3300 h |

It is specifically emphasized that no performance degradation shall result from any “worst case” combination of the environmental conditions defined in this specification.

Special attention shall be paid to the local sunlight intensity and resulting heat transfer by radiation.

D.1 Climate and Environmental Conditions

| | |
|--|-------------------|
| -Max. Ambient temp. | 45 °C (shade) |
| -Min. Ambient temp. | Minus 5 °C |
| -Relative humidity | 10% to 90% |
| -Altitude | - 400 m to +800 m |
| -Sunny hours per year | 3300 h |
| -UV Radiation MJ/m ² per year | 360 – 600 |
| -Rainfall mm/year | 400 - 800 |

D.2 Dust Concentration in the Atmosphere

| | Maximum Half-hour Value | Maximum Daily Value | Average |
|----------------|-------------------------|---------------------|---------|
| NOx | 1064 | 560 | 71 |
| SO2 | 780 | 260 | 21 |
| O3 | 312 | 143 | 84 |
| Suspended Dust | - | 350 | 100 |

Particle Size - 0.5 to 1 micron

Table D-1: Suspended Particle Matter (SPM)

Special attention shall be paid to potential contamination by chalk dust from the track-bed.

D.3 Sea Salt Concentrations in the Atmosphere

| Salt Element Position | Na | | Cl | | SO ₄ | |
|--------------------------|--------|------|--------|------|-----------------|-----|
| | Season | | Season | | Season | |
| | Dry | Wet | Dry | Wet | Dry | Wet |
| Sea Air at Coastline | 7.3 | 16.0 | 12.0 | 22.0 | 5.3 | 7.0 |
| 600 m from Shore | 3.1 | 4.8 | 4.2 | 7.9 | 1.9 | 2.0 |
| 6000m from Shore | 1.1 | 1.4 | 1.5 | 1.7 | 1.3 | 1.4 |

all values in micrograms per m³ atmosphere

Table D-2: Salt Concentrations in the Atmosphere

ANNEX "F"

1. Track geometrical parameters and rail types

The standard track gauge is 1,435 mm (nominal).

Rails on main lines are continuously welded except for the Beit – Shemesh – Jerusalem line, in which rails on curves with radius $R \leq 141$ m are connected with fish plates.

The following rail types are being used on the ISR network:

- UIC 60, UIC 60 320Cr, UIC 54, U 50, S 49, U 33, BS 37.
- B.3. Rail grades: R220, R260, R350HT, R320cr.
- B.4. S&C System: turnouts -- 1/8, 1/9, 1/12, 1/20, Scissor-Crossovers, Double Slips, Diamond Crossover, and Expansion Switches.

The rails are installed with an inclination of 1 in 40, and 1 in 30. Present types of sleepers are concrete monobloc, Franko-Bagon, Steel and Wood. The minimal number of sleepers is 1667 per km track.

2. Tunnels and bridges

For example, the new high-speed line to Jerusalem has tunnels and bridges as follows:

| Description | km start | km end | length [m] | Remarks |
|-------------|----------|--------|------------|---|
| Bridge 1 | 18.820 | 19.420 | 600 | bidirectional viaduct |
| Tunnel 2B | | | 220 | future tunnel Modiin-Jerusalem |
| Bridge 4 | 21.800 | 21.980 | 180 | bidirectional viaduct |
| Bridge 5 | | | 150 | bidirectional viaduct |
| Bridge 6 | 25.750 | 26.976 | 1,226 | twin bridge (2 parallel separate structures) |
| Tunnel 1 | 27.130 | 30.740 | 3,610 | double tube single track |
| Bridge 7 | 30.790 | 30.810 | 20 | twin bridge (2 parallel separate structures) |
| Tunnel 2 | 30.850 | 32.090 | 1,240 | double tube single track |
| Bridge 8 | 32.103 | 32.250 | 147 | twin bridge (2 parallel separate structures) |
| Tunnel 3 | 32.330 | 43.963 | 11,633 | double tube single track |
| Bridge 9 | 43.985 | 44.182 | 197 | twin bridge (2 parallel separate structures) |
| Tunnel 3A | 44.188 | 45.020 | 832 | double tube single track |
| Bridge 10 | 45.095 | 46.020 | 925 | starts as twin bridge merges to one bridge |
| Tunnel 4 | 46.237 | 48.557 | 2,320 | single tube double track |

Table 1: Tunnels and Bridges on new High-Speed Line to Jerusalem

3. Line and track parameter

| Parameter | Unit | Value |
|---|---------------------|---|
| Standard track gauge | [mm] | 1,435 |
| Gauge widening in tight curves (in addition to standard 1,435 mm gauge dimension) | [mm] | $R \geq 300 \text{ € } 0$ |
| | | $250 < R \leq 299 \text{ € } 5$ |
| | | $200 < R \leq 249 \text{ € } 10$ |
| | | $R < 200 \text{ € } 15$ |
| Horizontal Geometry | | |
| Curve radius R on main lines | [m] | $R \geq 190$ |
| Exceptional curves radii: - 1 curve on Rosh – Ha'ain line - Jerusalem Malha-Beit Shemesh - Some curve on secondary line | [m] | $R_{RH} = 191$ $R_{RH} = 141$ $R_{sec} = 120$ |
| Minimum S - curves radius: - With short tangent section (6 m) and - Without tangent | [m] | $150 + 150$ $190 + 190$ In some lines there are S-curves with short tangent section (6 m) and there are some without tangent. The S-Curve with the smallest radius of 141 [m] and without tangent. |
| Minimum radius in depot track | [m] | 90 |
| Vertical Geometry | | |
| Maximum gradient along the length of future lines | ‰ | 30 |
| Minimum vertical curve radius on lines (concave /convex) | [m] | 3,000 |
| Cant (super-elevation) | | |
| Maximum cant | [mm] | 150 |
| Maximum cant deficiency for conventional trains | [mm] | 130 |
| Maximum cant in special cases (ballast - less track) | [mm] | 150 |
| Transition curves | | clothoid |
| Minimum transition curve length L = length h = cant V = speed Cant is introduced at a regular rate along such transition curves | m [mm] [km/h] | $L = 0.006 * h * V$ |
| Distance between Centers of Tracks | | |
| $v \leq 160 \text{ km/h}$ | [m] | 4.7, 4.5 |
| $160 \text{ km/h} < v < 220 \text{ km/h}$ | [m] | 4.7 |
| rail cant | | 1 : 30, 1 : 40 |
| equivalent conicity from wheel profile and track | | 0.12 - 0.24 at 3 mm lateral movement of the wheelset, max. single 0.45 |

Table 2: Main Line and Track Parameters

4. Track superstructure

Allowed tolerances:

| | Speed [km/h] | Rank | Twist ¹⁾ [mm] – 2.5m base | Surface ¹⁾ [mm] | Gauge [mm] | Superelevation [mm] | Alignment ¹⁾ [mm] |
|---|-----------------|------|---|-------------------------------|---------------|------------------------|---------------------------------|
| 1 | 120 - 160 | B | 4.5 | 8 | -5 +8 | +/-5 | +/-6 |
| | | C | 9.0 | 15 | -6 +20 | +/-8 | +/-9 |
| | | D | 12 | 20 | -7 +30 | +/-12 | +/-12 |
| 2 | 80 - 120 | B | 5.0 | 10 | -5 +10 | +/-7 | +/-7 |
| | | C | 11 | 18 | -6 +25 | +/-11 | +/-11 |
| | | D | 14 | 22 | -7 +31 | +/-15 | +/-15 |
| 3 | 40 – 80 | B | 7.0 | 13 | -5 +15 | +/-10 | +/-9 |
| | | C | 14 | 22 | -6 +30 | +/-15 | +/-14 |
| | | D | 16 | 24 | -7 +32 | +/-21 | +/-19 |
| 4 | 0 – 40 | B | 10 | 18 | -5 +20 | +/-13 | +/-12 |
| | | C | 17 | 28 | -7 +30 | +/-20 | +/-18 |
| | | D | 18 | 30 | -9 +35 | +/-28 | +/-25 |

Table 3: Tolerances for Track Maintenance

Remark:

Deviations below "B": Track accepted condition – measuring values are less or equal to “B”

Deviations from "B" up to "C": Alert limit– measuring values are greater than “B” and less than or equal to “C” - Regular planned maintenance operation

Deviations above "C": Intervention limit – measuring values are greater than “C” and less than or equal to “D” – Corrective maintenance required

Immediate action limit is given by measuring values greater than or equal to “D”. This would either require reducing of the line speed or closing the track.

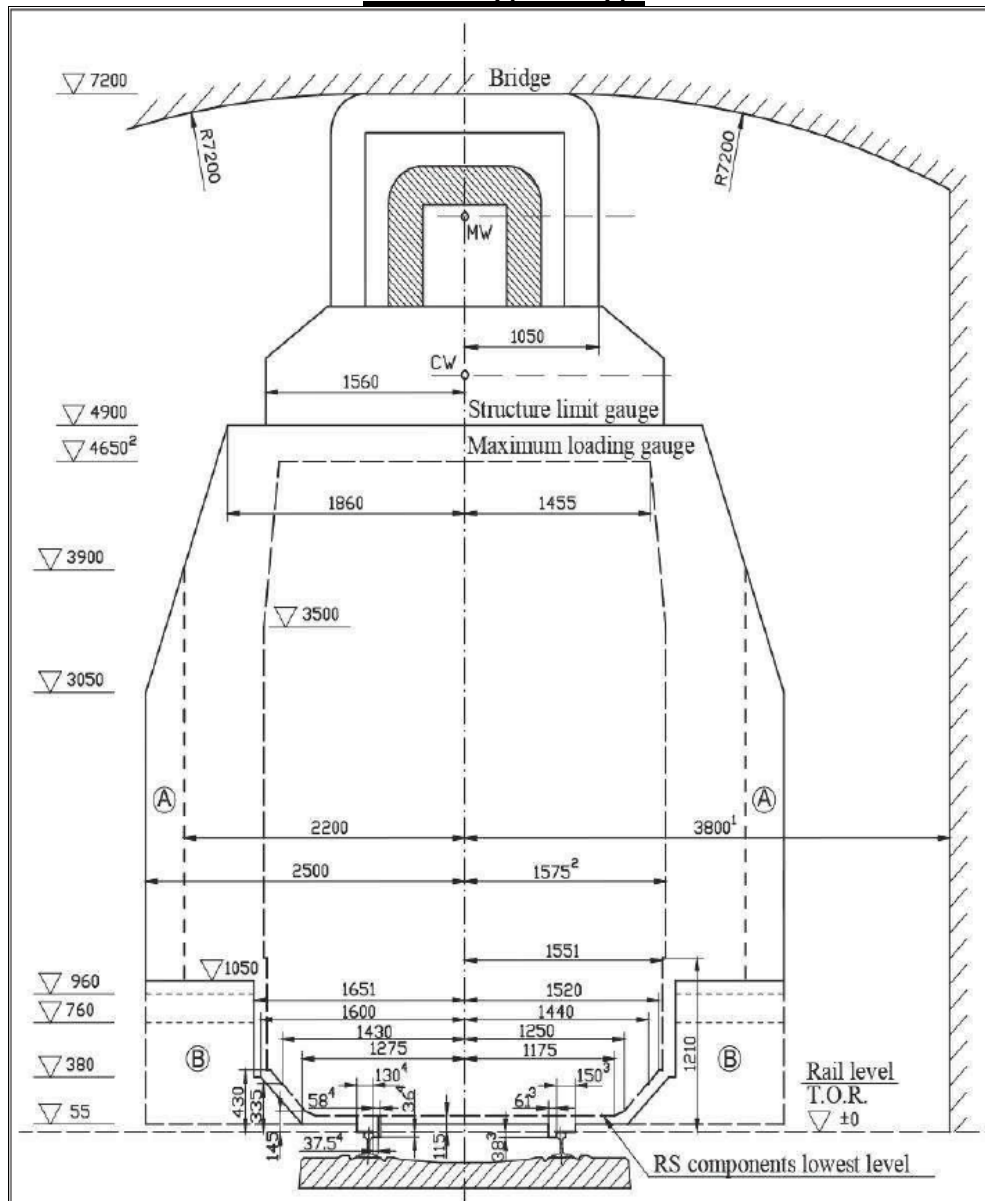
5. Specification for axle counters

To be provided by ISR to the winning Supplier.

ISR track will be featured with axle counters of Type AzLM from Thales manufacturer where the design is fully in compliance with EN standards. The Unit shall be compliant with related requirements of the standard family EN 50238.

ANNEX "G"

Loading Gauge



1. 3.800 m - for permissible speed greater than 160 km/h up to 250 km/h.
 3.300 m - for speed greater than 60 km/h up to 160 km/h.
 3.000 m - for speed up to 60 km/h on the secondary lines, stations and marshal yard lines.
2. Dimensions for new rolling stock. For existing Rolling stock height and width from track center line of maximum loading gauge for coach/Loco - 4.750 m and 1.660 m.
3. Dimensions for Infrastructure gauge.
4. Dimensions for Rolling stock static gauge.
5. Area between tracks or outside of track for signaling equipment.
6. Area for passenger platforms, ramps and signaling systems.

Comments:

- Dimensions on this drawing - for straight line only.
- Calculation of this dimensions in curves (see technical rules ISR).
- Location of structures on the passengers' platforms in relation to terminal tracks (see technical program for passenger stations of ISR).
- All basic dimensions of the ISR infrastructure reference profile follow the EN 15273 standard.
- The ISR infrastructure gauge refers to GC Reference Profile.

ANNEX "H"

NON-EXHAUSTIVE LIST of STANDARDS and REGULATIONS

| Standard | Title |
|-----------------|--|
| DIN 2441 | Steel tubes heavy-weight suitable for threading |
| EN 12663-2 | Structural requirements of railway vehicle bodies - Freight wagons |
| EN 13103 | Wheelsets and Bogies – Non powered Axles – Design Method |
| EN 13260 | Wheelsets and Bogies – Wheelsets – Products Requirements |
| EN 13261 | Wheelsets and Bogies – Axles – Product Requirements |
| EN 13262 | Wheelsets and Bogies – Wheels – Product Requirements |
| EN 13298 | Suspension Components – Helical Suspension Springs, steel |
| EN 13715 | Wheelsets and Bogies – Wheels – Wheels tread |
| EN 13749 | Wheelsets and Bogies – Methods of Specifying Structural Requirements of Bogie Frame |
| EN 13979-1 | Wheelsets and Bogies – Monobloc Wheels – Technical Approval Procedure |
| EN 14198 | Braking - Requirements for the brake system of trains hauled by a locomotive |
| EN 14363 | Testing for the acceptance of running characteristics |
| EN 15085 | Welding of railway vehicles and components |
| EN 15551 | Buffers |
| EN 15566 | Draw gear and screw coupling |
| EN 15612 | Brake pipe accelerator valve |
| EN 15827 | Requirements for bogies and running gears |
| EN 15877-1 | Marking on railway vehicles - Part 1: Freight wagons |
| EN 16241 | Slack adjuster |
| EN 16452 | Brake blocks |
| EN 16834 | Brake performance |
| EN 50126 | The specification and demonstration of RAMS |
| CLC/prTR50126-3 | The specification and demonstration of RAMS - Part 3: Guide to the application of EN 50126-1 |
| EN 50238 | Compatibility Between Rolling Stock and Train Detection Systems |
| UIC 432 | Wagons - Running speeds - Technical conditions to be observed |
| UIC 510-1 | Wagons - Running Gear - Normalization |
| UIC 510-2 | Trailing Stock: Wheels and Wheelsets. Conditions Concerning the use of Wheels of Various Diameters |
| UIC 510-5 | Technical Approval of Monobloc Wheels, Application Document for Standard EN 13979-1 |
| UIC 512 | Conditions in order to avoid difficulties with track circuits |
| UIC 520 | Wagons coaches and vans - Draw gear - Standardization |
| UIC 521 | Clearances to be provided at vehicle extremities |
| UIC 526-1 | Wagons - Buffers with a stroke of 105 mm |
| UIC 530-1 | Constructional conditions for wagons to be observed with a view to fitting the automatic coupler |
| UIC 530-2 | Wagons – Running Safety |
| UIC 532 | Trailing stock - Signal lamp brackets - Coaches - Fixed electric signal lamps |
| UIC 533 | Protection by the earthing of metal parts of vehicles |

| | |
|--|--|
| ERA/TD/2012-04/INT version | Standardization of steps and handrails on wagons |
| UIC 535-2 | Standardization and positioning on wagons of steps, end platforms, |
| UIC 541-1 | Brakes - Regulations concerning the design of brake components |
| UIC 542 | Brake parts - Interchangeability |
| UIC 543 | Brake – regulations governing the equipment of trailing stock |
| UIC 544-1 | Brakes – braking power |
| UIC 575 | Wagons - Label holders (Interchangeability) and hazard identification panels |
| UIC 581 | Wagons – lifting, re-railing |
| UIC 813 | Technical specification for the supply of Wheelsets |
| UIC 822 | Technical specification for the supply of helical compression springs |
| UIC 832 | Technical specification for brake shoes of phosphoric iron |
| UIC 833 | Technical specification for Brake Triangles |
| UIC 840-2 | Technical specification for the supply of Steel Castings |
| UIC 842-1 | Supply of paint products for the protection of railway vehicles and containers |
| UIC 842-2 | Methods for testing paint products |
| UIC 842-4 | Technical specification for the protection against corrosion and painting of wagons and containers |
| UIC 842-6 | Quality inspection of railway vehicle paint systems |
| UIC 897-6 | Technical specification for the acceptance of combinations of wire electrodes (solid or cored) and gases and also for the supply of wire electrodes (solid or cored) for automatic and semi-automatic gas-shielded welding of plain carbon or low-alloy steels |
| UIC 897-9 | Technical specification for the preparation, for welding, of the edges of rolled products made of plain carbon or low alloy steels... for arc welding with coated electrodes and for semi-automatic arc welding |
| UIC 897-11 | Technical specification for the acceptance of welders for fusion welding of steels |
| UIC 897-12 | Technical specification for acceptance or welding procedures for arc welding in steels |
| UIC 897-13 | Technical specification for the quality control of welded joints on steel rolling stock |
| Commission Decision (TSI) 2006/861/EC and Commission Regulation (EU) No 1236/2013 of 2 December 2013 | Rolling Stock - Freight wagons |
| GCU Edition dated 1 January 2020 | General Contract of Use for wagons |