משרד האוצר

State of Israel

Ministry of Transport
and Road Safety

נתיבי איילון
תחבורה מתקדמת לישראל

Tender No. 33/20

For Design, Acquisition, Implementation & Maintenance of an In-Motion Vehicle Charging System

Additional Future Requirements (Optional)

Volume D

1 General

Ayalon Highways Ltd. (hereinafter: "**The Company**") examines advanced technologies in-motion charging of electric vehicles. As detailed in Volume A to the Tender Documents, this document's purpose is to present the Bidders with optional requirements that might be required in the future regarding the system presented by them as part of an Individual Referral to be presented to them. These specifications are optional, subject to changes, including fundamental changes, according to the sole and professional discretion of the Company.

The Tender's objective is to examine technologies for its future integration in the Company's projects throughout the country.

As customary throughout the world, it is intended to integrate the charging system in the road's right lane or designated lanes, e.g., "NETIVIM MEHIRIM" and "MA'HIR LA'IR."

Electric vehicles relevant to the project include:

Buses

Minibuses

Private vehicles, including taxis

Trucks

Sinve the technology is intended to serve its users for several decades at the very least, and serve vehicles of varying sizes, it is possible to propose one of the charging methods based on an energy transmitter situated in/on the roadway's layers (see Figure 1):

Charging through contact with power conductors beneath the road surface.

Wireless charging.

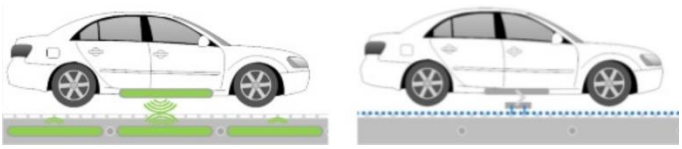

Figure 1: Wireless Charging (on the left) and Conduit Contact (Conductive power transfer) Charging (on the right)

Charging from the road must be of a sufficient energetic level - a level to be defined by the Company.

A high level of both availability and reliability is required from those parts of the energy transmission system set beneath and/or at road surface level to prevent the need to close the road for system maintenance on the one hand and the little care required in the parts installed in the vehicles, on the other hand.

Since the system is intended to convey a large amounts of energy in a short time from the road to the vehicle, it must comply with all the relevant standards concerning electricity and electromagnetism (electromagnetics compatibility).

Also, for any charging system requiring physical contact with power conductors in the road, it must be verified that the charging strip and/or the vehicle's charging system, do not convey any additional mechanical safety

problems, even when a vehicle must perform an emergency maneuver on the road (e.g., a sudden stop, a severe diversion from a lane, an accident, etc.), in any weather conditions.

This Appendix specifies the requirements of the Proof of Abilities Phase, as detailed in the TENDER CONDITIONS AND INSTRUCTIONS (Volume A).

2 Requirements of the Road Charging System

It is clarified that the requirements outlined in this Appendix are exclusively for evaluative purposes and do not obligate the Company concerning the requirements and specifications presented to the Framework Suppliers, or derogate from the Company's right to present to the Framework Suppliers other, additional, and/or subtract from the said requirements.

The proposed system must be approved and certified as per Israeli regulations.

The shall system identify (in combination with the vehicle's system) that the approaching vehicle is entitled to be charged by it.

The system is required to supply to each vehicle it charges an average 1.5-3 kWh/km, for the entire distance of the road, as per the vehicle's needs.

The system is required to measure each vehicle's power consumption and pool the data in its information system for subsequent customer billing.

Safety

General

The charging system will be divided to segments for survivability, safety, and prevention of electromagnetic disruptions.

Each segment shall transmit energy to a vehicle, only after the system identifies that the chargeable vehicle is in the segment.

Required functions from the in conductive power transfer charging system

The system shall contain preventive measures against electrocution of humans/animals present/roaming in areas where electricity is conducted.

Minimum requirements shall be regulated concerning the system's ability to operate in case of precipitation (water on the road, mud).

The system shall provide durability and a capability to operate near the sea (humidity with salinity).

The system shall contain a function enabling the disconnection of the short-circuited charging segment of the charging system.

Prevention/reduction of parasitic inductance/ capacitance and erroneous currents, and their effect on safety.

Power conductor strips on the road will not reduce any vehicle's mechanical safety crossing its path, in any scenario whatsoever.

Required functions in a wireless charging system

The parts embedded in the road are sealed, and their durability is ensured in the paving above them.

Prevent the effects of a magnetic field from the vehicle, its installed systems, its cargo, and passengers.

Prevent the effect of a magnetic field on other people/vehicles (non-electric vehicles).

The charging system's availability and survivability:

The system is designed to operate at 99.95% availability.

A charging segment does not contain any single failure point; the segment can operate in a partial configuration even if some of its components are inoperable.

A charging segment's preventive maintenance care does not require the segment's closure to traffic.

An analysis is required of the mutual effect on any vehicles being charged on the same segment.

Various requirements are predicted concerning the system's relationship with environmental conditions such as:

Temperature - -10 ÷70°C, including resistance to direct sunlight

Ingress protection - IP68 as perEN60529

Humidity - up to 100%

Electromagnetic compatibility EMC: 2014/30/EU, with an emphasis on proximity to an electric railroad track

Wireless charging - IEC 61980:2015

Electricity - LVD: 2014/35/EU

Shocks & vibrations - ENV EN60068

Wind resistance - SII 414

Lightning resistance - SII 1173

Earthquake resistance - SII 413

3 Requirements of the Charging System in the RPEV (Road Powered Electric Vehicle)

The charge rate is unaffected by the vehicle's speed. Alternatively, full-scale performance charging is required at speeds of up to 150 km/h.

Safety

The system requires a solution for preventing electrocution during vehicle maintenance.

The system requires resistance to operating near the sea (humidity with salinity).

Conditions are under regulation regarding preventing the effects of electromagnetic fields on the vehicle's systems, cargo, and passengers.

Conductive power transfer charging requires a mechanical solution for a scenario in which a vehicle (RPEV) undergoing charging from the road is forced to perform an emergency maneuver.

Wireless charging requires assurance that the space between the energy receiver to the road is sufficient for all roadway disruptions and obstacles (for all road types, including crossing slanted inclines at parking entrances, speed bumps, and the like).

Availability

The vehicle's system is designed to operate at 99.95% availability.

Periodic maintenance of the system installed in the vehicle is performed approximately to the vehicle's periodic service visits to the garage.

Regulated requirements concerning environmental conditions, such as;

Temperature - -10÷100° C, the manufacturer may propose another temperature range. Conditional upon the test results confirming the system's positioning on the vehicle.

Opacity- IP66 as perEN60529

Humidity - up to 95%, without condensation

Electromagnetic compatibility EMC: 2014/30/EU, with an emphasis on proximity to an electric railroad track

Wireless charging - IEC 61980:2015

Electricity - LVD: 2014/35/EU

Shocks & vibrations - ENV EN60068

Wind resistance - SII 414

Lightning resistance - SII 1173

4 Compulsory Standards

The system requires compliance with all the relevant standards for the entire duration of these operations, as defined in the Individual Referrals framework. For an indication and as a non-compulsory and non-exhausted

requirement, see Appendix B below, a partial listing for the standards relevant to the date of the Tender's publication.

Appendix A' - A List of Abbreviations

Abbreviation	Meaning
EM	Electromagnetism
ea.	Each
AH	Ayalon Highways
SII	Standard Institute of Israel
EMC	Electro-Magnetic Compatibility
EN	European standards
ENV	Environmental
FCC	Federal Communications Commission (USA)
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
LVD	Low Voltage Directive
POC	Proof Of Concept
POD	Proof Of Design
SAE	Society of Automotive Engineers
	To Be Determined
	To Be Revised
UL	Underwriters Laboratories

Appendix B' - A List of Compulsory Standards

Symbol	Standard	Comments
EMC 2014/30/EU	Electro-Magnetic Compatibility	
EN50121-4	Railway applications - Electromagnetic compatibility Part 4: Emission and immunity of the signalling and telecommunications apparatus	
EN60529	Ingress protection	
EN60068	Environmental testing	
FCC Part 15	Electro-Magnetic Compatibility	
IEC 61851:2017	Electric vehicle conductive charging system	or SII 61851
IEC62305	Lightning protection standard	
ISO 6469-3	Electrically propelled road vehicles — Safety specifications	
	Safety Specifications for an Electric Vehicle	
ISO9001	Quality Management	
ISO 19363	Electrically propelled road vehicles — Magnetic field wireless power transfer — Safety and interoperability requirements	
LVD: 2014/35/EU	Low Voltage Directive	
SAE J 2836/6	Use Cases for Wireless Charging Communication for Plug-in Electric Vehicles	
SAE J-2910	Use Cases for Wireless Charging Communication for Plug-in Electric Vehicles	
SAE J-2954	Wireless Power Transfer for Light-Duty Plug-in/Electric Vehicles and Alignment Methodology	
UL 2022	Charging System Safety	Voltage Up To 600V
UL 2231-(1-2)	Standard for Safety for Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits: Particular Requirements for Protection Devices for Use in Charging Systems	
SII 413	Design Provisions for Earthquake Resistance of Structures	
SII 414	Characteristic Structural Loads Wind Load	
SII 1173	LIGHTNING PROTECTION SYSTEMS FOR BUILDINGS AND INSTALLATIONS: EXTERNAL PROTECTION SYSTEM	

For each standard, please use the most current, existing version.