

## TECHNICAL DESCRIPTION



**TECHNICAL DESCRIPTION**

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**1. INTRODUCTION**

The present document (TECHNICAL DESCRIPTION) provides the Bidders with the Technical Description of the Project “RFP-360/19: EXPANSION OF THE TRAMWAY DEPOT IN THE AREA OF ELLINIKO” and with information relating to the design, characteristics and its implementation. It includes the most important requirements on the design and the construction of the Project, which must be met and it specifies or clarifies the scope of the Project, in addition to that given in the Final Design drawings that are available and are provided by ATTIKO METRO S.A.

The Final Design List of Drawings of the Project is enclosed herewith (Annex).

**2. BRIEF DESCRIPTION OF THE PROJECT SCOPE**

The Project concerns the expansion of the existing Tramway Depot in the area of Elliniko.

The expansion of the Depot has been decided upon and has been planned in combination with the development of a new tramway line along the northern perimeter of the former Elliniko Airport, which, on the one hand, would replace the existing connecting (service) line of the Depot and, on the other hand, it would approach ARGYROUPOLI Metro Station, so as to achieve the optimal transfer from the Tramway to the Metro network.

For the Depot expansion needs, KED had conceded an area of 5,000 square meters in contact with the existing Depot. Approval of the Environmental Terms for the Depot expansion and the new Tramway Line had been granted by the Special Service of Environment of YPEN in 2012.

However, the development planned nowadays in the area of the former Elliniko Airport envisages the construction of a new tramway line which will approach – through a different alignment – ARGYROUPOLI Metro Station (and the Depot); this is the reason why the northern extension of the tramway line to ARGYROUPOLI Station, which was designed and licensed in 2012, will not be implemented and, thus, this Project concerns only the expansion of the existing Tramway Depot.

The scope of the Contract includes all required designs and works pertaining to Civil Works, as well as to Electromechanical and Railway Systems concerning:

- The construction of a new metal 70m x 43m open (along its perimeter) building/shed, to be built in an area of approximately 5,000 square meters, adjacent to the existing Tramway Depot; the new Depot will serve the needs for stabling twenty two (22) new tramway vehicles on eleven (11) parallel new ballasted tracks, each one being able to accommodate two (2) vehicles – lengthwise. The new tracks will be connected to the existing tracks of the depot via new railway turnouts at their ends, while the 750V DC overhead catenary system will be also expanded in order to ensure smooth circulation of the tramway vehicles on the new tracks. The area in-between the tracks underneath the shed shall accommodate the required small-height platforms that need to be constructed and that will be used for cleaning the vehicles. Due to the expansion of the depot and in view of managing increased

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tramway vehicles’ fleet, the Electromechanical and Railway Systems in the existing depot must also be updated.

- The execution of additional works within the existing workshop building for constructing two (2) new manholes / repair trenches and covering the operational needs arising from the Depot’s expansion and the supply of the new tramway vehicles.

It is stressed that in view of meeting the needs in Tramway vehicles that derive from the extension of the Tramway line in Piraeus, in progress is the contract for the supply of twenty five (25) new tramway vehicles to be accommodated both by the existing and the new Depot facilities in the area of Elliniko.

In summary, the scope of the Project includes the following works, not limited to them. Namely:

### 2.1 Survey Works and Designs

The Contractor shall proceed with further survey work and designs in order to prepare the Detailed Final Design (DFD) of the Project, as described in more detail in the Specifications, on the basis of the Final Design (FD) of ΑΤΤΙΚΟ ΜΕΤΡΟ S.A. and the remaining contract documents. The survey work and designs to be carried out by the Contractor shall include the following items, as a minimum:

- Surveying design and works – cadastral diagrams / tables.
- Inventory of the existing features.
- Geotechnical Investigation (GI) and Geotechnical Survey Report.
- Line horizontal alignment layout and profile.
- Horizontal alignment layout and profile of the line in the Depot placing emphasis on the points where the new tracks’ network is connected to the existing Depot tracks and verification of non-interference of the vehicles’ construction gauge – increased by the respective jerks due to horizontal curves – with the adjacent fixed structures.
- Inventory of existing features and design for the integration of the new tracks into the existing network.
- Investigation and checking concerning the location of Public Utility Organizations (PUO) Networks and preparation of designs for their required diversions and deviations.
- Designs for traffic diversions.
- Detailed Final Geotechnical Designs for excavation and temporary and permanent retaining of C/C structures.
- Structural Designs for all permanent structures of the Project (sheds, retaining walls, etc.).
- Designs for the introduction of soil improvement measures and measures for the protection of buildings and structures, on an as required basis.
- Designs for the temporary and permanent drainage of the Project.
- Designs for the reinstatement of worksites and other areas where construction activities are executed.
- Flood Protection Design during the construction and operation of the Project.
- Environmental Impact Assessment Studies during the construction and operation of the Project.
- Noise and Vibrations Design for the duration of the construction and operation of the Project.

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- Architectural designs (layout and architectural finishes).
- Designs for Electromechanical Works.
- Designs for Railway Systems.
- Design for the calculation of Stray Currents, during the operation of the Tramway System, and the determination of measures necessary for the protection of adjacent structures and facilities.
- Coordination design among Civil Works, Electromechanical Works and Railway Systems.
- Compilation of the Plan for Safety and Health File.
- Design for the temporary circulation of tramway vehicles within the Depot determining/scheduling all special operation requirements under a reverse running safe environment.

The surveys / investigations / designs are subject to ATTIKO METRO S.A. approval and in certain cases to the departments and organizations concerned (e.g. DEDDHE, OTE, EYDAP, Municipalities, YPEHODE, MoC etc.) before their implementation.

### 2.2 Preliminary Works

These include, indicatively and not limited to, the following activities:

- Review, verification and completion of the data available (surveying works, geological, hydrogeological, geotechnical, hydrological, urban and environmental surveys, investigation of PUO networks, examination of the condition of the buildings etc.).
- Relocation of PUO networks and providing assistance to the PUO organizations in performing their work in relation to this project.
- Dismantling and removal of materials of any type of structures (indicatively: dismantling of existing depot fencing, removal of former worksite offices – containers, backfilling of irrigation manhole, dismantling of other structures).
- Issuance of permits of all kinds.
- Worksite installations.
- Traffic diversions throughout the construction of the Project.

### 2.3 Archaeological Works – Removal of Ammunition

They include investigations, investigation trenches, excavations, recordings, conservation, safe-keeping – temporary storing of the archaeological finds etc., as described in the pertinent article of the Conditions of Contract.

In addition, valid shall be the content of Ministerial Decision (ΥΠΕΚΑ/ΕΥΠΕ/Τμ.Α'/203853/14.12.2012, ΑΔΑ:Β4ΜΨ0-Α2Υ) about the Amendment of the Environmental Terms and Extension of their Validity pertaining to Athens Tramway and of the respective information envelope of Article 13 of Η.Π. 11014/703/Φ104/14-3-2003 ΚΥΑ about the Renewal and Modification of the Environmental Terms of the Project “Modern Tramway System in Athens Area”. The aforesaid Ministerial Decision and the information envelope of Article 13 constitute an Annex of the Conditions of Contract.

It is stressed that the implementation of the Project calls for the performance of any works that may be deemed necessary for the investigation of the area and the

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removal of any ammunition of any type (e.g. bombs from II World War airplanes) that might be still within the boundaries of the work front pertaining to the tramway depot extension as well as in the areas of the new manholes/repair trenches of the existing Maintenance/Workshop Building of the Tramway Depot. Both the investigation and removal of the ammunition shall be performed by TENX - the special Greek Army Unit.

### 2.4 Civil Works (CW)

As shown on the drawings of the Final Design (FD), the Project shall include the following Civil Works – without being limited to them – which the Contractor shall perform in the framework of this Contract. All K.P.s referred to therein are at FD level and the final K.P.s shall be determined at the Detailed Final Design (DFD) level.

### 2.5 Trackwork related Activities

The scope of Trackwork shall include the design, procurement, installation and commissioning of all types and fittings of tracks for the Expansion of the Depot, in compliance with the Design and Performance Specifications for Trackwork, the contractual documents and the Technical documents, approved by ATTIKO METRO S.A. – in coordination with the different Systems it can interface with.

In addition, a Track Interconnection Design shall be prepared recording in detail the existing tracks at their connection points with the new ones, aiming at confirming the proposed alignment and determining the construction methodologies, the required adjustments as well as their coordination with the remaining systems.

### 2.6 Architectural Works

The Contractor shall construct all architectural finishes of the shed in the area of the new lines where tramway vehicles shall be stabled, the fencing of the depot expansion and the fencing of the archaeological area; he shall also proceed to the reinstatement of the worksite surface areas, as shown on FD drawings.

### 2.7 Electromechanical Systems

The scope of the project includes the installation of all necessary electromechanical and railway systems required for the new shed to accommodate/stable the tramway vehicles, its operation and the stabling management procedure, as well as the cleaning and other activities concerning both Series (Series I and II) of the Tramway Vehicles in Elliniko Depot. Tramway Vehicles Series I (34 vehicles) has been in operation since 2004, while the Tramway Vehicles Series II (25 new vehicles) is at the procurement stage on the basis of an independent Supply Contract of ATTIKO METRO S.A..

The electromechanical and railway systems to be installed or modified and are to extend – as required – the existing systems of Elliniko Depot are the following:

1. 750V DC (TPS) Traction and Power Supply and SCADA Systems
2. Overhead Catenary System
3. Earthing and stray current protection
4. Lightning Protection
5. Power supply – Low Voltage (400/230V AC)
6. Lighting

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7. Water Supply
8. Drainage – Sewage – Pumping Stations
9. Fire Protection
10. Building Management System
11. Signaling System
12. Closed Circuit Television (CCTV)
13. Wi-Fi Networks
14. Depot Vehicles Management System
15. RF ID System

The aforesaid systems are briefly described in the following units of paragraph 4.

Except the aforesaid the concern the new shed, modifications to the electromechanical systems shall also be implemented within the existing maintenance building of the depot in the framework of the construction of the new manholes (trenches) on tracks 5 and 7 of the subject building. These works are described in detail in paragraph 3.6 of this Technical Description.

### **2.8 Project Log**

The obligations of the Contractor also include the preparation of the Project Log and its submission to ΑΤΤΙΚΟ ΜΕΤΡΟ S.A., in line with the content of Ministerial Decision ΔΝΣγ/οικ.38108/ΦΝ 466 (FEK 1956, ISSUE SECOND, 07.07.2017, Content of the Project Log), and the relevant article of the Conditions of Contract.



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**3. DESCRIPTION OF CIVIL WORKS AND TRACKWORK**

**3.1 General Issues**

**3.1.1 Inventory of Existing Features**

Before his establishment in the areas that are to form the Project worksite, the Contractor shall proceed with a detailed inventory of all features of the existing conditions in the areas, which will be occupied for the execution of all works of the Contract and the traffic diversions.

This inventory shall be made with drawings, descriptions, tables of quantities, photographs etc. and shall include all the existing features, such as sidewalks, sumps or manholes of rainwater drainage and sewage networks, trees, lighting fixtures etc.

The above inventory is necessary to exist as the Contractor shall have to reinstate all areas occupied into their previous condition and put back all those features that had been removed during the execution of the works, unless the reinstatement of the areas in question is provided otherwise in the contract documents.

All the above drawings and documents shall be submitted in printed and digital form prior to the start of works for approval to ΑΤΤΙΚΟ ΜΕΤΡΟ S.A., the local Municipality and other agencies, in accordance with the relevant specification.

The inventory of the existing tracks at the connection points with the new tracks shall be presented in detail (as part of an interconnection design) so that, prior to the construction, the tracks interconnection – in coordination with the remaining Systems – be confirmed for the purpose of the sound operation of the unified Depot.

**3.1.2 Surveying Works**

A topographical survey recording was prepared in the past, which is included in the contractual documents.

Within the framework of preparation of the Project designs, the Contractor has to check and confirm the adequacy and completeness of the data given to him, in relation to any section of the Project; moreover, the Contractor shall perform all the survey works required for the updating, completion and compilation of new cadastral diagrams, for the expansion and supplementation of the survey recording in all areas required.

The system that will be used for all the METRO works shall be the EGSA 87 reference system.

The Contractor shall establish a Topographical Survey Department, as per Article 9 of the Design Specifications for Civil Works.

Also, the Contractor shall perform all the survey works required for the measurement and establishment of all the horizontal and leveling networks, which will be used for the execution of the works, the updating and completion of all the diagrams in the area where the contract works will be executed, including traffic related activities, at a width, as described in the contractual documents, as well as

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the preparation of new ones, where and if required, along with their connection with the basic horizontal and leveling network.

Generally, the Contractor shall perform all the surveying designs and works and the checks that will be required during all Project construction phases (alignment, control related activities etc.) according to the documents of the Specifications (see relevant Article of the Civil Works Design Specification).

### 3.1.3 Traffic Diversions

In view of occupying the worksite area for executing the construction works of the project and the works for the diversion and deviation of any PUO networks, the Contractor shall compile traffic detailed final designs for all diversions of traffic, at sufficient number of phases, in an effort to minimize any disturbance, which (designs) shall incorporate the required signs and signaling, the objective being as follows:

- The circulation of the public in the wider area must be diverted outside the Project execution sites towards the main by-pass roads;
- Access of residents to their properties located adjacent to the worksite area must be ensured;
- Emergency vehicles, such as ambulances, fire-fighting vehicles etc., must have unhindered access to all areas situated adjacent to the worksite of the project.

Having received the required approvals by ATTIKO METRO S.A. and the Services and Agencies concerned, the Contractor shall then proceed to the implementation of the aforesaid diversions, his constant objective being the safe execution of works and the safety of the people using the road network.

In the framework of implementing the aforesaid diversions, the Contractor shall provide for and construct or install traffic signs, cones, separation means, signalling tapes, traffic lights, temporary lighting and other items of equipment related to road safety, intended to the temporary traffic arrangements. In addition, and on an-as required basis, he shall construct the retaining walls. The traffic measures that have to be introduced, as well as the required items of equipment in view of ensuring road safety rules shall comply by all means with the current practice and the applicable specifications for the execution of works.

### 3.1.4 PUO Network Diversions

The scope of the project shall include the relocation of all existing PUO networks passing through within the project outline, in line with the instructions/designs and requirements of ATTIKO METRO S.A. and the corresponding organizations. The works concern the excavation of new trenches, the supply and installation of the networks in accordance with the specifications of the organizations, the backfilling of the aforementioned trenches and the reinstatement of the areas, in line with the instructions of ATTIKO METRO S.A., either at their initial condition (road pavements, sidewalks etc.) or as to be indicated by ATTIKO METRO S.A. It is hereby stressed that as concerns hydraulic networks, signalling and municipal lighting, the Contractor shall execute all works, while as regards the remaining networks, he shall execute only excavation and backfilling activities, as well as

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works for the construction of pits (manholes) and concreting works in passageways etc, unless otherwise requested by the organization concerned.

Existing networks mean underground and overhead PUO networks, regardless of whether they are active or not. These are the following:

- EYDAP and YPOMEDI DEPARTMENT OF HYDRAULIC WORKS OF ATTICA PREFECTURE (D10) (water supply, fire-fighting pipes, sewers and storm water pipes)
- DEDDHE networks (high, medium and low voltage cables)
- OTE networks (telephones) and all mobile telephony networks
- EPA (gas) network
- ILPAP network
- D.KE.O networks (traffic lights)
- Municipal Lighting networks
- Municipal Water Supply networks

The Contractor shall receive all design approvals and licenses required for the implementation of the Project. An indicative representation of the existing networks is shown on the drawings attached to the tender documents. It must be stressed that all locations of the networks are indicative.

The Contractor is obliged to make his own surveys in view of identifying all networks within the outline of the Project and to verify their exact locations through the performance of investigation trenches. In addition, the Contractor must execute investigation trenches at the positions to be indicated by ATTIKO METRO S.A.. For each investigation trench, drawings shall be prepared and submitted to ATTIKO METRO S.A., in line with the latter's instructions.

On the basis of the results of the investigation trenches and through the coordination meetings with the representatives of all PUOs and ATTIKO METRO S.A., the Contractor shall prepare the coordination drawing, showing the proposed relocations of all networks. The coordination drawing shall be submitted to ATTIKO METRO S.A. for approval.

All permanent relocations' routing must be performed in public areas.

The Contractor shall be fully responsible for the coordination among the agencies and for finding the a solution to be commonly accepted by them.

On the basis of the approved coordination drawing, the Detailed Final Designs for the PUO network diversions shall be prepared and then implemented.

The Detailed Final Designs for the diversions of DEDDHE, OTE and all mobile telephony networks, along with the diversion of the Natural Gas Company network shall be prepared by the Organizations themselves. However, the subject Organizations may require the Contractor to prepare the Detailed Final Design at hand.

The detailed final designs for the diversions of EYDAP networks (sewage and water supply), Department of Hydraulic Works (D10) (rain water), Municipalities (municipal lighting and Signalling) shall be prepared by the Contractor. The Contractor shall submit, at first, the Detailed final designs to ATTIKO METRO S.A. for commenting purposes. Having incorporated any comments on the part of ATTIKO METRO S.A., the Contractor shall then submit the pertinent designs to the

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Organizations for approval. In case, remarks are made on the subject designs by the Organizations concerned, the Contractor shall then be obliged to re-submit the designs – as foreseen by the contractual documents – since he is solely responsible for the final approval of the subject designs.

On a per case basis and if ATTIKO METRO S.A. deems that, for minimizing any disturbance caused to the city function, the pipe-jacking method must be implemented for the diversion of a certain network, the Contractor is obliged to implement same, further to ATTIKO METRO S.A. relevant instruction.

### 3.1.5 Worksite Areas – Worksite Installations

All works described in this Article are included in the Scope of the Project to be executed by the Contractor.

ATTIKO METRO S.A. shall introduce all necessary measures, so that the Contractor be given in time all required worksite areas, which shall include work areas and the remaining necessary auxiliary areas for the development of the worksite (areas for worksite equipment storing, storage of materials, Contractor's, ATTIKO METRO S.A.'s and other worksite offices).

The Contractor shall execute all his activities related to the Project within the boundaries of the areas to be made available to him by ATTIKO METRO S.A..

The Contractor's work area shall be the area of the Depot expansion and the perimeter road, as well as the area of the new manholes/repair pits of the existing Maintenance/Repair building, as specified on the respective drawings. Within the boundaries of these areas, the Contractor shall organize his work method and the sequence of the individual construction works to be followed by him.

However, in no case is the Contractor allowed to extend his activities beyond the areas to be made available to him by ATTIKO METRO S.A..

The Contractor must record the obstacles required to be relocated, removed, dismantled or transferred, adjust his requirements on the basis of the areas available to him by ATTIKO METRO S.A., as regards the extent of the required worksite area and its use exclusively by him, and proceed with the cleaning of the worksite area prior to the worksite installation and commencement of construction works.

The Contractor must prepare in a precise and detailed manner and submit to ATTIKO METRO S.A. for approval the inventory of existing features of the areas to be occupied, as well as the related reinstatement/configuration drawings upon the completion of the relevant works. Moreover, the Contractor shall submit the drawings for the demarcation of the boundaries of the worksite area, including all required information.

Additionally, the Contractor must comply with the terms of the Environmental Impact Assessment Study (EIAS) related to the operation of the Worksite areas.

The Contractor is responsible for the preparation and submission to the Agencies concerned of all information (diagrams, drawings etc.) required for the issuance of any kind of permits.

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The issuance of the relevant permits falls exclusively under the responsibility of the Contractor, who cannot request compensation or extension to a deadline due to a delay or non-issuance of the relevant permits.

The Contractor must take all necessary actions, in consultation with the responsible entities and with ATTIKO METRO S.A.'s concurrence, for the relocation or transfer of any installations and/or structures belonging to the Municipalities, other agencies or private entities, such as transfer and relocation of electrical switchboards, containers, kiosks, signs, sheds, removal of any obstacles, shafts etc. in the area to be used as a worksite; moreover, he must prepare the designs for the aforementioned activities that may be required and execute the required cleaning/dismantling works prior to the commencement of works during the construction and the final cleaning both of the installations and/or the worksite prior to the acceptance of the Project by ATTIKO METRO S.A..

Prior to the commencement of the works and in accordance with the specifications, the Contractor shall install a temporary safety fencing at the perimeter of the worksite in the Project construction area. Apart from setting the boundaries and protecting the worksite area, fencing must secure the trenches against flood water upstream. Upon completion of fencing of the worksite area, the Contractor shall submit to ATTIKO METRO S.A. an inventory of the fencing boundaries including the measurement of the area of the entire surface that has been occupied as a worksite area. It is hereby stressed that special consideration should be given to the worksite fencing at its boundaries with STASY S.A.'s Depot in operation.

In addition, the Contractor shall be responsible for ensuring and constructing entrances and accesses (of vehicles and pedestrians) to the properties disturbed by the occupations of the areas for the construction of the Project.

For the worksite area, the Contractor shall submit to ATTIKO METRO S.A. for approval a layout plan of the worksite installations with full data concerning their operation. This plan shall also indicate the methods to deal with the problem related to the access of pedestrians and vehicles to the neighbouring properties, the traffic arrangements and, eventually, the time scheduling related to the blockage of accesses for the supply of shops etc. The Worksite Installations Plan shall be revised in accordance with any changes that may occur throughout the Project, and shall be re-submitted to ATTIKO METRO S.A..

More specifically, prior to the commencement of works, the Contractor, must examine whether it is possible to have temporary accesses (apart from the permanent ones) and, where possible, to and from the worksite area, to meet the construction needs in the most effective way. The Contractor shall proceed with the construction of these accesses, having previously obtained ATTIKO METRO S.A.'s approval.

The works for the implementation both of the subject accesses and the worksite installations and structures include the removal of any disposed and overlaying materials/structures from the area to be used, the reinstatement works based on the contractual provisions (upon completion of works), the dismantling of foundations, fencing, parapet walls and other overlaying structures, the restoration of any differences in elevation as concerns the above, the removal/destruction of any temporary structure or auxiliary work, the asphalt paving works and any other work required.

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More specifically, as regards the permanent accesses, the Contractor must maintain them throughout the duration of the Project and proceed with their complete reinstatement (asphalt paving etc.) upon completion of works.

There might be an interface between the Contractor's work, the works related to the Tramway Depot already in operation (by STASY S.A.) and other construction activities to be executed during the same time period by other entities in the adjacent area.

At no additional compensation and throughout the duration of works executed at the Depot buildings, the Contractor is obligated to introduce all necessary measures so that STASY S.A. employees can unobstructedly continue their activities (as an example, the need to install temporary wooden yellow-painted anti-slip pedestrian crossings of the appropriate length, at all manual turnout points), to organize a plan of interfacing works-activities and comply with ATTIKO METRO S.A. suggestions as to the actions required to ensure the unobstructed execution of all activities of STASY S.A. and other Contractors outside the fencing in the framework of making good use of Elliniko area. For all the above, the Contractor is not entitled to any particular compensation.

The commissioning, the works related to the dismantling/removal of the worksite structures and installations and the reinstatement in full of the areas (to their prior condition) occupied by these installations, unless otherwise specified by the contract, shall be carried out within the deadlines foreseen in the Time Schedule for the construction of the Project, thus, limiting as much as possible the disturbance caused to the smooth operation of the area.

The Contractor must proceed with the reinstatement of the occupied worksite area and the PUO network diversions, the traffic diversions etc., to be effected in accordance with the Detailed Final Designs and the reinstatement plan approved by ATTIKO METRO S.A..

The worksite installation works related to the Contractor's activities, in general, shall be carried out at his own care, responsibility and expenses in areas not causing nuisance to the execution of works by himself or by other entities possibly executing works in that area, taking into account any provision required for the protection of the environment.

Within the available areas, the Contractor must proceed with the construction of fully equipped worksite offices to be used both by ATTIKO METRO S.A. and himself. In areas where ATTIKO METRO S.A. has a site office, the Contractor shall also have a site office. The worksite installations/structures related to the Contractor's activities, in general, including all the PUO provisions required for the subject Project (related to the offices and those required for the execution of construction works) shall be implemented in areas not obstructing the execution of other works by the Contractor or other entities probably executing works in that area.

Prior to the commencement of the contractual works, the Contractor shall submit to ATTIKO METRO S.A. a list of the E/M worksite equipment including the technical characteristics of this equipment, as well as its guaranteed performance. If, for any reason whatsoever, ATTIKO METRO S.A. considers that this electromechanical equipment cannot guarantee both quantitative and qualitative construction of the



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Project in the framework of the Time Schedule and the Contractor's contractual obligations, in general, it can order that this list is immediately replaced or supplemented. The Contractor must comply immediately with the above.

The Contractor must proceed with the supply and installation of the worksite equipment (E/M and other), the implementation and maintenance of the worksite installations/structures (offices, warehouses, sheds etc.) related to his activities, in general, including all connections, disconnections, PUO supplies required for the subject Project. The Contractor's obligations also include the payment of the PUO consumption related bills.

The consumption bills pertaining to PUOs and their surcharges (fees, taxes etc. collected through the bills) shall be borne by the Contractor.

The Contractor must survey accordingly and identify the appropriate locations for the connection of the temporary or permanent sewage removed from the Project area, through the city's network.

If the existing sewage network is considered insufficient and it is identified that there is a failure to discharge the pumped water into the existing sumps close to the point of their outflow from the pumps, this water shall be channelled to locations to be indicated by EYDAP at the Contractor's cost.

The Contractor must implement all necessary procedures and pay all related expenses for the installation of the appropriate substations and the construction of the necessary networks for the transfer and distribution of the electrical power to be required for the Contractor's works, from the points of power supply to the points where power is used.

In any case, the dismantling and removal of the installed equipment, the PUO worksite supplies etc. constitute the Contractor's responsibility and liability.

If, for any reason whatsoever during the construction of the Project, it is required to remove or relocate any worksite installation/structure, the Contractor must proceed with all necessary actions.

The Contractor must pay the Municipal fees and taxes for the entire worksite area, as well as all expenses related to the operation, maintenance and cleaning of the subject worksite area.

Inside the worksite area, the Contractor shall have the obligation to provide the necessary transportation modes for the safe transfer of the appropriate personnel. Moreover, the Contractor shall accompany the aforementioned members of his staff during these transportations as and if requested.

In addition to the above, the Contractor must ensure the safe transfer of his personnel, or ΑΤΤΙΚΟ ΜΕΤΡΟ S.A. personnel within the Project area. In any case, however, the applicable safety related provisions should be met.

The Contractor must also see to the maintenance, cleaning and keeping in good condition of his and ΑΤΤΙΚΟ ΜΕΤΡΟ S.A.'s worksite offices, as well as to the supply of consumables and equipment necessary for the operation of these offices. Moreover, the Contractor must provide additional sanitary facilities, in case the

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number of his or ATTIKO METRO S.A.'s employees increases, to meet the required hygiene conditions.

The Contractor must extract/dismantle and remove from the worksite any temporary installation/structure, including any propping, foundation slabs etc., waste, tools, scaffolding, machinery, redundant materials useful or useless, temporary machinery installations etc and repair or re-construct parts of the road pavements, sidewalks, buildings etc. that suffered damage due to the execution of the Project, at his cost and prior to the delivery to ATTIKO METRO S.A. of the areas of the worksite, upon completion of the relevant parts of the Project. Moreover, he is obliged to remove or destroy/dismantle every auxiliary installation to be indicated to him by ATTIKO METRO S.A. as useless or detrimental to the future operation, to level the areas where the above were placed or were installed, to deliver the areas of the worksite in their previous condition totally clean, unless otherwise suggested to him by ATTIKO METRO S.A., and, in general, to see to any other activity required for the delivery and smooth operation of the Project, in accordance with the terms herein.

Upon completion of works, the Contractor shall deliver the areas reinstated in full, as also mentioned in the Project Specifications. All areas of the worksite can be visited by third parties with the permission of ATTIKO METRO S.A..

The Contractor must immediately comply with the above, while the related expenses shall be exclusively borne by him.

All the above obligations of the Contractor shall be fulfilled at his care, responsibility and expenses.

**3.1.6 Geological Conditions in the Project Area – Geotechnical Investigation, Geotechnical Investigations Report**

The geological conditions in the Project area are described in brief in Article 2 of the document “Design Specifications for Civil Works”.

The Contractor shall perform a Geotechnical Investigation (GI) and shall compile Geotechnical Investigations Reports, on the basis of which he shall ultimately determine the geotechnical conditions, in accordance with article 2 of the document “Design Specifications for Civil Works”. The determination of the geotechnical design parameters to be used in the Geotechnical Designs for all parts of the Project shall be based on the GI results.

**3.1.7 Temporary Drainage**

During the construction of the Project and, in particular, of the expansion of the Depot, excavation works shall be performed in an area of approx. 5,000m<sup>2</sup>.

The Contractor shall construct a temporary system for the collection, cleaning and discharge of water collected in the worksite, in accordance with the requirements of the contractual documents.

Water to be drained can derive either from penetrations of the ground water table or from usual rainfalls. The drainage system should ensure that the permanent works shall be constructed in dry conditions and shall be protected against the uncontrolled water inflow.



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The water collection network shall consist of perforated pipes, pits, tanks and pumps for water discharge.

Cleaning of water shall be effected in a settlement tank using a degreaser, if required, so that water discharged to the city network shall meet EYDAP's quality specifications.

### 3.1.8 Permanent Drainage of the Depot

The drainage network in the Depot serves two purposes: the drainage of tracks and of various places due to storm water seepage and the sewage of storm water coming from impenetrable surfaces (e.g. shed) and, finally, their transfer downstream to suitable sumps.

Thus, the Depot related Project is dimensioned for usual rainfalls with a return period of 5 years (T=5 years), per the Existing Detailed Final Design for the Sewage of Elliniko Depot, it shall be protected (T=5 years) and rain/storm-water shall be channelled through the installation of a permanent drainage network. At the same time, the surrounding area shall have the suitable slopes in view of the smooth discharge of rain/storm-water.

The new network shall consist of the following items of equipment, namely:

- Perforated PVC pipes, external diameter  $\Phi 200$ , L=157m long to be placed, via a suitable layout, underneath the tracks of the tramway network in the areas with penetrable surfaces. These drainage pipes shall be sloped (2%) (see typical cross section drawing).
- Slab tracks drainage layout.
- The depth and slop of the drains' gravity sumps shall be such that the water be satisfactorily channelled downstream and then towards the existing rainwater sump A.2.3 of the Depot.
- All 24 terminal manholes of the shed gutters to accommodate the rainwater discharge of the shed; dimensions: 40x40x50 cm.
- The runoff of the terminal manholes shall terminate, via non-perforated PVC pipes - diameter  $\Phi 200$  and L= 96 m – at the perimeter pipe collector – diameter  $\Phi 400$  - and, further on, downstream, to the existing manhole A 2.3.
- The perimeter pipe collectors made of reinforced concrete – diameter  $\Phi 400$  and L= 211,5 m – to collect the runoffs of the new shed and of the drains (see depot rainwater drainage drawing).
- The pipes to channel the rainwater to the existing manhole A.2.3 made of reinforced concrete – diameter  $\Phi 600$  and L= 54 m.
- The elevation of the existing junction manhole bottom shall dictate the gradient of the new pipes. In combination with the almost zero gradient of the configured surface, the minimum allowable gradient (0.5%) shall apply.
- The manholes, which shall be spaced every 50 m along the new collecting and channeling pipes.
- The manholes shall be of circular cross-section. They can be either cast in-situ or prefabricated. Their internal diameter shall be 1,20 m (manhole type EO1 and EO1a) if the diameter of the largest junction pipe is max.  $\Phi 500$  and

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1,50 m (manhole type EO2) for larger pipes (up to  $\Phi 800$ ) (see typical details drawing).

- The channeling pipe shall be connected within the depot area to the existing manhole A 2.3; its bottom elevation shall be +30.54 m.
- From that point, via the  $\Phi 700$  existing pipe and the existing intermediate manholes, the rainwater shall be channelled to the city network.

The Contractor shall prepare a Design for the Permanent Drainage of the Depot - at DFD level – in line with the requirements of the contractual documents.

### 3.1.9 Temporary Flood Protection

During the construction period, the Contractor shall introduce all necessary measures so that the flood discharge of the wider area, caused by usual rainfalls, not to enter within the worksite area.

The required protection can be achieved through several layout schemes.

As an example, the following are hereby indicated:

- Installation of concrete parapet walls, to ensure protection of the trenches.
- Placement of sandbags for the diversion of the water flow.
- Waterproofing the worksite fencing (sealing of the holes of the worksite precast concrete segment blocks).
- Mobile pumps and piping to remove accumulated water.

The Contractor shall prepare a Design for the Temporary Flood Protection of the Depot - at DFD level – in line with the requirements of the contractual documents

### 3.1.10 Permanent Flood Protection

During the operation of the Depot, all structures and, mainly, the fencing shall be at an adequate elevation so that the rain/storm water be discharged downstream via the perimeter road network and the Depot be protected against water ingress for a flood with a return period of 50 years ( $T=50$  years). At the same time, the surrounding area shall be given the appropriate slopes for the smooth channelling of the rain/storm water.

It is hereby stressed that the flood protection measures must not increase in any way what so ever the adjacent properties' flooding risk.

The Contractor shall prepare a Design for the Permanent Flood Protection of the Depot - at DFD level – in line with the requirements of the contractual documents.

### 3.1.11 Soil Improvement / Strengthening, Protection of Buildings / Structures within the Influence Zone of the Project

During the execution of works, proper care shall be taken so that no disturbance or damage be caused to the third parties' structures (buildings, pipes/ducts, networks, facilities, antiquities etc.) located within the influence zone of the project and that their function be not affected.

### 3.1.12 Connection with the Public Utility Networks (PUOs)

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All structures of the Project shall be connected with the DEDDHE, OTE, Water supply, sewage etc. networks.

### 3.1.13 Reinstatement of Areas

Upon completion of the Project construction and prior to its delivery to ATTIKO METRO S.A., the Contractor shall proceed to the reinstatement of the occupied areas, including all areas of the worksite, at their prior condition (on the basis of the area survey that he ought to have performed) and shall install/place anew all items (trees, paving slabs, benches etc.) that had been removed, unless otherwise foreseen (as regards the reinstatement activities) by the contractual documents and the drawings.

The Contractor shall prepare Reinstatement Designs, in line with ATTIKO METRO S.A. Final Design (FD) and the respective articles of the Material and Workmanship Specifications for Civil Works.

In the Technical Report of the Reinstatement Design, the Contractor shall include an Acceptance Protocol to be signed by the Agency in charge (Municipality, Ministry etc.) ensuring that the Agency assumes and accepts the items proposed by the Contractor as equivalent to those recorded in the inventory of existing features documents, in which (inventory) the Agency, as well, should have participated.

### 3.1.14 Irrigation Shaft - Water jet drilling

The area of the Depot to be expanded accommodates the irrigation shaft (well), which serves the water supply related needs of the wider area, along with the needs of STASY S.A.

In the framework of the construction of the Tramway Depot expansion, the Contractor shall see to the complete sealing of the subject shaft – heightwise. This sealing shall be effected by the use of tremie pipes, and by means of watertight concrete, of the suitable class and workability properties and certified wash-out properties.

The entire equipment found nowadays either in the shaft or used for water supply and irrigation (pump, pipes, switchboard, piping network etc.) shall be dismantled, at first, prior to the sealing of the shaft and those items considered operational shall be delivered to ATTIKO METRO S.A. (which shall deliver them to STASY S.A.), while the remaining items shall be disposed for recycling (e.g. extended plastic pipes).

The scope of this Project includes the construction of a new water-jet drilling, for the irrigation and water supply needs, that shall serve the needs of STASY S.A. at a location to be indicated by ATTIKO METRO S.A. in cooperation with STASY S.A.. The Contractor shall proceed with all necessary actions with ATTIKO METRO S.A.'s support to obtain the required relevant permits for the execution and operation of the subject water-jet drilling by the agencies involved.

Especially, with regard to the execution of the water-jet drilling, a permit is required in accordance with the provisions of the Joint Ministerial Decision No. oik 146896/17.10.2014 “Categories of permits for the use and execution of works using water. Procedure and terms for the issuance of permits, content and duration and

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other related provisions”, as amended and applicable to the present date. Moreover, the Contractor shall proceed with all required actions, in accordance with the applicable legislation, related to the procedure for the issuance of environmental permits, if required, for the execution and operation of the subject water jet drilling.

The depth of the water-jet drilling shall be determined in cooperation with the Contractor after having investigated all related information, but shall not be less than 30m. The Specifications for the subject water jet drilling are described in the Article “Water Jet Drilling” of the “Materials and Workmanship Specifications for Civil Works”.

Moreover, the Contractor shall be responsible for the installation of the relevant equipment at the new location of the water-jet drilling (pump, pipes, filter, supports, switchboard, piping network, sensors in the tank for start/stop of the pump etc.), in accordance with the above, in order to meet the irrigation and water supply needs of STASY S.A., as the case was before the abolishment of the initial shaft. Water shall be pumped by the new permanent stainless steel submersible pump, while another similar pump shall be delivered to ΑΤΤΙΚΟ ΜΕΤΡΟ S.A. (which shall deliver it to STASY S.A. in its turn) as spare part.

The subject structure shall include a new switchboard for power supply, protection and automation to be connected with a supply from the central switchboard for power supply in the Depot. The pump shall be connected with a new steel pipe network routed underground for its interconnection with the existing water tank in the Depot based on the maximum possible routing. The irrigation tank operation shall be automatic, depending on the level of the tank, while the manual operation of the pump shall be also feasible. At least two (2) sensors shall be placed in the pump for safety and redundancy reasons. Provision shall be also made for the respective manholes, where required, as well as for water supply outside the Depot fencing for the irrigation needs of the Municipality – supplying the road vehicles (water supply trucks), using the appropriate key to secure the water supply.

### **3.2 New Lines for Stabling the Tramway Vehicles in Elliniko Depot**

#### **3.2.1 Layout of the New Lines**

##### **3.2.1.1 General**

The extension of the tramway network is imposed by the supply of the new tramway vehicles that have to be stabled and maintained into the existing Depot in the area of Elliniko. As regards vehicles stabling, provision is made for the construction of a sheltered area and the required tracks that should accommodate the stabling of twenty two (22) tramway vehicles. These new tracks shall be incorporated into the existing linework of the Depot and they shall be laid at the same TOR +33,80, maintaining the Depot’s anti-clockwise operation. Due to the decreased area available, tracks shall have the appropriate signs for the vehicles’ stop position, which shall be quite clear to the drivers, so that the whole capacity for the vehicles’ stabling be fully utilized and be strictly adhered to. The items of equipment and the installation of the aforesaid signage is included in the Contractor’s scope.

Access of the drivers to the tramway vehicles shall be ensured through two transversal pedestrian passageways, 1.5m wide each (the option for widening the subject corridor by 1-1.5m. shall be investigated), which shall be at the same level

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with the TOR. The six (6) elevated platforms situated between the building's (sheltered area) tracks to stable the tramway vehicles shall start from/terminate at the aforementioned pedestrian passageways, as shown on the attached drawings. The platforms' level shall be flush with the tramway vehicles' floor, to facilitate access of the wheeled items of equipment for cleaning and maintenance purposes, while transversal access from the two platforms to two pedestrian passageways shall be ensured via ramps. The platforms' width shall be variable, respecting the contractual transversal distances of the platforms' edges (stops) from the track axis, while the relevant construction methodology shall be also taken into account.

### 3.2.1.2 Track bedding

Trains shall access the stabling tracks (anti-clockwise movement) via a set of motorized turnouts installed in ballast (except for turnouts 1 & 2 which shall be installed in concrete with a top layer of asphalt to facilitate existing road traffic).

Trains shall exit the stabling shed via non motorized turnouts.

All turnouts shall be trail able.

Rails in asphalt paved areas shall be 60R2 grooved rails. Moreover, this type of rails shall be also used at ladder turnouts.

The rails of the rest of the turnouts to be installed, as well as the stabling tracks, shall be 49E1 vignole rails.

The ballasted rails at the Depot expansion shall be seated on sleepers of the following types: (a) prestressed concrete monoblock sleepers for plain tracks, and (b) wooden sleepers for turnouts.

In areas with concrete, rails and turnouts shall be welded, without fishplates, embedded in electrically insulated elastic pads to contain stray currents.

In ballasted areas, the rail joints at turnouts shall be fish plated, while plain tracks shall be welded fishplate rails, nominal length of 36m.

## 3.2.2 Steel Shed

### 3.2.2.1 Bearing Structure

The proposed shed, approximately 70m x 43m, shall be made of hot deep galvanized steel, painted in a color to be selected by ATTIKO METRO S.A., following the submittal of the relevant samples.

The bearing structure of the shed shall consist of trusses placed transversely and spaced at 13.01m. Each truss shall be supported by four metal columns, whose upper end shall be connected to the truss with articulated joints, while the bottom end shall be embedded in concrete. Truss cooperation shall be ensured using longitudinal members and horizontal wind resistant bracings (cross members).

The foundation of the shed shall consist of twelve (12) independent 6.50m x 5.00m footings, each one supporting two columns. The footings shall be connected lengthwise by means of beams 1.00m x 1.00m.

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3.2.2.2 Roofing

Shed roofing shall be divided into two categories: (a) panels for trusses and (b) panels for the superstructure.

(a) Trusses are prismatic. The central leg of the prism shall be covered with aluminium louvers, indicative thickness of 2mm, electrostatically painted, whose form and shape shall allow air flow, shall prevent rainwater ingress and shall be fixed on an aluminium profile. The remaining parts of the prisms shall be covered with painted cellular polycarbonate sheets, 20mm thick, approximately 0.60x3.00m, fixed on an aluminium profile. A special 2mm thick aluminium piece shall cover the edges of the prisms along their entire length.

(b) The superstructure of the shed shall consist of five (5) sections in-between trusses. A galvanized trapezoid plate at least 1.2mm thick shall be placed over the steel longitudinal members, to meet the bearing capacity requirements, which shall be painted on both sides with RAL 9006 Gloss electrostatic paint. A self-adhesive elastomer vapor-barrier bitumen membrane shall be placed on the trapezoid plate, shall be strengthened with polyethylene fibres and covered with aluminium foil. This membrane shall be subsequently covered by 50mm-thick non-combustible thermal insulation slabs (100 kgr/m<sup>2</sup> of mineral wool). A highly reflective 1.2mm-thick EPDM sealing membrane shall be placed on top of the thermal insulation. Fixation shall be mechanical using 30mmx1.5mm continuous (along the entire length of the membrane) steel plates (of galvanized steel sheet or polymer synthetic material) fixed with self-drilling screws on the trapezoid plate. Four (4) vertical cast iron Ø 100 mm gutters shall be placed at each end, properly sloped that rainwater flows into the gutters. The dimensions of the individual bearing elements of the roofing shall be finalized at the DFD stage after the approval of the respective structural design.

3.2.2.3 Platforms

Platforms shall be made of reinforced concrete, with a hollow rectangular cross section. The void of the hollow section shall be filled with expanded polystyrene mould. The bottom of the 12cm-thick horizontal part of the platform is seated on a 20cm-thick sub-base; a soil improvement layer of the appropriate thickness shall be placed below the sub-base, according to the specifications. The vertical reinforced concrete members shall be 20cm thick. The upper 12cm-thick horizontal part of the platform shall protrude by 20cm from the vertical elements and shall be covered with strong cement mortar at least 5cm thick, treated with hardener and anti-slip epoxy paint. All visible platform edges shall be painted with RAL 7044 anti-rust paint.

3.2.2.4 Pedestrian crossings

3.2.2.4.1 New pedestrian crossings



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The two (2) Pedestrian Crossings mentioned in paragraph 3.2.1.1 herein shall be made of a 18cm-thick reinforced concrete slab placed on the ballast. The top part of the slab shall be covered with strong, at least 5cm-thick, cement mortar coated with hardener and anti-slip epoxy paint. All visible edges of pedestrian crossings shall be painted with RAL 7044 anti-rust paint. The finally configured level of the pedestrian crossings shall be equal to the ToR level.

### 3.2.2.4.2 Replacement of steel pedestrian crossings in the existing stabling area of the Depot

Steel pedestrian crossings in the existing stabling area of the Depot shall be dismantled and replaced by new ones made of reinforced concrete slab, whose width and layout shall be similar to the width and layout of the existing pedestrian crossings. The new pedestrian crossings shall be constructed in accordance with the stipulations of paragraph 3.2.2.4.1.

## 3.3 Roadworks – Perimeter Road to Aghia Paraskevi Church

The Depot shall be expanded by 5,000m<sup>2</sup> at its SE side by installing additional tracks for the stabling of the new Tramway vehicles. Thus, the fencing shall be relocated by approximately 46,00m to the SE, and the perimeter road leading to Aghia Paraskevi church shall be demolished. There is no significant traffic load on this road, because it leads to a dead-end and it shall be used to reinstate traffic at the section extending from the former entrance of ETHEL Depot to Aghia Paraskevi church.

### Layout plan

In terms of layout, the road alignment shall follow the new Depot boundary.

The starting point of the new alignment (K.P. 0+000) is adapted to the existing road leading to the former entrance to ETHEL Depot. After KP 0+011, the alignment turns left and, via 20m radius S turns, is adapted to the boundaries of the new fencing of the Tramway Depot, occupying an area of the former ETHEL Depot. At KP 0+142, it turns right and, via 20m radius S turns, it terminates at Aghia Paraskevi church, where it is intergraded into the existing condition (KP 0+234.26).

Upstream, the perimeter road shall be adjacent to the former ETHEL Depot and shall be properly adapted in terms of elevations. Downstream, it shall not be at the same level as the Tramway Depot, thus a retaining wall must be constructed.

The total length of the subject road shall be 234.26m. Across the building of Aghia Paraskevi church, a suitable area shall be configured for U-turn (cul de sac), as shown on the layout drawing (S3GFDDRCIVARALLHO001A).

### Longitudinal profile

The longitudinal profile of the road shall be designed for the best possible integration with the adjacent points of contact with ETHEL former Depot. At approximately the first 10m the road layout remains unchanged. From KP 0+015 to KP 0+164, the road shall run at an inclination of 0.3% (for rainwater discharge) at the level of the former ETHEL Depot. Afterwards and up to KP 0+216.82, it shall run

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at an inclination of 6.36%, properly adjusted – heightwise- to the surrounding area of Aghia Paraskevi church.

### Cross-section

The basic features of the perimeter road cross-section are as follows:

- One traffic lane per direction, 2.75m wide;
- Sidewalk structure on either side of the road, 1.50m-wide at the side of the right boundary line and 1.00m-wide at the side of the left boundary line.

The right sidewalk is foreseen to be planted as described in the Environmental Study.

### Asphalt Road Paving Layers

Taking into account that no considerable loads are expected, the thickness of the road pavement shall be 0.40m, layered as follows:

- One asphalt layer, 0.05m thick.
- One base asphalt layer, 0.05m thick.
- Two road base layers (bottom and top), 0.10m thick each.
- One road sub-base layer, 0.10m thick.

Asphalt treatment coating shall be applied between the road pavement base layer and the asphalt base layer, while asphalt adhesive pre-coat shall be applied between the asphalt base and the asphalt traffic layer (see cross-section drawings).

## **3.4 Fencing**

### **3.4.1 Depot Fencing**

Fencing type a and b is foreseen to be constructed in the area of the Depot expansion. Fencing shall be uniform and shall differ only as regards the foundation structure (footing or retaining wall, respectively).

The new and the current fencing shall be similar and shall consist of a concrete wall, approximately 25cm thick. Steel hot deep galvanized posts of circular cross section  $\Phi 60$ , placed every 2.50m, shall be embedded the wall.

The height of the posts above the road surface shall be 2m and their top end shall be bend by  $45^\circ$  for a length of 50cm. Galvanized 4x4cm barbed wire, 3mm-thick, shall be spread among the posts and its edges shall tied to the posts using wire. A horizontal girder beam of circular cross section  $\Phi 60$  shall be welded to the top end of the posts.

Wherever the depot finished floor and the sidewalk of the new perimeter road are at the same level a door shall be constructed. It shall be a single-leaf opening door 1.00x2.20m similar in terms of construction and appearance to the existing doors of the fencing, consisting of two rectangular frames made of  $\Phi 60$  girders. Galvanized 4x4cm barbed wire, 3mm-thick shall be sandwiched between the two frames. The door shall be complete, with all required hardware related to its suspension, operation and safety.



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Fencing walls shall be founded either on footings, or on retaining walls (in areas of considerable height difference between the alignment of the Tramway corridor and the perimeter road leading to Aghia Paraskevi church). The retaining walls shall be L-shaped and their upper part shall be placed at least 50cm higher than the level of the sidewalk of the new perimeter road (where the elevation of the perimeter road is higher than the elevation of the Depot flooring); otherwise, the upper part of the fencing shall be placed 20cm above the configured surface in the Depot area. A structural design and a flood protection design shall be prepared at the DFD phase, providing the exact dimensions of the retaining walls, as well as their reinforcement. A 10cm-thick layer of cleaning concrete shall be placed underneath the fencing foundation.

### 3.4.2 Fencing of Archaeological Area within the Depot area

Fencing (type c) shall be provided for the Archaeological Area at the SE side of the Depot.

A 90cm-high fence, approximately 166.00m long, shall be constructed using rectangular frames 1.20x0.75m made of 16x40mm steel plates, whose vertical members shall be longer so as to be embedded in the foundation. Vertical Ø 12 mm rods shall be installed on one side of the frame, every 15cm. A rectangular girder 60x60mm shall be welded on the top of the frames (on the horizontal plates).

At the north side of the fence, a two-leaf opening door shall be constructed, 1.80m wide, consisting of two (2) steel rectangular frames made of 16x40mm steel plates, each leaf 0.85m (wide) x 0.75m (high), which are hinged on 40x40mm girder posts. Five (5) vertical Ø 12mm rods shall be placed on one side of the frame. The door shall be equipped with all necessary hardware. The entire fencing assembly shall be made of galvanized and painted cross sections.

The fencing shall be supported on individual footings made of reinforced concrete. The circular part of the footing shall be 15cm wide X 13cm high, while the footing's base shall be 20cm wide X 30cm high.

### 3.5 Sidewalks

The sidewalks shall be constructed on a 15cm-thick ground slab reinforced with mesh T 131. The surface shall be covered either with 40 x 40 x 3.5cm cement slabs, or with grit fair-faced beton, in accordance with the general reinstatement drawings and the section drawings for the Tramway corridor.

Cement slabs shall be placed on the ground slab using strong plastering mortar.

The grit beton layer shall be 5-10cm thick and shall be reinforced with single mesh T 131, to be tightened on dowels approximately 15cm long; 10cm of the dowel shall be embedded in the ground slab and shall be bonded using either an adhesive or special resin; the remaining 5cm of the dowel shall protrude to accept the mesh and be incorporated into the grit beton (4 dowels per square meter). The surface shall have transverse expansion joints (2cm thick) spaced at 60cm, with its final surface treated with a coat of hardener made of quartz aggregates and dry cement. The surface shall be washed a few hours later, or shall be treated with a roller or brush or horizontal bar to form a rough, anti-slip surface.

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The sidewalk towards the inner side and the opposite side of the road pavement shall be paved using relief and grinded sidewalk slabs (pebble type) 40x40cm, of excellent quality, at a color and design to be selected by ATTIKO METRO S.A. after the submission of the relevant samples.

Wherever old or new trees are present in paved areas, special cast iron protection grating is foreseen around the trunks, flush with the surrounding surface (for sidewalks in contact with the Tramway corridor).

### 3.6 Works inside the Running Shed – Inspection Pits

The Contractor shall execute Civil and E/M Works inside the Tramway Depot current Running Shed, in the areas of tracks 2, 5, 6 and 7. More specifically:

#### A. Track 7

All along the entire length of track 7, a new inspection pit shall be constructed extending to the length of one vehicle (i.e. approximately 35m). Inside the building, on the façade, an access staircase to the pit shall be constructed in the direction of the track. At the other end of the pit, another access staircase shall be constructed, whose exact location and direction shall be designed during the DFD phase. Priority shall be given to finding the most suitable location in relation to the existing access staircase of track 6, so that to avoid the need for the construction new staircase, if feasible, a fact that will reduce the useful area of the floor. During the execution of works for the construction of the pit (demolitions, concreting etc.), movement of people and fork lift machines on the transverse corridor (inside the black striping on the floor) as well as to/from the building façade and entrance, shall be ensured at all times.

The pit's cross section shall be similar to the pit at track 6 (see also drawings No. S3GFDDRARCDPALLPL003A and S3GFDDRARCDPALLGE001A). The current rails along the pit shall be dismantled and removed during the demolition of the floor slab. Apart from the required demolition of the ground floor slab (the affected area depend on the actual excavation surface, i.e. approximately 50cm outside the perimeter of the pits), parts of the existing foundation connecting beams shall also have to be demolished, as shown on the drawings. During the demolition of the floor and the connecting beams, a sufficient length of the existing reinforcement shall be preserved, which shall be bent and anchored on the pit walls. If deemed necessary during construction, additional connecting items shall be placed (dowels, additional reinforcement etc) to connect the existing connecting beams with the new walls. In any case, the appropriate measures shall be implemented to ensure cohesion between the existing structures and the new pit and the overall structural integrity of the building. New rails shall be laid on top of the pit walls, using an appropriate (adjustable) bedding system. The details related to the above shall be specified by the Contractor during the DFD phase.

A shallow channel shall be constructed along almost the entire length of the pit floor center, which shall be covered by a metal grid for drainage. This channel shall have a slope of 1% up to its end point near the building façade- where a drain shall be placed connected to an embedded  $\Phi$  100 pipe. This pipe shall channel water via gravity (sloping >1.5%) to the drainage pipe routed outside and parallel to the building. The drainage pipe shall be also fitted with an odour trap. The two aforementioned pipes shall be connected by local excavation and subsequent reinstatement.

On track 7, almost mid-way the new pit's length and at a distance of approx. 0.6m from either edge of the pit, a pair of inclined holes shall be drilled to the bottom,

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approximately  $\Phi 150$ , down the depth of the pit's bottom. The holes shall be lined with a polyethylene or polypropylene pipe of a respective diameter. At the point where the holes nears the pit's bottom, a small manhole shall be constructed (approximately  $0.25\text{m} \times 0.25\text{m} \times 0.3\text{m}$ (depth) where the aforementioned  $\Phi 150$  pipe shall terminate, and which shall be covered with a metal grid. The same work shall be repeated at the other side of the pit. The two manholes shall be connected to each other via another  $\Phi 150$  pipe embedded in the floor, transverse to the pit and below the drainage channel.

Thus, a zigzag routing shall be actually provided, running from the building floor on one side of the pit, to the floor at the other side of the pit, thus allowing the routing of flexible piping of the vehicles' lifting jacks which are currently routed (for track 6) from the interior of the elevated vehicle, in case a vehicle is required to be lifted using the lifting jacks. Alternatively, instead of holes, the Contractor can demolish a sufficient part of the floor slab of the current building to route the sloping  $\Phi 150$  pipes, as required.

The following E/M Installations shall be accommodated within the pit of track 7, namely:

1. Lighting ensured through LED lighting fixtures of the appropriate power and properly spaced, installed on both inside slopes of the pit underneath the concrete cantilevers; their cabling shall be routed within exposed galvanized steel pipes in their part running inside the pit. Lighting fixtures shall be supplied by corresponding existing lighting or power supply switchboards of the building, which will be complemented and upgraded accordingly (with material and cabling).
2. Power supply ensured through single-phase 230V sockets and through 24V sockets at unified units installed every 10m approximately along the one inner slope of the pit, fed by the existing power supply switchboards of the Depot, which will be complemented and upgraded accordingly (with material and cabling). Cabling for powering the sockets shall be routed within galvanized steel pipes in their part running inside the pit. Cabling routing from the power supply switchboards to the pit shall be ensured through the combination of:
  - i. Piping embedded in the floor, by dismantling the floor where necessary to create channels at the depth required, installation of cable ducts and re-concreting for piping embedding, in order to ensure the required structural integrity of the floor for the circulation of fork lifts or other equipment carrying equipment. This will be ensured with steel pipes for cable routing and the appropriate reinforced concrete lining.
  - ii. Horizontal and vertical routing of grids or galvanized cable ducts properly configured on building walls, supports or beams.

The above requirements on cable routing also apply to lighting cabling (see 1 above).

3. Water supply. Water pipes shall be routed on the inner slope of the pit opposite the slope where power supply sockets are configured. Water supply (water tap) shall be provided every 10m, i.e. there will be three (3) taps with a  $1/2$ " diameter along the pit per every vehicle length, which shall not be flush with the sockets on the opposite walls. Routing of the water supply pipes shall be similar to the routing of the cable ducts (see item 2 above) and shall run up to the point of the building where the existing water supply is located.

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The existing central water supply network of the building is configured in a closed loop at the ceiling of the basement and shall run vertically through galvanized steel pipes with a 3/4" diameter.

With regard to track 7, the new hydraulic water supply shall be ensured through a vertical run of galvanized steel pipes with a diameter of 3/4" where the isolating ball valve with a 3/4" diameter shall be also installed up to the first tap. At the section where the routing shall be embedded on the floor, the galvanized steel pipe shall be installed within an embedded U-PVC heavy duty pipe. The diameter of the water supply pipe shall be 1/2" after the first tap.

4. Supply of compressed air. Three (3) compressed air supply points along of stabled vehicle (approximately every 10m). Piping shall be routed in the same inner slope of the pit as the water supply piping, located, however, higher. Compressed air piping shall be routed up to a point where a compressed air supply already exists by means of a new compressed air supply pipe fitted with an isolation ball valve. Piping shall be routed similarly to the power supply pipe and shall be properly sized, so as to avoid increasing the existing compressed air supply unit (in terms of pressure losses due to the length and the diameter of the piping).

At the existing installation, the compressed air network shall be constructed by galvanized steel pipes. The same material shall be used at this phase of the new works.

5. Drainage. As already stated, it shall ensure the drainage of water/waste water eventually found inside the repair/inspection pit and directed to the existing outer duct of the building.

More precisely, the bottom of the pit shall be properly configured to retain solids. At its central part, a solids grid equipped with a retaining mesh shall be installed (between the bollards supporting the rails) with 16mm x 76mm openings (13mm x 71mm clear opening) at the entire length of the pits. Grids shall be removable at one (1) meter sections. A wastewater discharge drain shall be installed on each grid, as mentioned above. From there, water/waste water shall be directed to the two existing transverse discharge ducts through a floor trap.

Piping shall be routed inside the floor performing all necessary dismantling works to create channels with the appropriate depth and inclination. Further to the installation of the piping, the floor shall be re-concreted and restored.

Industrial waste discharge pipes shall be made of polypropylene or polyethylene of 16 atm with  $\Phi$ 100mm diameter.

6. Installation of one (1) portable fire extinguisher in every pit for each vehicle length (i.e. 1 in track 7, 2 in track 5 and 1 in the existing track 6). Fire extinguishers shall be placed adjacent to the ends of the pits.

The facilities shall be considered as complete once the necessary tests shall have been performed and shall be ready for revenue service under full load.

B. Track 6

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In Track 6 and adjacent to the track, the necessary modifications/arrangements shall be made to the floor, so as to ensure an access staircase to the inspection pit of track 7, as already stated, possibly in combination with the existing access staircase of the pit in Track 6. The exact layout/location of the staircases shall be specified in the Detailed Final Designs of the Contractor.

At the existing track, an additional pair of core sampling shall be performed on the floor on both sides of all pits, as described for track 7, for the underground permanent routing of the flexible piping of the vehicle lifting jacks.

### C. Track 5

In Track 5 a new inspection pit, whose length will be equal to the length of two (2) vehicles, shall be constructed. The pit shall have the same cross-section, characteristics and E/M support as in Track 7 (see A above). At the two ends of the pit which are located adjacent to the two ends of the building access staircases shall be constructed, while only one staircase shall be constructed around the middle of the pit possibly in combination with the existing access staircase of Track 6, a layout which will be finalized on a land-planning basis and with due accuracy by the Contractor at the Detailed Final Designs phase, so as to ensure access to the pits and safe circulation of employers and fork lifts inside the building.

In Track 5, two water supply pipes with a vertical direction one for each section of the inspection pit twice its length equipped with the corresponding isolation valves.

In terms of the drainage of track 5, the first section of the pit located adjacent to the façade of the building shall be drained through the same configuration with the one described for the pit of track 7, gravitationally to the existing drainage duct which is routed on the outside – in front of the building and parallel to it. The second section of the pit, adjacent to the back side of the building, shall be also drained to the existing drainage duct which is routed on the outside – to the rear side of the building and parallel to it. In any case, the connection of the two ducts shall be ensured with the relevant local excavation works, connection of the piping and reinstatement works.

Similarly, for compressed air supply in Track 5, two (2) connections shall be required one for each section of the trench – twice its length - with the corresponding isolation valves.

In any case, the intermediate corridor of the building, as delineated by the existing black stripping on the floor, should be kept as is at the final configuration of the building for use by the employers, the fork lifts and other special vehicles etc.. Nevertheless, continued access across the length of 2 vehicles shall be ensured in the pit. However, in this area, the pit shall be covered with concreted slab, it shall be properly dimensioned and situated. The content of Paragraph A in terms of the required dismantling works and the connections between existing and new structural elements applies. The sides of the pit adjacent to the aforementioned transverse corridor shall be equipped with openable/removable safety steel railing on the floor for the protection of the personnel, while their exact layout shall be finalized at the Detailed Final Designs phase.

At the central longitudinal section of the inspection pit of track 5 extending under the transverse corridor of the building, the area will be lowered at the appropriate depth to ensure a height of approximately 2.10 m under the overlaying slab (with staircases on either side enabling crossing by one employer). At this point, a drainage pit with twin pumps shall be constructed with a 2m<sup>3</sup>/h supply and a 3m manometric head each. Their dimensioning



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shall be verified or modified, if necessary, by the Contractor at the Detailed Final Designs phase.

The power supply of the pumps shall be ensured by the existing power supply switchboard supplemented with due materials and cabling. The routing of the depression piping and cabling shall be similar to the routing already stated, while additional switches and protection devices shall be required, which will be installed at an existing power supply switchboard to feed the pumps. The pumping sump will have the standard dimensions 0.8m x 0.8m x 0.8m and shall be covered by a diamond-shaped galvanized steel sheet. The floor of the pit shall be properly configured for water suction at the pumps.

During the construction of the central section of Track 5 inspection pit (i.e. in the area of the transverse corridor of the building), due coordination with STASY will be required for scheduling construction activities in the best possible way and for minimizing impact on the operation of the Depot for the least possible time period.

### D. Track 2

Track 2 inside the maintenance building shall be required to be extended by 15m lengthwise for vehicle bogies to be able to be moved manually to the adjacent area for maintenance/repair. The extension of the 2 rails shall follow the same track embedment applied in the existing track. Rail extension shall also require local dismantling of the intermediary masonry wall with the adjacent area with net opening dimensions 3 m (width) x approximately 2.2 m (height). In the framework of the construction works, the remaining masonry wall shall be properly supported through a metal frame to be embedded on the floor. At this opening, a steel shutter shall be installed that will electrically open/close by means of a button placed locally on both sides of the separating wall. The roller mechanism shall be powered by the closest power supply while cabling routing shall be ensured on trays and/or through galvanized pipes.

### E. Additional works in the area of tracks 5, 6 and 7

The following additional works in the area of tracks 5, 6 and 7 shall be required.

- a. The floor of the building, in the areas of Tracks 5 and 6, at the perimeter of each inspection pit at a 1.2m wide zone and at the length of a vehicle that inspection pits serve, shall be dismantled at a sufficient width (approximately 5cm) and reconstructed with hardened industrial floor in line with the applicable specifications using the appropriate highly resistant concrete (minimum C30/37) and the appropriate lining/coating for industrial flooring. The subject areas shall be perfectly levelled so that the vertical axes of the vehicle lifting jacks do not deviate from the vertical axis, ensuring their sound and safe operation. Before proceeding with the demolition of the floor, the limit of the dismantling works shall be marked on the floor. Within these limits the first 3 cm of the concrete width shall be cut with a disc cutter (i.e. without affecting the underlying existing reinforcement).
- b. The remaining floor of the building in the wider area of tracks 5, 6 and 7 both between the tracks and up to the adjacent walls, shall be repaired using the appropriate mortar, where necessary, and shall be coated with the appropriate paint for industrial floors.

The Contractor shall execute civil works inside the building at separate phases. In Track 7 in one phase and in Track 5 in three phases (one for each vehicle length and one for the central section crossing the vertical corridor of the building). During each phase of works, the area where dismantling and/or excavation works will be executed, followed by concreting works, shall be isolated from the remaining building with natural obstacles etc., namely,

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through continuous panels up to 2.5m high minimum and through nylon sheets raising up to the ceiling of the building, so as: (a) to ensure the safety of the personnel of the Depot, (b) to prevent pollutants (dust) from being transported inside the remaining of the building and (c) to limit the noise generated from executed works in the remaining inner part of the building. Alternative phases may be proposed by the Contractor in agreement with STASY S.A..

In addition, all the employees of the Contractor shall be fully advised on the standard works executed by the personnel of the Depot, the eventual impact of the construction works and on the measures and procedures which should be foreseen to ensure safety, with due attention on the circulation of the Tramway vehicles, the electrification of the overhead catenary system inside and outside the building, the electrification of other E/M systems already existing in the building, the lifting of tramway vehicles with jacks, the use of special tools and maintenance, repair and testing arrangements, the circulation of fork lifts etc.

Then, the installation of the aforementioned E/M networks and equipment at the two new inspection pits (5 and 7) and their connections with the central supplies and networks shall be carried out as soon as possible with due scheduling and in agreement with STASY S.A., since they also affect existing, already operating E/M facilities of the Depot. Each inspection pit where works are completed shall be delivered to STASY S.A. for use, while the relevant cleaning works in the area surrounding the new inspection pit shall have been previously performed in the most exemplary way removing and construction and other remaining matter.

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**4. DESCRIPTION OF THE ELECTROMECHANICAL SYSTEMS**

**4.1 Description of the electromechanical and railway systems**

**4.1.1 750V DC (TPS) traction power system and SCADA system**

The Contractor shall design, install, test and commission an expansion/modification of the traction system of the Tramway Depot in the area of Elliniko, so that it can support the operation of the new stabling shed. The main works shall be executed inside the Traction Substation, where new supply fields/return equipment shall be fitted, the busbars in the DC switchboards shall be properly extended; new cabling shall be installed for the supply of the overhead conductor; the necessary routing of the required DC and auxiliary cabling shall be foreseen (supply cables 230V AC distribution pillars, control cables of new overhead isolators etc.) running from the Traction Substation to the local supply and return Pillar switchboards (2 +2), near the shed and from that point to the overhead conductors and the rails; the required new connections and terminations shall be implemented; new protections, relays, shunts, ammeters, controllers, earthing etc. shall be installed as required.

Moreover, the entire necessary control and surveillance equipment shall be fitted, both at the new fields and pillars, and at the existing live equipment of the Traction Substation in the Depot (properly de-activating the control and surveillance equipment no longer required), along with all Programmable Logic Controllers - PLCs, the related cabling and auxiliary items, the data transmission equipment and software (for the system and applications, as necessary), so that the Substation of the Depot can be fully surveilled and controlled by the new power supply control system – SCADA that has been designed and shall be installed in the OCC by the Contractor of the Tramway extension to Piraeus, which must be properly expanded (has the full required expansion capabilities) by de-activating the surveillance and control of the Depot Traction Substation (No. 15) from the earlier SCADA system, both at a local and central level.

In order to implement the aforementioned interventions, the SCADA system of Substation No. 15 must be fully upgraded (hardware & software), at a level where making it functionally interfaced with the new SCADA system installed by the Contractor of the Tramway extension to Piraeus. More specifically, the Contractor shall examine in detail the optimum method of communication between the existing equipment in the Substation (DC breakers relays, MV breakers relays etc.) installed 15 years ago - working on specific com protocols - and the new upgraded local PC-server of the Substation.

It is stressed that the existing local PC of the SCADA system (in operation) in Substation 15 is not merely DIP, supporting only the communications of the subject Substation, but also a Full Server, which connects Substations No. 1, 6, 9 and 14 with the SCADA system. Since in the framework of this Project, the SCADA system will change and Substation 15 shall be surveilled and controlled by the new system, while Substation 1 (in the SEF) shall be transferred from the Piraeus Extension Contractor to the new SCADA system that he will install and the corresponding upgrading is not desirable for the remaining Sub-stations 6, 9 and 14, the existing PC that now controls Substation 15 along with Substations 1, 6, 9 and 14 shall remain active, so that the old SCADA system continues to survey and control only Substations 6, 9 and 14. Moreover, as regards Substations 15 and 1, the software of the old SCADA system shall be properly modified so as to indicate them as



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inactive or as if they do not exist, while it shall not be able either to survey or to control these Substations.

### 4.1.2 Overhead Catenary System

The 750V DC overhead catenary system of the Depot shall be extended to cover the new stabling area and provide power to the Tramway vehicles. More specifically, single-cable overhead conductor system cross section of 120mm<sup>2</sup> (no catenary) shall be manufactured for all new tracks.

The Contractor shall design, install and test the suspension system (foundations, masts, frames, whalers, cantilevers, struts, spring mechanisms, weights and tensioning wheels where required, couplers, clamps, insulators, auxiliary items etc.), the overhead conductor itself which shall supply power to the 11 new overhead lines, as well as its connection with the existing conductor; the overhead conductor within the shed area shall be properly suspended on the metal structure/trusses of the shed.

The entire suspension system should be properly earthed.

### 4.1.3 Earthing and Protection against stray currents

The Contractor shall design, install and test a fully operational earthing system, as required for the safe operation of the new stabling area and the protection of the personnel, with all necessary conductors, materials and connections, with particular attention to the risk from the live overhead catenary conductor and its operation.

The perimeter of the new metal shed shall be equipped with foundation earthing, in the form of a steel earthing band. Each metal column and all other required metal items related to the suspension of the overhead conductor, shall be connected with the foundation earth. The foundation earthing shall be also connected through a steel band and the suitable couplers at two different points as a minimum with the existing galvanized band at the perimeter of the Depot.

### 4.1.4 Lightning protection

In connection with the lightning protection of the new metal shed of the Depot, one (1) separate additional enhanced ionisation lightning arrester of an appropriate protection coverage shall be designed and installed and shall be mounted on a mast, at least 16m high, with suitable tensioners. The exact installation point of the lightning arrester shall be determined following a pertinent design, taking into account the locations of the other lightning arrestors in the Depot, to ensure optimum coverage. The mast shall be seated on a concrete base. A triangle with earthing bars shall be constructed near this base where the lightning conductor shall be connected to.

### 4.1.5 Low Voltage (400/230V AC) Power supply

The Contractor shall design, install and test of a fully operational LV (230/400V) power supply distribution system to meet the needs of the new shed and the neighbouring area, which (system) shall be connected with the existing General Low Voltage Switchboard (GLVS) located in building No. 5 of the Depot. The system shall include the new switches, protection devices and cabling from the GLVS S/B to the secondary distribution switchboards, the secondary distribution

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switchboards, the cabling to the consumptions, the cable trays/ducts, the single/three-phase sockets of the shed, as well as and any other item required.

The sockets to be installed in the new shed/stabling area shall be single-phase industrial schuko type sockets (16A-230V), three-phase type sockets (16A-400V), in accordance with the drawings.

The Contractor shall also provide all necessary power supplies to the new systems to be installed, such as for example the CCTV cameras, the signalling system and point machines, the Depot management system and elsewhere. The Contractor shall also upgrade the power supplies as required in the Depot systems that have to be modified or upgraded.

As regards the cable routing from building No. 5 to the new shed/stabling area, the Contractor can use the existing embedded cable ducts, provided there is sufficient availability, without exceeding the maximum capacity of these ducts. The Contractor shall submit a relevant design to ΑΤΤΙΚΟ ΜΕΤΡΟ S.A. for approval. Otherwise, a new routing must be implemented in separate ducting work parallel to the existing routing.

### 4.1.6 Lighting

The Contractor shall design, install and test a fully operational lighting system in the new shed/stabling area in the Depot. The subject system shall include a lighting auxiliary panel, connection with the GLVS in the Depot Substation, natural light sensors (automatic switching ON/OFF for energy savings), materials, switches, cabling, lighting fixtures, routing, trays, cable conduits, supports and any other item required. The design and installation shall meet the lighting needs under normal operation conditions, emergencies and safety lighting. The lighting fixtures shall be of industrial bell type, and independent lights for emergency lighting. All lighting fixtures to be installed shall be equipped with LED type units.

Moreover, the Contractor shall be responsible for the dismantling of the lighting masts running along the current Depot boundary, which shall be removed in view of constructing the new shed and be placed back along the new Depot fencing. The Contractor shall be responsible for the installation of new cable manholes, trays, lighting bases, masts, cabling and of any other item required for the workmanlike installation of the masts and lighting fixtures in the new fencing area, so as to meet the lighting related specifications.

### 4.1.7 Water supply

The scope of the Project includes the extension of the existing water supply network in the new shed area.

More specifically, the Contractor shall design, supply, install and provide cold water for two (2) wash basins to be installed in the new shed area, between tracks 6 and 7, near the shed ends (their indicative positions are marked on the relevant drawing), as well as and any other item required for the new system to be fully functional, such as pipes, manholes, valves, collectors, cocks etc.

In the existing pumping station for water supply, a new 1” galvanized steel pipe shall be connected to the water supply collector; this pipe shall have a shut-off cock of the same diameter. The material of the pipe shall change and the pipe shall be made of cross-linked polyethylene with a diameter of Ø32 mm, when the network is routed underground. In the new shed area, between tracks 6 and 7, a manhole with a shut-off cock shall be constructed, to isolate the network and then the pipe shall

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supply the two (2) cleaner’s sinks to be installed in accordance with the architectural suggestions and requirements. The installation shall undergo a normal operation test.

All preventive measures must be implemented to avoid any contact between the water supply pipework and the reinforcement of at all points where they meet. Pipework shall be connected to the building’s earthing system.

During the shed’s foundation construction works, the existing irrigation shaft must be removed. The scope of the contracting work includes the installation of a new irrigation pipe (same diameter and specifications) at a new location, as well as its connection with the existing water supply network.

The Contractor shall be responsible for the construction of manholes, shut-off cocks and other spare parts, to keep the existing irrigation system of the Depot operational during construction period. Moreover, the Contractor shall be responsible to carry out the required tests to verify the proper operation the new irrigation system upon completion of works.

### 4.1.8 Drainage – Sewage – Pumping Stations

The Contractor shall design and install a rainwater/sewage network in the new shed area, for the purpose of collecting and discharging the foul and rainwater into EYDAP’s networks. The new network shall include all pipework, drains, channels, manholes, cleaning outlets and any other item required for collecting the foul water from the cleaner’s sinks and its discharge to the existing sewage network of the Depot, as well as for discharging/draining the storm water from the inclined shed roofs.

Moreover, the Contractor shall be responsible for the relocation of the existing sewage manholes and the respective pipes to an appropriate location, as that the manholes are accessible and compatible with the track alignment and location in the new stabling area.

The sewage installation shall include the collection of foul water through gravity flow from two (2) cleaner’s sinks to be installed in the new shed area, between tracks 6 and 7 (indicative locations are marked on the relevant drawing), where foul water shall be directed to the existing wastewater tank near the south corner of building 1A via an underground pipe and intermediate sewage manholes, wherever sewage pipe direction changes.

The subject network shall be constructed using plastic pipes made of hard PVC 6 ATM. The sewage networks in the surrounding area shall be constructed using plastic pipes made of hard PVC and shall be connected to each other by means of rubber sealing rings, allowing lengthwise expansion, suitable for underground installation. The gradient of the sewage pipes in the surrounding area shall be at least 1.5% and their minimum cross section shall be Ø100 mm.

At the points where the sewage network is located at a depth of down to 1.20 m and it runs underneath roads or various areas with eventual future vehicular traffic, it shall be embedded in concrete. If the network runs at greater depths, embedment is not necessary, but special attention shall be paid to the backfilling materials.

Rainwater shall be discharged from the roofs via collecting channels (horizontal semi-circular gutters) made of galvanized metal sheet at the low points (on either side of the gables); rainwater shall be channelled via vertical gutters made of galvanized steel pipes terminating at rainwater manholes at ground level. These manholes shall be connected with the storm water network made of PVC at the

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perimeter of the building, as well as with the rainwater manholes in the surrounding area.

The drainage of the surrounding area shall constitute the scope of a special design, according to the final elevations and the track installation level. If required, the Contractor shall properly configure the routing of the sewage network located outside the Depot boundary, to make it compliant with the final configuration of the surrounding area and the final elevations.

Installations shall undergo testing under full load conditions.

### **4.1.9 Fire Protection**

The Contractor shall design, install and test an active fire protection system in the new stabling area, which (system) shall include a wet pipe fire fighting system, to be used by the personnel or by the Fire Department, as well as portable fire extinguishers properly located in the new building, as required. The new wet pipe fire fighting system shall be connected with the existing fire fighting collector located at the respective pumping station. The Contractor shall design the extension of the water-based fire fighting network and shall verify the ability of the existing equipment to serve the needs of the new stabling shed network, according to the standard requirements of the Fire Department. The new network shall be tested against the worst case scenario of the most remote Fire Hose Cabinet.

### **4.1.10 Building Management System**

The Contractor shall connect the new switchboard for local lighting and sockets with the existing Building Management System (BMS). The switchboard shall be connected with the local control unit of building 4 and shall transmit signals to switch the lighting fixtures of the new shed ON and OFF, as well as to confirm system status mode. The Contractor shall modify accordingly the central PC in the OCC to display the new shed on the BMS.

### **4.1.11 Signalling and Point Machine Control System**

The Contractor shall design, install and commission the appropriate Tramway Signalling and Point Machine Control System of proven technology, and its interfaces with the new expansion of the Tramway Depot in the area of Elliniko. All point machines must be secured via a system that detects an approaching vehicle and blocks any point machine operation attempt. The scope includes the entire package required to deliver a reliable signalling and point machine control system by installing traffic lights, indicators, signals/signs, point machines, point machine control mechanisms, vehicle location detectors, cables, manholes, power supply, auxiliary panels, connections and any other required item.

The Contractor shall also supply and install, where deemed necessary based on the applicable regulations, the reflective signs; the Contractor shall re-arrange and upgrade the existing road signage and shall install a new one, where deemed necessary for the cases where the routes of Tramway vehicles cross in the Depot.

If existing equipment is abolished, the Contractor shall dismantle the outdated equipment, in communication with and at the approval of ATTIKO METRO S.A. and dispose them in an environmentally friendly way.

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The Tramway Signalling and Point Machine Control System shall consist of all those items allowing safe and controlled movement of Tramway vehicles within the boundaries of the Depot, as well as with other vehicles within the boundaries of the Depot.

The following are valid:

### Interoperability with the existing system

In the framework of the design and implementation of the Signalling and Point Machine Control System in the subject area, the Contractor shall follow the rules governing the operation of the current Tramway system, so as to avoid the establishment of new operation rules to the extent feasible. The technology of the new equipment to be installed must render it fully compatible with the technology of the interfaced existing equipment of the various systems and rolling stock systems.

### Movement of Tramway vehicles in the Depot during the execution of the Project

At the stage of interfacing the existing Project with the Depot expansion Project, entry to the Depot shall no longer be from the depot access track and the inbound vehicles shall travel to the existing berthing space via the Depot departure track. This movement shall be implemented via turnouts No. 5 and No. 6, on the basis of reverse movement procedures to complete this movement; thus, the electrically-driven point machine No. 6 must be temporarily replaced, due to the existing controller's inability to control the machine, by a manually operated mechanism and a spring back action. Upon completion of works, the electrically-driven point machine shall be re-installed and the manually operated one form part of the Project's spare parts. In case point machine No. 6 is rendered controllable before the commencement of works, there is no reason to replace it. Similarly, due to various restrictions, Tramway vehicles shall exit the maintenance and repair tracks travelling to the stabling area using the stabling area exit tracks.

For reasons of smooth operation during the implementation of the aforementioned interface, the Contractor shall implement all required measures to facilitate personnel and to ensure the safety of movements. For example, access shall be facilitated to all manually operated point machines via clearly marked pedestrian crossings, proper signage shall be provided to prevent reverse routing errors, telephone sets shall be installed at specific points for communication with the OCC.

### Movement of Tramway vehicles in the Depot after the completion of its expansion

The Depot expansion shall incorporate up to eleven (11) new pocket tracks as the side of the existing perimeter track.

Entering the stabling tracks shall be effected by adding a Ladder turnout. Exiting shall be similar by adding a ladder turnout. A traffic light shall be placed at the entry point to select a route to a specific berthing place. The operation of track 28 shall be modified and it shall be used as free pass track.

Shunting on either direction (moving backwards) is not signalled and not controlled by the system; however, in cases where this is deemed imperative, it is effected in the presence of personnel from the Operations Department based on a specified procedure.

### Point machine control system

The Contractor shall install a point machine control system, which shall function as route controller and shall serve at the system that controls the movement of electro-driven point machines and the position of the turnouts for the safe and correct routing of the Tramway vehicles. The system consists of individual control units.



## TECHNICAL DESCRIPTION

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Depending on the geographic location of the turnouts, the Contractor can group the individual turnout control units into a single cabinet to be installed near the controlled point machine(s).

### Point machines

The Contractor shall install nineteen (19) point machines in nineteen (19) turnouts of the trackwork. The point machines shall be complete, with all their spare parts, accessories and control equipment. The Contractor shall also install similar turnout position indicators near the respective point machines that shall indicate the position of the switch-rails.

### Tramway vehicle detection system

The Tramway vehicle detection system to be installed by the Contractor shall consist of the appropriate equipment capable of detecting the Tramway vehicle within the associated control area. This system shall be either track circuits and/or mass detectors.

### Railway light signals

The Contractor shall install railway light signals to serve the movements within the area of expansion/shed, as well as the movement to result on the basis of the comprehensive train route logic conditions.

### Power supply to the Equipment

The Contractor shall provide the power supply equipment for the signalling and turnout control systems. The point machines remote control systems must be fed from a line independent to the traction power line so that, in case traction power is lost, the remote control systems are not affected.

The Contractor shall integrate the loads feeding the signalling and turnout control systems into the Uninterrupted Power Supply (UPS), which shall be properly dimensioned and installed in an suitably protected and housed area, properly rated in terms of loads and autonomy.

#### **4.1.12 Closed Circuit Television System (CCTV)**

The Contractor shall design, install and test a new completed Closed Circuit Television System (CCTV) to control and survey the new shed/stabling area on a 24h basis. The system shall ensure the complete coverage of the shed area, without any “blind” spots, as well as the continuous surveillance, monitoring and recording of images from the indoor areas and the perimeter of the Depot shed. The system shall allow the transmission of image from each camera in real time to the OCC equipment. The Contractor shall also provide the OCC equipment necessary for system management by the personnel.

The new system shall include, as a minimum, a central unit – server, colour cameras (fixed type or dome type), IP technology, remote control from the OCC, network recorder, management software, the necessary cabling, routing, supports, auxiliary materials; it shall also include all necessary equipment for the smooth digital transmission. The detailed dimensioning and the exact locations of the cameras shall be determined in the Contractor’s design.

The system to be installed by the Contractor in the OCC shall be expandable, capable of accommodating the future needs for additional cameras to cover the fencing of the Depot perimeter.

Interface between the CCTV cameras and the OCC shall be via an appropriate new fibre optics network to be installed by the Contractor, using the existing routing infrastructure (if sufficient), or a new routing infrastructure to be constructed.

**TECHNICAL DESCRIPTION**

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**4.1.13 Wi-Fi Networks**

The Contractor shall install an independent wireless local network (Wi-Fi technology) in the new vehicles stabling area, in order to ensure communication and a bi-directional data transfer between (old and new) Tramway vehicles to/from the recently installed upgraded Telematics system in the OCC. The wireless network shall be fully compatible with the equipment installed in vehicles and with the central Telematics system. The Contractor shall design and supply all required materials (transmitters, access points etc.) and accessories (cabinet, converters, switches, cables, supports, routing etc.) for smooth connection with the OCC.

**4.1.14 Depot system for vehicle management**

The Contractor shall design, install and test a new system for the management of the vehicles in the Depot, which shall control and monitor all turnouts in the Depot, shall identify the trains in the (current and new) stabling areas, shall arrange the movement of Tramway vehicles in the stabling or workshop areas by means of commands from the Depot's Traffic Controllers, and shall enable the user to supervise the vehicles entering/exiting the Depot. The system shall be provided with a user friendly graphic environment.

In the framework of installation of the new system, apart from the central workstation in the OCC, 2+2 monitors shall be installed at specific locations in the existing and the new shed, to inform the personnel about the actual position of Tramway vehicles at all times within the Depot's stabling areas.

**4.1.15 RFID System**

The Contractor shall design, install and test a Radio Frequency Identification System (RFID) in the new shed area and in the existing Stabling Building, as well as on the entire fleet (34 existing and 25 new tramway vehicles), so that the identification of the position of each vehicle when stabled be feasible. Vehicles' transceivers shall be of passive type; the system shall be connected – as required – with the Depot Management System.

**4.2 Special issues related to H/M and railway systems to be taken into account during the Depot construction and operation**

The Contractor shall pay particular attention to the sequence of works during the construction of the new shed, in order to minimize problems and reduce obstacles to the smooth operation of the Depot and its systems. The Contractor shall submit a technical report describing in detail the sequence of his works, their duration, as well as the safety measures to be implemented, depending on the type of work, taking into account that works shall be executed at a close proximity to the overhead conductor, in an area where Tramway vehicles shall be moving.

More specifically, the Contractor shall take the following into account:

- The closing of the track entering the Depot for the installation of new turnouts connecting the new and old shall not last more than thirty (30) days.
- All necessary measures shall be implemented during the execution of works, to avoid disruption of the sewage network availability in the Depot, while the sewage network shall not be decommissioned for more than two (2) days.

**TECHNICAL DESCRIPTION**

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- Connection of the new overhead conductors shall take place in communication with STASY S.A. at hours when no Tramway vehicles enter/exit the Depot.
- The Contractor is required to deliver a comprehensive list of spare parts and a sufficient amount of spare parts for all new systems – equipment to be installed. The Contractor is required to deliver the customisation and diagnostics software, as necessary, as well as the software licences. The quantity of spare parts to be provided shall be proposed by the suppliers of the systems, based on the foreseen Mean Time Between Failures (MTBF) and the requirement for three (3) years coverage, with minimum quantity one (1) piece per type of equipment. This applies to all systems – installations: traction, overhead conductor, power distribution, water supply, drainage/sewage/pumping stations, lighting, signalling, CCTV, WiFi etc.



## ANNEX – LIST OF FINAL DESIGN DRAWINGS

ANNEX – LIST OF FINAL DESIGN DRAWINGS					
EXPANSION OF THE TRAMWAY DEPOT IN AREA OF ELLINIKO					
ΛΙΣΤΑ ΣΧΕΔΙΩΝ / DRAWINGS LIST					
A/A	ΑΡΙΘΜΟΣ ΣΧΕΔΙΟΥ/DRAWING NUMBER	ΤΙΤΛΟΣ	TITLE	ΚΛΙΜΑΚΑ/ SCALE	ΠΑΡΑΤΗΡΗΣΕΙΣ / NOTES
		<b>ΑΡΧΙΤΕΚΤΟΝΙΚΑ ΣΧΕΔΙΑ</b>	<b>ARCHITECTURAL DRAWINGS</b>		
1	S3GFDDRURBARALLHO001A	ΓΕΝΙΚΗ ΟΡΙΖΟΝΤΙΟΓΡΑΦΙΑ ΔΙΑΜΟΡΦΩΣΕΙΣ	GENERAL LAYOUT REINSTATEMENTS	1:500	
2	S3GFDDRARCDPALLPL001A	ΣΤΕΓΑΣΤΡΟ ΧΩΡΟΥ ΣΤΑΘΜΕΥΣΗΣ ΣΥΡΜΩΝ ΚΑΤΟΨΗ ΕΠΙΠΕΔΟΥ ΤΡΟΧΙΩΝ	TRAIN STABLING SHED TRACK LEVEL PLAN	1:100	
3	S3GFDDRARCDPALLPL002A	ΣΤΕΓΑΣΤΡΟ ΧΩΡΟΥ ΣΤΑΘΜΕΥΣΗΣ ΣΥΡΜΩΝ ΚΑΤΟΨΗ ΟΡΟΦΗΣ ΣΤΕΓΑΣΤΡΟΥ	TRAIN STABLING SHED ROOF PLAN	1:100	
4	S3GFDDRARCDPALLSE001A	ΣΤΕΓΑΣΤΡΟ ΧΩΡΟΥ ΣΤΑΘΜΕΥΣΗΣ ΣΥΡΜΩΝ ΤΟΜΕΣ 1-1, 2-2, 3-3	TRAIN STABLING SHED SECTIONS 1-1, 2-2, 3-3	1:100	
5	S3GFDDRARCDPALLDE001A	ΣΤΕΓΑΣΤΡΟ ΧΩΡΟΥ ΣΤΑΘΜΕΥΣΗΣ ΣΥΡΜΩΝ ΛΕΠΤΟΜΕΡΕΙΕΣ	TRAIN STABLING SHED DETAILS	ως έχει	
6	S3GFDDRURBDPALLPL001A	ΠΕΡΙΦΡΑΞΗ ΑΡΧΑΙΟΛΟΓΙΚΟΥ ΧΩΡΟΥ	FENCING OF ARCHAEOLOGICAL AREA	1:100 /1:10	
7	S3GFDDRARCDPALLPL003A	ΚΤΙΡΙΟ Νο1: ΚΤΙΡΙΟ ΣΥΝΤΗΡΗΣΗΣ ΤΜΗΜΑ 1Α: ΙΣΟΓΕΙΟ - ΓΕΝΙΚΗ ΔΙΑΤΑΞΗ 1/2	BUILDING Νο1: MAINTENANCE BUILDING PART 1A - STREET LEVEL - GENERAL LAYOUT 1/2	1:100	

**TECHNICAL DESCRIPTION**

8	S3GFDDRARCDPALLPL003A	ΚΤΙΡΙΟ Νο1: ΚΤΙΡΙΟ ΣΥΝΤΗΡΗΣΗΣ ΤΜΗΜΑ 1Α: ΙΣΟΓΕΙΟ - ΓΕΝΙΚΗ ΔΙΑΤΑΞΗ 2/2	BUILDING Νο1: MAINTENANCE BUILDING PART 1A - STREET LEVEL - GENERAL LAYOUT 2/2	1:100	
9	S3GFDDRARCDPALLGE001A	ΚΤΙΡΙΟ Νο1: ΚΤΙΡΙΟ ΣΥΝΤΗΡΗΣΗΣ - ΤΜΗΜΑ 1Α: ΒΟΗΘΗΤΙΚΑ ΦΡΕΑΤΙΑ (ΓΡΑΜΜΕΣ 5 ΚΑΙ 7)	BUILDING Νο1: MAINTENANCE BUILDING - PART 1A - ANCILLARY PITS (TRACKS 5 & 7)	1:100 / 1:50 / 1:5	
		<b>ΣΤΑΤΙΚΑ ΣΧΕΔΙΑ</b>	<b>STRUCTURAL DRAWINGS</b>		
10	S3GFDDRSTRDPALLPL001A	ΣΤΕΓΑΣΤΡΟ ΧΩΡΟΥ ΣΤΑΘΜΕΥΣΗΣ ΣΥΡΜΩΝ ΘΕΜΕΛΙΩΣΗ - ΟΨΗ	TRAIN STABLING SHED FOUNDATION - ELEVATION	1:100	
11	S3GFDDRSTRDPALLSE001A	ΣΤΕΓΑΣΤΡΟ ΧΩΡΟΥ ΣΤΑΘΜΕΥΣΗΣ ΣΥΡΜΩΝ ΘΕΜΕΛΙΩΣΗ - ΟΨΗ - ΤΟΜΗ	TRAIN STABLING SHED FOUNDATION - ELEVATION - SECTION	1:100	
		<b>ΣΧΕΔΙΑ ΧΑΡΑΞΕΩΝ</b>	<b>ALIGNMENT DRAWINGS</b>		
12	S3GFDDRGENARALLHO001A	ΓΕΝΙΚΗ ΟΡΙΖΟΝΤΙΟΓΡΑΦΙΑ ΕΡΓΟΥ	GENERAL HORIZONTAL ALIGNMENT	1:1.000	
13	S3GFDDRTCIVPALLHO001A	ΟΡΙΖΟΝΤΙΟΓΡΑΦΙΑ ΠΕΡΙΜΕΤΡΙΚΗΣ ΟΔΟΥ ΑΜΑΞΟΣΤΑΣΙΟΥ	STABLING TRACKS HORIZONTAL ALIGNMENT	1:200	
14	S3GFDDRCIVARALLVE001A	ΜΗΚΟΤΟΜΗ ΠΕΡΙΜΕΤΡΙΚΗΣ ΟΔΟΥ ΑΜΑΞΟΣΤΑΣΙΟΥ	DEPOT PERIMETER ROAD VERTICAL ALIGNMENT	1:500/1:50	
15	S3GFDDRCIVARALLSE001A	ΔΙΑΤΟΜΕΣ ΠΕΡΙΜΕΤΡΙΚΗΣ ΟΔΟΥ ΑΜΑΞΟΣΤΑΣΙΟΥ	DEPOT PERIMETER ROAD SECTIONS	1:200	
16	S3GFDDRALNARALLTY001A	ΤΟΜΗ Α-Α ΠΕΡΙΜΕΤΡΙΚΗΣ ΟΔΟΥ ΑΜΑΞΟΣΤΑΣΙΟΥ	DEPOT PERIMETER ROAD SECTION A-A	1:20	
		<b>ΤΟΠΟΓΡΑΦΙΚΑ ΣΧΕΔΙΑ</b>	<b>TOPOGRAPHICAL SURVEY DRAWINGS</b>		
17	S3GFDDRSURARALLHO001A	ΤΟΠΟΓΡΑΦΙΚΗ ΑΠΟΤΥΠΩΣΗ 1/2	TOPOGRAPHICAL SURVEY 1/2	1:500	
18	S3GFDDRSURARALLHO001A	ΤΟΠΟΓΡΑΦΙΚΗ ΑΠΟΤΥΠΩΣΗ 2/2	TOPOGRAPHICAL SURVEY 2/2	1:500	
		<b>ΣΧΕΔΙΑ ΟΔΟΠΟΙΙΑΣ</b>	<b>ROAD DESIGN DRAWINGS</b>		
19	S3GFDDRTWKDPALLHO001A	ΟΡΙΖΟΝΤΙΟΓΡΑΦΙΑ ΤΡΟΧΙΩΝ ΣΤΑΘΜΕΥΣΗΣ ΣΥΡΜΩΝ	STABLING TRACKS HORIZONTAL ALIGNMENT	1:200	
		<b>ΣΧΕΔΙΑ ΔΙΚΤΥΩΝ ΟΚΩ</b>	<b>PUBLIC UTILITIES NETWORKS</b>		

TECHNICAL DESCRIPTION

			DRAWINGS		
20	S3GFDDRREUARALLHO001A	ΥΠΑΡΧΟΝΤΑ ΔΙΚΤΥΑ Ο.Κ.Ω	EXISTING PUBLIC UTILITIES NETWORKS	1:500	
			<b>ΣΧΕΔΙΑ ΑΝΤΙΠΛΗΜΜΥΡΙΚΗΣ ΠΡΟΣΤΑΣΙΑΣ</b>	<b>DRAINAGE DRAWINGS</b>	
21	S3GFDDRDRNDPALLHO001A	ΑΠΟΣΤΡΑΓΓΙΣΗ ΟΜΒΡΙΩΝ	DRAINAGE	1:200	
22	S3GFDDRDRNDPALLDE001A	ΑΠΟΣΤΡΑΓΓΙΣΗ ΟΜΒΡΙΩΝ ΤΥΠΙΚΕΣ ΛΕΠΤΟΜΕΡΕΙΕΣ	DRAINAGE TYPICAL DETAILS	1:20	
			<b>ΗΛΕΚΤΡΟΜΗΧΑΝΟΛΟΓΙΚΑ ΣΧΕΔΙΑ</b>	<b>ELECTROMECHANICAL DRAWINGS</b>	
			<b>ΤΗΛΕΠΙΚΟΙΝΩΝΙΕΣ</b>	<b>TELECOMS</b>	
23	S3GFDDRELMPLVSEQ001A	ΑΣΘΕΝΗ ΡΕΥΜΑΤΑ ΚΑΤΟΨΗ ΕΠΙΠΕΔΟΥ ΤΡΟΧΙΩΝ	LOW VOLTAGE TRACK LEVEL PLAN	1:100	
			<b>ΑΠΟΣΤΡΑΓΓΙΣΗ-ΑΠΟΧΕΤΕΥΣΗ-ΑΝΤΛΗΣΗ</b>	<b>DRAINAGE-SEWAGE-PUMPING SYSTEMS</b>	
24	S3GFDDRELMDPWAREQ001A	ΑΠΟΧΕΤΕΥΣΗ ΚΑΤΟΨΗ ΕΠΙΠΕΔΟΥ ΤΡΟΧΙΩΝ	SEWAGE TRACK LEVEL PLAN	1:200	
			<b>ΠΑΡΟΧΗ ΚΑΙ ΔΙΑΝΟΜΗ ΥΔΑΤΟΣ-ΑΡΔΕΥΣΗ</b>	<b>WATER SUPPLY &amp; DISTRIBUTION-IRRIGATION</b>	
25	S3GFDDRELMPPPLUEQ001A	ΥΔΡΕΥΣΗ ΚΑΤΟΨΗ ΕΠΙΠΕΔΟΥ ΤΡΟΧΙΩΝ	PLUMBING TRACK LEVEL PLAN	1:200	
			<b>ΠΥΡΟΣΒΕΣΗ</b>	<b>FIRE FIGHTING SYSTEM</b>	
26	S3GFDDRELMDFPSEQ001A	ΠΥΡΟΣΒΕΣΗ ΚΑΤΟΨΗ ΕΠΙΠΕΔΟΥ ΤΡΟΧΙΩΝ	FIRE PROTECTION SYSTEMS TRACK LEVEL PLAN	1:100	
			<b>ΣΥΣΤΗΜΑ ΕΝΑΕΡΙΑΣ ΓΡΑΜΜΗΣ</b>	<b>OVERHEAD CONTACT LINE SYSTEM</b>	
27	S3GFDDRELTDPOCLHO001A	ΣΥΣΤΗΜΑ ΕΝΑΕΡΙΑΣ ΓΡΑΜΜΗΣ ΟΡΙΖΟΝΤΙΟΓΡΑΦΙΑ - ΓΕΝΙΚΗ ΔΙΑΤΑΞΗ	OVERHEAD CONTACT LINE SYSTEM HORIZONTAL ALIGNMENT - GENERAL PLAN	1:200	
28	S3GFDDRELTDPOCLDE001A	ΣΥΣΤΗΜΑ ΕΝΑΕΡΙΑΣ ΓΡΑΜΜΗΣ ΣΧΕΔΙΟ ΙΣΤΩΝ ΚΑΙ ΘΕΜΕΛΙΩΝ	OVERHEAD CONTACT LINE SYSTEM DRAWING OF POLES AND FOUNDATIONS	1:50	
29	S3GFDDRELTDPOCLDE002A	ΣΥΣΤΗΜΑ ΕΝΑΕΡΙΑΣ ΓΡΑΜΜΗΣ ΣΧΕΔΙΟ ΛΕΠΤΟΜΕΡΕΙΩΝ - ΠΛΑΙΣΙΑ, ΚΟΝΣΟΛΕΣ, ΑΝΤΙΡΙΔΕΣ	OVERHEAD CONTACT LINE SYSTEM DETAILS DRAWING - PORTALS, CANTILEVERS, TIES	1:50/1:25	
			<b>ΣΥΣΤΗΜΑ ΙΣΧΥΟΣ ΕΛΞΗΣ</b>	<b>TRACTION POWER SYSTEM</b>	

TECHNICAL DESCRIPTION

30	S3GFDDRELTDTPSDI001A	ΣΥΣΤΗΜΑ ΙΣΧΥΟΣ ΕΛΞΗΣ ΜΟΝΟΓΡΑΜΜΙΚΟ ΔΙΑΓΡΑΜΜΑ ΚΑΙ ΚΑΤΟΨΗ	TRACTION POWER SYSTEM SINGLE LINE DIAGRAM AND PLAN VIEW	1:50	
31	S3GFDDRELTDTPSEQ001A	ΣΥΣΤΗΜΑ ΙΣΧΥΟΣ ΕΛΞΗΣ ΔΙΑΤΑΞΗ ΕΞΟΠΛΙΣΜΟΥ Υ/Σ 15 - ΚΑΤΟΨΗ	TRACTION POWER SYSTEM EQUIPMENT LAYOUT OF TPS 15-PLAN	1:50	
		<b>ΙΣΧΥΡΑ ΡΕΥΜΑΤΑ - ΠΑΡΟΧΗ ΚΑΙ ΔΙΑΝΟΜΗ ΙΣΧΥΟΣ, ΦΩΤΙΣΜΟΣ, ΓΕΙΩΣΕΙΣ, ΑΝΤΙΚΕΡΑΥΝΙΚΗ ΠΡΟΣΤΑΣΙΑ</b>	<b>HIGH VOLTAGE, POWER SUPPLY AND DISTRIBUTION, EARTHING, LIGHTING PROTECTION</b>		
32	S3GFDDRELMDPLICEQ001A	ΠΑΡΟΧΗ ΙΣΧΥΟΣ - ΦΩΤΙΣΜΟΣ ΚΑΤΟΨΗ ΕΠΙΠΕΔΟΥ ΤΡΟΧΙΩΝ	POWER SUPPLY- LIGHTING TRACK LEVEL PLAN	1:100	