ATTIKO METPO A.E.

TITLE : **“EXTENSION OF METRO LINE 2 TO ILION, EXPANSION OF ELEONAS DEPOT AND UPGRADING OF THE E/M SYSTEMS”**

RFP-421/22 (Α.Σ. 192682)

INFORMATION DOCUMENT

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1 Introduction

This document gives a general description of the Project and provides information to the bidders regarding its design, characteristics and implementation.

2 Planning of Works

In the framework of further developing the Metro network in Athens, ATTIKO METRO S.A. has incorporated in its program the design and construction of the Extension of Line 2 past ANTHOUPOLI Station towards the area of Ilion and Aghios Nikolaos (and in the future further away, towards Acharnes region). The design of the subject extension aims at:

- Serving many densely populated areas of the Western Suburbs;
- Further increasing the Metro Lines networking, providing for a transfer station at ILION Station once the future extension of Line 4 to Petroupoli is implemented.

It is estimated that this section of Line 2 up to Aghios Nikolaos area will serve at least 67,000 passengers on a daily basis, while the number of citizens residing within a distance of 500m. from the 3 new stations is estimated to be approximately 42,000, and the respective work positions will be approximately 5,000.

The future operation of the Extension and the remaining current needs of ATTIKO METRO S.A. call for securing and constructing additional depot areas to serve the train fleet. Out of the solutions available to ATTIKO METRO S.A., the latter has chosen to expand Eleonas Depot to an adjacent neighbouring space of an area of approximately 20,000m^2 in the corner of Aghias Annis and Pierias Streets, which is currently occupied mainly by the warehouses of the former Athinaiki Chartopoiia S.A. factory and other properties.

In addition, the future operation of the Extension necessitates the upgrade/replacement of certain E/M Systems in a large section or even in the entirety of Metro Lines 2 & 3, without which it will not be possible to further extend them in the new extension to Ilion. These systems are no longer supported by their manufacturers, there are no spare parts and the number of their failures has increased.

3 Basic Characteristics of the Project

3.1 Extension of Line 2

The purpose of this tender is scheduling the implementation of Line 2 Extension beyond ANTHOUPOLI Station, approximately 4km long, which shall accommodate three (3) new stations, along with their ventilation shafts. The Stations shall be as follows: PALATIANI, ILION and AGHIOS NIKOLAOS. Moreover, six (6) Shafts shall be constructed along the Line, namely: Aghiou Sosti, Antipaxon, Filoktitou, Ermionis, Platonos and Aghias Glykerias Shafts, as well as two provisional shafts (see below).
The construction methods to be followed for the several structures of this Extension shall be as follows:

- Cut and Cover method (C/C). It applies to one Station, parts of the other two Stations and to all Shafts.
- The use of Tunnel Boring Machine (TBM). It applies to the double track tunnels between Stations.
- Underground Boring of Tunnels using Conventional Mechanical Means. It applies to the platform tunnels of the two Stations, staircase galleries, etc., increased cross-section/ triple track tunnel of the Forestation and the tunnel connecting the TBM tunnel with the current tunnel of ANTHOUPOLI Station Forestation (KP 2+517 approximately).

All Stations shall have side platforms and one or two entrances, shall be 110m. long and fully accessible to Persons with Special Needs.
The Stations shall be approximately from -22m. to -24m. deep, as to the TOR from the ground surface. Wherever deemed advisable for the construction of the stations, the required properties shall be expropriated.

3.2 Expansion of Eleonas Depot

The subject expansion of Eleonas Depot shall be implemented in the area which is attached to the existing Depot and is located in the corner of Aghias Annis and Pierias Streets. A section of this area has already been expropriated by ATTIKO METRO S.A. (Section A), while the remaining section (Section B) is to be expropriated in an area of approximately 20,000m^2, which is currently occupied mainly by the warehouses of the former Athinaiki Chartopoiia S.A. factory and other properties. The new Expansion of the Depot shall be connected with the existing Eleonas Depot and shall function in a combined manner.

3.3 PALATIANI Transfer Station

An underground 3-level car parking area shall be constructed at an adjacent area, attached to PALATIANI Station offering direct connection to the Station.

3.4 Upgrading of E/M Systems of Metro Lines 2 & 3

In the framework of this contract, the digital data transmission system shall be upgraded/replaced in all stations of Lines 2 and 3; moreover, the public announcement system shall be upgraded/replaced in all stations of the Base Project (except for the extension to Piraeus) and it shall be connected with the respective systems of the extension to Piraeus.

4 Scope of the Project

The Scope of the Project shall include the preparation by the Contractor of the required Final Designs (FD), the Detailed Final Design (DFD) (on the basis of ATTIKO METRO S.A.'s Preliminary Design and Specifications to be handed over during Phase B' of the Tender, as well as the remaining Contract Documents), and the execution of the respective works.

In addition, the scope of the Project shall include any adjustments of the Final Designs and the Detailed Final Designs that may be required due to differences between the foreseen and the actual conditions of the construction of the Project.

4.1 Civil Works

Civil works include *inter alia* in brief the following designs and works:

- Investigation and examination of land uses - in the wider area of the Project - which might have an impact on the Project construction and operation (e.g. gas station, rooms intended for safeguarding, storing, distributing etc. hazardous chemical substances and any pollution/leakages induced from these areas)
- Topographical works and surveys, cadastral diagrams/charts
- Inventory of existing features
- Actions, expenses and works required for temporary occupations, as well as topographical surveys and works and preparation of cadastral diagrams and charts for any additional expropriations to be required
- Worksite installations
- The necessary archaeological works. These works include: fencing and safeguarding of the areas where archaeological works are being executed, investigation works (investigation trench, etc.) for identifying archaeological finds including the required retaining works, archaeological excavations, recording and surveying of finds, as well as conservation and safeguarding of antiquities. Archaeological works shall be executed by the contractor under the supervision of the Departments concerned of the Ministry of Culture
- Demolition/dismantling of the existing buildings and structures that may be required for the needs related to the construction of works and their transport to areas having obtained environmental permits
- Geological, engineering-geological, hydro-geological surveys and studies
- Investigation of geological, hydro-geological, geotechnical, hydrological, topographical, urban, environmental, meteorological and traffic conditions prevailing in the area
- Investigation works for identifying shafts, ground voids and excavation conditions ahead of the tunnel excavation front (either from inside the tunnel or from the surface), filling and sealing of shafts and voids which might be encountered during the construction of the Project, addressing any over-excavation, collapse and failures, as well as the relevant remedial measures
- Layout and longitudinal profile of the line alignment
- The required investigation works for identifying PUO networks (PPC, OTE, EYDAP, Natural Gas, etc.) and preparation of all designs regarding all PUO networks relocation and/or diversion works (provisional and/or Permanent), except in cases that these designs are compiled by the PUO Organizations, as well as their implementation
- Coordination and provision of any assistance required to Public Utility Organizations, municipality departments, etc. executing works falling within the scope of their competence in the framework of this Project
- Designs for traffic arrangements, road works and signaling (temporary and/or permanent) and the relevant works
- Geotechnical designs for excavation and temporary retaining of open trenches and respective construction activities
- Geotechnical designs for the excavation and support of the tunnels to be bored by the underground method using conventional mechanical means and respective construction activities

- Inventory, Recognition and Assessment of the Importance and Special Vulnerability of Buildings and Structures, Special Vulnerability and Relative Risk Design for Buildings and Structures within the influence zone of the Project
- Designs concerning soil improvement measures and measures for the protection of buildings, structures, etc.. Soil improvement works, introducing of measures for the direct support of the tunnels, etc., as and where required
- Designs concerning the Geomechanical and Structural Monitoring of the project. The Geomechanical and Structural Monitoring of the Project structures, the buildings/structures and the sub-soil of the influence zone of the Project before and during the execution of the construction works, as well as during the Project maintenance – guarantee period
- Architectural Designs (architectural layout, finishes, etc.) and respective works for the construction of Stations, Crossovers, Shafts, Entrances/Exits of Stations, Depot Building (In Area B), Palatiani Transfer Station, works for the reinstatement of the surrounding area of Stations/Shafts and the Depot
- Structural Designs and related construction activities concerning all permanent structures of the Project, namely: Stations, TBM Tunnels and tunnels bored using conventional mechanical means, Shafts, Depot Building (in Area B), PALATIANI Transfer Station, etc.,
- Structural Designs and related construction activities pertaining to the works required for the foundation of the future Central Station of Interurban Buses (KSYL) in Area A of the Depot Expansion
- The preparation of designs and the implementation of temporary and permanent drainage works and flood protection activities during the execution and the operation of the project
- Designs for the reinstatement of the worksite and other areas and structures. The reinstatement of the occupied worksite areas, PUO networks diversions and traffic diversions upon completion of the construction works, ensuring full integration with the surrounding area
- Passive Fire Protection designs
- Acoustic Designs for Stations
- Designs for the coordination among Civil Works, E/M and Railway Systems
- Preparation of the Health and Safety Plan and File (HSP and HSF)
- Environmental Studies concerning modifications of the Project (including noise and vibration studies) should it be required
- All necessary designs and works related to the implementation of preventive, protective measures or even repair works for all buildings/structures affected by the Project, including structures and/or E/M and Railway Systems of the existing Athens Metro network, due to failures to eventually occur during Project construction
- The preparation of the Final Design (FD) and the Detailed Final Design (DFD), the supplementary designs, surveys, as foreseen by the Contract, as well as the designs and works required to ensure the compatibility of this Project with the existing Athens Metro network
- Designs for the coordination among Civil Works (Structural, Geotechnical and Architectural works), E/M and Railway Systems, Rolling Stock and Commissioning. The subject designs shall include all necessary procedures for the comprehensive digital representation of the physical and operational characteristics (Building Information Modeling – BIM) of the Metro Projects - in three of more dimensions – to be correlated with all Project information (designs, networks, equipment, specifications, materials, suppliers, test reports, etc.)

through well-organized and interdependent databases. The final Project File (as built) shall be in BIM format.

The designs shall be approved by ATIKO METRO S.A. and – if required – by the relevant Services and Organizations concerned (e.g. DEDDHE, etc.) prior to their implementation.

4.2 Electromechanical and Railway Systems

4.2.1 Geographical Units of the Project - Scope

The Project shall include four (4) individual categories of Electromechanical and Railway Systems that correspond to different geographical units:

1. Systems to be required for Line 2 Extension Project
2. Systems to be required for the Expansion of Eleonas Depot Project
3. Upgrading of specific systems in the entire Line 2 and the entire Line 3, as described below.
4. Systems to be required for PALATIANI Transfer Station Project.

The scope of the Project shall include the preparation of the Final Design (FD) and of the Detailed Final Design (DFD), the procurement, installation, testing and commissioning of the E/M and Railway Systems referred to in detail below and which concern the above categories.

The scope shall also include the coordination of designs, structures and facilities, so that all individual E/M and Railway Systems can be combined with the Civil Works and function as a whole, along with the remaining contracts of other E/M and Railway Systems relating to items (1) to (4) above as well.

4.2.2 Electromechanical / Railway systems for Line 2 Extension

The Electromechanical and Railway systems that are included in the section of the Project relating to Line 2 Extension to Ilion are as follows:

1. Ventilation of tunnels and public areas of the stations
2. Ventilation/ Heating/ Air-Conditioning (HVAC) of personnel areas and technical rooms
3. Traction Power System 750 V DC
4. Power supply - 20kV AC
5. Low Voltage Distribution (400/230V AC)
6. Power Remote Control System (PRCS)
7. Control and Supervision System in the Station Master Room (SMR) of the Traction Power Equipment of the Rectifier Substations
8. 110V DC Auxiliary Power Supply
9. Release system of the Rectifier Substations in Emergencies
10. Intertripping System along Line 3
11. Integrating the new Rectifier Substations of the Extension into the General Release System of Line 3
12. Earthing and stray-current protection
13. Equipment intended for the Station Master Rooms (SMRs)
14. Lighting

15. Lifts
16. Escalators
17. Fire detection, Fire fighting, Fire protection
18. Drainage, Sewage, Pumping Stations
19. Water supply
20. Automatic Telephone System (PABX)
21. Direct Line Telephone System (DLT)
22. Clocks System
23. Closed Circuit Television System (CCTV)
24. Public Announcement System (PA)
25. Traction Current Removal System (TCR)
26. Intercommunication System – intercom
27. Safety – Intrusion Detection System (IDS)
28. Digital Data Transmission System (DTS)
29. Telecommunications Cables
30. Indoor Structured Cabling for Digital Data Transmission
31. Uninterruptible Power Supply Systems (UPS)
32. Trackwork, including 3rd rail
33. Signage
34. Provisions for other Contractors' systems
35. Interconnection of the existing Metro network with the new Extension
36. Supplementing – modifying – upgrading of systems/facilities in the Operation Control Centre (OCC) in Syntagma Station
37. Furniture for personnel areas (e.g. SMR, ticket offices, etc.)
38. Keys system

The Contractor shall proceed to all actions required in order to ensure the completeness, perfection and completion of the works aiming at achieving the unhindered and safe operation of all systems.

It is stressed that the following systems **are not included in the scope of the Project** and shall be executed by other Contractors:

- Signaling system, including, *inter alia,* the Electrical Interlocking, (E-IXL), Automatic Train Operation (ATO), Automatic Train Protection (ATP)
- Automatic Train Supervision (ATS)
- Passenger Information System (PIS)
- Fare Collection System
- Radio Communication System - TETRA
- Building Automation and Control System (BACS).

As concerns the aforementioned systems that are not included in the scope of the Project, the Contractor shall be provided with the entire infrastructure intended for their installation, such as machinery bases, embedded pipes, power supply and control cable trays and ducts, etc.

4.2.3 Electromechanical / Railway systems for Eleonas Depot Expansion

The Electromechanical and Railway Systems in Areas A and B, including the Depot building (with Train Stabling, Maintenance and Repair areas, including the personnel areas and technical rooms etc.) in the Expansion of Eleonas Depot are as follows:

1. Ventilation/ Heating/ Air-Conditioning (HVAC)
2. Traction Power System 750 V DC
3. Power supply - 20kV AC
4. Low Voltage Distribution (400/230V AC)
5. Power Remote Control System (PRCS) (expansion to the existing power remote control system of the Depot)
6. 110V DC Auxiliary Power Supply
7. Earthing and stray-current protection
8. Lighting
9. Lifts
10. Fire detection, Fire fighting, Fire protection
11. Drainage, Sewage, Pumping Stations
12. Water supply
13. Automatic Telephone System (PABX)
14. Direct Line Telephone System (DLT)
15. Clocks System
16. Closed Circuit Television System (CCTV)
17. Public Announcement System (PA)
18. Traction Current Removal System (TCR)
19. Safety – Intrusion Detection System (IDS)
20. Digital Data Transmission System (DTS)
21. Telecommunications Cables
22. Indoor Structured Cabling for Digital Data Transmission
23. Uninterruptible Power Supply Systems (UPS)
24. Trackwork, including 3rd rail
25. Signage
26. Provisions for other Contractors' systems
27. Interconnection of the existing Eleonas Depot with the new Expansion of the Depot in relation to every system required in view of securing the complete operation of the new extension and the operation of the pertinent building
28. Supplementing – modifying – upgrading of systems/facilities in the operation control tower of the existing Depot in every scope of works included in this contract
29. Furniture for personnel areas, where required in the new depot (including the existing the Operation Control Tower)
30. Keys system
31. Equipment intended for train overhaul and light maintenance, as well as repairs.

The Contractor shall proceed to all actions required in order to ensure the completeness, perfection and completion of the works aiming at achieving the unhindered and safe operation of all systems.

It is stressed that the following systems related to the Depot Expansion are not included in the scope of the Project and shall be executed by other Contractors:

- Signaling system, including, *inter alia,* the Electrical Interlocking, (E-IXL), Automatic Train Protection (ATP)
- Radio Communication System - TETRA
- Building Automation and Control System (BACS)

As concerns the aforementioned systems that are not included in the scope of the Project, the Contractor shall be provided with the entire infrastructure intended for

their installation, such as machinery bases, embedded pipes, power supply and control cable trays and ducts, etc.

4.2.4 Upgrading – replacement of the existing systems of Metro Lines 2 and 3

In the framework of this contract, the digital data transmission system shall be upgraded/replaced in all stations of Lines 2 and 3; moreover, the public announcement system shall be upgraded/replaced in all stations of the Base Project (except for the extension to Piraeus), and it shall be connected with the respective systems of the extension to Piraeus.

The subject modifications to the aforesaid two (2) systems shall:

- Require new items of equipment and software in the OCC-Syntagma and, locally, in stations, shafts, etc.
- Be appropriately connected with all remaining E/M systems and networks, which are connected to the existing systems
- Be implemented without this entailing any interruption to Lines 2 and 3 service.

4.2.5 Electromechanical / Systems for PALATIANI Transfer StationAt the underground building of the Palatiani Transfer Station, the installation of the necessary building electromechanical systems shall be required; these systems shall include, as a minimum the following, namely:

1. Ventilation of underground car-park areas
2. Heating, Ventilation and Air Conditioning (HVAC) of personnel areas and technical rooms
3. 20 KV AC power supply
4. Low voltage distribution (400/230V AC)
5. Auxiliary power supply system 110 V DC
6. Earthing and lightning protection
7. Lighting
8. Lifts
9. Fire detection, firefighting, fire protection
10. Drainage, sewage, pumping stations
11. Water supply and irrigation at street level
12. Automatic Telephone System (PABX)
13. Clock System (it may be same with the extension)
14. Close Circuit Television (CCTV)
15. Public Address System (PA)
16. Intercommunication System (Intercom)
17. Security System – Trespassing Control
18. CO detection system and emergency announcements
19. Fare system for parking
20. Parking spaces occupancy system
21. Building Automation and Control System (BACS)
22. Telecommunications Cables
23. Internal structured cable-work for the transmission of digital data.
24. Uninterrupted Power Supply Systems (UPS).
25. Equipment of the room intended for the person responsible for parking spaces
26. Signage
27. Furniture for personnel areas (e.g. room of person in charge, etc.)

28. Key system.

The radio communication system (TETRA) shall be covered by another Contractor.

4.3 Coordination of Designs and Works

This Project includes the complete and overall coordination of designs and works both among the scopes included in the Project and those scopes mentioned above which are not included in the Project and are implemented by other Contractors, in view of achieving the correct and workmanlike construction of the Civil Works, the installation of all electromechanical and railway systems, the implementation of tests and the commissioning of the extension to Ilion and Eleonas Depot expansion.

4.4 Testing and Commissioning

The scope of the Project shall include Factory Acceptance Tests (FAT), Installation Tests (IT), System Acceptance Tests (SAT), System Integration Tests (SIT), System Performance Tests (SPT) and the trial run of all aforesaid systems in all four (4) scopes of paragraph 4.2.1 above.

4.5 Operation and Maintenance

In the framework of the operation and maintenance, the Contractor shall provide the following:

- The operation and maintenance manuals of the equipment.
- The required main spare parts for the systems to be installed, as these will be identified at Stage B' of the Tendering process. All spare parts pertaining to corrective maintenance for a three-year period and all spare parts pertaining to preventive maintenance for a one-year period, as of commissioning, shall be also included.
- The training of the operation company (STASY S.A.) personnel in the aforementioned systems and infrastructures.
- The periodic inspection and the "corrective" maintenance of the Project's Systems, i.e. repair/restoration of bad workmanship, of faults and failures, etc., for the warranty period of the Project.

The warranty period shall be extended to three (3) years further to the certified completion of the Project, on condition that the Contractor has submitted the final measurement of works within a period of two (2) months upon the subject completion.

4.6 Works in the Operation Control Center (OCC) at Syntagma

The scope of the Project shall also include the design, organization and execution of the required works for the modification, upgrading and additions to the existing Operation Control Center (OCC) at Syntagma, so as to cover the operation of the new extension.

The scope of the Contractor's works shall include completion, modification, upgrading and/or, if so imposed, replacement of relevant systems and layouts of the OCC at Syntagma, included in this tendering process, as well as any activities required for the completion of the designs, the procurement, installation, testing and their commissioning. Any reference on the part of ATTIKO METRO S.A. to any

"system" shall be always considered by the Contractor as inclusive of both hardware and the respective software. In the framework of this contract, these systems shall cover:

- The Power Remote Control System (PRCS)
- The Public Announcement (PA) System
- The Digital Data Transmission System (DTS)
- The Closed Circuit Television (CCTV) System
- Automatic Telephones (PABX)
- Direct Line Telephones
- The various control stations in the OCC at Syntagma shall be expanded and re-designed at software level, as required.

Moreover, it is stressed that the following systems in the OCC shall need to be upgraded; however, they are not included in the Contractor's scope:

- Building Automation and Control System (BACS)
- Signaling system, including, *inter alia,* the Electrical Interlocking, (E-IXL), Automatic Train Operation (ATO), Automatic Train Protection (ATP), as well as the rear view system for train traffic supervision
- Automatic Train Supervision (ATS)
- Passenger Information System (PIS)
- Fare Collection System
- Radio Communication System.

As regards the aforementioned systems, which are not included in his scope of works, the Contractor shall provide the necessary coordination between designs and works, along with the organization and scheduling of the required additions, modifications and upgrading of the systems of other contractors, as these systems are mentioned above, in the main room, the technical rooms accommodating the items of equipment and everywhere else required. In the framework of this work, cooperation and coordination shall be required with the remaining contractors supplying the aforementioned systems.

4.7 Creation of the Project Log

Upon completion of the Project, the Contractor shall compile and submit to ATTIKO METRO S.A. the Project Log, which shall include all "As Built" drawings of the project that will be in printed form and in BIM format, the operation and maintenance manuals of all systems and anything else required both in printed and digital format. they shall all be submitted in.

4.8 Rolling Stock

The procurement of the rolling stock is not included in the scope of the Project. The additional 6-car train-sets (series V) shall be procured via a separate procurement contract.

5. Description of the Project

5.1 Stations

There follows a brief description of each Station along with its positioning and main characteristics.

- Palatiani Station

The Station shall be located at the intersection of Thivon and Papandreou streets and shall have two entrances on either side of Thivon Street. It shall have 4.50m wide x 110m long side platforms inside a tunnel bored underground using conventional mechanical means underneath Thivon Street, while the Top of Rail (TOR) shall be located down to a depth of approximately 22.50m from ground surface. The Main Shaft, constructed using the cut and cover method in the un-built area at the intersection of Thivon and Andrea Papandreou Streets, shall be configured in 4 underground levels of operations. To ensure the ventilation of the tunnel, two Blast Shafts shall be configured, to be constructed on either side of the Station in un-built areas and underneath secondary streets, while they shall have emergency exits.

- Ilion Station

The Station shall be located at the intersection of Thivon and Elaion Streets and shall have two entrances on either side of Thivon Street; moreover, a provision has been made for this station to serve as a transfer station after its connection with Ilion Station of the future extension of Line 4 to Petroupoli. It shall have 4.50m wide x 110m long side platforms inside a tunnel bored underground using conventional mechanical means underneath Thivon street, while the Top of Rail (TOR) shall be located down to a depth of approximately 24.00m from ground surface. The Main Shaft, constructed using the cut and cover method in the un-built "triangle" area configured by Thivon, Gribovou and Elaion Streets, shall be configured in 5 underground levels of operations. To ensure the ventilation of the tunnel, two Tunnel Ventilation Shafts shall be configured; the SW blast shaft shall be integrated into the Main Shaft, while the NW blast shaft shall be located in a land plot at the intersection of Pogoniou and Thivon Streets.

- Aghios Nikolaos Station

The Station shall be located underneath a section of Aghiou Nikolaou Street, occupying a part of the configured green area surrounded by Paramythias, Olynthou, Zitsas and Aghiou Nikolaou Streets. It shall have 4.50m wide x 110m long side platforms and shall be constructed mainly based on the Cut and Cover method while the Top of Rail (TOR) shall be located down to a depth of approximately 23.20m underneath ground surface. Inside the main open trench and on either side of the 110 meters, the two tunnel ventilation shafts shall be constructed, so as the overall open trench be approximately 122m long. The inbound (direction to Athens) end of the trench of the Station shall be temporarily used for the installation and operation/support of the TBM, serving as a *quasi*-"TBM Launching Shaft". Thus, the permanent lining of the Station shall be constructed in sections and, in part, parallel to the TBM operation. In the framework of these construction works, the diversion of certain existing PUO networks shall be required.

5.2 Tunnels

The extension of Line 2 to Ilion shall commence from the tunnel of the Forestation of ANTHOUPOLI Station (approximately at KP 2+517) and shall finish at the end of the tunnel of the Forestation of Aghios Nikolaos Station (approximately at KP 6+698).

- All double track tunnels between Stations shall be bored using the TBM. The TBM shall be installed in the area of Aghios Nikolaos Station and shall bore the tunnel up to the area where the tunnel is connected with the existing Forestation tunnel of Anthoupoli Station; in this area, the TBM shall be disassembled and extracted through a temporary shaft to be constructed underneath a section of Anapafseos street ("TBM Extraction" Shaft).
- The increased cross-section/triple track tunnel of the Forestation of Aghios Nikolaos Station, as well as two tunnel sections adjacent to the "TBM Extraction" Shaft at the connection with the existing Forestation tunnel of Anthoupoli Station, shall be constructed by the underground boring method using conventional mechanical means.

In total, the Project shall have the following tunnels (whose lengths are presented by approximation):

- TBM double-track tunnel approximately 3.400m long (the length of two intermediate stations included) from Aghios Nikolaos Station up to the temporary "TBM Extraction" Shaft before Anthoupoli Station.
- Initially double-track and then increased cross-section/triple track tunnel approximately 560m long to be bored by the underground method, using conventional mechanical means from the end of Aghios Nikolaos Station up to end of the Forestation. The tunnel shall be bored from Bizaniou and Platonos Shafts.
- Double-track tunnel to be bored by the underground method, using conventional mechanical means, in the area of the "TBM Extraction" Shaft wherefrom the excavation/construction shall be performed. More specifically, there are two tunnel sections: one section, approximately 20m. long (which is also used as a chamber for the entrance of the TBM before the "TBM Extraction" Shaft) and one section, approximately 75m long on the other side of the "TBM Extraction" Shaft up to the beginning of the Project at KP 2+517, approximately.

5.3 Shafts

The project includes the Ventilation Shafts of the Stations (some of which are integrated in the Stations) and the six (6) shafts along the alignment, namely: Aghios Sostis, Antipaxon, Filoktitou, Ermionis, Platonos and Aghias Glykerias. All shafts shall be constructed using the Cut and Cover method, while their underground connections with the main tunnel shall be constructed through underground boring using conventional mechanical means.

Moreover, two temporary shafts shall be constructed, namely: the "TBM Extraction" Shaft approximately at KP 2+600 and Bizaniou Shaft in an un-built area in Bizaniou Street (approximately at KP 6+200) for the boring of the Forestation tunnel. These shafts shall be backfilled anew upon completion of the relevant works.

5.4 Expansion of Eleonas Depot

The basic scope includes:

- Demolition of existing buildings and structures (former Athinaiki Chartopoiia S.A. factory, etc.)
- Excavation works (Areas A and B) at a depth of approximately 7-8m and retaining of the excavation throughout its perimeter (except for the side in contact with the existing train stabling area where the existing knock out panels shall be demolished).
- Area A: Execution of the required works for the construction of the foundation of the future central interurban bus terminal (piles, foundation slab, properly positioned supports between the tracks to be constructed, ceiling slab/beams). Construction of connecting tracks with the existing Depot in track fan arrangement.
- Area B: Construction of train stabling/ repair etc. tracks and of the Depot Building made of steel (with some sections made of reinforced concrete) of an area of approximately 18,000m^2 that will accommodate tracks and various areas and operations of the Expansion.
- Construction of the overall railway infrastructure, trackwork, all systems and all items required for the operation of the Depot Expansion.
- Landscaping and fencing works.

5.5 Palatiani Transfer Station

This is an underground structure constructed using the Cut and Cover method in the un-build area in in contact with Palatiani Station under construction between Andrea Papandreou and Ikoniou Streets. The transfer station shall have three (3) underground levels accessed through ramps, with a total capacity of approximately 150 private vehicles offering direct transfer to the Metro. Upon its completion, a Bus Transfer Area shall be configured at street level.

6. Operation – Trackwork Layout

6.1 Operation - Headways

The service hours of trains moving in the Extension to Ilion shall be from 05:30 to 12:00 on a daily basis. The typical headway of the trains in peak hours shall be 300 sec; however, there may be cases – probably exceptional cases – in which, for a restricted time period, trains should move on a reduced headway up to 120 sec along this extension.

Train service in the expansion of the Depot shall depend on the operational needs of Line 3 that also includes the dual voltage trains intended for the service to airport. Trains in the depot shall circulate on a 24/7/365 basis.

6.2 Trackwork Layout

As regards the Extension, tracks in the Metro network shall be of a standard gauge, i.e. 1435mm, and shall consist of UIC 54 tracks, fixed on twin sleepers –with micro-cellular pads and rubber boots– semi-embedded on track-bed concrete.

Turnouts shall be TAN 1:9-190m Radius at the following locations, so as to ensure the operation of the extension and the redundancy of trains reversing at the terminal station. Turnouts shall be as follows:

- One (1) double turnout shall be dismantled at the existing Anthoupoli Forestation and shall be delivered to STASY S.A.
- One (1) single turnout shall be installed before ILION Station
- Two (2) single turnouts shall be installed after ILION Station, so as to connect the two tracks with the foreseen triple-track forestation.

The aforesaid layout shall reliably cover all operation modes, including circulation on the single-track line, and shall serve the system operation in the optimum way.

Noise and vibration mitigation measures shall be introduced and, to this end, the turnouts and sections of tracks, on an as-needed basis, shall be constructed on floating slabs.

Moreover, metal platforms shall be foreseen for the train drivers in the forestation of ILION Station.

In the depot expansion, multiple ballasted railway turnouts shall be installed in the area of the connection with the existing depot up to the new train stabling and repair building. The trackwork in the subject building shall be laid on concrete and on special tracks.

7. Geological – Geotechnical Conditions of the Project

7.1 Geological Formations

The project area in terms of geology consists of sedimentary - terrestrial and mainly lacustrine - Neogene deposits and of recent anthropogenic deposits. At relatively small depths from the surface, lacustrine deposits present lignite intercalations, which were exploited in the past. The geological formations encountered in the wider area of the project (top down) are as follows:

- *Anthropogenic deposits (Holocene)*: They mainly include deposits of mining waste originating from the exploitation of lignite mines – used as backfill materials for the backfilling of the exploitation galleries and chambers – as well as man-made backfilling materials used in building and other works. They are encountered as reworked and randomly deposited materials of variable cohesion. With the exception of backfilled galleries, their thickness varies from several meters in the area where the lignite deposits are mined and up to 2m in the remaining area.

- *Aluvial deposits (Plio-Pleistocene)*: Brownish-green sandy siltstones and sandstones with intercalations of brownish conglomerates. At various locations, older soil layers of red clay and impregnations of red oxides are encountered.

- *Upper formation of lacustrine deposits (Upper Miocene)*: They mainly consist of calcareous claystone and marly limestone with intercalations of brownish-green, at locations, sandy siltstone.

- *Littoral deposits (Upper Miocene)*: Brownish-green sandy siltstones, sand, sandstones.

- *Deltaic fan deposits (Upper Miocene):* Brownish conglomerates and gravels.

- *Lower formation of lacustrine deposits (Upper Miocene):* Cyan-grey siltstones, locally sandy, with intercalations of cyan-grey sand, clay, lignite and organic compounds.

In line with the findings of the subsoil investigations (geological, geotechnical and geophysical) carried out in the area where the lignite mine of Peristeri is located, it seems that the initial main section of the alignment crosses an area with an existing yet reduced possibility of entanglement with the older mining procedures of the lignite deposit (open or backfilled galleries).

7.2 Hydrogeology

The hydrographic network of the area is defined by the presence of torrents which had flooded in the recent years. More precisely, torrents are identified at locations around K.P. 4+800 (artificially configured axis) and around K.P. 6+300 (natural drainage axis). In addition to these specific branches, another three artificially configured torrents are also encountered in the Project axis.

In the greater part of the alignment of the project, water level is above the tunnel. More precisely, it is encountered at depths less than 8m from the soil surface. This is not the case in two areas, i.e. around K.P. 4+800 and from K.P. 6+000 to K.P. 6+470 where water level is encountered at depths from to 10m to 15m.

8. Environmental Studies and Permits

The Environmental Impact Assessment Study shall be prepared and shall be made available before the 2nd phase of the tender. The environmental terms of the Project to be finally approved shall be adhered to by the Contractor.

9. List of Drawings

General Layout of Line 2 Extension
General Longitudinal Profile of Line 2 Extension
Typical Tunnel Cross Sections
Drawings of ILION Station
General Layout of Eleonas Depot Expansion.