

**TITLE OF THE TENDER: “PROCUREMENT OF EQUIPMENT FOR THE
MODIFICATION OF THE FIRE DETECTION SYSTEMS
IN THE METRO STATIONS ON LINES 2 & 3 AND
THEIR INTERFACE WITH THE AUTOMATIC FARE
COLLECTION SYSTEM (AFCS) – OASA
RFP-297/16**

TECHNICAL DESCRIPTION - SPECIFICATIONS

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1. GENERAL FRAMEWORK OF THE PROJECT

1.1 New AFCS - OASA

The Athens Urban Transport Organization (OASA) is currently running a PPP Contract for a project that embodies the design, funding, installation, testing, operation, operation support, maintenance and technical management of a Unified Automatic Fare Collection System (AFCS) which will cover all transport modes of Athens (buses, trolley buses, tramway, Metro Lines 1, 2 and 3 and suburban railway). The system's key feature is the electronic ticket, which will give a decisive push to the public transport system, shall minimize ticket evasion and shall offer a substantial assistance to all transport studies and activities by providing a detailed record of passenger trips.

In particular, OASA's Contractor – Private Sector Partner (PSP), has undertaken the following tasks:

- Design, installation, ensuring the full / uninterrupted operation and technical management of the system
- Preparation of the necessary designs for the installation of the new equipment needed for the smooth operation of the system and the integration of the existing infrastructure into the new complete AFC System.
- Ensuring the correct and reliable operation of the new equipment, at specific availability rates
- Maintenance of the system and its components
- System and equipment customization in view of implementing the applicable fare types and the policies related to fare pricing, control and distribution, as decided by OASA.
- Technical support of the system, which shall address the periodical system upgrades, as well as the staffing of the system control centers throughout the contract duration
- Personnel training on system operation
- Procurement / printing of the initial quantity of the electronic “card”, as well as initial procurement of the “Multiple” ticket, either pre-loaded or not
- Insurance coverage for the equipment and other installations and systems comprising the AFC System and forming the PPP Contract scope, covering the project both during its design and construction stage, as well as during its operation maintenance period.

More specifically, for each station on the Metro Lines 2 and 3 the Contractor – PSP shall install:

- Access control Gates
- Station Management Center (SMC)
- In parallel, the existing ticket issuing machines shall be upgraded so as to accept smart cards – electronic tickets.

1.2 E/M Metro Systems interoperability with OASA’s AFCS

In this framework and in order to ensure interoperability among:

- the new systems of the AFCS (mainly the access control gates)
- the local (in stations) and central (in the OCC) gate control systems
- the already installed (earlier contracts) in the stations E/M systems for fire detection, Building Control & Automation Systems (BACS), direct telephones (DLT), data transmission (OTN), cameras (CCTV), clocks and power supply system

the aforementioned existing and operating E/M systems in the stations along Lines 2 and 3 must be amended and upgraded, with the view of finally achieving the smooth and safe operation of OASA’s AFCS, ensuring primarily the safety of the passengers both during normal operating conditions, as well as in emergency conditions which will likely call for passenger evacuation.

The above interfaces shall be implemented through a series of independent contracts, on a per technical scope basis.

Specifically :

- The fire detections systems must be interfaced with the new AFCS, so that - in case of an emergency – the gates will open automatically in order to facilitate passenger evacuation procedures. It is stressed that the Metro network is served by five distinct providers / installers of fire detection systems, each one being responsible for a distinct geographical area of the Lines 2 & 3 network; even though the general architecture and operational requirements are similar, a different technical approach is generally required in terms of DFD, required new equipment and implementation, as well as different software for each case. Certainly, any amendments to existing E/M system shall be carried out in a manner not affecting their existing functions and capabilities. Among the amendment will be the interfacing between the fire detections systems with the stations BACS. The scope of the amendment also includes the relevant preliminary safety assessment on a design level, so as to ensure that the combined AFCS, Fire Detection and BACS systems achieve the required SIL levels.

The amendment of the fire detection systems and their connection with the AFCS shall take place with the present contract.

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- The BACS systems must be interfaced with the new AFCS, so that in case of an emergency (e.g. activation of fire scenarios) the gates will open automatically in order to facilitate passenger evacuation procedures. It is stressed that the Metro network is served by two distinct providers / installers of the BACS systems, each one being responsible for a distinct geographical area of the Lines 2 & 3 network, namely one for the Base Project (Sepolia – Dafni on Line 2 and Ethniki Amaryna on Line 3 and one for all other extensions. Even though the general architecture and operational requirements are similar in the 2 BACS systems, a different technical approach is generally required in terms of DFD, required new equipment and implementation, as well as different software for each case. Certainly, any amendments to existing E/M system shall be carried out in a manner not affecting their existing functions and capabilities. Among the amendments will be the interfacing between the BACS and the respective fire detections systems in the stations. The scope of the fire detection amendment also includes the relevant preliminary safety assessment on a design level, so as to ensure that the combined AFCS, Fire Detection and BACS systems achieve the required Safety Integrity Levels (SIL)

The amendment of the BACS systems and their connection with the AFCS shall take place with the present contract.

- The direct telephone system is mainly required for the normal operation of the stations and is related to the option that must be provided to the passengers to immediately communicate with the personnel of each station at the gate control line area, whenever the passengers are unable to pass through the gates to either enter or exit the station (faulty electronic tickets or cards, inability to exit from the gates etc.). One DLT shall also be installed near the Fire Box in each station.

This system shall be amended – upgraded by means of an independent contract.

- The data transmission system is mainly required in order to serve the great number of new telephones to be installed in the stations and their connection to the OCC.

This system shall be amended – upgraded by means of an independent contract.

- The cameras – CCTV system is mainly required in order to provide the capability for automatic activation of the surveillance cameras at the control line area of the access gates in each station and, thus, to provide the capability to the Station Master and the OCC for immediate surveillance on the line, in case one or more gates fail.

This system shall be amended – upgraded by means of an independent contract.

- The Clock system must be connected to the AFCS system so as the new AFCS system is synchronized with the existing E/M systems in each station, in order to provide a more precise recording of the time of all events and functions especially in case of failures or incidents that require special addressing and/or subsequent investigation.

This system shall be connected with the AFCS by OASA’s Contractor for the AFCS system.

- The power supply system must be expanded/amended so as to feed the new AFCS system without affecting the operation of the existing E/M systems. These amendments shall be carried out by the PSP – OASA’s existing Contractor.

This system shall be supplemented, amended and connected with AFCS by OASA’s AFCS Contractor.

Before any works are executed, the required interfaces, the methodology for their implementation, the new software and all relevant tasks must be designed at a DFD level in cooperation with the original suppliers of the operating E/M systems.

All the above works shall require the cooperation with the PSP Contractor of OASA, at a technical and operation level, as well as with STASY S.A., because the systems to be amended must not lose their functionality at any given time period other than the night time engineering hours, after a detailed planning in terms of time and technical matters.

The amendments to the above E/M systems and to their connections with the AFCS system will be followed by individual and combined tests, which will demonstrate that the original function of each E/M system has not been altered, but also that the new operational requirements are met after each system is connected with the AFCS.

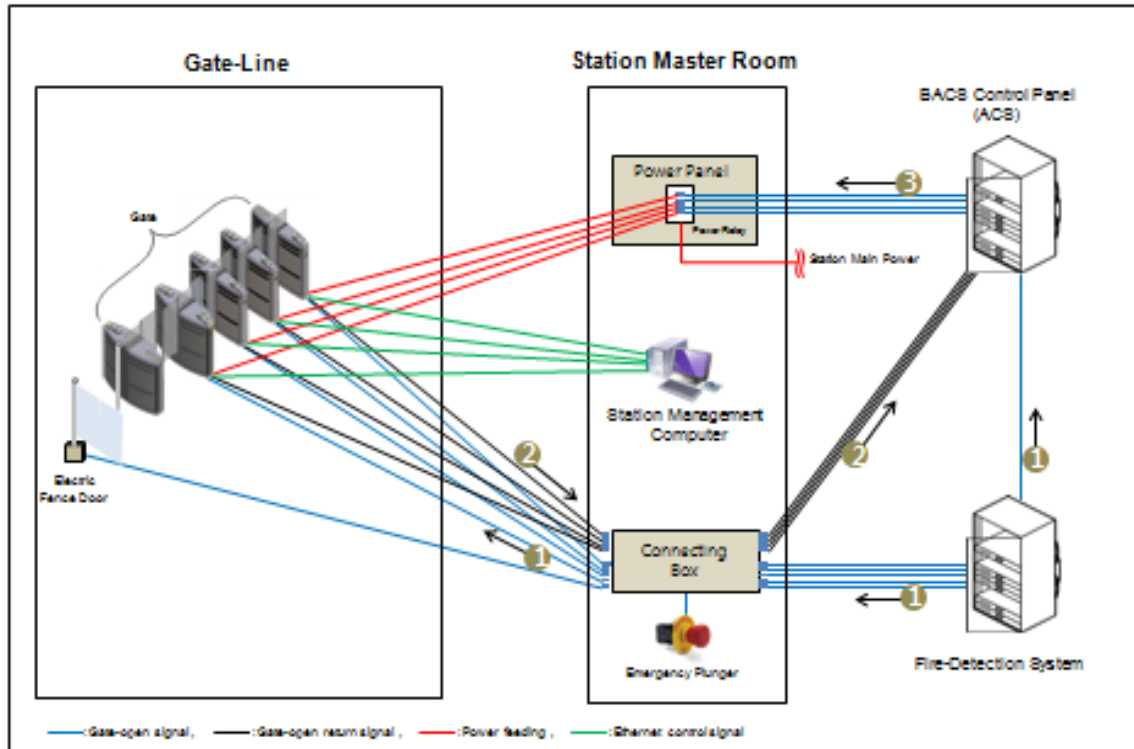
Finally, in parallel to the above activities and until their completion, an overall and independent safety assessment shall be required (by a specialized independent safety assessor) for the entire combined AFC system – E/M systems for:

- The layout of the gates in the stations and their operation both during normal and emergency operation;
- The safety and compliance with the required SIL levels as regards the connections and the combined operation of the AFCS with the E/M systems of the stations.

The following Figure is a schematic diagram of the interfaces among gates – fire detection – BACS:

● BACS & Fire-Detection Interface

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2. SCOPE OF THE PROJECT

2.1 Purpose

The scope of the Project embodies the design, supply, installation and commissioning leading to the implementation of all necessary upgrades, amendments/additions – to the extent required- to the existing operating equipment, the Fire Detection systems within the Metro stations on Lines 2 and 3, for their interface with the new Automatic Fare Collection system and, more specifically, of the new Automatic Access Gates foreseen to be installed in the stations.

The purpose of this interface is the automatic opening of the AFCS gates installed in public areas of the Metro stations, in case fire or smoke is detected, for the safe and orderly evacuation of passengers and personnel.

2.2 Designs

The Contractor shall be responsible for the Detailed Final Designs dealing with all necessary upgrades, amendments and additions to the equipment, new interfaces, software amendments or new software, as required, new materials, new cable routing, installation procedures, test procedures and safety assessment of the Fire Detection Systems for their interface with the Automatic Fare Collection system of OASA and, more specifically, with the access gates. The requirements set forth in this specification must be viewed as the minimum requirements.

In order to prepare the above designs, the Contractor's immediate cooperation with the following agents must be ensured:

- OASA's Contractor (TERNA – LG) who installs the access gates and the AFC system;
- An independent Contractor who shall amend the BACS system in the stations;
- The original suppliers of the operating E/M fire detection systems;
- The Operations Company STASY S.A., because the existing operating E/M systems may need to be amended in time windows to be specified by STASY S.A. without losing the functionality of the original systems during the Metro service hours;
- An independent safety assessor who shall evaluate the overall combined system of gates – fire detection – BACS and who shall play a decisive role in the design and the final configuration of the overall system, since the suggestions of this assessor must be adopted by all involved Contractors and the Contractor of this contract as well.

This cooperation shall be achieved through AM and OASA as required.

The designs shall incorporate the adopted standards, design reports, operational analysis of the amended system, calculations, single/multi line diagrams, connection diagrams, plan views of routing in each station (at a grid to be provided by AM), MSSs for each piece of material and equipment to be incorporated in the Project, installation and testing procedures and methodologies, and all other items required at a design level for the Project’s implementation, and shall be submitted to AM for approval. All employed symbols, abbreviations and code names shall be described in the drawings. The designs shall be precise, concise, easily understood, with sufficient information to provide a full understanding of the functionalities and the characteristics of the new combined system. After the implementation and successful testing of this system, the “AS Built” drawings shall be submitted.

The design approval codes are the following:

- Code 1 : “APPROVED” or “APPROVED AS NOTED”:
The design is approved, the works can be executed. In case the submittal receives comments of minor importance, AM can approve it with Code 1 – “Approved as noted” without the need for resubmission, but these comments shall be incorporated in the “As Built” drawings.
- Code 2 : “REVISE AND RESUBMIT”:
Works cannot be executed. The design shall be revised and resubmitted incorporating the comments, corrections and remarks of AM.
- Code 3: “REVIEW NOT NECESSARY”:
Review of the submittal is not necessary.

Each design shall be submitted in three (3) copies and in a digital form (CD or DVD) in two (2) copies.

Once the designs are approved, any design changes shall be submitted for approval and, after approval by AM, they shall be incorporated in the “As built” drawings.

The designs must be submitted within a period of 30 days from Contract signing. AM shall review and return the designs along with any eventual comments within 15 days. The designs shall be resubmitted for final approval also within 15 days.

2.3 Existing Fire Detection Systems installed in the Metro Network

This unit provides brief information on the Fire Detection systems installed in Metro Lines 2 and 3 in order to understand better the works required to be implemented by the Contractor or the individual Contractors who shall implement the entire scope of the Project.

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The Fire Detection system is one of the two basic components of the Athens Metro Active Fire Protection system.

The Fire Detection system covers all areas of Metro stations (public areas, personnel areas and technical rooms), as well as most of the shafts along the tunnels. All installed Fire Detection devices are certified by recognized Certification entities, while the entire Fire Detection system has been approved by the Fire Department for each Metro station separately.

2.3.1 Base Project Fire Detection System

The Fire Detection system installed in the Base Project (nineteen (19) stations, i.e. twelve (12) on Line 2 from Sepolia to Dafni and seven (7) on Line 3 from Monastiraki to Ethniki Amyra) is a conventional type system (i.e. no telegram assignments), while the manufacturer of all its components is Siemens (commissioned in 2000).

The system includes in each station:

- The Main Fire Detection Panel located in room 3.13 (Fire Fighting room)
- The Fire Detection Mimic Panel located in room 2.3 (SMR room)
- Visible smoke detectors
- Flashers
- Alarm activators (buttons and audible alarms)
- Buttons for manual fire fighting with INERGEN (located outside the rooms protected by INERGEN)
- Cables with suitable cross sections.

Whenever a fire is detected, specific only information/signals are transmitted by the Fire Detection System in each station of the Base Project to the Operation Control Centre (OCC); this is implemented via the independent BACS system (called ECS/BMS system in the Base Project). More specifically, the OCC receives information concerning only the fire alarm signal which affects the HVAC system deactivating the respective fans of the ventilation and smoke extraction systems. Such signals are those signaling a fire in public areas and technical rooms. These signals are centralized and may not include information from all geographical areas and rooms of the station.

Full information at station level as regards the Fire Detection zone is available only on the Central Fire Detection Panel.

2.3.2 Fire Detection System of the Extensions

As regards Phase A' and B' extensions of the Metro system, and specifically per extension, four (4) Fire Detection systems have been installed, of the analogue type with telegram assignments, manufactured by four (4) different companies. More specifically:

1. The Fire Detection system installed in the first phase of the extensions with seven (7) stations, i.e. Aghios Dimitrios and Aghios Antonios on Line 2, and Halandri, Doukissis Plakentias, Keramikos, Eleonas and Egaleo on Line 3, a has been manufactured by Esser (commissioned 2004-2007).
2. The Fire Detection system installed on the three intermediate stations of the northbound extension of Line 3, i.e. Holargos, Nomismatokopio and Aghia Paraskevi, has been manufactured by Detectomat (commissioned in 2009).
3. The Fire Detection system installed on the extension to Elliniko with four (4) stations, i.e. Ilioupoli, Argyroupoli, Alimos and Elliniko, has been manufactured by Siemens (commissioned in 2013).
4. Finally, the Fire Detection system installed on the extension to Anthoupoli (Line 2) and Haidari (Line 3), i.e. Peristeri, Anthoupoli and Aghia Marina stations, has been manufactured by Bosch (commissioned in 2013).

In each of the above stations, the Fire Detection system comprises:

- The Central Fire Detection Plan located in room 3.13 (Fire Fighting room)
- The P/C that processes the Fire Detection signals (FireAlarmManagement - FAM located in 2.3 (SMR)
- Visible smoke detectors
- Flashers
- Alarm activators (buttons and audible alarms)
- Buttons for manual fire fighting with INERGEN (located outside the rooms protected by INERGEN)
- Cables with suitable cross sections

The Main Fire Detection Panel in each of the aforementioned stations communicate via BACS with the OCC located in Syntagma station.

More information regarding the Fire Detection systems in the Base Project and its extensions are attached to the five (5) documents that accompany the DFD for the said Fire Detection systems.

Any additional information shall be provided by AM to the Contractor if available.

2.4 Works that need to be implemented for interfacing the Fire Detection System with the AFCS

The bidders can submit their offer for the amendment/upgrading/interfacing of the Fire Detection Systems in one or more sections of Lines 2 and 3 as they were described above in article 2.3.1 for the Base Project and article 2.3.2 for the four (4) extensions.

The scope of the present Metro stations interface project includes:

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- The DFD
- The supply of the necessary new interface equipment,
- The amendment – upgrading of the existing Fire Detection equipment, as required,
- The software and its necessary amendments, additions and upgrades,
- New cabling connecting the Fire Detection Panel with the gates system and the BACS system at a local level,
- Ensuring reliable communication among these systems,
- All power and control cables on the Fire Detection system side,
- Testing and commissioning of the combined system of gates/fire detection/BACS
- Preliminary safety/RAMS analysis
- Preparation of the “As Built” drawings.

The information from the preliminary safety analysis shall include quantified information and data for redundancy insurance and reliability/availability as regards the new fire detection system and specifically its internal architecture and connections with the interfaced BACS and gates systems. This information shall be passed to an independent safety assessor who shall undertake the task of assessing the safety of the entire AFCS system.

The aforementioned works are considered as the minimum required. If additional works become necessary during the DFD stage, then they must be implemented and applied in order to ensure the safe functionality of the interface.

The main requirements concerning the interface are the following:

1. Whenever the fire detection system detects a fire in station public areas, the system must transmit the appropriate command signal from the main FAP of the station to the gate system (ONE signal to the local control panel of the gates which shall be subsequently transmitted to the controller of each gate), in order for the gates to open automatically and facilitate the swift and safe passenger (and personnel, if required) evacuation. The gate opening function shall be also activated in certain stations with specific layout, where there is a fire in a technical room adjacent to a public area.

The gate opening activation command shall be supervised and in accordance with Standard EN54-14.

2. Each command from the FAP is connected via a dry contact with a 2-cable connection AWG #18 24V DC (I/O and input ground) with the gate control panel which will be installed by the gate Contractor; this panel shall distribute the incoming (from the Fire Detection system) signal for gate opening to all gates. The Contractor shall be responsible for the cable routing running from the FAP equipment to the gate control panel, while the interface between each gate and the gate control panel is the scope of the Contractor for the gates. All cable terminations from the FAP to the terminal blocks on the gate

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control panel fall in the scope of the AFCS Contractor. In the eventual case that additional equipment is required for the fire detection system, other than the already existing one, then this additional equipment must be identical or absolutely compatible with and from the same manufacturer as the installed equipment.

The installation of a new or supplementary Fire Detection Main Panel in the stations of the Base Project is acceptable. This panel shall comply with EN-54 or VDS standards, while its operation mode must be monitored. The critical control signals such as Power fail, Battery fault, Main fault, Disable shall be displayed in the OCC in one of the existing BACS systems, via interface contacts with the local PLC of the BACS.

When the gate controller receives the aforementioned 24V DC signal, the gate operation mode shall switch from normal operation to emergency operation (gate open).

3. The Fire Detection activation for gate opening shall be implemented both automatically from the fire detection network in the station public areas (or in specific technical rooms adjacent to public areas in certain stations), as well as manually from the MCP (Manual Call Points) buttons located on the Emergency Consolidated Units (in pairs on each platform), as well as at specific other locations in the station public areas. At this point, we stress the need to foresee in the design the management procedures required for the handling of the false alarm issues leading to unnecessary gate opening.
4. There must be automatic digital recording and filing of all commands issued by the Fire Detection System to the gate system for a reasonable time period. These commands must be always retrievable and shall contain all associated technical information, such as fire detector(-s) that have been activated, if they operate with telegram assignments, the zone that was activated, the time it was activated, acknowledgement of transmission to the gates etc.
5. As regards the stations of the extensions, whose SMR is equipped with a P/C, any gate opening command issued by the Fire Detection system shall be printed in the SMR printer, which is connected to the FAM computer of the fire detection system.

No such printing is required for the Base Project stations (since they are not equipped with FAM/Fire Detection Management System/printers).

6. In each Station SMR, a new P/C shall be installed (by the gates Contractor), which shall monitor and control the gates. The relevant gate opening command issued by the fire detection system shall be also transmitted to this computer. The precise layout and connections of the Fire Detection system/gate controllers/gate computer shall be defined at the DFD in cooperation with the gates Contractor.

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7. The Fire Detection signal/command for gate opening shall be independently transmitted (announced) to the local BACS of each station, via new cable routing to be installed by the Contractor. The local BACS system shall transmit this signal to the central BACS in Syntagma OCC. This latter transmission shall be implemented by another Contractor (Contractor for BACS/AFCS interface). In the above framework, an independent Contractor shall modify the existing infrastructure of the BACS system in Syntagma OCC to receive fire detection signals and/or commands and the subsequent gate opening signal in each station. Cabling from FAP to the BACS is the scope of the Contractor, while the connection of the cables from FAP to the BACS shall be implemented by the Contractor for the interface of the BACS/AFCS systems.
8. Apart from the commands or data ensuring the communication between the fire detection system and the gate activation commands by the fire detection system, no other commands or data are required to be transmitted from the gates system to the fire detection system.
9. The procedure for the exchange of all required commands/data between gates and fire detection system must be safe. SIL2 (as specified by CENELEC - EN 61508 and EN 62279) is considered as the minimum safety level. The relevant preliminary safety analysis that the Contractor must prepare shall take into account the architecture of the Fire Detection system, its operational characteristics, as well as the detailed characteristics of the gates and their connections.
10. In case of power failure, the gates shall open automatically (mechanically, by springs) and shall remain in the OPEN position until power is restored. The gate computer shall be powered by UPS and, therefore, communication between FAP (also powered by UPS) and gate computer shall be possible. All possible operation modes under power failure must be covered by the software to be developed for the implementation of the interface, in the form of indications to the user.
11. All cables connecting Fire Detection/gates/BACS shall be fire resistant and halogen free, FE180/E30 (fire resistance for one hour and keeping the circuit alive for ½ hour). Cables shall be routed either within the existing embedded ducts, or on the LV trays. Should new independent and exposed cable routing becomes necessary, this routing shall be implemented within new galvanized metal ducts. No visible cable routing in station public areas is permitted. Whenever cable routing passes through fire resistant walls, the drilled holes shall be sealed again using a special fire resistant mortar. Cable routing shall be coordinated with the gates Contractor who shall implement the pertinent architectural interventions in the stations to install the gates, e.g. removal and modification of floor granites at specific locations.
12. Any interventions/extensions/modifications to equipment and/or software shall not affect to the least the operability and capabilities of the Fire Detection

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system in its current form. In particular, it must be also ensured that any interventions or modifications to equipment or software shall have absolutely no effect on the procedure for the activation of stations/tunnels fire scenarios, and of the automatic fire extinguishing systems installed in special rooms with electrical equipment.

13. After the implementation of the interfaces, tests shall follow (see articles 2.6 and 2.7), which will cover independently and in a combined sense the operation of the two systems. As regards the independent Fire Detection system, the tests shall also cover all tests conducted when the system was initially installed (i.e. without connections to the gates).
14. The entire design and implementation procedure shall “incorporate” and independent safety assessor, who shall be selected by AM by means of an independent tender. This assessor shall control and comment -in terms of safety assurance- all detailed designs (down to the level of circuit diagrams and physical/operational interfaces among the Fire Detection/gates/BACS systems), so as to achieve the required safety level SIL2 for the entire AFCS. The said safety assessor must be provided with the preliminary safety analysis to be prepared by the Contractor of this contract.
15. The hours during which work is permitted to be executed for the implementation of the Project on the operating Metro network are the following:
 - Any works on equipment and software of the operating BACS and Fire Detection systems shall be carried out during the night time engineering hours (00:30 – 04:30),
 - Any works in technical rooms of the stations can be carried out any time and day,
 - Works in public areas shall be carried out during nighttime engineering hours (00:30 – 04:30),
 - The possibility to close down the stations for short periods of time (few days) for the safe and swift execution of the works for gates installation is under consideration.

In any case, access to the operating Metro network takes place after communication and the relevant permit by STASY S.A.

16. Upon completion of the Project, the following items must be delivered to AM:
 - a) All functional information of the new system, which may eventually lead to amended operating procedures of the Operations Company, as regards the operation of the Fire Detection system;
 - b) Modifications/upgrades to the Operation and Maintenance Manuals of the Fire Detection system, as required, possibly in the form of an Appendix to the original Manuals. The requirements of the above point (a) can be included in these Manuals;
 - c) “As Built” drawings of the new/additional routing cable layouts and new cable layouts, as well as single/multi-line diagrams for each station;

- d) A list with the required spare parts;
- e) There will be a 3-year good performance guarantee and any failures during this period shall be at the Contractor's cost.

2.5 Operation Principles for System Integration

To fully clarify the sequence of actions, note the following; in case a fire detector detects a fire, e.g. in a station public area:

- The FAP system shall issue one (1) command to the Gate Control Panel for opening the station gates. The Gate Control Panel shall transmit, in turn, this command to the controller of each gate, as well as to the gates computer in the SMR.
- The command shall be recorded in the files of Fire Detection Panel and shall be printed with all necessary information, such as time stamp etc.
- At the same time, the FAP system shall update the BACS system by wire that a fire was detected and the open gate command was issued. This updating shall be recorded in the BACS files along with all necessary information.
- Acknowledgement by each gate of its open state (or the signal that a gate has not opened) shall be re-directed from the gate control panel initially to the local gate control computer in the SMR, but also to the BACS system, where it shall be recorded. No such acknowledgement to the Fire Detection system is required.
- The BACS system, having received an update by the FAP system that the gate open command was issued and having not received the signal that the gates have opened within a specified time period, shall be capable to automatically issue a second command for gate opening with a predefined time delay. Should such a command be issued, it must be also recorded in the BACS files along with all necessary information.
- If the BACS system does not receive the gate open acknowledgment and after a predefined delay, it shall transmit a command to the power supply switchboard of the gates to cut out the power to the gates, so that they open via their fail-safe mechanism (mechanical springs in case of power failure). However, this case does not concern the present contract for the Fire Detection system.
- All details pertaining to the operation, sequence and characteristics of the signals, commands, indications and response times shall be decided in the DFD in cooperation with the Contractors for the gates and the BACS.

2.6 Site Acceptance Test (SAT)

Upon completion of all required works of the Contractor for the interface between the FAP system and the AFCS system and the conduct of the Installation Tests, the Site Acceptance Test (SAT) shall be carried out in each station.

The purpose of these tests is to verify that in case a detector is activated, all necessary actions shall be executed by the FAP system to the AFCS system and to the BACS system, as described above.

The time schedules of the SAT tests shall be developed by the Contractor and submitted to AM for approval.

2.7 System Integration Tests (SIT)

The System Integration Tests (SIT) shall be carried out after the successful completion of the SAT tests in all stations and associated tunnels on the complete system.

The time schedules of the SIT tests shall be developed by the Contractor and submitted to AM for approval,

These tests shall demonstrate that all equipment and fire detection/interface systems are fully integrated with the access gates/AFCS/BACS and operate properly as integrated systems, fully satisfying the specified operation and performance requirements.