

Special Brochure

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## Geotechnical Engineering

# Ports, Marinas & Harbours



March 2014

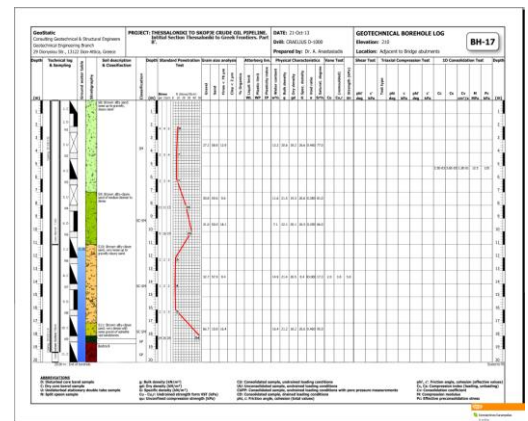
## A General Introduction to Geotechnical Works

**GeoStatic** maintains a strong service base and expertise in our original core business and specialty of geotechnical engineering. Through the initial Geotechnical Site Investigation and Characterization and the focused integration of geotechnical and structural engineering expertise, **GeoStatic** routinely addresses a variety of complex ground-related conditions.

We provide engineering analyses and design services for foundations, tunnels, dams, slope stabilizations, ground improvements, earth anchored retaining structures, buried utilities, marine facilities, highways, railroads, site development and temporary underground structures. From site selection through construction, **GeoStatic** provides each client with site-specific solutions for their below ground construction.

Our engineers are experienced in a wide range of geotechnical engineering applications, including:

- Geotechnical Site Investigation and Characterization
- Subsurface Exploration Programs
- Footing and Mat Foundations
- Piles and Caisson Foundations
- Tunnels
- Drilled Shafts
- Retaining Walls
- Deep Anchored Piled Retaining Walls & Structures
- Braced Excavations
- Soil and Rock Slope Stability
- Earth and Rock Fill Embankments
- Groundwater Control
- Preloading and Surcharging
- Deep Soil Densification
- Ground Improvement
- Pavement Design
- Seismic Design
- Geotechnical Instrumentation



**Head of Geo Department**  
**Director of GeoStatic**



**Prof. Dr Constantine Sachpazis**  
Civil & Geolog-Geotechnical Engineer  
B.Eng, Dipl. Geol., M.Sc.(Eng), Ph.D., Post-Doc. UK

**GeoStatic's** design approach is focused on reducing foundation and earthwork construction costs while providing our clients with a technically sound project. This often involves evaluating the costs and benefits of ground improvement alternatives to traditional structural solutions (i.e., deep foundations and structural slabs).

The construction oversight and management we provide our clients is as important as the up front work, and is a key element in keeping a project on track. **GeoStatic's** field engineers combine technical expertise, quality control and project understanding to confirm that the job gets done. We work as our clients' eyes and ears on the site, monitoring construction for conformance with project specifications and providing immediate engineering input when design or field conditions change. Our goal is to address on-site issues before they turn into problems.



**Geostatic's** main concept of work is to consider the interaction between ground and structure.

Having the capacity to provide an integrated process of work, it is easy to implement a holistic view in any kind of project. Thus, the basic differences in approach between structural and geotechnical engineering concept which very often leads to project time delays, increasing of predetermined budget or unreasonable claims, are easily resolved.

Also in the case when the **GeoStatic** it is not possible to be engaged for the whole project, due to the project delivery method, the structural branch assists providing the proper link in order to achieve the most efficient solution.



## Design and Consulting Availability

- Fully operational in Greek, English and Romanian.
- Fully conversant with European, American, British and Romanian Codes.
- Fully operational via IT and web networking technologies.



## A few Marine related Projects on Ports, Marinas & Harbours Executed by GeoStatic Partnership

#	Project Title	Employer	Project Budget
1	Supplementary geotechnical site investigation & characterisation, Soil Mechanics Study and foundation engineering design for the Port Authority buildings at Samothraki Island harbour - Greece.	"J/V S.M. ANEGERSIS SA - ALCON SA" - Consortium of Technical Companies, 37 K. Paleologos, PC 681 00, Alexandroupolis Municipality - Prefecture of Evros.	€ 150 million
2	Geotechnical site investigation & characterisation, Soil Mechanics Study and foundation engineering design for the Port Authority buildings at Samothraki Island harbour - Greece.	"Iakovakis Consortium of Technical Companies for Public Works", 37 K. Paleologos, PC 681 00, Alexandroupolis Municipality - Prefecture of Evros.	

### Kamariotissa Port, Alexandroupoli

**Kamariotissa Port** is located in NW end of Samothrace Island, Greece, in the homonymous bay. Kamariotissa Port is 29 nautical miles away from the port of Alexandroupolis and connected with it by cargo and ferry ships. The port is artificial and protected from windward and leeward breakwater, and its entrance forms an opening of 160 meters, with depths to its axis of -6.50 m and is facing SW. The port of Kamariotissa consists of the following projects, which have been built in several phases. Windward breakwater, constructed in phases in a zigzag line, a total length of approximately 422 m, flanked with vertical front and shield on the windward side with natural boulders and active depth before the front ranging from -3.00 to -6.00 m.

Beach quays, made in phases too in a zigzag line, extending south of the base of the windward pier, having successively (from north to south) the following elements:

- Section 1: length 90 m and active depth of -3,00 m, used for berthing small fishing boats and the Port Patrol Vessel of Samothrace.
- Sections 2 and 3: length 90 m and 105 m respectively, and depth varying from -3.50 m to -5.00 m , used for berthing vessels (commercial or otherwise) and cargo and ferry ships that serve coastal traffic of the island.

Leeward pier constructed by natural boulders of approximately 100 meters long and pier dimensions 40 by 50 m in contact with the lee breakwater, with quays wall vertical fronts (NE and NW edge) and floors of reinforced concrete.



**Map & Aerial Photo of Kamariotissa Port**

#	Project Title	Employer	Project Budget
3	Geotechnical site investigation & characterisation and compilation of Soil Mechanics and foundation engineering Study for the safe and economic foundation of quay wall / platform of the wharf of the third pier of Volos City Port, Magnesia Prefecture.	Volos Port Authority SA.	€ 250 million
4	Supplementary Geotechnical site investigation & characterisation and compilation of Soil Mechanics Study for the safe and economic foundation of the quay wall / platform of the wharf for the extension of the central pier of the Port of Volos City, Magnesia Prefecture	Technical Department of the Port Authority Fund. Prefecture of Magnesia.	€ 80 million
5	Geotechnical site investigation & characterisation and compilation of Soil Mechanics Study for the safe and economic foundation of the quay wall / platform of the wharf for the extension of the central pier of the Port of Volos City, Magnesia Prefecture.	“D. Katsaros SA” - Construction Company of Public Works. Submitted to Construction and Building Regulation Directorate / Ministry of Public Works & the Environment.	

## Volos Port, Magnisia

According to Mythology, the port that lies upon ancient Iolkos where one of the most legendary sea faring epics of ancient times started. Here, at the safe port of the wonderful Pagasitikos bay, Jason built his trireme, Argo, and along with his oarsmen set course for Colhis bringing back and getting married to priestess Medea.

The legend indicates the struggle of Greeks to tame the sea and communicate with other peoples.

The port was founded in 1893. Volos, an insignificant town of 5000 people who lived around the ancient castle, year by year turned into one of the most industrial and handicraft centres in Greece. Today, Volos numbers 120.000 people.

The port started to gain traffic due to the considerably rising number of the tourists who enjoy the attractions of Mount Pelion that towers over Volos, and the unrivalled coasts of Pagasitikos bay and the Aegean sea. Mount Pelion was the place of abode of the mythical Centaurs who were half men and half horses. The most famous was Centaur Chiron.

Also, a great volume of tourism is due to the magnificent islands with their enchanting beaches that lie 1-3 hours' trip from Volos, such as Skiathos, Skopelos, Alonisos and other smaller ones.

The Magnesia Port Fund, that is currently responsible for all the regional ports of the prefecture, pays particular attention to the development of tourism by cruise-boats. Thus, it is a member of an organization that promotes the development of that section in the Mediterranean region under the name of Medcruise and has been a founding member of the organization.

The works that have been under construction lately, and those that will soon be constructed, create one of the big Eastern European Union's gateways that may deal with any kind of cargo. The ones who may be interested will find themselves among a friendly environment and will be served by the port services.



Volos Port Map



Volos Port Aerial Photograph

#	Project Title	Employer	Project Budget
6	Alternative proposal for foundations of new buildings and foundation engineering calculations of covering slabs for the external flooring in front of Block 3 (Block O.T. 3), as well as of the pavement wearing course made of Concrete Slabs in the transit and parking floor of boats and yachts in the Tourist marina at Pythagorion Municipality - Samos Island, at Karpovolos location.	Samos Marines SA - Societe Anonyme Company of Marina Management. Spyrou Loui and Patmos, PC 151 24, Municipality of Maroussi - Attica.	€ 55 million
7	Geotechnical site investigation & characterisation and Soil Mechanics Study for the safe & economic design of the foundation of the new premises of the Tourist Marina at Pythagorion - Samos Island, in Karpovolos location.	Delos Marines SA - Construction Company of Public Works. Submitted to the General Secretariat of support of Tourism Marinas & ports Development in the Hellenic Ministry of Development.	

### Samos Pythagorion Marina, Samos

Samos Pythagorean Marina is situated on a strategic location on the island of Samos, at the eastern Aegean Sea. The facilities are located on the southeast part of the island, just 500m away from the picturesque village Pythagorio. Samos Marina provides mooring close to the village, but at an isolated and well-protected location. The marina is built in accordance with the state of the art specifications and provides full range services to boats and boaters.

With a berthing capacity of 260 boats, Samos Marina can host yachts up to 25m in length according to the official plan. Super yachts up to 50m of length have been already hosted in the marina, and a number of at least 10 berths for yachts above 25m is arranged and adequately equipped. The marina boatyard can host up to 170 boats serviced all around the year at the repair & maintenance zone area.

Samos marina also includes facilities that serve all of the guests needs: shopping, restaurants, supermarket, laundry washers; but also yacht club marine sport facilities, cultural events, hall, as well fuel station and waste pumps service.

Other Facilities in the Marina include:

- 12 room hotel with water pool
- Boat chandlery & supplies shop
- Café/Bar
- Diving centre
- Mini market
- Nautical Club of Samos
- Restaurant (Stake House)
- Yacht Club
- Yacht Chartering offices





Pythagorio Samos Marina Map



Pythagorio Samos Marina  
General aerial view



Pythagorio Samos Marina  
Lateral aerial photograph



#	Project Title	Employer	Project Budget
8	Geotechnical site investigation & characterisation, Soil Mechanics Study and foundation engineering aspects for the construction of the Marathon Olympic rowing game centre roads & marina at Schinias – Attica/Greece within the framework of the Project: "OLYMPIC GAMES ATHENS 2004".	Projects Division (a) of Specific Highway and Transportation Works of Attica, Direction of Public Works, General Secretariat of Public Works, Ministry of Public Works & the Environment.	€ 780 million

### The Schinias Olympic Rowing and Canoeing Centre, Marathonas, Attica

The Schinias Olympic Rowing and Canoeing Centre was built to host the rowing and canoe sprint events at the 2004 Summer Olympics in Greece.

It is the most northerly venue of the 2004 Games situated to the east of the town of Marathon. It covers 1.24 Km<sup>2</sup> and has a spectator capacity of 14,000. It is a part of Schinias National Park.

Although not fully completed until January 31, 2004, it held its first successful competition, the Junior World Rowing Championships, in August 2003. During these championships, many boats became waterlogged due to the gale force winds and the resulting water conditions. Most of the final rounds were raced over shortened course to avoid worse water in the second half of the 2 Km lake.

During the construction there was controversy over the environmental destruction as wetlands were remodelled for its construction.

The centre is one of the only FISA-approved training centers in the world, the others being Munich and Seville. It's Hosts domestic and international rowing and canoeing meets, and has hosted the 2008 European Rowing Championships in September 2008. After 2004 Olympics, the facility was completely reconstructed by the German company Hochtief.

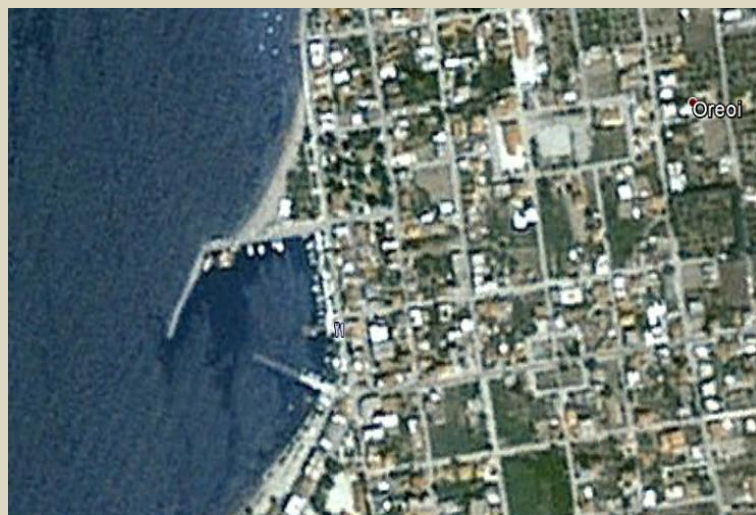


Rowing Olympic Center in Schinias,  
Marathonas, Greece

#	Project Title	Employer	Project Budget
9	Assessment of Geotechnical site investigation data and Soil Mechanics / Geotechnical Interpretive Report for the safe and economic foundation of the leeward breakwater jetty / wharf of Oreos Evia Isle port, as well as for the stability of excavation slopes.	ERKAT SA - Construction Company of Public Works. Submitted to Prefecture of Evia.	€ 15 million

### Oreos Evia Isle Port, Evia

Oreos Evia Isle Port is a small port situated in the North part of Evia Island in Greece. In the harbour during the summer time many sailboats are berthed. Also sailing races conducted at amateur level. The Oreos Port is also used for handling and transporting aggregates using cargo ships.



Aerial photo & Photo of Oreos Evia Isle Port

#	Project Title	Employer	Project Budget
10	Laboratry testing results interpretation report from borehole drilling samples for the project: "Larnaca Port - Cyprus". In collaboration with the consulting company "HYDROTECHNICS ATEAI CYPRUS".	The Cyprus Ports Organisation.	€ 700 million

## Larnaca Port, Cyprus

The Larnaca Port is a part of the infrastructure of an industrial business and tourist centre of the island and it is the nearest both to Nicosia, the country and to south eastern major agricultural and tourist areas of Cyprus. The Port serves both the cargo and the passengers and is the country's main service port for exports of agricultural products. Transhipment of containers and cars is also a major business of the port. Great strides have been made developing facilities at Larnaca Port with the most recent the dredging of the north quay to 12 meters, which is mainly used for container handling, the strengthening of container handling equipment with two 40 ton panmax plus gantry cranes, which raised the annual handling capacity of the port to some 250.000 TEUs.

### GENERAL INFORMATION OF PORT

**Geographical Location:**

Lat 34° 55' N, Long 33° 39' E

**Use:**

Multipurpose

**Regulatory Status:**

Customs free area for transhipment & distribution operations.

**Breakwater Port:**

Entrance Channel 12 m deep and 200m wide. Inner harbour ship turning circle 300m. area, 12m. deep. Tide 0,5m. Outer anchorage - open roadstead, Water depth 7,4m. - 14,7m.

**Marine Craft:**

4 tug boats (up to 35 ton bollard pull), 3 pilot lounches (up to 22 knots).

**Pilots:**

3 plus the Port Manager (all master mariners).



The Larnaka Port. General view



#	Project Title	Employer	Project Budget
11	Laboratry testing results interpretation report from borehole drilling samples for the project: "Limassol Port - Cyprous". In collaboration with the consulting company "HYDROTECHNICS ATEAI CYPRUS".	The Cyprus Ports Organisation.	€ 1,100 million

## Limassol Port, Cyprus

The Limassol Port is situated on the outskirts of the country's second main city in terms of population and economic significance. It is the largest port in Cyprus, serving most of the island's seaborne cargo and passenger traffic. It handles two thirds of the total container traffic locally generated and transshipment as well as the entire volume of grain imports. Similarly, over the 90% of the country's passenger traffic is presently served by this port. As a container port, Limassol provides two terminals with six gantry cranes and a total annual capacity of 600.000 TEUs. The port's new container terminal with a draft of 14 meters along the quay is a part of the first phase of the Limassol Port's development plan scheduled to be completed by the year 2010.

Limassol port has acquired recently two new tug boats in order to assist the handling of increasing number of bigger vessels. Additional improvements of facilities at Limassol Port include the expansion of the storage capacity of its grain silo, the construction of a significant number of dolphin berths on the south part of the basin, the upgrading of the western multi-purpose quay into a post panamax vessel facility as well as the extension of the passenger terminal. In addition to being a major container transshipment centre in the Eastern Mediterranean, Limassol is also an important cruise liner hub for mini excursions in the region as well as main stopover point for international liners cruising in the area.

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### GENERAL INFORMATION OF PORT

**Geographical Location:** Lat 34° 39' N, Long 33° 01' E

**Use:** Multipurpose

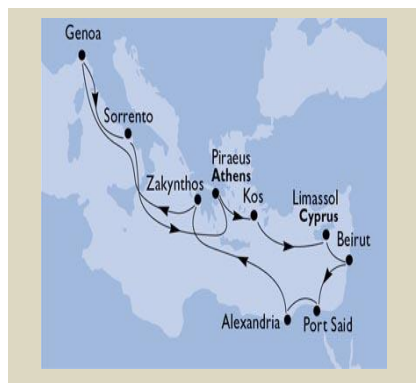
**Regulatory Status:** Customs free area for transshipment & distribution operations.

**Breakwater Port:** Entrance Channel 17 m. deep and 250m. wide. Ship turning circle 17 m. No LOA limitations - Tide 0,5 m. Outer anchorage - open roadstead, no draft limitations.

**Marine Craft:** 3 tug boats (up to 35 ton bollard pull), 3 pilot launches (2x375 BHP, 1 mooring boat 130 BHP).

**Pilots:** 6, all master mariners.

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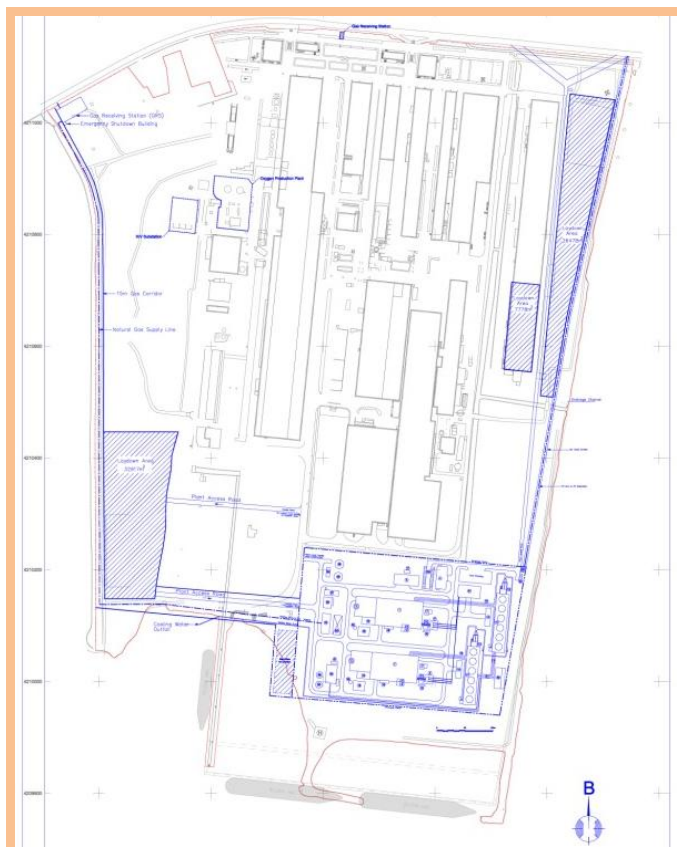


#	Project Title	Employer	Project Budget
12	Geotechnical Engineering Site Investigation / Characterization and Soil / Rock Mechanics Study for the safe and economic Foundation of the biggest Greek natural gas fired Combined Cycle Power Plant (CCGT) Project "Halivourgiki CCGT Project" in a 100.000 s.m. plot inside the Halyvourgiki S.A. property, located in Elefsina Municipality - Attica Prefecture. Project developed and owned by the Joint Venture between the Greek Public Power Corporation (PPC) and Steel Production Incorporated Industry «HALYVOURGIKI S.A.». Cooperation with the general Energy Project Consultant «Mott MacDonald Limited».	HALYVOURGIKI SA. - Steel Production Incorporated Company. 8, Dragatsaniou str. - 105 59, Athens - Attica, Greece. VAT Number: 094015074, Tax Office: F.A.V.E. Athens.	€ 950 million

### Halivourgiki CCGT Project, Elefsina, Attica

Halyvourgiki Combined Cycle Gas Turbine Power Plant, Greece. We are appointed to undertake a detailed Geotechnical Engineering Site Investigation / Characterization and Soil /Rock Mechanics Study relating to two single shaft gas turbine combined cycle blocks to be constructed on Halyvourgiki's steel plant located at the Gulf of Elefsina, Greece. This project included the Soil liquefaction potential assessment of a costal foundation ground and its suitability for a CCGT Power Plant construction ( <http://www.ejge.com/2011/Ppr11.049/Ppr11.049ar.pdf>).

It should be emphasized that the foundation of the project was placed on artificial embankments (man made backfilling material) and not on natural (in-situ) soil and hence the stability and security issues of the project's were of extraordinary and major importance, an issue that was dealt with by Geostatic very efficiently and successfully.



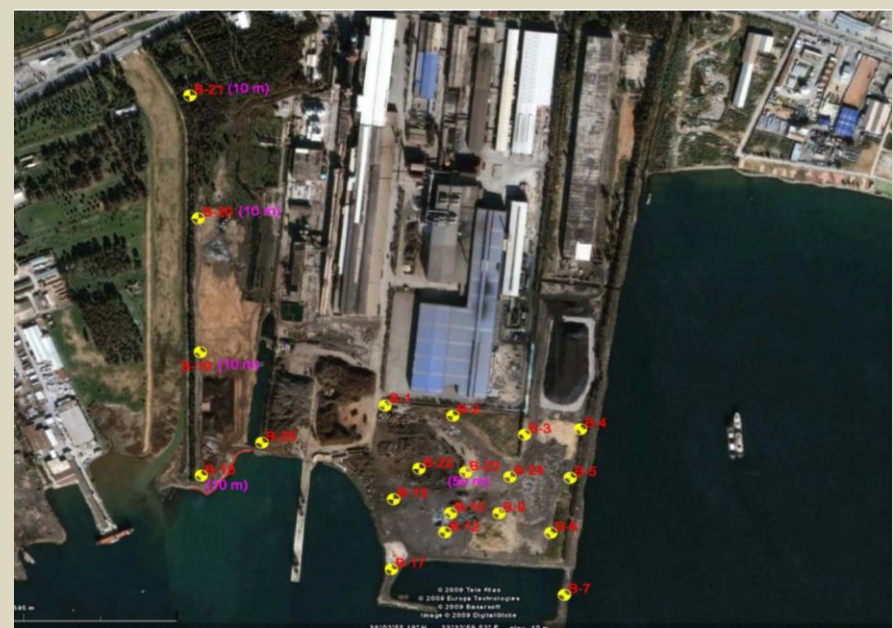
Topographic diagram of all anticipated installations, structures, buildings and plants of the "Halivourgiki CCGT Project", in an approximately 100.000 s.m. plot, of the Steel Production Incorporated Company Halyvourgiki S.A., located at around the 20th km chainage of E.O.A.K., in Elefsina Municipality - Attica District, Greece.





Topographic diagram presenting the adjacent region of development and foundation of this energy project “Halivourgiki CCGT Project” with the line (red) of the delimitation and arrangement of the old Shoreline before dumping the artificial embankments (man made backfilling material) with rubble and metal objects that emanated from metallurgic furnace slag and steel block material.

Aerial photograph, of a scale 1 : 8.500, with the locations of the investigation - sampling boreholes B1, B2, B3, B4, B5, B6, B7, B9, B10, B12, B15, B17, B18, B19, B20, B21, B22, B23, B24, and B25, in the area of foundation of the new anticipated installations of “Halivourgiki CCGT Project”.



During the execution of a geotechnical site investigation and sampling borehole.

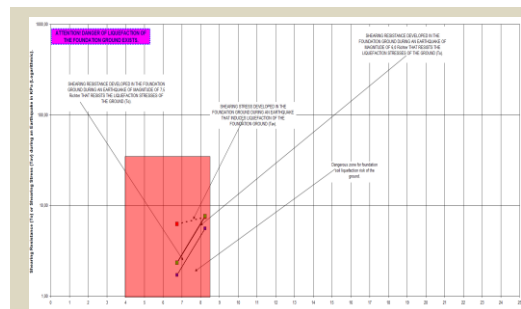


Diagram of control of foundation Soil Formations Liquefaction Risk Probability. Bore hole G-20

## Credentials

Prof. Dr. Constantine Sachpazis, Director of **GeoStatic**, Head of the Geotechnical Department, is also Associate Professor of the Department of GEOtechnology and ENVironmental Engineering (GEOENV), part of the School of Technological Applications based in Kozani, Greece (<http://env-pol.teiwm.gr/index.php?lang=el>)

Costas teaching the following courses:

- Soil Mechanics I (Theory, Exercises and Laboratory)
- Geotechnical Engineering for Tunnels and Dams (Theory, Exercises and Laboratory)
- Soil Mechanics II and Rock Mechanics (Theory, Exercises and Laboratory) with Computer Aided Geotechnical Engineering Design & Analysis.

[http://www.teiwm.gr/dir/cv/48short\\_en.pdf](http://www.teiwm.gr/dir/cv/48short_en.pdf)

**Committed  
To  
Excellence**

***GeoStatic***

***A company for  
Civil Engineering  
Works***



## Related equipment for geotechnical studies

Related equipment for geotechnical studies:

The **GeoStatic** geotechnical engineering department is comprised not only of the experts the project needs, but the equipment needed to get the project carried out correctly. Our staff combines decades of technical knowledge with a deep understanding of regional field conditions, and our array of testing equipment is the most extensive in our region.

For Subsurface Exploration our geotechnical fleet is ready to service any project, anywhere in our region. We operate a fleet of three drill rigs and one all-terrain vehicle, allowing for access to any site regardless of site conditions. Specialized field equipment includes pressure meters, inclinometer instrumentation, standard penetration test equipment, dynamic cone penetrometers, geophysical equipment for electrical resistivity measurement, ground penetrating radar, shear strength pocket penetrometers, traditional continuous sampling capability and coring, etc.

The drill rigs of our company are:

- Drill rig for sampling, type GREALIUS ATLAS-COPCO D-750, on the sled, with chassis number: 114, motor PERCINS 35 HP, and engine number : 1520, which is in excellent condition and ready at all times for operation,
- Drill rig for sampling, type GREALIUS ATLAS-COPCO XC 90, on the sled, with chassis number: 702, motor PERCINS 35 HP, and engine number: 5/152, which is also in excellent condition and ready at all times for operation, and
- Drill rig for sampling, type GREALIUS ATLAS-COPCO XC 90, on the sled, with chassis number: 224, motor PERCINS 35 HP, and engine number: 4700, which is also in excellent condition and ready at any time for operation.

### **Athens Branch:**

29 Dionysiou Str., 13122 Ilion-Attica, Greece  
T: 0030-210-523 81 27

### **Thessaloniki Branch:**

10 Taskou Papageorgiou Str., 54631,  
Thessaloniki, Greece  
T: 0030-2310-230.529



***Company registered office: DEPT 440, 61 PRAED STREET, LONDON W2 1NS***

**[www.geostatic.eu](http://www.geostatic.eu)**  
**email: [info@geostatic.eu](mailto:info@geostatic.eu)**

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