antiseismic reinforcement

THORAX®

You ’ve never experienced such safety!

ANTISEISMIC REINFORCEMENT THORAX

FIND OUT WHY THE BIG CONSTRUCTION WORKS TRUST THORAX!

The **ANTISEISMIC REINFORCEMENT THORAX** has been chosen by major Greek Construction Companies for the concrete reinforcement of significant works. This constitutes an ample proof of the unique combination of safety, usefulness, speed and cost effectiveness that the **ANTISEISMIC REINFORCEMENT THORAX** provides.

Some of the major construction works, that have been built with the **ANTISEISMIC REINFORCEMENT THORAX** are the following:

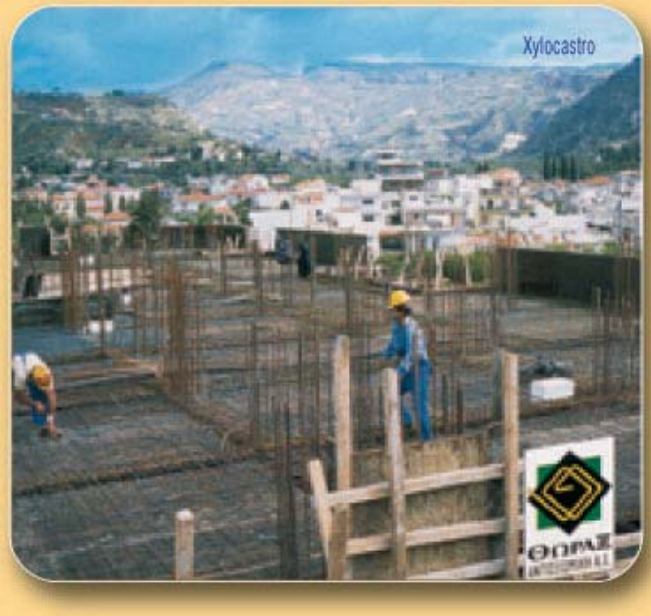
OLYMPIC PROJECTS:

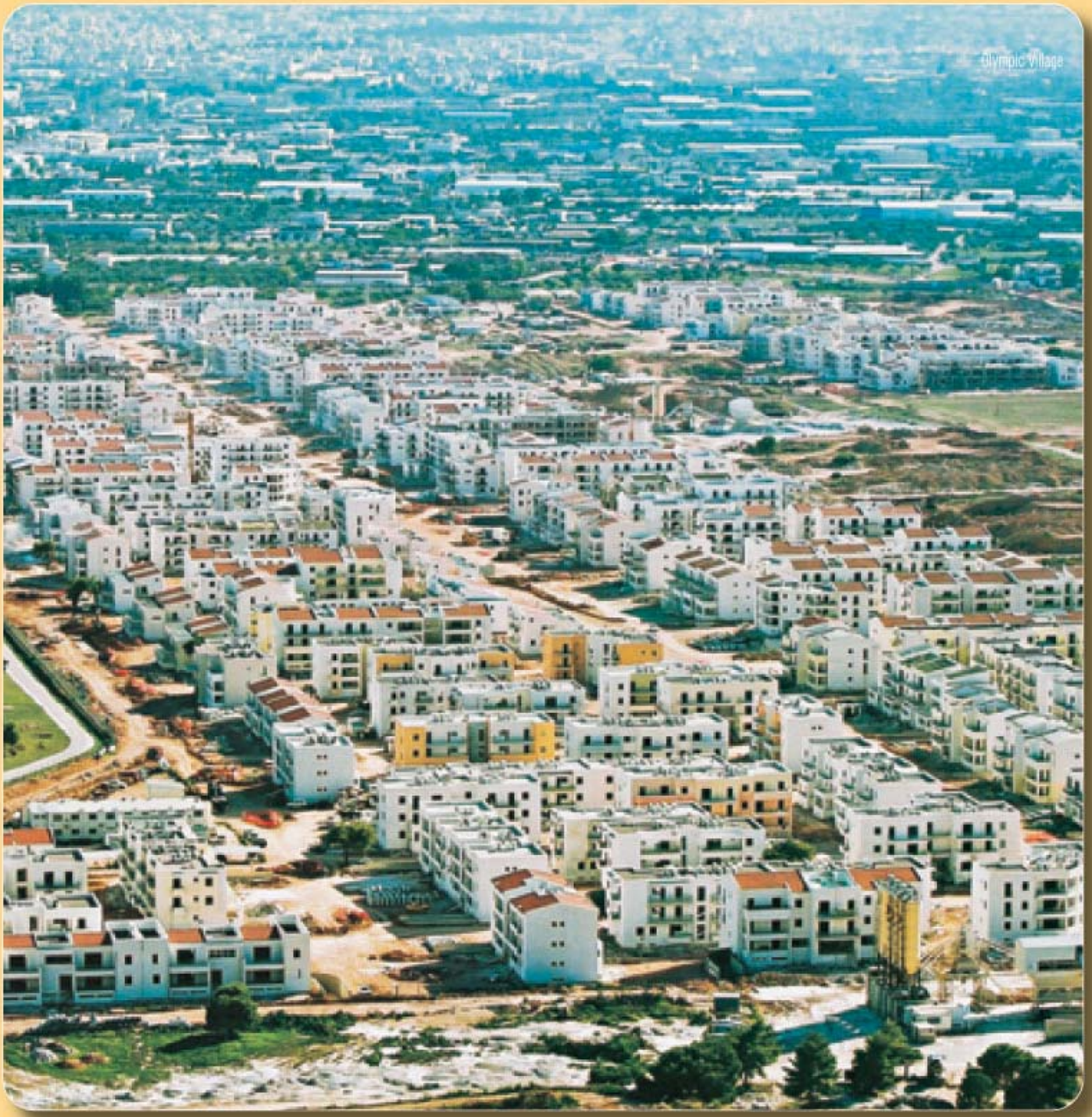
- Construction of 555 residential units at the **OLYMPIC VILLAGE,** awarded to the **ELLINIKI TECHNODOMIKI S.A. – GEKAT S.A. - ALTE S.A.** consortium
- Completion of the **OLYMPIC TENNIS CENTRE** (Athens Olympic Sports Complex) and upgrading/renovation of the **OLYMPIC SWIMMING CENTRE,** awarded to the **INTRACOM CONSTRUCTIONS - DIEKAT S.A.** consortium
- Upgrading of the **PATRAS OLYMPIC STADIUM,** awarded to the **DOMIKI KRITIS S.A. - ERGOKAT S.A. - GNOMON S.A.** consortium
- Construction of the **OLYMPIC VILLAGE MEDICAL CENTRE,** awarded to **K. KOURTIDIS S.A.**
- Construction of the **OLYMPIC VIP** and **DOPING CONTROL CENTRES** at the **ATHENS OLYMPIC SPORTS COMPLEX (OAKA),** awarded to **ERETVO S.A.**
- Construction of the **OLYMPIC VILLAGE FIRE STATION,** awarded to **K. KOURTIDIS S.A.**
- Construction of **BUILDINGS** for the **HELLENIC POLICE COMPLEX,** awarded to the **TOMI S.A. - HELMOS S.A. - KERAMOS S.A.** consortium
- **OLYMPIC CANOE** and **SLALOM CENTRE** in Helliniko awarded to the **TECHNERGA E. TSAMPRAS S.A - K. KOURTIDIS S.A.** consortium
- Two **INDOOR TRAINING CENTRES** at the **OLYMPIC VILLAGE,** awarded to **K. KOURTIDIS S.A.**
- Construction of **DEI (Public Power Corporation)** power station at the **OLYMPIC VILLAGE,** awarded to **ARKTOS S.A.**
- Construction of **IGME** building at the **OLYMPIC VILLAGE,** awarded to **GANTZOULAS S.A.**

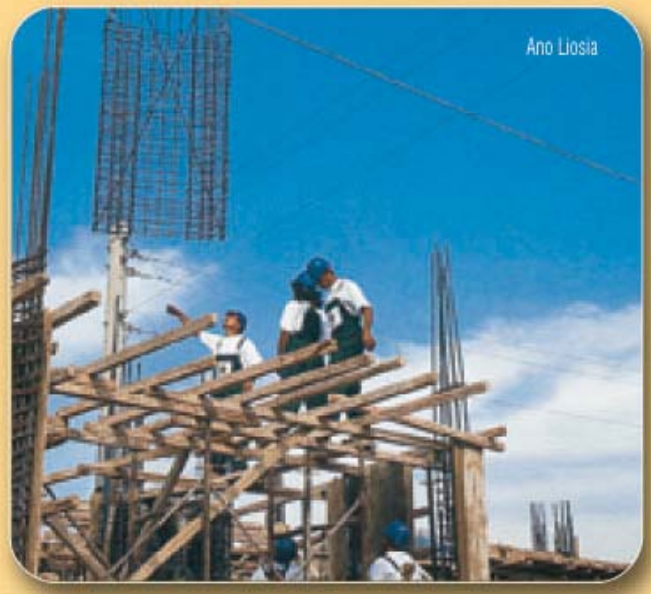
Moreover, **ANTISEISMIC REINFORCEMENT THORAX** was chosen by:

- The **JAPANESE STATE** in the construction of the **JAPANESE EMBASSY** new building in Athens
- The **"ANO LIOSIA RECONSTRUCTION"** Consortium **(ELLINIKI TECHNODOMIKI S.A. – AKTOR S.A. – TEV S.A. - TOMI S.A.)** in the construction of 1.100 residential units in the Ano Liosia Municipality, replacing an equal number of units damaged by the 1999 earthquake
- **GEKAT S.A.** in the construction of the **"CURRENCY SORTING AND HANDLING CENTRE"** (Treasury) of the Bank of Greece in Chalandri
- **GI & KATASKEVI S.A. (DIMIOURGIA S.A. [Latsis Group] and TEP S.A. Consortium)** in the construction of a 12,000 square metre holiday residential complex in Xylokastro
- **A&D APOSTOLOPOULOS S.A.** in the construction of **SCHOOL BUILDING COMPLEXES** in Nikea
- **ERETVO S.A.** in the construction of the **NIKEA HOSPITAL**
- **ERETVO S.A.** in the construction of **STUDENT HOUSING UNITS AT THE ATHENS UNIVERSITY CAMPUS**
- **PYTHAGORAS S.A.** in the construction of **SCHOOL BUILDING COMPLEXES IN GALATAS, TRIZINIA**
- **AIAS S.A.** in the construction of **TEE (Technical Vocational School) OF LAVRIO**
- **KOURTIDIS S.A.** in the construction of **TEE OF KORYDALLOS**
- **S. SARATSIS S.A.** and **KOURTIDIS S.A.** in the construction of **AB VASSILOPOULOS SUPERMARKET IN CHALANDRI, KORYDALLOS & PATISSIA**
- Thousands of construction companies, civil engineers and civilians for the antiseismic reinforcement of small or larger constructions.

And the list is continiously growing...




Olympic Village


Ano Liosia


Ano Liosia

antiseismic reinforcement THORAX®

In Greece, the country with the highest seismic activity in Europe, we have created a revolutionary product, a worldwide innovation, setting new standards in the concrete reinforcement sector, by providing a superior antiseismic protection of buildings / structural projects, of any kind.

It is currently known that the majority of buildings collapse during an earthquake is attributed to column failure.

The earthquake resistance characteristics of the columns mainly depend upon the stirrups that ensure containment of surrounding column steel bars, and also containment of concrete which tend to break due to lateral expansion during earthquake.

Summarizing, the column is the most critical element of the earthquake-resistance of a structure, and the stirrups the most critical element of the column.

THE ANTISEISMIC REINFORCEMENT THORAX is the only type of stirrup that provides the potential of full compliance to the antiseismic regulations in every case; thus offering the means to construct buildings to the highest possible earthquake security standards. Additionally, the **ANTISEISMIC THORAX** is cost effective, easy to apply and it's accompanied by the guarantee of an industrial-manufactured product, thus eliminating any risk of human negligence or error.

Its superiority over the standard reinforcements is due to its **spiral shape.** In other words it is comprised of a single piece iron element, successively bent in order to wrap around the longitudinal rebar from one edge to the other without any interruptions. This means that it **does not have any "weak points"** as for instance the hooks regarding the traditional ties. These may be "undone" or "loosened" in case of severe earthquake, allowing the longitudinal bars to bend and the concrete to dismantle. The latter results in column failure and eventually, the collapse of the building.

Using the ANTISEISMIC REINFORCEMENT THORAX, a new age for concrete reinforcement has begun: An era of responsibility, confidence and safety.

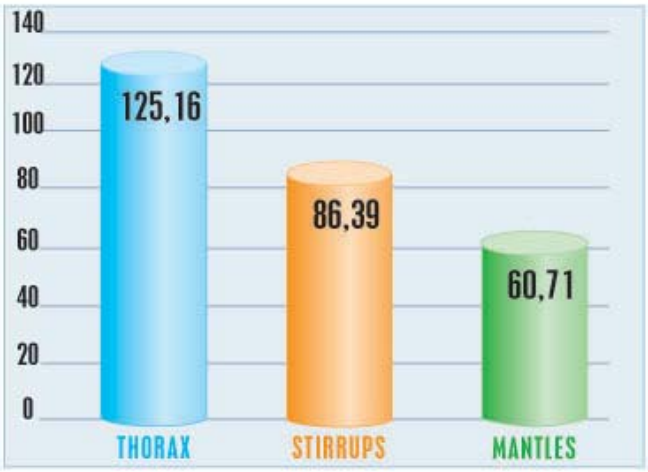
PROVEN TO BE THE SAFEST

THE PLASTICITY EXPERIMENT BY THE NATIONAL TECHNICAL UNIVERSITY OF ATHENS

The National Technical University of Athens Reinforced Concrete Laboratory has confirmed the superiority of the ANTISEISMIC REINFORCEMENT THORAX in 1998.

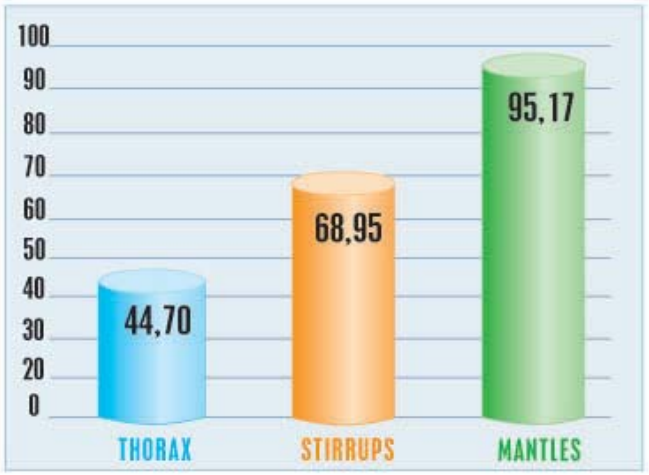
During the relevant experiments, the earthquake resistant behavior of the ANTISEISMIC REINFORCEMENT THORAX has been compared to the other types of stirrups. The results were impressive:

THORAX SUPERIORITY REGARDING EARTHQUAKE ENERGY ABSORPTION



The energy absorbed by the **ANTISEISMIC REINFORCEMENT THORAX** has been 50% higher than the energy absorbed by "*the individual hand made stirrups*" and 100% higher than the energy absorbed by the bended meshes *("mantles")*, in the form regularly used, i.e. with open hooks. (It is noticed that "mantles" are made by bending standardized prefabricated bended meshes).

THORAX SUPERIORITY REGARDING VARIATION OF THE BEARING CAPACITY



The reduction of the bearing capacity of the **ANTISEISMIC REINFORCEMENT THORAX** following the earthquake, has been 50% lower compared to the reduction occurring in the case of "*hand made stirrups*" with all specifications and 100% less than the corresponding reduction of the "*stirrups in the form of bended meshes (mantles)*".

REGULAR BENDED MESHES (MANTLES):
The erroneously constructed hooks have opened, the "bending length" of the perpendicular bars of the reinforcement has increased, the bars bended and eventually cracked.

HANDMADE INDIVIDUAL STIRRUPS OR TIES:
At the hooks location at the upper critical area, the stirrups have opened, resulting in the increase of the "bending length" and as an immediate consequence the bending and cracking of the steel columns.

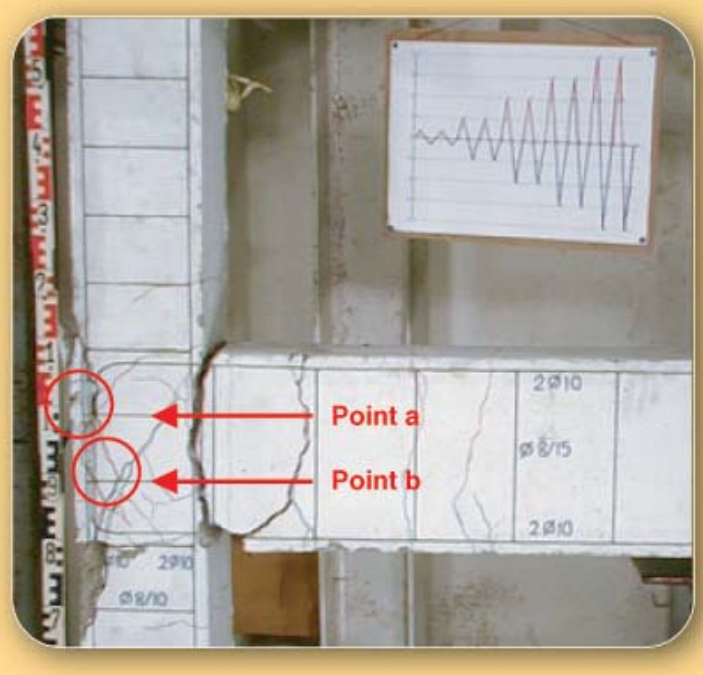
ANTISEISMIC REINFORCEMENT THORAX:
All stirrups have withstood well, both over and below the joint, contrary to the other types of stirrups. Regarding the latter, the position where the hook slippage started, coincided with the completion of the failure.

ANTISEISMIC REINFORCEMENT THORAX:
The exceptionally powerful wrapped-around pillar may be seen. Despite the exceptionally high plastic deformation, the interior of the pillar remains in an "elastic" state.

EXPERIMENTS OF BEAM - COLUMN JOINTS AT THE DEMOCRITUS UNIVERSITY OF THRACE

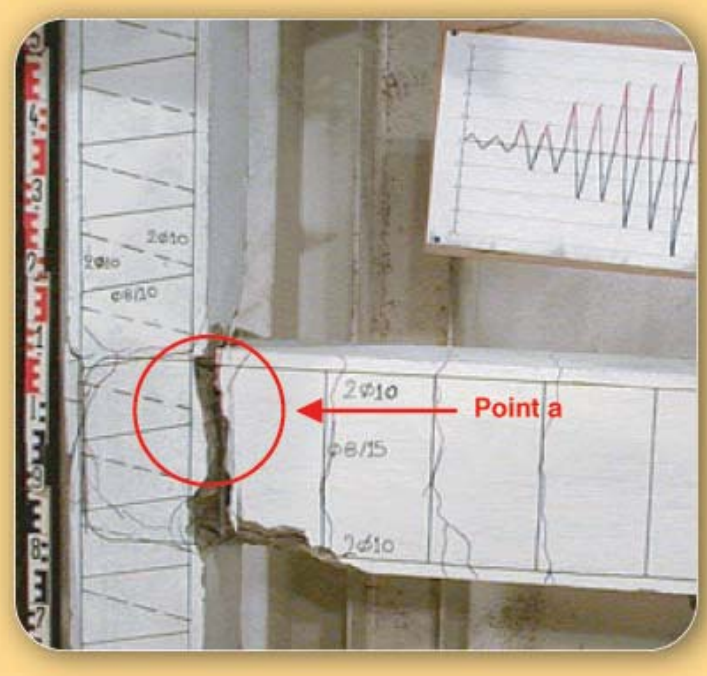
Based on observation of the results of various earthquakes over the last 20 years, it has been recognized that the behavior of beam-column joints has a very significant effect on the overall seismic response of structures. In an experimental program on the behavior of Reinforced Concrete external beam-column joints under cyclic loading **(Laboratory of Reinforced Concrete, Democritus University of Thrace, September 2003), ANTISEISMIC REINFORCEMENT THORAX** was once more proven to be superior.

Figure 1



External beam-column joint with conventional stirrups. Failure mode.

Figure 2



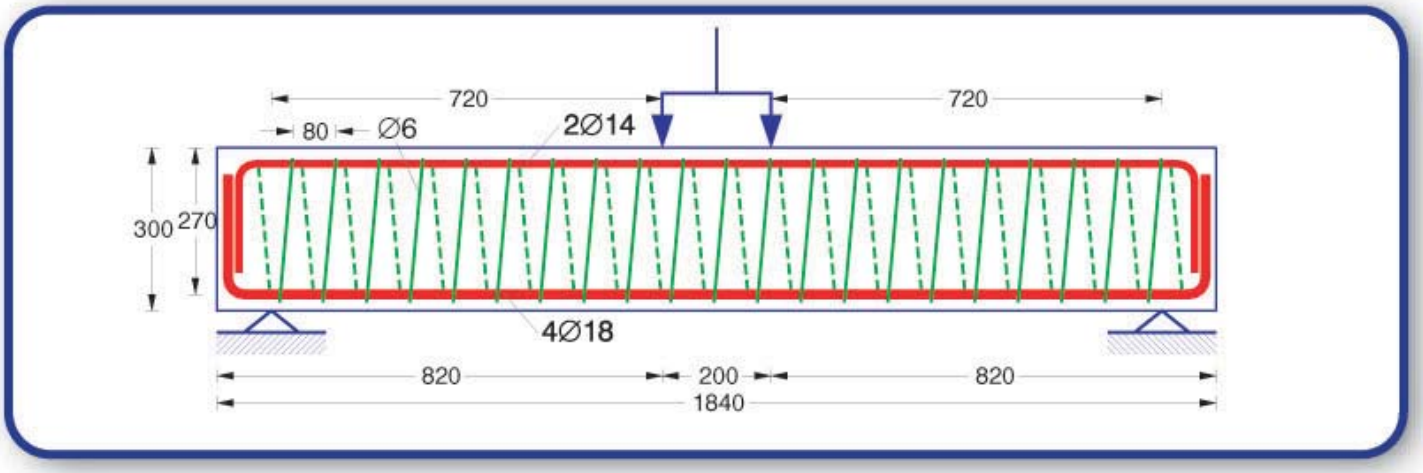
External beam-column joint with spiral THORAX reinforcement along the column and the joint area. Failure mode.

It was observed that **the beam-column joints with continuous spiral-type reinforcement had improved behavior** compared to the corresponding joints with conventional stirrups. With regard to the former, damages occurred were concentrated only in the area of the junction between the beam and the connection (point a, figure 2), while **the joint body of the beam-column connection remained almost undamaged.**

On the contrary, in the case of joints where conventional stirrups were used the damage extended to the joint area, where failure of the anchorage of the beam reinforcement occurred with progressive separation of a large part of the backside of the joint (point a, figure 1). Simultaneously segmental diagonal cracking and brittle failure was observed (point b, figure 1).

Based on the damage indices by Park & Ang and Kratzig & Meskouris, it appears that **the damage caused** under the same level of loading **is lower for joints reinforced with spiral stirrups (reinforcements)** than it is for joints reinforced with conventional stirrups, particularly for large deformations (Figure 3).

In the experimental research on **the shear behavior of beams (Laboratory of Reinforced Concrete, Democritus University of Thrace, September 2003),** the efficiency of using continuous, rectangular, spiral reinforcement for the beams was compared to the use of conventional closed stirrups for the same purpose.



Presentation of THORAX reinforcement setup in experimental beam specimen B8 - sp

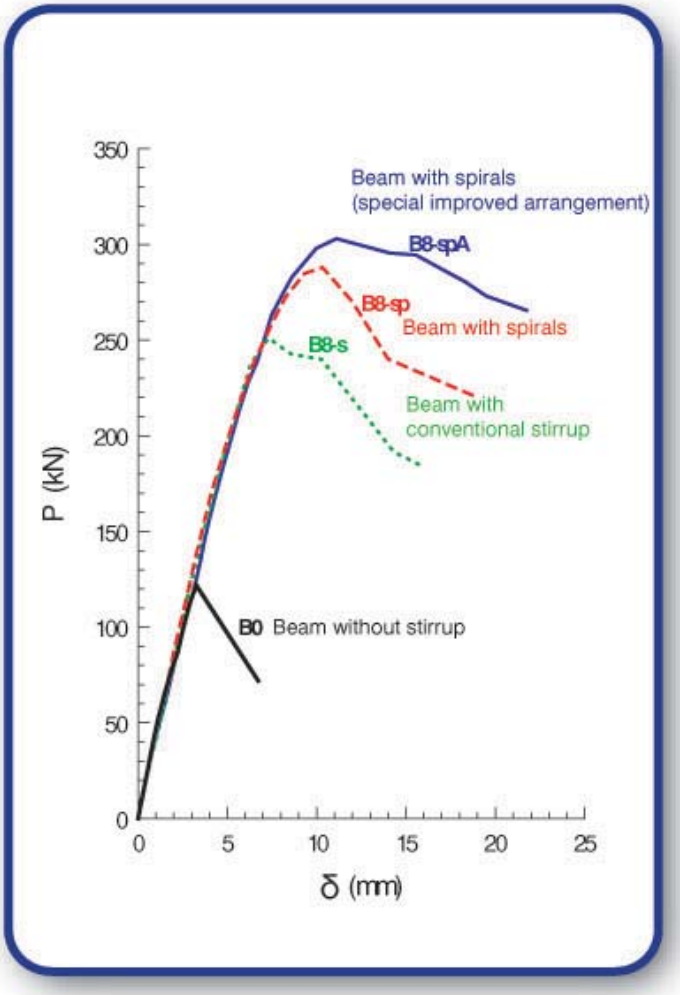
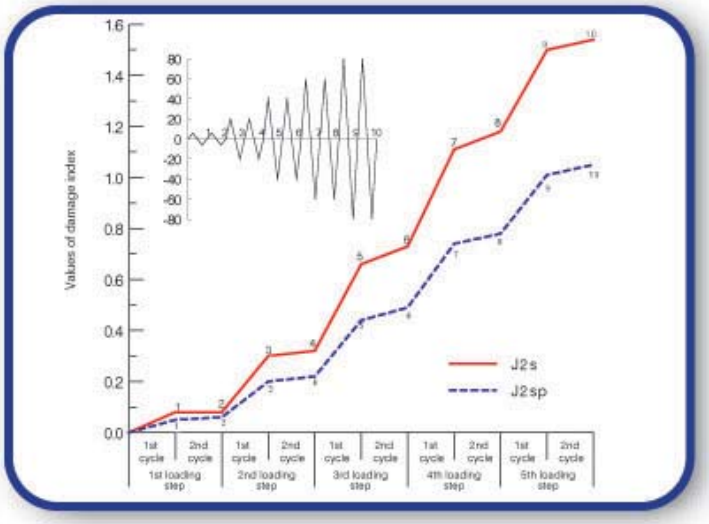


Diagram of loading vs deflection value of specimens

In general, **the beams with continuous spiral reinforcement (THORAX) in various sections and arrangements had improved shear behavior compared to the corresponding beams with conventional stirrups.**

Figure 3



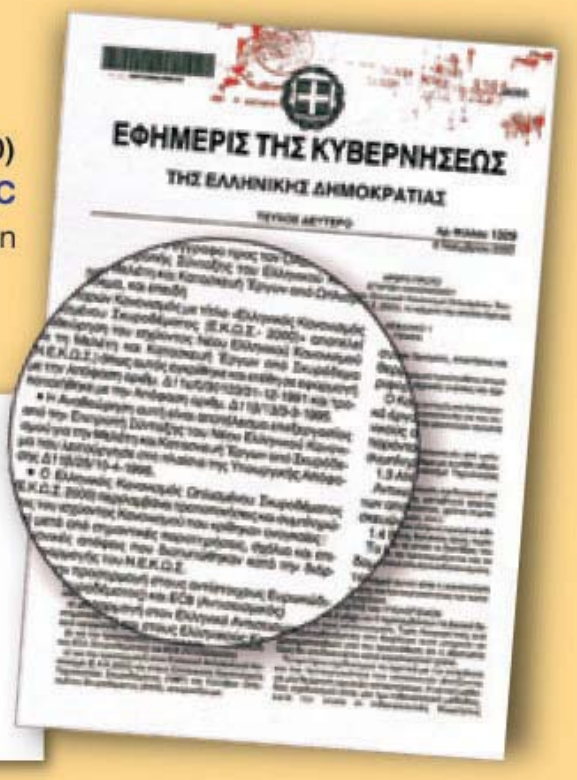
Values of damage index during the test of specimens

- - - - - - - - Antiseismic Reinforcement THORAX

———— Common Stirrups

THE HELLENIC CODE FOR REINFORCED CONCRETE (EKOS 2000)

The new Hellenic Code for Reinforced Concrete (EKOS 2000) acknowledges that spiral reinforcement, such as **ANTISEISMIC REINFORCEMENT THORAX,** features increased performance in containment binding:


ΕΦΗΜΕΡΙΣ ΤΗΣ ΚΥΒΕΡΝΗΣΕΩΣ
ΤΗΣ ΕΛΛΗΝΙΚΗΣ ΔΗΜΟΚΡΑΤΙΑΣ

In particular, paragraph 18.4.4.2 of the EKOS 2000 titled **"Confinement reinforcement"** states the following:

"... The performance index of the confinement may be calculated as follows: Depending on the distance between stirrups $a_s=(1-s'/2b_o)^2$

where: s' is the free distance between stirrups $(s'<b_o/2)$ and b_o is the core cross section width $(A_o=b_o^2)$.

Regarding spiral reinforced columns (circular or rectangular spiral), the as index is greater than or equal to $a_s=(1-s'/2b_o)$..."

If the particular formula is applied in practice, the increased resistance of the **ANTISEISMIC REINFORCEMENT THORAX** shall be verified, as the following examples demonstrate:

EXAMPLE 1

40x40 column with stirrups placed at 10 cm spacing.

$s'=10$ and $b_o=34$, therefore:

in case of standard stirrups (ties) the formula gives

$a_s=[1-10/(2x34)]^2=0,85^2=0,7225$,

in case of **ANTISEISMIC REINFORCEMENT THORAX** the formula gives $a_s=[1-10/(2x34)]=0,85$,

thus the **ANTISEISMIC REINFORCEMENT THORAX** suggests a more resistant (or equally more economical) solution by 15%.

EXAMPLE 2

25x80 column with stirrups placed at 10 cm spacing.

$s'=10$ and $b_o=19$, therefore:

in case of standard stirrups (ties) the formula gives

$a_s=[1-10/(2x19)]^2=0,737^2=0,543$,

in case of **ANTISEISMIC REINFORCEMENT THORAX** the formula gives $a_s=[1-10/(2x19)]=0,737$,

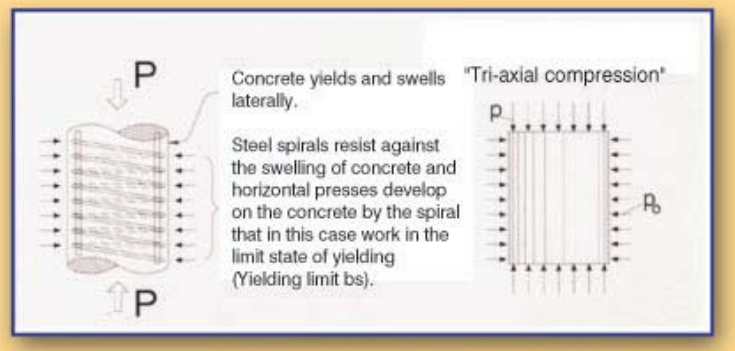
hence, the **ANTISEISMIC REINFORCEMENT THORAX** suggests a more resistant (or equally more economical) solution by 26%.

Indeed, the increased earthquake resistance of the spiral stirrups has been acknowledged for decades, since the circular spiral connectors, being the foundation for the evolution of the **ANTISEISMIC REINFORCEMENT THORAX,** are used throughout the world in columns requiring high resistance, ensuring:

A) Actual tri-axial function (see drawing)

B) High plasticity, which ensures highly effective operation during extremely destructive earthquakes

C) Eliminating the risk of bar bending



Reinforced Concrete Textbook, Th. Tasios, 1972

FULL COMPLIANCE TO THE CODES SPECIFICATIONS

ANTISEISMIC REINFORCEMENT THORAX is the only reinforcement ensuring full compliance to the requirements of all relevant Codes: the Hellenic Antiseismic Code (EAK 2000), the Hellenic Code for Reinforced Concrete (EKOS 2000) and the Concrete Reinforcement Steel Technology Code (KTX).

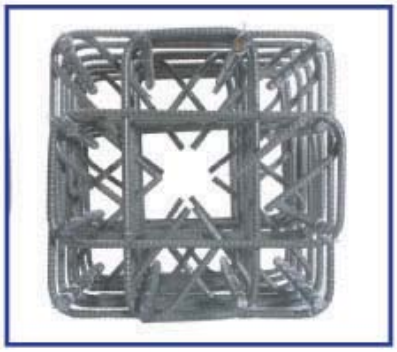
COMPREHENSIVE ANCHORING

ANTISEISMIC REINFORCEMENT THORAX is made up from a single bar, continuously rising, thus requiring no anchoring. In other words it has the **absolute anchoring.**

PROPER CONCRETING

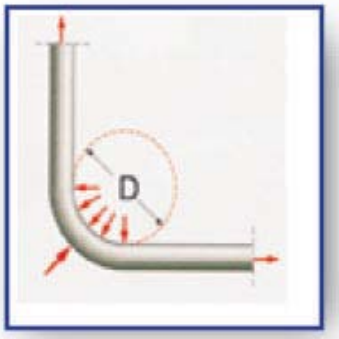
Due to the non-existence of hooks, **ANTISEISMIC REINFORCEMENT THORAX** ensures **perfect concreting;**

On the contrary, the proper construction of the hooks of the other types of stirrups and especially the rotation of the hooks' position, according to the regulations, creates a "cluster" of hooks within the cage which is often impossible to be penetrated by the concrete and the vibrator, resulting in the creation of voids within the concrete.



BENDING AT THE REQUIRED PIN

Because the production of **ANTISEISMIC REINFORCEMENT THORAX** is industrialized the bending of the single piece rod is carried out at the required pin with a **D = 4Φ** diameter, changing automatically depending on the diameter of the rod.



ASSURANCE OF BINDING

In order to avoid systematic sensitivity throughout the entire length of the element when only one end of the stirrups is not anchored, the anchor position, shall alternate by height, according to **EKOS 2000 (paragraph 17.9.2).**

ANTISEISMIC REINFORCEMENT THORAX due to the lack of intermediate hooks exceeds this requirement, while mantles are unable to comply to the same due to the nature thereof.

Regarding common stirrups, compliance to the above mentioned requirement creates a major problem during concreting, and for this reason it is omitted in practice.

EKOS 2000 SPECIAL REQUIREMENTS FOR CRITICAL COLUMN AREAS

EKOS 2000 (paragraph 18.4.4.1) provides that: *"When joints, overlapping the longitudinal bars, are carried out within the critical column areas with increased plasticity requirements, the maximum distance between stirrups is limited to the quadruple of the minimal longitudinal bar diameter".*

The above provision results in a maximum stirrup distance of 4x20=80 mm for the columns of most buildings for Φ20 longitudinal bars and 4x16=64 mm for Φ16 longitudinal bars.

The **ANTISEISMIC REINFORCEMENT THORAX** easily conforms to this requirement since it can adapt to any distance, unlike mantles whose distances between connectors remain fixed.

COMPLIANCE TO STIRRUPS SPACING

The density provided by the regulations and the engineering study regarding all elements is achieved, both in the critical areas and in the interior of joints, **with the possibility of varying spacing i.e. denser - sparser,** a possibility not provided by the mantles due to their nature.

INSTALLATION OF ALL ANTICIPATED STIRRUPS

All stirrups provided by the regulations and the engineering study are installed (e.g. regarding a pillar with 80 cm size a sixsection stirrups must be used).

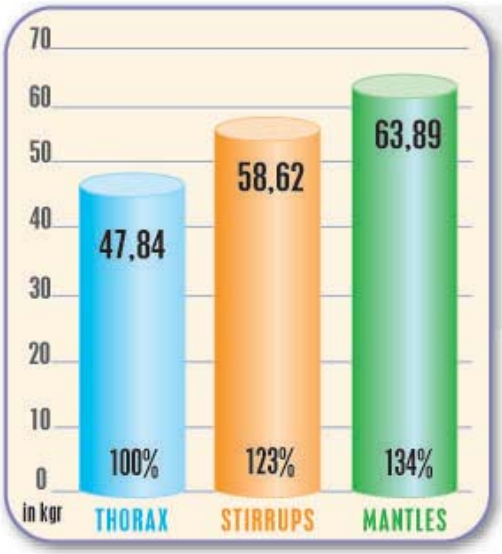
THE MOST COST-EFFECTIVE

ANTISEISMIC REINFORCEMENT THORAX, unlike other types of stirrups, utilizes each and every square centimeter of its cross section and each millimeter of its length.

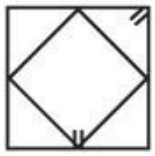
This results in being considerably lighter both in comparison to the mantles (mainly due to the standardization of their dimensions, which has as a result a lot of waste material, their hooks, the connecting bars and their inability for variable spacing), **and to the standard stirrups** (mainly due to the hooks but also to the material overlap that is required for the formation if multi-faceted cross sections).

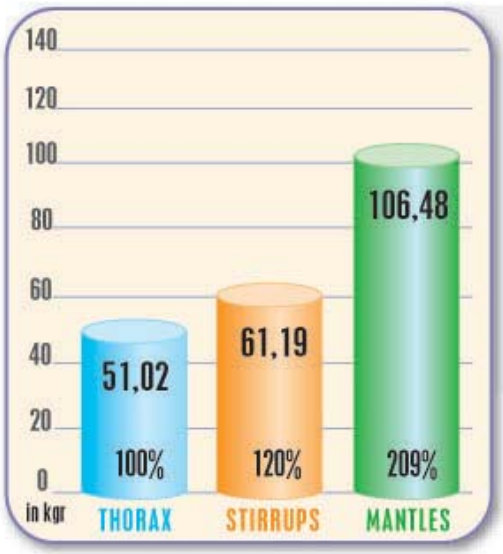
Exemplary cases of weight comparisons between the three types of stirrups in widely used column, shear wall and beam cross sections are mentioned below.

WEIGHT COMPARISONS BETWEEN ANTISEISMIC REINFORCEMENT THORAX, MANTLE AND COMMON STIRRUPS IN TYPICAL STRUCTURAL COLUMNS

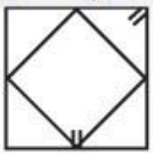


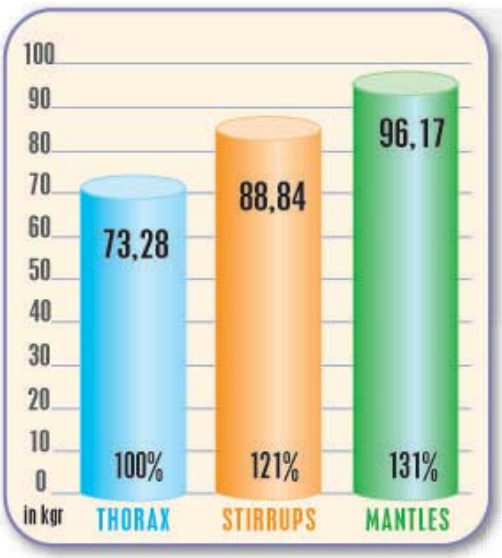
1a Column with dimensions 45x45 with diamond shape (without variable spacing)
H=3,00m, U=Φ10/10, Hcritical=3,00m



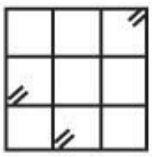


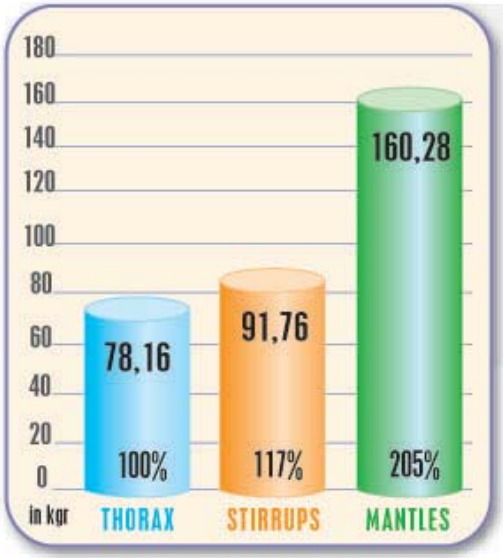
1b Column with dimensions 45x45 with diamond shape (with variable spacing)
H=3,00m, U=Φ10/15, Hcritical=1,00m, U=Φ10/8



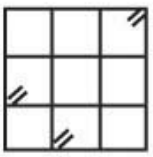


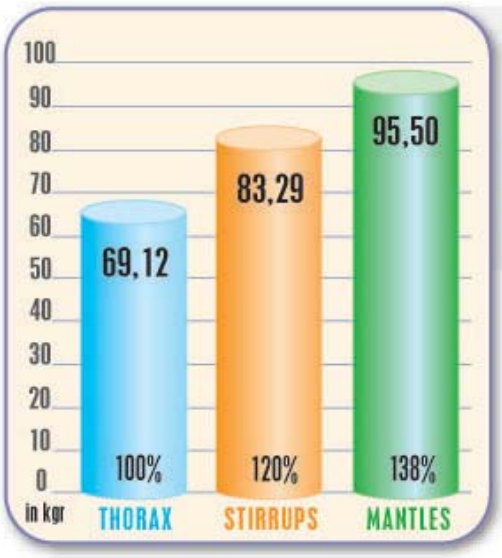
2a Column with dimensions 50x50 with cross shape (without variable spacing)
H=3,00m, U=Φ10/10, Hcritical=3,00m



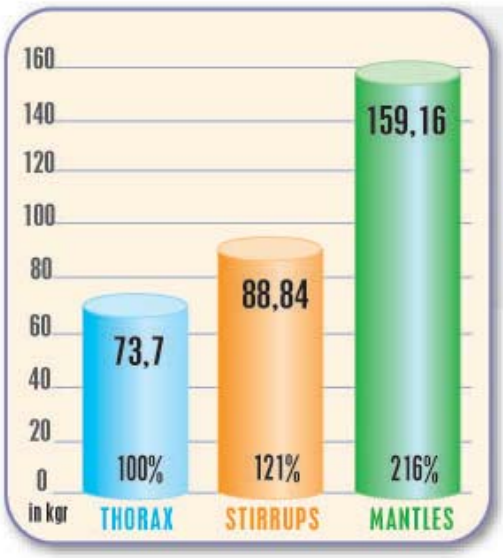


2b Column with dimensions 50x50 with cross shape (with variable spacing)
H=3,00m, U=Φ10/15, Hcritical=1,00m, U=Φ10/8

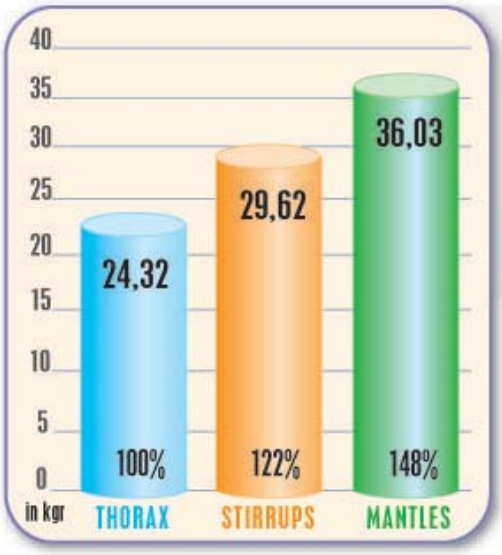




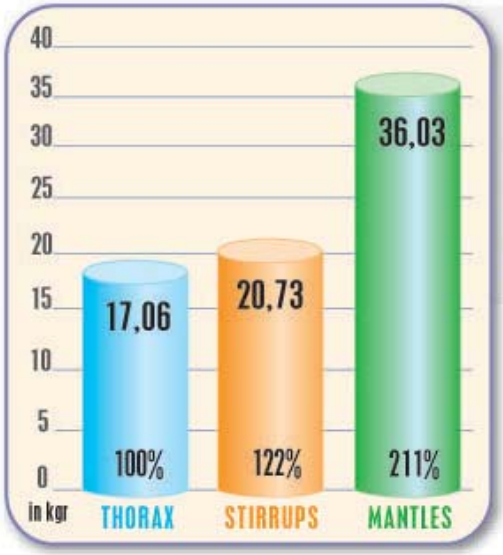
3a Column 25x100 (without variable spacing) **H=3,00m, U=Φ10/10, Hcritical=3,00m**



3b Column 25x100 (with variable spacing) **H=3,00m, U=Φ10/15, Hcritical=1,00m, U=Φ10/8**



4a 25/50 beam (without variable spacing), beam length (window frame) **5,00m, U=Φ8/10**



4b 25/50 beam (with variable spacing), beam length (window frame) **5,00m, U=Φ8(10)20(10)**

CONCLUSION:

Mantles are heavier than ANTISEISMIC REINFORCEMENT THORAX by 31% to 116%, while common stirrups by 17% to 23%.

In the weight comparison it must be taken into account the economy in materials, which the **ANTISEISMIC REINFORCEMENT THORAX,** provides if its increased strength, due to the superior binding of its spirals, is calculated, which, according to **EKOS 2000** (paragraph 18.4.4.2), as mentioned above, is on the average equal to 20%.

Economy in materials is accompanied by **economy regarding formation and installation costs (labor),** due to the fact that the latter costs are directly dependent upon the weight of the installed reinforcement. In addition, another economy factor that must be taken into account is economy due to comprehensive concreting achieved by using **ANTISEISMIC REINFORCEMENT THORAX,** which results to the minimization of the plastisizer quantities required.

APPLICATION OF ANTISEISMIC REINFORCEMENT THORAX: QUALITY AND FLEXIBILITY

EASY TO USE – MULTIPLE OPTIONS

ANTISEISMIC REINFORCEMENT THORAX is easy for even unskilled workers to use, because the methods are simple and can be adapted to suit any site conditions (available space, building height, crane availability, transportation costs etc.)

DEPLOYMENT ON A WORKBENCH WITH THE USE OF TIE BARS

ANTISEISMIC REINFORCEMENT THORAX is transported to the construction site in compact form (palletized per floor) and is then deployed on a workbench, with 8 mm auxiliary bars.

The spirals are held in place by means of black wire or welding.
Subsequently, the stirrup cage can be fitted on the splice rebars and then the longitudinal reinforcement rods are installed.

Due to the flexibility of the **ANTISEISMIC REINFORCEMENT THORAX** cage, it is possible to fit the reinforcement into the rebars either from the upper part of the formwork, or from the inside.

This technique can be easily applied, even at construction level, with the use of an off-hand bench of two simple planks, two cross braces and two tower frames.

DEPLOYMENT OF THE ANTISEISMIC REINFORCEMENT THORAX OVER THE LONGITUDINAL REINFORCEMENT

If a tower crane or telescopic crane is used, the **ANTISEISMIC REINFORCEMENT THORAX** can be deployed directly over the longitudinal reinforcement and the prefabricated column can then be inserted into the formwork.

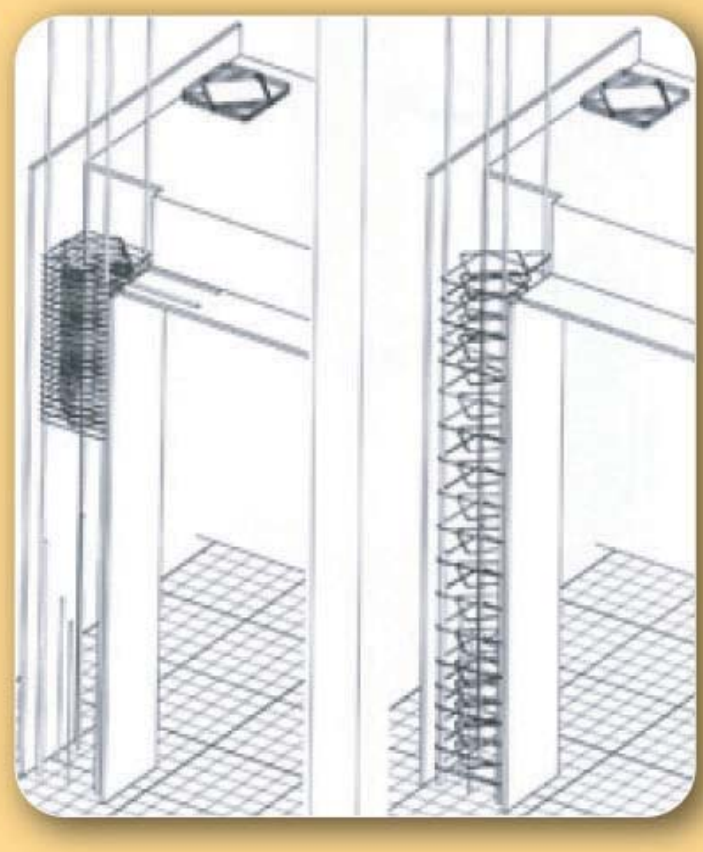
DEPLOYMENT INSIDE THE FORMWORK

ANTISEISMIC REINFORCEMENT THORAX can be deployed inside the formwork without forming it into a cage before.

In that case, the four reinforcing bars are put in place first and **ANTISEISMIC REINFORCEMENT THORAX** is fastened at the upper part of the column.

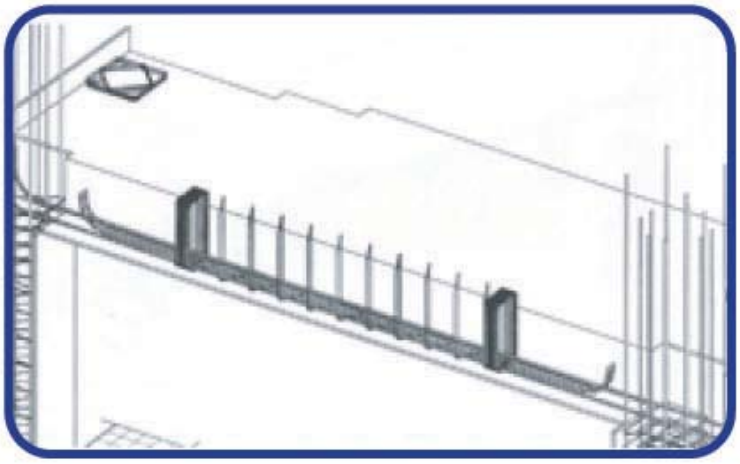
It is then stretched and deployed, assuming its final position under its own weight.

It can also be deployed in reverse, from the base upwards.



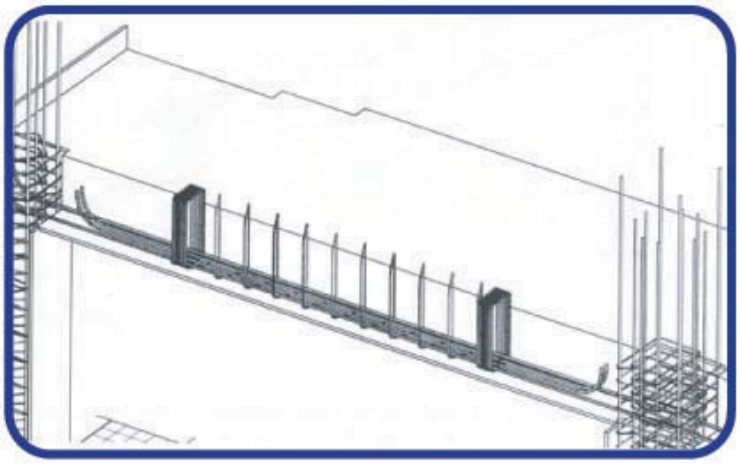
REINFORCEMENT OF BEAMS AND BEAM-COLUMN JOINTS WITH THORAX ANTISEISMIC REINFORCEMENT

For the reinforcement of beams, all the lower bars of the beam are first put in place, the central section of **THORAX ANTISEISMIC REINFORCEMENT** is stretched and the bars are fastened at the two limits of the critical areas.

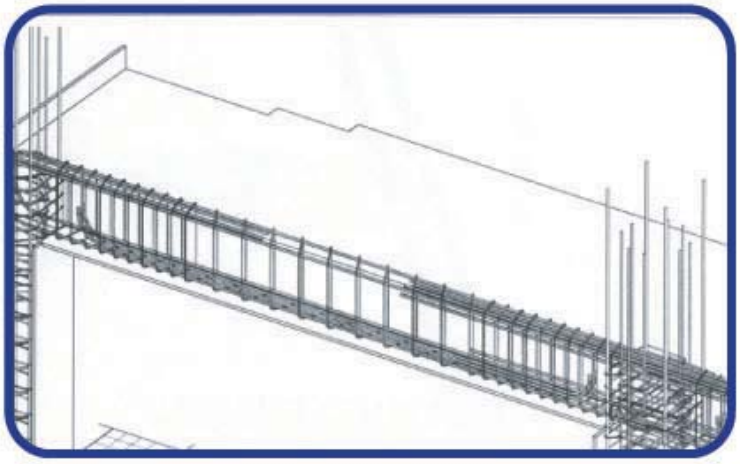


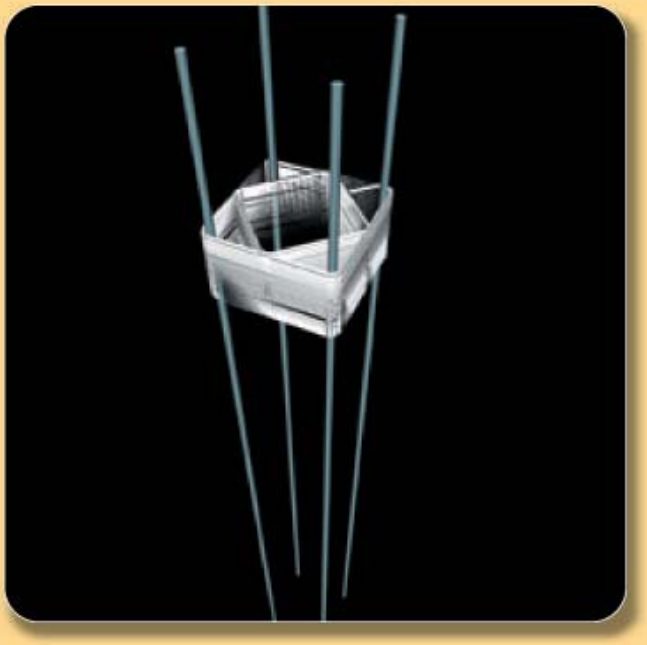
The spirals of the joints can then easily be placed inside the joints and fastened in their final position. The fastening of the two spiral sections must be carried out according to the provisions of the Greek Reinforced Concrete Regulations (EKOS), i.e. either by means of a hook or by welding.

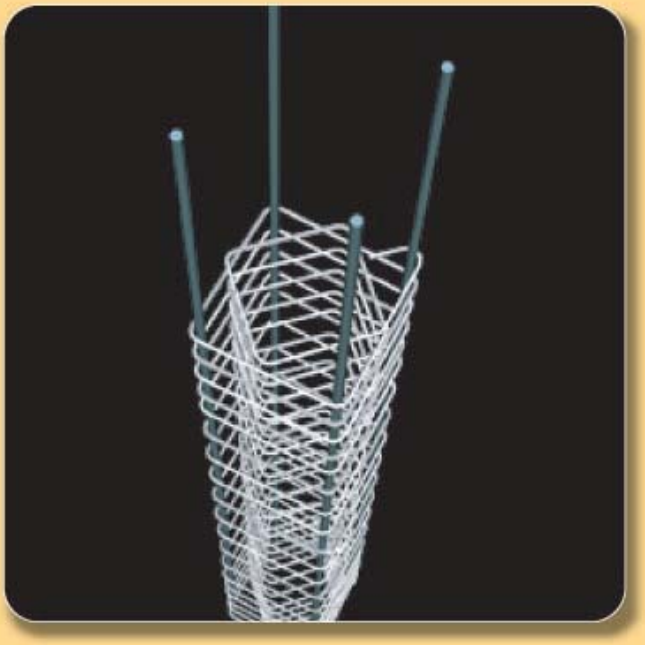
Since there is a gap at both ends of the beam, it is easy to put in place the upper bars (negative reinforcements), which are supported on the **THORAX ANTISEISMIC REINFORCEMENT** of the joints.



By means of two simple hooks, both ends of the **THORAX ANTISEISMIC REINFORCEMENT** are pulled manually and fastened with the rods in their final positions.



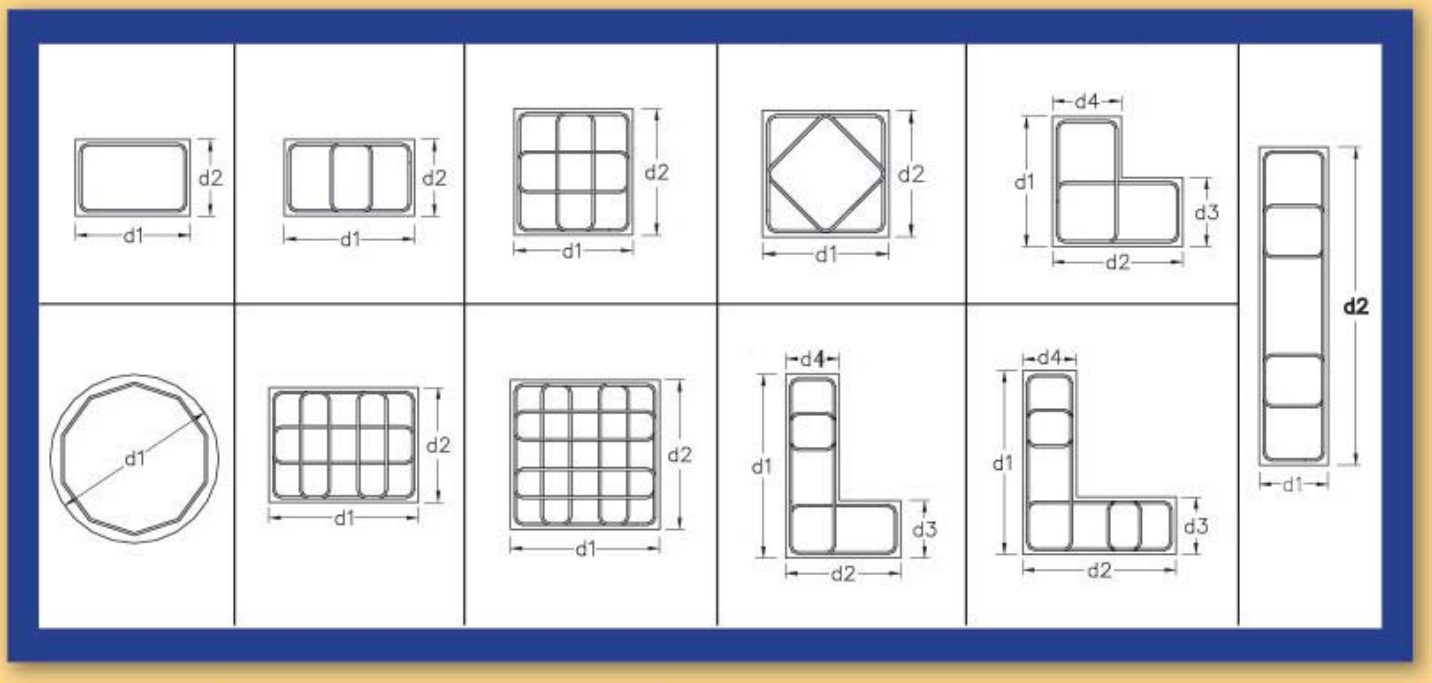




SUITABLE FOR ALL COLUMN AND BEAM TYPES

ANTISEISMIC REINFORCEMENT THORAX may be easily formed in any shape provided by the static engineering study, e.g. right angle, T-shaped, rectangular or polygonal. Ordering of standardized cross sections indeed accelerates production and facilitates installation.

Standard production is carried out in 8 mm, 10 mm and 12 mm diameters; thus, the engineering study does not need to be adapted to existing stirrups types and dimensions, as per the customary practice with conventional stirrups (especially the mantles); on the contrary, **ANTISEISMIC REINFORCEMENT THORAX is produced and delivered precisely adapted to the requirements of each individual engineering study.**



Any other shape may be delivered on special request.

INDUSTRIAL MANUFACTURING PRECISION

Full compliance to code requirements is ensured by the inherent characteristics of **ANTISEISMIC REINFORCEMENT THORAX** and its production process, thus eliminating the possibility of omissions or defects during installation.

The supervising engineer does not have to worry about the installation of the required connectors, if they have been spaced equally, if they have been properly anchored, if they have been bent at the correct pin and so on, since all the above facts are ensured by the construction of the material.

THORAX ANTISEISMIC S.A. is certified from the Hellenic Organization of Standardization (ELOT) for ISO 9001.

COMPREHENSIVE TECHNICAL SUPPORT

The application of **ANTISEISMIC REINFORCEMENT THORAX** is supported by a network of engineering representatives throughout Greece. Experienced engineers and qualified installation crews may cater to any **ANTISEISMIC REINFORCEMENT THORAX** installation requirement, or to the training of technicians appointed by the Customer. Support not only refers to product application, but to the provision of more generic consultation services in order to comply with the applicable building project construction codes.

GUARANTEED QUALITY

ANTISEISMIC REINFORCEMENT THORAX production plants excel in the compliance to the Steel Technology Code requirements, regarding not only the quality of the steel used for their production but the accuracy in following the processing and handling rules as well. Each **ANTISEISMIC REINFORCEMENT THORAX** shipment is necessarily accompanied by the Technical Delivery Sheet and the suppliers' Certificates of Conformance.

ANTISEISMIC REINFORCEMENT THORAX
TOTALLY EFFICIENT!

ANTISEISMIC REINFORCEMENT THORAX, from its design stage up to its successful application in the market, **has demonstrated that it can cover in the most complete way, the earthquake resistance requirements of any type of building.**

It is endowed with all the advantages that might be required from a modern antiseismic reinforcement. **THORAX ANTISEISMIC S.A.** believe that **ANTISEISMIC REINFORCEMENT THORAX** offers to you, the individual customer, another benefit which cannot be calculated in terms of numbers or cost: **the ASSURANCE that your building will have the capability to withstand any hazard,** fearlessly and at any given moment.

DArcyAthens

THORAX
ANTISEISMIC S.A.

ΕΛΟΤ ΕΝ ISO 9001

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