

Isoslab



D E S I G N , B U I L D , M A I N T A I N



FREYSSINET
SUSTAINABLE TECHNOLOGY

CX9

ISOSLAB: SIMPLE, QUICK AND SAFE

The Freyssinet Group

Freyssinet brings together an unrivalled set of skills in the specialist civil engineering sector. It implements solutions with high added value in two major fields: construction and repair.

With its 5,500 employees, Freyssinet is involved in numerous major projects on five continents, making it the world leader in its specialist areas of: pre-stressing; construction methods; cable-stayed structures; structural accessories; repairs, and structural reinforcement and maintenance.

Freyssinet is highly involved in sustainable development issues and has set up a number of initiatives, particularly to reduce the environmental impact of its projects and enhance its social responsibility policy.

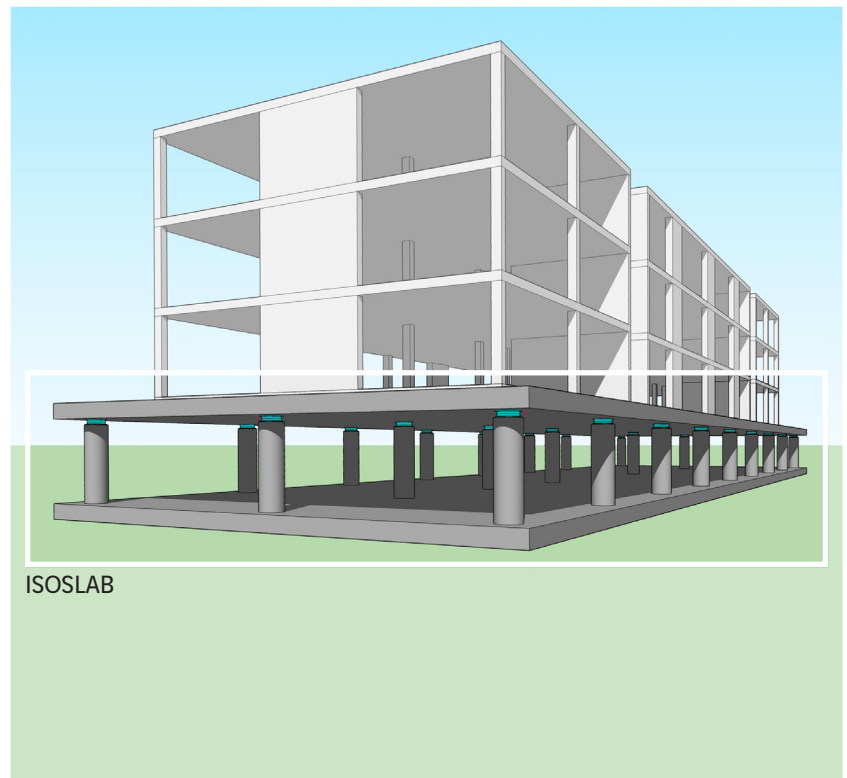
Freyssinet is a subsidiary of the Soletanche Freyssinet group, a world leader in the soils, structures and nuclear sectors.

With ISOSLAB, Freyssinet has developed a technology that greatly simplifies the design and the construction of buildings in seismic areas. The ISOSLAB technology provides a seism free area on which developers can build standard buildings with very limited consideration of earthquake loads and seismic construction details.

ISOSLAB relies on the base isolation principle. Working as a mattress, it is designed to absorb the earthquake vibrations coming from the ground into the building structure with four components: a foundation slab cast directly on the ground, columns, isolators placed on top of the columns, a top isolated slab on which the building is built.

The volume situated between the foundation slab and the isolated slab and the column pattern have been designed to use this space as a car park.

Designed in association with Prof Calvi, ISOSLAB has been planned in a modular way, as a kit constituted of standardized elements, providing rapidity and reliability in design, procurement and erection.



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References for base isolated structures

The earliest and the simplest isolation system was proposed in 1909 by an English medical doctor, J.A. Calantarientis. He suggested separating the structure from the foundation by a layer of tale. Since then numerous buildings have been built or retrofitted on this principle, including city halls, hospitals, nuclear plants, housings.

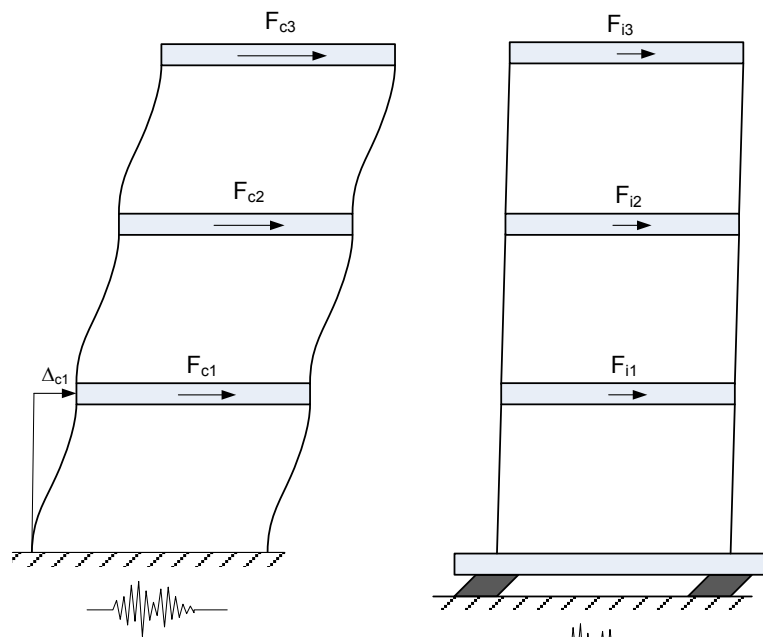
CONSTRUCTION IN SEISMIC AREAS

The advantages of base isolation

With base isolation, the idea is not to increase the capacity of the structure but to limit the accelerations and displacement demand that the structure has to suffer because of the earthquake. As a consequence the amplitude of seismic forces to which buildings are subjected will be reduced. To obtain this result a high percentage of structural masses are disconnected from the foundation system in the horizontal direction. In this way the movements of the ground and the structure are uncoupled.

Advantages due to the base isolation of structures are numerous. The huge reduction of accelerations induced by earthquake on the structure compared to equivalent fixed base configuration provides:

- Lower inertia forces and as a consequence lower internal actions in the structural elements that will not exhibit damage due to seismic excitation;
- A reduction of the interstorey drift with a consequent reduction of damage to non structural elements. This property is important when anticipating the after-event management;
- Reduced perception of the shaking by the occupants of the structure.



Comparison between conventional and isolated structure behaviour

The main socio-economic advantages related to base isolation of the structures are even much more evident when considering the post-event emergency management. A building designed on the structural capacity principle will stand during the event but will exhibit noticeable damages that will require post-event investigation, assessment, repair, possibly reconstruction during which the building is improper for use, implying very difficult situation like necessity for emergency housing for thousands of people. On the contrary, a building designed on the base isolation principle is protected from the seismic effects and will be fit for purpose immediately after the earthquake.

ISOSLAB: COMPONENTS

Isolators

ALGAPEND are Friction Pendulum Isolators resulting from the most advanced technology. Their main characteristics are the following:

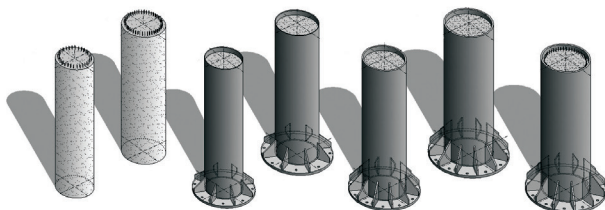
- They allow the relative displacement of the structure in respect of the foundations following one or two spherical surfaces.
- The natural period is independent from the mass of the structure. Therefore there is no torsion around the vertical axis during an earthquake since the centre of mass and the centre of stiffness are coincident.
- The friction coefficient of the sliding surface determines the equivalent friction damping of the isolation system.
- They are self re-centring after a seismic event.

ALGAPEND isolators are based on the application of a series of sliding materials called HOTSLIDE, which are the result of a research program involving Politecnico di Milano and are protected by international patent. The HOTSLIDE controlled friction materials have an outstanding resistance to high pressure, to wear and to high temperature. This property makes them particularly suitable for compact friction based energy dissipating elements with exceptional performances.



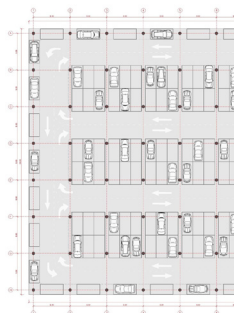
Columns

Depending on the building dimensions, seven types of column can enter in the ISOSLAB kit, to meet the strength capacity required for supporting the building and the isolators. In concrete or composite, these columns have been designed to ease both the installation on site and the use of the basement as a convenient car park.



The Car Park

The ISOSLAB column pattern has been designed to use the basement of the building as a car park.





Ground configurations



Depending on the site configuration and the preferred use, the basement can be either at ground level or underground.

Special seismic devices

At the interface between the isolated slab and the ground, specific devices are installed to provide continuity of function while enabling to accommodate seismic movement during an earthquake.

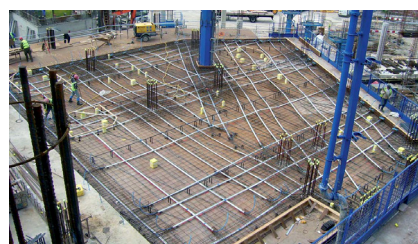
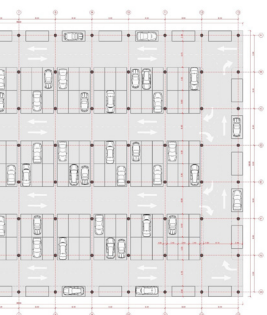
Among those equipments are footpath joints, flexible connexions for utilities (water, heating, sewage)

Post tensioned slabs

The use of post tensioning in the foundation and the isolated slabs allows for a wider span between columns facilitating the vehicle parking. It also provides material and weight savings for a more efficient seismic design.

The Freyssinet B system is used. It is specifically designed for post tensioning flat slabs. Produced by Freyssinet Product Company, it has been granted a CE marking.

has been planned to enable the use



ISOSLAB: DESIGN AND DOMAIN

ISOSLAB is designed through a collaboration between Freyssinet and Studio Calvi.

Eurocodes are the reference codes for preliminary design. The structure can be adapted to any local regulation in a more detailed approach.

ISOSLAB is the result of extensive research program. Detailed dynamic calculations and numerous parametric studies have allowed to determine the few parameters governing the design and to optimally size the standardized components of the system.

ISOSLAB is applicable for virtually any building project in any seismic area:

- Plan dimensions of the isolated area: rectangular, based on a 8x8m unit cell;
- Seismic intensity: up to 0.9 g PGA (Peak Ground Acceleration);
- Soil condition: A, B, C, D, or E, as defined in Eurocode 8-1 Table 3.1;
- Number of storeys: up to 9;
- Typical load per floor: low (residential) to heavy (storage, industrial).

A design protocol has been developed to efficiently design and budget your ISOSLAB project.

Only limited basic data are needed to perform this study:

- PGA
- Soil conditions
- Slab dimensions and occupation factor of the isolated slab
- Number of floors
- Typical weight per sqm of floor.

Freysinet scope of work

Freysinet can assist in designing & constructing your seismic proof building at different stages of the project:

Engineering

- Preliminary design of the ISOSLAB;
- Detailed design of the ISOSLAB;
- Assistance to design the building;
- Checking of the building under seismic conditions.

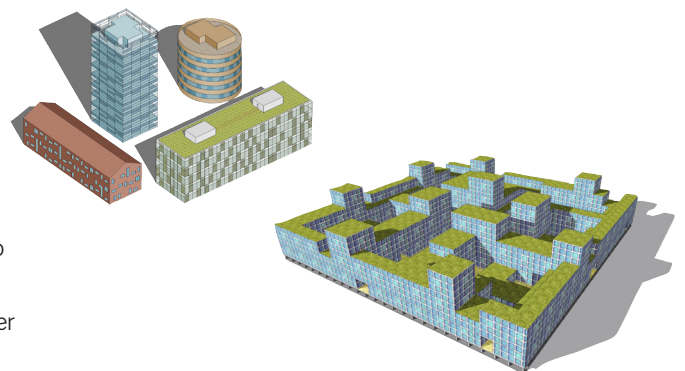
Construction

- Supply of the ISOSLAB kit;
- Technical assistance for construction of the ISOSLAB;
- Turn key construction of the ISOSLAB.

Simple specifications for the building

To be compatible with the ISOSLAB, the projected building has only to comply with a few non stringent specifications:

- Up to nine storeys
- Maximum floor weight during earthquake (including live load): 10 kN/sqm, averaged on a 8x8m area.
- Main vibration period: not more than 1.0 sec.
- Resistance to static horizontal load applied to the building floors equivalent to a lateral acceleration of 0.15 g.
- The superstructure does not cause local actions in the isolated slab that are larger than the one caused by the chosen design load uniformly applied on the slab.



OF USE

Construction

Isolated from the ground by the ISOLSAB, the building can be built in a traditional manner, without taking into account anti seismic heavy rules, leaving total freedom to the architect to imagine an elegant and pleasant-to-live-in structure.

- 1 - Bottom slab reinforcement
- 2 - Installation of isolators
- 3 - Preparation for top slab casting
- 4 - Erection of the building
- 5 - Project after delivering





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