Title of the article: Protects and Heats

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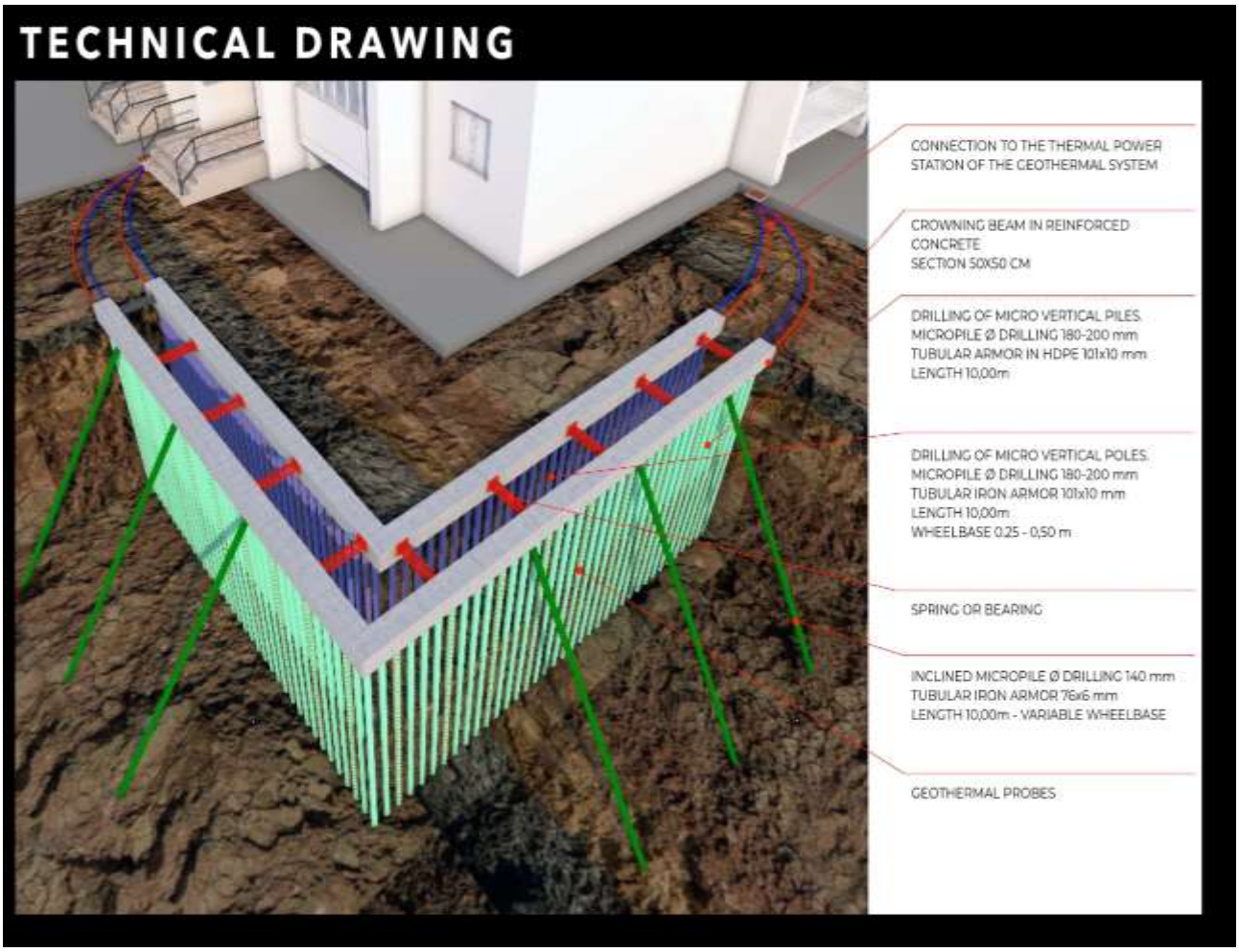
ABSTRACT

The project “Protects and Heats” aims to safeguard the environment, to reduce the carbon dioxide emissions and the risk of collapse of buildings affected by earthquakes.
This is a new way to heat and cool buildings and at the same time mitigate the seismic vibrations.

The logic of the project is to create a discontinuity (Moat) in the ground in front of the structures to be protected, similar to the damping methods that are implemented to dampen the vibrations produced by mechanical machines.
To form the dissipative element, we need to create a sort of "Moat" near the buildings without compromising the stability of the buildings themselves.



The project involves the construction of a double row of aligned micro piles and the insertion of HDPE and steel pipes inside the vertical drilling holes.

Closed circuit geothermal probes will be positioned, inside some vertical holes, with a low enthalpy closed circuit geothermal system.

The method of the project is achieved by combining two types of technologies:

- The first concerns the interposition, between the direction of origin of the seismic waves and the buildings to be protected, of a damping barrier.

The vertical barrier starting from the topographic surface will be positioned outside the buildings, generally orthogonal to the direction of propagation of the seismic waves.

- The second concerns the installation of geo-exchange pipes, in the holes.

The piles support the excavation walls and allow the removal of a part of the ground between the two rows of piles and its replacement with lighter and granular materials, to create a stratigraphic discontinuity between the waves and the buildings.
Reinforced concrete beams can be placed on the heads of the poles, aligned and opposite each other and equipped with contrasting springs.
The geothermal probes will be installed inside the holes and connected to the heat pumps.
The first row of aligned vertical poles will be formed with plastic, flexible and elastic materials, capable of vibrating and producing the damping of seismic waves. The second row will be equipped with steel tubes to deflect and reflect vibrations.
The absorbing barrier is flexible and is detached from the structures and foundations, in order not to transmit vibrations, but to dissipate energy and protect the buildings behind.

See the examples described in the following figures.

Figure 1: **system configuration.**

Section and Plan of a building (tower...) with a square base, surrounded by a double alignment of vertical micro piles, in which closed circuit geothermal probes are alternately inserted.

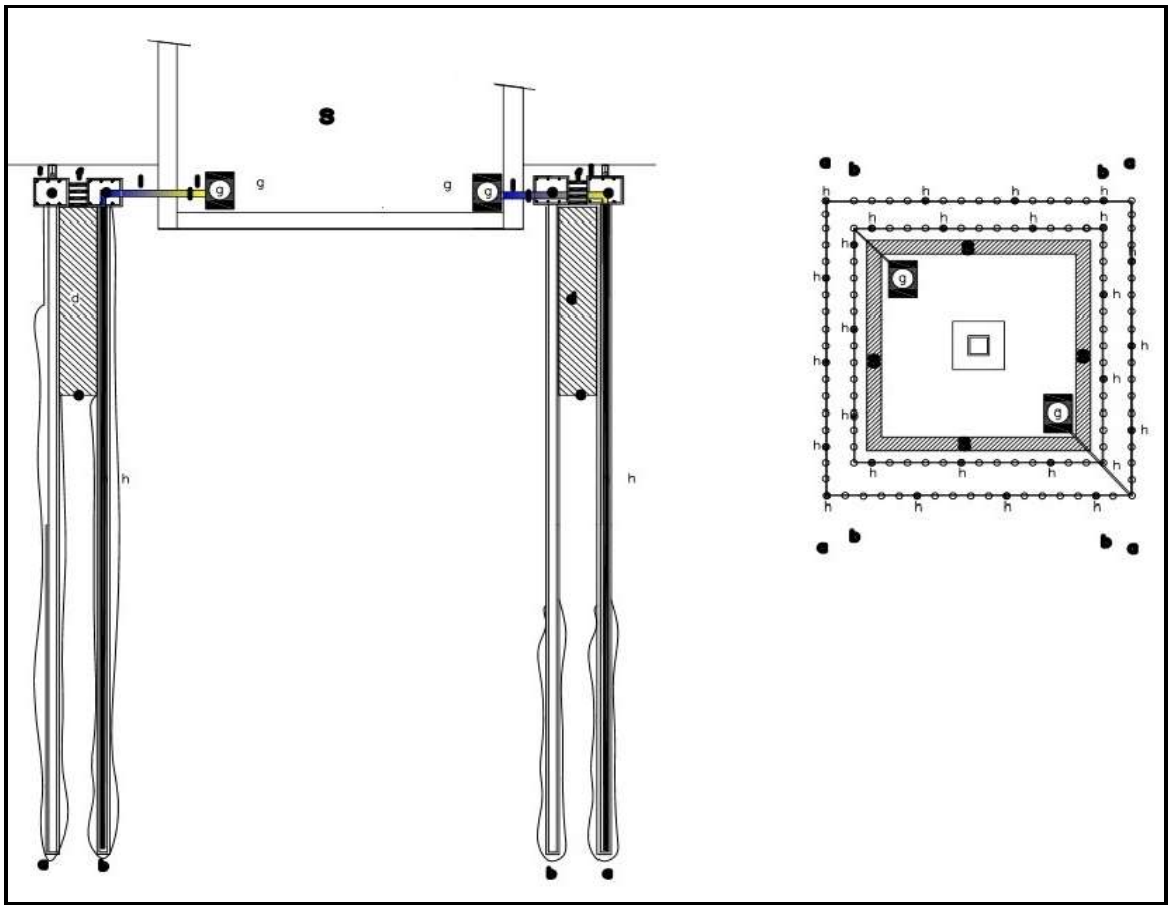
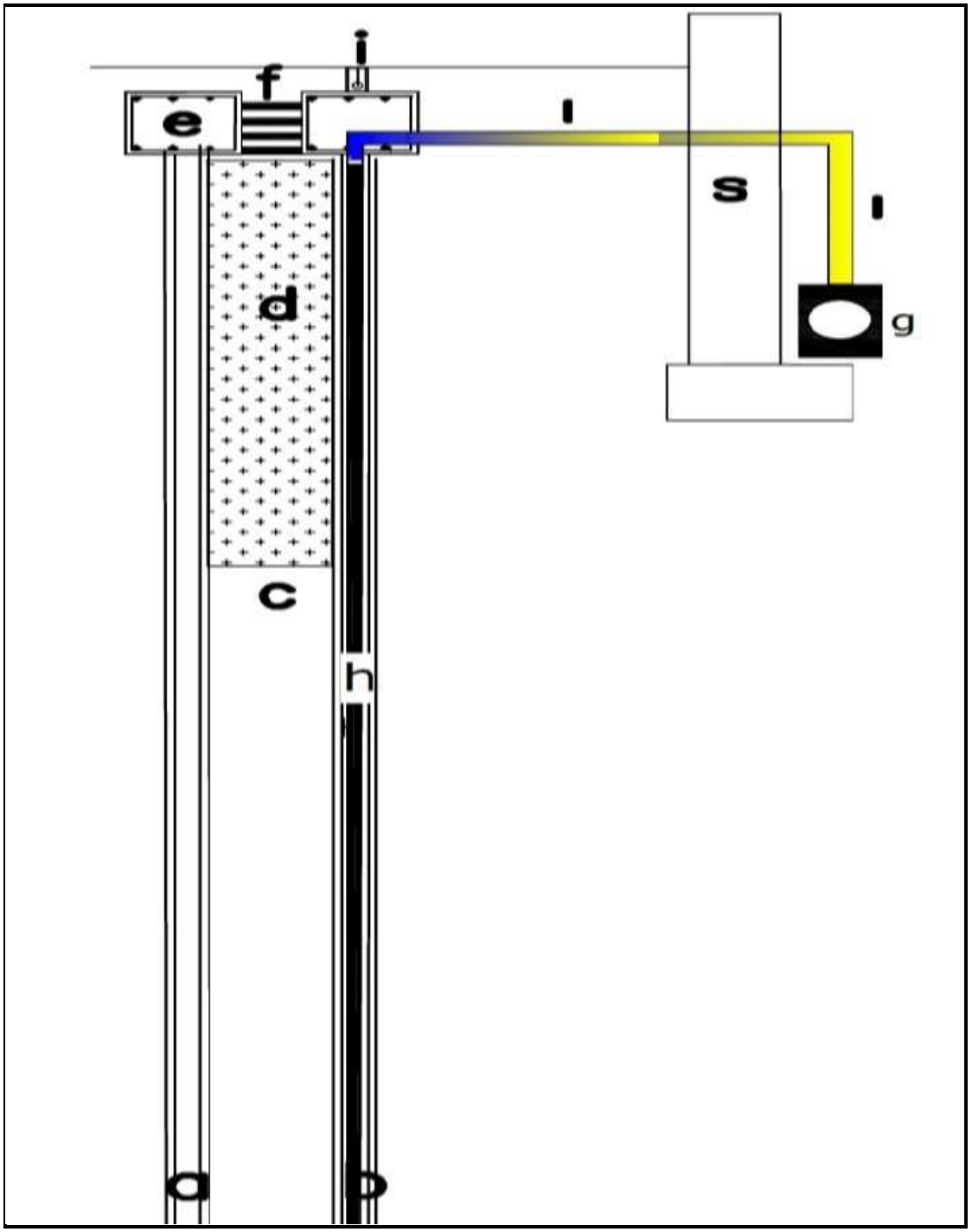
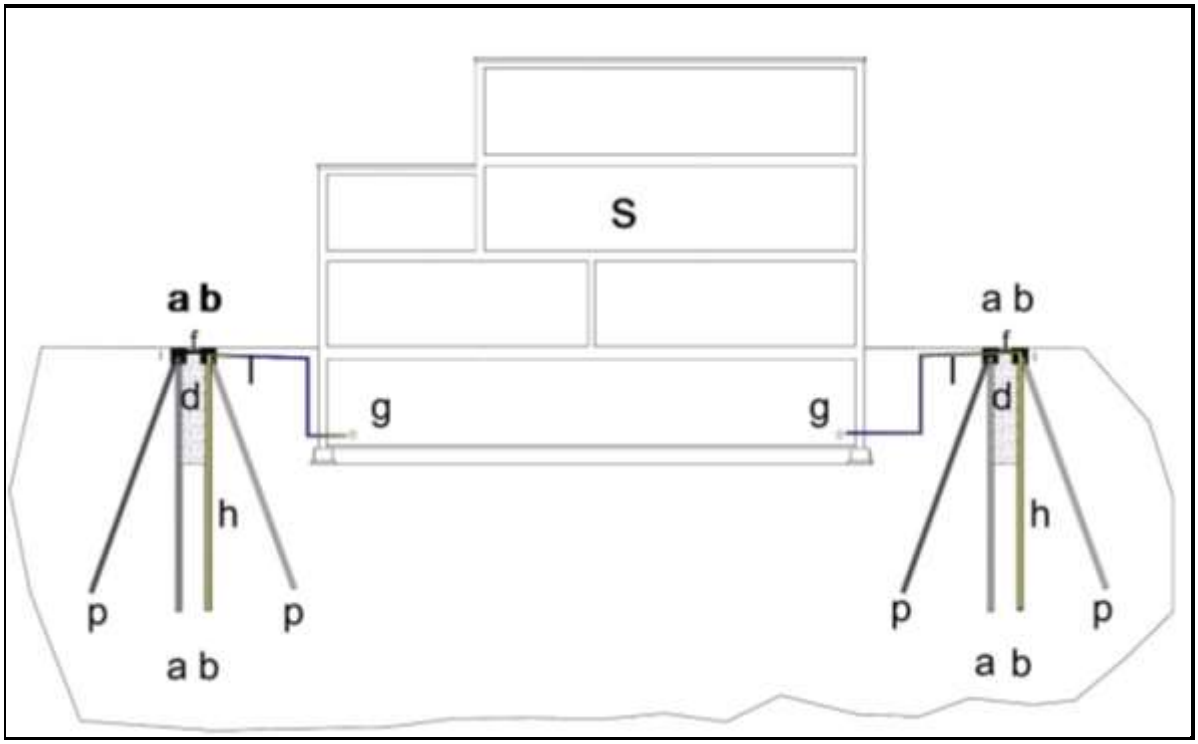


Figure 2: **A particular of the damping barrier and closed-loop geothermal probes.**



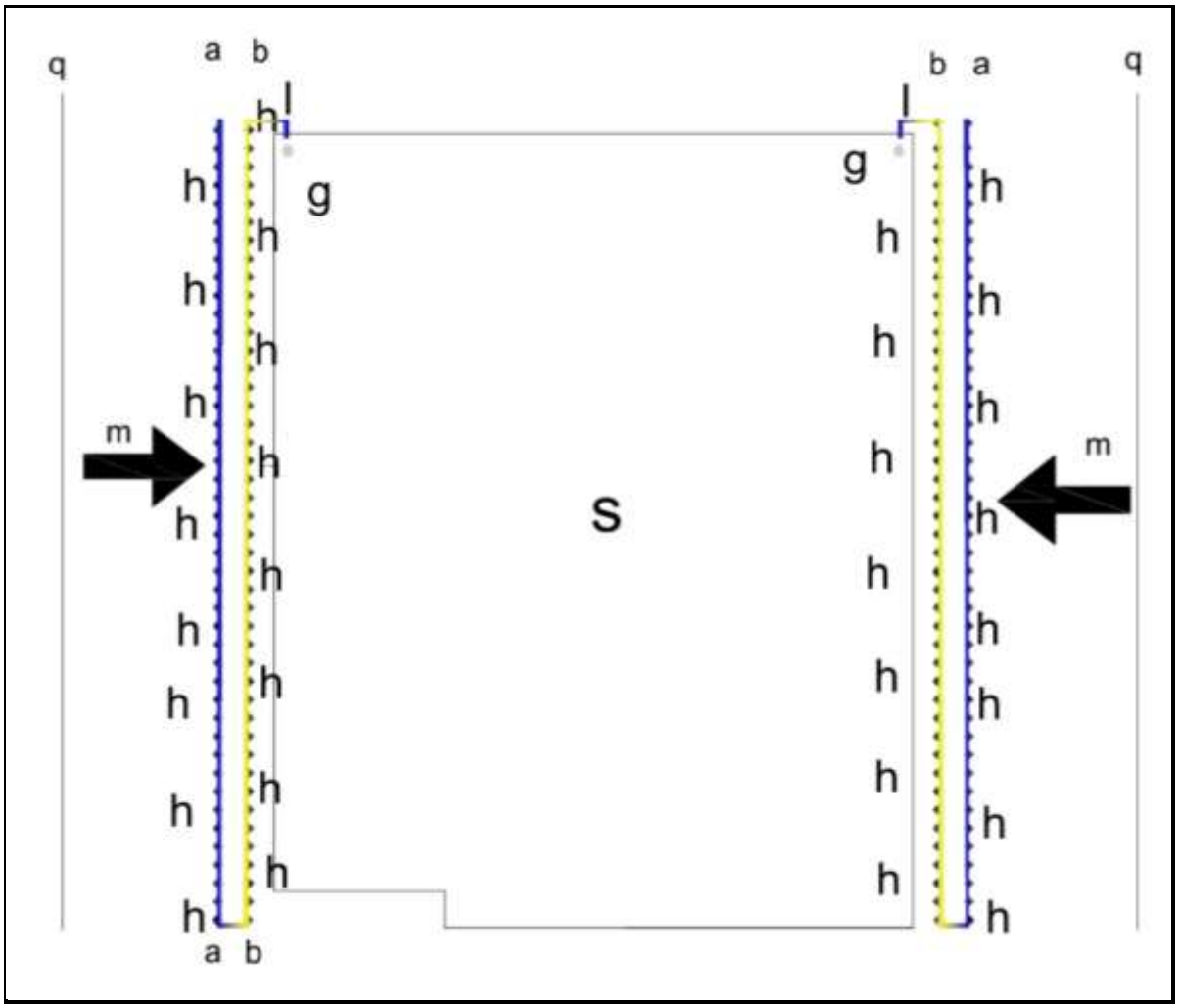
a) micro piles reinforced with steel pipes
b) micro piles reinforced with HDPE pipes
c) excavation between the two alignment of vertical micro pile;
d) filling of the excavation with expanded clays or light materials;
e) head beams of the piling;
f) springs or supports between the reinforced concrete beams.
g) boiler room and the heat pump;
h) coaxial geothermal probe
i) monitoring station
l) connections of the probes to the heat pump;
s) section of a Barrier

Figure 3: **Section of two damping and geothermal barriers on the two sides of a building.**



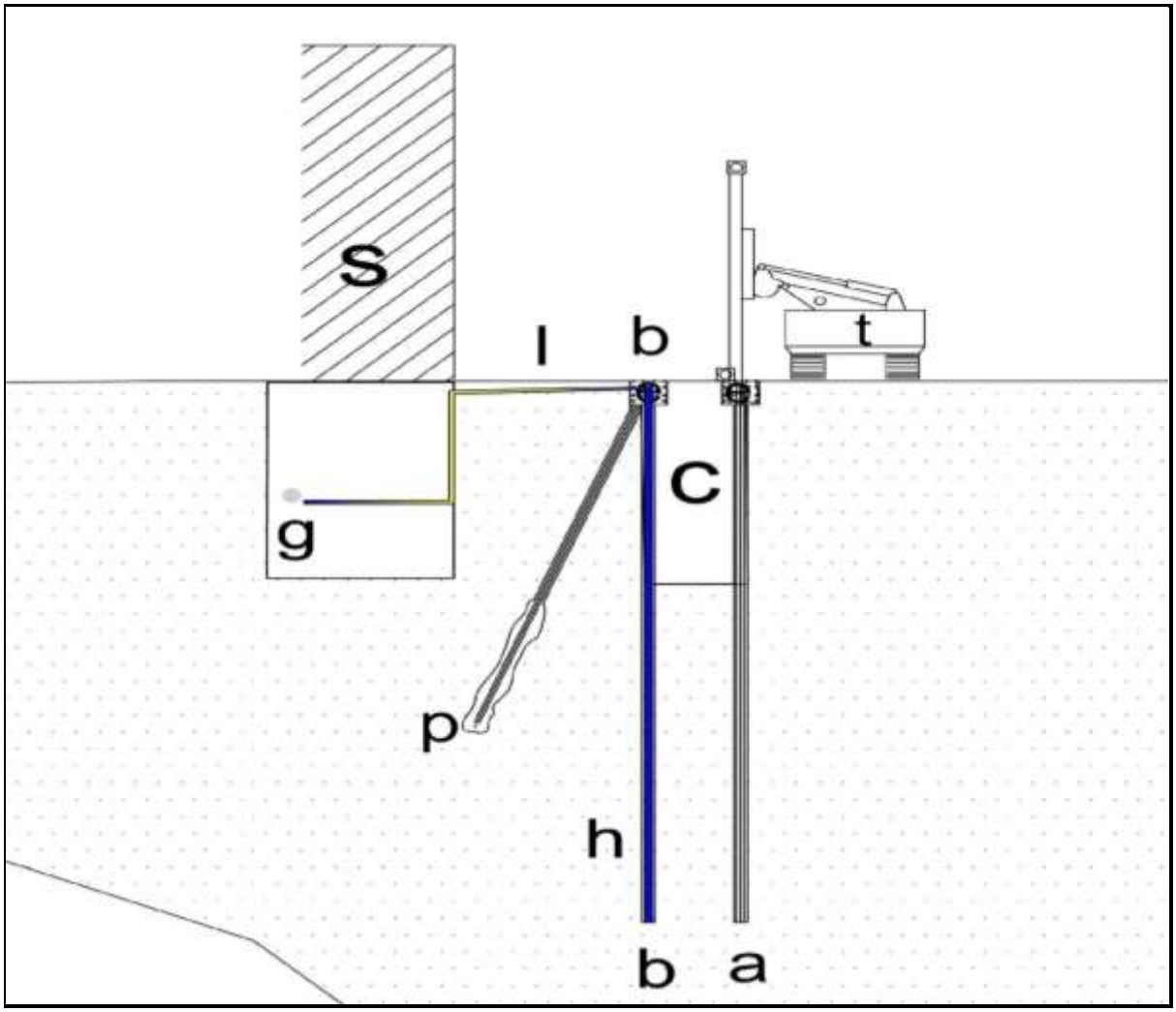
p) inclined micro pile reinforced with steel pipes
s) residential or commercial multi store building with basement

Figure 4: **plan of a damping barrier placed on two opposite sides of a building**



m) direction of origin of seismic waves;
h) position of the geothermal probes inside the micro piles;
q) presumed fault line;
s) floor plan of a building.

Figure 5: **Section of a damping barrier with inclined micro piles.**



p) inclined reinforcement micro piles
t) small auger

8. Conclusions

The project aims to reach two main objectives, to heat/cool buildings and at the same time dampening the vibrations produced by earthquakes, and still:

-control the changes in the ground with thermometers, seismographs, rare gas meters and other sensors, to try to predict the trend of seismic phenomena.

-adapting the methodology to any topographical and infrastructural conditions encountered.

- build the system quickly, without additional drilling costs, with low installation and maintenance costs, with zero environmental impact, without causing interference with the normal activity that should take place inside the buildings.

Although the project has not yet been tested in its entirety, there are good reasons for considering it valid and feasible also because the experimentation carried out in an industrial area, albeit partial, has had good results.