2023

SLB DEVICES

| SMART TECHNOLOGY WILL BUILD THE FUTURE

Visita nuestra web:

BROCHURE SLB DEVICES

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Our PROJECTS

6 Countries

+3,000 Devices

40 PROJECTS

Our **HISTORY**

SLB DEVICES SL is the third generation of a highly specialized family-owned structural engineering company with over 70 years of continuous innovation in structural systems and construction procedures. In this company, we are characterized by the combination of professional expertise along with constant research and development in conventional engineering techniques.

Since the 1960s, with the invention of construction procedures and finite element analysis for mixed grid slabs or "tridilosas" by Engineer Miguel Bozzo and Dr. Luis Bozzo, respectively, to the Shear Link Bozzo (SLB) dissipators developed by Dr. Luis M. Bozzo and MSc. Guillermo Bozzo with the collaboration of dozens of engineers worldwide contributing research on them. In particular, MSc. Guillermo Bozzo contributed in 2021 to doubling the deformation capacity of the devices and opened the doors for SLBs to meet the demanding specifications of the AISC 2016 and its load protocols.

Over these 70 years, five documents have been patented in Peru, Europe, and the United States related to industrialized prefabricated systems for roofs or seismic energy dissipators with very rigid behavior and high-performance large displacements.

Luis M Bozzo, Msc., Ph.D
Guillermo Bozzo, MSc.

Eng. Miguel Bozzo

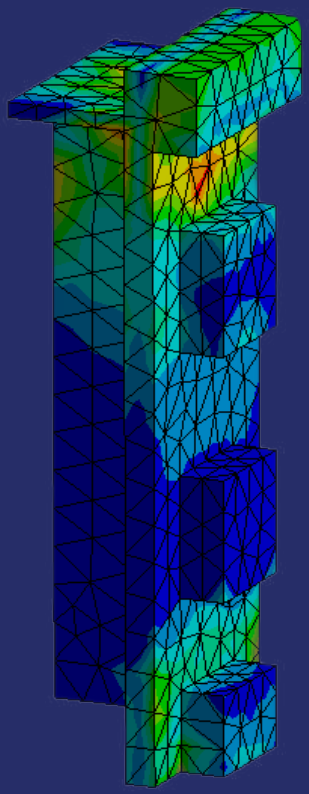
70 YEARS
OF CONTINUOUS
INNOVACIÓN

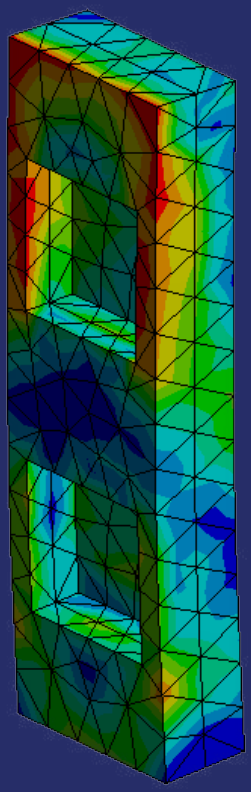
DISSIPATORS
SHEAR LINK BOZZO (SLB)

The Shear Link Bozzo system represents an innovative advancement in conventional design based on ductile flexible frames or stiffness walls, achieving a seismic-resistant design that changes the structural hierarchy. Through this system, deformations are concentrated in the devices, thus **protecting the structural elements**.

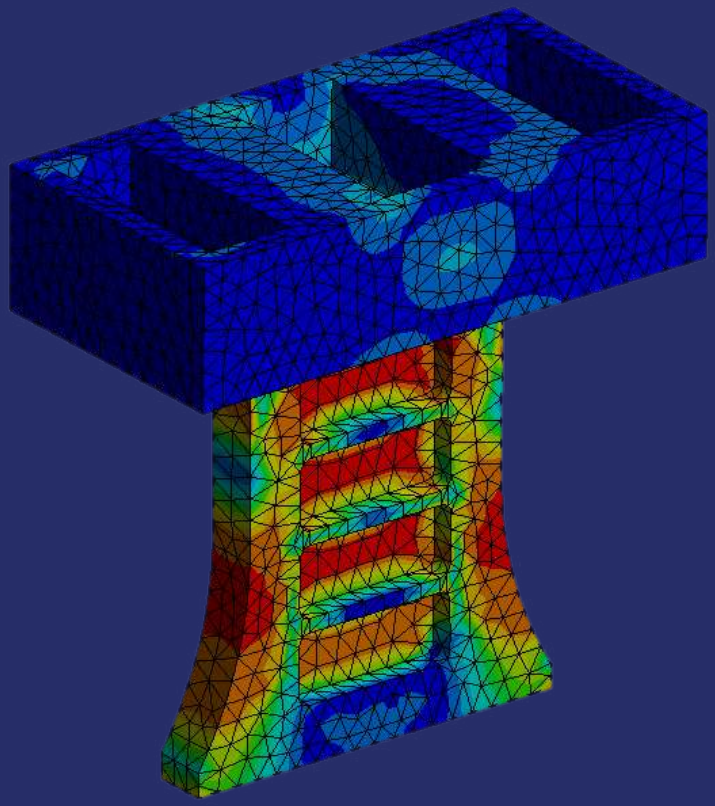
Our devices are characterized as the only rigid dissipator on the market that begins to yield (and protect the structure) from tenths of a millimeter, and it presents a double failure mode for added safety and structural redundancy within the device itself.

The system is employed in both new constructions and the reinforcement of existing structures. The following QR code shows the video of the i**nstallation process of the devices in decoupled walls**, one of the most common systems for connecting SLB dissipators.





ADAPTIVE TECHNOLOGY



Left to right:
Guillermo Bozzo, Msc.; Edinson Muñoz, Msc. y Luis M. Bozzo, Msc., Ph.D.

Enter to our YouTube chanel to see more videos:

Testing **EXPERIMENTS**

The SLB have a large number of experimental tests, which has allowed for their progressive development across four generations, demonstrating high precision in their real-experimental behavior. SLB devices are highly validated through numerous laboratory experiences, with the most notable ones listed:

- INEC – Portugal (2000)
- ISMES – Milan, Italia (2001)
- Pontificia Universidad Católica del Perú (2013)
- Pontificia Universidad Católica del Perú (2014)
- Pontificia Universidad Católica del Perú (2015)
- Universidad Federico II– Nápoles, Italia (2016)
- Instituto de Ingeniería de la UNAM, México (2018)
- Laboratorio LADICIM – Cantabria, España (2020)
- Laboratorio Universidad de Lima, Perú (2022)

Laboratory LADICIM – Cantabria, Spain(2020)

Laboratory Universidad de Lima, Perú (2022)

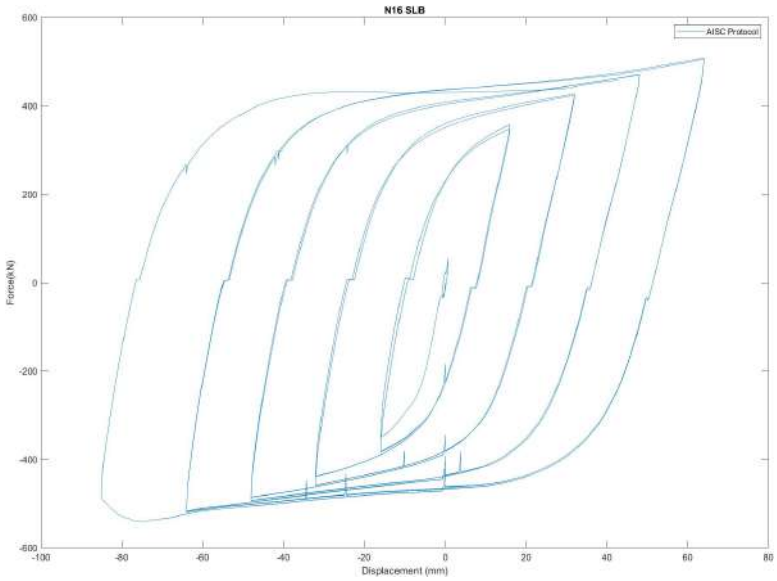
Testing
EXPERIMENTS

More information in our web:

During 2023 over 20 tests have been carried out in the University of Lima, Peru. Both monotonic and cyclic tests were conducted on the SLB devices following different protocols, including the ones dictated by codes such as AISC or ASCE, and even asymmetric patterns.

The image below shows the hysteretic curve of one of the specimens tested in this set of experiments. The device exhibits stable hysteretic behavior throughout all loading cycles without experiencing any loss of strength or necking in the force/displacement curve.

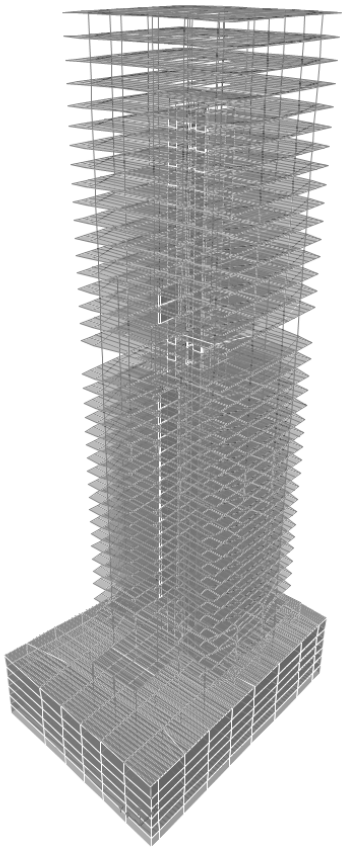
With this tests it was shown that the SLB Devices are able to reach 64mm through the AISC 318-19 protocol with a stable hysteretic behavior with over 500.000kN·mm of energy dissipation.



LOADING PROTOCOL

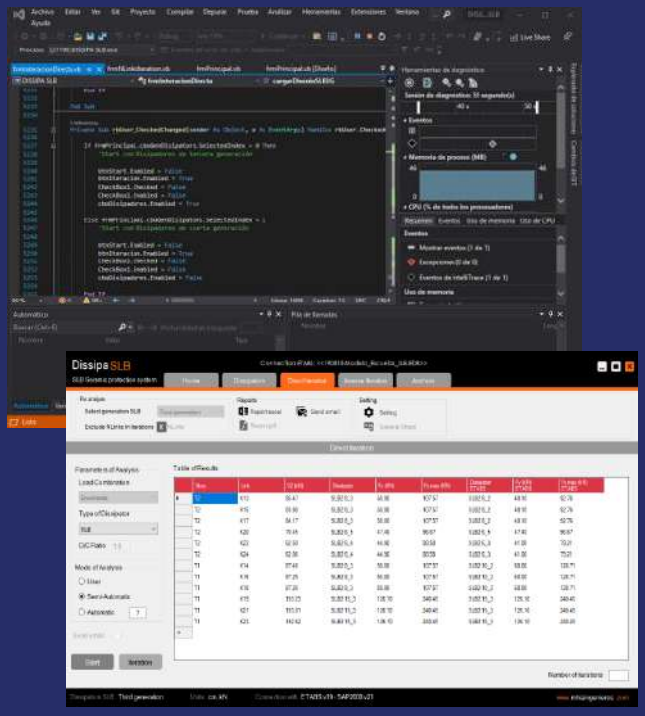
- 2 Complete cycles of 0.8mm;
- 2 Complete cycles of 16mm;
- 2 Complete cycles of 32mm;
- 2 Complete cycles of 48mm;
- 2 Complete cycles of 64mm y
- 1 Cycle of 85mm

SOFTWARE
DEVELOPING



At At SLB DEVICES, we are also specialized in developing programs to optimize and automate the analysis, design, and generation of structural drawings. The conventional process for carrying out these tasks still follows patterns that are not entirely automated, leading to additional costs and, more importantly, higher risks due to human errors.

Currently we have 3 commercial programs: the plug-in **DISSIPA SLB**, **WALL DETAILING** and **COLUMN DETAILING** all integrated into the ETABS program.



PLUG-IN
DISSIPA SLB

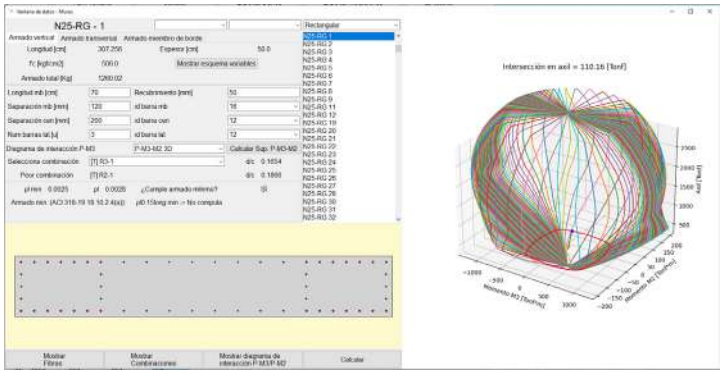
The iterative procedures for the pre-design of seismic dissipators have been automated in the Dissipa SLB application, which establishes a bidirectional connection with ETABS and SAP2000 software. In other words, this application functions as a post-processor by extracting results from the spectral modal seismic analysis conducted in the ETABS or SAP2000 program. It then processes and assigns the appropriate SLB device type to the numerical model through a precise transfer of information.

PLUG-IN
BEAM, WALL & COLUMN DETAILING

The WALL & COLUMN DETAILING is a plug-in with connectivity to the CSI ETABS program, designed to perform rapid calculations for reinforced concrete shear walls, spandrels and columns following the strict strength calculation and detailing guidelines of the ACI318-19 code. Additionally, it will generate assembly drawings, reinforcement quantifications, and calculation reports.

The plug-in allows for interactive calculation of longitudinal and transverse reinforcement of the elements, assessing its resistance to bending, shear, and edge members. It also handles reinforcement and detailing for confinement in the case of walls, and for spandrels, it addresses diagonal reinforcement.

The speed at which these calculations are performed enables users to efficiently optimize longitudinal and transverse reinforcements of the wall and in the preparation of assembly drawings.



www.slbdevices.com

STRUCTURAL
EXPERIENCE

TOWER
PARADOX

Location

Santa Fe, México

Height

196m / 60 stories

Year

2018

The Paradox Tower is one of the tallest and most iconic towers in all of Latin America. Comprising 3 interconnected towers at various heights, 2 of which are inclined. Thanks to SLB dissipators, a significant saving in the structure was achieved, reducing over 2,000 tons of weight from the original design.

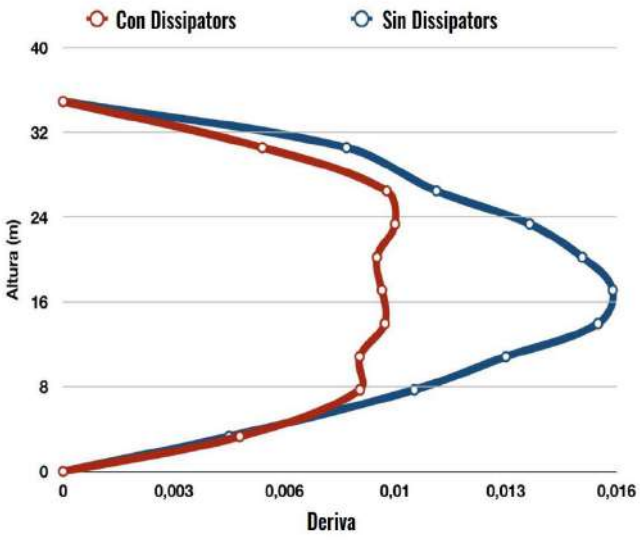
Furthermore, the SLB seismic protection system has ensured that the structure exhibits elastic response to seismic events. Following the June 2020 earthquake measuring 7.5 on the Richter scale, it was confirmed that the structure had no residual deformation, validating its elastic response.

Video during the 2020 earthquake measuring 7.5 on the Richter scale recorded on the 53rd floor of the Paradox Tower:

MARINA
VALLARTA

More information in our web:

Location	Height	Year
Puerto Vallarta, México	30m / 8 stories	2019



The project is located in Vallarta, Mexico, an area with a very high seismic activity. Due to the architectural layout, long concrete walls could not be installed, so the building had to be designed with ductile spatial frames.

For this project, and thanks to SLB dissipators, a 40% reduction in floor displacement was achieved, as shown in the graph on the left. Additionally, the SLB system reduced seismic demand on the structure, allowing for adjustments to beam and column sections.

PENÍNSULA
IXTAPA

More information in our web:

Location	Height	Year
Ixtapa, México	60m / 18 stories	2017

The Ixtapa building has a height of 60 meters and is located on the Pacific coast of Mexico, prone to potentially high-intensity earthquakes. It is crucial that, in the event of a seismic event, the structure exhibits a robust response while being easily inspectable and repairable.

As a result, the original structural design was modified, replacing concrete walls with the SLB dissipator system connected with steel diagonals.

URBANIA **T100 Y T200**

SLB DEVICES

T100 & T200
URBANIA

More information in our web:

Location

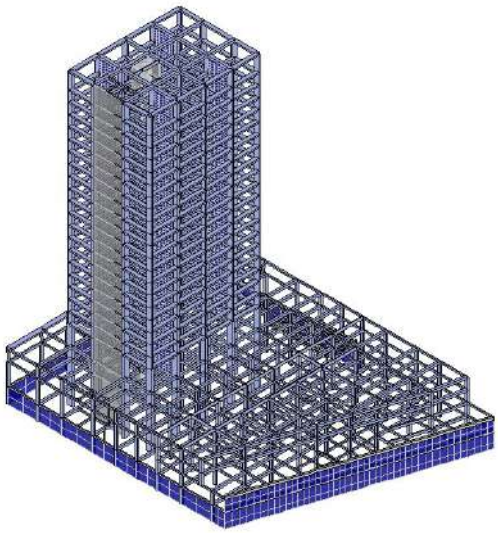
Zapopan, México

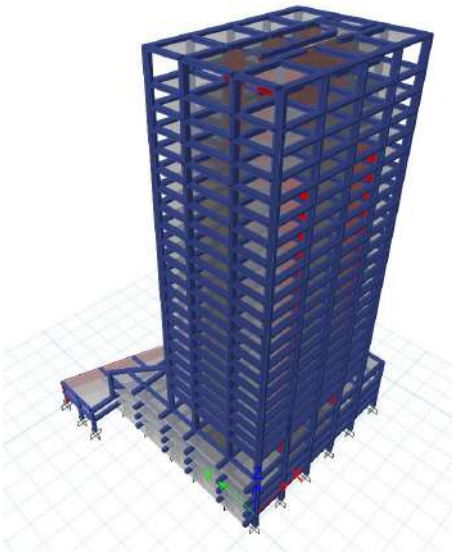
Height

80m / 26 stories

Year

2017





The project consists of three residential towers: T100, T200, and T300 (the latter still in the project phase). The structural scheme of towers T100 and T200 follows the same criteria, using walls and 3D frames. Due to the architectural layout with walls only on one perimeter axis of the buildings, they exhibited significant torsion.

SLB DEVICES provided a pioneering worldwide solution by incorporating the first SLB decoupled walls strategically placed in the structure to control torsion.

More information in our web:

PENSINSULA
PLAYA DIAMANTE

Location	Height
Acapulco, México	72m / 23 stories

Year
2015

Located in Acapulco, this building, protected with SLB energy dissipators, has already experienced several seismic events, including the September 2021 earthquake in Guerrero, Acapulco, measuring 7.1 on the Richter scale, with the epicenter less than 30 km away from the building and at ONLY 10 km depth.

TOWER
OAK 58

Location

Puebla, México

Height

220m / 51 stories

Year

2019

The Puebla OAK58 tower is a unique building comprising two large structures interconnected by three bridges at different heights.

To minimize building vibration, a critical condition in such structures, 400 SLB units are incorporated through decoupled walls that provide rigidity to the structure.

LEGACY TOWER

Guadalajara, México.

SLB DEVICES

TOWER
LEGACY

Location	Year
Guadalajara, México	2020

Height	Engineering
120m / 31 stories	Cautín

The Legacy Tower, engineered by Cautín, is located in Guadalajara, Mexico.

The structure has an L-shaped floor plan and a framed structural configuration, making it very flexible.

To stiffen the structure and avoid torsional issues, SLB energy dissipators placed in the core of the building were chosen. The system is connected through decoupled walls, allowing for significant reductions in both the base shear and floor displacement. Various seismic protection alternatives were studied for this building, including SLB, BRB, and VWD. As seen in the following graph, the SLB system provides excellent performance, significantly reducing the building's drift.

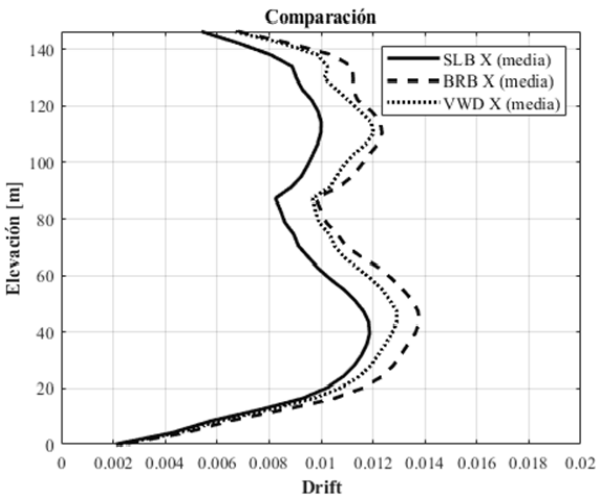
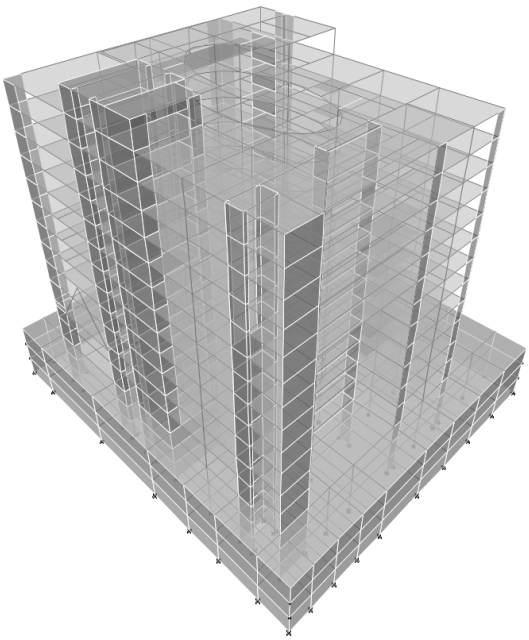


Image extracted from the article "Performance Evaluation of Three Types of Energy Dissipators for the Seismic Protection of Tall Buildings."

CATHOLIC UNIVERSITY
SANTA MARÍA



Location	Height	Year
Arequipa, Perú	43.0m	2019

The postgraduate school of the Santa María Catholic University is located in Arequipa, Peru, in one of the country's most seismic-prone zone. The project consists of ten floors and three basements, representing technological advancement in university infrastructure by incorporating 65 SLB seismic dissipator units installed in the perimeter frames of the structure. Chevron braces, both in double and single height, are employed to enhance rigidity and control lateral displacements caused by seismic events.

CATHOLIC UNIVERSITY
SANTA MARÍA

The dissipators were delivered to the construction site along with the calculation report and the certificate of quality for the material tested in the laboratory according to ASTM standards. Additionally, these devices were provided with proper paint protection, where the type and thickness of the paint were defined based on their level of environmental exposure.

Retrofitting

SCHOOLS PRONIED

Location	Height	Year
Lima, Perú	6.40m	2022

Schools, in general, are structures of high importance that must be designed with standards for immediate occupancy and minimal damage in the face of extreme seismic events. Collapse-only criteria are clearly insufficient for them. Additionally, during the past years it has been shown that many structures of this kind need reinforcement and retrofitting in order to verify with the new strict codes. Moreover, schools often share similar architectural characteristics, featuring diaphragm walls at their ends to provide significant stiffness in the short direction and relatively flexible frames in the other direction, often with windows that can result in short columns.

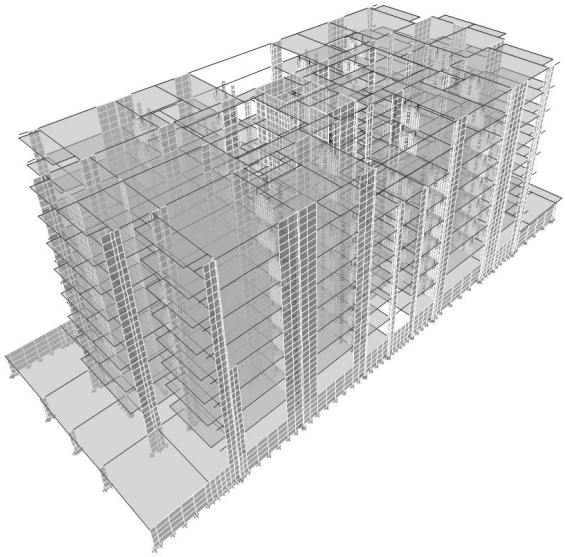
Retrofitting
SCHOOLS PRONIED

The proposed solution using decoupled walls, short diagonals over them, and rigid energy dissipators SLB presents significant construction and technical advantages. Firstly, the intervention is minimal in terms of drilling or connections with the original structure, as horizontal holes are only required in the center of the beams and only in their central core (outside the zones of maximum reinforcement of the beams). Additionally, the diagonals allow light to pass without distorting the original architecture, and the energy dissipators, by yielding within tenths of a millimeter, control the overall response. This way, schools can be reinforced in a minimal time frame and with a low-cost technological solution.

Below are the schools that have been retrofited using SLB devices:

- IE 7047 Tacna - Barranco, Lima - Perú
- IE 0074 Belaunde Terry - Ate, Lima - Perú
- IE 2078 Nuestra Señora de Lourdes - Los Olivos, Lima -Perú
- IE 7220 Villa María del Triunfo - Villa María del Triunfo, Lima -Perú

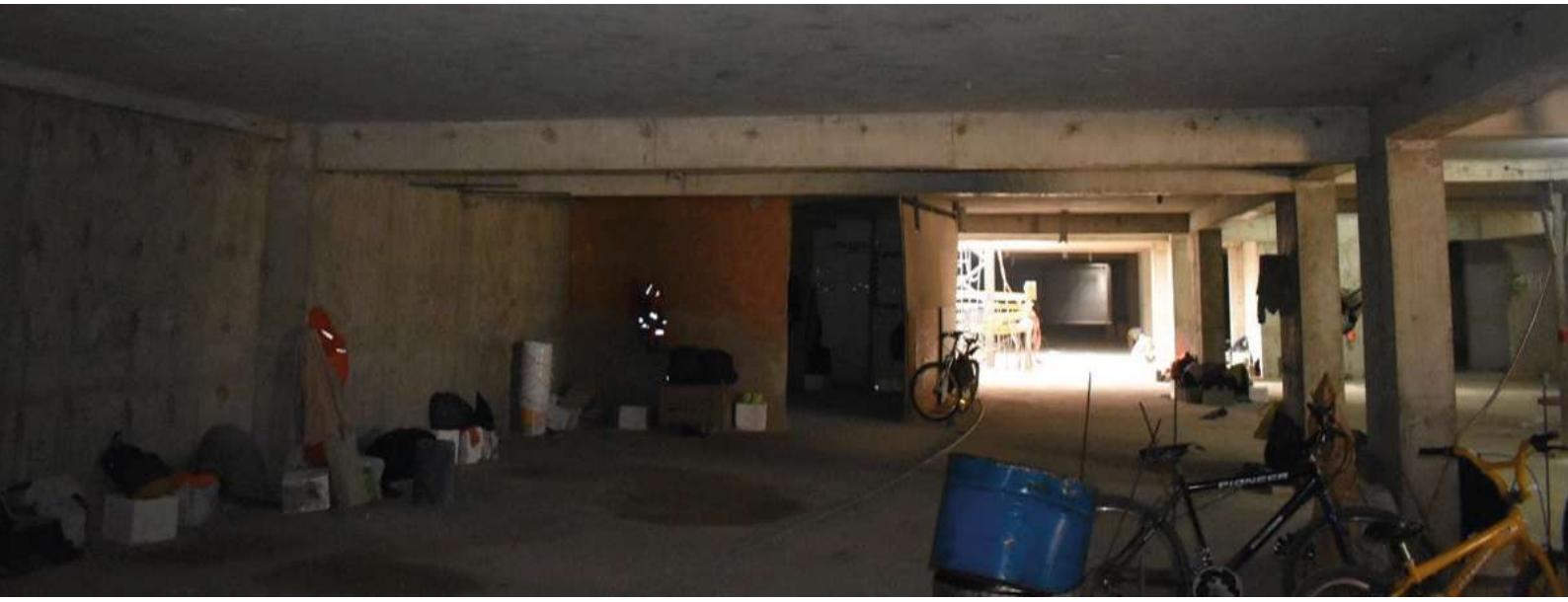
ECOPALMAR
RESIDENTIAL



Location	Height	Year
Trujillo, Perú	21.60m	2018

The residential building Ecopalmar is the most exclusive and secure project in the city of Trujillo, Peru, boasting 218 SLB dissipator units to support its seismic performance. The structure comprises a semi-basement and eight levels, primarily consisting of structural concrete walls and the SLB dissipation system. These dissipators are installed in decoupled walls, replacing partition walls and creating an imperceptible impact on the architecture.

ECOPALMAR
RESIDENTIAL



For the project, the use of SLB dissipators with decoupled walls, installed from the first level to the eighth level, proved to be the ideal solution by providing rigidity without adding continuous vertical elements. This achieved an open space for parking on the semi-basement level, with the decoupled walls strategically placed to accommodate the architectural requirements of the project.

NATIONAL UNIVERISTY
HERMILIO VALDIZAN

Location	Height	Year
Huánuco, Perú	34.80m	2023

The Professional School of Civil Engineering at the National University Hermilio Valdizan is a project currently under construction, featuring 71 devices distributed around the perimeter of the structure. These devices are installed using chevron braces and decoupled walls, strategically placed at varying heights to accommodate the architectural requirements of the project.

Reservoir
QHAPACÑAN

More information in our web:

Location	Year
Cajamarca, Peru	2023

Height
52m

An iconic structure, unique in its architecture and structural system, inspired by the tripod of the Cajamarca culture. Built on a very challenging terrain, characterized by medium to high plasticity clays (CL and CH) with high freatic level.

The superstructure incorporated SLB seismic dissipators, enhancing its seismic efficiency. As a result, for a very rare earthquake (Tr=2475 years), it does not exhibit hinges as a preventive measure against collapse, meeting the life safety performance objective.

This project will contribute to closing gaps in potable water supply, directly serving 18 thousand residents and indirectly benefiting another 10 thousand inhabitants by freeing up another reservoir to supply other sectors of the city.

Tower
MAWA22

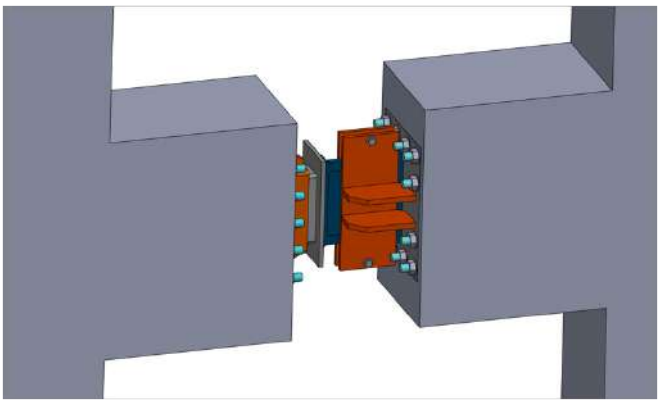
More information in our web:

Location	Year
Manta, Ecuador	2024

Height
86m

The Mawa22 tower is a residential building located on the sea front of Manta, Ecuador. the building is equipped with 84 SLB dissipators located in the coupling beams of the two cores of the building. The SLB coupling beams allow to connect the core walls and ensure a good response of the building during and after an earthquake.

Whilst the classical coupling beams suffer great damage during earthquakes due to their high stiffness, the SLB coupling beams create a stiff and ductile system that prevent any major damage from happening as the SLB dissipators abosrb most of the deformation and protect the rest of the elements.



Tower VIANTO

More information in our web:

Location	Year
Guadalajara, Mexico	2024

Height
155m

Spain

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