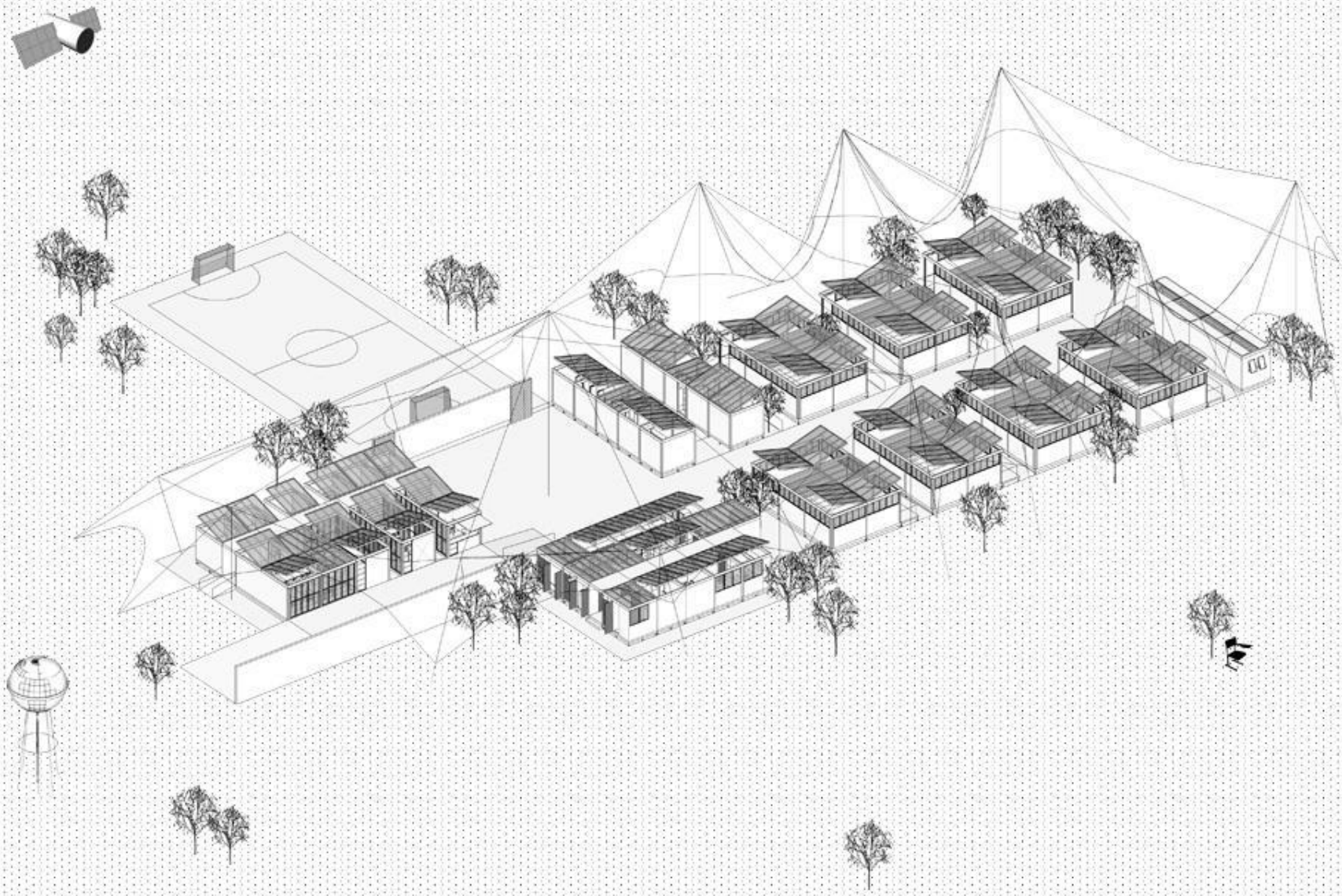
escola de bolso

[POCKET SCHOOL]

FINAL PROJECT/ RAFAEL PINHO
EA.UFMG/ SCHOOL OF ARCHITECTURE AND URBAN PLANNING/ FEDERAL UNIVERSITY OF MINAS GERAIS/ BRASIL
2003/2004

OR/ PROFESSOR DR. MARIA LÚCIA MALARD
OR/ PROFESSOR PORFÍRIO VALLADARES

II



ABSTRACT/

The *Pocket School* is an "assembly kit" school, intended for temporary and/or emergency use. It consists of modules and panels which make up the internal spaces, all covered by a tensile structure. Disassembled, the kit is reduced to standardized volumes, all compatible with the dimensions of the cargo compartment of most trucks [2,5x12m], enabling the kit to be easily transported anywhere.

Once assembled, the school can function in the same spot for months, or even years. When applied to settlements that are supposed to become permanent, such as MST relocation programs [MST is a group that attempts to take unproductive farmland from owners of large tracts and redistribute it to poor, landless farmers, in order to reduce the social disorders and improve wealth distribution in Brazil] the Pocket School can be used until a permanent building is ready for use, in which case some of the modules may be "absorbed" by the building. In the case of temporary use, such as relief efforts for victims of natural disasters, semi-nomadic populations, temporary MST encampments, settlements on remote construction sites [dams, bridges, etc.], the *Pocket School* could be assembled, disassembled and moved to other locations as necessary.

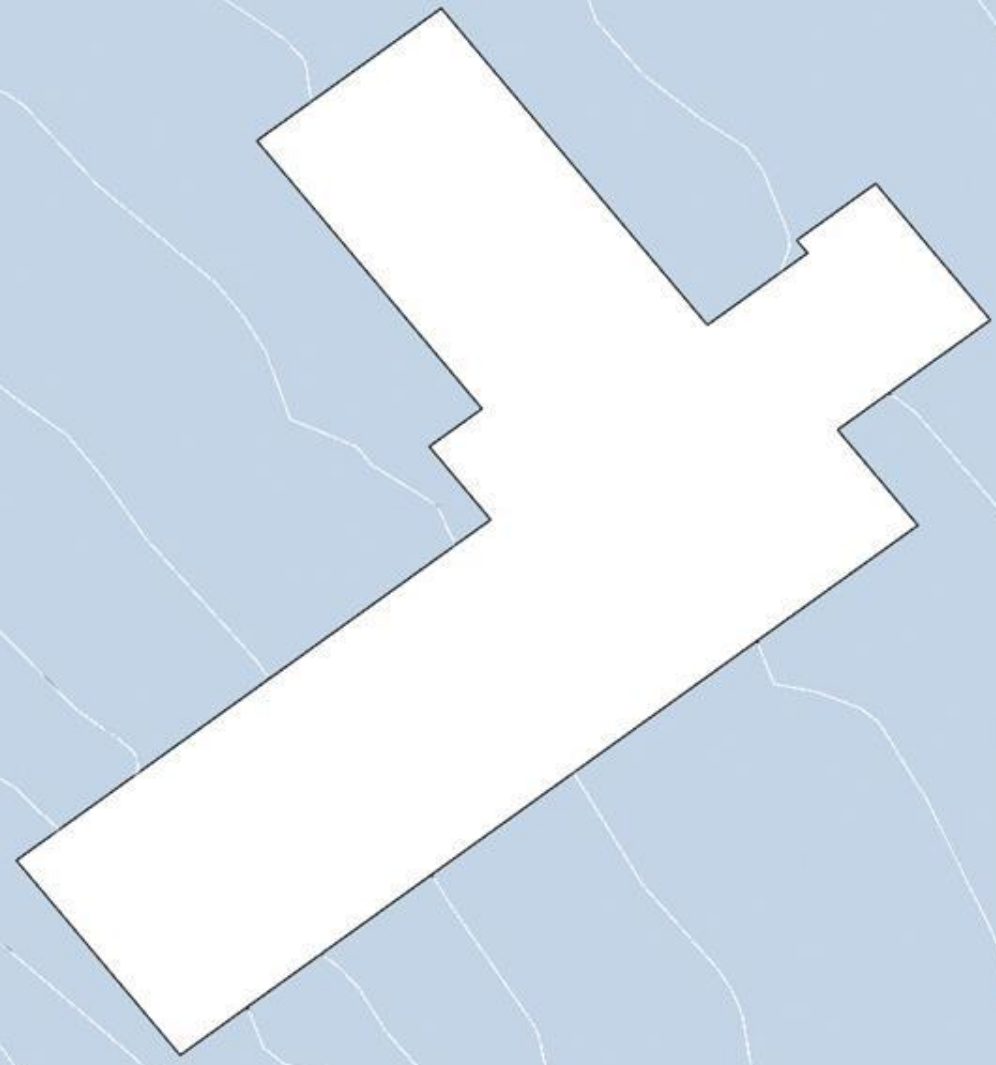

2,8m
12m
2,5m

ASSEMBLY.

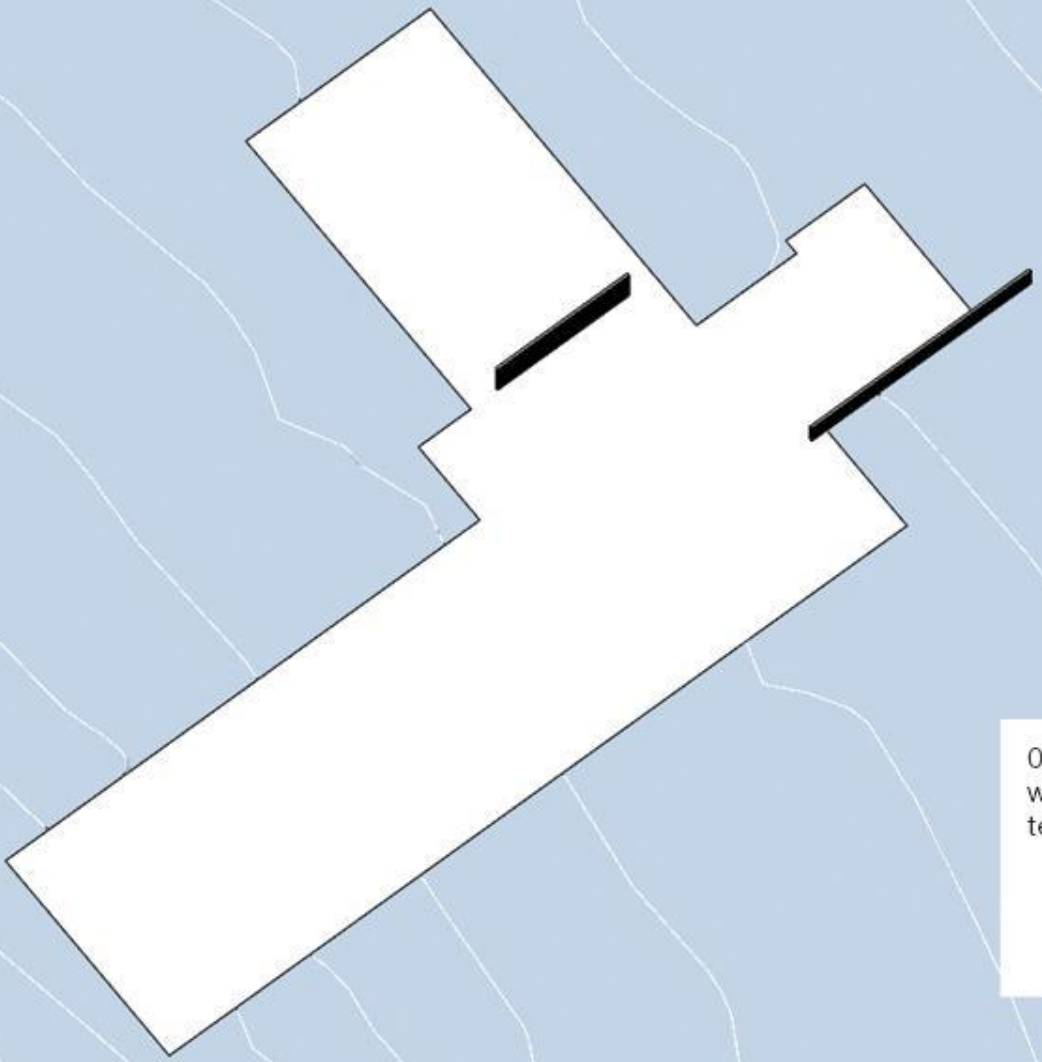
In sites where earthwork is not necessary, the Pocket School can be quickly assembled – once the foundation is ready, and the soil is compacted, only a few days are needed for full assembly. The structure is intended for repeated use, thus reducing the cost per use. It can also be assembled in various shapes and sizes, in order to adapt to specific circumstances, needs and topography[1]. The resulting space is multifunctional and of flexible usage, designed to be used as an elementary, middle or high school, an institute of higher learning, or even a community center.

[1] The possibility of installing the school in extreme climates has not been addressed here, but is also not excluded. Such option would demand special attention and a more complex and sophisticated climate control. No harsh climates can be found in Brazil. Most of the territory is under a mild tropical climate - often too hot, but never too cold.

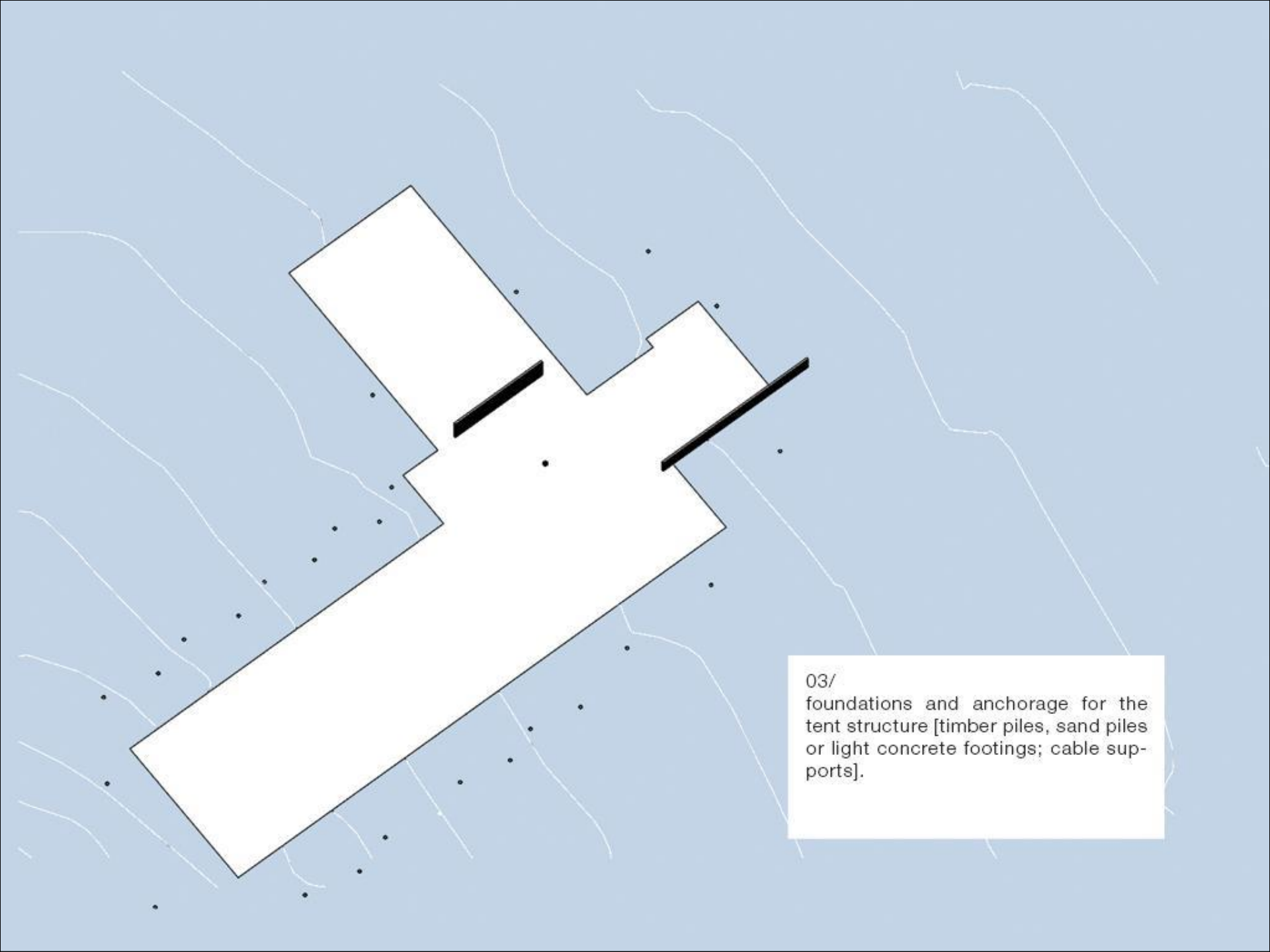
00/
site choice.
no earthwork is necessary unless the natural grade is too steep (over 8%).



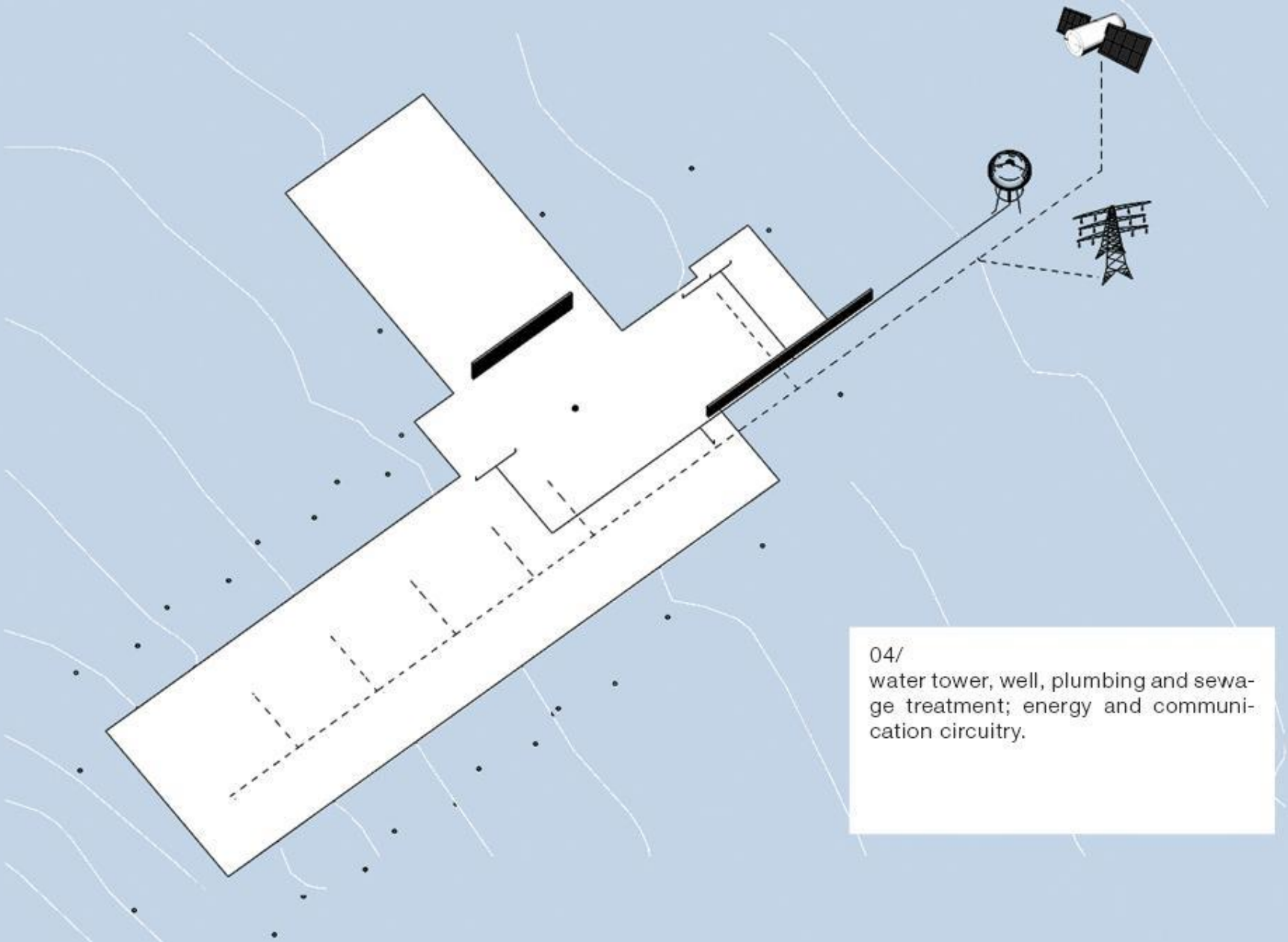
01/
sitework.
compaction, fine grading, drainage trenches.



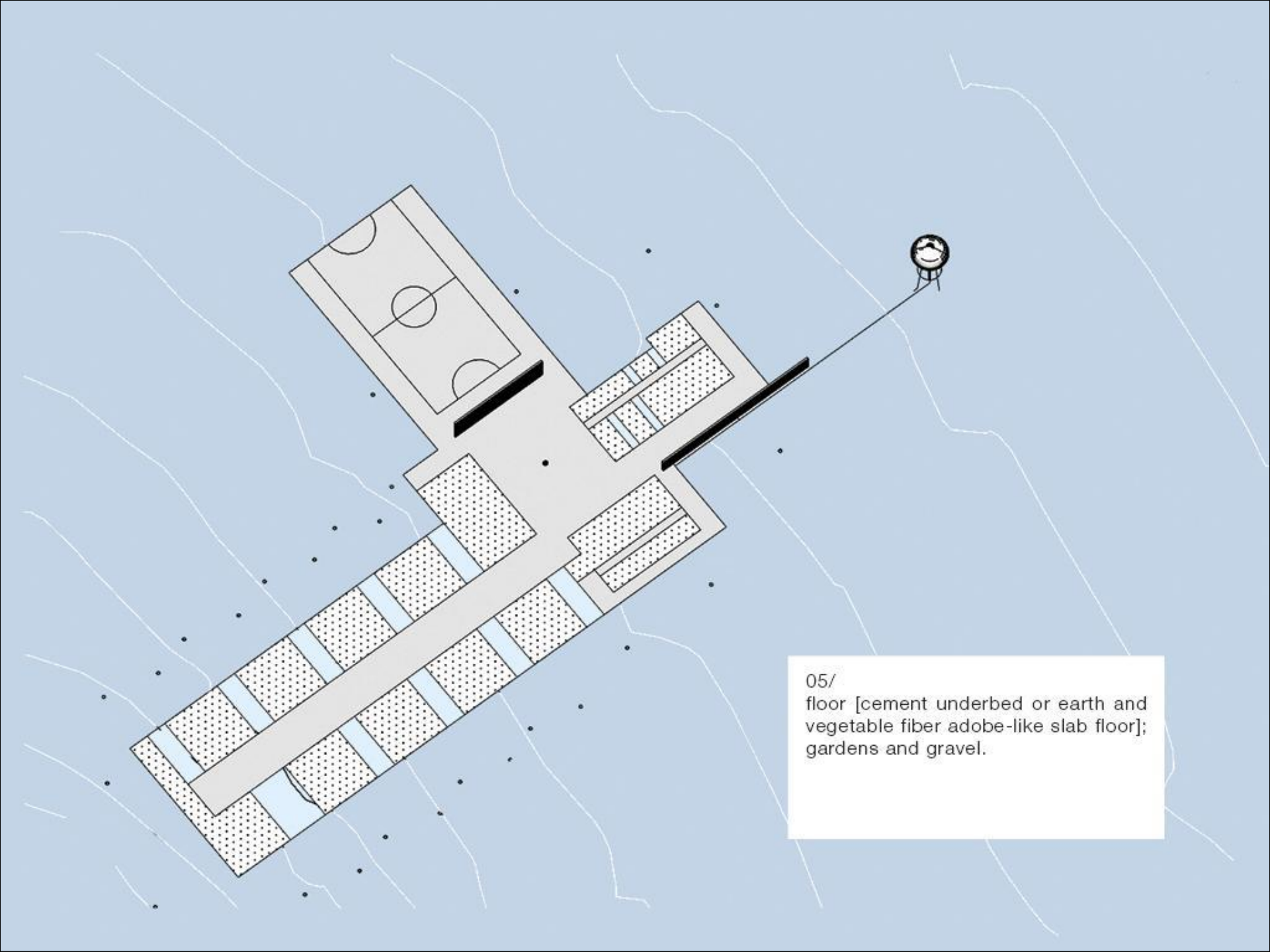
02/
walls built with local labor, vernacuar technology and materials.



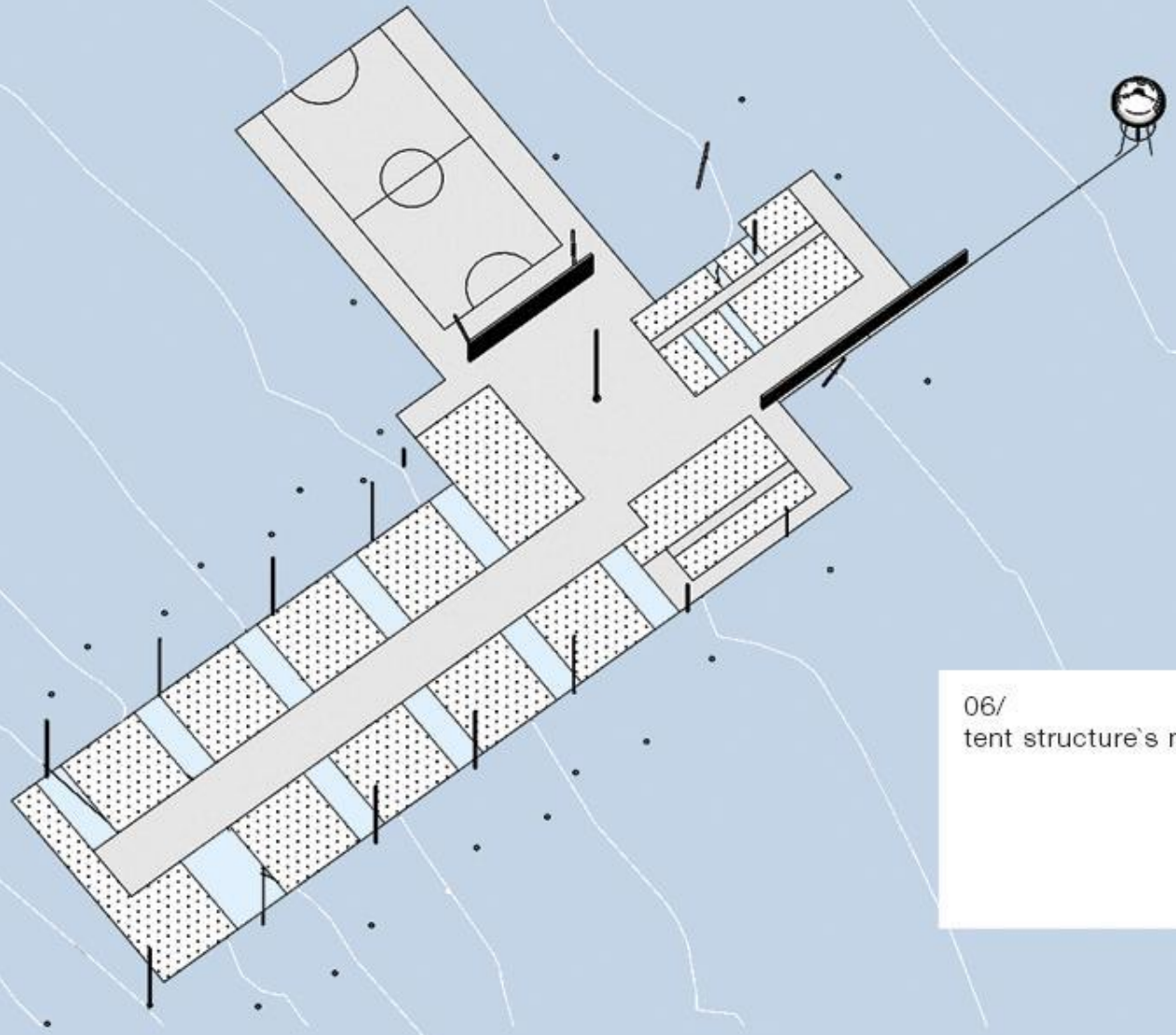
03/
foundations and anchorage for the tent structure [timber piles, sand piles or light concrete footings; cable supports].



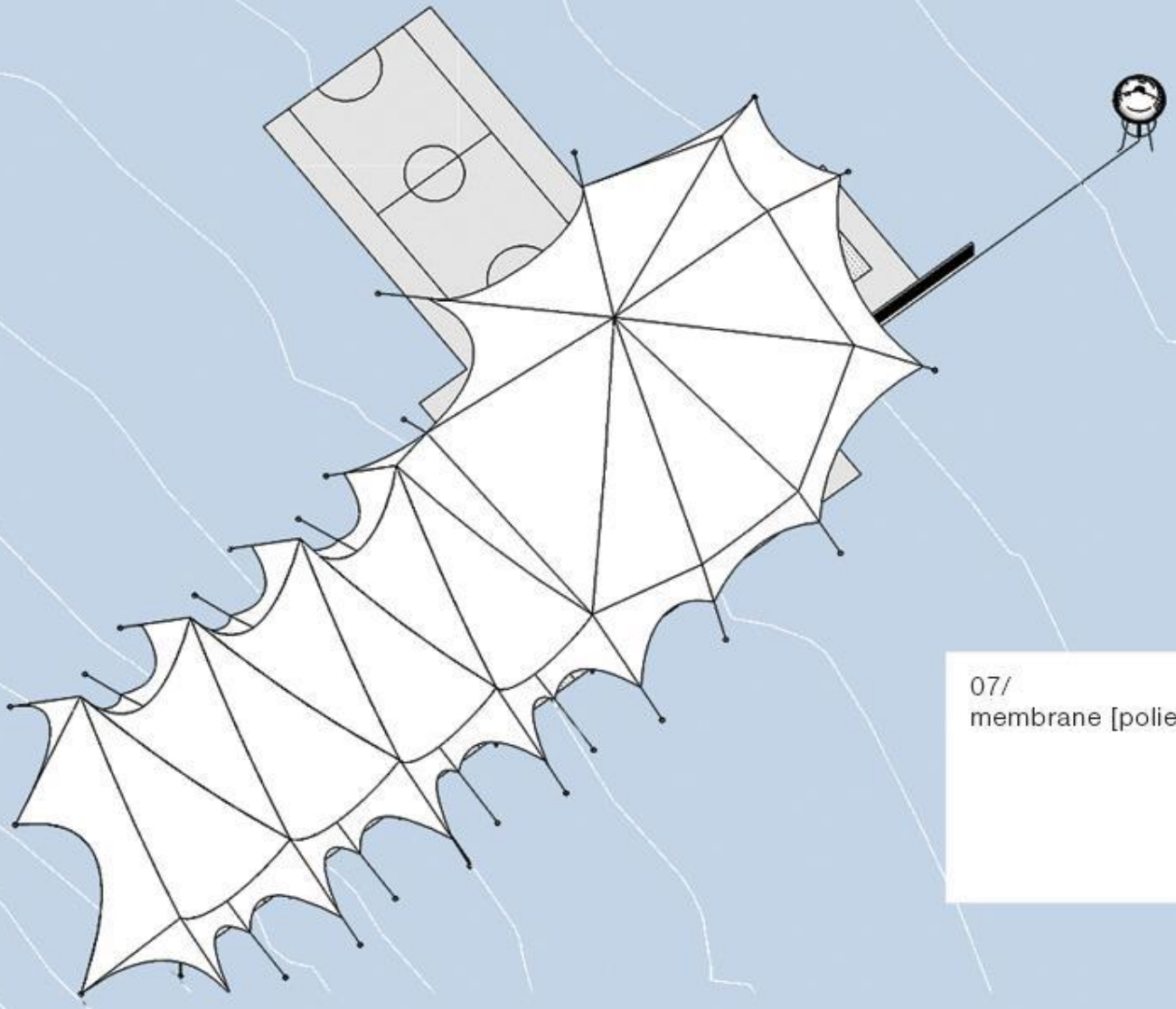
04/
water tower, well, plumbing and sewage treatment; energy and communication circuitry.



05/
floor [cement underbed or earth and vegetable fiber adobe-like slab floor]; gardens and gravel.

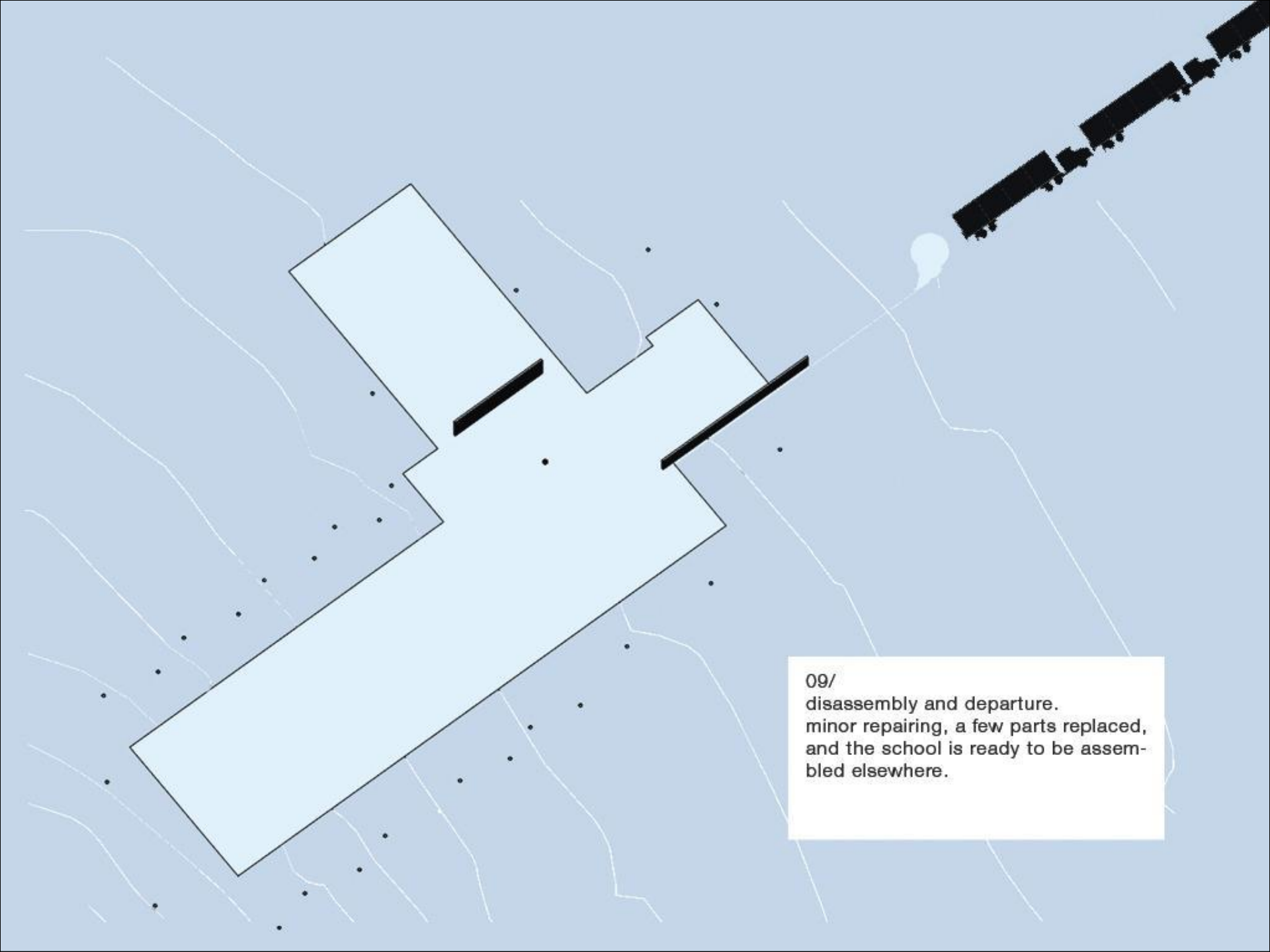


06/
tent structure`s masts.



07/
membrane [poliester + PVC + PVDF].

08/
assembly of modules and panels underneath the tent.
school ready for use and fully wheelchair accessilble.



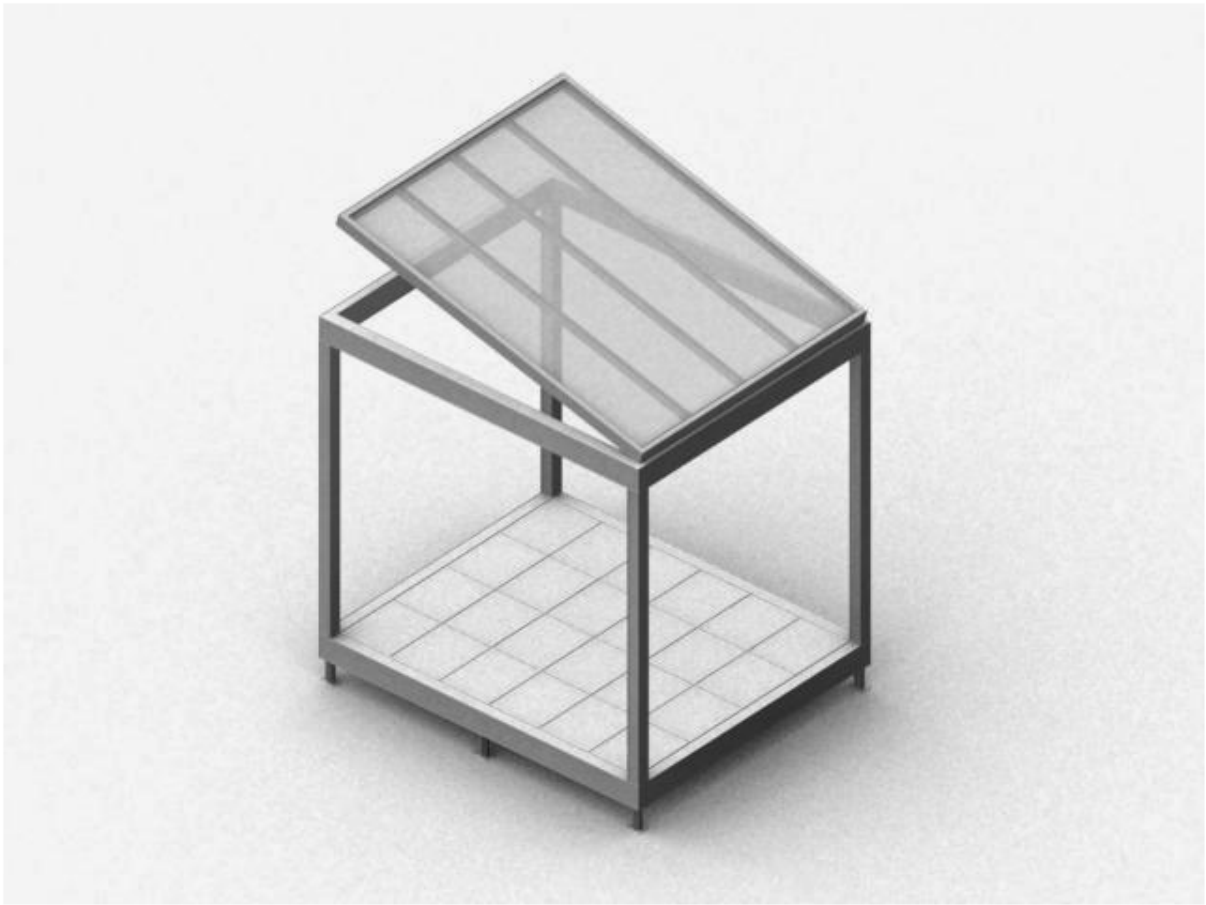
09/
disassembly and departure.
minor repairing, a few parts replaced, and the school is ready to be assembled elsewhere.

UNITS.

The kit is divided in modules and panels. Groups where there are water [PEX system] and sewage installations, or any other permanent furniture and structures, are made up of modules. The classrooms and administration are assembled out of floor, wall and ceiling panels.

In the panel system, all elements fit into each other [tongue and groove joints], and are held together by screws. The modules and panels are supported by adjustable-height steel monoposts, in order to accommodate small terrain irregularities without the necessity of major sitework. The monoposts are anchored to shallow foundations, built specifically for the local terrain characteristics. The walls connect to the floor, and the ceiling panels lock the structure.

Each functional group, be it modules or panels, or both, is an entirely independent structure, which makes its use in irregular terrain much easier. The dimensions of modules and panels are limited by the size of a standard truck cargo compartment, as well as by the industry standards, especially in the case of steel beams.



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PROGRAM.

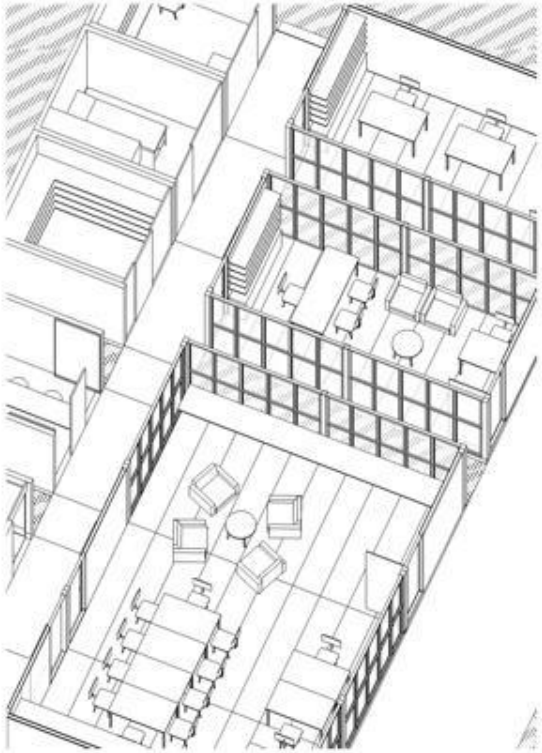
The *Pocket School* is divided in 5 functional groups: administration, toilets, library, kitchen/cafeteria and classrooms. Aside from the transportable and re-usable parts, some conventional constructions should precede the assembly of the school. In the hypothetical example used, two walls should be built, using local labor and vernacular technology. One of them functions as service wall. The water tower connected to the public water system or to a well supplies the school through buried pipes, and septic tanks receive all sewage. Similarly, the electrical and telecommunications network is distributed by buried conduits. The soil must be compacted before receiving the flooring - a cement underbed or adobe-like slabs made of earth and vegetable fibers, or any other simple technology available locally. The most elevated stretch of the school perimeter should have drainage trenches, and the external areas must include a sports court, preferably to be made available to the local community when it is not in use by the school.

According to the selected site and its surroundings, the school can be more or less able to close. Generally, it is a much more penetrable structure than a conventional school building, especially due to its being covered by a membrane

GROUP 1: ADMINISTRATION

MODULES AND PANELS.

THE MODULES HAVE PLUMBING WALLS AND/OR PERMANENT STRUCTURES AND FURNITURE. PANELS ARE CONNECTED TO MAKE UP EMPTY ROOMS.

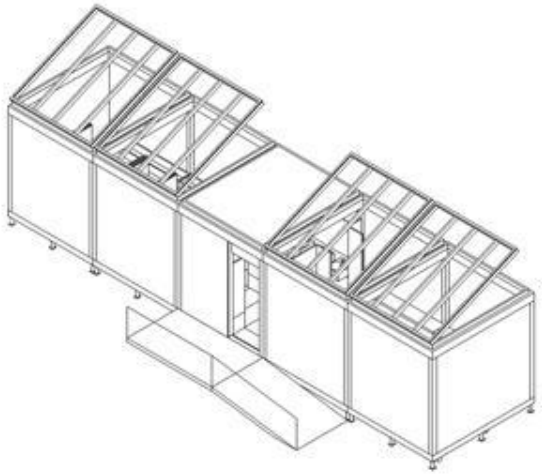


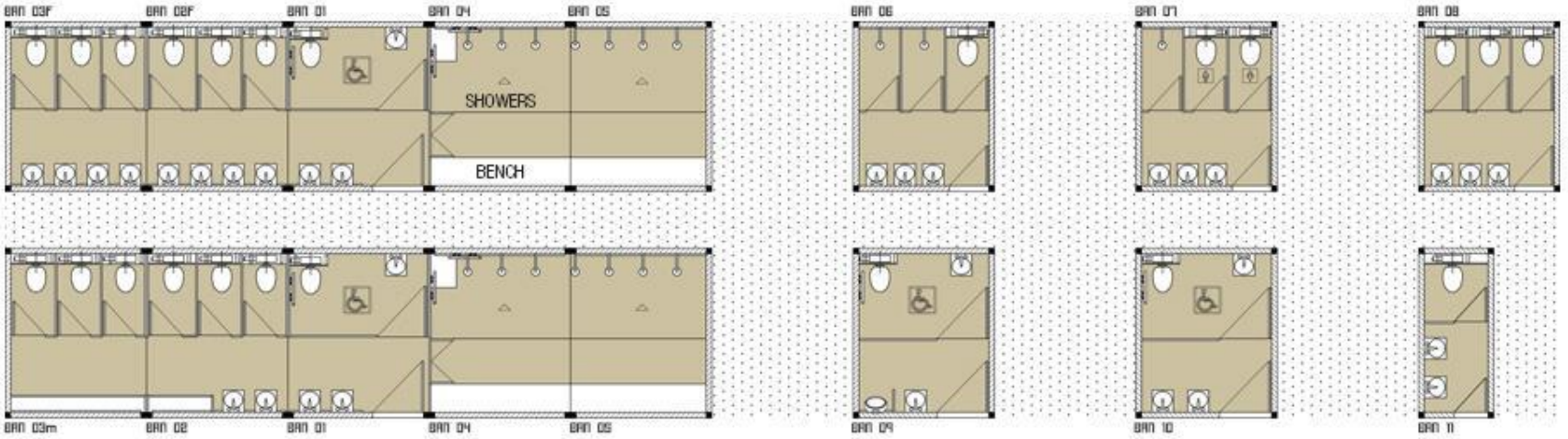
S
STORAGE
KITCHEN
W.C.
TEACHERS' LOUNGE
M
NURSE
STORAGE
KITCHEN
W.C.F
W.C.M
SERVER/
COPY
SECRETARY
PRINCIPAL
TEACHERS' LOUNGE
L
NURSE
STORAGE
SERVER/
COPY
KITCHEN
W.C.F
W.C.M
SECRETARY
PRINCIPAL
TEACHERS' LOUNGE

GROUP 2: TOILETS

MODULES.

PEX: PLUMBING SYSTEM CONSISTING OF HARD CONDUITS AND FLEXIBLE HOSES SIMPLIFIES THE CONNECTION BETWEEN THE MODULES.

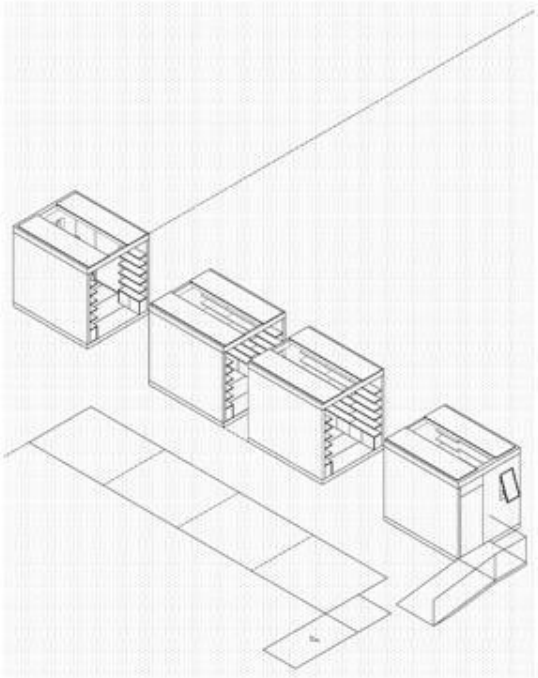


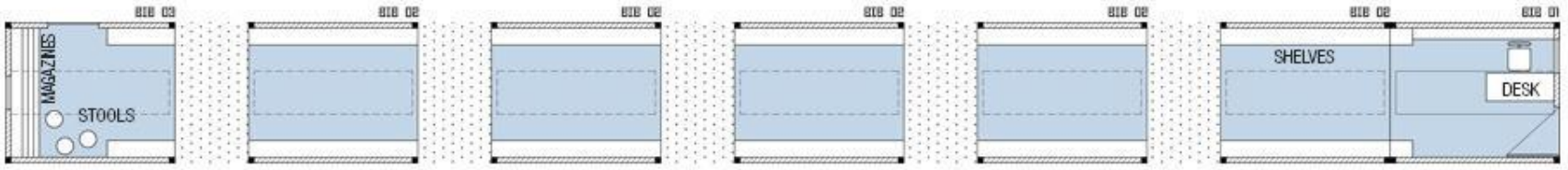

BAN 03F
BAN 02F
BAN 01
BAN 04
BAN 05
SHOWERS
BENCH
BAN 06
BAN 07
BAN 08
BAN 03m
BAN 02
BAN 01
BAN 04
BAN 05
BAN 09
BAN 10
BAN 11

GROUP 3: LIBRARY

MODULES.

THE LIBRARY MAY BE TRANSPORTED ON A SINGLE TRUCK, ASSEMBLED. THUS IT COULD FUNCTION AS A TRAVELLING LIBRARY, SERVING SEVERAL SCHOOLS AND COMMUNITIES WITHIN A SPECIFIC AREA. IT HAS NO READING ROOM, ONLY STORAGE.

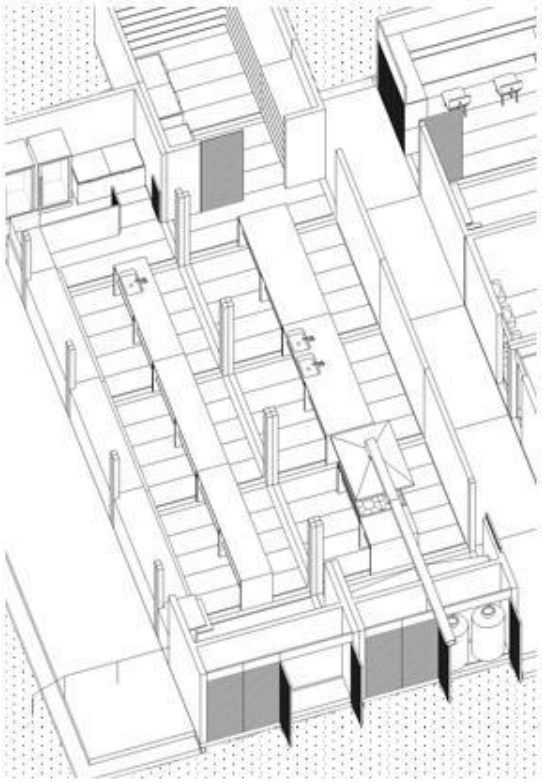



BIB 03
BIB 02
BIB 02
BIB 02
BIB 02
BIB 02
BIB 01
MAGAZINES
STOOLS
SHELVES
DESK

GROUP 4: KITCHEN/CAFETERIA

MODULES.

ALL OF THE KITCHEN MODULES HAVE PERMANENT FURNITURE AND/OR PLUMBING.




GAS
LAUNDRY
COOKING
FREEZER
COUNTER
C02.17b
C02.19b
XS
GAS
LAUNDRY
COOKING
FREEZER
COUNTER
STORAGE
W.C.
C02 17
C02 18
C02 19
BAN.B
S
C02.04
C02.03
C02.02
C02.01
WASHING
WORK TABLE
COUNTER
FREEZER
GAS
COOKING
WORK TABLE
STORAGE
STORAGE
C02 06
C02 11
C02 09
C02 07
C02.06
GARBAGE
LAUNDRY
W.C.M
W.C.F
MANAGER
C02.18
BAN.08
BAN.08
C02.19
M
C02.04
C02.03
C02.03
C02.02
C02.01
WASHING
WORKTABLE
COUNTER
FREEZER
GAS
COOKING
WORKTABLE
STORAGE
STORAGE
C02 06
C02 11
C02 10
C02 09
C02 07
C02 06
GARBAGE
LAUNDRY
W.C.M
W.C.F
LOUNGE
MANAGER
C02 16
BAN 06
BAN 06
C02 13
C02 14
L

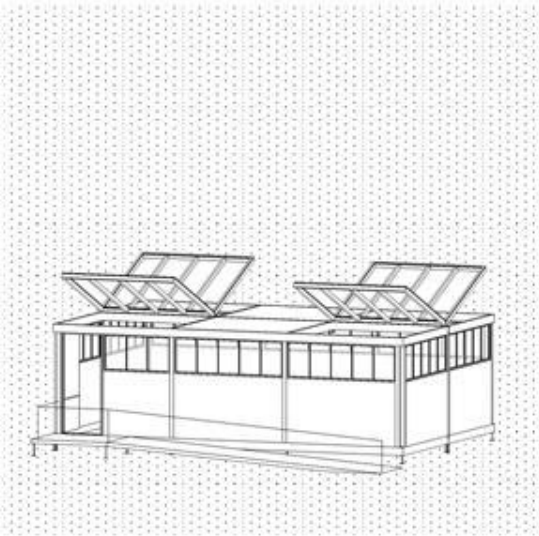
GROUP 5: CLASSROOMS

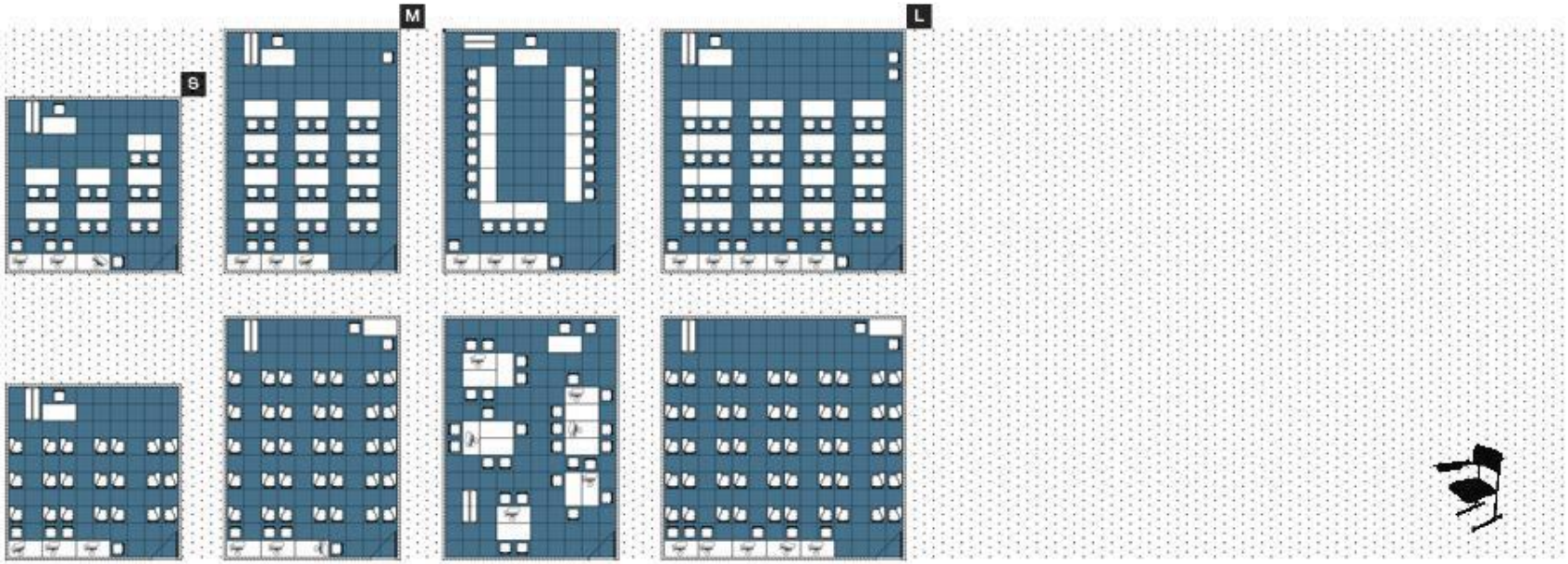
PANELS.

THE CLASSROOMS MAY BE SMALL, MEDIUM OR LARGE – 9x9M, 9x6M OR 6x6M.

THE INTERIOR SURFACES HAVE A PLASTIC LAMINATE FINISHING THAT MAY BE USED AS A WRITING BOARD. ALL OF THE CLASSROOMS HAVE COMPUTERS CONNECTED TO THE SCHOOL NETWORK.

SEVERAL LAYOUTS ARE POSSIBLE USING THE FLOOR MODULATION OF 60x60CM AS PERSONAL SPACE.

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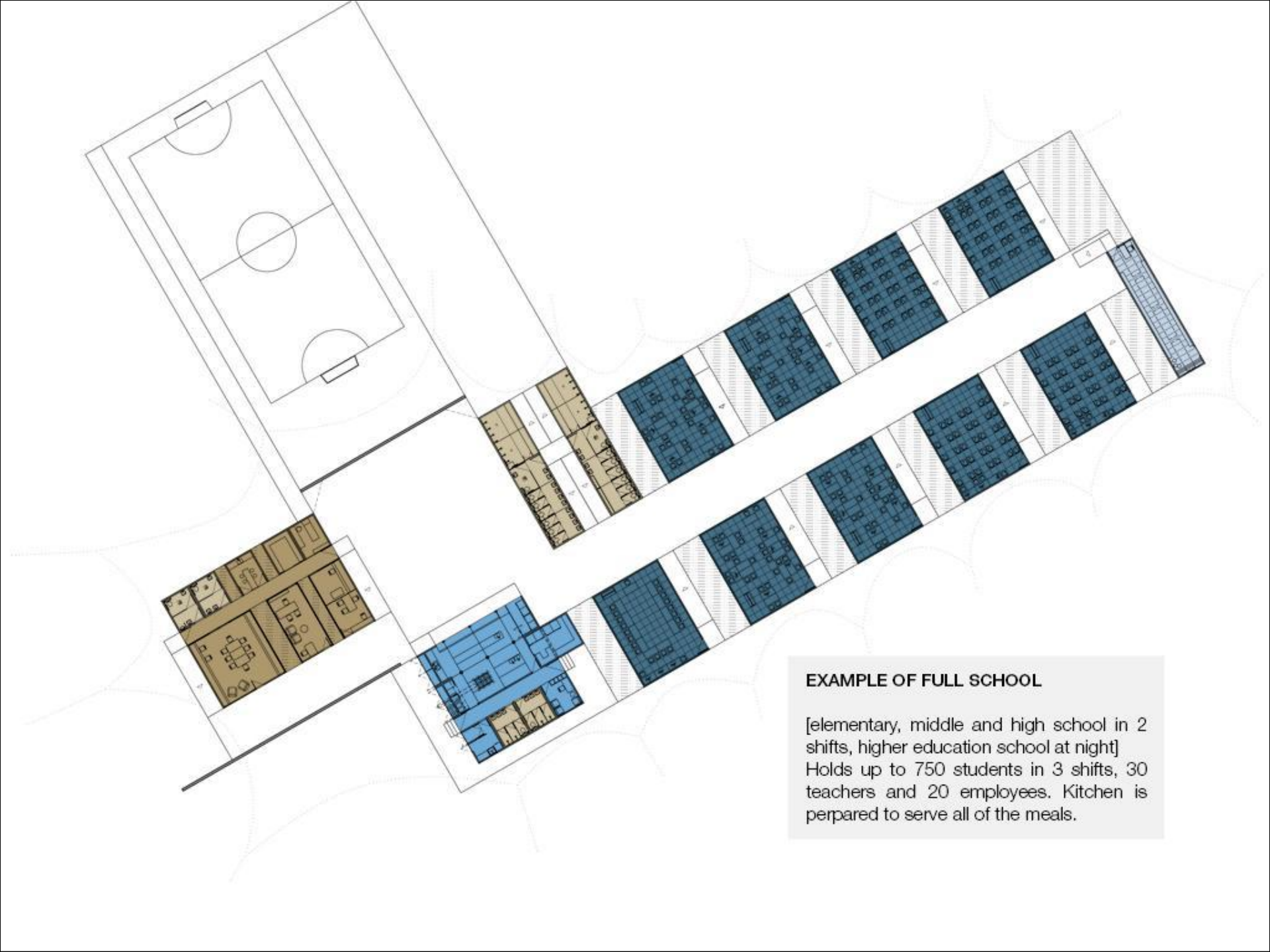
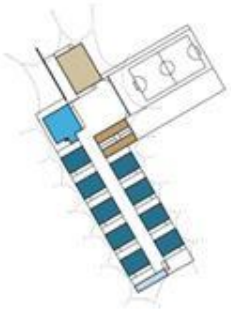
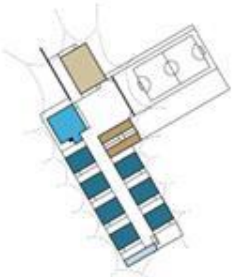


EXAMPLE OF FULL SCHOOL

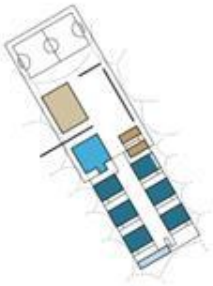
[elementary, middle and high school in 2 shifts, higher education school at night]
Holds up to 750 students in 3 shifts, 30 teachers and 20 employees. Kitchen is perpared to serve all of the meals.



SL 9.720 19C

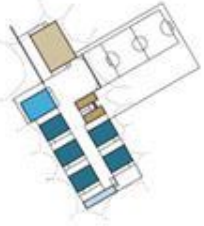


SL 7.600 17C

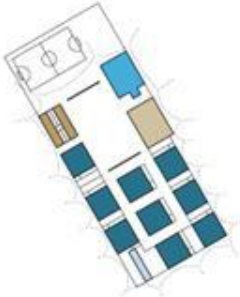


SL 6.550 12C

SL 3.300 7C



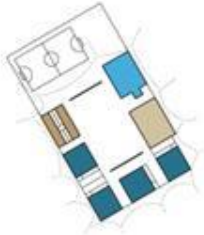
SL 5.450 11C



SL 9.800 20C

SL 5.500 09C

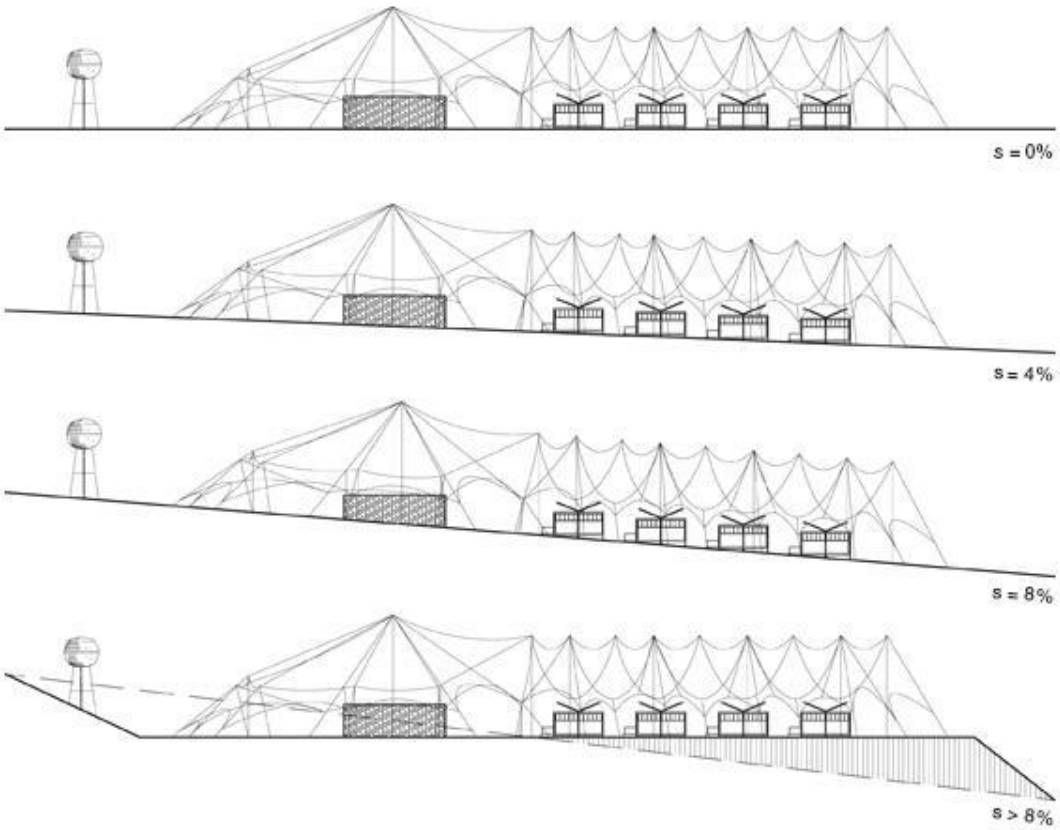
SL 7.650 17C



SL 4.400 C

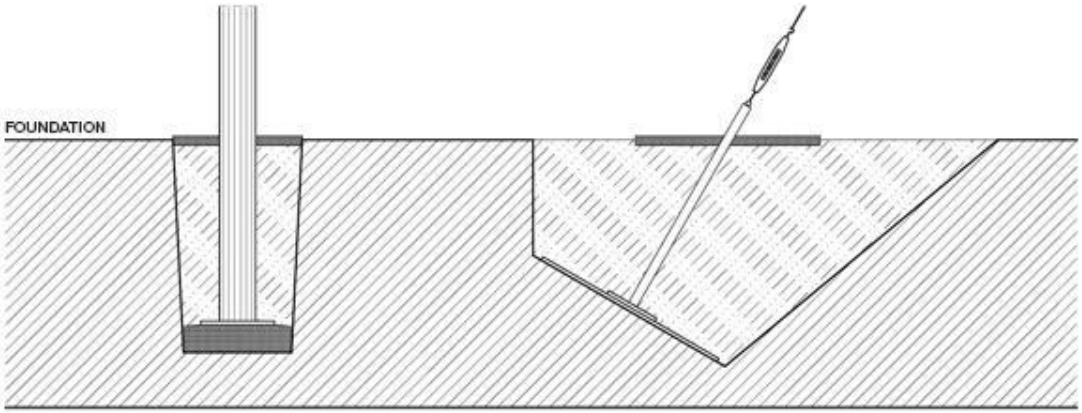
LAYOUTS

A few possibilities of composing the *pocket school* in different shapes and sizes.



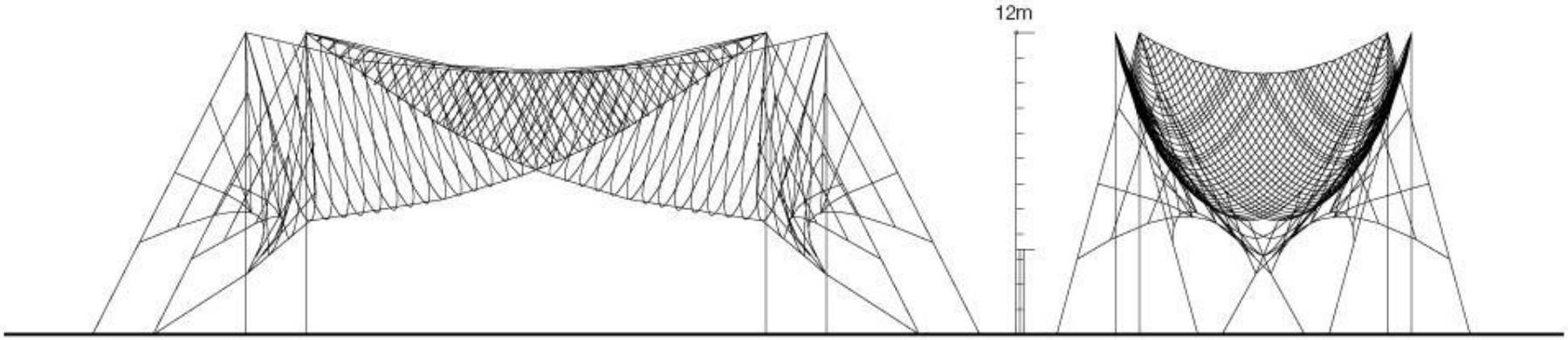
NATURAL GRADE

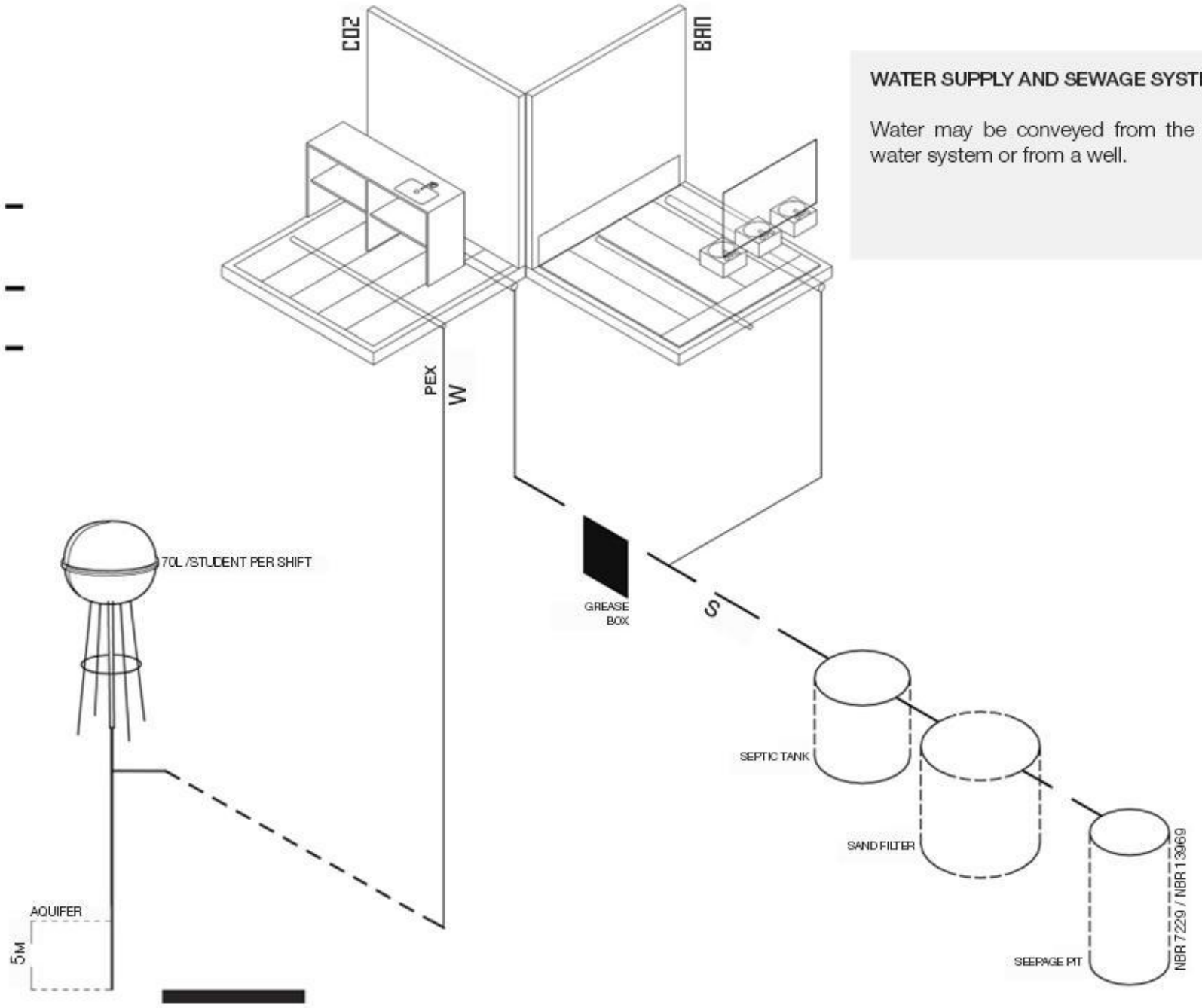
As each group of modules and panels is structurally independent, the school may be set on irregular and sloped sites.
No earthwork is necessary unless the natural grade is too steep [over 8%].



TENT STRUCTURE

The tensile structure consists of 12m tall steel masts [structural pipes], cables [wire ropes] and the membrane [pvc + pvdf coated polyester].
Temporary tensile structures require periodic membrane replacement. Once the molds are made, replacement membranes can be made at a much lower cost [about US$15/m² in Brazil]. As tensile structures become more popular its cost tend to drop, making the pocket school more affordable.



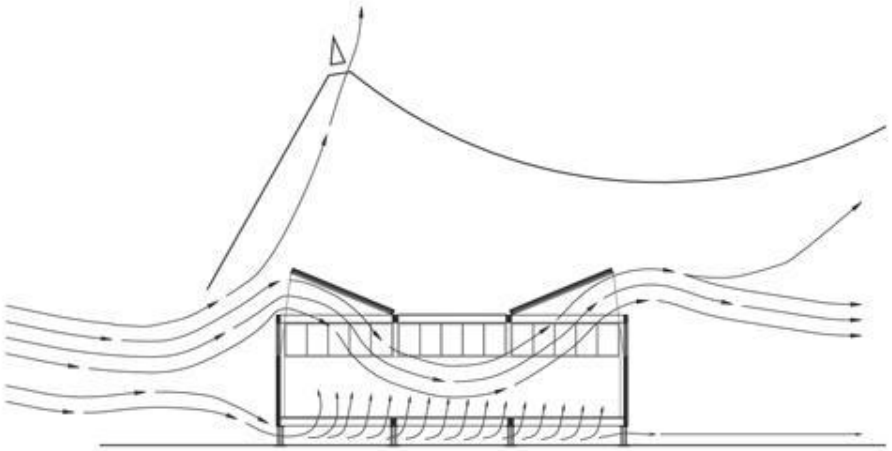


WATER SUPPLY AND SEWAGE SYSTEM

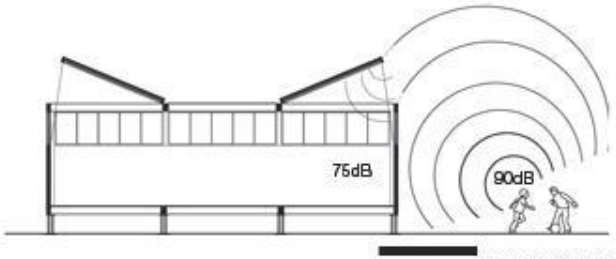
Water may be conveyed from the public water system or from a well.

ENVIRONMENTAL CONTROL SYSTEM

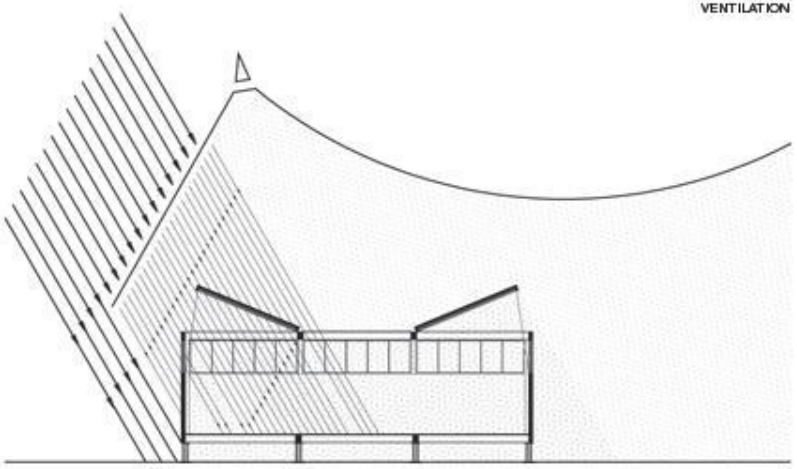
The membrane softens the sunlight coming into the school, and provides quite efficient ventilation. The ceilings, which are translucent in order to maximize use of natural light, can be opened for better ventilation and temperature control. PVC walls provide good thermal and acoustic isolation. Most of the windows are mounted near the ceiling, and cannot be opened.



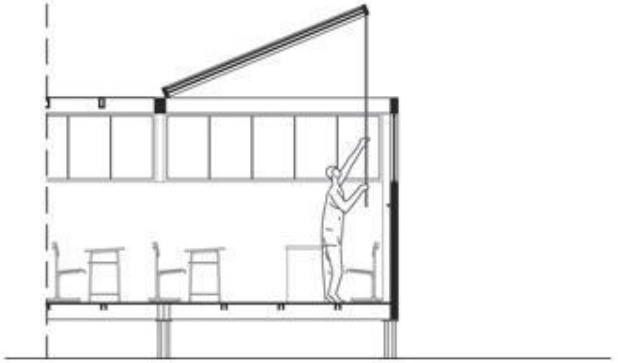
VENTILATION



NOISE REDUCTION

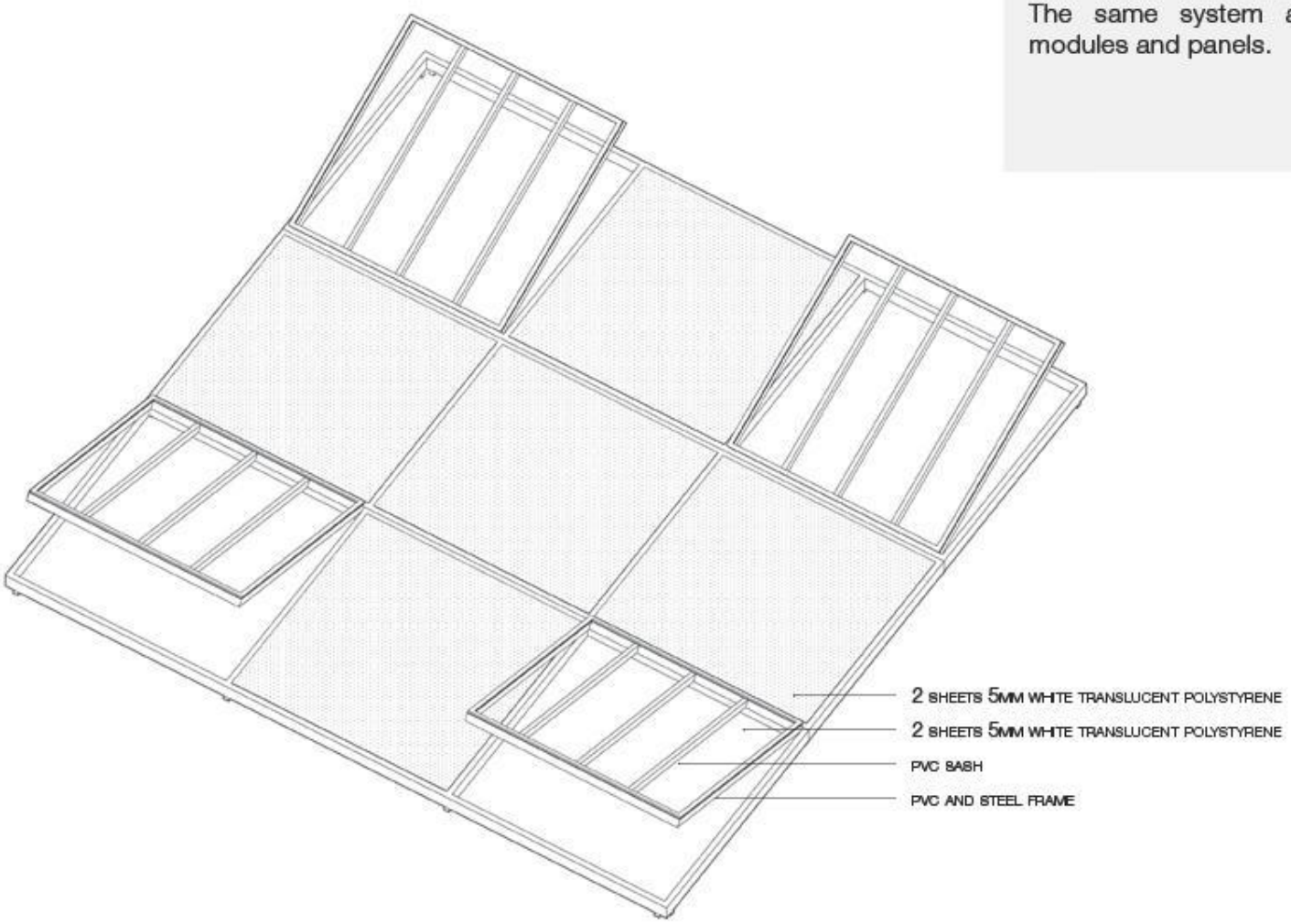


SUNLIGHT



CONSTRUCTION SYSTEM

The same system applies either to modules and panels.



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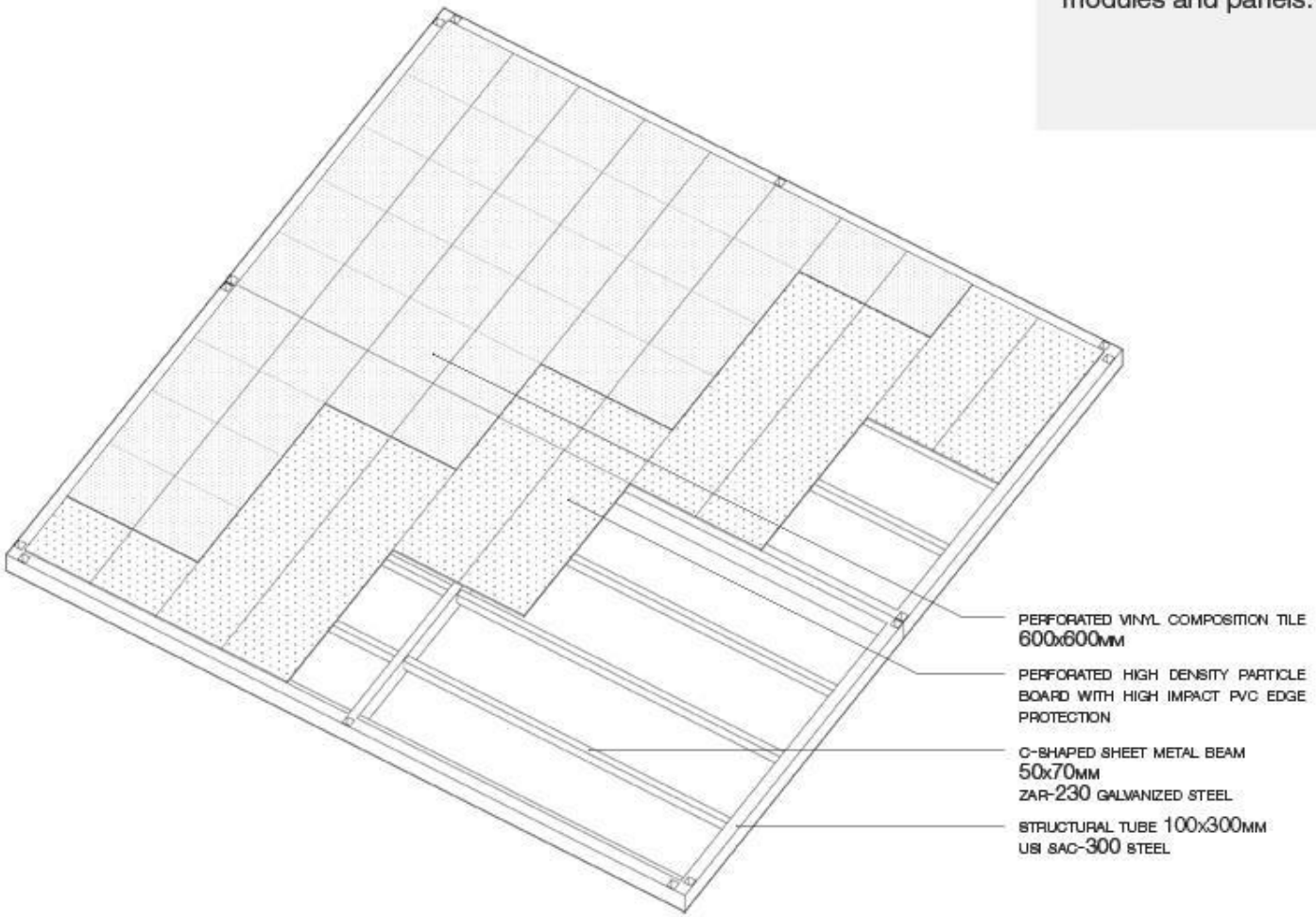

CONSTRUCTION SYSTEM

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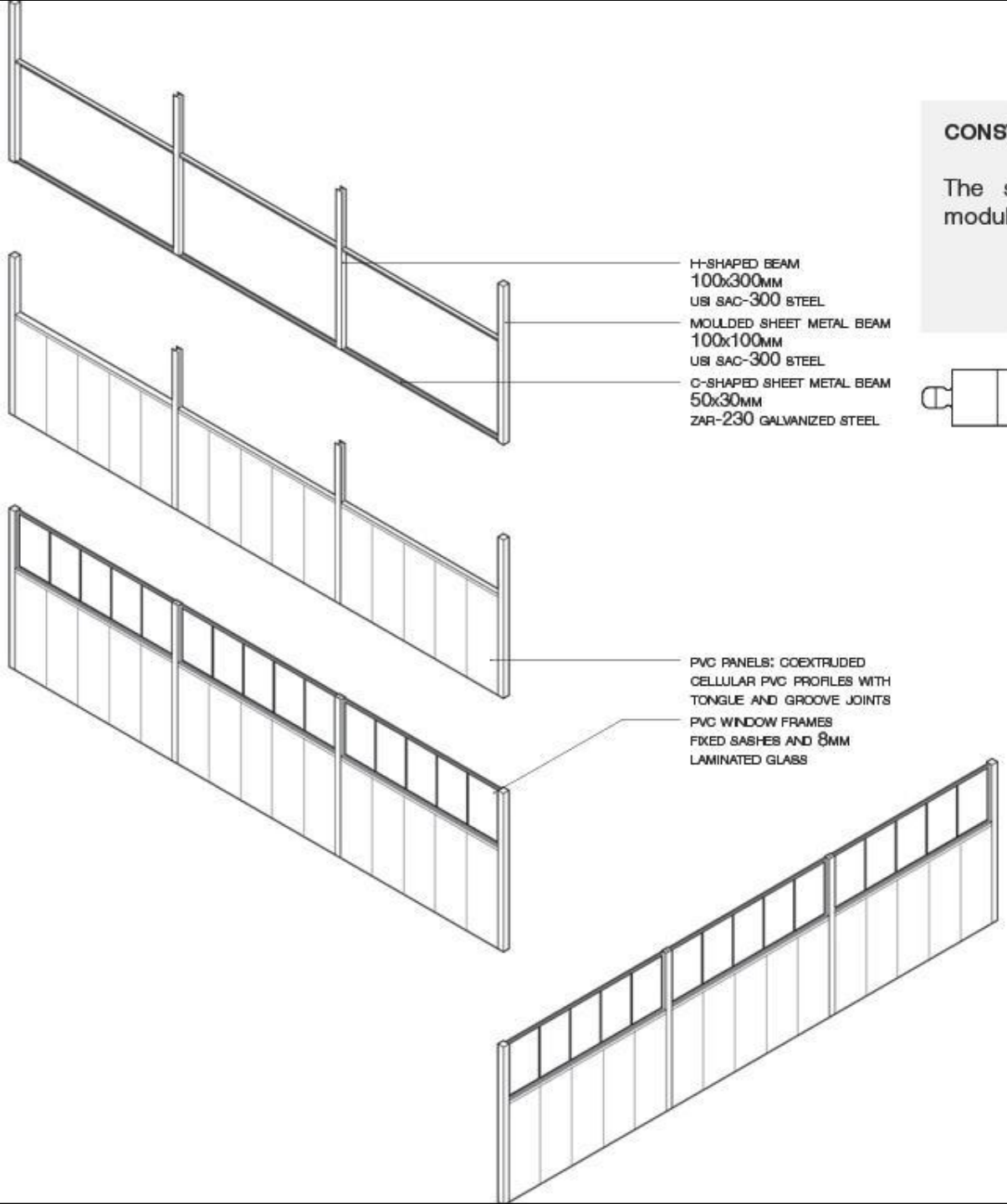
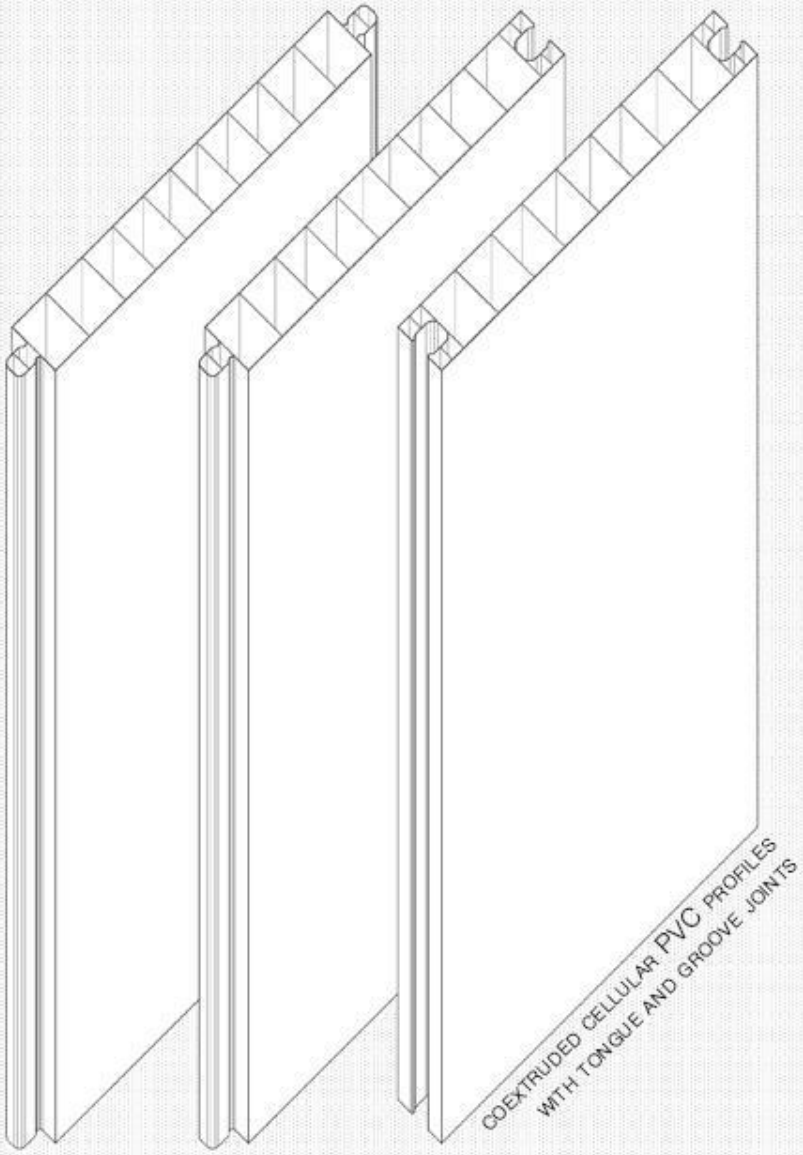
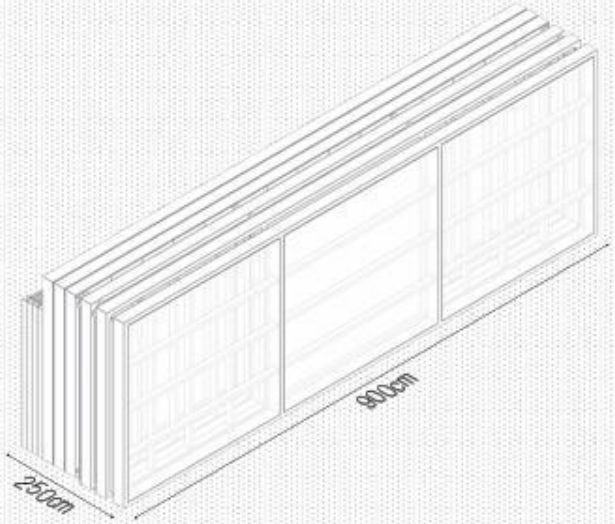


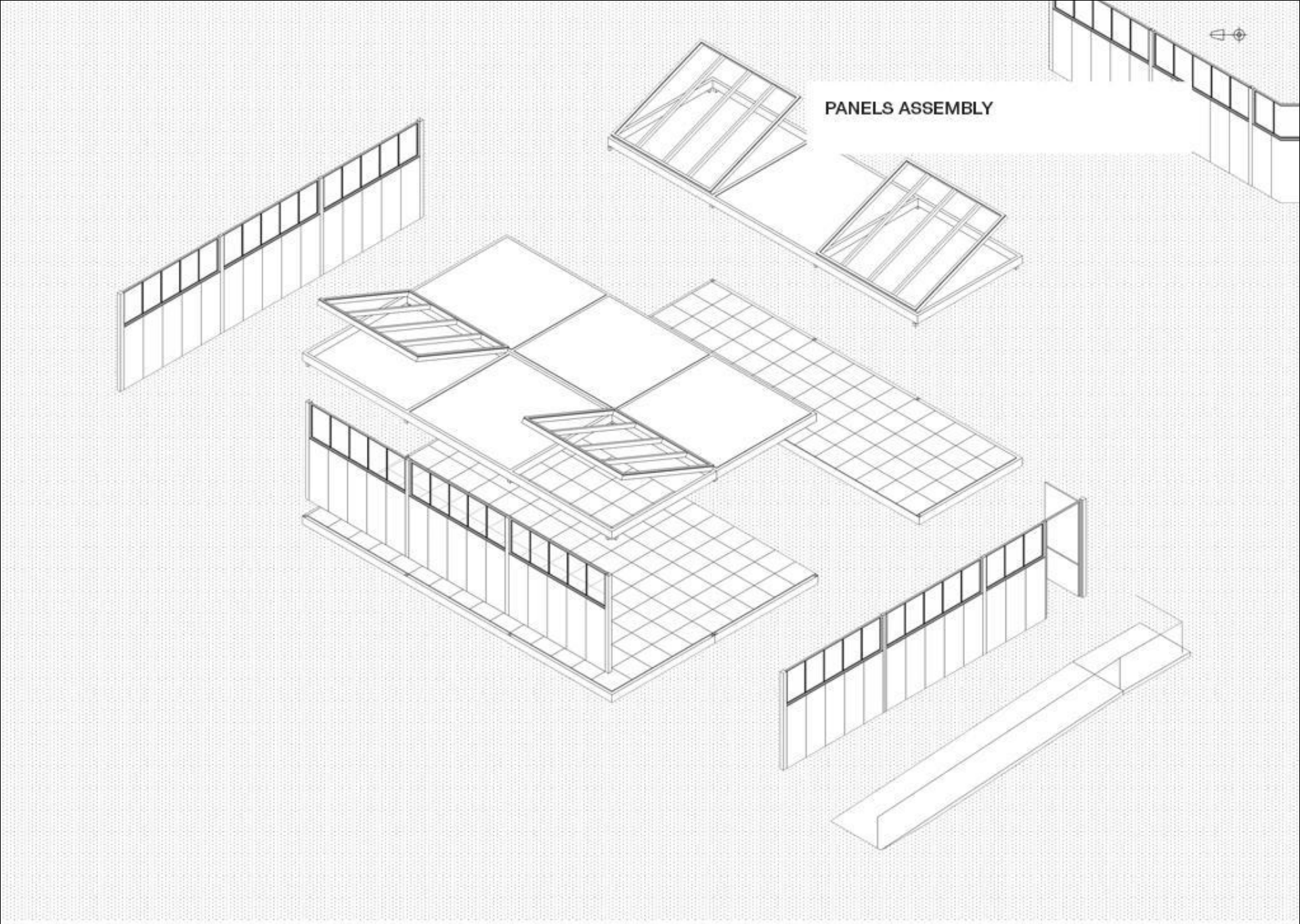


PVC

The *pocket school's* construction system was inspired by PVC truck cargo compartments. Essentially, the system consists of coextruded cellular PVC profiles with tongue and groove joints fit into a steel frame. The result is a structure with no apparent rivets or screws, except at the metallic connections. Also, the panels are light, due to the air cushion contained within the cellular PVC profiles, as well as having good thermal and acoustic isolation, and a long life-expectancy [approximately 20 year manufacturer warranty]. When burned, the plastic resin does not hold combustion nor melts, and is classified as a Class A Non-Flammable product. At last, the inspiration behind the system is totally compatible with the moveable nature of the *pocket school*.

PANELS ASSEMBLY




PANELS ASSEMBLY

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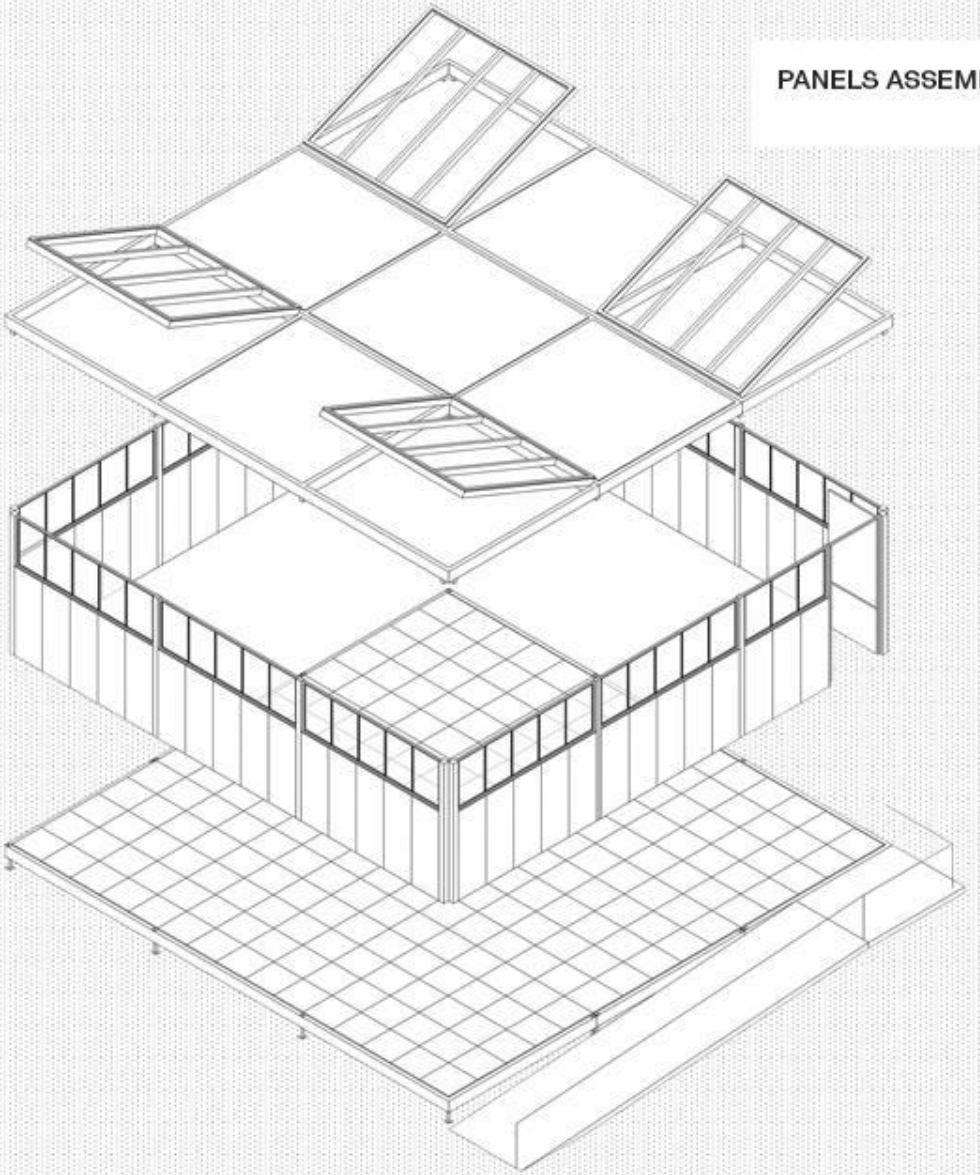
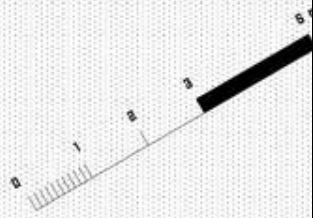
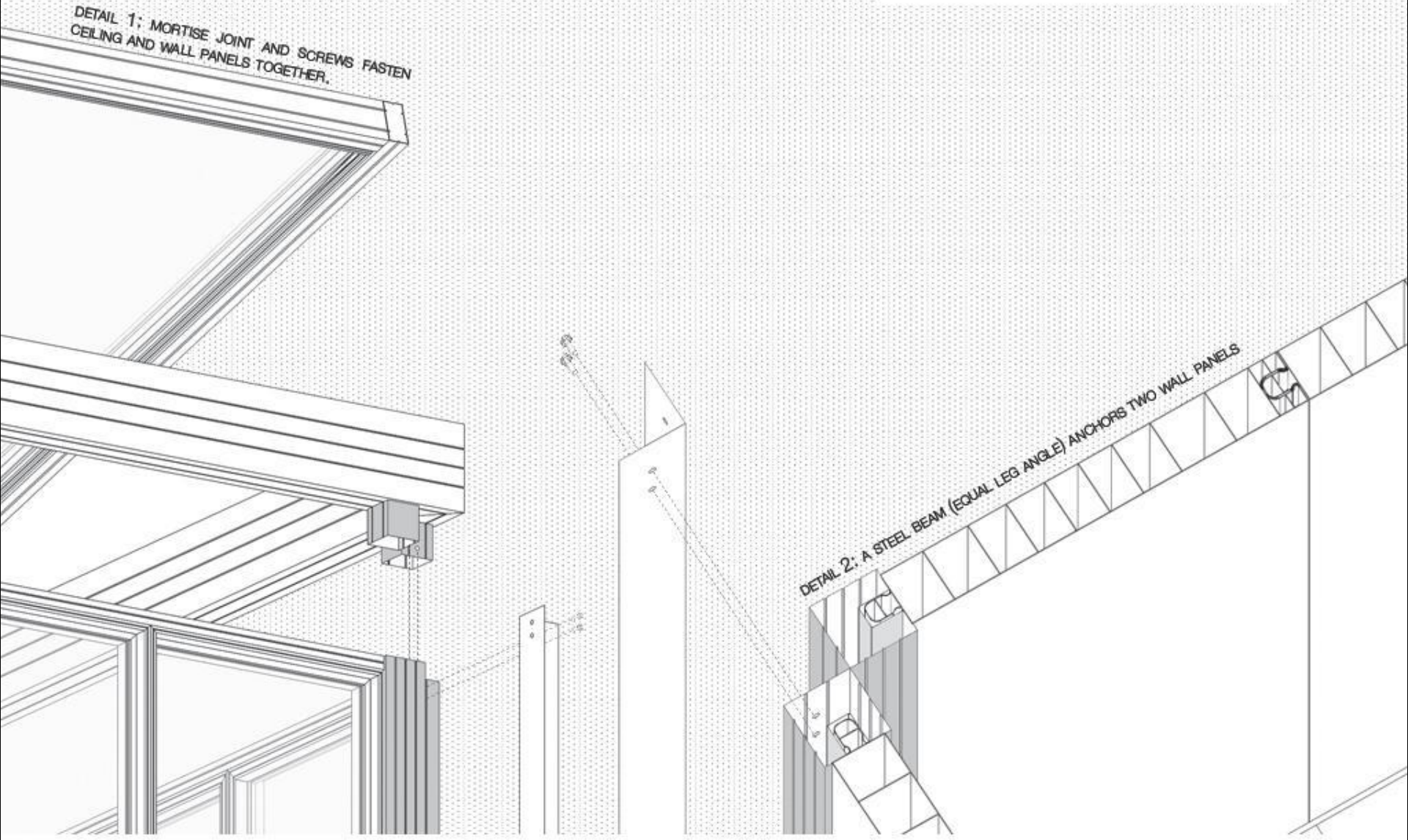
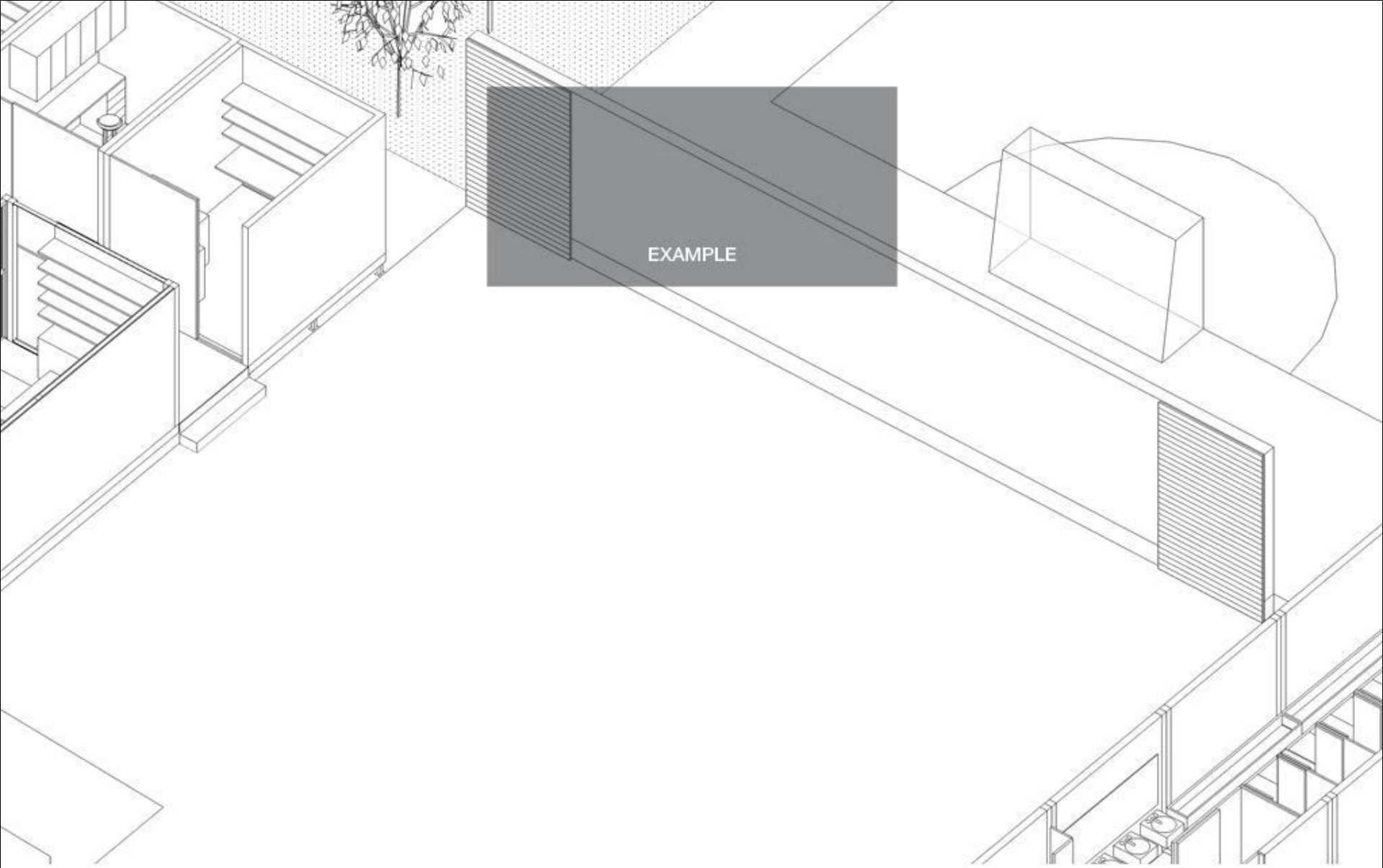




PANELS ASSEMBLY




EXAMPLE