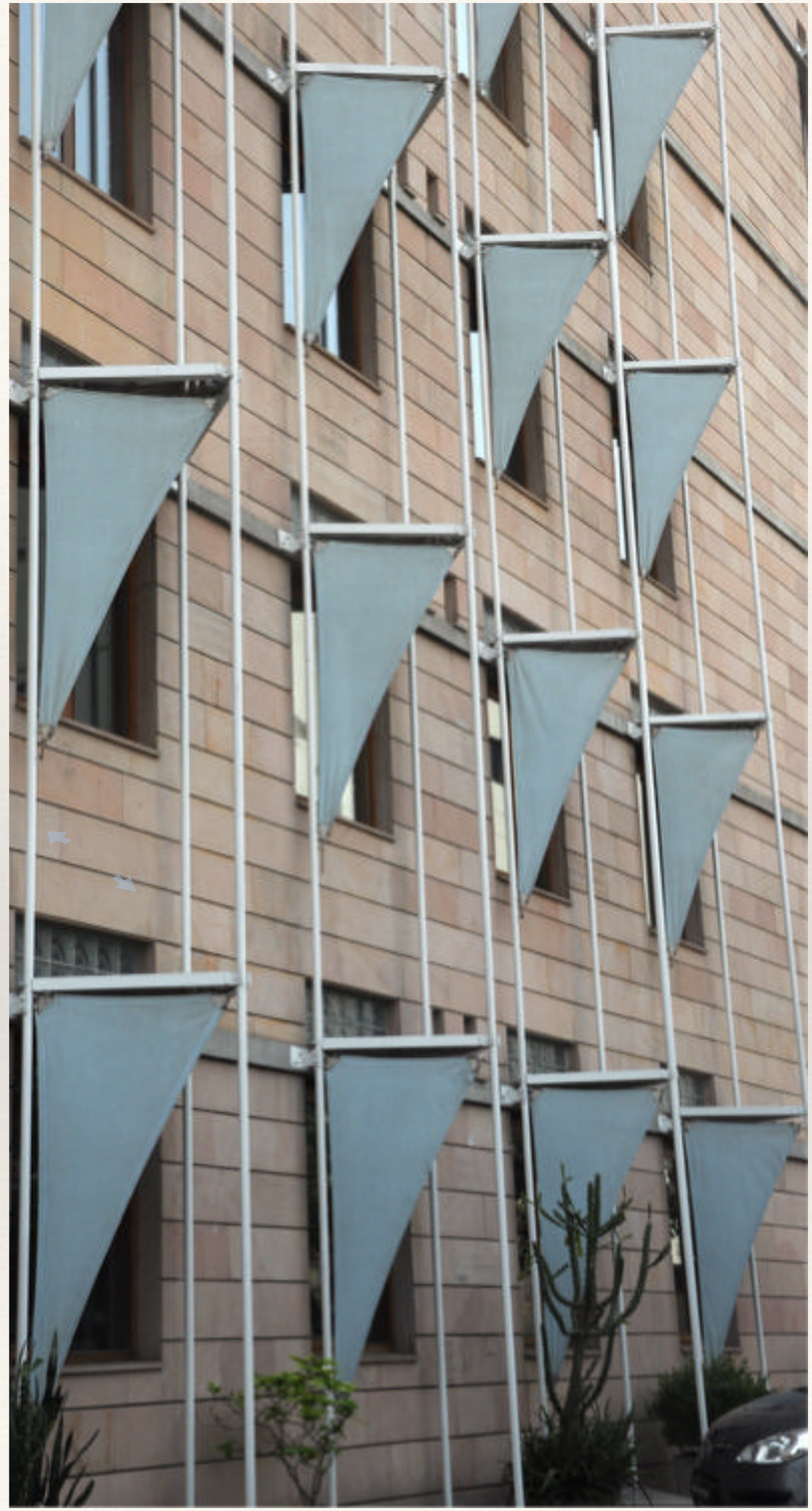
IRRAD - PHASE II

RADIANT COOLING - DESIGNING FOR FLEXIBLE PARTITION OF SPACE

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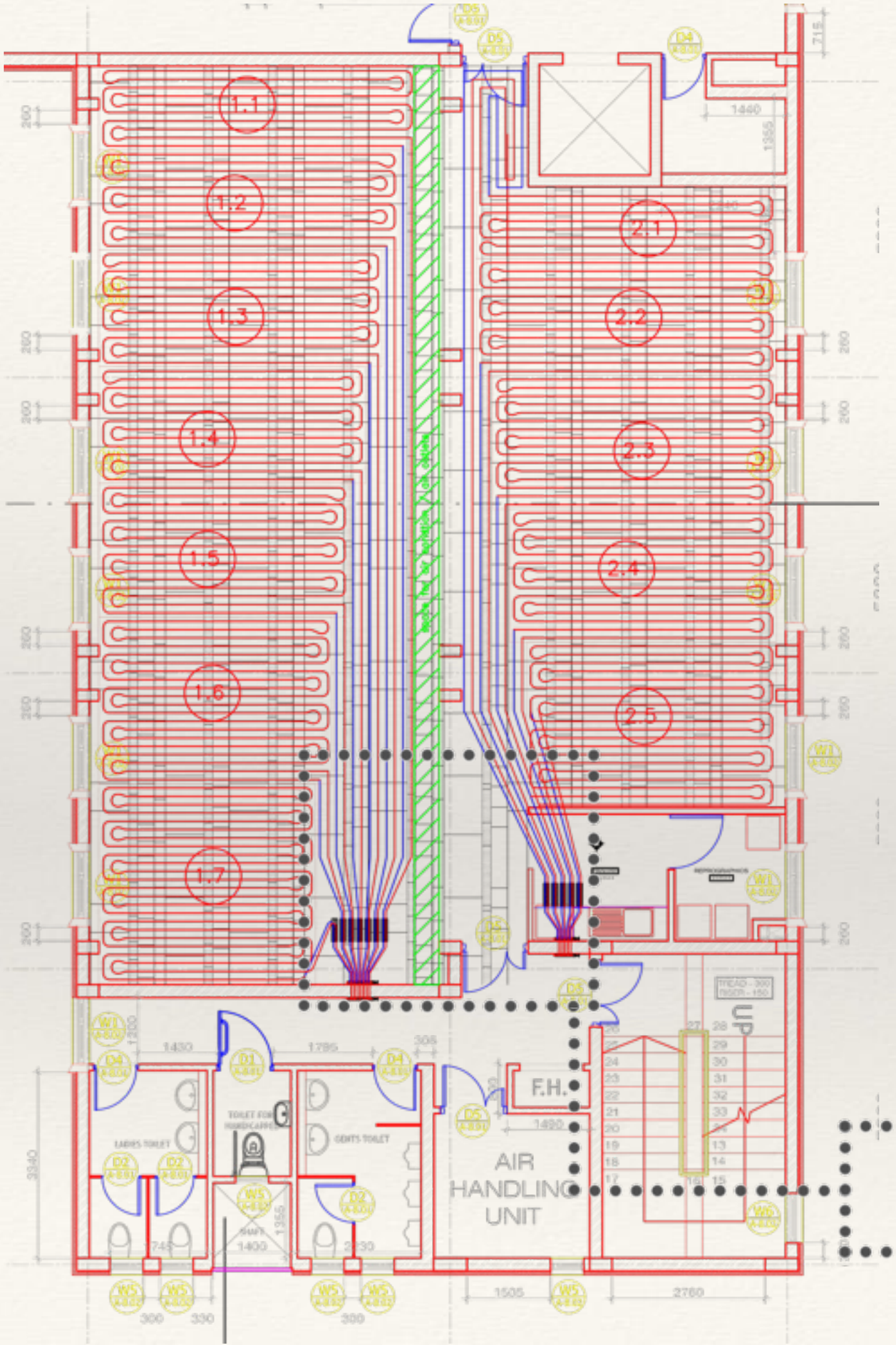
Cooling System

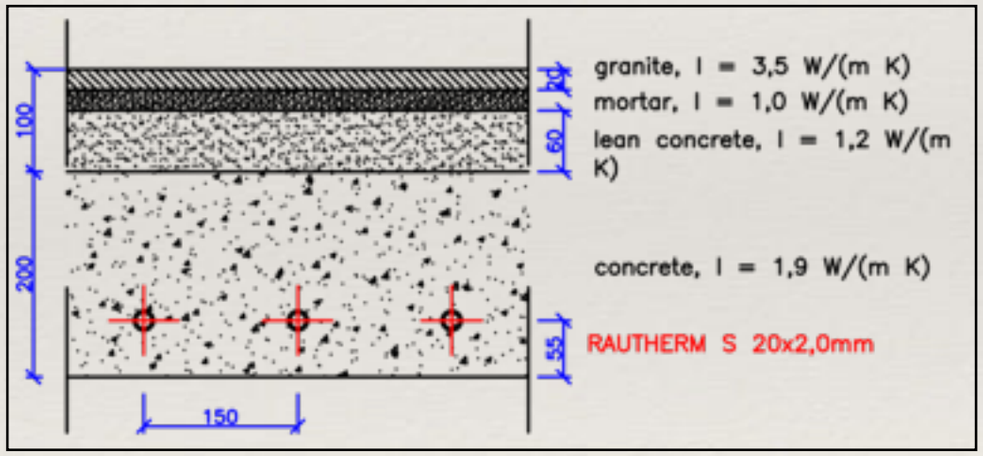


RADIANT COOLING PIPING LAYOUT

Proposal for the REHAU core temperature control (CCTC)
pipe size: RAUTHERM S 20x2,0mm
pipe spacing: 15cm, pipe mounted on the lower reinforcement

This piping layout of the CCTC is a first proposal, it has to be clarified:
- occupied areas
- distances to structural walls and beams
- distances to ducts and air outlets
- flow rate
- position of the manifolds, in this proposal: manifold in the suspended ceiling
  below the chilled slab
- pipe position in the concreted slab

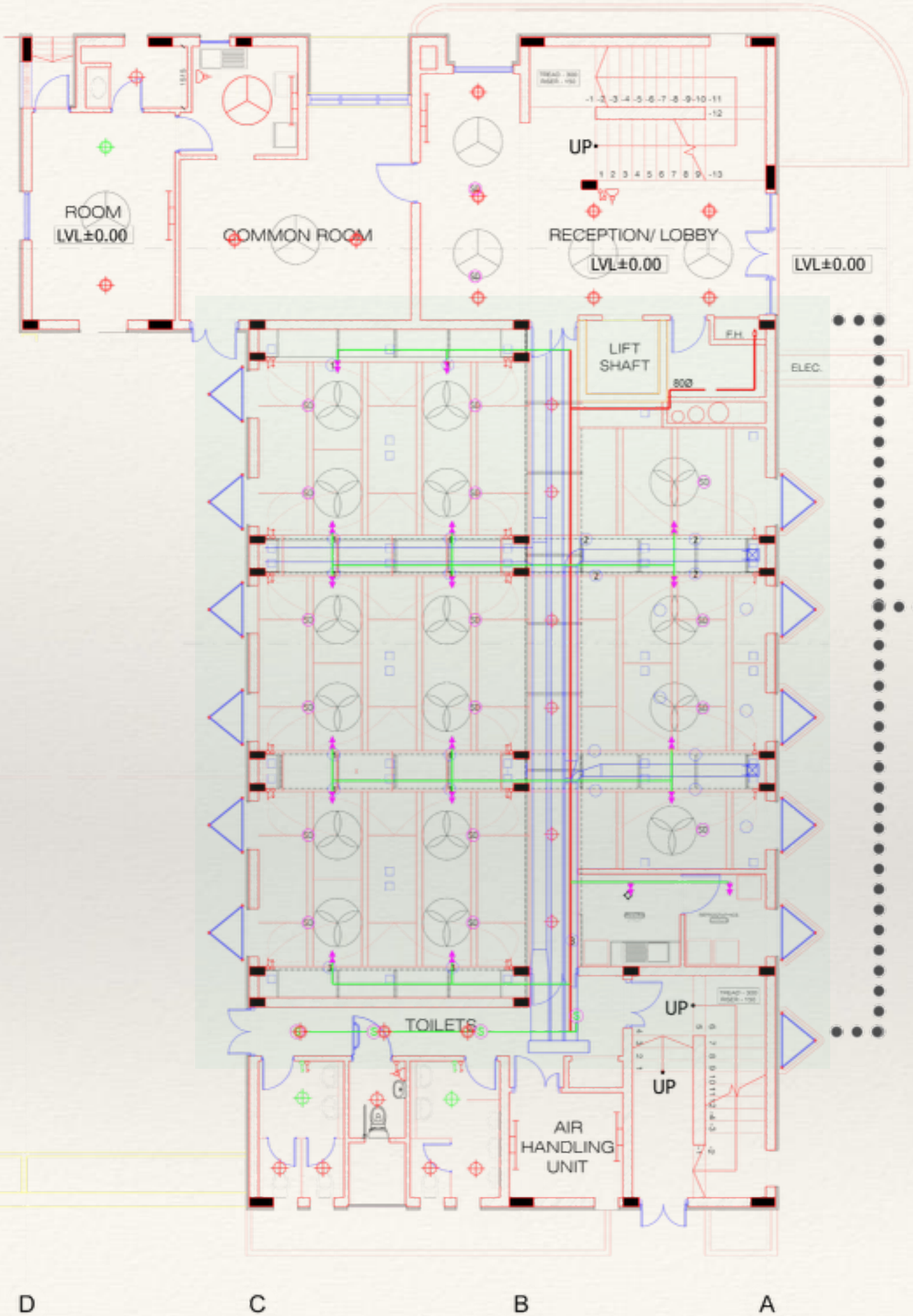
- **SECTION OF THE SLAB:**



pipes near the manifold with a spacing of less than 15cm and pipes outside the chilled slab led in corrugated pipe

The position and size of the space for air conditioning or air outlets has to be checked

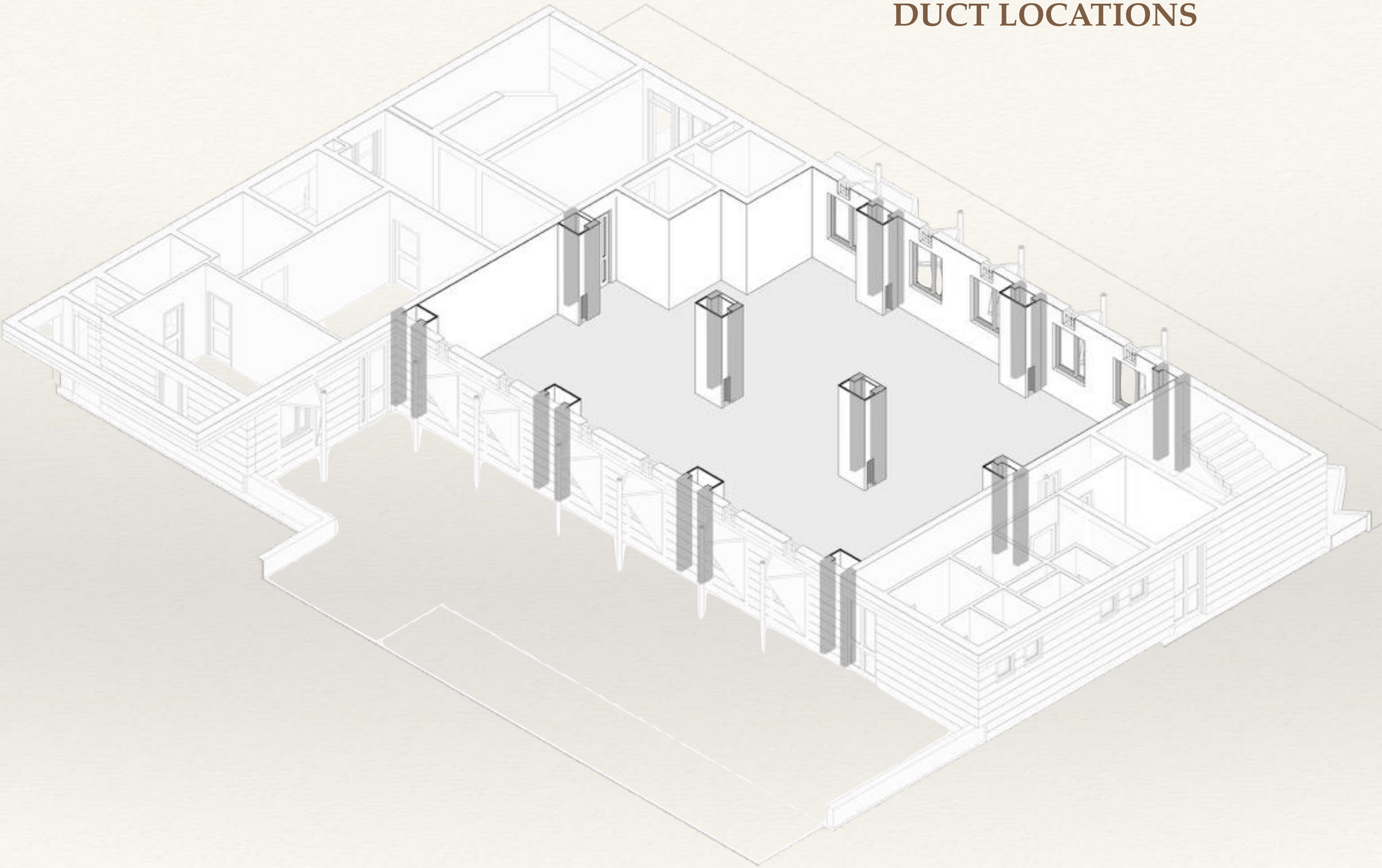
REFELECTED CEILING PLAN



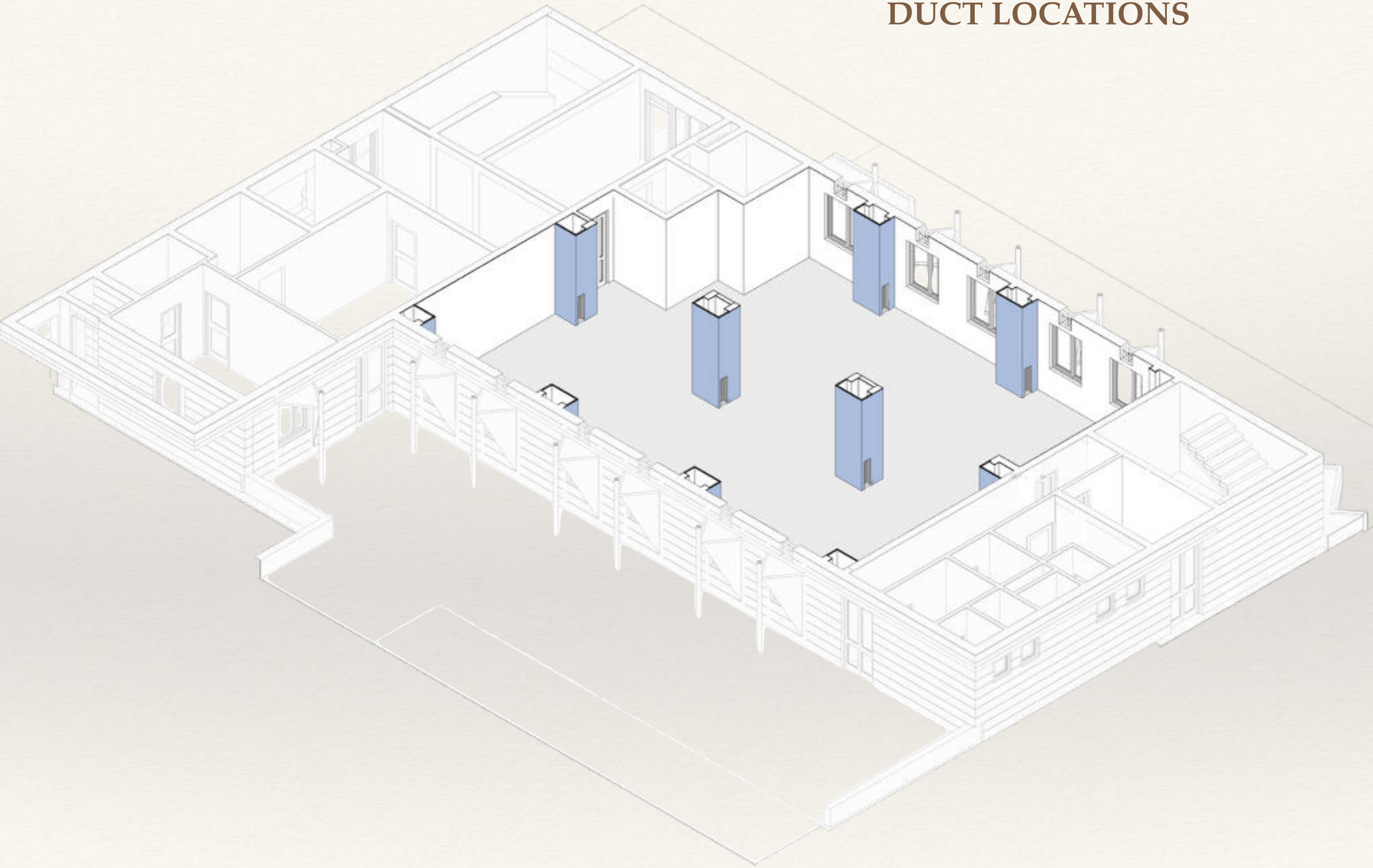
The planning of the structural system, external windows, placement of lights and fans in the slab and other services is such that each sub-divided space continues to receive:

- Radiant cooling for the RCC slab.
- Fresh Air Supply
- Daylight from the windows
- Artificial lighting
- Ceiling Fan
- Sprinkler system
- Fire Detector

COLUMN PLACEMENT AND VERTICAL DUCT LOCATIONS



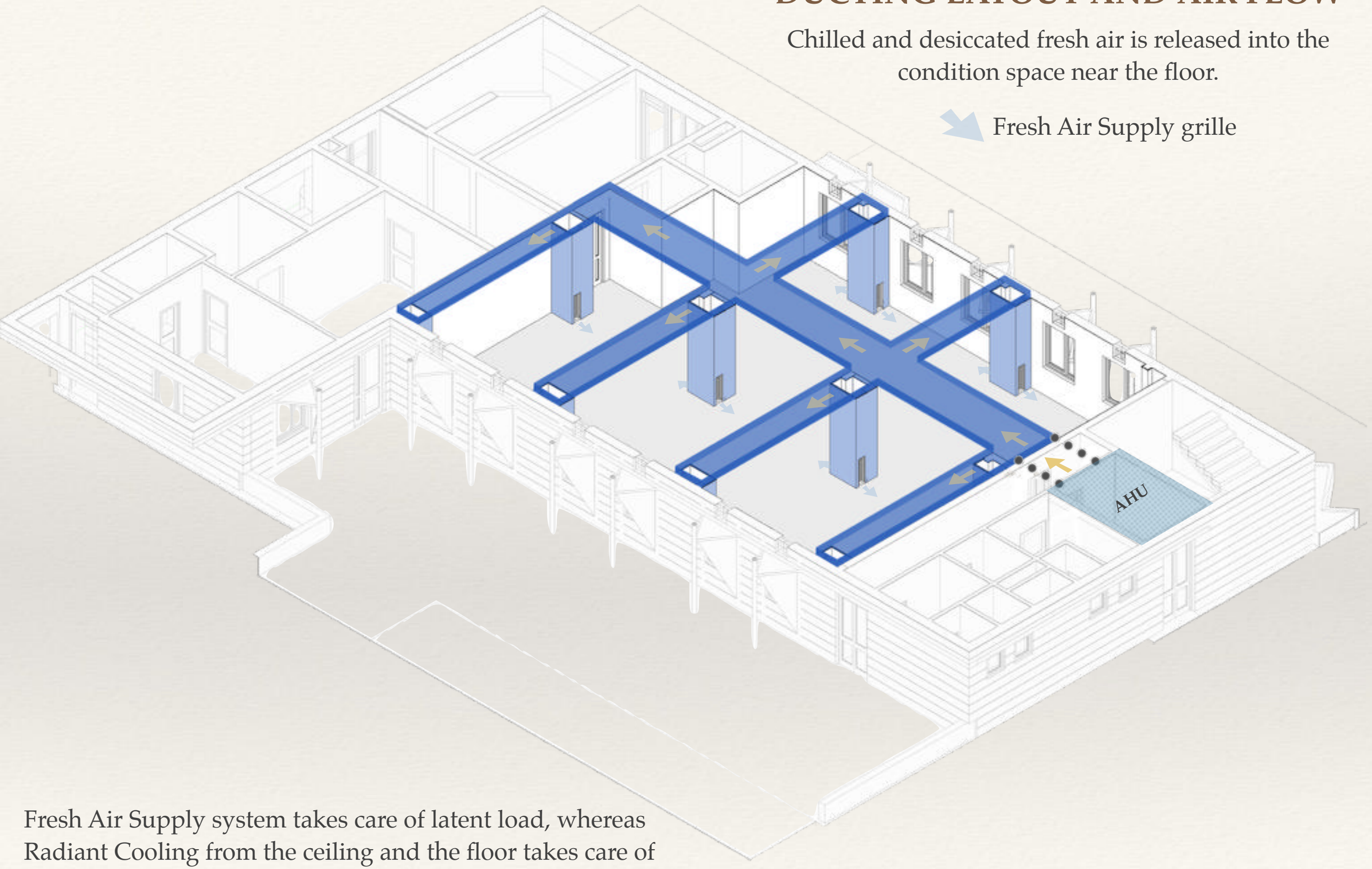
COLUMN PLACEMENT AND VERTICAL DUCT LOCATIONS



DUCTING LAYOUT AND AIR FLOW

Chilled and desiccated fresh air is released into the condition space near the floor.

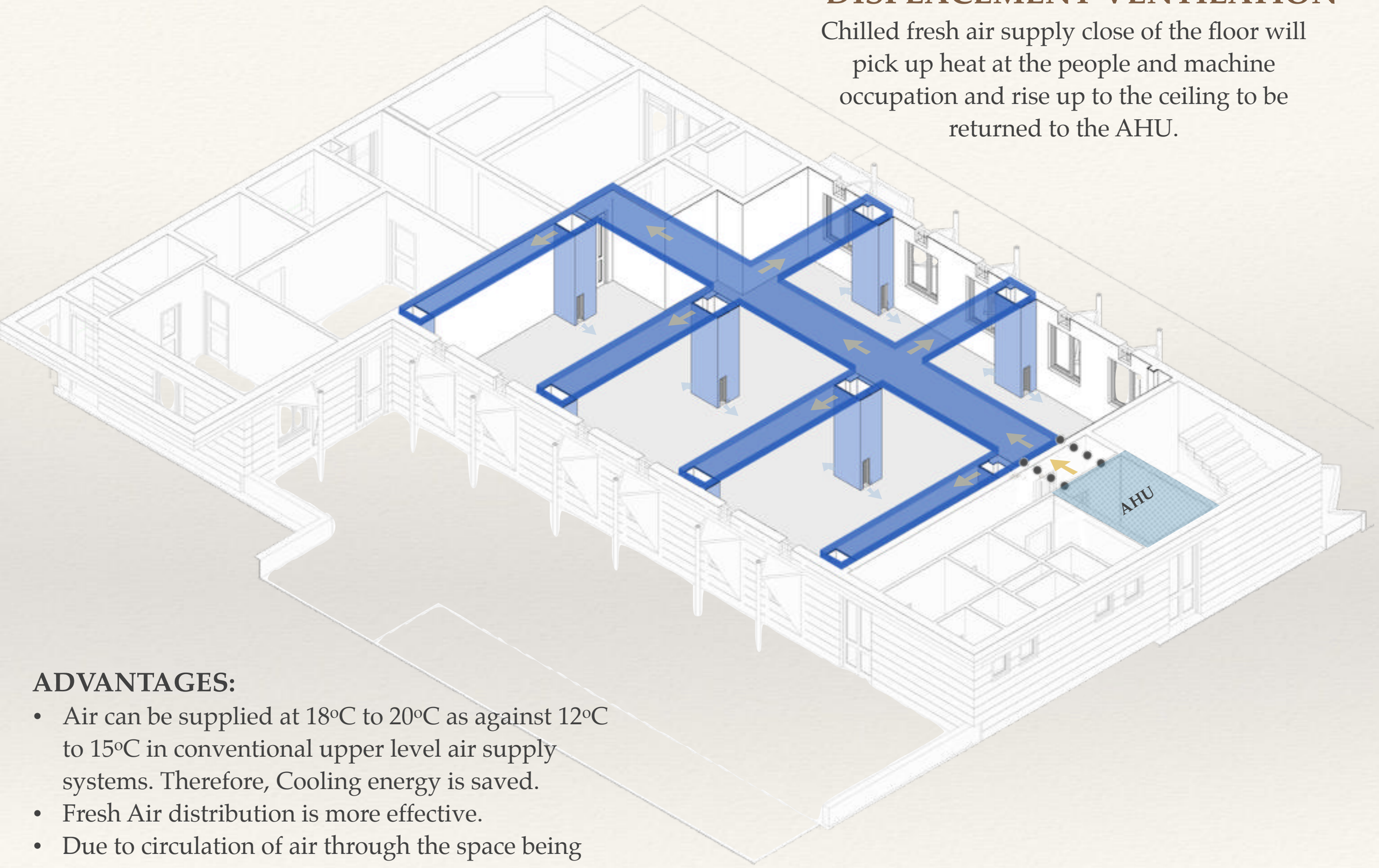
Fresh Air Supply grille



Fresh Air Supply system takes care of latent load, whereas Radiant Cooling from the ceiling and the floor takes care of the sensible load

DISPLACEMENT VENTILATION

Chilled fresh air supply close of the floor will pick up heat at the people and machine occupation and rise up to the ceiling to be returned to the AHU.



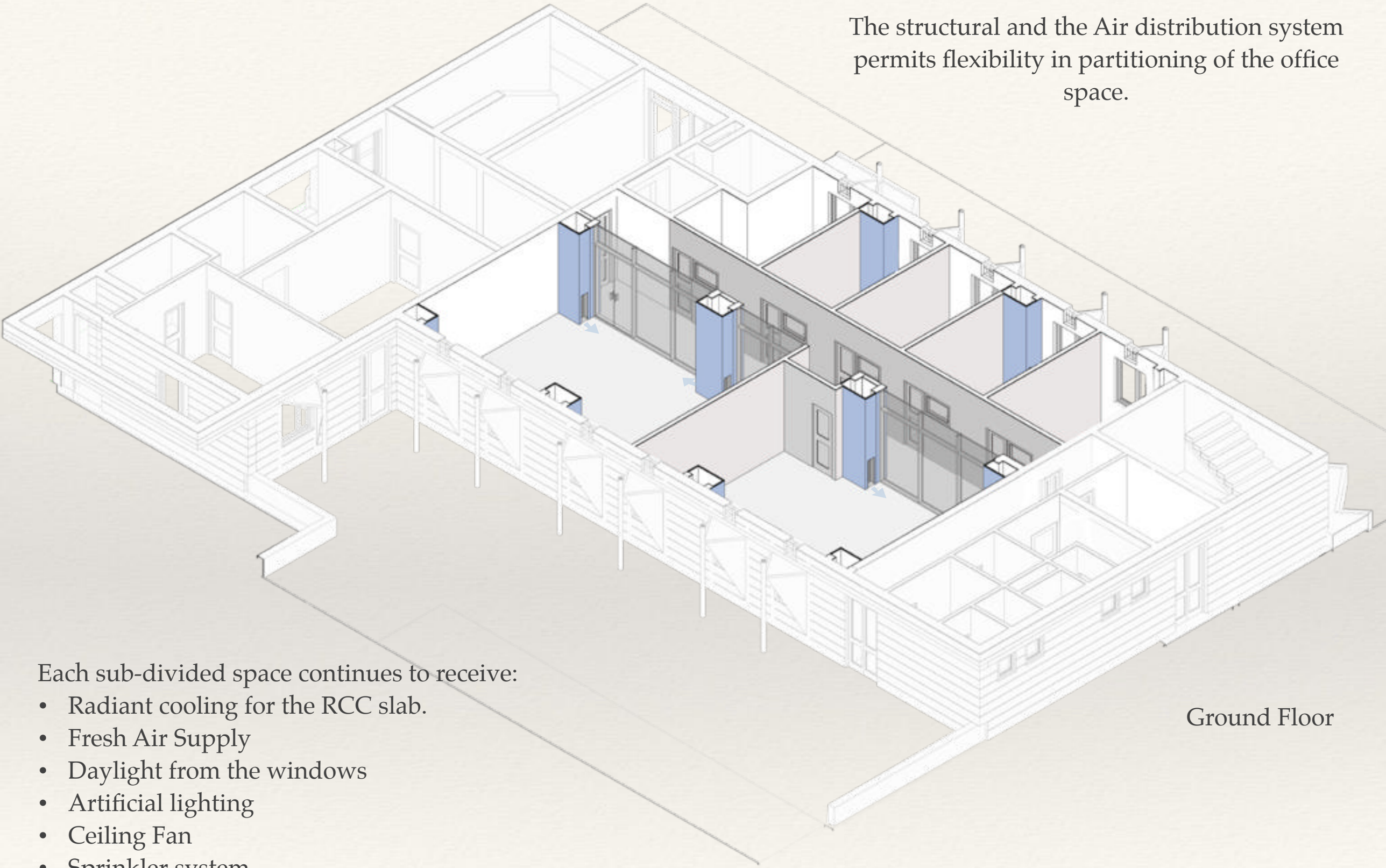
ADVANTAGES:

- Air can be supplied at 18°C to 20°C as against 12°C to 15°C in conventional upper level air supply systems. Therefore, Cooling energy is saved.
- Fresh Air distribution is more effective.
- Due to circulation of air through the space being partially supported by natural buoyancy, less air circulation power is needed.

Partition Layout

PARTITIONS

The structural and the Air distribution system permits flexibility in partitioning of the office space.



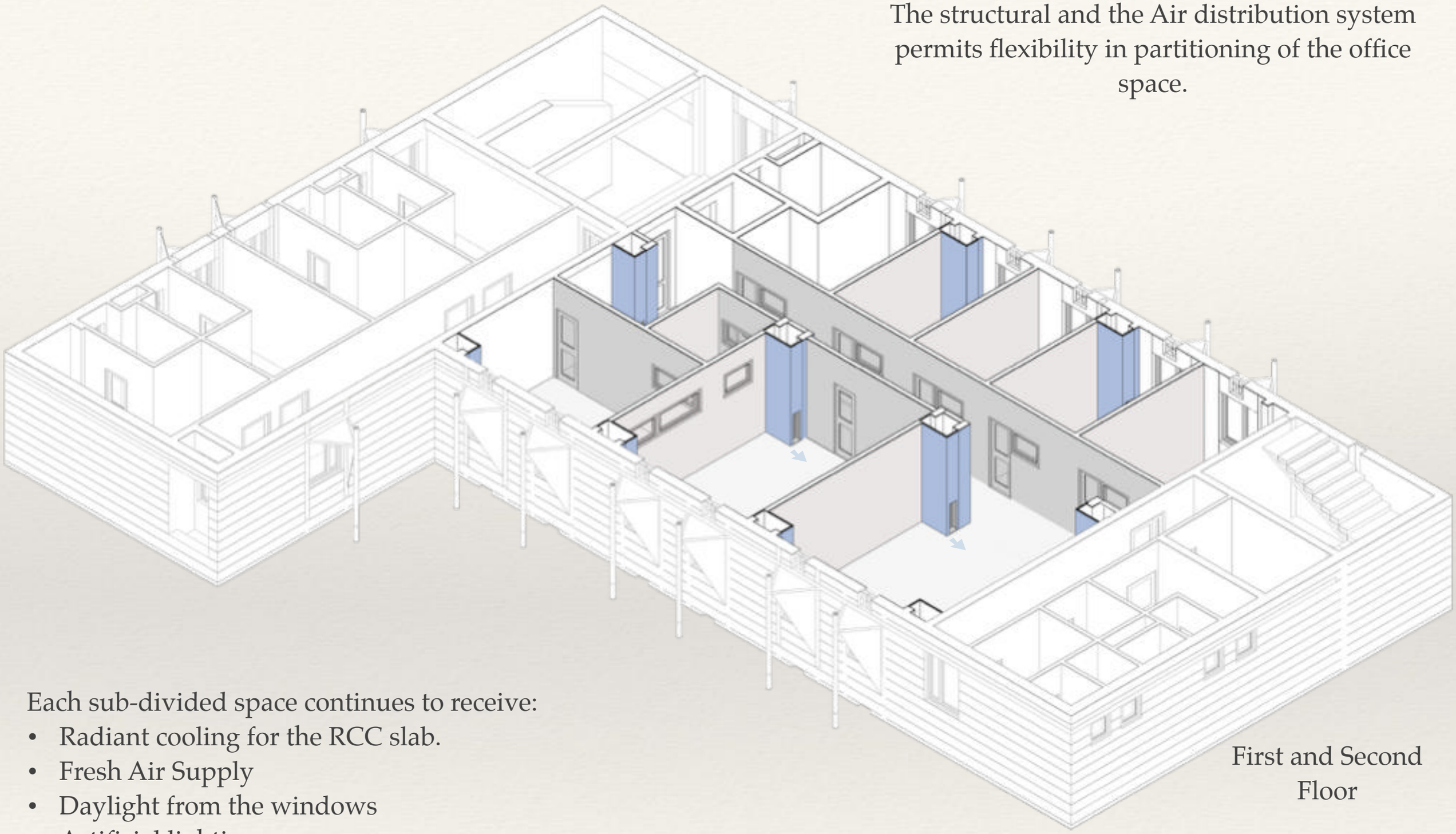
Ground Floor

Each sub-divided space continues to receive:

- Radiant cooling for the RCC slab.
- Fresh Air Supply
- Daylight from the windows
- Artificial lighting
- Ceiling Fan
- Sprinkler system
- Fire Detector

PARTITIONS

The structural and the Air distribution system permits flexibility in partitioning of the office space.



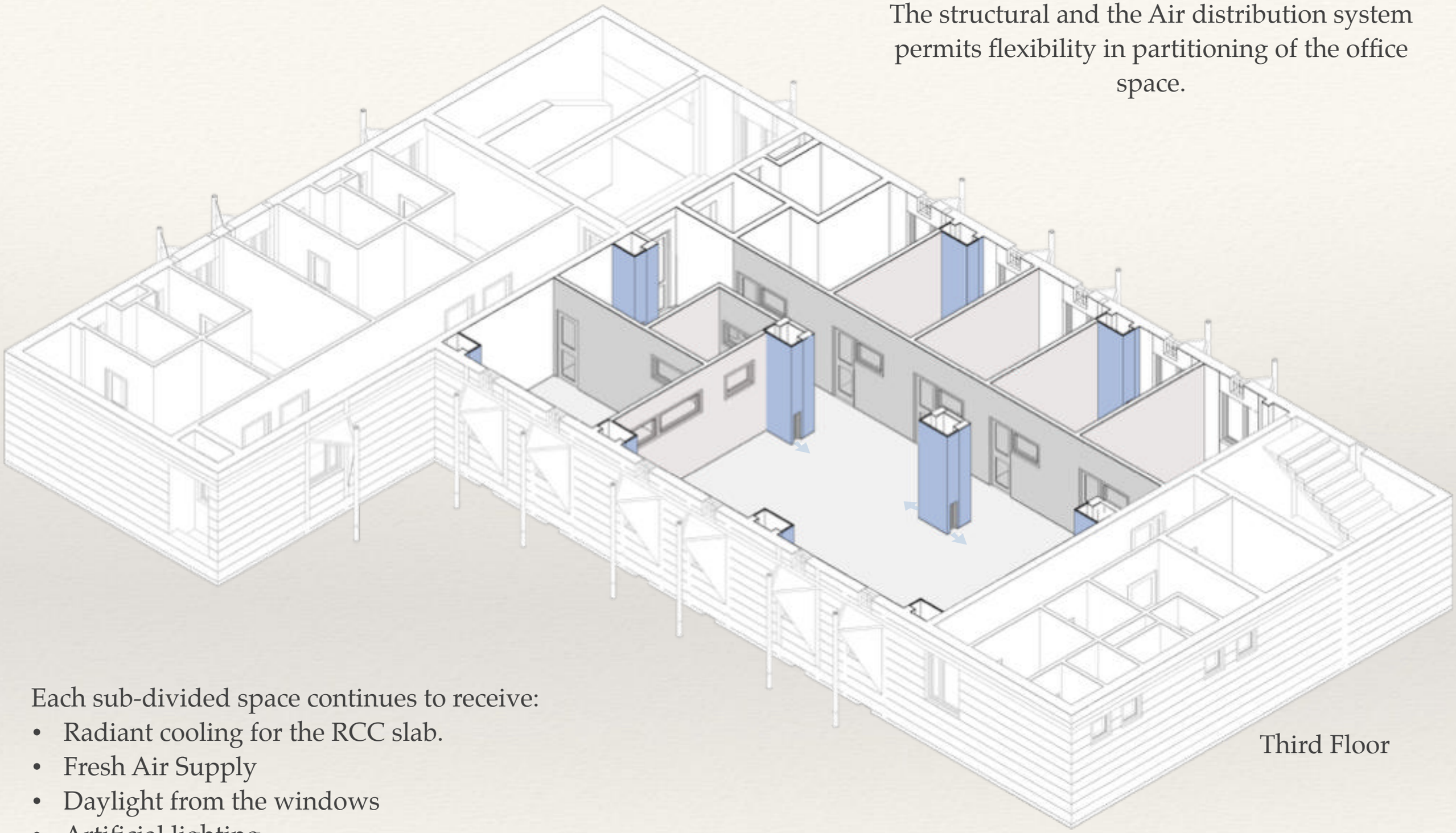
First and Second Floor

Each sub-divided space continues to receive:

- Radiant cooling for the RCC slab.
- Fresh Air Supply
- Daylight from the windows
- Artificial lighting
- Ceiling Fan
- Sprinkler system
- Fire Detector

PARTITIONS

The structural and the Air distribution system permits flexibility in partitioning of the office space.



Third Floor

Each sub-divided space continues to receive:

- Radiant cooling for the RCC slab.
- Fresh Air Supply
- Daylight from the windows
- Artificial lighting
- Ceiling Fan
- Sprinkler system
- Fire Detector

Results

INTERIORS AND TEMPERATURE ANALYSIS : FIRST FLOOR

Surface temperature of Wall, Floor and Ceiling

Air temperature

INTERIORS AND TEMPERATURE ANALYSIS : SECOND FLOOR

Surface temperature of Wall, Floor and Ceiling

Air temperature

INTERIORS AND TEMPERATURE ANALYSIS : THIRD FLOOR

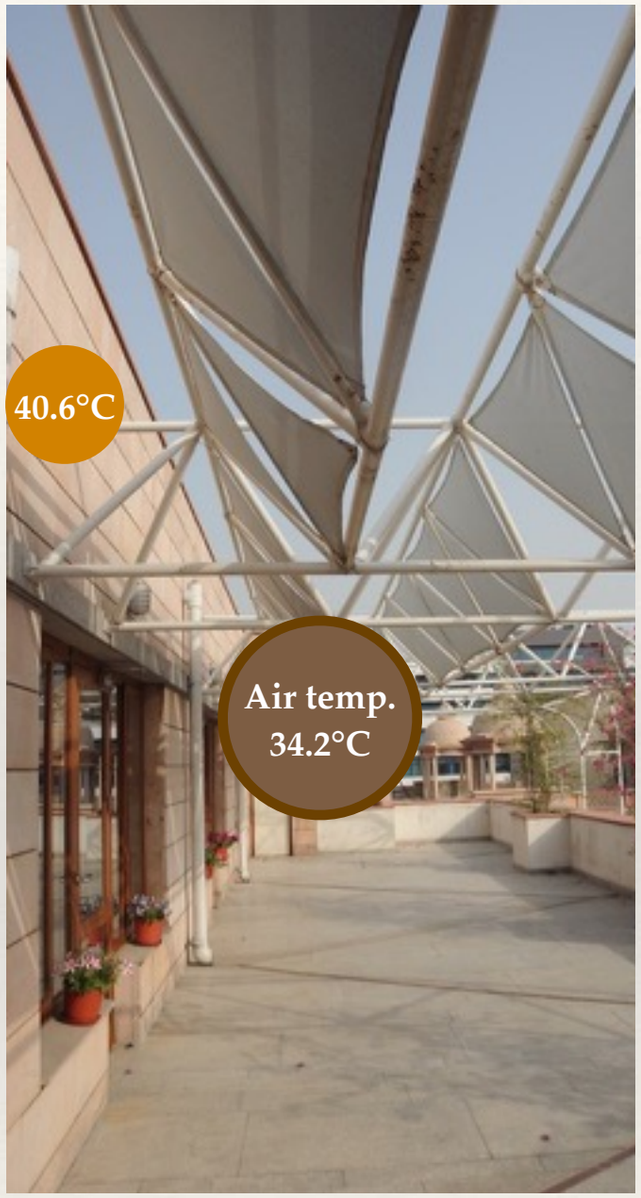
Surface temperature of Wall, Floor and Ceiling

Air temperature

INTERIORS AND TEMPERATURE ANALYSIS : FOURTH FLOOR

Conference Room

Corridor



Outdoor

NOTE : The cooling system on this floor (Top Floor) had not been turned on

Surface temperature of Wall, Floor and Ceiling

Air temperature

CONCLUSION

- Occupants on all floors except fourth floor (which is not occupied), have expressed high degree of satisfaction with thermal comfort.
- It is seen that the Air temperature is considerably higher than surface temperatures.
- This shows that the perception of thermal comfort is strongly affected by Radiant temperatures of surrounding surfaces.
- Design of office spaces that require flexibility of space sub-division overtime, require a planning grid of services.
- Design of office spaces with Radiant Cooling through chilled slabs require careful planning of services.
- The service plans need to be such that space sub-division of different sizes of office cabins is managed with the use of suspended ceilings.
- The combination of Radiant Cooling from the ceiling slab and desiccated fresh air input close to the floor works best. This combination gives a high degree of satisfaction for thermal comfort and also ideal fresh air ventilation.