# Ex. topics

ICT for Building Design

AY 2019-20


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# Main overview – step I (design optimization)

| Building type | Variable to be optimized | | | Climate |
|---|---|---|---|---|
| | U-values | | WWR | |
| Residential | X | | X | Cold, temperate, hot |
| Office | X | | X | |

| Group | Type | Variable | Climate |
|---|---|---|---|
| #1 | Residential | U-value | Turin |
| #2 | Residential | U-value | Rome |
| #3 | Residential | U-value | Palermo |
| #4 | Office | U-value | Turin |
| #5 | Office | U-value | Rome |
| #6 | Office | U-value | Palermo |
| #7 | Residential | WWR | Turin |
| #8 | Residential | WWR | Rome |
| #9 | Residential | WWR | Palermo |
| #10 | Office | WWR | Turin |
| #11 | Office | WWR | Rome |
| #12 | Office | WWR | Palermo |
| #13 + | Residential/Office | U/WWR | Moscow, Tunis, Antofagasta |


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# Main overview – step II (profiling & control)

| Building type | Variable to be optimized | | | | Target |
|---|---|---|---|---|---|
| | ACH | % opening | Scheduling eq. | Shading | |
| 1 building conf. | a. | b. | c. | d. | Q or Temp. or ACH |

| Group | Target var. | Main season |
|---|---|---|
| #i | a.Q | S |
| #ii | a.T | S |
| #iii | b.Q | S |
| #iv | b.T | S |
| #v | b.ACH | S/W |
| #vi | c.Q | S/W |
| #vii | d.Q | S |
| #viii | d.T | S |

Better defined together with prof. Bottaccioli

# Group #1-3 | U-value Residential - Step I

- Main objective: describe energy need variations varying the U-value of of opaque surfaces and the U-value of windows.
- seasonal and yearly values are analysed to define correlations using polynomial regressions
- Three WWR configurations are considered (5% - 15% - 50%)
- Two ventilative cooling mode (on/off) (scheduled)

# Group #1-3 | U-value Residential – step I

- Target variable: Q [kwh/m2] (separately summer and winter + annual)
- Input variables: – U-value of opaque surfaces, U-value of windows – To change the U-value, change insulating layer (0-35cm) in Energy plus for opaque surfaces and change the windows (0.7-5) (or define at least 3 window configurations) – Use design builder to get a translation to U-value or you can use the formula in the lectures directly inside the python script
- Scenario variables: ventilative cooling on/off (in summer) (on mode = 6 ACH with external temperature 24 to 18°C 24hs/7day, while a critical difference between building temperature and external one is set to 3 K for effective convection)
- Energy signature will be calculated and different scenarios compared

# Group #4-6 | U-value Office - Step I

- Main objective: describe energy need variations varying the U-value of opaque surfaces and the U-value of windows.
- seasonal and yearly values are analysed to define correlations using polynomial regressions
- Three WWR configurations are considered (15% - 50% - 90%)
- Two ventilative cooling mode (on/off) (scheduled)

# Group #4-6 | U-value Office – Step I

- Target variable: Q [kwh/m2] (separately summer and winter, and annual)
- Input variables: – U-value of opaque surfaces, U-value of windows – To change the U-value, change insulating layer (0-35cm) in Energy plus for opaque surfaces and change the windows (0.7-5) (or at least 3 window configurations) – Use design builder to get a translation to U-value or you can use the formula in the lectures directly inside the python script
- Scenario variables: ventilative cooling on/off (in summer) (on mode = 6 ACH with external temperature from 24 to 10°C during night (19:00-7:00), while a critical difference between building temperature and external one is set to 3 K for effective convection)
- Energy signature will be calculated and different scenarios compared

# Group #7+ | WWR – Step I

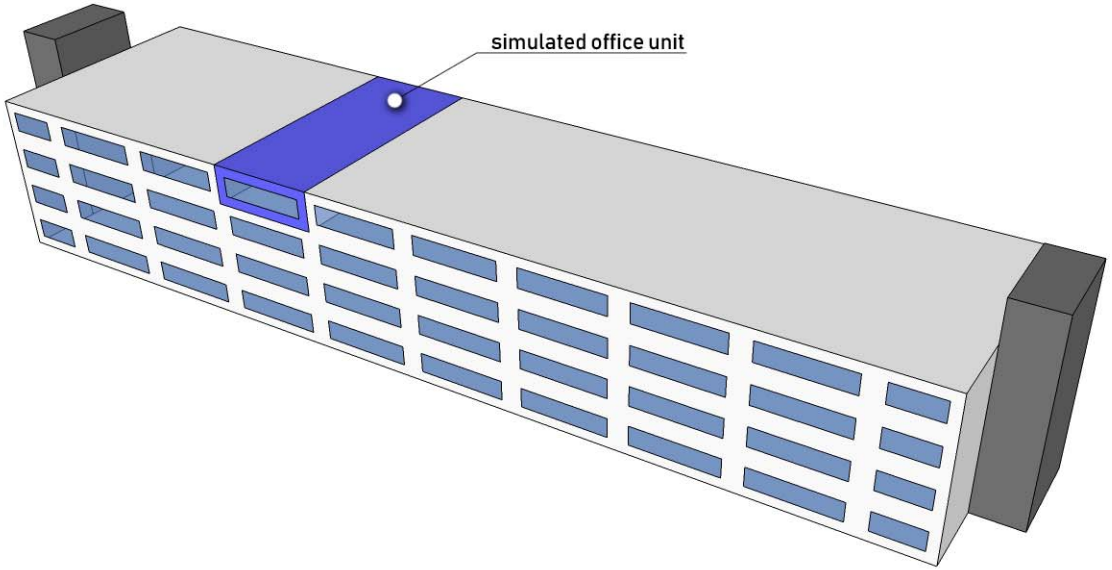
- Main objective: describe energy need variations varying the WWR.
- yearly values are analysed to define correlations using polynomial regressions
- 3 configurations are assumed by modifying the same reference building: not insulated (e.g. envelopes of 50-60's), insulated (current U-value limits for climate zone), highly insulated (U wall half of the limit; Uwind. A/B 1.4; C/D 1, E/F 0.6),
- Two ventilative cooling modes (on/off) (scheduled) - summer
- Two shading modes (on/off) - summer

# Group #7+ | WWR – Step I

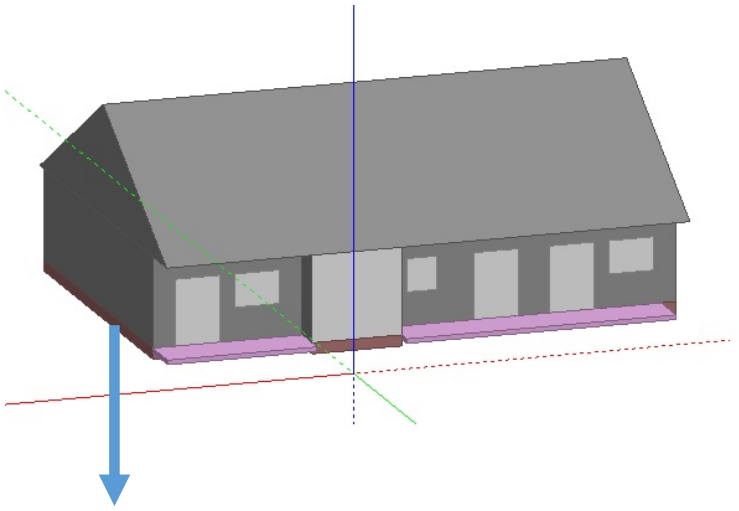
- Target variable: Q [kwh/m2] (year balance) assuming all electrical – heating + cooling + lighting
- Input variables: window percentage in respect to outdoor facing wall
- Scenario variables: – 3 configurations are assumed by modifying the same reference building: not insulated (e.g. envelopes of 50-60's), insulated (current U-value limits for climate zone), highly insulated building (U value walls = …; U value windows = …) + 2 shading configurations (on/off) + 2 CNV summer configurations (on/off) (schedule)
- Energy signature will be calculated and different scenarios compared

- Each group is characterized by working in a specific climate.

# Office




# Residential





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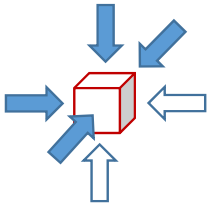
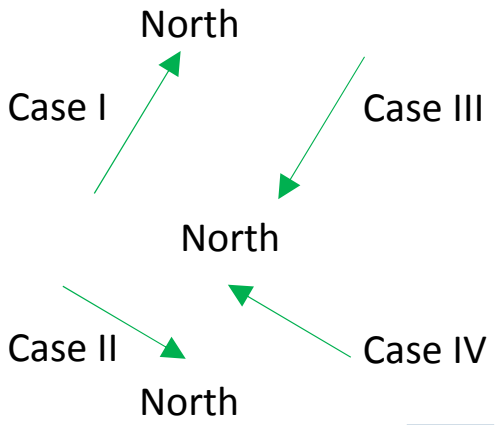
# Group #1-3 | U-value Residential

min. windows' area = 1/8 pavement
(min 7.5 $m^2$ → 3.75 for façade)


Alternative design configurations are accepted



Not-adiabatic
adiabatic





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# Group #4-6 | U-value Office

min. windows' area = 1/8 pavement – you can also consider continuous windows – in office is general bigger than in residential

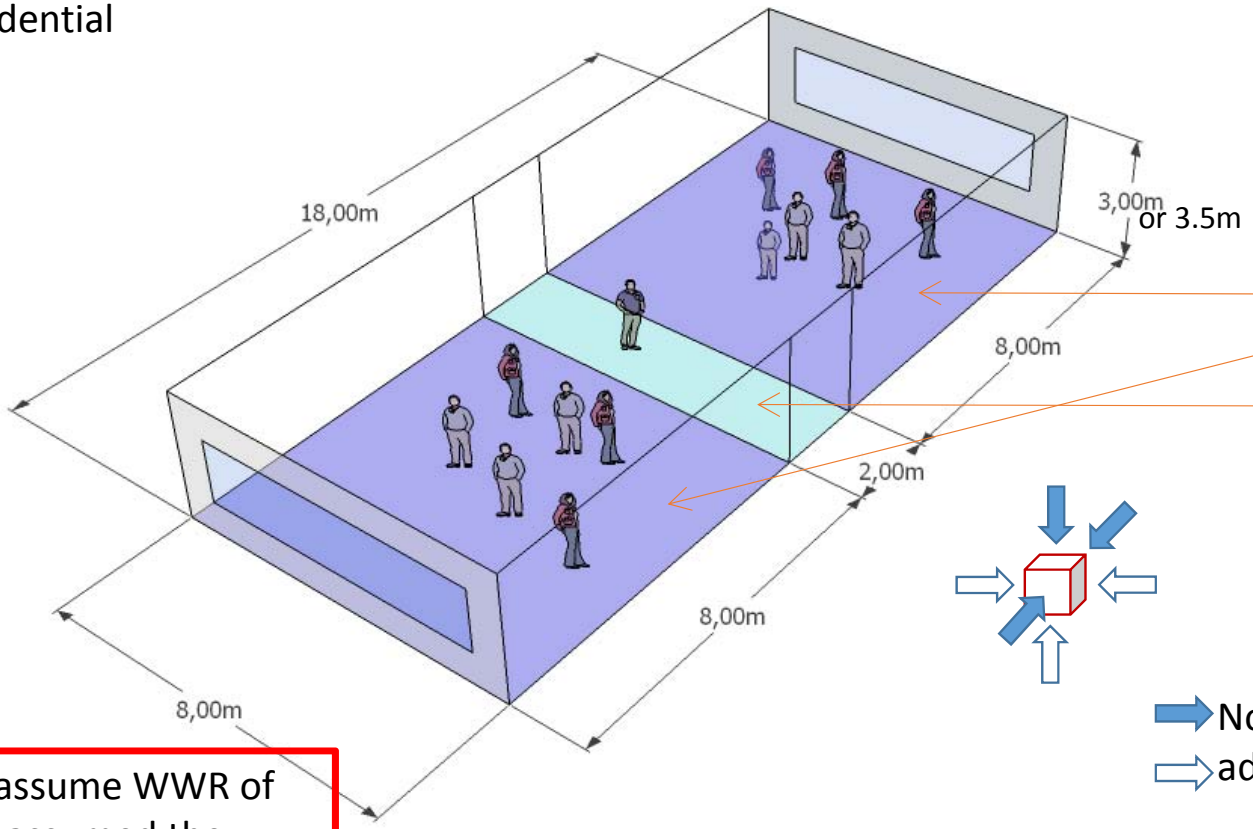
North

Case I

Case II

North

Symmetry N-S & E-W




Occupancy from Design Builder schedule for the specific activity

Office schedule

Office corridor schedule



Not-adiabatic

adiabatic

Alternatively, groups may assume WWR of vertical facades = 100% or assumed the following design configuration (or another)



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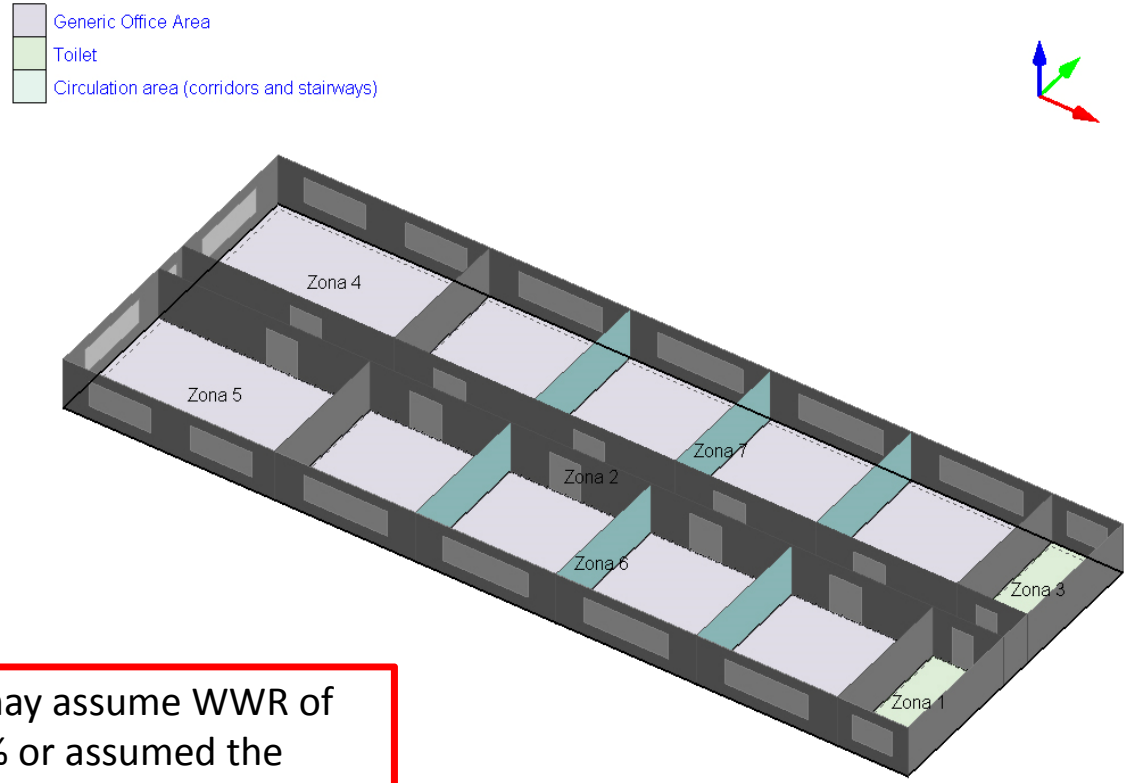


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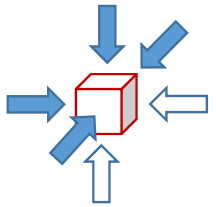

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adiabatic

Alternatively, groups may assume WWR of vertical facades = 100% or assumed the following design configuration (or another)



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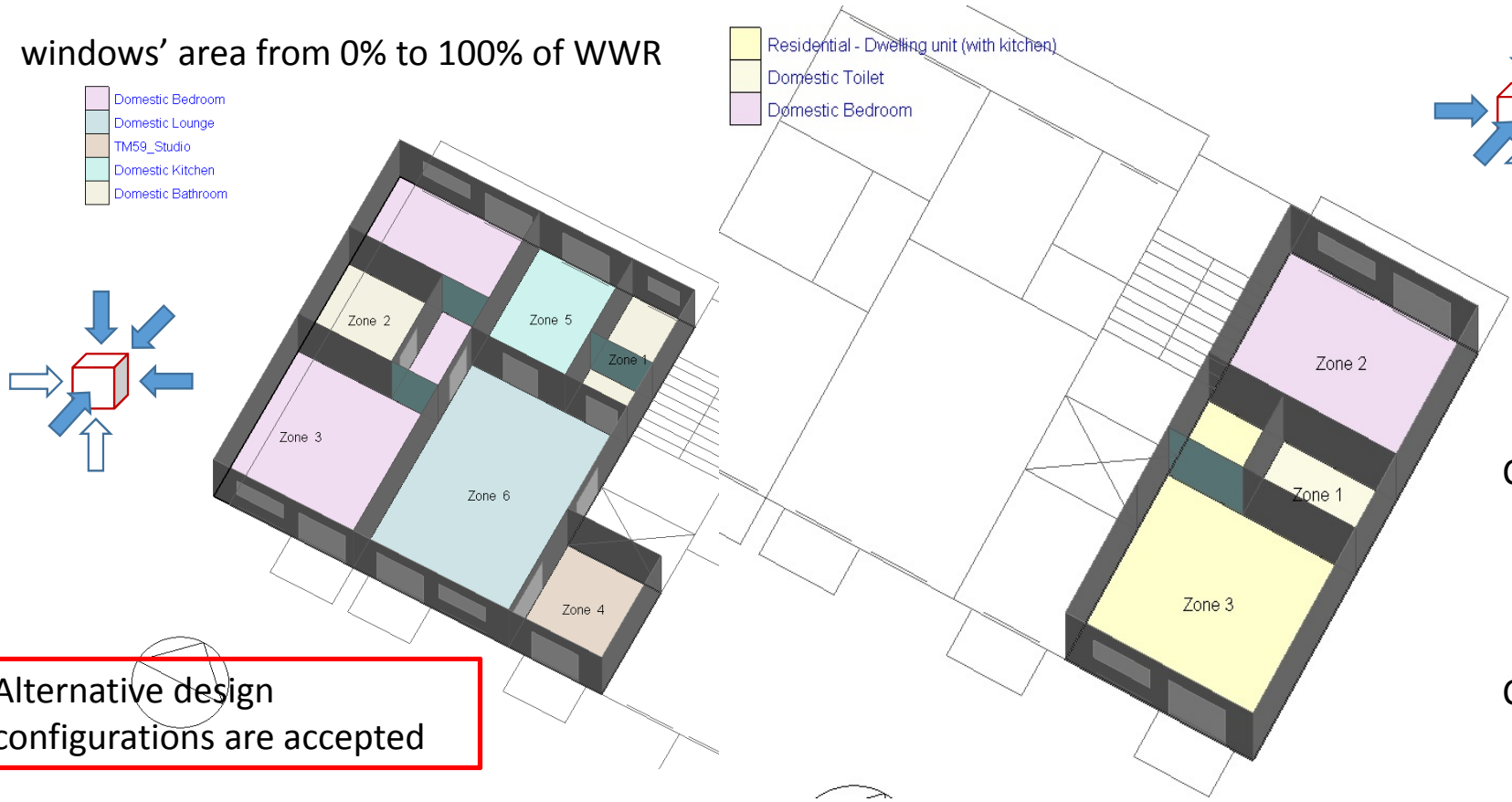
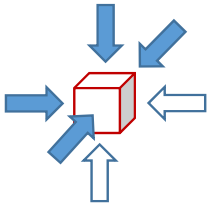
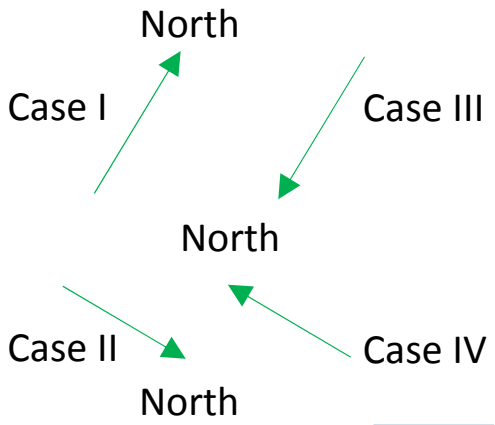
# Group #7+ | WWR Residential

windows' area from 0% to 100% of WWR



Not-adiabatic
adiabatic

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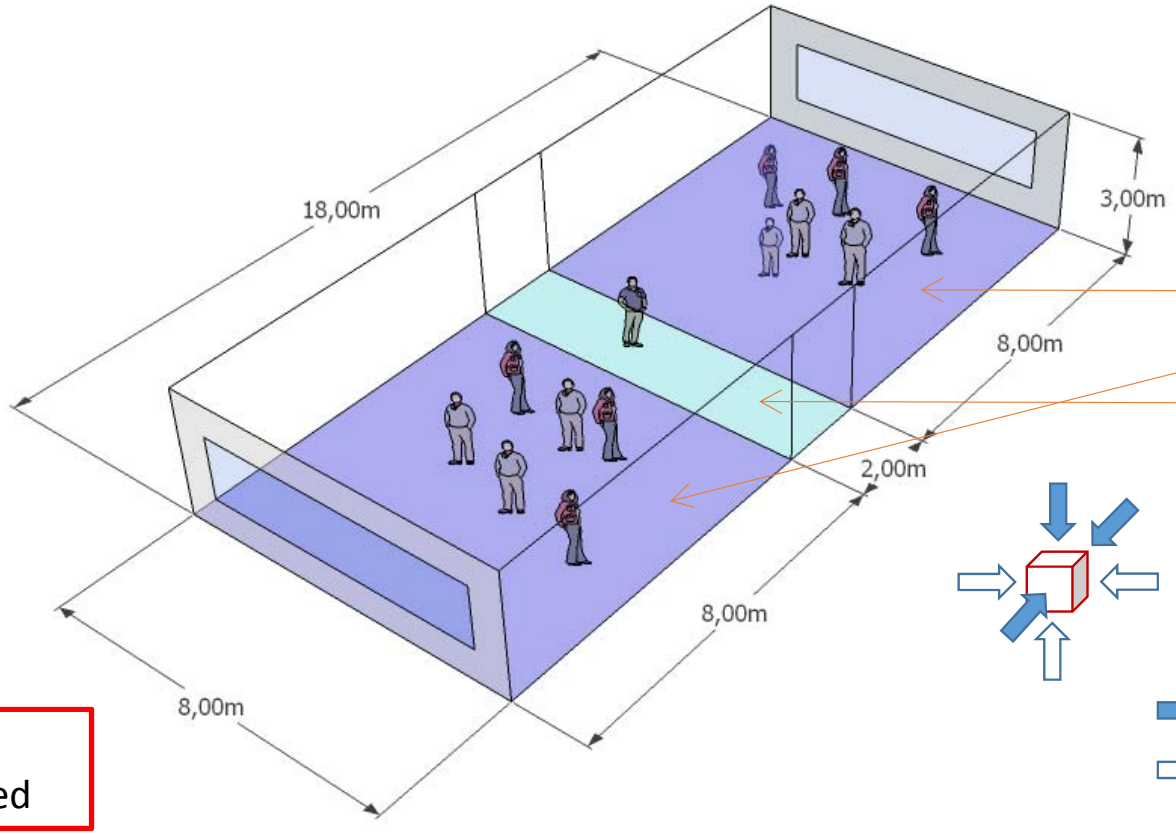
Symmetry N-S & E-W




Occupancy from Design Builder schedule for the specific activity

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