Chair of / Cátedra de / Lehrstuhl für

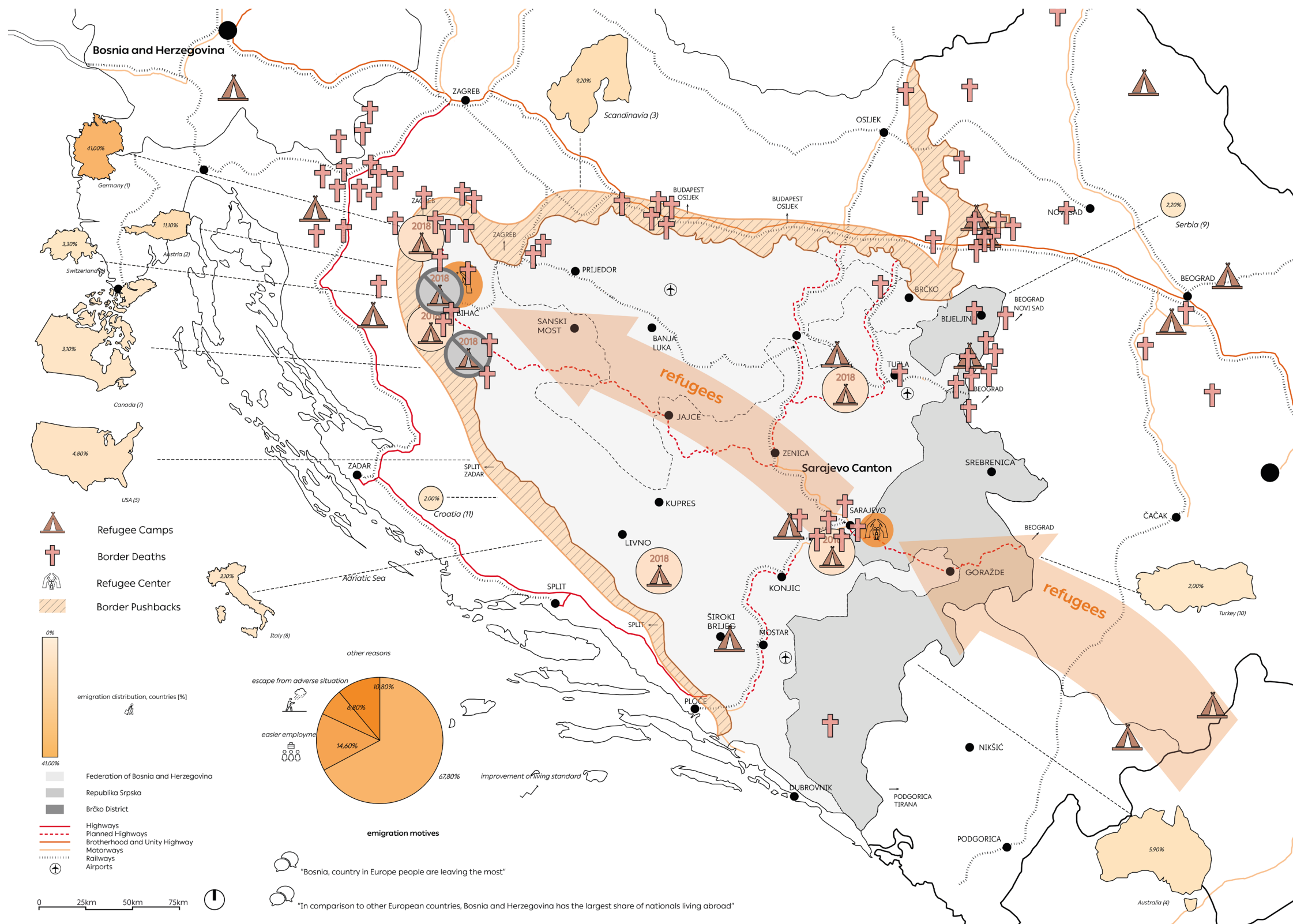**Archi-
tecture
&
Urban
Design**

Prof. Hubert Klumpner

Aline Lang

Growing City

Inclusivity and Safety through Densification

Densification #AffordableHousing #Shrinking&Growing
#UrbanSprawl #NaturalDisaster #Migration

ETH zürich

Chair of Architecture & Urban Design Prof. Hubert Klumpner

Bosnia and Herzegovina

Migration in Bosnia and Herzegovina

84'120

Arrivals in BiH since 2018 through the Balkan Route

4000

arrivals are stranded in BiH at the moment - 2200 in centers, 1100 in inadequate conditions

816

Landslides in Sarajevo between 2000-2014

58%

of the energy consumption is used for heating of houses
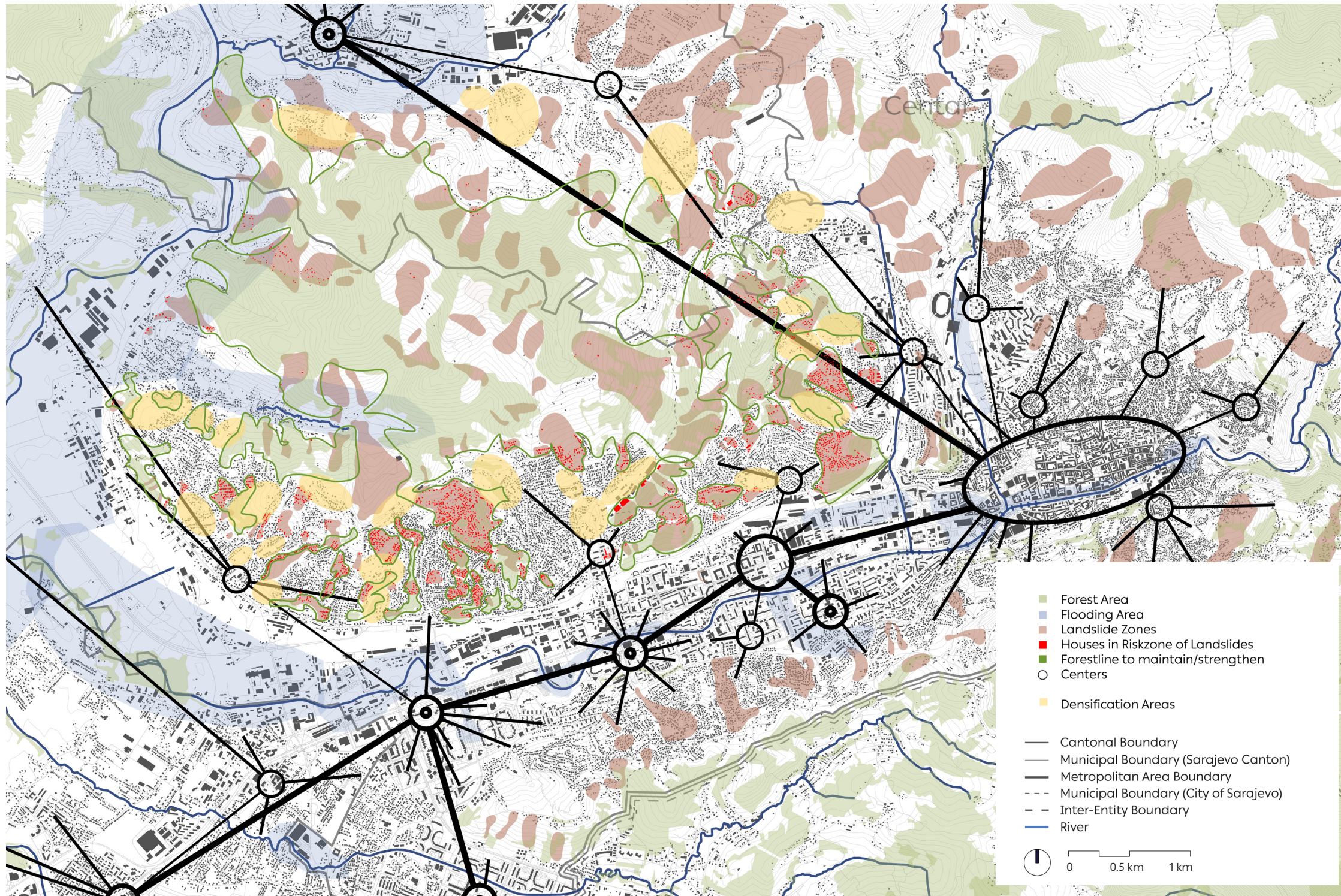
65%

of the air pollution is caused by heating

1368
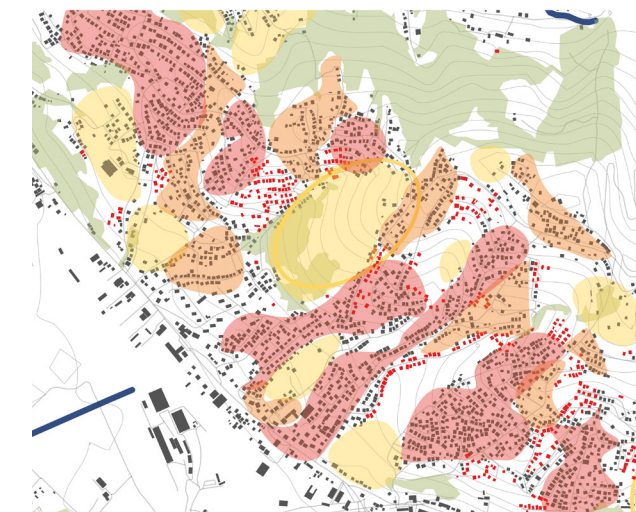
kWh/m² yearly sum of horizonal global irradiation
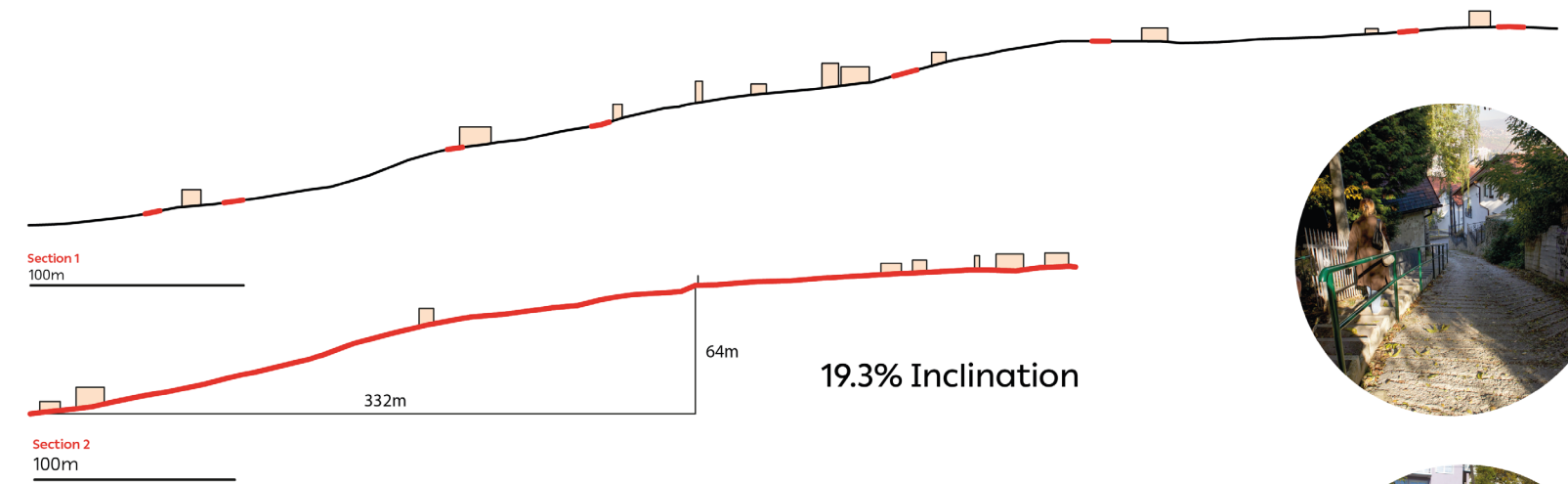
37.5%

walking as transportation

Legend

- Refugee Camps
- Border Deaths
- Refugee Center
- Border Pushbacks

emigration distribution, countries [%]

0% — 41,00%

- Federation of Bosnia and Herzegovina
- Republika Srpska
- Brčko District

- Highways
- Planned Highways
- Brotherhood and Unity Highway
- Motorways
- Railways
- Airports

emigration motives

"Bosnia, country in Europe people are leaving the most"

"In comparison to other European countries, Bosnia and Herzegovina has the largest share of nationals living abroad"

Pie chart - emigration motives

- other reasons: 10,80%
- escape from adverse situation: 6,80%
- easier employment: 14,60%
- improvement of living standard: 67,80%

Scandinavia (3): 9,20%
Germany (1): 41,00%
Austria (2): 11,10%
Switzerland: 3,30%
Canada (7): 3,10%
USA (5): 4,80%
Croatia (11): 2,00%
Italy (8): 3,10%
Serbia (9): 2,20%
Turkey (10): 2,00%
Australia (4): 5,90%

0 25km 50km 75km

City
of
Sarajevo

Areas of Sarajevo

Areas around Intervention Zone

Density around Intervention Zone

Legend (central map):

- Forest Area
- Flooding Area
- Landslide Zones
- Houses in Riskzone of Landslides
- Forestline to maintain/strengthen
- Centers
- Densification Areas

- Cantonal Boundary
- Municipal Boundary (Sarajevo Canton)
- Metropolitan Area Boundary
- Municipal Boundary (City of Sarajevo)
- Inter-Entity Boundary
- River

0   0.5 km   1 km

Legend (density map):

- Forest Area
- Flooding Area
- Landslide Zones
- Forestline/Green Area
- Housing Area
- Work Area
- Houses in Riskzone of Landslides
- Densification Areas
- Densly built Areas
- Medium-densly built Area
- Empty Areas

Growing City Aline Lang

Climate Corridors Sarajevo

Analysis of the Hillside Streets

Section 1
100m

Section 2
100m

332m

64m
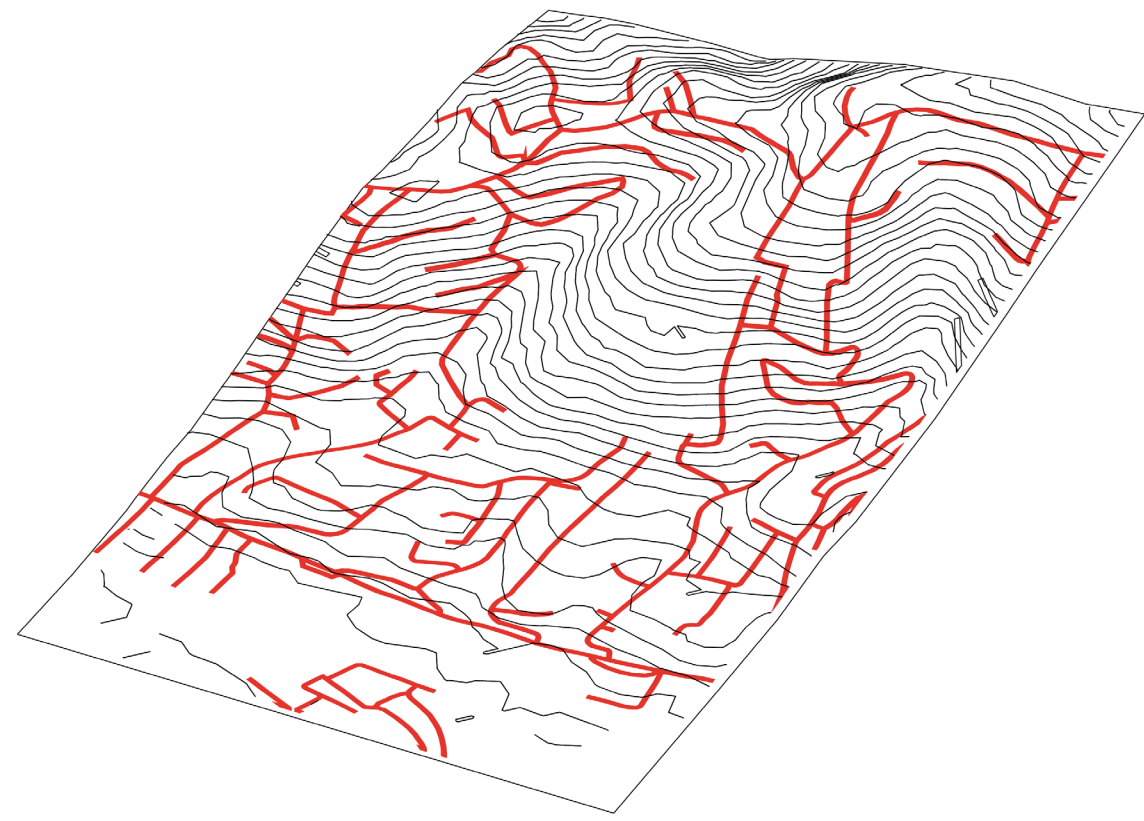
19.3% Inclination

recommended inclination comfortable for longer distances: 6%

Section 1

Section 2

500m
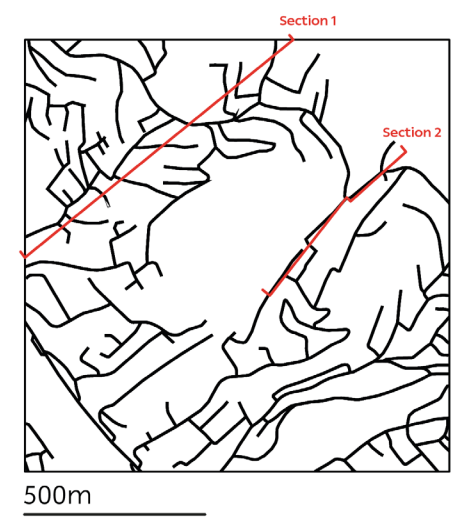
Current streets patterns:
- very steep
- often narrow
- accessibility not guaranteed
- trash collection
- winter service

Street Analysis

Analysis of the Hillside Settlements

Work

Housing

Green Area

4. House partly built in ground

2. different number of storeys

3. House on / outside ground

1. House on platform (platform may be partly in ground)

4   3

chimney > heating

window + balcony door

tiled roof

son's family

parents

grandparents

outdoor staircases for entrances

balconies: long terraces or small niches

often empty / living

living

parking / family business

Parking / Car-Situation:

on groundfloor:
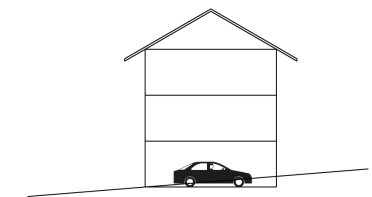
car beside / in front of house:
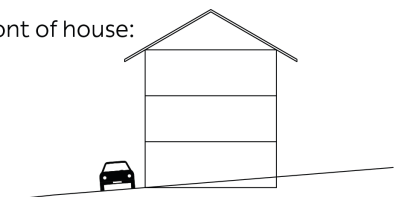
separate parking garages:
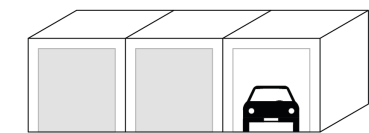
Problems:
• one family housing (unsustainable)
• heating
• car parking / storage
• hydro- /thermal insulation

Opportunities and important details:
• multi-generation/ -family houses
• balconies as threshold between private and public
• maintain privacy >courtyard, sight protection

Before / Traditional
• 3-Generation housing
• separate entrances through outdoor staircases
• not too many windows - privacy is important

Today
• one-family housing
• occasionally empty topfloor
• often parking or family business on the groundfloor

Analysis of the Hillside Settlements

New Street Pattern
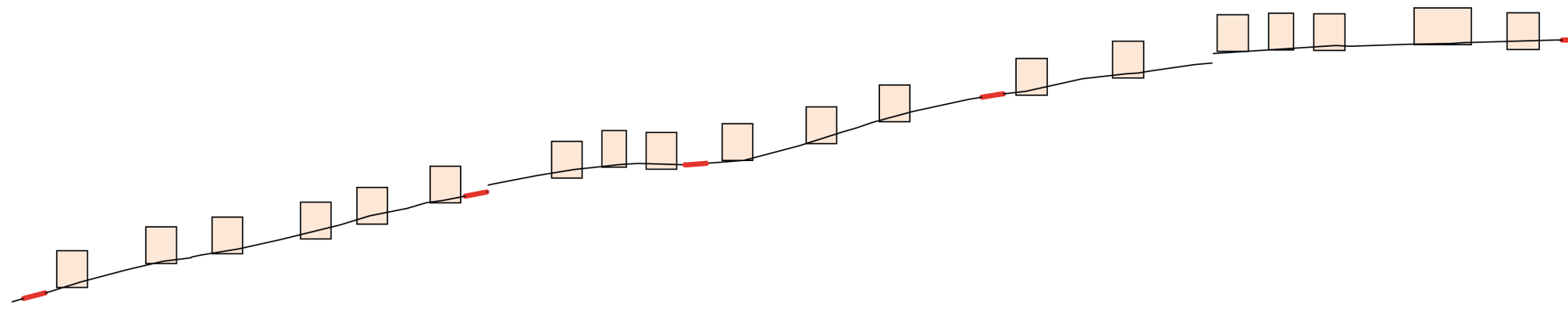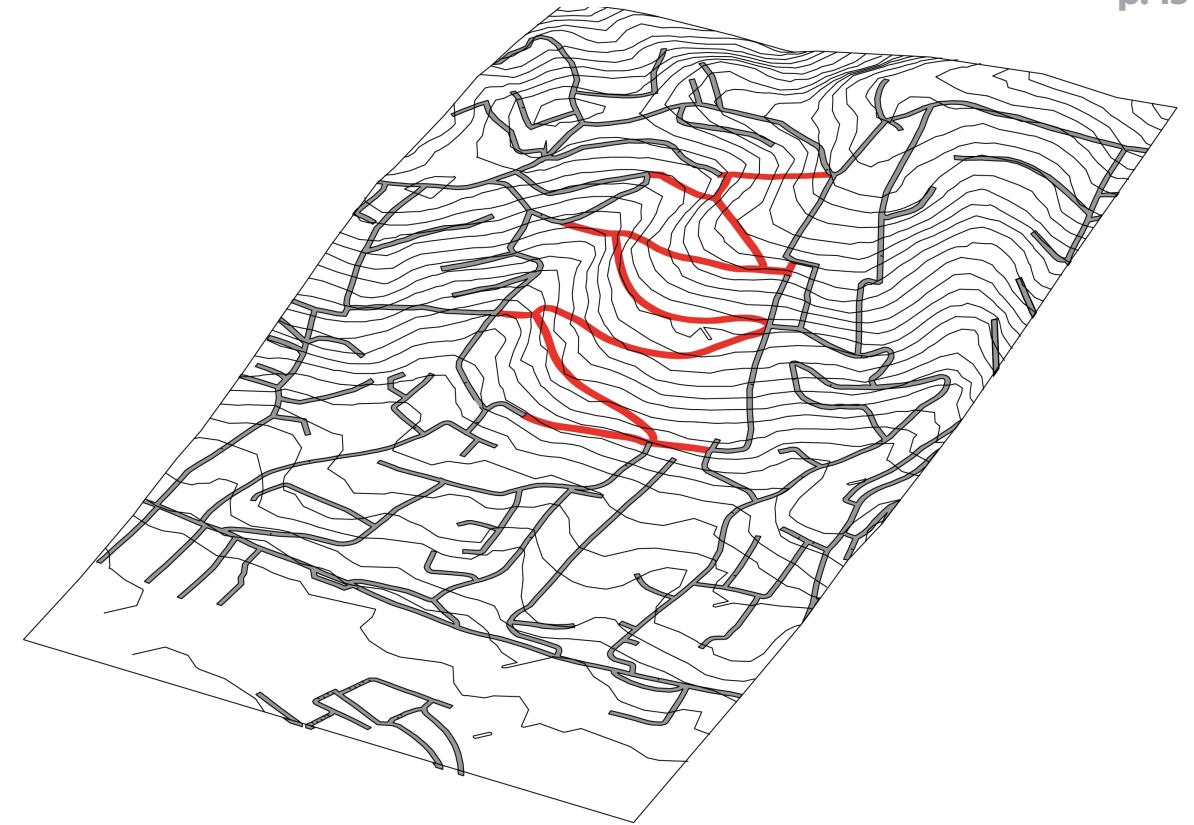
Section 3
100m

9.6% Inclination

24m

249m
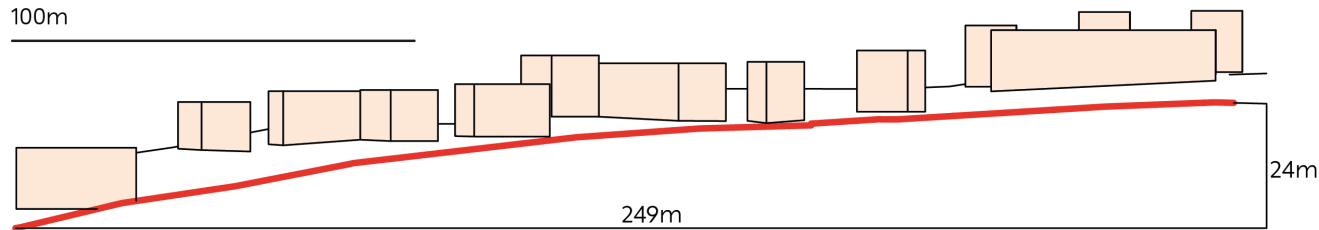
Section 4
100m

Section 3

Section 4

100m
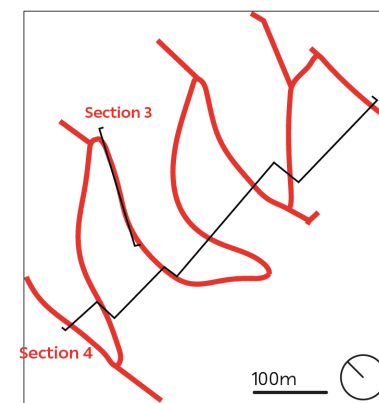
Advantages:
• less steep: inclination between 6-10%
• wider street:
     ->safe for pedestrians
     ->encourage social gathering
     ->facilitates public services
• winter sercive and trash collection
• connecting different neighbouhoods
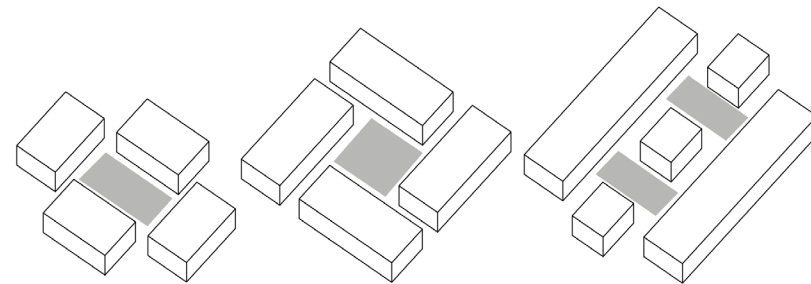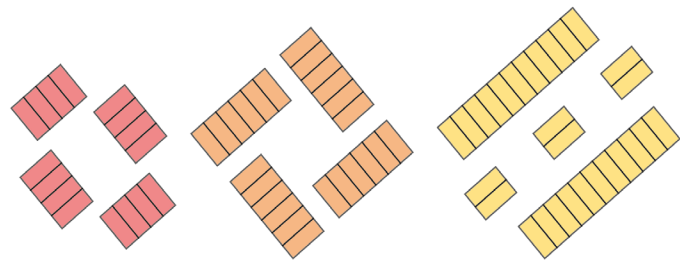• additional pedestrian short-cuts for
more efficient mobility

New Settlement
Constellation
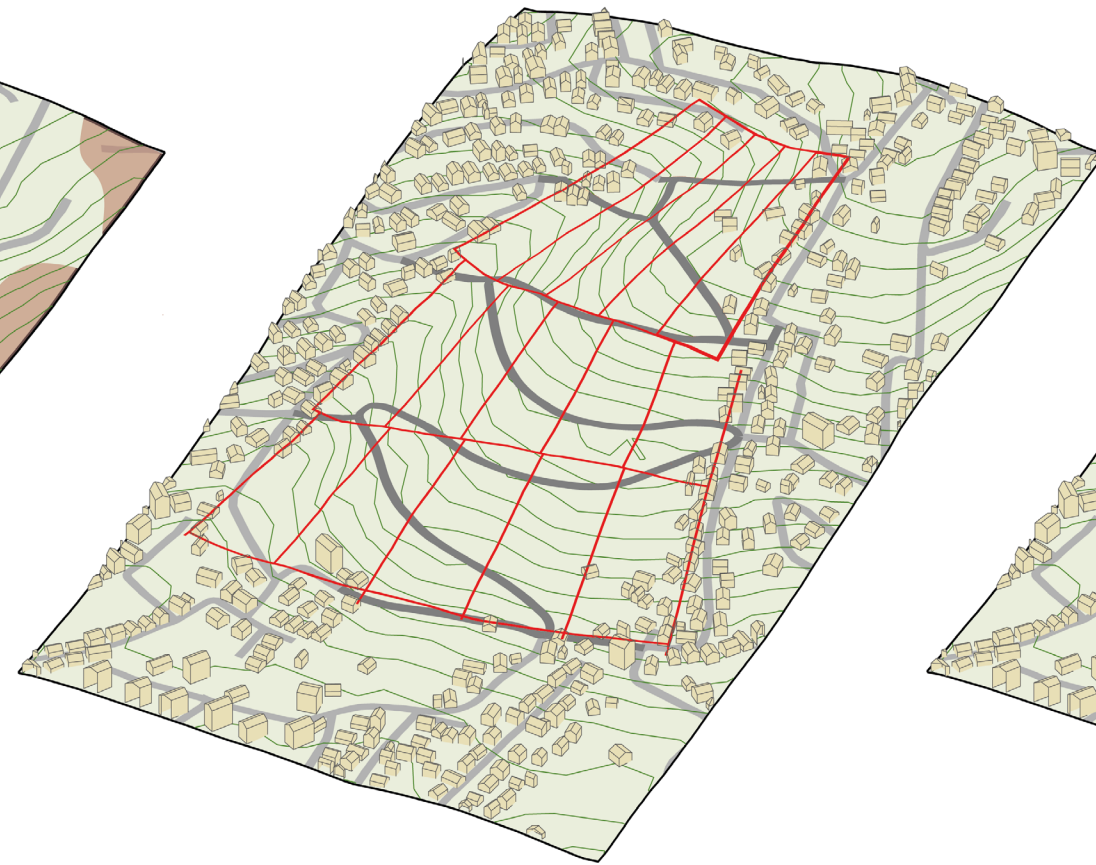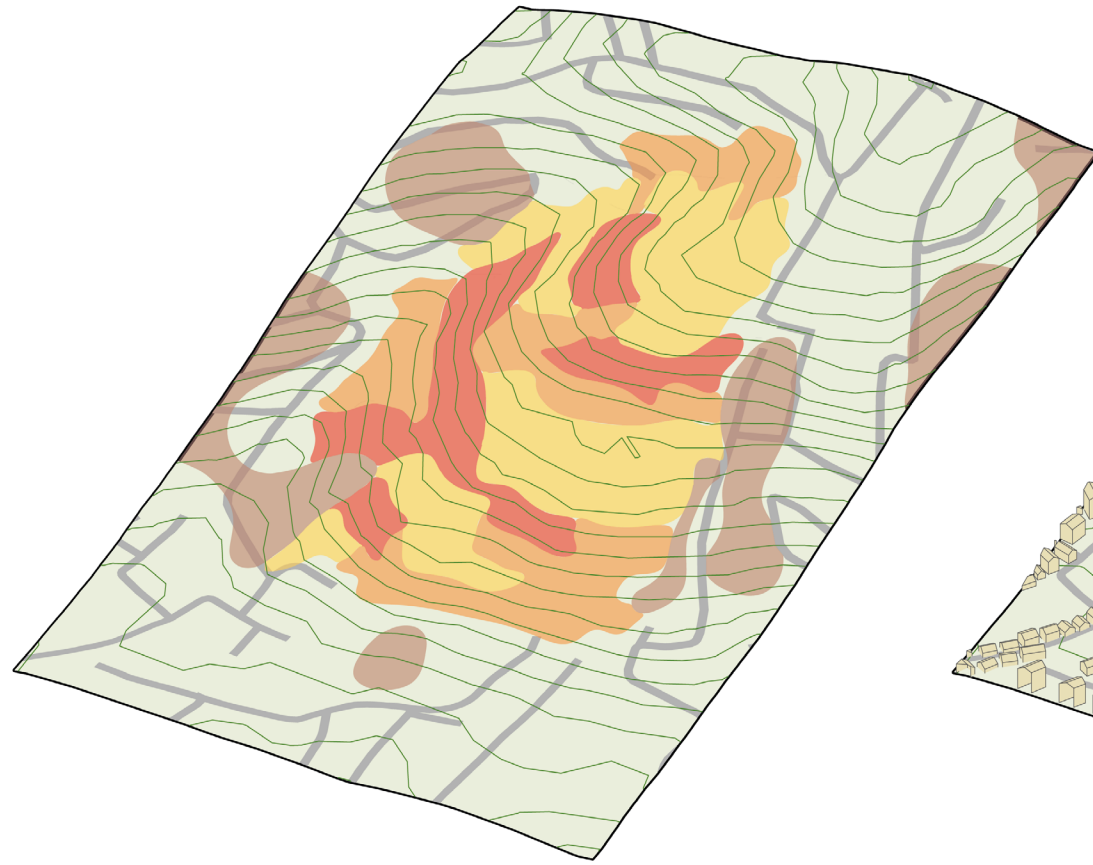
Inclination − +   ■ Landslide Area

■ Reference and Grid Lines

New Settlement can house around 2500 people on 132'000m²
The Hillside Settlement houses around 700 people on the same area

Inclination - Grid - New Settlement

Sunlight Analysis
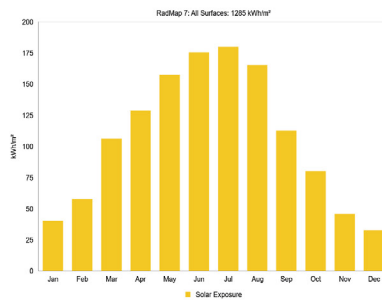
Solar Radiation on the Roofs:

RadMap 7: All Surfaces: 1285 kWh/m²

Yearly Cumulative:
• Most Exposted: 1319kwh/m²yr
• Least Exposed: 1225 kWh/m²yr
• July Cumulative: 180 kWh/m²
• December Cumulative: 33 kWh/m²

• **Solar energy Production: 5200 kWh per Person-yr**

• Average Electricity Consumption per capita: 3618 kWh/yr
• Average Energy Consumption per household: 10'715 kWh/yr

Solar Radiation in Public Space:

RadMap 4: All Surfaces: 986 kWh/m²

• Yearly Cumulative: 886-1041 kWh/m²yr
• July Cumulative: 116-154 kWh/m²

Solar Radiation in Courtyards:

RadMap 6: All Surfaces: 550 kWh/m²

• Big Courtyard: 487 kWh/m²yr 71 kWh/m² in July
• Medium Courty.: 358 kWh/m²yr 54 kWh/m² in July
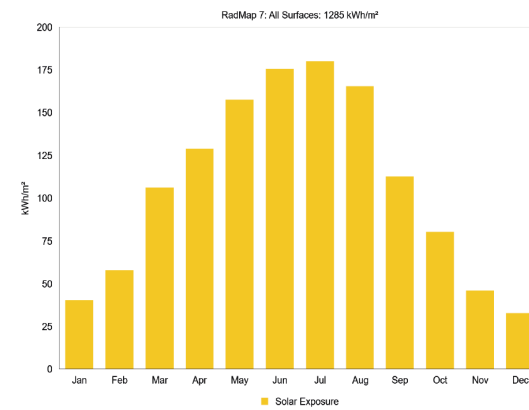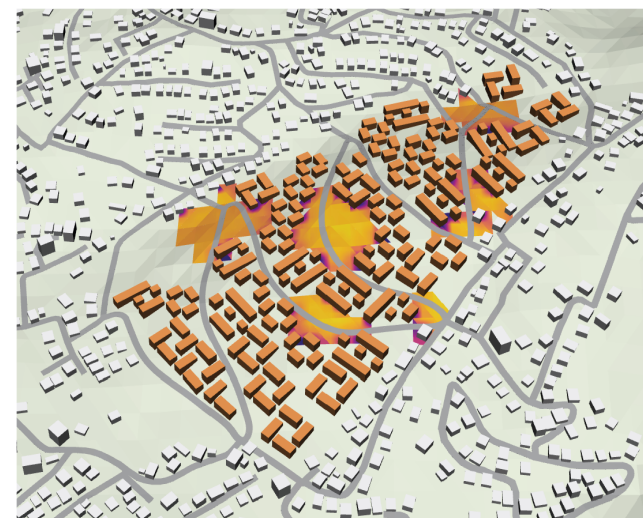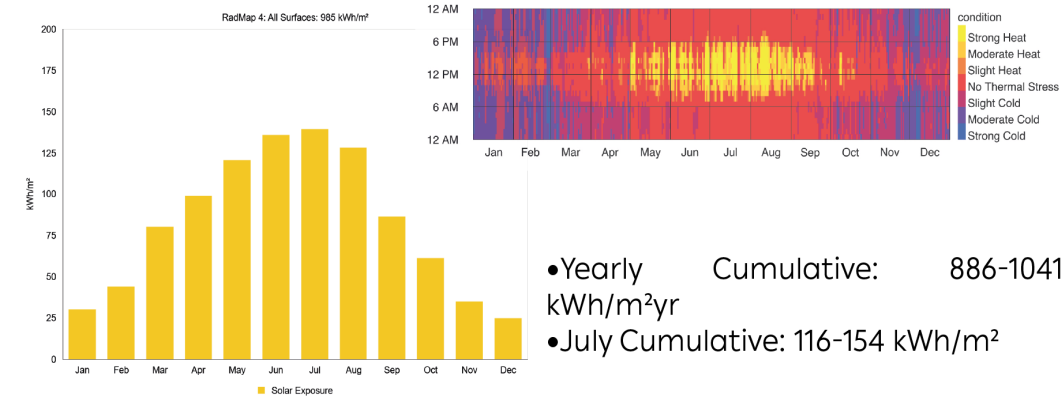• Small Courtyard: 531 kWh/m²yr 82 kWh/m² in July

0 kWh/m²   1500 kWh/m²

Sunlight Analysis - Radiation and Shadow
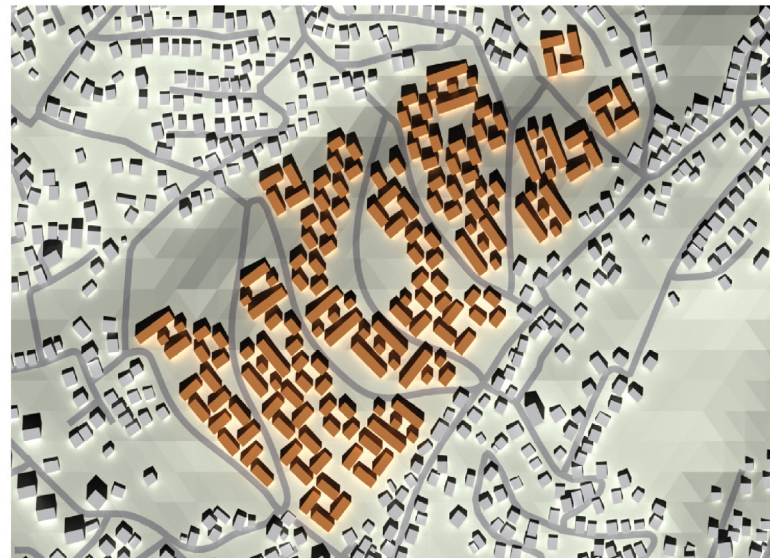
20th of March, 12:00

21st of June, 12:00
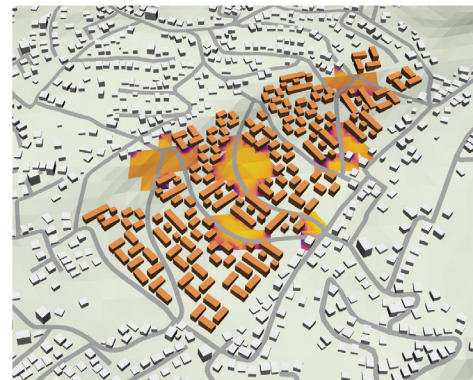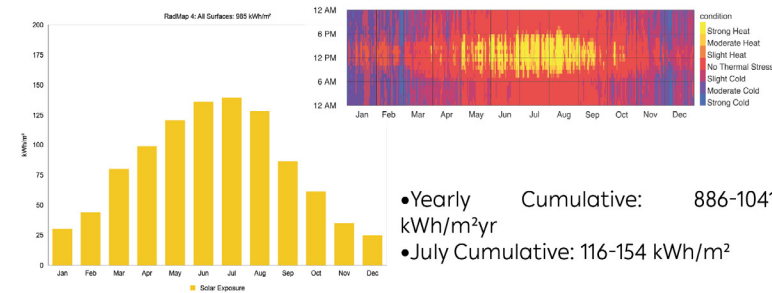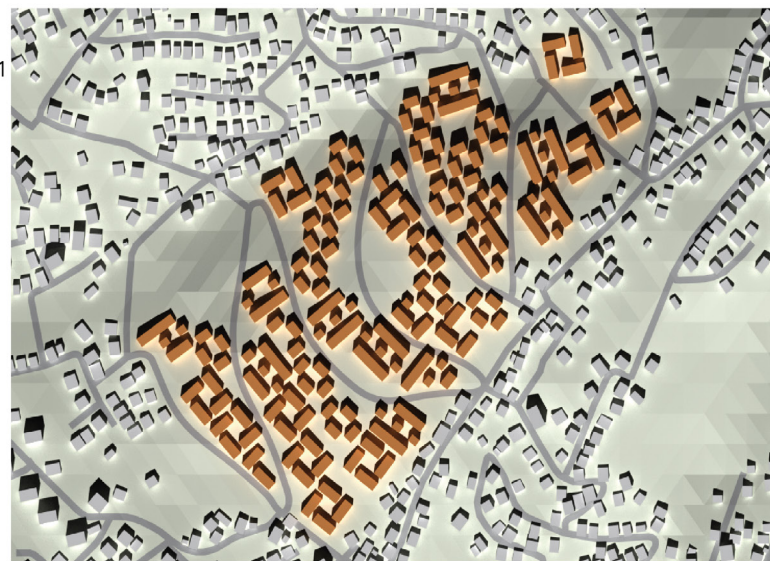
22nd of September, 12:00

21st of December, 12:00

Sunlight Analysis

Solar Radiation on the Roofs:

RadMap 7: All Surfaces: 1285 kWh/m²

Yearly Cumulative:
- Most Exposted: 1319kwh/m²yr
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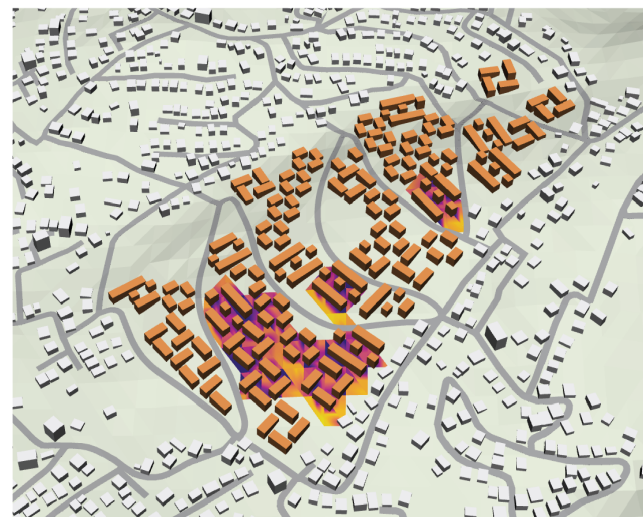- **Solar energy Production: 5200 kWh per Person-yr**

- Average Electricity Consumption per capita: 3618 kWh/yr
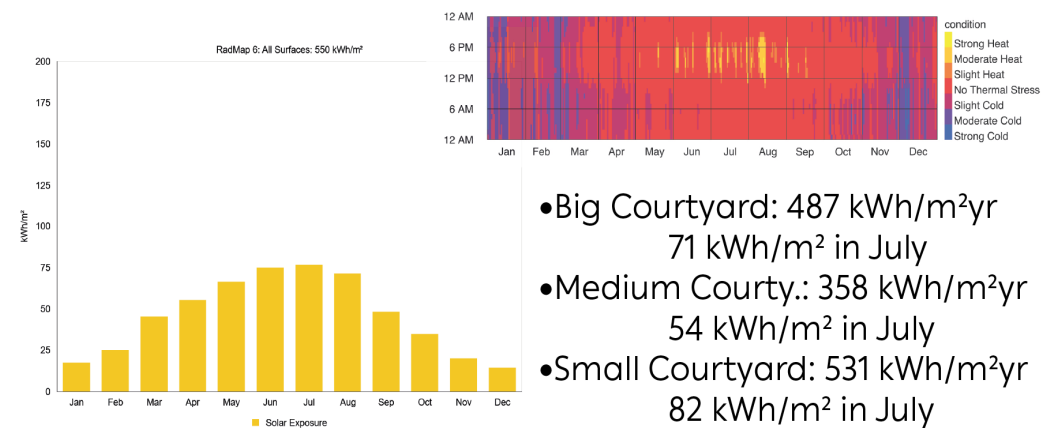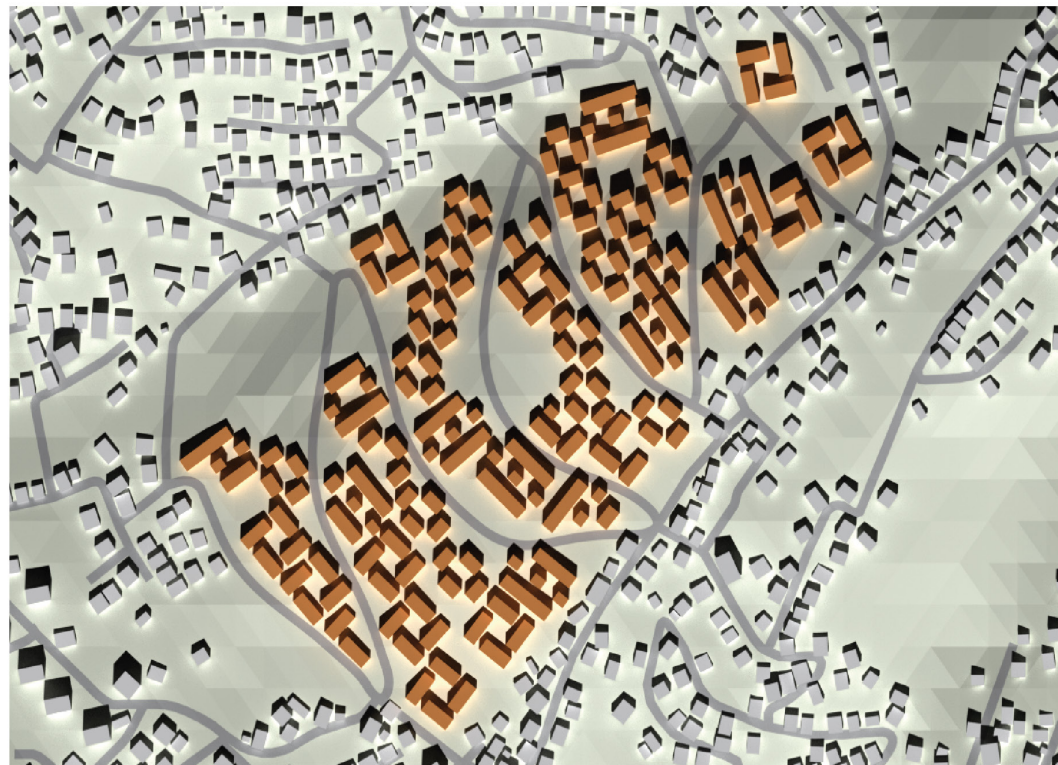- Average Energy Consumption per household: 10'715 kWh/yr

Solar Radiation in Public Space:

RadMap 4: All Surfaces: 985 kWh/m²

condition
Strong Heat
Moderate Heat
Slight Heat
No Thermal Stress
Slight Cold
Moderate Cold
Strong Cold

- Yearly Cumulative: 886-1041 kWh/m²yr
- July Cumulative: 116-154 kWh/m²

Solar Radiation in Courtyards:

RadMap 6: All Surfaces: 550 kWh/m²

condition
Strong Heat
Moderate Heat
Slight Heat
No Thermal Stress
Slight Cold
Moderate Cold
Strong Cold

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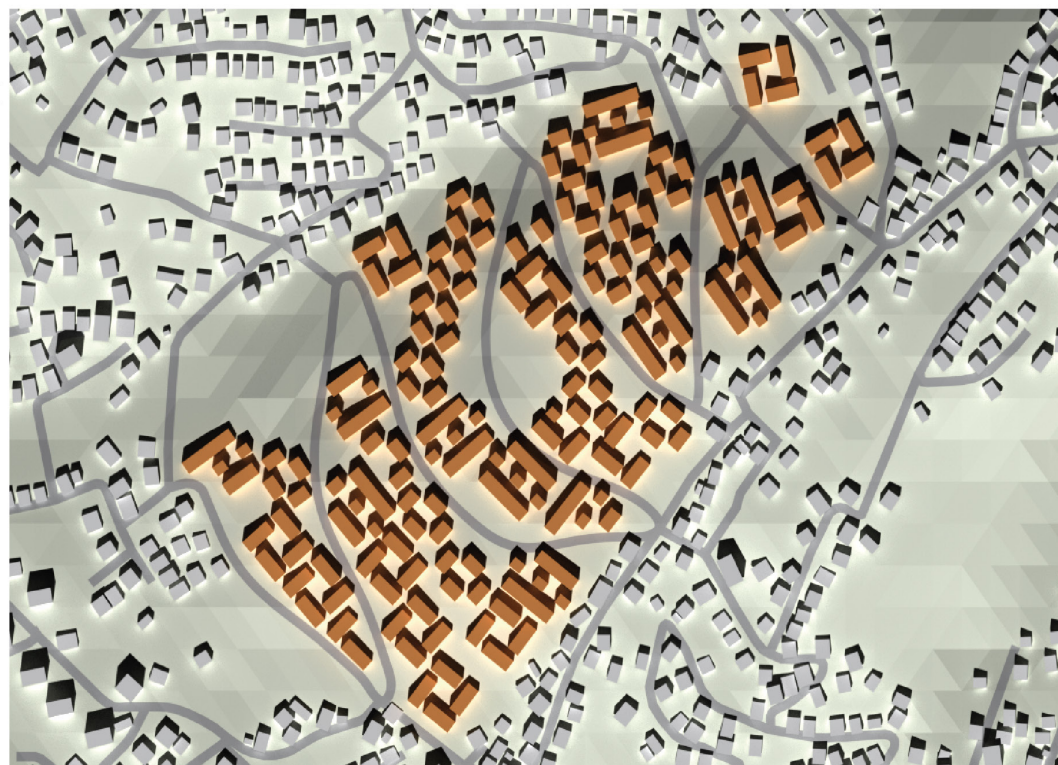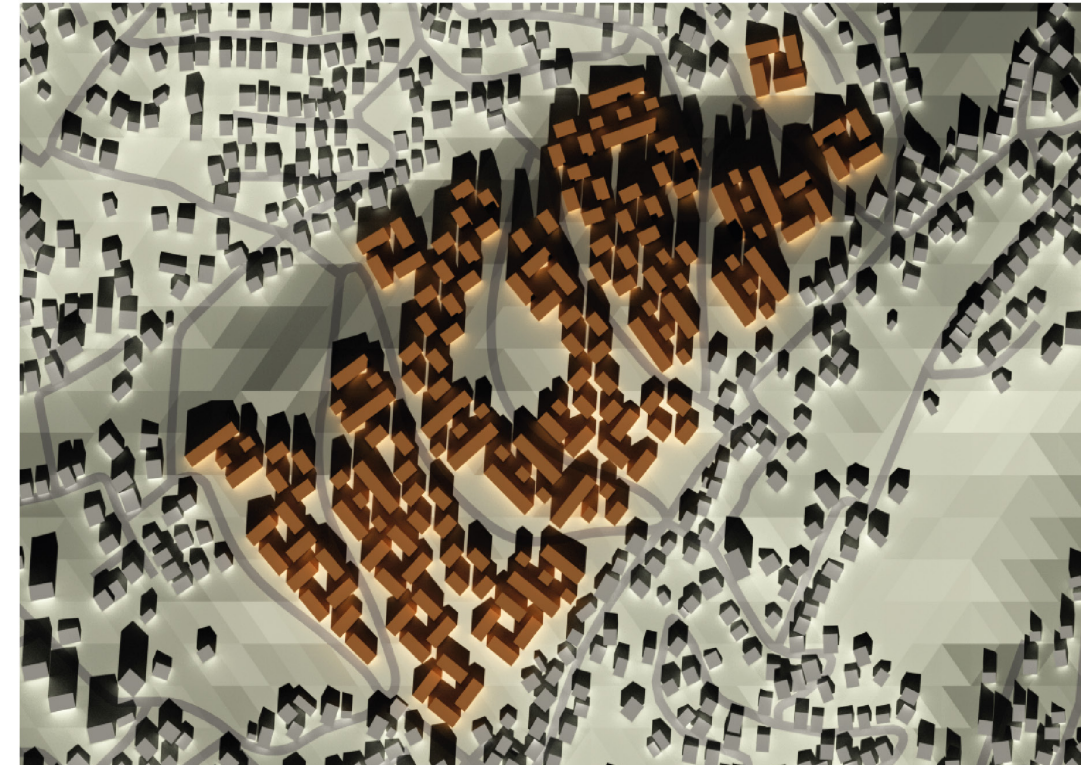0 kWh/m²   1500 kWh/m²

Sunlight Analysis - Radiation

Sunlight Analysis
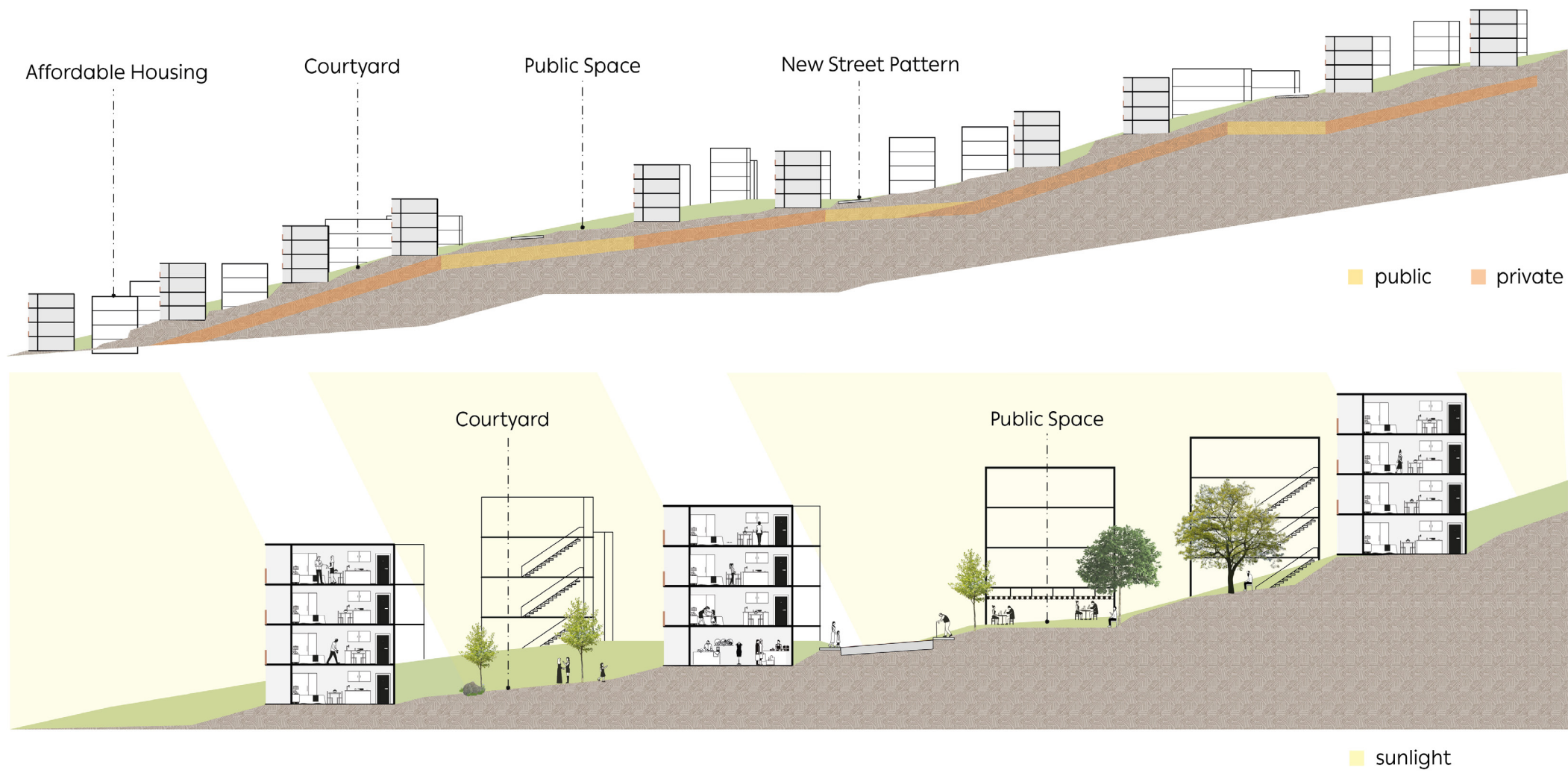
20th of March, 12:00

21st of June, 12:00

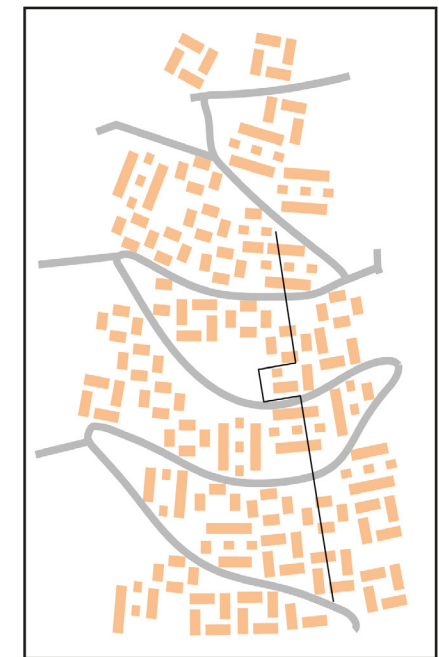

22nd of September, 12:00

Sunlight Analysis - Shadows
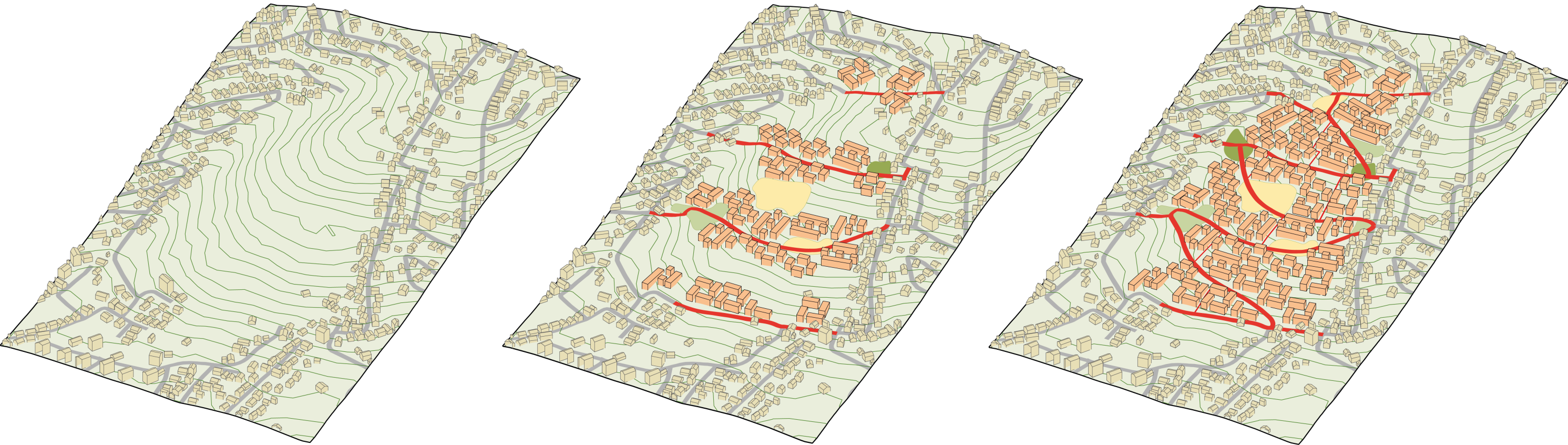

21st of December, 12:00

Section of the new Settlement Constellation

Affordable Housing

Courtyard

Public Space

New Street Pattern

public   private

Courtyard

Public Space
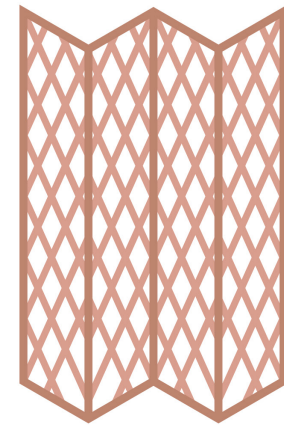
sunlight

Sections of the Settlement
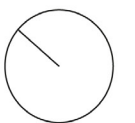
Process Axonometry

Process Drawing

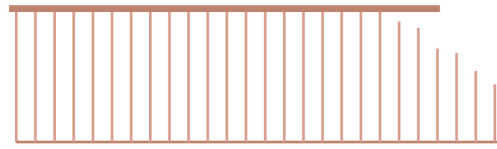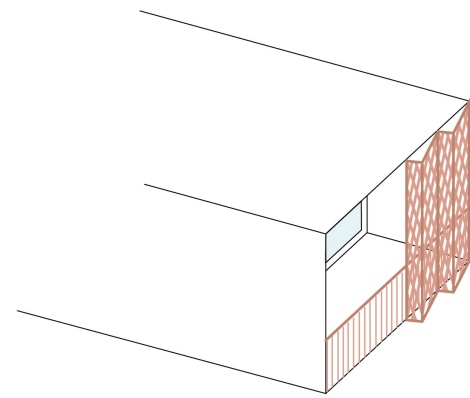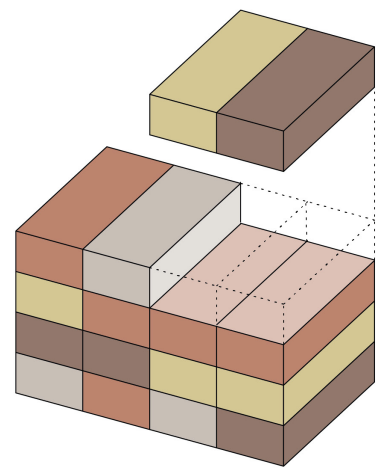# Modularity and Important Details

Visualization
Courtyard

Visualization
Public Space

Project Axonometry