HOT TOWN!
SUMMER IN THE CITY
A research into the relation between Rotterdam's South socially deprived neighbourhoods and the urban heat island

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Mentors

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Introduction
Cities face challenges related to high air temperature as an cause of the urban heat island.
Cities face challenges related to high air temperature as an cause of the urban heat island.

Climate change predictions of global temperature rise exacerbate the urban heat island.
Cities face challenges related to high air temperature as a cause of the urban heat island.

Climate change predictions of global temperature rise exacerbate the urban heat island.

Urban heat island is an issue of environmental justice on the city scale.

Lower income groups are disproportionately exposed to higher air temperature.
Cities face challenges related to high air temperature as an cause of the urban heat island.

Climate change predictions of global temperature rise exacerbate the urban heat island.

Urban heat island is an issue of environmental justice on the city scale.

Lower income groups are disproportionately exposed to higher air temperature.

However ...

Urban design can reduce exposure to high air temperature and adapt and mitigate to the urban heat island.
How is the urban heat island related to social deprivation, why is this in the city of Rotterdam an issue and how urban design can mitigate and adapt to these effects?
Theoretical framework
Statistical analyses
Observations and micro interviews
Neighbourhood analyses
Design interventions
Appendix
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Theoretical framework
Urban heat island

Net radiation + Anthropogenic Heat = Convection + Evapotranspiration + Heat storage
Characteristics contributing to the urban heat island

- Lack of vegetation
- Widespread use of impermeable surfaces
- High building mass
- Low Solar reflectance of urban materials
- Urban geometries that trap heat
- Lack of water for evaporation
- Increased levels of air pollution
- Increased energy use
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**Legend**

- **Land surface temperature**

  - **47.0 °C**
  - **0.0 °C**

- **Category of different land uses**
  - Continuous Urban fabric (S.L. > 80%)
  - Discontinuous Dense Urban fabric (S.L.: 50% - 80%)
  - Discontinuous Medium Urban fabric (S.L.: 30% - 50%)
  - Discontinuous Low Density Urban fabric (S.L.: 10% - 30%)
  - Discontinuous Low Density Urban fabric (S.L.: < 10%)
  - Isolated Structures
  - Mineral extraction and dump sites
  - Construction sites
  - Land without current use
  - Green urban areas
  - Sports and leisure facilities
  - Agricultural Areas, semi-natural areas and wetlands
  - Forests
  - Water
  - Industrial, commercial or public
  - Fast transit roads and associated land
  - Other roads and associated land
  - Railways and associated land
  - Port areas
  - Airports

- **Share of Area in Land use categories**
Environmental justice: disproportionate exposure to an environmental hazard

Population characteristics

Environmental hazard

Urban characteristics

MY NEIGHBORHOOD IS KILLING ME

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Birmingham
The urban heat island is often the most intense in neighbourhoods with urban characteristics of little to no vegetation, a high population density, high building mass, lack of shade and bad building quality.

Socially deprived neighborhoods share such characteristics and people, due to their social-economic and health status, are more vulnerable to effects of urban heat island and more exposed to high air temperature.
Climate change

- Expected increase of hot summer days
- Global temperature rise +1 °C +2 °C
- Change of air flow pattern

Dutch context

- Urban heat island
- Mean deviation of annual income

Expected increase of hot summer days
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Statistical analyses
Statistical analyses

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LEGEND
Average summer day temperature

- 22.0
22.1 - 23.0
23.1 - 24.0
24.1 - 25.0
25.1 - 26.0
26.1 - 27.0
27.1 - 28.0
28.1 - 29.0
29.1 - 30.0
30.1 - 31.0
31.1 - 32.0
32.1 - 33.0

Property value

y = -2E-05x + 30,286
R² = 0.3152

Euro

20
22
24
26
28
30
32
34
50000 250000 450000
T (°C)

Social bonding

y = -1.32x + 34,852
R² = 0.3597

Index

20
22
24
26
28
30
32
34
3 5 7 9
T (°C)

Sealed soil

y = 7.4409x + 23,291
R² = 0.429

Ratio

0% 50% 100%
T (°C)

Total green

y = 4.1949x + 24,926
R² = 0.423

Ratio

0 1 2 3
T (°C)

Living environment

y = -1.7128x + 38,11
R² = 0.3706

Index

20
22
24
26
28
30
32
34
3 5 7 9
T (°C)

FSI

y = -4.1949x + 24,926
R² = 0.423

Ratio

0 1 2 3
T (°C)

Environmental hazard

Population characteristics

Urban characteristics
Hot town summer in the city! A research into the relation between Rotterdam's South socially deprived neighbourhoods and the urban heat island

Statistical analyses
Hot town summer in the city! A research into the relation between Rotterdam’s South socially deprived neighbourhoods and the urban heat island.
Observations and micro interviews
Observations & micro interviews

Micro interview retired Dutch man in the Roggestraat Tarwewijk:
• Life is good here in Tarwewijk.
• The postal code 3081 has a bad reputation.
• It gets quit hot in the summer, when I have the grand kids I let them sleep on the east side.
• A few weeks ago they rolled up a cannabis plantation.

Municipality Rotterdam: ‘Elderly don’t open the windows as they think the air draught makes them ill. Neither do they easily open the door as they are afraid they will be robbed’.
Observations & micro interviews

Micro interview with Dutch-Hindustan Woman (40+), lives in an apartment in Tarwewijk:
• During the summer it gets really warm or stuffy in the neighbourhood and my house.
• I keep the windows closed for the mosquito or drug addicted burglars.
• There has been some renovation of the inner-walls but it only helps for sound.

Micro interview with Moroccan women (40+), lives in a maisonette apartment in Tarwewijk:
• It gets really warm in my apartment, however the ground flour is much cooler.

Woonstad: The notion of the national program for Rotterdam South in terms of increase in number of houses we interpreted as adding more diversity to the neighbourhood. We are not considering increasing density.'
Neighbourhood density and public spaces
Neighbourhood’s analyses: ground and floor space
Neighbourhood’s analyses: sun study and green structure
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Neighbourhood’s analyses: public spaces
Neighbourhood’s analyses: policy documents

High burglar percentage

Small and bad insulated houses

Lack of green; no small parks or green with quality

Youth hang out at squares with nuisance

Need for more diversity of houses

Critical mass in housing and services for a diverse target audience.

Real quiet residential areas for more diversity to attract different groups.

Insufficient transport capacity

High percentage of paved surfaces and lack of green

Need for open water but not sufficient
Design interventions
Improving density with new building blocks.

Improving the quantity and quality of vegetation in the public spaces and private space and the network.

Adding water bodies.
Five main sources for design principles
Urban heat Island

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Valuation of design principles

<table>
<thead>
<tr>
<th>Score</th>
<th>Negative</th>
<th>Neutral</th>
<th>Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-1</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Heat storage / ground flux
Convection / Sensible heat

Water capacity
Water transport
Urban form
Housing mix
Parking
Density

Sun / shade
Urban characteristics
Waterplan
Urban heat Island

Score
-1
0
1
The principle of a loggia (Huijbers & Dobbelsteen, 2012, p. 84; Lenzholzer, 2013, p. 118).

Solar blinds (Huijbers & Dobbelsteen, 2012).


A pergola (Lenzholzer, 2013, p. 121).

Roofs with intensive green (Gartland, 2008; Lenzholzer, 2013, p. 162).

A green facade provides and water storage on roof (Lenzholzer, 2013, p. 123).

Heat and cold storage system (Climate Proof Cities consortium, 2014).
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Courtyard building block

LEGEND
Terraced housing building block

Water
Balcony
Grass roof in combination with water and PV
Parking lot 2.30 m by 4.50 m
Tree 9 m diameter
Tree 12 m diameter
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A mixture of bigger and smaller plants (Lenzholzer, 2013, pp. 134, 165).

Large trees (Lenzholzer, 2013).

A mixture of bigger and smaller plants (Lenzholzer, 2013, p. 169).

Water body (Meyer, 2012).

The effectively of the water body increases with vegetationy (Lenzholzer, 2013, p. 169).

Parking solution in where the parking garage is part of a terraced building block.

Improving network.
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Terraced housing block

LEGEND
Courtyard building block

Water
Grass
Grass roof in combination with water and PV
Parking lot 2.30 m by 4.50 m

Tree 16 m diameter
Elevator and staircase
Terraced housing block

LEGEND
Building block I  Indoors (i.), Balcony (b.)
Total apartments 21
Parking lots: 25
Type A: 150 m² (i.) 60 m² (b.)
Type B: 224 m² (i.) 130 m² (b.)
Type C: 161 m² (i.) 77 m² (b.)
FSI: 0.94  GSI: 0.29

LEGEND
Building block II  Indoors (i.), Balcony (b.)
Total apartments 29
Parking lots: 37
Type A: 205 m² (i.) 125 m² (b.)
Type B: 275 m² (i.) 115 m² (b.)
Type C: 185 m² (i.) 77 m² (b.)
FSI: 1.09  GSI: 0.30

LEGEND
Building block III  Indoors (i.), Balcony (b.)
Total apartments 13
Parking lots: 18
Type A: 150 m² (i.) 60 m² (b.)
Type B: 275 m² (i.) 115 m² (b.)
Type C: 161 m² (i.) 77 m² (b.)
FSI: 0.82  GSI: 0.24

LEGEND
Building block IV  Indoors (i.), Balcony (b.)
Total apartments 25
Parking lots: 34
Type A: 150 m² (i.) 60 m² (b.)
Type B: 195 m² (i.) 145 m² (b.)
Type C: 185 m² (i.) 77 m² (b.)
FSI: 1.00  GSI: 0.28
Greening private and public space

Een geveltuin aanleggen in vier stappen

Aandachtspunten voor u begint:
• Het tuintje mag niet breder zijn dan 45 centimeter;
• Na aanleg dient minimaal 1,50 meter mouter vrij te blijven voor gebruik;
• Een geveltuin legt u aan tegen de gevel van de woning, niet tegen een voortuin of in een winkelstraat;
• Gebrekkige tegels die u verwijderd heeft als rand of bewaar ze;
• Hou gaten en ontlastingspoortjes in deze gevel vrij.
• Als u een grotere geveltuin of bloembak wilt realiseren, neem dan even contact op met één van de vijf gemeenteonderbouwers via telefoonnummer 14 010.
• Deze noemt dan de oplossingen met u door aan de hand van een afsprakenlijstje dat beide partijen onderkennen;
• Druifvormige tegels gelden voor het plaatsen van een smalle bloembak op het trottoir tegen de gevel.


2. Haal het vuil niet weg en plaats de gewenste planten in het gat. Gebruik de stoeptegels die u eruit gehaald hebt om een rand aan te brengen.

3. Schep het zand voorzichtig weg tot 30-40 cm diep. (Kijk uit voor kabels en leidingen.)

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**Greening private space**

Ground covering (Lenzholzer, 2013, p. 165).

Small trees (Lenzholzer, 2013, p. 130).

**LEGEND**

Description of plants

- **GC**: Ground covering plants
- **UP**: Unpaved path
- **SH**: Shrubbery
- **NB**: Naturalizing bulbs
- **TR**: Trees
Greening streets

Greening street lanterns (Lenzholzer, 2013, p. 172).

A green facade (Lenzholzer, 2013, p. 123).

Replacing the paved surfaces of parking spaces in the public space with semi paved tiles (Lenzholzer, 2013, p. 179, ICI Consultants, 2015, p. 154).

Conscious community (Teeuw & TU Delft Faculteit Bouwkunde SMART Architecture, 2010).

An interpretation of build shade elements (Lenzholzer, 2013, p. 140).
Greening streets: Violierstraat
Greening streets: Kamperfoeliestraat
Greening private and public space: green network

Legend
- Building
- Building Island
- Grasland
- River
- Water
- Tree plantboxes
- Vegetation on and along side facade.
- Also represents semi-paved parking surfaces.
- Tree crowns
- Project borders
Greening public squares
Greening public squares
Shading public squares
Research conclusions

Rotterdam socially deprived neighbourhoods are disproportionately exposed to the urban heat island as they lack the means to escape from high air temperature both in the private and the public space.

Urban design can mitigate and adapt to the urban heat island and at the same time improve upon broader social issues, water and meet ambitions of growth.
Recommendations for further research
Research design with a broader relation of urban form and micro-climate.

Severity of high air temperature for people.

Higher resolution data of the nocturnal urban heat island phenomenon.
Questions and discussion
Methodology

Convergence Evidence
(single study)
- Documents
- Observations (direct and participant)
- Structured interviews and surveys
- Focus Interviews

Non-convergence Evidence
(separate substudies)
- Site visits
- Survey
- Documents analysis
- Findings
- Findings
- Findings
- Conclusions
- Conclusions
- Conclusions
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Social bonding

Hot town summer in the city! A research into the relation between Rotterdam's South socially deprived neighbourhoods and the urban heat island
Neighbourhood’s analyses: functions, building year and typologies

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## Population characteristics

<table>
<thead>
<tr>
<th>Age</th>
<th>Ethnicity</th>
<th>Education</th>
<th>Health</th>
<th>Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>The elderly and young are more vulnerable due to physical fragility because of young age or elderly often from diseases such as cardiovascular diseases, respiratory conditions and diabetes.</td>
<td>Are more likely to live in warmer neighbourhoods with a greater exposure to heat stress.</td>
<td>Education is linked to socioeconomic status. Lower education limited the ability to understand or access warning or recovery information.</td>
<td>Physical fragile, particular those with renal &amp; cardiovascular conditions and diabetes.</td>
<td>Physical fragile, particular those with renal &amp; cardiovascular conditions and diabetes.</td>
</tr>
</tbody>
</table>

(Cutter, Boruff, & W, 2003; Schauser et al., 2010, p. 33)

## Environmental Hazards

<table>
<thead>
<tr>
<th>Pollution</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental pollution is defined as the undesirable change in physical, chemical and biological characteristics of our air, land and water.</td>
<td>High temperature is considered hazards as it negatively influence thermic comfort resulting in misbalancing the thermal body management system also known as heat stress. Effects of heat stress our reduced concentration, learning capacity, labour productivity and sleep problems. Certain groups within a population are more vulnerable (see population characteristics).</td>
</tr>
<tr>
<td>Population characteristics</td>
<td>Urban characteristics</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Density</td>
<td>Vegetation</td>
</tr>
<tr>
<td>High density in terms of dense building construction positively correlates with urban heat island.</td>
<td>Vegetation positively relates to the evaporation of energy into the air and provides shade.</td>
</tr>
</tbody>
</table>

(EEA, 2012b; Gartland, 2008; Roth, Oke, & Emery, 1989)

(Lenzholzer, 2013; Sharma, 2009)
<table>
<thead>
<tr>
<th>Indicator / Applies to</th>
<th>Score</th>
<th>source</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Heat storage / ground flux</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heat storage or ground flux depends on the heat capacity of materials and is the biggest factor for the nocturnal urban heat island.</td>
<td>Negative: -1</td>
<td>Increases the amount of impervious surfaces or mass that collects energy from the sun re-emitted during the evening or reduces the amount of evapotranspiration.</td>
</tr>
<tr>
<td><strong>Convection / Sensible heat</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Convection is sensible heat where energy is transferred from a solid surface to a liquid or gas and as such heats the air.</td>
<td>Neutral: 0</td>
<td>-</td>
</tr>
<tr>
<td><strong>Evapotranspiration / Latent heat</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evapotranspiration is the latent heat and the combination of energy transmitted away from the Earth’s by water vapour and by plants.</td>
<td>Negative: -1</td>
<td>Decreases the amount of greenery and shallow water available for evapotranspiration.</td>
</tr>
<tr>
<td><strong>Sun / shade</strong></td>
<td>Direct radiation by the sun a strong influence on the experience of heat by the human body.</td>
<td>More exposure to direct sun light due to lack of shade.</td>
</tr>
<tr>
<td><strong>Density</strong></td>
<td>Density of urban fabric in terms of FSI and GSI are beneficial as it provides critical mass in terms of inhabitants for services and the need for more dwelling because of expected growth.</td>
<td>Density decreases</td>
</tr>
<tr>
<td><strong>Urban form</strong></td>
<td>Urban form, defined by Taleghani, that is beneficial for providing thermal comfort at reference point.</td>
<td>Singular</td>
</tr>
<tr>
<td><strong>Housing mix</strong></td>
<td>The housing mix is perceived as problematic as its to homogeneous with houses of bad quality in terms of isolation, maintenance and size.</td>
<td>-</td>
</tr>
<tr>
<td><strong>Parking</strong></td>
<td>Reducing the parking pressure on the streets, as these are often narrow, as this is perceived as nuisance by the residents.</td>
<td>The parking pressure increases due to reasons of increased population density without providing sufficient parking places.</td>
</tr>
<tr>
<td>Public squares</td>
<td>The quality of public spaces in terms of greenery, playgrounds and benches.</td>
<td>The quality of a public space declines caused by reduction in one of the indicators as described in (Gebiedscommissie Feijenoord, 2014)</td>
</tr>
<tr>
<td>----------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Water storage capacity</td>
<td>The capacity of a neighbourhood to temporal store water as a cause of heavy rainfall.</td>
<td>The amount of water capacity reduces.</td>
</tr>
<tr>
<td>Water transport</td>
<td>Transport capacity to water bodies like ‘singels’.</td>
<td>The transport capacity to water bodies decreases.</td>
</tr>
</tbody>
</table>
### Casualties during heat wave of 2003

<table>
<thead>
<tr>
<th>Location</th>
<th>Additional causalities</th>
<th>Increase (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>England and Wales</td>
<td>2091</td>
<td>17</td>
</tr>
<tr>
<td>France</td>
<td>14802</td>
<td>60</td>
</tr>
<tr>
<td>Germany</td>
<td>1410</td>
<td>-</td>
</tr>
<tr>
<td>Italy</td>
<td>3134</td>
<td>15</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>1400-2200</td>
<td>-</td>
</tr>
<tr>
<td>Portugal</td>
<td>1854</td>
<td>40</td>
</tr>
<tr>
<td>Spain</td>
<td>4151</td>
<td>11</td>
</tr>
<tr>
<td>Switzerland</td>
<td>975</td>
<td>7</td>
</tr>
</tbody>
</table>
Heat and the human body

- Respiration
- Infra-red radiation
- Metabolism
- External
- Conduction
- Sun or other radiation
- Direct radiation
- Reflected radiation
### Effects of heat

<table>
<thead>
<tr>
<th>Effect</th>
<th>Symptoms</th>
<th>Mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuisance</td>
<td>Irritable, lethargic, reduced alert, sleep disturbance, headache, dizziness, concentration problems, anxiety, muscle pain</td>
<td>Change of psychological functioning and social interaction with others</td>
</tr>
<tr>
<td>Sleep disturbance</td>
<td>Loss of concentration, tired, listless, irritable</td>
<td>Decrease in sleep quality that results insufficient recovery</td>
</tr>
<tr>
<td>Edema</td>
<td>Non painful swelling of ankles in which a well can be pushed</td>
<td>Withdrawal of fluid from the bloodstream by dilating blood vessels</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blockage of sweat glands</td>
</tr>
<tr>
<td>Rash</td>
<td>Itchy blisters and redness</td>
<td>Blockage of sweat glands</td>
</tr>
<tr>
<td>Heat exhaustion, heat syncope, heat exhaustion</td>
<td>General: dry mouth, tired, dizziness, headache \n Skin: red, sweating \n Body temperature to 40 ° C</td>
<td>Moisture loss through transpiration and dilation of blood vessels</td>
</tr>
<tr>
<td>Heat Cramps / muscle Cramps</td>
<td>Skin warm and dry</td>
<td>Extreme loss of fluid and salts through sweating at effort</td>
</tr>
<tr>
<td>Heat stroke</td>
<td>General: confused, drowsy, unconscious \n Body temperature above 40 ° C</td>
<td>Skin warm and dry \n Extreme loss of fluid and salts by perspiration</td>
</tr>
</tbody>
</table>
Perceived quality of life

- Moderate to severe loneliness
- Socially loneliness
- Residents with overweight
- Obese
- Difficulty making ends meet
- Quality of life
- A sufficient for green
- Experiences health as really good
- Mildly or fully unhappy
- A sufficient for green in the neighbourhood

Perceived quality of life

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Safety index

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**Income threshold**

<table>
<thead>
<tr>
<th>Neighbourhoods</th>
<th>Temperature</th>
<th>Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afrikaanderwijk</td>
<td>30.8</td>
<td>13000</td>
</tr>
<tr>
<td>Feijenoord</td>
<td>29.8</td>
<td>13100</td>
</tr>
<tr>
<td>Hillesluis</td>
<td>30.1</td>
<td>13300</td>
</tr>
<tr>
<td>Tussendijken</td>
<td>29.7</td>
<td>13400</td>
</tr>
<tr>
<td>Spangen</td>
<td>29.2</td>
<td>13600</td>
</tr>
<tr>
<td>Bloemhof</td>
<td>29.9</td>
<td>14100</td>
</tr>
<tr>
<td>Oud Crooswijk</td>
<td>28.7</td>
<td>14300</td>
</tr>
<tr>
<td>Bospolder</td>
<td>30.6</td>
<td>14600</td>
</tr>
<tr>
<td>Tarwewijk</td>
<td>29.6</td>
<td>14900</td>
</tr>
<tr>
<td>Oude Noorden</td>
<td>29.8</td>
<td>16100</td>
</tr>
<tr>
<td>Delfshaven</td>
<td>30.1</td>
<td>16400</td>
</tr>
<tr>
<td>Oude Westen</td>
<td>29.5</td>
<td>16800</td>
</tr>
<tr>
<td>Oud Charlois</td>
<td>28.2</td>
<td>17300</td>
</tr>
<tr>
<td>Agniesebuurt</td>
<td>30.4</td>
<td>17700</td>
</tr>
<tr>
<td>Carnisse</td>
<td>28.3</td>
<td>18100</td>
</tr>
<tr>
<td>Nieuw Mathenesse</td>
<td>32.9</td>
<td>-</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>single</th>
<th>couple</th>
<th>parent</th>
<th>average</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>no</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

- **Lower income threshold**: 10.100 13.900 16.900 19.000 13.500 15.000 14.800
- **‘not much but adequate’-threshold**: 10.600 14.500 17.700 19.900 14.100 16.000 15.500
Hot town summer in the city! A research into the relation between Rotterdam’s South socially deprived neighbourhoods and the urban heat island

Population growth

LEGEND
Municipal population growth compared
- - Prognosis 2016-2035
- - Prognosis 2013-2030
- - Prognosis 2010-2025
- - Realized 2015
<table>
<thead>
<tr>
<th>Topic</th>
<th>Scale</th>
<th>Policy document</th>
<th>Main points</th>
<th>Source</th>
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</table>
| Housing          | Rotterdam South| National program| • Need for critical mass in housing and services for a diverse target audience.  
• Need for quiet residential areas to create more diversity in housing to attract different groups.  
• Private owned small apartments are worrisome. | (programmbureau NPRZ, 2015)                 |
| Population       | Rotterdam      | Chart of the city| • Population of Rotterdam is growing with 40,000 more in 2025 according to the prognosis 2015-2035 then a previous prognosis of 2010-2015. | (Stadsontwikkeling Rotterdam, 2015)         |
| varied           | Afrikaanderwijk| Area plan city district | • Streets have high percentage of pavement.  
• Afrikaanderwijk needs improvement of its shopping street.  
• Improvement of the facades  
Parking pressure is high. | (Gebiedscommissie Feijenoord, 2014)          |
| varied           | Bloemhof       | Area plan city district | • High burglar percentage.  
• Small and bad insulated houses.  
• Lack of green; no small parks or green with quality.  
• Youth hang out at squares with nuisance.  
• Diversity of houses. | (Gebiedscommissie Feijenoord, 2014)          |
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| varied    | Hillesluis  | Area plan city district Feijenoord | • Transition neighbourhood: people don’t stay long.  
• Homogenous type of housing.  
• Create room for meeting, playing and relaxing.  
• More diverse houses.  
• Improvements public space and facade of the boulevard. | (Gebiedscommissie Feijenoord, 2014)                                                        |
<p>| Water     | City district Feijenoord | Waterplan 2013 | Afrikaanderwijk, Bloemhof and Hillesluis do not meet the requirements for the norm for water nuisance. | (Gemeente Rotterdam, Waterschap Hollandse Delta, Hoogheemraadschap van Schieland en de Krimpenerwaard, &amp; Hoogheemraadschap van Delfland, 2013) |</p>
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<tbody>
<tr>
<td>Water</td>
<td>Afrikaanderwijk, Tarwewijk, Hillesluis and Bloemhof</td>
<td>Waterplan Feijenoord and Charlois</td>
<td>With a high percentage of paved surfaces, lack of green and insufficient transport capacity there is a need for open water to give the water system a quantitative and qualitative new impulse. However due to a high density, a higher ground surface and limited capacity in its surrounding water system there is a need for innovative solutions.</td>
<td>(Gemeentewerken, 2010)</td>
</tr>
</tbody>
</table>
| Density and greenery      | Rotterdam make stad verdichten + vergroenen = duurzame stad | Rotterdammers          | • Higher density stimulates walking and cycling.  
• Higher improves employment as the demand for services increase.  
• Higher density intensifies the use of greenery. | (Tillie, 2012)                |
Hot town summer in the city! A research into the relation between Rotterdam’s South socially deprived neighbourhoods and the urban heat island.
Building block micro climate performance

LEGEND
Mean radiant T (°C) at reference point

- Singular E-W
- Singular N-S
- Linear E-W
- Linear N-S
- Courtyard

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