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Tehrān-Karaj

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The Shahre Javan Community Detailed Plan

Planning for a Climate Responsive and Sustainable Iranian Urban Quarter

Elke Pahl-Weber, Sebastian Seelig, Holger Ohlenburg (Eds.)

Land Use Categories	Area in ha	Area in % of Total	Per Captiva in m²
Residential	1,231,348.74	2.85	78.25
Commercial	23,233.28	0.05	1.48
Residential—Commercial	8,998.08	0.02	0.57
Educational—Kindergarten	1,141.75	0.0026	0.07
High Level Education (University)	30,495.57	0.07	1.94
Religious	3,108.59	0.01	0.20
Cultural	66.25	0.0002	0.0042
Park and Green Spaces	769,022.96	1.78	48.87
Sport	48,773.91	0.11	3.10
Sanitary	51,823.57	0.12	3.29
Administrative	31,324.04	0.07	1.99
Military-Police	3,481.99	0.01	0.22
Urban Infrastructure	35,873.24	0.08	2.28
Urban Equipment	17,077.11	0.04	1.09
Parking	1,800.99	0.0042	0.11
Roads	3,303,163.52	7.63	209.91
Vacant (Previously Developed)	37,642,882.24	87.0	2,392.15
Sum	**43,266,417.35**	**100.00**	**2,749.52**

Tab. 5: Existing land use in Hashtgerd New Town

Land Use Categories	Area in m²
Housing	221,207.8
Administrative and military	4,380.49
Local shopping center	5,546.74
Regional shopping center	1,758.32
Kindergarten	1,607.6
Primary school	10,045.2
Secondary school	7,020
Cultural	1,669.03
Green space	40,287.70
Green boundary	3,724.54
Streets network	54,812.95
Sum	**352,060.39**

Tab. 6: Proposed land use within the Shahre Javan Community area (without extended planning area)

2.2 Architectural Studies

Philipp Wehage | Elke Pahl-Weber

The common housing typology is based on an orthogonal urban layout in Hashtgerd New Town and the Shahre Javan Community area as intended in the 'medium occupancy' scheme in the Hashtgerd New Town comprehensive plan (NTDC 1993 and Paykadeh Consulting 2008a) (see Tab. 7). According to this system, buildings are oriented in a north-south direction, such as that access to the buildings is either from the north or the south. The plots are arranged in a rectangular layout without regard to topography. The common plot width is 15 to 18 m. The common plot area is about 600 m². The position of the building volume on the plot is defined by regulations on distance, which are based on light exposure, privacy aspects, and regulatory plot coverage (see Fig. 29). Ignoring light orientation, staircases are often arranged towards street-side façades. This type of attached buildings ('closed coverage type') brings about a southerly oriented linear structure of building volumes in a "back to back" arrangement (see Fig. 30 and 31). The linear arrangement of the buildings makes for uniform linear open spaces oriented towards the public and private sides of the houses (see Fig. 32). The only spatial measure for defining the private open spaces is the enclosure of the plots with walls. Thus, the spatial boundaries for the north-south oriented open spaces, e.g. streets and parks following the topography, are not properly defined (see Fig. 33). Furthermore, the ends of the linear building structures simply cut off with a closed shear wall, lacking any architectural corner design.

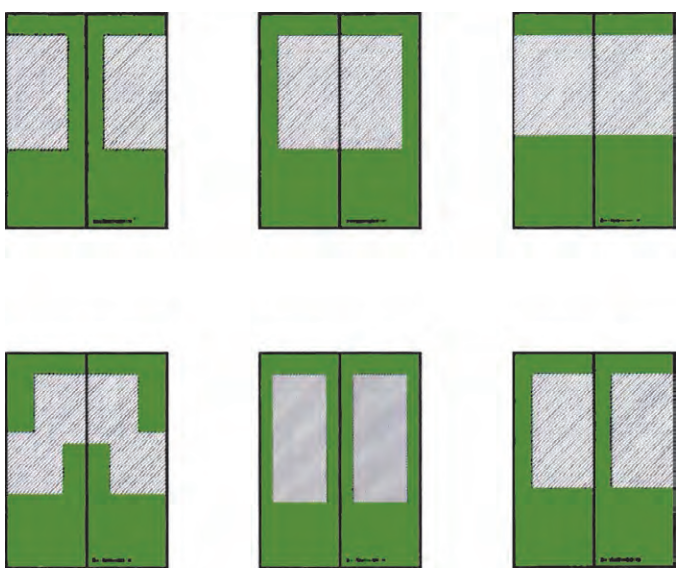


Fig. 29: Volume positions on plots in Hashtgerd New Town (BHRC 2006)

According to the Iranian tradition, the hierarchy from public to private is a central element of architectural and urban design. In the traditional Iranian city, a well defined spatial system in a dense urban context guides the residents through different levels and scales of privacy. Every scale of privacy (from town to quarter, to neighborhood, and to house) and the barriers between these scales are defined by architectural features, which are accepted and understood by Iranian inhabitants. The combination of local habits, hierarchic access systems, and the specific location creates an urban identity. In the tradition of vernacular architecture and urban design in Iran, introversion is the spatial base for the sense of place (cf. Bianca 1991, pp. 196–252). Introversion allows for a climate adapted dense urban configuration and for privacy as the main requirements of the socio-cultural context. The introversion of the traditional courtyard house is the spatial expression for the need of tranquility and intimacy (cf. Wirth 2000, pp. 325–336). Areas for access, guests, services, and family life are integrated in a well-defined floor plan around a central courtyard. The adaption of modern 20th century western housing typologies in Iran reorganized the housing complex as an extroverted space. The definition of space, as known in the introverted Islamic tradition, was turned 'inside out'. This new approach offered the advantage of light and air exposure from the outside, leading to the possibility of the vertical organization of floors. However, the former central space of the courtyard could not be included within such extroverted building. Thus, the centralized scheme of the introverted house had to be transformed into a linear scheme orienting the main living zones to the façade. Thus, the formerly horizontal neighborhood organization scheme was turned into a vertical scheme. As a consequence, the stairway was adapted as a vertical

No.	Type of Occupancy (plot ratio)	Building Area	Phase 1	Phase 2	Phase 3
1	**Residential Garden** (one to two stories)	Plot Ratio	–	–	35% 350, 351–700, 701–1000, 1001–1600 40 % 35 % 30 % 25 %
	Low (one to two stories).	Building Area for the Plot Ratio	60 % 75 %	60 % 250, 251–300, 301–400 90 % 85 % 75 %	50 % 80 %
	Medium (three to four stories)	Building Area for the Plot Ratio	55 % 160 %	55 % 160 %	55 % 140 %
	High	Building Area for the Plot Ratio	35 % 240 %		35 % 220 %
	High-Rise				
	Terrace Apartment	Building Area for the Plot Ratio			80 % 120 %

Tab. 7: Calculation of building area (BHRC 2006)

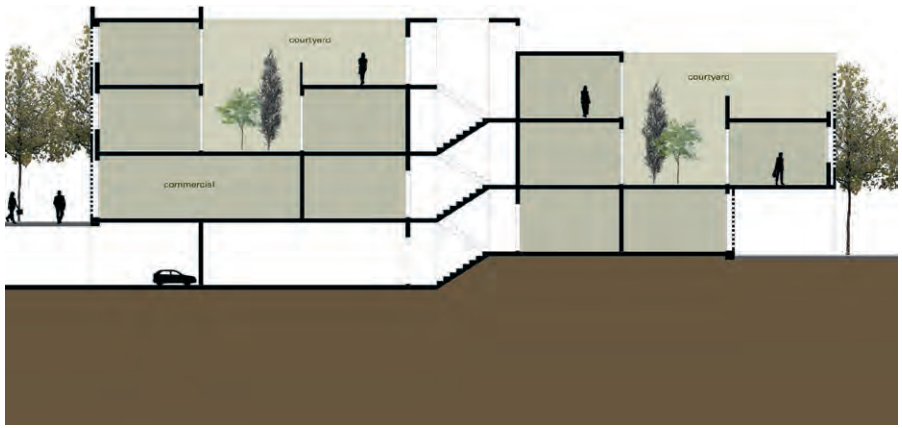
Fig. 30: Access system of housing typologies
Fig. 31: Orientation of existing housing typologies,
both figures: north of Shahre Javan Community (Wehage/TUB 2010)

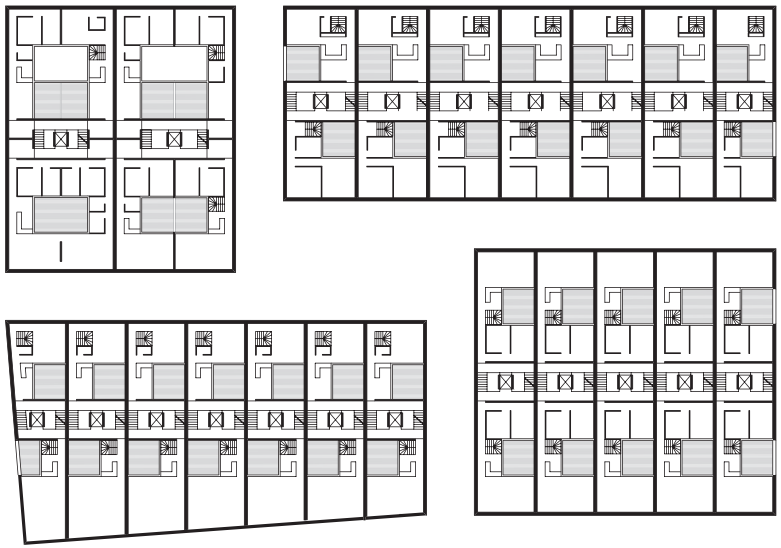
Fig. 32: Linear building arrangement of existing housing typologies
Fig. 33: Endings of linear building arrangements, both figures:
north of Shahre Javan Community (TUB 2009)

architectural 'dead end' and displaced the role of the semi-private space in Islamic tradition (cf. Wirth 2000, pp. 325–336).

The contradiction between the spatial organization of privacy in dense urban configuration and the linear arrangement of vertical housing typology is not solved in the existing housing schemes of Hashtgerd New Town. The approach for the housing typologies of the Shahre Javan Community tries to address this issue by a contemporary design, in which the combination of privacy and energy efficiency in a dense urban arrangement is realized in the language of the courtyard typology. By accepting the spatial hierarchy from public to private, this housing typology design creates identity while integrating the needs and habits of both present and future users (see Fig. 34 to Fig. 37).

The housing typologies developed here transfer the concept of introversion into the vertical dimension. The buildings on small plots (type 7.5 m to 9 m) are organized as maisonette units around a central courtyard,





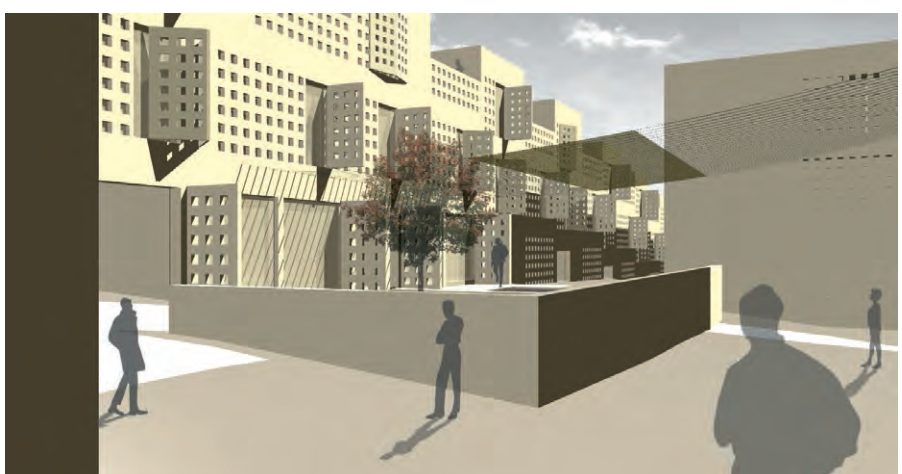


Fig. 34: Systematic section of vertical courtyard house (Wehage, Timme/TUB)
Fig. 36: Housing typologies, view into the semi-public sub-neighborhood courtyard (Timme/TUB 2009)

Fig. 35: Housing typologies, vertical courtyard housing, section (Timme/TUB 2009)
Fig. 37: Housing typologies, view from the terrace into sub-neighborhood (Timme/TUB 2009)

which serves as the private open space for every unit. On the bigger plots (15 m), the courtyard can be shared due to its larger dimensions. The spatial formulation of the volume in the upper floors (such as formulation of niches) allows for sunlight even in the rear parts of every unit. Moreover, it guarantees privacy. The flexible organization of floors around the courtyard allows for zoning of the living rooms depending on privacy and climate. Moreover, organization of the flats around the inner courtyards fosters light exposure and ventilation for every living room. The façades facing the public space are characterized by a grid of small scale openings, which allow supplementary light exposure, regulated by architectural measures such as mechanical sunblinds. Units on the ground floor can be used as small-scale mixed-use units (see Section 3.1). A central staircase in the middle of the building structures the space. In order to allow for barrier free access, escalators can be installed (for further details see 3.2 and 3.3).

3 Proposed Goals, Strategies, and Measures

Six main goals have been set for the urban development of the Shahre Javan Community pilot project:

Goal 1: Resource and energy efficiency, incl. reduction of CO_2 emissions;

Goal 2: Environmental protection and improvement;

Goal 3: Strengthening local identity;

Goal 4: Flexible and adaptable structures;

Goal 5: Sufficient supply of green and open spaces;

Goal 6: Unrestricted accessibility.

Each goal also has a set of sub-goals. An overview of the goals and sub-goals is given in Fig. 101. The goals and sub-goals, as well as the strategies and measures for achieving them, are restated and elaborated in the sections that follow.

Planning Dimension	Goal	Sub-goal
Urban Planning	1	1.1 Energy efficient forms of land use based on mixed and dense land use models
		1.2 Efficient infrastructure in a dense and compact urban form
	2	2.1 Protection of soil, water, flora and fauna, and improvement of the local micro-climate
	3	3.1 Protection of the local environmental values
	4	4.1 Enabling the adaption of the neighborhood to future requirements
Urban Design	1	1.3 Reducing fossil energy demand for cooling and heating
		1.4 Compactness in order to reduce building surfaces
		1.5 Compactness through a reduction of building height
	3	3.2 Identity of urban design through a strong spatial hierarchy
	4	4.2 Flexible plot design with development potential
Architecture	1	1.6 Natural light for living zones and passive solar energy gain
		1.7 Reducing the embedded energy of materials and construction
	3	3.3 Ensuring privacy and respecting socio-cultural habits within a compact urban form
		3.4 Strengthening identity through architecture
	4	4.3 Regulation of floor zone use by location
		4.4 Flexible floor use while keeping light and sun exposure in compact housing
		4.5 Flexibility of unit sizes
Landscape Planning and Environment	1	1.8 Saving water
		1.9 Saving energy
		1.10 Carbon-binding measures for climate protection
	2	2.2 Improvement of the micro-climate near residential areas
		2.3 Protection, maintenance, and development of the natural environment and landscape
	5	5.1 Sufficient supply of public green spaces near residential areas
		5.2 Provision of private green spaces

Planning Dimension	Goal	Sub-goal
Transport and Mobility	1	1.11 Reduction of fuel demand
		1.12 Support of mixed land use approach
		1.13 Maximization of coverage with public transport stops
		1.14 Reduction of car ownership and use within Shahre Javan Community
	2	2.4 Support of environmentally friendly traffic (slow modes)
		2.5 Support of public transport
		2.6 Avoidance of through-going traffic
		2.7 Minimization of soil sealing and creation of rainwater infiltration areas
		2.8 Minimization of traffic noise emissions
	6	6.1 Barrier-free mobility within Shahre Javan Community
		6.2 Improvement of traffic safety
		6.3 Maximization of public transport stations
Water and Waste Water	1	1.15 Saving water and energy by reducing water consumption
		1.16 Saving water and energy by recycling waste water in wetlands
Energy Supply	1	1.17 Reducing the total energy demand and fossil fuels need for heating and cooling
		1.18 Reducing the water demand for cooling

Fig. 101: Goals and sub-goals in order to achieve climate responsiveness and resource efficiency

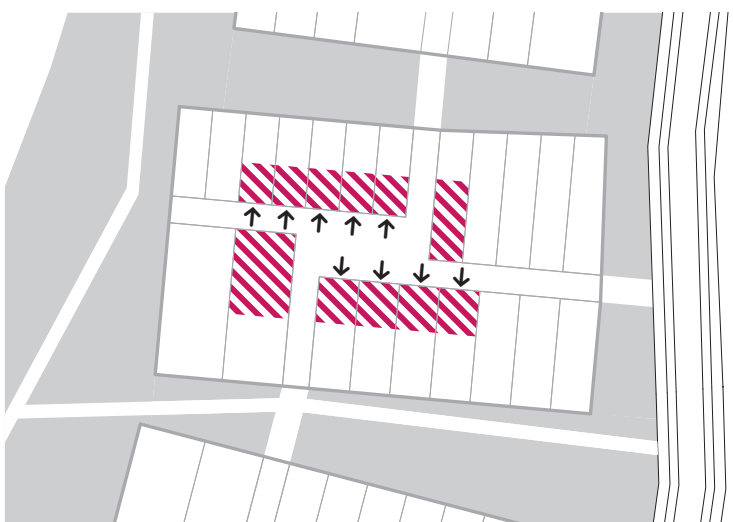
Goal 1: Resource and energy efficiency incl. reduction of CO_2 emissions

Sub-goal 1.1: Energy efficient forms of land use based on mixed and dense land use models

Strategy: The analysis of the reports of Paykadeh Consulting (see Section 2.1) showed an urgent need for new flexible spaces, in the form of mixed land use models in respective housing typologies, to meet the needs of current inhabitants and future private investors. The concept for the Shahre Javan Community area envisions a medium urban density and a land use concept based mainly on both horizontally and vertically mixed uses.

Measures: Mixed land use patterns are characterized by two or more uses in one building (vertical mix) or by two or more uses in separated, adjacent units (horizontal mix). Mixed use areas help foster a vital and lively city by shortening distances between infrastructures for housing, work, supply, and social activities, encouraging walking and, thereby, reducing the need for motorized transport. Consequently, mixed land use patterns provide an important incentive for changing mobility behavior, reducing both energy consumption and CO_2 emissions. Due to these advantages, the land use system introduced is based on mixed-use structures. The entire Shahre Javan Community area is designated as a Mixed-Use District (MUD). A MUD encourages developments consisting of residential uses mixed horizontally and vertically with retail, non-disruptive commercial, or office uses as well as educational or cultural uses. A horizontal mix implies that larger commercial, traffic intense land uses are located adjacent to the residential uses but at the edge of the neighborhood. Larger commercial functions include a regional shopping center, an office building, and a secondary school. These uses have larger catchment areas with a regional impact. The secondary school will be used by approx. 20,000 to 40,000 inhabitants and the regional shopping center by 5,000 to 15,000 inhabitants. Hence, they imply car traffic and public transport. Allocating the larger commercial uses at the neighborhood's edge will ensure efficient access by public transport and keep the cars out of the residential neighborhood. The social functions (a mosque, attached cultural functions, a kindergarten, and a primary school) are located next to the residential areas at the heart of the Shahre Javan Community. The central location of social amenities, all within a walking distance of 300 m, guarantees access by foot for most of the children. Finally, social uses are coordinated with the public transport system.

Most of the mixed uses are organized in so called 'Vertical Mixed-Use Units' (VMUs). In order to achieve fine-grained, small scale mixed-use zones, the VMUs are introduced on the sub-neighborhood scale. Small, decentralized neighborhood centers, where commercial and so-



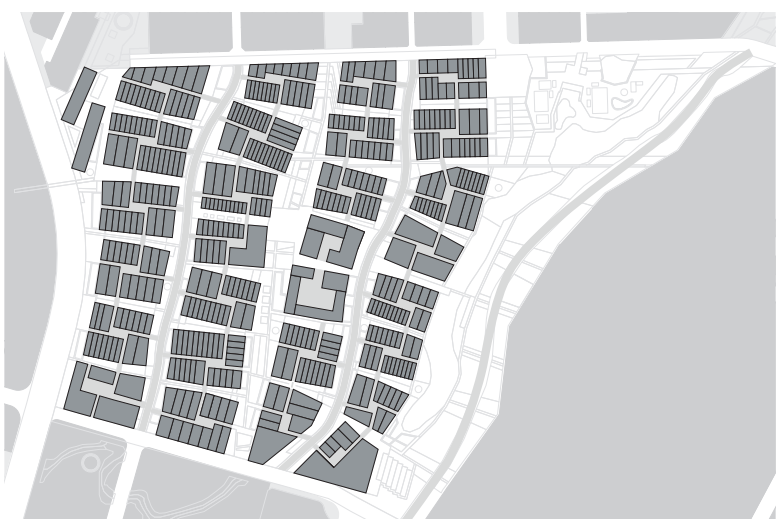


Fig. 102: Small-scale mixed-use areas around the courtyards
Fig. 103: Scheme of commercial areas on the ground floor
Fig. 104: Urban form

cial functions are within walking distance, will cater to everyday needs. The VMUs are concentrated around and face inwards towards the courtyards of each sub-neighborhood, making them lively and vibrant neighborhood centers. VMUs combine primary functions, such as residential uses, with small scale commercial and social uses, such as convenience shops for the daily needs, service units for the supply of the neighborhood (crafts, restaurants, copy shop, barber), and small scale social amenities (e.g. neighborhood center). In order to minimize car traffic, the vertical mixed-use concept is connected with the city-wide public transport concept as well as to walking and cycling routes. The catchment area of each unit is planned at 500 inhabitants.

Fig. 105: Principle of accessibility
Fig. 106: Catchment areas of public transport (Orange: minibus, Green: tram and bus)

Sub-goal 1.2: Efficient infrastructure in a dense and compact urban form
Strategy: Spatial and functional integration of dense and compact urban and infrastructure systems such as traffic, energy, and water.

Measures: The analysis of different infrastructure systems in Hashtgerd New Town has highlighted an urgent need for more efficient water (including waste water disposal), energy, and transport systems.

Dense urban form allows for more efficient infrastructure and also enhances efficiency in resource use. One central goal for the Shahre Javan Community area is to reduce travel distances and, thus, the volume of on-site traffic by concentrating people, uses, and activities at medium population and building densities. This creates compact neighborhoods with short distances, potentially changing the travel behavior of the individual inhabitants away from car towards walking, cycling, and public transport. Thus, the density approach requires a city-wide public transportation system connected to the Shahre Javan Community area and well-connected walking and cycling routes on-site. Moreover, a dense settlement model, with high utilization density and rates, is especially suitable for the implementation of decentralized water disposal systems. This includes decentralized waste water treatment plants, like constructed wetlands, which can play an important dual role by contributing to the irrigation of parks and green areas (see App. 9).

Moreover, since compact building structures have a higher heat density, they are better for energy efficient grid-bound supply systems than less compact structures. This translates into an energy concept based on co-generation of both heat and power from natural gas. Co-generated heat will be distributed via district heating networks and solar cooling will be provided by decentralized absorption chillers (powered by solar thermal energy and district heating) (see App. 15).

Goal 2: Environmental protection and improvement

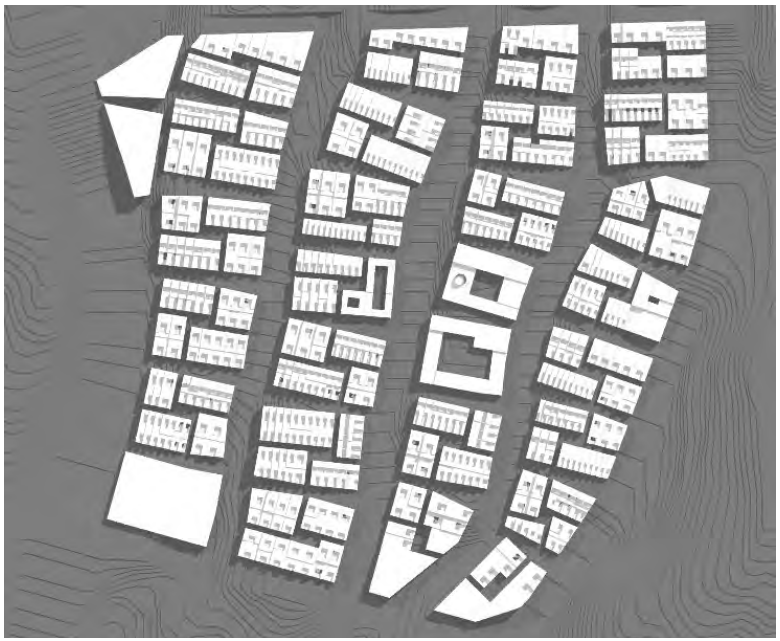
Sub-goal 2.1: Protection of soil, water, flora and fauna, and improvement of the local micro-climate
Strategy: The pilot project minimizes soil sealing, enhancing the protection of flora and fauna and improving the micro-climate (e.g. through infiltration of rainwater into the soil and evaporation humidity). Planting appropriately adapted plants further supports this effect.

Measures: In order to avoid sprawled and dispersed development patterns, with the associated negative ecologic, economic, and social effects, the growth of the settlement area should be reduced by encouraging a dense settlement structure. Measures to ensure compact city structures cannot be proposed in the detailed plan, and should, therefore, be included in both the high-level comprehensive plan and the settlement development at the municipal level.

On the Shahre Javan Community neighborhood scale (level of the detailed plan), the soil should be protected in order to avoid harming natural functions, such as habitat, retention of precipitation water, filtering, and chemical buffering (for further details see Section 2.3). Moreover, a higher percentage of not-built-up areas reduces the heat-island effect by leaving room for vegetation with its associated cooling and humidity functions. Vegetation on the Shahre Javan Community plot, irrigated with treated greywater, reduces the heat island effect by providing shade and humidity. The following measures are central for reducing negative soil impacts:

a) Taking the existing topography into consideration when planning and designing urban structures in order to avoid and reduce soil movement and deposition;
b) Density and compactness of settlement patterns with medium to high urban density and compact urban form (see Fig. 107 and Fig. 109); and
c) Reduction of sealed access areas by efficiently using sealed areas and minimizing streets and paths in the Shahre Javan Community area (see Fig. 108).

Concerning a) The design recognizes the local topography and adapts the design to the environment. Locating the residential clusters on the ridges and the streets in the valleys minimizes soil movements.



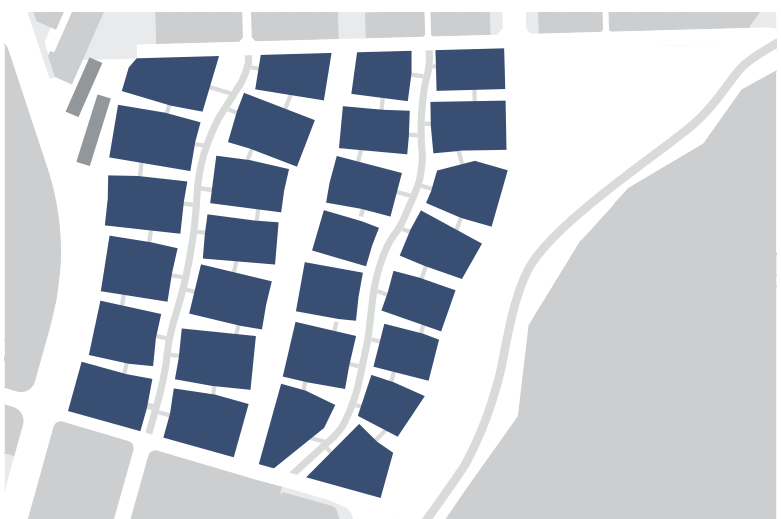


Fig. 107: Building windows

Fig. 108: Early layout visualization of Shahre Javan Community area pilot project
Fig. 109: Building windows, urban structure

Concerning b) The building masses on the Shahre Javan Community area are organized in four rows with 28 compact urban clusters stretching from north to south of the site and a density of 228 inhabitants per ha. The first comprehensive plan density can be achieved with a more compact urban form and reduced built-up areas: 56 % of the area is built-up area compared to 72 % of the comprehensive plan proposal by NTDC. There is more open space than was anticipated in the comprehensive plan, which benefits the micro-climate by minimizing soil impacts and leaving space for planting adapted vegetation.

Concerning c) Sealed areas can be reduced by minimizing sealed traffic access systems. The site is accessed by two main north-south roads, whose width is reduced to 13 m (compared to 16 m proposed in the first comprehensive plan). Neighborhood clusters themselves are accessed by foot and bike via a six meter wide path from the access streets. The north-

south connecting paths provide excellent accessibility by foot and bike for the entire Shahre Javan Community area. Cars are not desirable, but service and emergency mobility is provided. This introverted access system allows for a compact urban fabric and a reduction of the infrastructure areas.

In order to achieve the desired density, the built-up area must be regulated by the definition of building line boundaries (building windows) and by a numeric qualification regulation of the density inside the buildings. The Floor Area Ratio (FAR) is a tool for creating numeric qualifications. It indicates the relation between the total floor area of all of stories of a building and the size of the parcel. Thus, a FAR of 2.0 would indicate that the total floor area of a building is two times the gross area of the plot, on which it is constructed. FAR defines the maximum density for every plot, with the volume and floor area ratio of plot layouts in the Shahre Javan Community varying with differences in topography and design concept. Access areas are reduced with the provision of underground parking below the buildings and paths of the sub-neighborhoods. Sealed access routes to the underground parking are minimized by direct entrances from the access roads in the valleys.

Measures: The analysis in Section 2.3 has shown that Hashtgerd New Town's natural features are its major assets, including significant topographic features, flora and fauna, and surrounding vistas. A major goal is the protection of these features with topography as the top priority. Shaped by temporary surface run-off from the Alborz Mountains in the north, the area is characterized by alternating ridges and valleys (see Fig. 110 and Fig. 111 as well as Section 2.3).

This natural formation is a distinct local feature of the area. It has great environmental significance, since it affects the aesthetic character of the area, its micro-climate, its drainage, and views. Therefore, its protection deserves precedence. This is the main motivation of compact urban clusters and access systems, which adapt to the local topography. The 28 compact clusters are located on the ridges of the hills. The main access systems are located in the valleys. This adaption of the urban design and the access system to the topography reduces earth moving work to a minimum while protecting the soil. The second major aim is the integration of the Shahre Javan Community area's existing vegetation and plants into the urban concept. Since vegetation is scarce, this aim mainly focuses on keeping the green corridor on the eastern edge. Due to the importance of the valley east of the Shahre Javan Community area, the plan proposes a reorganization of the eastern access roads in order to minimize the impacts on the existing vegetation and watercourse. The third major measure limits building height to three stories in order to keep the views of the surrounding low-lying areas south of Hashtgerd New Town.

Fig. 110: Topography east adjacent to the planning area

Fig. 111: Vistas over the extended planning area into the lowlands from the north-eastern edge of the planning area

Goal 3: Strengthening local identity

Sub-goal 3.1: Protection of the local environmental values

Strategy: The identity of the site itself can be significantly enhanced by integrating the quality of the environment, the site topography, the existing landscape scenery, and the local views into the planning concept.

Goal 4: Flexible and adaptable structures

Sub-goal 4.1: Enabling the adaption of the neighborhood to future requirements

Strategy: Robust and flexible land use concepts, parceling concepts, and building typologies together allow for a phased development and adaption to the changing requirements of users.

Measures: The analysis of Section 2.1 has shown that, currently, Hashtgerd New Town has severe problems attracting inhabitants. This situation requires a flexible urban concept, which would allow Hashtgerd New Town to adapt to an uncertain demographic and economic future. A modular site development plan, which permits a phased, step-by-step development of the area, is a central measure for developing the Shahre Javan Community area in a flexible and adaptable way. This allows the area to be developed in different stages, depending on the interest of potential investors. Introducing a hierarchic spatial system of modules (sub-neighborhoods) supports this phased development approach. The modular parceling system defines five standard widths of building types for the entire Shahre Javan Community area (6 m, 7.5 m, 9 m, 12 m, and 15 m). The broad range of parcel depths is also designed to support long-term adaptability. The parceling approach is backed by flexible regulatory land use frameworks prioritizing mixed-use development (cf. Goal 1). Flexibility and adaptability are also applied to supply and disposal systems, such as those for water and energy (see e.g. for energy App. 15). The fact that a decentralized supply and disposal system can be expanded in stages—and financing can be spread out accordingly—is another significant asset for the project.

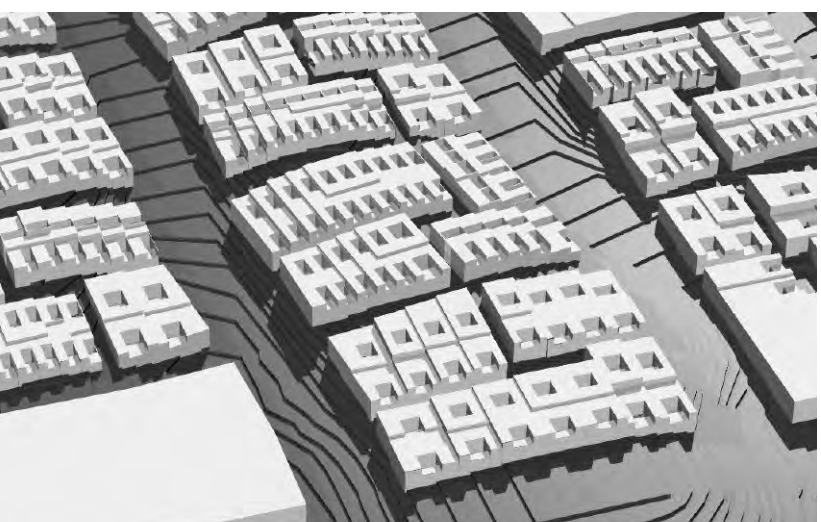


Fig. 112: Integration of topography into design

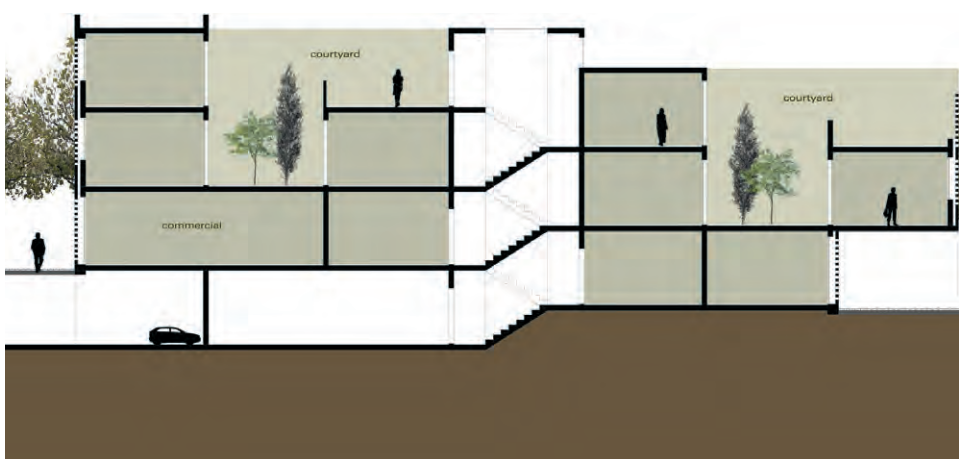


Fig. 113: Limitation of height to three floors

3.2 Urban Design

Philipp Wehage | Sebastian Seelig | Elke Pahl-Weber

Goal 1: Resource and energy efficiency incl. reduction of CO_2 emissions

Sub-goal 1.3: Reducing fossil energy demand for cooling and heating

Strategy: In order to reduce fossil fuel consumption, the urban design should support utilization of renewable energies. Hashtgerd New Town's semi-arid climate, with approx. 4,100 h of sunshine per year, a high solar altitude (77 in summer), and the perfectly suited topography of the south side of the Alborz Mountains, the Shahre Javan Community area has high potential for passive solar gain, a potential, which should be exploited.

Measures: Building orientation is chosen both to maximize the solar gains for passive use (minimizing of cooling and heating energy use) and to exploit the active use of regenerative energy systems (photo-voltaic for heating and cooling, solar thermal power). In Hashtgerd New Town, this requires orienting the buildings primarily north-south. The Shahre Javan Community area is located on a north-south running slope; the sub-neighborhoods are placed on the ridges of the slope in a southerly orientation for best sun exposure.

Sub-goal 1.4: Compactness in order to reduce building surfaces

Strategy: The relation of a building's surface to its volume defines its compactness. Compactness is crucial for the energy efficiency of buildings, the more surface area to volume a building has, the easier the building envelope transmits temperature, increasing the energy required to heat or cool the structure.

Measures: Closed coverage design in the urban concept increases compactness by avoiding surfaces on two sides. Only the corner plots at the end of every building group add additional surface. Compactness also supports the shading open spaces. Given Hashtgerd New Town's semi-arid climate, encouraging shading is critically important. In addition to intentional shading devices, shading can be achieved by configuring the compact built environment such that the ratio of building height to inter-building space enables the shading of open areas (see Fig. 114 to Fig. 116).

Sub-goal 1.5 Compactness through a reduction of building height
Strategy: An energy efficient structure is characterized by simple building measures (see also Section 3.3). Reducing the height of buildings also reduces the effort required for construction. The reduction of the building height also minimizes distances of built-up areas and increases light exposure even in compact urban form.

Measures: Building heights should include considerations of efficient construction technologies as well as the desire for natural lighting. In order to enhance earthquake resistance, the buildings should be low rise, with the added benefit of further reducing construction efforts. Thus, the plan's medium building density should be achieved with a low-rise development with a moderate number of stories, which allows natural light at every floor and a simple technical and constructive supply.

Goal 3: Strengthening local identity
Sub-goal 3.2: Identity of urban design through a strong spatial hierarchy
Strategy: In order to create identity on an urban scale, the spatial organization has to follow a logic, which will be accepted and understood by the users. Thus, the spatial system is based on a spatial hierarchy of very public to very private spaces. This approach supports the importance of privacy in the built environment in Iran.

Measures: The logic of the spatial system is determined in the urban concept. The dimensions of the open spaces and access systems communicate the level of privacy. Beginning with the neighborhood entrance with linear access roads following the valleys from north to south, these streets have a broad profile and face public spaces. This layout emphasizes public use and creates identity through topography. From a functional point of view, the width of streets and adjacent open spaces underline their function as a main escape route in case of an earthquake.

Access to sub-neighborhoods is indicated by a change of road dimensions and direction, diverting in an orthogonal manner from the access roads with 12 m width, the streets shrink to only 6 m in width. This change expresses the next step in the spatial hierarchy from public sphere into the semi-public sub-neighborhood. The narrow paths defined by the maximum three-story buildings guide into semi-public courtyards in the center of each sub-neighborhood. These small plazas serve as social centers of the community on a sub-neighborhood scale, further strengthened by the mixed-use units on the ground levels of the buildings.

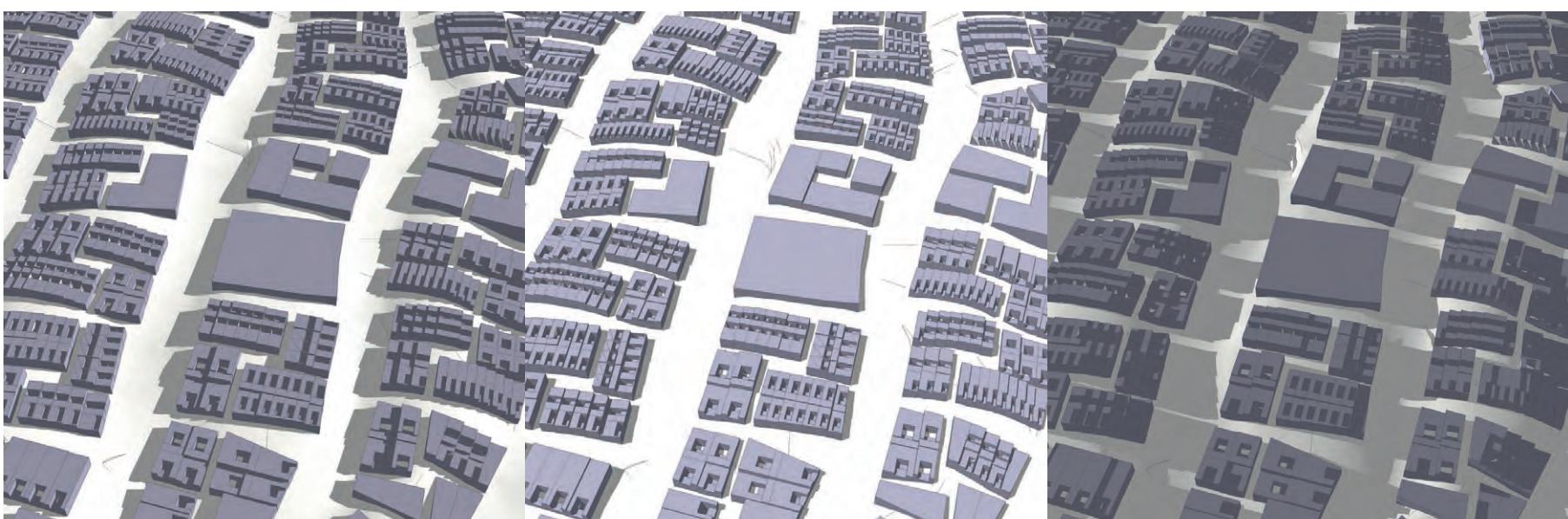


Fig. 114: Sun simulation in July at 8 a.m., 2 p.m., and 6 p.m. o'clock

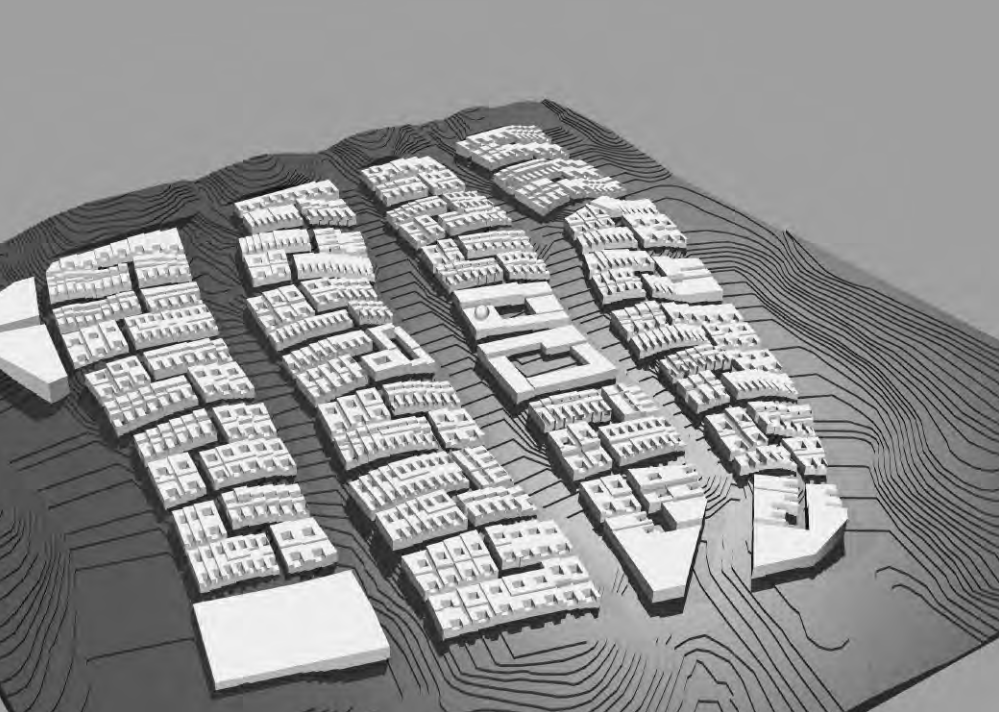


Fig. 115: 3D simulation of Shahre Javan Community area pilot project
Fig. 116: Model of building

Fig. 117: View into sub-neighborhood courtyard
Fig. 118 | Fig. 119: Perpectives of sub-neighborhood courtyard

The next level into privacy is highlighted in the access to the housing unit and corresponds to the architecture. The small entrance hall, organized again in an orthogonal arrangement to the semi-public space, marks the transition into the privacy of the house. These design measures enable the perception and formation of spatial identity.

Goal 4: Flexible and adaptable structures

Sub-goal 4.2: Flexible plot design with development potential

Measures: Flexible plot dimensions and layouts can be achieved in two ways on a variety of scales. The first is to manipulate the dimensions of the plot's width, developed in an axial system, so that different widths can offer different typological applications. The second option is the ability to consolidate single plots into larger plots in order to create building

plots for bigger structures and for different uses (e.g. office buildings). Coordinating the orientation of buildings with infrastructure areas and open spaces will guarantee the accessibility of every plot and allotment Thus, the boundaries of the open space should dictate the maximum expansion potential of the flexible plots.

3.3 Architecture

Philipp Wehage | Elke Pahl-Weber

Goal 1: Resource and energy efficiency incl. reduction of CO_2 emissions

Sub-goal 1.6: Natural light for living zones and passive solar energy gain

Strategy: Building volumes and the zoning of floors both follow the southerly orientation of the plots. Privacy is promoted through architectural introversion. Careful combination of architectural design and planning measures will achieve both privacy and energy efficiency within a dense, compact, urban form.

Measures: Reducing the volume of upper floors allows for more natural light to reach the rear zones of the building plot. The courtyards and niches of each building plot expand the total surface area of the façades, further enabling passive solar gain. Courtyards and terraces offer direct light for living zones within the buildings. The façades on the southern boundary of the courtyards work as passive design measure shading the private, open space of the courtyard.

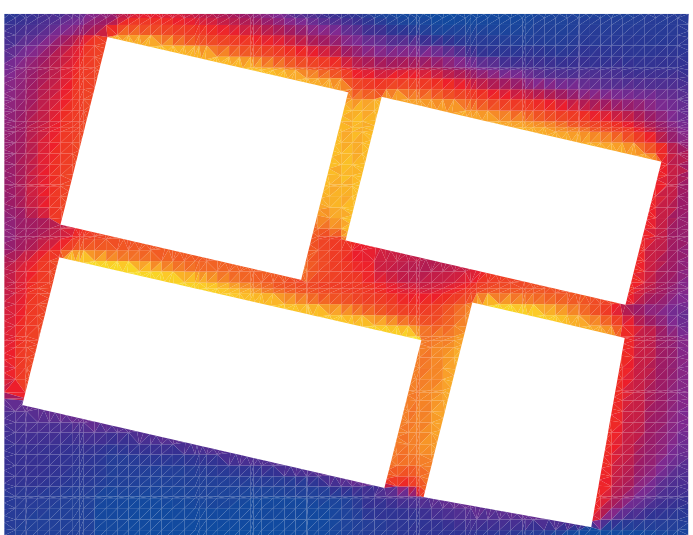


Fig. 120: Simulation of the opacity of a sub-neighborhood (Legend see Fig. 121)

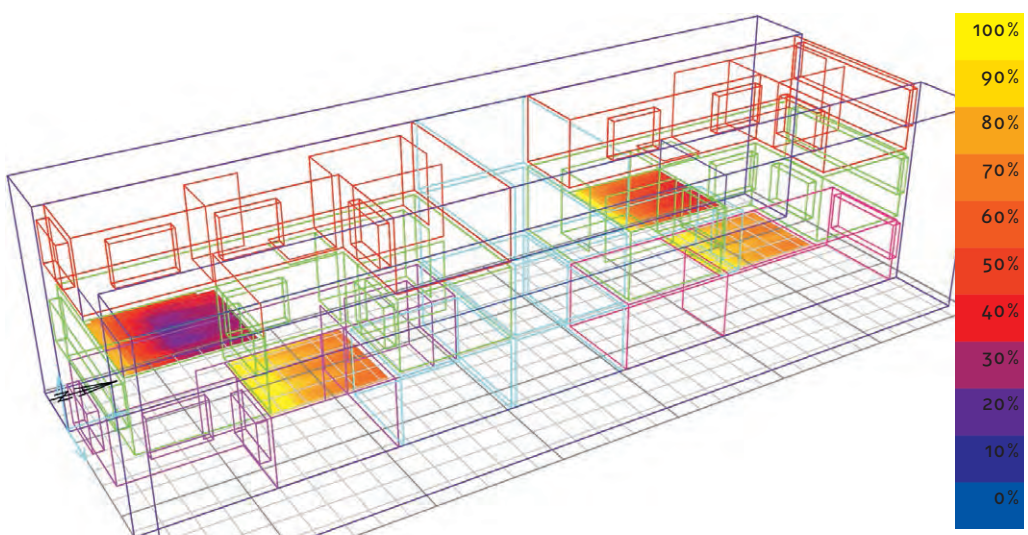


Fig. 121: Simulation of the opacity of courtyards in the buildings

Sub-goal 1.7: Reducing the embedded energy of materials and construction

Strategy: Use of low tech options, simple construction and planning measures allows for reducing the embedded energy of materials and construction.

Measures: The materials should be conventional and the construction should, where possible, be done manually in order to avoid energy inten-

sive equipment. The structure of the units is based on commonly used construction metrics allowing for a relatively simple and straightforward construction. Energy consumption should be reduced via technical methods (e.g. reducing heat production by insulating the façades) as well as through the optimal use of both materials and surfaces (e.g. colors and structures).

Goal 3: Strengthening local identity

Sub-goal 3.3: Ensuring privacy and respecting socio-cultural habits within a compact urban form

Strategy: Introverted housing units will ensure privacy within a dense urban form.

Fig. 122: View from private courtyard into the house

Measures: The inward orientation of the buildings is an expression of privacy and has temperature regulating benefits. Open courtyards inside the building volume guarantee a good micro-climate combined with a high level of privacy (cf. Goal 4). The façade openings follow the principle of introversion: windows and doors minimize public exposure while maximizing privacy.

Sub-goal 3.4: Strengthening identity through architecture

Strategy: Support of the spatial urban design concept through architectural measures also allows for strengthening identity.

Measures: The concept of a spatial hierarchy creating orientation and identity (cf. Goal 3 in Section 3.2) must be supported by architecture. The smallest unit of urban design is the sub-neighborhood. The façades of the buildings constitute the interface between urban design and architecture as well as the transition from semi-public into individual privacy. Given the interdependency of urban design and architecture, the façades, as an architectural element, play a crucial role in the creation of the spatial vision. Their design must include the urban context of the sub-neighborhood.

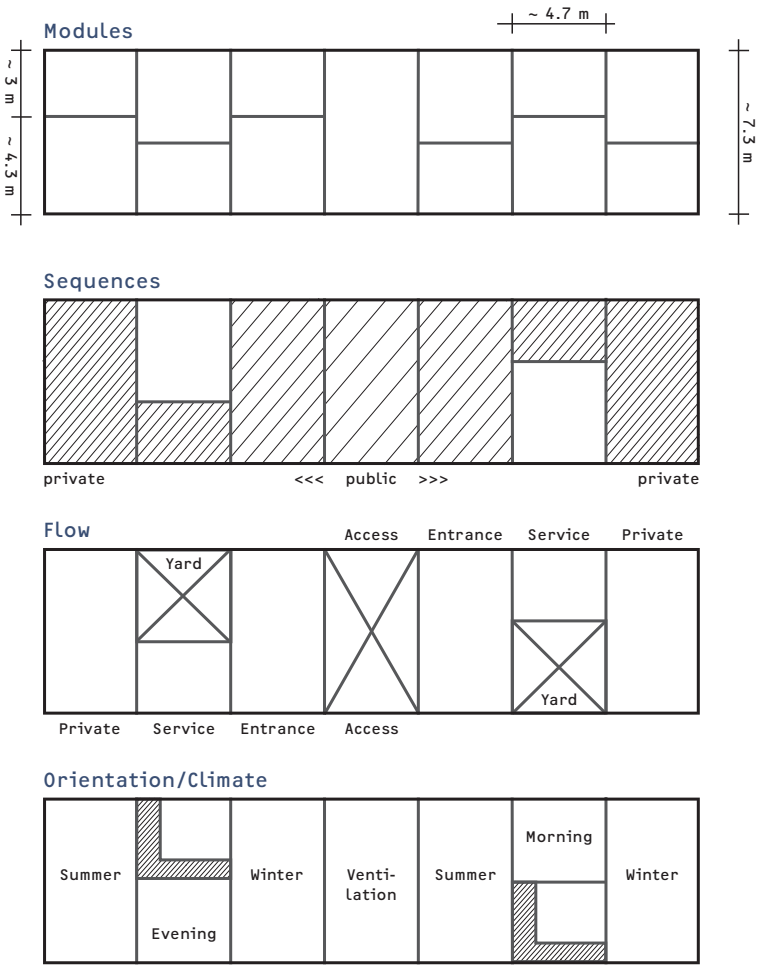


Fig. 123: Flexibility of modules

Goal 4: Flexible and adaptable structures

Sub-goal 4.3: Regulation of floor zone use by location

Strategy: In order to achieve high flexibility, the architectural typology should provide different floor layouts for varying uses. The ground floor can be used for service units or housing units. In the mixed-use zones, the ground floor can be used for commercial and social uses. The upper floors should be for housing. The kind of use depends on the location within the urban context (cf. Goal 3).

Measures: In order to achieve a wide range of flexibility, the architectural design has to provide a structure, which allows adaptation to new and different uses. In pursuit of this programmatic approach, the structure is based on a flexible construction of an axial system, which can easily adapt to and assimilate a variety of functions.

Sub-goal 4.4: Flexible floor use while keeping light and sun exposure in compact housing

Strategy: The south façades should provide light and air circulation for the main living zones.

Measures: In order to achieve a maximum flexibility for floor organization while also guaranteeing light and natural ventilation for the main living zones, the service zones should be arranged in the interior of the building or on the western or eastern sides of the courtyards.

Sub-goal 4.5: Flexibility of unit sizes

Strategy: The horizontal dimension of the housing units is defined by the plot layout (cf. also Goals 3 and 4). In order to offer a wide range of sizes, the residential units can be organized in a maisonette layout (duplex).

Measures: The morphological building approach allows for vertical organization of housing units prioritizing both privacy and light (cf. Goals 3 and 4). The vertical organization allows every unit a direct connection with the open space outside of the lower levels as well as optimal light and sun exposure for the main living zones of the upper levels. The dwelling spaces within the units (two-story and three-story duplexes) are regulated by the housing typology design and by the plot layout (cf. Goals 3 and 4). Depending on the organization (by unit type or by floor layout), a wide range of dwelling sizes is possible.

3.4 Landscape Planning and Environmental Assessment

Bernd Demuth | Theresa Garske | Stefan Heiland (Section 3.4.1)
Holger Ohlenburg | P. Nagel | Johann Köppel (Section 3.4.2)

The following goals and sub-goals for landscape and environmental planning attempt to protect, maintain, and develop the natural environment and landscape as the basis of human life. The intention to protect (cf. § 50 of the Iranian Constitution) extends to biotic and abiotic aspects of the ecosystems (i.e. soil, water, climate, air, biotopes, flora, and fauna), to the scenery aspect of the landscape, and to the interactions of these. Ecosystems provide a variety of complex functions, which benefit humans and contribute to livelihood, health, recreation, and general quality of life. These include such functions as providing clean water, fresh air, and food (see Sections 2.3.1 to 2.3.5 for an overview of ecosystem functions). The overexploitation, permanent impairment, or outright destruction of natural environment and landscape has serious consequences for human use, such as settlement sites, food production, and health, to name only a few.

Sustainable use of ecosystem services takes a long-term ecological, economic, and social view intended to maintain and even cultivate these essential functions. Overarching goals for the detailed plan of the Shahre Javan Community area will meet the requirements of sustainable planning while simultaneously considering local conditions (despite their abstract character). These goals provide the basis for more detailed sub-goals, specified below. The sub-goals further develop the goals by considering not only the ecological demands and local conditions, but also the structural use requirements of the area and social concerns of future residents.

3.4.1 Landscape Planning

Goal 1: Resource and energy efficiency incl. reduction of CO_2 emissions

Sub-goal 1.8: Saving water

Strategies: The protection and recharging of groundwater are priorities given the region's semi-arid climate and constantly decreasing groundwater level. Due to the extensive extraction of groundwater over recent years, the average groundwater level (in a depth of 150 to 200 m) has been significantly reduced (see Section 2.3.4). Therefore, the following measures focus on the reduction of water consumption and the recharge of groundwater.

Measures: Firstly, greywater (shower and sink water etc.) from adjacent private households must be purified for reuse in irrigation by constructed wetlands (newly established and designated for that purpose). The use of drinking water for irrigation of open and green spaces will not be admissible.

Secondly, it is stipulated that groundwater must be recharged via the infiltration of cleaned surplus greywater from the constructed wetlands. The infiltration of surplus greywater into groundwater will be measured

4 Proposed Plans and Regulations

	35 ha-Area	Extended Area	Sum
Total	**353,699.7**	**91,523.8**	**445,223.5**
Green and Open Space	**86,676.4**	**74,060.7**	**160,737.1**
Artificial lush green	12,781.2	3,095.4	15,876.6
Utility area	1,600.2		1,600.2
Big scale green	6,747.7	29,356.9	36,104.6
Constructed wetlands	17,662.8	960.0	18,622.8
Dry landscape	20,848.3	30,222.2	51,070.5
Pocket parks	1,665.1		1,665.1
Green connection	5,416.1		5,416.1
Leisure and sports		9,935.5	9,935.5
Private gardens	19,054.4		19,054.4
Rainwater collector	900.6	490.7	
Land use	**159,827.1**	**100.0**	**159,927.1**
Primary and secondary school	8,864.4		
Kindergarden	2,159.8		2,159.8
Office	5,565.0		5,565.0
Religion	491.1		491.1
Culture	1,730.6	100.0	1,830.6
Regional shopping	4,009.7		4,009.7
Residential	137,006.5		137,006.5
Vertical mixed-use			

	35 ha-Area	Widened Area	Sum
Traffic areas	**107,196.2**	**17,363.1**	**124,559.3**
Main road	10,341.8		10,341.8
Collector road	6,717.6	550.9	7,268.5
New eastern road		5,019.7	5,019.7
Access road	21,737.1		21,737.1
Access way	28,739.2		28,739.2
Access way between block	1,706.0		1,706.0
Foot path	8,636.5	5,537.0	14,173.5
Parking for handicapped	1,440.6	372.3	1,812.9
Parking		649.5	649.5
Access area /staircase	664.6		664.6
Urban connection	27,212.8	5,233.7	32,446.5

Tab. 20: Quantitative specification of land uses on Shahre Javan Community Area

The following sections propose plans and regulations for achieving the goals and sub-goals presented in Chapter 3.

4.1 Urban Planning, Urban Design, and Architecture

Sebastian Seelig | Philipp Wehage | Elke Pahl-Weber

Several plan proposals have been developed for the Shahre Javan Community area in relation to neighborhood and district structure, general land use, urban densities, and distribution:

- District Plan (see App. 1);
- Land Use Plan (see App. 2);
- Mass and Space Plan (see App. 3);
- Building Lines Plan (see App. 4);
- Parceling Plan (see App. 5).

Proposed rules and regulations concerning land uses, densities, constructions, land divisions, road development, urban space, and urban design, are presented in the following.

Regulation for Sub-goal 1.1 (Energy efficient forms of land use based on mixed and dense land use models): A gross population density of 250 persons per ha is the goal for the planning area, a medium density according to Iranian standards.

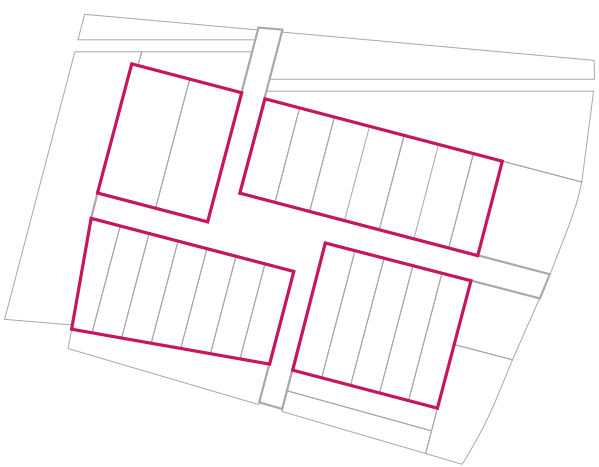


Fig. 137: Example for building lines on the Shahre Javan Community

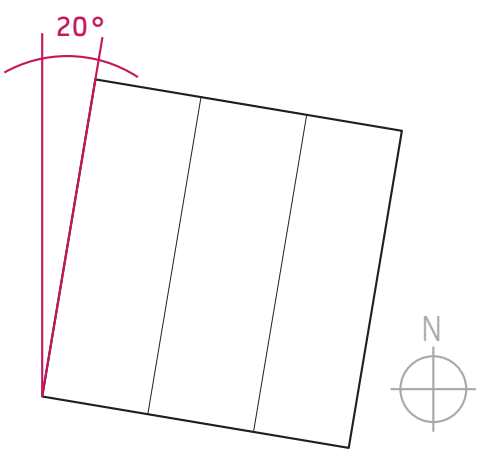


Fig. 138: Orientation of buildings

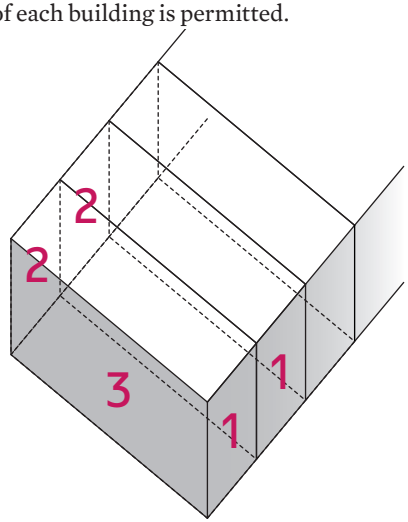


Fig. 139: Plots with two or three exterior façades

Regulation for Sub-goal 1.2 (Efficient infrastructure in a dense and compact urban form): The Shahre Javan Community area is defined as a Mixed-Use District (MUD). The following uses are permitted in MUDs:

- Residential uses;
- Retail uses;
- Non-disruptive industries;
- Administrative and professional offices/services;
- Religious uses;
- Cultural uses;
- Social uses;
- Vertical Mixed Units.

The following are the quantitative specifics of each land use for the Shahre Javan Community area (Tab. 20).

In Vertical Mixed Units (VMU), two or more uses are permitted in the same building. The exact areas and plots dedicated as VMU are defined in the plan. The following are allowable uses for a VMU in a MUD:

- Residential;
- Retail;
- Non-disruptive industries;
- Administrative and professional offices/services;
- Social and cultural uses.

Non-residential uses are only permitted in the ground floor areas of the VMU. The absolute occupancy of non-residential uses on the ground floor depends on each plot individually. The VMU can use a maximum of 50 % of the ground floor area. This regulation is applicable for all VMUs defined in the land use plan, except at especially marked plots. In these plots, the full occupancy (up to 100 %) of the ground floor area of each building is permitted.

The exact location of the VMUs is defined in the land use plan on a plot scale. A general development rule is that the VMUs should be located around the courtyards of each sub-neighborhood. Within the MUD, up to 10 % of the total residential ground floor area of each sub-neighborhood can be dedicated as VMU. This is equivalent to approximately 13,000 m² of non-residential uses in VMUs. The maximum ground floor area for VMUs within each sub-neighborhood is indicated in the land use plan. The gov-

erning body has deciding supervision over the 10 % development rule. In order to facilitate permission from the governing body, mixed-use development applicants should illustrate their proposed mixed-use development concept with a site plan submitted as a part of the building application.

Each non-residential ground floor space in the VMU must have a customer entrance that opens directly onto the public space through the courtyard. The purpose of this requirement is to ensure that buildings in the MUD complement pedestrian activity by providing direct access to the building and business activities from the sidewalk. All properties in the VMU shall orientate their frontage to the public streets. The primary building entrance in VMUs must be oriented towards the courtyard. Building entrances may include entrances to individual units or lobby entrances. On corner lots, buildings and their entrances must be oriented towards the courtyard. Once a mixed use development is constructed and occupied, changes in tenants may be permitted, but the owner or owners of the mixed-use development shall not violate or allow the violation of the mixed land use provisions outlined in this section.

Regulation for Sub-goal 2.1 and 3.1 (Protection of the local environmental values as well as of soil, water, flora, and fauna and improvement of the local micro-climate): The permissible lot coverage, i.e. the proportion of a site's surface, where the construction of buildings is admissible, is fixed by building lines (see Fig. 137). Building lines stipulate the exact location of development. Departures from the building lines are prohibited. Building lines are individually stipulated for each parcel. This concept is additionally supported from the landscape planning perspective through the definition of open and green areas, where construction is prohibited within the Shahre Javan Community.

Regulation for Sub-goal 1.3 (Reducing fossil energy demand for cooling and heating): The parceling designations for the built-up area create building orientations intended to maximize sun impact. The maximum deviation is 20 ° from the orthogonal south orientation (see Fig. 138).

Regulation for Sub-goal 2.7 (Minimization of soil sealing and creation of rainwater infiltration areas): The maximum FAR of the plot area's construction zone, about 2.6 (260 %), is individually regulated for each plot (see App. 3: Mass and Space Plan). The regulations of architecture concerning design and organization have to be followed. Underground parking at sub-neighborhood scale must be provided below the access paths and construction zones.

Regulation for Sub-goal 1.4 (Compactness in order to reduce building surfaces): The surface-to-volume relation should not exceed 0.65 for buildings with three external walls and 0.5 for buildings with two external walls (see Fig. 139).

Regulation for Sub-goal 1.5 (Compactness through a reduction of building height): The maximum building height is three stories above ground level.

Regulation for Sub-goal 3.2 (Identity of urban design through a strong spatial hierarchy): The boundary of lots (sub-neighborhood) and plots (buildings) is regulated by building lines (see above). Every plot must have at least two sides oriented towards open spaces. One side must be oriented to provide semi-public access (path/courtyard), the second side must be oriented to the surrounding open space of the sub-neighborhood (private garden or public green). In order to minimize east-west façades, the buildings must be closed coverage design.

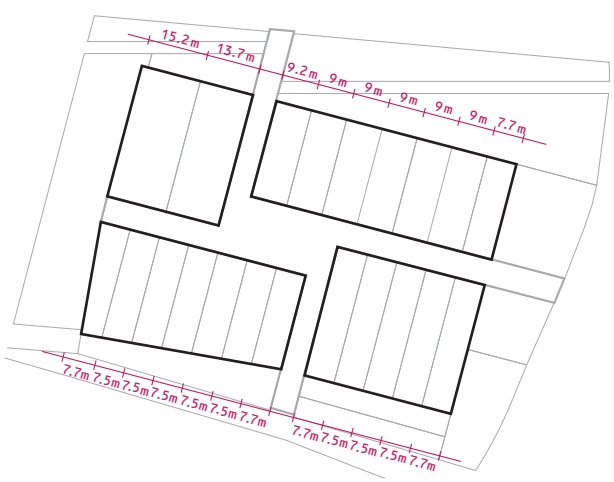


Fig. 140: Plot widths

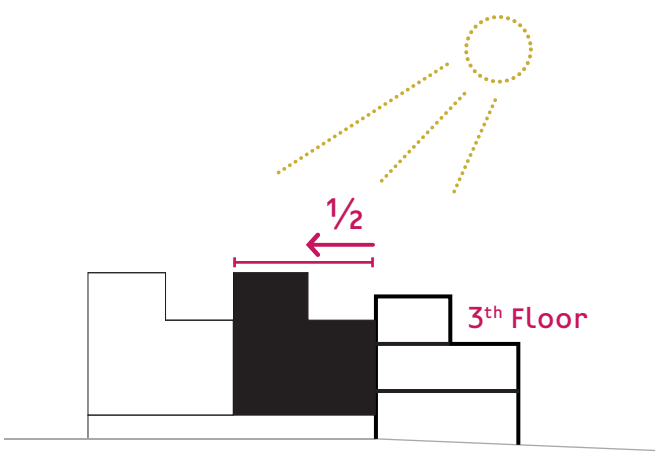


Fig. 141: Offset of upper floor

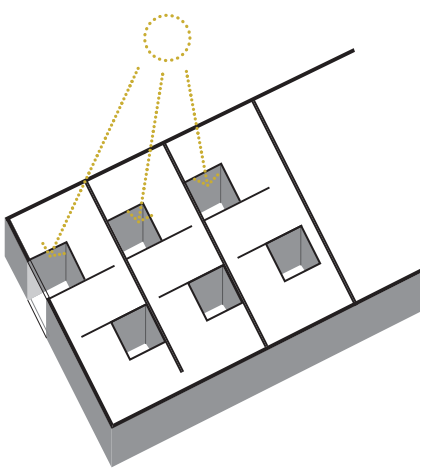


Fig. 142: Inner courtyards

Regulation for Sub-goal 4.1 and 4.2 (Enabling the adaption of the neighborhood to future requirements as well as Flexible plot design with development potential): For the dimensions of each plot, the regulation of width is defined by an axial system. This axial system is defined by 1.5 m steps as smallest regulation unit, which allows common floor layouts and constructions. The width of the plots ranges from 6 m up to 15 m. Due to the requirement of attached façades at the east and west building ends, each construction zone (lot) is extended by 20 cm to allow for construction of an exterior façade (see Fig. 140). The north-south plot width is regulated by building lines, which vary with the situation and topography. When combining plots, the dimensions will, again, be regulated by building lines and construction zones. For bigger structures with special uses, the maximum combination can cover an entire construction zone and is regulated by the building line surrounding that construction lot.

Regulation for Sub-goal 1.6 (Natural light for living zones and passive solar energy gain): In order to maximize natural light penetration into the deeper zones of the upper floors, the length of the southern façades on the third floor (oriented towards public spaces) must not exceed 50 % of the total façade length. The third floor coverage can be a maximum of about 75 % of the ground area (see Fig. 141). The main living zones or rooms must be orientated towards at least one façade for natural light and air ventilation. Courtyards can be implemented within the buildings on the first floor (see Fig. 142). Courtyards within buildings must be bordered by no more than two stories to the north and one story to the south.

Regulation for Sub-goal 1.7 (Reducing the embedded energy of materials and construction): In order to optimize sun reflection, façade materials must be a light colored surface of stone, concrete, plaster, or bricks. The adapted energy saving standard for every building must be 50 % lower than the standard set out in Iranian Energy Efficiency Code 19. Only flat roofs are allowed, in order to reduce the volume and construction height as well as to reserve roofs for solar gain efforts (e.g. thermal power, photovoltaics). However, green roofs can be implemented, where solar gain efforts are not made.

Regulation for Sub-goal 3.3 (Ensuring privacy and respecting socio-cultural habits within a compact urban form): Courtyards as private open spaces are only accessible from one unit. Efforts should be made in building design to avoid a direct view from one unit into the courtyard of another (e.g. orientation of openings; see below). Architectural elements in semi-public spaces (e.g. sun blinds) must be constructed within building lines. In order to avoid direct views, doors or windows larger than 30 x 30 cm should not be placed opposite windows of neighboring buildings (see Fig. 144).

Regulation for Sub-goal 3.4 (Strengthening identity through architecture): Façades as architectural elements are highly relevant to semi-public and public space and must support the overall urban design vision. As the smallest unit in the urban concept of the Shahre Javan Community, the sub-neighborhood plays a crucial role in urban identity. As the interface between urban design and architecture, the façades of buildings must support identity on the sub-neighborhood scale. Thus, a single, continual façade concept should be implemented for every sub-neighborhood. The façade concept for each sub-neighborhood should be a harmonic part of the general layout by using the same composition of structural arrangement, openings, materials, colors, and other elements (e.g. equipment like sun-blinds).

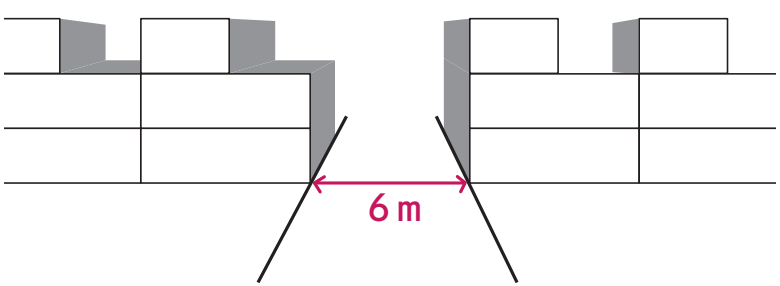


Fig. 143: Street size

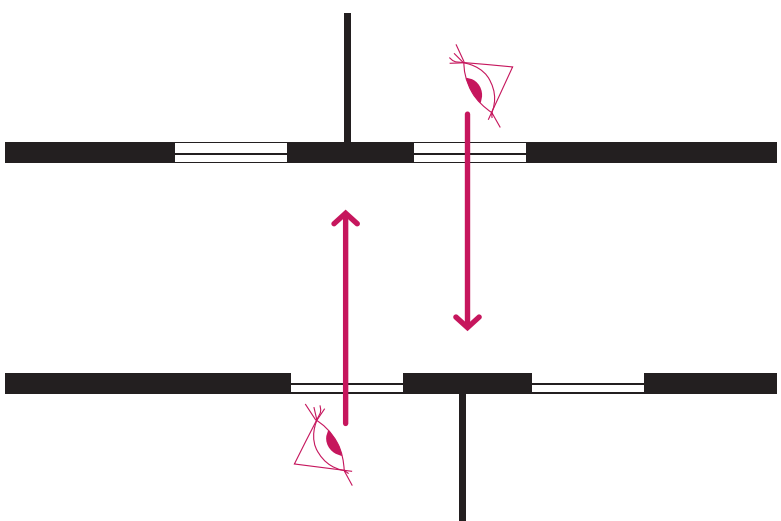


Fig. 144: Orientation of openings

Regulation for Sub-goal 4.3 (Regulation of floor zone use by location): The ground floor zones allow for flexible use within the axial system of construction and the available material options. Connection to footpaths should be maximized by orienting the entrance of the housing units towards the bordering partition walls separating the plots.

Regulation for Sub-goal 4.4 (Flexible floor use while keeping light and sun exposure in compact housing): A central staircase with access from the street is the only vertical zoning element, which must be located inside the building (see Fig. 145). Space should be provided for an escalator to allow for flexibility in vertical organization. The staircase also works as a constructive vertical gap within the building to increase both earthquake resistance and air ventilation.

Regulation for Sub-goal 4.5 (Flexibility of unit sizes): The smallest housing unit is a quarter floor area on the large plots (15 to 12 m houses) or half floor on the smaller plots (9 to 7.5 m houses). The maximum number of apartments per building is ten units in the 15 m house. Private open spaces (terraces, courtyards, gardens) should be guaranteed for every unit. The width of parcels within fixed building lines is set at 6 m, 7.5 m, 9 m, 12 m, 13.5 m and 15 m (see Fig. 146). The depth of each parcel will be defined individually.

Further explanatory maps and illustrations are presented in App. 7 and 8.

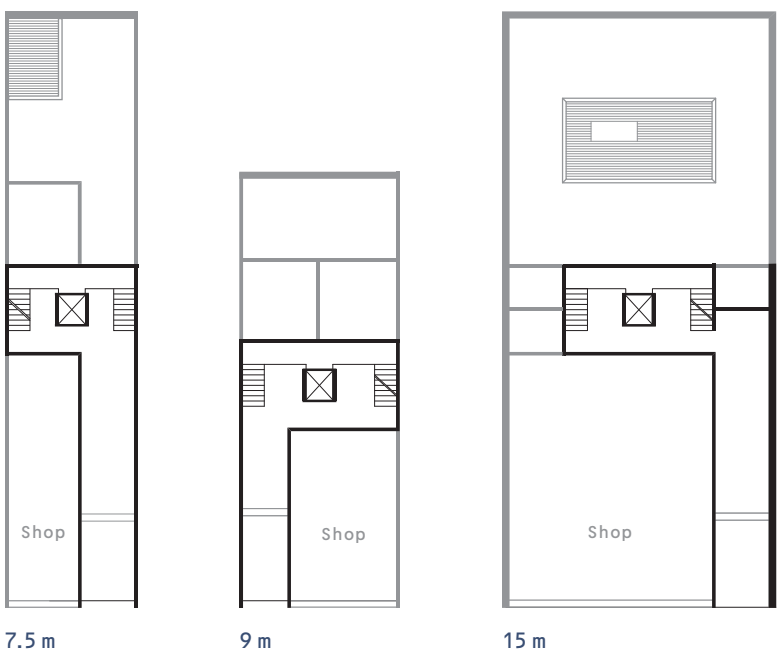


Fig. 145: Central staircase

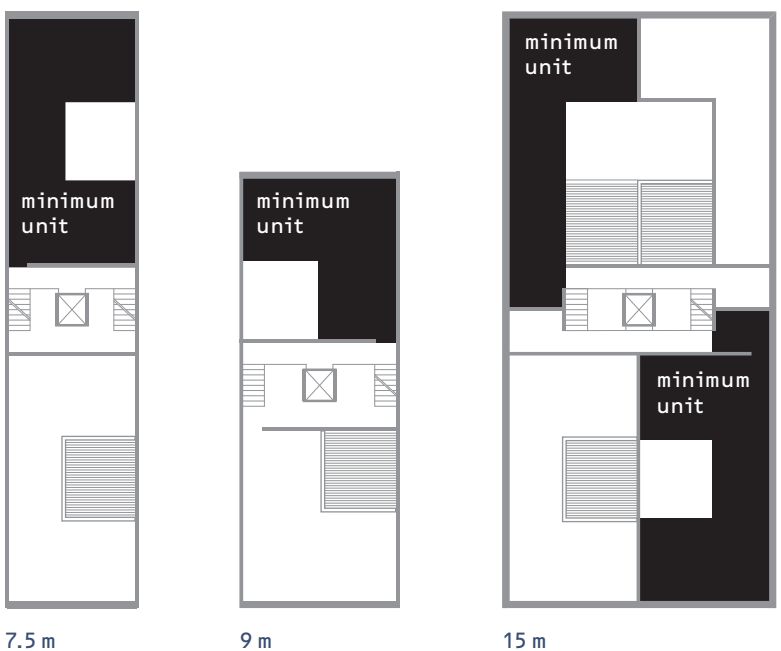


Fig. 146: Flexibility of unit size