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# Spatial-structural qualities of mixed-use main streets: two case studies from the Amsterdam metropolitan region

Birgit Hausleitner and Mae-Ling Stuyt

*Streets are where the needs and values of different users and activities come together. Main streets in the Netherlands were either planned in major urban expansions or developed over time in the shape of ribbons upon dykes – 'long lines' of continuously active streets. This chapter presents two cases from the Amsterdam metropolitan region: vanWoustraat-Rijnstraat, a main street planned as part of an urban expansion, and Westzijde, a main street that developed over time as part of a long line. While vanWoustraat-Rijnstraat is tightly organised and coherent in both appearance and function, Westzijde is characterised by a multitude of different buildings and functions. This study visualises the spatial-structural qualities that facilitate the evolving economic activities of these two streets. It explores the variation between them by morphological differentiation and determines several spatial characteristics that enable the mix: modularity of the urban plan, complementary 'front' and 'back' sides, structural coherence and territorial depth – the sequence of spaces between the urban 'front' and 'back' sides of buildings, blocks and neighbourhoods.*

## Introduction

Amsterdam, in line with many other major cities, has recently begun to promote a 'mixed-use' environment (Gemeente Amsterdam 2011; Gemeente Amsterdam 2021; Hoppenbrouwer and Louw 2005) for two primary reasons: first, mixed-use development promises health (Stevenson et al. 2016), a reduced need for travel (Hoppenbrouwer and Louw 2005), urban vitality (Jacobs 1961; Kang et al. 2020) and safety (Bellair and Browning 2010; Coupland 1997); second, mixed-use development is compact, meaning that it aligns with the aim of limiting urban growth to the pre-existing boundaries of an urban fabric (Gemeente Amsterdam 2021). Compactness and mixed-use are increasingly prioritised in urban development as land becomes more scarce (European Commission and UN Habitat 2016). In this context, the question regarding mixing industrial and other uses on everyday streets is no longer 'do we want it?' but 'how can we make it work?' – what spatial qualities support the integration of various functions? Everyday streets in Amsterdam constitute a reliable site for such an investigation, as they include both 'the ordinary and extraordinary' (Highmore 2002, 16).

One consequence of the push for compact, mixed-use development is the increasing multi-functionality of urban environments. Diverse activities increasingly occur in close proximity to one another, often with conflicting needs. Grant (2002) considers that there are three categories of mixed-use environments depending on their potential for conflict. The first is a mix of dwelling types. The second is a mix of residential and commercial facilities. The third is the integration of typically segregated uses, such as industry and housing. However, the presence of multiple functions in one area does not necessarily make a mixed-use neighbourhood. Montgomery (1998) names three pre-conditions for a truly mixed-use environment: 'users must use the same streets and spaces, users must use at least some of the same facilities, and activity must not be concentrated into a particular time of the day.' In other words, the spatial scale of the mix of functions and the proximity of different activities and users are central; Montgomery's pre-conditions focus on the street as a key space in which to integrate users and activities through design.

Each of the two main streets presented in this chapter belongs to a neighbourhood with historically and contemporarily diverse functions. The first, vanWoustraat-Rijnstraat, is more common. It features a

mix of residential, commercial, retail and service functions; industrial activities are usually excluded by functional zoning. The second, Westzijde, comprises fragments of industrial typologies and uses that are integrated with residential and commercial facilities. The historical evolution of the two streets is significant, as it is indicative of the type of mix that residents expect on their everyday street, which influences


**Figure 9.1a:** Location of the main streets parallel to the main waterways, including main commercial and industrial activities
**Figure 9.1b:** Streetlife on vanWoustraat (bottom left) and Westzijde (bottom right). © Hausleitner and Stuyt 2022

what they appreciate or object to. Both streets are parts of neighbourhoods considered to be 'liveable' (Leefbarometer 2020). Main streets in the Netherlands were either planned in major urban expansions or developed over time in the shape of ribbons upon dykes – 'long lines' of continuously active streets. vanWoustraat-Rijnstraat is one of the former; Westzijde one of the latter.

Spatial form is an important factor with regard to economic activities; the two are intimately intertwined. Jacobs (1961) was the first to suggest that spatial and functional diversity are related. The impact of the street network and its differentiation on economic activities have since been extensively explored (Chiaradia et al. 2009; Froy 2021; Hillier and Hanson 1984; Marcus 2000; Narvaez et al. 2014; van Nes 2005). In addition, places that accommodate urban economic processes (e.g. shops, factories) can be identified by how the main elements of urban form are combined and differentiated (Hausleitner and Berghauser Pont 2017): the street network (centrality of a place), the built density (building types), the grain of parcellation, and territorial depth (the sequence of spaces between the urban 'front' and 'back' sides of buildings, blocks and neighbourhoods) (Hausleitner 2012; Hausleitner 2019). This chapter explores streets in two types of areas with regard to how a functional mix occupies street space and what spatial qualities facilitate the mix.

## Two mixed-use main streets: one planned, one developed over time

The two streets evolved in different ways. These differing histories resulted in different patterns of spatial form. vanWoustraat-Rijnstraat was planned with aesthetic and functional considerations, while Westzijde was shaped by landscape engineering and functional requirements. vanWoustraat-Rijnstraat (see Figure 9.1a) is centrally located in modern Amsterdam South, crossing two neighbourhoods: Pijp and Rivierenbuurt. The street runs parallel to the city's namesake, the river Amstel. It lies 300–450 metres (the equivalent of two to four city blocks) away from the western riverbank, the old main dyke along the Amstel. Similarly situated by a waterway, Westzijde (see Figure 9.1a) runs along the Zaan (a canal) northwest of Amsterdam and through the neighbourhoods of Oud Koog and Oud Zaandijk. Along its length, its official name varies – Zuideinde, Lagedijk, Hoogstraat and Lagendijk. The street is separated from the canal by a strip of plots ranging in

depth from 50 to 200 metres. While the development of Pijp and Rivierenbuurt was driven by large-scale development plans executed over a relatively short period of time, the development of Oud Koog and Oud Zaandijk occurred slowly, plot-based, over a far longer period.

The urban plan for Pijp, which included vanWoustraat, was part of the nineteenth-century Plan vanNieftrik-Kalff, initiated in 1877 (Figure 9.2, top left), while Rivierenbuurt, which included Rijnstraat, was part of Berlage's plan for Amsterdam's southern expansion in 1915 (Figure 9.2, top right). Plan van Niftrik-Kalff aimed for the area 'by means of form continuity to be experienced as a total' (Van der Hoeven and Louwe 1985). It based the area's street network on agricultural land divisions (Jobse 1980), resulting in narrow, stretched urban blocks that have been rationally subdivided into plots with maximised street-front and relatively little depth. Van der Hoeven and Louwe (1985) describe the resulting urban plan as a system that could deal well with exceptions and maximise the number of houses. The plan behind the development of Rivierenbuurt, south of Pijp, follows a different rationale: Berlage did not consider previous agricultural parcellation. Instead, he emphasised two main aspects: a monumental system of main streets and introverted residential sub-areas. Berlage emphasised coherently designed streets and pleaded for at least whole blocks to be designed by a single architect to achieve cohesion (Hoekstra 2018).

vanWoustraat-Rijnstraat links Pijp and Rivierenburt. In Pijp, the street was planned as a 20-metre-wide main radial connection to the old part of Amsterdam, featuring shops and a tram line. Two special streets cross Pijp's section of Woustraat-Rijnstraat. First, Albert Cuypstraat was built along the former sawmill waterway. At an average of 15 metres wide, Albert Cuypstraat is wider than most side streets and has accommodated a market since 1905. Second, Centuurbaan is part of a continuous street that encircles the seventeenth-century city; at 30 metres wide, it leads to a bridge across the Amstel at the eastern edge of Pijp. Both Centuurbaan and Albert Cuypstraat accentuate vanWoustraat and host more commercial activities than most other side streets (see Figure 9.1a). Extending vanWoustraat, Rijnstraat was initially conceptualised in the Berlage plan as a main traffic connection only. In its realisation, Rijnstraat became a main street with social and economic activities. The orientation of the long sides of the urban blocks along Rijnstraat results in fewer side streets connecting Rijnstraat and its hinterland. This spatial setting led to a differentiation of a mixed-use main street with a predominantly residential hinterland.

In contrast to the planned nature of vanWoustraat-Rijnstraat, Westzijde, which runs through Oud Koog and Oud Zaandijk, was developed piecemeal alongside local developments in water engineering. The dyke constituted the main connection between settlements; as those settlements grew, they eventually merged into a long line parallel to the Zaan (Figure 9.2, left). Westzijde is an exemplary ribbon-shaped settlement that runs along the top of dykes on the high ground of the 'lowlands'. Its hinterland is characterised by land divisions that followed drainage ditch patterns dug during the reclamation process (Palmboom 1990). After the dykes were built in the thirteenth century, settlers developed an intricate system of ditches and both high and low dykes. Farmers built their houses on the high dyke along the Zaan. To cultivate the land, they dug ditches perpendicular to the dykes. This practice led to land subsidence. To keep the land dry, they extended the system of ditches plot by plot along the dyke. Around 1580, industrial activities began to occupy land previously used for agriculture. Serving the markets of Amsterdam and Haarlem, the area around the Zaan did not receive city rights, which would have come along with strict regulations, so more polluting industries settled. At the beginning of the seventeenth century, larger homes and warehouses were built on the riverside of the dyke, overlooking the agricultural land and the mills, oriented away from the river. Ditches perpendicular to the dyke led to the industrial mills on the land side, with small workers' homes established along these paths.

During the second industrialisation in the late nineteenth century, large steam-engine-powered factories replaced the mills. These factories were mainly located between Westzijde and the Zaan – outside of the dykes, as these plots were accessible by ships. These buildings and plots were larger than those built during earlier periods. Many homes, offices and shops were established along the dykes to serve the factories and their workers. On the land side of the dyke – the western side of Westzijde – small wooden workers' homes were replaced by warehouses and larger villas for factory directors with a direct view of their factories and the Zaan. The rail network was developed in the area around 1860, attracting many settlers. The village paths and dykes were hardened, and ditches were reclaimed to serve traffic instead of boats. During the twentieth century, the number of factories increased, resulting in increased housing demand. New workers' neighbourhoods were built between the dyke and path structures (Figure 9.2, bottom-right). After World War II, new neighbourhoods were developed in line with modernist principles, no longer viewing the water system as

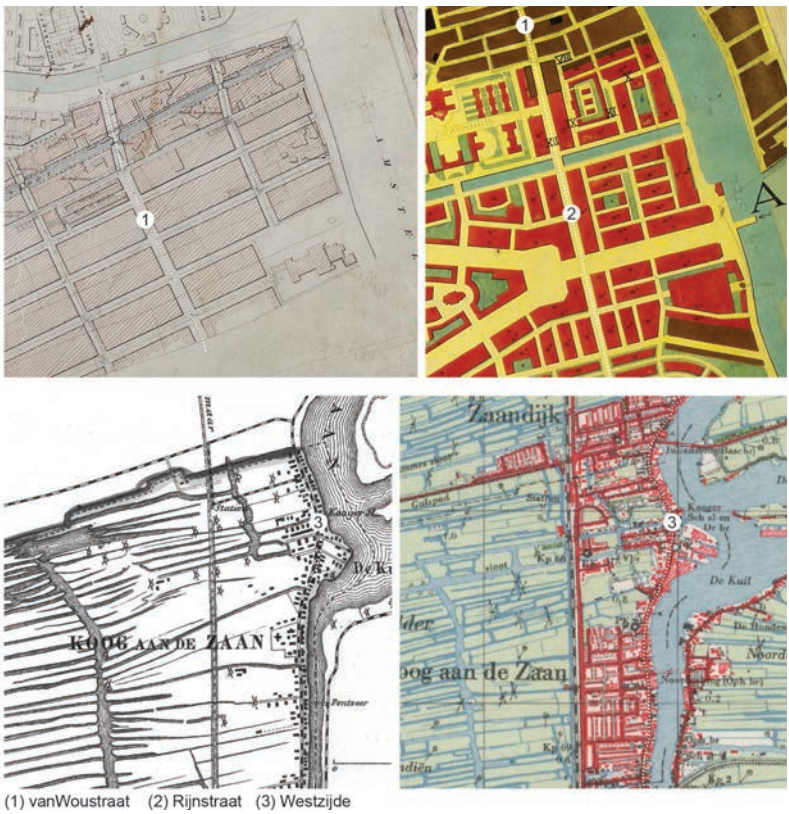


**Figure 9.2:** Historic plans of the case study areas. Top: plan Kalff (left) and plan Berlage (right). Bottom: Koog aan de Zaan in 1868 (left) and 1950 (right). Sources (websites accessed 1 November 2022): Top left: plan by Jan Kalff 1875.

a structuring element. The piecemeal development of Westzijde over more than 500 years resulted in an urban grain that is very different from that of the planned districts around vanWoustraat-Rijnstraat.

## Today's variation in the mix of economic activities

The historical maps (Figure 9.2) and narratives of the two streets indicate two different development paths that have impacted today's uses and are the underlying conditions for their different economic and urban lives. On vanWoustraat-Rijnstraat in Pijp and Rivierenbuurt,

shops are dominant. On Westzijde in Oud Koog and Oud Zaandijk, industry is dominant. However, there is a diverse mix of uses on both streets. Their varying economic activities reveal a distinct pattern in both areas. Figure 9.1a shows these patterns, including commercial (red) and industrial (dark grey). As a result of their divergent histories, Pijp and Rivierenbuurt are about three times more densely populated than Oud Koog and Oud Zaandijk, and the residential densities are mirrored by different dwelling types prevailing in each neighbourhood.[1] The planned Pijp and Rivierenbuurt areas feature almost exclusively multi-family housing with closed urban blocks, while most homes in Oud Koog and Oud Zaandijk are terraced, single-family homes.

The types of uses on the two streets (and in the neighbourhoods through which they pass) are similar overall but distributed differently as a result of their morphology and available building typologies. Additionally, business density is more than five times higher in Pijp and Rivierenbuurt than in Oud Koog and Oud Zaandijk. In Pijp and Rivierenbuurt (see Figure 9.1a, left), there is significant variation in the density of economic activities. In Pijp, small-scale manufacturing, construction and logistics companies are relatively spread out across the area, which hosts a lively community of small-scale furniture makers, printing houses, shoemakers, metal and woodworkers, bakeries, fashion and textile designers, and creative businesses. The main sectors represented here are commercial shops and service providers, both of which align well with small plot sizes. Further south, Rivierenbuurt hosts a few bakeries and some home-based craft workshops in metalworking, clothing design and furniture making. Overall, Pijp is more commercial with higher business density, while Rivierenbuurt hosts more small-scale amenity providers spread throughout the area in relatively smaller numbers. On average, there are twice as many manufacturers and service providers in Pijp than in Rivierenbuurt.

Westzijde, in contrast, has a distinctly industrial character. It features larger factories producing at scale with smaller crafts businesses serving local areas. Manufacturing industries are the dominant sector in the area, followed by business services and shops. The factories produce cocoa, chocolate-making equipment, oils and starch; the smaller businesses include metalworkers, woodworkers, bakeries and breweries as well as producers of furniture, musical instruments and electronics. Unlike vanWoustraat-Rijnstraat, which is relatively homogenous in terms of scale and functional mix, despite the spatial differences between Pijp and Rivierenbuurt, Westzijde hosts industrial clusters alternating with residential clusters featuring some

commercial activities. Overall, Westzijde does not have a continuous line of commercial activities; rather, it boasts clusters with various functions (see Figure 9.1a, right). The intersection of Westzijde and Guisweg, a street linking Westzijde to the provincial road, features a cluster of shops, restaurants and hotels, a fire department, a furniture store, a construction business and a stone supplier, serving a larger area than just the local neighbourhood. Due to the larger plots available in Oud Koog and Oud Zaandijk, business density is more than five times lower there than in Pijp and Rivierenbuurt.

In all of the discussed neighbourhoods, commercial activities and amenities are concentrated along the main street. However, the reach of these activities differs. Most shops and services on vanWoustraat-Rijnstraat, such as clothing stores and hairdressers, perform typical functions of a main street, serving their local community. One exception is the market in Albert Cuypstraat, which attracts people from across the city and constitutes a tourist destination. Thus, it features a disproportionate number of cafes. Like Albert Cuypstraat, supported by its high connectivity, Westzijde and around its intersection with Guisweg is a similar exception, hosting functions serving tourists going from the train station to the Zaanse Schans, a popular tourist attraction.

Mapping the mixes shows that the mixed-use environments in both areas manifest at different scales with differing distributions. The mix of uses shown in Figure 9.3 was calculated using four simple categories: housing, retail and services, productive industry and business services.[2] Figure 9.3b shows the degree of mixed-use in buildings (the darker the grey, the more businesses) and the mix in each street segment (the darker the red, the more mixed), as measured by Simpson's diversity index (Simpson 1949). Many buildings in Pijp are mixed-use, particularly on vanWoustraat-Rijnstraat and its cross streets adjacent to the main street. In Rivierenbuurt, the street is predominantly mixed, with a lower diversity of economic activities in the buildings than in Pijp. Behind the main street, Rivierenbuurt has only a few mixed-use buildings. In contrast, most of the buildings in Oud Koog and Oud Zaandijk are mono-functional, while mixed-use buildings are primarily located on Westzijde, where use diversity is present in adjacent buildings.

Importantly, in both of the case studies, the main street seems to constitute the main structural element organising a mix of functions. In Pijp and Rivierenbuurt, the mix changes in a gradient away from the main street. In Oud Koog and Oud Zaandijk, the mix changes sequentially along the street.


**Figure 9.3:** Degree of mixed-use buildings and mixing in street segments in vanWoustraat-Rijnstraat (left) and Westzijde (right). © Hausleitner 2022

## Differentiation of spaces of economic activities

Economic activities appear in different ways on the two streets. Here, we turn to the question of how spatial form facilitates mixed-use differences.

vanWoustraat-Rijnstraat and Westzijde (see Figure 9.4) are in their neighbourhoods the main central street, the 'front' side, which is generally associated with high footfall and in both cases contain the highest number of shops and services (see Figure 9.1a). The clear urban front sides of the blocks that line vanWoustraat-Rijnstraat (see Figure 9.5) make these buildings particularly suitable for public-facing

economic activities, such as shops. The entirety of both Pijp and Rivierenbuurt is designed with closed urban blocks that clearly define the border between public and private on the block scale, creating clear urban front sides facing the street. Westzijde, in contrast, does not have a clearly defined front side. Instead, the alignment of the buildings with the street and facades with entrances oriented toward the main street form the front side. The places at the river and the canal form the 'back' sides on the neighbourhood scale (see Figure 9.4); these are less accessible from the main street and are complementary to the main street. Such 'back' sides are not as clear in their shape as the 'front' side in both places but appear to cluster building types, and plot sizes differ from those of the front sides (see Figure 9.4). The large grain plots along the river – originally factory sites – constitute an exception in Pijp and Rivierenbuurt, providing space for activities with a larger footprint. The 'back' side location takes further advantage of the lower

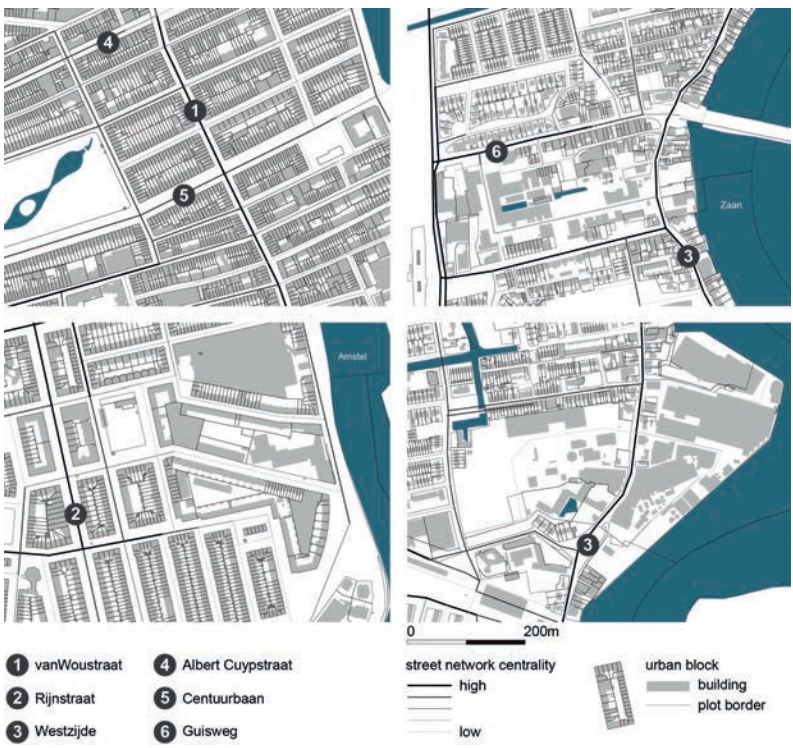


**Figure 9.4:** Mapping of plots, buildings and betweenness centrality in two zooms in vanWoustraat-Rijnstraat (left) and Westzijde (right). © Hausleitner 2022

connectivity to the main street. Vehicular traffic attracted to the back side comes from the road along the waterfront without impacting life on the main street.

On a smaller scale, variation within blocks forms complementary 'back' sides, offering space for extraordinary activities. Some of the western side streets of vanWoustraat feature craft workshops and car-repair workshops with a larger footprint in mostly low-rise industrial buildings in the courtyard of the block (see Fig. 9.5). Similarly, on Westzijde, medium-grain areas along the main street facilitate buildings with a larger footprint behind the street-front buildings. These courtyard activities are facilitated by deeper plots in both places, providing space for a second building in the blocks' interior (see Figures 9.4 and 9.5). A pre-condition for active back sides is their accessibility (see Figure 9.5). The back sides in Pijp and Rivierenbuurt are accessible via doors on the main street's front buildings. The back side buildings on Westzijde have access roads and are often accessible from multiple sides of the plot. This means less industrial traffic and, in turn, fewer nuisances on the main street. These accessible courtyards along Westzijde also provide loading space, which Woustraat-Rijnstraat lacks. Thus, on the latter main street, delivery trucks have to unload on the 'front' side. Evidently, this distinction between 'front' and 'back' sides is relevant on plot, block and neighbourhood scale for ordering activities with similar needs.

Territorial depth creates distance between the front and back sides on multiple scales. In both cases, the streets between the main street (the urban front side) and the river (here interpreted as the urban back side) increase the territorial depth on the neighbourhood scale. A differentiation of the street network is visible in both cases, though this is much more explicit along Westzijde, where the main street is considerably wider than its side streets. Proximity to the river means that the side streets east of vanWoustraat-Rijnstraat are less accessible, resulting in less economic activity than on the side streets west of vanWoustraat-Rijnstraat. The urban blocks on the northern part of vanWoustraat-Rijnstraat are oriented with their short side along the main street. Consequently, fewer turns are necessary to access the main street from every part of the neighbourhood. In contrast, more turns are necessary on the southern part of vanWoustraat-Rijnstraat, as long blocks build a barrier between the main street and its hinterland. Thus, the predominantly residential area behind this part of the main street is more 'private' than the main street. On both vanWoustraat-Rijnstraat and Westzijde (see Figure 9.4) deeper urban plots foster


**Figure 9.5:** Spatial organisation of diverse functions on vanWoustraat (top) and Westzijde (bottom). © Hausleitner and Stuyt 2022

a gradual decrease in publicness inside the block. In the more fine-grain, higher-density areas around both streets, public storefronts have more hidden storage and office space behind publicly accessible rooms. Residential units are located on the upper floors of mixed-use buildings – a vertical step from the main street. While the findings in this chapter concern the differentiation of places by territorial depth for business activities, Clossick and Smink (this volume) have found that depth is of similar importance for social conditions. Evidently, distance can be created by different types of morphological elements or spaces.

In terms of buildings and plots, the scale of the urban grain on vanWoustraat-Rijnstraat is largely homogeneous. Westzijde, however, boasts high variation in plot and building sizes on account of its fragmented development. Still, variation in the density of the street mesh leads to some variation in block sizes on vanWoustraat-Rijnstraat. Especially on its southeastern part, a less dense street network near the river results in relatively large urban blocks, contrasting with the rest of the neighbourhood. These large blocks host a tram shed and large commercial buildings on the site of a former car factory.

Minor variations in footprint and storefront size of the buildings on vanWoustraat-Rijnstraat enable a variety of public-facing businesses to occupy these buildings. The urban blocks along the northern part of vanWoustraat-Rijnstraat tend to have slightly deeper plots in their middle sections (see Figure 9.5), providing open space in the blocks' interior. Here, the ground floor is typically divided into two- or three-deep units. Each has a short storefront along the main street, both providing businesses with sufficient floorspace to operate and taking advantage of their place on the main street. The corner shops, while operating in smaller buildings, have more metres of storefront. In some cases where businesses require more space, ground floors have been internally connected.

Westzijde, in contrast, depicts alternating sequences along the street with fine-grain and large-grain urban blocks. Plot sizes vary greatly, accommodating many different use types, including large-scale industry. Blocks with fine-grain plots and buildings for shops and housing facilitate functional diversity by integrating medium-size plots into the block. These medium-sized plots facilitate buildings with larger footprints behind the main street.

The main spatial and morphological diversity along vanWoustraat-Rijnstraat is evident in the differentiation of its hinterland. There, one can find a wide range of businesses that do not require a public frontage but may still benefit from their proximity to the main

street. vanWoustraat-Rijnstraat entails a typological and functional transition – gradients of combinations of plots, building types and accessibility: from highly accessible, small-grain and similarl sized mixed-use buildings along the main street (the 'front' side) to less accessible, relatively lower-rise buildings with larger footprints on the 'back' sides of the blocks. Pijp and Rivierenbuurt have gradients on the block and street-network scales. Additionally, they demonstrate typological contrast with large-scale industrial inserts behind Rijnstraat.

Along Westzijde, street sections of small-grain plots and buildings with small local shops, service providers and housing alternate with street sections of large-grain industrial plots and buildings. Surrounding the clusters of large-scale industry along Westzijde is a gradual typological and functional transition between industry and housing. Surrounding the industrial plots, medium-sized and small-grain plots feature construction companies and multi-business centres. Finally, surrounding these are housing units. On the plot level, the large industrial plots of Westzijde comprise office and storage buildings along the public sides of the block, offering a buffer from the production and logistics activities occurring in the centre of the plot. The industrial plot of the cocoa factory is such an example. Notably, it occupies an entire block on both sides of the main street. Although the factory has a public frontage facing the main street, the continuous line of facades on the main street is interrupted due to the factory's need to access the waterfront. The production process is conducted on both sides of the street, enabled by pipes crossing above the main street. The factory here is just one example of the interesting functional alternations on Westzijde.

## Accommodating mixed use in main streets

Vital mixed-use streets are not merely containers for a random mix of functions; rather, they afford function combinations based on specific functional-spatial relations. In both of the discussed localities, the type and scale of the uses found on the main streets and in their hinterlands are dependent on available building types, which are, in turn, dependent on plot sizes, connectivity and centrality, which are, once again, dependent on local topography, geography and history – whether the place was planned or developed organically. While shops and services can generally fit in smaller spaces, most manufacturing industries require space beyond that offered by standard mixed-use city

plots and buildings. Manufacturing at scale requires proper consideration in the planning of the urban layout, by providing larger business units and considering routing to prevent overlaps in road traffic by trucks and slow traffic. From the observations made in the two case studies, we can draw four main conclusions regarding the urban structural conditions that afford a mixed-use environment on main streets and their hinterlands:

*Modularity of the urban plan* on the building, plot and block scale levels helps to maintain coherence along the street while still allowing for differences and adaptability. Modular organisation in the urban plan enables the upscaling and downscaling of business space based on a smaller unit within the units of the next higher scale (building combinations up to the plot, plots combined up to the block). The large-scale aggregation of multiple blocks can be successful if the main street and street network remain permeable for all users. Within a modular frame, variation in building types, plots and streets forms the basis for their future occupation, businesses of various sizes, and needs.

*Providing complementary 'front' and 'back' sides in proximity* and across several scales is a pre-condition for providing places with different environmental conditions. On the neighbourhood scale, main streets are the most public place – the 'front' side. The presence of territorial borders near the main street in the form of rivers or infrastructure elements enables the integration of spaces for producing and selling in proximity. Larger plots and main traffic routes form urban 'back' sides. These are good sites for industrial facilities and large-scale amenities. They foster a mixed-use environment by clustering similar spatial needs and providing separate routes for industrial and slow traffic. Without territorial borders, physical design on other scales becomes relevant to the creation of distance between spaces, allowing the co-existence of disparate activities. The topology of the street network differentiates place accessibility. Public front sides and interior back sides on urban blocks afford differentiation in visibility, allowing for less capital-strong economic activities to have a place next to 'A-locations' along the main street.

*Structural coherence* that still allows for exceptions creates a clear character for the street space. While neither of the case studies showed solid structural coherence, they indicate two different ways to achieve it: spatial sequences that show transition gradients and spatial

sequences that show typological contrast. The front-to-back transition gradient has two purposes: first, it organises affordability of place; second, it organises the alignment of environmental qualities, which supports functional diversity in proximity and thus mixed-use.

*Territorial depth with steps between front and back sides* provide for transitions between environmental qualities (e.g. from more noisy to less noisy, from more footfall to less footfall). Such transitions can be organised at different scales and supported by elements of the urban plan, such as varying grades of accessibility, or varying plot sizes and building types (the latter two being aspects of modularity). Various spatial elements can facilitate transitions from one to the other zone: fences or hedges, stairs, new building types, plot sizes or street turns. Thus, spatial transitions can appear as horizontal or vertical. Both case studies showed places where the 'extraordinary' function appears with typological contrast of built form. In both cases the processes that could result in nuisances for the main street had little spatial overlap with the main street, meaning that such business can use the main street, but only when minimising their operation along the main street. Integrating factory shops along the main street – that part of factory activity most similar to common main street activities – can facilitate mediation in places of functional-spatial typological contrast. In this way, coherence is not necessarily provided by spatial characteristics; it is provided by activities that align with the common functions of the main street.

vanWoustraat-Rijnstraat was planned as a part of a major urban expansion. It appears, in its functional mix, to be more closely in line with what is commonly thought of as a main street, being embedded in a residential, mixed-use neighbourhood. Westzijde boasts activities in the mix that are more commonly thought of as incompatible, shifting from an industrial street to one with more commercial and residential places. The spatial-functional description of the two streets presented here has shown how spatial-structural characteristics are related to the functionality of everyday street spaces and the appropriate location for production and selling – from craft and manufacturing at one end of the spectrum to retail on the other. It has offered guidelines for urban designers who wish to facilitate a mixed-use environment.

## Notes

1 Data on the sub-neighbourhood areas have been aggregated, including CBS 2022 for inhabitants and BAG 2018 and fieldwork for businesses.
2 The business categorisation employed SBI codes (G, I and parts of S covered retail and services; F covered production industries; J, K, L, M and N covered business services). Source: ARRA business database provided by DRD Amsterdam.

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**Figure 10.0:** Map of Kiruna © Anna Skoura