WP2: ACCESSIBILITY

SYNTHESIS REPORT

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WP2: Accessibility
Synthesis Report

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Summary

Accessibility was defined in the project by how well an individual can achieve services or a target from a specific location. Aggregate, measurable indicators need a lot of input data, as both land use and networks should be available in digital form, supplemented by trip data and transport service descriptions.

In practice, a two-level approach was chosen. A general screening was defined to be done using statistical indicators, which related pedestrian infrastructure supply to population on macro level. Micro level assessment was based on site visits and GIS analysis. Accessibility was defined to be measured for typical, representative origin-destination pairs.

Accessibility analysis shows that the lack of suitable crossing facilities is the most common problem concerning pedestrians. Segregation and border effect caused by high-volume, high-speed car traffic can be found in most case areas. Another modern shortcoming is the segregation of housing, services and work. Urban sprawl, centralised shopping malls and city planning based on the availability of car are phenomena which will continue if planners and decision makers don't change their attitudes. These problems are sometimes even more common in new areas than in the older ones.

Both of these major malaise affect especially children, the elderly, handicapped and those who don't use car for their everyday mobility. They also enforce each other in worsening accessibility – long distances together with difficult environment decrease walking. They also cause more accidents – long distances mean high exposure, and at the same time high car volumes increase risk. It has to be noted that sometimes the problems are solved only in theory, like expensive under- and overpasses in places where they are not used or with a geometry that repels potential users.

In northern Europe, and also at high altitudes, winter maintenance, snow and ice, are a major difficulty. Sudden changes make maintenance demanding, and shared responsibilities together with the cost of the work may cause both delays and neglect. Rare snow and ice situations are also difficult in central and southern Europe, as people and community are neither prepared nor equipped for them.

Geographical characteristics are difficult and expensive to cure. Hills, slopes, stairs, rivers etc. may cause detours and need special arrangements (lifts, bridges, ramps, benches..), which have to be planned with the potential need and demand in mind – and taking the budget restrictions into account! The same applies to missing links or missing pedestrian routes and sidewalks. Narrow sidewalks and poor quality of pavement were found especially in old towns.

All kind of obstacles are an everyday hindrance for pedestrians in many European cities. Advertising signs, lighting poles and parked cars may be seen as a sign of indifferent attitude against pedestrians. Even connecting public transport and walking proved to be difficult, poorly situated bus stops and conflicts between cars and people trying to reach tram stop as typical examples.

Most frequently mentioned problems were:

- crossing facilities,
- separating effect,
- segregation of services, long distances,
- snow, winter maintenance,

- hills and slopes,
- narrow sidewalks,
- kerbstones and steps,
- high motor traffic volumes.

Other common problems:

- excessive speeds of motor traffic,
- parked cars,
- poorly located public transport stops,
- poor quality of pavement.

Sometimes also mentioned:

- capacity restrictions and obstacles on sidewalks,
- over and underpass geometry,
- lacking links, poor connectivity.

The tentative solutions given to the problems are aimed only to help accessibility. In practice there are several other aspects to be taken into account in decision making. Also the conflicts between different user groups lead to different packages of solutions at different sites.

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1. Accessibility and its analysis

1.1 State of the art

Literature review and expert interviews revealed that pedestrian accessibility has usually been neglected in urban transport planning and research. Compared to the current analysis methods of motorised traffic, especially private cars, planning and analysis practices concerning pedestrians are neither as sophisticated nor generally used. Compared to the vast research concerning pedestrian safety accessibility has really been forgotten.

Accessibility and mobility get more and more attention when quality of life, problems of special groups or general transport policy objectives are discussed. Needs of disabled people have to be met, and at the same time the transport environment will be improved for all users.

1.2 Definition of accessibility in PROMPT

In prompt accessibility was defined as the ease of pedestrians to reach their destinations in urban environment. Accessibility was measured using generalised cost, a friction factor including all relevant inconveniences affecting trip making. The case areas were studied using land use and networks as the starting point. Different user groups have been considered taking into account people's daily mobility needs. Many findings are relevant to both 'average pedestrian' and to special groups (mobilty, visually, etc. impaired) but often special groups face special, even conflicting, problems.

The accessibility analysis in PROMPT was aimed to reveal both common (pan-European) and area (country) specific problems and suggest new solutions for them. The solutions have been formed specificly with accessibility problems in mind, so in practice other needs may overrun them!

1.3 Used analysis methodology

Statistical analysis, GIS analysis, site visits and questionnaires were used in order to map the accessibility properties, needs and problems. Accessibility was analysed on two levels. On the urban scale the land use patterns and relations between housing, services and work are assessed. On the street scale details of street planning and the needs of different user groups are screened.

1.4 Data collection

On the macro (area) scale, accessibility analysis was performed using two sets of tools. The first one is based on general *statistical* data concerning the study area. The second tool is based site visits at the study area and *mapping* of different obstacles and infrastructure.

On the micro (detailed) level, walking distances and the average walking times between chosen locations were used as indicator. Time component is disaggregated to walking time and waiting time. Distance is disaggregated to 'normal' walking and usage of stairs, lifts, ramps etc. These evaluations are made taking into consideration several user groups. GIS analysis was completed with a limited number of simple on spot *measurements*.

2. Analysis results

2.1 User demands

2.1.1 User categories

Most pedestrian accessibility questions are similar to all user groups, but in practice the groups marked in **bold** have got special attention in the analysis:

Age

1. Children under the school age
2. **School children at first and second degrees**
3. School children at higher degrees
4. Adults (young/mature?)
5. **Aged people**

Sex

1. Female
2. Male

Handicap

1. No special handicap
2. Physically disabled, using cane or crutches
3. **Physically disabled, using rollator, wheel chair etc.**
4. **Visually impaired**
5. **People with carriages**
6. People carrying burdens
7. People with babies
8. People with pets
9. People with special equipment (rollerblades, skateboard, leading bicycle etc.)

Purpose of the walk

1. **School trip**
2. Work trip
3. **Shopping/service trip**
4. "Night life" walk (to/from restaurant, disco, theatre, concert, opera, cinema etc.)
5. **"Linkage" walk (to/from a car park, bus/tram stop etc. The main purpose is some of those above or their mixture)**
6. Other purposes (keeping fit, hiking, walking with a pet, roller skating, skate-boarding, sledging, skiing etc.)
7. Idle walk (evening walk, window-shopping, "taking fresh air" etc.)

Hurry

1. Unhurried
2. A bit hurried
3. Very busy

Acquaintance

1. **Living at the area**
2. Visiting the area regularly or often
3. **A new visitor**

Mood?

1. Stressed
2. Relaxed

Cultural background

(This is only a very suggestive classification)

1. Northern
2. Central European
3. Southern

User needs in respect to accessibility are quite similar independent of the case area, even though there are differences in the shares of different pedestrian groups. Especially the role of private cars in the transport system differs a lot, which affects especially to adults and work trips. For accessibility, *Age, Handicap* and *Acquaintance* may be seen the most important factors.

2.1.2 Environmental conditions

Environmental conditions are the most heterogeneous of the topics affecting accessibility. Though, also here some common problems arose. *Density*, *Topography*, *Climate* and *Distance to the city centre* were seen the most relevant conditions. *Weather* and *Distance to nature* were not seen as crucial.

1.

2.1.3 Urban scale

Common demands

On urban scale land use density is he key factor affecting the accessibility of walking compared to other modes of transport. Land use mix affects the daily mobility of inhabitants. If one has to travel a lot in order to reach daily services or working place he/she often has to use motorised transport. On the other hand, theoretical self-sufficiency of working places in an area does not in practice guarantee that the majority of people would live and work in the same area. Also daily services need a certain demand, this means that there is a critical size which is needed to create an independent area.

Specific demands

Specific demands on urban scale accessibility relate to continuity of networks, maintenance and conflicts with motorised traffic. Geographical conditions and climate are often seen as problems. Even though the tables 1 and 4 concentrate on specific pedestrian

groups, also “normal” people benefit on solutions that ensure accessibility for these other groups.

Table 1 Accessibility related user demands depending on the urban density.

Urban density **User category**	**Sparsely built**	**Moderately dense**	**Dense**	**Congested**
School children, 1st degree	safe school trips, short distances	safe school trips, segrega-tion	safe school trips, segrega-tion	safe school trips, segrega-tion
School children, higher degree	safety	safety	safety	safety
Disabled with canes or crutches	short dis-tances	short dis-tances	lower car traffic vol-umes	lower car traffic vol-umes
Disabled with wheel chair or rol-lator		short dis-tances	no kerbs or stairs	no kerbs or stairs
Visually impaired		continuous pedestrian network	continuous pedestrian network	audio aids, continuous pedestrian network
People shopping and carrying bur-dens	moderate slopes, stairs			
Young adults in a hurry to work	continuous pedestrian network, shorter dis-tances			
Aged people idle walking				
People returning from night events	continuous pedestrian network	continuous pedestrian network	continuous pedestrian network	continuous pedestrian network

Table 2 Accessibility related user demands depending on the topography.

Topography **User category**	**Relatively flat**	**Moderately contoured**	**Highly up-and-down**
School children, 1st degree			
School children, higher degree			
Disabled with canes or crutches			moderate ramps, elevators, stairs
Disabled with wheel chair or rollator	no kerbs	no kerbs	no kerbs, moderate ramps, elevators
Visually impaired			
People shopping and carrying burdens	moderate slopes	moderate slopes, stairs	moderate slopes, stairs
Young adults in a hurry to work			
Aged people idle walking		stairs	stairs
People returning from night events			

Table 3 Accessibility related user demands depending on climate and weather.

Topography **User category**	**Summer**	**Winter**
School children, 1st degree		lighting
School children, higher degree		
Disabled with canes or crutches		maintenance, anti-skid treatment
Disabled with wheel chair or rollator		maintenance, ploughing
Visually impaired		maintenance
People shopping and carrying burdens	Shadow	anti-skid treatment
Young adults in a hurry to work		
Aged people idle walking		anti-skid treatment
People returning from night events		

2.1.4 Street scale

Common demands

On street scale unobstructed connections are required. Conflicts with motorised traffic and certain dimensioning and geometry needs arose.

Specific demands

Specific demands on street scale accessibility relate to street crossings, climbs and kerbs. This reflects the fact that user demands have to remembered through the whole process from land use planning and transport network planning to street furniture details, implementation and life cycle maintenance.

Table 4 Accessibility related user demands on the street scale.

Urban density **User category**	**Sparsely built**	**Moderately dense**	**Dense**	**Congested**
School children, 1st degree	direct routes	direct routes	safe school trips	safe school trips
School children, higher degree	safety	safety	safety	safety
Disabled with canes or crutches	even pavements	even pavements	even pavements, low kerbs	even pavements, low kerbs
Disabled with wheel chair or rollator			no kerbs or stairs	no kerbs or stairs
Visually impaired	clearly marked routes and over-passes	continuous pedestrian network, clearly marked routes and over-passes	continuous pedestrian network, clearly marked routes and over-passes	audio aids, continuous pedestrian network, clearly marked routes and over-passes
People shopping and carrying burdens	moderate slopes, stairs			
Young adults in a hurry to work				
Aged people idle walking				
People returning from night events				

Table 5 Accessibility related user demands depending on the topography.

Topography **User category**	**Relatively flat**	**Moderately contoured**	**Highly up-and-down**
School children, 1st degree			
School children, higher degree			
Disabled with canes or crutches			moderate ramps, elevators, stairs
Disabled with wheel chair or rollator	no kerbs	no kerbs	no kerbs, moderate ramps, elevators
Visually impaired			
People shopping and carrying burdens	moderate slopes	moderate slopes, stairs	moderate slopes, stairs
Young adults in a hurry to work			
Aged people idle walking		stairs	stairs
People returning from night events			

Table 6 Accessibility related user demands depending on climate and weather.

Topography **User category**	**Summer**	**Winter**
School children, 1st degree		lighting
School children, higher degree		
Disabled with canes or crutches		maintenance, anti-skid treatment
Disabled with wheel chair or rollator		maintenance, ploughing
Visually impaired		maintenance
People shopping and carrying burdens	Shadow	anti-skid treatment
Young adults in a hurry to work		maintenance
Aged people idle walking		anti-skid treatment
People returning from night events		

2.2 Problems with the existing physical environment

Accessibility analysis shows differences between case areas, but they are not directly related either to the size or the nationality of the city. Both good and bad examples can be found in all areas, and similar solutions may be useful in most cases. It is promising to discover that pedestrian questions, including accessibility, are seen important all over the EU. High level objectives of CTP are taking practical form in the cities, but resources and time are needed. Following summaries highlight some findings of the work in each case area.

2.2.1 Belgium

Liege, Downtown is part of the city's historical centre, and constitutes the business and commercial district of the city. It is demarcated by the river "Meuse" and by a belt of boulevards and streets built in the 19th century, whose constitute the main access network to the city. Inside this belt, most of the streets are full or semi pedestrian zones. In some other streets, where the motorised traffic is allowed, it's mostly to give access to parking places serving the centre.

The "border-effect" of the river and the motorway along it can be seen. This route is usually not used to connect the north to the south of the studied area. From the bridges over the river, the itineraries are mostly orientated East – West, what appears in the longer journeys times picked up between Northern and Southern nodes than between Eastern and western nodes, for equal distances.

Similar border-effect appears along the boulevards belt but not so strong or so clearly than along the riverside (generous sidewalks and a lot of amenities as well as the vehicle flow constrained by several traffic lights and side parking give a more friendly environment for pedestrians, except some hindrance caused street furnishment, advertisements, etc.). Waiting times at crossings may be long and detours are needed. The boulevards are then effectively used by pedestrians to connect nodes along them. Nevertheless, the crossings are very restricting. Overall, though, the studied area appears quite pedestrian friendly, which itself may cause pedestrian congestion.

Especially positive in Liege is that non-motorised traffic or calmed traffic is the general rule inside the area, so that we have fully permeability for the pedestrian (few problems of street crossing due to the traffic, except at the borders of the area, and that the improvements of the streets are tidy and offer high level of accessibility also to handicapped people, elderly, parents with little children, etc. (no or lowered kerbstones, sidewalks wide enough, sound systems at the crossings, good pavements, etc.).

In **Ans, Rocourt**, the general accessibility of the area seems on the map rather good but in fact, the continuous traffic jam, the poor level of public transport services and the very poor level-of-service for the non-motorised modes tend to confer on this area a problematic accessibility level all day long.

In the area, the main streets are very disturbing and even repulsive (traffic noise and very bad safety) for the walkers due to the high traffic flow. Moreover, the high distances are perceptible because of the straight character of the flat streets. So, it is not usual to walk between the north to the south of the studied area. Also the sidewalks are mostly no more useful (bad pavement) and are cluttered with a lot of things (urban furniture, traffic signals, cars, …).

Nevertheless, there is a potential for walking between the residential area and the commercial and leisure amenities. In certain cases, the beeline distances are really short, but

the lack of connections between the plots impose long detours favourable to the car users.

Eupen is hilly (+/- 30 M between top and bottom). On some places, stairs allow to climb the slope. From the point of view of the pedestrian accessibility, it's much more easier to come to the centre (bottom) from the residential areas at the periphery of the studied area (top) than the contrary, particularly in the Eastern and Southern zones.

Regarding the main roads network surrounding the studied area, one can note the same "border-effect" as enlightened in the case of Liege – Downtown. It seems that the transit traffic on those streets is too heavy (a lot of trucks) and that the speed is too high for the urban environment. Crossing those roads seems to be a problem.

Inside the studied area, on ancient streets, sometimes the sidewalks are very narrow, forcing the pedestrians to walk with the cars. It is not really a safety problem, because the average speed on those streets is relatively low, but much more a comfort lack, especially for the disabled or the elderly. In the same way, till now, those ancient streets are not really "improved" with high standards of quality, at the opposite to what we enlightened in the case study Liege. Orientation may also be difficult, as signing is sparse.

2.2.2 Finland

Helsinki, Myllypuro is a typical suburb in Helsinki. The houses are block of flats, both rental and owner-occupied. It was mainly built in the second half of the 1960's. The commercial and administrative services in the area have diminished during the 1990's, as competition of nearby shopping centre and city centre have attracted the customers.

The major problem in the accessibility in Myllypuro are the long distances. Land use spreads on a large area, but many services are concentrated in the eastern edge of the area. On the other hand, majority of the area is covered with a good pedestrian network and practically car free. For public transport trips the bus connection to nearby Itäkeskus shopping and service centre supplement the metro connection to the city centre.

Helsinki, Töölö case area is in the heart of Helsinki city. The south-eastern corner of the area is only few hundred meters from the main railway and bus stations. Area is surrounded by main arterials and also pierced by some streets with heavy traffic. These are the main accessibility and safety concerns of Töölö. Another specific characteristics are the steep hills, which are especially problematic during winter. Otherwise transport services are quite good, bus and tramlines serve the area, and both railway and metro stations are in a walking distance.

Töölö offers a lot of services, and therefore most inhabitants can fulfil daily needs in their own neighbourhood. The public transport is very good. High volume streets with quite high speed level are the main accessibility problem. As most of the intersections are equipped with signals, the streets can be crossed relatively safely, but the waiting times tend to be long.

Street network in **Kuopio, City centre**, is a typical grid network consisting of mainly one-way main streets and pedestrian and cycle streets in between the main streets. An important feature is that every second street is practically a pedestrian and cycle street, a so called "rännikatu" providing pedestrians with a "woonerf" type calm and agreeable environment.

Main accessibility problems concern street crossings. The main streets around the market square can be crossed relatively fluently at zebra crossings and traffic lights. Some junctions, especially north of the market square, have a lot of car traffic, and pedestrian

delays are considerable. Kuopio centre is a compact area, with majority of the services in a walking distance for most of the citizens. The pedestrian network is better than in typical Finnish towns of similar size and same age.

Jyväskylä, City centre, has a conventional grid layout with sidewalks on both sides of the streets. Some bicycle routes are offered through the area, and the heart of the business area is the north-south pedestrian street. The new Science Park is located near the city centre, and connected to the city with pedestrian route. It and the newly opened Travel centre (combining train and bus services) will form the city in the near future. University campus is located to the southern end of the study area.

Typically for other cities of similar size, most of the street crossings are zebra crossings, either with or without traffic lights. Only few underpasses and overpasses have been arranged. Some east-west streets have steep slopes between the pedestrian area and railway station. Especially there the winter maintenance questions arise. For accessibility, the topology of Jyväskylä centre seems to offer short distances for most of the citizens. Public transport services for local trips are sufficient. Street crossings and slopes on the way to the Travel centre may be seen as a problem.

Jyväskylä, Kortepohja is a suburb of he City of Jyväskylä. It situates about 2 km to the north-west from the city centre and is separated from it by the lake Tuomiojärvi and the Rautpohja industrial park. Southern part of the area has the service centre with shops etc, schools and mostly large blocks of flats. The northern part consists of detached houses. In Kortepohja, streets and parking have been gathered to certain streets and areas, and a lot of the network is mainly for pedestrians and bicycles. Some delivery transport is allowed throughout the area. A couple of underpasses have been built under the main street delimiting the area on west. The bus services between Kortepohja and centre are frequent. For other directions there isn't enough demand for bus lines.

The area is quite long, so the distance from the northern end to the services in south is a problem Also the difference in elevation between the ends of the area may cause inconvenience, especially for the elderly and the handicapped. During the winter time, many of the minor routes are not maintained at all. Inhabitants have complained about cars and trucks using the pedestrian area, but the evaluation team got the opinion that most of the vehicle traffic was related to delivery etc., and that the speeds were low.

One specific problem is the accessibility of bus stops. Both zebra crossings as well as underpasses cause a substantial detour. Inside Kortepohja the pedestrian accessibility is good, except in winter, when ice and snow may cause trouble especially for the elderly and handicapped people. Connections to and from the city centre are mainly based on motorised transport.

2.2.3 France

In **Bellevue, Nantes**, accessibility to the outer boulevards appears to be suitable due to a redesigned layout when the tram service commenced. Pedestrian paths are now wide and comfortable alongside the tram tracks. Many pedestrian crossings have been designed in the ground level so those person may easily either reach the tram stops or cross the boulevards.

Due to the transformation of *Mendès France* square to accommodate a multimodal interchange station, it is now very easy for pedestrians to use it. They now only need to cross one road, used by vehicles, to reach the West Side of square.

Within the area, the streets are wide with a low traffic, except one which is a rather important link north/south throughout the area and so has a high traffic. The inside area is also characterised by pedestrian paths which wind between buildings, each one being the shortest way to the destination.

One of the less practical sectors for pedestrians is to the rear of the shopping centre in *Mendès France* square. Many people walk there but it is a sector where initially, no special measures were planned for pedestrians.

Saint-Leu, Amiens In comparison with the rest of the town, the Saint-Leu area is characterised by a high proportion of students amongst the inhabitants. The socio-professional categories are comparable with those in other parts of the town. The most important difference is that private cars are used far less, seeing that nearly 1 household out of 2 does not own a car (1 out of 3 for the remainder of the town). Main boulevards are, though, sometimes difficult to cross, especially for the school children.

The case area is separated from neighbouring quarters by major divisions : wide roads and small canals. In spite of these divisions, the openness of the urban fabric is facilitated by both a network of covered passageways giving access to cross over the small islands and several old or recent footbridges to reach many areas. However, steps are used for access to the majority of these footbridges and, in rarer cases, there are sloping approaches.

The numerous footbridges and pedestrian paths crossing the small islands are often convenient for pedestrian use. However, some of these footbridges have steps which limit access to people with restricted mobility due to certain reasons (children's prams and pushchairs, elderly people, wheel chairs..). Real difficulties vary according to whether the handicap is slight or not. This means that people have to make more or less long detours. There are no specific signs to indicate alternative routes for visitors whose mobility is restricted.

Within the area to the east, in the oldest part of the area, the network comprises small narrow and winding streets. Some of them are pedestrian streets and most of them can be considered as "woonerf" because of their layout and the spontaneous pedestrians and car use. To the west, the layout is just the opposite, streets are larger and straighter. In this part, and more especially around the university, parking is intensive and generates problems (prohibited parking at street corners, on pavements, on pedestrian crossings …).

2.2.4 Italy

In **Frascati, S. Rocco** Area accessibility is hindered by the peculiar morphology of the town, settled on a hill and with differences in levels that are up to 40 meters. Typical walking distances are quite always, more or less, under 400 m, and this could be, at least under the theoretical point of view, an affordable value for many users and for many trips; anyway this value is far from being an optimum, because of the presence of many stairs and slopes (the latter very often with a gradient higher than the 15%) to be climbed.

Besides the "physical" hindrances, also other elements can be considered as obstacles: crossing points are many too, very often unruled, and this can be considered a problem both at safety and at accessibility level; under this twofold aspect can be seen also the inappropriate provision of bollards in some streets: indeed they create a too tight lane for pedestrians, who then prefer to walk in the middle of carriageway. The not good maintenance of roads, together with the type of road paving, made of "sampietrini" (lit-

tle blocks of porphyry) in the inner zone, contribute to diminish the accessibility level (as well as the related safety of use) especially for the elderly and for wheelchair users.

L'Aquila, La Villa Area is one of the coldest in Italy, with snow and regularly recorded minus 0°C temperatures in wintertime. The zone, settled in 1911 according to the Urban Master Plan, and developed in the 30s following the model of a garden city, with its small "villas" maintains still nowadays its characteristic aspect; in spite of the different interventions, it presents indeed a compact and quite homogeneous building structure. There are three different building types, that reflect the building phases of the area: the little villa, a typical residential building of the 30s, located on one side of the area, some popular housing (row houses with courtyards), and some small residential block of flats, the so-called "palazzine", recently built.

In the city centre, and in some zones nearby, vehicular traffic is forbidden; this restriction has various negative effects on the considered, adjacent area; the flow of traffic that it generates moves through the area with the aim of ringing the forbidden centre; the amount of this traffic flow is even worsened by the addition of the local one, caused by people leaving the area. The second aspect is connected to the consequent role assumed by the area: a parking basin for the downtown area. This parking demand diminishes the availability for La Villa residents, where parking is free along the streets, with in line typology, along one or two sides, depending on street dimensions. In addition, some sidewalks are not in good maintenance and, this contributes to foster motorisation.

There are some general problems, like the overall lack of facilities for disabled people, or the missing public transportation pattern with scattered stops close to the residential compounds. Anyway, the main reflection to stress is that the real problem within the area is the great distance between services and residences.

Modena, Salicet Panaro area is located in the East inner suburb of Modena, and is surrounded by an inter-district street (Strada Minutara) along the West side and by a local street (Saliceto-Panaro) along the North side. Even if the area is mainly residential, constituted by buildings of the '70s six/seven storeys high, and by even more recent ones, small row houses, some medium size factories are also located there. Local problems are related to vehicular traffic. The main one is caused by the presence of the industrial compound in the area, that attracts lorries, vans, etc. and that creates congested situation in peak hours, especially along the main streets that surround the area (as for instance along Via Divisione Acqui, used as alternative to the Via Emilia, where big traffic flows are regularly recorded. Jammed situations have been also detected within the area, around the local primary school premise (Via Palestrina) during entrance/exit school time. The overall car density rate is one of the highest in Italy, about 0.65.

Most sidewalks of the area are very narrow, very often they are less than the minimum standard set by law; this is a safety problem that also deals with accessibility, because such kind of unsuitable supply for pedestrians pushes people to select their paths giving preference to routes that offer these performances more than others, and making sometimes longer trips. Kerbstones are typically high, zebra crossings are scarce and crossings with traffic lights cause delays. So, in the Modena case study, unsuitableness of sidewalks, of public lighting, the presence of lorry traffic, of few shops, and the lack of devices for disabled people make some streets left apart by pedestrians and totally not accessible by impaired people, revealing that such habits are much more related to the missing facilities for walking than to the safety feeling.

2.2.5 Norway

Trondheim, Midtbyen NE, is a rather compact area located at the seafront, bounded by the fjord and the river Nid. The case area is the northeastern part of the city centre (Midtbyen), with connections to new development areas Brattöra to the north and Nedre Elvehavn to the east. All streets in Midtbyen have 50 km/h speed limit. Most streets in Midtbyen N-E are wide with sidewalks on both sides, while there are some passages where the sidewalks are narrow. There are two pedestrianized streets in the shopping area. Most alleys are narrow with mixed traffic, although a few of the alleys are only for pedestrian and bicyclist traffic. Along the canal there is a passage for pedestrians. The area is generally rather flat, but there are some steps and steep slopes to the alleys and warehouses along the river to the east and the canal to the north.

Midtbyen N-E is part of the city centre with a concentration of shops, offices and services. Being a downtown area, distances are short for most services and the area is well served with bus lines (bus stops) for both city buses and regional buses.

Most junctions of the main streets have pedestrian all-walk signals, meaning all vehicles have a red light when the light is green for pedestrians to cross in both directions. They also have acoustic signals to guide visually impaired persons. Other crossings are non-signalised zebra crossings, while in the alleys there are usually no specific pedestrian facilities.

There are two pedestrianised streets in the area, both busy shopping streets. Thomas Angells gate is a pedestrian/bicycle-only street 11,25 metres wide paved with rectangular paving stones, and a narrow drainage grate runs down the centre of the street, dividing it in two. Most of the main pedestrianized shopping street, *Nordre gate*, has pavement heating to keep the snow away in the winter.

Looking at accessibility width of sidewalks, snow removal and evenness of pavements are some major challenges, as well as ways to reduce the problem of obstacles caused by sign posts, advertisements and shop equipment. Delivery vehicles are supposed to access *Thomas Angells gate* between 6am and 11am in the morning and enforcement of this regulation would eliminate the obstructions vehicles cause in trying to drive through crowds.

Trondheim, Lade, is a residential area near (0-3 km) the city centre of Trondheim consisting of housing built in different periods, including new housing areas. Located at the seaside, Lade has less snow than most of Trondheim. Along the shoreline there is a pedestrian path connected to housing areas, sport fields, playgrounds and beaches. Part of the Lade area is rather hilly with nice views to the fjord and the city centre. To the south the railway and highway are significant barriers to the rest of Trondheim.

Centrally located at Lade is a commercial and industrial area with most services and shops available, surrounded by the residential areas. Two bus lines serve the area with three buses per hour on weekdays, with good access for central area, but there might be some distance to a bus stop from some of the residential areas. In addition the area is served by a *service-line* (TT-flexibuss) twice a day. Minibuses equipped for handicap transport travel close to homes, shops, public service and medical centres.

The main streets either have sidewalks (wider than 1,5 metres) or pedestrian lanes, for *Lade allé* only on one side of the street. The residential streets have 30 km/h speed limit and some measures have been taken to calm the speed, mainly bumps. About half of the residential streets have mixed traffic not giving priority to pedestrians. The other residential streets have sidewalks of varying quality and quite often rather narrow, intended

for snow storage rather than walking. Some of the residential streets are rather hilly, especially the Ladehammeren area to the west. Altogether only a few benches were available for sitting down.

Many complaints about accessibility difficulties concern slippery surface. Other comments are darkness, no sidewalks, narrow sidewalks, sidewalks in bad condition, no snow removal on sidewalks, lack of pedestrian crossings and lots of traffic.

The main problems concerning *accessibility* at Lade seem to be area segregation, separating residential areas from the central area where shops and working places are located. This means that some of the residents have fair distances to walk for shopping and errands. Also, there are many elderly people living in Lade, and for them the hilly parts may be hard when walking.

Trondheim, Tillerbyen is a residential area 8-11 km south of the city centre of Trondheim. It was planned in the 60's and constructed mainly through the 70's and 80's although some housing areas are built recently. Tillerbyen includes a commercial centre with a larger shopping mall and most sectors of trades and services present, as well as an area of industry and storehouses. Construction going on is both filling in and enlarging this commercial and industrial area. Post office and some health service are available, while social services are located in the neighbouring area west of the E6 highway.

Tillerbyen has a well distributed pedestrian network between housing areas, kindergartens, schools and sport fields. The street network is to a large degree separated with overpasses over the main streets within the area and some underpasses under the highway E6 bordering the area to the west. Still this highway is a significant barrier to the neighbouring areas. Also, within the shopping area there is not a good pedestrian network and sometimes a long way to walk to get to the shop entrance.

Trip lengths are short for school and local buses in Tillerbyen, but trips to local service are longer. Within the residential areas short cuts are made or found. Within the area with shops and industry, though, we see a development with more establishments filling in the gaps where short cuts were possible. Also, many of the buildings and parking lots are enlarged, making it a longer distance to walk around. Tillerbyen is a relatively flat area. Still, climbing the overpasses and underpasses may be difficult for persons with mobility problems, and especially when slippery in winter.

In **Lillehammer, Town Centre**, the central shopping area is pedestrianized around the historic *Storgata* main street which is flanked by wooden houses dating back over 150 years. In an area along the main shopping street, they have been able to keep the buildings in the traditional style. Speed limits are 50 km/h. Speed levels are measured to be below 30 km/h for *Anders Sandvigs gate* and between 30-40 km/h in *Gamlevegen*, both streets are east borders of the area. Generally streets within the case area have sidewalks on both sides.

Signalised zebra crossings in the town centre do not have separate periods for pedestrians, but the green light for pedestrians start a few seconds before the green light for turning vehicles. Zebra crossings (without signals) in the town centre are only marked with road marking and not with signposts, which may be a problem in the winter.

The streets in north-south direction are rather level, while the streets east-west are steep hills. Although the case area is longer in the north-south direction, the climb can be considerable for all trip purposes depending on the east-west distance. Lack of snow removal makes it difficult to cross roads, streets are cleared before sidewalks, and routes

to school should be cleared before school hours. Two intersections are mentioned as difficult places when walking.

Lillehammer, Vingrom is a part of Lillehammer Municipality situated about 8 km south of the town centre, close to the lake Mjösa and the national highway E6. Parts of Vingrom have scattered housing, while some residential areas are concentrated around the school and general store. The length of the area makes some trips long, and for many directions also the hilliness makes walking tough.

The highways cutting through Vingrom have high speed levels, asphalt pavement and no pedestrian facilities. Some of the local roads are gravel roads, and some of them are rather narrow, curved and hilly. Especially for children it is difficult to cross *Torpaveien* at the crossroads (*Torpaveien/Vingromveien*) because of restricted view. And it is difficult to walk on the walkway when it is not cleared of snow before school hours, while the street is.

2.2.6 Switzerland

Geneva, La Cluse, is situated near the centre of the city on the south side, between a great city-parc (Plainpalais), the cantonal university hospital and the river Arve. It has a mixed urban structure and a high housing density. The area was chosen, because of the new plan for pedestrians (March 2000) with its different measures to increase the quality of public space for pedestrians in this area.

The street network consists of 5 longitudinal axis in north-south direction and a greater number of cross connections in west-east direction. The majority of the streets are one-way streets with sidewalks on both sides. For local streets the number of the traffic lanes is one in one-way streets (exception of 2) and two in two-way streets. The greater main roads have as much as 4 to 5 lanes. The highest signalled speed is 50 km/h, near schools it is 40 km/h signalled and for the one existing woonerf it is 20 km/h. In addition to the streets there exist some footpaths that are short cuts for pedestrians. Main roads have a major separating effect because of high speed, noise and air pollution, traffic lanes with more than 2 lanes and wide apart crossing devices. Crossings require detours and additional walking and waiting time.

The main problems for pedestrians are hindrances caused by car traffic on district- and main streets, crossings, air pollution and noise, unsatisfactory public spaces, streets overloaded with car parking, various obstacles on sidewalks like motorcycles, bicycles, street lamps, posts and so on.

To the case area **Sursee Mitte** belongs a district with rail station, old town, shopping street , schools and residential area. The case area can be divided into 4 different parts: historical old town with a mixed urban structure, *Bahnhofstrasse* with shops and supermarket, the railway station and industrial area as well as the large residential area in the south part of *Bahnhofstrasse* until the border of the municipality. In the old town there is a 30 km/h zone, the public space has been remodelled very carefully. The main Ringroad has been a great barrier for pedestrians, with underpasses. In the last years some new crossings at surface level have been installed.

Because of the missing bus service the accessibility from the residential areas in the southern part of the case area is poor. Long trips are necessary. This disadvantage is not compensated with crossings without waiting time or minor detours. The same applies to trips to bus stop and rail station.

The separating effect of the wide *Ringstrasse* (main road) is mainly problematic at night when the underpass isn't used and the separate pedestrian and bicycle lane is avoided (in connection with security) and a walk is replaced by a car drive. The crossing situation on Münsterplatz with a crossings of the main road requires for pedestrians a detour and can't satisfy. Pedestrian network is fine-meshed in the old town, but wide-meshed in residential areas and some pedestrian connections beyond street network are still missing.

Zurich, Langstrasse is situated near the centre of the city, on the back side of the main station of Zurich. It's an urban mixed area with a high level of inhabitants from foreign countries. The *Langstrasse* is a important street, which is used mainly for shopping and going out. It has a high demand for pedestrian crossings every where.

The street and pedestrian network is dense, has sidewalks on both sides and some additional footpaths. There are 3 30 km/h zones. On intersections a raised or marked circle has been added and practically all zebra crossings have been eliminated as well as the signals for stop and no-precedence. In one longitudinal street driving at night is prohibited (*Ausstellungsstrasse*). Bicycles can use several one-way streets in both directions. The *Sihlquai* has heavy traffic (connection to highway) and separates the case area from the river bank. Air pollution and noise from the traffic make a trip along the riverbank unattractive. The *Limmatstrasse* has 4 lanes (2 for the tram), is wide with the result that crossings exterior to zebra crossings are not attractive. Also there is a great need of crossings, only on intersections there are zebra crossings.

Trips to primary schools are quite long for children on both sides of *Langstrasse* from the areas along the railway. Of importance are the crossings over the wide *Limmatstrasse* (zebra crossings with and without traffic lights, with and without median refuge). The accessibility of central facilities round about Limmatplatz as well as tram and bus stops are not very good from the areas along the railway. The mixed urban structure of the district (e.g. shops for everyday use) improve the accessibility from all parts of the area.

Zurich, Schwamendingen Mitte, became a part of Zurich in 1934. For Zurich it was the largest reserve of building land. After the second world war, Schwamendingen was built up more and more. Today it is a residential area on the northern outskirts of Zurich. It is bounded on the west and north side by a highway with it's respective air pollution and noise, in the south with the former village centre, the *Schwamendingerplatz* and in the west with a residential area as far as *Winterthurerstrasse*. The district has a low housing density and makes a green impression.

There are 2 major main streets (*Ueberlandstrasse, Winterthurerstrasse*) and 2 smaller main streets (*Saatlenstrasse, Herzogenmühlestrasse*). The other roads are in 30 km/h zones. Traffic calming measures are alternately on-street parking and road humps as a chicane (*Luegislandstrasse/Glattstegweg*). Noticeable is the unequal width of the sidewalks. The narrower one is less than 1.50m wide. Small paths lead in between the residential units but are not always a through way. Signalled footpaths (walkways) cross the hole area and meet at *Schwamendingerplatz*. The path along the bank of the river Glatt in the northern part (opposite the high way) is narrow and used by bicycles.

Main problems for pedestrians are the air pollution and noise from the highway, the hindrances of car traffic on the major main roads (crossings, air pollution, signal control with long time interval for red, short time interval for green). The accessibility of the centre is reduced by a non passable location line of the tram next to the street. The speed in 30 km/h zones (implementation in 1991) is still too high.

Separating effect of main roads is a major concern. Main roads have a need of crossing that doesn't correlate with the offer and therefore leads to a higher accident risk (entrance to schools, access to bus stops, access to shops and facilities in the centre). For example, *Ueberlandstrasse* with 4 lanes is a barrier between the residential area in the north and the district. The 3 zebra crossings without a median refuge are dangerous for children and disabled persons. The existing overpass near the bus stop requires long detours and climbs and is hardly ever used.

Street- and pedestrian network is not everywhere suitable for disabled persons (for wheelchairs, blind or deaf persons). Chamfered kerbstones are missing, crossing assistance at traffic lights and crossings (without tactile blocks and audible pedestrian signals) are missing as well as directories and access help for tram- and bus stops (tactile surface).

2.3 List of problems

Problems are categorised according to the following classification:

G. General

C. Climate dependent

T. Topography dependent

A. Area type dependent (central, suburb, old, new etc.)

U. User type dependent (child, handicapped, elderly people etc.)

S. Social or culture dependent (habits etc.)

The classification has been indicated at the end of the problem (reason) description by the corresponding capital letters of the classes. It may be noticed that often category *General* may be closely related to financial restrictions.

2.3.1 Urban scale

Problem	**Reasons**
Segregation of services, long distances, 8 cases (G, S)	Low densities, poor land-use planning, competitiveness of walking.
High motor traffic volumes, 7 cases (G, A)	Inappropriate street classification.
Hills and slopes, 6 cases (T)	Topography, street planning
Excessive speeds of motor traffic, 3 cases (S, G)	Incorrect street planning
Poorly located public transport stops, 3 cases (distances, conflict with cars) (G)	Poor street planning, public transport network planning
Lacking links, poor connectivity, 3 cases (G, T)	Lack of financing, poor network planning
Orientation, 1 case (A)	Complicated network, poor signs
Security (S)	Social control, surveillance

2.3.2 Street scale

Problem	Reasons
Crossing facilities, 14 cases (wide streets, long waiting times, sight distances, traffic characteristics, geometry, etc.) (G)	Lacking over/underpasses, poor respect to zebra crossings, lacking or poorly phased traffic lights, high motor traffic volumes and speeds
Separating effect, 8 cases (G, T)	Rivers, railroads, topography, lacking over/underpasses, poor respect to zebra crossings, lacking or poorly phased traffic lights, high motor traffic volumes and speeds
Poor quality of pavement, 5 cases (G)	Lack of maintenance/repair, wrong materials (stones), damage caused with winter maintenance
Narrow sidewalks, 4 cases (A, G)	Poor planning, historical reasons, competition between parking and pedestrians
Kerbstones and steps, 4 cases (G)	Poor planning, poor implementation, lack of chamfers[1], ramps, or lifts.
Snow, winter maintenance, 7 cases (C)	Maintenance cost, preparedness to take actions, readiness to cope with circumstances
Parked cars, 3 cases (S, G)	Insufficient enforcement, nonchalant attitudes
Capacity restrictions and obstacles on sidewalks, 5 cases (G, S)	Insufficient dimensioning, incorrect prognoses, poor enforcement, unpredicted changes in land use
Over and underpass geometry, 2 cases (G)	Poor planning, lack of space
Lacking sidewalks or pedestrian paths, 2 cases (A, G)	Implementation costs, poor planning
Lighting, 1 case (G)	Implementation and operating costs

[1] Chamfered kerbstones at street crossings are preferred by most user groups, but visually impaired have claimed that they make locating of the kerb difficult.

2.4 Suggested solutions

2.4.1 Urban scale

The tentative solutions described below are formed only as regards to accessibility needs. Final decision-making has of course take into account all other relevant aspects and be adapted to local circumstances. The list is also not exhaustive, alternative solutions are to be found in most cases.

Common problems

Problem	Solutions
Segregation of services, long distances, 8 cases	• Aim at concentrated urban structures having a core of services with good accessibility from all parts of the structure. • Increase the competitiveness of walking.

Case area specific problems

Problem	Solutions
High motor traffic volumes, 7 cases	• Aim at a street classification, which conducts the heavy traffic flows outside the pedestrian oriented areas.
Hills and slopes, 6 cases	• Locate services so that the topography of the area makes least possible hindrances for reaching them. • Avoid creating steep slopes and stairs in street planning. • Guarantee always the alternative to use of ramps or lifts besides stairs.
Poorly located public transport stops, 3 cases (distances, conflict with cars)	• Provide public transport stops with safe accessibility and short distances. Suggested maximum distance from home or other locality to the nearest public transport stop is 300 m.
Lacking links, poor connectivity, 3 cases	• Provide continuous pedestrian networks between dwellings and daily services. • Avoid creating isolated pedestrian islands. • Develop methods for gathering sufficient financing for such endeavours.
Orientation, 1 case (Thus, not a very general problem.)	• Aim at clear pedestrian network systems. A rectangular grid gives the best

Problem	Solutions
	orientation capabilities also for non-residents, even though not the shortest routes. • Use clear landmarks and provide sufficiently signposts and guides.
Security	• Avoid creating dubious routes between home and daily services. • Guarantee enough illumination also on dark hours to the principal pedestrian routes. • Increase surveillance.

2.4.2 Street scale

Common problems

Problem	Solutions
Crossing facilities, 14 cases (wide streets, long waiting times, sight distances, traffic characteristics, geometry, etc.)	• Subordinate motorised traffic to pedestrians with raised crossings, narrow lanes, special pavements, etc. • Provide passable over- or underpasses on crossings of wide streets with heavy traffic. • Arrange zebra crossings so that they provide shortest links in the whole pedestrian network. • Provide wide crossings with median refuges. • Adjust traffic lights in order to minimize the waiting time for pedestrians. • Provide good visibility to all directions of the traffic in crossings.
Separating effect, 8 cases	• Avoid splitting the pedestrian network to separate parts by insurmountable barriers like rivers, railroads, motorways, clifts, closed industrial areas etc. • Provide passable crossing facilities (see above).
Poor quality of pavement, 5 cases	• Use appropriate pavement materials depending on the situation. Consider especially the abilities of disabled people. • Take into account the easy mainte-

Problem	Solutions
	nance of the pavements. • In the northern climate pay heed to possible damages caused by the winter maintenance.
Narrow sidewalks, 4 cases	• Aim always at least at the minimum standard (1,5 m, even 2,5 m, which also makes snow removal with appropriate machinery easier) of the sidewalk width. Where this is not possible, like in historical centres, aim at pedestrian precincts or woonerf streets. • Reduce parking on narrow streets. • Increase the surveillance of illegal parking.
Kerbstones and steps, 4 cases	• Provide easy access to and from the sidewalks for the disabled people everywhere, where there is a need for it. Use chamfers, ramps or lifts to that purpose. • Use kerbstones, which will not be damaged by the street maintenance or use proper maintenance equipment.

Country specific problems

Problem	Solutions
Snow, winter maintenance, 7 cases	• Improve maintenance of pedestrian paths, especially during wintertime. • Develop flexible and cheaper maintenance systems. • Increase the priority of pedestrian networks in the maintenance of streets. • Increase readiness to cope with various circumstances.
Parked cars, 3 cases	• Increase enforcement of illegal parking. • Edify altruistic attitudes in traffic. Emphasize understanding instead of obeying.

Case area specific problems

Problem	Solutions
Capacity restrictions and obstacles on sidewalks, 5 cases	• In planning make correct estimations of the pedestrian traffic taking into account also the future development of the surrounding area. Take also into account the peak hours. • Increase enforcement of illegal parking. • Arrange service transport so that it will not harmfully block walkways.
Excessive speeds of motor traffic, 3 cases	• Use speed-reducing devices to intensify appropriate speed limits. Humps, bumps and roundabouts are more effective means than just speed limits.
Over and underpass geometry, 2 cases	• Plan over- and underpasses with easy geometry taking advantage of the terrain, if possible. • Don't plan over- or underpasses, which most probably will be passed illegally. Use other crossing facilities instead.
Lacking sidewalks or pedestrian paths, 2 cases	• Provide safe ways for pedestrians everywhere, where they probably will walk. Practice and theory can be here in conflict. Remember that pedestrians always want to take the shortest and easiest way to their destination.
Lighting, 1 case	• Consider in street lighting also the needs of pedestrians. Dark walkways can be dangerous in many ways.

3. Critical evaluation of the used methods

3.1 Expert analysis

There were some difficulties in the accessibility analysis. GIS-data was not always as detailed as was expected, and the analysis required more manual work than was anticipated. Also the amount of case areas compared to their size was quite large, which meant that site visits took a lot of time. On the other hand, usually it was quite easy to choose the representative itineraries, even though it was feared that this could have caused trouble. The check-list should also be improved, for example wheel cair users' needs were only mapped when the problem was significant, many important minor difficulties may have been neglected.

3.2 School questionnaire

School questionnaire was more aimed at safety issues, so its meaning for accessibility analysis might be increased in the future. Similar improvements relate to other interviews, which aimed more at comfort issues than accessibility questions.

4. Discussion

The treatment of this chapter is rather free to each WP leader. Nevertheless, everybody should gather the tentative solutions. It is also good to highlight the most important demands and the most burning problems. The following division reflects more or less the topics written by Liv.

4.1 Main findings

Which were the most important *demands* of pedestrians? Which were the most severe *problems* of the existing environments revealed in the analyses?

4.2 Tentative solutions

Some tentative solutions to the revealed problems were already listed in the national reports. These could be collected here and classified according to the used problem and even by referring to the corresponding problems. It is better to not yet in this phase consider more the solutions themselves.

4.3 Conclusions

- European dimension: What was common to all countries? How the problems reflect different situations at the European level?
- European challenges concerning pedestrians.
- Implications for new means concerning data collection and data analysis.
- Future research themes.

Annex

Possible annexes.