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1. Summary

Infrastructure projects are only sporadically central to the restructuring process of the partners participating in the project. The city of Utrecht in particular gives special importance to the realisation of new infrastructure – expansion of the rail and street infrastructure as a local development measure as well as connection to the interregional traffic network. In the other projects, questions of infrastructure are only one element in the restructuring task at hand.

New or restructured or revitalised areas, as well as industrial and commercial sites, require up-to-date, modern, efficient internal development, as well as attractive connection to supralocal centres. Thus, Newcastle tries in the course of an extensive new development program to keep traffic volume generally low with integrated planning, to quiet the traffic that cannot be avoided, and to give greater room to environmentally friendly transportation means (bicycle, public transport) and pedestrians. Additionally, a location was chosen for the realisation of the residential building project and the business district project that is characterised by outstanding supralocal traffic connection.

As a rule, one also sees a need to adapt to high traffic volume in regard to the dimensioning and routing of traffic lines. One also somewhat expects from that a reduction of environmental pollution, at least as far as noise and exhaust fumes are concerned. The causes for traffic are addressed only in single cases. Thus, in the Duivenvoordecorridor (Projekt Leidschendam), it is attempted to reduce traffic volume by shifting retail dealers, and in the Zuid-Holland project area, by establishing in single cases a geographic proximity of working and living in the project phase of development areas.

2. Introduction

2.1 Definition of the term

In this study, infrastructure denotes location-specific development measures that are required for the existence or development of single sites, settlements, or larger connected spatial entities such as trafficways, connections and transport lines. In the following, infrastructure is looked upon with an emphasis on transport systems for people and goods.

Excluded from consideration is infrastructure of the institutional kind, including legal, political or social framework conditions influencing a site or region, as well as personnel infrastructure, that is, the local or regional quantitative or qualitative structure of the work force.

2.2 The importance of infrastructure for the public sector (national, regional, municipal), the public and the potential investor

The location at or near intersections of highly efficient traffic arteries is always of decisive importance to the development of a site or region. Entire cities and economic centres of states owe their existence and economic prosperity to location at these lifelines.

Due to population condensation at these predestined locations, the requirement for further supply and disposal infrastructure exists.

Apart from traffic lines for various transport media like private and transport vehicles, trams, subways, suburban fast trains, inter-regional trains, ships and aeroplanes, infrastructure also includes diverse line-based transport systems for supply and disposal.

Essential supply lines that are put in or near the ground are:

- Drinking and industrial water supply

- Energy supply (low-, medium- and high-voltage)
- Gas supply
- Local and long-distance heating supply
- Telecommunications (copper cable, glass fibre)

The most important disposal lines are:

- municipal and commercial wastewater disposal
- rainwater drainage

The importance of traffic as well as supply and disposal infrastructure for a city is made clear by, amongst others, material and energy throughput. An European city with 1 million inhabitants uses and produces, for example, a daily average of

- 11.500 t fossil fuel
- 320.000 t water
- 2.000 t food
- 300.000 t wastewater
- 1.600 t solid waste (1)

The greater part of these consumer goods cannot be produced within the city, but must be brought in from outside. The reverse also holds true for leftovers and waste. They must be continuously and efficiently removed from the city. Infrastructure is therefore one of the essential starting points for a municipality, to improve the environmental balance sheet and support an ecologically sustainable housing and city development.

Traffic serves the internal development of a space or area as well as the integration into the surrounding area. The outer traffic connection of a site is as always considered as one of the, if not the, most important site factor. Especially areas for commercial and/or industrial use are judged on this point by potential investors as well as by companies willing to establish.

But residential sites are also being chosen because of user-friendly and efficient traffic connections by people wanting to settle in an area or by investors, even in times when motorized individual mobility seems almost unlimited. This traffic connection should not, however, dominate or limit the quality of life. The time required to travel distances is especially decisive for a positive or negative assessment; of lesser importance is the absolute spatial distance that has to be travelled.

For the assessment of residential areas by inhabitants and investors, the aspect of environmental friendliness of traffic connections (tram connection, cycling route network, public short-distance passenger traffic network) lately holds increasing importance. Increasingly expensive operating resources reinforce this attitude, as well as a loss of attractiveness of the individual vehicle due to street and parking bottlenecks.

Infrastructure is important to the qualitative evaluation of not only residential or commercial areas or centres, but also of single sites. Internal and external development is critically evaluated. Because of this, derelict sites that were previously commercially or residentially used gain a site advantage compared to sites in greenfield areas, because these old sites generally have a more or less intact or usable internal and external development.

2.3 External development of old sites

A functioning and effective connection to area surroundings means a qualitative upgrade and competitive advantage for an old site in comparison to a site in a greenfield area. An intact external development is advantageous in two regards:

Firstly, the connection of the site to the surroundings offers advantages during the processing and preparation phase of the area: demolition masses, soil masses and building materials can be easily transported to and from the site via streets and/or tracks, or even on a waterway. An intact power supply facilitates operation of various equipment, all the way to demolition and building machinery. Power supply is also of advantage for establishing the construction site and the accommodation of workers on it. A functioning water connection will be highly valued, especially in situations where workers come into contact with contaminated material and special requirements are placed on hygienic conditions that must be offered at the site.

Secondly, existing external development means an improvement of the quality and value of the site: an increasingly critical public is less and less willing to accept new construction of traffic infrastructure and with it additional sources of noise and exhaust fumes. Viewed as less of a problem – also with respect to permits that must be obtained – is the extension of existing facilities as well as the upgrading of connections that already exist and are established. Thus, old infrastructure permits timesavings in the realisation of projects. Unforeseeable time expenditures for approval procedures that are lengthy and difficult to calculate can be avoided.

2.4 Internal development of an old site

The existing internal development is generally of little use for the follow-up use as far as the infrastructural line layout is concerned, as well as in regard to its dimensioning and technical conditions, but it does offer advantages for preparation and processing of the area.

- The establishment of a construction site is easier if power and water are available at the site and used water (for example, wastewater from showers, toilets, etc.) can be drained off.
- Old hall buildings can be used for storing equipment, building machinery and building materials that need to be protected from the weather, as well as for the collection and preparation of old building materials or isolated contaminants for disposal.
- The mass transport within the site surely can be done easier and thus in the end cheaper on paved routes, since the erection of construction roads and other preliminary traffic areas is not necessary. Especially for larger construction measures, the infrastructure is an important element in the cost calculation.

The plans can consider these circumstances and plan demolition and dismantling measures in a way that the old infrastructure serves the purpose as long as possible.

It also must be pointed out, though, that the internal development must be removed in the course of area processing if it is not usable for the follow-up use. For that, the old infrastructure does not even have to be dilapidated. Environmental restrictions alone, such as the required installation of a drainage system for separate drainage of wastewater and rainwater at new construction projects, make the follow-up use of a mixed system impossible.

Depending on the arrangement of the old infrastructure, and depending on its earlier purpose, the specific cost for demolition and dismantling can become considerable. This is the case, for example, when tar-containing street surfaces must be removed and pipes and canals that contain contaminated deposits (residues from industrial wastewater, deposits in gas supply pipes) exist.

3. The theme as an element in the restructuring process

The importance of infrastructure to the restructuring process is examined in the following with regard to its effect on single sites as well as with regard to its effect on larger spatial entities such as cities or regions.

3.1 Single-site related observations

An important part of the evaluation of the site potential of an area are the criteria

- integration into the supply and disposal network
- integration into the street traffic network
- connection to the public short-distance passenger traffic network

With regard to the infrastructural connection criteria, old sites that have potential for revitalisation have advantages when compared to natural sites that are yet to be developed, because it can generally be assumed that an external development of the old site exists. This infrastructure is in the ideal case usable for the revitalised site in the course of a minor upgrade without a massive expansion effort.

In single cases and especially with a complete change in utilization, as is the case with the conversion of a former industrial or commercial site into a residential area, an extension or dismantling or complete new construction is necessary due to inadequate or oversized capacity and/or an inadequate technical standard.

In only a few cases can it be assumed that no external connection exists. This is sometimes the case with former military areas that are to be converted to civilian use. Military-used sites were often entities that were almost autarkically used without direct link to the infrastructure of their surroundings. An exception is the connection to the inter-regional road network. These military sites were for decades partially outside the planning authority of the municipalities. Their reintegration therefore often requires considerable technical and financial means, apart from an extensive planning effort.

For a municipality, integration of an old site that is no longer used into the existing supply and disposal infrastructure can bring rationalisation advantages, since the existing technical supply and disposal infrastructures and traffic facilities often still have considerable transport potential. The integration into an up-to-date, technically high-quality infrastructure can help reduce emissions, thus improving the environmental balance sheet of the cities and supporting a sustained residential and city development (2).

A better utilization of existing capacities can increase the profitability of public supply and disposal facilities. Apart from economic efficiency, a better utilization of existing potential ensures the preservation of energy and raw material resources.

Infrastructural provisions that are insufficient, or that work at the limits of capacity, force a municipality to newly create or expand supply and disposal facilities when wanting to integrate an area into the urban development. It must be positively observed, though, that normally the infrastructure lines exist and only the dimensions and technical standard of pipelines and trafficways have to be changed.

3.2 Observations regarding larger spatial entities

Since World War II, residential areas in the Federal Republic of Germany have been significantly expanded. With that, municipality street and line networks also grew. Because of a stagnating and partly decreasing settlement density, the average utilization of an ever-expanding infrastructure decreases. That means that the settling system becomes yet more resource- and area- intensive, and thus more cost-intensive (3).

Spatial expansion of settlements normally concerns the city outskirts. Due to area resources that are perceived to be available, areas are developed extensively and only minimally condensed. The allowable dimensions of a building, such as the used area allowable per storey, is often not fully utilized. This inefficient settling development causes high costs for the creation of infrastructure.

The sprawling of the cities, the spread of settlements into the landscape and the utilization of formerly open areas, leads therefore to – apart from ecological damage – negative economic consequences. The majority of municipalities are at the edge of financial collapse. Investments in infrastructure go mostly into new development at the outskirts of the city, and investments for maintenance of the inner municipality network are put off as long as possible. The failure to invest in maintenance and repair brings with it high costs for the general public. Losses in the water supply networks due to damaged pipes is one example of this.

High infrastructure costs are negative site factors. Municipalities that must offer such costs to companies wanting to establish experience problems in their settling efforts or have to think of “subsidies” of other kinds. Expensive infrastructure and therefore high charges thus also hinder the restructuring process in the end.

4. The position of the theme infrastructure

Development costs are normally up-front contributions of the municipalities. As explained already, the creation of technical infrastructure and an efficient and modern traffic connection are important criteria for site evaluation.

Traffic connections are still a most important site factor in this. A highway connection that is close or quickly accessed can especially be the base for a decision to establish a company. This holds true to a special degree for companies with high customer-traffic frequency that want to be customer-friendly and quickly accessible, also from other regions. Good accessibility to the highway network allows even peripherally located economic areas to entice companies that have high customer-traffic frequency to set up. A quick accessibility of the highway network enlarges the catchment area.

Integration into the network of main traffic roads is also meaningful for a business willing to set up. Transport costs are important for the investor for the determination of a favourable site. The location advantages of a site are evaluated higher than possible restrictions on use due to existing contamination (4).

The train has noticeably lost importance. This is due in part to a change of the structure of goods. Instead of transport of bulk goods and raw materials, increasingly it is products, semi-finished and finished goods that are transported. Old sites that have efficient railroad connections, such as for example coking plants, mines or steelworks, therefore have deficits in their connection to the street network in the case of a revitalisation and an associated change of purpose.

Apart from infrastructure, other factors also play a role in the evaluation of a site. Of importance are of course all other factors that determine the quality of a location, such as:

- market proximity
- supply proximity
- wage level

and site specific factors such as:

- use potential
- restrictions
- planning and permit restrictions
- liability security
- credit possibilities
- attractiveness/image

4.1 Traffic and environment

Freight traffic as a transmission belt of the economy of commodities, along with motorised individual traffic, has a significant impact on the environment and urban development. The main ecological problems of freight traffic are, from the view of the cities:

- The traffic of utility vehicles contributes meaningfully to the emission of nitric oxides, soot particles and other air pollutants. It contributes disproportionately to noise pollution.
- The space needs of vehicles are considerable due to vehicle dimensions and the resulting towing radii, overhead clearance profiles, as well as the transported mass, and pose a problem with regard to urban development dimensions. Damage to street surfaces and bridges are due in large part to utility vehicle traffic.
- Freight traffic implies a considerable area consumption, not least to provide sites for storage, transshipment and disposition of goods.

Traffic results from the separation of functions within cities and municipalities and itself contributes to further dispersion and increases in traffic volume because of its spatial demands.

4.2 The compact city

The arrangement of the settling structure has a considerable influence on traffic volume. A city's structural and spatial planning should therefore pursue the primary goal of avoiding traffic by suitable development, and to shift traffic that cannot be avoided and make it environmentally compatible.

The most important elements of city development concepts that reduce traffic include:

- highest possible density of urban development
- sparing use of settled and traffic areas
- altogether compact city form
- greatest possible mix of uses
- at least a spatial attribution of urban functions to city districts
- an environmentally friendly urban mobility
- regaining urban public space
- regional spatial structure concentrated on railway
- unity of public short-distance passenger traffic network and centre structure in the urban region (5)

5. Future development

5.1 Gain of importance of the railway compared to the street

Maintenance of the primary street network already requires considerable financial means. An extension of this network should be left undone for economic as well as ecological considerations.

A need to catch up exists in railway traffic. Aside from the expansion of the highspeed network, an expansion of the entire network is necessary.

Within the city a renaissance of the railway-based transportation can be observed. More and more German and European cities bet on a city train as the means of transportation of the future. The city train has different advantages compared to bus traffic.

- City trains run generally more on-time and reliably than buses, which have to “flow” in passenger automobile traffic and can be delayed.

- City trains run on their own lines and have a significantly more efficient drive assembly than buses, therefore the driving times are considerably shorter.
- Low-floor technology of the city train offers passengers, especially parents with children, handicapped and senior citizens, a smooth ride, generous space, comfortable entry and high transport capacity.
- City trains find higher approval than buses. Many people prefer the fast and comfortable vehicles.
- With the expansion of the fast and comfortable city train the use of public transportation also becomes more attractive in the wider catchment area. Due to the increased demand, a denser network of bus lines is created for feeder traffic.
- The city train itself produces no exhaust fumes and little noise. It diminishes traffic jams on streets and thus noise and exhaust fumes from cars. This increases the residential value of the urban district and region.

5.2. The future: the compact city

The development of the settled area and the development of traffic are closely tied together. The encroachment of settled areas creates increasing traffic and this in turn requires the use of new area which supports the dispersion of settlements. This negative growth spiral requires countersteering especially in spatial planning. The avoidance of traffic should receive priority over other necessary measures such as shifting traffic and environmentally compatible arrangement of traffic.

Essential preconditions for avoiding automobile traffic are (6):

- To protect city districts with high historic urban qualities; that is, to protect from pressure to change those districts with appropriate population density, utilization mixture, good street atmosphere, limited automobile traffic, etc.
- Better spatial distribution of various urban functions; that is, above all to reduce the preponderance of work-places in the city centre by making more housing available in that area.
- To generally strive for a higher building and utilization density in connection with a better urban development quality and open space quality.
- To concentrate the housing development activity to areas within the city and close to the network of the public short-distance traffic network.
- To dampen automotive traffic and the number of cars and give priority to pedestrian traffic, bicycle traffic and the public short-distance passenger traffic.
- To keep the landscape around the city free.
- To concentrate housing development in the region on towns and cities that are well equipped with supply facilities and that can easily be reached with public transport means.

6. A comparison of the current policies

6.1 The Netherlands

The Netherlands have for years pursued the goal of reducing traffic volume with target-orientated spatial planning. The avoidance of traffic, especially a reduction of private automobile traffic, is central to this effort (7). The guiding principles of the government for spatial and structural development prefer, amongst others, urban development within existing borders. This offers good possibilities for public transportation and avoids private automobile traffic.

To avoid traffic, basic principles of site policy for workplaces and central facilities were developed, concretized and published for all three administrative levels – government/kingdom, provinces and municipalities.

With that, the governmental principles collide in some cases with local development projects, which give a high importance to the growth of cities – even outside the borders – and to expansion of traffic infrastructure.

6.2 Federal Republic of Germany

6.2.1 Condensed development

Positive effects for the need and organization of infrastructure come from a condensed, multifold structural development. The concept for sustainable residential development is based on the fundamental principles of

- density (compact building forms, utilization of unused area)
- mixture (socially compatible, building and spatial diversity)
- polycentric (decentralized concentration, environmentally compatible bundling of supply and disposal structures, supply-autonomous districts) (8)

The following principles determine planning in the sense of sustainable urban development:

- decentrality before centrality in city and region
- support of residential density and protection of free areas
- improvement of mixed utilization in city and region
- strengthening of the inner cities and city district centres
- consideration of needs of disadvantaged people
- more goal-oriented use of the sparing potential of ground, energy and water
- more goal-oriented use of the avoidance potential of traffic volume
- securing regional potential
- preference for precaution rather than remedy
- promotion of regional cooperation between municipalities
- promotion of participation of all groups of society

6.2.2 City train concept

City trains are traffic systems that occupy an area between classic trams and suburban (fast) trains. In city areas the city train runs on its own rail network, outside the cities the railway network of the Bahn AG (German Railway Ltd) can be used.

The following facts speak for a city train system:

- rail traffic is more attractive than bus traffic
- rail traffic can be conducted easier independent from individual motorized traffic
- especially at the junction between city and periphery there's a high potential for people changing from car to public transport
- the supply gap between a faster tram on the one hand, and an underground train and suburban train on the other, cannot be filled by the bus, which has to be rated below the tram
- city trains can optimally use existing resources in the form of rail tracks and other open lines

- city trains can if needed cover longer distances on their own railway system at high speed, as well as – if sensible – use existing streets that are suited for development

A further expansion of the underground rail network can hardly be financed. The operating losses of such an expensive system as the underground railway, especially in city outskirts, can only be compensated for – if at all – by a general thinning of the offer of public transport. Such a destructive competition within the public short-distance passenger traffic system is expensive and trades advantages for one group of passengers with disadvantages for another. Advantages that the underground has in the areas close to the centre turn into disadvantages further outside the city.

6.3 Great Britain

The spatial planning system in England consists of four essential elements (9):

- local development plan (municipal level)
- development control (building permit procedures)
- structure plan
- planning policy guidance – PPG (planning guideline of the government)

The planning guidelines from the department of the environment are concretized and strongly influence local planning. PPG 13 is additionally supported by the ministry of transport. The guideline is from 1994 and integratively treats traffic and area utilization. The most important objectives of this guideline are:

- reduction of growth of motorized traffic
- promotion of alternative traffic means with less environmental pollution
- reducing the importance of the private automobile
- promotion of integrated zoning and traffic planning

In the PPG 13 concrete goals are formulated:

- sites for new development should ensure accessibility via various means of transportation
- workplaces and other facilities that create traffic should be situated at sites that can be reached well by public transportation systems
- at sites with a good public transportation accessibility, higher densities should be planned for
- auto-oriented developments of low density should be prevented, especially shopping centres and small freestanding settlements in the landscape
- parking spaces in areas with good public transportation service should be reduced

7. The instruments

7.1 Spatial planning

Spatial planning is an outstanding instrument for municipalities to steer the development of mobility and its associated infrastructural requirements. A target-oriented coordination of locational planning and traffic policy is required for this.

A pioneering and successful “ABC site planning” procedure has been developed in the Netherlands (10). For that, accessibility profiles of sites are compared with mobility profiles of the companies and correspondingly optimized site allocations are designed.

- Site type A

Work- and visit-intensive businesses and facilities such as administrative, service and other public-oriented, regional businesses like trade and services, hotels and schools.

- Site type B

Companies and facilities with moderate work- and visit-intensity and moderate dependency on cars, such as rental businesses, fine industry, repair businesses for consumer goods, business- and product-oriented services, clothing industry, graphic industry, sport and recreation, social services.

- Site type C

Companies and facilities with low work- and visit-frequency. High dependency on cars and high importance of the transport of goods, such as industrial businesses, distribution, building industry, transport companies and other production activities.

The stipulations for the site policy that result from this are being realised in plans on the urban regional level.

The execution plans should incorporate the following elements:

- development of sites on plans and corresponding current or future accessibility profile
- traffic infrastructure with regard to the desired future accessibility profile
- parking policy for public and private area
- bicycle traffic policy
- lot policy
- assignment of companies and facilities according to mobility profiles
- site steering; that is, the optimized settling of the companies on the most suitable sites in regard to the desired mobility development
- coordination of realisation dates
- external publicity

7.1.1 Accessibility profiles (11)

The accessibility profile of a site shows its accessibility by public transportation and motorized individual traffic. Additionally, parking possibilities are considered. Three different site types can be distinguished.

- A sites

Optimal connection to means of public transportation; the accessibility by car is of subordinate importance. These sites are situated at junctions of railway traffic on agglomeration and state level; that is, in close proximity to the main train stations.

- B sites

The sites are situated at junctions of the public transportation network (train, bus) and at the same time at a main traffic road. The accessibility by car is of medium importance and quality.

- C sites

Accessibility by private car is above average; a connection to the regional street network exists. The public transportation connection is of subordinate importance. The sites are located in or at the border of urban regions.

7.1.2 Mobility profiles (12)

The mobility profile of a company or public facility is defined as the potential utilization of public transportation system and bicycles by employees or visitors. The mobility profile thus reflects the real dependence of the company on cars, for example for business contacts, or for the transport of goods. Reference numbers for the mobility profile are:

- Work intensity (area requirement per employee)
 - extensive: > 100 m²
 - moderate: 40-100 m²
 - intensive: < 40 m²
- Dependency on automobiles (in percent of employees)
 - < 20%
 - 20-30%
 - >30%
- Visit intensity (area per visitor per day)
 - extensive: >300 m²/day
 - regularly: 100-300 m²/day
 - intensive: < 100m²/day
- Importance of freight traffic (by street)
 - hardly important
 - possibly important
 - important

A rise in price of sites at the outskirts or outside developed areas by market-conformed means is one possibility to compensate for site disadvantages of inner-city sites (13). For the conservation of the inner city as a site for retail industry it should therefore be a goal of federal and municipal policy to make external effects and costs economically assignable.

An initiation point for this may be the cost for the creation of traffic infrastructure, which currently constitutes an indirect subsidy. As long as the cost to the public sector for the development of these sites cannot be assigned to a site, companies will use the cost advantage and with it the competitive advantage of the greenfield areas.

7.2 Marketing economy steering instruments

A reform of the economic framework conditions, amongst others, is required. Today's real property tax regulations support trends such as land consumption and area spreading of settlements, which contradict a sustainable urban development. Market economy regulations should therefore complete the spatial planning. The German institute for urban studies suggests introducing a combined land value tax and land area tax as well as a combined surface-sealing charge and traffic-creation charge (14).

A market-economy steering element for land area utilization must fulfil the following requirements (15):

- “Polluter-must-pay” principle: High use of resources, high environmental impact and other high external costs, such as area-intensive and dispersed settlements, should be charged to the causing parties for reasons of causal justice and cost honesty.
- Planning value compensation: Profit from land-value increases, which are generally determined by location of lots and by planning decisions, should accordingly go to the community.
- Tax justice: Land and soil should be taxed in amounts similar to any other capital and income.
- Steering function: Steering instruments should develop a clear ecological steering effect. The goal is the sparing use of land area and the promotion of internal and external development.
- Practicability: Instruments should be cost-effectively handled and simple to administer.

Apart from this, passenger car traffic and the number of cars has to be steered by market economy instruments. For that, the German institute for urban studies suggests (16):

- Increase of the petrol tax in steps
- Converting of the highway utilization fee for trucks into a general heavy transport charge
- Increase of the car tax based on weight, size, engine power and noise emission
- Removal from state building regulations of the requirement to provide parking spaces

7.3 Other framework-setting steering instruments

Superior framework conditions also influence sustained urban and traffic development. The following must be reformed in a goal-oriented and useful way (17):

- The national trafficway investment policy, with the goal of preference for rail traffic as well as a qualitative expansion of the street network instead of a further quantitative expansion
- The area and administrative structures must be reformed in the direction of establishing municipally structured city regions with strong political and planning competencies
- The financial support of housing, economic and structural policy which should also be oriented on spatial planning and urban development criteria
- The urban development support program in the direction of stronger support for measures of internal development.

8. Infrastructure as an element of the planning process

A functioning infrastructure of the external as well as internal development can be included in numerous ways in the plans for the realisation of necessary land-processing measures.

8.1 Internal development

Existing storage areas and halls can be used for storage of machinery, equipment and materials, and if needed may, with approval of authorities, be erected on a secured area even as intermediate storage for problem waste that is produced by demolition.

Electricity and water as well as possibilities for wastewater drainage facilitate the establishment of a construction site. The water can also be used as extinguishing or cooling water with torch-cutting work and for moistening dusty areas. Paved areas facilitate mass transport during the construction phase.

Another aspect is the planning of infrastructure for the new utilization of the area while taking into account local conditions. This addresses to what extent existing lines can be kept for the new construction of infrastructure as well as the consideration of covering problem areas of the site with a paved surface for parked and moving traffic.

8.2 External development

External development is a decisive factor for the development potential and development objectives of an area or site. On the other hand, the utilization concept of an area or site that exists or is planned is decisive for the conception, dimensioning and line routing of the traffic systems.

Moreover, the scale of the area to be developed, the geographic traffic situation, traffic volume and capacity of the traffic network, are the basis for whether and which impacts result to the local regional and inter-regional traffic situation.

In the framework of the restructuring process, it is possible to realise new demand-oriented and modern traffic routes. Positive effects can result from that in regard to the local traffic situation, for example, by avoiding detours and thus reducing environmental impacts caused by them, by removing of traffic conflict points and the improvement of the flow of traffic, as well as the relief of residential areas from through-traffic from outer areas.

8.3 Reform of the state building regulations

In state building regulations, regulations that stand in the way of a conception of condensed development must especially be reconsidered. Aside from existing separation space requirements that generally force open development and thus higher area requirements, the duty to build and furnish proof of parking spaces for private owners of buildings deserves special attention.

The reasoning behind this requirement is that newly developed facilities are the cause for additional automobile traffic and for additional demand for parking spaces, and therefore provisions must be supplied on the building lot for the parking of cars. This is to prevent excessive use of streets for parking cars. The maintenance of this regulation has numerous disadvantages, though:

- lower building density and therefore increased area and traffic needs
- the expansion of the supply of parking space stimulates additional ownership of cars which creates demand for more traffic area
- a low consciousness for area consumption and cost of parking
- new housing developments with higher building density and lower parking space offering or higher cost for parking space meet with refusal

For reasons of traffic avoidance the duty to furnish proof of parking space should be lifted with the exception of requirements for the physically handicapped and the proof of parking spaces for bicycles (18).

9. Infrastructure as an element in connection with implementation

The quality of traffic connection of a site is determined by its distance from local and regional traffic connections. This is true for individual traffic in regard to residential areas as well as for freight traffic in regard to commercial or industrial areas.

The traffic connection is one decisive factor for site quality and thus for later demand and sales profit that can be realised for the area.

The nature of external area development is characterized by:

- the street network – highway, major roads, rural roads
- pedestrian and bicycle path network
- the short-distance traffic network and public transportation network catchment area, distance of bus stops, line routing, duration of trip
- railway connection – railway network
- waterways

- airways

In the framework of planning the following questions must be answered:

- Is the existing traffic network laid out in its conception and efficiency so that orderly traffic connection of the area for the intended use is ensured?
- If the existing traffic connection is not efficient, can new traffic development be realised without impacting other areas by additional traffic volume?

Possible results of the examination of the situation are:

- an improved utilization of existing traffic facilities
- the overstressing of existing traffic facilities with resulting traffic jams, such as at junctions
- the requirement to expand existing traffic facilities

- the requirement to newly build site-related traffic facilities

10. Affecting the outcomes of the different case studies

10.1. Camphausen coal mine

The favourable traffic infrastructure is given, amongst others, as a site quality. Corresponding to the terracing of the area into three sections, there are three entrance and exit roads, respectively, leading to a rural road with connection to a highway. Still the development of parts of the area has to be improved since the street connection and the street routing is partly unclear.

10.2. Reden coal mine

The site is not conveniently placed in regard to traffic facilities. Summing up, the following evaluation can be given:

- The site is situated secluded in the woods, but not out of the way

- The location is not conveniently placed; the site can be reached, however
- The site is situated at the outskirts of a rural and sparsely populated area, but only 20-40 km away from the bigger cities of Saarbrücken, St. Ingbert and Neunkirchen

This deficit should be compensated for on the one hand by an unmistakable character ensured by the conservation and restoration of value to witnesses of the industrial culture; on the other hand, a new traffic connection to the inter-regional street network is intended. This shall be done by the expansion of a forestry road. Thus, an additional traffic burden to nearby city Friedrichsthal can be avoided. Public transportation connections exist via bus routes and the train station Landsweiler-Reden.

10.3 Fürstenhausen coking plant

The Fürstenhausen coking plant is connected to the local street network at several places. The connection to the L 163 secures the direct link to the highway via the access point Luisenthal. Inner development is done via ring developments that enable accessibility to single sectors as well as via a former plant road that runs from east to west and is the main development axis. The area is connected to the network of the German railway via extensive rail lines.

For the intended future commercial use, traffic connections must be further improved.

10.4 Utrecht

The realisation of modern infrastructure is one of the most important topics. In the centre of plans is the connection of the city centre to the highway through an efficient street. From that one expects, apart from a better connection of the inner city to the inter-regional street network, additional positive effects for three older industrial areas at the northwest city border: Lage Weide, Cartesiusweg und Cartesiusdriehoek. The current location at the outskirts of these old industrial areas should be made more attractive by the fact that the new highway connection runs through it. The areas are presently located on the northwestern fringe of Utrecht, but will eventually become more centrally located as a result of major new developments further to the west of the city. The construction of a new road, the Spoorlaan, linking the A2 highway to the city centre, will also attract more development to the western districts. The goal is the development of high-quality office and commercial areas. Because of traffic bottlenecks inside the area and around the city it is necessary that new infrastructure be built. Exactly how and where new roads will be built is not yet decided. The local elections of November 2000 have changed things and the “spoorlaan” road planning activities are terminated.

The realisation of a new fast train as well as a high-quality bus connection is planned. It is very likely that Lage Weide will have its own railway station in the near future. This would create opportunities for development, new functions and more intensive **use of space**.

10.5 Leidschendam

Here the topic is generally given a low importance. Traffic problems are not the cause for restructuring plans.

A good accessibility and effective traffic connection is still generally considered an important precondition for the creation of an attractive economic site (Vlietboundary). An expansion of the settled area should also be possible outside the actual city limits alongside efficient trafficways such as the highways and the railway lines.

An increase of traffic is also seen as a problem, though, in regard to bicycle and pedestrian traffic amongst others.

10.5 Gouda

In Gouda the topic traffic infrastructure in its entirety is considered of high importance for the solution of structural problems. It is critically noted that spatial planning has in the past referred too little to efficiency of traffic routes. Spatial planning and traffic route planning are a single entity and influence and cause each other. The improvement of traffic infrastructure is a fixed constituent of different development projects.

10.6 Zuid-Holland Province

According to their own statement: Not a motive for reconstruction, but infrastructure is seen as one of the main structural elements for spatial development.

10.7 Newcastle

In Newcastle the topic infrastructure is not the causal factor but is still very important. The main reasons for restructuring in the area are for economic and housing development. However, to make these schemes viable and attractive the road system must be of good quality, linking the sites to the city and the national trunk road network.

Links to the A1 trunk road allow access to the motorway system, giving fast and efficient travel both north and south. In the housing areas there are numerous narrow, twisty lanes, making it hard for buses to travel round. Many roads are blocked off due to the demolition schemes making access by bus or car difficult. There are several main roads through the area, providing easy access for private vehicles, however the public transport system is not as good as other areas of the city. There are relatively few bus routes through the more deprived areas compared to the rest of the city. The majority of the existing transport system will remain the same, with amendments to the existing roads and routes, and an increase in quality and quantity of public transport routes.

Better transport links to the local district centre, city centre and the region must be supported and increased if the area is to attract a greater population. An ambitious Rapid Transport System will link the West End to the city centre, employment and retail opportunities across the river, and is seen as one of the most crucial elements of the plan. The plan is for a tram network like Amsterdam.

The bus services running through and past the site are at this moment just meeting the requirements of the population. However once development begins on the scheme, more bus routes will be needed to run through the site, at a more frequent rate, and travelling to a variety of destinations. The sustainable nature of the scheme requires high quality public transport, meaning that a large amount of investment is needed to provide an upgrade in the public transport network.

To handle traffic problems, traffic calming is planned. This instrument will stop or hinder people taking their car to work, as the journey will be slower and longer. It will also prevent car crime and “joy-riding” with carefully designed road layouts.

11. Recommendations

Traffic volume can be influenced with integrated planning. Great distances and a lack of attractive public transport offers inevitably lead to high individual motorized traffic. If vehicles are used to overcome distances, then areas must be provided at the beginning and end of the routes for parking. Because of that, the need for area increases and leads in the end to further increasing distances.

Through more intense use of commercial building land, for example by multistorey building and by overbuilding car and truck parking spaces, one can build more compactly, and thus distances can be shortened and superfluous traffic avoided.

The mixing of functions – for example, of living and working – also has a traffic-lowering effect. Condensed building can diminish urban sprawl and settling pressure on surrounding open areas. Shorter distances result in less traffic and facilitate the accessibility of facilities of all kinds by foot, by bicycle, or with public transport systems.

Measures may also be taken in residential building to contain traffic volume. Thus, higher density should generally be sought after, while at the same time enriching functions and keeping ecologically valuable open areas. Public funding of residential building should influence that in a suitable way, and should be tied to corresponding approaches. Condensed building, especially in new residential areas, is a precondition for evolution of public life in a city district toward increasing pedestrian and bicycle traffic on routes within the city district while decreasing motorized individual traffic. Generally, the assignment of areas for flowing traffic as well as for parking should be sparse within residential areas.

12. Conclusions

Infrastructural aspects gain importance to the extent that economic interests and objectives move into the centre of the restructuring project. Efficient and environmentally compatible traffic infrastructure is mostly seen as a basic precondition and basic equipment for an economically efficient and attractive location (Newcastle, Utrecht, Saarland). Traffic infrastructure is, as always, ranked highly in the favour of companies willing to establish.

The expansion or modernisation of traffic infrastructure is then also especially essential if geographic site conditions must be taken into account, and an area planning that decreases traffic can only be accomplished to a limited extent.

In the end, traffic and the corresponding need for trafficways are a consequence of area utilisation. This in turn is directed essentially by the planning. That means that a landscape cut and pieced by traffic routes is also the consequence of an uncoordinated and/or short-sighted planning of large areas. Future traffic and a need for additional traffic infrastructure can therefore also be seen as a measuring gauge for a more or less successful restructuring.

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