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Urban Traffic
Preliminary Communication
U. D. C.: 656.01:711.553
Accepted: Mar. 14, 2003
Approved: Apr. 28, 2003

FUTURE-ADAPTED URBAN STRUCTURES UTOPIA, VISION, OR NECESSITY?

ABSTRACT

Behavioural preferences of people are changing rapidly and making use of all sorts of technical opportunities or progress. These changes mark a general and global process usually summarized by the term "urbanization" – rightly referring to urban settlements. Towns and cities are particularly prominent manifestations of cultural achievements of mankind. They are, at the same time, the most important means of housing, and are tools to create the values for the material base of life. Most cities and towns do, however, cope no more with the speed of development, they lag behind and end up in structural chaos, they fail to adapt to the future requirements. As analysis reveals, the foremost reason is inadequate location of functions resulting in unnecessary traffic. Urban settlements are inefficient, indeed, strangling themselves.

To help solve this problem a model is presented here of a full-fledged city of average size. Implementation may be accomplished piecemeal. It is a realistic target, it is not utopia but necessity.

KEY WORDS

urban planning, urban traffic

1. INTRODUCTION

It is advisable, from time to time, to direct the attention to seemingly banal – because well known – facts such as the general global population growth, and in particular to the even more pronounced growth in urban population. This worldwide phenomenon has repeatedly been described – and in view of the many consequences, overwhelmingly with great concern. In matters of up-to-date town management it is increasingly admitted that current methods are hardly, or even not at all, up to meet the future requirements. Useful support from constituent disciplines of urban research often fail to make full use of their theoretically conceivable impact, because once legally laid down, conditions, and vested rights persist, or policies with an ideological mind of their own gain the upper hand, thus preventing sensible innovations. Such dilemmas concern not only mega-cities or conurbations with more than 10 million inhabitants, but tend to affect most towns irrespective of size, though details of their problems and their priorities may vary greatly. Models for resolving these difficulties prefer greenfield solutions, though this may not be a particularly realistic option. And yet, there is no other way to study and analyse the complex and competitive facts and processes. The yield is promising intriguing stimulations which, in the end, indeed may lead to good solutions even if they are only partially satisfactory. The oecumene, i.e. the habitable and indeed inhabited part of the earth's surface, is already (almost) completely settled and to a large extent urbanized; that is, interspersed and covered by settlements which, thanks to a high degree of division of labour, and global integration, contribute substantially to the creation of material values, even in excess of basic requirements. Only this comfortable surplus can be made available for developing human culture and preserving the cultural heritage. It is important to protect and, if possible, to increase it. Urban renewal must be directed towards this goal, by making use of all the technical civilizational progress available. It is consequently desirable that every town inhabitant recognizes this collective will for shaping the living conditions as the best possible context for safeguarding his own personal freedom and creativity, and lends support according to his own abilities.

This is a compelling reason for the great interest in constructing towns in such a way that, in accordance with the prevailing state of technology, they are as suited to and efficient in creating these values, including their cultural applications. Unfortunately, such endeavours are, however, blocked by a number of partly very substantial obstacles. These are chiefly buildings, including their subterranean installations. Buildings are durable, possibly hundreds or even thousands of years old.

Even if they are past their usefulness, they are often rightly protected as monuments. Occupying their site, they often escape the changes demanded by the new economic requirements and permitted by the rapidly advancing technology.

Continuous updating of the town's substance thus constitutes the major task of urban politics. In concrete cases, providing a town with the necessary opportunities for success by ongoing updating requires exercising the right of disposal, in order to be able to regulate utilization and every change thereof in the collective interest.

Utilization of urban location is a sober business, which can be assessed in the form of monetary value. From time to time it collides with changing mental evaluation criteria of a geomantic or ideological kind. Physical geographical qualities have, of course, also to be taken into account. The large number of obstacles to change which arise from all this, explains why urban renewal is so difficult to achieve, and so expensive. The difficulties, however, must not deter one from repeated search for ways which might improve the competitiveness of a town. Competitiveness is the ability of a town to survive by its own efforts. In fact, the current balance needs to show a clear surplus if the town is to contribute its share to the burden of higher national administration and beyond that of international responsibilities.

On no account should an urban settlement represent a machine for running up deficits over a long period of time. In the end the communal balance sheet says all that is to be known about the vitality of a state, and thus attributes paramount importance to it.

2. STRUCTURAL SUGGESTIONS

The following structural suggestions endeavour to take into account not only the above-mentioned general premises but also take to heart certain ordering principles without which the future suitability would be difficult to achieve.

2.1. Traffic (in general)

As a modern conception for creating wealth, a town needs to satisfy high ergonomic demands, which means: the spatial ordering of its functions has to permit its running (interactions) at all times, and with the least possible losses caused by friction or waste of time. The interaction of numerous urban functions spells traffic. The quality of traffic, in turn, has a decisive influence on the productivity of a town. It is therefore important, that in every situation the most suitable means of transport are available at all times, speedily and without impediment.

Long distance communications are served by air traffic (with airports close to towns), by inland navigation (with urban ports), and railways (conventional (wheels on rail) and maglev (magnetic levitation/ Transrapid)) all with complete sets of maintenance and transfer installations, motorway connections and facilities for all kinds of inter-modal transfers.

Intra-urban traffic is regulated as follows: every building has 24 hour-access by road. There is no parking on traffic lanes. Track-tied public transport is served along the metrorapid (maglev) principle, because it does not wear out, nor causes pollution through noise or emissions, but saves energy and accelerates fast. A network is formed by a system of circular lines, replacing the hitherto commonly used radial system. This helps to avoid stationary (idle) periods at the terminals, and also the usually extremely varied demand on central and peripheral sections of the track. Electrically operated taxis in the form of people-carriers and mini-buses (suitable for prams and wheel chairs) supplement requirements of local transport, with access services to metro stations. Offering cheaper fares when used as metro feeder. Stations are constructed so as to provide direct connections by stairs or escalators and lifts between taxi ranks and platforms. – Sections with intense pedestrian traffic (as for instance in city shopping arcades) are fitted with travelators (protected from the elements) so that even distances of several hundred and more than 1000 m (with short gaps every 70 m or so to step on or off) can be covered fast and easily by many passers-by without being inconvenienced by all other moving traffic.

2.2. Traffic (special solutions)

Planned ordering also includes the third dimension – and that not only for aesthetic reasons. This may be, as an example, demonstrated in the complex of the central station: there are no intermodal crossings despite very close integration of static and moving road traffic, as well as train and pedestrian movements. Buses, taxis, private and hire cars are given round-the-clock and immediate access to the transverse platform, and large numbers may be parked in immediate proximity, be it for short stays or long term stays, and are perfectly protected from all weathers.

In the same way, the construction of the city core allows delivery vehicles direct access at all times to warehouse space below the retail areas, it provides for parking spaces for employees and customers of the retail trade and the offices above, which offer a varied spectrum of services and, further up, a large number of city flats for single and "dinky" (double income, no kids) households.

A third variant of this kind of vertical planning may be found in the malls of residential quarters and on other occasions.

3. AREA SUBDIVISION

The total area of the town is subdivided into specific large sections (urban quarters) (Fig. 1).

3.1. The City Core

The centre consists of the (approximately circular) city with a radius of ca. 700 m. Three to five radial boulevards grow out of a generously proportioned circular central place.

The distance of the alignments alongside these routes corresponds to about the double height of the gutters from which the buildings may further rise several floors by terraces stepping back as parts of luxurious suites and apartments in the upper floors. These boulevards are superior shopping streets, with unbroken display window fronts and comfortable, pedestrians-only promenades, their width part-covered by the roofs of predominantly two-stores arcades and, again protected from the vicissitudes of weather, parallel running mechanized walkways (travelators) in front, which give way every 70 m for some 15 m to provide access and exit points. These points also offer opportunities to cross over to the other side of the route, and, respectively, to provide passages through to the backside of the 40-50 m wide blocs to stairways and lifts, and the level crossings to the multi-storey car park, which fills the entire sector up to the next shopping street. – At the peripheral end, the car parks are connected to the circular urban motorway while the shopping streets are directly linked to a station of the metrorapid, in one case in combination with the central station of the long distance rail and Transrapid network (Figs. 2,3).

3.2. The Industrial Quarter

Beyond the central station, situated between it and the airport, there is the core of an industrial area, which is surrounded by a circular metro line (Fig. 4) and, parallel to it, a motorway with a radius of ca. 1000 m. The approach to this area from the city core is satisfied by a generously proportioned roundabout system that includes the access to the main station as well. In addition, the industrial area has direct connection to the regional motorway system by-passing the urban quarters. The industrial quarter is opened up by a few public trunk roads radiating from one central roundabout.

Location and size of all the roads that branch off from there and provide access to the various industrial enterprises depend on the area and shape of the plots selected by the entrepreneurs who intend to establish themselves here. They are also required to pay for construction and maintenance of these side roads. In principle, all car parking must be confined to the firm's own sites. Traffic lanes are for moving traffic only. All streets are, however, flanked by sufficiently efficient footpath and cycle tracks. The far-reaching liberality in creating tailor-made plots is complemented by similar freedom in respect of elevation and architectural style of buildings. There will be a guarantee of maximum flexibility for every future development. Apart from the airport on one side, and the central station on the other, logistics, spacious truck services and transfer facilities between road-, rail- and inland navigation on the third side serve to promote this goal. These facilities are further supplemented by adequate storage and maintenance capacities. They are directly connected to the long distance networks. The fourth side of the industrial estate is left open for future developmental requirements.

3.3. Supplementary Quarters of High-ranking Urbanity

The remaining radial paths of the central city district also run towards intensely urbanized areas of great importance: towards a cultural quarter and towards a sports quarter. Additional development of the city core is possible by completion of further radial boulevards of the circular centre area. One may, for example, connect with a trade fair of ample 35 to 50 hectares in space. On the other side plenty room is available to accommodate office buildings for provincial, national or international authorities etc.

Continuing as a direct extension of the adjacent city core, the road axis in the cultural quarter is home to an opera house, a concert hall, a festival hall for large-scale events, a broadcasting centre, a film studio, museum and library, as well as hotels. It is to have an axial length of some 300 m, with the motor traffic located in a furrow about 5 m below the pedestrian level, and the distance of the alignments of 50 – 70 m. The frontages are to house first-class shops under arcades (such as bookshops/antiquarian booksellers, art and antique shops, galleries, fashion/cosmetics, carpets/interior décor, jewellery, travel agents, cars etc. and restaurants), all of which are built over two-storey garages. To the rear, these house fronts dovetail with high-class ateliers and workshops as well as affiliated training centres (for the stage, music, ballet, journalism, media technology etc.) and student halls of residence. The cultural quarter is flanked by metro stations on three sides and, supplementing underground car parks, by multi-storey car parks, which will help to cope with great visitor numbers. Skilful arrangement of access gates and multi-storey car parks will leave suitable space for a large festival/fair ground for short-term events (fairs, circuses, demonstrations etc.).

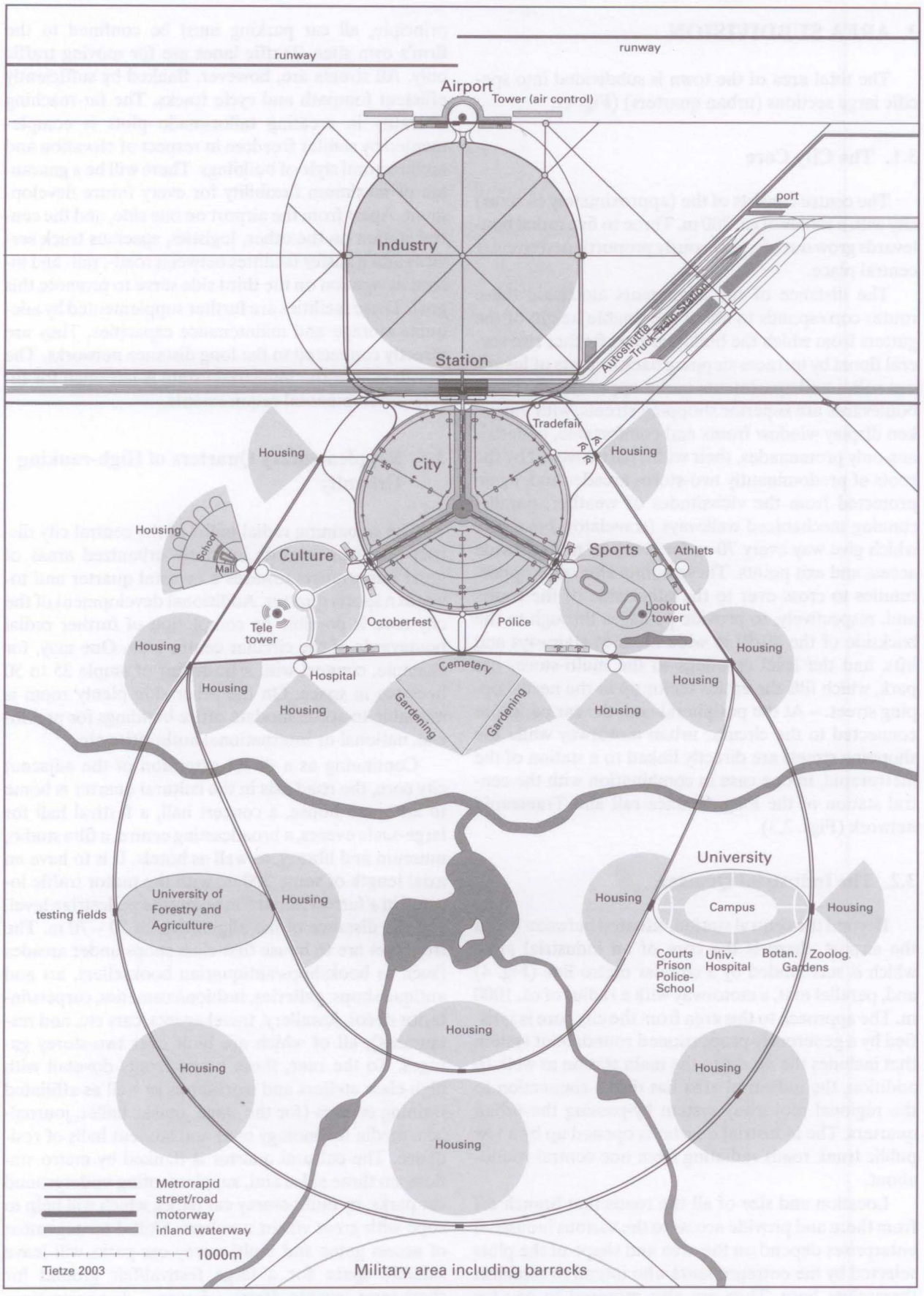

Figure 1 - Recommended locational pattern of urban functions

An urban area of some 60 km² is subdivided into distinct quarters of specific functions. A circular city core with radius of ca. 700 m may have 3 - 5 wide boulevards radiating from the central place to the outer circle which is formed by a four-lane motorway paralleled by a double track metro line (magnetic levitation technique; maglev). The boulevards are flanked by business buildings with retail shops in the first and second floor with unbroken display window fronts along spacious pedestrian promenades sheltered by arcades. In front of the arcades roofed travelators (mechanized walkways) are available to comfort hurrying people to move forward (either one direction on each side of the boulevard). There is no vehicle traffic on these boulevards at all. – The next upper three storeys may be used as offices of any kind. Another three storeys further up are available as suites and apartments for well-to-do singles and dinkys (double-income-no-kids households). – Storey zero (below the retails space) is used as storage room for the shops above. Also on the zero level below the pedestrian promenades is ample room for all technical supply lines with easy access for maintenance and repairs at any time. The central lane on this zero level is reserved for maintenance and emergency vehicles. It is overbridged to allow pedestrians to change from one side of the boulevard to the other. These bridges correspond to the interruptions of the travelators at about every 70 m for getting on or off. Also corresponding to these crossovers are throughways to the rear side of the business buildings. On both sides of these passages are lifts and staircases connecting with the upper storeys. The passages continue directly to the spacious parking garage occupying the entire sector between two boulevards with levels congruent to the storeys in the front building. There is a sufficiently wide gap between the front buildings and the parking garages for safety reasons, while the zero level allows access for trucks to deliver cargo to the storage sections of the shops any time. This lane is also available for garbage trucks and emergency vehicles. (Fig. 2).

On the zero level the main central place of this city core provides the interlink the central (rescue) lanes from sector to sector as well as a crossover between the sectorial parking garages in a roundabout scheme. The same amenity is available for the pedestrians on level one.

The crucial point of this arrangement is a definite separation of pedestrian traffic from any vehicle traffic. Nevertheless, each building can be reached by motor vehicles, on level zero, even by trucks, at any time. Maintenance and emergency service must not interface with normal business. In addition, it would be easy, also to provide access to the rear sides by bicycles. The respective passages are not shown by reason of scale.

The interlinkage of the boulevards and the parking garages with peripheral rings of motorway and metro affords three different levels (Fig. 5).

At the peripheral end the first boulevard leads across the intersection of urban and regional motorways to and through the main railway station (Fig. 3) to the industrial park.

This industrial quarter is circle-shaped with a radius of about 1000 m with a roundabout in the middle from which eight wide streets radiate at 45° angles. This traffic circle in the centre of a straight axis between the main station and the airport provides eight prominent plots for representative headquarter buildings of large firms and/or economic associations. The periphery of the industrial park is marked by the encircling urban motorway and the metro line with stations on opposite sides (Fig. 4). The industrial park has several links with the regional road system, and is open on one side for generous extension, while the opposite side gives room to a large truck park with all the necessary service installations, and, next to it, multimodal cargo handling and storage (auto-shuttle, truck-train, port and inland navigation). Adjacent to this area are the railway shunting yards and maintenance shops for rail and maglev trains. There is also the main power and heating station of the entire city.

The airport is fitted with all the modern facilities for passenger and cargo handling, storage and maintenance. The runways are in shifted position to allow for minimum movements of planes on the ground. Needless to say that the terminal has its own metro station.

The remaining boulevards of the city core, too, lead to very distinct urban quarters such as fair ground, sports centre, cultural quarter and buildings of the supra-communal bureaucracy. The space left open in between may benefit from the existing excellent traffic connections by metro, motorway and parking facilities. This model suggests items such as a festival area, the site of the central fire-brigade, police facilities, and the site of a cemetery with related services (funeral homes, flower shops and gardening etc.). The sports quarter only is shown in more detail as an example of these very special urban elements (Fig. 5).

The remaining urban space, about half of the total, is mainly reserved for a number of separate residential quarters located each around a metro station and urban motorway intersection along the double circle line. Optimum landscaping is the absolute priority. The population size of these quarters is restricted to some 20,000 – 40,000, just sufficient to support the day-by-day services, schools etc. The conceivable varieties are unlimited, though basically controlled by the general geographical environment. On the outer fringe of this type of residential quarters there is room even for modern farms to cultivate the farther adjacent area and yet participating in all the amenities of modern urban life.

Between the encircling traffic lines or outside, room may also be found for research institutions, university (Fig. 6) and military installations respectively.

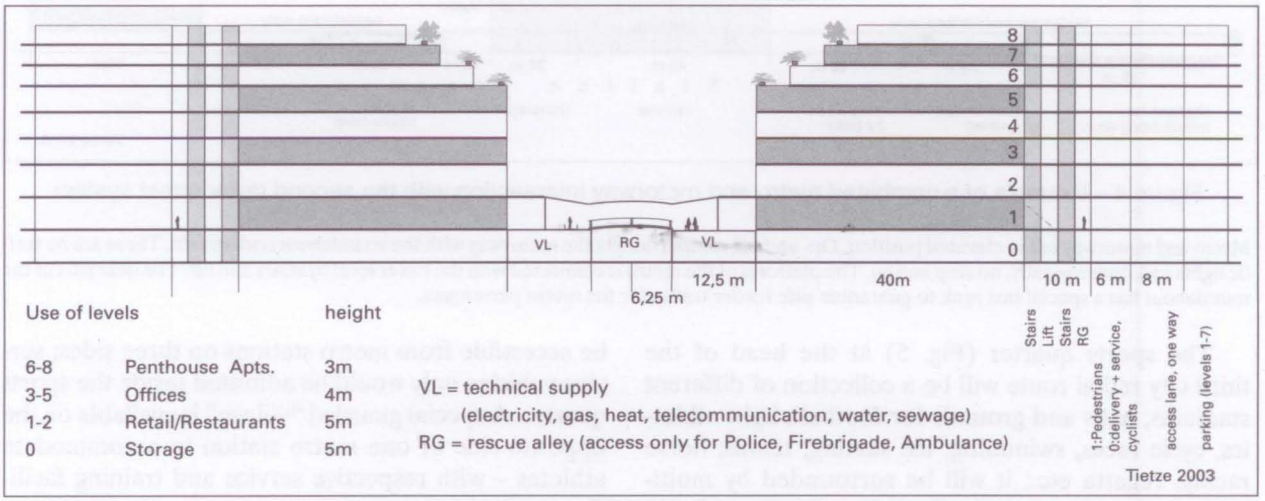

Figure 2 - Elevation of business buildings and attached parking garages along the boulevards of the city core

While a circular city core of a radius of about 700 m covers an area of some 150 hectares of which each boulevard would absorb about 10 ha leaving 100 ha for parking if five boulevards would be built – sufficient space for 50,000 cars (including access lanes and serpentines / ramps to serve multi-level structures). Each boulevard would provide a shopping area of some 100,000 m² and 300,000 m² office space corresponding to 2000 jobs in retail and 8000 jobs in offices. Some 2000 people may be accommodated in the apartments of the three upper storeys. The ratio of one car per head would result in 24 ha parking capacity. If about the same number of customers would use their cars roughly 50 ha of parking space would be needed per boulevard corresponding to only three levels in the parking garage. This quite comfortable situation might invite architects to use additional levels on top of the garage for leisure installations and/or additional penthouse-type dwellings.

The build-up of the city core may proceed along one boulevard after the other, beginning with that which connects with the main railway station. The use of the finished boulevards would not be disturbed by the construction activities going on along the next following boulevard.

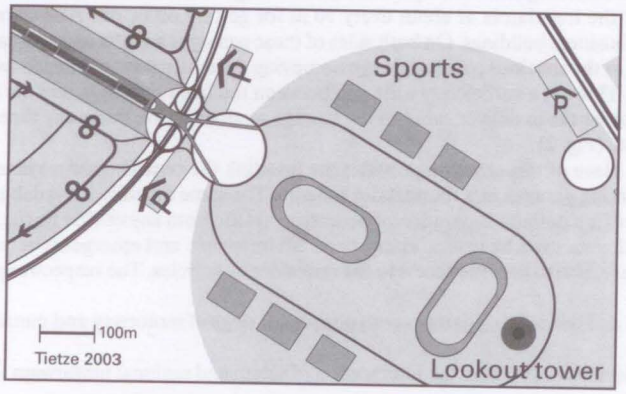

Figure 3 - Elevation of the main railway station

The first boulevard connects the city core with the main railway station. The pedestrian galleries continue across the intersection of the peripheral and the regional motorways (for more comfort also fitted with travelators, protected from the elements). In front of the station building does the pedestrian alley broaden place-like to provide spacious ramps for buses on one side and taxis and cars on the other. The vehicles turn up along a wide bend from the through road passing underneath on level zero and turn down again after passengers have embarked or disembarked on level one. While the pedestrian alley continues straight on forming the transverse platform, restaurant, counters for tickets and luggage etc. are arranged on one side, and shops and offices for car hire etc. on the other – with a multi-storey parking garage behind. A hotel may rise above the counter-area as well as offices for the railway administration. Escalators lead down from the transverse platform to the regular platforms between the trains, also lifts which continue further up to provide access to parking levels on the one side and to hotel and offices on the other. The parking garage is on level one reserved for buses and car hire business and therefore including petrol station and car washing. Ramps/serpentines lead up to ample private parking levels for travellers and employees. There is also a station of the urban metro on level two.

The transverse platform continues straight on across the freight rail by-pass and a shipping canal and a generous promenade in between thus linking the station with the industrial park.

To summarize: The railway station is a compact building unit accommodating long distance rail and maglev trains, post and parcel services, urban metro, taxi, (hire) car and bus service as well as all related businesses, hotel etc. It is open for pedestrians on the shortest possible way, comfortably fitted between city core and industrial park. It is also directly connected to the urban and regional motorway system. However, none of the various traffic modes interferes with each other.

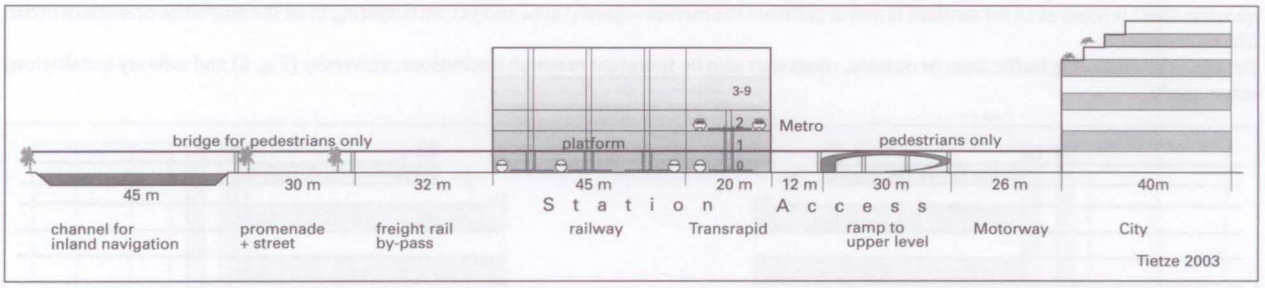

Figure 4 – Example of a combined metro and motorway intersection with the second order street system

Metro and motorway are in elevated position. On- and off-ramps connect the motorway with the roundabout underneath. There are no traffic lights and, consequently, no stop and go. The platform of the metro is connected with the lower level by stairs and lift. The near part of the roundabout has a special taxi rank to guarantee safe feeder traffic for the metro passengers.

The sports quarter (Fig. 5) at the head of the third city radial route will be a collection of different stadiums, halls and grounds for football, light athletics, cycle races, swimming, ice skating, tennis, horse racing, regatta etc.; it will be surrounded by multi-storey car parks, and like the cultural quarter, it will be accessible from metro stations on three sides; service vehicles only would be admitted inside the sports quarter. A special guarded "village" is available on the opposite side of one metro station to accommodate athletes – with respective service and training facilities.

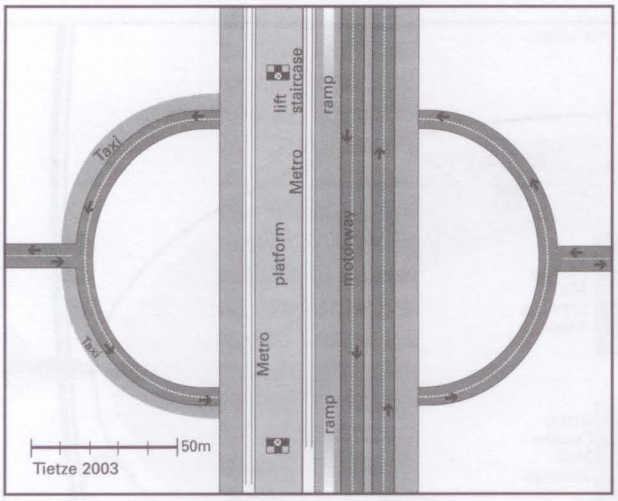

Figure 5 – The sports park

Since the sports park is fitted with facilities of a variety of different sports (football, athletics, swimming, boxing, skating, horse-riding and racing, regatta etc., indoor and open-air) simultaneous events are possible up to more than 50,000 visitors at the same time. To cope with the respective traffic the area has direct access to the metro and urban motorway on three sides. No vehicles other than service are admitted inside the area. Sufficient parking space is provided in multilevel garages at the three entrance points. To host the visitors restaurants are available and a lookout tower as a special attraction.

Annexed to the outer metro station is a special "village" at hand for safe accommodation of athletes, supplemented by additional training facilities.

This graph also indicates roughly the more complicated intersection at the end of the city boulevard. Three levels are necessary to handle the various types of traffic. The uppermost level is for pedestrians only: The boulevard galleries join and form the traverse platform bridging the motorway and metro, then forking to join the access promenades of the sports quarter. Escalators/stairs and a lift connect this traverse bridge with the metro platform as well as with the lowest level where taxi ranks allow for feeder traffic. For this purpose the lowest level roundabout is fitted with two special inserted circles open for taxis only. The main circle, instead, is fairly large in diameter to give room to on- and off-ramps of the motorway proper plus the exit- and access-ramps of the city parking-garages and, finally, rescue-lane in the middle of the boulevard on the zero level. – Similar three-level systems are needed at the remaining boulevard exits, too.

Transport provision for these two important quarters adjacent to the city core proper, which need to cope with a considerable influx of traffic within a short time, will be handled by metro and urban motorways. They will provide the fastest link between railway station and airport and the centre of the city, as well as the separately laid out, cluster-like quarters of the university, the residential and garrison quarters along a single, or, if necessary in response to growing demand, double circular system (cf. Figs. 1,4,5). This arrangement of through roads and metro lines facilitates additional usages for a number of items indispensable as parts of a modern urban organism: The fire-brigade and the police headquarters (including barracks for standby staff) may be situated right in the centre between fair ground and sports quarter with the city core on the third side. The fourth side of this area may be occupied by a large central cemetery with a metro station in front of the entrance and ample visitor parking and cemetery-related businesses. Nursery-grounds adjacent to the cemetery may shift on if by the time more space might be needed.

Similarly, the open space (some 35 – 50 hectares each) on both sides of the city core and flanked by the main railway/motorway axis is an irresistible invitation to locate office buildings of higher communal status in hierarchy, colleges etc. and, respectively and preferably in the vicinity of the logistic installations, to develop an assemblage of buildings to accommodate a variety of trade fairs. – This type of urban growth would provide good reason also to develop the fourth and the fifth city full-fledged boulevards.

After all, attention may be drawn to three prominent towers – true urban landmarks emphasising the three most pronounced axes of the city: (1) the control tower of the airport, (2) the tele-tower in the cultural centre, and (3) the lookout tower in the sports centre (Figs. 1,5).

3.4. The University Campus

The university forms a campus with twelve faculties, each of them with widely differing numbers of departments/seminaries, with varying requirements of space and different numbers of students, but nonetheless a total of about 20,000. The buildings may be arranged along an oval street with axial dimensions of c. 500 and 1000 m (Fig. 6). They will include a computer centre, library, synagogue, church and mosque, together with concert hall, maximum auditorium (congress centre) and hotel, as well as an administration block for vice chancellor and deans. The departmental buildings of the faculties consist of a large administrative wing which faces the oval street, each 60-150 m long, and, depending on requirements, four to ten storeys high (2500-60,000 m^2). Behind these, flanking a wide corridor, there are towers for staircases and lift shafts, both adjacent to lecture halls, seminar rooms, library and laboratories – as required – across the corridor. At its far end again staircases and lift shafts follow on both sides, which lead into student halls of residence. The latter are built on a T-shaped ground plan (ca. 40 x 60 m per wing = 72,000 m^2 per floor), and provide space for up to 250 students per floor. Two-storey cellars built on a total ground layout of 24,000 m^2 would accommodate up to 1200 cars. The lecture halls, departmental main building, labs and library, too, will be set upon two-storey cellars, so that all the vehicles can be parked below ground level. – The centre of the oval site plan will house shopping mall, refectory, casino and disco space, each bloc with two upper floors, as well as two-storey underground car parks

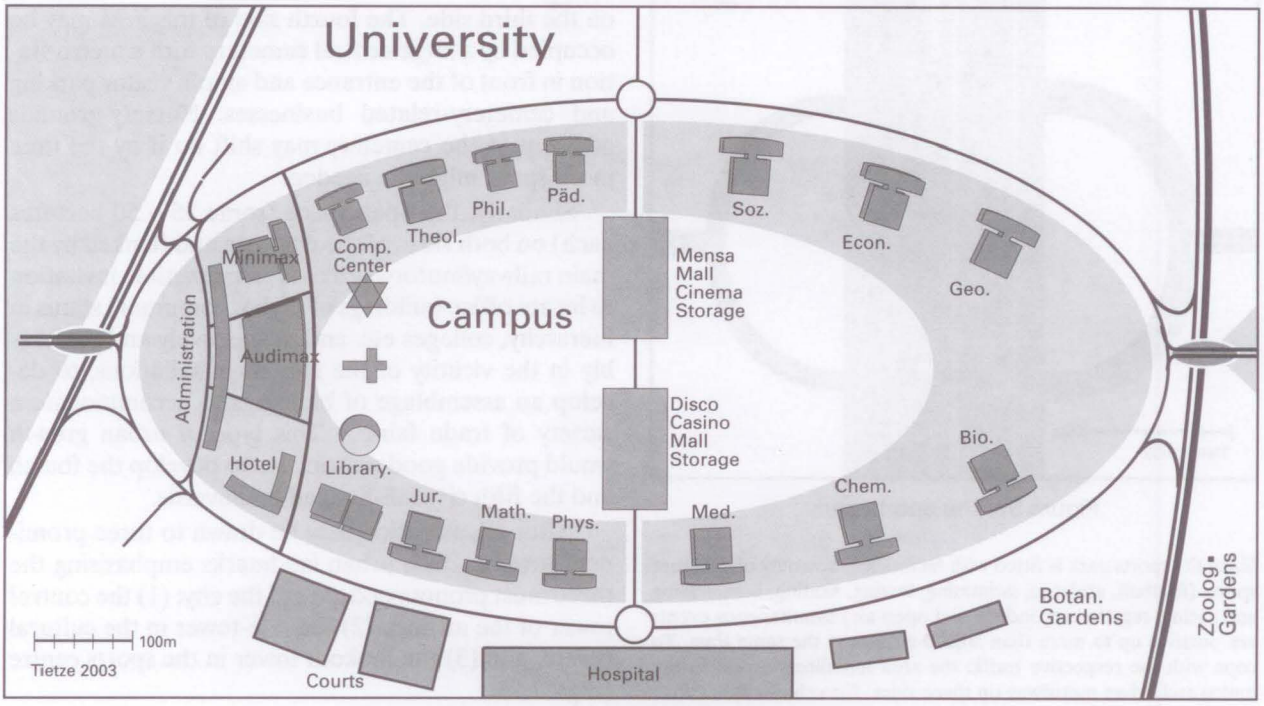

Figure 6 – The University Campus

The campus extends between stations of the two ring lines (combined with the parallel motorways) to provide optimum access. The main area is shaped as an oval of about 1000 m in length and 600 m wide. The main administration (chancellor, deans etc.), the congress facilities (audimax, smaller auditorium "minimax", hotel) are assembled near the inner pole of the oval with double-deck parking underneath. The next range of buildings are the computer centre and the library with representative buildings in between for worshipping of the three religions: Jewish, Christian and Muslim. Again: all parking underground. – Twelve faculties are then lined up along the oval, of course, of different sizes and different space requirements. In general, the office wing is facing the oval road with lecture theatres, laboratories etc. behind, and students' residences immediately annexed. On the ground area of about 7200 m² the latter may accommodate up to 250 students per floor; the entire complex with double-deck parking underground. Central services (mall, mensa etc.) are arranged in the middle of the oval. Outside of the oval supplementary facilities find ample space such as courts (opposite the faculty of law) with prison and police school further on, and a large university hospital opposite the faculty of medicine. A school for the nursing personnel and medical technicians should be annexed as well as an independent power-and-heating plant, laundry etc. And thus it is obvious to have botanical and zoological gardens opposite the faculty of biology. These installations are open to public as well. While the university has much space for further extension on one side of the oval, the space which might also be used by high-tech industries, related residential areas may develop beyond the two traffic rings.

below ground level with stores and access for lorries. Their access drives are reached via low-lying roundabouts, which are spanned by a wide bridge for pedestrians and cyclists, thus providing the link to plots outside the oval. These areas could accommodate more residential halls for students and other auxiliary buildings, flats for staff, sports fields (if required in addition to the facilities provided by the sports quarter in the near vicinity, and open to members of the university). On the opposite side of the oval (facing the schools of chemistry, physics, medicine and biology) any amount of space required by a complex of multi-specialist university hospitals will be made available. A nursing college, university-run utility buildings and the university's own power-generating plant will be attached.

Other faculties, too, will use the space outside the oval: biologists will run botanical and zoological gardens, both, of course, open to the public. The faculty of law is situated opposite the law courts, and these in turn will be near the prison and police college.

All the structural suggestions intend spatially to arrange the largest possible number of activities in such a way as to allow the maximum of vitality and mobility to flourish in spite of the shortest lines of communication, and so that spatial effects of synergy are given the greatest possible scope.

4. FURTHER STRUCTURAL COMPLEXES

4.1. Schools of Forestry and Agriculture

Unlike university, schools of forestry and agriculture though enrolling considerably smaller numbers of students (ca. 10%), require substantially larger areas. Bearing in mind the variety of departments, from soil science and microclimatology, from plant- and animal breeding to microbiology and veterinary science, agrarian and forestry techniques to irrigation and food

science, from viticulture to protection of the environment, not only lecture halls but numerous laboratories, greenhouses and open spaces for experiments are needed. The size of the campus will therefore have to be similar to that of the university.

4.2. Military

Garrisons with their substantial differences, according to which arm of services they are serving, are similarly demanding regarding space. The type of terrain and its availability will largely determine the decision. However, barracks capacity of 10,000 men, including sufficient terrain for training in easily accessible locations on the periphery of a town may be an advantageous complementary factor for the latter complex.

4.3. Residential Quarters

And so we have come to the most important issue: the residential quarters. There are very different ways of living; may they always prove appropriate.

As has been mentioned above, there will be a large supply of penthouse-style flats in the city with ample, even luxury space for 2000 single person or "dinky" households per completed boulevard or some 6000 people in a three-lane city, up to 12,000 with five boulevards. Similar, though fewer, perhaps around 1000, offers could be available in the cultural quarter. In line with the category of their takers, there are no schools or nurseries in the immediate vicinity. The same "disadvantage" applies to flats for caretakers/concierges, up to 1000 of which may be needed in the city, in the industrial quarter and the cultural and sports quarter, in order to guarantee high standard of maintenance of these buildings. It may be assumed, however, that these posts are predominantly staffed by ex-servicemen, who left the service because of age, and are unlikely to have school-aged children. Caretaker families on the university campus will at least be able to make use of the campus kindergarten, whilst school might be available in immediately adjacent residential quarters.

The residential quarters proper are built in groups clustering along the concentric rings of the metro in 700 - 900 m radius sectors of different sizes, with tips always directed towards the station, so that access along radial routes is provided by the shortest possible way.

The size of the angle of the sector naturally depends on the terrain, and also in part on the spatial requirement of service trades flanking and shielding the residential areas against traffic (the urban motorway runs parallel to the metro line). In the centre of the residential quarters the necessary retail- and local service facilities will be available, together with schools, kindergartens and churches. These centres are surrounded by concentric circles of varying density which may be graded from 900 inhabitants/ha to 300/ha and ca. 30/ha (detached houses with private gardens). Shopping mall, schools and compact high-rise residential areas are set upon underground car parks of sufficient capacity. The remaining plots, both housing and trade, must accommodate parked cars on their own ground in the same way industrial estates do. Public road space is available for moving traffic only.

The residential quarters remain compact built-up complexes, whereas the spaces in between will always be kept free from any buildings, in order to provide space for parks, ponds, some playgrounds or sport grounds, paths for walking and cycling – though suitable for vehicles like ambulances etc.

At 360° the population capacity of such residential quarters rises to 40,000; a 90° sector therefore accommodates ca. 10,000, a figure which must be regarded as the lowest limit for retaining the viability of minimal amenities, such as retail trade and schools. If necessary, the radius of the built-up area or the density of development need to be increased. Adaptation, perhaps once per generation, should in any case not be ruled out. – The model presented can accommodate about 290,000 inhabitants, or 320,000, if university and garrison population are included. The urban space available would easily permit pulsations in time up to some 500,000 or even 600,000 inhabitants. - It remains to be seen whether the currently typical ratio of 1:0.4 (residential population : working population) will remain a regionally and timewise lasting base for town planning. Presumably, a purely quantitative relationship is no longer satisfactory. The number of working hours of the individual per week/year, the length of the working life will have to increase, if the rising expectation of prosperity is to be satisfied. Changes in the productivity of individuals may well not affect their incomes, unless they are self-employed, but even that is far from certain. Every generation creates its own obligations, and buildings must correspond to their specific requirements. In many societies, for instance, shifts in demand for schools and retirement homes clearly point towards an increase in the latter. They must be accommodated in the existing residential quarters. Another shift may be observed in the rapidly increased urbanization of agriculture: instead of maintaining separate "rural" settlements, modern farms may well cultivate fields from the urban fringe. This applies not only to experimental plots of agricultural colleges.

5. GENERAL CONSIDERATIONS, RESULTS AND SHORTCOMINGS - CONCLUSION

The above outlined urban model tries to satisfy the ideal expectations found in First World societies – and

offers solutions. Needless to say that an almost endless number of varieties is conceivable. The character of landscape, topography, climate may enforce very specific adaptations. The fantasy of architects and planners is challenged boundlessly. The essential point is always to keep the decisive goal in focus: the development of urban organism which functions to the maximum effect in line with adequate social and environmental standards. This principle implies continuous adaptation to the requirements of fast proceeding modernisation. Urban settlements are the most important tools of mankind to produce all the material wealth which is desired and which is indispensable to develop and maintain human culture including religion, education, science, security, arts and welfare. This production can be efficient or wasteful. Much depends on the clever use of space, on perfect locational relations. The manifold functions need to communicate easily and at any time. Although a great deal of the communication is nowadays handled by electronic means, a considerable volume is sheer traffic. Along with growing sophistication of both the material production and the cultural vitality, traffic is growing by volume, by diversification, and by its requirements of reliability and speed. Traffic lines are the arteries of the organism. They must never be choked.

Consequently, the above-outlined urban model has been displayed mainly under the perspective of easy traffic – short distances, best technical means of traffic, accessibility at any time, cheap. Traffic means movement. There is no room for parking in lanes, streets and roads. Parking facilities, however, must be available if the gain in time is not spoiled when the goal is reached. In dense areas adequate multi-level parking must be provided. The model offers a variety of solutions. Heavily frequented pedestrian alleys should be equipped with travelators for better comfort and to dispense of other means of traffic.

As far as intraurban collective (public) transport is concerned, a maglev (metrorapid) system is the choice of the day. It is fast, comfortable and next to noiseless. The system is arranged in rings with stations at almost equal distances, which allows standardization of the travel time between stations. Delays at halts can easily be balanced by subsequent acceleration. The trains move on and on, there is no idle time at peripheral terminals at the end of otherwise poorly frequented sections of the system – a characteristic shortcoming in conventional cases.

Long distance connections are served by a very compact main station with easy access by bus, taxi, private and hire cars including ample multi-level parking, as well as by metro and pedestrian traffic from both the nearby city centre and the industrial park. Cargo handling has all technical means at disposal necessary for air, road, rail, maglev and inland waterways including intermodal transhipment and storage. Special installations serve auto-shuttles and truck-trains. At the airport, runways and terminals are located in a way which permits the shortest possible movements of the planes on the ground.

There are still a number of methodological shortcomings:

It might be desirable to establish and to define certain lead figures in order to allow the comparison of theoretical models to the existing cities which may benefit from step-by-step application of new research in future planning.

Currently, no acknowledged definition is available of terms such as "built-up area" or "road length per capita". The meanings are uncertain. Does "built-up" include parking spaces, does it also refer to the developed underground installations and access roads and ramps? What about supplementary space between buildings necessary for ventilation, light or emergency? The model presented here covers some 60 km$_2$ providing ten to twenty hectares per inhabitant if population ranges between 300,000 and 600,000. This population density appears to be in line when compared to recently published figures on the present population density in Australian / NZ cities (15 inh./ha), the same with the American cities, however, 55 for average European cities and 150-200 for cities in Asia. The discrepancy would be less extreme if the agriculturally used area were included.

Similarly hopeless appears any attempt to compare the "road length per capita". It is important to know the traffic capacity of roads. This would include, besides the length, the width, the number of lanes and crossings per length, the type of crossings (number of branches, traffic lights or (and size of) roundabouts), the quality of the road surface, the average convenient speed possible and other items. These methodological shortcomings have been ignored in this study.

It is understood that the working day circulation of the citizens should be as short as possible (short in terms of distance and of time). Location of homes and of working places must allow for a minimal journey to work. If walking or cycling need to be excluded monomodal connections would be the next choice. If public scheduled transport (metro) is to be used and feeder links on foot or cycle allow for electro-taxi (minibus with capacity for prams and/or wheelchairs) they would provide the necessary flexibility. If the street pattern is not just ornamental but fitted to a purpose, much time can be saved.

When summarizing, it is obvious that appropriate localization is of key importance to all the planning activities which in turn means: it must provide first priority to respective decision-making. Creating of value results from the revenue of resources such as labour, capital, machinery and installations, knowledge and

skills as well as time and appropriate structures of urban settlements. The inherited structures of towns and cities are mostly adverse to efficient creation of material values. The precious resource "time" is usually swallowed without any scruple. A fundamental change in the goal-setting of urban planning is therefore vigorously postulated. Location and interlinkage – that means traffic - are the key items.

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ZUSAMMENFASSUNG

ZUKUNFTSTAUGLICHE STADTSTRUKTUREN UTOPIE, VISION ODER NOTWENDIGKEIT?

Die Verhaltensvorlieben der Menschen ändern sich schnell und nutzen dabei technischen Chancen und Fortschritte aller Art. Diese Veränderungen kennzeichnen einen allgemeinen und globalen Prozess, den man gewöhnlich unter dem Begriff „Urbanisierung" zusammenfasst – womit ganz richtig auf städtische Siedlungen verwiesen wird. Städte sind besonders prominenter Ausdruck kultureller Errungenschaften der Menschheit. Sie sind zugleich die wichtigsten Plätze des Wohnens und die Werkzeuge der Wertschöpfung für die materielle Lebensgrundlage. Die meisten Städte halten jedoch nicht mehr Schritt mit der Geschwindigkeit der Entwicklung; sie bleiben zurück und verfallen in ein strukturelles Chaos; es gelingt ihnen nicht, sich den Erfordernissen der Zukunft anzupassen. Wie die Analyse ergibt, ist der Hauptgrund die ungeeignete Lage der diversen Funktionen mit der Folge viel unnützen Verkehrs. Das macht die städtischen Siedlungen ineffizient – sie strangulieren sich selbst. Zur Lösung dieses Problems wird ein Modell vorgestellt von einer voll entwickelten Stadt mittlerer Grösse. Die Realisierung ist schrittweise möglich. Die Zielsetzung ist nicht utopisch, wohl aber dringend erforderlich.

SCHLÜSSELWÖRTER

Stadtplanung, Stadtverkehr

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