

Introducing Integrated Eco-Mobility to the New Asian Urban Model – Filling Systemic Transit Convenience Gaps. A Case in Chongqing’s High-Density Jiangbei Centre

Stefan Rau, Jianfeng Xu, Hang Yi Chen, Yi Hua Zhang

(Stefan Rau, Manila/Shanghai, stefanrau@metrosynergies.com)

(Prof. Dr. Jianfeng Xu, Chongqing, jdp2000@126.com)

(Director Hang Yi Chen, Chongqing, via: in_archit@126.com)

(Dr. Yi Hua Zhang, Chongqing, zhang.2.yh@qq.com)

1 SUMMARY: FILLING “TRANSIT CONVENIENCE GAPS” WILL OPEN POSSIBILITIES FOR ECO-MOBILITY WITH IRRESISTABLE CONVENIENCE

Very high densities characterize many transforming and new urban centres in Asia and China. Allocating the right mix of uses and finding good economic models for real estate development and property ownership to achieve economic sustainability continues to be challenging in light of competing developments in all larger cities. Creating robust urban morphologies, roadway- and public space typologies that balance multiple modes of transport in the public realm effectively, while managing local preferences requires planning geniuses – or even better: intensive horizontal cooperation and coordination – to achieve compactness and livability. Serving new Asian and Chinese high density centres with transportation often becomes the single-most critical concern of planning and approving authorities. Apparently, relying heavily on individual car-ownership and road-based transportation cannot be a satisfactory solution and already results in gridlock and in an unpleasant fight for public space between buses, cars, pedestrians and others. It is not uncommon in Asia that private vehicles are given high priority, discriminating pedestrians due to an implied difference in social status and to promote a car-based economy. Intelligent solutions for eco-efficient urban mobility need to be based on public transportation and have to match or even have to go beyond the best of what we have in cities around the world today in terms of a wider range of (electric) and innovative vehicles, attractive places of interchange, finer networks of accessibility, real-time mobile mobility information systems as well as consumer-oriented operations and reasonable pricing and convenient payment systems.

China is in the very fortunate situation of having a leadership that understands the importance of good infrastructure and thus funding and implementing networks for various modes of transport, private and public, road-based and rail-based enjoys a high priority in Chinese cities. A system of urban highways, ring roads and arterial roads has been constructed over the past 15 years. Three LRT/MRT lines are in operation and several more are planned. The main mode of public transport at present are buses. One experimental BRT line in the Yuzhong district has been largely regarded as a failure, but this is arguably due to suboptimal routing. The existing and planned LRT/MRT system will greatly improve accessibility within the metropolis. However it seems that there is a systemic service gaps both between the lines as well as between the actual stations particularly in centre locations. In Chongqing the topography of steep valleys and hills up from the Rivers as well as a hard rock geology presents an additional challenge to development and connectivity.

The authors identify systemic „transit convenience gaps“ most urban public transportation systems intrinsically have. And, we believe that, if these gaps were to be filled, it would make public-/semi-public-/shared mobility solutions more user-friendly and convenient. Innovative solutions and creative technology for vehicles, places for intermodal exchange and mobility information for mobile devices will make a huge difference. If the focus is on user-friendliness, availability, positive experience, safety and security, there is a substantive potential for much higher acceptance of transit and eco-mobility choices.

Four transit convenience gaps have been identified by the authors for the transit system in Chongqing and in the Jiangbei Centre area:

- (1) MRT/LRT lines station distances are too far apart from each other to make it convenient to walk to a station and to walk between stations. This becomes apparent when compared with other world cities.
- (2) The mesh of MRT/LRT lines leaves gaps that are too great to be convenient to walk to stations. An intermediate system of rapid transit within a district or between two districts is needed. Ideal would be BRT or a streetcar.
- (3) The inconvenience that exists between bus-service and taxis or private vehicles could be filled by service through minibuses or vans, public and semi-public models are possible.

(4) The gap between walking and bicycle riding or cars and taxis might be filled with publically available, individual mobility assistants like Segways, e-bikes and other innovative technology yet to come.

2 CHONGQING AND “TWO RIVERS” NATIONAL LEVEL SPECIAL DEVELOPMENT ZONE: DEVELOPMENT TREND NORTHWARDS WITH JIANGBEI BEING MOST CENTRAL

Chongqing is on its way of becoming a major urban agglomeration and economic powerhouse on the upper reaches of the Yangtze River in China’s western region. Urban and economic development is surging and the city has redeveloped in its centre area and expanded over the past ten years almost beyond recognition. High density places have been rising and continue to develop in the historic centre of the Yuzhong peninsula bounded by the Yangtze and the Jialin Rivers. And several centres outside the historic urban area are under way. The most notable centre development is the new Jiangbei CBD just north of Yuzhong across the Jialin River. This CBD is the most significant centre development of the „Two Rivers“ national level special development zone that is north of the Jialin river and west of the Yangtze River and includes the airport and Yangtze Port facilities as well as several large scale industrial clusters. This new development direction northwards will put the Jiangbei CBD in a strategic centre of gravity of the region.

The ongoing urbanization can be described, in a simplified manner, as two primary patterns. 1. Core city redevelopment: high-density mixed-use development and re-development of historic areas on the Yuzhong Peninsula and 2. New city districts and industrial development: development primarily with functional separation and a system of super-blocks and overly wide roads radiating primarily north into the “Two Rivers” zone. In this process a system of high-density commercial and business centres and many high-density residential compounds as well as manufacturing and logistics zones are being allocated and built. This model can be observed in many places throughout urbanizing China and in other countries in Asia.

The city’s dramatic topography at the confluence of the Jialin and the Yangtze Rivers with steep slopes at both rivers and hills elsewhere presents major challenges to urban development. The topography also offers many opportunities both for unique place settings and views, natural district ventilation and creative pedestrian connections with public escalators and elevators that are being planned in some new areas, comparable to Hongkong’s „Mid-level“ area south of „Central“. However, „bull-dozing“ away hills to ease development is a commonly accepted practice to increase developable land in the city.

Planning and implementing an eco-efficient transportation and mobility system in Chongqing in light of these circumstances faces several challenges:

- The topography is a challenge for development planning as well as for transportation planning;
- Due to the topography, the use of bicycles is not part of Chongqing’s mobility vocabulary,
- Codes and transportation engineers tend to prioritize private vehicles with wide roads and many highway-style intersections over transit and non-motorized traffic,
- MRT/LRT are difficult to construct due to the steep topography and a hard-rock geology,
- The development model of separating uses on an urban superblock scale makes walking from residences to work, factories, offices, as well as to restaurants, shopping and parks very inconvenient due to long distances.

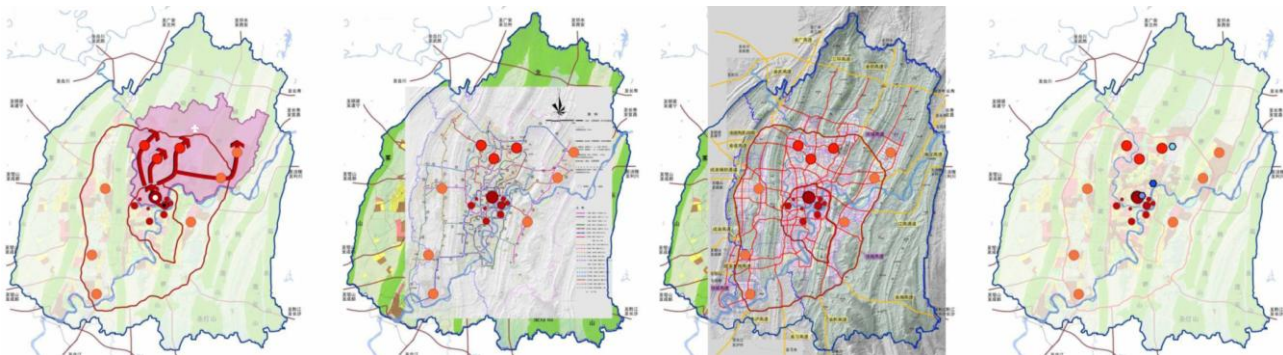


Image 1: Chongqing strategic urban area plan within outer ring road. The purple area in the left image is the “Two River” zone. In blue is shown the future outer ring road and red the ring road and orange the arterial roads system. Red dots are centres. Arrows indicate growth trajectory. Second image shows planned MRT/LRT. Third image shows existing and planned trunk roads. Right

image shows locations of international airport (north) container port and high-speed railway station locations. All these initiatives support a shift of gravity from historic Yuzhong Peninsula with the new “Jiefang Bei” CBD (black dot left image) towards the north with Jiangbei CBD (white dot left image) becoming clearly most accessible and central. Significant improvements to public transit are essential filling the transit convenience gaps much needed to avoid gridlock. Source: Stefan Rau over Chongqing’s strategic plan.

3 HYPER-DENSITY DEVELOPMENT PROPOSAL AND TRANSPORTATION CHALLENGES

The new Jiangbei CBD is continuing to be refined and developed. Within this high-density environment the authors were asked by a private client to propose a master plan including programming, land use and – intensity definition, building types development, open space configuration and transportation concepts. For the relatively small site of five hectares within a dense urban context that has been developed over the last 15 years, the authors proposed a very high density with a floor area ratio of nine (FAR: 9). Although this is very high, there are many examples of such densities within mixed-use centres and mixed-use developments in Asia and China.

The justification of the density in this particular site is based on several factors such as central location, proximity to a green space and the lack of several urban functions that might be allocated within the site to complement land uses in the context and complete the land use mix creating compactness and “short distances”. Accessibility to the centre area at large is excellent with a new subway and arterial roads. However, access to and from the micro-location of the site itself needs to be improved as well as management of circulation in and around the site.

Due to the centrality of the location and the anticipated density, regular in-progress discussions with and informal pre-approvals from the district planning department, district government and the city department of planning were essential. The proposed very high density and the details of the mix of uses were discussed at length to ensure an optimization of functions that would complement those already existing, planned and under construction in adjacent areas. This exercise results in a conceptual reduction of distances from housing to jobs, commerce, services, education, health care and open space within the new centre. In short: the objective was to create compactness.

What has been the biggest concern of the local officials however, was vehicular accessibility avoiding roadway congestion and the planning of sufficient number of parking spaces as well as access to parking that avoids backlogs onto roads. The authors were very concerned about access via public transportation and in reviewing the transit system - existing and planned - major shortcomings on a systemic level were identified and they had to be overcome through innovative concepts.



Image 2: High density developments in the area of the Jiangbei CBD. Pedestrian environment has some nice elements in some places already but need to be completed and connected to become a cohesive, convenient, pleasant and safe system: Pathways through green spaces. Beautifully landscaped and wide sidewalks with cars at times parked on them. Public stairs and public escalators enhance walkability. Roadways with Taxis and capacity to handle exclusive bus-lanes/BRT. Source: Stefan Rau and Wang Dan.

4 EXISTING AND PLANNED MRT/LRT SYSTEM LEAVES TWO SYSTEMIC GAPS: NETWORK LINES ARE TOO FAR APART AND STATION DISTANCES ARE TOO GREAT

In Chongqing the planned network of MRT and LRT lines is very ambitious and it is very laudable. However there are two kinds of convenience gaps in this system, the first being the lines are too far apart and the second being the stations are too far from each other.

The mesh that is woven with planned and existing MRT and LRT lines leaves holes too great to be conveniently serving all urban areas. This is surely due to the difficulties dealing with the topography and the involved capital investments due to the geology.

To solve this systemic problem, the authors recommend to introduce a bus rapid transit overlay inbetween the rail-based transit network. This BRT system can easily be accommodated within the existing new road carriageways, built in the last several years. This would be easy to install with exclusive bus lanes and effective bus stops and flexible to change routings if adjustments are needed for better service.

The second type of gaps that are created by the MRT and LRT network is that distances between two stations are too far apart from each other to be conveniently serving citizens and not conducive for them to switch from a car to public transit. The concept behind this is to have the trains run quickly from start to end which is a reasonable objective with respect to speed and effectiveness. However, it defeats the purpose of a public transit system which is to offer a convenient mode of transportation, a desirable service for people to use.

If compared with cities around the world it becomes apparent that Chongqing’s MRT and LRT network and station distances leave too many convenience gaps. This may be true for other networks in other Chinese cities as well, where station distances are spaced 1 to 2 kilometers apart generally, and not becoming significantly denser in center areas as is the case in other world cities with successful transit systems with a high modal split of public transit ridership.

The authors recommend to review this principle both for Chongqing and as well for other Chinese cities and simply add stations inbetween on existing and planned lines to enhance user-friendliness and make people use transit as their first choice of getting to and around in the cities and their high density centres.

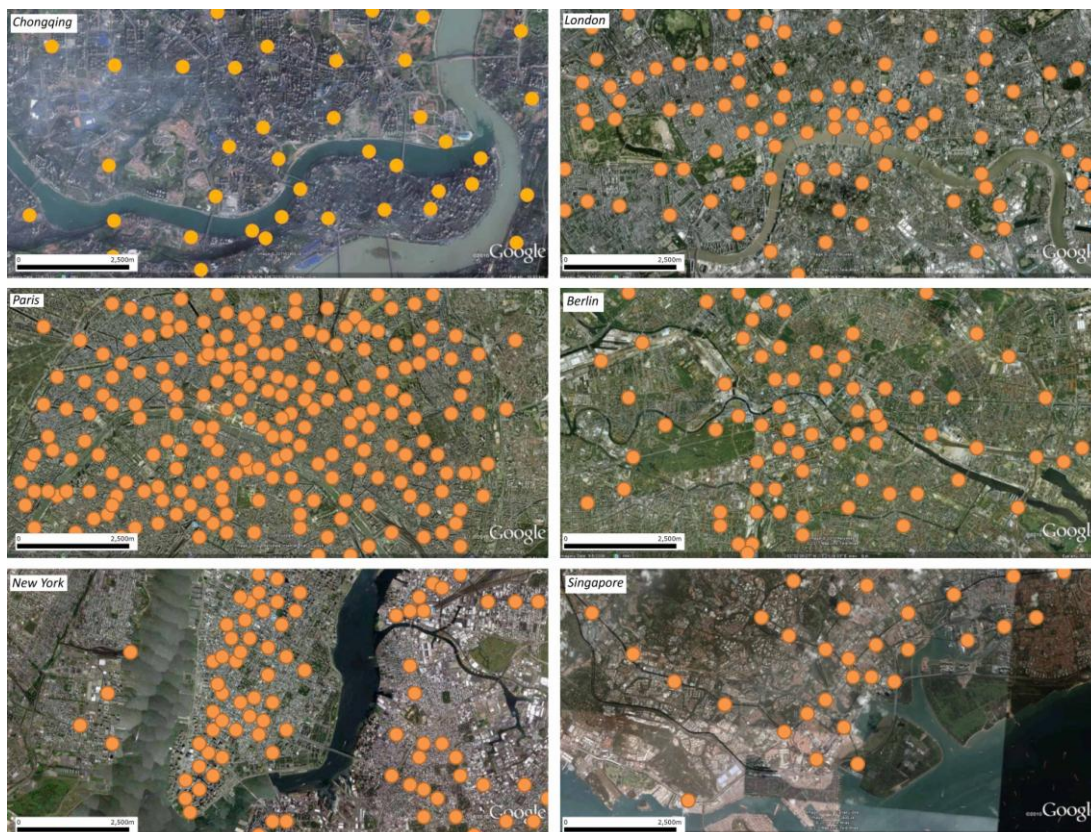


Image 3: Comparing subway station density of six cities. Chongqing’s planned subway line stops to be implemented by 2030 (top left) is by far the city with the station distances too great to be convenient for citizens to use. Clear transit convenience gaps. Singapore (bottom right) comes next and here it is apparent that in the central locations station distances become nearer compared with peripheral locations. Source: Stefan Rau over Google Earth and Google Maps.

5 BUS LINES AND BUS STOP DISTANCES TEND TO BE TOO FAR APART AS WELL

In Chongqing and in many Cities in China buses tend to have stops spaced rather far apart compared with buses in western cities. The reason behind this is identical with the reason behind the distance between subway stops: long-distance speed and effectiveness. Also in this case it comes at the cost of convenience for commuters. More stops, even stops on demand on every intersection would make it much more attractive for people to switch to buses and thus many traffic jams due to individual vehicles can be avoided.

Not too seldom it can be observed that bus routes and bus stop locations stay unchanged even with new transit lines opening and at time bus stops are not relocated to be next to transit stations which makes interchange inconvenient.

Bus routes need to be adjusted and revised to respond to transit system changes and to respond to changes in land uses and densities reflecting new magnets of trip generation. Stops need to be nearer to one another in dense places and on-demand in lower dense places.

6 PROPOSAL FOR ECO-MOBILITY CHOICES AND MULTI-MODAL PUBLIC TRANSPORTATION: STRATEGICALLY FILLING THE “TRANSIT CONVENIENCE GAPS”

Solving traffic challenges for cities especially in high-density environments is rather critical in various respects. Accessibility, urban livability, community life, environmental quality, public health, safety and security in public spaces, eco-efficiency and low-carbon economy are all directly related to urban transport and vice versa.

If a commonly accepted goal is achieving low-carbon eco-efficient mobility, we must be serious about the need to get people out of their cars by offering most attractive, convenient mobility choices that cannot be resisted. It is of utmost importance that public transportation service offers convenience to individual mobility needs of all residents, workers, shoppers and visitors both to get to and from the centres as well as to get around inside the centre areas.

To achieve convenience we have to fill „transit convenience gaps“ that seem to exist systemically in most places, not only in Asia. These gaps exist due to, among other reasons: physical urban patterns, transport technology used, the scale of vehicles and operations economics.

These convenience gaps may be filled through various means, number one being intermediate sized vehicles and innovative new vehicles. Number two, most importantly – as we don't have to reinvent the wheel – is employing creative models for shared ownership and mobility services, management and operations models are most needed with many encouraging examples already in place in various cities. Number three is information on mobility choices and ordering capabilities ought to be readily available on people's mobile phones real time and anywhere on the go.



Image 4: Proposed multiple modes of transport integrated to become an eco-efficient and convenient mobility system. Filling transit convenience gaps. Source: Stefan Rau and various internet sources for icons.

The authors were originally asked to work on a five hectare site and ended up consulting transportation consultants and the district and city government on improving the transportation system. For the example in the Jiangbei Centre of Chongqing, a place with virtual non-existence of bicycles due to topography and culture and in addition to roadway- and roadway management improvements as well as parking provision,

the authors proposed eight specific strategies to provide an attractive and convenient system of eco-mobility filling the transit convenience gaps:

(1) MRT/LRT more stops:

Additional stops in-between existing and planned stations to serve residences and offices within a five to ten minute walk maximum. China's subway systems tend to have distances between stations too great reasoning speed is of greater importance than convenience. However a balance needs to be found and convenience and other factors of user-friendliness will ultimately decide on the success of system which can be measured by transit ridership and modal split.

(2) BRT added in-between network:

Introducing a City-wide BRT system on the existing and planned new roads which have enough capacity to give one lane exclusively to buses. The BRT lines strategically fill the systemic gap between subway lines that exists also due to the topography and it will provide rapid transit within a district and between two districts. BRT seems to be an obvious choice offering effectiveness at a very reasonable capital upfront investment while also being flexible with routing and adjustments over time.

(3) Improved bus routing and added Minibus service using electric vehicles:

Introducing a district-wide minibus system with convenient stops and personal cargo delivery will serve the need for a strategic level of public or semi-public service needed below that of buses and above that of taxis or private vehicles. On-demand stations and service flexibility will make this effective and convenient to go around within a district and to go to and from MRT/LRT stops.

(4) Renting/Sharing/Pooling a variety of vehicle types:

Introducing a variety of vehicle types and vehicle sizes and ownership models as well as management and operations models with vehicle stations in every residential community and even every residential block and high-rise buildings and with branches in all major office and commercial buildings. Car or vehicle sharing associations and vehicle rentals with membership or preferential treatment and competitive rates will be fun and attractive and combines the best of all: providing individual mobility and great choices of vehicles on demand and tailored to the actual need each time, with the benefit of a hassle-free mobility not needing to worry about vehicle maintenance.

(5) Slow-moving individual mobility assistants:

Electric bicycles, segways and a new generation of assisted electrical slow moving individual mobility devices will fill a gap where one feels walking is just a little too far and takes just a little too long or is inconvenient due to topography. In addition to private ownership and parking options offered in many, convenient and safe locations, shared and rental models of these mobility assistants should be offered to ensure availability of devices and flexibility of useage.

(6) Pedestrian friendly environments, fine-meshed networks, safety and security:

Pedestrian system planning is introduced with completed pathway-network, road crossings, public elevators and escalators to overcome hills, and overall design for pedestrian safety and security. Walking needs to be a most safe and pleasant experience to be the first of all choices to get around in a centre area. To improve pedestrian connectivity sometimes it is needed to create additional infrastructure, beyond sidewalks and pathways. In centre areas that could be a system of elevated walkways directly linking the commercial areas of buildings with one another and connecting to public transportation. And it could be a system of underground connections from subways directly to buildings along commercial or cultural pathways. Attractive and safe public spaces, sidewalks, plazas, parks and pathways are essential for a walkable place and a prerequisite for people to chose walking as a first choice of getting around. Detailed planning and urban design is required to ensure seamless, safe and attractive connections between different modes of transportation on foot.

(7) Inter-modal transit stations and eco-mobility centers and -stations:

Changing from one to another mode of transportation is an inconvenience most of the time. One aspect is the proximity, accessibility and attractiveness of stations. Here the authors proposed that in every residential compound and all major residential, office, commercial and service buildings there would be an inside and outside space with a variety of vehicles, storage space and with supplemental services like lounge,

conference room, wifi, concierge, convenience retail and small services. These are offered in two categories as comprehensive eco-mobility centers with many choices of transportation modes and vehicles and as eco-mobility stations sometimes just canopy roofs or niches or rooms with vehicle or devices storage outside or inside a building. Of course inter-modal transfer stations are associated with all subway stops and there will be safe and attractive exchanges with buses, minibuses, rented/shared vehicles and slow-moving individual mobility assistants.

(8) Interactive, real-time mobility choices information and ordering system for mobile phones:

On the level of operations the authors propose creativity on design, pricing, fare integration, real-time mobile information on mobility choices, mobile orders of vehicles and customization of service. This may be realized with GPS tracking of all modes of transportation and en-route vehicles and information on time, route details, energy use and carbon footprint for each specific mobility choice will give every individual all options for an intelligent, custom-tailored mobility choice at each situation.

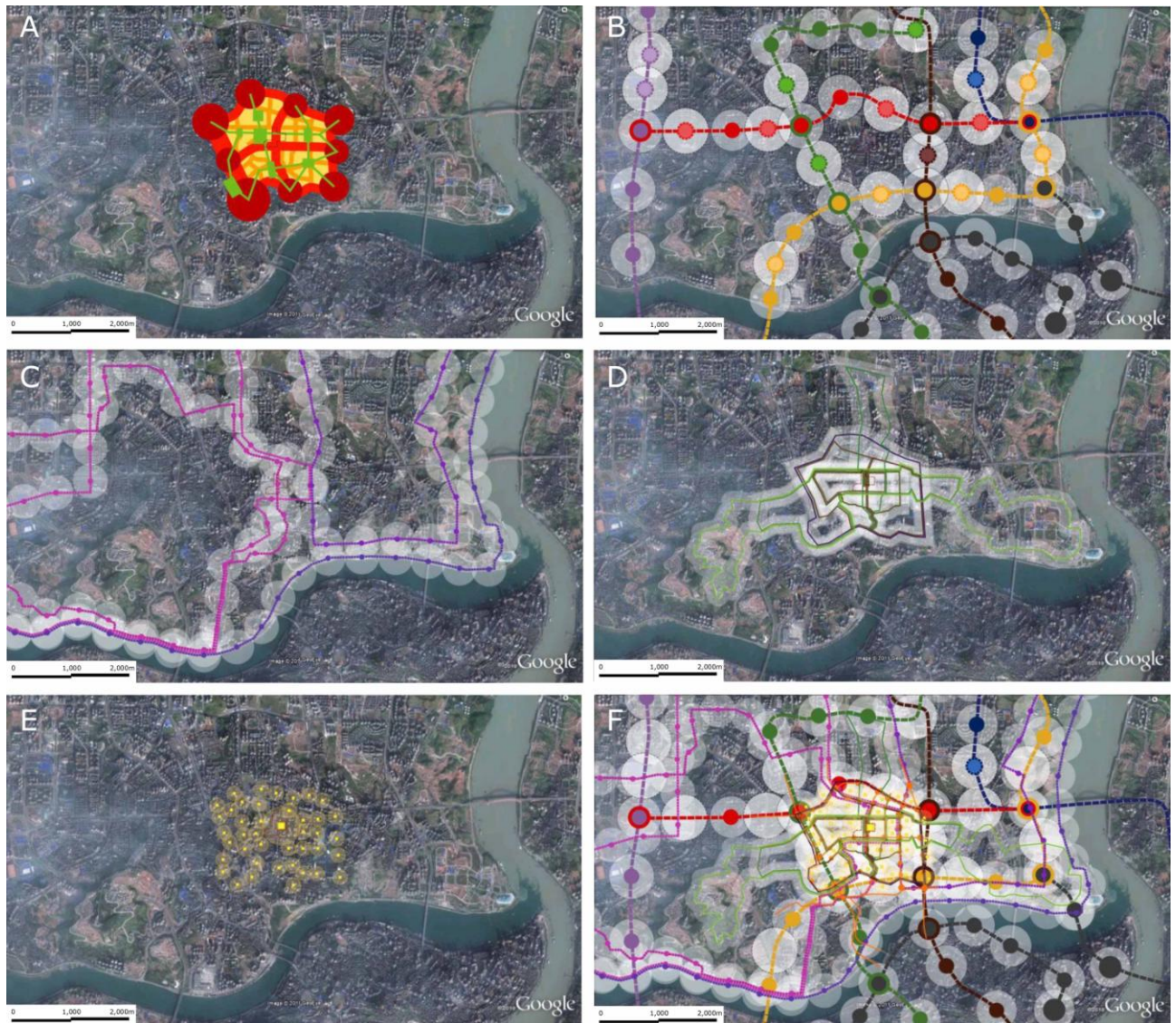


Image 5: Proposed Eco-Mobility system, networks and station locations for the Jiangbei CBD. Filling transit convenience gaps on city-wide, district scale and local levels. A: Concept diagram of highest densities and mixed commerce and office at MRT/LRT stations, commercial corridors linking them, high-density residential and neighbourhood main-streets as well as pedestrian connections and green spaces. B: MRT/LRT network and stations as planned and with added stations (with dashed lines) to enhance convenience. White circles are 5-10 minute walks. C: Proposed BRT lines on already existing mostly new roads with capacity to handle an exclusive bus-lane. Filling the systemic gap left by the MRT/LRT system due to topography and cost. D: Proposed district-wide minibus system to fill the convenience gap left by buses. White shaded lines are 3-minute walking distances from the routes that have on-demand stops. E: Eco-mobility center and eco-mobility stations conveniently located right where people demand mobility. Minibus-stops, taxi-stations, taxi on demand, car-rental and -sharing, individual mobility assistant storage. F: Overlay of all public and semi-public mobility systems on the map. Orange lines and dots show adjusted bus-routes and added stops. Source: Stefan Rau over Google Earth.

7 CONCLUSION

For high-density urban centres effective eco-mobility is needed to avoid gridlock, excessive use of energy and to enhance livability and environmental quality. Especially in the hyper-dense Asian and Chinese urban centres, transportation increasingly challenges the centres' livability. While the synergies of the mix of uses and the densities are appreciated, the experience of congestion increasingly becomes a turn-off for business locators and residents choosing their housing.

To solve the accessibility challenge to and within the new hyper-dense Chinese and Asian urban centres we need a variety of creative solutions both for the hardware of lines and vehicles but also for the software of operations and service design to systematically fill the transit convenience gaps. The focus of the action needs to be on maximizing the convenience of mobility consumers when conceptualizing eco-efficient mobility solutions.

During their planning effort for a private client and in negotiations with the district- and municipal governments, the authors identify three major „transit convenience gaps“ of public transportation service that need to be filled strategically. Filling these „gaps“ seem to be of strategic importance as they indeed seem to be systemic and not only in centres in Chongqing, China or Asia. To improve public transportation service aiming for ecologically-efficient mobility the authors recommend three strategies to address these „gaps“.

- Rapid transit for intra-district and inter-district transport filling the inconvenience gap in the MRT/LRT network. Electric run BRT is the system of choice with flexibility and low-cost and streetcar a long-term solution.
- The inconvenience gap between in the bus-service and inbetween bus service and taxis or private vehicles might be filled by electric minibuses/vans as well as ubiquitous electric-car sharing and e-car-rentals. PPP is encouraged.
- The convenience gap between walking and bicycle riding or cars and taxis might be filled with readily available, individual mobility assistants like Segways, e-bikes, smart-wheels etc.

Due to the very high densities of residents, jobs and shoppers in the new Asian centres, the market viability for these intermediate public and semi-public mobility solutions are, and the authors are quite firm on this: most certain.

8 REFERENCES

- BREITHAUPT, Manfred et al: Sustainable Urban Transport Project. BRT, eco-mobility, various transportation aspects. www.sutp.org/
- City of Chicago, Department of Transportation. Chicago Pedestrian Plan. <http://chicagopedestrianplan.org/>
- City of Portland Office of Transportation Engineering and Development Pedestrian Transportation Program: Pedestrian Master Plan 1998. <http://www.portlandonline.com/shared/cfm/image.cfm?id=90244>
- ICLEI Local Governments for Sustainability - Global Alliance for Eco-Mobility: <http://www.ecomobility.org/>
- JESSEN, Johann & RAU, Stefan: Planning new forms of urban mix of uses in Sweden. In: Praxis Experimenteller Wohnungs- u. Staedtebau 02/99. Bonn 1999
- JESSEN, Johann & GOERKE, Peter & RAU, Stefan: New forms of urban mixed use Districts - a European Comparison. For Federal Government of Germany, Ministry of Construction. Stuttgart University Press 1996
- Municipal Research and Service Center Washington: Designing Transportation Facilities for Bicycles and Pedestrians - Complete Streets. <http://www.mrsc.org/subjects/planning/planpedbike.aspx>
- New Zealand Transportation Agency: Pedestrian planning and design guide. <http://www.nzta.govt.nz/resources/pedestrian-planning-guide/docs/pedestrian-planning-guide.pdf>
- RAU, Stefan: Balancing car accessibility and creating liveable cities". In: Business Forum China 05/01. Shanghai 2005
- RAU, Stefan: Modern trains and splendid stations - railway renaissance in the USA. In: Deutsche Bauzeitung 03/02. Stuttgart 2002