

INTEGRATED SPATIAL PLANNING DAN TRANSPORTATION SYSTEM TO REDUCE MOBILITY IN SUBURBAN AREA

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Abstract

Makassar suburban areas growth widespread and sporadic (urban sprawl), causes automobile dependence, increased traffic on the main road. The discussion purposes: 1)spatial planning with vertical building to the problems of transportation 2)Suburban Society's perception of transportation problems, 3)the concept of integrated spatial planning and friendly transportation. Data obtained from, 80 respondents who live in suburban (Rusun), analysis of land use generation, public perception data, and spatial analysis to develop the concept of planning. The results show the concept of smart growth which to reduce mobility from suburban area, can be grouped into two characters of planning: 1)transit cluster closer distance to social/economic/industrial and recreation services, preferably at the central node of Daya commercial area, industrial area and housings, 2)cluster that gave priority to the transit system on the main road corridors, namely the concept of park and ride, kiss and bye, on the cluster education-housing, or housing-commercial or office-residential function.

Key Word: urban sprawl, TOD, suburban, mixed land use

INTRODUCTION

The role of transportation, become an important part in city life. Economic growth and changes in modern lifestyles have led to increased population of more trips. Urban transport problems, such as Makassar, is influenced by 1) development into suburban areas partially, 2) the economic development of urban communities need houses, as well as urban infrastructure 3) Public transport is limited and not integrated with the place of demand.

The problems that concern today in suburban areas is Government focused address to the housing needs of Low-Income Communities (MBR), build a house as a compound (vertical occupancy), but not yet integrated with the mobility to social and economic activities of society, so that the pattern of development has caused new issues on the transportation system of Makassar.

Development in a way that affects the population density increased so suddenly, as there are currently eight towers in the suburban area of Makassar, each region has a $\pm 2880-3840$ people, with total area of $\pm 50.000m^2/5$ ha, mean population density is very high (576-768 people per

hectare). Increased density has led to increased mobility of population movements into the city, namely to increase the frequency of traffic on the main road axis. Traffic congestion at peak hours of the morning from suburban to urban and vice versa in the afternoon (Road of Perintis Kemerdekaan will reach degree of saturation standard/0.85 on 2014, according Wunas, 2009).

Traffic jams cause environmental problems, such as issuing vehicle emissions of carbon monoxide (CO), nitrooksida (NO_x), hydrocarbons (HC). Motor vehicle emission 76% of road network (website <http://www.sutp.org>). Carbon emissions will increase 140% in 2000-2050 in Indonesia. Study 1989 (World Bank) explained that the population of vehicles in congested areas 12.8 times greater risk of health problems than the rare vehicles.

CO is a poisonous gas which when inhaled can cause sudden death exaggerated. NO_x and HC can damage the lungs gradually, causing lung leak in a long while on the move on the highway. Also in the air portion of the NO_x gases can be transformed into nitric acid (HNO₃), which causes acid rain, will result in damage to soil, which would interfere with farming activities and the lives of biota in rivers, lakes and seas.

Planning for land use and buildings that are not integrated with the transport system, has caused a problem that affects traffic density on environmental issues. In Makassar the compound housing to MBR has been good in suburban areas, because the priority of land use efficiency, network efficiency (environmental infrastructure), but should also consider the mobility needs for social and economic activities of such resident, take into consideration the concept of mixed land use and the distance to achieve non-motorization such as walking with good romantic shade of green, and supported by smart transportation (bus transportation and transit systems/TOD) in order to address the needs of economically MBR, and reduce mobility.

The objective of the discussion is to explain, 1) spatial planning with vertically building in order to transport problems that arise on main road from suburban-urban, 2) public perception who live in vertical housings about transportation issues, 3) the concept of spatial planning and integrated urban with friendly transportation.

LITERATURE REVIEW

References used in this discussion involves some concept planning of urban spaces that are environmentally friendly and related to the transportation system, such as the concept of smart growth, compact-city, mixed land use, transit-oriented development (TOD), pedestrian friendly, complete street and others.

According to Knaap (2004), the concept of smart growth should use the concept of mixed land use, with vertical housing and the area for pedestrians friendly. Vertical housing will create a high density area, but if planned in the right location with a distance of facilities and services of social and economic activities are affordable by walking or non motorization vehicle as mentioned above, then this concept will be able to reduce the need for private

vehicles, could save transportation costs, save on fuel usage, decrease the density of traffic, reduce pollution/emissions vehicles, and can improve the quality of the environment (PPG3, 2010).

Meanwhile, according to Edwards (2000), and Wunas (2007), development of the city should apply the formula 3E +2S (Energy, Environment, Ecology, Society and Sustainability). Currently there are three approaches to develop the concept of mixed land use: 1) increasing the intensity of land use, 2) increase the different types of land use groups, 3) integrate the functions of different land. This concept is a basic component of several theories and concepts that are emerging, such as Transit Oriented Development (TOD), Traditional Neighbourhood Development (TND), liveable communities and smart growth principles (Grant in Weddel 2010).

Transit Oriented Development (TOD) is the integration of public transport and road infrastructure humanist with a mix land use. TOD component comprises: 1) Network circulation (roads, pedestrian and sidewalk), 2) Bus Rapid Transit and the place of discharge, 3) pedestrian and bicycle facilities to save the movement of motor vehicles, 4) Public facilities such as parks, plaza, fitness centres, schools, libraries, daycare, post office etc. (Harno, T, 2010).



Figure 1. Examples of TOD and the land use mix

Currently management of TOD system covers three main aspects: cluster, routes and scheduled. The benefits of TOD concept is to improve the quality of better life, reduce private vehicle usage and congestion, reduce traffic accidents, reduce household transportation costs, a healthier lifestyle by walking, reducing pollution and environmental destruction, reduce the chances of the formation sprawl, enabling the development of compact, less expensive when compared to construct roads.

Ewing (1997), proposes two concepts with the TOD system, namely corridor transit and transit nodes. Both systems, should be supported with the concept of mixed use land, such as vertical housing, educational facilities, shopping, hotel, motel, warehousing.

Complete Street (Livable Street) is a transportation sistem infrastructure that prioritize safety, attractive, and access to a comfortable ride for all road users, including pedestrians, cyclists, motorists and public transport of all ages and abilities, applied since 1984 by the State of Florida, (Brandon 2010). Bicycles also provide recreational value and support the healthy physical movements (Mc Cullagh, 1977).

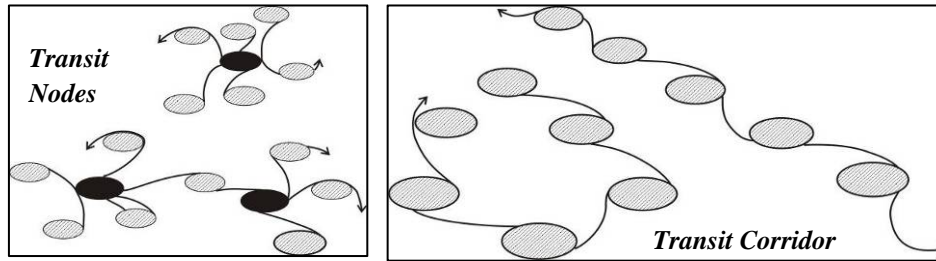


Figure 2. Concept of Urban Catalysis (Watson, D. 2001)

Walkable city in city planning supported by concept of mixed land use, in order to facilitate pedestrians and cyclists to achieve social and economic needs of the facility, and do not need to have a motor vehicle. Urban planning should be in fast lane and transit, to ensure convenience and safety for the people living around it (ORMSB,1994).

Problems of urban transportation is a result of urban sprawl, housings built irregular, low density, without a well equipped infrastructure, causing increased mobility of people into urban areas to full fill the social and economic activity, which causes density on main road from suburban to urban. The city become not humanist because of traffic congestion problems, air quality declines, increased vehicle emissions on the road, automobile dependence, the trip became unfriendly and unsafe.

Based on the GTZ (2010), several instruments are required to reduce carbon emissions from transport 1) planning instrument, 2) policy instruments, 3) economic instruments, 4) information and 5) technology. Each instrument has been directing the theory and the concept of targets that can be applied in three different issues, namely the stage of production to avoid carbon, stage of change and improvement phase. Example concept reduce the mobility, turns into a non motorization of transport (walking, bicycle), and public transportation (buses, trains), as well as repair of motor transport, private cars and taxis.

This study concludes that conclusion of this study revealed the concept of suburban planning should be integrated to the transportation system, in order to achieve humanist city and environmentally friendly (eco city) and non motorization road. Carbon emissions from transport can be avoided early through a new urban planning concepts that integrate with transport systems in suburban areas.

METHOD

The data used comes from field surveys and interviews with 80 respondents, who focused on the entire population living in vertical Housing (Rusun) in the suburban area of Makassar. Using comparative and quantitative analysis of traffict generation of vertical land use, and origin-destination matrix analysis, descriptive analysis (public opinion data), and use satellite map the for analysis mixed land uses and transportation systems for the planning concept.

Conceptual framework (Figure 4) explains the rules of spatial (PPRI NO15 of 2010) which shall consider the utilization of an integrated spatial planning, integrated infrastructure development and improvement of environmental quality. Makassar City developed into urban sprawl, not yet integrated with land-use functions for social and economic activities of society, cause to transport problems. Thus, we need to develop the concept of integrated urban development plans that are friendly to pedestrians and cyclists.

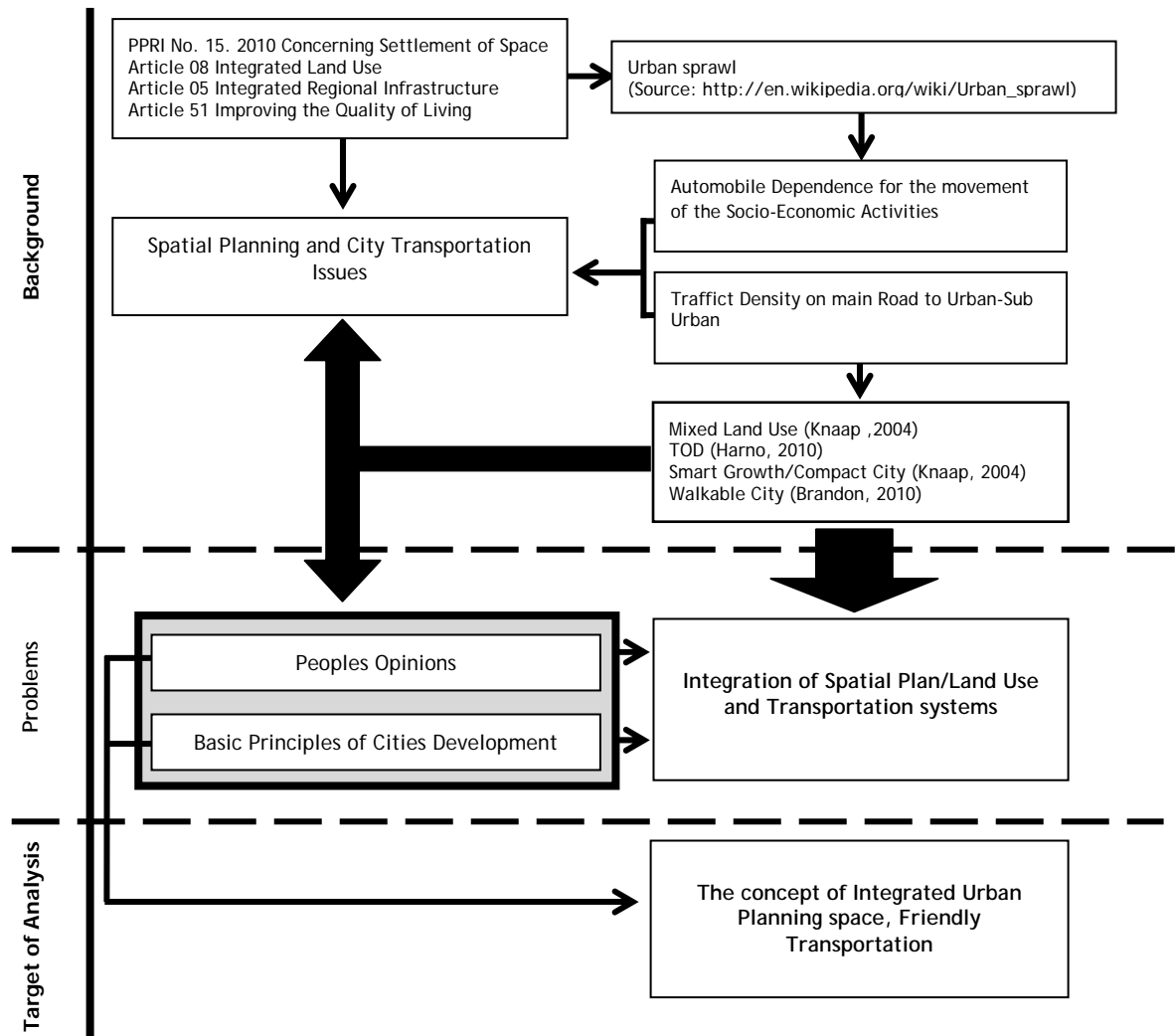


Figure 3. Concept of Frame Work

DISCUSSION

Discussion of these items include three things, namely an analysis of the spatial planning with vertical building towards transportation problems, and perceptions of suburban community about transportation issues and the concept of integrated planning of urban space and friendly transportation.

Development of Vertically Land Use Create Transportation Problems

Infrastructure and transport plays an important role in urban systems, particularly to achieve the development of cities that grow smart, friendly transportation, and environmental quality of healthy life. Transportation network function is strongly associated with land-use and affect the function space. Interaction of destination and origin of the movement influenced the function of the space cause more distance and transportation costs.

Makassar City has 3 access to the city and/or surrounding counties to other provinces in the island of Sulawesi (Sulawesi trans). The main access is 1) Road of Perintis Kemerdekaan (the primary artery) and 2) The Highway Ir.Sutami connecting access to the city in the western region (South Sulawesi and West Sulawesi), and 3) Road of Sultan Alauddin (primary artery) connecting the access to the city/districts in the southern part of South Sulawesi region.

Makassar city has a total population of 1,272,349 inhabitants (Makassar in figures, 2009) and there is $\pm 29\%$ of the population growing in suburban areas. In the area of development to the east (District of Tamalanrea, Biringkanaya), 221.124 people, population, growth of 2.30%, and in the development of the city to the south (District Tamalate), 154.464 people population growth of 2.09%. Population growth in suburban areas are larger than the population growth of Makassar (1.63%).

In suburban areas, the pattern of mass-housing developments are horizontal (low density, dispersed) and vertical (high-density, dispersed), evolve to spread and sporadic, is urban sprawl, see figure 5.

Urban sprawl is a process of extension urban activities into suburban area with the irregular pattern of development. However, the process is positive, because it has moved the majority of high population density in urban areas to suburban. But the impact of development patterns in this way has a strong influence on the mobility of population movements into the city, namely to increase the frequency of traffic on the main road axis (urban-suburban and Road of Perintis Kemerdekaan and Sultan Alauddin). Currently there are traffic jams at peak hours in the morning and afternoon (Road of Perintis Kemerdekaan will achieve a standard degree of saturation of 0.85 in 2014, according Wunas 2009).

Based on Akhmad (2010), peak hour traffic flow on major roads eastern suburbs (Road of Perintis Kemerdekaan) is the 4703 smp/hour, the lowest 2661 smp/hour (ideal level of service class C = 1400 smp/hr) with average speeds of 35, 37km/jam (ideal 60km/jam). Traffic flow on major roads of Western suburban areas (roads Sultan Alauddin) at peak hours is 4016 smp/hour, the lowest 2468 smp/hour (ideal level of service class C=1400 smp/h), with an average speed of 30.45 km/h (60km/jam ideal). Traffic density currently available in the main corridor of suburban-urban areas is projected to increase more strongly again, because the suburban areas of Makassar since 2008, already has a development target of 80 twin block, and now have constructed 4 tower of vertical housing (Rusun) at eight locations with 31 twin blocks.

Development needs will be increasing again, due to the city of Makassar City Metropolitan Maminasata which includes four surrounding municipalities (Makassar, Maros, Sungguminasa, and Takalar), and PT. Kima planned five industrial development zones in the region Mamminasata (KIMA, KIROS, KIMAMA, Kiwa, KITA, figure 5), which will affect population growth and housing needs in the suburban city of Makassar.

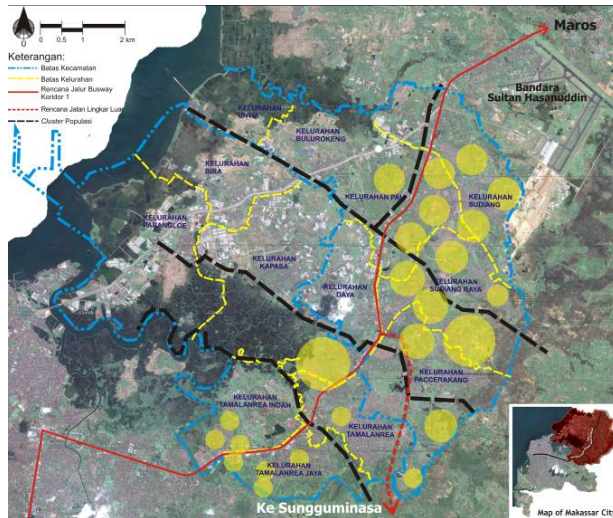


Figure 4. Condition of housing development in suburban areas of Makassar (Veronica, 2010)



Figure 5. Map of the industrial park development plans in the metropolitan Mamminasata

Urban development and construction plans, if not supported by the development centers of social activity and economic integration with the transportation system, then the problem of transportation will increase even more from suburban to urban Makassar.

At present the road network that connects urban-suburban (Road of Perintis Kemerdekaan) increased solids in the city of Makassar. The City Development in urban sprawl has led to population mobility from suburban to urban areas to full fill the social and economic activities (Table 1).

Table 1 Condition of People in Suburban Mobility

DISTANCE TO CENTRE OF ACTIVITY (Km)	% TO CENTER OF SHOPPING AREA DAN RECREATION	% TO WORK LOCATION	% TO EDUCATION LOCATION
Regional < 40	03,0	08,0	00,0
Local ± 5,0	46,2	38,0	80,9
Urban ±10-20	50,8	54,0	19,1
Total	100	100	100,0

Data Table 1 shows the percentage of population activities are still carried out in urban suburbs, or within ±5km. Educational activities generally are made public in the

neighborhood, within ± 5.00 km, but the use of motor vehicles (public transportation or bikes), as well as for work activities, shopping and recreation, >90% of the 5.00-20km distance (urban), use of private vehicles (cars and motorcycles, table 2), that make transportation problems getting worse, which affect the environmental degradation (Wunas 2010).

Table 2 Mode of Activity Mobility

MODA TRANSPORTASI	%
Jalan kaki	4,9
Becak/sepeda	0,9
Sepeda motor	44,0
Mobil	21,5
Pete-pete	17,5
Ojek/bentor	10,3
taxi	0,9
total	100,0

Table 2 shows 65.5% of the public use of private vehicles such as motorcycles and cars. People who use public transport there are formal and non formal education 27.8%. Users can switch to use of private vehicles to public transportation if provided a bus rapid transit which convenient and on time (according to interviews 2009).

If the population is found on six sites in suburban Makassar, compared with the data DLLAJR (forumpetarung.blogspot.com 2005) which describes the lifestyle of people living in suburban areas and activities in urban areas, then the characteristic movement of population in suburban areas Makassar is not the same as data from DLLAJR (Table 3), so it can be presumed that the movement of the suburban-urban population is not affected by lifestyle, but because the development of suburban residential has not been integrated with the provision of supporting infrastructure, and not yet integrated with the transport system.

Table 3 Data of suburban lifestyle population in urban activities

Type of Trip	DLLAJR Data (2005)	Makassar Suburban Data (Interview 2010)
Shopping trips	15%	50,8%
Education trips	30%	19,1%
Work trips,	40%	54,0%

Makassar City has managed to reduce the density of urban areas, with the move/migration of population to suburban areas, but on the other hand is causing transportation problems, because the movement increases, the use of private vehicles increases, the effect of which is wasteful of fuel, energy inefficiency and travel time (jam), increased carbon monoxide and noise pollution/noise. Control of air quality in areas of urban development, has to be balanced with the control of emission sources (traffic volume).

Therefore Makassar should start re-arrange the space of suburban with the concept of smart growth, that is the concept of a predictable growth by clusters, namely vertical housing (Rusun), which has social and economic infrastructure (mixed land use), build smart transportation with transit /parking access, which is friendly area for pedestrians.s

Smart growth concept has been supported by smart transportation, because since 2005, Makassar already planned the development of transportation systems with application of Bus Rapid Transit/BRT (RTRW Makassar 2005-2015), and the development of public transport to

support the BRT, namely with the development of feeder lines/feeder, *angkot* is planned as a feeder to the bus, and others such as *ojek*, *becak/bentor*, as a feeder to *angkot* (Dinas Perhubungan Kota Makassar, 2007). Currently Makassar is doing road widening, construction of the middle ring road (middle ring road) and the outer ring road that connects the suburban and the south side of Makassar, and improving the quality of public transport to support the BRT. Also currently being carried out studies of procurement mono rail in Makassar.

Based on Soderstrom (2008), housing development was supposed to be integrated with the functions of trade and industry to achieve harmonization, and according to Wunas (2007) construction of vertical Housing had to be vertical with the concept of smart growth, namely the concept of mixed land use, so that access to facilities and social and economic infrastructure can be reached by walking. Because it can reduce the movement, and cost-effective transportation, support energy efficiency, and helps the reduction of air and noise pollution, improve public health, and supports the global warming mitigation (Knaap 2004).

Based on the analysis above, then the nodes are potentially arranged in the suburban city of Makassar, which is contained within a radius of 5km arterial road network, service centers, settlements and land availability. The proposed first node is integrated as the mix with the industrial area (KIMA, KIMAMA), Daya regional terminals, Daya Vertical Housing (Rusun) and Sudiang, Daya Trade Center. Other nodes of the proposed potential is developed as a transit node around Unhas housing and education, nodes around residential and commercial Makassar Town Square, and the node around the housing and the office of Governor of South Sulawesi.

Public Perceptions in Suburban About Transportation Issues

Urban infrastructure facilities and services should be around the neighborhood, and friendly to the pedestrian (walkable). Based on field observations, some areas of suburban development construct without street infrastructure yet, there has been no pedestrian paths and green lines on neighborhood streets and collector roads (roads connecting the new area), unserved by public transportation.

Some of the perceptions of people living in vertical housing of the transportation problem is: 65.4% of the population know that the family have a high transport costs and longer travel time. In addition 34.6% of the bikers also argue that transport costs are very heavy, too hot to walk.

Communities that have a vehicle (car/motorcycle), 75.0% are willing to switch to use mass transit buses (bus rapid) if faster, safe and comfortable as well as scheduled. But the concept of non-motorization way not approved by 64.5% of the people, by reason of inefficient, would disrupt the activities of the population. It can be concluded that most people approve access by walking with a green shade to achieve the infrastructure of the city, agreeing with the provision of transportation parking transit buses are fast and convenient.

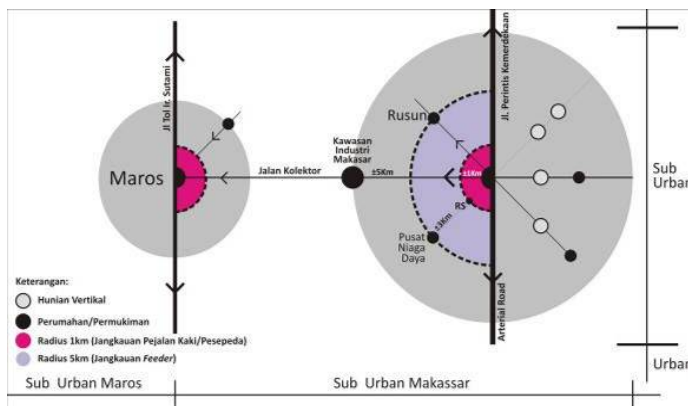
Integrated Urban Development Planning Concept of Transportation Friendly.

Under conditions of spatial growing suburban city of Makassar in sporadic vertical occupancy, which is not equipped with the infrastructure area, has led to rise of high traffic on the main route connecting the suburban-urban, then the concept of spatial plans need to consider the concept of space planning urban development with mixed land use.

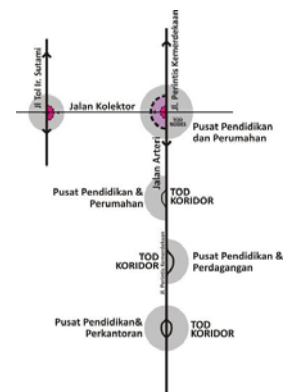
Furthermore the public expects a convenient and efficient transportation, and approve access by walking, then the concept plan needs to consider the concept of spatial planning to close the gap between space settlement with the service centre of social and economic activities, in order to walk away (walkable) and can save on transportation costs.

Analysis of these data indicate that the concept plan of the development of the Makassar, which can be proposed is the concept smarth growth, can be grouped into two characters of planning: 1) cluster centers close the distance transit services means social needs, economic industrial and recreation (Figure 7 and 8) preferably in the commercial center of the Daya node, Kima and the surrounding housing, 2) cluster that gave priority to the transit system on the main road corridors (Road of Perintis Kemerdekaan and Sultan Alauddin), namely the concept of park and ride, kiss and bye, especially on the cluster function space education-housing, or housing-commerce functions, or functions of office-residential.

The concept of smart growth with a transit system can provide positive impacts socially and economically, because the integration of both spatial and transport concepts mentioned above is a concept that promotes walking, so that pollution and congestion is reduced, population health can be improved. Besides trading service center through which the pedestrian (pedestrian ways) can increase sales, residents can save on transportation costs and obtain the environmental quality of life better.



Gambar 7 Cluster transit yang mendekatkan jarak pusat pelayanan sarana kebutuhan sosial, ekonomi/ industri dan rekreasi



Gambar 8 Cluster transit koridor, konsep *park and ride*, *kiss and bye*

CONCLUSION

Spatial development of the vertical housing in suburban areas has led to rise very high traffic on the main road from suburban-urban areas, both on the East or the South of Makassar. Because >90% of the population still works and social and economic activities in urban areas (5.00 to 20.00 km), and > 60% of the population that uses private vehicles.

Vertical housing community perceptions about expensive transport, and long travel times can be overcome by the concept of urban space planning with land-use mix and the transit system (the concept of smart growth), with the aim to bring infrastructure in cities around the residential area of suburban residents, in order to be reached by foot, bicycle with bicycle paths and green path.

Transit system can provide a positive impact socially and economically, because of increased people health, pollution and congestion is reduced, the function of the building trade that traversed by pedestrians (walkable) can increase sales, residents can save on transportation costs and gain a better environmental quality good.

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