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International Journal of Advanced Studies in Humanities and Social Science

Volume 1, Issue 8, 2013: 1195-1208

Corridor development of Melbourne metropolitan area, Australia

Mohammad Rahim Rahnama[1*], Ray Wyatt [2]

[1] Corresponding author, Associate Professor, Visiting Fellow, Department of Resource Management & Geography, University of Melbourne, Australia (2011-2013) and Geography Department, Ferdowsi University of Mashhad, Iran.

[2] Professor of Department of Resource Management & Geography, University of Melbourne, Australia.

Abstract

By introducing public transport-oriented corridor development to scientific urban planning literature, the present paper aims at identifying and prioritizing development corridors of Melbourne metropolitan region according to corridor model of GIS software. To this purpose, six variables were employed; population density in 2011, main commercial centers (17 centers), metro-based transport network, tramway, freeways and main arterial highways. The resulted mapping layers were converted from vector to raster based on access radius of 400 and 800m buffers from connection lines. Considering different natures of variables, they were weighted by the option Reclassify of Arc.Gis software. Then using the option Cost-Distance, required layers were formed and finally three mapping corridor models were obtained by combining six variables using corridor model. Finally a new map was drawn indicating hybrid and the most accessible corridors by combining three corridor maps and called hybrid corridor map. This corridor map is suggested as the best model for development of Melbourne metropolitan region.

Key words: corridor development, Melbourne metropolitan region, prioritization

Introduction

Increased population and urban sprawl, increased household automobile per capita, increased daily trips per capita, increased share of work trips by automobile compared to other public transports in one hand and lack of a dynamic link between transportation system and land use planning on the other hand have led to dominance of a car city model, increased distance between workplace and living area and increased oil consumption and consequently increased pollution and environmental problems for urban residents which is considered as the main concern for urban planners and managers (Alderson and Stephanedes, Trasportation corridor strategies and land use 1986, 18). These problems have changed approach in urban planning and design theories to reorganize spatially from personal vehicle-based transportation to other development models including corridor development and transit-oriented development (TOD) (Sung-Eun, Kim and Soon-Tak 2012, 417). Meeting these goals is possible through increasing population density and compacting urban form and corridor development. In particular when it is supported by combining different usages it has a deep effect on trip behavior and employing car and can lead to sustainable transportation model. Numerous studies have been performed on this field; for example identifying new railway-based integrated transportation corridors in the city of Thane in Bombay metropolitan region, India which is demand-oriented, or Gipps et al(2001) suggested that in building new road or railway-

based transport corridors, accessible land and cost considerations are important (Verma and M.ASCE 2005, 98); or in their studies on transit corridors strategies and land use Alderson and Stephanedes(1986) found that "movement" for corridors users and "access" for development of sites are two main purposes in highway corridors. They suggested three corridor strategies to maintain or improve transport capacity or development and support emphasizing on controlling land use using zoning, parking regulations and decreased vehicle trips to big development sites (Alderson and Stephanedes, Trasportation corridor strategies and land use 1986, 20).

A corridor is a multi-modal transportation network, knit together around a major transportation facility such as a road or rail line. It encompasses all the surrounding land uses. A corridor links places together like pearls on a necklace. These places or nodes are comprised of existing destinations in the community-they can be as large as a downtown or as small as a street corner with a few shops (wallijasper 2008, 12).

In successful corridors, the transportation system unites adjacent communities. It fits into the context of each community and is accessible to drivers and non-drivers alike. In a failing corridor, transportation facilities divide communities, spawn debilitating congestion and create visual blight. In extensive study of a wide range of corridors, the most successful exhibit the following attributes:

1. They improve communities' long term goals
2. They offer a variety of land uses
3. They offer a diverse and connected network of transportation choices
4. They provide community destinations
5. They incorporate the vision of communities

In corridor development theory, transit development (public-oriented) is emphasized (Transit-oriented development(TOD) 2013). Residential and commercial areas are designed to maximize access to public transportation and often incorporate properties to encourage transit ridership. A TOD neighborhood typically has a center with a transit station or stop (train station, metro station, tram stop, or bus stop) surrounded by relatively high-density development with progressively lower-density development spreading outward from the center. TODs generally are located within a radius of 1/4 to 1/2(400-800m) from transit stop as this is considered to be an appropriate scale for pedestrians (Ibid, p1).

In the United States, a half-mile-radius circle has become the de facto standard for TOD catchment area. A half mile (800 m) corresponds to the distance someone can walk in 10 minutes at 3 mph (4.8 km/h) and is a common estimate for the distance people will walk to get to a rail station. The half-mile ring is a little more than 500 acre (2.0 km^2) in size. Its formula is:

(1) $S = \pi r^2 \rightarrow 3.14 * (800 * 2) =$2009600/1000000=2 Square kilometer

S= area(km2) π=3.14 r=radius of the circle

Spatial scale of transit-oriented corridor development is a compact design. Hybrid development model uses rail or public transport stations as a center and encourages people to use public transportation rather than personal cars through a reasonable design and combined use development. Rail station is considered as a circle center and limits transit-oriented area. MA Qiang(2003) suggested that most people want to walk within 150m and about 40% of them want to walk within a radius of 400m and less than 10% want to walk within a 800m radius. So people choose to use a transit rail station and walk for 5-15min within a radius of 400-800m as a spatial domain of transit-oriented development (TOD). Figure 1 shows spatial domain of transit-oriented development (DAI, LU and LUO 2010, 31).

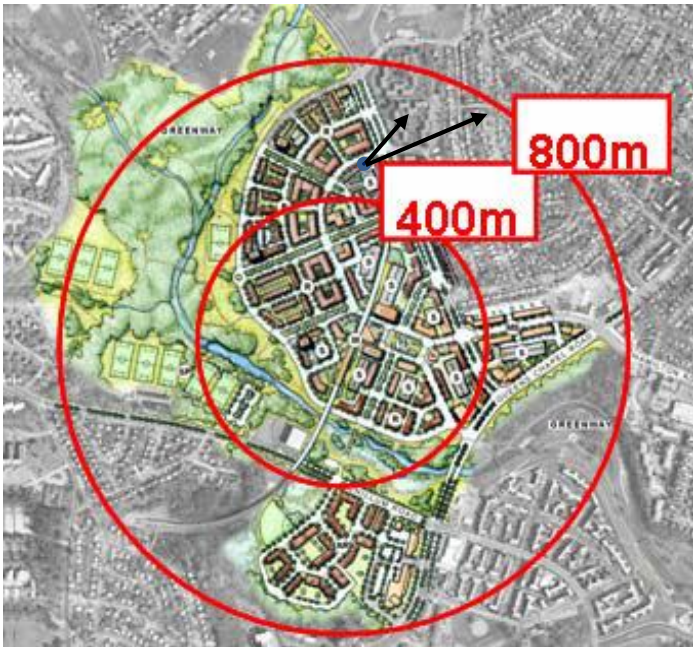

Figure1: spatial scale of transit-oriented development

The results of the researches undertaken in United States and Canada (1995) in 19 cities with 261 rail stations indicate that there is a positive correlation between use rate of railway and population density as by 10% increase in using railway, population density increases by 6%. Other researches also indicate that about 1200 jobs can be organized around rail station within the radius of 800m (Ibid, p 31). Land use density and performance diversity are the most important factors for assuring success of transit-oriented development. Using transit-oriented development requires both increased residential density and combination of use and public transportation for preparing a sustainable transportation system.

Many cities in United States began to develop railway-based transportation system with the purpose of furthering concentration of economic development near transit stations and along transit corridors. Also evaluating 40-yaer performance of Federal Government about public transportation indicates annual budget increase of 8% in transit especially since 1998. 4.5% growth of public transport trips versus 2% vehicle trips indicates efforts undertaken for reviving public transportation as an alternative solution for personal vehicles. However it is still less than previous decades (Gyulavary 2010, 151).

Although transit-oriented and corridor development are in their primary steps of planning, it is called as quiet revolution in transportation planning. Since corridor development enhances local community conditions and corridor planning approach considers multiple forms of transportation, adjacent land uses and the connecting street network can transform the transportation planning process into one that respects and enhances our natural and human environments (Walljasper 2008, 3).

Corridor development aims at capturing compact city theory. Compact city concept is used widely as a planning tool in developed countries. Compaction can be defined as high density or single center development or be considered as employment focus, dwelling and wide range of uses. Compaction is defined controversially as a mechanism for controlling and regulating urban sprawl through improving or increasing density. Mixed use of urban structure is supported by a more efficient public transportation system and provides increasing opportunities for walking and cycling (Chhetri, et al. 2013, 78). The important examples of compact city form in the world can be noted the comparison of Atlanta and Barcelona. Table 1 indicates the differences of two cities. As shown in table 1, Atlanta is 25.6 times

larger than Barcelona in size (U. N. UN-Habitat, planning Sustaiable Cities:Global report on human settelments 2009, 360). However its population is 0.89 of Barcelona. Differences can be observed in other indices. Figure 2 also indicates lateral spread difference of Atlanta and Barcelona with the same scale in 1990 (Berated 2013).

	Atlanta	Barcelona
Area(km2)	4280	162
Population(millions,1990)	2.5	2.8
Density(people per hectare)	6	171
Population close to metro	4% within 800m	60% within 600m
Trips undertaken by public transport	4.5%	30%

Table 1: density and public transport access: comparing Atlanta and Barcelona

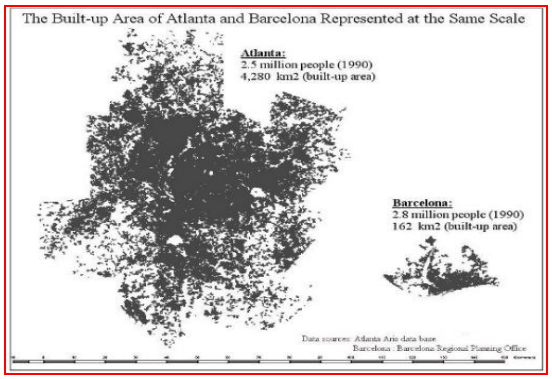

Figure 2: comparing built-up area of Atlanta and Barcelona with the same scale

So in corridor development, it is not only emphasized on combining private and public transportation systems but also mixed uses including residential and commercial ones and transportation system especially public transportation, walking and cycling associated with diversity and usage density. Core to the corridor development idea is transit-oriented development emphasizing on public transportation and mixed residential, official and commercial uses and spending free times around (catchment radius 1/2-1/4 miles) public transport stations(rail and tramway) so that using personal car and consequently energy consumption decrease leading to decreased pollution. Indeed by linking land use, urban public transportation system and other urban infrastructures, smart city growth was formed its rules were enforced in Maryland, United States in 1997. According to smart growth regulations less subside is allocated for building road, sewage system, schools and other infrastructures out of original city growth limit. This urban income difference was allocated to developmental activities to prevent excess urban sprawl (U. N. UN-Habitat, planning Sustaiable Cities:Global report on human settelments 2009, 363). Generally, building corridors aims at creating a dynamic connection between a package of different choices of transportation (walking, cycling, bus, rail) and different uses along connection paths with a specific radius and establishing shopping centers, population centers, gyms, expos, hospitals and clinics, universities and higher education institutes, industrial centers, zoos, parks and centers for spending free times around corridors so that a close connection between use and transport network is established Auckland east-west corridor in new Zeeland is one of such corridors which is a home to a of regional attractions in the form of two major hospitals, horseracing tracks square, the Auckland Expo Center, two regional parks and a sub regional shopping centers(figure 3) (Stanford Bell and Anthony Johns, A

Strategic Approach to Developing Livable and Sustainable Arterial Corridors in Auckland City, New Zealand 2006, 33).

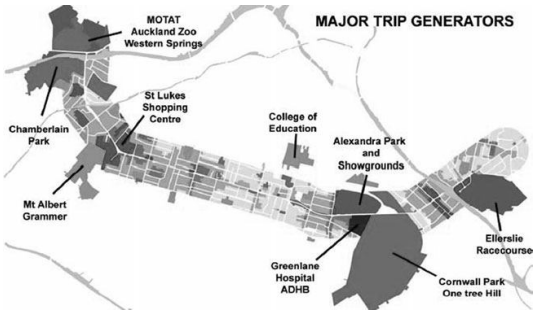

Figure 3: land use along Auckland east-west corridor

Recent research undertaken by Curtin University in Australia found that for every 1000 dwellings, the costs for infill and fringe developments are estimated $309 and $653 million excepting additional fringe development costs including water and power, transport and health costs. So by encouraging infill development, economic savings to society would equate to over $300 million per 1000 housing units or in Melbourne case, if the next million people were located within existing developed areas, $110 billion over the next 50 years (Victorian Department of Transportion 2010, 9).

A new development paradigm for Australian cities should recognize the need to not only direct future development to activity centers around rail infrastructures, but also to recognize the enormous development potential of the road based public transport corridors created by bus and tram movements. The aim should be to maximize development along new and future transport corridors (Ibid,13). Development in fringe regions involves additional cost of $300 million per 1000 houses. If a small proportion of this $300 million was invested in the corridors, it would both help ensure the viability of this approach and go some way to remedying market failure with current development patterns. So the secret is to recognize the need to transform our existing infrastructure rather than building and expanding in the hope that increased size will improve our capacity. Considering many Australian cities use infrastructure planning as the main part of spatial planning because former market-oriented approach made access to desired outcomes difficult and led to disorder among different sections, integrated approach linking spatial planning and infrastructure planning especially transportation infrastructures, use and services is considered (U. UN-Habitat 2009, 368). This is clearly evident in Melbourne strategic plan 2030. In this plan, for additional one million people (2000-2030) more than 130 new sites are projected for potential big scale development and 25 centers for dense house (Department of infrastructure 2002). So built-up area of the metropolitan Melbourne with 2248.95km^2 wide and population of 3810287 is one of the most expanded cities in the world and combination of railways (about 16 lines of suburban railway with 372km and 22 million passenger trips in 2011-2012) (Railways in Melbourne 2013) and tramway with 30 lines and 250 km long and 487 wagons and 1763 stop stations being the biggest tramway system in the world (Trams in Melbourne 2013)and 346 bus lines with 106.1 million passenger trips in 2010-2011 is the largest transport network in Melbourne (Melbourne Buses 2013). This transport network associated with vehicle transit network of highways and freeways have led to form partially planned corridors in the metropolitan Melbourne. Considering the importance of inner development and especially concentration of population and activity around connective corridors in particular stop stations of public vehicles and diversity of transportation networks including railway (train and tramway), freeway and highway and arterial, the present paper aims at identifying development corridors in the metropolitan Melbourne and prioritizing them to lead population and activity around these corridors to prevent suburb expansion.

Methodology and research variables

Research methodology includes research type (developmental- applicational), statistical population and research variables (78 statistical units of the metropolitan Melbourne and 6 communicational and socio-economic variables), research procedure and finally research model (corridor) which are explained as follow:

1. Statistical population and research variables: the research is quantitative (explaining) and applicational in view of purpose. Research statistical population includes Melbourne metropolitan area consisting 78 statistical units; built area includes 65 statistical units which were analyzed. Research variables include six variables: 1. Population density of statistical units in 2011 2. Rail transport network (metro) 3. Tram transport network 4. Road transport network of freeways 5. Main arterial transport network 6. Main commercial centers(17 centers)
2. Research procedure: first connection network map including railway, freeway and highway was drawn using geographic information system (GIS) software. Then considering the standard of 400 and 800m access radius buffers were drawn using Multi-buffer option in GIS software. In the next step maps were converted from vector to raster and maps were reweighted and remarked. Their marks were decreased as the distance from railway network, highway and commercial centers outwards increases. In connective network in buffers realm higher marks were assigned to statistical units with high population density providing the opportunity for using corridor model.
3. Corridor model: to obtain corridor model first cost-distance layer was formed by combining two rater layers. Actually 6 variables were converted to 3 cost-distance layers. Then by combining two cost-distance layers, corridor layer was formed. It means that any corridor layer is formed by combining four layers (two cost-distance layers). Considering six layers and combination of them three corridor layers were obtained. Finally using Map calculator option by combining three corridor layers, the most accessible mixed corridor layer (integrated) was formed. Figure 4 indicates the formation process of corridors.

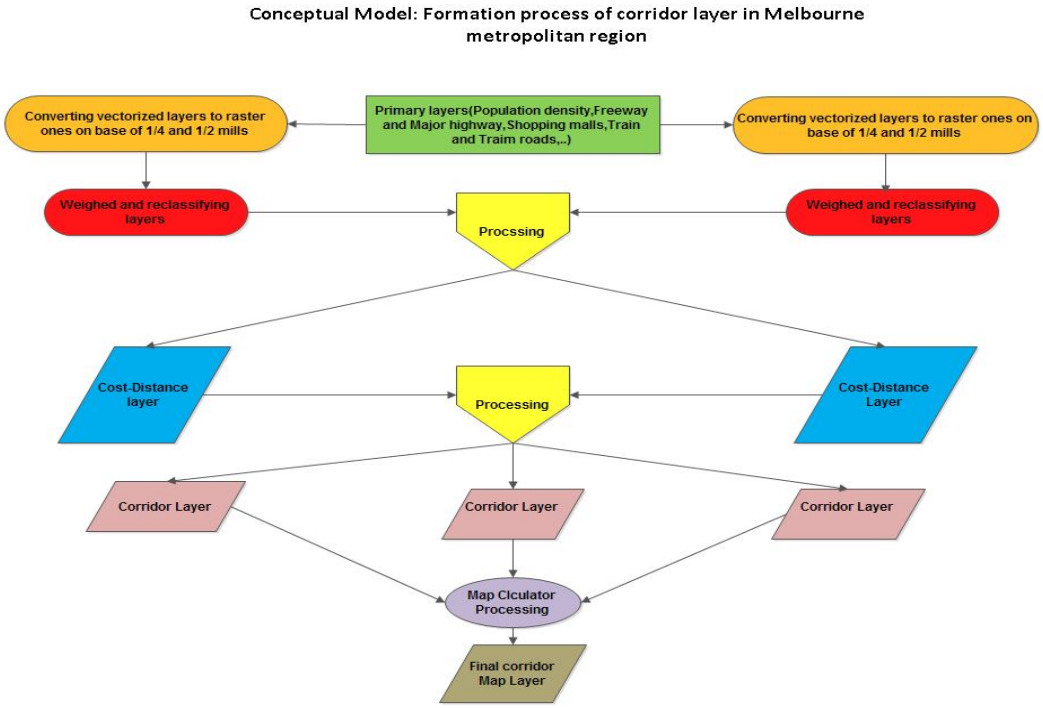

Figure 4: formation process of corridor layer in Melbourne metropolitan region

Results

Melbourne is the second metropolitan in Australia with the population of 3810287 in 2011, and one of the most expanded cities in the world. Melbourne metropolitan region has 78 statistical districts with the area of 7681.48km^2. The built area is 224895 hectares (2248.95 km^2 equal to 29.28% of the area of Melbourne metropolitan region) in size. Average population density in the metropolitan Melbourne is 496 people p square kilometer (4.96 people per hectare) however this is 16.94 per hectare in the built area. Central commercial part in Melbourne is 1*15 km^2 in size. It indicates a big difference to other regions of metropolitan Melbourne by population density (Melbourne 2013). Figure 4 indicates this situation evidently.

The metropolitan of Melbourne's suburban railway network consists of 16 lines with the total length of 372km and 376 wagons and 222 million passenger trips in 2011-2012 (Railways in Melbourne 2013). Melbourne tramway network consists of 250km track, 487 trams, 30 routes and 1763 tram stop and is the largest tramway network in the world (Trams in Melbourne 2013). There are 346 bus routes with 106.1 million passenger trips in 2010-2011 and is the largest transportation network in Melbourne (Melbourne Buses 2013). In the face of huge public transport networks, the share of personal vehicles in urban transportation in 2008 was 91% which was dominant transportation pattern. However about 80% of trips to the central part are by public transportation and 20% by personal vehicles. Between 2001 and 2006 census data (figure 5)shows that Melbourne has had:1)7.6% population growth,2) 8.6% employment growth,3)15% increase in the number of passenger vehicles on the road,3)6% increase in the total number of kilometers driven by those vehicles ,4)7.3% increase in CO2 emissions from passenger vehicles.

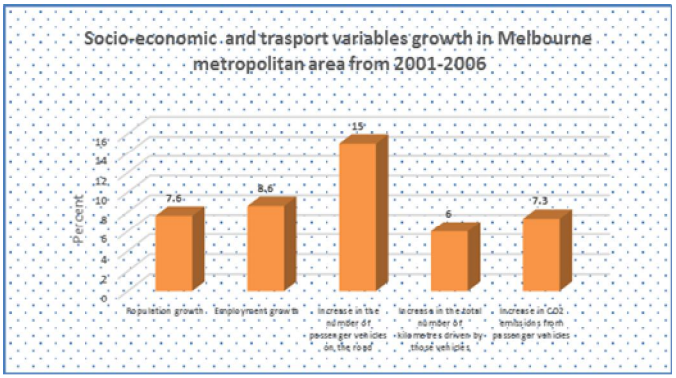

Figure 5: Socio-economic and transport variables growth in Melbourne metropolitan area from 2001-2006

Dominance of vehicle transportation may be due to lateral spread pattern of Melbourne since building the main commercial centers (17 centers) around Melbourne metropolitan regions after 1950's in car city era. This approach was criticized due to increased distance between workplace and living area, increased use of private cars, increased fuel consumption and pollution. So outer development was replaced by inner development approach; and compact city idea and mixed use dominated in the literature of urban planning and design (Victorian Department of Transportation 2010). Numerous efforts were undertaken to change Australian cities and Melbourne strategic plan 2030 was suggested to prevent lateral spread and capture compact city and urban development around connective corridors and increased use of public transportation (State of Victoria 2013, 45). Figure 6 indicates population density in Melbourne metropolitan; as the distance from downtown increases, population density decreases.

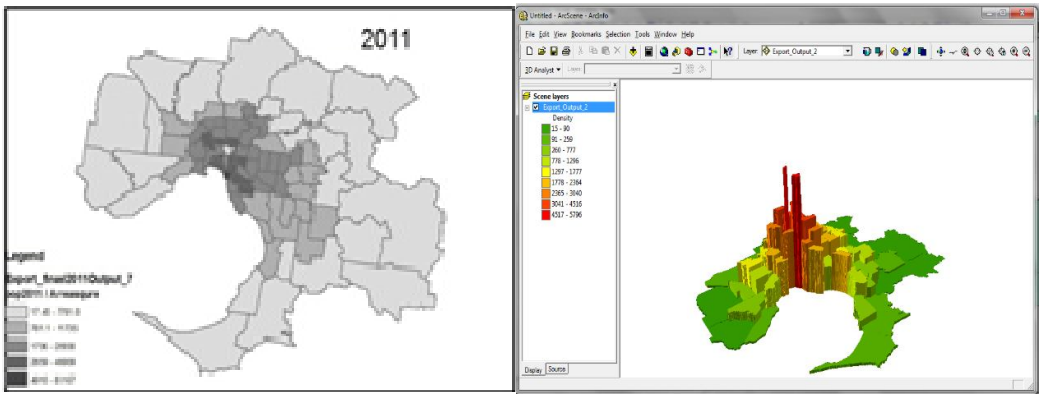

Figure 6: population density map and its 3d view in statistical districts of Melbourne metropolitan region in 2011

Government wishes to acquire 20% share of public transportation by 2020. Most of personal trips use road connective network and 80% of daily trips occur in 20% of road network. So identifying and prioritizing this corridor connective network can be effective in transit-oriented development.

Considering current transport network including railway and road, population density and establishment of commercial centers (17 centers), identifying and prioritizing development corridors is an effective step toward realizing compact city and preventing lateral spread to surrounding regions and finally sustainable development. So, 6 variables were selected indicating the relationship between activity, population and transportation system. By combining and weighting them, Melbourne development corridors were identified and prioritized. Given research variables (6 variables) and corridor pattern requiring 4 layer variables in the form of two distance raster inputs(every layer combining two variables) for determining each corridor layer, three corridors were obtained by combing layer variables and finally the most accessible development corridor known as hybrid corridor(integrated) for Melbourne was obtained by combing three layers,.

1. Corridor with the priority of public transportation (train, tramway): this corridor consists of four variables: a) railway transportation network (train) b) tramway transportation network (tram) c) population density map 2011 in statistical districts in the built area and d) main commercial centers (17 centers). Access radius for the four variables is calculated 400 and 800m; as distance from center decreases access value decreases. The result of combing layers is shown in figure 7.

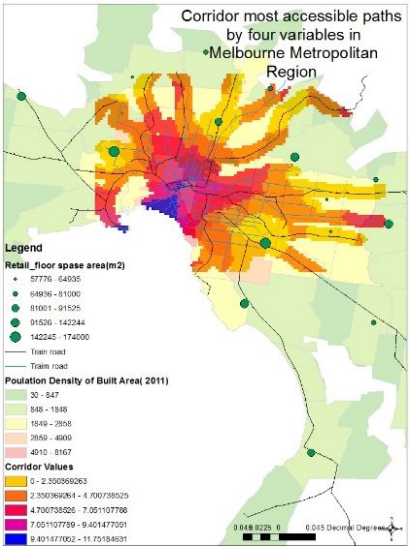

Figure 7: the most accessible corridor considering public transportation variables

In this pattern, the city has compact corridors branching from Melbourne downtown. Corridors are relatively short in length. Overlapping of corridors around downtown caused spatial integration. As distance from central area increases, distance between corridors having minimum access is evident as a toe. This reminds us urban development pattern of Helsinki, Finland which is known as five fingers (Helsinki commuter rail 2013). In some regions in which commercial centers and tram and railway transportation network don't have proper access radius, corridors aren't formed. So it seems necessary to form this space through connecting railway transportation network to main shopping centers for corridor formation. However in some parts (eastern south and western north ends) there is also railway system but due to low density population and distance from access radius of shopping centers, corridors aren't formed. So there is a good potential capacity for such vectors for developing corridors which can be exploited by a regular program.

2. Corridor with road transportation priority (main arterial highways and freeways): this corridor consists of 4 variables: 1. Freeway road transportation network 2. Main arterial highways-based road transport network 3. Population density map in 2011 in statistical units in the built area 4. Shopping malls (17 centers). The result of combining layers is shown in figure 8.

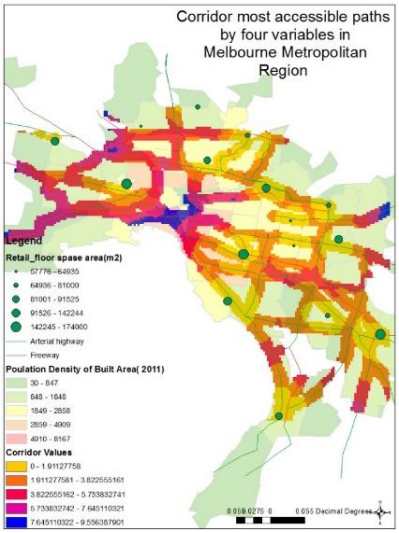

Figure 8: the most accessible corridors considering road transportation variables

In this pattern, considering distribution of main arterial highways and freeways out of central area of Melbourne metropolitan in one hand and distribution of commercial centers and population density in the metropolitan region on the other hand, development corridors have wider spatial distribution (figure 8) and cover wide area of Melbourne metropolitan. However densification rate and significance factor of corridors are different. Integration and overlapping are observed rarely among corridors and between corridors access minimizes gradually. Access rate in development corridor in the central area of Melbourne is more than surrounding regions. In this pattern in layers being more overlapped corridors are found discontinuous and as separate (isolated) strips with higher access point in the map. Spatial range of this pattern is not only toward eastern south but also western north and west indicating distribution pattern and lateral spread.

3. Corridor with road transportation priority (freeway and main arterial highway) and public transport (metro and tramway): this corridor consists of four variables: 1) Freeways road transport network 2) main arterial highways-based road transport network 3) rail transport network (metro) 4) tramway transport network (tram). The result of combining layers is shown in figure 9.

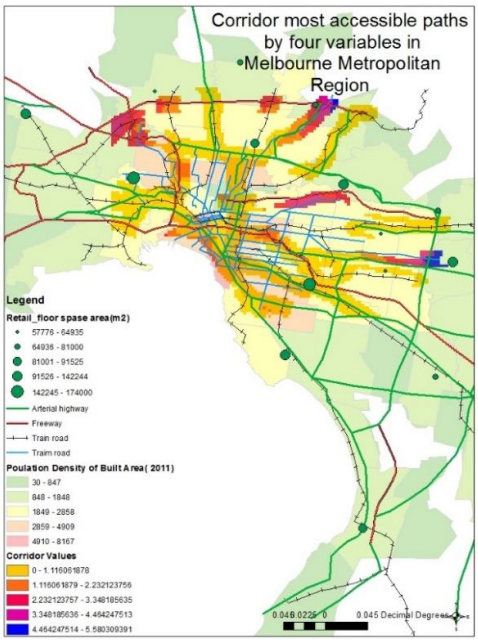

Figure 9: the most accessible corridors considering road and public transport variables

In this pattern spatial distribution of corridors is wide. There is a high access of corridors in the regions in which overlapping of rail network and arterial highway is more. This is observed out of Melbourne metropolitan region. Since highways and freeways road transport network occurs in surrounding region of Melbourne metropolitan region so its outward sprawl is justified. The main point is that corridors are scattered. High value corridors marked by darker color in the map can be useful for future development of Melbourne metropolitan region especially in suburban regions in which there is a possibility for combining road and rail transport.

4. Integrated corridor (road transport, public transport, population density and shopping centers): this is obtained by combining three above corridors using map calculator option shown in figure 10.

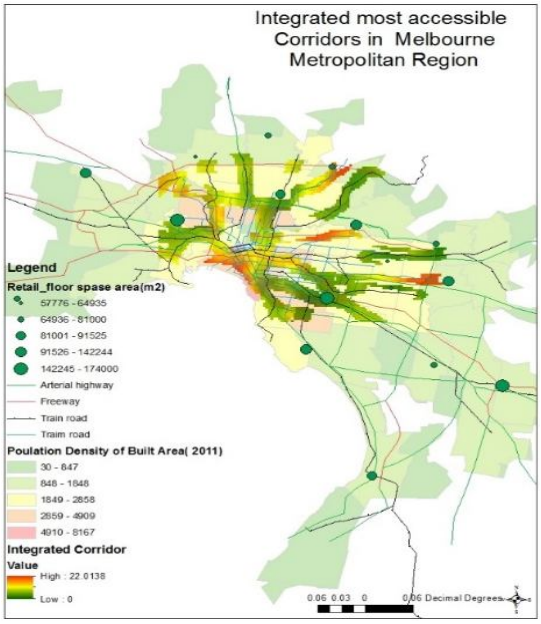

Figure 10: Integrated corridor (road transport, public transport, population density and shopping centers)

Considering six variables and employing four variables in each development corridor pattern three variables were created by combining variables. Since it is possible to combine patterns in GIS software, the final result called the most accessible corridor is obtained by combining three above corridors. Considering shopping centers and population density are considered as source indices and transport indices are expressed as distance-cost indices due to more relevant nature, it was possible to combine them using Map Calculator option in GIS software by establishing logical condition between layers. The result is shown in figure 10. In this figure corridors being more accessible are red colored. They are scattered. Generally integrated corridor is less overlapped than others and is more related to public transport including rail and tramway associated with high population regions and commercial shopping centers. Because it is based on public transport it seems that focusing on this corridor pattern may prevent urban sprawl, limit car use leading to decreased pollution and enhanced environment and obtain urban sustainable development. Leading future city development toward these corridors may be an effective step for realizing compact city and obtaining smart growth.

Discussion and conclusion

Quiet revolution in transport planning is corridor development the core of which is transit-oriented development based on rail public transport including metro and tramway combined with walking, cycling, decreased car use in development corridors around rail stations and bus stops within a radius of 400-800m with mixed use and concentrating activity centers, residence and work and spending free times. Since 1970's numerous efforts were undertaken to skip from car city-based urban development patterns relying on low-density and suburban sprawl of separate uses and led to several environmental problems such as air pollution resulted from increased oil consumption and increased costs for affording service infrastructures. Patterns which are based on transit-oriented development and corridor development pattern are suggested to lead urban spatial sprawl around public transport vectors. Hierarchical combination of transport systems including walking, driving and density, concentration and diverse uses around main lines of public transport have posed development corridor subject. Studies undertaken by Australian transport department indicate that this idea is in its infancy practically in spite of long history. According to Luo (2010) transit-oriented development idea is in planning steps. The results of the present paper indicate that employing corridor and transit oriented development idea for new development (on

empty lands) isn't so difficult. As noted by Verma and M.asce (2005), accessible land and cost considerations are two main indices in designing new corridors. However fitting this idea to build regions posed identifying current corridors and prioritizing them. So the strategy adopted should focus on development intensification and emphasizing people movement not car movement in corridors. So what is unique in this research and less considered in other studies is using GIS software for identifying and prioritizing development corridors by accessibility. This can be considered as a planning priority to lead future spatial development and population and activity in Melbourne metropolitan and shifts node development in 2030 Melbourne development plan to corridor development. In studies undertaken case studies including Brunswick corridor were emphasized while in this research corridor development in Melbourne was viewed generally and high priority corridors for future development were recognized. It is evident that corridor development idea for leading future city development using GIS software requires additional studies. More detailed analysis of corridors identified in view of population density and mixed use and recognizing actual capacity for population and activity concentration are suggestions for future researches.

References

Victorian Department of Transportion. 2010. *Transforming Australian Cities.* Melbourne: Victorian Department of Transport and the City of Melbourne. Accessed 7 23, 2013. http://www.melbourne.vic.gov.au/AboutMelbourne/Statistics/Documents/TransformingCitiesMay2010.pdf.

Alderson, Stephen R, and Yorgos J Stephanedes. 1986. "Trasportation corridor strategies and land use ." *Journal of Transportation Engineering* 112 (1): 15-28.

Alderson, Stephen R, and Yorgos J Stephanedes. 1986. "Trasportation corridor strategies and land use ." *Journal of Transportation Engineering* 112 (1): 15-28. doi:http://dx.doi.org/10.1061/(ASCE)0733-947X(1986)112:1(15).

Berated, Alain. 2013. *Urban Sprawl and the New Urbanism - City Densities and Smart Growth.* 6 27.

Chhetri, Prem, Jung Hoon Han, Shobhit Chandra, and Jonathan Corcoran. 2013. "Mapping urban residential density patterns: Compact city model in Melbourne, Australia." *City, Culture and Society* 4 (2): 77-85. doi:http://dx.doi.org/10.1016/j.ccs.2013.03.001.

DAI, Shuai, Huapu LU, and Ming LUO. 2010. "Study on Coordinating Development of Railway Station and the Land Use –Discussion about P&R and TOD." *ICCTP 2010: Integrated Transportation Systems* 30-37. doi:doi: 10.1061/41127(382)4 .

Department of infrastructure, State of Victoria. 2002. *Melbourne 2030: Planning for a sustainable growth.* Melbourne: State of Victoria, iv.

Gyulavary, Peter. 2010. "The transit planning process in the unted states." *Australian Planner* 37 (3): 151-156. Accessed July 17, 2013. www.tandfonline.com/loi/rapl20.

2013. *Helsinki commuter rail.* 7 3.

2013. *Melbourne.* 6 12.

2013. *Melbourne Buses.* 6 15.

2013. *Melbourne Buses.* 6 15.

2013. *Railways in Melbourne.* 7 21.

2013. *Railways in Melbourne.* 6 13.

Stanford Bell, Gareson, and David Anthony Johns. 2006. "A Strategic Approach to Developing Livable and Sustainable Arterial Corridors in Auckland City, New Zealand." *ITE Journal* 76 (7): 32.

Stanford Bell, Gareson, and David Anthony Johns. 2006. "A Strategic Approach to Developing Livable and Sustainable Arterial Corridors in Auckland City, New Zealand." *ITE Journal* 76 (7): 30-36.

State of Victoria, Department of infrastructur. 2013. *Melbourne 2030, planning for sustainable growth, a more compact city.* 6 17.

Sung-Eun, Lima, Jin-Ah Kim, and Suhb Soon-Tak. 2012. "Urban Form and Sustainable Transport: Lessons from the Ankara Case." *Journal of Sustainable Transportation* 7 (5): 416-430. doi:: http://dx.doi.org/10.1080/15568318.2012.676152.

2013. *Trams in Melbourne.* 6 26.

2013. *Trams in Melbourne.* 6 13.

2013. *Transit-oriented development(TOD).* 6 5. http://en.wikipedia.org/wiki/Transport_corridor,8.5.2013.

UN-Habitat, United Nation Human Settlements Program. 2009. *Planning Sustainable Cities: Global report on human settlements.* New York.

UN-Habitat, United Nation Human Settlements Programme. 2009. *planning Sustaiable Cities:Global report on human settelments.* New York: UN-Habitat.

—. 2009. *planning Sustaiable Cities:Global report on human settelments.* New York: UN-Habitat.

Verma, Ashish, and S. L. Dhingra M.ASCE. 2005. "Optimal Urban Rail Transit Corridor Identificationwithin Integrated Framework Using GeographicalInformation System." *JOURNAL OF URBAN PLANNING AND DEVELOPMENT* 131 (2): 98-111. http://ascelibrary.org.ezp.lib.unimelb.edu.au/toc/jupddm/139/3.

Victorian Department of Transportation. 2010. Accessed 201. http://www.melbourne.vic.gov.au/AboutMelbourne/Statistics/Documents/TransformingCitiesMay2010.pdf.

wallijasper, jay. 2008. *Great Corridors,Great Communities.* New York: Project for Public Spaces, Inc. Accessed 7 8, 2013. www.pps.org.

Walljasper, Jay. 2008. *Great Corridors,Communities,.* New York: Project for Public Spaces, Inc., 3. Accessed 6 8, 2013. www.pps.org.