

Street Network in Bandung City, Indonesia: Comparison between City Center and New Commercial Area

Siska Soesanti, Norihiro Nakai

Abstract—Bandung city center can be deemed as economic, social and cultural center. However the city center suffers from deterioration. The retail activities tend to shift outward the city center. Numerous idyllic residences changed into business premises in two villages situated in the north part of the city during 1990s, especially after a new highway and flyover opened. According to space syntax theory, the pattern of spatial integration in the urban grid is a prime determinant of movement patterns in the system. The syntactic analysis results show the flyover has insignificant influence on street network in the city center. However the flyover has been generating a major difference in the new commercial area since it has become relatively as strategic as the city center. Besides street network, local government policy, rapid private motorization and particular condition of each site also played important roles in encouraging the current commercial areas to flourish.

Keywords—city center, commercial area, space syntax, street network.

I. INTRODUCTION

CENTRALITY can be seen from several different concepts. Cutini [1] suggests three points of view of centrality: a historicist point of view, which considers centrality principally as historical heritage and appraising the center as the main place of memory for the whole urban community; an architectural point of view, which appraises centrality as a morphological condition and related to the shape of urban blocks as well as the presence of monuments and buildings; a functionalist point of view, which refers to centrality essentially to the presence, density and typology of the located activities and land uses. Meanwhile Van Nes [2] stated two concepts of centrality, spatial and social. From a spatial point of view, metrical centrality means that something is located in the middle of an area and topological centrality implies that something is spatially integrated in an area. From social point of view, cultural centrality describes an urban area as a concentration of historical or artistically relevant artifacts.

With regards to the concepts of centrality, Bandung city center can be deemed to have various functions as central area.

Siska Soesanti is with the Department of Social Engineering, Tokyo Institute of Technology, Tokyo, Japan (e-mail: soesanti.s.aa@m.titech.ac.jp).

Norihiro Nakai is Professor of Urban Planning at the Department of Social Engineering, Tokyo Institute of Technology, Tokyo, Japan (e-mail: nnakai@soc.titech.ac.jp).

It is renowned for its large stocks of Dutch colonial architecture. It is relatively easy to reach the city center since most public transportation routes pass through it. In spite of its advantages, central city gains less from investments and economic development compared to the other area within the city. The city center is not well functioning; neither as a social meeting place nor for commercial activities. Identifying the nature of the city center problem associated with economic decline and social disadvantage has been at the government agenda since last several years. A number of efforts have been carried out by local government. However these government projects did little to resolve the problems and the economic growth remains stagnant. In comparison with the city center, new commercial area located towards the north of the city but not far off the city center has gained and benefitted from tourism industry, especially after a new highway and flyover was constructed in 2005.

Numerous studies have shown that investments in transportation infrastructure generate accessibility, economic, environmental and social impacts. Hillier [3,4] argues the pattern of spatial integration in the urban grid is a prime determinant of movement patterns in the system or in other words globally, the process selects locations which have the appropriate degree of integration with respect to the settlement as a whole and locally, locations are selected with certain local grid conditions. How this theory works in determining economic development in Bandung city? This paper, therefore, will analyze the syntactic integration level of streets in Bandung city, particularly in the city center and new commercial area and to find in what extent the new street network affected the syntactic integration in both areas. This study presents a hypothesis that after the construction of flyover the street network in new commercial area becomes better integrated thus it attracts more investors.

II. BANDUNG CITY OVERVIEW

Bandung, the capital of West Java Province in Indonesia and the country's fourth largest city, was established by the Dutch Colonial during the eighteenth century. It is an elongated city stretching along the superior transportation networks of the trans-Java highway and railway. Bandung city area, living space for more than 2.5 million people, in 1906 was only 19.22 km² and it has been expanded several times until 1987

expansion into 167.29 km². As seen in Fig. 1, this policy influenced the hierarchy of street network and the location of

Lebak Gede (Fig. 2). It was triggered by a modern shopping mall development in late 1980s. During 1990 the commercial

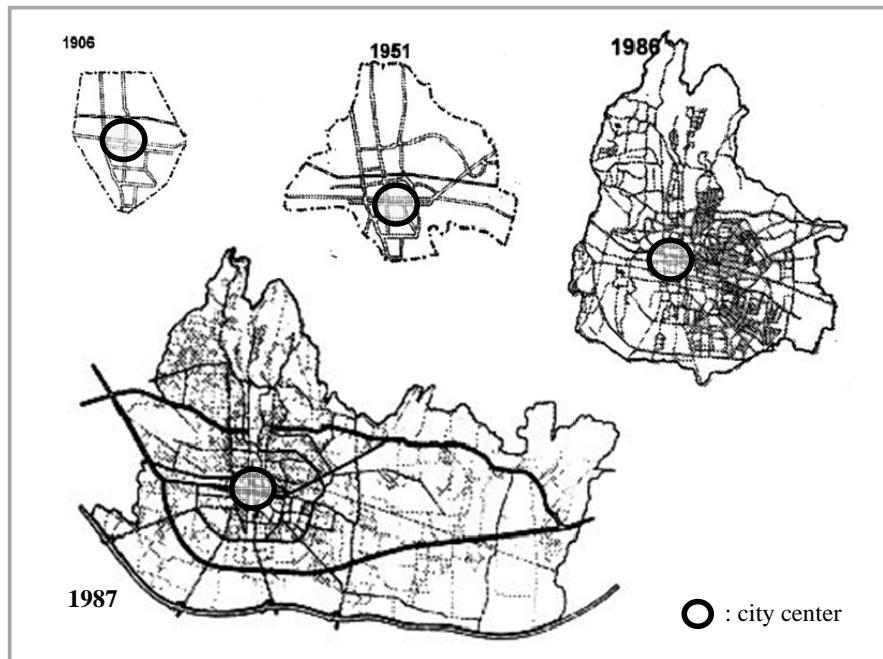


Fig. 1 Expansion of Bandung city area from 1906 to 1987

city center since geographically it is no longer located in the middle of the city.

The city structure itself was divided into three major segments: north part, a wealthier side of the city, planned for European settlements; west part dominated by economic activities as well as east foreign nation settlements and south part used as indigenous settlements. Those segments were joined by a city center. The city center was considered as cultural and economic center respectively. It is also known as the starting point of Bandung city development. Historically it comprised an open square surrounded by mosque, official residence of the regent, markets, and prison. A famous promenade street was adjacent to the open square. Chic cafes, boutiques and restaurants with European ambiance along the street had made the city to attain 'the Paris of Java' nickname.

In modern day, Bandung city center consists of nine villages. Its transformation has been uttered by retail and commercial interest. The city square is surrounded by shops and malls; various offices were built along the arterial road. Until 1980s the distribution of retail activities in city center was relatively steady. The dominance of city center was to be challenged by continuing decentralization and competition from other areas. Small retailers and some of the shopping malls struggled to remain in business and are under constant threat from professional and leisure service outlets, however in the long run their efforts ended in failure.

At present economic activities tend to shift towards north part of the city, particularly in two villages namely Citarum and

activities started to penetrate into housing areas when local government allocated the primary collector street that is Juanda streets as mixed use area. This policy has great influences on its vicinity and it was noticeable that in the village of Citarum which is nearer to city center the idyllic residences changed into business premises. Meanwhile the village of Lebak Gede remained dominated by housing. During the same period an area not too far from Citarum village that is Pasirkaliki village started to flourish into a commercial area. The Pasirkaliki village is easily accessed from Pasirkaliki street which is part of the north south secondary arterial road. Dozens of clothes stores and catering outlets had been established and replaced housing occupation in the area. Similar to the new commercial area, Pasirkaliki village was also used to be Dutch settlements in the past. However in 2003 one by one the stores were relocated to Citarum village because local government considered commercial activities violated land use planning and since then any commercial activities were banned [5].

In 2005 a new highway connecting Jakarta and Bandung was opened and a few months later construction of a new flyover was completed. The flyover with the length of 2.8 km is directly connected to the highway and passes through the village of Citarum and Lebak Gede. Shortly after its open, houses in Lebak Gede village were mostly used as commercial activities and those areas gradually turn into a bustling commercial area marked by large number of clothes stores, catering outlets, accommodation facilities, banks, and offices along the main streets. This area is famous for its factory outlet

stores. As seen in Table 1, number of stores in new commercial area has significantly increased, followed by catering outlets. It is obvious that the area develops into a tourism area and attracts domestic tourists that mostly come from Jakarta. In 2006, more than 68% of the former housing land was used as commercial uses. Since then the shop agglomerations become a new icon of Bandung city as giving Bandung another nickname, the "Tourist Shopping City".

III. SPACE SYNTAX METHODOLOGY

The street network in Bandung city is examined through the

use of Space Syntax. It provides the right theory to understand urban spatial structure in this condition. Space Syntax is about topology and the analysis of natural movement, which is the proportion of movement that is determined by the configuration of space itself, rather than by the presence of specific attractors or magnets [8,9]. One of the main findings of space syntax has been that in modern cities the location of economic space correlates strongly with those spaces with high natural movement, or in space syntax terms, high integration levels [3,4,10]. In other words, patterns of natural movement and of space come before land uses; land uses merely reinforce the

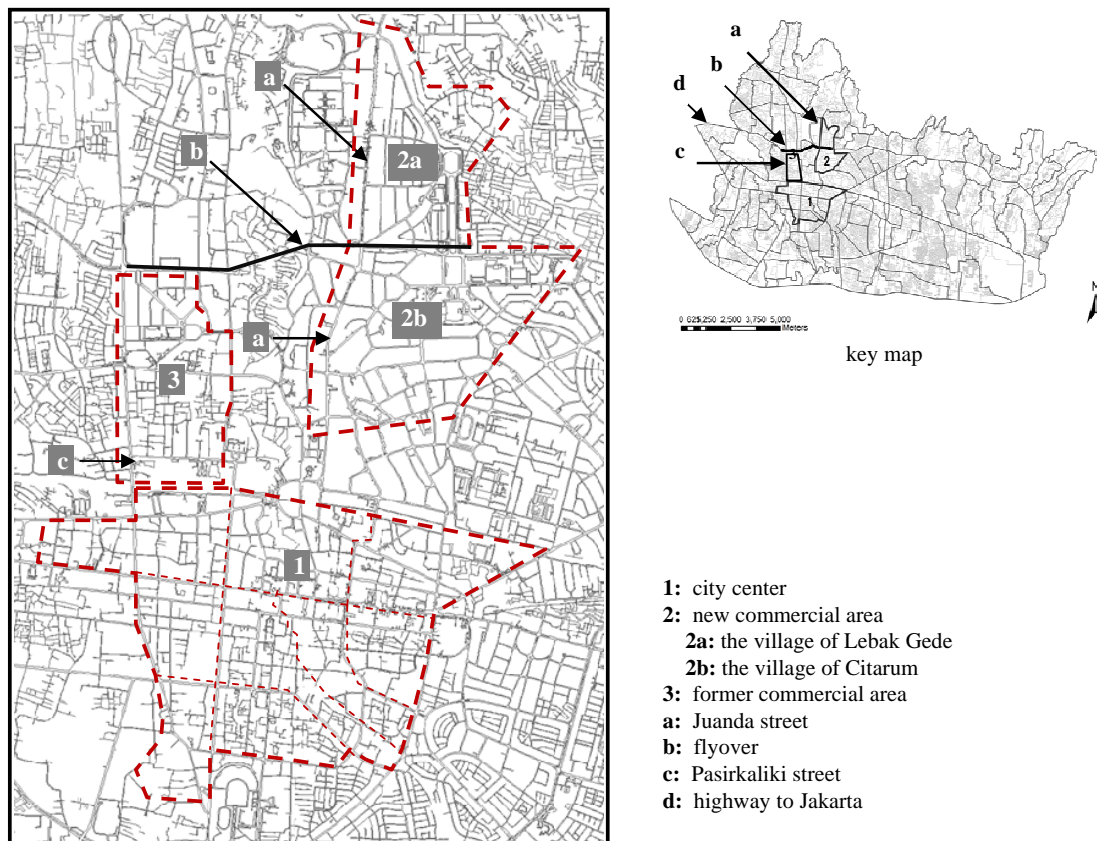


Fig. 2 Location of city center and new commercial area

TABLE I
NUMBER OF ECONOMIC ACTIVITIES IN THE CITY CENTER AND NEW COMMERCIAL AREA

Activities	City center		New commercial area	
	2003	2007	2003	2007
Stores	24	28	34	66
Catering outlets	33	43	52	85
Accommodations	22	29	16	20
Finance	78	76	30	30

* Source: Spatcom Bandung Map [6] and Jendela Bandung Pengalaman Bersama Kompas [7]

basic movement pattern. Thus some locations in city will have more potential than others because of their structure of the grid and how they relate to it.

Integration is the central concept of space syntax. An integrated line is more easily accessible than a 'segregated' one because it can be reached by simpler routes from other lines. A more integrated line is more likely to be selected as part of a route between other pairs of lines, that is, it will produce a multiplier effect and attract more retail and other uses through movement since accessibility plays a vital role for decision makers in deciding where to locate public facilities or amenities so as to maximize their usability. This dynamic process is called the 'movement economy'. It is therefore, about syntactic, not about metric, accessibility and the word 'depth' rather than 'distance' is used to describe how far spaces lie axially from one to another [11]. Connectivity relates to the number of intersections along a line's length. Together with connectivity, integration calculates the level of accessibility of street segments from all other street segments within a spatial system. On the other hand, space syntax defines the intelligibility of layouts in terms of the relationship between the local and global properties. Intelligibility is an important measure that is predictive of way finding and environmental cognition within environments.

The spatial structure of Bandung's street layout is represented using axial map, the basis analysis of a settlement. The axial map represents how far observers can have an uninterrupted impression of visibility and permeability as they move about the town and look from a distance towards various directions. Large number of people in Bandung travel by vehicle and the study areas serve the whole city area thus a global integration analyses will be used. It is presumably the best predictor for vehicular movement, since people on longer trips tend to read the grid in a more globalised way.

IV. SPATIAL ANALYSIS OF BANDUNG'S STREET NETWORK

Fig. 3 is the map of global integration structure of Bandung's street network, with lines colored from green to blue indexing values from low to high. As a whole city, before and after the flyover construction the average global integration indicates value of .410 and .411 respectively. It suggests that in general the flyover has no significant influence on the street network as well as considerably more depth and less integration for Bandung's street network. Moving further away from the city centre, particularly to the east part of the city, the grid structure of streets becomes disrupted. This structure was resulted by exclusive destination of residential complex since it becomes only a place to go rather than a place that might also be passed through on the way to somewhere else.

Fig. 4 represents map of 10% most globally integrated lines. Roughly the most integrated lines are located in the city centre or extend from it, mainly to the east and west with a few segments to the north and south. Both east west and north south arterial roads were the first connecting road that established during the Dutch period. At the time the traditional markets

marked by dot in Fig. 4 were the main center of socio economic activities for indigenous people and presently those are still the place for wholesale trading. This result is in accordance with the statement of Hillier [8] that in most town or urban areas integration core maps will pick out the main thoroughfares and shopping areas. The results also reveal that the dominant axis of the old Bandung city survived and is still present today.

Fig. 5 is the zoomed-in map of 10% most globally integrated lines around the city center, former and new commercial area. It represents syntactic centrality before and after the flyover construction. The global integration value of city center is relatively unchanged that is .566. However a major change occurred in the new commercial area. Initially only segment of Juanda street that laid in Citarum village was included in the 10% most integrated streets and after the flyover was built all segments become part of syntactic centrality. Globally, the integration value slightly increased from .485 to .487. If we make a comparison between global integration value of former and new commercial area, it is noticeable that essentially the former commercial area is more strategic with global integration value of .546 and .547. This reason that apparently made the area earlier developed as a commercial area before banned in 2003. These results suggest that commercial area development in Bandung city follows space syntax theory that believes globally, the process selects locations which have the appropriate degree of integration with respect to the settlement as a whole and locally, locations are selected with certain local grid conditions. Yet in the long run it is the government regulation that will determine the development of an area in a city.

Fig. 6 represents scattergrams of connectivity and global integration correlation. The black dots show lines located inside city center and new retail area. The grey dots show all lines in whole city area. A high correlation coefficient indicates an easily orientation for way-finding through a street net, while a low one indicated the opposite. As can be seen in Table 2, coefficients of intelligibility for city center, former and new commercial area are extremely low before and after the flyover construction. This indicates connectivity is no longer a good guide to integration or in other words those areas can be considered as unintelligible system. In most cases, curvilinear streets contribute to a perplexing street system for visitors when finding their way through city. Thus we cannot clearly understand about the layout as a whole from what we see locally. Compared with the connectivity value of city center, the street network of former and new commercial area have higher values which are 3.00 and 3.14 respectively even before the flyover construction. The main streets in city center itself have the highest connectivity value among other streets, however due to lots of narrow laddered streets on the south part of the central city; the average value becomes lower than the value of former and new commercial area.



Fig. 3 Axial map of global integration of Bandung city before and after the flyover construction

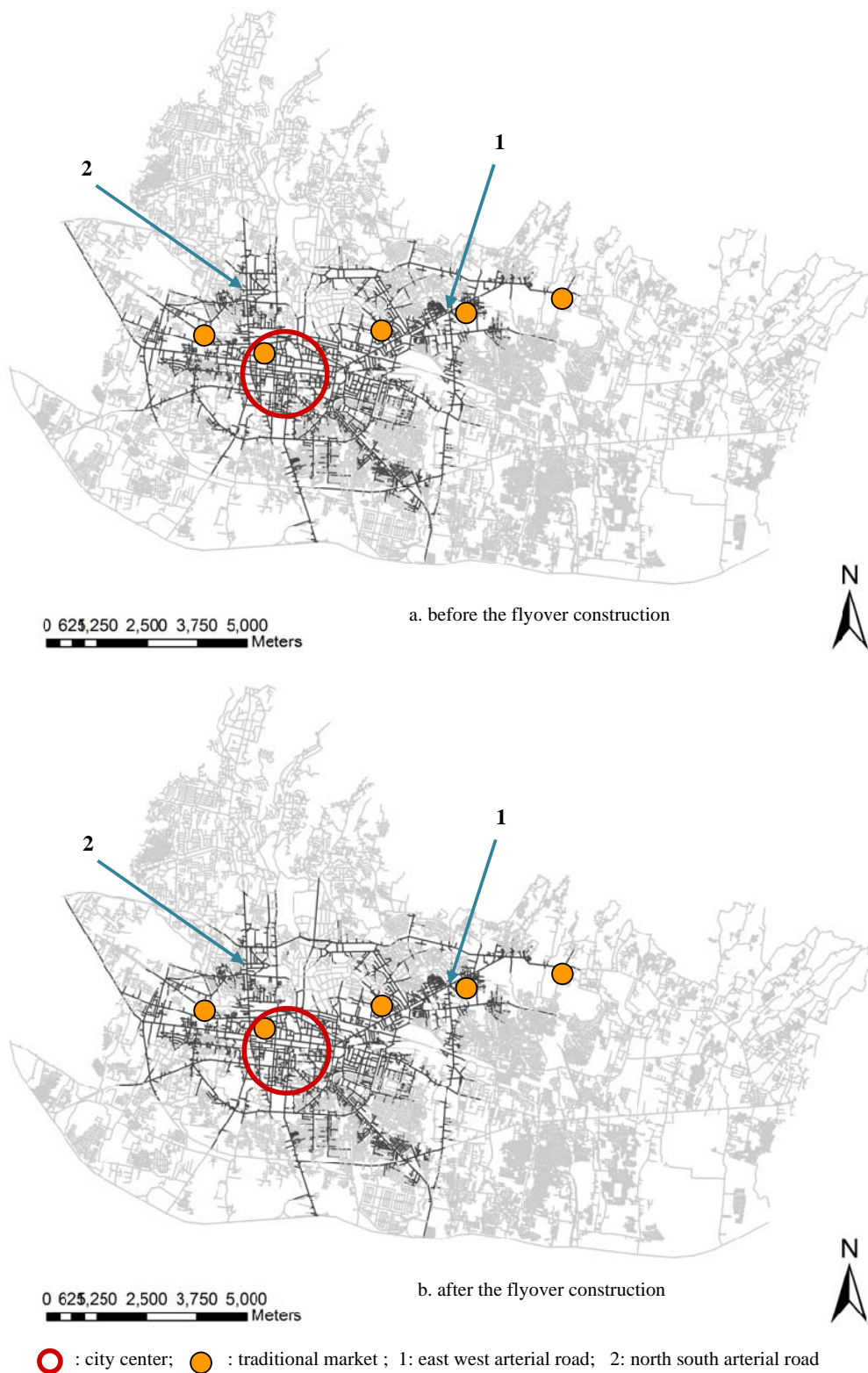


Fig. 4 Axial map of 10% most globally integrated streets in Bandung city before and after the flyover construction



1: city center; 2: new commercial area; 3: former commercial area; a: Juanda street; b: flyover; c: Pasirkaliki street
 darker line: 10% most globally integrated line; brighter line: non-10% most globally integrated line

Fig. 5 Axial map of 10% most globally integrated streets in the city center, former and new commercial area before and after the flyover construction

TABLE II
 THE SYNTACTIC CHARACTERISTICS OF THE CITY AND SELECTED AREA

Area	Av. Global Integration		Connectivity		Intelligibility	
	before	after	before	after	before	after
The city as a whole	0.41024	0.41093	2.61282	2.61304	0.019	0.019
The city center area	0.56610	0.56634	2.89636	2.89636	0.096	0.096
New commercial area	0.48465	0.48716	3.13962	3.14340	0.105	0.11
Former commercial area	0.54574	0.54744	2.99500	3.00000	0.139	0.142

The connectivity analysis results suggest that contemporary areas of socio-economic coincide with the street patterns inherited from the past. Since the beginning of 20th century the settlements of different ethnic residents in Bandung city were separated. The east west arterial road divided the riff-raff in the south from the wealthy European in the north. The development of North Bandung was believed to support the Dutch government plan to move the capital city from Batavia to Bandung. In accordance with the 1917 North Bandung Development Plan, the streets of Juanda and Pasirkaliki were considered as the most important infrastructures in Bandung [12]. Between 1910 and 1940 modern settlements and villas for European were built along those streets and its vicinity based

on Garden City principles facilitated with education and health facilities, as well as military complex. European houses were subject to building codes. The settlements were designed with large public spaces such as streets and lanes, squares and parks, spacious and green residential areas thus it is obvious that the former European settlements were better planned. In contrast south part of the arterial road was deliberately allocated for indigenous settlements. Simple houses of wood and bamboo matting were built along narrow streets on less developed land. The settlements covered up more than 50% of city center area. Although many in the south now also live in brick houses, the condition is still incomparable to the north as seen in Fig. 7.

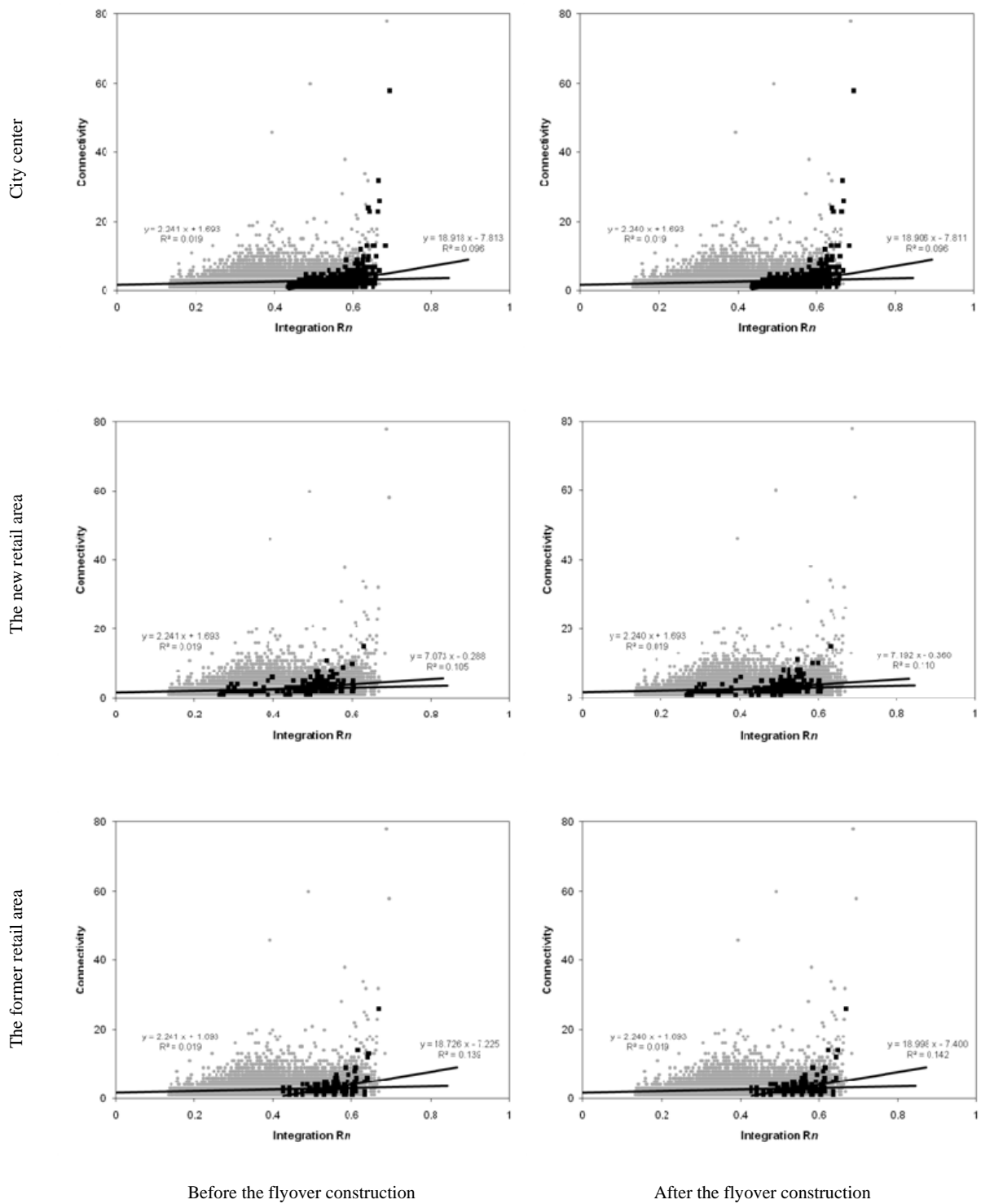


Fig. 6 Scattergram showing the intelligibility for the axial map of Bandung city



Fig. 7 Narrow streets in the city center area formerly used as indigenous settlements



weekday



weekend



weekday



weekend

Fig. 8 Above: the city center, below: new commercial area during weekday and weekend

V. DISCUSSION: CURRENT CONDITIONS AND FUTURE IMPLICATIONS

A. Current conditions

Based on the syntactic analysis, it suggests despite the fact that global integration value for city center is better than the new commercial area, the flyover simply give high contribution to location in its direct vicinity. Before flyover establishment, Juanda street was not included in the main core of activity. After its establishment, the location can be considered about as strategic as the city center. The shops in the new commercial area benefits from the location because people can reach it easily from Jakarta. In fact the former commercial area has better global integration values than the new commercial area however it cannot thrive due to government policy. Local government requires the owners to relocate their stores to the new commercial area. The new commercial area is also supported by its healthier environment and better facilities. It triggered the retail activities to gradually shift to current location.

Rapid private motorization in Indonesia also induces new commercial area development as Indonesian people themselves can be considered as a vehicle-dependent society. The number of vehicles registered in Bandung city which consisted of 40% car and 60% motorcycle showed rapid increase from 501,885 in 2001 to 821,562 in 2005 (by 12% p.a.)(13]. Meanwhile number of private cars in Jakarta was 2.2 million increased by 9-10% p.a.[14]. During weekdays vehicular movement remains to have tendency to be concentrated in the city centre and its neighborhoods as seen in Fig. 8. The congestion and traffic jams regularly occurring in the city centre is not merely a product of its narrow streets, but of its topological position in the city structure as well. As the main streets in city center are considered to have the highest connectivity and integration, it is unavoidable for people not to pass through when travelling. In contrast during weekend number of vehicles moving through city center significantly decrease. Every weekend at least 36,000 private cars from Jakarta enter Bandung [15] and fill up the streets in new commercial areas. This condition depicts that the city center is no longer considered as main destination for shopping or entertainment as well as travel distance and time no longer become an obstacle.

Indonesia's protracted economic crisis in 1998 caused minor merchants and street vendors to use the sidewalks as their shop space in city center and this led to discomfort for shoppers. Buildings built by the colonial Dutch suffer under pressure of new development. Old buildings have been torn down and lack of public facilities is another problem Bandung city center is facing today as well, which also have a role in the spatial shift of commercial area.

B. Future implication

The space syntax analysis suggests that both city center and new commercial area are relatively equal in term of global integration value after the flyover constructed. However the new commercial area is flourishing and on the other hand the

city center gradually deteriorates. The street network itself is not the main problem. As the most strategic area within the city, city center still has chances to be a lively commercial area as before. Yet the quality of urban fabric and public realm activities need to be promoted to enhance attractiveness for business and investment and increase the city center's competitiveness. It should be able to play a multi- purpose role as commercial area as well as civic pride and identity. City center and new commercial area have utterly different characteristics. Thus it is possible to plan those areas into two different attractive places that complement each other. For example the city center area can be developed as walking museum because it is rich in famous historical buildings.

VI. CONCLUSION

As a whole city, before and after the flyover construction the average global integration indicates value of .410 and .411 respectively. The flyover has no significant influence on the street network in Bandung as a whole city. The dominant axis of the old Bandung city survived and is still present today because roughly the most integrated lines are located in the city centre or extend from it, mainly to the east and west with a few segments to the south and north. The global integration value of city center is also relatively unchanged that is .566. Coefficients of correlation between connectivity and global integration are extremely low that indicates both city center and new commercial area can be considered as unintelligible system. After the flyover construction the biggest difference on global integration and connectivity value occurred in new commercial area since the location can be considered almost as strategic as the city center. It can be concluded that the flyover only give major contribution to location in its direct vicinity. Besides the street network, it is obvious that local government policy, rapid private motorization, and particular condition of each site also play important roles in encouraging the retail activities to gradually shift to current location.

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