Green Open Space Approach to the Building Mass Arrangement in Yogyakarta: Case Study of the Revitalization of the Tugu Rail Station

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Abstract **- This paper is to analyze the green open space approach to the building mass arrangement in urban block areas. The case study is "The Project Preparation Consultant for Revitalization of Yogyakarta Rail Station and Pedestrianization of Malioboro." The Green Open Space (GOS) Regulation in Indonesia states that the minimum green open space in urban area is 30%. With an 85% BCR (Building Coverage Ratio), the railway station project tends to maximize the lot for building construction. Therefore, it is difficult to wish the building ownerships providing 30% GOS from their lots. Due to such a problem concerning on the GOS regulation, how to encourage building ownerships to provide at least 30% of their lots to be GOS during their site development in central urban lot areas for the future constructions for any public services such a railway station. This paper tries to model and encourage (public and private) urban developers to provide more green open space on their lots to be replaced by more space on top of its floor area ratio based on the current building code. The method is using the case study of the Tugu rail station development of in Yogyakarta as a model of analysis. The researcher believes that the incentive floor area to reduce the current BCR will increase green open space on urban lot areas. In this respect, the character of the building mass is determined by the BCR and representing how the green approach of its open space. This model will support the urban GOS regulation in Yogyakarta and Indonesia generally to have minimum 30% of GOS in the near future urban areas.**

Index Term-- **Green Open Space, BCR, FAR, Tugu Rail Station.**

I. INTRODUCTION

The high rate of population growth is mainly because urbanization is one of the problems of cities in Indonesia. The big number of urban population is creating a high pressure on the utilization of urban space, especially the reduction of open spaces in urban areas, both green open space (GOS) and non Green Open Space [1]. In this case, GOS consists of public and private green space. Ideally, the city has a GOS least 30% of the total area of the city, referring to the Earth Summit in Rio de Janeiro, Brazil (1992), and reaffirmed at the summit Johannesburg, South Africa in 2002 [1, 2]. Regulation of the Minister of Home Affairs Decree No. 1 of 2007 on Spatial Planning can be obtained the information that the minimal of green open space in urban areas is 30%, which consists of 20% public and 10% of private GOS [3]. Based on data from the Environment Agency of Yogyakarta in 2010, the public GOS was amounted to 17.17% (557,90 hectares) of the city area of Yogyakarta. That number is still less than 20% as stipulated by the Public Work Regulation Number: 05/PRT/M/2008.

Lack of the development of public GOS in urban areas caused by: 1) the limited cultivable land for green space development, 2) the rise of a variety of development projects that violates environmental rules. So the government needs to increase the number of Yogyakarta urban public green spaces. In order to increase the GOS of Yogyakarta, the Municipality Government issued regulations including the Yogyakarta Mayor Regulation No. 5 of 2007 concerning on green open spaces and the Mayor of Yogyakarta Regulation No. 6 of 2010 regarding the Provision of Private Green Open Spaces. This shows a good willingness of the city of Yogyakarta due to the provision of urban green spaces in its urban area. In order to reach the ideal size of GOS as mandated in the Spatial Planning Act, the city of Yogyakarta facilitated by the Provincial Government of the Yogyakarta Special Region (YSR or DIY) and the Directorate General of Spatial Planning - Ministry of Public Works, planned a public provision of green space in the form of increased green spaces through community initiatives that embodies the design competition for the detailed engineering design to be implemented [1]. However, there is no significant impact from the competition to the GOS growth in the Yogyakarta urban area so far. This means that the Yogyakarta government has some diviculties to increase more public GOS due to the limited budged and the number of grey land limitation. In this respect, the government should encourage any public and private development in Yogyakarta to provide more GOS by providing building volume incentive of any urban building construction. Therefore, it is crucial to create a model regarding a Green Open Space Approach to the Building Mass Arrangement in Yogyakarta urban area. This approach will use case study of the revitalization of the Tugu Rail Station in the city of Yogyakarta.

Supporting to the Spatial Planning Act, this paper is proposing to analyze a green open space approach to the building mass arrangement by using the case study of the revitalization of the Tugu rail station in Yogyakarta. The objective this paper is to encourage public and private building development to provide more green spaces by promoting the government in providing some floor area incentive more than the existing Floor Area Ratio based on the Yogyakarta Municipality Building Code.

The method to provide some building volume incentive more than the basis Floor Area Ratio is by 1) increasing open space from the basis BCR and 2) Increases/decreases bonus floor area ratio based on the greenery ratio. To provide some incentive building volume, the site development has to provide green open spaces in their site development more than the BCR basis as seen on Figure 1. To increases/decreases the bonus building volume in the site development is to increase their greenery ratio as seen on Figure 2 including: 1) increasing bonus floor area ratio for any developments of greenery ratio more than 45% and 2) decreasesing bonus floor area ratio for developments of greenery ratio below 35% [4].

The scope of this research is concernong on urban design as part of urban planning process. However, it is realized that the limitation of this research work is regarding the physical concern and it does not include social and economic aspects of analysis.

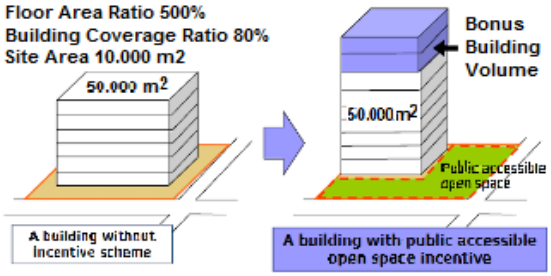

Fig. 1. 3-Dimension Analysis and Approach to encourage the private green open space in urban area [4]

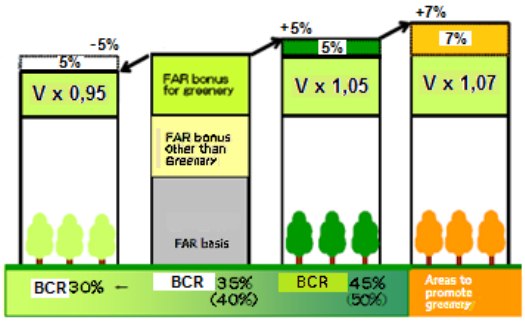

Fig. 2. Increases/decreases bonus to the floor area ratio (FAR) [4]

II. GREEN OPEN SPACE APPROACH

The concept of greening of the city, or *green urbanism*, shows an important design approach to the sustainable urban development form. The urban sustainability is included on the green open space which has an ability to contribute positively to some key agendas in urban areas [5]. Urban greening approach tries to find the integration between the urban itself and natural environment as a dynamic urban of city dwellers through a diversity of open landscapes [6, 7].

The GOS is an open space area outside the building, which serves for various activities. Regulation of the Minister of Public Works No. 05/PRT/M/2008 concerning on the Guidelines for the Provision and Use of green open space (GOS) in urban areas states that the GOS in offices, shops, and places of business generally in the form of sidewalk and parking lane. Provision of green space in this area are as follows: 1) To the extent Building Coverage Ratio (BCR) 70% -90% will need to add a potted plant, 2) Offices, shops and places of business with BCR over 70%, have at least 2 (two) small tree or medium were planted on land or in pots above 60 cm in diameter, 3) tree planting requirements in offices, shops and business premises with BCR below 70%, such as the requirement applies to yards with GOS, and planted in areas outside the BCR has been determined. Spacious yard complies with BCR in urban areas, as set out in the Regional Regulation on spatial planning in each city. To facilitate classification yard in the specified category yard large, medium and small. Large courtyard is spacious yard with a larger 500 m2. Due to the case study Tugu Rail Station has lots more than 500m2 of commercial activities (shopping, office and hospitality), the appropriate rules of GOS model used for this concept is on the Big House category [8].

Building Coverage Ratio (BCR) and Floor Area Ratio (FAR) are the most commonly used to indicate for quantifying the building density at lot scale. The BCR is defined as the ratio of the building coverage area (i.e. the area of building footprint) to the size of land lot. Since the footprint represents the plani-metric shape of a building, the BCR measures the building density in two-dimension (2D) space. The FAR is defined as the ratio of gross building floor area to the size of lot. The value of FAR is determined not only by the planimetric shape of the building, but also by the vertical distribution of the floors in different height and it represents the three-dimensional (3D) building density. *Open space ratio (OSR)*: is the percentage of open space to the area of the land or lot. An open-to-sky space without a roof is considered an open space. The location, size, distribution and surface nature of open spaces could change the local environment by altering the air flow, humidity and heat balance with the urban canopy layer [9]. *Green coverage ratio (GCR)*: is the percentage of the total area of all green spaces (including above green and below green coverage) to the area of the land or lot. Trees and smaller plants such as shrubs, vines, grasses, and ground cover, help cool the urban environment. Thus, *GCR* is an important parameter in describing urban surface cover, which is affects urban climate such as radiation and surface temperature through shading and evapo-transpiration. Generally the sun's energy reaches the area of trees, with the remainder being absorbed by leaves and used for photosynthesis, and some being reflected back into the atmosphere [10].

The Big House category in the Regulation of the Minister of Public Works No PU 05/PRT/M/2008 provides green space provision of the following schemes: 1) a category that includes big house is a house with a land area of over 500 m2, 2) green open space is the minimum required land area (m2) less extensive base building (m2) in accordance with local regulations, and 3) the number of shade trees to be provided a minimum number of trees combined with shade trees and shrubs as well as shrubs and ground cover or grass. Furthermore, the green space on offices, shops, and businesses, in addition to the utility, can be used also as an open parking area, carport, and a place to organize various outdoor activities such as ceremonies, fairs, sports, and others [8]. The provision of Public Open Space in Private

Development (POSPD) seeks primarily to achieve better quality design, optimisation of land use, better site planning, and/or synchronising the availability of open space and the community needs arising from developments. With proper design and management, POSPD could contribute towards the provision of quality leisure and recreational space and improve urban living environment [11]. A lot of recently developed commercial and residential areas comprise higher FAR and lower Building Coverage Ratio (BCR), compared with old ones [12]. Timely and complete information about urban building density and morphology has need of the measurement of land use intensity and efficiency, design and adjustment of zoning regulations and land use policy, monitoring and enforcement of urban management policies [13, 14].

Urban designers should control some crucial variables shaping the building form and massing in the contexts of urban design including building line, setback, land use, floor area ratio (FAR), and building coverage ratio (BCR) [15]. The green building character to lower impact on local site ecology is to 1) increased green space (small building footprint, minimal surface parking), 2) provide green roofs and has highly efficient building envelopes [16]. The compact city is designed to make more efficient use of existing land resources and infrastructure, as well as reducing automobile usage as public transportation becomes more viable at higher urban densities [17]. The legislative and regulatory framework for stimulating "green" projects has been gradually taking place in Europe, particularly in France. For new residential construction, a decree relative to the Energy Policy Orientation Program authorizes the building coverage ratio up to 20% provided in all other local planning rules respectively [16].

To respond the green open space approach on the site and building scale, there are four concepts including 1) Specific block, 2) Intensive Land Use District, 3) District Planning with Redevelopment Promotion, and 4) Comprehensive Design [4]. Due to the preparation of initial design of the Tugu Rail Station, particularly on the building mass arrangement, the comprehensive design concept will be omitted on to this discussion.

The analysis model of the green development approach concerning on the building form and massing of the Tugu Rail Station will use the three dimension analysis to see the schematic approach. Building Coverage Ratio (BCR) and Floor Area Ratio (FAR) are the most commonly used indicates for quantifying the building density at land parcle scale. The BCR is defined as the ratio of the building coverage area (i.e. the area of building footprint) to the size of land lot in Eq. (1), where S is the building coverage area, and SL is the area of land lot. Once the association between building footprints and land lots is determined, the BCR for each land lot can be computed using Eq. (1). Since the footprint represents the planimetric shape of a building, the BCR measures the building density in two-dimension (2D) space. The FAR is defined as the ratio of gross building floor area to the size of land lot (Eq. (2)) [12, 14]

$$BCR = \frac{S}{S_L} \quad \text{..... Eq.(1)}$$

$$FAR = \frac{\sum_{i=1}^{t} A_i}{S_L} \quad \text{..... Eq.(2)}$$

Where Ai is the area of the first floor, and t is the total number of floors. The value of FAR is determined not only by the planimetric shape of the building, but also by the vertical distribution of the floors in different height and it represents the three-dimensional (3D) building density . A study of a proposed project implementation is part of a development scenario. An example that the study on "*Downtown Edmonton Commercial, Office and Residential Forecasts 2009 – 2044*" examined the development growth of residential units, retail and service commercial, and office building in the Downtown. The study had two alternative approaches concerning on a „Baseline" and „Alternate" scenario. The „Baseline" scenario assumed a „status quo" or „business as usual" scenario and the „Alternate" scenario assumed that the vision outlined in the Plan for the Downtown would be implemented [18]. It can be seen that the „Alternate" scenario is part of planning and development process. It can be seen that spatial and infrastructure development is always behind the economic growth resulting physical construction that is driven by social and economic activities without referring the urban spatial plan. This will be naturally growing that existing economic activities do not fit with the current urban development plan.

III. Tugu Rail Station Project in Yogyakarta

The Yogyakarta Special Province (Daerah Istimewa Yogyakarta, or DIY) is located in south-central Java surrounded by the province of Central Java with the Indian Ocean to the south (See Figure 3). Yogyakarta in 2009, the population and area of DIY is 3,281,000 people and 3,185.80 km^2 respectively with density of 1,030 people per km^2 and annual population growth rate is about 0.9 % per year. The Gross Regional Product (at nominal prices) is Rp. 3.5 trillion in 2000 and Rp. 4.7 trillion in 2007. Rail passengers rose from 1.7 million in 2000 to 1.9 million in 2007. Vehicular traffic has been increasing annually in the area where the proposed project is located at the Tugu rail station of the Malioboro Business District. As a note, Rp stands for Rupiah which is Indonesian currency where US $ 1 = Rp. 10,225.00 on July 23, 2013.

Fig. 3. Yogyakarta in the Central Java as a Part of Indonesia

Due to the large number of passengers and tourists visiting to this area, traffic congestion on the Malioboro road and surrounding road networks has become more acute from year to year. Moreover, since the street is rather chaotic and congested with street vendors, it is necessary to achieve the smooth traffics and to accelerate the redevelopment to the Malioboro area. On the other hand, due to the budgetary constraints, the effective solution has not been carried out in the infrastructure development scheme [19].

Under this circumstance, the study of "Public-Private Partnership for Urban Infrastructure Project, Pilot Project of Yogyakarta City" with two stages was conducted in 2005 and 2008 respectively. In the study, the several examinations were implemented to solve the above issues, which are 1) selection of potential project packages, analysis of technical and 2) financial feasibility, identification of legal issues, especially in land status, analysis of social and environmental impacts by implementing the proposed project, implementation of public consultation meetings among relevant government agencies.

The study of the proposed project implementation "the Project Preparation Consultant for Revitalization of Yogyakarta Rail Station and Pedestrianization of Malioboro" was proposed by application of ADB Loan No. 2264-INO (SF): Infrastructure Reform Sector Development Program. The case Study is located in Malioboro urban area in the Yogyakarta Municipality which is the capital city of DIY [19] as shown in Figure 3, Figure 4, and Figure 5.

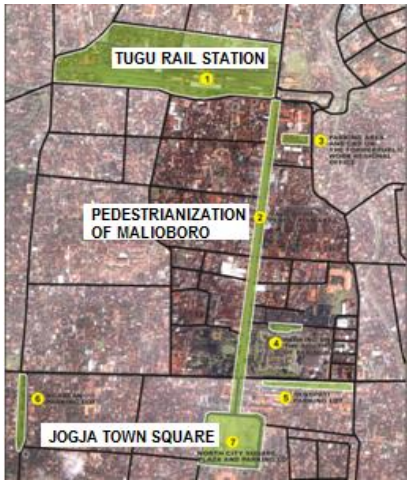

Fig. 4. The Tugu Rail Station in the Malioboro Area of the Yogyakarta Municipality

IV. Analysis of the Green Open Space Approach

The Tugu Rail Station Project is located in the Gedongtengen Sub District of Yogyakarta Municipality. The land use and the building code of the site location of the proposed project can be seen on the Figure 5 and Table 1. The site location consists of four different zones including Zone 1, Zone 2, Zone 4, and Zone 7. The description of the zones and area are clearly stated on Table 1 concerning on uses, building height, BCR, and FAR of the Tugu Rail Station area.

Fig. 5. Land Use and Building Code of the Study Area

The proposed project covers 21 sites including 15 sites accommodating commercial, office, and residential uses, and six lots accommodating parks and building conservation of the Tugu Rail Station (see Figure 5, Figure 6, and Table 1). On the current study, the project is using the existing building code (BCR 80% with the current respecting FAR) resulting maximum floor area 624.337 m2 divided on to 4 up to 6 floors (see Table 2). The following outcomes (see also Table 2) are based on the same approach:

1) With BCR 70%, the maximum floor area is 670.250 m2 divided on to 5 up to 7 floors.
2) With BCR 60%, the maximum floor area is 691.999 m2 divided on to 6 up to 9 floors.
3) With BCR 50%, the maximum floor area is 710.526 m2 divided on to 6 up to 10 floors.

It can be seen that the more GOS installed the larger bonus floor area can be received (see Table 2 concerning comparative green open space to the building mass arrangement). These schemes suggest that the municipality government of Yogyakarta should encourage vertical building development in its central business district (CBD) of Malioboro without providing the budget to purchase any land to provide more greenery in urban areas. The government with the GOS incentive could privately and publicly increase GOS in urban areas, especially in the Malioboro CBD without any additional government budget. Otherwise, the City Government would spend more money to increase GOS in central urban areas of Yogyakarta.

Tabel I
Yogyakarta Municipality Building Code concerning on the Tugu Rail Station Area

Zone 1:
Buffer Zone of Natural and Cultural, Trade and Services F.2.1 Medium-high Intensity of Land Use (Segment)

Land Area	BH	BCR	FAR
40 - 100	18	90	2,7
101-200	20	90	3,2
201-400	20	80	3,0
401-1000	20	80	3,0
>1000	26	80	3,9

Zone 2:
Buffer zone of Natural and Cultural, Trade and Services F.2.1 Medium-high Intensity of Land Use (Block)

Land Area	BH	BCR	FAR
40-100	16	90	1,8
101-200	18	90	2,7
201-400	18	80	2,4
401-1000	18	80	2,4
>1000	20	80	3,0

Legend: Land Area in m2

BH	: Building Height
BCR	: Building Coverage Ratio
FAR	: Floor Area Ratio

Zone 4
Fully Development Zone (Economy, Social, and Culture), Trade and Services F.2.1 High Intensity of Land Use (Segment)

Land Area	BH	BCR	FAR
40-100	18	90	2,7
101-200	20	90	3,2
201-400	24	80	3,5
401-1000	26	80	3,9
>1000	32	80	4,8

Zone 7
Buffer Zone for Nature and Culture (Tugu Rail Station) Medium-high Intensity of Land Use (Block)

Land Area	BH	BCR	FAR
40-100	16	90	1,8
101-200	16	90	1,8
201-400	18	80	2,4
401-1000	20	80	3,0
>1000	20	80	3,0

Legend: Land Area in m2

4 - 17 - 14	: Building Demarcation and Setbeck
17	: Road or Path Way
4	: Building Setbeck from the Road or Pathway

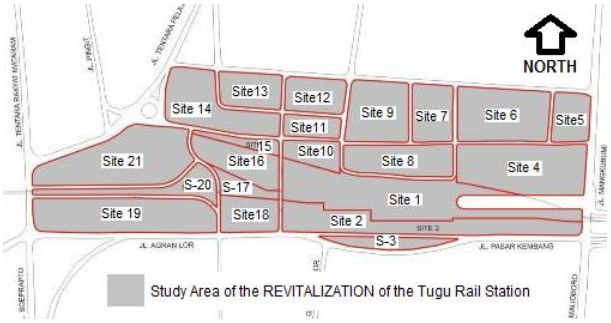

Fig. 6. Site 1 up to site 20 located in the Tugu Rail Station

The 2 D and 3D building mass arrangement scenario provides four different BCR base lines comparing BCR 80%, BCR 70%, BCR 60%, and BCR 50% (See Table 2, Figure 7 and Figure 8). The 2D and 3D model scenario benefit people to view spatially comparative pictures (as seen on Figure 7 and Figure 8). Figure 7 and Figure 8 showing the 2D and 3D landscapes comparatively concerning on the building mass arrangement based on BCR basis with other alternate BCR incentive affecting different sizes of FAR bonuses (see yellow colors on Figure 7 and Figure 8). The more BCR decreased the bigger incentive FAR bonus.

Table II
Green Open Space to the Building Mass Arrangement with BCR 70% and BCR 80%

No	GREEN OPEN SPACE APPROACH		BCR=80%					BCR=70%					BCR=60%					BCR=50%				
No. of Site /Lot	Building Type and Use of the Tugu Train Station	Efective Site Area (m2) exclude the City Park and Concervation	BCR (%)	FAR	FAR Basis as on the Building Code (m2)	First Floor area = BCR (m2)	Number of Floors	First Floor Area = BCR 70% Area (m2)	Bonus Area = Open and Green Space (30%) (m2)	Decreased Bonus FAR (V x 0,95) (m2)	FAR Basis (m2)	New Total Number of Floors	First Floor Area = BCR 60% Area (m2)	Bonus Area = Open and Green Space (40%) (m2)	Increased Bonus FAR (V x 1,05) (m2)	FAR Basis with the Increased Bonus FAR (m2)	New Total Number of Floors	First Floor Area = BCR 60% Area (m2)	Bonus Area= Open and Green Space (50%) (m2)	Increased Bonus FAR (V x 1,07) (m2)	FAR Basis with the Increased Bonus FAR (m2)	New Total Number of Floors
1	Train Station Conservation	-	-	-	-				-							-						
2	Retail Shop House (Ruko) Building	16.291	80	3,9	63.535	13.033	5	11.404	4.887	4.643	63.535	6	9.775	6.516	6.842	63.535	7	8.146	8.146	8.716	63.535	8
3	City Park and Commercial Facility	3.725	80	3,0	11.175	2.980	4	2.608	1.118	1.062	11.175	5	2.235	1.490	1.565	11.175	5	1.863	1.863	1.993	11.175	6
4	Hotel & Its Facility	18.665	80	3,9	72.794	14.932	5	13.066	5.600	5.320	72.794	6	11.199	7.466	7.839	72.794	7	9.333	9.333	9.986	72.794	8
5	Retail Shop House (Ruko) Building	5.020	80	3,9	19.578	4.016	5	3.514	1.506	1.431	19.578	6	3.012	2.008	2.108	19.578	7	2.510	2.510	2.686	19.578	8
6	Rental Office & Its Facilities	14.711	80	3	44.133	11.769	4	10.298	4.413	4.193	44.133	5	8.827	5.884	6.179	44.133	5	7.356	7.356	7.870	44.133	6
7	Rental Office & Its Facilities	7.011	80	3,0	21.033	5.609	4	4.908	2.103	1.998	21.033	5	4.207	2.804	2.945	21.033	5	3.506	3.506	3.751	21.033	6
8	Apartment & its Facilities	9.964	80	3,0	29.892	7.971	4	6.975	2.989	2.840	29.892	5	5.978	3.986	4.185	29.892	5	4.982	4.982	5.331	29.892	6
9	Apartment & its Facilities	11.251	80	3,0	33.753	9.001	4	7.876	3.375	3.207	33.753	5	6.751	4.500	4.725	33.753	5	5.626	5.626	6.019	33.753	6
10	City Park as aditional KLB	-	-	3,0	-	-			-					-		-			-	-	-	
11	Stack House & Its Facilities 3-5 Floo	3.693	80	3,0	11.079	2.954	4	2.585	1.108	1.053	11.079	5	2.216	1.477	1.551	11.079	5	1.847	1.847	1.976	11.079	6
12	Stack House & Its Facilities 3-5 Floo	6.267	80	3,0	18.801	5.014	4	4.387	1.880	1.786	18.801	5	3.760	2.507	2.632	18.801	5	3.134	3.134	3.353	18.801	6
13	Dwelling low Intensity of 2-3 Floor	6.299	80	4,8	30.235	5.039	6	4.409	1.890	1.795	30.235	8	3.779	2.520	2.646	30.235	8	3.150	3.150	3.370	30.235	10
14	Dwelling low Intensity of 2-3 Floor	13.234	80	4,8	63.523	10.587	6	9.264	3.970	3.772	63.523	8	7.940	5.294	5.558	63.523	8	6.617	6.617	7.080	63.523	10
15	City Park	-	-	-	-	-			-				-	-		-			-	-	-	
16	Train Warehousing Conservation	-	-	-	-	-			-				-	-		-			-	-	-	
17	City Park	-	-	-	-	-			-				-	-		-			-	-	-	
18	Retail Shop House (Ruko) Building	6.139	80	3,0	18.417	4.911	4	4.297	1.842	1.750	18.417	5	3.683	2.456	2.578	18.417	5	3.070	3.070	3.284	18.417	6
19	Mall building & its Facilities	18.709	80	4,8	89.803	14.967	6	13.096	5.613	5.332	89.803	8	11.225	7.484	7.858	89.803	8	9.355	9.355	10.009	89.803	10
20	City Park	-	-	-	-	-								-	-	-			-	-	-	
	Hotel & Its Facility	20.122	80	4,8	96.586	16.098	6	14.085	6.037	5.735	96.586	8	12.073	8.049	8.451	96.586	8	10.061	10.061	10.765	96.586	10
		161.101			624.337	128.881		112.771	48.330	45.914	624.337		96.661	64.440	67.662	624.337		80.551	80.551	86.189	624.337	
		FAR Basis with			624.337			FAR Basis with a			670.250		FAR Basis with a			691.999		FAR Basis with a			710.526	

Source: Analysis

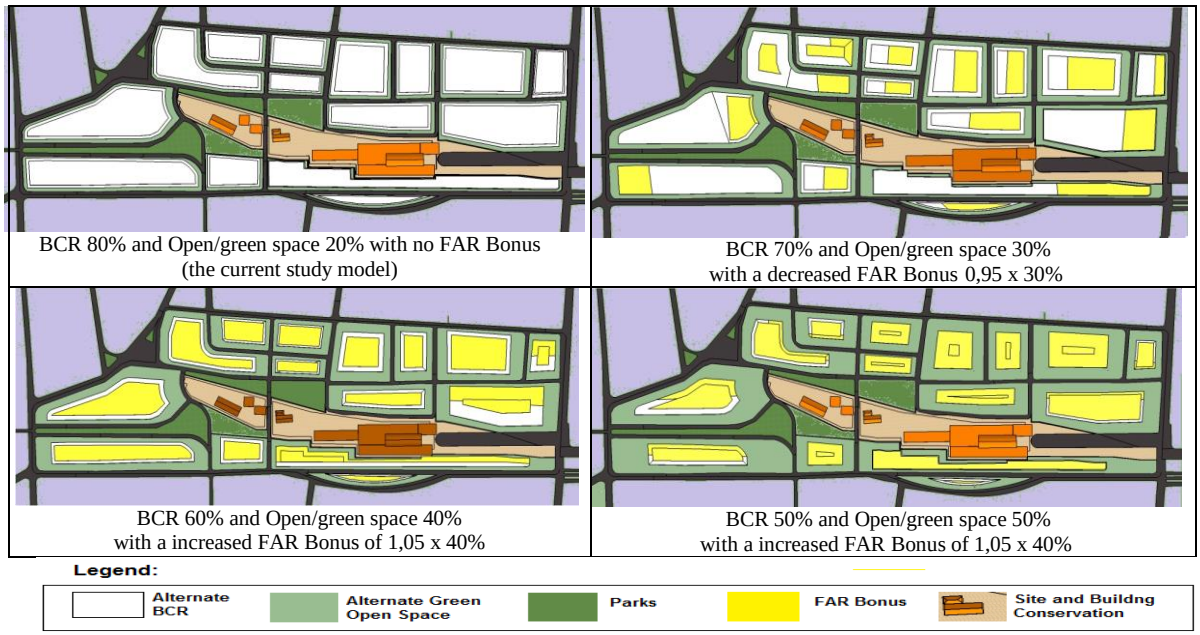

Fig. 7. 2D of Green Open Space comparation concerning on FAR Basis and FAR Scenario Models

The alternate BCR on Figure 7 and Figure 8 is showing the four scenarios concerning on the following schemes [4] (based on Figure 2 Formula):

1) the BCR 80% with no FAR bonus (the total site area is 161.101 m2)
2) the BCR 70% with a decreased bonus = 0,95 x 30% of the site area = 45.914 m2
3) the BCR 60% with an increased bonus = 1,05 x 40% of the site area = 67.662 m2
4) the BCR 50% with an increased bonus = 1,07 x 50% of the site area = 86.189 m2

In this respect, the city government is to be sure to starting to improve its existing building code to provide some incentive floor area based on the alternate BCR as shown on Figure 7 and Figure 8. This green spatial approach also pulls and creates more opportunities for business activities and property development in central urban area concerning on commercial business growth (such as shopping, offices, hotels, apartments, etc.). Therefore, the design approach with using BCR 70% up to 50% as on Figure 7 and Figure 8 is confirmed with the concept of greening the city or green urbanism declared by Swanwick *et. al.* [5].

Therefore the Yogyakarta government should develop some key agendas in increasing GOS as part of the urban sustainability of Yogyakarta municipality. Greening more open space in the Tugu rail station is also in line with the integration between Tugu rail station area (as part of urban central area) and natural environment as a dynamic of the proposed Tugu Rail Station commercial and residential business activities. This also confirms with *Elkin et al* and Jabereen's theories concerning on diversity of open landscapes [6, 7].

This concept will also encourage more people living in central urban area because more regular people will stay in vertical housing due to easy for them to find jobs and public facilities such as retail, shopping, recreation, and vertical housing that economically fits with lower middle income. This opportunity should be captured by the city government to develop more scenario in planning the city area for the next 25 up to 50 years. This descripsion also confirms with the master plan of the city of Edmonton [18] suggesting that the GOS approach with building mass arrangement to show its concept of sustainable vibrant well design accessible.

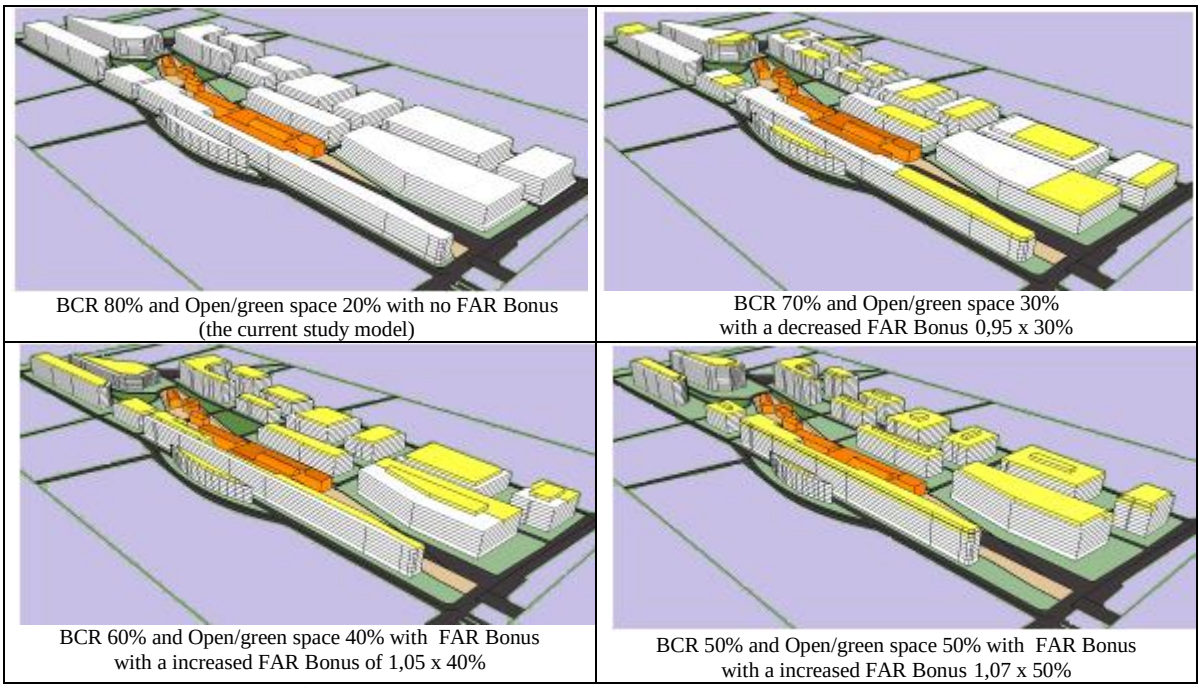

Fig. 8. 3D of Green Open Space comparation concerning on FAR Basis and FAR Scenario Models

V. CONCLUSION

The green open space approach to the building mass arrangement in Yogyakarta urban area is a good scheme to be implemented due to the ability for the city government to increase more green open space in Yogyakarta urban area without any crucial budget to purchase land for urban greenery. The Tugu rail station project has been chosen because the project is in urban central area of Malioboro area and using the current building code that does not guarantee to provide more green open space in any construction project development in urban area. The case study of the revitalization of the Tugu rail station will be more greenary to support in sustaining Yogyakarta urban development for the future by using the floor area incentive. The FAR incentive will use two formulas including 1) increasing open space from the basis BCR and 2) Increases/decreases bonus floor area ratio based on the greenery ratio.

If this kind of approach could be implemented in urban area such as Yogyakarta. The preparation that should be conducted by the Yogyakarta government is including:

1) Vertical urban development zones outside airstrips and historical conservation areas.
2) Urban development area as a priority to increase social and economic investment gradually.
3) Based on the development area priority, the land consolidation to provide accessible motorized urban environment in Yogyakarta is important to be introduced.
4) Increasing the collaboration networks with urban business community to encourage the Public-Private Partnership for Urban Infrastructure Project to prioritize urban development areas.

This approach will promote more commercial and residential development scenarios respecting to more private investment and entrepreneur activities in Yogyakarta urban areas. If vertical urban development gradually increases due to more interesting FAR bonus schemes, it is believed that **public accessible green open space** in Yogyakarta central urban area will grow more areas without any special government budget for greenery program. Therefore, the green open space approach will support the future fresh and vibrant urban area and also promote the urban GOS regulation in Indonesia to have minimum of 30% GOS in Urban areas.

Due to the limitation of this research work on urban design as part of the physical urban planning process, the future and further research is important to analyse the green open space concerning on social, economic, and environmental aspects comparatively.

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