

Implementation of The Smart Building Concept in Parahyangan Office Rental Space and Apartment Design

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Abstract - The design of Parahyangan Office Rental Space and Apartment is intended to create offices and residential areas that accommodate business and residential functions with the concept of smart building applied to various aspects of architectural design. Parahyangan Office Rental Space and Apartment is the offices and residential areas that accommodate the needs of community in Kota Baru Parahyangan, not only in business activities but also in residence. In this area, the offices become a place for business and economic activities for the people of Kota Baru Parahyangan and its surroundings. Moreover, the offices also become the biggest business center and office center in Kota Baru Parahyangan and/or Bandung Regency and its surroundings. Meanwhile, the residential areas are the place for the emergence of vertical residential needs in Kota Baru Parahyangan. The Smart building concept is chosen because of the need for efficiency in activities. Living in urban areas requires a high level of mobility and movement, which can be supported using the smart building concept. The system of buildings, in which the occupants live and do their activities, can be set through the intelligent building, so that residents can allocate their time and energy to other things. Smart building can also generate comfortable, productive, and simpler life for residents of the building

Keywords: *Smart Building, Office, Residence*

Introduction

Kota Baru Parahyangan (KBP) is the first city-scale residential project in Bandung Raya, as the satellite city. The vision of KBP is to become an independent city which can accommodate all urban facilities and functions. KBP is aimed to form a new community to break the population needs of Bandung and its surroundings. KBP is allocated in accordance with the planned development of the Padalarang city spatial plan (RTRW) and detailed plan for city spatial planning (RDTRK). This is located in areas of West Bandung Regency which is developed as an area of trading-service center. It is also in the area of the local-activity center, the Padalarang Economic Strategic area, which is directly connected to the national highway. This area is not a disaster-prone area, and is an allotment area for the development of an independent settlement in West Bandung Regency (Central Bureau of Statistics of West Bandung Regency, 2018).

Kota Baru Parahyangan is planned to be able to accommodate more than 100,000 people. Kota Baru Parahyangan is located in two subdistricts: Padalarang Subdistrict which consists of Kertamulya Village, Kertajaya Village, and Cipeundeuy Village, and Saguling Subdistrict which consists of Bojonghaleuang Village and Cikande Village. Based on the data of the Central Bureau of Statistics (BPS) of West Bandung Regency Government in 2017 and Kota Baru Parahyangan Town Management in 2018, the followings are socio-economic conditions in the two subdistricts and Kota Baru Parahyangan.

Table 1. Socio Economic Conditions in Five Urban Villages and Kota Baru Parahyangan

Indicator		Information
Livelihood	Trade Entrepreneur	2374 People
	Industrial Entrepreneur	1157 People
	Civil Servant/Indonesian Army/Indonesian Police Officer	1820 People
	Bank Worker	395 People
	Retired	729 People
Keluarga Sejahtera plus (KS+)		10.292
The rate of population growth in West Bandung Regency		1,97% (The highest in Bandung Raya)
House Prices in Kota Baru Parahyangan		The Smallest type: <i>Tatar Wangsakerta</i> which costs 1,2 billions The biggest type: <i>Bandoeng Tempe Doeloe</i> which costs 9 billions

Source: Central Bureau of Statistics & Kota Baru Parahyangan Town Management, 2018

The increase of the needs for business space in Kota Baru Parahyangan is one of the backgrounds for the growth of office activities, especially offices rental space.

Table 2. Data on the Numbers of Businesses in West Bandung Regency

Types of Business	Numbers of Business		
	2016	2017	2018
<i>Manufacturing</i>	178	163	163
<i>Insurance</i>	424	533	620
<i>Advertising</i>	1124	1432	1662
<i>Finance</i>	831	907	1132
<i>Trade Association</i>	634	630	732
<i>Publishing</i>	612	708	676
<i>Banking</i>	553	610	617
<i>Accountant</i>	346	342	367
<i>Consultant</i>	934	1125	1233
Numbers of Business	5636	6450	7202

Source: Central Bureau of Statistics of Kabupaten Bandung Barat, 2018

Based on data from the Central Bureau of Statistics of West Bandung Regency in 2018, the number of businesses in various fields is able to experience growth of more than 20% annually. The business of advertising, finance, and consultants becomes a type of business that experiences rapid increases in terms of quantity every year (Permana et al., 2019). Basically, the business begins with a start-up (beginner) business which later develops into a well-known business in its field. Not all businesses have their own offices. Thus, they rent the offices as the impact of their needs on office spaces. Start-up (beginner) business is a business which is still in the development stage and usually uses internet as the publication media facilitating the promotion of its services. In 2020, this potential business is predicted to be increasing, so that it requires sufficient office spaces(Central Bureau of Statistics of West Bandung Regency, 2018).



Figure 1. Apartment Building in Kota Baru Parahyangan which Costs 350 Million Rupiahs
Source: Lamuji, 2017

The developer of Kota Baru Parahyangan, Belaputra Intiland Inc., decides to build apartment buildings which cost 350 Million Rupiahs (Widiattmanti, 2015)(Yuswohady, 2012), along with the property market needs grew in Kota Baru Parahyangan. It is stated that the sale of the residential housing in Kota Baru Parahyangan increases by 20% every year, and in 2027, the housing of horizontal scale in the cluster coverage will be totally sold. Therefore, the construction of vertical scale housing becomes the developer solution of Kota Baru Parahyangan in fulfilling the future housing needs (Central Bureau of Statistics of West Bandung Regency, 2018).



Figure 2. Graph of Demand for West Java Offices Rental Space on 2016-2018
Source: Bank of Indonesia, 2018

Office rental spaces (Fachrial, 2010)(Gove & Merriam-Webster, 1986) and apartments (Stegmeier, 2008)(Lubis, 2008) are buildings that can be built in cities with high economic-growth rates(Sepang et al., 2016). One of the centers of economic development is Padalarang, West Bandung Regency. The construction of the commercial buildings (Goble, 1985) is also related to the efficiency of building performance and the influence of buildings on the surrounding environment. Thus, the application of the smart building concept in the design of Parahyangan Office Rental Space (Travor Hanekamp, 2013)(Fachrial, 2010) and Apartment is sought to improve design efficiency(Sukarno et al., 2015)(Hariyono, 2014)(Budiharjo, 2009)(Pedoman Teknis Pembangunan Rumah Susun Sederhana Bertingkat Tinggi, 2007).

Literature Review

A. Smart Building

Smart Building is a building that has the ability of *intelligent building* and *integrated green building* (Rahadian & Sulistiawan, 2019)(Goldsmith, 1984). Intelligent building is related to the building capabilities to manage and control the operation of automated and integrated electronic

infrastructure, including the availability of ICT services, such as telecommunications, internet, Pay TV, and other services. Furthermore, the addition of Building Energy Management System (BEMS), an application of the value-added building to control the energy consumption of the building (Permana, 2012), will facilitate an intelligent building to become green building (GBCI, 2010) (Marlina, 2008) (Pedoman Persyaratan Teknis Bangunan Gedung, 2006).

B. IP (Internet Protocol)

The application of single internet protocol (IP) network in a region will make management more effective, responsive to potential risks, easily controlled, and able save costs. Additional advantage which can be obtained from the application of convergent IP networks is the ability to provide IP-based services, such as IP Phone, IPTV, Broadband Internet, etc. for tenants. This will provide additional revenue for building integration (GBCI, 2010) (Stegmeier, 2008).

C. FTTH (Fiber to The Home) GPON

FTTH GPON is an optical fiber network which functions as the single platform network for buildings. FTTH GPON will deliver all services, such as telephone, internet, and TV/video services within the region. This optical fiber network can also be used for building control and management applications, namely BAS, CCTV, Access Control, BEMS, IBMS, etc. in the integrated areas. The FTTH technology can significantly save costs, reduce operational costs, and provide better service to customers (GBCI, 2010) (Kleissl & Agarwal, 2010).

D. BAS (Building Automation System)

Building automation system (BAS) is programmed, computerized, intelligent-network electronic equipment that monitors and controls systems in a building. BAS-based computer controls are used to coordinate, organize, and optimize subsystem controls in buildings, such as security, fire or safety, elevators, etc (GBCI, 2010) (Stegmeier, 2008).

The process of controlling and monitoring equipment can be done automatically in real time. With BAS, building management is more effective, responsive to potential risks, easily controlled and able save costs.

E. BEMS (Building Energy Management Systems)

The Building Energy Management System (Permana, Akbardin, et al., 2020) is a simultaneous fulfillment of Intelligent Building and Green Building. The BEMS will increase the efficiency of use and cost of building energy expenditure towards Green Building (Hariyono, 2014) (GBCI, 2010) (Chiara et al., 2001)

Energy Management System includes:

1. Portal Management
2. Control
3. Meter Data Manager
4. Analyzing Service
5. Tenant Management

The BEMS connects building systems such as lighting, HVAC (heating, ventilation, and air-conditioning), and factory equipment to create a single, centralized platform for managing the energy consumption of building (Wahyudi, 2019). It can also be used to control some functions on several sites/locations (Machdi, 2019). The BEMS provides measurement (Permana, Akbardin, et al., 2020), sub-measurement, and monitoring functions that collect energy data which enable the managers of buildings and facilities to obtain detailed insights regarding the energy use of their buildings (Hariyono, 2014) (Kleissl and Agarwal, 2010) (GBCI, 2010).

Design Review

A. Site

The site is located in the commercial zone of Kota Baru Parahyangan (Town Center), Jl. Gelap Nyawang, Jl. Bujang Manik Blok 3A, Cipendeuy Village, Padalarang Sub-district, West Bandung Regency.



Figure 3. Determination of Site based on the Area Coverage
Source: Author, 2019

B. Physical Condition of the Site

B.1 Existing Condition

The site specified has existing condition in the form of 41,316 m2 empty land, at the contour elevation of +666 MASL to +656 MASL. The north side of the site is directly related to Jl. Parahyangan Raya, and the east side of the site is directly connected to Jl. Gelap Nyawang. Meanwhile, the south and west side of the site is directly related to Jl. Bujang Manik



Figure 4. The Existing Condition of the Site in 3D
Source: Author, 2019.

B.2 Accessibility

The site is close to the main access of Padalarang-Cileunyi toll road with two accesses into the site, from Bandung and Jakarta. From the exit of the toll road, the site can be accessed within a distance of about 5 km. Besides, there is an alternative route to the site via Jl. Stasiun Padalarang, in which the line plays role as railway to the site. The distance to the site from Jl. Stasiun Padalarang is about 4.5 km.

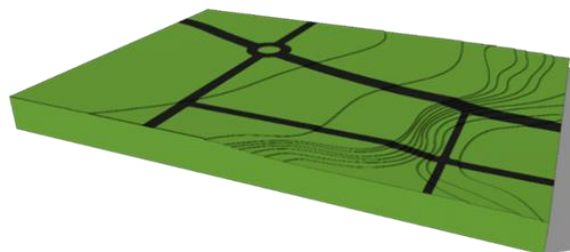


Figure 5. The Accessibility of the Site
Source: Author, 2019

B.3 Site Potentials

The site has the potential as land. Its contour has 80% of slope at 7° and 20% of slop at 15° on the east side of the site. For this reason, the construction of the Parahyangan Office Rental Space and Apartment will be set at the same level of the land elevation, considering the elevation based on the space requirements.

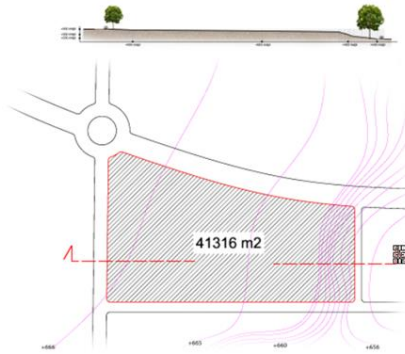


Figure 6. Site Potentials
Source: Author, 2019

b.4 City Infrastructure



Figure 7. Infrastructure of Kota Baru Parahyangan
Source: Author, 2019

The site which is located in Kota Baru Parahyangan has city infrastructure related to commercial, health, educational, cultural, and social needs. In addition to large-scale housing development, Kota Baru Parahyangan provides an ease in accessing the city facilities. This is supported with Jl. Parahyangan Raya as the main access to the City area.

B.5 Development Regulations

Related to the detailed plan for city spatial planning (RDTRK) of West Bandung Regency in 2015-2031, the development regulations to support the construction of the Parahyangan Office Rental Space and Apartment is based on 30% of the Building Base Coefficient (BBC), 6.4 of the Building Floor Coefficient (BFC) with a total floor calculation of 21 floors maximum, 70% of the Green Base Coefficient (GBC), and the regulation for determining the function of land as a commercial area. This regulation is determined by the Town Management, based on the decision of the Spatial Planning of West Bandung Regency in 2014.

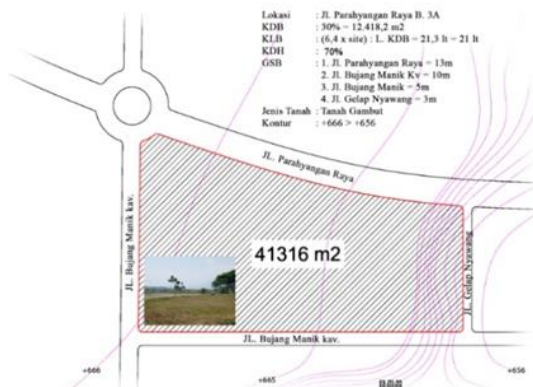


Figure 8. Site of Kota Baru Parahyangan and the Regulations
Source: Author, 2019

Results

A. Concept of Form Design

The shape of the building is derived from the consideration of the site form and the prevailing regional regulations (BBC, BFC, and GBC). At the final stage, building grouping which is based on its functions is carried out. The grouping consists of office rental tower, apartments, and other supporting facilities by considering the maximum BFC which does not exceed 21 floors.

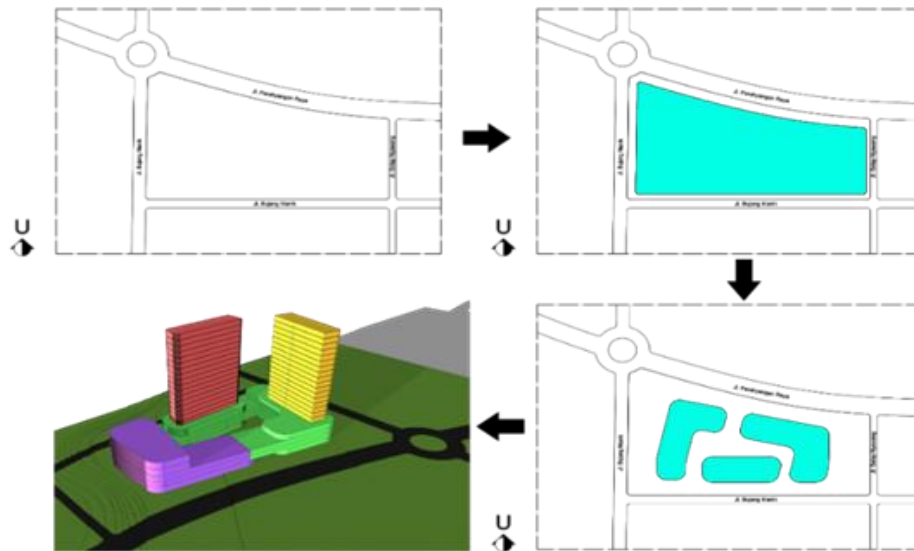


Figure 9. Atmosphere Perspective
Source: Author, 2019

B. Concept of Site Design

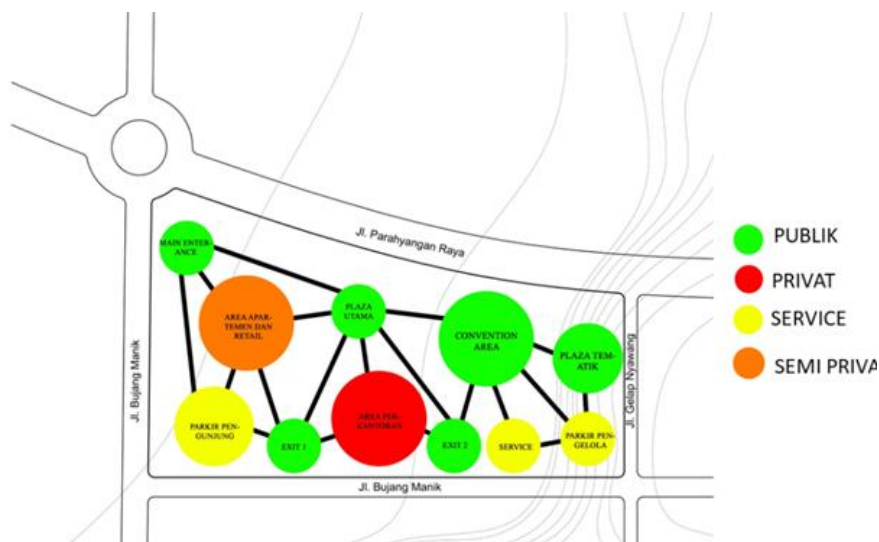


Figure 10. Horizontal Zoning of Parahyangan Office Rental Space and Apartment
Source: Author, 2019

Horizontal zoning is performed based on the land-area grouping of space function requirements on sites (Permana, et al., 2020). This consists of public, private, semi-public, and service zoning. Then, the application of the zoning into a site plan is carried out by considering the layout of the space needed as follows:

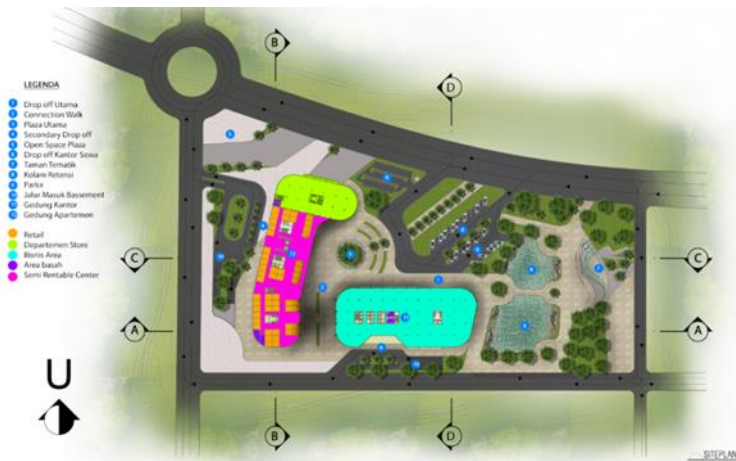


Figure 11. The Application of Horizontal Zoning on the Site Plan
Source: Author, 2019

Vertical zoning is done based on the land-area grouping of space function requirements. This is related to the division of floors consisting of public, private, semi-public, and service zoning.

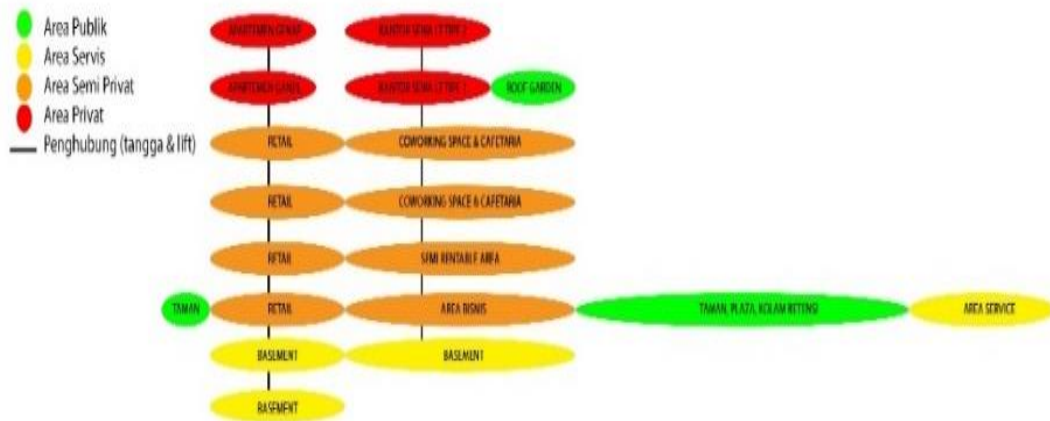


Figure 12. Vertical Zoning of Parahyangan Office Rental Space and Apartment
Source: Author, 2019

Later on, the implementation of the zoning is carried out in the space requirements of each floor in the building. In this process, the layout of the space needed is taken into account as follows,



Figure 13. The Application of the Vertical Zoning to Part of Site Plan
Source: Author, 2019

C. Concept of Structural Design

The structure which is built uses skeletal system, with the mixture of steel construction and reinforced concrete. Meanwhile, the foundation used is the pile foundation. The description of the structure system is illustrated in the following figure:

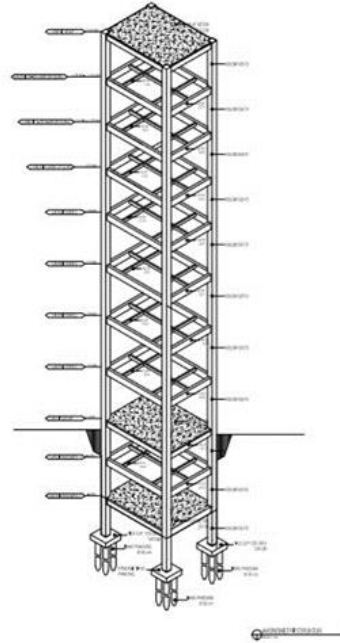


Figure 14. Isometry of Building-Structural Systems in the Design
Source: Author, 2019

D. Concept of Smart Building

D.1 Internet Protocol Room

The internet protocol room is set for the Parahyangan Office Rental Space and Apartment building in one of the building parts (Travor Hanekamp, 2013)(Stegmeier, 2008). Optimally(Aji, 2016)(Chandra et al., 2015), this room is placed at basement 1 area which is the location of the Internet Protocol Core. This place becomes the control room and building-system control room which is related to the BAS (Building Automation System) system or the overall utility of the building (Sukarno et al., 2015).

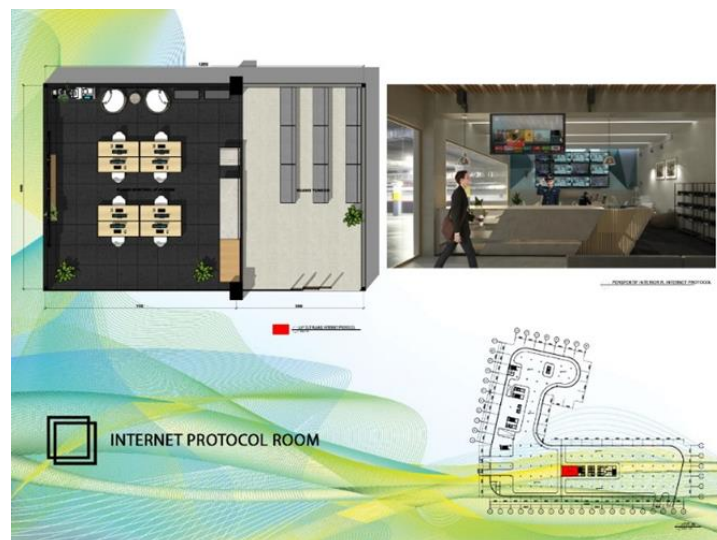


Figure 15. Isometry of Building-Structural Systems in the Design
Source: Author, 2019

D.2 Fiber to The Home

The Parahyangan Office Rental Space and Apartment system will deliver all services within the area. This process is integrated through internet-protocol core systems, so that it can save costs, reduce operational costs, and provide better service to users(GBCI, 2010).

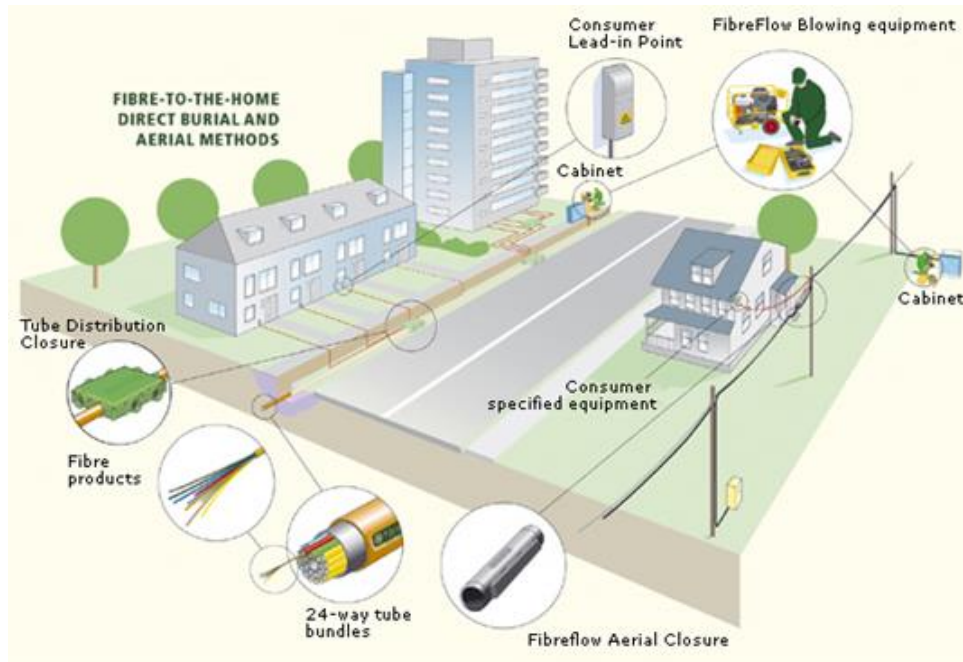


Figure 16. Isometry of Building-Structural Systems in the Design
Source: Kleissl and Agarwal, 2010

D.3 Building Automation System

Movable barrier and movable facades are architectural components in building that use the BAS systems. In addition, this system is also applied to every building opening and building utilities. This BAS system is controlled through one internet-protocol core of Integrated Building Management System.

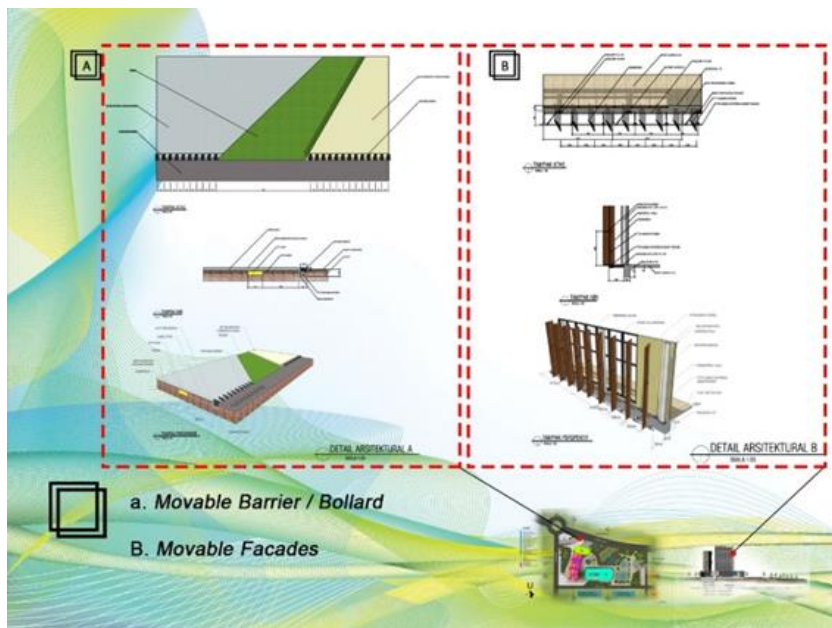


Figure 17. Isometry of Building-Structural Systems in the Design
Source: Author, 2019

D.4 Building Management Energy System

Building Energy Management Systems (BEMS) in Parahyangan Office Rental Space and Apartment uses a computer-based system that controls, monitors, measures, and optimizes technical development services and energy consumption of devices used by buildings.



Figure 18. Isometry of Building-Structural Systems in the Design
Source: Author, 2019

Conclusion

Smart building is an integrated building-technology system related to the construction and operational efficiency as well as improvement on building-management functions for residents. Intelligent building and the building energy management system are part of smart building which will provide energy control and savings in building costs because the integration of the control system is tighter on the internet protocol as the core of the smart building system. The smart building which is the part of the green building is very supportive and influences the condition of the HVAC (heating, ventilation, and air-conditioning) building to be more efficient. The concept of smart building is applied to support the design of Parahyangan Office Rental Space and Apartment buildings to deliver multi-services (voice, video, data, picture, building automation, and management systems) in an integrated network. An IP-based integrated network allows an integrated building management system to be implemented. This makes Kota Baru Parahyangan an area that applies modern technology. This high-rise-type building is one way to increase the housing value.

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