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ADAPTIVE REJUVENATION OF URBAN OFFICE

REMEDIATION OF LAND SUBSIDENCE ON THE GOLDEN TRIANGLE

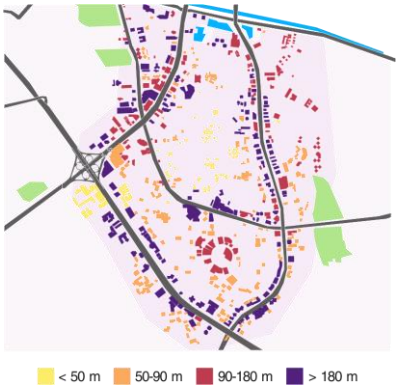
Location: Jakarta, Indonesia.

I. INTRODUCTION

In Jakarta, the rate of land subsidence varies while the largest rate is occurred in Central Jakarta, with height above sea-level of Central Jakarta was decreasing from 3.42 meters in 1993 to 1.02 m in 2005 (decrease about 20 cm/year). The Jakarta Mining Agency data shows: 80% of the land subsidence is caused by the structural load of high-rise building, 17% by groundwater exploitation, and 3% by natural causes.

With major urban activities in the city, Central Jakarta encounters land subsidence significantly due to proliferation of groundwater exploitation, especially in high-rise building. It could be concluded that there are two main issues which can be controlled, **high-rise building structure and groundwater exploitation.** These issues become the key principles of our proposal, Adaptive Rejuvenation of Urban Office in the Jakarta's Golden Triangle.

II. MAIN ISSUES

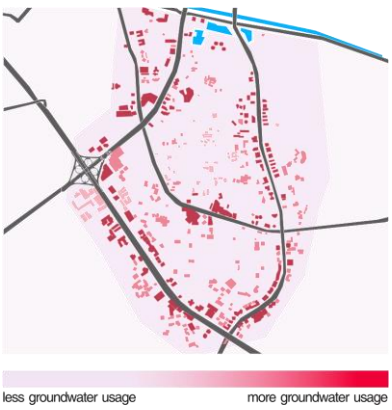


A. HIGH RISE BUILDING STRUCTURES

Building structures, especially high-rise building structures, are the main cause of land subsidence in Jakarta.

A joint study by PT Suconfindo and City Mining Agency has found that a six-story building with 30 meters to 40 meters height in Central Jakarta could cause up to 71 cm of land subsi-dence within 20 years, or 3.55 cm/year.

While there are 192 high-rise buildings with average height about 93.9 m (mostly located in the Golden Triangle in Central Jakarta), land subsidence issue is undoubtedly a very critical issue in Jakarta.



B. GROUNDWATER EXPLOITATION

Excessive groundwater exploitation is also one of the worst cause of land subsidence in Jakarta, which is located in a low area near the sea in the delta of thirteen rivers and is vulnerable to flooding. In December 2014, land subsidence by ground-water extraction in Jakarta was reported to reach 17,5 percent.

Groundwater usage in Jakarta is also increasing. Groundwater consumed about 8.8 million m^3 in 2014, growing to 7.2 million m^3 in 2013. Without using integrated approach in groundwater management and flood risk management, the aquifers will continuously affected, causing unavoidable flood everywhere in Jakarta.

III. CASE STUDY

A. CHASE PLAZA AS CASE STUDY

Chase Plaza is one of the first high-rise office buildings in the Golden Triangle area, Central Jakarta. Chase Plaza is located at Sudirman Street since 1984.

In Indonesia, green building regulation was just started to be proclaimed in 2010. Since then it's mandatory for architects and engineers to concern about environment and energy efficiency, recreating new urban quality with sustainable infrastructure, buildings and eco-social lifestyle.

Environmental issues such as annual flood and global warming are undeniably caused by ecological unawareness in the1980s. Chase Plaza was one of construction projects that was constructed in those years. Until now, there are still no green building regulation on greening existing building like Chase Plaza. This adaptive rejuvenation project on this strategically situated building is expected to act as a catalyst to enhance following similar movements on many high-rise buildings in Jakarta. By implementing this movement on urban scale, Jakarta's main causes on major issues like flood and land subsidence are expected to be reducted.

B. DESIGN VISION

Land subsidence is a phenomenon that could not be solved just by designing a single building. Adaptive rejuvenation project of Chase Plaza as will act as role-model and catalyst encourage another typical movement around the city, creating rejuvenation on urban scale. This massive rejuvenation movement will eventually take effect to reduce land subsidence in Jakarta, which is majorly caused by high rise building structure and groundwater exploitation.

IV. MAIN CONCEPT

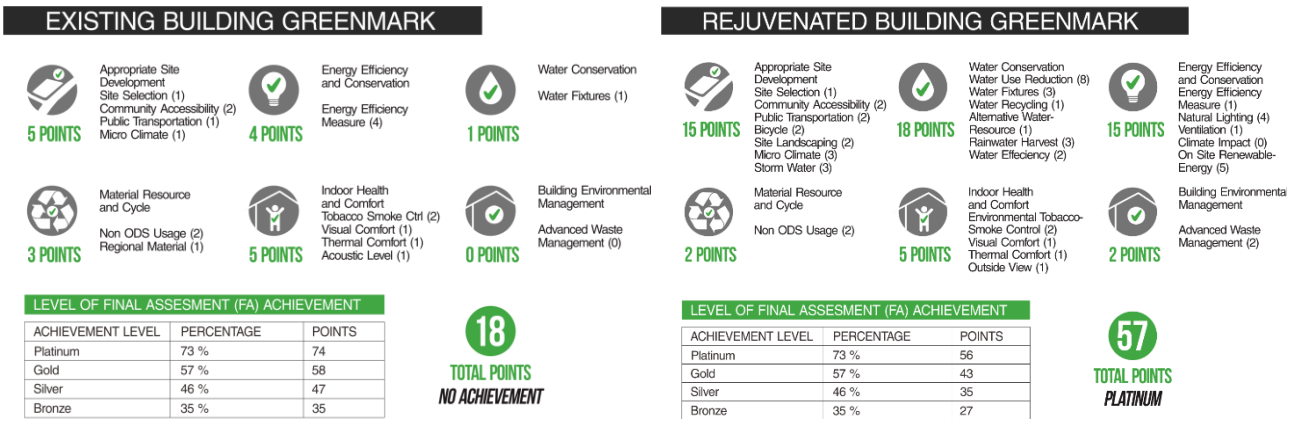
What is ADAPTIVE REJUVENATION?

Adaptive Rejuvenation is a design approach focusing on analysing issues and renovating existing building while at the same time preserving its positive values.

ADAPTIVE REJUVENATION OF URBAN OFFICE

The **MAIN IDEA** is to rejuvenate an existing office building into a more sustainable building by adapting GBCI Greenship Rating Tools, while land subsidence is emphasized as main issue. This green intervention will also recognized as role-model for greening existing buildings, creating green offices without adding another load of new high-rise buildings. Land subsidence management is also supported by smart water system to rejuvenate groundwater management at the same time recovering soil structure beneath the existing building.

Greenmark aim on our proposal:



V. STRATEGIES AND FEATURES

A. PASSIVE DESIGN STRATEGIES

NATURAL AIR CONTROL

Dominant wind load from the south is responded with space addition for gardens on north and south corners, which are functioned as wind breaker and natural air filter. This air filtering system creates healthy air distribution through the interior of the building.

GREEN VOID

Existing building's core is redesigned with void to improve service and circulation efficiency. The void is designed with rich greeneries, while at the same time bringing daylight and rainwater into the building.

INTERIOR GARDEN

Interior gardens are located on every floors, with bamboo trees located to produce more oxygen (produce 30% oxygen more than average trees). Fresh air and natural nuance are expected to reduce building users stress optimally.

SKY GARDEN

Sky Garden is provided for building users as central recreation area. Integration between natural nuance and supporting funcions as cafes and retail tenants is expected to improve social interaction and livability on the rooftop.

LIFTED PLAZA

Plaza is lifted to optimize groundfloor area for water infiltration area. Permeable platform system is also implemented in this Public Park to allow rainwater to seep down to ground floor.

URBAN FOREST

The whole ground floor area is rejuvenated as urban forest. Biopore infiltration hole is implemented to optimize groundwater rechar-ging, even in deep soil layers. Rich vegetations are also planted to recover soil structure by absorbing more water in the area.

PLANT SPECIALIZATION

AIR PURIFICATION PLANTS

These plants are placed on the outer part of the building interior to filter exterior air to healthy and pollution-free air, creating better indoor air quality for building user:

Areca Palm	Chrysalidocarpus lutescens
Ficus Alii	Ficus macleilandii
Lady Palm	Rhapis excelsa
Boston Fern	Nephrolepis exalta

COOLING PLANTS

These plants are placed on the interior garden and green void to improve Co2 absorption. These plants also produce more oxygen than average plants, creating cool and comfort micro-climate:

Bamboo	Phyllostachys aurea

Acacia	Acacia auriculiformis
Butterfly Tree	Bauhunia purpurea

GROUNDWATER REMEDIATION PLANTS

These plants, which have more capability on helping water absorption, are placed on the urban forest to optimize groundwater recharging system, combined with biopore infiltration holes system:

Teak Tree	Tectona grandis L.f
Vetiver	Vetiveria zizanioides
Bamboo	Phyllostachys aurea

B. ACTIVE DESIGN STRATEGIES

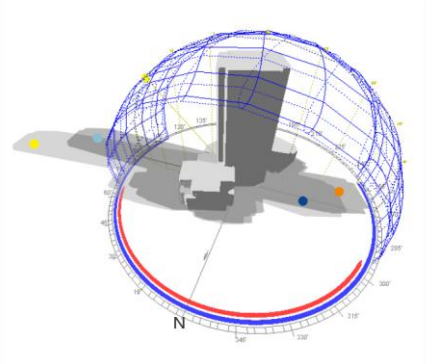
INTEGRATED WATER SYSTEM

1. *MULTI – WATER TANKS*
   Rainwater is harvested and collected optimally in these tanks. With integrated water supply system every two floors, these tanks are expected to optimally reduce power consumption on pumps usage. Multi - water tanks are connected to water distribution pipes to provide clean water needs for every floor. Greywater from toilet is also collected for flush and garden watering system.
2. *GROUNDWATER RECHARGING*
   Rainwater is gathered, collected, passed on to green void and then to the ground to improve groundwater recharging process.
3. *SUBTRACT FLOOR - EXTEND RAIN CATCHER*
   Trimmed floor areas above the groundwater tanks are meant to give more rainwater catchment space. The collected rainwater then get filtered and passed on into the water tanks.
4. *WASTEWATER MANAGEMENT*
   Collected rainwater in the multi water tanks are used as main clean water supply. This tanks are integrated with toilets on every floors to distribute the collected and filtered water to be used in bathroom fixtures such as water basin and shower. Greywater then get recycled to be used as toilet flush and irrigation.
5. *RAINWATER LOOPS*
   Multi water tanks are placed every 2 floors. After one water tank got completely filled, water then distributed to another water tank below. If the upper water tank is running out of water, then water on the lower water tanks will be pumped to fill the tanks above.
6. *PERMEABLE LIFTED PLAZA*
   Permeable floor allows rainwater to be passed on to urban forest for groundwater recharging.

7. *ADIABATIC COOLING SYSTEM*
   The system uses energy from the hot air generated in the algae skin. Algae is capable to provide cooling through vaporization processes. Hot air is collected in the algae through the natural stack effect of hot air rising. The hotter the intake air, the more cooling process can be generated.

ALGAE BIOREACTOR SKIN

Operable algae bioreactor skin is implemented as second layer to filter incoming day light. The existing building geometry is diagonally oriented to the sun path, causing more exposure to direct sunlight on the building facades. This issue leads to algae bioskin optimalization on every building sides, which also creates improvisation to reach optimal renewable energy.



DAYSIM ANALYSIS

The building geometry is diagonally oriented to the sun path, causing more exposure to direct sunlight on the building facades, whether it is in dry season or in rainy season. This existing design caused an issue: too much sunlight passes through into the building interior space; so facade redesign is necessary to reduce heat and improve indoor thermal comfort. This heat may also be used as alternative energy to improve building performance.

A calculation result for thermal analysis by using DAYSIM simulation software has shown a development on thermal comfort in the interior space of the building. Temperature in the interior space of the building is significantly reducted, from 32^{O}C, the existing condition, to 27^{O}C, after implementing algae bioreactor skin as second layer on building facade. Thermal comfort in the interior space is also improved by adiabatic cooling process which is effective for adaptive heat reduction.

VI. CONCLUSION

We propose to invite the building owner and government to simultaneously start the movement and take action about land subsidence in Jakarta. Land subsidence is not an issue that can be solved by rejuvenating a single building. This design is expected to be recognized as a prototype and catalyst to inspire more rejuvenation projects, especially in Golden Triangle area. This following actions will create a massive building remediation movements on urban scale, which is also expected to significantly inhibits the land subsidence in Jakarta.

Although this proposal reduces commercial area in the existing building, we believe that this adaptive rejuvenation design has more economical values by improving sustainability on people and this critical environment.