TOWARDS HYPER-OPENNESS
Transforming Vacant Office Building By Applying Hyper-Open Building System

RESEARCH DOCUMENT + DESIGN REFLECTIONS

Architectural Engineering Graduation Project | AELab-09

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PART I: Research Document
THE AUTONOMOUS VERTICAL
Research, Development & Design Towards A New Generation Of Open Building System

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Conventional buildings, due to their inflexibility and permanence, can hardly stay in a high quality and being adaptive to changing demand during their life span. Historically, some architectural innovations such as Open Building System practiced the notion of building flexibility. However, the customizing freedom of Open Building System is only limited in the form of façade and interior. Other decision levels such as structure, programme and capacity have not been discussed. Can we architects push forward this “vertical autonomy”? Is it possible to de-centralize the design authority not only in the level of form but also in the other levels of grid, programme and capacity? And how will this evolution reflect on support construction and infill customization? These puzzles initiate the exploration for a new generation of Open Building System.

Starting with observation of undergoing urban transition in Amsterdam Sloterdijk -one of the typical pure business districts in Netherlands, through tackling one of the most critical issues -the mismatch between supply and demand in building market-which considered as the primary cause for the office vacancy and urban mono-function, via the reflection on architectural position in this situation, through the formulation of objective and research question, via the reference to urban planning evolution, and eventually reaching the destination of a definition for Hyper-open Building System and its reflection on architectonic, this research document is trying to develop a building system, which can achieve a set of goals including the individual autonomy in decision-making, interchangeability in typology, evolvability in architectural quality and efficiency in design construction process.

As an interim achievement of entire graduation project and a technical guideline for subsequent design, this document will be concluded by a catalog of architectonic criteria and an optimized building prototype. And by using the criteria, a set of existing vacant office buildings around Amsterdam area will be evaluated in order to get the general idea about the current building conditions and transformation potentials.
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Bibliography
I. Prelude: An Unbalanced Market
1.1 Transition

Amsterdam Sloterdijk, also known as Amsterdam Teleport, locates in the middle of the Brettenzone strip between Amsterdam central and Haarlem. Before its shortly twenty-years urbanization history, Sloterdijk was just a small village belongs to the municipality of Amsterdam. After the Station Sloterdijk opened in 1983 (fig.1), the chance of rapid urbanization was brought to the area. The village started to be surrounded by large-scale developments: highways, railways, stations, and bus/metro lines. Due to its high accessibility, the urban planning for Sloterdijk made by local government aims to orient and develop the area into one of the most important node in national railway network and one of the largest concentrations of office jobs in entire Amsterdam region.

Till 2005, after two decades of development, most of these goals have been achieved successfully(fig.2). However, shortly after this, Sloterdijk area did not manage to resist the economic crisis starting in 2008 and the development slowed down dramatically(fig.3). The recession strongly stroked the mono-functional neighborhood and left a large amount of empty office buildings. Sloterdijk seems to lose its attraction.
1.2 Vacancy

According to the data of We’re Amsterdam 2011 Report, the current vacancy rate in office market of Sloterdijk already reached the historical peak in 22.4%. With a total stock of 424,000 m², this means over 95,000 m² of office area is currently left empty, not to mention the “invisible” vacancy, which part of the vacant office is not in the market for some reason.

Actually, the vacancy itself is a very common phenomenon since the quantitative supply and demand are always different more or less (Keeris, 2007). And if this mismatch rate is in between 3% and 8%, it will be considered as frictional vacancy, which is a natural phenomenon caused by the friction between supply and demand (Wheaton, 1999; Tse & Webb, 2003). When the rate rises over than 8%, this type of vacancy is called structural vacancy considered as a long-term and unhealthy mismatch (Wheaton, 1999; Tse & Webb, 2003).

Based on this definition, the situation here in Sloterdijk should be seriously pay attention to. The vacancy up to 22.4% (fig.4) needs to be relieved as soon as possible. Otherwise, a series of social issues such as taxes loss, building devaluation and Deterioration, and decline of urban quality. In fact, this situation not only happens to Sloterdijk area but also national-wide. The statistics shows that the vacancy in Dutch office market already reaches 14.1%, which means over 6,795,000 m² of office area in total is left empty (DTZ, 2012). In 2010 the Minister of Housing, Spatial Planning and the Environment (VROM), Tineke Huizinga, presented a report on the scale of office vacancy and took the initiative to start a taskforce to reduce the vacancy. The structural vacancy in office market is seen as a national and societal problem and not only a problem for the owner of vacancy property.
1.3 Pork Cycle

Zooming in to the detail of historical statistics, a continuous increase of office supply can be observed since 1995. While the office space that actually been taken starts to decrease since 2000. As a result, more and more office space is left empty. Besides, according to the report of EIB (the Economical Institute of the Dutch Building Industry), this overcapacity problem will be getting worse in a foreseeable future due to the insufficient demand caused by a various of reasons including economic recession, work-population decline, politic orientation, working-style shift and so on.

In fact, in economic terms, the primary cause of this mismatch between supply and demand is a mechanism called Pork Cycle (fig.5). In economic market, to pursue the short-term interests, lots of investments entered in supply market. Since the formation from investments to final products usually costs a quite long time, when the products are finally put into the market, the demand may already insufficient. The key to kill the Pork Cycle phenomenon is eliminating the responsive lag between supply and demand. Otherwise this pattern will periodically repeat.
1.4 Trends

To deal with the office vacancy in the future, a simple but superficial way is, directly control and reduce the office supply by limiting new office project and redeveloping existing project to other uses such as housing and commerce. Meanwhile activate the demand for office space. However, to be more critical, this solution can hardly kill the responsive lag and solve the fundamental problem of Pork Cycle. And turns out, the same pattern will repeat in the building market.

So, a sustainable way of redevelopment should not only consider the short-term solution but also aim the long-term balance. Therefore, by synchronizing the supply and demand, the tumor of responsive lag will be eliminated and a constantly balanced market will be achieved. Of course, it is not an easy task.
II. Architectural Position
2.1 Synchronization

To achieve the goal of synchronization thoroughly, it involves lots of different social aspects and is impossible to be accomplished only by architectural solutions. Nevertheless, it still vital to know what is architectural position in this situation and what architecture can contribute to the redevelopment.

Zooming into the architectural domain, two reasons mostly cause the pork cycle phenomenon in building market. One is the permanence of architecture while the other is the duration of design and construction process(fig.7). Normally, the inflexibility of architecture determines that the purpose and the quality of a building can be hardly changed to adapt the ever-changing demand of market. And the response to market is delayed due to the construction duration. Therefore, if architecture wants to contribute something to this synchronization, maybe should start from these two “weaknesses”. And to overcome these two “weaknesses”, basically a set of goals including the interchangeability in typology, the evolvability in architectural quality and the high-efficiency in design and construction process need to be achieved.

2.2 Dream

Tracing a typical developing track of a conventional building, a discontinuous history can be observed(fig.8). And within each fractured fragment, the properties such as the programme composition, capacity and form are static and inflexible. These discontinuity and low changing frequency prevent architecture from the resilience, adaption and sustainability.

On the other hand, the current situation of Sloterdijk is very delicate. The up-coming urban transition will lead the city to an unforeseeable future. The only certainty is that, more programmes tend to enter the area due to the functional diversification(fig.9). However, a lot more uncertainties are left behind. What kind of new programmes will be? What is the composition and capacity of these programmes? Where will these new spaces be located in the neighborhood? What is the demand in future market? For so many uncertainties, how can a building without resilience, adaption or sustainability survive from this situation?

What if the discontinuity becomes continuity? What if architecture constantly stays dynamic? What if the building is developed gradually towards an optimized result? What if the programme composition, capacity and quality of a building can perpetually fit the ever-changing demand? (fig.10)

2.3 Research Questions

In order to chase this dream, a comprehensive research question is waiting for the answer. How to develop an open, flexible and resilient building system, which can stay in dynamic, keep evolving and constantly adapt...
to the ever-changing context?

Besides, several sub-questions are following: How to innovate the decision-making process of the architectural design, instead of a predetermination of every decisions, and leaves enough possibilities to future? How to give a building the flexibility to achieve the interchangeable in typology and evolvability in architectural quality? How to increase the efficiency in building design and construction process?

Fig 8. A Discontinuous Development, Author, 2013

Fig 9. Urban Diversification, Author, 2013

Fig 10. A Dynamic And Resilient Development, Author, 2013
III. Horizon and Vertical
3.1 Horizon

Generally, through formulating a block-grid matrix, urban planning establishes the two-dimensional discipline (fig. 11). However, meanwhile, autonomy can be observed within each block. After the agreement achieved between government and developer, the block become “private property” (fig. 12). In essence, all the financial issues of the block including profits, costs, maintenance, taxes and so on will be only related to its owner.

But, this absolute ownership does not come with absolute authority, which means, developer does not dominate the decision-making process. On the contrary, it is usually the government who controlling the game. And the story of development authority can be addressed in several layers including grid (border), programme, capacity, and form (fig. 13).
3.2 Grid

On one hand, grid draws the boundary for each private land. On the other hand, as urban structure, the grid itself contains all the physical service facilities including transportation network and underground pipeline system. Both of which guarantee the constantly running of the metropolitan machine(fig.14). And government, as the manager of urban property, is responsible to the design, construction and maintenance of the grid by using the revenue.

Grid defines the border and position for each block, and somehow these two properties, to some extent, predetermine the block's destiny since the programme and capacity are partly depended on size and location.
In a top-down planning system, the autonomy of block is strictly limited by central government. Through the establish of zoning law or another regulatory plan, the land-use purpose, capacity, density and green area of each block are regulated by a set of index (fig. 15). Even the building form is controlled by urban design regulation and needs to follow certain rules. The top-down approach can easily ensure the general coordination of urban spatial resources and achieve a harmony of urban landscape. However, effect and result of top-down planning highly depend on the cognition and capability of urban planner or decision maker. While the interests of developers, individual demand and market orientation are repressed by the controlling power of central authority.

On the other hand, the bottom-up theory respects the individual demand, interest and behavior (fig. 16). Via the de-centralization of authority, through the individual autonomy, and via the activation and coordination of intercommunication and interaction, the bottom-up approach can gradually and sustainably generate a dynamic solution which balancing all the public interests and capable of dealing with the uncertainty of context. Although the performance of problem-solving ability of bottom-up system is satisfactory, the undesirably long duration of solution-finding process lowers down the efficiency.

Currently, most of the planning methods are the combination of top-down approach and bottom-up approach (fig. 17). Take the ideology of Dutch planning system for instance: after 90s, the original top-down approach oriented planning method started to integrate with bottom-up thinking. Therefore, more and more public participation, market orientation and zoned autonomy are considered and implemented in planning process. The land-use, developing capacity and not to mention the form style are no longer dominated by government. Instead, the individual developers acquire more and more authority in decision-making process of their private realm.

3.3 Top-down and Bottom-up
3.4 Urban Dynamism

This revolution of planning system brings flexibility and resilience to urban development. As matter of fact, this inner-block autonomy based on the control of urban grid creates a flexible and resilient urban dynamism. To be more specific, due to the bottom-up thinking, every individual block follows a unique and independent developing track and changes in a certain frequency. However, the juxtaposition of these blocks emerges a more frequently changing urban pattern—the programme or capacity of one block changes, the total urban programme composition changes as well(fig.18).

This dynamism has largely enhanced the urban resilience and adaption. First of all, comparing to a pure top-down planning process, this development process could manage to balance among common interests, market orientation and individual wills. Secondly, the increased change frequency brings a more sensitive response ability to cope with the ever-changing context. And thirdly, through the spontaneous intercommunication, interaction and collaboration among all the equally positioned and connected blocks, it actually forms a bottom-up behavior, which can gradually explores a maximum-optimized composition for neighborhood instead of a pre-mature decision in the very beginning.
3.5 Vertical Reproduction

Modern architecture, the artificial construction, can be seen as the reproduction of original site, an extension of urban spatial matrix in vertical dimension (fig. 19). In that matters, structural similarities can be observed via analogy (fig. 20). Although urban planning system has already made progress on bottom-up revolution, the horizontal autonomy does not extend to vertical dimension. In architectural domain, the design process still follows a pure authoritarianism. Most of the decisions are pre-decided by the building develop in the beginning.

The hypothesis is, can the horizontal dynamism be extended to vertical? Can the urban model of autonomy be transplanted to architecture? (fig. 21)
3.6 1909 Project

A fictional architectural project in the form of a cartoon published by a popular magazine in 1909 perfectly shows the ideal performance of vertical autonomy(fig.22). The building, so called Globe Tower, consists of 84 floors reproducing the original site and all supported by a slender steel structure. “Each of these artificial levels is treated as a virgin site”(Koolhaas, 1994). In that sense, the building becomes the stacking of 84 pieces of individual private land. And to express this strictly private realm in vertical dimension, a range of buildings from villa to factory combining with a set of architectural styles from the rustic to the palatial are displayed in different floor. “The use of each platform can never be known in advance of its construction” (Koolhaas, 1994). An unpredictable and unstable combination of parallel activities, which makes the building more dynamic, more flexible and less foreseeable than before.

Fig 22. “Each of these artificial levels is treated as a virgin site”, Rem Koolhaas, 1994
IV. From Left to Right
Fig 23. Reference Scale, Author, 2013
4.1 Reference Scale

If creating a reference scale to indicate the different degree of autonomy, located in the far-left side are ordinary buildings, which are usually pre-designed by single developer and professions following a purely top-down methodology. While on the far-right side lies the ideal model-1909 project, whose programme, capacity and form can be completely decided by individual users or sub-developers. (fig.23)

There are also some other reference projects positioned in this scale. Both the Nakagin Capsule Tower project from Metabolism(fig.24) and the CitizenM Hotel Project(fig.25) formulated by IFD Building System share the similar attitude toward the industrialized, demountable and flexible building concept. However these two representative projects do not give a clear definition about the sub-division of autonomous space and limit the user’s discourse right in decision-making process. Therefore, these two models still follow a strictly top-down approach. And pretty-much all the design decisions are made by central-authorized developer and professionals in the very beginning of the project. In fact, these two projects can be only seen as technological innovations in building flexibility while still located close to the far-left side in the reference scale due to the arbitrary approach.

The inspirations from British avant-garde Archigram initialize the separation between support structure and infill not only in technical meaning but also in level of authority. In the project Plug-in City(fig.26), a mega-structure, which considered as public infrastructure and extension of urban grid, is constructed as primary building support. And individual housing units, which considered as purely private property, are positioned in between the infrastructure. This ideal of separation in authority and ownership is the vital pre-condition for the autonomy of sub-space.

The Open Building System originally proposed by John Habraken divides the building into two detached parts-the support and the infill(fig.27). Only the design of support is pre-determined by developer, while individual users according to their requirements can decide the design of infill. This breakthrough de-centralizes the authority and gives the discourse right in decision-making process especially enhancing user’s flexibility in form level. However, in the decision level of grid, programme and capacity, open building system still has certain limits for users. In fact, Open Building System is usually applied in the practice of residential building, the programme and capacity of which have been already pre-determined. In this sense, Open Building System still has certain distance to far-right side of autonomy.
4.2 Manifesto

If consider the original Open Building System as a starting point of our notion of vertical autonomy, while the 1909 project could be seen as a visionary utopia of this dream-an Ultra-open Building System.(fig.28)

And what will be developed here in the document is a new building system, a system which is located somewhere in between the “beginning” and the “destination”, a system which combines both the top-down and bottom-up approaches, a system which de-centralizes the authority in multi-level of decision-making process, a system which is built on current situation of technology, a system which can balance the requirements of flexibility, economy and efficiency, a system which is upgraded from Open Building, towards the Ultra-open Building, a system which is defined as Hyper-open Building System.

Fig 28. Autonomy of Decision-making, Author, 2013

Fig 29. Sub-divisions , Author, 2013

Fig 30. Sub-division Types , Author, 2013
4.3 Autonomous Vertical

The most fundamental and vital progress for Hyper-open Building System is an enhanced vertical autonomy. Instead of a pre-determination for every design decisions in the very beginning, via the sub-division of building entity, individual owner’s these sub-space are authorized in decision-making including the level of programme, capacity and form. In other words, each of these sub-divisions is treated as a virgin site (fig. 29). Therefore, in vertical, a similar dynamism appears by stacking all the development tracks of each sub-division (fig. 31).

Compare with Open Building System, the sub-divisions of Hyper-open Building System are not only limited in unit-based division. According to different situation and different requirement, the Hyper-open Building can split in units, layers, masses or even mixed composition (fig. 30). The more flexible sub-division generates more possibilities for individual users. Based on personal needs, spaces with different location and different volume can be acquired.
4.4 Location

Similar to the urban situation, the property of location in the building grid, to some extent, limits the uses for sub-space due to the accessibility. For instance, the space of ground floor usually has the direct connection with the urban grid and does not depend on any vertical circulation shaft. As a result, this part of the building can easily adapt to those public programmes requiring high accessibility. The space located from first floor to fourth floor is tend to be less public due to the lower accessibility because of the dependence on vertical circulation such as stair cases, escalators or elevators. And the space above fifth floor highly depends on the elevators so that the programme and capacity are limited by the circulation ability. Therefore, normally, the higher levels are occupied by private programmes such as housing and office, or some public programme mostly serving for adjacent floor space only. (fig.32)

Fig 32. Location Analysis , Author, 2013
4.5 Dimension

Normally, different programme requires a different minimum continuous space. For instance, programmes such as housing, office and small-scale commerce only need a dimension of 4 x 5 square meters roughly with a 3-meters floor height, while the programmes such as indoor sports (swimming pool) and entertainment (theater, cinema) usually require a continuous space larger than 15 x 20 x 6 cubic meters(fig.33). Besides, it is easy to embed the small dimensional space inside the large dimensional space, which means that the larger dimensional space tends to be more functional flexible(fig.34). That is why those old factories and warehouses with over-dimensioning volume are highly adaptive to other uses.

As a conclusion, the stacking of small dimensional spaces finalized in regular grid can only acquire a limited flexibility, while the combination of extra-large dimensional space finalized in large-span structure can achieve a maximum flexibility. On the other side, the over-dimensioning space seems to be energetically inefficient, and not to mention the expansive cost for structure. Therefore, an appropriate composition of structural dimension is vital for building flexibility and sustainability. Combining with aforementioned analysis of location and accessibility, a mixed model with larger dimensional spaces in the lower part, smaller dimensional spaces in the upper part and also some medium size inserts seem to be an optimized solution ended up with an informal hybrid structure(fig.35).
4.6 Circulation

The positioning of circulation core normally influences two aspects—the subdivision of floor space and the horizontal distribution of circulation (including service system). Summarized in four types, the first two types, single central core and multi central core, are both qualified a high efficient horizontal distribution while having the limitation in floor space division. The latters have no limit in sub-division while lowering the efficiency of horizontal distribution. The additional advantage for the detached core is the convenience for future upgrade and maintenance. (fig.36)
4.7 Construction

At least five aspects (fig. 37) of building construction including façade construction, parapet, floor construction, beam and column/wall highly effect on the infill customization.

Firstly, the demountable façade element needs to be as much as possible. Therefore, a load-bearing façade is unexpected to be applied in Hyper-open Building System (fig. 38). Besides, the parapet elements will also limit the demountable area and exterior extension (fig. 38). Secondly, a perforable or a removable floor construction is preferred due to the creation of the sectional flexibility and spatial diversity. Thirdly, the internal load-bearing structure elements also affect the interior freedom. For example, the load-bearing wall would restrict the sub-division of floor space. And the denser the column grid is, the less flexible the interior space will be (fig. 39). Lastly, the floor to column construction is expected to be as simple as possible, otherwise it will generate additional detailing difficulties. (fig. 39)
4.8 Infill-Customization

Compare to conventional buildings, besides the interior decoration, furniture and devices, the demountable façade elements and interior partition walls allow to be customized in Hyper-open Building System (fig. 40). Which means the entire private realm is completely flexible for personal requirements of spatial organization and design.

In traditional design process, it is easy to achieve a harmonious exterior appearance due to the top-down approach. On the other side, if the individual users dominated the design of their own façade fragment, it tends to acquire a chaotic exterior pattern, which may outputs a negative impression to urban landscape. However, an additional procedure of consultation between the general developer and individual users might solve the problem. Although the façade fragment still designed by different individuals, all these design schemes need to follow a certain regulation or a protocol made by developer. In this scenario, a diverse but rhythmic façade pattern is expected to achieve. (fig. 41)
Apart from the traditional construction method, another two methods seem to be more efficient and appropriate used in the infill construction of Hyper-open Building System. The panel-based construction divides the façade and wall elements into prefab panels. By using a set of panels with different function, form and dimensions, extensive infill compositions can be achieved. The advantages of this construction type include the easy maintenance and free plan coordination. Meanwhile, the installation of these panels may cause detailing difficulty in connection and construction impact to neighbors. On the other side, via directly inserting a self-structured and self-insulated capsule, the module-based construction tends to be less depended on primary support and more rapid in construction. However, this integrity limits the shape and creates space waste. Besides, the dimension of the module is highly restricted by external conditions such as manufacture and transportation. (fig.42)

Another aspect needs to be tackled is, both for developer and individual users/sub-developers, how to regulate and implement a feasible, maneuverable, highly efficient customization process. Obviously, one option would be that, each individuals design the schemes for their private realm by themselves or under the help of designers. Then, to ensure the integral harmony, the schemes need to pass the examining procedure run by the developer and government before being constructed. This type of process, named as Active Customization Process (ACP, fig.43), gives the adequate freedom to individual users. Meanwhile, due to the amount of individuals, this design-examine-redesign/construction process may be repeated for a lot of times. The redundant sequences will largely lower down the efficiency and operability of the customization process. On the other hand, a compromised alternative, named as Passive Customization Process (PCP, fig.43), can eliminate the
the procedure redundancy by establishing an upgradable Library, in which extensive infill presets are pre-designed and approved by developer, government and designers. Through the Library interface, individual users can choose their favorite preset and make some adjustments. Although the establishment of Library may take time and partly limit the user’s customization, this kind of experience of user-customization successfully ingrates the trends of informatization and commercialization.

Fig 43. Active Customization Process and Passive Customization Process, Author, 2013
4.9 Criteria

Eventually, all these reflections on authority, architectonic and user-customization collectively formulate a catalog of criteria, which can not only guide the new projects but also evaluate the feasibility of transformation for existing buildings. The criteria include five aspects ranged from authority, dimension, circulation, construction to infill customization.

The first part, as the standards for the virtual properties, involves the regulation for decision-making process and ownership sub-division. This part of the criteria guarantees the fundamental precondition for the autonomy of architectural sub-space. The subsequent three aspects involve all the architectonic requirements to ensure an adaptive and flexible building condition for sub-spatial autonomy. Additionally, to achieve a not only fully-flexible but also highly-efficient customization, the last part of the catalogue defines the user’s authority and regulates the user-customization process including the clauses about the demountable infill elements, construction type method, and customization-making process.
4.10 Prototype

As a fictional conclusion for this chapter of research, by applying the aforementioned criteria, this building prototype can be seen as an ideal example showing the notion of vertical autonomy.

a. To achieve a maximum accessibility in lower part of the building, a spiral path extruded from the urban grid provides the circulation for public including both pedestrian and vehicle;

b. Due to the maximum accessibility, three stories of large and extra-large dimension space are located within the spiral path. By using large-span structure, this spatial continuity achieves the high flexibility for a wide range of various programmes and capacity;

c. On higher levels, most of the floor space becomes dimensionally smaller and only fits for several certain types of programme. The application of regular column grid aims to balance the financial cost and increase the energy efficiency;

d. Meanwhile, to ensure the possible public programmes settle on higher level, two stories of medium and large size space are inserted into the upper tower;

e. As a solution compromised between economic efficiency and functional flexibility, the building construction is finalized in an informal hybrid structure to gain a vertical diversity of spatial dimension;

f. According to the different publicity and variousness of space in different parts of the building. Two types of user-customization process-active customization process and passive customization process-are applied to achieve a sufficient flexibility, a harmonious exterior and an efficient, convenient customization flow simultaneously.

Fig 44. Hyper-open Building Prototype, Author, 2013
4.11 Conclusion

As a conclusion for the research, comparing Hyper-open Building System with original Open Building System, three main improvements in three different levels can be seen:

1. Authority Level:
The most vital progress for Hyper-open Building is the increasing of sub-spatial autonomy. The individual owners of sub-divisions gain the authorities not only limited in the decision level of interior form but also involving the decision levels of grid (free subdivision), programme and capacity. This de-centralization of design authority stimulates the following evolution in support construction and infill customization.

2. Support Level:
Intuitively paralleling the typical section of Open Building and section of Hyper-open Building Prototype, several ameliorations based on the reflection and rethinking of support construction can be observed:

- An optimized and diversified sectional dimensions which can accommodate more kinds of programmes;

- An informal hybrid of structure composition to achieve a diverse composition of dimensional spaces while considering the structural efficiency;

- A detached circulation core which is allowed a easier future upgrade and gives maximum freedom for the subdivision of floor space;

- A more compact and flexible construction with less interrupting structural elements to enhance the spatial continuity and reduce detailing difficulties.

3. Infill Customization Level:
The additional diversity and uncertainty generated by the increased user-flexibility are easy to cause chaotic exterior pattern and enhance the difficulty for the regulation and operation of infill customization. In order to balance the tension between the excess complexity and the processing efficiency, multi-layer solutions are purposed:

- The customization protocol between developer and user in order to achieve a diverse but rhythmic exterior pattern;

- The combination of panel-based construction and module-based construction methods in order to optimize the customization flexibility and construction efficiency;

- The combination of Active Customization Process and Passive Customization Process in order to ensure the individual autonomy while cutting down the procedure redundancy.
V. An Evolving Future
5.1 Evaluation

Besides the instructive meaning for new building project, the aforementioned criteria of Hyper-open Building System can be also used to evaluate the existing vacant office building to see the transformation potentials. Comparing to the option of demolishment and reconstruction, building transformation is a more economic alternative. The conversion directly reduces the current office supply and creates other products for the market. According to an available database (2008) from department Real Estate and Housing with information about 200 vacant office buildings, all located in or around Amsterdam, four most important aspects from the criteria, including dimension, typical plan, façade and construction, will be evaluated. The results of the evaluation will give an overview condition about the feasibility of applying Hyper-open building transformation to existing vacant office buildings.

5.1.1 Dimension

Based on the office typology, most office buildings are design in a rectangular shape and a regular grid. The grid sizes are usually standardized in a module of 1.8 meters. The database concludes the dimension in two ways: the dimension parallel to the façade and perpendicular to the façade. As the former related to the façade size, in this research, only the dimension parallel to the façade has been considered. According to analysis, the most common dimension is 7.2 meters (38%), followed by 5.4 meters (17%) and in-betweens (18%).

![Fig 45. Dimension (Parallel to Facade) Evaluation, Author, 2013](image)
5.1.2 Typical Plan (Shaft Positioning)

The Dutch office buildings, apart from the rare cases built before 1970 (8%), are commonly designed according to a certain typology in a rectangular shape (Remoy, 2007). And the floor plans can be concluded in two typical compositions. Firstly, in high-rise buildings, the floors are supported by columns and stabilized by a central concrete core consisting vertical shaft. Secondly, in low-rise buildings, besides a central core, there are also several stabilizing walls or side cores containing stair cases.

5.1.3 Façade

Although in the database, there is not a very specific classification for the façade construction, it describes the general idea about what types of façade are in use. The load-bearing group (64%) consists the most popular façade type with concrete elements (52%). While the curtain-wall group (36%) includes the second popular type- the glazing-curtain-wall façade (29%). (fig. 46)

5.1.4 Floor Construction

Generally, most of the office buildings are applied the column support system with beams or hidden beams. Among all the types, two floor constructions are standing out: the concrete flab slab (36%) and precast concrete panel floor slab (34%). (fig. 47)
5.2 Conversion Potentials

On one hand, as conversion opportunity, the characteristics of office building such as the standardization of grid, the over-dimensioned construction and regular shape give enough possibilities for future transformation. The generality and similarity of office building may stimulate architects to think in a more macro view and try to find a more generic solution.

On the other hand, as conversion challenge, the current vacant office buildings show an irregular pattern in the composition of dimension, plan, façade and construction type. There is no certain relation between different aspects. For instance, the building with a desirable grid dimension does not necessarily qualify a non-load bearing façade. This irregularity largely increases the selection difficulty. For the application of Hyper-open Building System, there are at least three basic clauses of criteria need to be satisfied:

1. Grid Dimension: a minimum of 5.4 meters
2. Building Shape (floor plan): regular or at least not too complex
3. Façade Type: non load-bearing, easily removable and without structural parapets
Using these requirements as a filter, 70.5% of the buildings (141 out of 200) from database are screened for Hyper-open Building Transformation. (fig. 48) Besides, some further evaluation in aspects such as the feasibility and difficulty of façade clearance, the condition of construction detailing, specific plan coordination and even building location also highly is quite difficult or even impossible to process only according to the database. However, a sure thing is that among the left 59 buildings, there will be more buildings unqualified for transformation.

Therefore, the selection of an appropriate office building for design project (vacant office building conversion by applying Hyper-open Building System) does not seem to be an easy job. The previous choice, DPA office building located near the Sloterdijk station, is unqualified for the conversion. The expressive façade turns out to be a load-bearing construction with structural parapets. Nevertheless, this difficulty actually demonstrates the importance of a flexible support construction for building adaption from a different angle and encourages me to continue the exploration of Hyper-open Building System.
Bibliography


SARIA, A., 1998, Open and Industrialised Building, St Edmundsbury Press, Suffolk, 5p

KENDALL, S., TEICHER J., 2000, Residential Open Building, TJ international Ltd, Padstow, 176P


THILLART, C.C.A.M. van., 2002, Consumentgerichte industrialisatie in de woning bouwsector: virtuele kits als instrument voor benchmarking, variantvorming en selectie, Delft, EBURON

BEEMSTER, W., 2000, Bouwen in Japan, ARKO Nieuwegein,


RANDEN, A.van., 2005, The Power Of An Idea, Concept House Proceeding, The Netherlands


LEOPEN, B., 2005, The Frame Concept Providing Freedom For Dwelling, Concept House Proceeding, The Netherlands

HORDEN, R. SCHMIDT, W., 2005, A European Concept House, Designed by Europeans for Europeans, Concept House Proceeding, The Netherlands


PART II: Design Reflections
A DOUBLE LIFE OF HYPER-OPENNESS

The Design Summary And Reflections For Graduation Project: Towards Hyper-openess

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1. 'Game Settings'

The idea of Hyper-openness is about decentralizing design authorities, which means, the actual users of the building can participate in the design process and have the design authorities not only in interior design but also in volume, layout, façade and climate solutions.

More specifically, after the designing of support construction, individual users are invited to the design process. Through the interface, users can customize the size of their unit based on predesigned modularity according to their personal requirement. Besides, for dwelling users, they also have the possibility to change the interior layout. Additionally, users can also define their front space and customize the backside façade. Because of the decentralized climate concept, the climate solution for each unit can be individualized via choosing the different climate units.

Reflections:

The key problem is, after the initializing stage, how can the building still provide constant flexibility when it is in use. The situation gets much more complicated when the building fully occupied. For instance, it will be difficult or even impossible to change volume if the neighbor space has been taken. And how do the scenarios such as ‘Growth’, ‘Switch’ and ‘Split’ actually happen? It might need a more clear and feasible plan. Besides, the definition of public space is also controversial and lots of questions remaining. What are these spaces used for? Who owns the property and who makes decisions? The ‘game settings’ of Hyper Open Building require further development and improvement.

Fig 1. ‘Choose the volume from Typelib’
Fig 2. ‘Customizing Lay-out’
2. Infill System

To achieve the free floor plan and functional flexibility, the project introduces some open building infill systems and design innovations. For instance, in order to freely organize the plumbing system, the Matrix Tile raised floor system is installed. The metal stud wall system keeps the possibility of floor space free division. Besides, the façade system is also designed specifically in order to achieve the individual customization.

Reflections:

Practically, the fact is, the application of these innovative infill system will bring a lots of construction problems and detailing difficulties. For instance, the use of Matrix Tile raised floor system or not is depended on the interior function. Therefore, there suppose to be two different finished floor altitudes and it is difficult to define a standard altitude for each floor especially for the construction of stairs and elevators. Besides, the mass-customized and demountable façade panels also cause some detailing difficulties especially the making of insulation layers and not to mention the joints detailing of the façade panels.
3. 'Front Image'

The creation of ‘front image’ intends to formulate the vertical neighborhood and represents the idea of diversity and identity. Through the setback of front façade, an open buffer space, which can be defined and decorated by individual users, is inserted between the public corridor and private space. This space can be used as entrance space, front yard or balcony.

Reflections:

However, the insatisfaction is, the absence of sunlight (north orientation scenario) may affect the expected the atmosphere. Also, in this case, the buffer can hardly be used as front yard or balcony.

Besides, the designed building elements such as exterior corridors, stairs and setbacks may block part of the sunlight in to interior space.
4. Back Side

In order to achieve a rhythmic exterior while in the same provide certain user-flexibility such as interior sunlight preference, visual contact, interior decoration and climate solution.

But the idea of customizing sunlight condition also depends on the façade orientation. And for dwelling purpose, this part of the façade cannot be turned into balcony space because of the use of closed elements.

Additionally, the high costs of this type of mass-customization façade also could be economically problematic.
5. Ground Floor Coordination

The redesign of ground floor intends to create a public space both served for the residences of the building and the surrounding neighborhood. Instead of the original office units, a set of commercial blocks along with two inner streets is introduced in order to bring more living functions to the neighborhood. Besides, the existing outdoor parking space is turned into a park to provide a leisure space and achieve a more pleasant visual environment while the parking lot is invited inside of the building.

Reflections:

However, to be practical, the neighborhood currently is still a business district. Therefore, the decision of introducing commercial space to the site seems to be immature.
6. Market

The purpose of this project is reusing the existing vacant office building and converting to other uses. Different from normal product, this project provides certain user-flexibility in dimension, functionality, and interior layout. Therefore, the potential customers would be those people who have an unstable lifestyle such as students, young couples, designers, artists and so on.

On the other hand, because of the extra construction cost on flexible infill system and mass-customized façade, the selling price will be much higher than average. However, these aforementioned target groups do not have very strong purchasing power. Besides, the location of site does not belong to a high-end neighborhood. Therefore the project can hardly be defined as a high-grade property and it will be difficulty to attract rich buyers. This contradiction between the expensive costs and geographic disadvantages could be problematic when the product is finally released to the market.

The characteristic of the project is that the property can provide flexibility and be adaptive to demand change in a very long period. Comparing to conventional project, beside the higher initial investments, the collecting cycle also would be relatively long. So, how to balance the financial plan via appropriate development mode and make it more economically feasible will also be a challenge.