

ARCHITECTURE AS MEDICINE

Reusing abandoned Dutch-colonial architecture for health care applications in coastal Java, Indonesia

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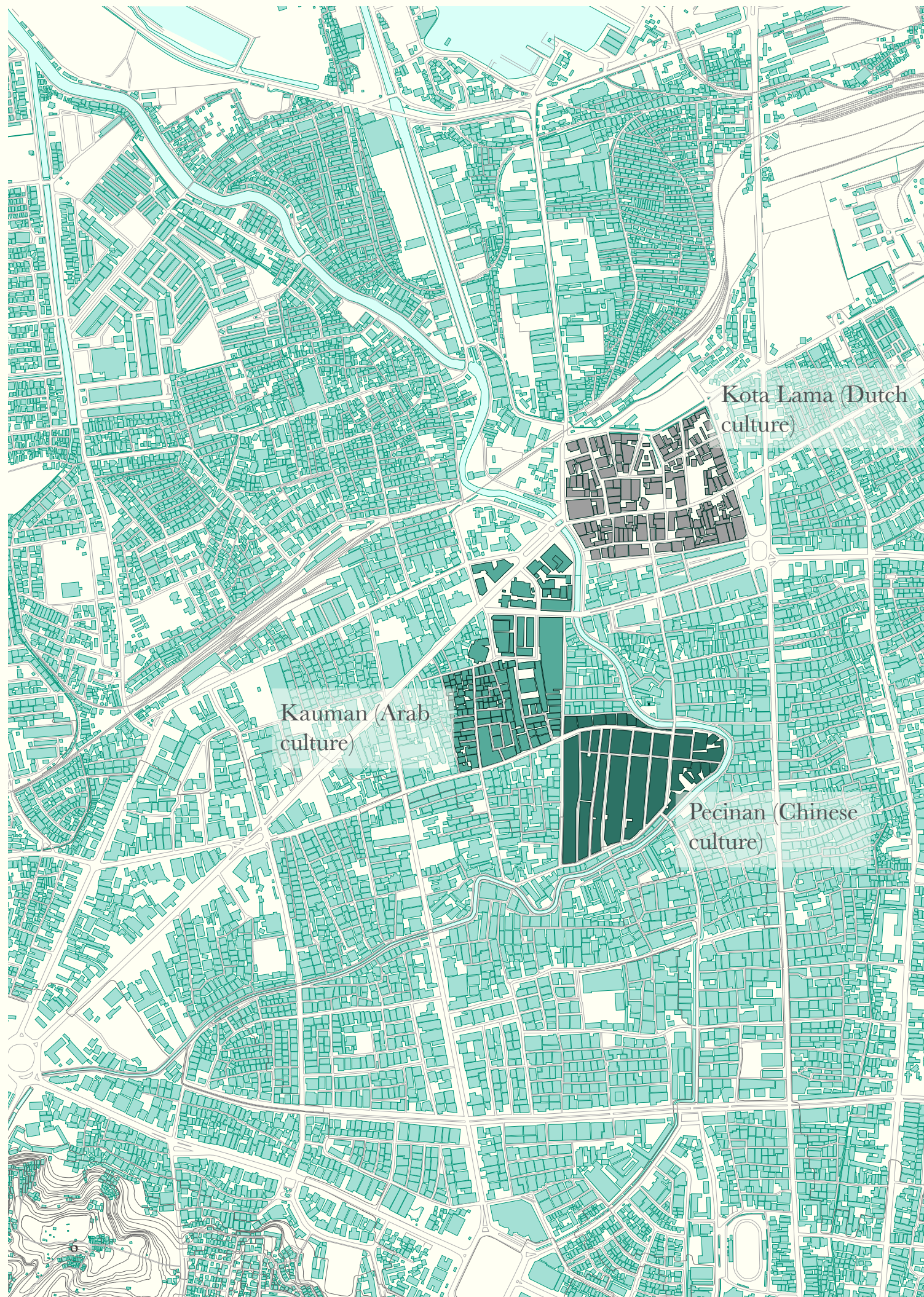


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INTRODUCTION

Semarang is one of the three large historical harbour cities on Java, Indonesia. The historical centre of the city is characteristic for its colonial set up. The various ethnic cultures in Java initially lived together but the arrival of increased numbers of Western immigrants gradually created a segregated society (Roosmalen, 2005a). This system is still very visible in the historical city planning of Semarang, as shown in this figure: Kota Lama is the historical colonial-Dutch neighbourhood, Pecinan is situated on the south of that and is the Chinese neighbourhood. The Arab neighbourhood of Kauman is in-between these neighbourhoods. During colonial times, the indigenous population would live all around these centres.



PECINAN

Pecinan, the Chinese neighbourhood of Semarang, in the south of the historical districts is lively and its markets and shops are popular and well-known throughout the city. Buildings therefore have always been in use. Although they have been adapted through time, most houses kept their Chinese character and its passive climatic strategies.



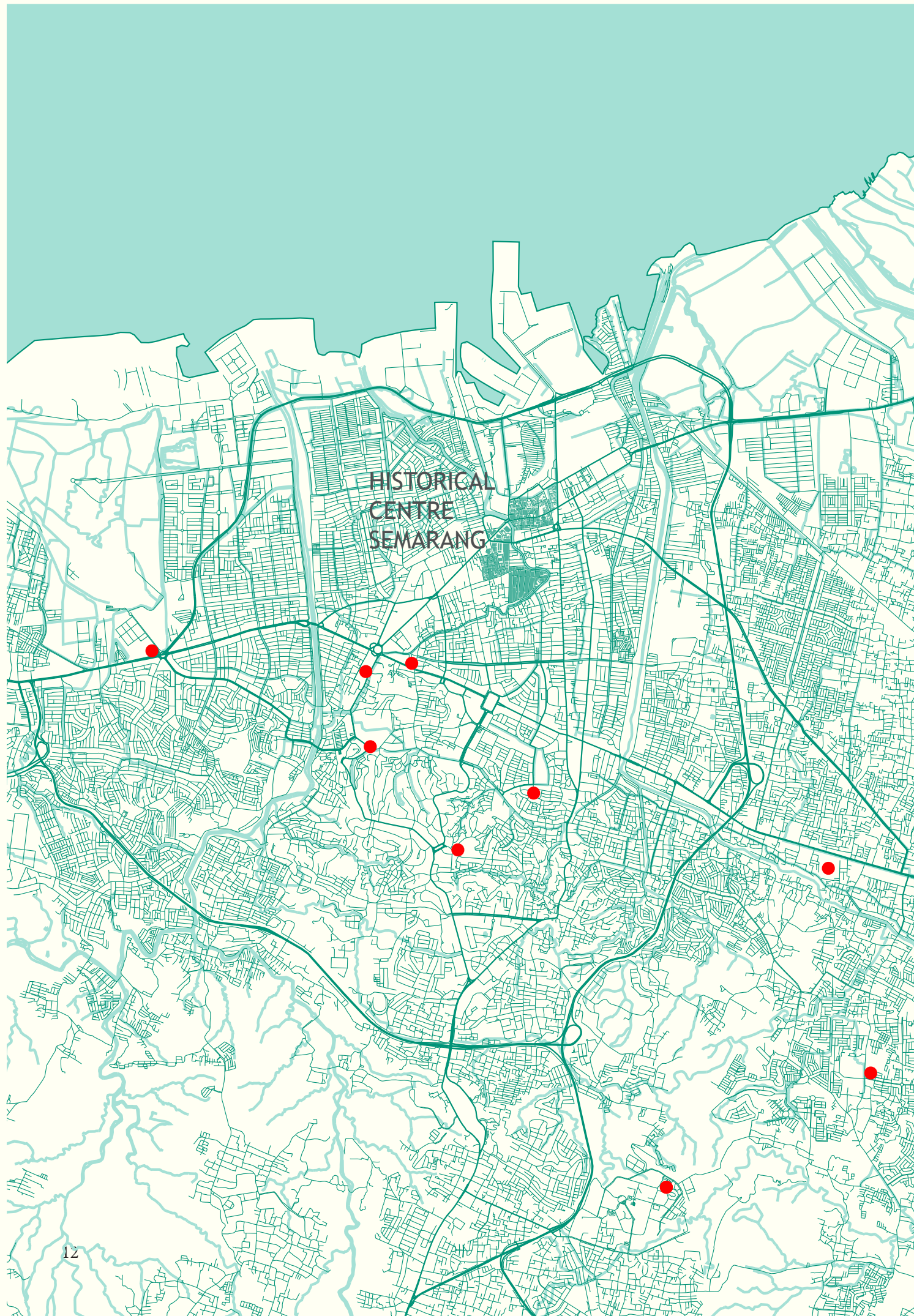


KOTA LAMA

Kota Lama, the Dutch neighbourhood however, is quiet. Only the main streets are visited by tourists. After Indonesian independence, the Indonesian War of independence and the Bersiap caused Dutch and Indo-European citizens to move abroad, leaving historical neighbourhoods such as Kota-Lama empty. In the young republic, generally speaking, there was no interest to maintain the buildings, but there was also no interest to demolish them.

During the last few decades the city of Semarang has been expanding rapidly. Nowadays, the historical centre of the city is not central anymore.





URBAN GEOGRAPHY OF HOSPITAL LOCATIONS

During the past few decades, a vast expansion of cities due to population growth and urbanization occurred. Many of these large cities are situated in less developed countries like Indonesia, where the problems of providing adequate health care are immense (Mayhew, 1986). In Semarang for instance, one of the large Javanese coastal cities, the functions which require a lot of space, such as health care facilities, are likely to be located in the peripheral, newer neighbourhoods, where space is still available. And so, the dense cores of these cities lack medical functions.

The geography of health care systems is rarely given much importance and yet, the availability of health services to the population, in terms of hospitals, clinics and other facilities, is strongly influenced by their location (Mayhew, 1986). During more certain times, Indonesia's health care system already has to deal with challenging circumstances. As the scarcely distributed and non-inclusive character of the Indonesian health care system has to deal with one of the biggest crises in medical history, opportunities arise as people are forced to focus on the distribution of health care services. This awareness around health care distribution, activated by the COVID-19 crisis, could accelerate the increase of availability and distribution of Western medicine in Indonesia.

As Dutch-colonial buildings are available in the centre of large Javanese coastal cities, transformation could provide a solution to the lack of appropriate places for the establishment of health care institutions. In this graduation project, a possible role for Dutch-colonial architecture as host for medical applications is explored. The technical possibilities of Dutch-colonial buildings, regarding their ability to adapt to the Javanese climatic circumstances and their structural integrity have an important role in the project.

NATURAL VENTILATION IN TROPICAL MEDICAL ARCHITECTURE

While most new developments in Semarang are using air conditioning systems within completely sealed, concrete and glass buildings, the structures in the historical Dutch-colonial district are overlooked. In the figure, you can see that historical architecture, provided that they optimize their ventilation flow, can lower the risk on airborne contagion, even more than an air-conditioned building could accomplish. In the corona pandemic this forms a substantial quality.

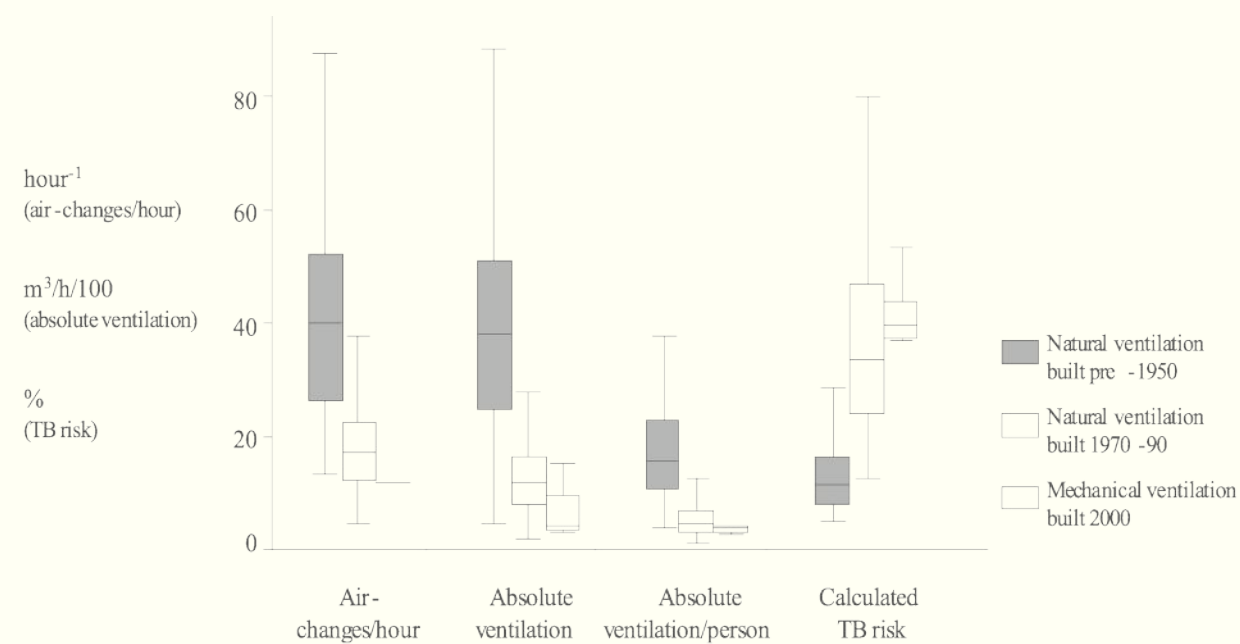
One important quality any ventilation system should have is the prevention of airborne contagion. You simply don't want contaminated air to be transported through a building. This is very important in the corona era, but also for more usual diseases in Indonesia like Tuberculosis.

Because of the location of the colonial Dutch architecture, and its qualities in providing natural ventilation, in this research the possibility of installing health care applications in historical Dutch-colonial buildings is investigated.

The research question therefore is:

How can centrally located Dutch-colonial architecture serve as a foundation for the development of a socio-cultural and socio-economical based health care facility, in order to develop a more inclusive medical system in Indonesia?

The local climatic circumstances and the local customs and traditions should be considered when answering the research question. The answer to the research question has the form of a proposal for the reuse of a particular building that is suitable to explain the impact of the design on the Dutch-colonial architecture.



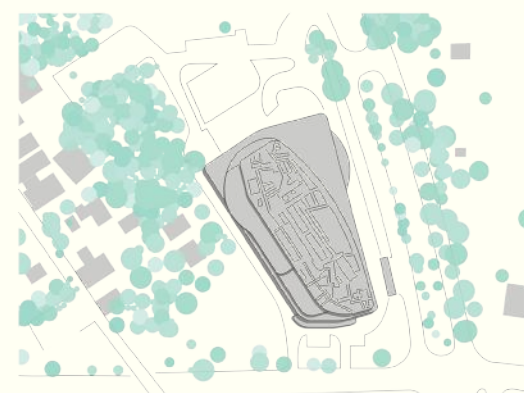
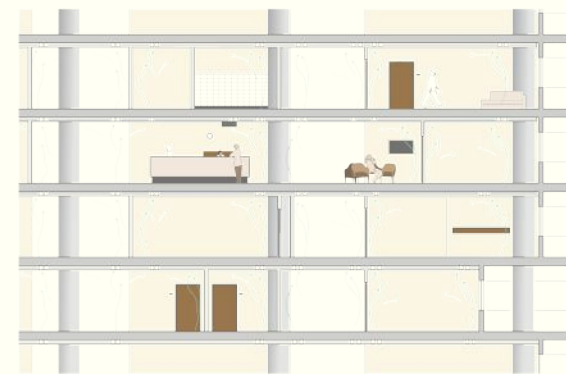
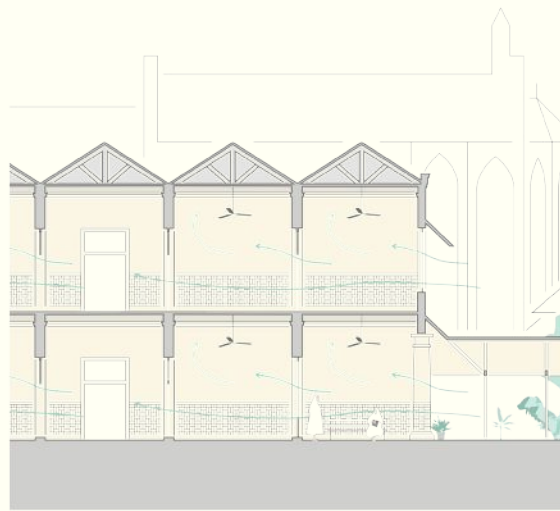
(Escombe et al., 2007)

LOCAL CLIMATIC CIRCUMSTANCES

Whether a natural ventilation system is able to reach all spaces in a building to supply fresh air, relies on pressure differences. As temperature and humidity differences are difficult to generate in the Javanese coastal climate, which is particularly warm and humid all year round, pressure differences are most practical to establish by using a natural ventilation flow, based on wind power.

In this figure the natural ventilation system becomes visible as important characteristic of Dutch-colonial architecture. Modern architecture offers a ceiling height of only three metres, and usually is completely sealed from the environment. The old building, has ceiling heights of five metres. The outside air is cooled down and freshened by the surrounding gardens, after which it enters the interior spaces.

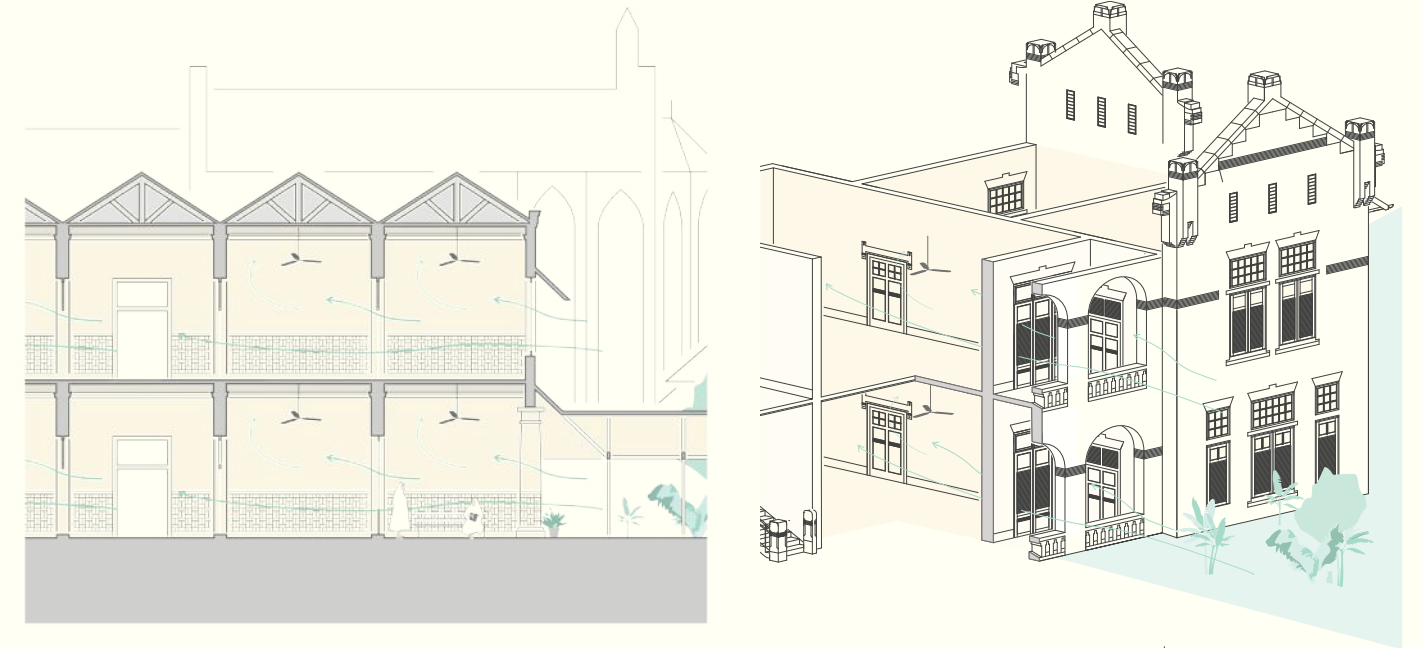
The building on the left is a historical, Dutch-colonial hospital building in Semarang. In this building, opposing the way modern hospitals are built nowadays, the Dutch used local methods to establish a natural ventilation flow throughout the buildings. Characteristic for this adaptation to the local climate are the numerous gardens to provide clean air, corridors to resist the intense sun, and the adaptation of openings in the facades that allow fresh air to flow into the interior spaces continuously.



St. Fransiskus of Assisi, Semarang
2500-5500 m³/h
10/20% TB risk

RS Pondok Indah Bintaro, Jakarta
800-1200 m³/h
40% TB risk





Promising, when speaking about the possibility of using Dutch-colonial architecture for medical applications, is that the climatic strategies of this ancient hospital, here on the left, are not unique, and can be recognized in other Dutch-colonial architecture. In figure above, a comparison is made in climatic design, between the historic hospital building and a former Dutch-colonial office building. These two buildings use a similar approach in creating a natural ventilation system, while blocking direct sunlight from the interior space.

MEDICAL CULTURE ON JAVA

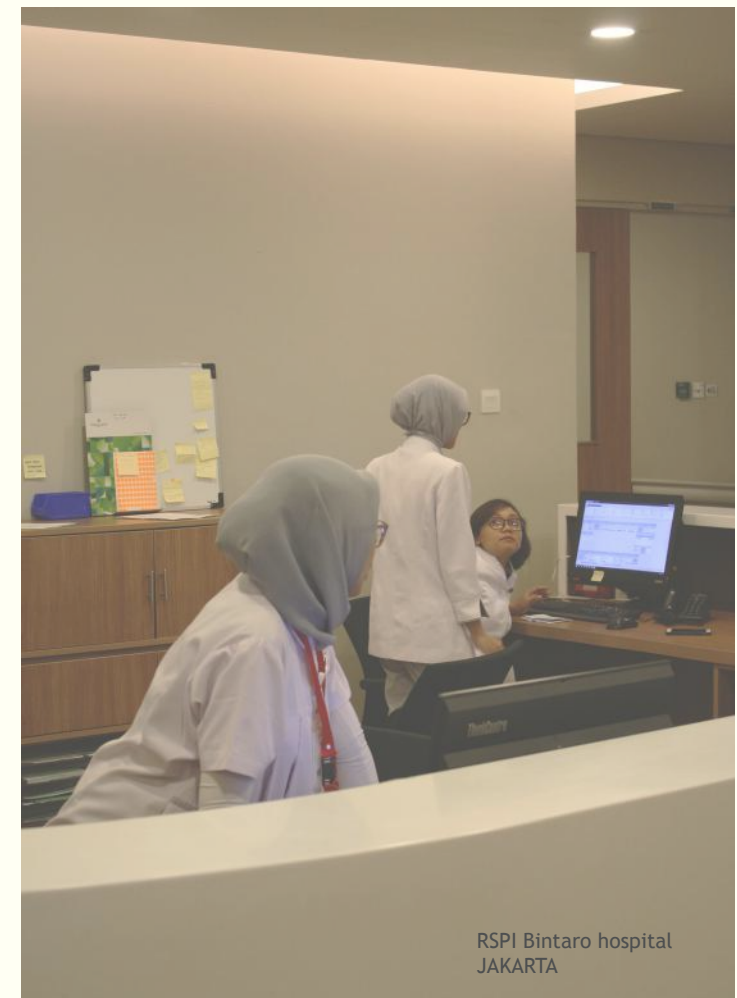


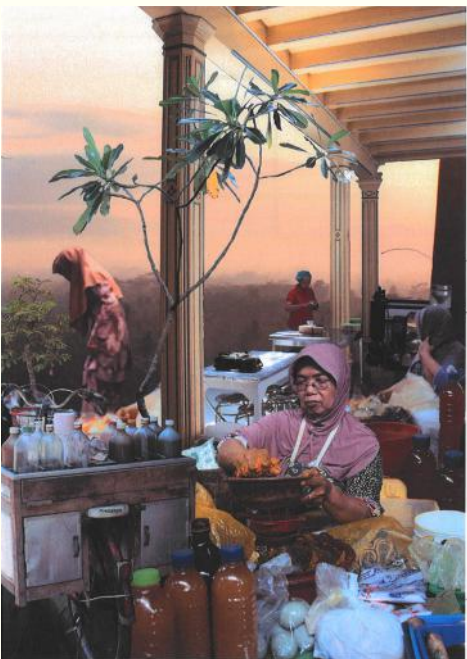
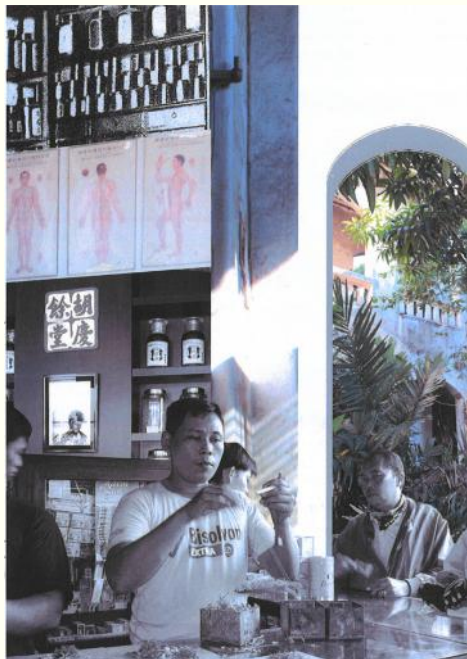
The diversity in strategies in which health care is distributed in a country – besides the aforementioned urban morphology – is also linked to the national identity, the history of a country and the country's prosperity. The Indonesian health system has developed rapidly during the past decade. For the first time, lower income citizens of Indonesia got the opportunity to purchase a health insurance which is based on their income. But there are many historically-rooted reasons why people who rely on this new insurance system are hesitant to use it. The historical background of the Indonesian health care system is explored by a literature study.

An important conclusion that can be extracted from the literature study regarding the historical background of the Indonesian health care system, is the fact that the traditional and Western medical systems in Indonesia once were working together in order to find ways to help the 'indigenous' population and to extract local knowledge for Western medical publications. Nevertheless, also inequality and exclusivity were very much part of Indonesia's health system during colonial times. Some traits of this historical background can be recognized in the privatized character which is exemplary for the health care distribution in the present-day Indonesian society.

The design proposal should reflect Indonesian society and the future needs. During the last decades lower income citizens of Indonesia got the opportunity to purchase a health insurance which is based on their income. But there are important, historically-rooted reasons why people who rely on this new insurance system are hesitant to use it. And for an important part this started during the class system in colonial times.

Every population group on Java during colonial times, had its separate market of medical goods and services. There was only overlap in the field of native herbs: These herbs often were provided by the Chinese and were then used by the indigenous population, the Chinese themselves and by the European practitioners and their patients (Hesselink, 2009). Nowadays, the medical system on Java is still segregated, but the common use of native herbs in all different groups of Indonesian society is also still present. In the proposed design which forms the conclusion of this design project, the diverse local cultures are therefore combined with the Western system. So how could such an inclusive medical system in the Dutch-colonial neighbourhood of Kota-Lama in Semarang look like?



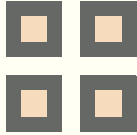
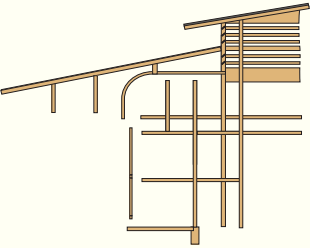
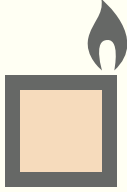
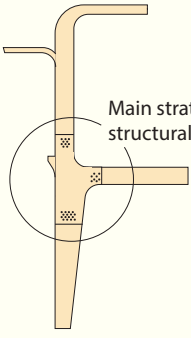


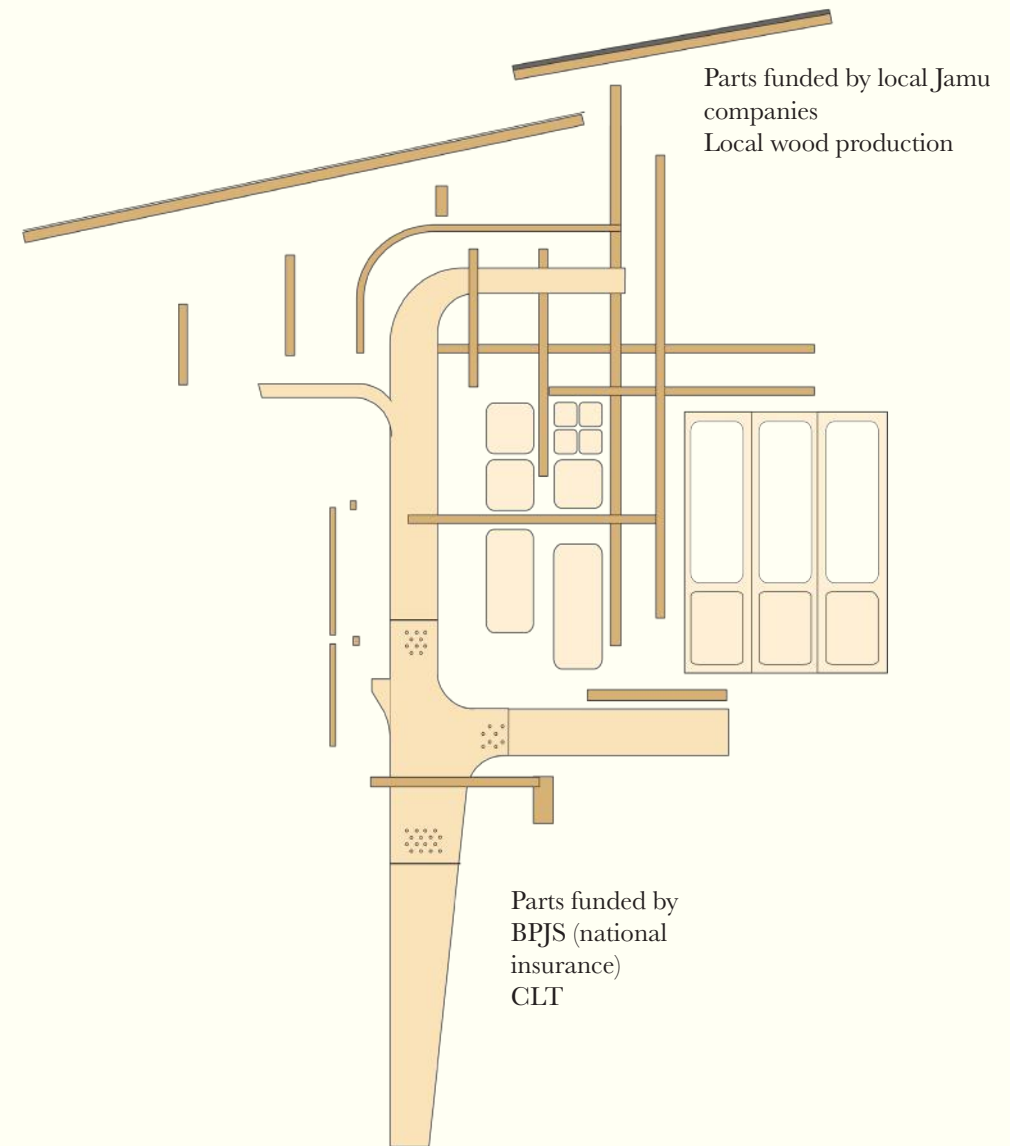
There are three types of medical systems on Java. The Jamu industry, the trade and fabrication of indigenous herbs, should be closely connected to the exterior, the herbal gardens. The Western medical use benefits most from proper ventilation and stability for technical appliances. Therefore this system should be placed on a higher level, where the wind is stronger.

The traditional Chinese industry, benefits from similar use, on both levels.

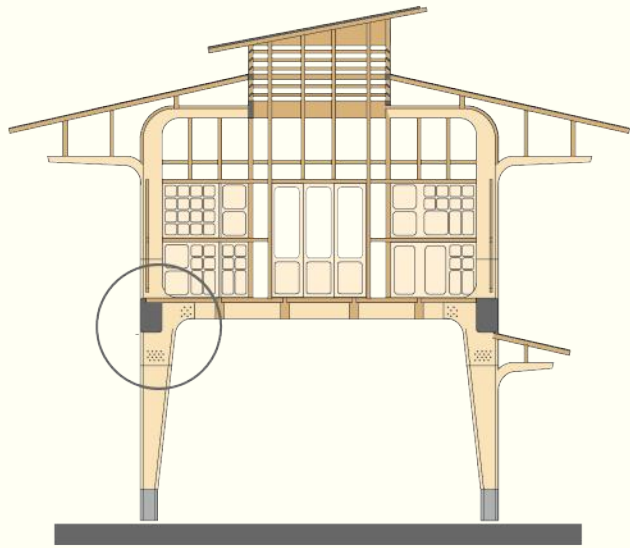
DESIGN STRATEGY FOR REUSING DUTCH-COLONIAL ARCHITECTURE FOR MEDICAL APPLICATIONS

The design which is developed in this graduation project is a modular system which should be easy to replicate in segments. In this way, the new medical function can be tailored to fit the existing structures in coastal Java. Also, a larger or smaller extension can be developed to host a small inpatient ward. The modular system exists out of prefabricated, columns and beams, and the infill and roof structure are made out of local wood. The prefab elements have a relatively long lifespan, while the infill can be adjusted and replaced within a shorter interval. The Fire resistance of the base structure is important, to create a proper evacuation time in case of a calamity. The infill could be existing out of recycled wood from local sources. This material will give the structure a local identity. The form of the structure is developed in such a way, so that it can be cleaned properly. And it supports the wind flow patterns. Cabinets are placed in the wind direction to support the main wind flow.

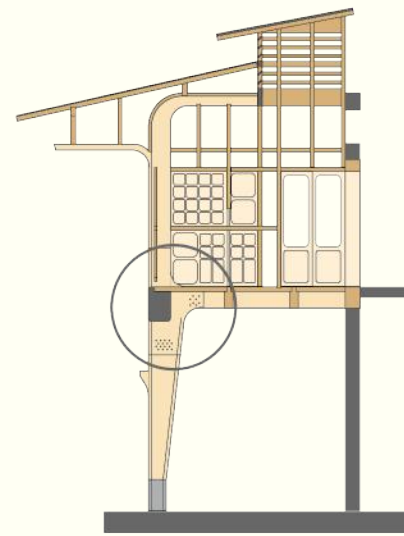
	Charring and remaining integrity of the wooden structure	Structural design
Local timber supply		 <p>Life span of +- 30 years Open for own interpretation of user Made by local manufacturer</p>
Pre-fabricated timber supply for main load bearing structure	 <p>$f_{char} \beta = 0,7 \text{ mm/min}$ (for solid hardwood with a characteristic density of 290 kg/m^3. Method after ir. T. van Huijstee (2014)).</p> <p>30 minutes gives a char layer of 21 mm</p>	 <p>Main strategy for structural integrity</p> <p>Life span of +- 60 years Established design Manufactured in factory</p>



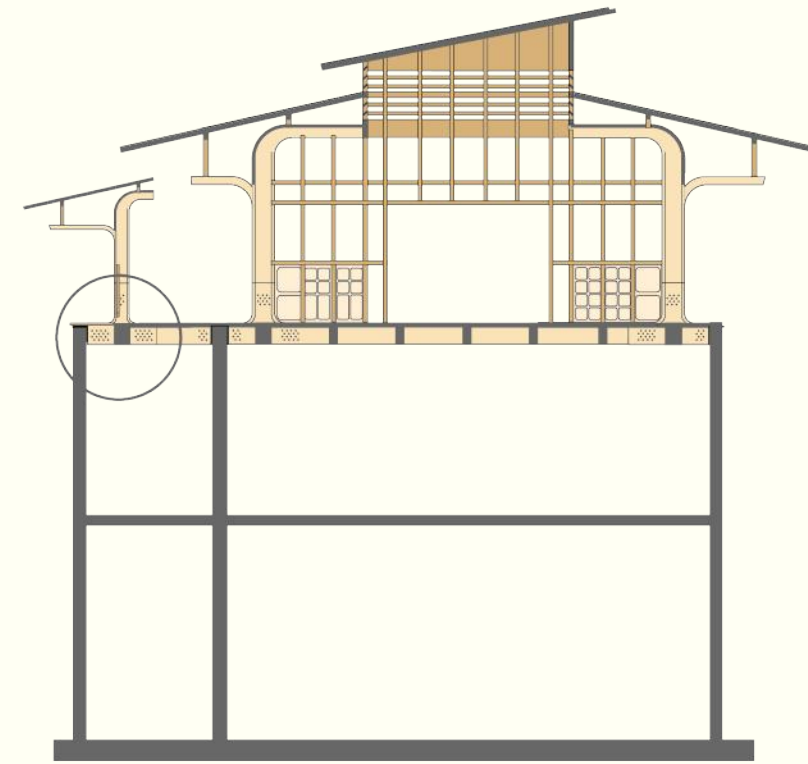
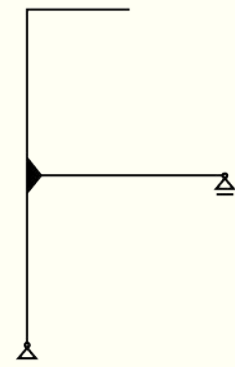
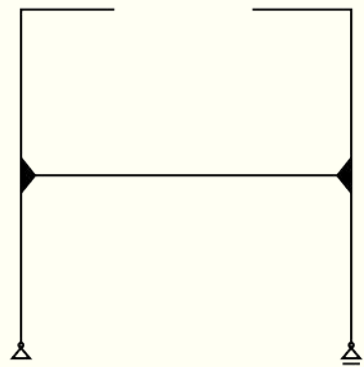
Structural integrity is created by the connections in the prefabricated structural elements. For buildings where a horizontal ventilation flow is not suitable to establish or to restore a climatic system, a venturi system is developed.



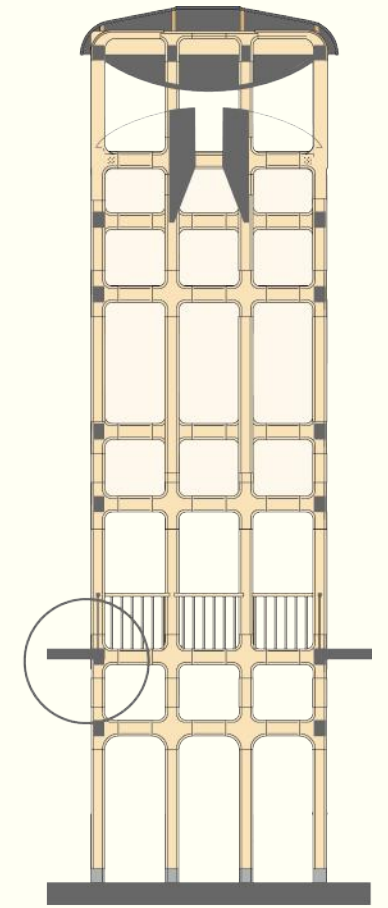
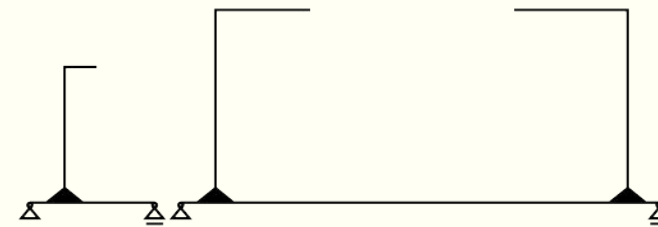
External ward



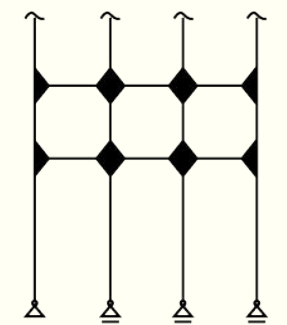
Extension

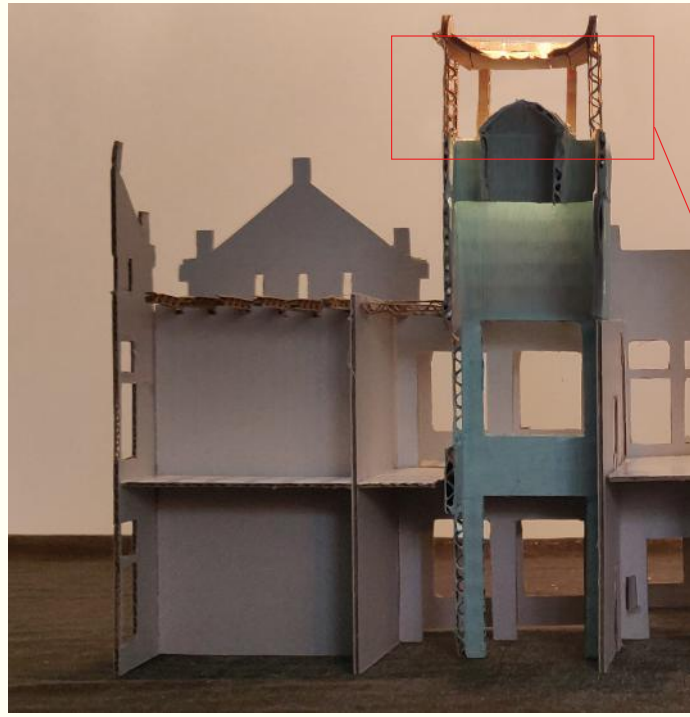


Roof system

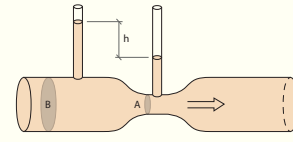


Venturi system

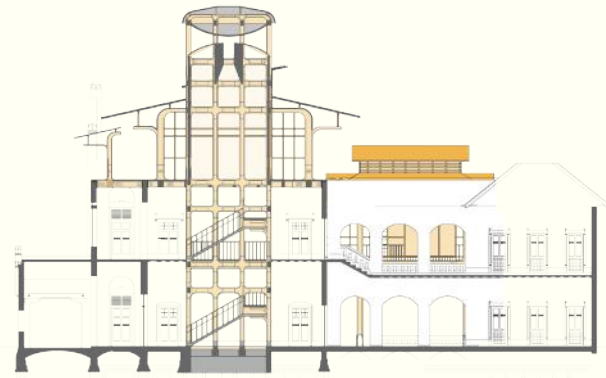
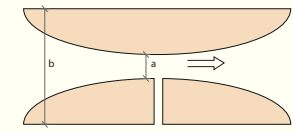




Venturi effect to create wind-induced natural ventilation in the hospital building



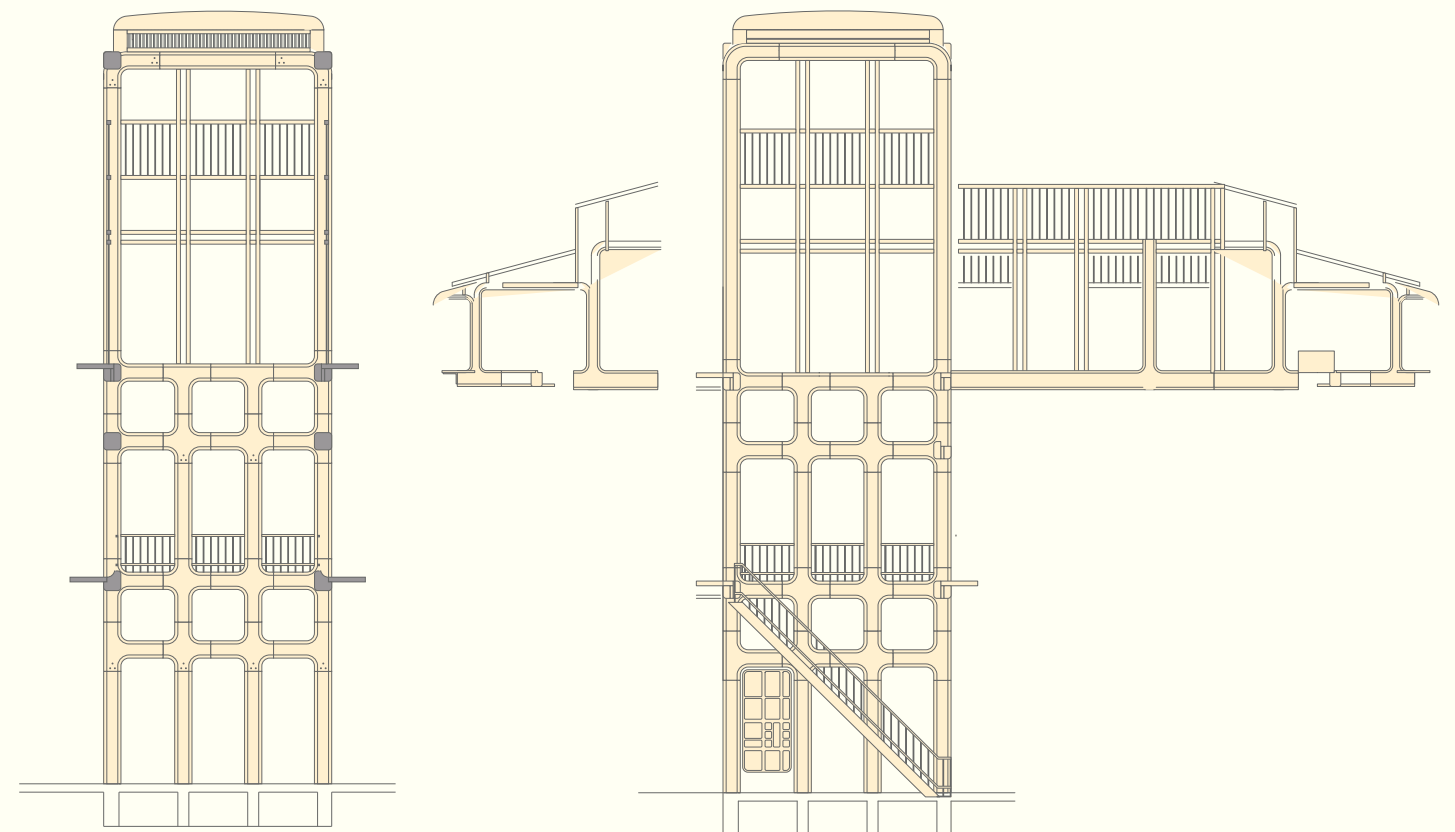
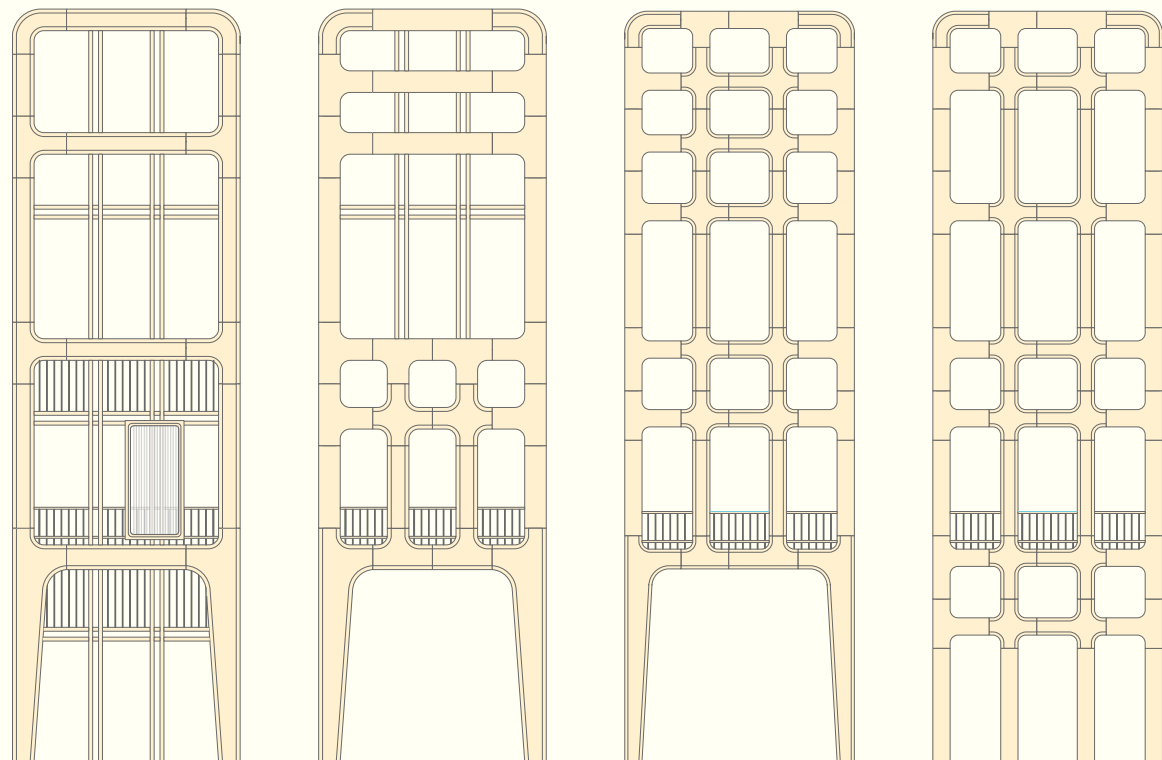
Contraction ratio: $a/b=0.2$ (Kemperman 2012)

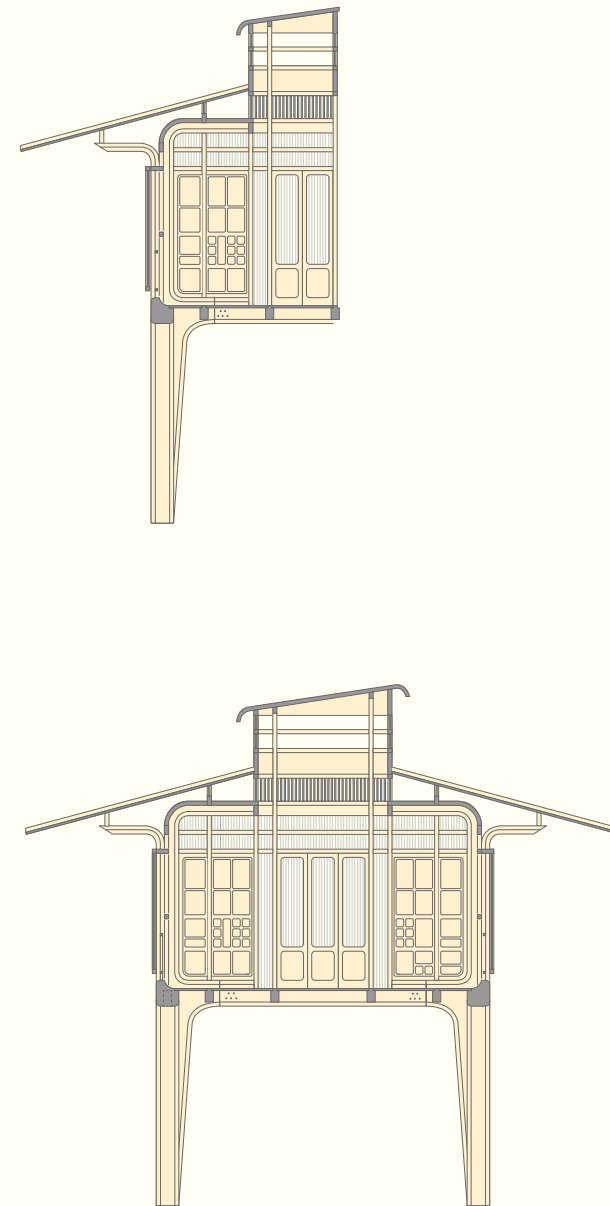
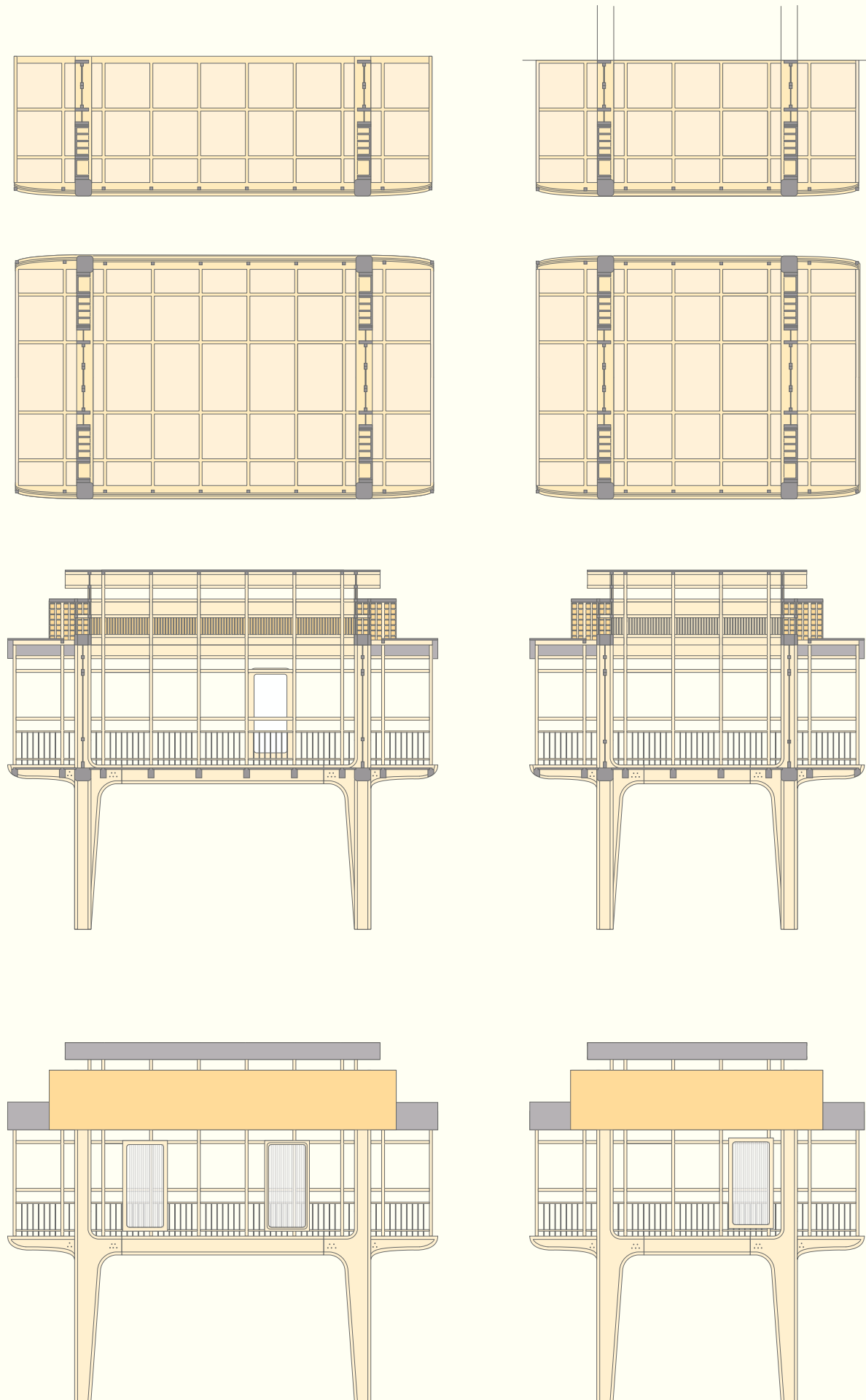


The venturi system holds a special place in the proposal, because it functions as a core and therefore needs to carry the loads of the existing floors of Dutch-colonial heritage. The Venturi system can be placed in the middle of a building to extract the air in a vertical direction. Together with creating this ventilation flow, the venturi core let light enter the interior spaces of a building.

The venturi core can also be used as staircase.

To fit many different Dutch-colonial buildings, multiple variants of the Venturi core are developed for structural purposes of different number of floors.





Additions to buildings can be created by using this modular system, which is designed for horizontal cross ventilation. It uses a basic grid system of 1,5 by 1,5 metre to maintain the basic notion of keeping social distance. This grid is also used in the walls. The walls have many storage opportunities for the use of the patient and the personnel, or in the case that the extension is used for Traditional Chinese Medicinal purposes, the storage can be used to store herbs. As all elements are made out of wood, they can absorb a certain amount of moist, and release it when the air is dryer. The wood also allows elements to be repaired, instead of fully replacing them.

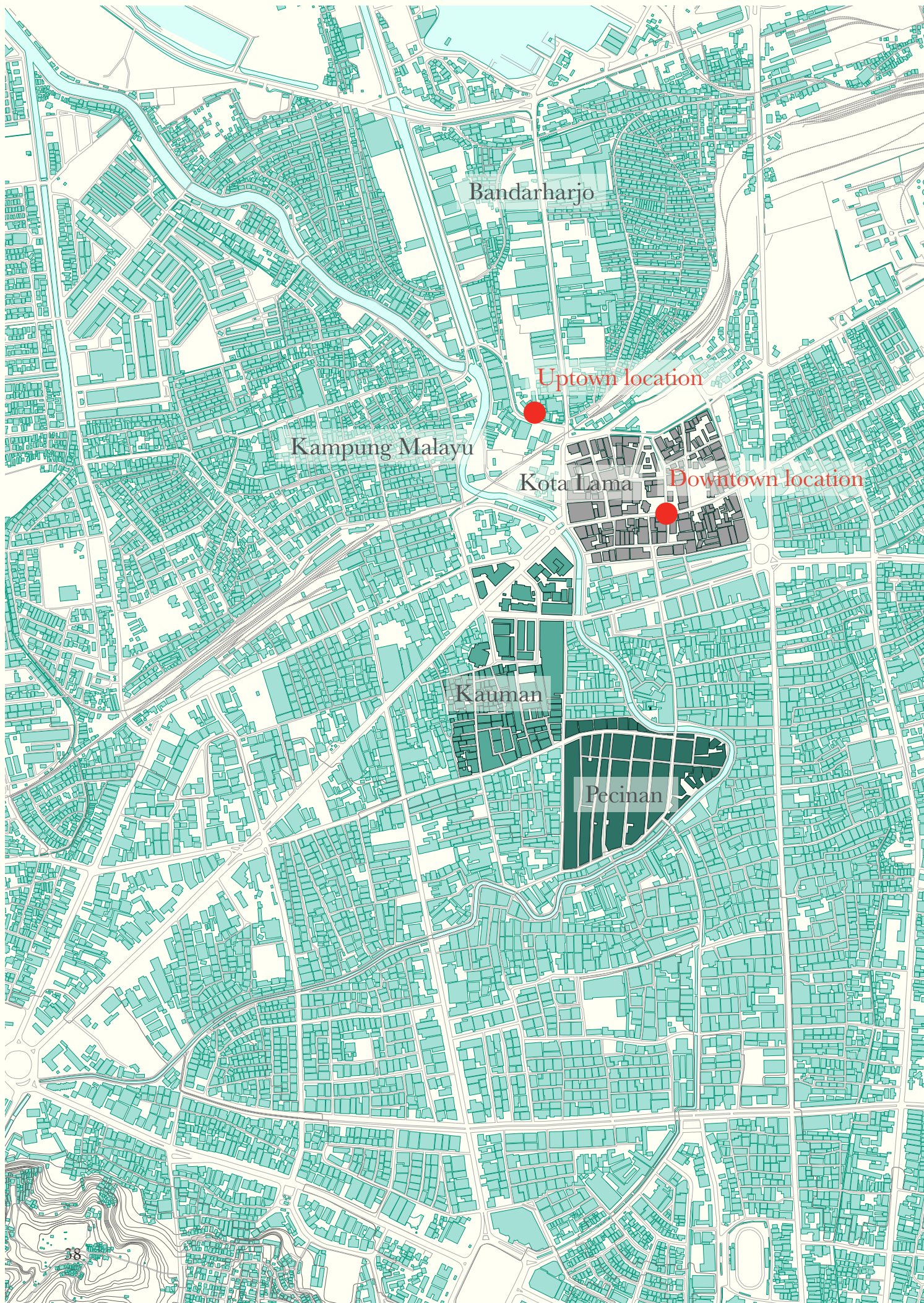


The extension is based on the idea of creating the best combination between opening the interior to let wind ventilate the space, keeping sunlight out while keeping the interior light, and a view on greenery which comforts patients.

The modern Indonesian society cannot be separated in clear segments of traditional and Western medical services. And so it is here combined in one environment, on different levels.



The column which was developed for the extension will indicate the use of the space which it supports.

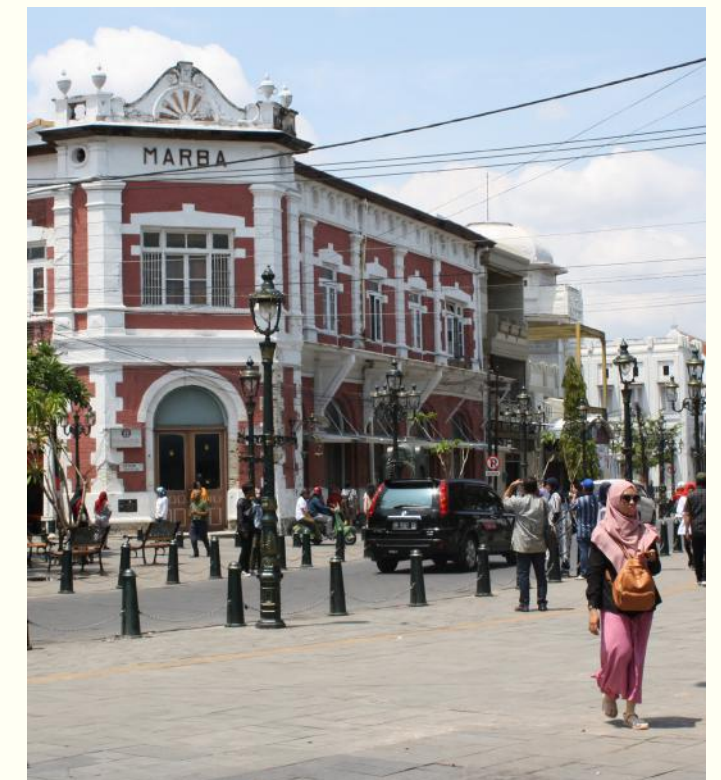


IMPLEMENTATION OF THE STRATEGIES IN KOTA LAMA SEMARANG

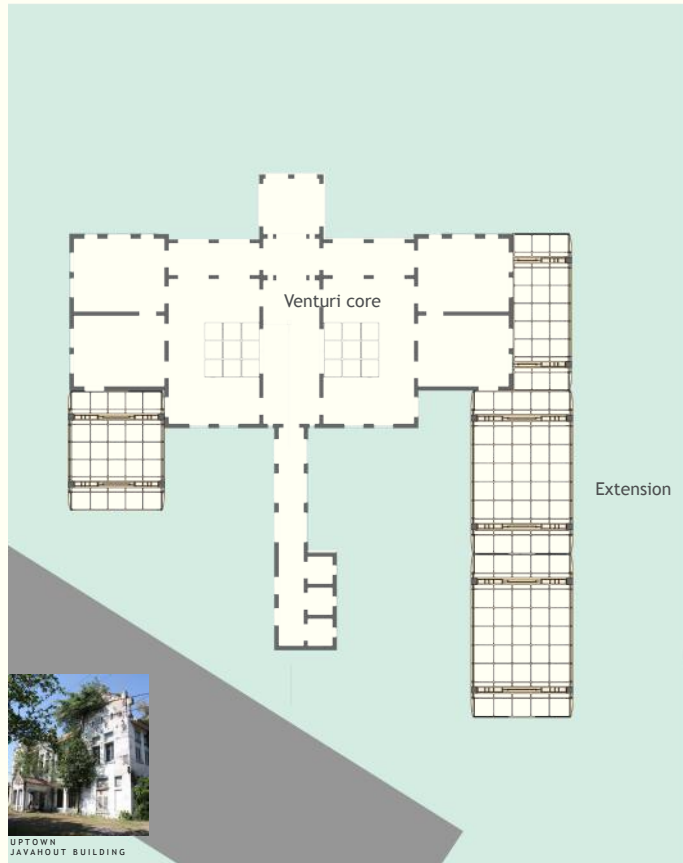
The use of the modular systems in this design proposal will be demonstrated by showing the effect they have on two historical structures with different needs. There are downtown circumstances: The transformation and reuse of the historical MARBA building and there are uptown circumstances: The transformation and reuse of the historical Javahout building. The main difference between these two circumstances is the availability of open space and fresh air, which in the uptown case is considerably better than in the downtown case.



UPTOWN
JAVAHOUT BUILDING



DOWNTOWN
MARBA BUILDING



Uptown version space to install more extension and to use horizontal wind flow.



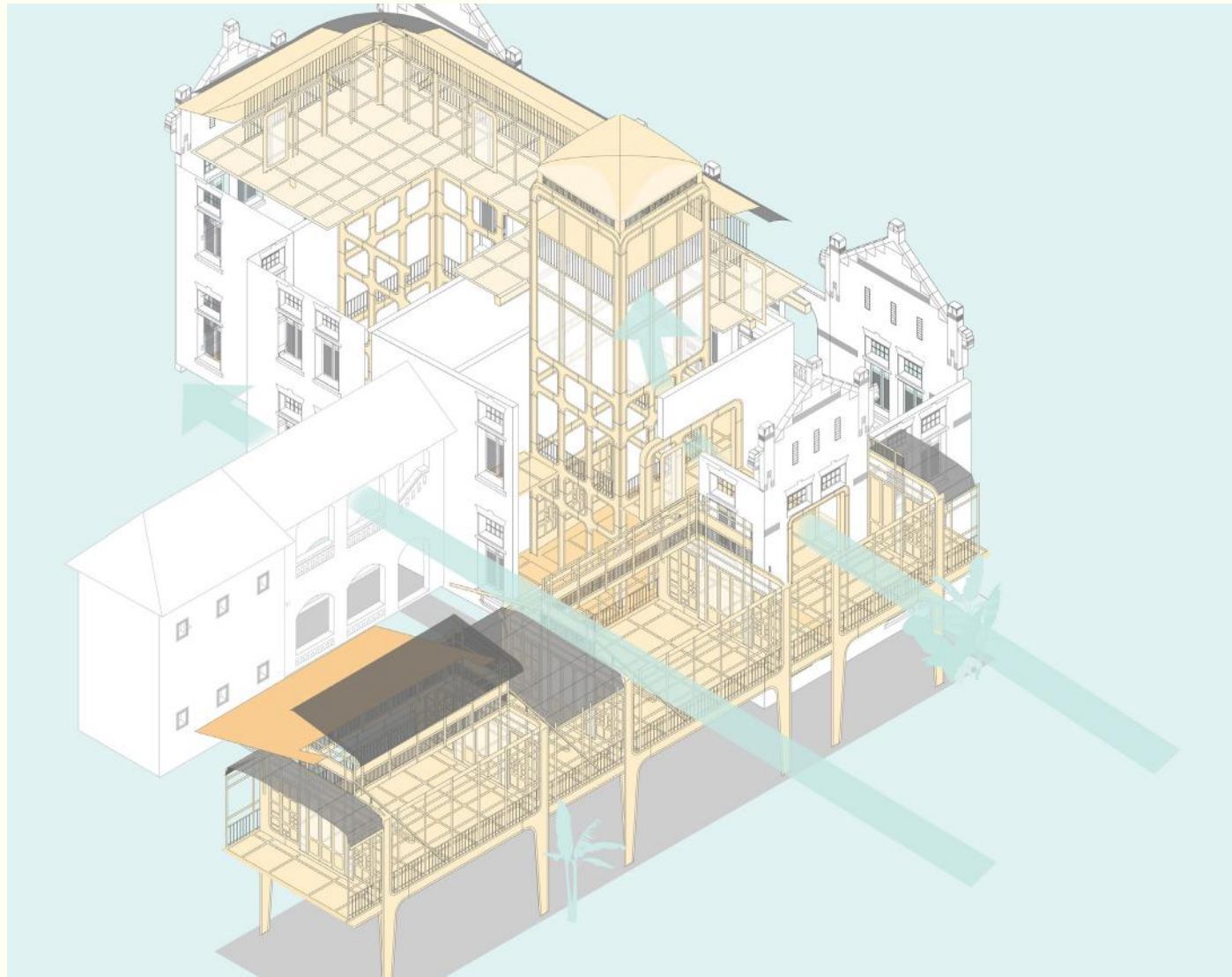
In the downtown version, a vertical flow pattern is made possible by the Venturi system. The small courtyard can cool down and freshen the incoming air.



UPTOWN JAVAHOUT BUILDING



DOWNTOWN MARBA BUILDING



An elaborated design is explained through the implementation of the modular system in the Javahout building, the uptown location as all modular elements are present in this strategy to convert this building.

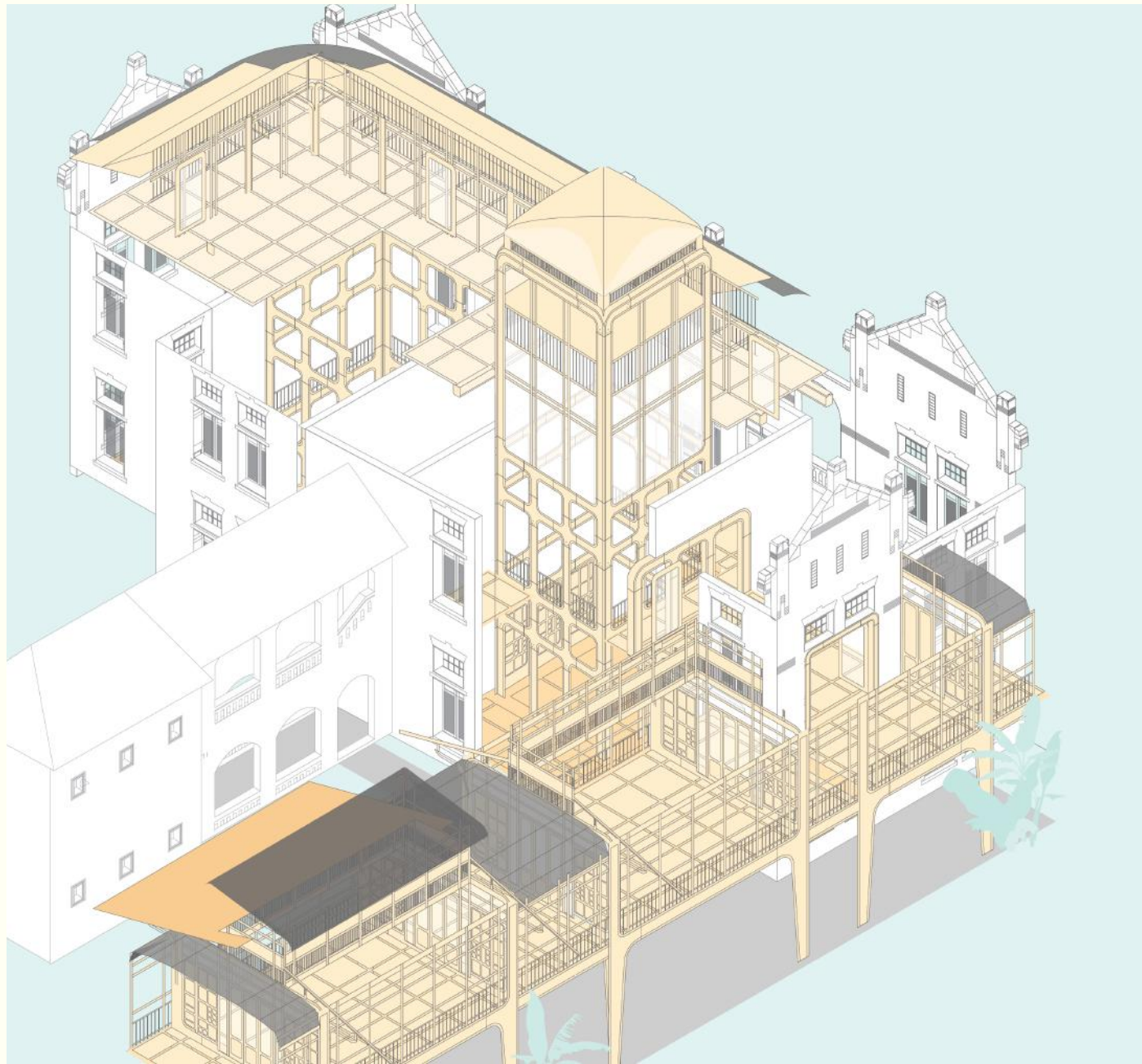
There are two strategies in the Javahout situation: The vertical flow established by the venturi system and the horizontal flow that ventilates the extension.

This is how we can reuse Dutch colonial architecture, to host medical applications: Using Lightweight materials to create a modular system which is adjustable and which enhances the existing climatic qualities of the heritage buildings. But this conclusion on its own leaves one issue unanswered. To make sure right choices are being made when implementing this system in Dutch-colonial architecture, we have to address what the cultural value is of this architecture and which elements therefore cannot be altered or taken out.





Colonial architecture, as product of multi-ethnic societies that are the result of cultural cross-fertilization, often does not fit in with Western criteria (Wright, 1991 in Roosmalen, 2005a). Therefore, specific qualities and characteristics should be acknowledged so that this heritage is not considered as merely a derivative of Western culture (Roosmalen, 2005a).



CONSERVATION STRATEGY

The Javanese architectural traditions, deployed for the colonial dutch architecture, makes these buildings unique. To maintain these qualities for future generations, the reuse of Dutch Colonial architecture is not a matter of placing it in a museum, but rather to acknowledge these qualities by using it. The conservation strategy should therefore fit Indonesian standards.

As the design proposal adds to the comfort-level of the user, it creates opportunities to conserve the strategies of vernacular architecture. To keep the traditional way of doing things operative within present day mass culture, a combination between the old and the new is necessary. By making the medium suitable for present day use, meaning can be given to history.

In this dialogue between the new and old, the qualities of the past are maintained for future generations, while the usability is adapted to operate in a modern Indonesian society.



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