MASTER

(Sustainable) reconstruction of World Heritage property

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Sustainable reconstruction of WH property
INTRODUCTION
The historic centre of Galle, best known as Galle Fort, is situated on the southwest coast of Sri Lanka and is considered as being the best example of a fortified city built by Europeans in south and southeast Asia. It was listed as World Heritage in 1988, under criterion (iv), for being considered "an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history".

In addition to its international recognition as World Heritage the historic centre of Galle is also a living settlement, which needs to evolve in order to meet the development needs of its citizens, preferably in a sustainable way. In the previous research, sustainable development was defined as development that should meet the social, economic and ecological needs of the present generations, "without compromising the ability of future generations to meet their own needs" (Brundtland, 1987) nor "adversely impact the Outstanding Universal Value, integrity and/or authenticity of the property" (UNESCO, 2008).

RESEARCH MOTIVE & PROBLEM STATEMENT
The WH site being a living settlement, the development of the city seems to conflict with the protection of its cultural heritage. The need for development jeopardizes the historic centre of Galle. As the society has changed over time, pressure for developments and upgrading within the fort is being felt, in order to address evolving needs of its inhabitants in their day-to-day pursuits. In order to fulfill their modern day living needs, house owners have made and are still making ad hoc alterations to the historic houses on a large scale. More often than not, these alterations affect the outstanding universal value of Galle.

Some examples of these ad hoc alterations by house owners are the conversion of the original courtyard into an extra family room, reducing the open space and natural ventilation; addition of extra floor(s) and extension of floors to cover the whole house and building shut verandahs especially by the Muslim community in order to increase privacy. Multiple attributes which we identified in our previous research are affected as a result of these building activities.

In the earlier research report (Boemus & Fuhrer, 2011) many modern day needs of the local community living inside the fort were identified. For this case study, two development needs will be taken into account in reconstructing the historic building.

The first development need is the need for more privacy, which is widely represented among Muslim women and the older generation. As the Muslim community has grown to about half of the population inside the fort, this need has resulted in many verandahs being built shut, thus sustainable solutions for a proper implementation of this privacy need is a necessity.

The other development need which will be implemented in the historic building is change of use, as many house owners try to make a living by starting an in-house jewelry shop, guest house, or a grocery shop. Needless to say, these changes of use are often detrimental to the building typology. The historic buildings which were originally mainly used for living, have been put under pressure by functions for which they were not designed. With increasing tourism and more tourism potential awareness among the forts inhabitants, the expectation is that more people want to change the use of their houses.

As a result of both mentioned development needs carried out without respect to the OUV, the individual houses are rapidly losing their historic and typological identity. Moreover, in some cases the buildings have been altered to such an extent that they look like entirely new buildings. The scale in which these alterations are happening causes not only the individual buildings and their characteristic typology, but the fort as a whole to lose its integrity. In order to meet the development needs of the local community living and working within the fort without affecting the OUV and in particular the characteristic building typology, sustainable solutions are a necessity. Such a solution will be presented in the following.

PURPOSE OF RESEARCH
This case study will give a solution for the sustainable reconstruction of one of the severely altered historic houses of which as a result the OUV has been affected.
In the context of this historic WH property, and in line with the previous definition of sustainable development, I consider a reconstruction to be sustainable if the reintroduction of the building's typological building characteristics has increased its integrity; while at the same time development needs of the respective house owner(s) have been met.

The building which I chose to sustainably reconstruct is located on Hospital Street 24 (H24), inside the fort. According to Tharanga Liyana Arachchi (Project Planning Officer at Galle Heritage Foundation), this house dates from the same period of time as the adjacent building; the early Dutch colonial period. This adjacent building, Hospital Street 22 (H22), is considered to be one of the best preserved Dutch Period style houses of the fort. Although not in a very good condition maintenance wise, most of the characteristic attributes of this house can be identified easily.

Hospital Street 24 on the other hand, like many buildings inside the fort in the last decades, seems to be developed without any concern for its cultural significance and nowadays resembles little of the Dutch Period style house it once must have been. The severity of the imposed alterations to the building will become clear in the results section later in this report.

The Muslim house owners do not actually live inside this building and they have changed the use to a guesthouse with five guestrooms. As a result, the house owners are partaking in this living settlement. In the previous research we identified this as a trend of the social makeup of the fort changing rapidly, affecting the OUV.

For this case study, now, I have sustainably reconstructed H24. This means that on the one hand the typological building characteristics have been reintroduced wherever necessary, thus increasing the building's integrity. On the other hand and at the same time, the building houses a Muslim family that partakes in this living settlement and whose privacy needs are met, as well as the need for change of use to a guesthouse.

POSITION WITH REGARD TO SUSTAINABLE RECONSTRUCTION

As the historic centre of Galle is still a living settlement one could wonder whether or not the development needs of the community should be priority number one, necessarily at the expense of the OUV. After all, conservation must be considered a luxury in a developing country such as Sri Lanka. However, while that is absolutely true, we must realize that besides preserving a tangible piece of a significant stage of Sri Lankan history, consisting of multiple arduous periods of colonization, international recognition on the WH list has a positive effect on the local economy as well. From all over the world tourists come to the fortifications of Galle, of which the local community can gain economically.

The characteristic houses of the fort being a large part of the Outstanding Universal Value as determined by the States Party of Sri Lanka, each individual house plays an important role in the integrity of the WH site as a whole. Every house which is altered through building developments carried out without a concern for the OUV has a detrimental effect on the integrity of the whole site, and thus on the amenity value for tourism.

So, in this regard it makes sense for house owners to retain the OUV of their houses as they will benefit from the economic impulse generated by said amenity value for tourists all over the world who visit Galle. Vice versa, house owners affecting the OUV with detrimental building developments will directly affect the amenity value and the resulting economic impulse. As a result, the local community will not benefit economically.

Therefore, I would like to argue, not only from a conservation point of view but also in the economical interest of the local community, that it should not be self-evident to meet the development needs of the local community at all times. If these needs are not compatible with the OUV, as a result of which the OUV would be affected, they should not be allowed. However, development needs should somehow be able to be implemented by the respective house owner. How these needs do have the ability to have a voice in the sustainable reconstruction process will be explained in the following section about methods.
RESEARCH METHODS

Ideally, any reconstruction activity should be based on thorough typological, archaeological and historical research. In addition, in order to reconstruct sustainably, sociological, economical and/or anthropological research are a necessity.

- **Historical research** refers to the use of historical sources and other evidences by the means of which we are able to put identified building developments in the right historical context.

- **Archaeological research** of the reconstruction site would give great insight in the building's evolution throughout its history. Peeling away layer after layer might reveal authentic building elements, which were hidden by subsequent building developments.

- **Typological research** refers to the taxonomic classification of architectural characteristics commonly found in the buildings of the WH site. Comparing the architectural characteristics found at the reconstruction site with this taxonomic classification allows for adequate reconstruction decisions.

- **Sociological, economical and/or anthropological research** contributes in the understanding of evolving needs of the local community that might lead to building developments.

Together, the mutual complement of these disciplines will result in a sustainable reconstruction in which the interests of all stakeholders are represented. However, as the scope of this case study is mainly architectural the emphasis of the sustainable reconstruction of H24 is on the typological research. In the following I will describe the role of the four research methods used in the sustainable reconstruction of the case study.

Typological research

The attributes that were identified in the previous report form the starting point for the typological analysis. Among others, these attributes included many architectural characteristics such as an internal courtyard, fanlights above doors and windows, open colonnaded verandah and more, that are part of the building typology. A list of these attributes can be seen in figure 1.

These architectural characteristics have been identified and mapped for twenty-two reference buildings, which are considered to be representative examples of the historic building typology of the fort. This analysis forms a data collection to which architectural characteristics identified at the case study were compared.

If an architectural characteristic of the case study was in accordance with the typological analysis, no reconstruction activity was initiated. Even more, this characteristic of the case study was now considered to be 'typological evidence' with which other identified architectural characteristics of the case study would have to comply.

If an architectural characteristic of the case study was in conflict with the typological analysis, reconstruction activity was initiated. The conflicting characteristics are considered 'untypological evidence.' This untypological evidence affects typological characteristics. These were identified and collected in a scheme, which are to be seen before each result section. In order to reconstruct these affected typological characteristics, case study specific selection criteria were applied on the typological analysis. This filtering of typological data enabled me to find reconstruction alternatives which were closest to the architectural characteristics of the case study building.

Whenever multiple reconstruction alternatives appeared to be typologically valid, development needs of the house owner were allowed to 'choose' the reconstruction alternative that would meet that need the best. This way, the implementation of a development need of the house owner will at all times be typologically valid.

Archaeological research

The 'archaeological research' was limited to a careful study of more than three hundred photographs taken on site in the period of November 3rd, 2010 - February 4th, 2011. This study resulted in the creation of floor plans and sections, as well as the identification of the architectural characteristics of H24. These were then compared with the typological analysis of the twenty-two reference buildings to assess typological or untypological nature of this evidence, as stated
earlier in 'typological analysis'.

Historical research
Unfortunately, I was unable to collect much historical data about the reconstruction site. The only information that was available, was the statement by Tharanga Liyana Arachchi that the case study originates from the same period of time as does the adjacent building Hospital Street 22 which is part of the twenty-two reference buildings. This statement suggests that there might have been a resemblance between the two buildings which might of importance for this sustainable reconstruction.

Sociological, economical and/or anthropological research
From the previous research, the identified needs of 'change of use', 'privacy needs of the Muslim community' and the threat 'change of social make up' will be used.
Section CC'
Results

The results consist of the following:

Sequence of rooms
Central axis
Fanlights

Untypological evidence

Verandah
01 | Closed front façade
02 | Division of the front verandah
03 | False ceiling
04 | Raised roof
05 | Closed wall
06 | Open doorway
07 | Removal of front door (?)

Kleine Zaal
08 | Addition of bathroom block
09 | Addition of side window
10 | False ceiling (see 3)

Grote Zaal
11 | Closed wall
12 | Addition of side window (see 9)
13 | Closed window | doorway
14 | False ceiling (see 3)

Rear verandah
15 | Addition of side doors (see 9)
16 | Concrete columns, beams and ceiling
17 | Narrowing depth of rear verandah (see 22)
18 | Addition of bathroom block (N/A)

Courtyard
25 | Concrete columns, beams and ceiling

Right wing
23 | Closed arches
24 | Buttresses

Left Wing
19 | Addition of side window (see 9)
20 | Concrete columns, beams and ceiling
21 | Addition of bathroom block
22 | Left wing not aligned with right wing
Sequence of rooms

Of the twenty-two reference buildings used for the analysis of the sequence of rooms, 19/22 buildings met the sequence of: Verandah | Kleine Zaal | Grote Zaal | rear verandah | Side wing(s) / Courtyard | back wing.
The side wings and the courtyard lie adjacent to one another in most cases. See attachments for an overview of the analysis.

1/22 buildings did not have a Grote Zaal, but this was compensated with a vast rear verandah. This building was Hospital Street 22, adjacent to the case study building.

The 2/22 remaining buildings were inconclusive in their appearance, as the drawings of these buildings were not ideally interpretable.

Now, the floor plan of H24 does show many similarities to the typological sequence of rooms; However, we start off with the absence of an open verandah, which is considered to be an important attribute of the OUV. Then, Kleine Zaal and Grote Zaal are easily identified. After that, there seems to be evidence for the rear verandah, however, it has been completely built shut due to the addition of the first floor. The same is true for the courtyard, in between the two side wings, which are also easily identified. There is no back wing to be identified. There has been found no evidence for the typological validity of the garden in the back.

So, H24 seems to have indeed been of the same typology as the reference buildings.

Action to be undertaken
Restore the typological sequence of rooms in H24 to again meet the sequence verandah | Kleine Zaal | Grote Zaal | rear verandah | Side wing(s) / Courtyard | back wing.
Avg. of reference buildings

<table>
<thead>
<tr>
<th>Left side axis</th>
<th>Kleine Zaal</th>
<th>Grote Zaal</th>
<th>Rear verandah</th>
<th>Left wing</th>
<th>Courtyard</th>
<th>Right wing</th>
<th>Back wing</th>
</tr>
</thead>
</table>

Hospital Street 24

<table>
<thead>
<tr>
<th>Left side axis</th>
<th>Kleine Zaal</th>
<th>Grote Zaal</th>
<th>Rear verandah</th>
<th>Left wing</th>
<th>Courtyard</th>
<th>Right wing</th>
<th>Back wing</th>
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<table>
<thead>
<tr>
<th>Central axis</th>
<th>Kleine Zaal</th>
<th>Grote Zaal</th>
<th>Rear verandah</th>
<th>Left wing</th>
<th>Courtyard</th>
<th>Right wing</th>
<th>Back wing</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Right side axis</th>
<th>Kleine Zaal</th>
<th>Grote Zaal</th>
<th>Rear verandah</th>
<th>Left wing</th>
<th>Courtyard</th>
<th>Right wing</th>
<th>Back wing</th>
</tr>
</thead>
</table>
Central axis

After analysing the central axis and side axes of the twenty-two reference buildings, this resulted in the following minimum requirements for reconstruction:

The central axis should go all the way through the sequence of rooms.
H24 complies with this requirement

At least one of both side axes extents at least as far as the left wing/courtyard/right wing.
H24 does not comply with this, as the left side axis does not extent beyond the verandah.
H24 does not comply with this, as the right side axis does not extent beyond Grote Zaal.

The one side axis that is allowed to not extent as far as the left wing/courtyard/right wing must at least extent as far as the rear verandah.
H24 does not comply with this, as the left side axis does not extent beyond the verandah.
H24 does not comply with this, as the right side axis does not extent beyond Grote Zaal.

Action to be undertaken
The central axis must be retained as it is.
The left side axis must be restored to go as far as either the rear verandah or beyond.
The right side axis must be restored to go as far as either the rear verandah or beyond.
One of both side axis must extent as far as the left wing/courtyard/right wing.
Top left - Modern window frame with fanlights on the side
Top right - semi round fanlight
Bottom right - bad craftsmanship shown at semi round fanlights
Bottom left - Square fanlight
Fanlights

The building drawings of the reference buildings did not give much information about fanlights inside the buildings, as there was only one longitudinal section available per building, and no transverse sections at all. Nonetheless, 9/20 buildings did show fanlights in the longitudinal section, these were used for further research. Then, of these reference buildings, 9/9 (100%) showed consistency between the type of fanlight observed in the front views and the type of fanlight seen in the longitudinal section. In other words, there seems to be a consistent use of one type of fanlights for both the exterior and interior of a building.

As this conclusion was obtained from limited information we have to be careful when interpreting it. However, until further research proves this conclusion wrong, the conclusion will be used in this research as being true for the building typology.

Three types of fanlights were identified in the reference buildings: the square fanlight, the half round fanlight and the semi-round fanlight. According to the previous data, a combination of these fanlights would not be typologically valid.

However, H24 shows a wide array of different door and window styles, with varying fanlights. These fanlights used in H24 can be classified in the three types as shown on the left.

Modern style fanlight: This fanlight type is characterized by the fanlights on the side of the windows, instead of above them. This type was observed in the outside walls of H24. As it was observed in the closed front façade, which will later be identified as a typologically invalid element of the building, and in the newly added first floor, we can deductively argue that this fanlight type is a modern addition and type.

Semi round fanlight: This semi round fanlight type at first glance seems to be typologically correct. However, if we look closer, we can observe very bad workmanship in installing them. It seems as though square fanlights have been cut off on top in order to make place for the semi-round type. As the same type of fanlight (including the bad workmanship) can also be found in the newly added first floor, these fanlights appear to be modern additions as well.

Square fanlight: This square fanlight type looks the most genuine of them all. The big door frame and square fanlights resembles the descriptions of the original old doors and windows the most. However, the infill pattern diverges from the typologically valid square tiling as shown on the right.

As it stands, the choice for a typologically valid reconstruction type remains inconclusive. The only certainty is that the modern style fanlight is inappropriate in the WH site, as it has the fanlights on the side.

However, because of the consistency in use of fanlight types we can only have one type in the building. As a result, a choice has to be made for one. As the square fanlights look the most genuine, and as the adjacent building which is considered to be the best preserved historic house of the fort also has square fanlights, the choice will be made for that alternative, as the streetscape integrity will benefit.

However, further research into the fanlight types in general and of those identified in H24 needs to carried out in order to make an adequate assessment.

Action to be undertaken
Reconstruct doors and windows analogous to the fanlight type of Hospital Street 22.
<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model A</td>
<td>High performance</td>
<td>Performance data and benchmarks</td>
</tr>
<tr>
<td>Model B</td>
<td>Cost-effective</td>
<td>Cost analysis and ROI calculations</td>
</tr>
<tr>
<td>Model C</td>
<td>Easy to use</td>
<td>User feedback and satisfaction rates</td>
</tr>
<tr>
<td>Model D</td>
<td>Versatile</td>
<td>Use cases and application scenarios</td>
</tr>
</tbody>
</table>

**Additional notes:**
- Model A is currently being used by 90% of users due to its high performance.
- Model B has shown a 25% cost reduction over the last year.
- Model C has received an average satisfaction rating of 4.5/5 from users.
- Model D is being considered for integration into a new project due to its versatility.
Closing the front verandah results in the attribute ‘open verandah’ to be affected, which is one of the main features of the buildings in the fort. In the figures on the right we can see pictures of H24 (top left and bottom left) and the adjacent building H22 (top right and bottom right). The photographs are taken from the same perspective. H22 still contains the open verandah attribute. We can observe an immensely different experience of space when comparing both. Multiple evidences have been found for an open verandah of H24.

Evidenced by the OUV
ICOMOS’ Advisory Body Evaluation:
“The wide streets, planted with grass and shaded by suriyas, are lined with houses, each with its own garden and an open verandah supported by columns, another sign of the acculturation of an architecture which is European only in its basic design.”

This shows that indeed the open verandah is part of the OUV and that this attribute should be preserved at all cost. Building shut the front façade therefore should not be allowed.

Evidenced by sequence of rooms
The sequence of rooms analysis showed that 19/22 of the reference buildings contains an open verandah. Therefore we can conclude that the verandah is a typological characteristic.

In addition, the building layout of H24 largely matches the sequence of rooms found in the typological analysis. One of the deviations can be found in the open verandah in the front, which is absent in H24. However, due to the large resemblance of the sequence of the typology and the case study, it seems plausible that the front room of H24 used to be an open verandah. Thus, it is typologically invalid for H24 not to have an open verandah.

Action to be undertaken
Remove the front façade in order to restore the open verandah attribute, as well as the typological sequence of rooms.
Verandah

1 | Closed front façade

By closing the front façade, the sequence of entering the building through intermediate space has been affected: outside | outside/inside | inside-relation. The intermediating verandah between inside and outside is characteristic for the architecture in Sri Lanka, and the fort affected typological characteristic:

Open verandah as intermediating space between inside and outside
Verandah

1 | Closed front façade

By closing the front façade, one of the main attributes of the fort, the open verandah supported by columns, was affected as all columns (or arches) have been removed from the building façade.

Evidence from ICOMOS' Advisory Body Evaluation:

"The wide streets, planted with grass and shaded by sariyas, are lined with houses, each with its own garden and an open verandah supported by columns, another sign of the acculturation of an architecture which is European only in its basic design."

Evidence from the typological analysis

19/22 (86.4%) buildings have an open colonnaded verandah (with either columns or arches)

Of these 19 buildings, 4/19 contain arches (21%), while 15/19 contain columns (79%), either Tuscan (8/19 - 42.1%) or wooden columns (7/19 - 36.8%). The remaining 2/19 (10.6%) are untypological concrete columns which are considered to be modern day alterations.

Action to be undertaken

The evidence shows that the closed front façade is untypological and should be removed. Either Tuscan columns, timber columns or arches must be reintroduced. However, no sensory evidence has remained of either columns or arches after closing the front façade. While the evidence put forward does show that columns or arches are typologically valid in this building, there is no conclusive evidence for the use of either Tuscan columns, timber columns or arches. Therefore, in the following, typological characteristics of the current space have been compared with the typological analysis of the twenty-two reference buildings in order to justify the choice for one of these reconstruction alternatives.

<table>
<thead>
<tr>
<th>No.</th>
<th>Front verandah</th>
<th>Support structure</th>
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<tbody>
<tr>
<td>1</td>
<td>Y</td>
<td>Wooden columns</td>
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<tr>
<td>2</td>
<td>Y</td>
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<tr>
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<td>Y</td>
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<td>Y</td>
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<tr>
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<tr>
<td>22</td>
<td>Y</td>
<td>Arches</td>
</tr>
</tbody>
</table>

affected typological characteristic: Columns or arches supporting verandah
Verandah
1 | Closed front façade

In finding justification for one of the three reconstruction alternatives laid out in the previous, case study specific selection criteria were applied to the typological analysis in order to find building types whose architectural characteristics are closest to those of the case study building.

These selection criteria were the following:
Verandah depth > 2.4 m
Amount of rooms in Kleine Zaal: 3
Building width: 8 - 12 m

What stands out immediately was that the selection criterion of a verandah depth larger than 2.4 m yields only one other building: No. 4, Leynbaan Street 80. Both building's verandah depths are identical: 3.6 m. Also, the other two selection criteria match. Therefore, in the absence of other reference buildings I find it typologically justifiable to apply architectural characteristics of this reference building to H24.

The reference building stands out for having a double colonnaded verandah, which must be the result of the larger verandah depth. Both column rows are of the Tuscan column type.

Action to be undertaken
Now, the verandah of H24 will be reconstructed with a double colonnade, of which the back row of columns will consist of the Tuscan column type.

While it would be typologically valid to use the Tuscan column type for the front row of columns as well, in the following I will plead for the use of timber instead.
Verandah

1. Closed front façade

Between the similarities of architectural characteristics of the case study with the reference building mentioned earlier, there also is a reasonable chance that there is a historical connection between H24 and the adjacent building, which is considered to be one of the best preserved historic buildings of the fort. From this historical point of view, according to Mr. Arachchi of Galle Heritage Foundation the two buildings date from the same period of time, being the early Dutch colonial period. Therefore, I would like to argue that it is probable that there was a homogenous streetscape, with matching materials.

**Action to be undertaken**
In order to increase the integrity of the streetscape, I suggest to reconstruct the front row of columns of H24 using the timber column type, matching the surrounding buildings, in particular the authentic adjacent building at Hospital Street 22. Now, if there will ever be an infill development for Hospital Street 26, it is advised to include timber columns there as well, complementing the timber column streetscape. This would increase the integrity of the streetscape tremendously.

Reference: Front verandah of Church Street 80
veranda breedte ≠ woning breedte

veranda breedte = woning breedte
Verandah
2 | Division of verandah

In H24, we can observe a wall separating the former verandah into two rooms. This division of the room is typologically invalid, as 0% of all analysed reference buildings have their verandah divided into parts.

Action to be undertaken
The division of the front room into two adjacent rooms, which is to be restored to the 'open verandah supported by columns or arches', must be undone so the verandah width comprises the full width of the building again.

affected typological characteristic:
verandah width = building width
Verandah | Kleine Zaal | Grote Zaal

3 | False ceiling

In the case study building, a false ceiling causes the house to be experienced as a very cramped space. It feels as if there is no pitched roof above you at all. However, high lofty ceilings showing the sloped roof construction from the interior of the building is characteristic for the buildings in the fort. Obviously, implementation of this modern false ceiling affects this quality immensely. The room is deprived of its spaciousness. Also, the false ceiling does hardly allow for any natural ventilation, whereas the traditional ceiling does through openings in between the roof tiles. The two photographs on the bottom illustrate the potential experience of the space of H24, when the false ceiling has been removed.

Evidence
Of all analysed buildings, 0% have a false ceiling but instead a high, lofty ceiling.

In addition, the photograph on the right hand side (left, top) shows the presence of a high lofty ceiling in the Grote Zaal which is only obstructed by this ceiling.

Action to be undertaken
Remove the false ceiling.

High ceilings with visible roof construction
Natural ventilation
Verandah
4 | Raised roof

The whole roof of H24 proofs to be untypically high as well as pitched. This will be illustrated by means of the verandah height.

In order to investigate the typological roof height, four analysis have been carried out, with a subsequent addition of one selection criterion. Thus, analysis round 1 had no selection criterion and encompassed all twenty-two reference buildings. Analysis round 2 had one selection criterion; building width 8-13m and as a result encompassed 10 reference buildings (see table on the right), and so on. As mentioned before, this way with every analysis the architectural characteristics increasingly match those of H24.

Evidence from analysis (left)

After analysis, the table on the right shows that the average eave height of reference buildings with variable selection criteria ranges in between 3,2m and 3,4m compared to the eave height of H24 of 3,9m, which is a discrepancy of in between 0,46m - 0,70m. These differences are considerable and seem to match the difference in roof height between H24 and the adjacent building (see photo below right).

After carrying out this analysis for several locations on the roof a selection of ranges is obtained, in between which the roof of H24 would need to be reconstructed in order to be typologically valid. In order to pinpoint the typologically best suitable roof heights for H24 within these ranges, the pitch analysis will be of help.

In addition to the height analysis, the pitch analysis shows the following. The table on the right shows that the average verandah roof pitch of the reference buildings is in between 23 - 27 degrees compared to the corresponding roof pitch of H24's (built shut) 'verandah' of 23 degrees, which is a difference of 0 - 4 degrees. Also, the same data has been collected for the roof pitches of the other locations on the roof. Here too, ranges of typologically valid roof pitches are obtained, in between which the roof of H24 would need to be reconstructed to be typologically valid.

Interestingly, the combination of both results will yield the optimal reconstruction alternative for H24. When the ranges of the roof pitch analysis are projected on the ranges of the roof height analysis, we can clearly observe that this interaction of results leads to one possible roof shape, which is typologically valid.

### Action to be undertaken (1)

- **Lower the eave height** by 0.46 - 0.70m
- **Lower the verandah - Kleine Zaal height** by 1.05 - 1.40m
- **Lower the ridge height** by 0.28 - 0.57m
- **Lower the Kleine Zaal - Grote Zaal height** by 0.83 - 0.97m
- Reintroduce rear verandah at a height of 2.27m - 2.54m

### Action to be undertaken (2)

- Increase the roof pitch of the verandah with 0 - 4 degrees
- Increase the roof pitch of the Kleine Zaal with 4 - 9 degrees
- Increase the roof pitch of the Grote Zaal with 2 - 8 degrees
- Introduce the roof pitch of the 'rear verandah' with 2 - 5 degrees

### Action to be undertaken (3)

- Lower and reconstruct the roof of H24 to comply with the final results shown on the left.

---

**Table: Selection criteria vs. Reference buildings**

<table>
<thead>
<tr>
<th>Selection criteria</th>
<th>Reference buildings</th>
<th>Avg. verandah roof height</th>
<th>difference to H24</th>
<th>Avg. verandah roof pitch</th>
<th>difference to H24</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Hospital Street 74)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>[None]</td>
<td>22</td>
<td>3.37</td>
<td>0.53</td>
<td>27</td>
<td>-4</td>
</tr>
<tr>
<td>(Building width: 8 - 13m)</td>
<td>10</td>
<td>3.26</td>
<td>0.64</td>
<td>27</td>
<td>-4</td>
</tr>
<tr>
<td>(Verandah &gt; 2.4m)</td>
<td>5</td>
<td>3.44</td>
<td>0.66</td>
<td>26</td>
<td>3</td>
</tr>
<tr>
<td>(Verandah &gt; 2.4m)</td>
<td>2</td>
<td>3.20</td>
<td>0.70</td>
<td>23</td>
<td>0</td>
</tr>
</tbody>
</table>

**Table: Roof reconstruction**

<table>
<thead>
<tr>
<th>Roof reconstruction</th>
<th>H24</th>
<th>Typological avg.</th>
<th>Avg.diff. w. H24</th>
<th>Action to be undertaken</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verandah roof height</td>
<td>3.9m</td>
<td>3.3 - 3.4m</td>
<td>0.40 - 0.70m</td>
<td>Lower by 0.40 - 0.70m</td>
</tr>
<tr>
<td>Verandah - Kleine Zaal roof height</td>
<td>3.7m</td>
<td>3.3 - 3.4m</td>
<td>0.50 - 0.70m</td>
<td>Lower by 0.50 - 0.70m</td>
</tr>
<tr>
<td>Ridge height</td>
<td>6.7m</td>
<td>5.8 - 6.3m</td>
<td>0.30 - 0.97m</td>
<td>Lower by 0.30 - 0.97m</td>
</tr>
<tr>
<td>Kleine Zaal - Grote Zaal roof height</td>
<td>3.9m</td>
<td>3.3 - 3.4m</td>
<td>0.40 - 0.57m</td>
<td>Lower by 0.40 - 0.57m</td>
</tr>
<tr>
<td>Grote Zaal - 'rear verandah' roof height</td>
<td>4.0m</td>
<td>3.2 - 3.4m</td>
<td>0.20 - 0.75m</td>
<td>Lower by 0.20 - 0.75m</td>
</tr>
<tr>
<td>Rear verandah eave height</td>
<td>-</td>
<td>2.77 - 2.7m</td>
<td>-</td>
<td>Reconstruct at 2.77 - 2.7m</td>
</tr>
<tr>
<td>Roof pitch verandah</td>
<td>23 degrees</td>
<td>23 - 27 degrees</td>
<td>0 - 4 degrees</td>
<td>Increase pitch by 0 - 4 degrees</td>
</tr>
<tr>
<td>Roof pitch Kleine Zaal</td>
<td>23 degrees</td>
<td>23 - 27 degrees</td>
<td>0 - 4 degrees</td>
<td>Increase pitch by 0 - 4 degrees</td>
</tr>
<tr>
<td>Roof pitch Grote Zaal</td>
<td>20 degrees</td>
<td>21 - 27 degrees</td>
<td>2 - 6 degrees</td>
<td>Increase pitch by 2 - 6 degrees</td>
</tr>
<tr>
<td>Roof pitch 'rear verandah'</td>
<td>19 degrees</td>
<td>21 - 27 degrees</td>
<td>2 - 5 degrees</td>
<td>Increase pitch by 2 - 5 degrees</td>
</tr>
</tbody>
</table>
Verandah
5 | 6 | 7 | closed wall / door / doorway

Symmetry of (original) façade

<table>
<thead>
<tr>
<th>Selectie criteria</th>
<th>Type nr.</th>
<th>Breedte (m)</th>
<th>Aantal ramen</th>
<th>Aantal deuren</th>
<th>Aantal ruimtes Kleine ZaalG</th>
<th>evelsymmetrie</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aantal ruimtes Kleine Zaal: 3</td>
<td>2</td>
<td>13</td>
<td>21</td>
<td></td>
<td>3Y</td>
<td></td>
</tr>
<tr>
<td>Breedte: 8 - 13 m</td>
<td>4</td>
<td>10</td>
<td>21</td>
<td></td>
<td>3Y</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>8,42</td>
<td>21</td>
<td></td>
<td>3Y</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>10,12</td>
<td>13</td>
<td></td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>9,72</td>
<td>13</td>
<td></td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>12,92</td>
<td>13</td>
<td></td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>18,5</td>
<td>13</td>
<td></td>
<td>Y</td>
<td></td>
</tr>
</tbody>
</table>

affected typological characteristic:
Decentral axis on left side | 5
Symmetry of façade | 5 6 7
Verandah
Final reconstruction result

Section CC'

Front view

Section EE'

Hospital Street 24
After
# Kleine Zaal | overview of untypological evidence

<table>
<thead>
<tr>
<th>Untypological evidence observed at H24</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BATHROOM BLOCK</strong></td>
<td><strong>Commentation</strong></td>
<td><strong>Evidence</strong></td>
<td><strong>Action to be undertaken</strong></td>
<td></td>
</tr>
<tr>
<td>1. Oblique axis through the building</td>
<td>Insertion of windows blocks in Kleine Zaal affects the natural longitudinal orientation of the building.</td>
<td>One evidence observed. No. 32; detail no. 32. As a result of the windows blocks in Kleine Zaal, the building no longer has a coherent orientation.</td>
<td>Remove the windows blocks in Kleine Zaal, restoring the coherent orientation of the building.</td>
<td></td>
</tr>
<tr>
<td>2. Identical depth of all recesses</td>
<td>Insertion of the windows blocks in Kleine Zaal affects the equal depth of the recesses. The windows blocks, which were installed for aesthetic reasons, created a lack of cohesion between the recesses on the same floor.</td>
<td>The typological analysis of 24 buildings proves that recesses with equal depth and equal size are not consistent in all cases. However, the windows blocks create a uniform depth in the recesses.</td>
<td>The windows blocks are untypological.</td>
<td></td>
</tr>
<tr>
<td>3. Original arches</td>
<td>Insertion of the windows blocks created an arch structure that was not present originally.</td>
<td>Additionally, the presence of arches in the windows blocks in Kleine Zaal creates an inconsistent typological feature.</td>
<td>Additionally, the windows blocks should be removed to maintain the untypological feature.</td>
<td></td>
</tr>
<tr>
<td><strong>SIDE WINDOW</strong></td>
<td></td>
<td></td>
<td>Remove the side window and restore the original wall.</td>
<td></td>
</tr>
<tr>
<td>1. Timber frame with side walls</td>
<td>These characteristic features are a result of the building traditions of Dutch houses after construction石语, simulating the front, back, and side windows. The side windows are especially visible in the building.</td>
<td>The 24 investigated types of windows blocks have a consistent appearance. There was no evidence found for other types of windows blocks or the entire building. The windows blocks in Kleine Zaal are consistent in terms of appearance and function.</td>
<td>The windows blocks in Kleine Zaal are untypological.</td>
<td></td>
</tr>
<tr>
<td><strong>FALSE CEILING</strong></td>
<td></td>
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<tr>
<td>1. High, fabric ceiling</td>
<td>One 3</td>
<td></td>
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<tr>
<td>2. Retractable fabric through ceiling</td>
<td>One 3</td>
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</tbody>
</table>

37
Kleine Zaal
8 | Addition of bathroom block

The axes analyses showed that although the central axis goes all the way through the building as it typologically
should, the left axis does not go past Kleine Zaal (in fact: it does not exist at all). With the right axis going as far
as Grote Zaal, the left axis should at least extent to either the side wing or courtyard, depending on the layout.
As a result of the bathroom block in Kleine Zaal, the left side axis cannot extent beyond this room. As such, the
architectural characteristic of the axes is affected and as a result the natural longitudinal ventilation through the
building.

Evidence:
Axes analysis: One or both of the side axes should at least extent to the rear verandah, as a result of which the other
should extent as far as the side wing / courtyard or beyond.

In addition, analysis of the depth of the Kleine Zaal among the twenty-two reference buildings shows that the rooms
of Kleine Zaal at all times have an identical depth. As a result, placement of the bathroom block has an detrimental
effect on this architectural characteristic.

Evidence:
22/22 (100%) of the reference buildings have an identical depth of all rooms of Kleine Zaal.

Furthermore, the photographic evidence on the right hand side, taken of one of the bathrooms, shows that for the
insertion of this bathroom block an original door or arch had to be built shut.

Evidence:
Photographic evidence

Action to be undertaken:
Remove the bathroom block, in order to restore above mentioned typological characteristics

affected typological characteristic:
Decentral axis on left side
Identical depth of all rooms of Kleine Zaal
Original arch or door
Kleine Zaal | Grote Zaal | Rear verandah | Left wing

9 | 12 | 15 | 19 | Addition of side windows and doors

Uninterrupted side walls were a result of the building tradition of rows of Dutch houses sharing construction walls, leaving only the front, back and inner courtyard for daylighting. The introvert character of the building would not be done justice using side windows and/or doors.

Evidence
Of 22 investigated types, 20 types showed uninterrupted side walls: there was no evidence found for the existence of side windows or doors. In the two other cases, the presence of a servants entrance evidenced a window and a door respectively in type 14 and 21. As H24 does not evidence the former existence of a service entrance, it seems that the present side door and windows are untypological elements within the building.

Action to be undertaken
Remove the side windows and doors and restore the closed wall.

affected typological characteristic:
Uninterrupted, thick side walls
Introvert character of building
Kleine Zaal
Final reconstruction result

Door snede CC'

Section FF'

Hospital Street 24
After
Doorsnede CC'

Doorsnede GG'

Office

Guest room

Guest room

Guest room

Living

Reception

Sitting room

Storage

Kitchen

Garden

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<table>
<thead>
<tr>
<th>Untypological evidence observed at H24...</th>
<th>...affects typological element or characteristic...</th>
<th>Commentary</th>
<th>Evidence</th>
<th>Action to be undertaken</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>OPENED WALL</td>
<td></td>
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<tr>
<td>13</td>
<td>addition of shutters window with access</td>
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<td>14</td>
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</tbody>
</table>
Aangetast typologisch element:
Open verbinding tussen ruimtes van Grote Zaal

20/22 (90,1%) woningen heeft Grote Zaal

Van de 20 woningen met Grote Zaal heeft 5/20 (25%) woningen een Grote Zaal opgedeeld in twee ruimtes (A+B) en 15/20 (75%) woningen heeft een Grote Zaal van één grote ruimte (C)

Van deze 5 woningen (A+B), heeft 5/5 (100%) woningen géén gesloten wand, maar een open verbinding tussen beide ruimtes
Grote Zaal
13 | Closed window / door(way)

Aangetast typologisch element:
Sequentie van gevelopeningen

Op basis van het programma en ruimtelijke indeling die volgt uit de reconstructie van en keuzes voor de zijvleugel(s), binnenplaats en achtervleugel kies ik voor A. Ook de fanlightstudie, waaruit bleek dat de semironde fanlights niet oorspronkelijk zijn, doet twijfel ontstaan over het RAAM, kan misschien ook een deur zijn. C valt af aangezien ik aanneem dat de zijvleugel wordt aangesloten op GZ.
Doorsnede CC'

Doorsnede GG'

Hospital Street 24
Before

Office
guest room
guest room

Reception
Sitting room
Living

Storage
Kitchen

Garden

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Grote Zaal
Final reconstruction result

Doorsnede CC'

Section GG'

office / family bedroom

family bedroom

Verandah

Living

Hospital Street 24
After
Doorsnede CC'

Doorsnede HH'

Office

Guest room

Guest room

Guest room

Guest room

Living

Storage

Kitchen

Reception

Sitting room

Garden

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Rear verandah | overview of untypological evidence

<table>
<thead>
<tr>
<th>Untypological evidence observed at H2A</th>
<th>...affects typological element or characteristic...</th>
<th>Commentary</th>
<th>Evidence</th>
<th>Action to be undertaken</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Addition of side walls</td>
<td>The addition of side walls</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Concrete, columns, beams and ceiling</td>
<td>The addition of side walls</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Concrete columns, beams and ceiling</td>
<td>The addition of side walls</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Concrete columns, beams and ceiling</td>
<td>The addition of side walls</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Concrete columns, beams and ceiling</td>
<td>The addition of side walls</td>
<td></td>
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<td></td>
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<tr>
<td>8. Concrete columns, beams and ceiling</td>
<td>The addition of side walls</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Concrete columns, beams and ceiling</td>
<td>The addition of side walls</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Concrete columns, beams and ceiling</td>
<td>The addition of side walls</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
Only No. 16 'Concrete columns, beams and ceiling' will be elaborated upon in this paragraph.
No. 15 'Addition of side doors' has been addressed at Kleine Zaal: No. 9
No. 17 will be addressed at Left wing: No. 22
No. 18 will only be addressed in the overview above.
Rear verandah

16 | Concrete columns, beams and ceiling

Aangetast typologisch element:
Traditionele constructiemethoden

Hellend dak met houten draagconstructie en dakpannen ondersteund door kolommen

Veranda als intermediaire ruimte tussen binnen en buiten

Natuurlijk (dak)ventilatie door dakpannen

De final result will be shown after reconstruction analysis of LW/RW as the shape of RV is in a direct relation to these rooms
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### Courtyard - overview of untypological evidence

<table>
<thead>
<tr>
<th>Untypological evidence observed at H24</th>
<th>Commentary</th>
<th>Evidence</th>
<th>Action to be undertaken</th>
</tr>
</thead>
<tbody>
<tr>
<td>Courtyard is between the two side wings</td>
<td>Whatever the former shape of the courtyard and the typological status of the left side wing, the presence of this concrete ceiling on the first floor negates the existence of a courtyard in between (next to the side wings). In addition, there was no proof found of buildings with only a courtyard and no courtyard, as in the case here of H24.</td>
<td>Only 2/2 buildings have two close side wings and no courtyard between. However, it is fair to assume that these are altered. 20/22 buildings now have a courtyard adjacent to one wing or in between two wings.</td>
<td>In line with the actions of the wings and rear verandah, remove the concrete ceiling and the first floor which it carries.</td>
</tr>
<tr>
<td>Sequence of space</td>
<td>Sequence of winning the courtyard after the intermediating space of the rear verandah has been affected.</td>
<td>Sequence analysis</td>
<td></td>
</tr>
</tbody>
</table>

---

57
Courtyard

18 | Concrete columns, beams and ceiling

Aangetast typologisch element:
Courtyard as a whole

just as rear verandah, the courtyard is severely hindered by the added first floor. In fact, the presence of this floor causes the courtyard to be non-existent

Whatever the former shape of the courtyard and the typological status of the left side wing, the presence of this concrete ceiling and the first floor impedes with the existence of a courtyard in between / next to the side wing(s) Whatever the former shape of the courtyard and the typological status of the left side wing, the presence of this concrete ceiling and the first floor impedes with the existence of a courtyard in between / next to the side wing(s)

Only 2/22 buildings have two close side wings and no courtyard in between. However, I assume that these are altered. 20/22 buildings now have a courtyard adjacent to one wing or in between two wings.

In addition, there was no proof found of buildings with only a backyard and no courtyard.

So, somehow, there has to be inserted a courtyard. In the following we will see how (reconstructing LW)

De final result will be shown after reconstruction analysis of LW/RW as the shape of RV is in a direct relation to these rooms
Doorsnede DD'
# Right wing - overview of untypological evidence

<table>
<thead>
<tr>
<th>Un typological evidence observed at H24...</th>
<th>...affects typological element or characteristic...</th>
<th>Commentary</th>
<th>Evidence</th>
<th>Action to be undertaken</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLOSED ARCHES</td>
<td>New row of arches in right wing</td>
<td>Analysing to the adjacent building (Hospital Stret 22), H24 seems to contain a row of arches which have been built up for the lower rooms.</td>
<td>Photographic evidence from the inside of the right wing room.</td>
<td>Open the arches in order to restore the sequence of arches of the right wing.</td>
</tr>
<tr>
<td>BUTTRESSES</td>
<td>Although the buttresses do not directly affect a typological element or characteristic, in itself these massive construction elements are highly out of place within the building’s profile.</td>
<td>Out of 22 building types (9%) have similar buttresses.</td>
<td>Reduce the buttresses.</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
Only No. 23 ‘Closed arches’ will be elaborated upon in this paragraph
No. 24 ‘ will only be addressed in the overview above.
Reconstruction of World Heritage property

Rene Fuhrer | (Sustainable) Reconstruction of World Heritage property | Prof. Dr. B. Colenbrander; Dr. Ir. A. Pereira Roders; Ir. L. Veldpaus; Ir. J. Bieman | TULe
Right wing
23 - Closed arches

In the right wing of H24 we can observe a closed sequence of arches. Patchwork on the outside of the right wing showed seams in the shape of the former arches. When investigating the inside it became quite obvious that indeed arches were built shut by the house owner (see figure 2).

Evidence
The analysis of the twenty-two reference buildings with the selection criterion ‘sequence of arches in side wing’ resulted in only one reference building. Normally, this would not be a convincing plea for these arches to be typologically valid. However, this reference building proved to be Hospital Street 22, the adjacent historic building which is considered to be the best preserved historic building in the fort (see drawing on far left, below). Indeed, there seems to be a degree of resemblance between both buildings, as stated by Mr. Arachchi of GHF. This historical information and the resemblance between both wings have convinced of the typological validity of the arches found in H24.

Even more, the similarities do not stop here. Also, the timber ceiling construction is alike (figure 3). As such a construction is used whenever a second floor exists above the ground floor, we have found some evidence that this second floor of H24 is typologically valid as well. This presumption is strengthened by figure 1, in which we can observe the original height of the second floor and the later addition on top. The original wall portion seems to be made of a material other than modern concrete; presumably a material with the addition of coral and/or granite, which were used in the colonial period.

Action to be undertaken
Open de arches in order to restore the sequence and further reconstruct analogous to the wing of this reference building. This will result in the removal of the enormous, modern roof.
Doorsnede DD'

Doorsnede BB'

Doorsnede II'

First floor

Ground floor

Hospital Street 24
Before
Right wing
Final reconstruction result

Section DD'

Section BB'

Section II'

First floor

Hospital Street 24
After
## Left wing | overview of untypological evidence

<table>
<thead>
<tr>
<th>Untypological evidence observed at H24</th>
<th>Commentation</th>
<th>Evidence</th>
<th>Actions to be undertaken</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete columns, beams, and roofing</td>
<td>The architecture is highly influenced by British Influence (Donald W. B. L. Froth, 1980)</td>
<td>I have the notes to determine the influence</td>
<td>Remove the concrete columns, beams, and roofing. This will result in the removal of the untypological elements. We should consider a sign on the building to indicate the necessity for the original building sequence to be restored.</td>
</tr>
<tr>
<td>Traditional construction methods used in the typology</td>
<td>Traditionally, wooden floor beams, stilted beams, and roofing were used, just like the typical right wing. These modern concrete construction elements are highly misplaced.</td>
<td>I have notes on the traditional methods used</td>
<td>Ensure that the concrete construction elements located in the right wing are removed.</td>
</tr>
<tr>
<td>Natural ventilation through eaves of roof</td>
<td>The ventilation is key to and allows for proper air circulation. The traditional wooden floor remains intact.</td>
<td>I have the notes on the ventilation through eaves</td>
<td>Ensure that the ventilation elements are removed and replaced with traditional methods.</td>
</tr>
<tr>
<td>Addition of brickwork</td>
<td>The typological analysis shows that the addition of brickwork in the right wing does not enhance the overall quality of the building.</td>
<td>I have the notes on the brickwork</td>
<td>Remove the brickwork in the right wing.</td>
</tr>
<tr>
<td>Left side wing with right side walls</td>
<td>The position of the side wing may influence the overall typological analysis. No evidence of significant deviations in the position of the side wing was found.</td>
<td>I have the notes on the position of the side wing</td>
<td>Ensure that the position of the side wing is maintained as per the original typological analysis.</td>
</tr>
<tr>
<td>Negative depth of rear corridor</td>
<td>The position of the rear wing of the building seems to be too deep on the side compared to the other wings.</td>
<td>I have the notes on the depth of the rear corridor</td>
<td>Ensure that the depth of the rear corridor is maintained as per the original typological analysis.</td>
</tr>
</tbody>
</table>
Left wing
20 - Concrete columns, beams and ceiling

Aangetast typologisch element:
Traditionele constructiemethoden
Natuurlijke (dak)ventilatie door dakpannen of houten vloerdelen
Left wing

21 - Addition of bathroom block

This bathroom is just a square block inside the wing. The typological analysis shows that compartmentation of rooms in the side wings is done over the whole width of the side wing, not by the insertion of a 'cubicle' as is done here. Therefore, this bathroom block is typologically invalid.

Action to be undertaken
Either extend the bathroom to the whole width of the side wing (resulting in the window to become superfluous), or remove the bathroom block.

Homogenous width of side wings
There is a direct relation between the position of the side wing and the rear verandah; the position of the wing accounts for the verandah depth. In this case the presence of two non-aligned side wings causes the 'rear verandah' to be of varying depth, which is untypological for the buildings in the fort.

**Evidence**

The analysis of the twenty-two reference buildings with the selection criteria 'two wings,' 'wings detached from Grote Zaal' (or: 'rear verandah width = building width') resulted in four reference buildings which architectural characteristics resemble those of H24 the most. Of these four buildings, nos. 3, 11, 13 and 22, it was observed that all four (4/4 - 100%) of these building's side wings are aligned with each others.

Also, if we expand the analysis to all reference buildings, or in other words, refrain from the use of selection criteria, none of the twenty-two reference buildings show any sign of non-alignment with regard of the side wings.

Thus, the position of the left wing of H24, causing the rear verandah to be less deep on the left wing side compared to the right wing side, seems to be typologically invalid.

**Action to be undertaken**

In order to satisfy the typology, the left side wing should be aligned to the right wing by moving back the wall, or removed.
Left wing

Additional typological evidence

After the previous analyses of the rear verandah, courtyard, right wing and left wing, we saw that the presence of the 'concrete columns, beams and ceiling,' and thus the addition of the entire first floor affected the typology immensly. It had to be removed in order to restore the sequence of rooms. After all, the presence of this enormous construction caused both the rear verandah as well as the courtyard to be absent in the floor plan, and these form crucial parts of the OUV.

With the right wing already reconstructed and set, the reconstruction of the left wing will have vast consequences for the final reconstruction layout, as the appearance of the rear verandah and especially the courtyard(s) are defined by the mutual positioning of both side wings.

Now, for the purpose of reconstructing the left wing, again relevant architectural characteristics of the case study will be compared to the same characteristics of the twenty-two reference buildings. These selection criteria are the following:

- amount of side wings $\geq 1$
- complies with sequence of rooms: Y
- Width of one side wing > 37% of building width

These selection criteria have resulted in five reference buildings with similar features: Nos. 1; 7; 9; 10; and 20. Among these five buildings, three typologically valid reconstruction principles for the left wing were distilled. Now, as multiple reconstruction alternatives appear to be typologically valid, development needs of the house owner were allowed to 'choose' the reconstruction alternative that would meet that need the best.

These three reconstruction principles will now be elaborated upon, as well as on the eventual decision for the one best suited to the need for privacy of Muslim women inside this family guesthouse.

Reconstruction principle A

The first possible reconstruction principle is based on the one observed in both reference building no. 10 and 20 and can be seen on the left page, below. This principle does not include a left wing in its layout, thus creating a wide courtyard on the left side of the right wing extending all the way to the back, in case of the absence of a back wing. This solution would be ideal for H24, as its 'right wing width - building width' -ratio of 42% is fairly high (left page, top), leaving relatively little room for both a left wing and a proper sized courtyard in the middle. However, in this case the courtyard would at all times be shared between the guests and the family, leaving little option for Muslim women to retreat as a result of their privacy needs while at the same time being able to continue their daily routines.

Reconstruction principle B

The second possible reconstruction principle is based on the one observed in reference building no. 7 and can be seen on the next page, top. This principle does include a left wing in its layout, thus creating a very narrow rear verandah. This narrow verandah is, despite being observed at one of the twenty-two representative reference buildings, typologically questionable in my honest opinion. Also, the tight space created could create uncomfortable situations for the women in relation to the guests. In addition, the spacious quality of the open relation between the Grote Zaal and the courtyard through the intermediating rear verandah, as was the case in principle A, is absent here.

Reconstruction principle C

The third and last possible reconstruction principle for the left wing is based on the one observed in reference buildings no. 1 and 9 and can be seen on the next page, bottom. This principle does include a left wing as well, but as it is set back it could potentially create two courtyards. Here, the courtyard in the back (B) could be solely for family
Left wing
Additional typological evidence

use, whereas the front courtyard (A) would be for common use, so for both the family as well as the guests. So, in this case, Muslim women are perfectly able to retreat as they like as a result of their privacy needs while at the same time being able to continue their daily routines.

Needless to say, for the reconstruction of the left wing principle C has been chosen as the proper sustainable solution. Here, we have witnessed a perfect example of how a development need that is allowed to ‘choose’ among multiple typologically valid reconstruction principles is able to both best meet the need as well as remain typologically valid.

Sustainable reconstruction of the left wing
Back wing

As the back wing was not intensively researched, further research is necessary in order to map the various alternatives which are typologically valid. The twenty-two reference buildings show a large diversity of the back wing, possibly due to modern day alterations.

Action to be undertaken
Reconstruct a small, simple back wing as can be seen on the left page.
Left wing and resulting courtyard and rear verandah
Final reconstruction result

Section II'

Section BB'

Section AA'

Hospital Street 24
Before
Left wing and resulting courtyard and rear verandah

Final reconstruction result

Section II'

Section BB'

Section AA'

Hospital Street 24
After
Now, after the sustainable reconstruction of the building, it is time to do a walk through the result building result. Besides the elaborate reconstruction of the open verandah supported by columns, the front part of the house was in a pretty good typological state. Before reconstruction, this part of the house was also used for guest rooms, but has been 'given back' to the family. The Kleine Zaal now houses a family bedroom and another family bedroom/office. This way, the family is always aware of the people who go in and out of the building. The choice was purposely made not to make guest rooms here, as these would require to be shut tightly for the guests. This would affect the open character of the front of the building, in my opinion. Also, as I wanted to reintroduce a local family in the fort office. This way, the family is always aware of the people who go in and out of the building. The choice was purposely made to not make guest rooms here, as these would require to be shut tightly for the guests. This would affect the open character of the front of the building, in my opinion. Also, as I wanted to reintroduce a local family in the fort office. This way, the family is always aware of the people who go in and out of the building.

As the verandah, Kleine Zaal, Grote Zaal nor the rear verandah gave any reconstruction alternatives for guest rooms to be introduced, it was not until the reconstruction of the right wing that this was made possible. However, the ground floor of the right wing was also not an option for the insertion of guest rooms, given the typological necessity for the sequence of open arches. However, as proof was found for the validity of the second floor, there was no typological hinderance there for the insertion of two guest rooms. We will see that for this building in its current setting this is also the maximum of guest rooms possible. The guest rooms can be reached by the stairs in the right wing. This staircase is adjacent to the dining room for the guests, by which it can also be entered. Reaching the top of the stairs, the guest arrives on the balcony analogous to that of Hospital Street 22, with a view over the courtyard and the characteristic tiled roofs. On the balcony there would be a couple of typical (fake) colonial chairs. The rooms can be pretty straightforward, the charm of this guest house is not to stay in the rooms, but to engage in the family life of a Sri Lankan family. Therefore, the bathroom is not located inside the room, but on the ground floor adjacent to the courtyard. Typologically, bathrooms were always situated here. The family has several options for exploiting the two rooms. In essence, they are big enough to accommodate multiple bunk beds, creating an informal setting which fits the idea of engaging in family life. Also, this type of backpack traveler is not accommodated very often in Sri Lanka, so economically this could be a good concept. On the other side of the spectrum, the rooms are big enough to create two longstay rooms for students, such as myself, who are doing research in the fort. As it is a WH site, during our stay we have met many people doing research. So, although only two guest rooms might seem as little, it is up the creative mind of the local community to be smart about the exploitation of the rooms. There are multiple options.

Back downstairs and around dinner time, the guests can enter the guest dining where a wonderfully prepared meal awaits. Coconut sambol and papadam, rice & curry, it is all there. Eating and cooking is the ultimate way of meeting people and getting to know them. Getting to know a foreign kitchen is to get to know a culture. Forget about restaurants trying to imitate western cuisine. It is the local families that know how to cook! The concept of shared rooms and sanitary and the possibility of shared meals will make for a stay to remember. In order to serve dinner even more quickly, the kitchen is situated next to the guest dining. As you remember, this right wing was characterised by its sequence of arches, resulting in an open connection between the guest dining and kitchen with the courtyard. A monsoon shower during dinner was never more impressive. The kitchen forms the center between the common courtyard and the family courtyard and maybe more important, between the family courtyard and the guest dining. As a result of this the guest dining forms the ideal encounter of two cultures. Meanwhile, the Muslim women of the family are free to retreat to their family courtyard if they feel the privacy need, while at the same time being able to continue their daily routines, such as cooking and clothes washing. Around the family courtyard, a separate family bathroom and an additional large bedroom is located. Thus, the women have all their necessities within reach in the family courtyard.
Conclusion & limitations

Conclusion
In this case study the privacy need of Muslim women and the change of use to a family guesthouse were development needs that were successfully implemented while at the same time, typological characteristics were reintroduced in the building, increasing its integrity towards the OUV. The results show the reconstruction of a severely altered historic building in the Fort, based on the typological analysis of twenty-two typological reference buildings. The final result of this research shows that it is possible to sustainably reconstruct a building within Galle Fort, as both the OUV was retained and development needs of the local community were met.

Limitations
When interpreting the results of this case study one must bear in mind the following limitations:

As this is a case study the results that are drawn must be interpreted carefully. For instance, the implementation of only two guestrooms in this case study does not mean that this is a result that can be generalized simply to all other buildings; different results can be obtained for different case studies. For each individual building which requires sustainable reconstruction, one should follow the same method as has been used for H24. One should not blindly impose the results obtained in this case study on another.

Furthermore, the typological analysis which is to be considered the base of this research, is based on documents dating from 1992. Then already, we could observe alterations to the historic buildings. So, aside from these documents being rather outdated, reconstruction decisions made using the typological analysis put forward in this report could very well be 'contaminated' by these building alterations. However, hopefully this analysis will not be the last made of buildings in the fort. As said in the former research document (Boxem & Fuhrer, 2011), it is imperative that as much buildings as possible are fully documented, as I have with this case study. That way, by adding to the data collection of these buildings, the typological analysis can be extended and 'purified'.

These drawings of 22 buildings in the fort, containing the floor plans, a front view of the façade and one longitudinal section, are (to my knowledge) the only available building documents. Moreover, these drawings are not very detailed so there is not much information about for instance the materials used.

The more data will be collected, and the more all encompassing the research gets, the better the understanding of the OUV and the building typology. Then hopefully, we will be able to systematically do the same research for other severely altered buildings in the fort which are a plenty. This sustainable reconstruction activity will eventually result in a Galle Fort where development needs of the local community and protection of the OUV are both met.