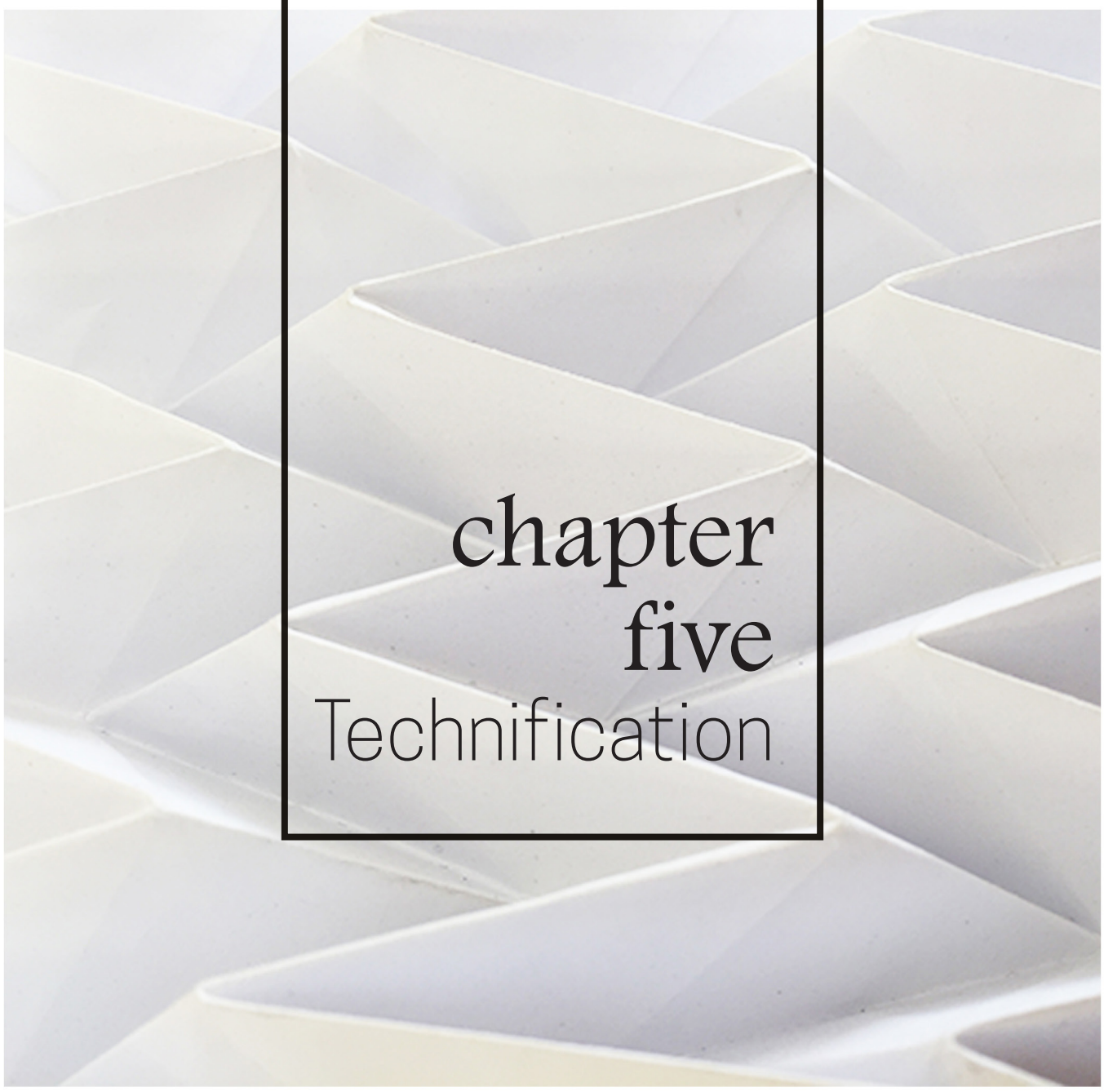


chapter five
Technification

This chapter follows on the conclusions made in chapter 4, the third phase of the making process is introduced through a series of photographs and design development sketches supported with written observations and reflections. The third phase of making focusses on the technification of the paper artefact and the fabrication and installation thereof. The guidelines and *cybrid* characteristics identified in earlier chapters are elaborated through the application of design elements.

Chapter 5 introduces the intervention approach for the space, where after the technical requirements for the artefact are defined. The documentation, reflection and conclusions of the third phase of making is followed by a section drawing through the whole space, to place the paper artefact installation in context. A series of drawings express the detail, construction and installation process of the paper artefact, further followed by a series of technical drawings, perspectives and details which visually expresses the final spatial outcome of the design and making process. The specific environmental requirements for the archive will also be elaborated in this chapter.

5.1
INTERVENTION

The general design intent for the space is developed at different levels of intervention as indicated in figure 5.1.1 To allow for the installation of new work the following procedures will be followed as specified by Scott (2008:108):

Stripping back: this entails the stripping out of damaged and unwanted fabric. Refer to figure 5.1.2 and 5.1.3.

Enabling works: this involves the demolition and removal of fabric which would prevent the application of new work if it were to remain.

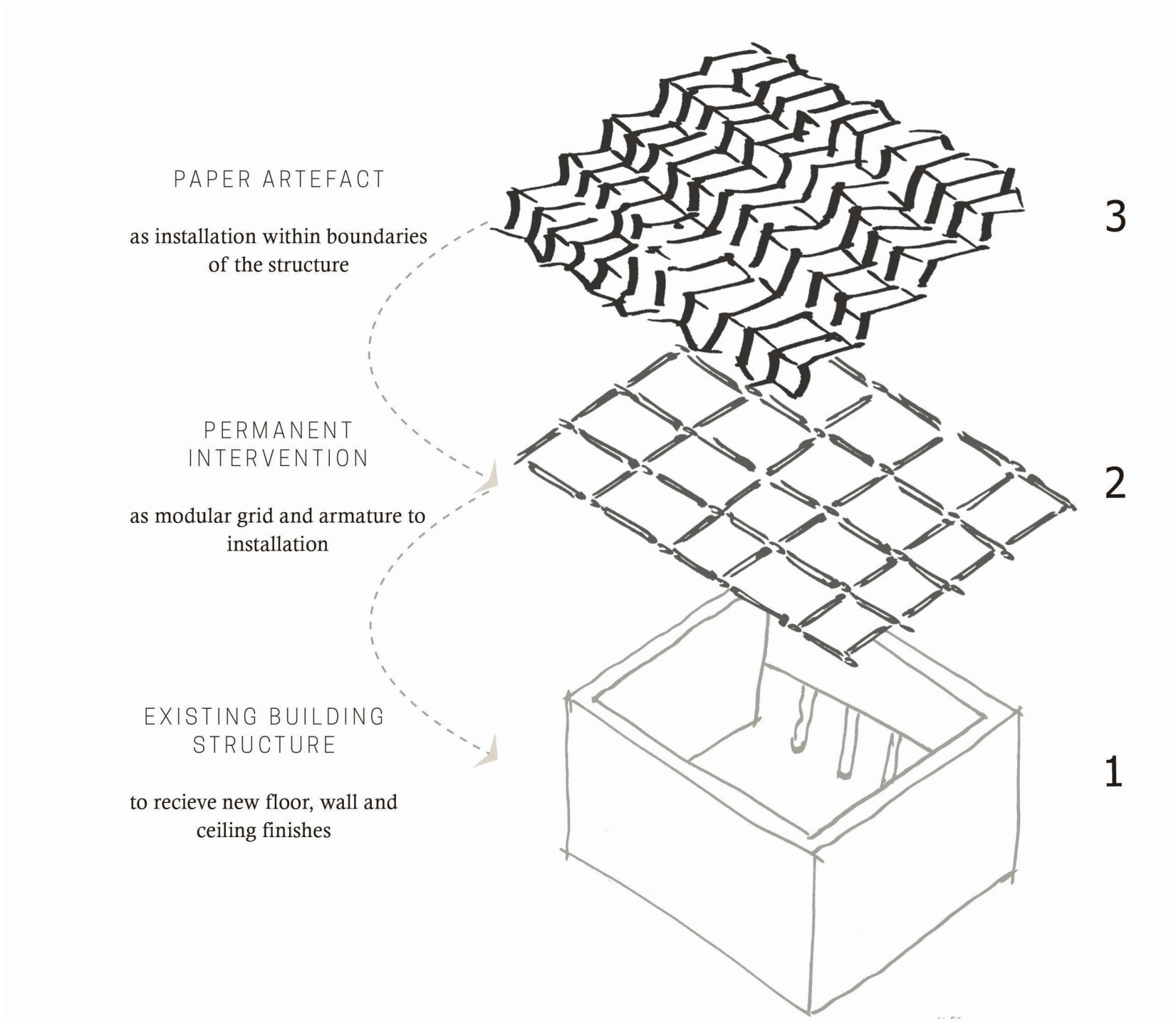


Figure 5.1.1 Levels of intervention (Author, 2016)

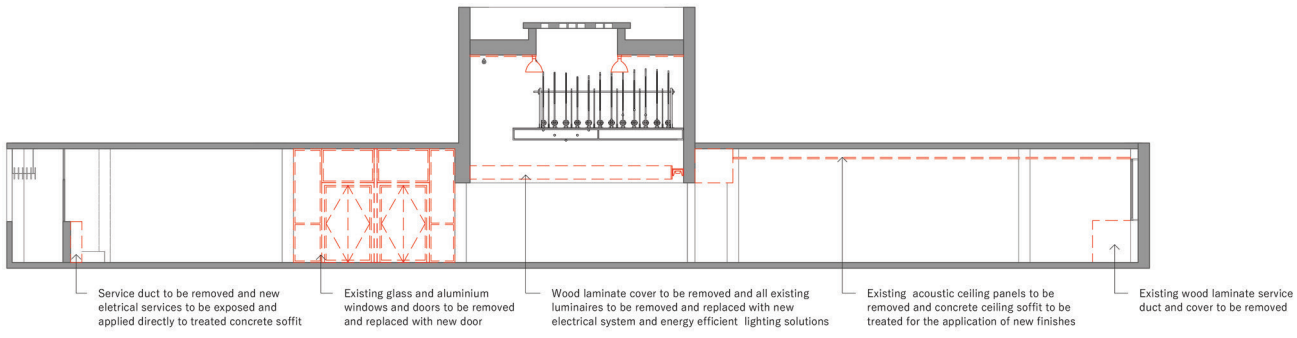


Figure 5.1.2 Demolition section (Author. 2016)

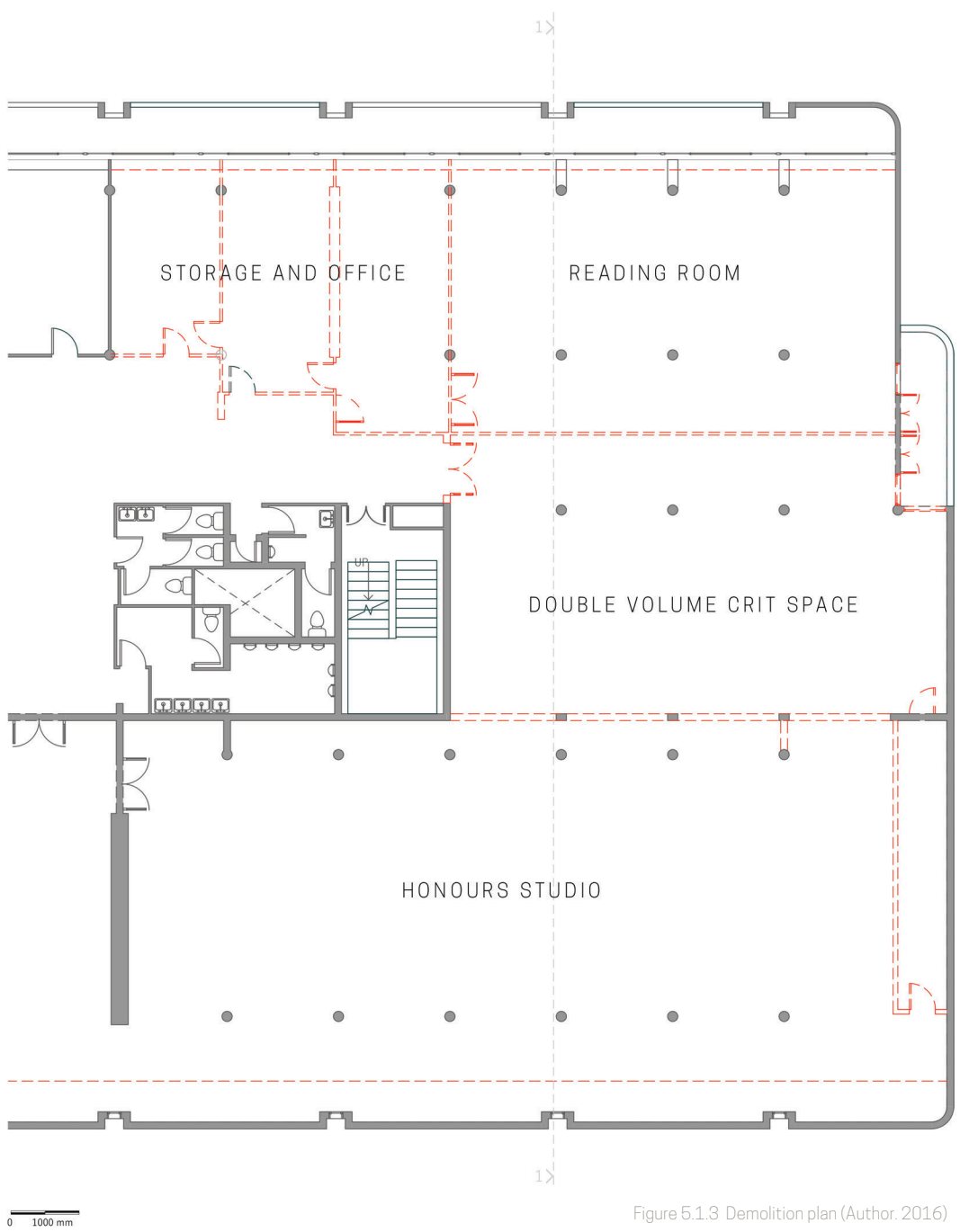


Figure 5.1.3 Demolition plan (Author. 2016)

LINE LEGEND

To be demolished

Existing structure

5.2 SPATIAL REQUIREMENTS

The requirements listed below is a continuation of the conclusions made in Chapter 4, where the possibilities and limitations of the application of the paper artefact where explained. This section addresses what the requirements are for the paper intervention.

5.2.1 SPACE DEFINING ELEMENT

Any three dimensional form naturally articulates the volume of space surrounding it and generates a field of influence or territory which it claims as its own (Ching. 2007:102).

Ching (2007:122) explains that a ceiling plane can be manipulated to articulate zones within a space and as the edges of the overhead plane could define the boundaries of the space, the texture, form, height, colour could support and define the formal qualities of the space. Refer to figure 5.2.1 through 5.2.3 where the form of the ceiling plane is explored diagrammatically. The artefact should be able to:

> Articulate zones in the space where information can be accessed whilst creating a stimulating environment.

5.2.2 LIGHT CONTROL

With the presence of reflective surfaces of the digital screens in the space, it becomes important to consider the lighting conditions for the different functions that will take place. The overall light quality of the space should be manipulated to create the ethereal quality to breathe new life into the space, which would encourage interaction and stimulate a vibrant sensory experience. The paper artefact should be able to:

> Minimize the glare on the individual digital screens.

> Create a ethereal light quality that would enhance the aesthetic of the space as per the *cybrid* characteristics.

5.2.3 PERCEIVED PRIVACY

The space should allow for multiple users in the space whilst separate activities are taking place in designated areas. The intention is to create visual delineation where focus is needed for a scenario such as a formal presentation as elaborated in figure 5.2.4, whilst allowing for interaction between users to encourage conversation as shown in figure 5.2.5. The artefact should be able to:

> Create perceived acoustic privacy.

> Create visual delineation and privacy to focus attention to specific activity.

The development of the artefact to accommodate these requirements will be elaborated in the sections to follow.

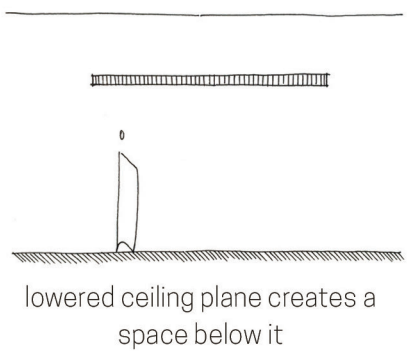


Figure 5.2.1 Flat ceiling plane (Author. 2016)

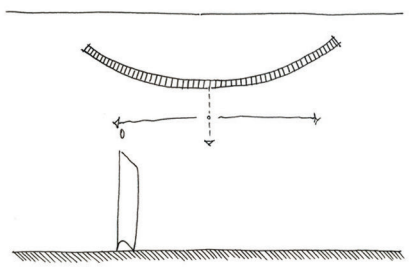


Figure 5.2.2 Convex ceiling plane (Author. 2016)

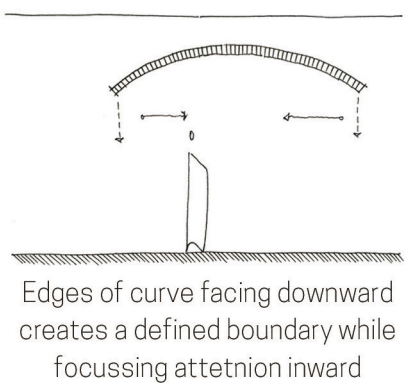
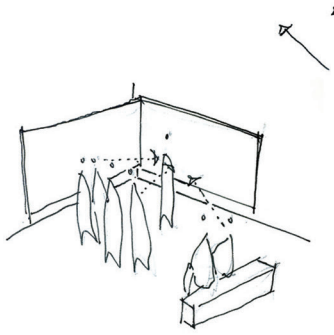
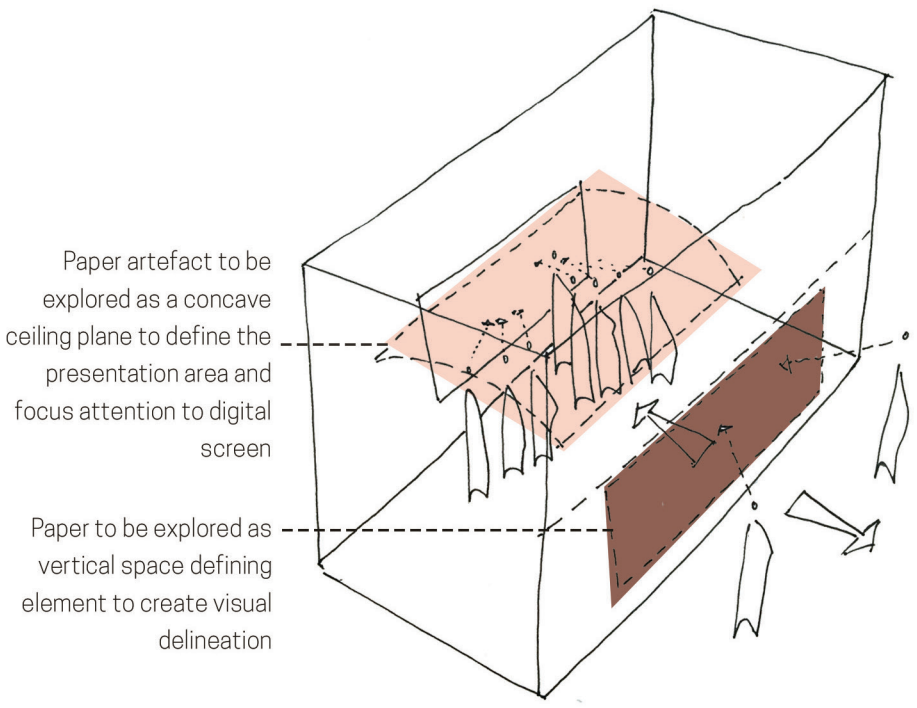


Figure 5.2.3 Concave ceiling plane (Author. 2016)



PRESENTATION SPACE

Formal presentation requires visual focus toward the vertical plane on which the work is presented, as well as a visual delineation to create percieved visual privacy.



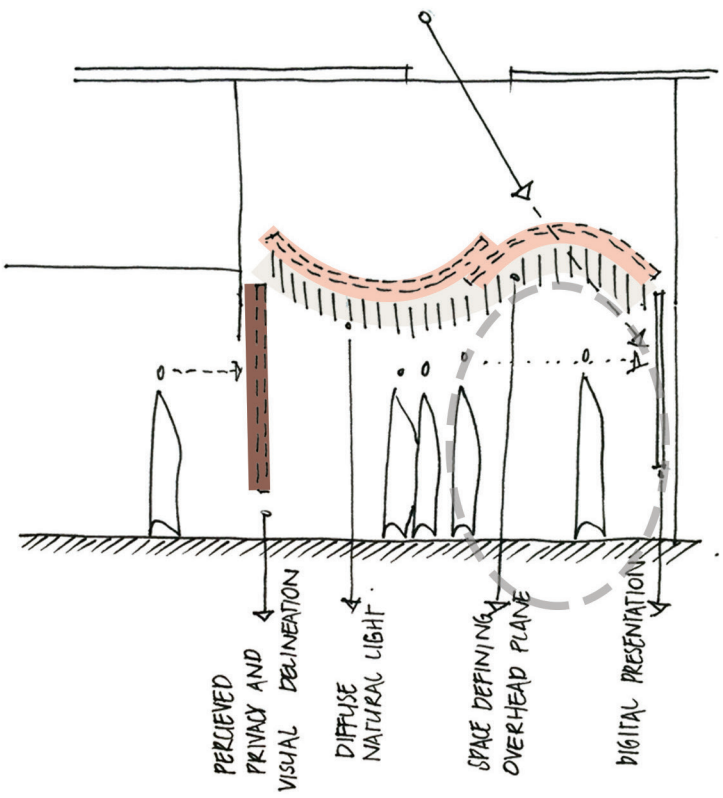
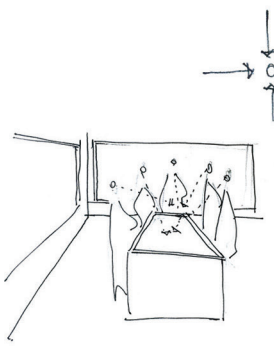
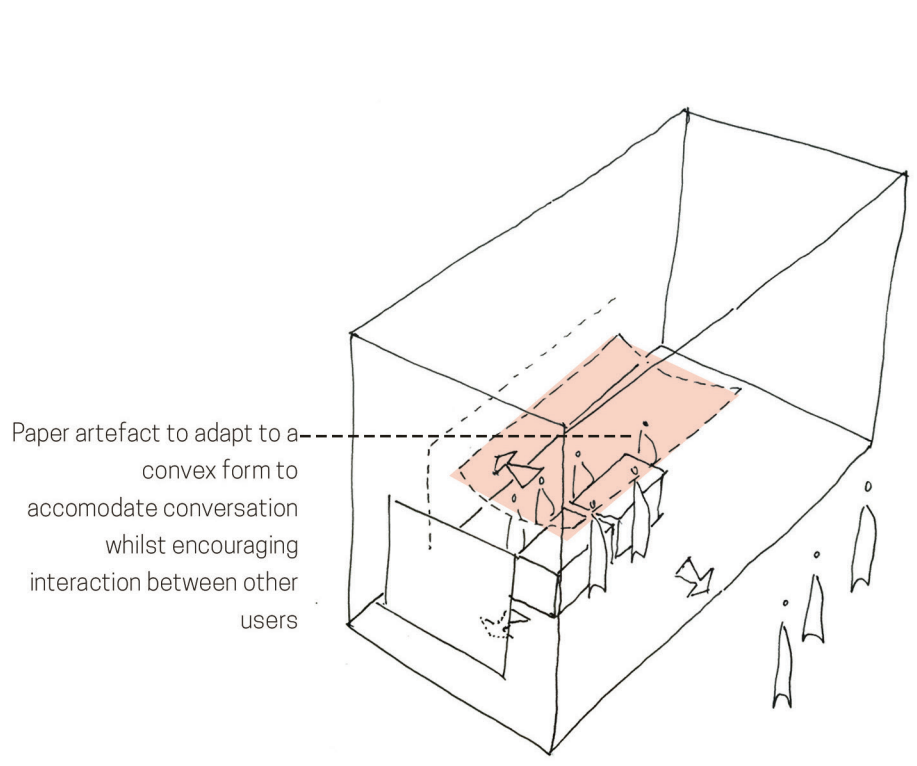


Figure 5.2.4 Scenario 1: Presentation (Author. 2016)



CONVERSATION SPACE

The conversation space should allow for visual access to adjacent spaces to encourage interaction from other users



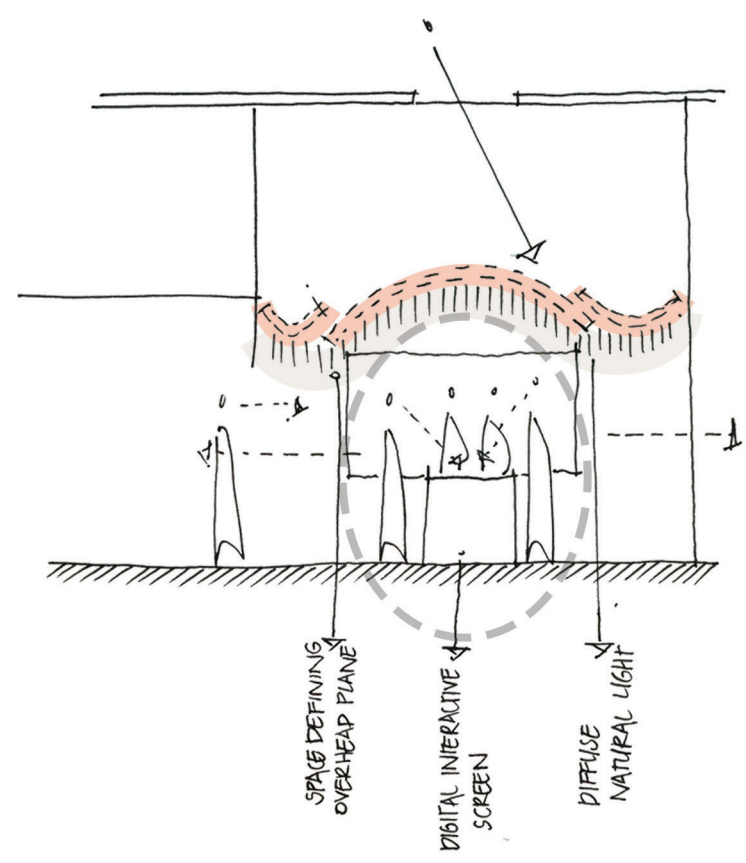


Figure 5.2.5 Scenario 2: Conversation and debate (Author. 2016)

5.3
TECHNIFICATION: REFLECTIONS

From the second phase of making the image with the support of the sectional spatial models, the focus of the investigation shifted toward the form of the space and the movement of the paper artefact as part of the kinetic mechanical system.

With a clear understanding of the spatial qualities that could be achieved with the paper, further spatial development was explored through sketches, spatial planning and computer generated models. Conventional two dimensional plan and section drawings where generated for the space as a whole.

The potential and requirements discussed in section 5.2, is developed further through the 3rd phase of making where the technification of the paper artefact becomes the focus. With the support of various drawing explorations on section and plan, the overall form of the space was developed to define the perceived acoustic and visual privacy through the application of a kinetic mechanism. The form and movement is determined by two dominant scenarios of the space, refer to section 5.2 figure 5.2.4 and 5.2.5, which creates opportunity for the application of adaptable elements manipulated by the kinetic system. Refer to Appendix B for the sketch development of the technical details.

Figure 5.3.1 Suspended grid model (Author. 2016)

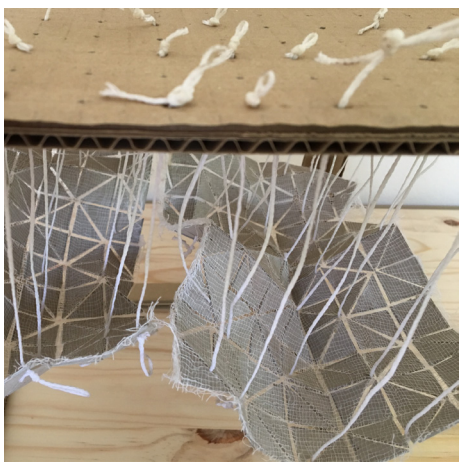


Figure 5.3.2 Representation of paper artefact (Author. 2016)

Figure 5.3.3 Movement of suspended artefact (Author. 2016)

5.3.1
SUSPENDED GRID MODEL

Description: Sample was built as a representation of the paper artefact, using cardboard triangle cut outs fixed to a textile to allow for flexibility, see figure 5.3.1 and 5.3.2. The model was not built to scale. The sample is suspended from a cardboard structure and attached to a grid with rope to be able to manipulate investigate movement of the sample.

Observation: Because the sample is one single element, the movement is limited, once a string is pulled the entire sample pulls slightly towards that point, as illustrated in the photograph series in figure 5.3.3. The model gives a good understanding of what the limitations and possibilities are for the suspended paper artefact.
The pattern of the sample creates interesting shapes when pulled at single points, but when pulled in a similar motion as a kinetic wave, the form stays flat.

Reflection: Build a suspended model that can illustrate a continuous kinetic movement for the paper sample. Explore the depth of movement and pattern of the paper artefact, to move beyond a flat surface.

Figure 5.3.4 Kinetic mechanism with staggered cam and arm (Author. 2016)

Figure 5.3.5 Kinetic mechanism (Author. 2016)

Figure 5.3.6 Flexible grid (Author. 2016)

Figure 5.3.7 Dowel and eye hook (Author. 2016)

5.3.2
KINETIC MECHANISM

Description: In order to achieve the required motion for the manipulation of the paper in the space, a mechanical system was investigated, from which the model was developed and technified. The model is a lasercut cardboard model with multiple parts, some exaggerated to represent the actual detail. It was built in order to determine the placement of the cams and the result it would have on the movement of the paper. See figure 5.3.4 and 5.3.5 for clarity.

Observation: The depth of movement is limited to the radius of the cam and placement of the shaft on the mechanism, within the limitations of the space a depth of 400 mm could be achieved. The intention of creating movement in two directions, allowing spatial manipulation in four planes is eliminated as it is an extremely complex system to construct.

Reflection: The rotating mechanism enables the motion of the paper therefore further exploration to a grid system as armature to the paper should be investigated.

5.3.3
FLEXIBLE GRID

Description: Grid model was constructed on a scale 1:2 with the use of 6 mm timber dowels and eye hooks. The dowels are attached to one another in a 150 x 150 mm square grid and fixed to a cardboard sheet with rope to manipulate the height of the suspended grid.

Observation: Simple construction with eye hooks allows for an extremely flexible grid that could accommodate a fluid motion of the kinetic mechanism. The smaller the grid (the more moveable parts) the more flexibility it has.

Reflection: The joining of rope to the eye hook, refer to figure 5.3.7, should be investigated further to achieve a more sophisticated yet simple detail. Thickness of timber dowels should be explored as well as the potential fixing points for the paper artefact.

5.3.4
GLIDE REFLECTION FOLD

Description: White cartridge paper 420 x 420 mm sheet.

Observation: Folded product size is limited to the flat sheet size because the folding technique results in more than 50% shrinkage in size after folding.

Small folded piece are flexible but not as organic as would be required to achieve specific aesthetic quality. The artefact should be extremely malleable to manipulate the suspended paper to achieve the fluid spatial form.
The form of the folded paper creates an intricate texture as a result of the shaping process, and the texture is no longer just surface based but three dimensional. Paper as a object in itself has a vibrant texture.

Once the paper is applied to the space the texture could be perceived as being surfaced based and a organic textile like form is a result of the folded texture, creating a new dimension for paper to move in.

Reflection: Investigate the folded product on a larger scale with a larger sheet of paper. Investigate similar folds that could potentially be more relaxed and even more organic and malleable. The artefact should have the ability to be draped from the ceiling to achieve morph and ethereal quality as specified in Chapter 4 table 4.7.1, while being extremely delicate and intricate.

Investigate the texture of the fold to create more diversity in its spatial application, to create spaces where texture becomes a supportive space defining element.

Figure 5.3.8 Stretched glide reflection fold (Author. 2016)

Figure 5.3.9 Glide reflection fold texture (Author. 2016)

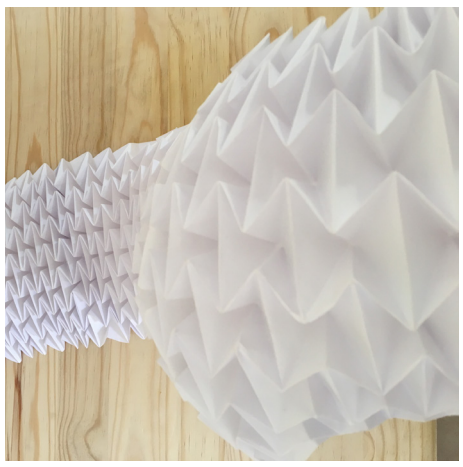


Figure 5.3.10 Fluidity of glide reflection fold (Author. 2016)

5.3.5
MULTIPLE V-FOLD

Figure 5.3.11 Fluidity of multiple v-fold (Author. 2016)

Figure 5.3.12 Collapsed multiple v-fold (Author. 2016)

Figure 5.3.13 Multiple v-fold texture (Author. 2016)

Description: The intention of this fold pattern is to explore the scale of the folds for the paper artefact as well as to test its flexibility in two directions, to allow for kinetic motion in one direction and form manipulation in the other.

Observation: Small scale folds are harder to collapse into the three dimensional shape and if the pattern is not folded extremely accurately, the folds crumple on the edges.

The V-fold is extremely malleable in one direction but does not flex enough in the other direction.

Individual panels (+- 500 x 500 mm) do not have the same dramatic aesthetic quality as one large element. The smaller individual folded panels move one another and not as one structure. Joining the individual panels with glue is not an optimal solution (aesthetically and practically).

Reflection: Investigate more intricate fold patterns to achieve variation in texture. Explore the joinery between individual panels to contribute to the aesthetic quality as well as to make installation and maintenance more efficient.

Extend size of fold sheet in direction two to test if the size could add flexibility. Test perforated paper to see if it makes folding process easier.

5.4
SPATIAL INTERVENTION

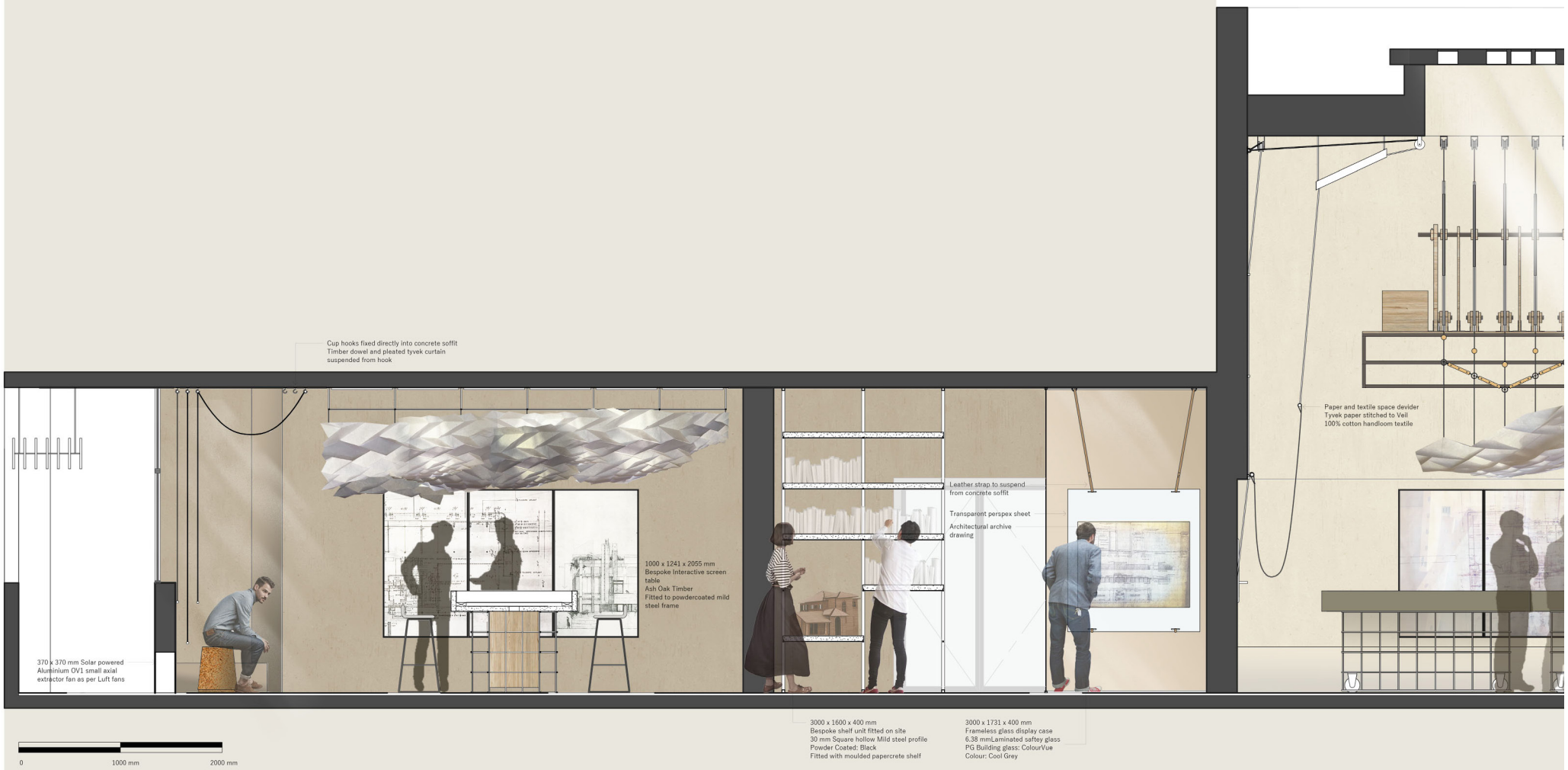
Understanding and appreciating the fundamentals of detail design in regard to architecture and interior architecture is without a doubt important: it is not until the architectural elements are brought together through sensitive detailing that a space becomes wholly believable and creditable Hay (2007:36).

The development of the spatial design response is informed by all the data generated through the phases of making with paper, as well as the analysis and interpretation of collected data.

The intention of this study is focused on the aesthetic and atmospheric quality achieved through the re-representation of the architectural drawing archive. The design was developed to achieve an ethereal spatial quality with the application of a suspended paper intervention as the visual link between the material and immaterial. Through the act of making the sublime beauty and potential of paper within the context of the paper archive was realized. The movement, textures and light qualities of the paper is intended to stimulate the user's senses and breathe new life into the perceived redundant archive.

Throughout the space, subtle design elements are developed to define the new *cybrid* space. The space is designed to be perceived as a robust space which captures the very basic character of the architectural shell, to which the addition of the paper installation contributes all of the intricate aesthetic, intangible and functional qualities.

The intention is to ultimately create a space which celebrates the significance of the architectural drawing archive, through the integration of both the physical and digital realm. The unique qualities which will be showcased in the following diagrams, three dimensional models, plans and section, will each highlight specific qualities that are introduced back into the space as per the discussion in Chapter 3 section 3.3.1 the comparative analysis.



SECTION 1-1 SCALE 1:20

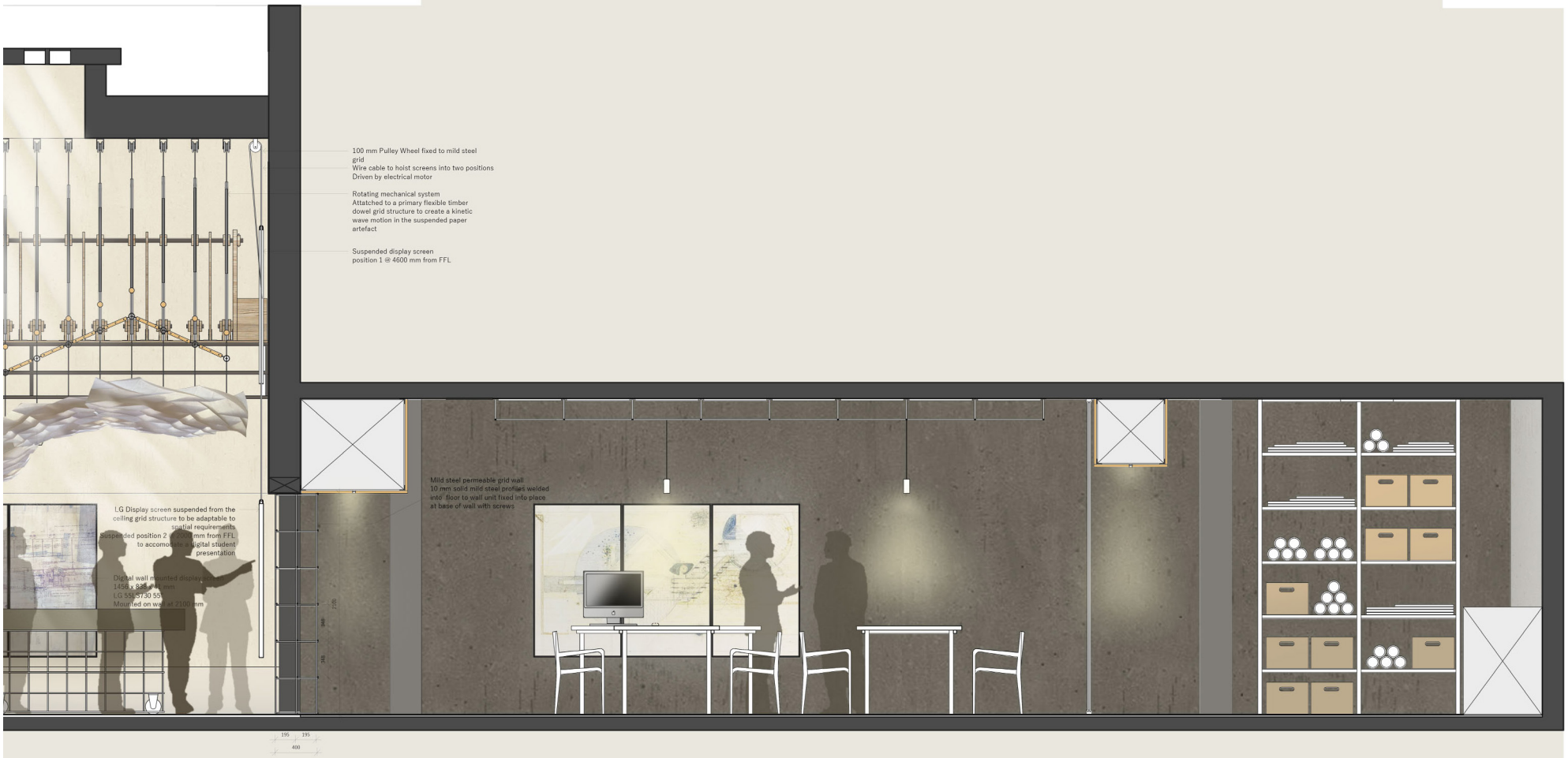


Figure 5.4.1 Section 1-1 (Author, 2016)

5.5
SUSPENDED PAPER INSTALLATION

The development of the paper artefact is informed by the following *cybrid* characteristics: Ethereal, morph and meticulous detail.

The paper artefact is developed as the infill to the modular grid intervention which serves as armature to enhance the spatial impact of the installation. The paper installation creates an intriguing spatial experience which aims to capture the essence of both realms whilst supporting and enhancing the operation and activities that takes place in the *cybrid* archive by:

+ Defining space as both an overhead plane and vertical plane

+ Controlling natural and artificial light within the space to minimize glare on smooth surfaces

+ Creating an ambient and ethereal light quality to stimulate the senses

+ Introducing textures as supportive space defining elements

+ Introducing texture and pattern to encourage interaction of the senses

+ Reintroducing sound of paper through the kinetic sculpture

+ Extricating the qualities of the physical paper archive whilst representing the new *cybrid* character in the ability to morph, create ethereal spatial quality and through meticulous joinery.

Section 5.7 through 5.8 will elaborate the material selection, fabrication and installation of the paper artefact within the space.

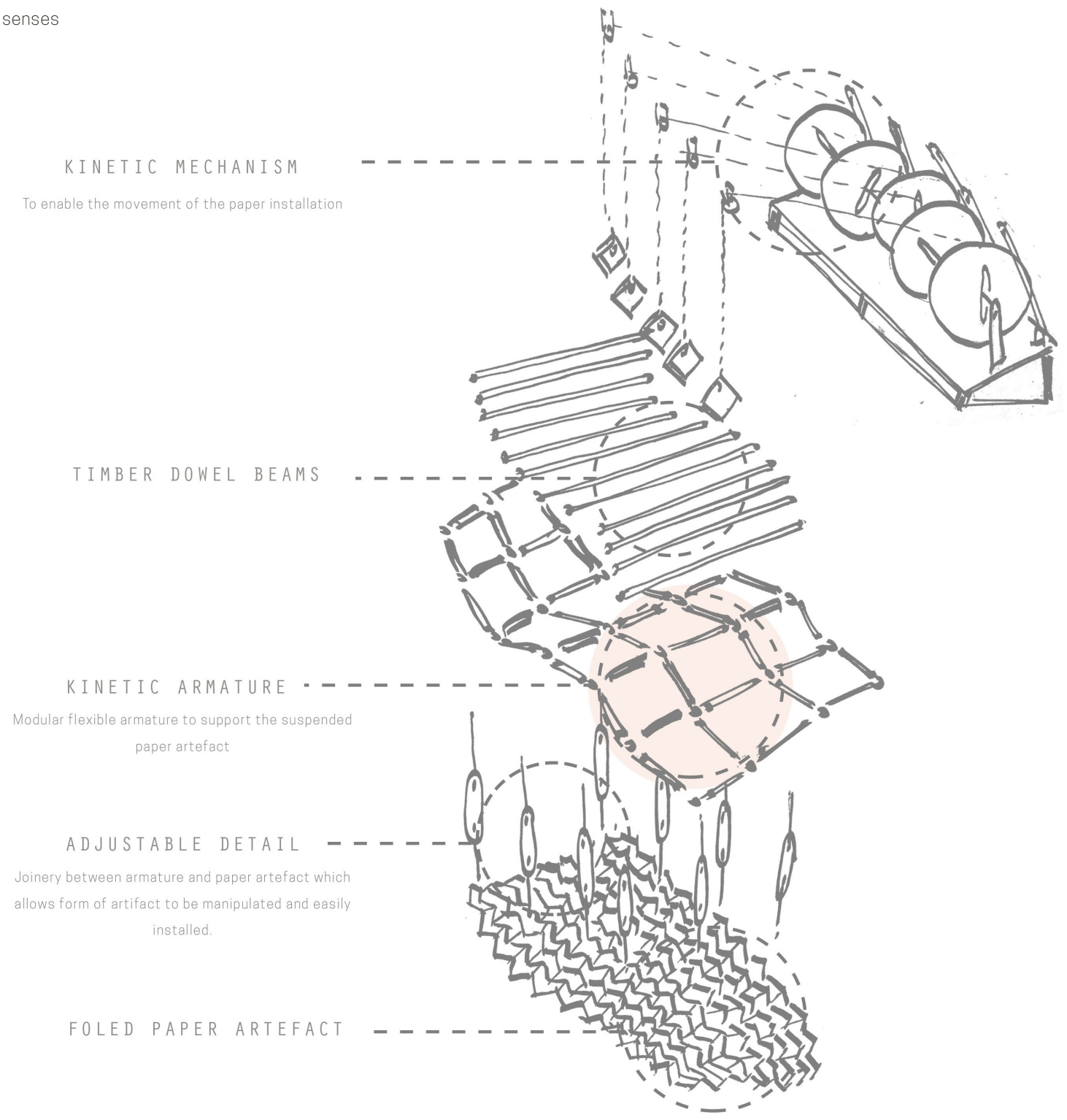


Figure 5.5.1 Suspended installation diagram (Author. 2016)

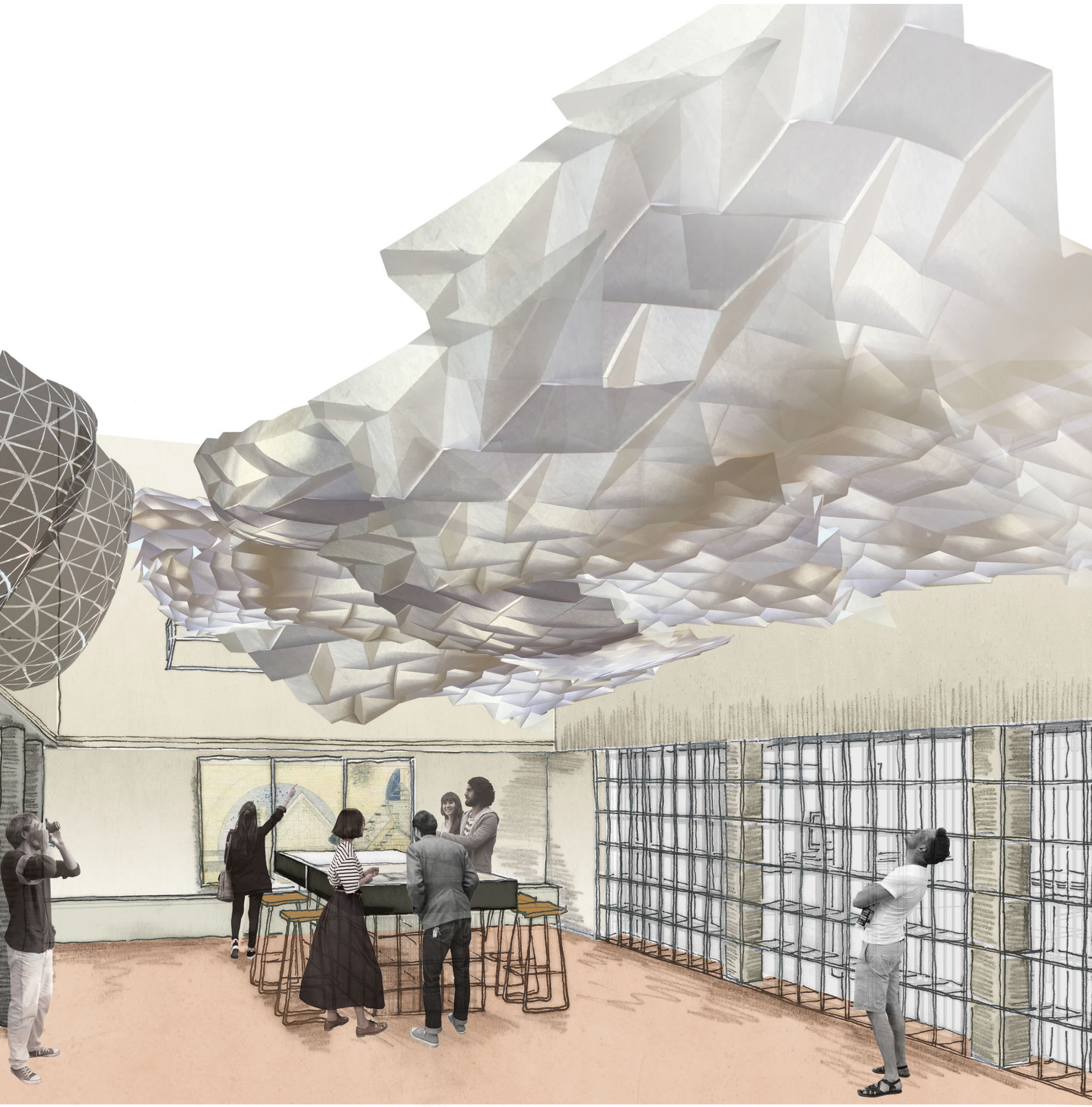


Figure 5.5.2 Double volume space (Author. 2016)

5.6 GRID AND KINETIC MECHANISM

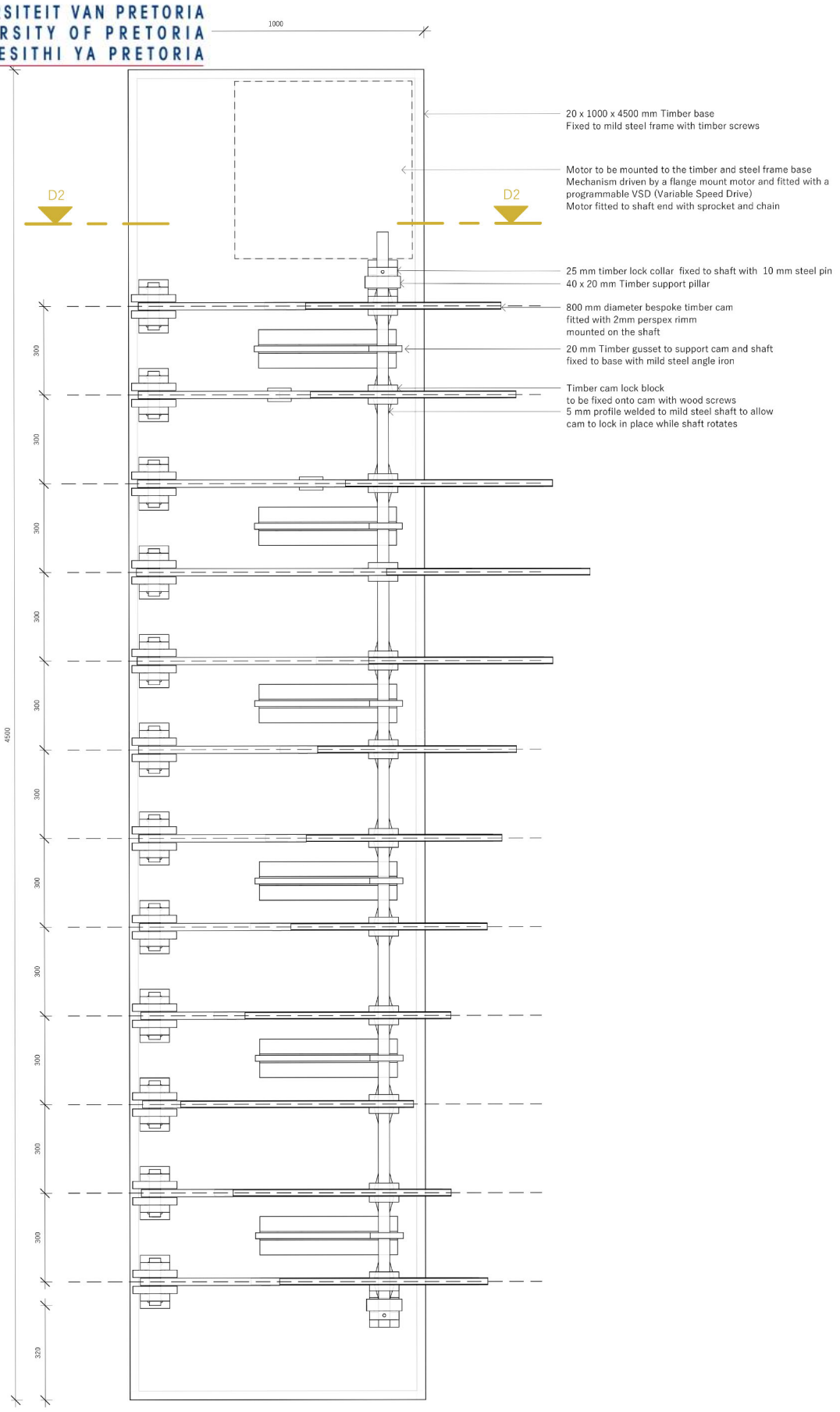
The spatial development is informed by the following *cybrid* characteristics: morph, ethereal, visual access and meticulous joinery.

The intention of both the fixed and kinetic modular grid structure throughout the space is to allow for multiple smaller spatial interventions to take place. The grid system is designed as an armature to enable the paper installation to achieve the specific aesthetic and functional requirements of the *cybrid* archive.

The mechanical system is developed as a permanent intervention within the boundaries of the existing structure. The bespoke timber constructed mechanism, refer to figure 5.6.1 through 5.6.4, enables a wave motion to be translated to the suspended grid system, see drawing for further detail, which ultimately allows the manipulation of the space through the paper installation.

5.6.1 MANAGEMENT SYSTEM

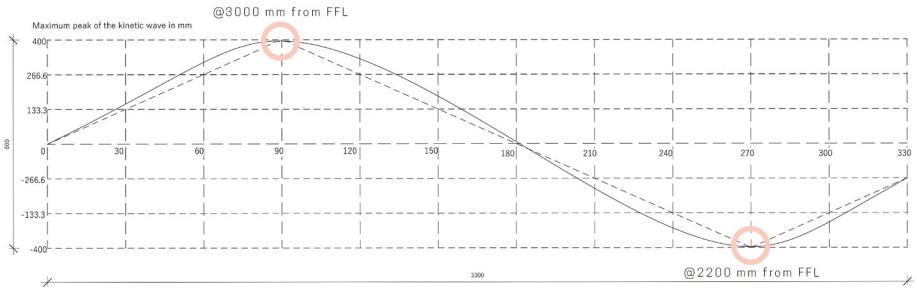
The kinetic wave motion will be enabled by an electrical motor which would be programmed to move in a continuous wave motion for one minute from when the digital interactive screens, refer to section 5.12 Digital screens, are turned on and off. The kinetic mechanical system will be manipulated through the activation of settings installed to the digital interactive screens, for which the system will have two static positions, refer to figure 5.2.4 and 5.2.5,which will support the individual spatial scenarios.



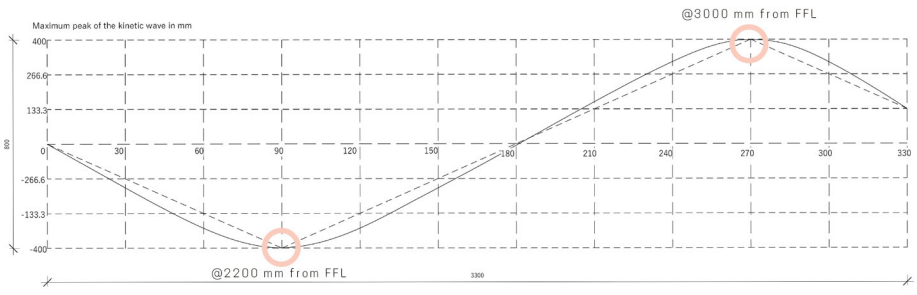
D1 KINETIC MECHANISM SCALE 1:10

Figure 5.6.1 Plan view of kinetic mechanism (Author. 2016)

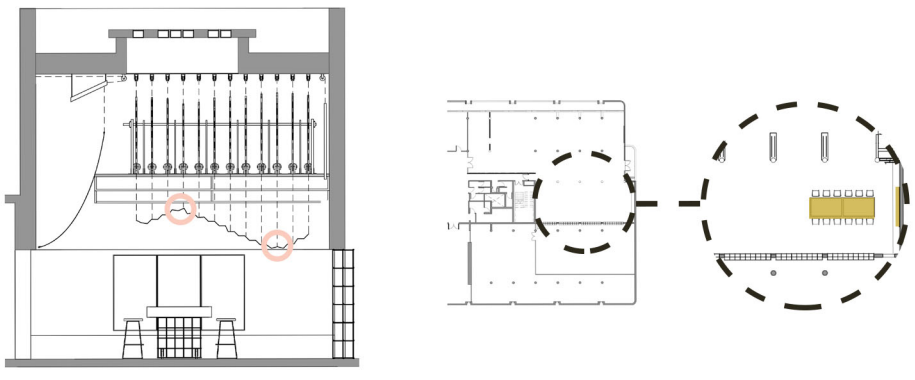
SCENARIO 1: CONVERSATION AND DEBATE



SCENARIO 2: FORMAL PRESENTATION



FORM OF KINETIC WAVE IN POSITION 2 SCALE 1:10



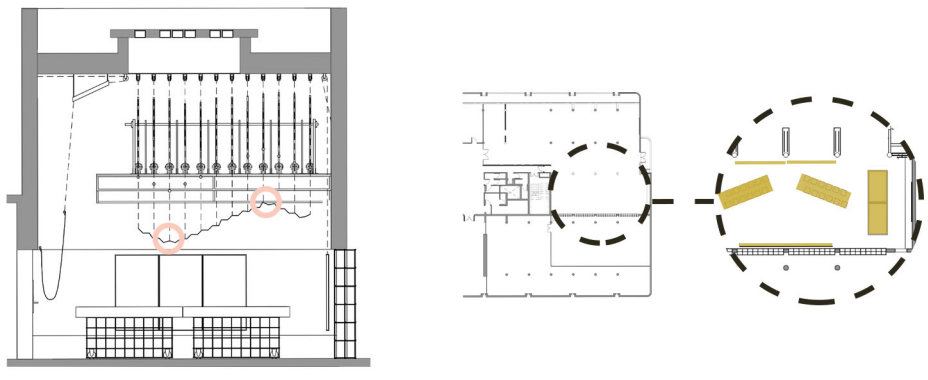
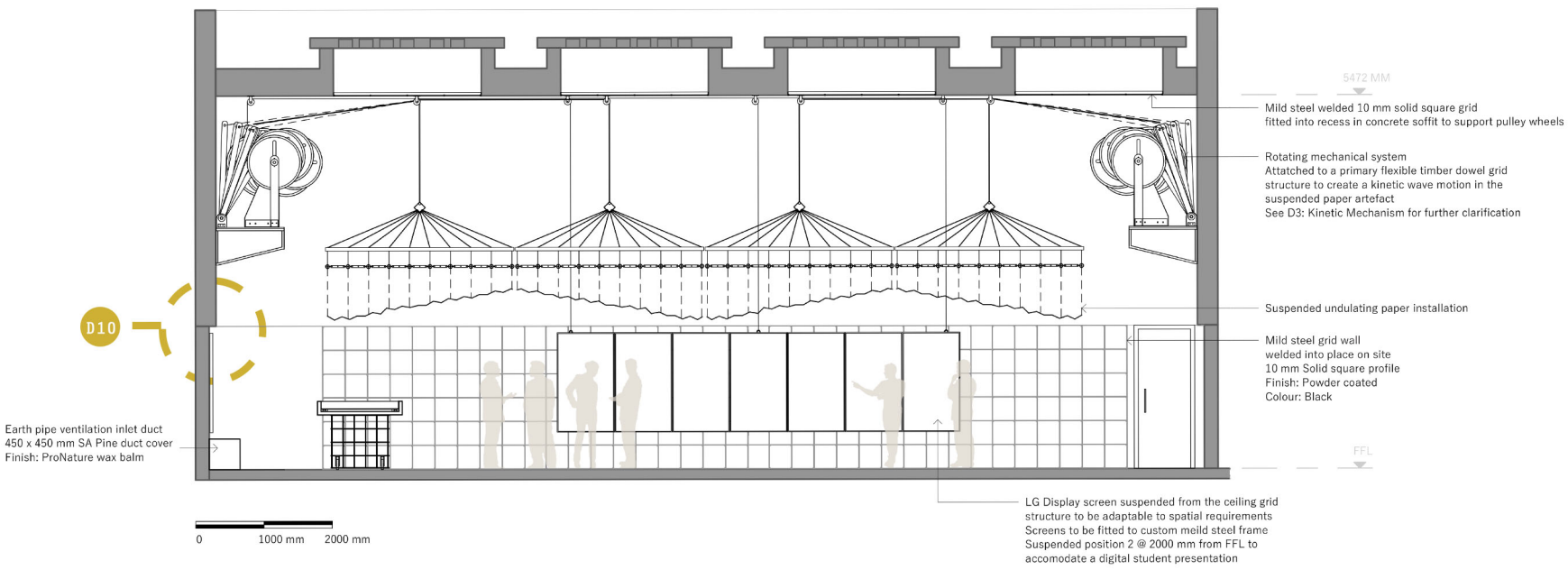
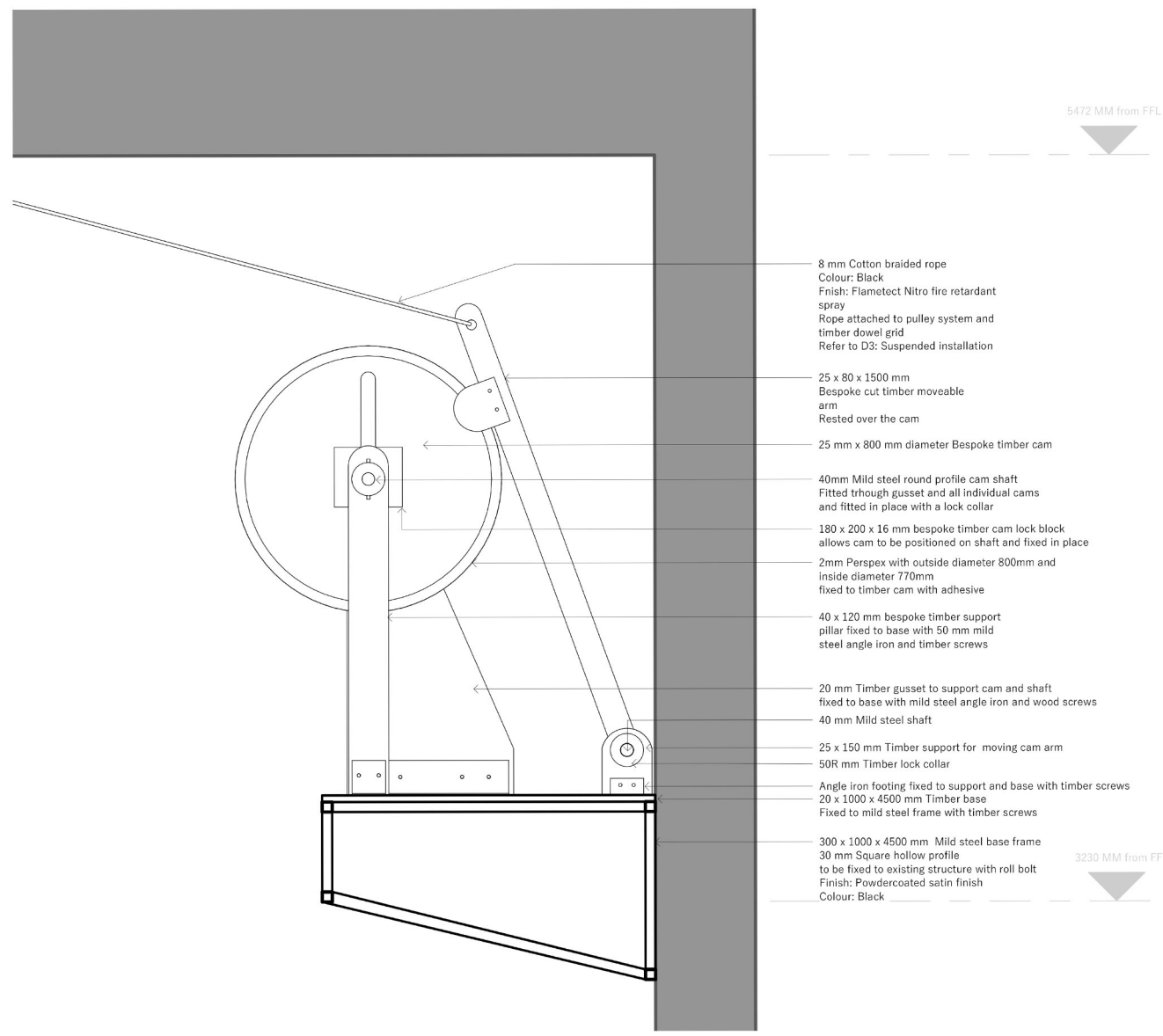


Figure 5.6.2 Spatial scenarios (Author. 2016)



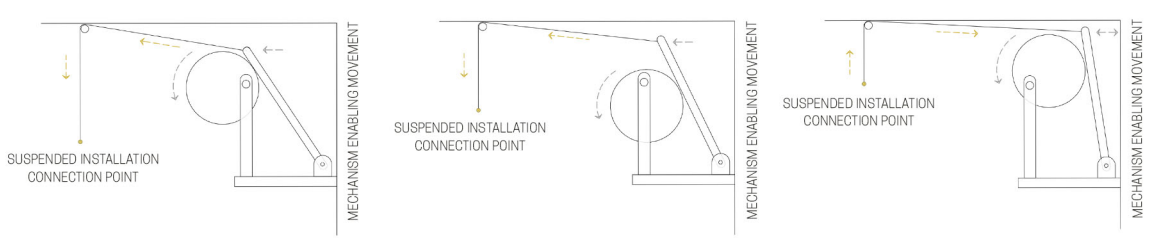
SECTION 3-3 SCALE 1:50

Figure 5.6.3 Section 3-3 (Author. 2016)



D2 KINETIC MECHANISM SCALE 1:10

Figure 5.6.4 Call out detail: Mechanism (Author. 2016)



5.7
GRID INSTALLATION

The grid number column in table 5.7.1, indicates the point on the kinetic grid system as per figure 5.7.1, where the adjustable detail will be placed and attached to the folded paper artefact. The detail setting column in table 5.7.1 indicates the setting on the adjustable detail to achieve required heights for the paper installation.

Distance is measured from the hook to the joinery of rope knot to paper artefact.

ROPE 1:

A1 = 500 mm

A2 = 550 mm

A3 = 600 mm

A4 = 650 mm

A5 = 700 mm

A6 = 750 mm

A7 = 800 mm

A8 = 850 mm

A9 = 900 mm

ROPE 2:

A1= 300 mm

A2= 400 mm

A3= 500 mm

A4= 600 mm

A5= 700 mm

ROPE 3:

A1= 900 mm

A2= 1000 mm

A3= 1100 mm

A4= 1200 mm

A5= 1300 mm

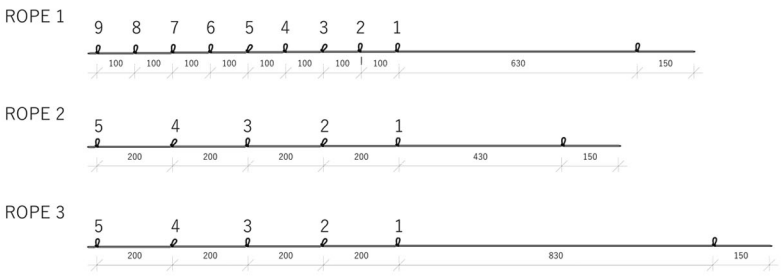
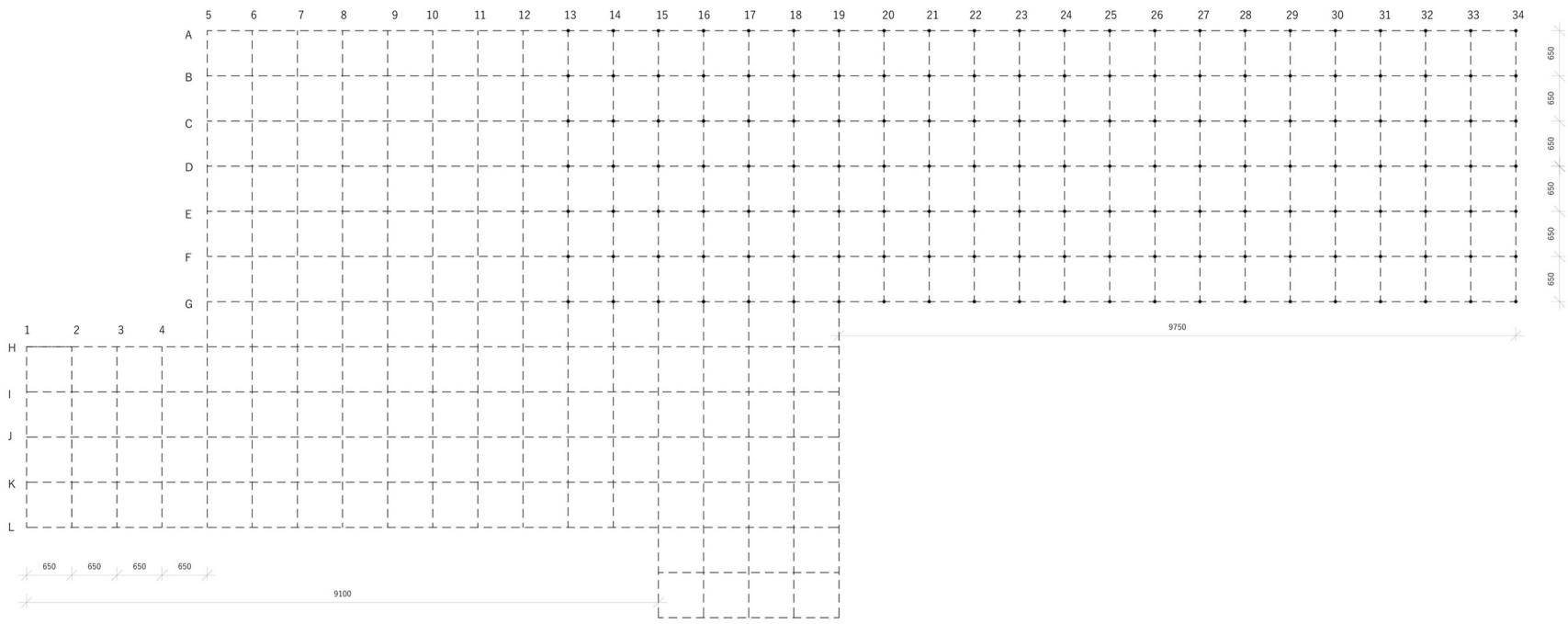
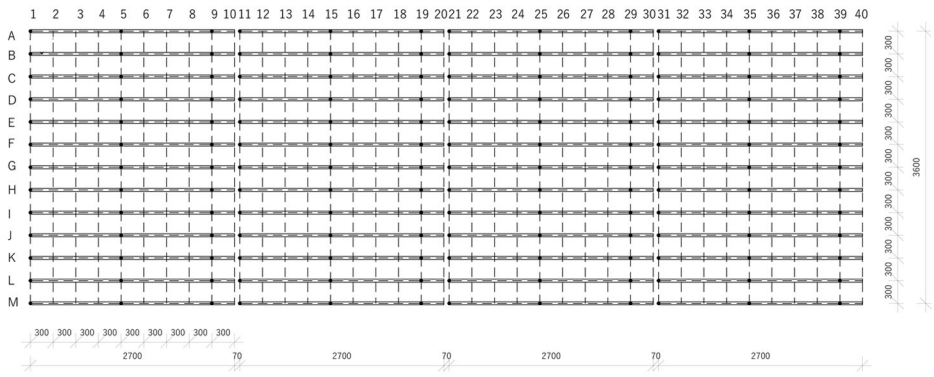


Figure 5.7.1 View of conversation and debate spaces (Author. 2016)



G1 STATIC ARMATURE LAYOUT SCALE 1:50

Figure 5.7.2 Static armature layout (Author. 2016)



G2 KINETIC ARMATURE LAYOUT SCALE 1:50

Timber dowel beam

Adjustable detail

Kinetic armature (grid)

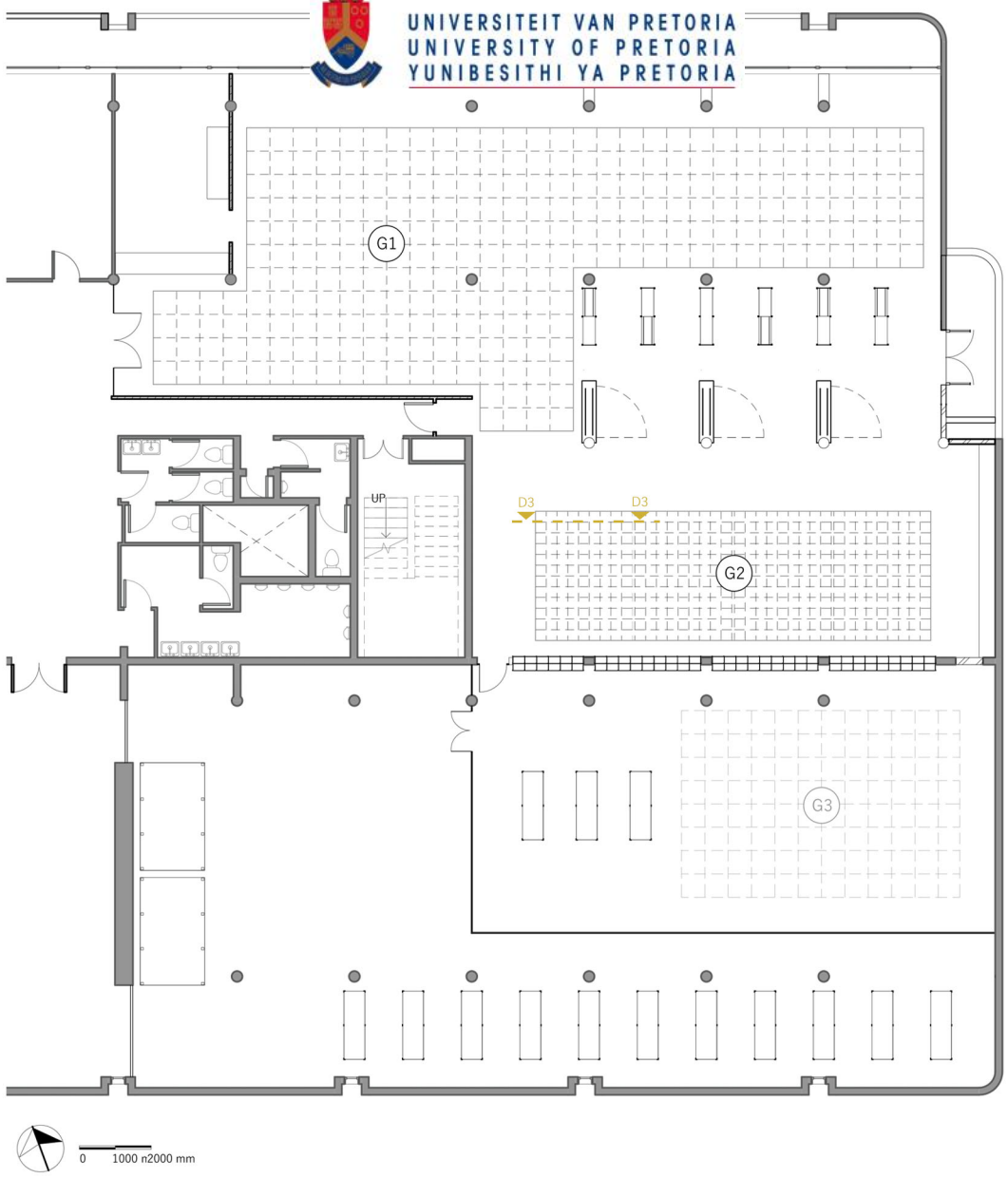
Figure 5.7.3 Kinetic armature layout (Author. 2016)

GRID NUMBER	DETAIL HEIGHT SETTING
A1 – M1	A9
A 5 - M5	A5
A 9 - M9	A1
A11 - M11	A1
A15 - M15	A5
A19 - M19	A9
A21 -M21	A9
A25 - M25	A5
A29 -M29	A1
A31 - M31	A1
A35 - M35	A5
A39 - M39	A9

Table 5.7.1 Kinetic grid installation specifications (Author. 2016)

GRID NUMBER	DETAIL HEIGHT SETTING
A13 - G 13	R2: A1
A14 - G14	R2: A4
A15- G15	R3: A5
A16- G16	R3: A2
A17- G17	R2: A5
A18- G18	R2: A4
A19- G19	R2: A3
A20- G20	R2: A2
A21- G21	R2: A2
A22- G22	R2: A4
A23- G23	R2: A5
A24- G24	R3: A2
A25- G25	R3: A5
A26- G26	R3: A2
A27- G27	R2: A5
A28- G28	R2: A4
A29- G29	R2: A3
A30- G30	R2: A2
A31- G31	R2: A2
A32- G32	R2: A2
A34- G34	R2: A2
A35- G35	R2: A1

Table 5.7.2 Static grid installation specifications (Author. 2016)



ARMATURE (GRID) LAYOUT SCALE 1:100

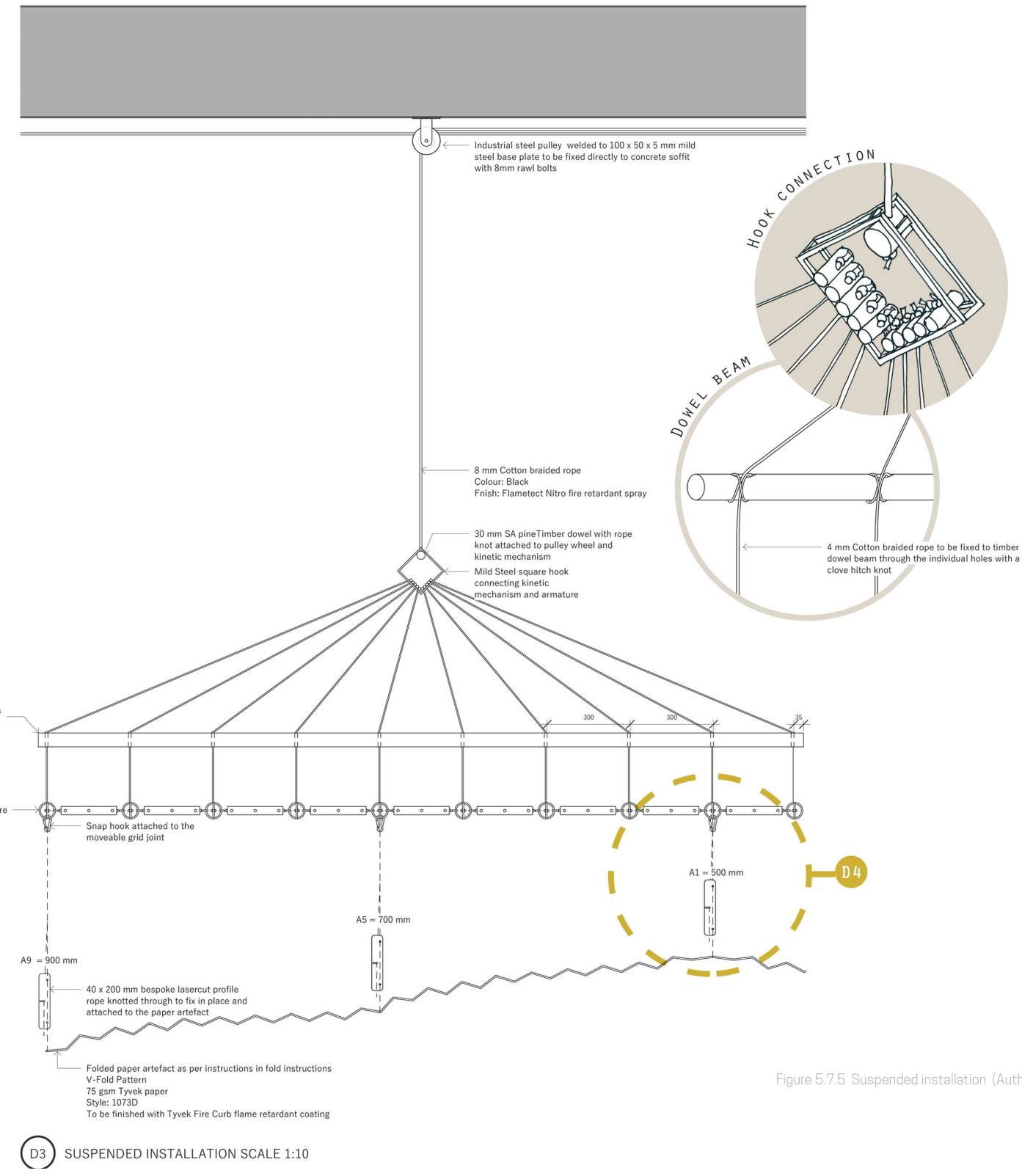
GRID LEGEND:

G1 STATIC ARMATURE:
7750 x 5200 mm Static 10 mm solid square profile mild steel grid fixed directly to existing concrete soffit base at 650 x 650 mm spacing @ 2800 mm from FFL
Finish: Powdercoated black

G2 KINETIC ARMATURE:
Kinetic undulating grid suspended from concrete soffit base and movement enabled through electrical motor driven mechanism
Material: Perforated timber dowels and bespoke moulded Perspex profiles

G3 STATIC GRID:
Static 10 mm solid square profile mild steel grid fixed directly to existing concrete soffit base at 650 x 650 mm grid spacing @ 2800 mm from FFL
Finish: Powdercoated black

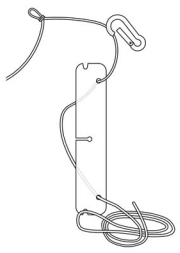
Figure 5.7.4 Plan indicating grid for installation (Author. 2016)



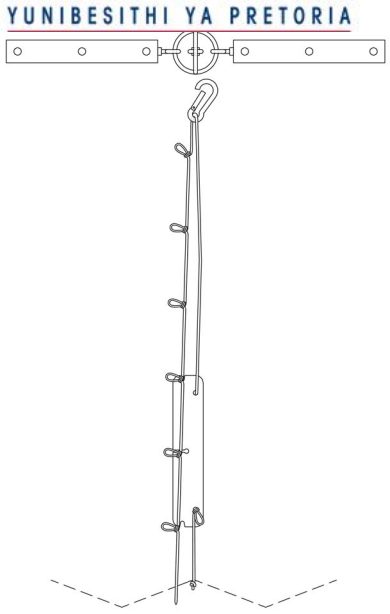
D3 SUSPENDED INSTALLATION SCALE 1:10

Figure 5.7.5 Suspended installation (Author. 2016)

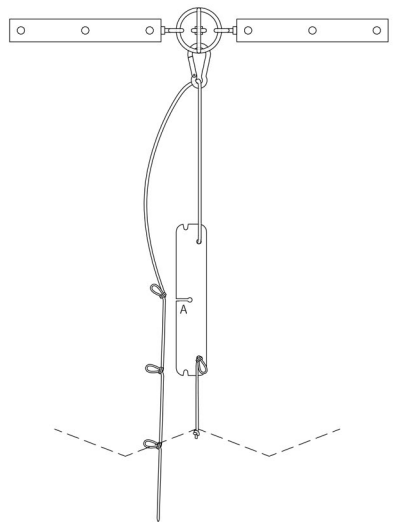
Rope to be knotted as per lengths indicated in



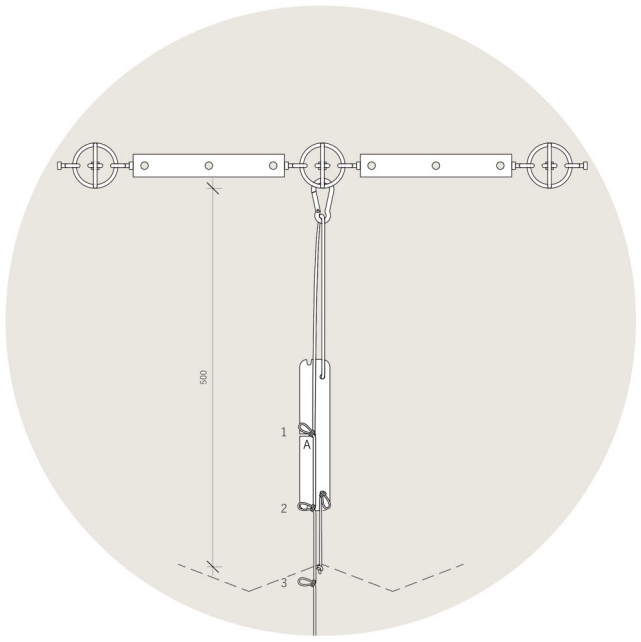
End of knotted rope to be woven through laser cut profile and loop knot to be made at end to fix into position
Leave a remaining 150 mm at rope end
Snap hook to be attached to rope



Detail to be attached to folded paper artefact with knot and whole unit to be attached to kinetic armature

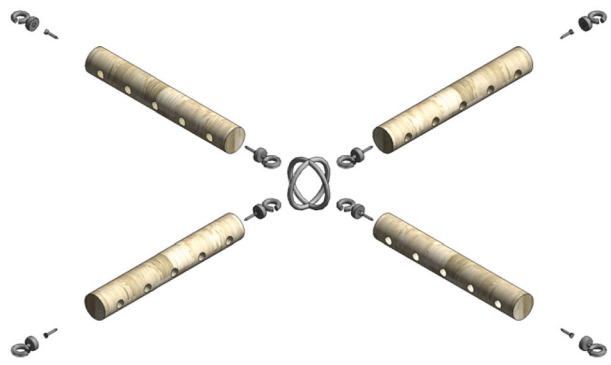


Height of artefact can be adjusted according to requirements specified



D4 KINETIC ARMATURE AND ADJUSTABLE DETAIL SCALE 1:5

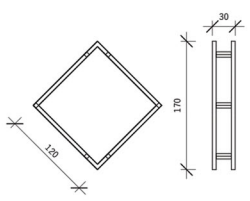
Figure 5.7.6 Detail: Kinetic armature and adjustable detail (Author. 2016)



D4 EXPLODED 3D: KINETIC ARMATURE

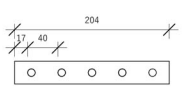
Figure 5.7.7 3D: Timber dowel grid (Author. 2016)

HARDWARE LEGEND

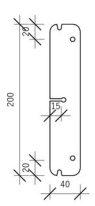


Bespoke welded hook profile
Material: 5 mm Mild steel solid square profile
Finish: Powdercoated satin black

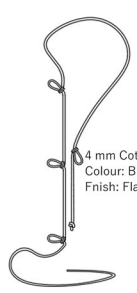
Bespoke moulded connection ring
Material: Perspex Cast Acrylic Vario
Colour: Grey



Perforated grid dowel
Material: 30 mm Pine timber dowel with 10 mm holes
Finish: ProNature clear wax balm



Bespoke lasercut profile
Material: 2 mm Perspex Cast Acrylic Vario
Colour: Grey



4 mm Cotton braided rope
Colour: Black
Fnish: Flametect Nitro fire retardant spray

Bespoke moulded eye hook
Material: Perspex Cast Acrulic Vario
Colour: Grey

60 mm Stainless steel snap hook

5.8 MATERIAL SELECTION

The material selection process is guided by all the characteristics listed in Chapter 4 section 4.4. The primary requirements for the paper or paper like material are the following:

+ Material should fold easily and retain its shape

+ Material should be available in large format sheet sizes

+ Material should be flexible enough to create malleable folded element

+ Material should be able to diffuse light to create an ambient atmosphere to achieve an ethereal spatial quality

Two additional tests are done which include the light quality as well as the durability of the material, to assist with the material selection for the specific spatial application.

5.8.1 DURABILITY FOLD TEST

The intention of the experiment was to establish an estimated wear and tear on the fold lines of the paper. No specific data was captured and only observation used to draw conclusions from. Each 150 x 150mm paper has one fold down the middle and was folded in both directions, 300 times. Two samples where used for each type of paper, one folded with no tools and one perforated beforehand and then folded one the perforated line.

The fold motion for this test was elaborated in comparison to the motion of the kinetic paper installation, therefore the wear and tear documented in table 5.8.1, can be assumed to much less in the case of the actual paper installation.

5.8.2 LIGHT QUALITY

The light quality achieved in the material exploration, see Chapter 4 section 4.5.4, as well as the *cybrid* characteristics identified serve as the guideline for the light quality required for the spatial application.

The lighter paper types achieve a better aesthetic and lighting quality that is more suitable for the specific application. The kraft paper, refer to figure 5.8.3 is too dense and allow minimal light through therefore the Kraft paper is not suitable for this installation. The tracing paper and white paper, refer to figure 5.8.1 and 5.8.2, has a beautiful light effect and allows more light through which could create an ethereal atmosphere in the space. The Tyvek, see figure 5.8.4, has a unique light effect as all the fibres can be seen if illuminated from behind and also allows enough light through to create an ambient light effect.

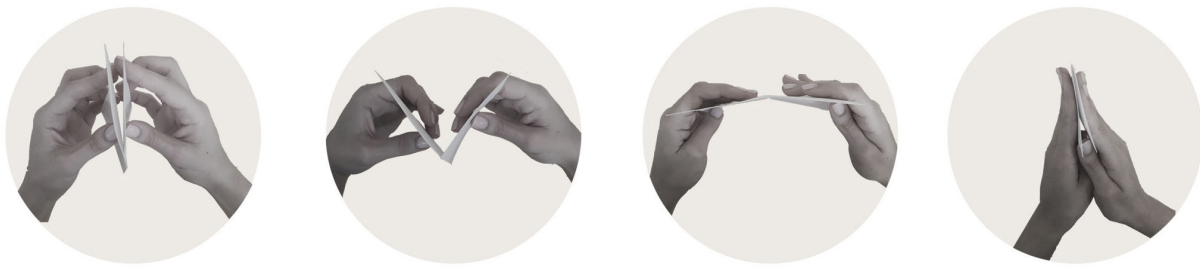


Figure 5.8.1 Fold test (Author. 2016)

MATERIAL	FOLD (NO TOOLS)	FOLD (PERFORATED)
Kraft paper	Because paper is more stiff it does not fold as easily and starts to crack on the fold line, but still remains intact	After 200 folds the paper starts to tear on the edges
Tracing paper	Paper does not fold evenly and becomes stiff on the fold line, making it harder to fold in the opposite direction	The perforation makes it easy to fold but weakens the paper making it easy to tear
White 80 g/m2 paper	The fold line remains consistent and no noticeable damage occurs during the fold test	Perforation allows for easy folding but weakens the paper, but the fold line remains consistent without any noticeable damage.
White 200 g/m2 paper	The fold line remains consistent and very little damage occurs during the fold test	After 200 folds the paper cracks along the fold line and tear on the outer edges
Tyvek 55g/m2	The fold line remains consistent and no damage occurs during the fold test	Perforation allows for Tyvek to be folded easily along fold line whilst the fold edge remains consistent and no damage occurs

Table 5.8.1 Fold test observations (Author. 2016)

Paper: n. 1. Material manufactured in thin sheets from the pulp of wood or **other fibrous substances**, used for writing, drawing, or printing on, or as wrapping material. 2. A sheet of paper with something written or printed on it.

Paper is a **thin flexible sheet** of material which can be used as a **flat mechanical object** or be ***manipulated into three dimensional artefact.***

5.8.3 CONCLUSION

Tyvek as a paper-like material was considered for this investigation as it clearly fulfils the definition of paper, as elaborated in Chapter 1 section 1.8.
As per the definition above as well as other similar characteristics elaborated throughout the study, Tyvek can be defined as a paper product for the purpose of this study. Dupont Tyvek is the most suitable choice for this specific spatial application and the product description and technical features will be elaborated in section 5.8 and 5.9. The material is chosen for its novel character as it fulfils all the qualities of the paper products whilst having advanced technical characteristics. The Tyvek creates opportunity for intricate material to material investigation without the limitations and fragility of the paper products.

* Following this investigation the product brand Dupont Tyvek will be referred to as Tyvek paper.

5.8.4 TYVEK PAPER

Dupont Tyvek (2015:3) states that Tyvek is manufactured from 100% high density polyethylene (HDPE) bonded by heat and pressure in a sheet form. Marshall Hinds (2013) elaborates that Tyvek is a non-woven structure which bonds very fine polyethylene fibres to create a durable and flexible paper like sheet material which is 100% recyclable.

Tyvek® combines the best properties of paper, film and fabric and thus makes it ideal for a wide range of applications, in which strong resistance is needed Dupont Tyvek (2015:3).

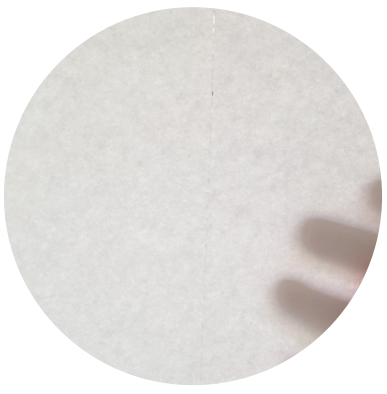


Figure 5.8.2 White paper 80g/m2 light quality (Author. 2016)

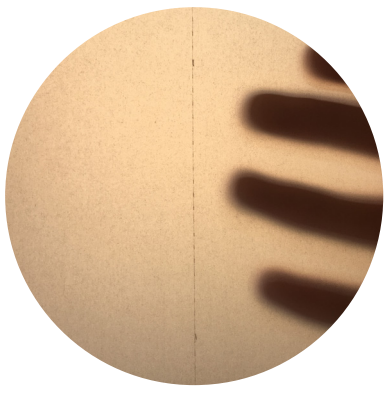


Figure 5.8.3 Tracing paper light quality (Author. 2016)

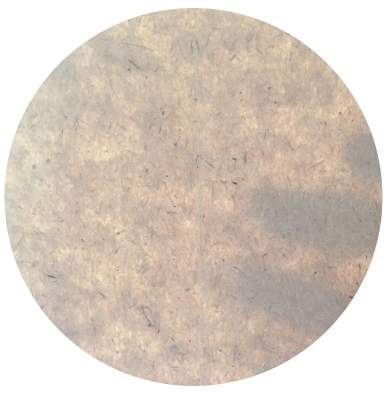


Figure 5.8.4 Kraft paper light quality (Author. 2016)

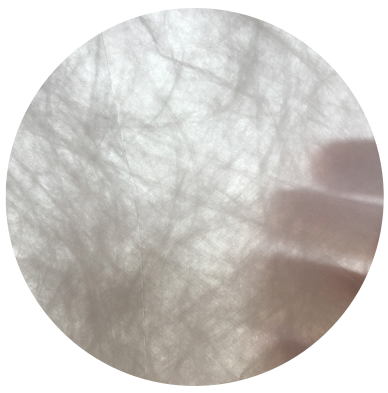


Figure 5.8.5 Dupont Tyvek light quality (Author. 2016)

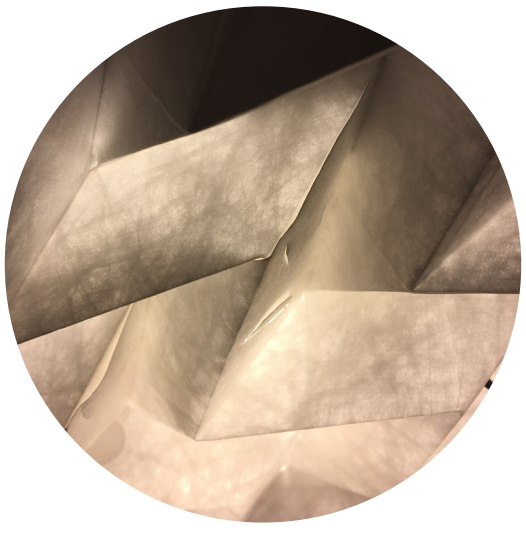


Figure 5.8.6 Dupont Tyvek (Author. 2016)

5.9 FINISHING AND MAINTENANCE

Although the material is extremely durable, the installation and nature of the artefact remains temporary. The application, installation and lightness of the artefact communicates the temporal character as specified in Chapter 4, section 4.4

The modular system, as elaborated in section x, serves as an armature to support the folded paper artefact and it also creates a system for efficient installation. Because the paper is installed as separate folded panels, this means that individual panels can easily be removed and replaced if necessary.

The Tyvek paper artefact can be removed for scheduled cleaning by staff on site. The material's resistance to water allows for dirt to be washed off without damaging the artefact. Care should be taken for the application of heat to the product.

The fabrication and installation of the paper artefact within the actual space would become an extension of the three phases of making addressed in this study, as the fourth and final phase of making. The space becomes a test site to determine how the paper will react in full scale and to investigate the lifespan of the kinetic paper artefact. This process will be a continuation of the Research Through Making methodology followed in this study, and therefore would require rigorous documentation for further development of the material in this context.

The life span of the installation is to be determined by the Department of Architecture.

5.9.1 FIRE RETARDANT FINISH

The fire treatment discussed below is based on the application for future use of paper within the space and does not apply to the Tyvek paper.

O'Neil (2009:65) investigated finishes for cardboard which would make it fire retardant and amongst a list of options the Boric acid is the most sustainable option that would be best suited for this specific application.

Because paper is a flammable material, it will be treated with boric acid powder which is both and insecticide and a fire retardant. O'Neil (2009:65) states that the boric acid is an organic compound that can either be used as a coating or be added during the pulping process of the paper.

The Tyvek paper will not receive any alternative finishes as the material in itself complies with the technical requirements as listed in table 5.9.1 below. The paper-like qualities of the Tyvek will be tested in its application as a prototype installation to determine its durability and lifespan within this specific spatial application. The intention is to further explore what the visual impact will be if and when the Tyvek paper starts to wear and tear, as it connects well to the concept of processes found in archiving of the architectural drawings.

PRODUCT FEATURES	DESCRIPTION
Flammability	*A strip of clean untreated Tyvek® when first exposed to an open flame, shrinks away from it. If the flame follows the strip, it will catch fire, burn slowly and drip melted polymer* (Dupont.2015:5).
Toxicity	*Tyvek® is classified as non-toxic. Testing on skin resulted in no irritation, swelling or allergic reaction* (Dupont.2015:5).
Strength	*Tyvek® is tear resistant whether wet or dry. Due to its unique structure it remains strong even when nicked and folded* (Dupont.2015:4).
High flex strength	*Tyvek® can be creased and bent almost indefinitely without losing its strength* (Dupont.2015:5).
Water resistant	*Physical properties of Tyvek® are not affected by water* (Dupont.2015:5).
Rot and mildew resistant	*Tyvek® does not degrade after being buried in soil for an extended period. Clean Tyvek® will not promote the formation of mildew or other micro-organisms* (Dupont.2015:5).
Chemical resistance	*Tyvek® is unaffected by most acids, bases and salts. Prolonged exposure to oxidising agents such as concentrated nitric acid or sodium persulphate may cause some loss of strength* (Dupont.2015:4).

Table 5.9.1 Technical specifications of Tyvek (Author. 2016)

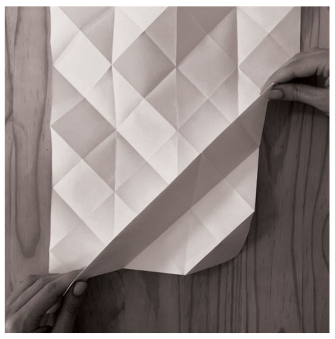
5.10
FABRICATION AND ASSEMBLY

This description for the folding process is based on the description found in Jackson (2011: 124-127), which will be slightly adapted to this study.

The 1020 x 4000mm Tyvek paper sheets will be perforated and cut off site, to the specific pattern which will assist with a more accurate and easy folding process. The sheets will be printed with the graphics before folding.

1. Pleat along the vertical black lines as indicated in the fold pattern of figure x to create universal folds, refer to figure x

2. Pleat along the diagonal lines facing down, to create alternating mountain and valley folds



3. Repeat the process described in step 2 with the diagonal lines facing up

4. Crease the vertical universal pleat lines again to create alternating mountain and valley folds.

5. From the base of the pleated paper, start to collapse the first row of zigzags. The first row should form a mountain zigzag and the second a valley zigzag. Work across the paper from edge to edge.

6. Gently continue pressing the zigzag rows to pop them into place. The pleats are already there so no new folds should be made.

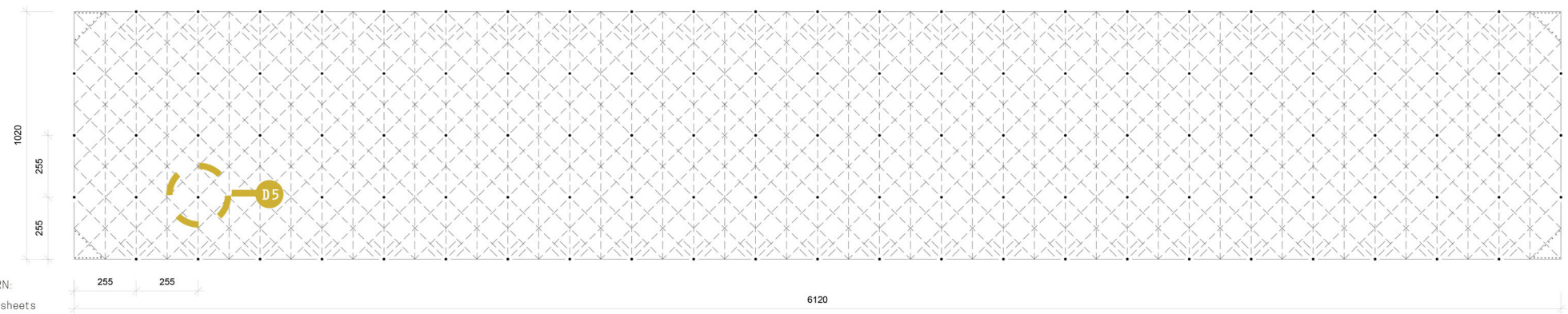
7. Continue until all the rows are collapsed

8. Collapse the folded paper into a narrow stick and press it on a flat surface to sharpen all the folds

9. Pull open to reveal the three dimensional folded paper

Figure 5.10.1 Fold instructions (Author. 2016)

PERFORATION AND CUT LINES

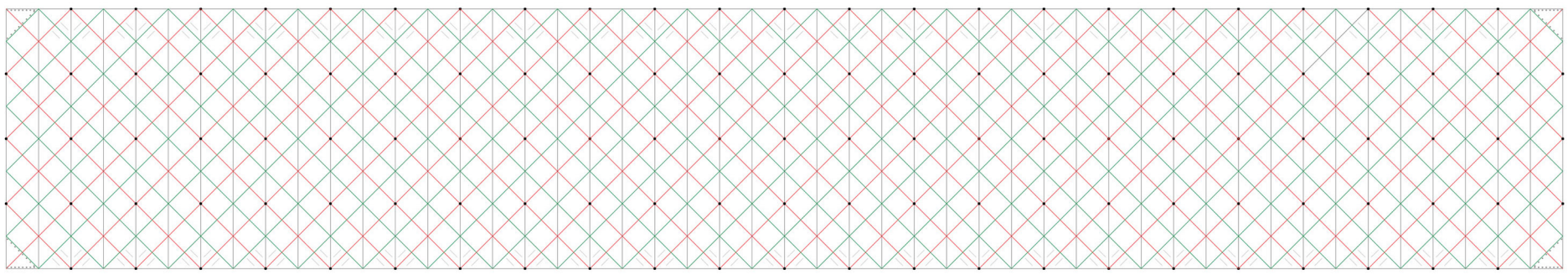


PERFORATION PATTERN:
75gsm Dupont Tyvek sheets

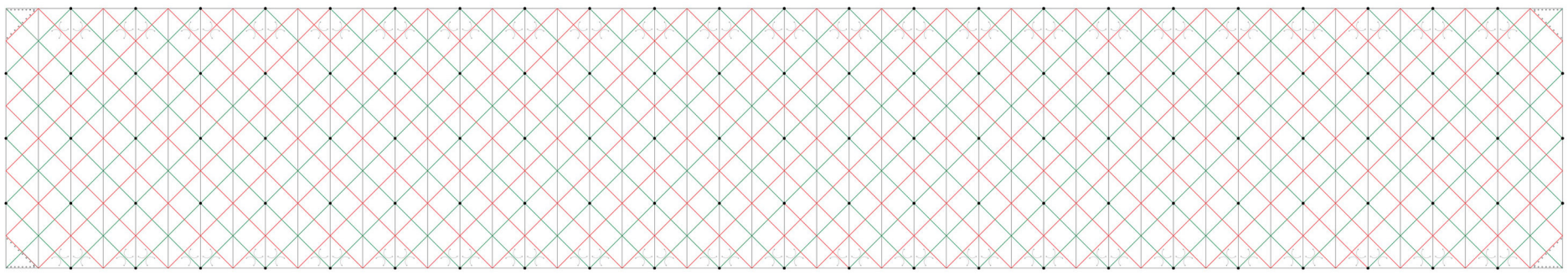
- 2 mm holes to be punched at ends of paper sheet for stitch pattern
- 3 mm hole punched into paper sheet
- Perforation line
- Cut lines

FOLD PATTERN

SHEET 1



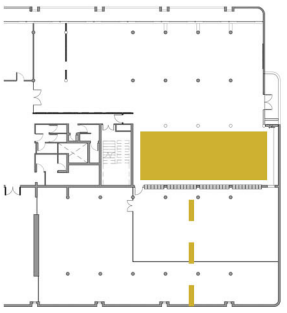
SHEET 2

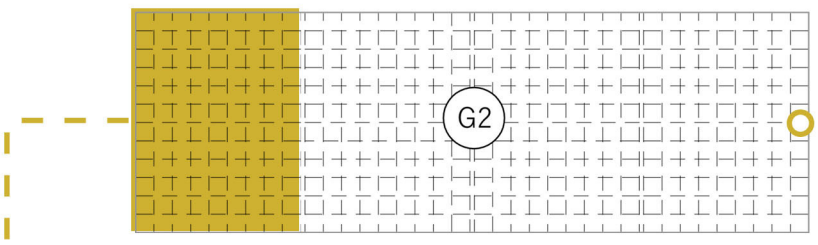


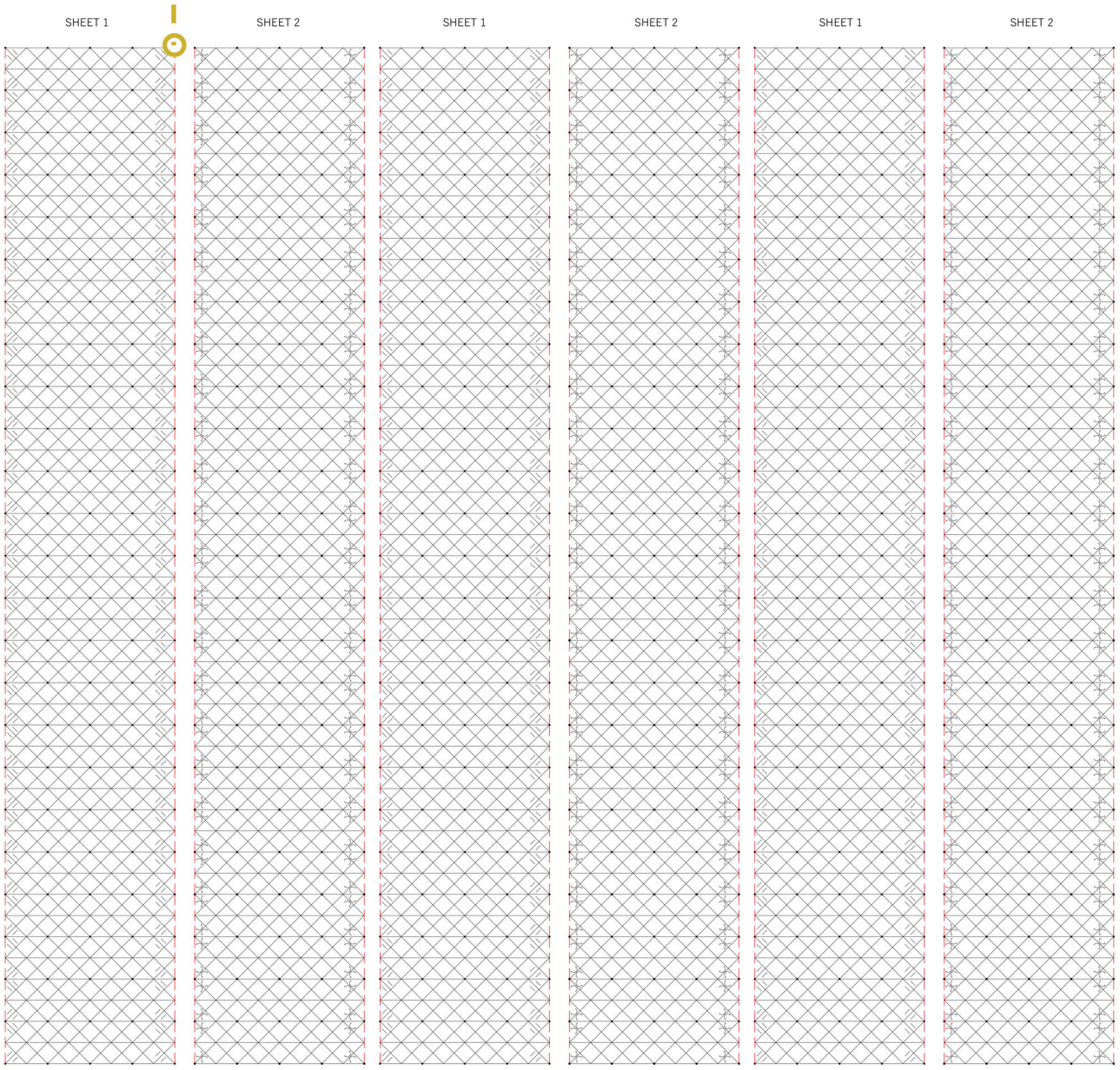
V-FOLD PATTERN SCALE 1:5

- Valley Fold
- Mountain Fold
- Universal Fold

Figure 5.10.2 Fold and perforation pattern (Author. 2016)







FOLDED SHEET ASSEMBLY SCALE 1:20

Joinery Line
Edge of folded sheet to overlap with adjacent sheet edge

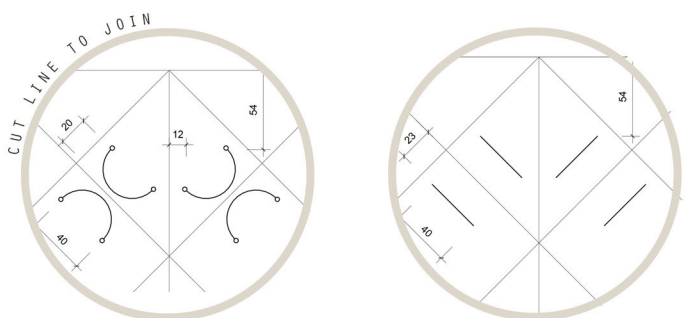
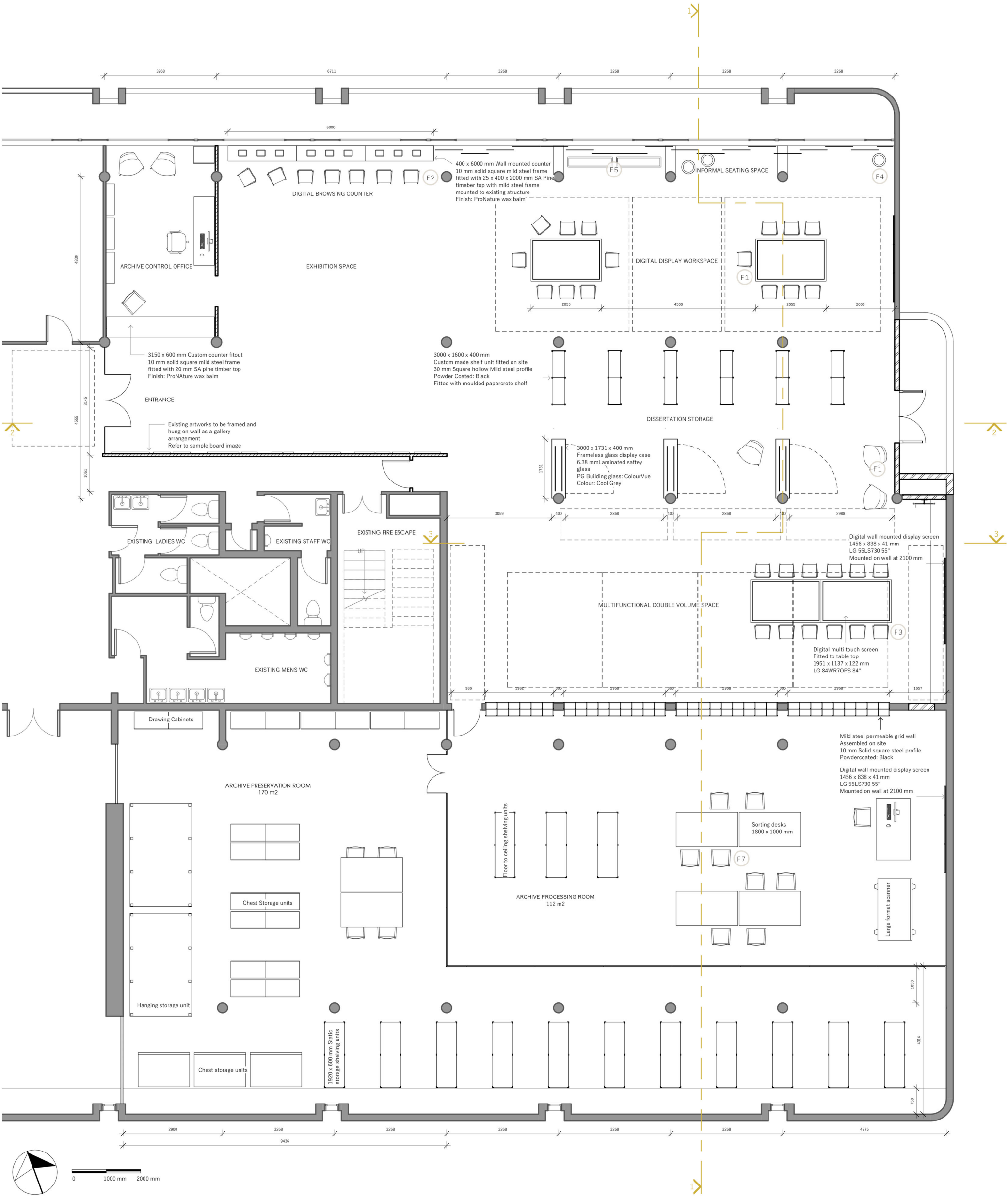


Figure 5.10.3 Folded sheet assembly (Author. 2016)

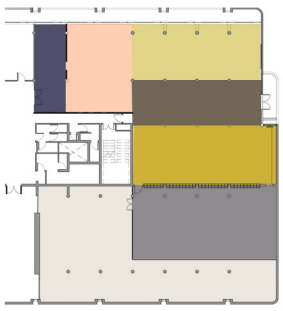


LAYOUT PLAN SCALE 1:50

Figure 5.10.4 Layout plan (Author. 2016)

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

SPATIAL USE:



- Conversation and debate space
- Formal presentation space
- Exhibition space
- Dissertation storage
- Archive preservation room
- Archive processing room
- Open single volume space
- Control desk and entrance

FURNITURE LEGEND:

F1
Ava Chair
Casarredo
Colour: Pink and

F2
650mm 440 x 430 x 650 mm
Industrial Stool
Weylandts
Colour: Saddlewood Grey, Water Based
Natural
Finish: Powder Coated, Water Based

F3
460 x 530 x 850 mm
Leila Bar Stool
Weylandts
Colour: Grey
Finish: Natural, Powder Coated
Code: CONTIMP0003

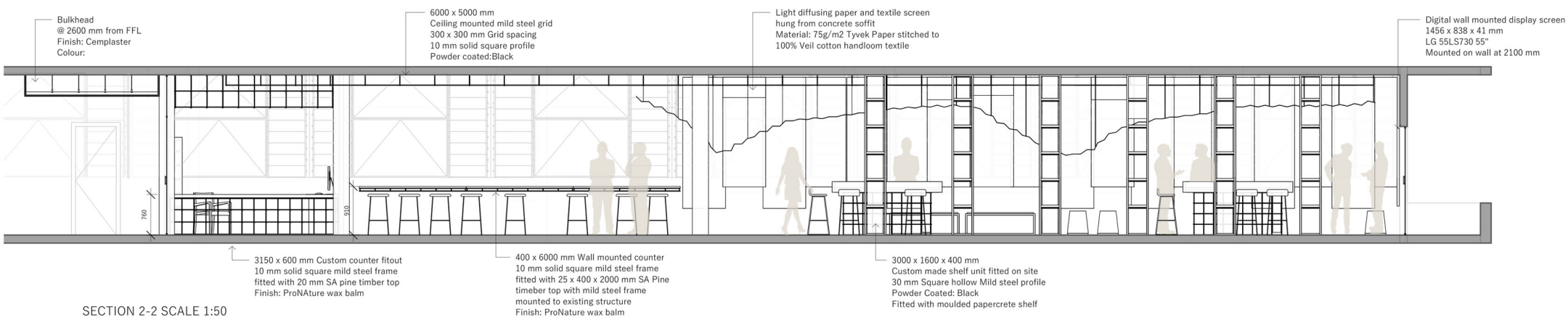
F4
450 x 300 x 1300 mm
Cork Low Stool
Wiid Design
Finish: Cork

F5
450 x 300 x 1300 mm
Cork and steel bench
Wiid Design
Colour: Black
Finish: Powder Coated, 50mm Cork

F6
Existing lounge chair to be

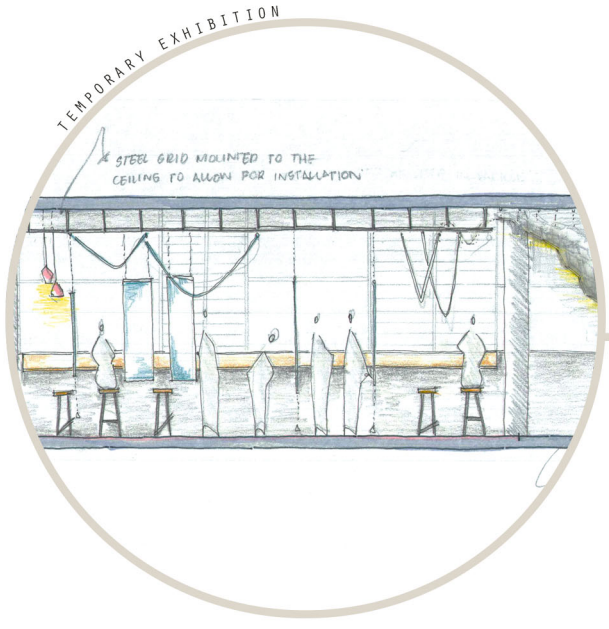
F7
Existing black

Figure 5.10.5 Furniture legend (Author. 2016)



SECTION 2-2 SCALE 1:50

Figure 5.10.6 Section 2-2 (Not to scale) (Author. 2016)



0 1000 n2000 mm

FLOOR FINISH PLAN SCALE 1:100

FLOOR FINISH LEGEND:

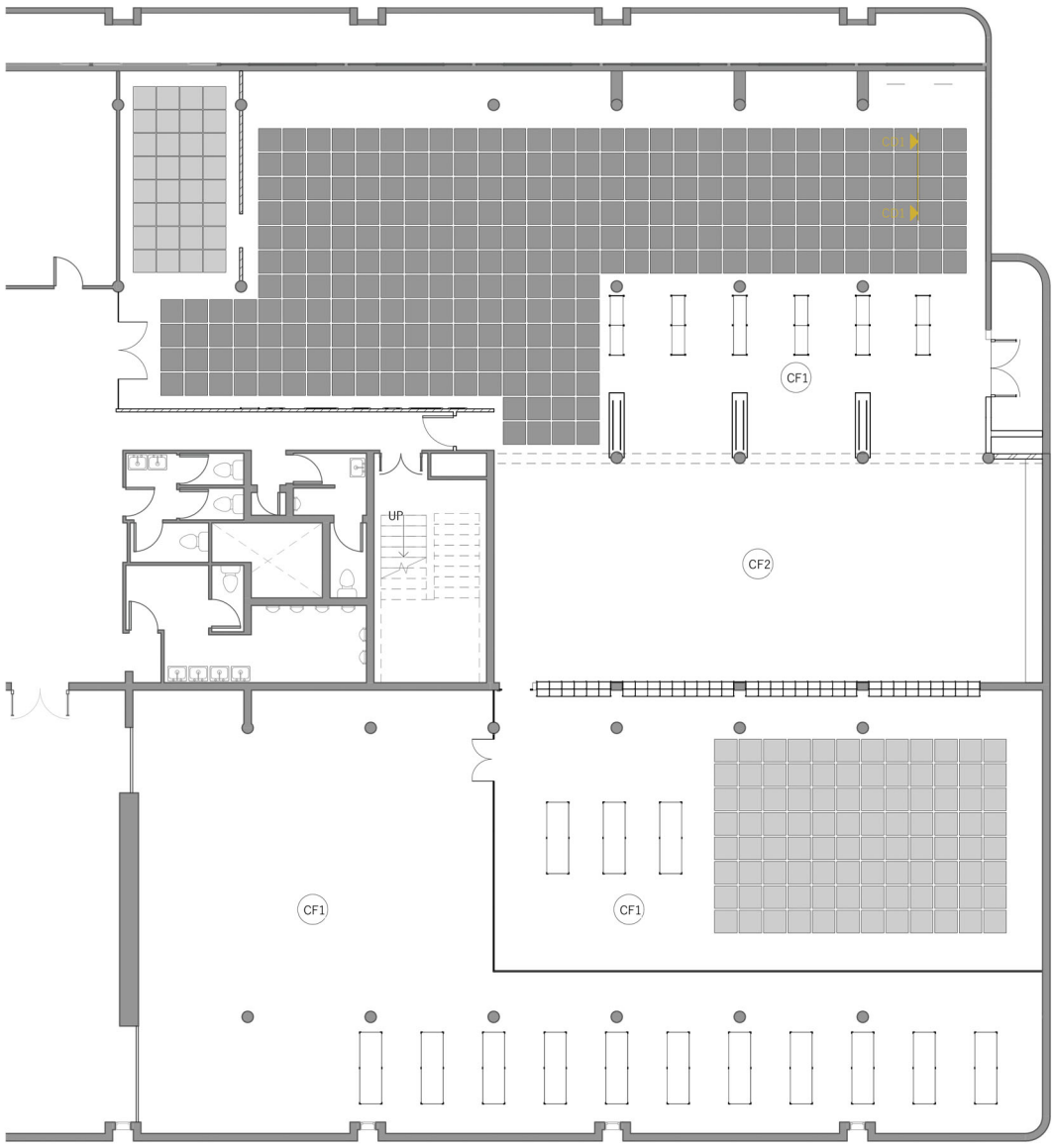
200 x 200 mm Existing Mosaic floor tiles

2 mm Self leveling screed applied over woodfloated concrete screed
Finish: Matt
Colour: Dusky Rose

2 mm Self Leveling Screed applied over woodfloated concrete screed
Finish: Polished
Colour: Dusky Rose

Brass strip floor detail

Figure 5.10.7 Floor finishes plan (Author. 2016)



0 1000 n2000 mm

ACOUSTIC CEILING LAYOUT SCALE 1:100

CEILING PANEL LEGEND:

NOTE: Existing suspended ceiling to be removed
Base of concrete soffit, uneven surface to filled and sanded
Surface to be skimmed and prepared for new finish

Ecophon Focus SQ
600 x 600 x 20 mm 8 mm spacing
Direct application to concrete soffit
Finish: Akutex FT
Colour: Soft Slate

CF1 Soffit to be painted with PLASCON one coat ceiling paint ultra matt finish
Colour: Zaire Junctions GR N03

Ecophon Focus SQ
600 x 600 x 20 mm 50 mm spacing
Direct application to concrete soffit
Finish: Akutex FT
Colour: Soft Slate

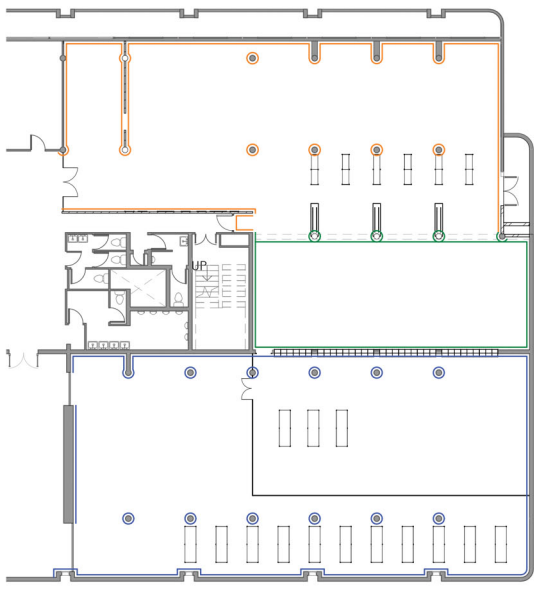
CF2 Soffit to be painted with PLASCON one coat ceiling paint ultra matt finish
Colour: Misty Dawn GR G04

WALL FINISHES

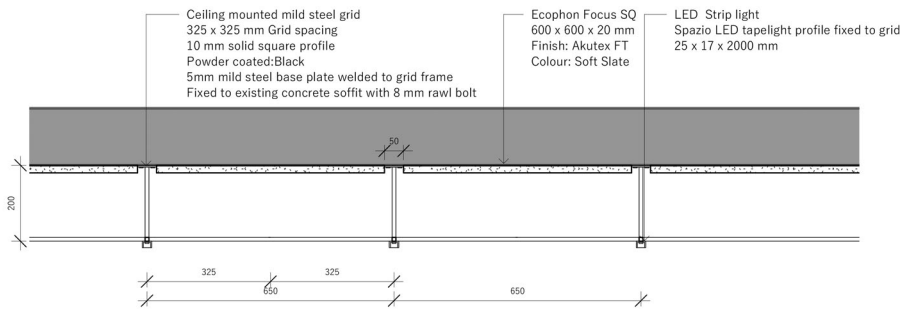
Walls to be striped and uneven surfaces to be filled and sanded
Surface to be skimmed and primed
Walls to be painted with PLASCON Evolution Super Matt VOC free paint
Colour: New York Square GR N02

Walls to be stripped and plaster surface to be prepared as per product specifications
Cemplaster to be applied onto wall with trowel
Colour: Milano Milk

Walls to be stripped and plaster surface to be prepared as per product specifications
Cemplaster to be applied onto wall with trowel
Colour: Pavilion Grey



WALL FINISH DIAGRAM SCALE 1:100



CD1 STATIC ARMATURE (GRID) SCALE 1:10

Figure 5.10.8 Acoustic ceiling (Author. 2016)

5.11 ARCHIVE

The spatial development is informed by the following *cybrid* characteristic: process, preservation and visual access.

Visual access is achieved through the design development of the permeable mild steel grid wall which creates a physical barrier for the purpose of access control between the double volume space and the archive processing room whilst allowing visual access into the archive processing room and the archive preservation room.

The archive processing room is designed to allow for the sorting, indexing and digitizing process of large format architectural drawings and documentation. The room is equipped with large format scanner, printer and wall mounted digital screens to allow for archive material to be digitized. Within the space a floor to ceiling colour tinted double glazing wall separates the archive processing room from the archive preservation and storage room. The intention of the glass wall is to allow a glimpse into the space when it is illuminated.

5.11.1 ARCHIVE REQUIREMENTS

Ogden (n/d) explains that the control of the environmental conditions which include the light, temperature and relative humidity is critical for the preservation of archival material which could increase the life expectancy of the artefacts. Ogden (n/d) further states that with installation of adequate operation systems which could control the environmental quality to specific requirements will retard the deterioration significantly.

Temperature and Humidity:

Ogden (n/d) states that a constant environmental quality is very important, and a climate control system should be on throughout the year.

Canadian Counsel of Archives (2003:12) explains that low humidity can make archive material brittle and susceptible to cracking when handled, and high humidity can increase the chemical deterioration of the artefacts. According to Wilson (1995:1) and Canadian Counsel of Archives (2003:12) the optimal humidity for the preservation of paper would be minimum of 30% and maximum of 50%. The optimal conditions are not always easy to achieve for both temperature and humidity, but a critical point of departure would be to keep the humidity constant throughout the year.

According to Canadian Counsel of Archives (2003:23) The optimal temperature for the preservation of paper drawings is a maximum of 15.5˚C and18.3˚C with a 2˚C fluctuation, for storage, whereas occupied space can go up to a maximum of 23.8˚C.

Light:

According to Canadian Counsel of Archives (2003:19) all light damages the archive material by fading and yellowing of the paper artefacts, while light with shorter wavelengths like UV light is more damaging to the material. Canadian Counsel of Archives (2003:20) lists the following requirements for lighting in an archive:

+ Eliminate sunlight where possible or reduce the UV light with the application of a UV filter film to windows.

+ Lights should be turned off when archive is not in use.

+ Reduce overall lux and UV levels

+ Reduce heat gain from the light source, and do not locate lights close to archive material.

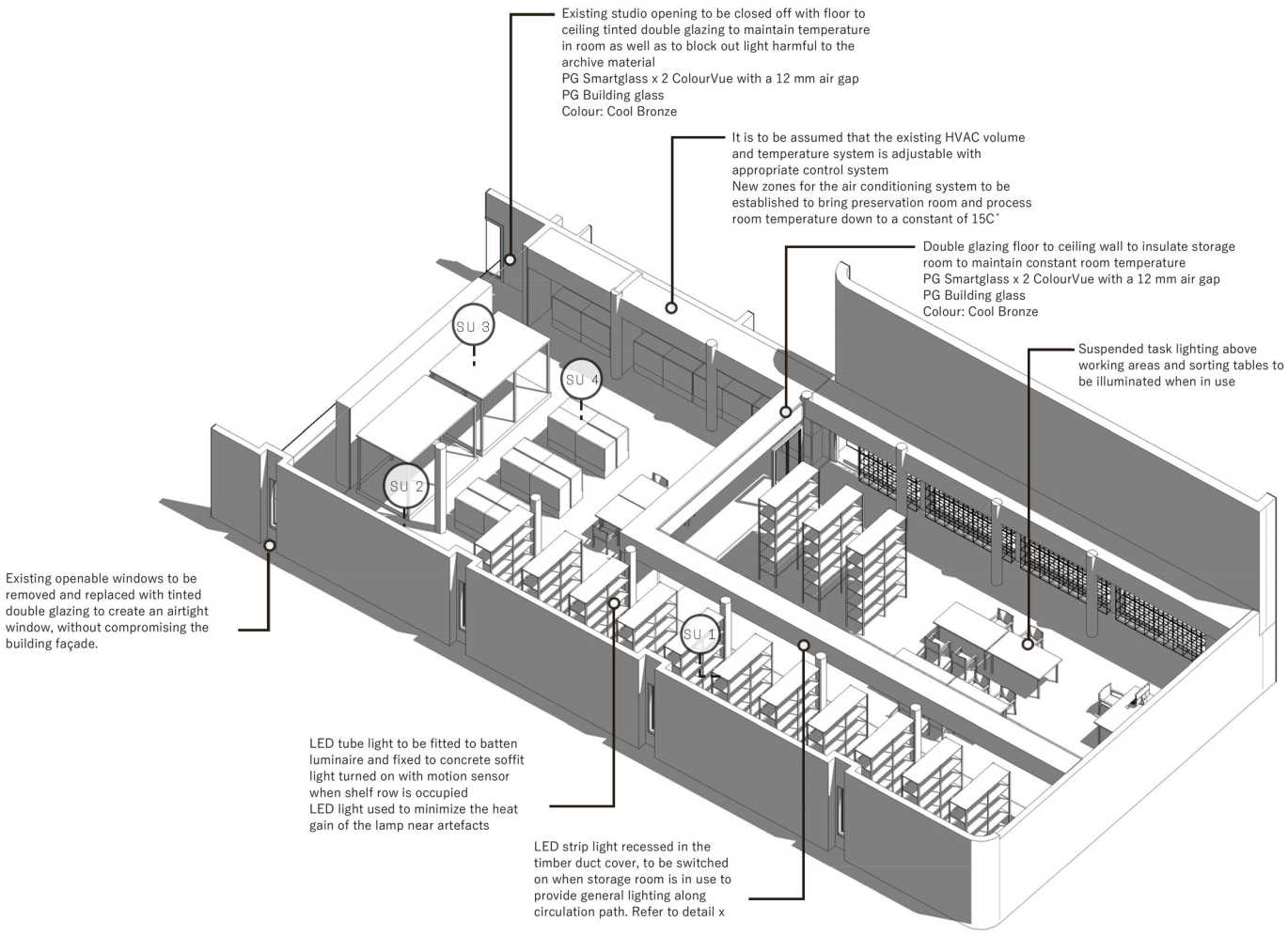


Figure 5.11.1 3D: Archive (Author. 2016)

STATIC STORAGE SHELVING UNIT

CHEST STORAGE UNIT

HANGING STORAGE UNIT

DRAWING CABINETS

SPECIALISED STORAGE UNITS

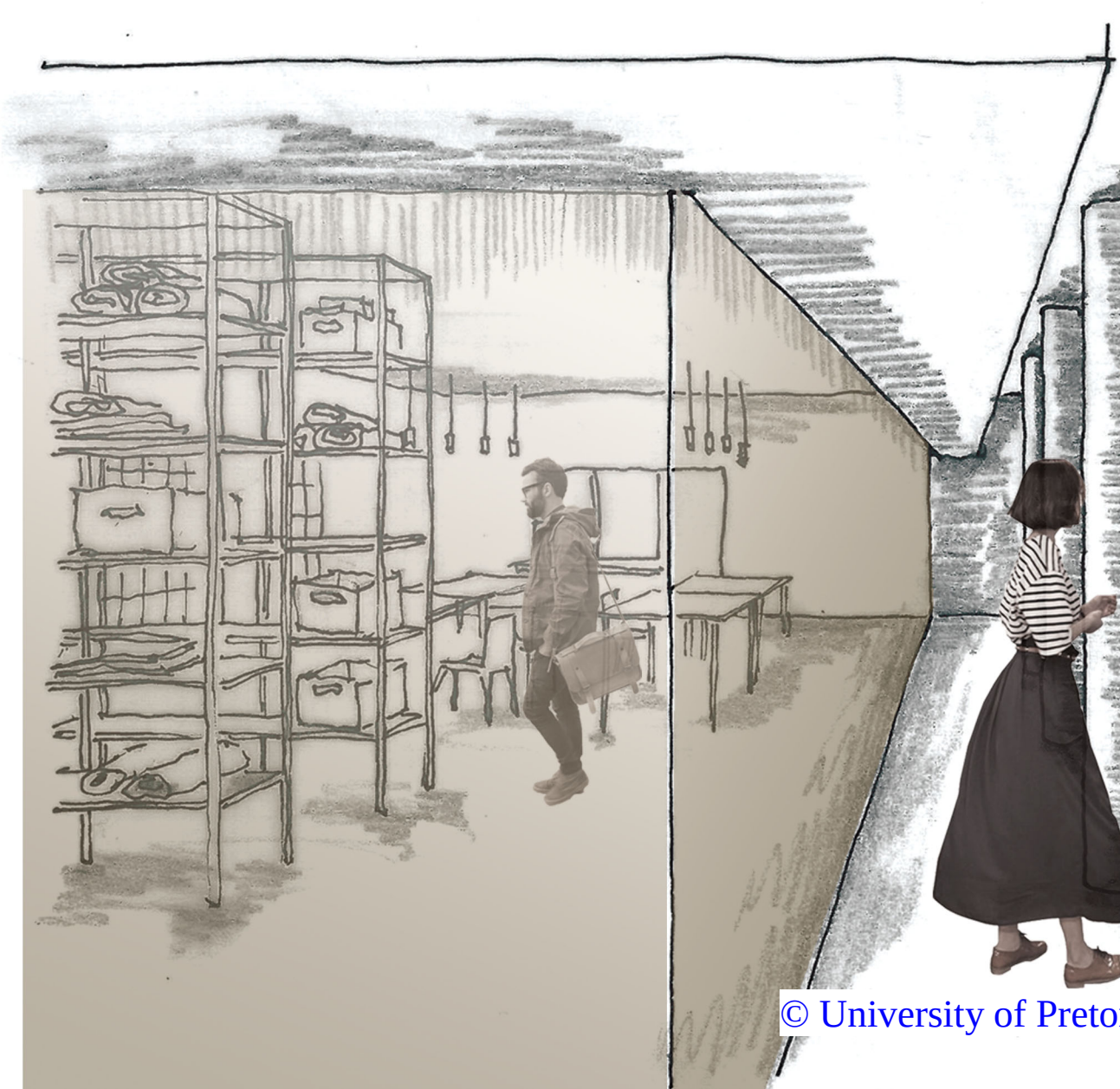
All storage units for the preservation archive room as per Rackline

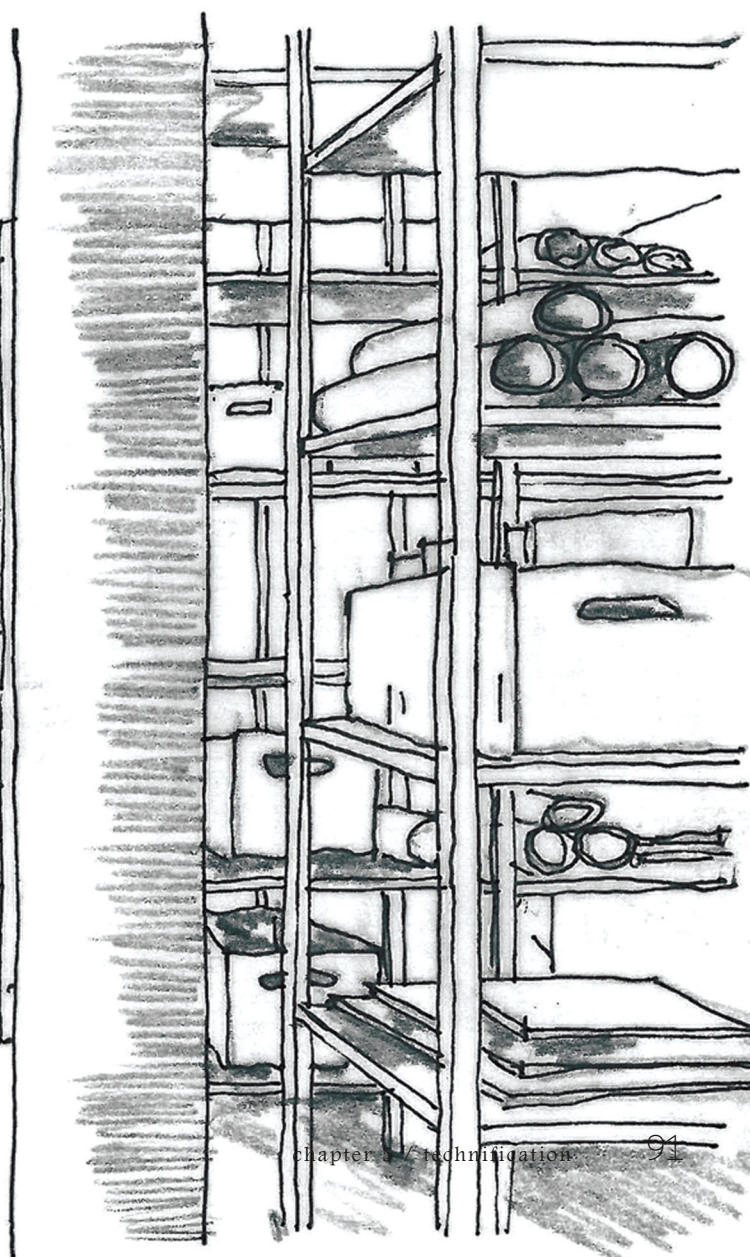
Bespoke units are fitted to spatial requirements and dimensions

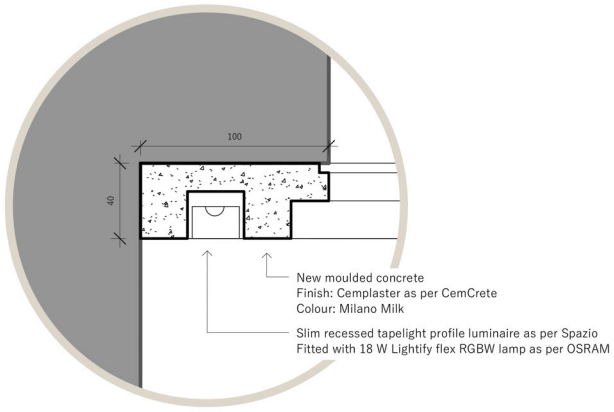
Material: Aluminium

Colour: White

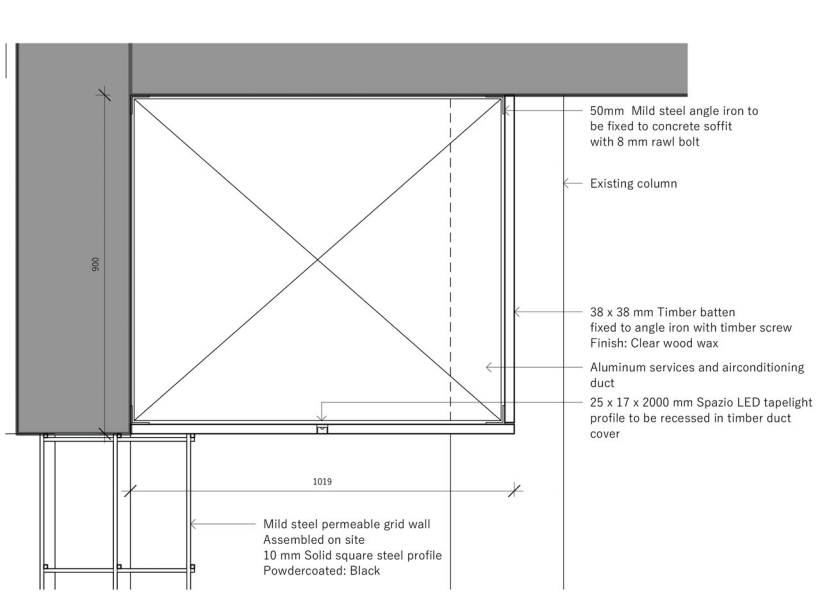
Figure 5.11.2 View of archive storage space (Author. 2016)



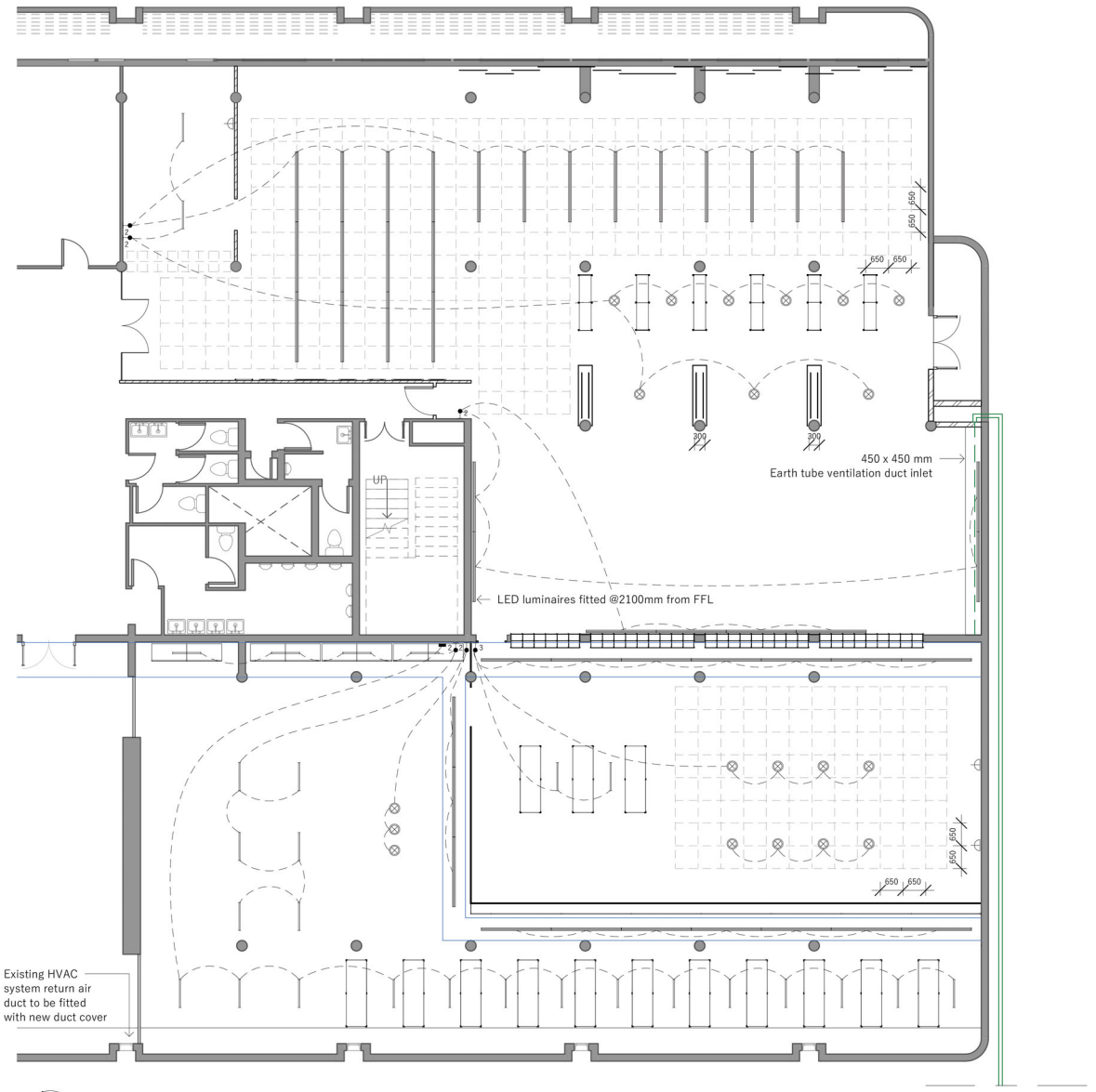




D10 LIGHT STRIP DETAIL SCALE 1:5



DUCT DETAIL SCALE 1:10



GRID AND LIGHTING LAYOUT SCALE 1:100

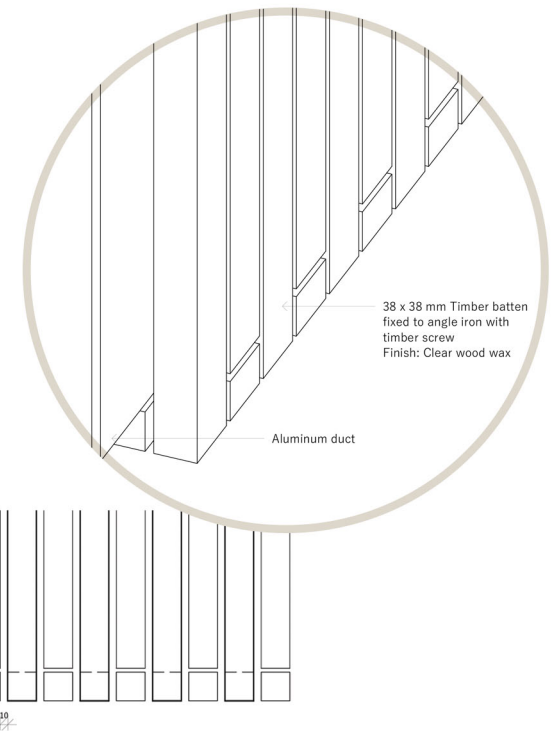
LIGHTING LEGEND:

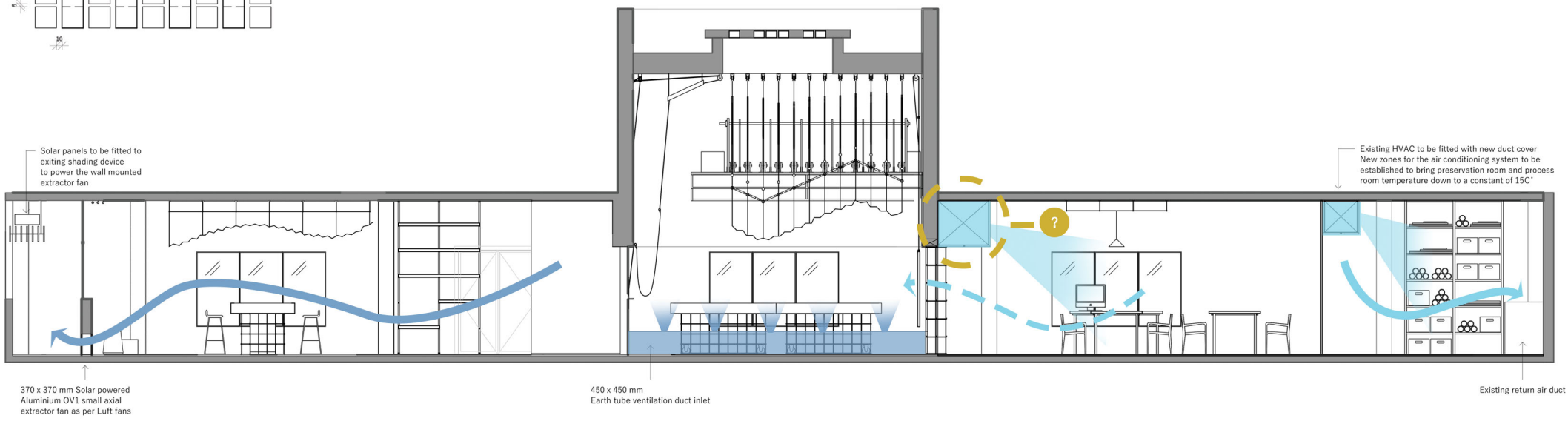
- Surface mounted slim tapelight profile luminaire as per Spazio to be fixed to mild steel grid with adhesive
  Code: 1039.1.05
  Colour: Powdercoated Black
  Fitted with 18 W Lightify flex RGBW lamp as per OSRAM
- Solo round pendant luminaire as per Spazio mounted to mild steel ceiling grid
  Colour: Black and gold
  Fitted with 40W Parathom advanced CLASSIC A lamp as per Osram
- Surface mounted 50 x 32 mm profile as per Spazio
  Code: 1044.1.05
  Colour: Powdercoated Black
  Fitted with 8.9 W SubstiTUBE Advanced HF lamp as per Osram

LINE LEGEND:

- Existing HVAC to be fitted with new duct cover
  New zones for the air conditioning system to be established to bring preservation room and process room temperature down to a constant of 15C˚
- Mild steel grid fixed to concrete soffit
- Earth tube to run along eastern side of building into new service duct from the ground floor up
- Existing shading device to block direct nothern sun

Figure 5.11.3 Electrical layout (Author. 2016)





VENTILATION DIAGRAM SCALE 1:50

Figure 5.11.4 Ventilation section diagram (Author. 2016)

5.12
DIGITAL SCREENS

The addition of large format digital screens as interactive tables as well as wall mounted screens, allows for a vibrant experience and access to the information. The significant drawing collections can be displayed in full scale on the digital screens, allowing the users to interact and form conversations without the potential of damaging the physical architectural archive drawings.

Suspended display screens are able to be hoisted into position, to allow a digital presentation to take place. This addition of a digital pin up creates opportunity for new and innovative ways in which students can present to and interact with an examination panel.

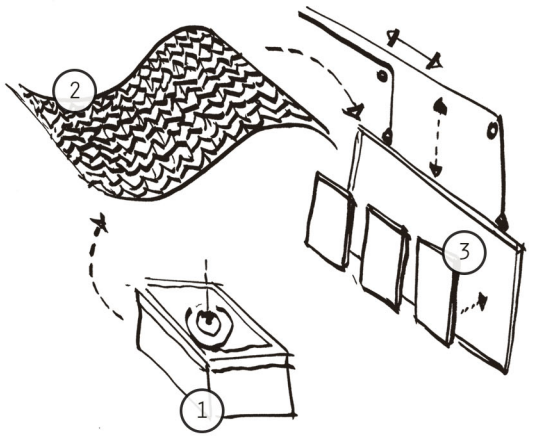
The intention of the digital screens is to encourage conversation and debate regarding valuable archive material as well as previous master student dissertation work.

Figure 5.12.1 View of digital interaction spaces (Author. 2016)

1 Interaction with the touch table

2 Mechanism is activated by electrical motor and the mechanism enables the movement of the suspended installation and paper artefact

3 Space is manipulated according to the programmed setting selected on the digital touch screen (as per the specific technical spatial requirements)



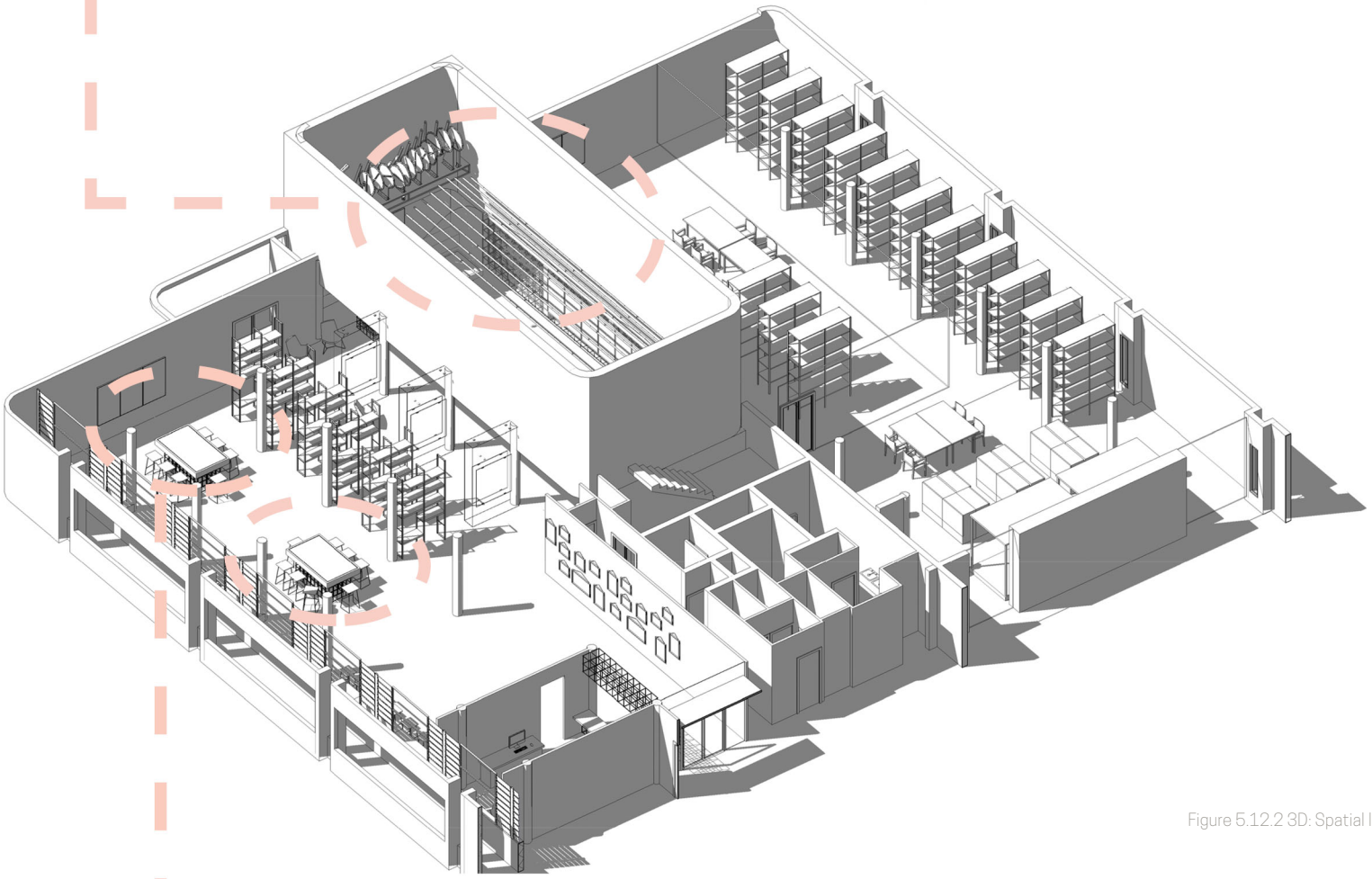


Figure 5.12.2 3D: Spatial layout (Author. 2016)

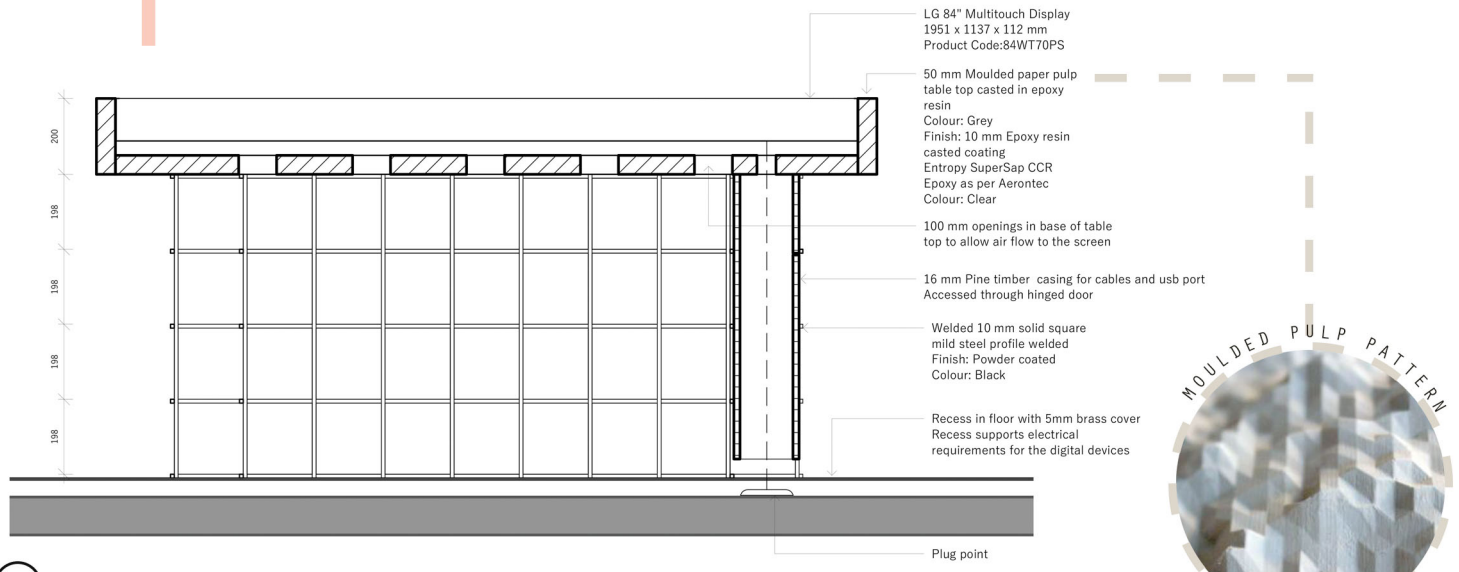
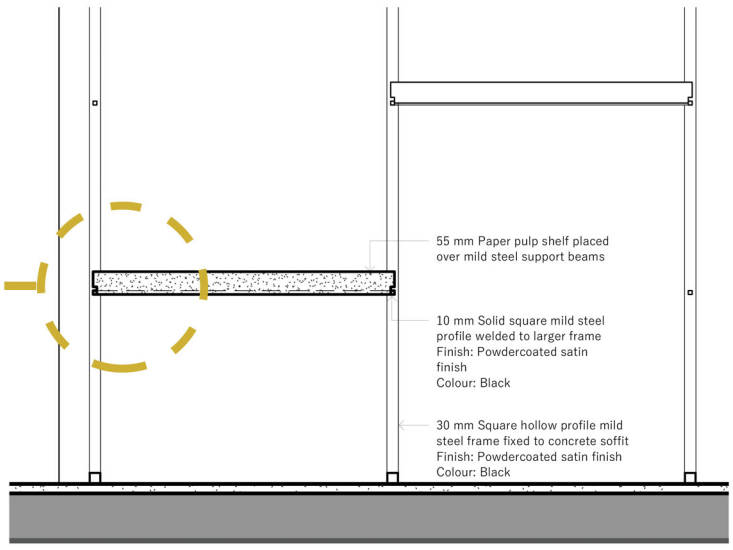
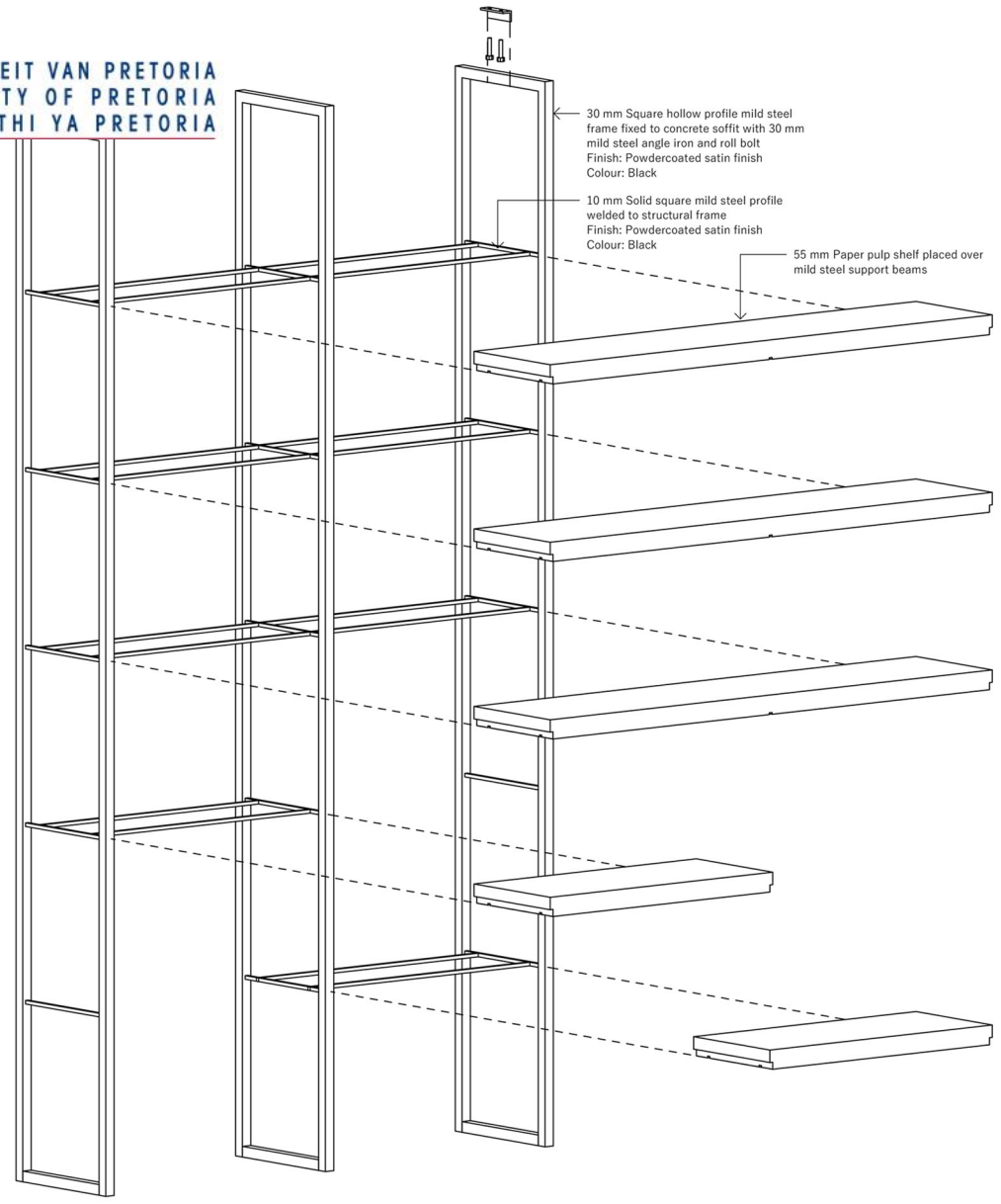


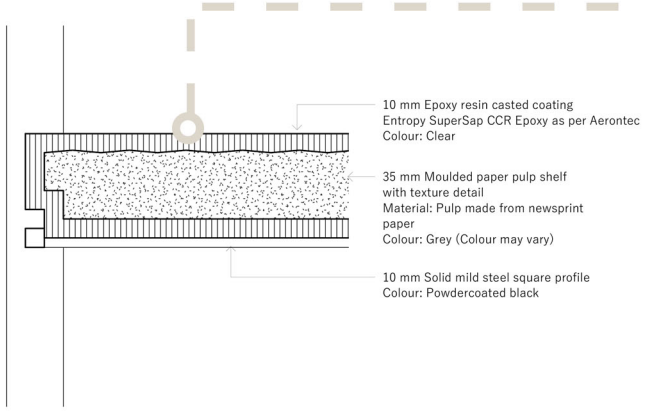
Figure 5.12.3 Digital interfaces (Author. 2016)



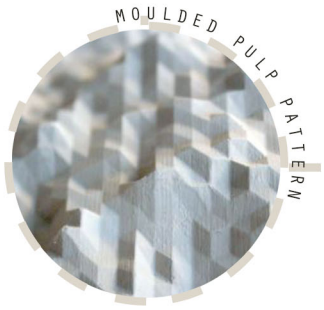
SHELF DETAIL SCALE 1:10

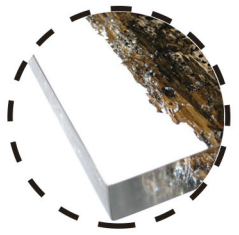


CUSTOM FLOOR TO CEILING SHELF UNIT SCALE 1:10



D6 SHELF DETAIL SCALE 1:2





ALCAROL

CHIMENTI TABLE

Alcarol creates unique furniture pieces by covering organic materials in resin.

The Chimenti table is a Solid oak timber covered in clear vegtable resin to capture the unique qualities of the weathered timber.

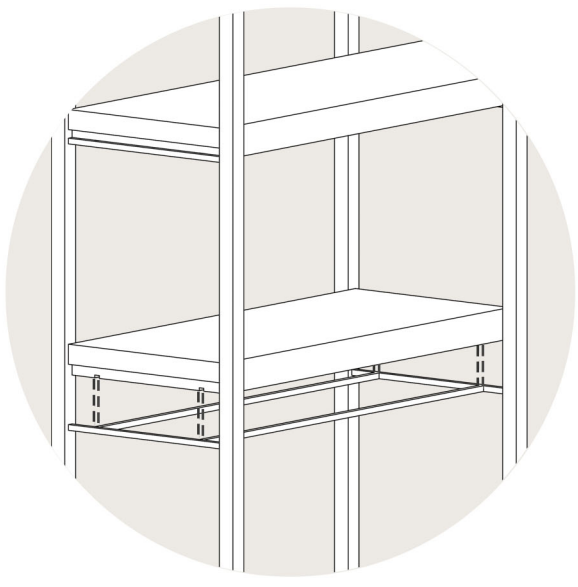
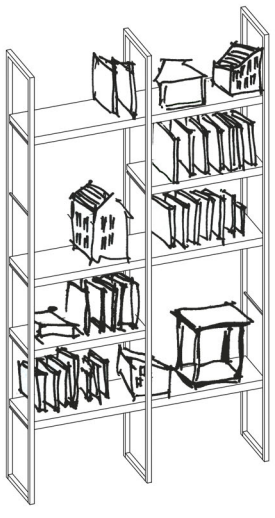
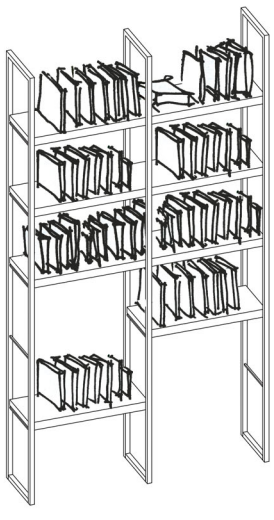


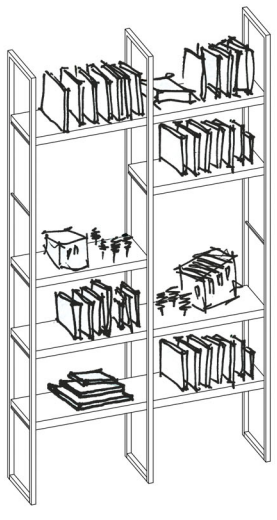
Figure 5.12.4 3D: Shelf details and configuration (Author. 2016)



CONFIGURATION 1



CONFIGURATION 2



CONFIGURATION 3

5.13
CONCLUSION

This chapter was a continuation of the making process introduced in Chapter 4: Making and focussed on the technical aspects of the spatial outcome of the space as a whole. The technical drawings conveyed the spatial integration of the paper installation as an element that supports the activities in the space by defining zones, controlling light qualities and creating a unique spatial aesthetic which supports the characteristics of the *cybrid* archive. The chapter clearly defined the character of the new space and created clear links between the theoretical approach and the design development and application.

Further reflections of the design and making process of the study will be discussed in Chapter 6: Final reflections.