

Rethinking brickwork as a contemporary technology

An advanced construction artisan campus in the inner-city of Pretoria



Wessel J Ebersohn_u25024915

Rethinking brickwork as a contemporary technology

An advanced construction artisan campus in the inner-city of Pretoria

Old Government Printing Works, Pretoria Central
25°44'42"S 28°11'07"E

Abstract

The focus of this dissertation is primarily a technological enquiry in which brickwork is reconsidered as a contemporary technology that is expressed tectonically, with consideration of local specificity. It is argued that this reconsideration positions the dissertation within the ever-expanding discourse of craft. The rich brick tradition as evident in Pretoria, will also be contextualised as it influences how the design discussed in the dissertation responds to the context.

Key words: Abstract-regionalsim, craft, tectonics, nested catenaries, hyperbolic-paraboloid, heritage, brickwork

Programme_Advanced construction education campus
Research field_Memory, Legacy and Identity
Study Leader_Cobus Bothma

In accordance with Regulation 4(C) of the General Regulations (G.57) for dissertations and theses, I declare that this dissertation, which I hereby submit for the degree Master of Architecture (Professional) at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.

I further state that no part of my dissertation has already been, or is currently being submitted for any such degree, diploma or other qualification.

I further declare that this dissertation is substantially my own work. Where reference is made to the works of others, the extent to which that work has been used is indicated and fully acknowledged in the text and list of references.

Wessel Johannes Ebersohn



Contents

1_Position and situation

1.1_Introduction	15
1.2_Situating the problem	
1.2.1_Background	17
1.2.2_General issue	21
1.2.3_Theoretical framework	21
1.2.4_Urban issue	27
1.2.5_Architectural issue	28
1.3_Research design and method	29
1.4_Postulation of the programme	33
1.5_Conclusion	35

2_Design research

2.1_Introduction	39
2.2_Urban conditions	41
2.3_Contextual analysis	
2.3.1_Proposed urban framework	43
2.3.2_Interpreting the Regional Spatial Development Framework of 2018	47
2.4_Site analysis	51
2.5_Site history	53
2.6_Statement of significance	
2.6.1_Nieuwe Staatsdrukkerij (Wierda building) 1896	59
2.6.2_Administration block 1927	61
2.6.3_Letter press building 1937	66
2.6.4_Lithography building 1942	65
2.6.5_Finishing plant 1955	67
2.6.6_Conclusion	69
2.7_Heritage approach	71
2.8_Urban intentions	73
2.9_Technological intentions	79
2.10_Architectural intentions	83
2.11_Conclusion	89

3_Synthesis

3.1_Introduction	93
3.2_Design development	93
3.3_Key iterations	
3.3.1_Site iterations	94
3.3.2_Design iterations	97
3.3.3_The design outcome	97
3.4_The technological concept	101
3.4.1_Research	101
3.4.2_Precedents	103
3.4.3_The technological outcome	105
3.5_Water harvesting	119
3.6_Solar harvesting	123
3.7_Light	125
3.8_Sustainability	127
3.9_Conclusion	129

4_Critical reflection

4.1_Initiation	133
4.2_Investigation	135
4.3_Application	137
4.4_Reflection and extension	139

5_References

List of references	143
--------------------	-----

6_Addendum

List of figures

Figure 1 _ Aerial view of the focus area (Author, 2022)	16	Figure 36 _ Aerial view of the finishing plant (Author, 2022)	67
Figure 2 _ The Pioneer Museum, Pretoria. An example of early Pretoria architecture c. 1840 (Author, 2022)	18	Figure 37 _ Position of the finishing plant on the cultural significance scale (Author, 2022)	68
Figure 3 _ East facade of the Old Government Printing Works (Author, 2022)	20	Figure 38 _ A collage of diagrams of the specific significant components of the finishing plant (Author, 2022)	68
Figure 4 _ East facade of the Old Government Printing Works (Clarke, 2014)	24	Figure 39 _ A collage of site images (Author, 2022)	70
Figure 5 _ Corner of Het Schip, Amsterdam (Van Diemen <i>et al.</i> , 2018)	26	Figure 40 _ A scale of non-dialectic attitudes (Author, 2022, adapted from Barker, 2020:132)	71
Figure 6 _ The barrier formed by the south facade (Author, 2022)	27	Figure 41 _ Diagrams of non-dialectic approaches (Author, 2022, adapted from Barker, 2020:134)	72
Figure 7 _ A nested catenaries shell (Hensel & Bover, 2015)	28	Figure 42 _ Diagrams of the application of different non-dialectic approaches (Author, 2022)	72
Figure 8 _ Diagram explaining the research by design process (Author, 2022)	32	Figure 43 _ A series of explorations towards the development of a block framework (Author, 2022)	74
Figure 9 _ Diagram explaining the postulated programme (Author, 2022)	34	Figure 44 _ Church Square public space diagram (Author, 2022)	75
Figure 10 _ Diagram explaining the intention of the dissertation, adapted by the author from Imbern, 2014:213 (Author, 2022)	36	Figure 45 _ 012 Central public space diagram (Author, 2022)	75
Figure 11 _ Locality map (Author, 2022)	40	Figure 46 _ Lillian Ngoyi Square public space diagram (Author, 2022)	75
Figure 12 _ Contextual mapping of programmes (Author, 2022)	42	Figure 47 _ State Theatre public space diagram (Author, 2022)	76
Figure 13 _ Co-Arc West Capital Precinct Plan, preview 02, adapted by the author from Co-Arc, 2014 (Author, 2022)	44	Figure 48 _ Sammy Marks Square public space diagram (Author, 2022)	76
Figure 14 _ Co-Arc West Capital Precinct Plan 2, preview 05, adapted by the author from Co-Arc, 2014 (Author, 2022)	46	Figure 49 _ Pretoria City Hall public space diagram (Author, 2022)	76
Figure 15 _ RSDF 2018 zoning map (Author, 2022)	48	Figure 50 _ A diagram depicting the intention with the envisioned public space (Author, 2022)	77
Figure 16 _ Comparison of the capacity of a multi-modal street with that of a car-oriented street (Global Street Design Guide, 2016:115)	50	Figure 51 _ A diagram depicting the envisioned concentration of pedestrian movement on the site (Author, 2022)	77
Figure 17 _ The current car-oriented condition of Madiba Street (Author, 2022)	50	Figure 52 _ A collage of diagrams examining the relation of pedestrians to the buildings and the street (Author, 2022)	78
Figure 18 _ Mapping of bus routes and stops around the site (Author, 2022)	52	Figure 53 _ A series of maquettes and diagrams toward the development of the block framework (Author, 2022)	78
Figure 19 _ Summer solstice shadow study – 21 December (Author, 2022)	52	Figure 54 _ Chi She exhibition centre, Archi-Union Architects (Su, 2016)	80
Figure 20 _ Winter solstice shadow study – 21 June (Author, 2022)	52	Figure 55 _ Silk wall, Archi-Union Architects (Zhonghai, 2017)	80
Figure 21 _ De Pers / The Press offices ca. 1889 (Swanepoel, 2013)	54	Figure 56 _ Diagrams explaining the digital fabrication procedure of the 'silk wall' (Author, 2022)	80
Figure 22 _ The demolished Staatsgimnasium ca. 1899 (Barker, 2014:138)	54	Figure 57 _ Teaching builders to use the templates (Yuan, Zhang & Han, 2013:146)	80
Figure 23 _ Aerial view of the old GPW precinct (Author, 2022)	58	Figure 58 _ Facade of the Unhistoric Townhouse, Systemarchitects (Systemarchitects, n.d.)	82
Figure 24 _ Aerial view of the <i>Nieuwe Staatsdrukkerij</i> (Author, 2022)	59	Figure 59 _ Interior of the Unhistoric Townhouse, Systemarchitects (Systemarchitects, n.d.)	82
Figure 25 _ Position of the Wierda building on the cultural significance scale (Author, 2022)	60	Figure 60 _ The church of Cristo Obrero, Atlantida, Uruguay (Palacio, 2012)	82
Figure 26 _ A collage of diagrams of the specific significant components of the Wierda building (Author, 2022)	60	Figure 61 _ Interior of the Cristo Obrero church (Oliveira, n.d.)	82
Figure 27 _ Aerial view of the administration block (Author, 2022)	61	Figure 62 _ Diagrams depicting the generation of ruled surfaces (Palacio, 2012)	82
Figure 28 _ Position of the administration block on the cultural significance scale (Author, 2022)	62	Figure 63 _ A collage of conceptual diagrams linking the different programmes of the project (Author, 2022)	84
Figure 29 _ A collage of diagrams of the specific significant components of the administration block (Author, 2022)	62	Figure 64 _ A series of design maquettes exploring the intervention's relation to the public space (Author, 2022)	84
Figure 30 _ Aerial view of the letter press building (Author, 2022)	63	Figure 65 _ A collage of conceptual diagrams (Author, 2022)	84
Figure 31 _ Position of the letter-press building on the cultural significance scale (Author, 2022)	64	Figure 66 _ A collage of design sketches (Author, 2022)	86
Figure 32 _ A collage of diagrams of the specific significant components of the letter-press building (Author, 2022)	64	Figure 67 _ Basement plan – June (Author, 2022)	87
Figure 33 _ Aerial view of the lithography building (Author, 2022)	65	Figure 68 _ Ground floor plan – June (Author, 2022)	87
Figure 34 _ Position of the lithography building on the cultural significance scale (Author, 2022)	66	Figure 69 _ Third and fourth floor plans – June (Author, 2022)	88
Figure 35 _ A collage of diagrams of the specific significant components of the lithography building (Author, 2022)	66	Figure 70 _ South and east elevations – June (Author, 2022)	88
	7	Figure 71 _ Sections AA and BB – June (Author, 2022)	90
		Figure 72 _ A collage of images of the proposed intervention – June (Author, 2022)	90

Figure 73 _ Thumbnail iterations for the design of the public space (Author, 2022)	94
Figure 74 _ Key site iteration 1 (Author, 2022)	96
Figure 75 _ Key site iteration 2 (Author, 2022)	96
Figure 76 _ Final site iteration (Author, 2022)	96
Figure 77 _ Thumbnail iterations of the design (Author, 2022)	98
Figure 78 _ Final design iterations – August to September (Author, 2022)	99
Figure 79 _ A self-standing nested catenary structure (Hensel & Bover, 2015:123)	102
Figure 80 _ Pinell de Brai cooperative wine cellar, Pinell de Brai, Catalonia, Spain (Cèsar Martinell & Associates, 2016)	102
Figure 81 _ Prototype on 1:10 scale of a hyperbolic-paraboloid brick assembly without mortar (Hensel, 2008:72)	102
Figure 82 _ Julio y Obes Warehouse, Eladio Dieste, Montevideo, Uruguay (ArchDaily, 2021)	102
Figure 83 _ Mapungubwe Interpretation Centre (Baan, 2010)	104
Figure 84 _ The construction of the vaults at the Mapungubwe Interpretation Centre (Ramage, Ochsendorf, Block & Rich, 2008)	104
Figure 85 _ The Fjordenhus corporate office building (De Larrea Remiro, 2018)	104
Figure 86 _ A catenary arch employed in the new building (Author, 2022)	106
Figure 87 _ The hyperbolic-paraboloid structure covering the building yard (Author, 2022)	106
Figure 88 _ Site plan – September (Author, 2022)	107
Figure 89 _ Ground floor plan – September (Author, 2022)	109
Figure 90 _ First floor plan – September (Author, 2022)	111
Figure 91 _ South elevation – September (Author, 2022)	114
Figure 92 _ East elevation – September (Author, 2022)	114
Figure 93 _ Section BB – September (Author, 2022)	115
Figure 94 _ Detail of the internal arcade and roof opening of the existing building – September (Author, 2022)	117
Figure 95 _ Detail of the new colonnade attached to the existing building – September (Author, 2022)	118
Figure 96 _ Detail of the footing of the new colonnade – September (Author, 2022)	118
Figure 97 _ Water harvesting diagram (Author, 2022)	119
Figure 98 _ Roofscape with potential number of PV panels (Author, 2022)	123
Figure 99 _ Daylighting analysis, adapted by the author from Sefaira (Author, 2022)	126
Figure 100 _ SBAT report, adapted by the author from the SBAT toolkit (Author, 2022)	128
Figure 101 _ Aerial view of the proposed intervention (Author, 2022)	130
Figure 102 _ Un-urbane street barrier (Author, 2022)	134
Figure 103 _ Urban investigation (Author, 2022)	136
Figure 104 _ Applied research (Author, 2022)	138
Figure 105 _ Diagram illustrating envisioned architectural practice, adapted from Yuan, Zhang & Li, 2013:140 (Author, 2022)	140
Figure 106 _ Site plan (Author, 2022)	152
Figure 107 _ Ground floor plan (Author, 2022)	154
Figure 108 _ First floor plan (Author, 2022)	156
Figure 109 _ Section AA (Author, 2022)	158
Figure 110 _ Section BB (Author, 2022)	160
Figure 111 _ Key details (Author, 2022)	162
Figure 112 _ Key brick technologies (Author, 2022)	164

List of tables

Table 1 _ Values-based matrix of the Wierda building (Author, 2022)	59
Table 2 _ Values-based matrix of the administration building (Author, 2022)	61
Table 3 _ Values-based matrix of the letter press building (Author, 2022)	63
Table 4 _ Values-based matrix of the lithography building (Author, 2022)	65
Table 5 _ Values-based matrix of the finishing plant (Author, 2022)	67
Table 6 _ Calculations of the effective rainwater collection area (Author, 2022)	120
Table 7 _ Water collection calculations (Author, 2022)	120
Table 8 _ Irrigation demand calculations (Author, 2022)	121
Table 9 _ Sanitation demand calculations, adapted by the author from the Green Star assessment tool (Author, 2022)	121
Table 10 _ Total water demand calculations (Author,2022)	122
Table 11 _ Water supply and demand calculations (Author, 2022)	122
Table 12 _ Energy supply calculations, adapted by the author from the Climatebiz Solar Calculator (Author, 2022)	123
Table 13 _ Energy supply calculations, adapted by the author from the Climatebiz Solar Calculator (Author, 2022)	124
Table 14 _ Energy demand calculations, adapted by the author from the Green Star assessment tool (Author, 2022)	124
Table 15 _ Energy supply and demand calculations (Author, 2022)	124

1_Position and situation

1.1_Introduction

The focus of this dissertation is primarily a technological enquiry in which brickwork is reconsidered as a contemporary technology that is expressed tectonically, with consideration of local specificity. It is argued that this reconsideration positions the dissertation within the ever-expanding discourse of craft. The rich brick tradition as evident in Pretoria, will also be contextualised as it influences how the design discussed in the dissertation responds to the context.

A theoretical framework will be established that will seek to situate this dissertation within the continuum of architectural thinking. The selected theories hold particular interest for the author and are considered appropriate in the heritage discourse within which the design project is situated.

A general issue that refers to the theoretical framework will be discussed, followed by an urban issue that addresses the contextual and urban situation of the proposed project. Lastly the architectural issue will be discussed.



Figure 1 _ Aerial view of the focus area (Author, 2022)

1.2_Situating the problem

1.2.1_Background

The Pretoria region is ideally suited to human habitation with its abundant water sources, shelter, and diverse plant and animal life. For this reason, the region has been occupied by humans since prehistoric times (Van Vollenhoven, 2006:82). Some of these early inhabitants were the Sotho -Tswana groups who occupied the area from as early as 1450 (Louwrens, 2006:120). Mzilikazi, a prominent Ndebele chieftain, would later drive these early Sotho -Tswana groups from the area in c. 1827. After an attack from Dingane's Zulu-impi in 1832, Mzilikazi himself vacated the area and in 1839 the first white people settled here (Van Vollenhoven, 2006:191-193).

For the purposes of this dissertation however, the discussion of the historical background of Pretoria will be limited to the time period that ushered in the development of the rich brick tradition that now exists within the city. The historical focus therefore will be placed upon the Western peoples that settled in the area after Mzilikazi's departure.

After the migration of the Voortrekkers to the north in the latter part of the 1830s, a new independent republic was established, one that would be free from the dictates of the colonial powers of the British. This fledgling independent republic, the *Zuid-Afrikaansche Republiek* (ZAR), was established in 1852, with Potchefstroom as its first capital. Pretoria would be founded later in 1855, and would eventually become the ZAR's new capital in 1860 in an effort to provide a more centrally located capital for the agrarian citizens of the new republic (Bakker, 2014; Clarke & Lourens, 2015). The British imperial ideal, to connect the Cape to Cairo, would see the annexation of the ZAR in 1877. The redrafted constitution of the ZAR by Britain made provision for the creation of a small *Departement Publieke Werken* [Department of Public Works (DPW)] that would ultimately set the scene for the architectural works of Sytze Wopkes Wierda (1839-1911) (Bakker, 2014:67-89).

The 1877 annexation of the ZAR eventually spilled over into the first of two conflicts, the First Anglo-Boer War from 1880 to 1881, and the Second Anglo-Boer War from 1899 to 1902. Victory by the Boers at the Battle of Majuba (27 February 1881) led to the British suing for peace and the resultant signing of the Convention of Pretoria on the 3rd of August 1881. A manner of self-rule was restored to the former Boer republic and, as Bakker (2014:68) notes, "... the dialectic particulars of the peace treaty were instrumental in furthering a greater sense of nationalism and independence in the Transvaal". Paul Kruger was elected as president of the ZAR in 1883 and ushered in a greater sense of nationalism and independence from the Crown. This rise in nationalist sentiment oversaw the signing of the London Convention in 1884 and, according to Bakker, with this increased independence, although marginal, the "*Zuid-Afrikaansche Republiek* was reborn" (Bakker, 2014:68).

The discovery of gold in the Transvaal led to a rapid increase in wealth and industrialisation within the ZAR, and with it a sudden demand for infrastructure. Bakker (2014:70-71) further notes that there was a dearth of professionals and skilled artisans within the republic and, as a result, President Kruger looked to the Netherlands, and especially to pro-Boer Dutchmen, as strategic human capital to staff his reconstituted DPW.

The ZAR parliament (Volksraad) approved the position of State Architect on 24 June 1887 and as a result, Klaas van Rijse Jr (1860-1941), a Dutch architect, was appointed as temporary Government Engineer and Architect for the republic. During a visit to the Netherlands in 1884, Paul Kruger, then president of the ZAR, had inspected some of Sytze Wopkes Wierda's architectural work and in so doing, secured a civil service position

for Wierda in the ZAR. Wierda was appointed head of the DPW on the 1st of November 1887, taking over from Van Rijse Jr, who would continue to work under him during his tenure at the DPW.

These imported Dutch architects were well versed in the Dutch tradition of brick facades without any finish (Van Diemen, Heijdra, Koers, Van der Leeden, Pater & Wansing, 2018:105), and introduced this tradition to the burgeoning capital of Pretoria. The tradition of the started back in the Middle Ages when demand for a less flammable construction material increased. The abundance of clay, due to the profusion of river deltas and lowering seas, meant that this stone substitute was soon to become the dominant Dutch building material. Van Diemen *et al.* (2018:105) note that appreciation of the brick diminished as international trade made natural stone imports available. During the 19th century a renewed appreciation of the brick emerged, as industrialisation enabled methods of brick manufacturing which offered new possibilities with regard to finish, colour, and form (Van Diemen *et al.*, 2018:105). This period of brick revival in the Netherlands, coincided with the education and practice of Wierda so he looked to this familiar material to craft a new identity for the ZAR, particularly in its capital, Pretoria.

Wierda, on his arrival in Pretoria in late 1887, would be confronted with a formidable task. At this time the city was primarily a rural town with a few single-story buildings, all interpretations of Cape Dutch architecture and built with mud walls and thatch roofs (Bakker, 2014).

The Transvaal was a Republic of farmers, and there was no foundation of industry or built-environment professions to speak of. The building-related artisans were mainly skilled in the vernacular building tradition, with only a few contractors being able to work with stone and industrialised components. There were no iron foundries, no established brick factories (up to 1888), no stone masonry yards, no established quarries, no factories producing building supplies, and no locally made building services. Almost everything had to be imported and transported by rail... (Bakker, 2014:74-75).



Figure 2_ The Pioneer Museum, Pretoria. An example of early Pretoria architecture c. 1840 (Author, 2022)

Wierda would become responsible for the creation of an architectural identity for the new republic, "... a new 'ZAR Style' from a European tradition, without taking over any specific nation's total stylistic iconography" (Bakker, 2014:75). This new national identity would also be exclusionary of the previous inhabitants who still lived in the surrounding areas, as the Boers viewed the African tribes as heathen and, as a result, there was little to no consideration of their architectural contribution in the creation of this new identity (Bakker, 2014:75). In addition, Wierda also had to contend with a general lack of skills and materials, as these had not been established at the time of his arrival in the new republic.

John Johnston Kirkness (1857-1939), a Scottish immigrant and building contractor, made his way from Durban to Pretoria and established himself in the Transvaal capital in 1887. IN 1888 Kirkness founded the Groenkloof Brick, Tile, and Pottery Works on the southern slope of Muckleneuk Hill, on what is today known as the University of Pretoria's Groenkloof Campus. At the height of its operations, the Kirkness brickworks would produce 50 million bricks annually, and these bricks would be used in projects from the Groote Schuur Hospital in Cape Town to the Post Office in Harare (Basch, 2019; Fisher, 1998; Kirkness Bricks, n.d.).

The arrival of both Wierda and Kirkness in 1887 would provide the architecture, material and building craft with which the DPW would create the regionalist aesthetic that has become so prominent in the core of the capital. Fisher (1998:226) credits the *Departement Publieke Werken* with the creation of this Pretoria brick tradition. In 1895 Wierda, through the DPW, oversaw the design and building of the *Nieuwe Staatsdrukkerij* [New Government Printers, also referred to as the Old Government Printing Works], on a block northwest of Church Square, built with Kirkness bricks in the new ZAR style - Eclectic ZA Wilhelmiens. It demonstrated the increased application of building craft within Pretoria.



Figure 3 _ East facade of the Old Government Printing Works (Author, 2022)

1.2.2_General issue

The inner city of Pretoria, which the government refers to as the capital core in the Metropolitan Spatial Development Framework of 2021 (MSDF), contains the majority of the City of Tshwane's heritage structures, approximately 39% of its total heritage assets (Clarke & Lourens, 2015:44). Furthermore, it is argued by Clarke and Lourens (2015:44) that this wealth of built heritage is being neglected and faces destruction, as these buildings have fallen out of use or have failed to keep up with current demands in the inner city. New creative ways to adapt or alter these valuable heritage assets need to be found in order not to lose them to insensitive alterations or demolition.

Furthermore, it is noted by Clarke and De Villiers (2015:82) that the necessary skill to restore these artefacts might not be readily available within South Africa - it will necessitate the importation of specialist skills. Oke, Ngwenya, Aigbavboal and Khangale (2019) seem to agree, as they cite a study conducted by the South African Association of Consulting Engineers on skills availability in the construction sector. This study found that a shortage of mid-career professional staff exists and that this is due to poor productivity at workmanship level, resulting in a high demand for a workforce with experience and high-level critical skills.

The *Staatsdrukkerij*, designed by Sytze Wopkes Wierda in 1895, forms the focus of this dissertation as it is one of the at-risk heritage resources within the capital core of the City of Tshwane. The *Staatsdrukkerij* is a prime example of craft that would be introduced to the ZAR after the arrival of Wierda and Kirkness. The building demonstrates the great skills development that took place in Pretoria at the time, as technology developed from mudbrick and thatch Cape Dutch style structures to the complicated English bond brickwork found at the *Staatsdrukkerij*. The building is constructed in the typical Eclectic ZA Wilhelmiens style (Bakker et al., 2014) that established the architectural identity of early Pretoria, whilst also contributing to the rich brick tradition for which especially the inner city of Pretoria would become known.

It is this author's opinion that a return to construction craft can aid the development of the necessary skills to adapt and preserve Pretoria's heritage resources. The contemporary high-tech potentialities of brickwork, that could initiate a much-needed return of the master builder, will form part of the technological investigation conducted in this dissertation.

1.2.3_Theoretical framework

The following theoretical themes are considered appropriate for this study and serve to form the theoretical framework within which this dissertation will be positioned: Regionalism, Craft, and Tectonics. The project is situated within a clearly defined political-regionalist context, i.e. that of the Dutch Revival, and therefore a more inclusive contextual attitude needs to be adopted for the research. For this reason, regionalism is included in the theoretical framework of this dissertation. Craft is included because of how the artefact (the *Staatsdrukkerij*) demonstrates building craft which is seemingly diminishing in current practice. Tectonics is included because "... we are not alluding here to the mechanical revelation of construction but rather to a potentially poetic manifestation of structure in the original Greek sense of *poesis* as an act of making and revealing" (Frampton, 1990:519).

Critical Regionalism

Contextually, the intention with the study is to design an intervention that will be sensitive to the existing artefact,

whilst at the same time breaking free of the typical binaries found in contemporary heritage approaches, namely, mimesis (copy) and contrast (Barker, 2020:126). Furthermore, it is important to note that the majority of the structures that contributed to the regionalist aesthetic were designed and constructed during the time of exclusionary politics in South Africa, particularly in the Transvaal (ZAR), as alluded to by Bakker (2014:75). In lieu of this fact, the question arises as to whether the above situation contributes to the dilapidation of these heritage assets because they seem to belong to only one cultural group in the new South Africa (post-1994). This possibility, as well as the contestation of the binaries, provides the backdrop to the research in Critical Regionalism, or as Ozkan (1985) defines it, abstract regionalism (Louw, 2021:70; Ozkan, 1985:107).

Abstracting elements from the past in order to derive building form from it constitutes what we call "abstract regionalism." ... It mainly incorporates the abstract qualities of a building, for example, massing, solids and void, proportions, sense of space, use of light, and structural principles in their reinterpreted form. It also endeavours to bring back to existence the cultural issues (Ozkan, 1985:109).

Harris (1978:67) defines regionalism as the "love of one's locality, pride in its accomplishments and loyalty to everything in it". Pretoria Regionalism, however, has been exclusionary since it was established and for the majority of its existence, and as a result the current inhabitants of the city have little pride in, or love or loyalty for this established identity. In regard to nationalism in architecture, Harris (1958:61) asserts that "The nation needs buildings which hold up a picture of what their citizens would like to believe they are, that call their achievements to the attention of the world, that advertise their power ... This is why conquerors always build." This statement, at least, could clarify the seemingly apparent rift that exists with regard to the heritage assets in the inner city - assets that were very much a nationalist expression of the ZAR and later the Apartheid Government.

Thus, it is the author's opinion, that Critical Regionalism (or abstract regionalism) could mediate between past and present. Tzonis (2003:11), in the seminal work with Lefaivre, *Critical Regionalism: Architecture and Identity in a Globalized World*, calls for a "rethink of regionalism" in the conflict between globalization and local identity. In this dissertation the author contends that the above approach can be applied to the creation of a new identity for the inner city of Pretoria. In referring to the writings of Ernesto Nathan Rogers, Lefaivre (2003:43) notes that the "environment" that needs to be considered is "... the natural context inside which a new project had to be inserted, but it also means the "cultural" one, the "historical setting" ... and that it means one must consider history". Patteuw and Szacka (2019:93) attempt to provide a contemporary way to understand Critical Regionalism as "... a compositional understanding of the figure ground of the project; ... an interest in the cultural and material histories of a specific site; or ... an awareness of the technical constraints and opportunities that a site can imply". Frampton (2007:327) remarks that: "Critical Regionalism is not so much a style as it is a critical category oriented towards certain common features ... or rather attitudes." In reading Frampton's *Modern architecture: A critical history* (2007), this author must agree with Louw's (2021:70) distillation of the "features" or "attitudes" Frampton refers to in order to define Critical Regionalism as:

1. Being a marginal practice which accepts modernisation but distances itself from "normative optimisation"; 2. Being consciously bounded but part of a larger context; 3. Being tectonic rather than scenographic; 4. Emphasising site-specific elements like topography, local light conditions and local climate (as opposed to artificial air-conditioning); 5. Designing for all senses and regarding the tactile and visual as equally important; 6. Being opposed to "sentimental simulation" of the local vernacular, while supporting the reinterpretation of vernacular elements; and 7. Flourishing in places that are not completely globalized (Louw, 2021:70).

According to Lefaivre (2003:45), Critical Regionalism is "... a regionalism that is self-examining and self-questioning", and it is the belief of this author that this abstract approach to regionalism provides a framework within which a new identity can be created for the inner city of Pretoria - an identity that would seek to mediate between the past and the present.

Craft

For the purposes of this dissertation, craft and craft-based design will be limited to architecture and its manifestation, i.e. construction. Hurcombe (2007:538) cites three attributes required for craft expertise, namely: "knowledge, skill and aptitude". Referring to these attributes, Barker (2013:2) expands upon their presence within the architectural works of Gawie Fagan:

Knowledge of building traditions and local materials, new technological advances, culture, climate and place are essential ingredients for a craft-based design approach. Skill is developed through a physical, hands-on approach fused with haptic sensibility that encompasses both the tangible and the mythical. Aptitude is the innate ability of a designer to understand the qualities of materials and the inherent possibilities (Barker, 2013:2).

Michael McCullough (1997:311) argues for a more inclusive definition of craft to include digital practices, as the "artisan" is still, with his or her hands, performing a "sophisticated and unprecedented set of actions". He further argues (1997:311) that "craft remains skilled work applied toward practical ends" and it entails "indescribable talent with describable aims". In attempting to define craft, Adamson (2010:2) writes that it is "... the application of skill and material-based knowledge to relatively small-scale production", and states that this open-ended definition allows for connections across wider ranges of activities than only "the so-called 'crafts' themselves" (Adamson, 2010:2). He includes in his list of crafts architecture, digital rendering, and construction work, to name but a few. In line with this thinking, this author must agree with the definition of craft as posited by Louw (2021:x) in his doctoral thesis, "The search for hybrid tectonics in contemporary African architecture: Encounters between the global and the local". Louw states that craft is

... a localised mode of production where the mental or physical skill and the knowledge of materials or a medium is applied on a relatively small scale usually making use of manual means. This is typically performed by an individual or a group of individuals with no, or a minimal, division of labour. Where there is a division of labour, the individual craftspeople are not alienated from the thinking process and have an understanding of the entire production process or are able to perform the entire process individually should they choose to do so. It does not sever the links between thinking and making and it usually aims to prevent the alienation or dehumanisation of labour. The definition of craft is becoming broader to not only include so-called traditional artisanal modes of production and handicrafts [the visible hand], but to also apply to the skillful [sic] manipulation of digital software and manufacturing [the invisible hand] (Louw, 2021:x).

In considering craft within these definitions, the *Nieuwe Staatsdrukkerij* can be regarded as a manifestation of craft-based construction. Here, the English bond is proudly expressed throughout the structure, with a *speklaag* [streaky-bacon coursing] serving as a unifying horizontal datum with stepped gables and pediments with finials, all in the Dutch Revival style (Clarke & De Villiers, 2015:79).



Figure 4 _ East facade of the Old Government Printing Works (Clarke, 2014)

Tectonics

The generally accepted term “tectonics” denotes the assembly of lightweight structural components into what could be considered a lightweight frame. The origin of the term might be attributed to Gottfried Semper in his writings on the Caribbean hut, where juxtaposition exists between the stereotomic earthworks and the tectonics of the frame and wall infill (Frampton, 1995:5). This common understanding of tectonics probably became limited to referring to *tekton*, which in Greek signifies “carpenter” or “builder” and to the Sanskrit *taksan*, which refers to the craft of carpentry and the use of the axe (Frampton, 1995:3).

For the purposes of this dissertation tectonics, tectonic craft, and tectonic expression will be defined as “not mere revelation of constructional technique but rather ... expressive potential” (Frampton, 1995:2). In elaborating on tectonics, Frampton (1983:28) cites Adamson (1980:83): “‘Tektonik’ referred not just to the activity of making the materially requisite construction ... but rather the activity that raises this construction to an art form ... The functionally adequate form must be adapted so as to give expression to its function.” In his reading of Frampton (1995), Auret (2010:106) notes that both Semper and Botticher state that tectonics is not only focussed on structure and materials, “... but also [on] the poetics of construction by referring to the Greek *poiesis* as the act of making and revealing” (Frampton, 1995:519). This dissertation will be positioned in light of this definition of tectonics. In defining tectonics, Louw (2021:x) asserts that it is “... something that transcends the mere expression of structure by encompassing the art of making (which includes design and construction), material properties, and structural expression, in an artful manner”.

In “Structure, construction and tectonics” Edward F Sekler states:

Through tectonics the architect may make visible, in a strong statement, that intensified kind of experience of reality which is the artist’s domain – in or case the experience of forces related to forms in a building. Thus structure, the intangible concept, is realized through construction and given visual expression through tectonics (Sekler, 1965:92).

Tectonics then, for the purposes of this dissertation, is considered to be inseparable from craft in the pursuit of *poiesis* in architecture - an architecture that is not merely scenographic, but also haptic - an architecture that seeks to serve more than just the visual sense. In his article, “Toward the poetic in architecture”, Auret (2010:100) refers to Pallasmaa (2000:78), who argues against the ocularcentric architecture of the eye toward an architecture of hapticity, providing a multi sensory experience, and breaking free from the “flatness of surfaces and materials and uniformity of illumination” to an experience of the “qualities of matter, space and scale” through the “eye, ear, skin, tongue, skeleton and muscle” (Pallasmaa, 2000:78). Tectonics and craft become the means through which to achieve this multi sensory architecture that Pallasmaa advocates.



Figure 5 _ Corner of Het Schip, Amsterdam (Van Diemen et al, 2018)

1.2.4_Urban issue

The current MSDF for the City of Tshwane (Tshwane Metropolitan Spatial Development Framework, 2030, 2021:91) seeks to promote compaction and densification of the Pretoria CBD (the capital core) up to a radius of 25 km from Church Square. The specific site for the proposed design, located a block northwest of Church Square, is positioned well within the capital core. To create a project that would contribute to the making of the city, whilst remaining sensitive to the historical heritage of the site, the following issues will have to be addressed:

1. Little to no pedestrian interaction currently takes place with the site.
2. The site is not open for circulation, although an opportunity exists to allow pedestrian access across the site.
3. The surrounding areas are predominantly focussed on vehicular access and movement.
4. "The façade of the building forms a barrier to the street, lining the sidewalk, and is hard, un-urbane and unfriendly" (Clarke & De Villiers 2015:82).



Figure 6 _ The barrier formed by the south facade (Author, 2022)

1.2.5_Architectural issue

Within a context of neo classical typologies adhering to the traditional use of brick, the aim with this dissertation is to investigate and comprehend the context of the building and convey a more contemporary typology, incorporating new methods and technologies of construction to explore the versatility of the brick where appearance and construction techniques are concerned. The tectonic potential of brickwork will be investigated as a contemporary technology in the adaptation of a heritage resource and as an abstract regionalist response to its context.



Figure 7 _ A nested catenaries shell (Hensel & Bover, 2015)

1.3_Research design and method

The Master's of Architecture (Professional) degree is primarily positioned to bridge the spheres of architectural practice and academia. As such, the development of this dissertation is focused upon the "research by design" approach in order to deliver practitioners that can apply research to the various design issues faced within the professional environment. Research by design can be defined as "that kind of research in which the process of designing, as well as experience gained from practice, plays a crucial role in research – not only as inputs to be observed, but, more importantly, as the actual methods and outcomes of the research itself" (Verbeke, 2014:137).

Verbeke (2014:145) developed the following points from the European Association for Architectural Education Charter on Architectural Research. These points are considered important for the positive advancement of research by design:

Firstly, in terms of research by design, the act of designing is the key process to develop understanding and knowledge. Secondly, peer reviewing is essential to maintain quality. Thirdly, research by design needs to be openly connected to practice and studio work. And finally, we should be careful not to impose a strict list of qualitative aspects, as a sort of checklist, but rather keep things open for interpretation by practitioners, reviewers and research assessment panels (Verbeke, 2014:145).

As the purpose of the research by design approach is the application of theory and not the creation of theory, the research for this dissertation will employ a mixed-method and interpretivist approach which will make use of multiple sources of knowledge, especially case studies. In their book, *Architectural research methods*, Groat and Wang (2013:136) consider this approach appropriate for the purposes of a master's of architecture degree:

We now consider theory in relation to architectural design in the case of an MArch student thesis. Here, theory can once again be applied broadly to the outcome, which is usually the design of an entire building, or at least a project at this scale if not larger. But ultimately, the transition from theoretical constructs to formal gestures in these cases is necessarily interpretive, rooted in the designer's value-full deontic decisions.

The research for this dissertation started with a wide scoping of writings on regionalism, tectonics, craft, and technology in order to gain an understanding of these concepts and to define the theoretical framework for the dissertation. This scoping ultimately led to an in-depth literature review.

First literature review

The first literature review consisted of an intensive reading of the works of Kenneth Frampton, especially *Studies in tectonic culture: The poetics of construction in nineteenth and twentieth century architecture* (1995). This together with other works such as Canizaro's *Architectural regionalism: Collected Writings on Place, Identity, Modernity, and Tradition* (2007) and Adamson's *The Craft Reader* (2010), led to the realisation that craft in architecture is inseparable from tectonics and context (such as regionalism and all its associated definitions). Tectonics, and by association technology, is the physical manifestation of the architecture, and regionalism is its contextual (locally specific) response.

Second literature review

The second literature review consisted of a scoping of writings on history, urban design and heritage, followed by an intensive reading of Bakker, Clarke, and Fisher's *Eclectic ZA Wilhelmiens: A shared Dutch built heritage in South Africa* (2014). Together, these readings formed the historical context within which the artefact will be situated, along with approaches to deal with the urban and architectural issues that will be defined.

Research questions

The literature reviews informed the formulation of the following research questions against which the various design iterations will be tested in a research by design approach.

Main research question:

How can a rethinking of brickwork as a contemporary technology convey a more time-specific typology within the political neo classical typology of the inner-city of Pretoria?

Research sub-questions:

- How can brickwork be employed in the conceptualisation of an abstract regionalism within the defined regionalist context of Pretoria?
- How can brickwork contribute to an expanded understanding of tectonic expression surpassing the limited definition of a light framed structure?
- How can brickwork mediate between traditional and digital craft?
- How can brickwork be employed in the adaptation of sensitive architectural artefacts without the binary approaches of copy and contrast?

Primary sources

In addressing the above questions, the research for this dissertation will mainly consist of desktop studies and the analysis of secondary data through an interpretivist approach. Site analysis and interpretation will entail site visits along with the study of contemporary and historical mapping data of the selected site. Archival documents within the Architecture Archive of the University of Pretoria (AAUP) will also be consulted in order to facilitate a more in-depth understanding of the selected site and its historical development within Pretoria.

The primary focus of this dissertation is the rethinking of brickwork - as a contemporary technology through tectonic expression - towards a contextually responsive design within the critical regionalist paradigm. As the focus of the dissertation is primarily that of technological investigation, no human participants or physical experiments are required to complete the dissertation; therefore, ethical concerns are limited.

Relevant case studies that focus on Critical Regionalism, craft, tectonics, and heritage are key factors in the extraction of architectural principles that can be applied in the design process. These principles will be explored (physically and digitally) through sketches, diagrams, and maquettes in order to develop a conceptual framework which will serve to guide the various interventions and iterations in context. This design process will also form the primary means of architectural investigation, which will then culminate in a design proposal that would explore the expressive potential of the application of contemporary brickwork on various scales of the project.

As Verbeke states:

The design and/or practice drives the whole research project throughout its entirety, which seems to offer the most fertile condition for research by design ... Instead of simply research 'on' architecture, researchers should try to establish research 'in the medium' of architecture: this means to investigate architecture through architecture and not through history, theory, social science or environmental science (Verbeke, 2014:150).

In referring to the book *The reflective practitioner* by Donald Schön, Verbeke (2014:140) further notes that reflective thinking is important in the development of understanding and knowledge in the creative disciplines. This reflection and contemplation of the design will be used to extract key aspects of the project which will then be communicated to other practitioners and will thus result in the work being peer-reviewed regularly.

All secondary data will be acquired ethically and where applicable will be referenced properly. The research will furthermore be conducted as per the ethical guidelines set out by the University of Pretoria (University of Pretoria 2012).

The research by design process



Figure 8 _ Diagram explaining the research by design process (Author, 2022)

1.4_Postulation of the programme

The selected site for this dissertation could be considered a site of knowledge creation, multiplication and dissemination. The site also hosted technological advances in both the medium of printing and architecture. In his master's dissertation, "Being some account of the history of the printing, packaging and newspaper industry of South Africa, and of the National Industrial Council for Printing, prepared to mark the Jubilee of the Council 1919-1969", Picton (1969:110-121) asserts that the technological advances that took place in the printing industry in South Africa, resulted in the redundancy of the artisans responsible for the manifestation of the printed word. Clarke and De Villiers (2015:80) discuss the exceptionally innovative construction technology (most probably imported) that would result in the free plan of the interior of the Old Government Printing Works, which was ideal for industrial activities. The transitions from the ZAR government to the British, and later to the National Party that instigated the Apartheid laws, also need to be considered as the gazettes proclaiming the relevant laws were also printed at and distributed from this site. The isolationism of the policies of the National Party government and being a national key point, also requires appropriate spatial responses.

In considering the above, the site requires a democratic educational programme focussing on the training of artisans. The site at large needs to be opened up to the public in an effort to democratise the isolationist nature of the city block.

The envisioned programme aims to address the current skills shortage within the construction sector and, in so doing, to align itself with the goal of the South African Government's National Apprenticeship and Artisan Development Strategy 2030. This strategy aims to produce 30 000 artisans annually by 2030. The TVET College was selected as an appropriate client, focussing specifically upon the National Certificate Vocational (NC(V)) curriculum as the means to produce artisans skilled in construction. Furthermore, in an attempt to future-proof these artisans as the 4th Industrial Revolution progresses, the CSIR (Council for Scientific and Industrial Research) and Delft University of Technology (TU Delft, The Netherlands) were included as collaborative clients in an advanced construction technology research and development programme. It is intended that this programme would find practical application through the students of the TVET College, thus resulting in the development of appropriate technologies for the Global South.

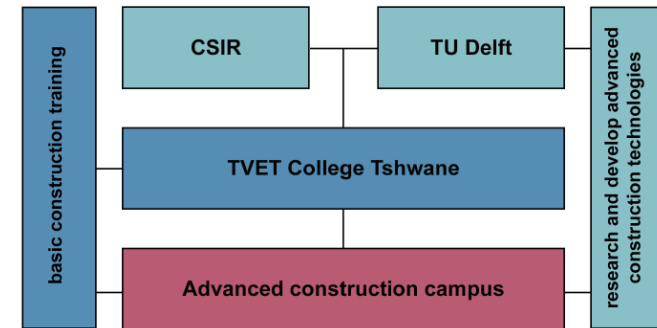


Figure 9 _ Diagram explaining the postulated programme (Author, 2022)

1.5_Conclusion

To conclude, this dissertation is situated within the theories of Critical Regionalism, Craft, Tectonics, and Heritage. Critical Regionalism informs the contextual approach to working within the historical and cultural context in which the proposed project is placed. Craft and Tectonics are the inseparable themes that contribute to a poetic final manifestation of the design.

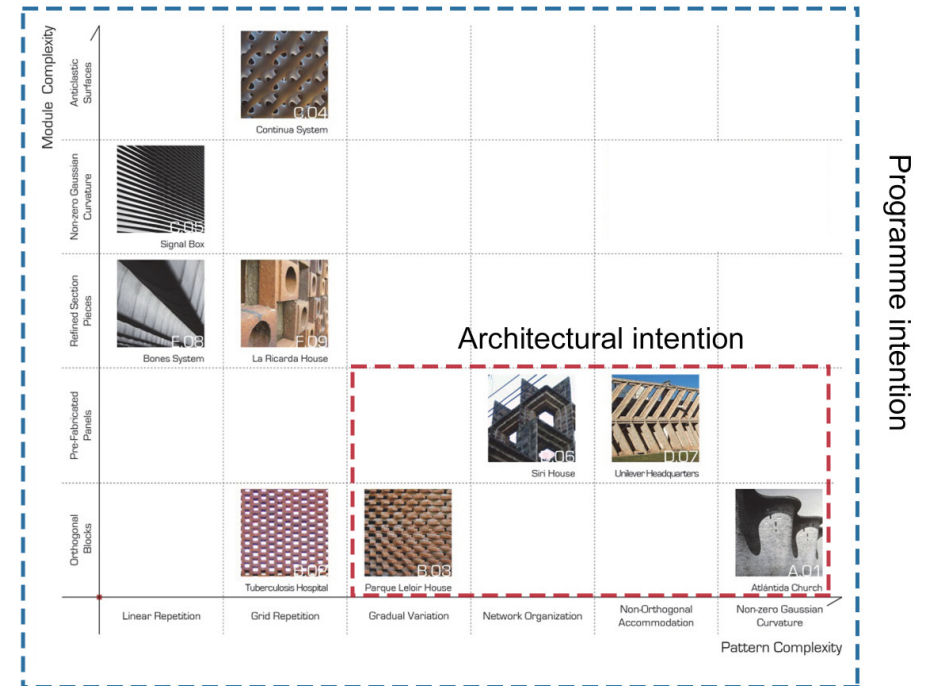


Figure 10_ Diagram explaining the intention of the dissertation, adapted by the author from Imber, 2014:213 (Author, 2022)

2_Design research

2.1_Introduction

In order to express a contemporary inclusive identity, the reconsideration of the role of the old Government Printing Works (GPW) within the City of Tshwane (CoT) requires mediation between the different layers that formed the site. The theories of Heritage, Critical Regionalism (Abstract Regionalism), Craft and Tectonics are considered appropriate for this envisioned mediation.

To focus the design investigation, the physical context of the proposed intervention and its relation to contemporary city-making and technology need to be understood. To this end, a study of the context (urban, historical and technological) will be conducted. Firstly, contextual analysis concerning urban conditions, proposed urban frameworks, and the Regional Spatial Development Framework of 2018 (RSDF) will elucidate key contextual and urban issues and opportunities that will be addressed in the proposed design. Secondly, the study of the history and heritage will guide appropriate responses to the cultural significance of the site. Lastly, the study of technological precedents will inform opportunities for the design of the intervention.



Figure 11 _ Locality map (Author, 2022)

2.2_Urban conditions

The old Government Printing Works (GPW) precinct is located a block northwest from Church Square on the corner of Madiba Street (formerly Vermeulen) and Bosman Street (formerly Koch/Kock). The precinct covers almost an entire city block and has been continuously developed since the construction of the *Nieuwe Staatsdrukkerij* in 1896, until the last building, the finishing plant, which was built in 1955.

The site is bordered by three streets, namely Madiba Street to the south, Bosman Street to the east, and Johannes Ramokhoase Street (formerly Proes) to the north. Furthermore, the site is surrounded by residential, commercial, institutional, educational and religious buildings. The site falls into what is described as the northwest quadrant of the city of Pretoria (defined by the axes that cross Church Square).

The majority of the northwest quadrant has been plagued by the results of the forced removal policies of the Apartheid government, as well as by large-scale demolition to make way for a proposed ring-road highway that was never realised. This desolate situation in the north-west quadrant has led to the coining of the term, "Pretoria se eie braak" [Pretoria's own fallow land] (Naude, 1991:106-108). As one continues to venture further across this quadrant the 'remnants of this warzone' imbues one with a sense of volatility and insecurity. For this reason, attempts to invigorate the Western Capital Precinct (the current term for the northwest quadrant) were initiated and frameworks developed in order to attract much-needed capital investment to the area. The aim was to heal the scars of the past still evident on the urban landscape.

In considering the location of the GPW, Clarke and De Villiers (2015:79) note that the site is strategically located to "bridge the gap between Church Square and the north-western quadrant" and as such could provide a "stepping-stone to cross the physical, social and economic divides".

With consideration of the identified urban issues (Chapter 1.2.4), the proposed design seeks to open up this isolated Government precinct to the public, envisioning a pedestrianised inner city in accordance with the City of Tshwane's Regional Spatial Development Framework (RSDF) of 2018.

1. Little to no pedestrian interaction currently takes place with the site.
2. The site is not open for circulation, although an opportunity exists to allow pedestrian access across the site.
3. The surrounding areas are predominantly focussed on vehicular access and movement.
4. "The façade of the building forms a barrier to the street, lining the sidewalk, and is hard, unurbane and unfriendly" (Clarke & De Villiers 2015:82).

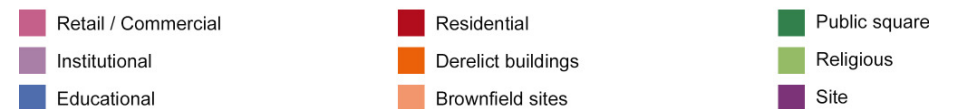
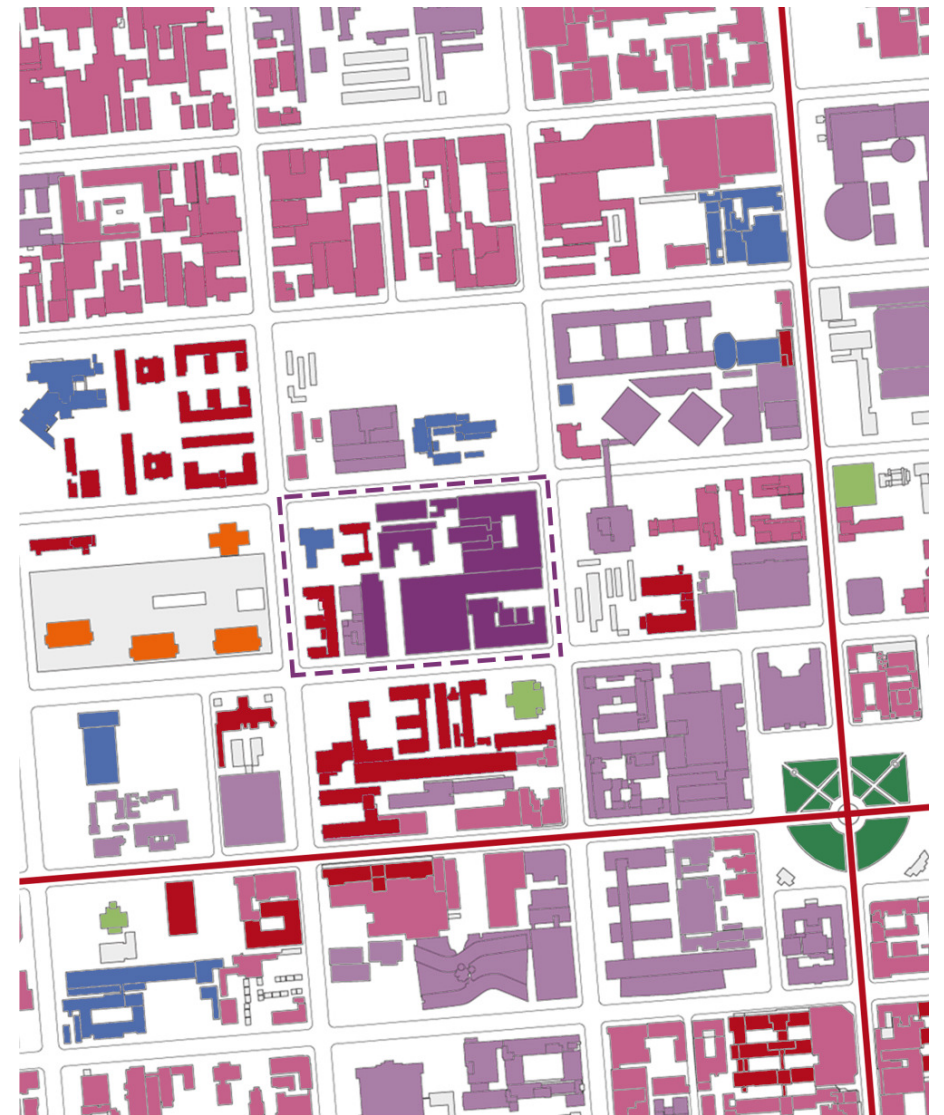


Figure 12 _ Contextual mapping of programmes (Author, 2022)

2.3_Contextual analysis

2.3.1_Proposed urban framework

Co-Arc – City of Tshwane Redevelopment – Iteration 1

In 2014, a consortium under the leadership of Arup was appointed to develop a masterplan of which the redevelopment of Marabastad would form the core focus. In order to reintegrate Marabastad with the capital core of Tshwane, the masterplan had to include large portions of the north-western quadrant of Pretoria. Co-Arc International Architects were appointed as the urban designers of the framework that would be known as the West Capital Precinct Plan.

Although the design was chiefly concerned with the redevelopment of Marabastad, the overarching framework would come to include the site of the GPW. This masterplan developed by Co-Arc, formed the basis for the development of the GPW block framework for the proposed design. Ultimately, the intention is to integrate the GPW precinct with the framework which was proposed by Co-Arc.

The masterplan developed by Co-Arc, includes plans with differing levels of density and intervention across the north-western quadrant. Two plans were developed; these include specific interventions on the site of the GPW and will be discussed and critiqued here. As the rest of the West Capital Precinct Plan focuses specifically on Marabastad, it will not be included in this discussion as it falls outside the scope of this dissertation.

Figure 13 is simply named preview 02 from Co-Arc's website. The envisioned development of the site proposes large-scale demolition of most of the buildings on the GPW site, except for the Wierda building (*Nieuwe Staatsdrukkerij*). This provides an opportunity for pedestrian movement across the large city block. Furthermore, smaller perimeter blocks are created purposefully to form internal courtyards (internal public space), which would seem more appropriate if the envisioned development were residential in nature. In their discussion of the urban masterplan, Co-Arc (2014) appears to show little respect for the envisioned programmes for this specific site. The overarching plan does however state that the development would be mixed-use in nature, and would include "housing, student housing and amenities, while taking care to ensure the correct urban densities within the area" (Co-Arc, 2014).

The proposed development, however, does not consider the larger heritage issue as it pertains to the demolished buildings. As noted earlier, the site was continuously developed from ca. 1896 to ca. 1955. The problem that this poses is that most of the buildings are therefore older than 60 years and, as a result, simple demolition should be reconsidered. Another critique of the aforementioned plan is that it enables very little interaction between the proposed scheme and the old Wierda building. The following positives should however be considered in the development of the block framework:

1. division of the block into smaller sections to facilitate pedestrian movement across the block;
2. creation of internal public spaces;
3. favouring the creation of perimeter blocks; and
4. inclusion of 'green' space.

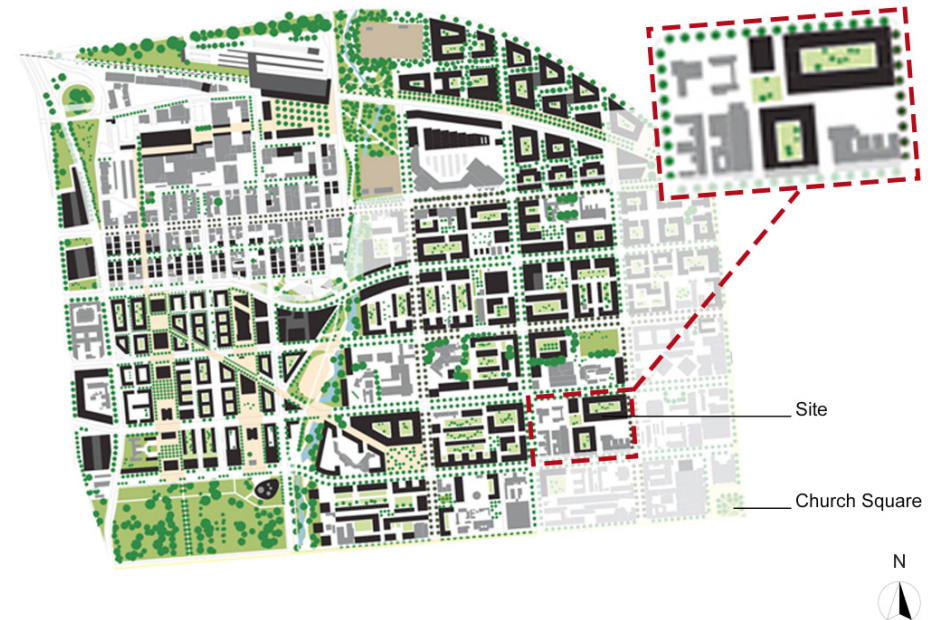


Figure 13 _ Co-Arc West Capital Precinct Plan, preview 02, adapted by the author from Co-Arc, 2014 (Author, 2022)

Co-Arc – City of Tshwane Redevelopment – Iteration 2

Figure 14 depicts the second masterplan that includes a proposal for the site, labelled as preview 05 (Co-Arc, 2014). This second proposal by Co-Arc for the site suggests a retail / commercial programme for the envisioned development. Street frontage is given priority, with semi-public courtyard spaces framed by the proposed buildings. The proposal again facilitates pedestrian movement across the site, which will also activate the retail spaces. This second proposal also retains more of the heritage buildings on the site – with the new proposal re-establishing the corner condition of the old admin building on the north-eastern corner. Limited green space is proposed, and the development seems to turn its back on the heritage buildings, leading to a lack of interaction with these buildings. As with the first proposal, the desire is to divide the large city block into smaller, more urbane and pedestrian friendly-spaces. Key ideas derived from this second proposal:

1. divide the block into smaller segments to facilitate pedestrian movement;
2. define street edges and corner conditions; and
3. align proposed forms with envisioned programmes (public / private).

In considering the abovementioned, the following approaches can be adopted to develop the site in a more urbane and pedestrian-friendly way, thus addressing key issues and in so doing, integrating with the proposed masterplan:

1. divide the block into smaller sections;
2. create pedestrian streets / arcades across the site to facilitate movement;
3. adopt a pedestrian friendly approach, providing buildings with street frontages where pedestrian flow occurs;
4. create internal public spaces (this should include green spaces); and
5. integrate culturally significant heritage buildings with the scheme.



Figure 14 _ Co-Arc West Capital Precinct Plan 2, preview 05, adapted by the author from Co-Arc, 2014 (Author, 2022)

2.3.2 Interpreting the Regional Spatial Development Framework (RSDF) of 2018

In the 2018 RSDF the site and most of the capital core of Pretoria are zoned for retail development. A retail strategy is proposed by the City of Tshwane, instead of taking an authoritative approach with top-down implementation that would create undue limitations within the retail sector. The following quote sets out this retail strategy favoured by the City of Tshwane:

Retail development should balance the needs of the retail sector with the needs of communities, urban functionality and sustainable development and should make a positive contribution to the overall urban environment. The local authority will take a more facilitative approach toward retail developments, provided that the actual development is in line with and support the urban objectives and contribute to a more functional, equitable, convenient and attractive metropolitan environment. Retail development should therefore be approached holistically, looking at the economic, social and environmental aspects (RSDF, 2018:18).

This strategy is primarily market driven, allowing the private sector to determine the needs within this area and then to address them accordingly. Thus the focus, within the capital core, is on the recapitalisation of the area, allowing for:

- Equitable access to retail opportunities
- Economic stimulation by redirecting spending that might otherwise leave the urban core back towards the core to increase development (RSDF, 2018:19).

The RSDF (2018:60) further defines the retail land use as “areas of concentration of mixed land uses with the focus on retail”, thus allowing for a mixed-use development oriented towards retail development.

The site is also included in the Transit Oriented Development (TOD) node of the city. Key principles guiding the development within the TOD were developed, and these are:

- Develop TOD's that promote walking [walk]
- Prioritize non-motorised transport networks within and to TOD's [cycle]
- Create dense networks of streets and paths within the TOD [connect]
- Locate development near high-quality public transport [transit]
- Optimize density and transit capacity [densify]
- Create regions with short commutes [compact]
- Increase mobility by regulating parking and road use
- Reduce car dependence
- Encourage active interfaces between buildings and streets
- Residential and non-residential uses combined within the same or adjacent blocks
- Encourage vertical mixing of uses (RSDF, 2018:22).

In order to address the issue of the proposed multiple modes of transit, the City of Tshwane (hereafter referred to as the 'city') furthermore incorporates the “Livable Streets Concept” (RSDF, 2018:26), which can be defined as “... streets for everyone that are planned, designed and operated to enable a network of safe access for all users, including pedestrians, cyclists and transit riders” (RSDF, 2018:26).



Figure 15_ RSDF 2018 zoning map (Author, 2022)

The following principles were developed to assist in the designing of these "complete streets" (RSDF, 2018:25):

- traffic-calming measures to lower the speed of vehicles
- a road diet to reduce the number of lanes for vehicles and on-street parking
- landscaping and streetscaping elements such as trees and benches to create a pedestrian-friendly environment and protect pedestrians from vehicles
- wide sidewalks to accommodate comfortable pedestrian movement
- widening of sidewalks in some places to allow for socialising spaces
- accommodation of cyclists, such as protected or dedicated bicycle lanes
- accommodation of public transport such as the bus rapid transit (RSDF, 2018:27).

These principles form part of the adoption of the multimodal street as advocated in the *Global Street Design Guide* (2016:14-15) by the Global Designing Cities Initiative. The purpose of this adoption is to move away from car-oriented streets to multimodal streets that can serve and move more people.

Multimodal streets help to make cities more efficient. A reduction of private cars on streets has a direct link to reduced production of greenhouse gasses, related to climate change. This shift also helps in increasing space for commerce and public use, and contributes to a better quality of life and economic growth (Global Street Design Guide, 2016:14).

The *Global Street Design Guide* (2016:14) furthermore states that the multimodal street has "positive economic effects, such as higher retail sales" because "... people who walk or cycle often spend more at local retail businesses than people who come to an area by car." This then provides the necessary justification to incorporate multimodal street designs with the streets bordering the site, opposing the current car-oriented situation.

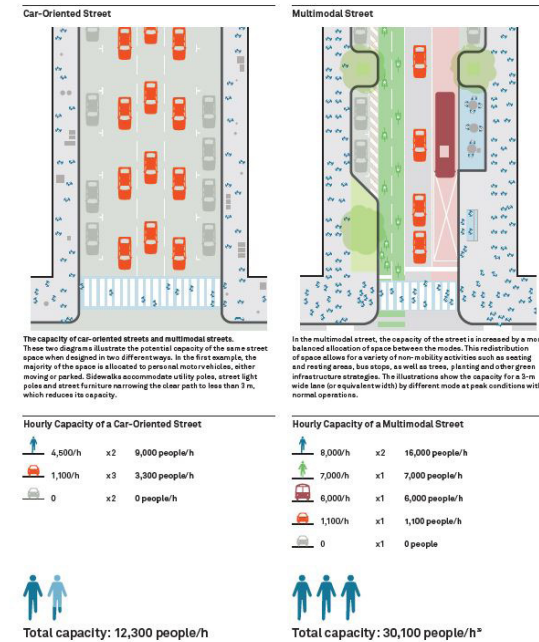


Figure 16 _ Comparison of the capacity of a multimodal street with that of a car-oriented street (*Global Street Design Guide*, 2016:15)



Figure 17 _ The current car-oriented condition of Madiba Street (Author, 2022)

2.4_Site analysis

Since the site falls within the TOD (Transit Oriented Development) of the city, it is well serviced by public transit. Two bus routes run along the east and west borders of the block (Bosman and Schubart Streets) and the site is close to the Tshwane BRT (A RE Yeng) system. Furthermore, two bus stops are also located on the east and west sides of the block, as can be seen in figure 18. Therefore a strong motivation exists for opening the site to pedestrians and allowing them to move freely between these bus stops, and also for providing public spaces along the routes.

The dense development of the site, and the tall Telkom Towers on the adjacent block, necessitated a shadow study to determine sun access to the site. This shadow study was conducted by modelling the various buildings and their associated heights and sun angles in 3D at different times during the winter and summer solstices.

As evidenced through the shadow study (figures 19 and -20), little impact from the adjacent buildings, especially the Telkom Towers, is indicated during the summer months. During the winter months the site is almost completely enveloped by shadow during large parts of the day with some impact from the Telkom Towers. In considering that the city does experience low temperatures during the winter months, adequate solar access – especially in public areas – is required. This would entail some sensitive demolition to provide the necessary solar access, along with solar-conscious design for optimal daylighting of the interior spaces.

To avoid being insensitive to the adaptation of the Wierda building and proposing ill-considered, large-scale demolition of the other buildings on the GPW precinct, a historical lens needs to be applied. This will assist in determining the cultural significance of the block and its associated buildings.



Figure 18 _ Mapping of bus routes and stops around the site (Author, 2022)

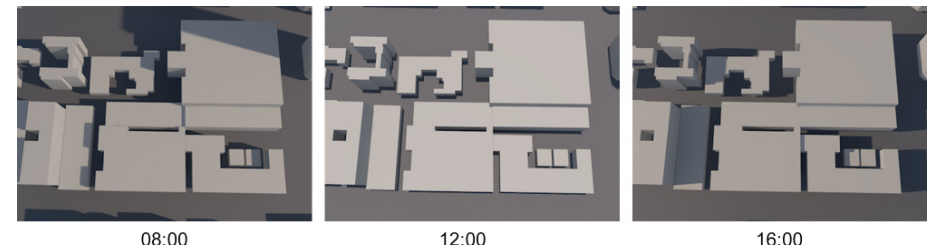


Figure 19 _ Summer solstice shadow study – 21 December (Author, 2022)

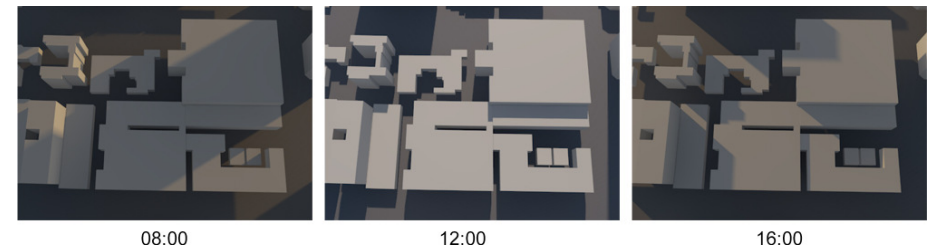


Figure 20 _ Winter solstice shadow study – 21 June (Author, 2022)

2.5_Site history

As mentioned previously, the GPW precinct has been the site of continuous development since ca. 1896. The Wierda building, however, was not the first to be constructed on the site. Alois H Nellmapius (1847–1893), a wealthy farmer, financier and supporter of President Paul Kruger (1825–1904) started a printing works in ca. 1889 on the same site as the Wierda building (Swanepoel, 2010). It would produce the Dutch *De Pers* and the English *The Press* (Picton, 1969:89). This printing works would play an enormous role in the history of Pretoria. Leo Weinthal (1865–1930), who in 1898 started the *Pretoria News*, and writer Eugene Marais (1871–1936) were the editors of the two papers. The papers also employed the artists William Schröder (1851–1892) and later Anton Van Wouw (1862–1945) as cartoonists (Swanepoel, 2013; Picton, 1969:90). It is however not clear as to whether the Nellmapius printing works that printed *De Pers* were demolished to make way for the Wierda building; sources only indicate that both were located on the same site. The papers did move to a new building in Church Street in 1894/95 (Swanepoel, 2013), making it highly probable that the old buildings were demolished to make room for Wierda's building

According to a map included in the book *Young Pretoria 1889-1913* by Lola Dunston, the Excelsior School was also located on the site of the GPW. Furthermore, the surroundings of the site have a rich history of educational programmes. The location of the current Telkom Towers in Bosman Street (on the corner of Johannes Ramokhoase Street) was home to the *Staatsgymnasium*, another Wierda building (Barker, 2014:138). Mention is also made of a girl's school, run by a Mrs Van Pommeren in the 1880s on the location of the current *Goewermentsgebou* (south-eastern corner of Bosman and Madiba Streets). Across from the precinct is the Eendracht School (on Johannes Ramokhoase Street) which was built after the Second Anglo-Boer War.



Figure 21 _ The De Pers / The Press offices ca. 1889 (Swanepoel, 2013)



Figure 22 _ The demolished Staatsgymnasium ca. 1899 (Barker, 2014:138)

2.6_Statement of significance

As noted earlier, the GPW precinct was continuously developed from ca.1896 to ca.1955. In 2016/17 the GPW was relocated to a new site in Visagie Street. The activities on the old GPW precinct are being reduced and the site will be completely vacated in the near future. The Wierda building has been used for storage for several years and needs to be readapted in order to meet contemporary urban demand and to not fall into complete disrepair.

The old GPW precinct has historically been the site of technological advancements in both architecture and printing. Architecturally, innovative systems such as the cast-iron column system in the Wierda building, reinforced concrete post-and-lintel construction in the admin block, and the saw-tooth roof of the finishing plant, were early examples of these technologies. With regard to printing, advancements in printing processes and new methods and machines led to an industrial revolution in the printing world in the ZAR. Craftspeople were relegated to unemployment lines as machines took over jobs that previously required highly skilled technicians (Picton, 1969:110-120).

The National Heritage Resources Act 25 of 1999 (NHRA) safeguards any structure 60 years or older from demolition, whether partial or complete. The majority of the buildings on the GPW precinct fall within the ambit of this legislation, and therefore it is necessary to determine the cultural significance of these buildings to motivate any demolition, whether complete or partial.

In the book, *Architectural Conservation*, Aylin Orbaşlı (2008) argues for a values-based approach to determine the cultural significance of a built artefact. These values were used to develop a matrix for the assessment of each building on the site. Orbaşlı's approach was favoured above that of the *Burra Charter 2013* (The Australian ICOMOS Charter for Places of Cultural Significance 2013), as it provides a wider range of values that could be incorporated for the creation of the matrix. The intention here is that this matrix will serve as a framework for the design approach. Artefacts with little to no cultural significance could potentially be demolished or massively adapted to serve the programme, whereas artefacts with great cultural significance will be approached in a different way. Orbaşlı's values-based approach also corresponds to the Cultural heritage survey guidelines and assessment tools for protected areas in South Africa (2016) by the South African Department of Environmental Affairs (DEA).

The values and definitions advocated by Orbaşlı (2008) and the DEA (2016) were considered; a series of questions was then formulated, and a binary (0 or 1) score was allocated to the answers. The resultant total of all the questions was then used to position the artefact on a Scale of Cultural Significance.

Values-based Matrix

Age and rarity value: Relates to the age of the building as well as to the number of extant artefacts of this specific style, typology or demonstrated technology. In the context of the NHRA, buildings 60 years and older automatically qualify.

Question: Is the building older than 60 years, or a rare example of a specific style or use of technology?

Architectural value: Relates to the contribution that the artefact makes to a specific style or typology, or whether it is the work of a well-known or -respected architect. Building techniques or materials that could be considered pioneer examples are also included.

Question: Was the building designed by a well-known or -respected architect, or does it display any building technique or material that could be considered an early (pioneer) example of that material or technique?

Artistic value: Relates to any artwork that is integral to the building. Examples include murals, mosaics, or a high quality of demonstrable craftsmanship evident in the building's construction.

Question: Are there any artworks that are integral to the building, or is high-quality craftsmanship evident in the construction of the building?

Associative value: Relates to a connection with a historic event or person.

Question: Does this place have any association with historically important people or events?

Cultural value: Relates to any materials, techniques or craftsmanship that has contributed or continues to contribute to a cultural tradition (vernacular). For the purposes of this matrix, the cultural value is included under *local distinctiveness* due to the widely acknowledged regionalism prevalent in Pretoria.

Economic value: Relates to whether the artefact currently attracts or could possibly in the future attract tourists and the associated economic potential of such tourism.

Question: Does the building, or site, currently attract any tourists, or could it potentially do so in the future?

Educational value: Relates to the knowledge that can be gained from the building, or site, specific to the period in history, social relations, or construction techniques.

Question: Can any pertinent knowledge be gained from the study of the building as it relates to a period in history, social relations, or construction techniques?

Emotional value: Relates to the emotive quality of the artefact, such as attachment or awe.

Question: Is there any emotional attachment to the building, or does it inspire a sense of awe in those that visit it?

Historical value: Relates to any event or period in the past of which the artefact is physical evidence.

Question: Was the building the scene of any historic event, or does it provide physical evidence of a historical period?

Local distinctiveness value: Relates to the vernacular setting of the artefact, and the use of regional (local) materials, building techniques or a regional style.

Question: Does the building contribute to the vernacular of the context, and were local materials, techniques or a regional style used?

Political value: Relates to the association of an artefact to a specific political period (regime or nationality) or political identity.

Question: Does the building reflect a previous political period or political identity?

Public value: Relates to whether the artefact served as a place of public congregation, or whether it was the scene of public rallies, demonstrations or revolutions.

Question: Does the building define a public space or was it ever the scene of a public demonstration such as a rally, demonstration or revolution?

Religious and spiritual value: Relates to whether the artefact has any spiritual or religious value attached to it.

Question: Is, or was the building the site of any religious or spiritual activity?

Scientific, research and knowledge value: Relates to knowledge that can be gained from the study of the building materials, techniques or technologies employed during construction. Due to the connection with *educational value*, it is excluded from this matrix.

Social value: Relates to the connection the artefact has to the local community and whether it contributes to social interchange such as a park, local square etc.

Question: Does the building have any connection to the local community or does it serve as a place for social interchange?

Symbolic value: Relates to the potential of the artefact to serve as a monument, whether it commemorates a specific historic event, or if any social group attaches symbolic value to it.

Question: Does the building commemorate a specific historic event or does a social group attach any special meaning to it as a memorial or monument?

Technical value: Relates to the demonstration of specific technological systems that are present in the artefact and whether these contributed to the advancement of building techniques during the period of construction. Also refers to the presence of any environmental systems incorporated in the design.

Question: Was any innovative technological system (for the period) employed in the construction of the building, or was any innovative environmental system employed in its design?

Townscape value: Relates to the contribution of the artefact to the immediate context, and to whether it defines the street, city or town.

Question: Does the building help define the street edge, the urban fabric, or a square?



Figure 23 _ Aerial view of the GPW precinct (Author, 2022)

2.6.1_Nieuwe Staatsdrukkerij (Wierda building) 1896

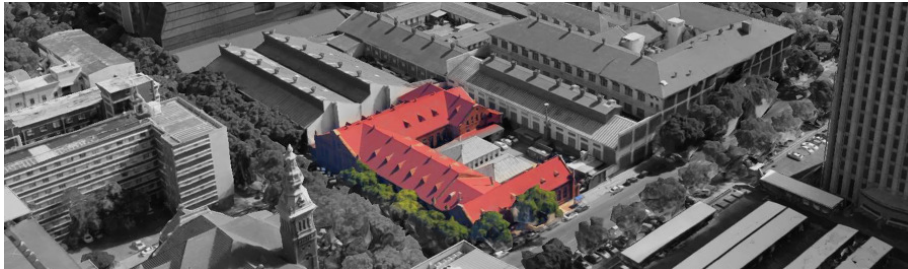


Figure 24 _ Aerial view of the Nieuwe Staatsdrukkerij (Author, 2022)

Table 1 _ Values-based matrix of the Wierda building (Author, 2022)

Values	Answer	Additional comment
Age & rarity value	1	The building is older than 60 years and is an example of the Dutch Revival Style within Pretoria. Not many of these buildings are still in existence and some are under threat.
Architectural value	1	The building is a prime example of the Dutch Revival Style with newly adopted (for the time) construction in clay brick. The building was also designed by a respected architect who played an important role in the regional aesthetic of Pretoria. Innovative technologies and examples of construction craft are on display.
Artistic value	1	Demonstrable craftsmanship in the construction of the building.
Associative value	1	The site is associated with important people such as Sytze Wierda, Leo Weinthal, William Schröder, Anton van Wouw and Alois Nellmapius.
Economic value	1	The site could potentially attract tourists depending on the success of the development.
Historical value	0	The artefact was never the scene of any profound historical events.
Local distinctiveness value	1	The building has played a role in the establishment of a regional aesthetic in Pretoria. Local materials and techniques were employed in construction.
Political value	1	Built in a Dutch Revivalist Style the building has a specific political value that demonstrates the connection that existed between the Netherlands and the ZAR.
Public value	0	No evidence of public rallies or events linked to the site could be found.
Religious & spiritual value	0	No spiritual or religious activity was found to have taken place on site.
Social value	0	Apart from the historical connection to the community, no community interaction currently takes place on the site; however potential for community connection and interaction exists.
Symbolic value	0	This building commemorates the historic Boer regime (ZAR) of Pretoria, but no memorial or monumental attachment exists.
Technical value	1	The building demonstrates technological advances in its construction. An innovative, probably imported cast-iron-column-and-bracket system supports the roof, freeing up the interior. The local brick technology only became established in 1888, eight years prior to construction.
Townscape value	1	The building currently defines street edges, but could contribute more.



Figure 25 _ Position of the Wierda building on the cultural significance scale (Author, 2022)

The Nieuwe Staatsdrukkerij, according to the set parameters, could thus be defined as a culturally significant building, therefore, insensitive adaptations or alterations should be avoided. The following diagrams define which specific components of the building should be preserved. As far as possible, the gables should be preserved, as well as the eastern facade as these are areas of concentrated detail design. Furthermore, some of the innovative technology should also be preserved where possible.

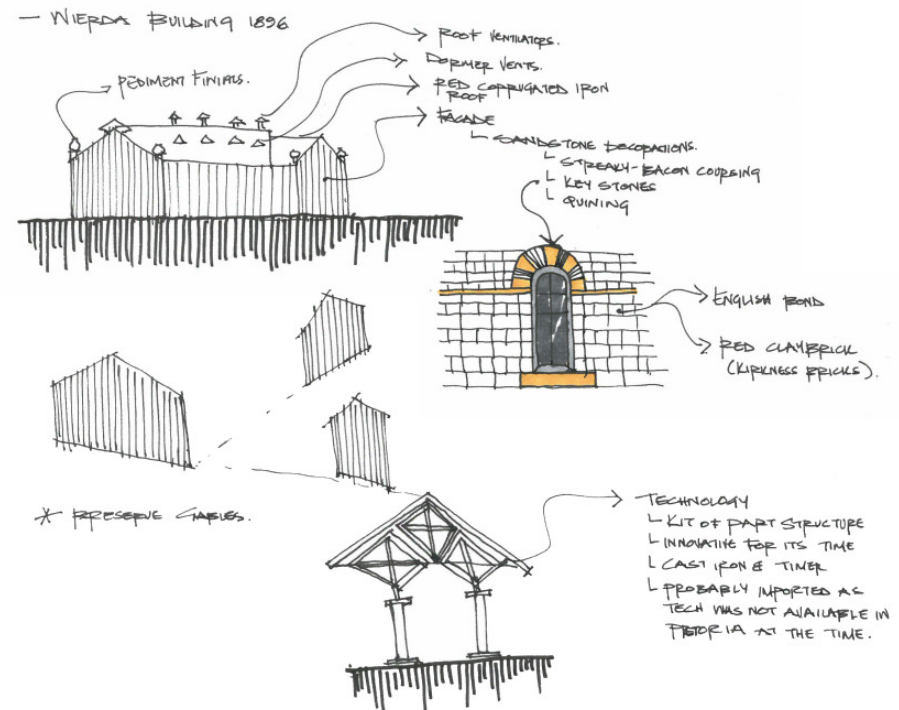


Figure 26 _ A collage of diagrams of the specific significant components of the Wierda building (Author, 2022)

2.6.2 Administration block (1927)

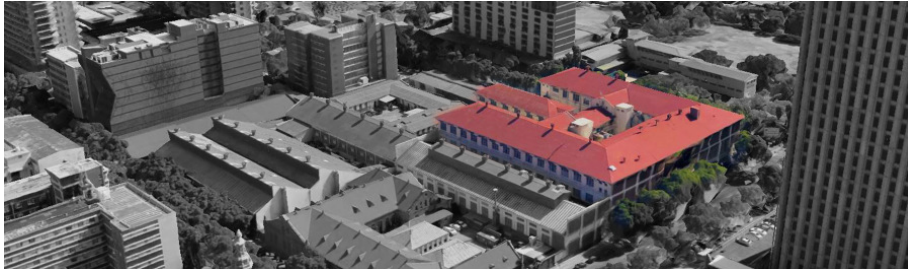


Figure 27 _ Aerial view of the administration block (Author, 2022)

Table 2 _ Values-based matrix of the administration block (Author, 2022)

Values	Answer	Additional comment
Age & rarity value	1	The building is older than 60 years and is an early example of reinforced concrete post-and-lintel construction. This type of building is not rare within Pretoria.
Architectural value	0	The building is an example of early reinforced concrete construction. No information as to the architect or building had been found at the time of writing. Architectural value is considered low.
Artistic value	0	No artwork integral to the building, nor construction craft evident in this building.
Associative value	0	No associative value was found in relation to this part of the GPW precinct.
Economic value	0	No tourism potential; however, great potential for adaptive reuse exists.
Historical value	0	The artefact was never the scene of any profound historical events.
Local distinctiveness value	0	Although the building is constructed using brick infill with a reinforced concrete frame, the local distinctiveness value is negligible.
Political value	0	Although the building was constructed during colonial British rule, it has no political value as it does not demonstrate any English building style.
Public value	0	No evidence of specific public rallies or events linked to the site could be found.
Religious & spiritual value	0	No spiritual or religious activity was found to have taken place on site.
Social value	0	No community or social value were found to exist with this building.
Symbolic value	0	No memorial or manumental attachment exists.
Technical value	1	The building demonstrates technological advancement in its construction. It is an early example of reinforced concrete column and slab construction which during the time was a relatively new technology, popularised by architects such as Le Corbusier.
Townscape value	1	The building currently defines the street edges and the corner of the site.



Figure 28 _ Position of the administration block on the cultural significance scale (Author, 2022)

— ADMINISTRATION BUILDING 1927.

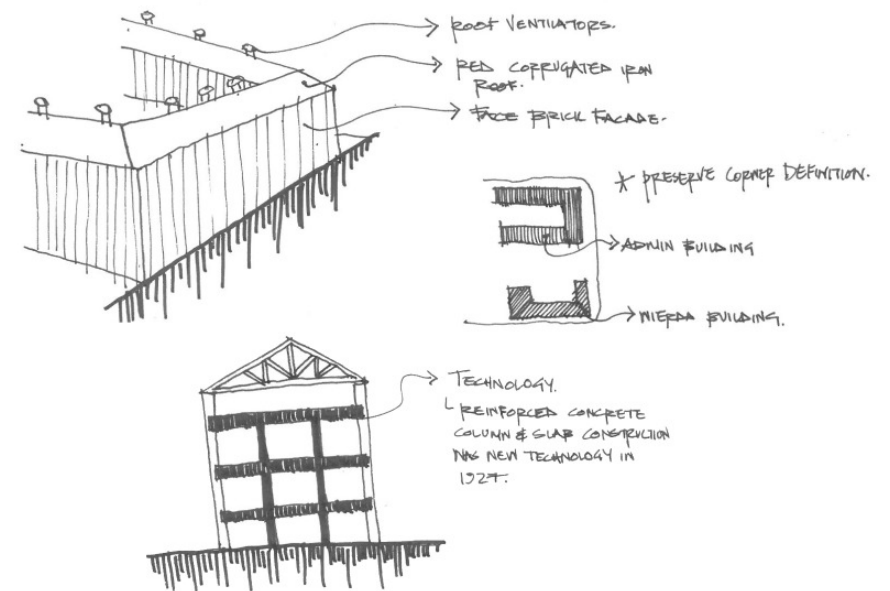


Figure 29 _ A collage of diagrams of the specific significant components of the administration block (Author, 2022)

2.6.3 Letter-press building (1937)

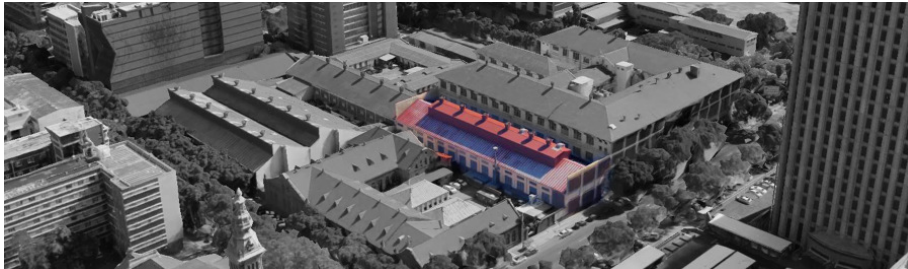


Figure 30 _ Aerial view of the letter-press building (Author, 2022)

Table 3 _ Values-based matrix of the letter press building (Author, 2022)

Values	Answer	Additional comment
Age & rarity value	1	The building is older than 60 years and is an early example of reinforced concrete post-and-lintel construction. This type of building is not rare within Pretoria. The intricate roof however is a unique example.
Architectural value	0	The building is an example of early reinforced concrete construction. No information as to the architect or building had been found at the time of writing. Architectural value is considered low.
Artistic value	0	No artwork integral to the building, nor construction craft evident in this building.
Associative value	0	No associative value was found in relation to this part of the GPW precinct.
Economic value	0	No tourism potential; however, great potential for adaptive reuse exists.
Historical value	0	The artefact was never the scene of any profound historical events.
Local distinctiveness value	0	Although the building is constructed using brick infill with a reinforced concrete frame, the local distinctiveness value is negligible.
Political value	0	Although the building was constructed during British colonial rule, it has no political value as it does not demonstrate any English building style.
Public value	0	No evidence of specific public rallies or events linked to the site could be found.
Religious & spiritual value	0	No spiritual or religious activity was found to have taken place on site.
Social value	0	No community or social value were found to exist with this building.
Symbolic value	0	No memorial or manumental attachment exists.
Technical value	1	The intricate roofscape of this building contributes to its technical value as it is rarely seen anywhere else.
Townscape value	0	The building has little to no townscape value.



Figure 31 _ Position of the letter-press building on the cultural significance scale (Author, 2022)

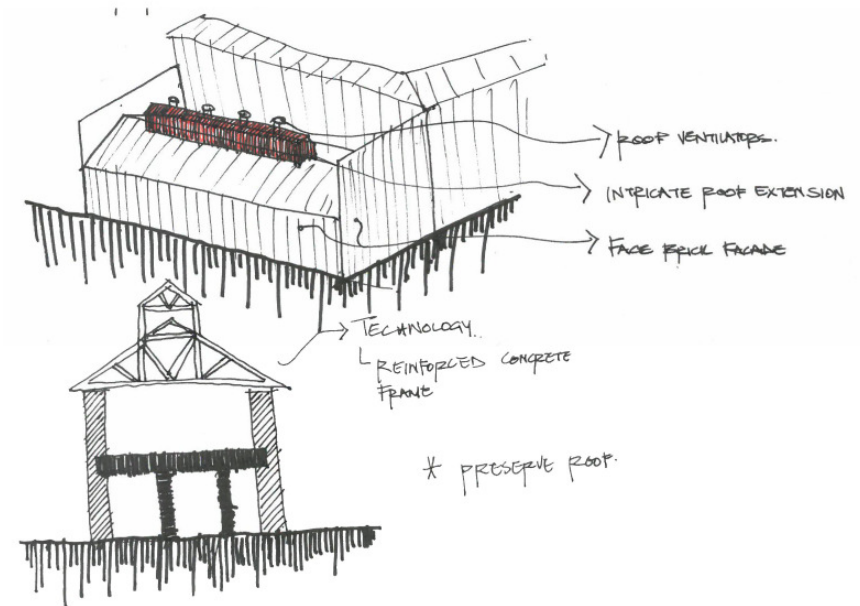


Figure 32 _ A collage of diagrams of the specific significant components of the letter-press building (Author, 2022)

2.6.4_Lithography building (1942)



Figure 33 _ Aerial view of the lithography building (Author, 2022)

Table 4 _ Values-based matrix of the lithography building (Author, 2022)

Values	Answer	Additional comment
Age & rarity value	1	The building is older than 60 years and is an early example of reinforced concrete post-and-lintel construction. This type of building is not rare within Pretoria.
Architectural value	0	No information as to the architect or building had been found at the time of writing. Architectural value is considered low.
Artistic value	0	No artwork integral to the building, nor construction craft evident in this building.
Associative value	0	No associative value was found in relation to this part of the GPW precinct.
Economic value	0	No tourism potential; however, great potential for adaptive reuse exists.
Historical value	0	The artefact was never the scene of any profound historical events.
Local distinctiveness value	0	Although the building is constructed using brick infill with a reinforced concrete frame, the local distinctiveness value is negligible.
Political value	0	Although the building was constructed during colonial British rule, it has no political value it does not demonstrate any English building style.
Public value	0	No evidence of specific public rallies or events linked to the site could be found.
Religious & spiritual value	0	No spiritual or religious activity was found to have taken place on site.
Social value	0	No community or social value were found to exist with this building.
Symbolic value	0	No memorial or manumental attachment exists.
Technical value	0	No technical value was found to exist in this building.
Townscape value	0	The building has little to no townscape value.



Figure 34 _ Position of the lithography building on the cultural significance scale (Author, 2022)

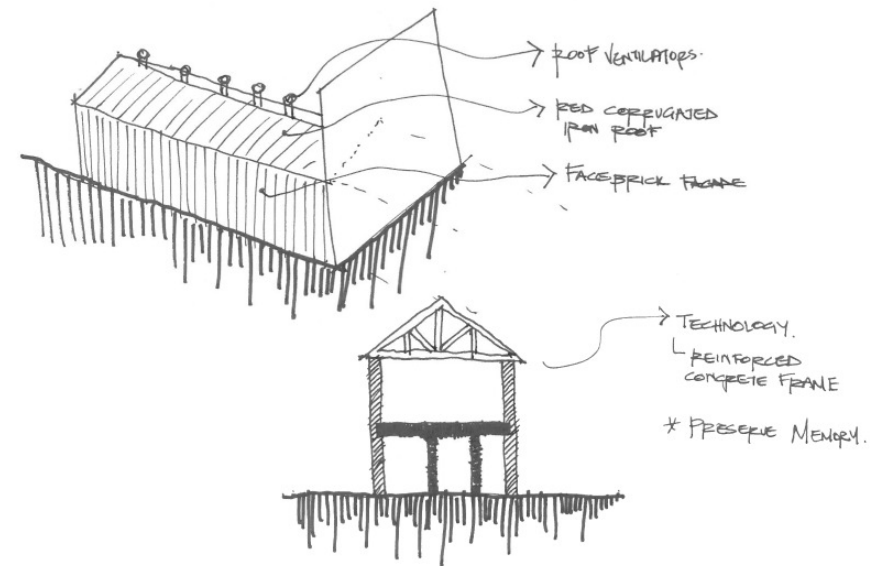


Figure 35 _ A collage of diagrams of the specific significant components of the lithography building (Author, 2022)

2.6.5_Finishing plant (1955)

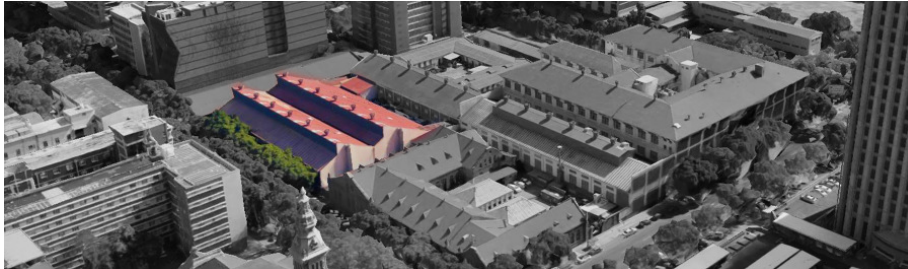


Figure 36 _ Aerial view of the finishing plant (Author, 2022)

Table 5 _ Values-based matrix of the finishing plant (Author, 2022)

Values	Answer	Additional comment
Age & rarity value	1	The building is older than 60 years and is an early example of reinforced concrete post-and-lintel construction. The roof is an early example of saw-tooth roof construction.
Architectural value	0	No information as to the architect or building had been found at the time of writing. Architectural value is considered low.
Artistic value	0	No artwork integral to the building, nor construction craft evident in this building.
Associative value	0	No associative value was found in relation to this part of the GPW precinct.
Economic value	0	No tourism potential; however, great potential for adaptive reuse exists.
Historical value	0	The artefact was never the scene of any profound historical events.
Local distinctiveness value	0	Although the building is constructed using brick infill with a reinforced concrete frame, the local distinctiveness value is negligible.
Political value	0	The building was constructed during the self-rule of South Africa that started in 1948. This building does not form part of the political styles that would later be adopted by the Apartheid Government.
Public value	0	No evidence of specific public rallies or events linked to the site could be found.
Religious & spiritual value	0	No spiritual or religious activity was found to have taken place on site.
Social value	0	No community or social value were found to exist with this building.
Symbolic value	0	No memorial or manumental attachment exists.
Technical value	1	The building is an early example of the large-scale warehouse structures that would become commonplace in industrial areas. The roof is also an early example of saw-tooth roof construction that became part of the industrial heritage of Pretoria. Furthermore, a spaceframe system is used, freeing up the interior space. This was also a relatively new technology at the time.
Townscape value	1	The building defines the street edge; however, the building is un-urbane and not pedestrian friendly.



Figure 37 _ Position of the finishing plant on the cultural significance scale (Author, 2022)

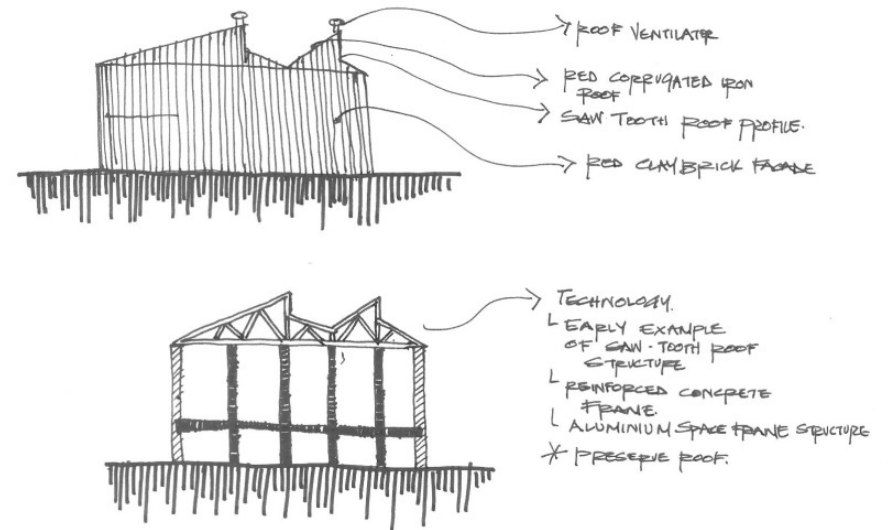


Figure 38 _ A collage of diagrams of the specific significant components of the finishing plant (Author, 2022)

2.6.6_Conclusion

From the above tables, scales and diagrams it becomes clear that the only building on the site that has any real cultural significance is the Wierda building, thus, a specific heritage approach will have to be adopted to adapt or alter this building. For the sake of sustainability, large-scale demolition of the other structures should not take place, as these buildings could easily be adapted and altered to serve new programmes and, by so doing, limit the environmental- and resource impact that new construction would have. Where demolition is proposed, as many materials as possible should be recycled in new structures.

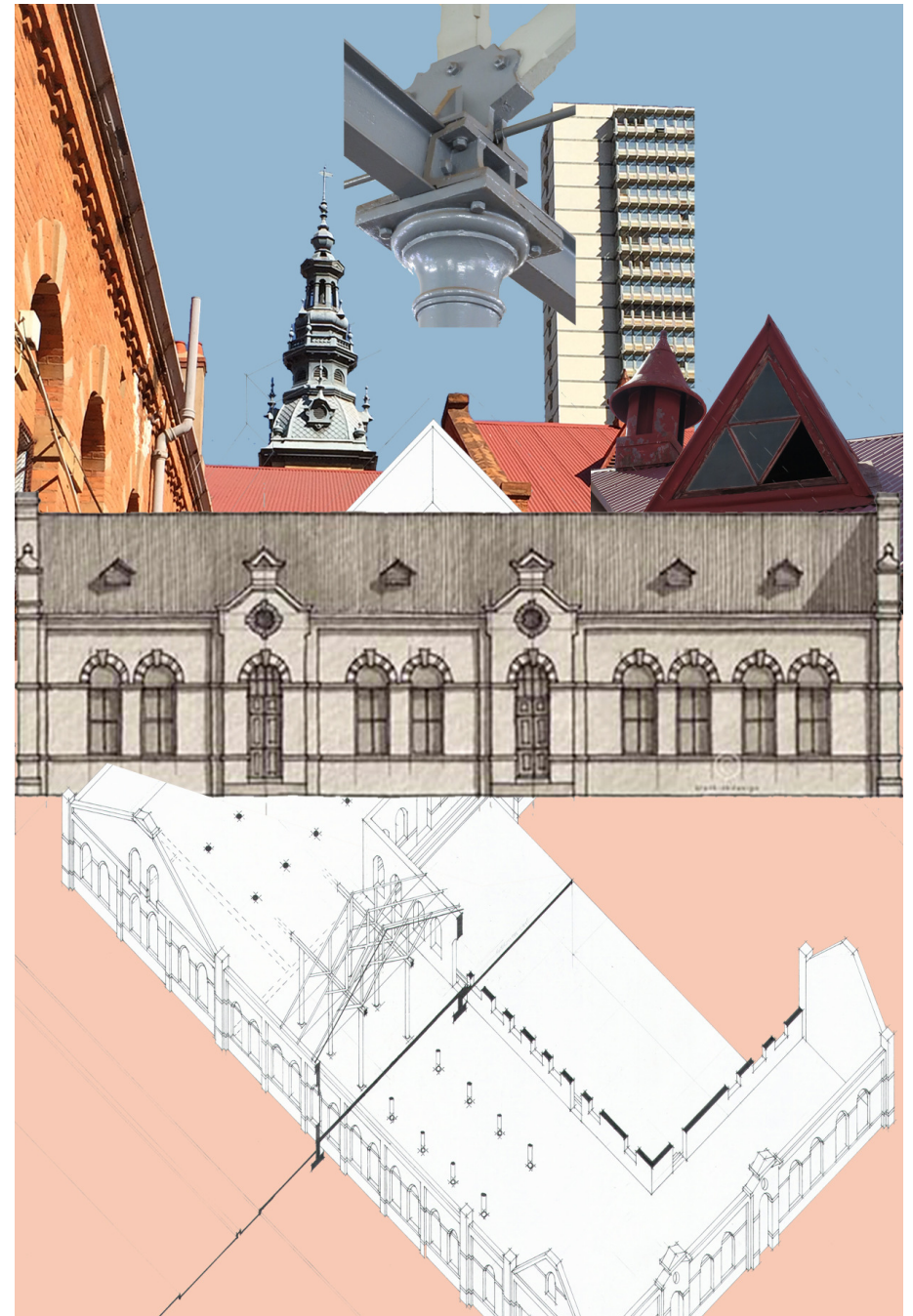


Figure 39 _ A collage of site images (Author, 2022)

2.7_Heritage approach

In an attempt to deal with the various scales of cultural significance that have been introduced in the previous chapter, a heritage approach needs to be developed for the proposed project. The intention is that this approach will guide the various urban and architectural interventions on the site.

Extensive reading of Barker's (2020) article, "Limiting binary thinking: Architectural design in historic urban contexts", influenced the development of approaches deemed appropriate with respect to the envisioned interventions.

Barker (2020) argues for heritage approaches that would break free from the binaries of copy and contrast, and further argues that these initial and entrenched binaries were the result of the restoration (conservation) and anti-restoration (preservation) philosophies of Violet Le Duc (conservation), and John Ruskin and William Morris (preservation) (Barker, 2020:121).

The various approaches presented by Barker (2020:132-142) require one to have or adopt a specific attitude to dealing with heritage practice, whether this attitude is positioned toward preservation or conservation. Barker (2020:132) introduces a non-dialectic scale that highlights different attitudes to heritage. The attitude guiding the proposed interventions will be situated towards the conservation end of the scale.

By positioning one's attitude at the conservation end of the scale, the following approaches offered by Barker (2020:132-142) become appropriate: "derive prototype", "transform", and "defamiliarise". These approaches favour contrast as opposed to copy.

The highlighted approaches are considered appropriate in the context of the site and the position taken in this dissertation.

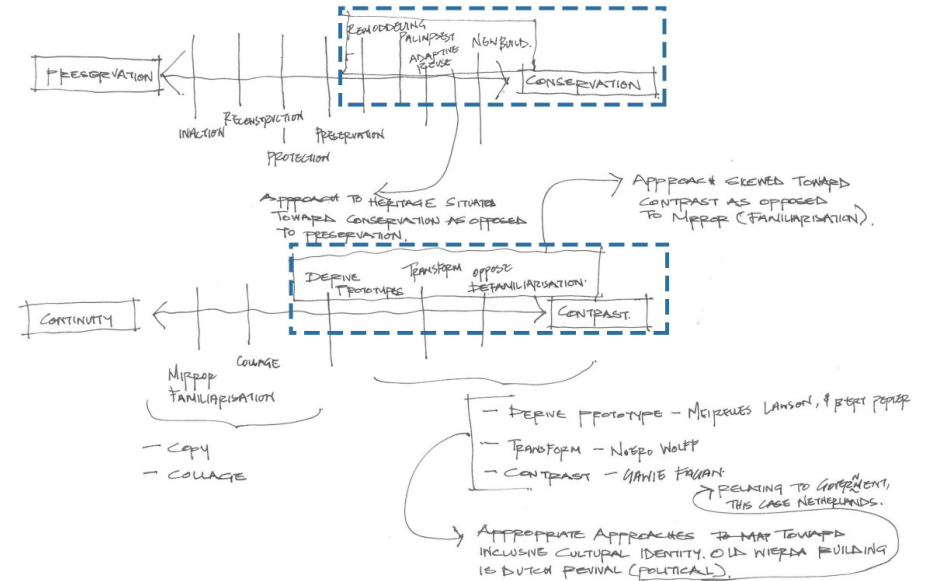


Figure 41 _ Diagrams of non-dialectic approaches (Author, 2022, adapted from Barker, 2020:134)

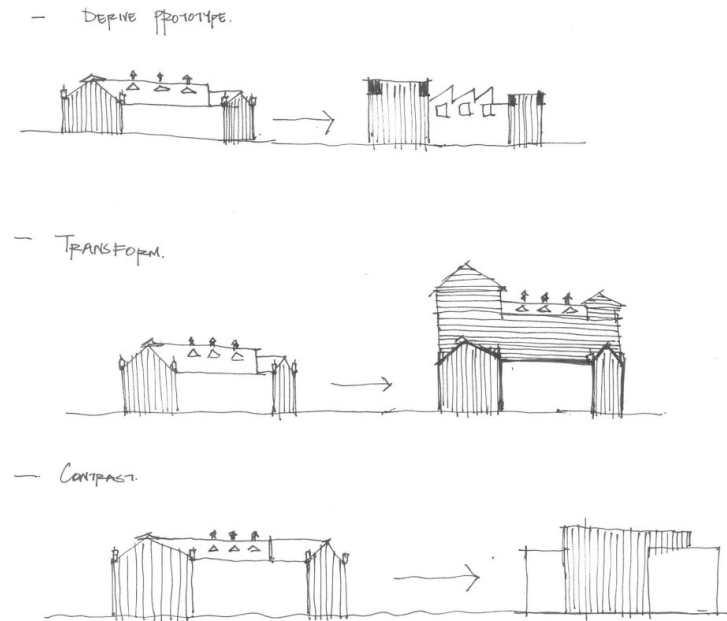


Figure 42 _ Diagrams of the application of different non-dialectic approaches (Author, 2022)

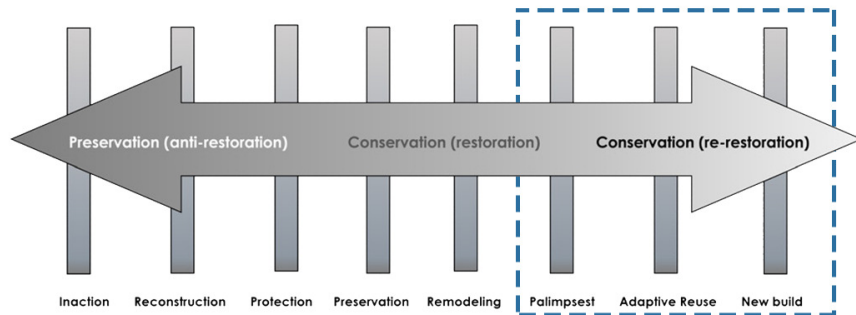


Figure 40 _ A scale of non-dialectic attitudes. (Author, 2022, adapted from Barker, 2020:132)

2.8_Urban intentions

The development of a block framework that would tie into the urban masterplan as proposed by Co-ARC in 2014 (Chapter 2.3.1) started in May 2022. Volumetric explorations were done using various maquettes.

The intentions with the early explorations were to open the site up to facilitate pedestrian movement and provide for internal public spaces along these routes.

The first series of explorations led to the realisation of the importance of well-defined public spaces, and this became the inspiration for a scoping on urban design. The specific focus was on the creation of well-defined public spaces of which streets are an important manifestation. This was done in order to facilitate a more informed approach to the urban intervention on the site.

*Have we truly recognised that our cities are places of hope for millions of urban migrants who view the city as the greatest opportunity to exchange with others? That they are places that enable exchange of **information**, friendship, material goods, culture, **knowledge**, insight, **skills**, and also exchange of emotional, psychological and spiritual support?* (Hansen, 2009:238) [Author's emphasis].

The creation of a pedestrian street / arcade through this first set of explorations, became a dominant theme. The site could act as a place of attraction and movement that would activate the retail spaces envisioned in the RSDF (2018).

People come to shared spaces with simple needs: rest, relaxation, recreation and respite from the city and day-to-day routines. Good civic spaces not only address and meet these community needs, but also enable deeper longings, stimulating ideas, gives hope and a sense of possibilities. It is more than just a pretty thing to look at, but also to inspire, create appreciation of what is good among us, broaden the community's capacity to imagine and create a better future (Hansen, 2009:244).

The creation of meaningful public spaces along the envisioned arcades prompted the investigation of public spaces within the inner city of Pretoria. Diagrams were drawn to investigate the movement through and definition of these public spaces to discover the associated meanings. The intention with this exercise is to derive an approach that could be applied to the GPW site to create a well-defined public space imbued with meaning.



Figure 43 _ A series of explorations towards the development of a block framework (Author, 2022)

Church Square is a well-defined public space. The building facades provide edges that contain the space. The green area and the statue at the centre were positioned to act as points of attraction, facilitated by the various access routes; thus Church Square can serve as a place of public assembly.

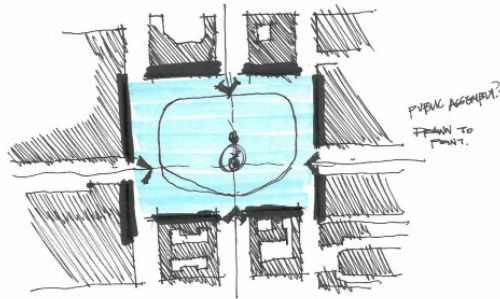


Figure 44 _ Church Square public space diagram (Author, 2022)

012 Central is a private public space. Access is controlled and only given to patrons.

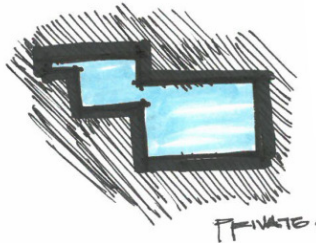


Figure 45 _ 012 Central public space diagram (Author, 2022)

Lillian Ngoyi Square is considered a cultural public space. The buildings frame the space have permeable edges, allowing the public to view the activities taking place inside. Engagement with the buildings is optional.

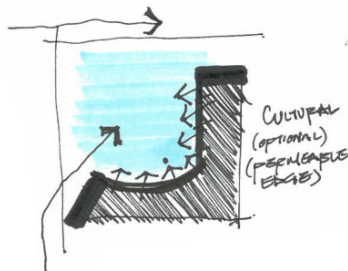


Figure 46 _ Lillian Ngoyi Square public space diagram (Author, 2022)

The public space in front of the State Theatre is defined in a similar way to that of Lillian Ngoyi Square. The permeable edge of the building allows the activities inside to be showcased.

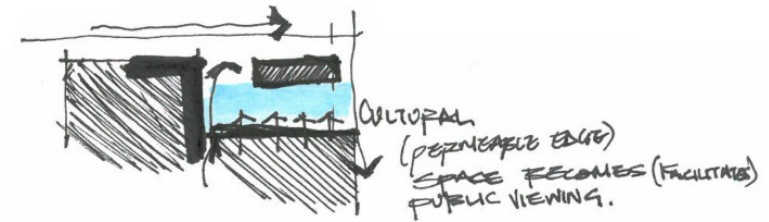


Figure 47 _ State Theatre public space diagram (Author, 2022)

Sammy Marks Square is a place of economic exchange. Routes are provided through the retail spaces to the Square. These retail spaces define the square and allow for through movement of the public to increase economic activity.

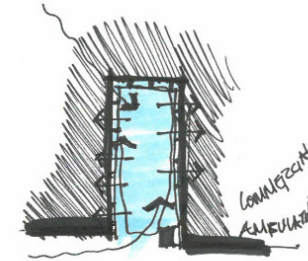


Figure 48 _ Sammy Marks Square public space diagram (Author, 2022)

Pretoria City Hall conveys a feeling of power to the public space in front of the building. The public area here becomes a place for the ruling authority to address the masses. No allowance is made for engagement with the building.

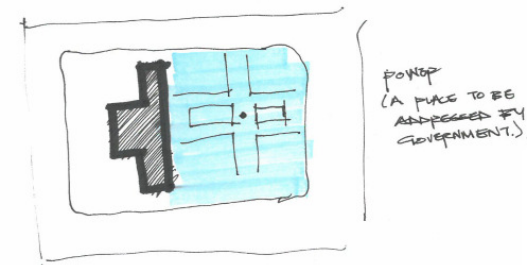


Figure 49 _ Pretoria City Hall public space diagram (Author, 2022)

The examination of these different public spaces in the city led to the creation of a set of diagrams that convey the underlying design intentions of the proposed public space.

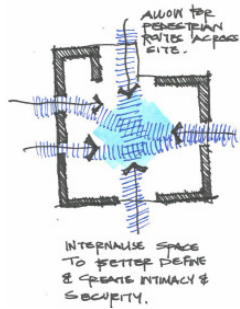


Figure 50 _ A diagram depicting the intention with the envisioned public space (Author, 2022)

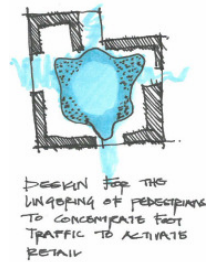


Figure 51 _ A diagram depicting the envisioned concentration of pedestrians on the site (Author, 2022)

By allowing multiple entry points to the site, a place of rest, respite and relaxation can be created along the newly established pedestrian routes. Areas of increased intensity of movement will be situated close to buildings, and these could further activate the economic activity on the site.

The pedestrian streets – that will ultimately shape the internal public space of the site – will have to be designed in a way that will promote the creation of a neighbourhood space. This neighbourhood space could then act as the necessary point of attraction for the retail spaces. In his book *The street: A quintessential social public space*, Mehta (2013) provides the following set of design guidelines:

1. Design and manage the neighborhood commercial street as a gathering space.
 - Provide easy access to the street.
 - Encourage and support seating on the street.
 - Provide shade and shelter.
 - The street must be well lit after dark.
2. Make the street attractive to all users.
 - Design the street for children – inquisitive and creative.
 - Design the street for older adults – gathering and mobility.
 - Consider the less fortunate and needy.
 - Consider community places for all.
3. Preserve and support community gathering places.
 - Encourage and support independent businesses.
4. Strive to achieve a complete and self-sufficient neighborhood commercial street.
 - The street must be a place for a variety of businesses.
 - Provide goods and services in a unique ambience.
5. Make the street a delightful place.
 - Encourage personalization of store fronts.
 - Design buildings with articulated facades at street level.
 - Design buildings with street fronts that are permeable to the street.

To create a pedestrian-friendly environment, the buildings will have to front onto flowing pedestrian routes while also being scaled down so as not to be perceived as intimidating. Following the above exploration, a new series of maquettes were developed with the aim of creating an internal public space at neighbourhood scale.

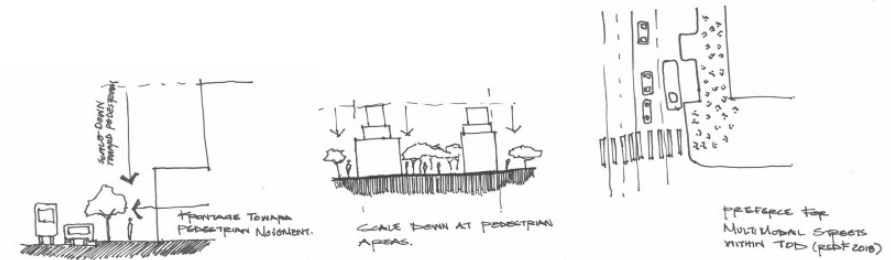
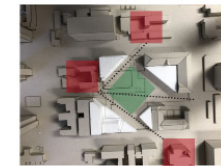
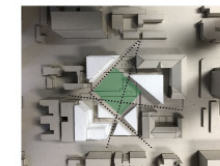


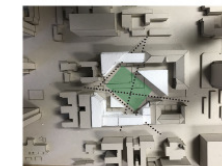
Figure 52 _ A collage of diagrams examining the relation of pedestrians to the buildings and the street (Author, 2022)



linking the church, primary school & Huis Davidtz



increased building front and pedestrian access



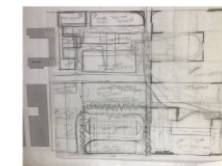
increase density and contain public space



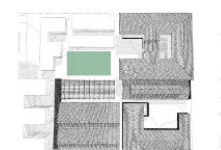
preserving historic buildings



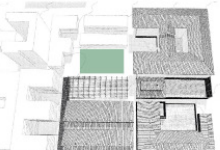
defining separate courtyards of main public space



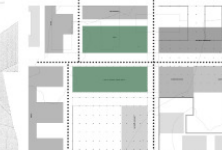
Attempting to keep as much of the historic fabric as possible



iteration



iteration



iteration

Figure 53 _ A series of maquettes and diagrams toward the development of the block framework (Author, 2022)

The conceptual approach to the development of the block framework, was to open the isolated precinct to the broader public. Through creating pedestrian streets, public spaces for rest and respite could be defined. Dividing the large city block into smaller blocks by using pedestrian routes – provides opportunities to create semi-public courtyards to separate different programmes.

2.9_Technological intentions

The focus of this dissertation is primarily a technological enquiry in which brickwork is reconsidered as a contemporary technology. The intention is that technology would serve as the driver of the architecture. To this end, precedents that push the limits of the structural potential of brickwork were investigated to explore the potentialities of this technology and to ultimately inform the making of the architecture.

Precedents

Chi She exhibition centre, Archi-Union Architects, 2010

The conceptual intention of the architects for the Chi She exhibition centre in Shanghai, China (Figure 54) was to represent the artistic function of the building on the exterior. Bricks from the existing building were reused in this renovation. The centre was constructed using an advanced construction robot. Robotic construction in countries with high levels of unemployment, such as South Africa, does raise ethical concerns; however, Yuan and Keke (2020), in their article "Novel bricks: A scenario of human-machine collaboration", argue for a collaboration between the two. This collaboration is also envisioned in the programme for the advanced construction campus proposed by this dissertation.

Silk wall, Wuwei Creative Industry Park, Archi-Union Architects, 2010

In this project in Shanghai, Archi-Union renovated and converted an old silk factory into their own offices using "low-tech" digital fabrication procedures (Yuan, P., Zhang, M. & Han, L. 2013). The texture of a silk cloth was converted into a bitmap image. Distances between the surface and perpendicular plane were then used to inform the parameters for the rotation of the concrete blocks which manifested the expressive facades. Templates were then cut using a computer numerical control (CNC) machine, and these templates were handed to the builders to accurately rotate the blocks to achieve the desired result.



Figure 54 _ Chi She exhibition centre, Archi-Union Architects (Su, 2016)

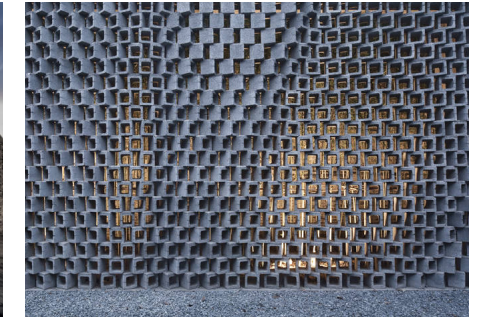


Figure 55 _ Silk wall, Archi-Union Architects (Zhonghai, 2017)

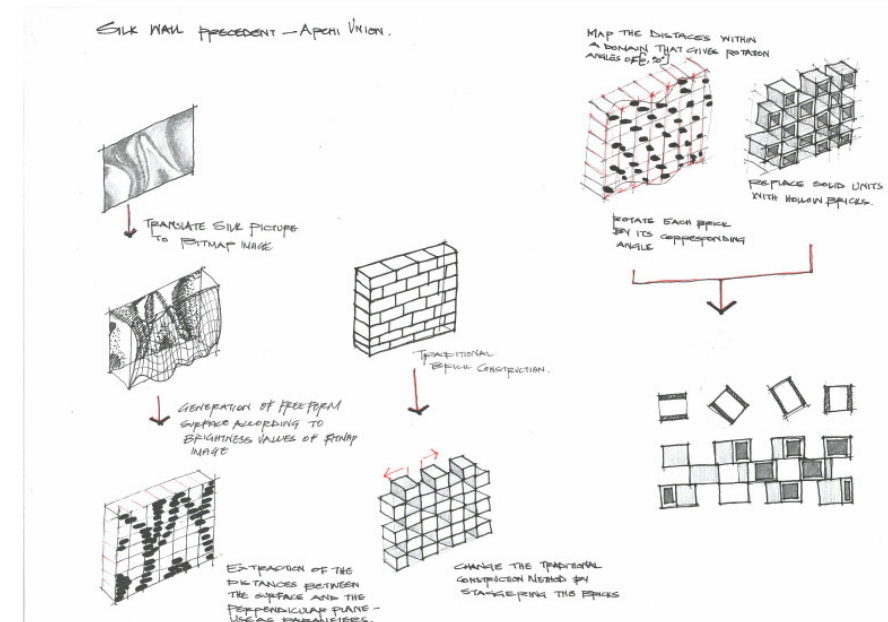


Figure 56 _ Diagrams explaining the digital fabrication procedure of the silk wall (Author, 2022)



Figure 57 _ Teaching builders to use the templates (Yuan, Zhang & Han, 2013:146)

Unhistoric Townhouse, Systemarchitects, 2019

With the design of the “Unhistoric Townhouse”, Systemarchitects sought to reinterpret the fabric of the historic New York City neighbourhood within which this project is situated. Standard bricks were used in the construction. Systemarchitects intended to use advanced construction robots to construct the façade; the elaborate forms, however, were too difficult for the robotic arms to navigate and thus were built by humans. Rigid foam insulation was CNC'd to serve as a guide for the bricklayers.

Church of Cristo Obrero, Eladio Dieste, 1960

Eladio Dieste was a structural engineer turned architect who practiced in Uruguay. Much of the contemporary form explorations in brickwork today are based upon his work and research. By using double curvatures in form, Dieste managed to span large areas using post-tensioned brickwork. The Church of Cristo Obrero in Atlantida is one of the examples of Dieste’s work which demonstrates the potential of brickwork if a double curved surface (also known as a ruled surface) is employed in form-giving.

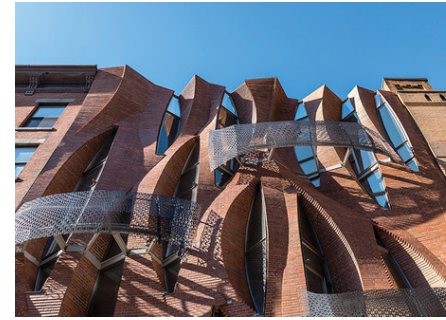


Figure 58 _ Facade of the Unhistoric Townhouse, Systemarchitects (Systemarchitects, n.d.)

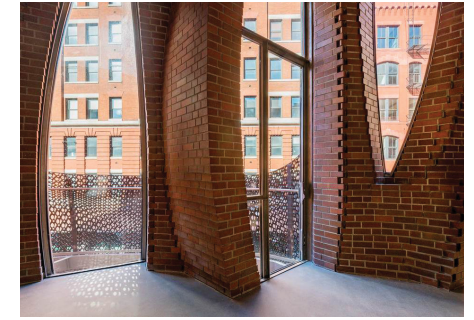


Figure 59 _ Interior of the Unhistoric Townhouse, Systemarchitects (Systemarchitects, n.d.)



Figure 60 _ The church of Cristo Obrero, Atlantida, Uruguay (Palacio, 2012)



Figure 61 _ Interior of the Cristo Obrero church (Oliveira, n.d.)

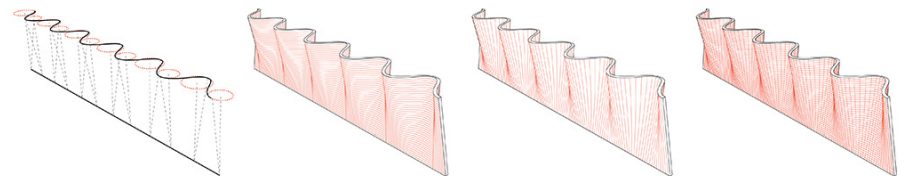


Figure 62 _ Diagrams depicting the generation of ruled surfaces (Palacio, 2012)

2.10_Architectural intentions

The intention with these early iterations was for the GPW campus to function as an interface with the streets and newly created arcades. These streets and arcades could then serve to showcase the activities on the campus to the public at large. Early interventions were developed that would either frame or protrude into the courtyard formed by the Wierda building. The conceptual intention here was to stratify the different programmes on the campus to convey different meanings. The educational facilities of the TVET College were placed on the basement level to communicate the foundational nature of the programme. The ground plane was positioned as the primary means of facilitating public interaction and, as a result, required the workshops to be placed here. The research and development (R&D) facilities were positioned atop the ground plane to communicate the high function of this programme, with the intention to convey the idea that the research needs to find practical application in the Global South.

These intentions were explored using various intuitive maquettes and sketches:

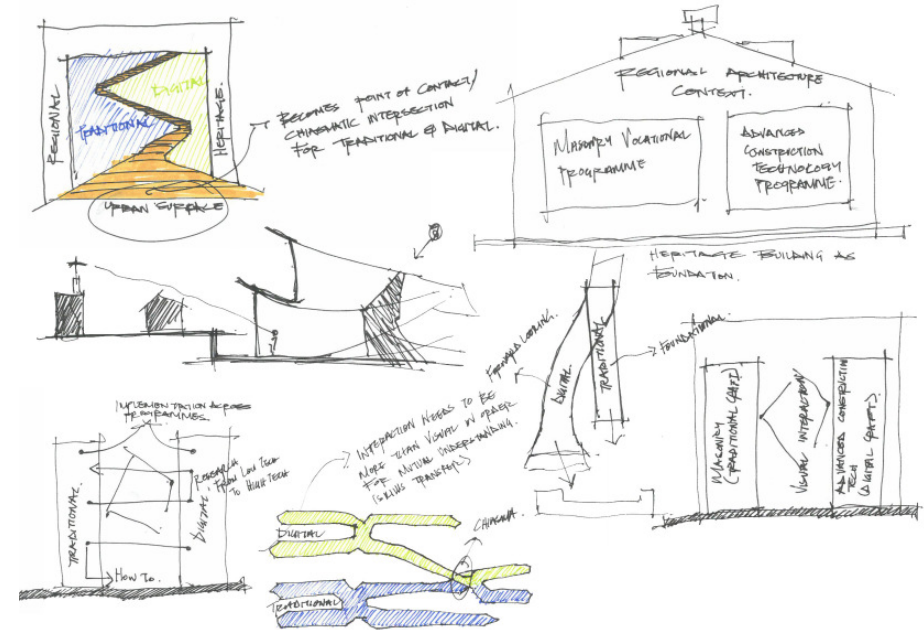


Figure 63 _ A collage of conceptual diagrams linking the different programmes of the project (Author, 2022)



amorphous form penetrating courtyards, framing Wierda building building as urban surface to create new interfaces for admin block linking street to Wierda building, digital wrapped around traditional



building as urban surface, seeking link to larger public space building as urban surface, framing Wierda building, separation from public linking courtyards over surface building

Figure 64 _ A series of conceptual maquettes exploring the intervention's relation to the public space (Author, 2022)

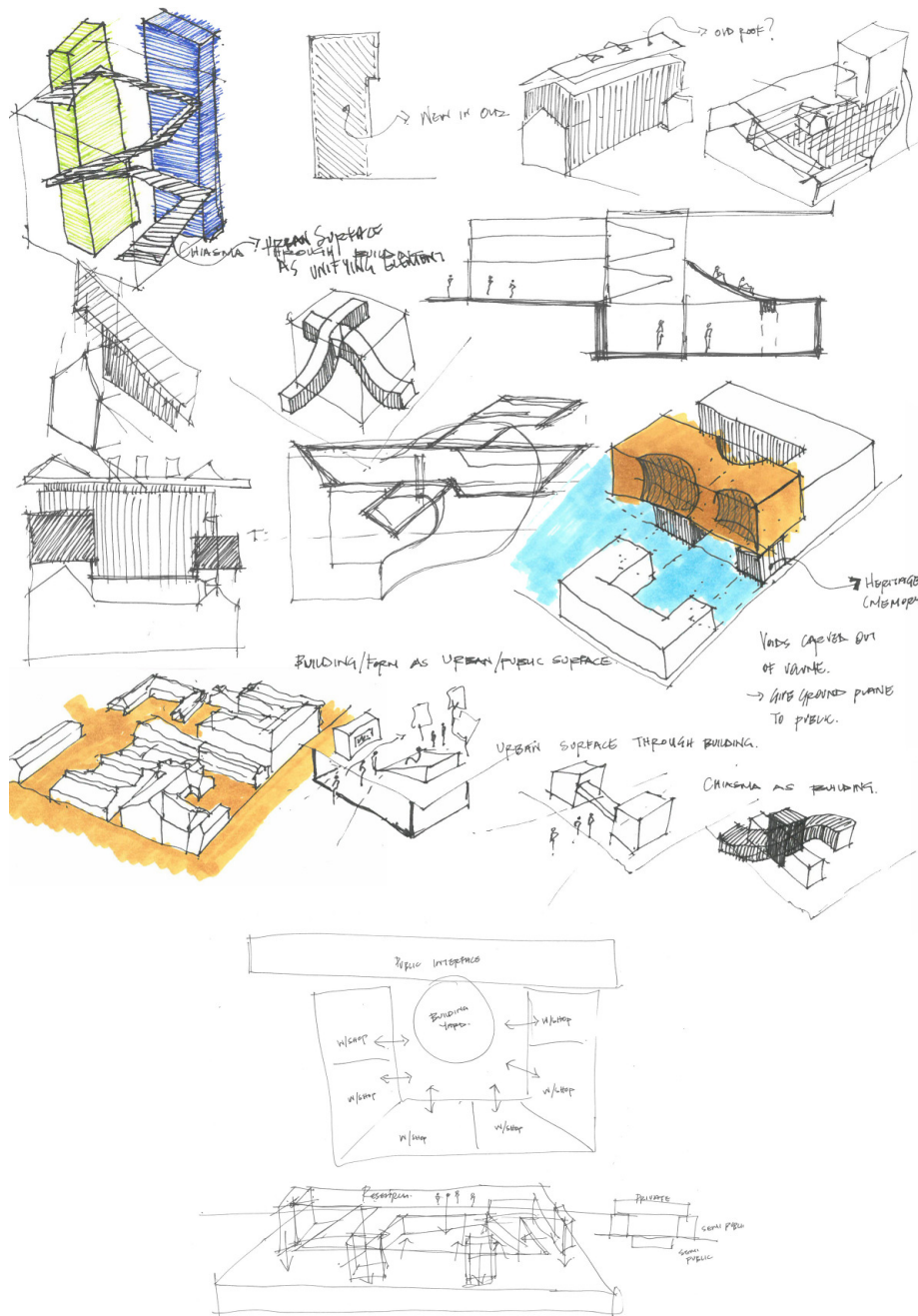


Figure 65 _ A collage of conceptual diagrams (Author, 2022)

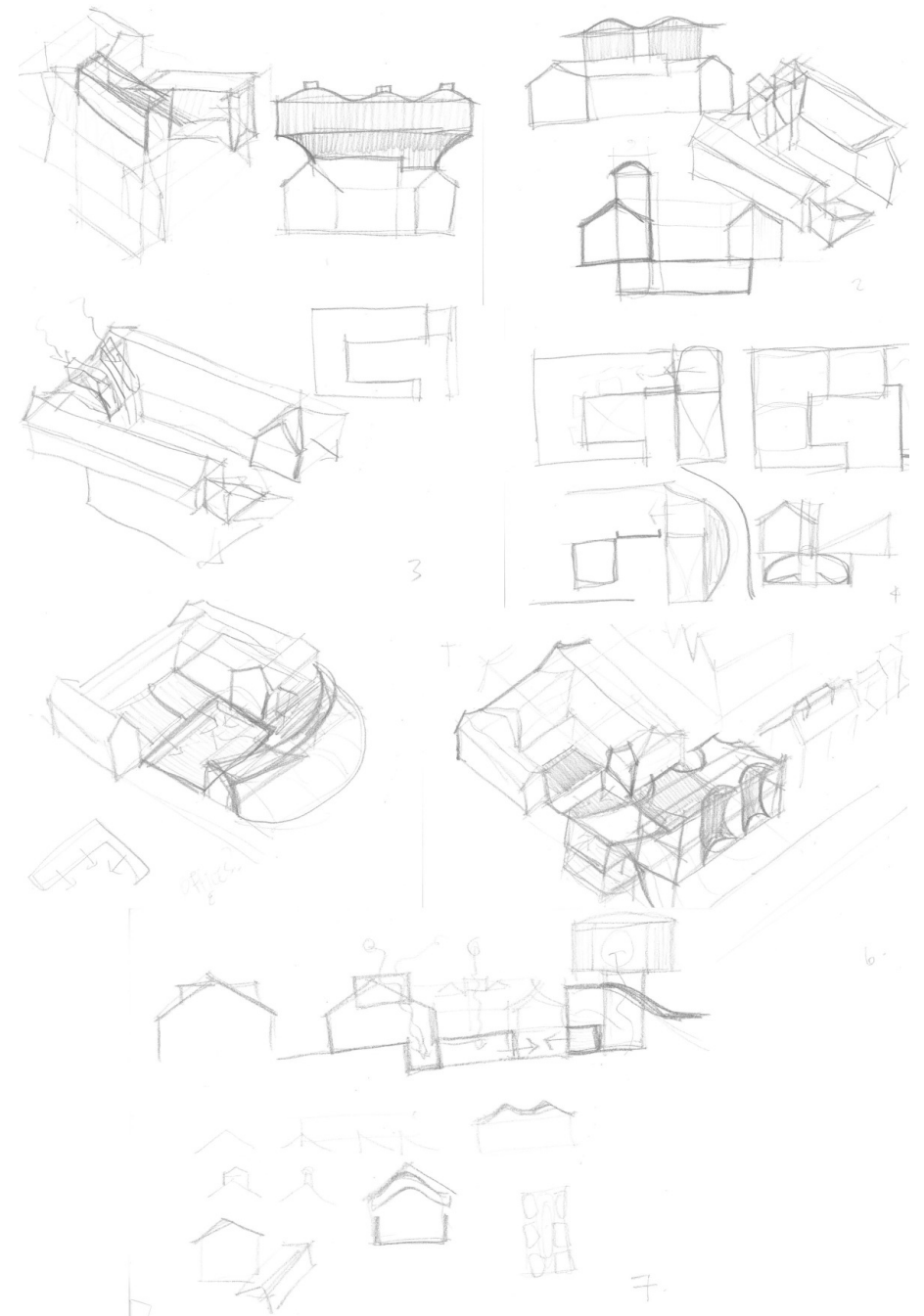


Figure 66 _ A collage of design sketches (Author, 2022)

The various diagrams, maquettes and sketches led to the development of initial sketch plans for the design of the campus. This initial design was digitally modelled, and early renders were developed to convey the spatial intentions.



Figure 67 _ Basement plan – June (Author, 2022)

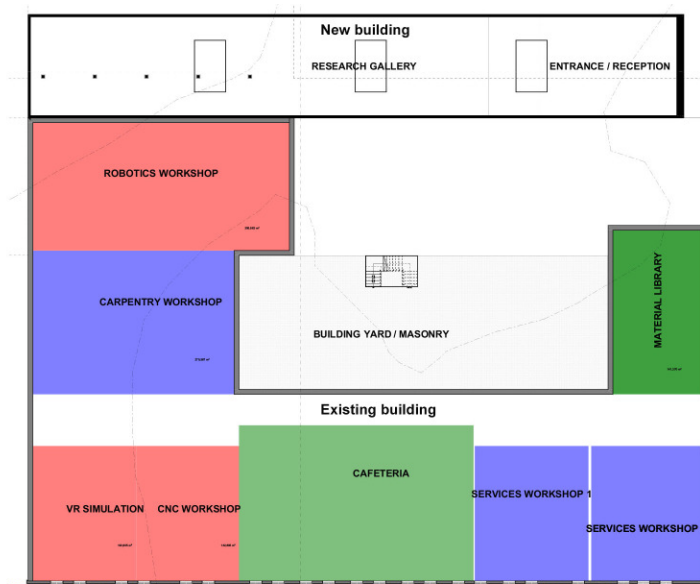


Figure 68 _ Ground floor plan – June (Author, 2022)

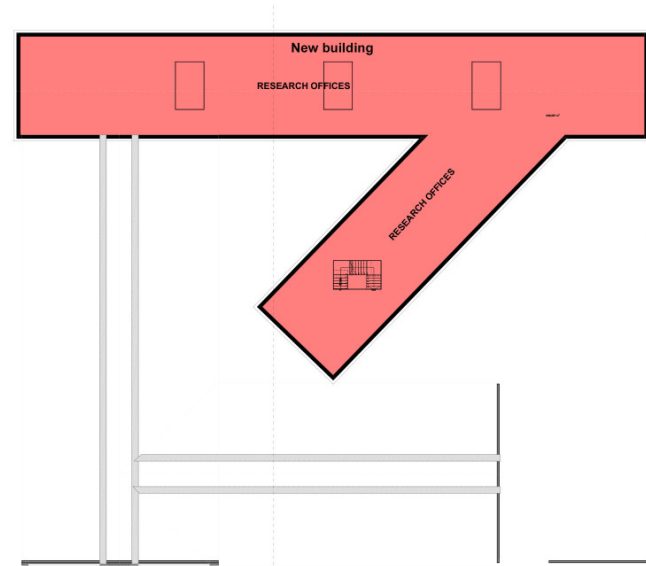


Figure 69 _ Third and fourth floor plans – June (Author, 2022)

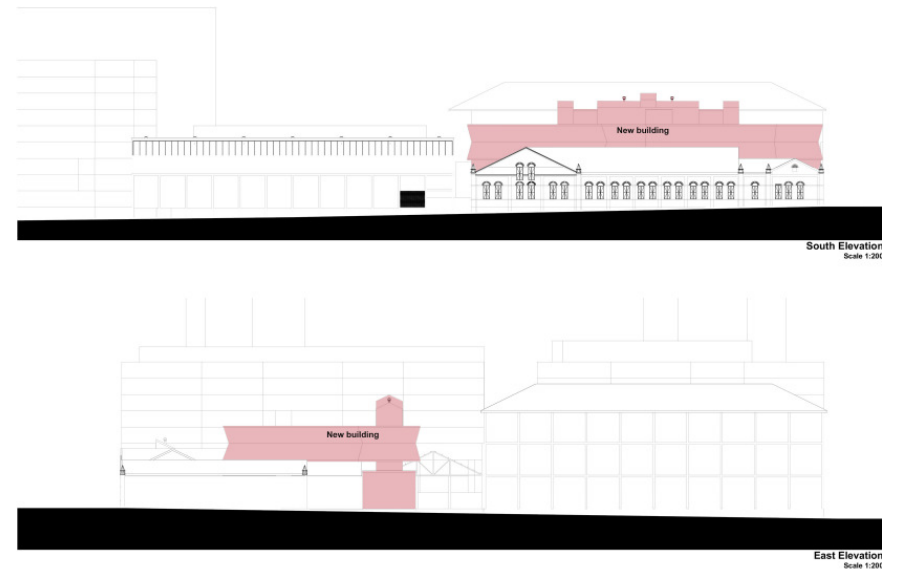


Figure 70 _ South and east elevations – June (Author, 2022)

Critique

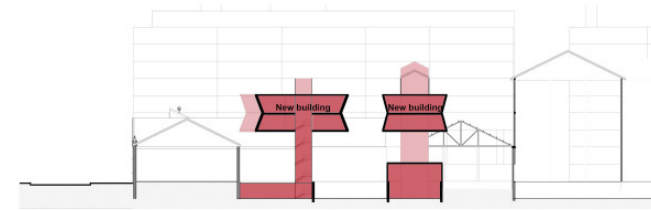
The initial design allowed little to no interaction of the public with the Wierda building. Some of the fluidity of the design was lost in the transition to digital media. The proposed courtyards stand in isolation from one another. The problematic hard edge of the Wierda building on the south façade (along Madiba Street) remained untouched. Pedestrian flow should be considered in order for interaction to take place between the public and the campus. The boundaries of the buildings should be dissolved to open the buildings up to the public – resulting in a more successful urban connection.

The refined concept

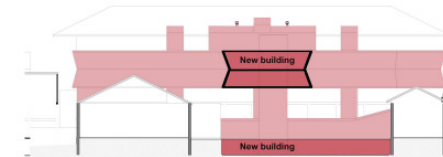
Conflict may arise at the meeting points between spaces, materials and users. Mediation is required between these meeting points, and the author believes that this would best be achieved through considered articulation. The conceptual approach, therefore, can be refined as the considered insertion of the new into the old, whilst celebrating the nexus of the contemporary and the historic to mediate the urban, heritage and technological principles, as elucidated in the dissertation.

2.11 Conclusion

The recognition of the history of the old Government Printing Works, alongside the urban potential of the site to foster greater urbanity will ensure the making of a space that will meaningfully contribute to the City of Tshwane. This will require appropriate responses to the heritage buildings and the permeation of the site's boundary through the introduction of arcades – a regional response to the large city blocks of Pretoria. The focus of this dissertation on a technological enquiry will furthermore require that contemporary applications of brickwork guide the design and allow for maximum material expression.



Section AA
Scale 1:200



Section BB
Scale 1:200

Figure 71 _ Sections AA and BB – June (Author, 2022)

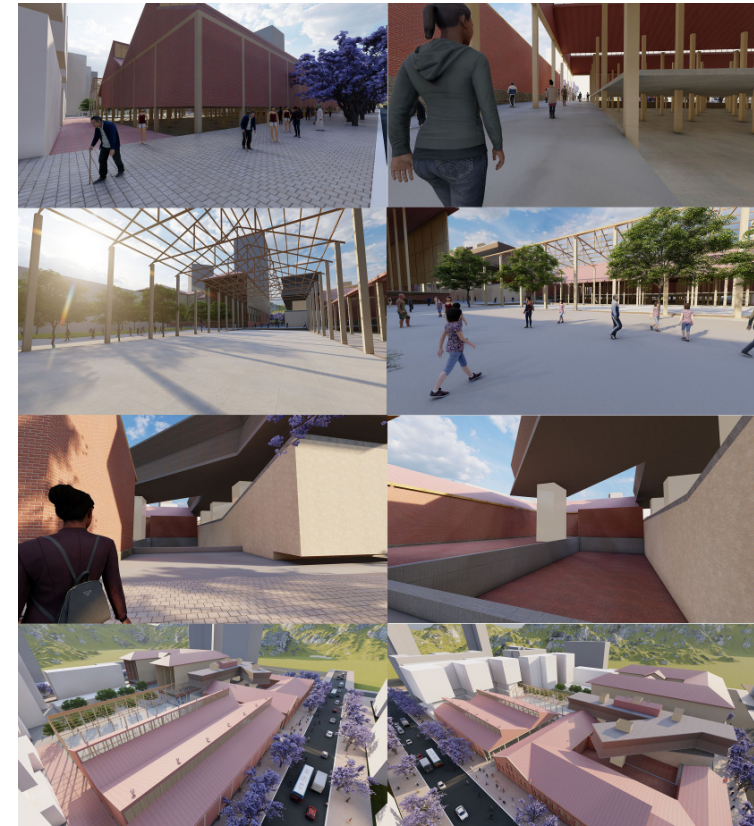


Figure 72 _ A collage of images of the proposed intervention – June (Author, 2022)

3_Synthesis

3.1_Introduction

The rethinking of the Government Printing Works (GPW) precinct as a retail node within the capital core of Pretoria requires recognition of the site's history and urban role, as elucidated in the design research. The precinct is a National Key Point. It is positioned as an isolated island within the inner city and, considering that it was a place for the printing and dissemination of Apartheid laws, any architectural intervention would need to contribute to the urbanity of the site to democratise the newly created public space.

The technological position taken in this dissertation, which seeks to rethink brickwork as a contemporary technology, forms the basis of the exploration of design iterations towards a consolidated design. The design intention is to create an urban campus for training in construction that showcases the activities of the programme to the larger public. The considered insertion of the old into the new is the foundation of the conceptual approach to the technological expression of the intervention. The pursuit of an abstract-regionalist response expressed tectonically (architecturally) in brickwork, whilst also seeking to contribute meaningfully to the making of the city, forms the basis for the formal exploration of the intervention.

3.2_Design development

The intention of the preliminary design response is the synthesis of the historical, urban and theoretical informants, as discussed in previous chapters. In responding to the history of the site, it is important to acknowledge the following key aspects. Initially, the site was the location of The Press and, as discussed previously, its role was that of knowledge gathering, multiplication and dissemination. Secondly, it was on this site where technological advances were made in construction as well as printing. The technological advances in the latter resulted in the large-scale unemployment of printing craftsmen as they became redundant. This history of technological advancement and knowledge creation, multiplication, and dissemination needs to be celebrated.

The GPW precinct later became a place for the distribution of Apartheid-era laws that led to the segregation, and in a sense, the privatisation of public space. An urban response that democratises public space needs to be considered together with the retail zoning of the site.

Along with the response to the historical aspects of the site, the urban response needs to create a meaningful public space that would activate the proposed retail function of the site. The intention then is to design a public space that would act as a point of attraction whilst also providing a place of respite within the city. This would necessitate the opening of the site to the public through the creation of arcades.

The historical and urban responses will guide the resolution of the project whilst responding to the context in an abstract-regionalist manner. The reinterpretation of brickwork as a contemporary technology will guide the physical manifestation of the intervention.

The abovementioned synthesised design informants were used in explorations on plan to discover possibilities for the envisioned intervention. Numerous iterations were conducted to develop a site-appropriate response.

3.3_Key iterations

3.3.1_Site iterations

The following key iterations demonstrate the development of the urban response to address the urban issues discussed previously, namely:

1. Little to no pedestrian interaction currently takes place with the site.
2. The site is not open for circulation, although an opportunity exists to allow pedestrian access across the site.
3. The surrounding areas are predominantly focussed on vehicular access and movement.
4. "The façade of the building forms a barrier to the street, lining the sidewalk, and is hard, un-urbane and unfriendly" (Clarke & De Villiers, 2015:82).

These iterations were first explored and developed by means of thumbnail sketches to distil the critical intentions of the design of the public space.

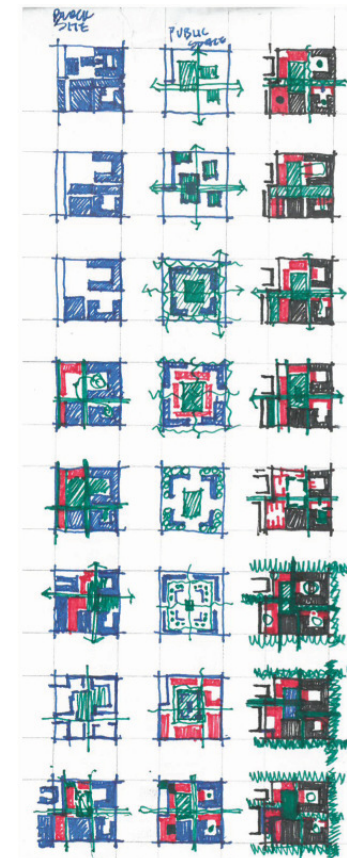


Figure 73 _ Thumbnail iterations for the design of the public space (Author, 2022)

Iteration 1

After several explorations and iterations to open the site to the public, this first key iteration represents an attempt to maximise the proposed retail area whilst providing a public square along the main arcade linking the west access point to the east, retaining as many of the existing buildings as possible. This iteration allows pedestrian access between the north and south of the proposed intervention. Although opening an arcade to link the east and west of the precinct, the pedestrian access from the east is constrained and does not allow for the natural flow of people through the site. Furthermore, the proposed new buildings sit awkwardly in respect to the existing buildings on the western boundary of the site (Figure 74).

Iteration 2

Key iteration 2 addresses the shortcomings of the previous iteration in relation to the neighbouring buildings. Here, the edges of the existing and proposed buildings are lined up to allow for an unobstructed flow of pedestrian movement across the site from west to east. The proposed intervention is placed adjacent to the Wierda building to give greater prominence to the arcade. As with the previous intervention, an attempt is made to define the street edges of the precinct. The public square is still not well defined, and this space seems to bleed into nearby courtyards. The existing structure, south of the square, also obstructs pedestrian flow (Figure 75).

Iteration 3

This final iteration opens a dominant arcade linking the east and west boundaries of the site. The public space is defined by platforms that could be used for seating or for the envisioned informal market. The courtyard of the administration block (the building on the northeast corner) is framed by a new insertion. The landscaping is used as a point of attraction and to create a space of rest and respite within the inner city. The arcades provide glimpses of the public space, and the intention with this is to draw the attention of pedestrians moving through the precinct, with the public space acting as a wayfinding mechanism (Figure 76).

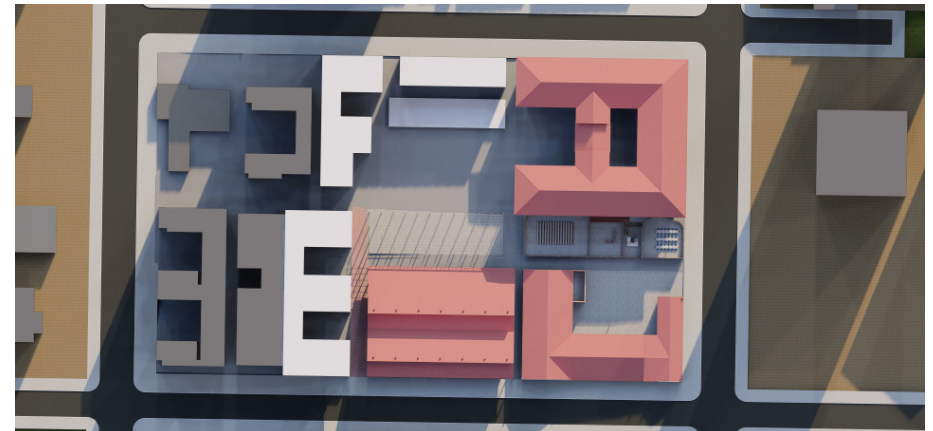


Figure 74 _ Key site iteration 1 (Author, 2022)



Figure 75 _ Key site iteration 2 (Author, 2022)



Figure 76 _ Final site iteration (Author, 2022)

3.3.2_Design iterations

The main design intention was the creation of a public campus for training in construction that would showcase the advanced construction school programme. To present the school's activities to the public would require a design that does not infringe upon public movement, but would celebrate it. This requirement necessitated a reassessment of the previous design proposal, which was conducted through thumbnail sketches to rapidly generate numerous iterations. These iterations were then critiqued, and key iterations were used in the development of the final design.

3.3.3_The design outcome

The design outcome is the culmination of numerous explorations that sought to synthesise the history and the urban role of the site, along with the technological explorations in the potentialities of a contemporary application of brickwork. With regards to the existing building, the intention is to articulate new insertions in a considered manner so as not to detract from the existing artefact. The urban role of the campus is to facilitate public interaction and, as a result, the design prioritises public access, thereby contributing to the urbanity of the campus. Brickwork is explored through conventional and unconventional applications. The unconventional (contemporary) use of brickwork was informed by new research conducted to invigorate the use of this traditional material.

The conceptual intention with the intervention is the considered insertion of new into old, and through the articulation of the junctions between them, to mediate the conflict that may result.

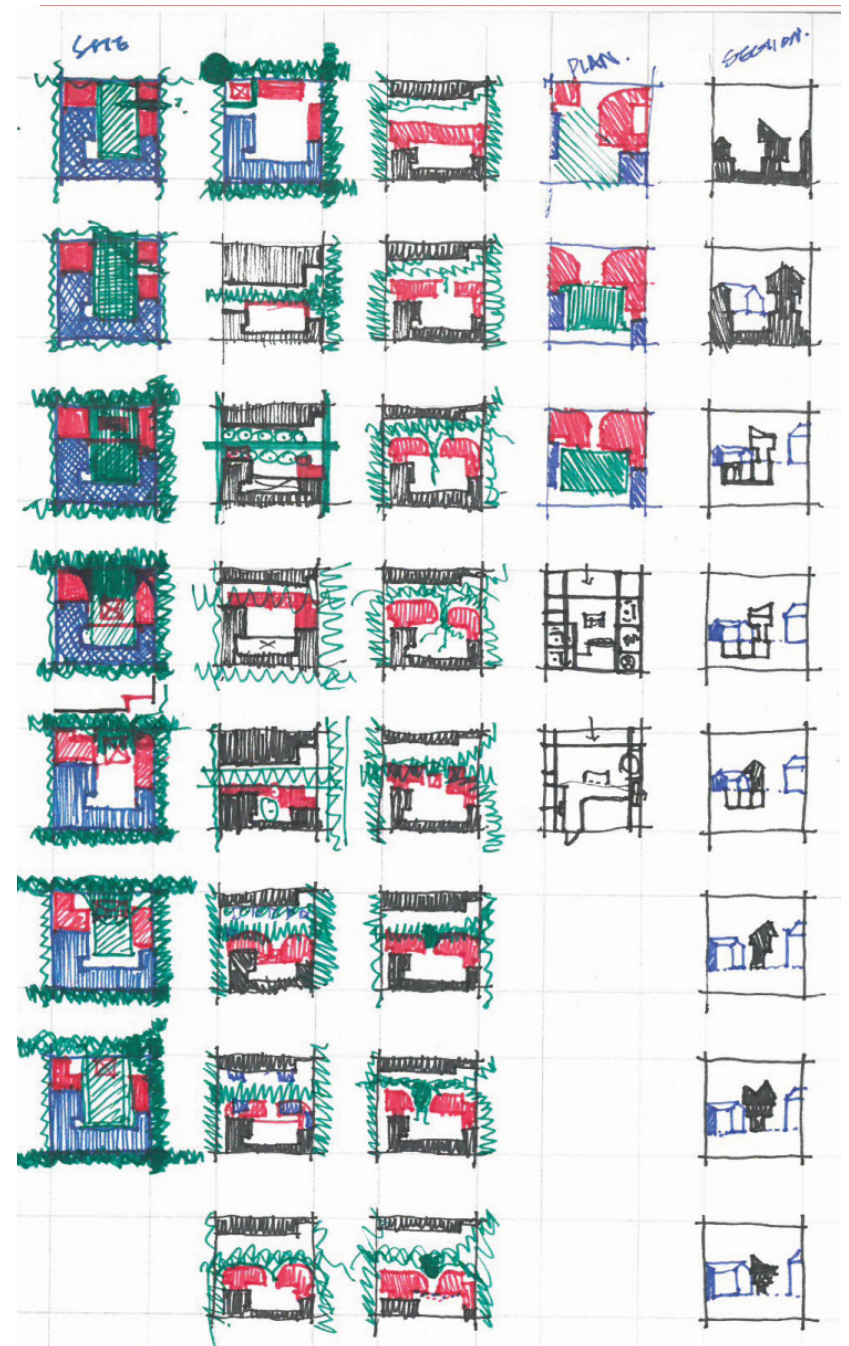
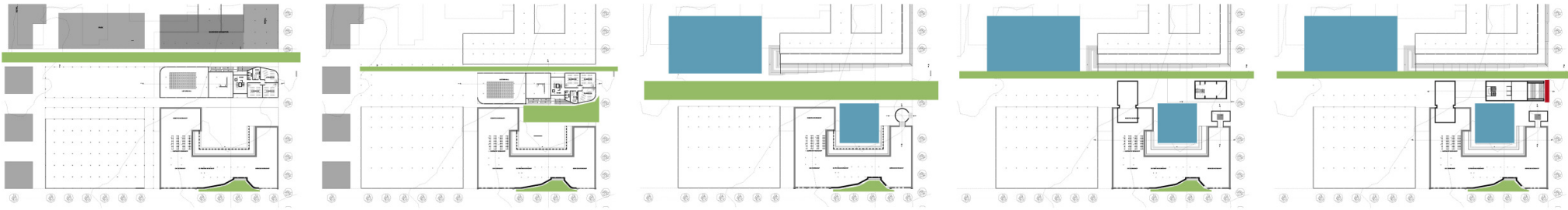


Figure 77 _ Thumbnail iterations of the design (Author, 2022)



Adapting the existing letter-press building to accommodate pedestrian movement across the site (east-west). The Wierda building's facade is shaped to facilitate movement into the campus and to break the un-urbane barrier.

The letter-press building was removed in order to create a more prominent arcade that would also allow for access to the courtyard of the Wierda building, linking the public spaces.

An attempt was made to define the edges of the arcade and street. A building setback was created to inform users of the entrance.

Another dominant entrance was added on the street edge.

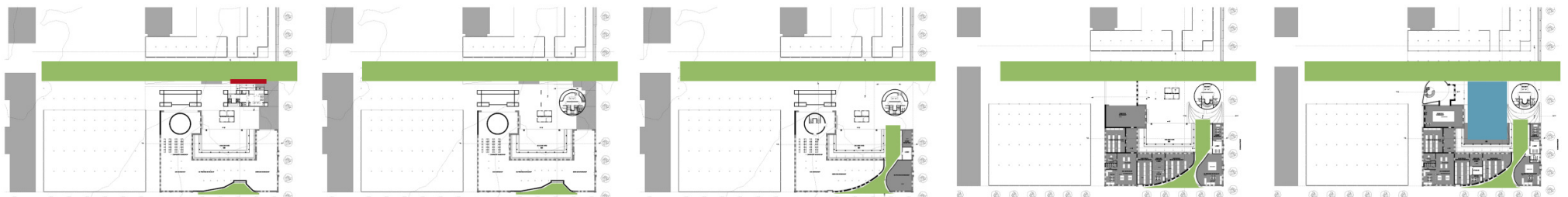


Additional entrances were carved out on the sides of the block to lead users into the building.

The secondary entrances were reconsidered to flow into a security check point.

The primary entrance was reconsidered and positioned on street level. Less hierarchy was given to secondary entrances.

The courtyard of the Wierda building was closed and the primary entrance positioned on the dominant pedestrian arcade.



The primary entrance was once again considered, being now positioned on the dominant pedestrian arcade. An architecture of mass and void was pursued to highlight the character of the brick. The courtyard was once again opened up to showcase the activities of the campus.

The urban role of the campus was re-assessed and forms that would better facilitate pedestrian movement became the focus. To showcase the activity of the campus, greater emphasis was placed upon opening the campus to the city.

The emphasis of opening the campus to the public allowed for the creation of an arcade through the Wierda building that allows for movement through the campus.

The courtyard is completed on the first floor in order to not obstruct pedestrian flow through the campus. Curvilinear forms allow for pedestrian movement along the arcades without creating hard, un-urbane edges. The forms on either side serves as bookends of the enlarged courtyard.

Figure 78 _ Final design iterations – August to September (Author, 2022)

3.4_The technological concept

The focus of this dissertation is primarily a technological enquiry in which brickwork is reconsidered as a contemporary technology that is expressed tectonically. As such, this rethinking (reconsideration) becomes the conceptual premise for technological explorations in the new intervention. To this end, the following research and precedents inform the technological explorations for the final design.

3.4.1_Research

Hensel, D.S. & Bover, G.B. 2015. "A developmental route to local specificity: Nested catenaries."

The research by Hensel and Bover (2015: 120-127), as presented in their article "A developmental route to local specificity: Nested catenaries" formed the basis for the reinterpretation of the arches that are presented in the design outcome. The arch formed by the catenary (the curve made by the hanging of a chain or cable under self-weight) allows for the creation of an unreinforced masonry shell structure that acts in the same manner as an ordinary arch. This idealised shape, in the case of the chain under self-weight, is in perfect tension, and when this shape is inverted, it is in perfect compression. As a result, it works perfectly in conjunction with the characteristics of the brick, which is stronger in compression as opposed to tension. Although the research by Hensel and Bover (2015:120-127) makes use of a single layer of unreinforced brick, the catenary arches employed in the final design make use of multiple layers with overlapping joints to mitigate waterproofing issues.

Hensel, D.S. 2008. "Complex brick assemblies".

In elaborating on the work of Eladio Dieste and Rafael Guastavino, the research presented by D.S. Hensel (2008: 64-73) in the article "Complex brick assemblies" proposes that brick assemblies with synclastic and anticlastic surfaces, based on the hyperbolic-paraboloid surface geometry, could be employed in brick construction without the use of mortar. This would require a pre-tensioned cable-net system which could provide the means for a reinterpreted *cobogó*. For the proposed design, this research was employed in the creation of the double-curved vault (based on the hyperbolic-paraboloid surface geometry) spanning the building yard. Mortar and a double brick skin are used in the construction to create a unified shell structure, in conjunction with a pre-tensioned cable-net system. This double-curvature vault also works in compression throughout the structure – again highlighting the compressive character of brickwork.

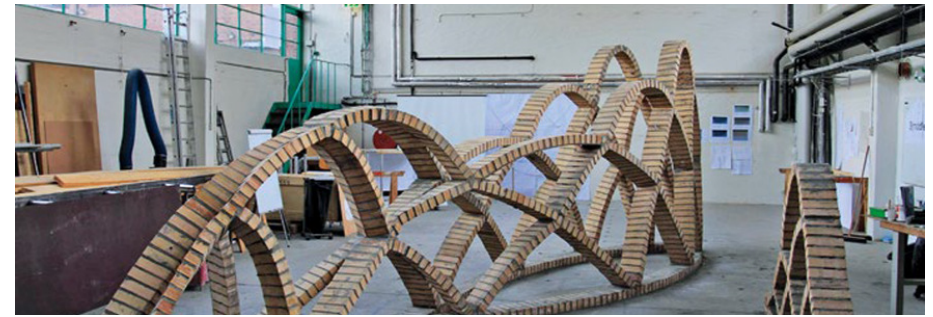


Figure 79 _ A self-standing nested catenary structure (Hensel & Bover, 2015:123)



Figure 80 _ Pinell de Brai cooperative wine cellar, Pinell de Brai, Catalonia, Spain (Cèsar Martinell & Associates, 2016)

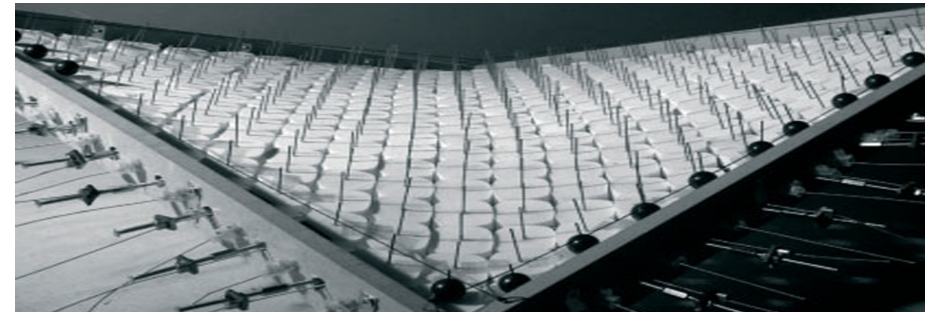


Figure 81 _ Prototype on 1:10 scale of a hyperbolic-paraboloid brick assembly without mortar (Hensel, 2008:72)

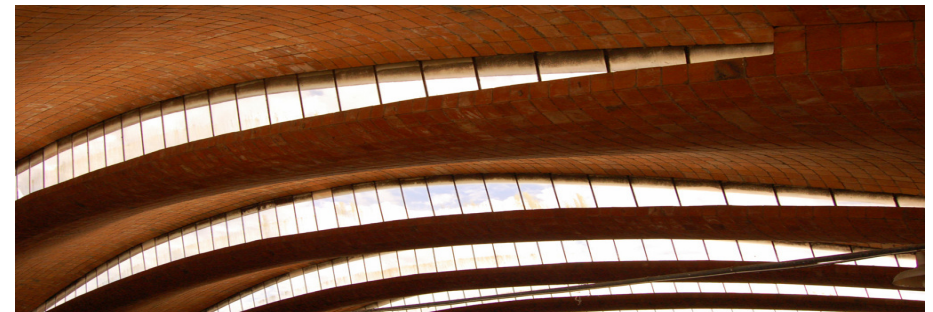


Figure 82 _ Julio Herrera y Obes Warehouse, Eladio Dieste, Montevideo, Uruguay (ArchDaily, 2021)



Figure 83 _ Mapungubwe Interpretation Centre (Baan, 2010)

3.4.2_Precedents

Mapungubwe Interpretation Centre, Peter Rich Architects, 2010

The Mapungubwe Interpretation Centre by Peter Rich Architects is based on the same structural principles as elucidated in the abovementioned research. Hand-pressed local soil-and-cement tiles were bonded with a quick-setting gypsum mortar. The use of this traditional timber-vaulting technique allows for the design and construction of thin unreinforced masonry-shell structures (Ramage, Ochsendorf, Block & Rich, 2008). These structures work in compression only, as is the case with the previously noted examples. The structural shape and quick-setting mortar furthermore allow for limited structural formwork to be employed.

Fjordenhus, Olafur Eliasson and Sebastian Behmann, 2018

Another contemporary example employing the previously noted research, is the Fjordenhus corporate office building by Studio Olafur Eliasson and Sebastian Behmann. In this building, the catenary arches are proudly displayed and inform the internal spatial configuration. The use of these catenary arch structures allows for new form-giving possibilities in brick architecture, as they work in conjunction with the compression characteristics of bricks.



Figure 84 _ The construction of the vaults at the Mapungubwe Interpretation Centre (Ramage et al, 2008)



Figure 85 _ The Fjordenhus corporate office building (De Larrea Remiro, 2018)

3.4.3_The technological outcome

In considering the abovementioned research and precedents, new form-giving possibilities were explored in the design process. The above examples informed the use of catenary arches in the new intervention and the development of the hyperbolic-paraboloid structure which forms the canopy of the building yard. Catenary arches were specifically employed in the new intervention as a reinterpretation of the existing arches in the existing artefact. The building yard, which facilitates the learning of masonry construction, was specifically selected as the site for the brick canopy form, with the intention that this expressive form would demonstrate to students of the possibilities that exist within brickwork, elevating it from a mundane technology to a contemporary technology.

The technical concept for the new intervention entails the rethinking of brickwork as a contemporary technology. It requires that new possibilities, informed by contemporary research and precedents, in turn inform the form-giving possibilities that have become possible in the application of brickwork. The heritage building required a more nuanced approach to the insertions, and thus the concept here was the considered insertion of the new into the old whilst articulating this nexus of the contemporary and the historic.

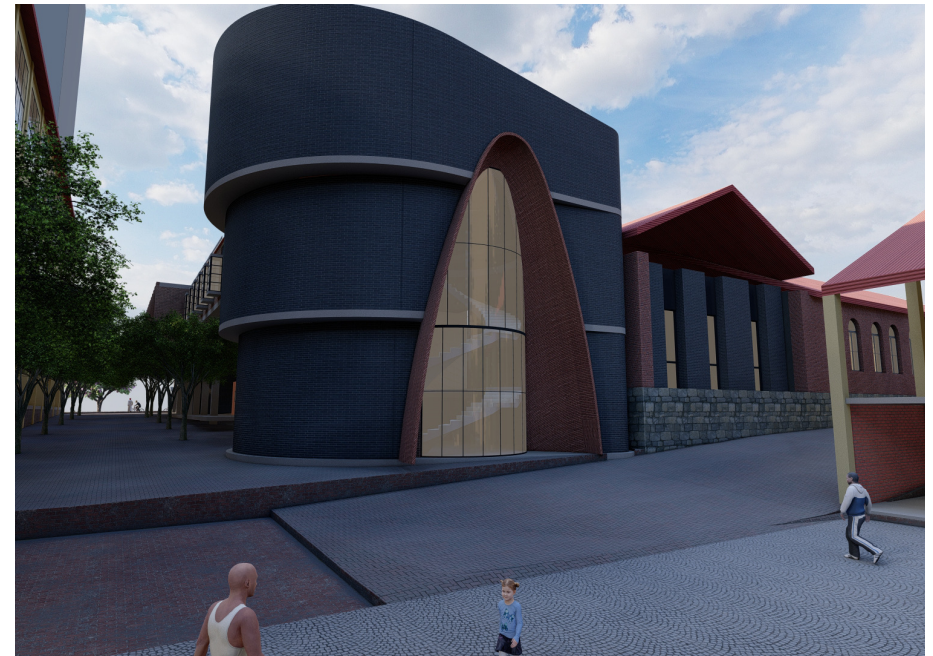


Figure 86 _ A catenary arch employed in the new building (Author, 2022)

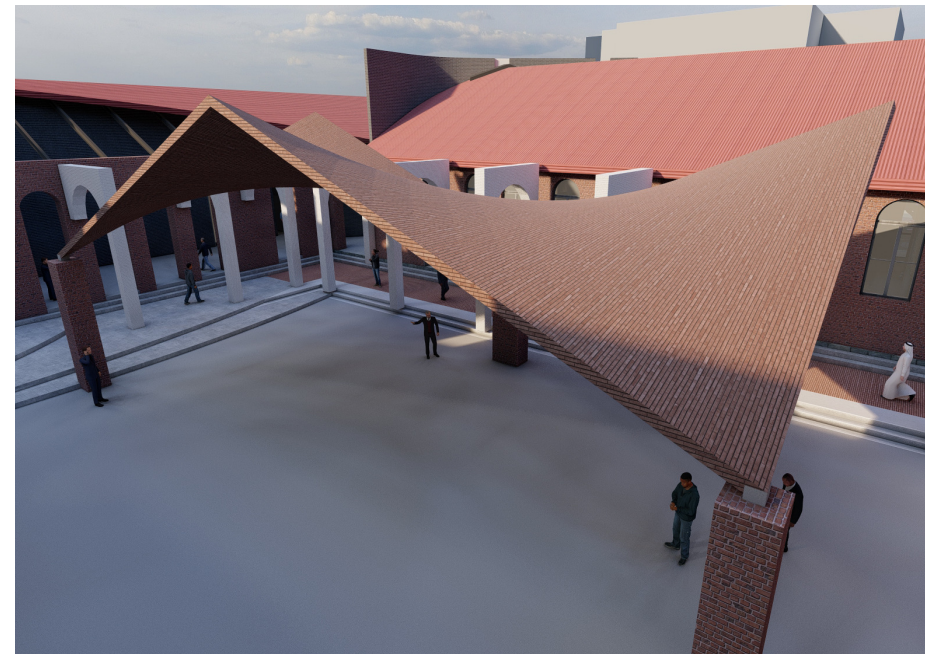


Figure 87 _ The hyperbolic-paraboloid structure covering the building yard (Author, 2022)

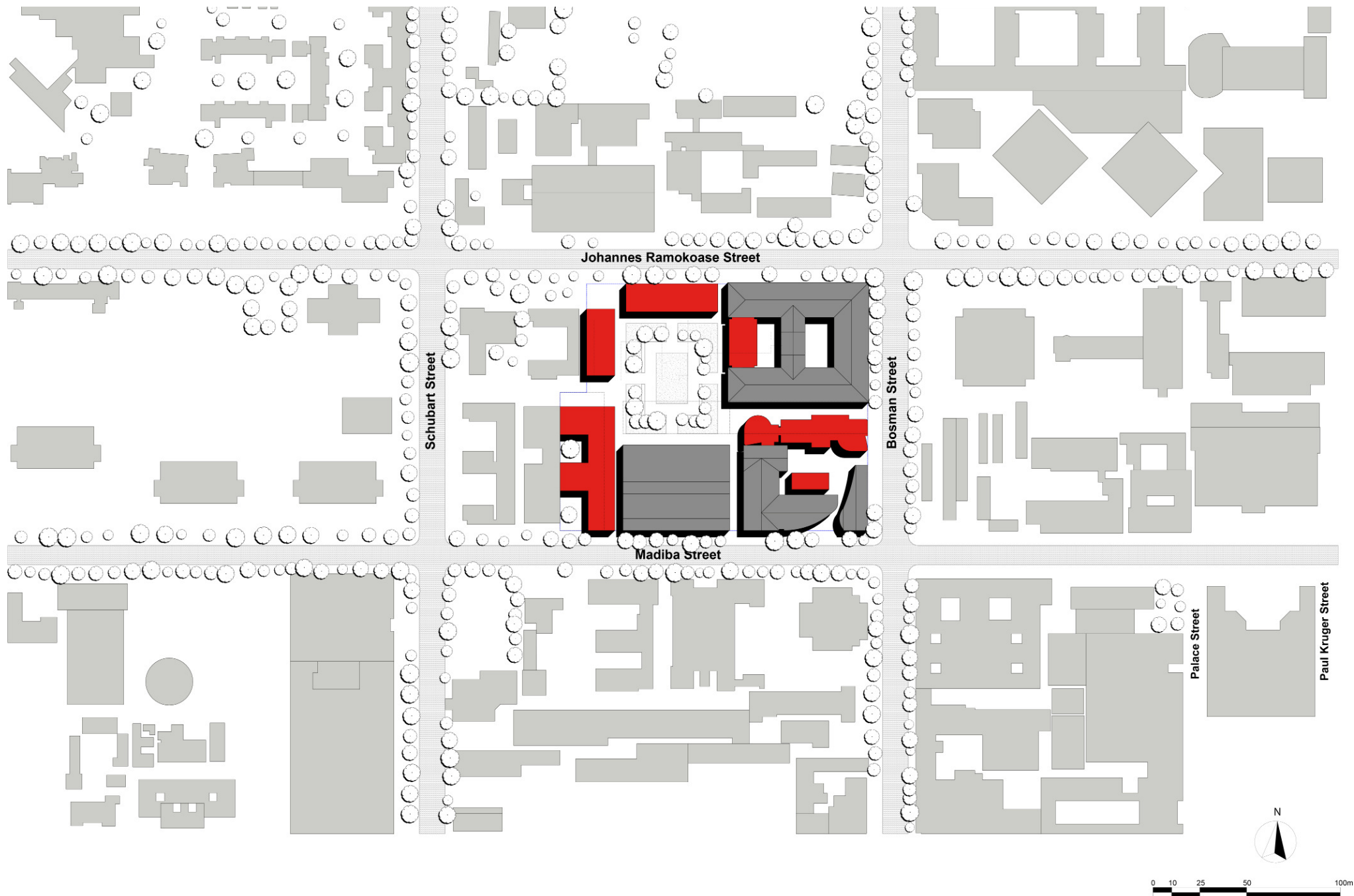


Figure 88 _ Site plan (Author, 2022)

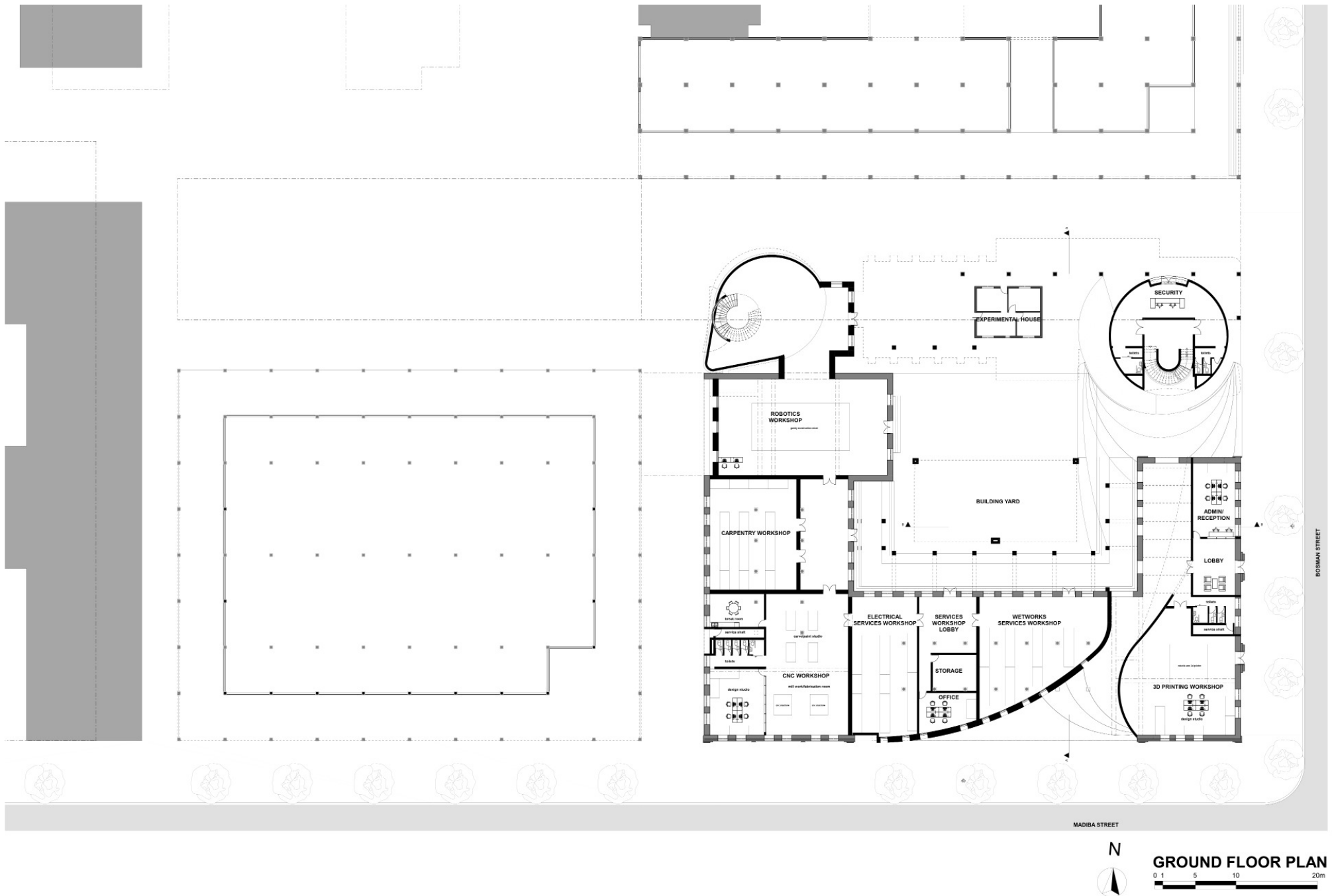


Figure 89 _ Ground floor plan (Author, 2022)

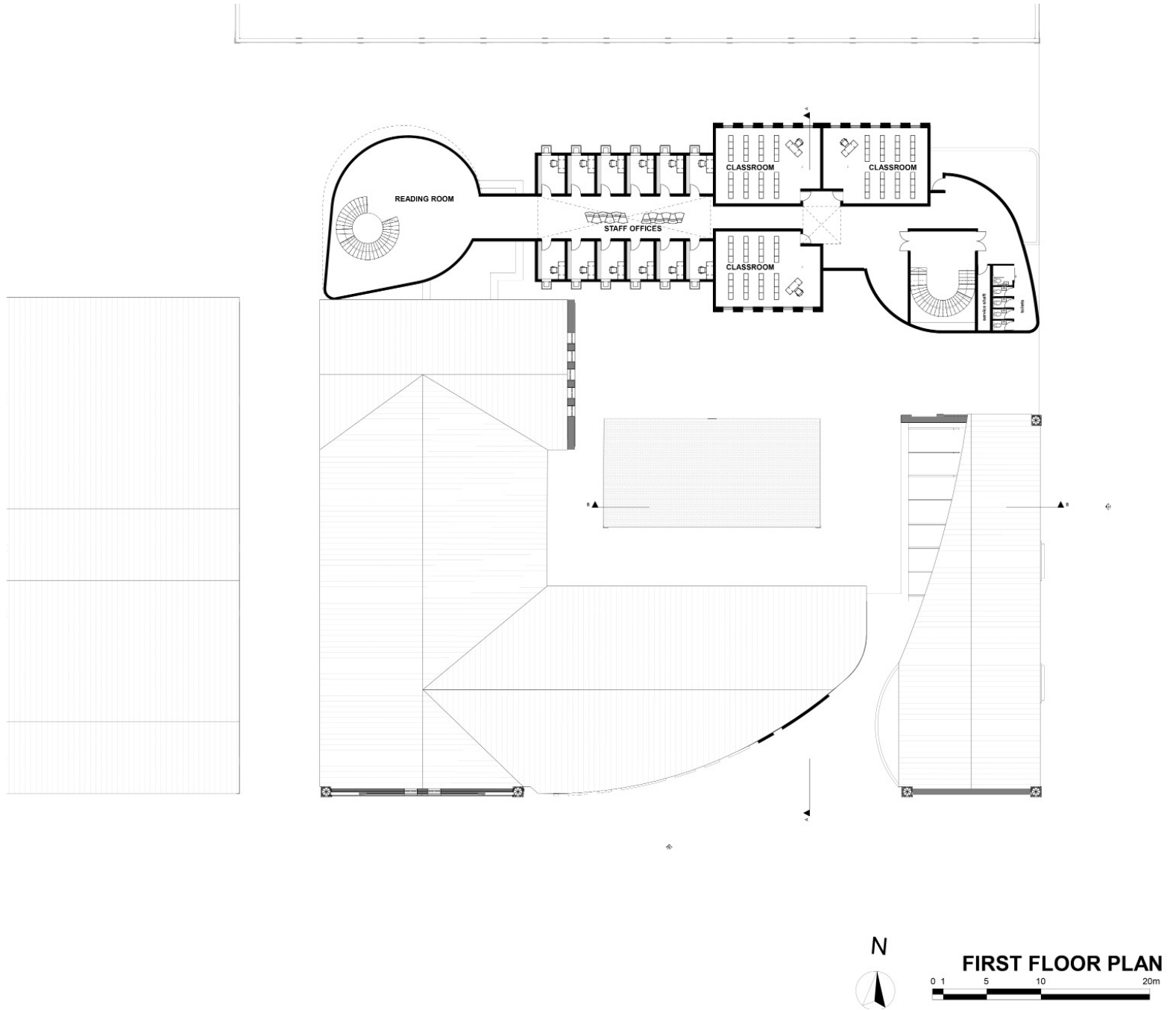


Figure 90 _ First floor plan (Author, 2022)

The south façade has been opened to the public to break the hard, un-urbane barrier that formerly lined the sidewalk. The entrance to the campus along this south elevation serves to draw the public in and through the campus, with the intention of displaying the various activities along the newly formed arcade.

The east façade of the existing building was left untouched. It was deemed significant to the heritage of the building, as it is on this façade where the primary entrance to the old GPW used to be located. The intervention continues to serve the movement of the public through the site to the inner public square, and for this reason a hard barrier on the east elevation is avoided. The first floor of the new building continues to define the street edge. The pitched roof on this elevation serves to mediate between the differing scales of the existing buildings.

The new additions and insertions are articulated in an attempt to mediate the conflict between existing and new. New interpretations of existing forms seek to convey a more contemporary typology without disregard of the existing. Expressive forms - informed through research and precedent - serve to elevate brickwork as a modern technology.

Whenever an insertion or addition was made to the existing building, a separation between the new and old materials was privileged in order to highlight the distinction between the two. This separation of elements was carried through to the meeting of the different planes.

This separation then highlights the contrast between the old and the new, which in turn reflects the author's attitude towards heritage. This attitude developed from extensive reading of Barker (2020) "Limiting binary thinking: Architectural design in historic urban contexts", as elucidated in Chapter 2.7.

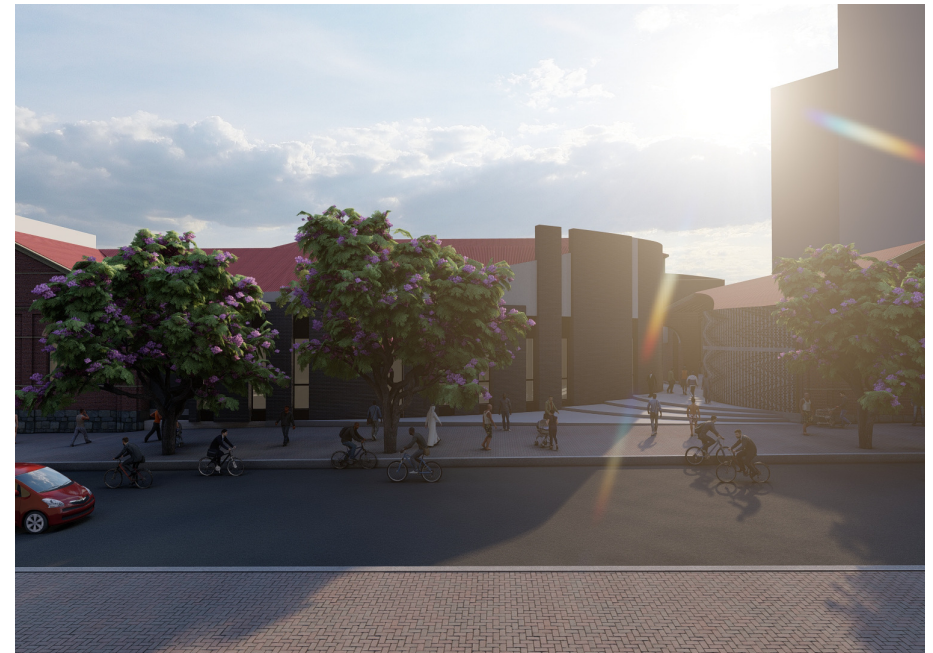
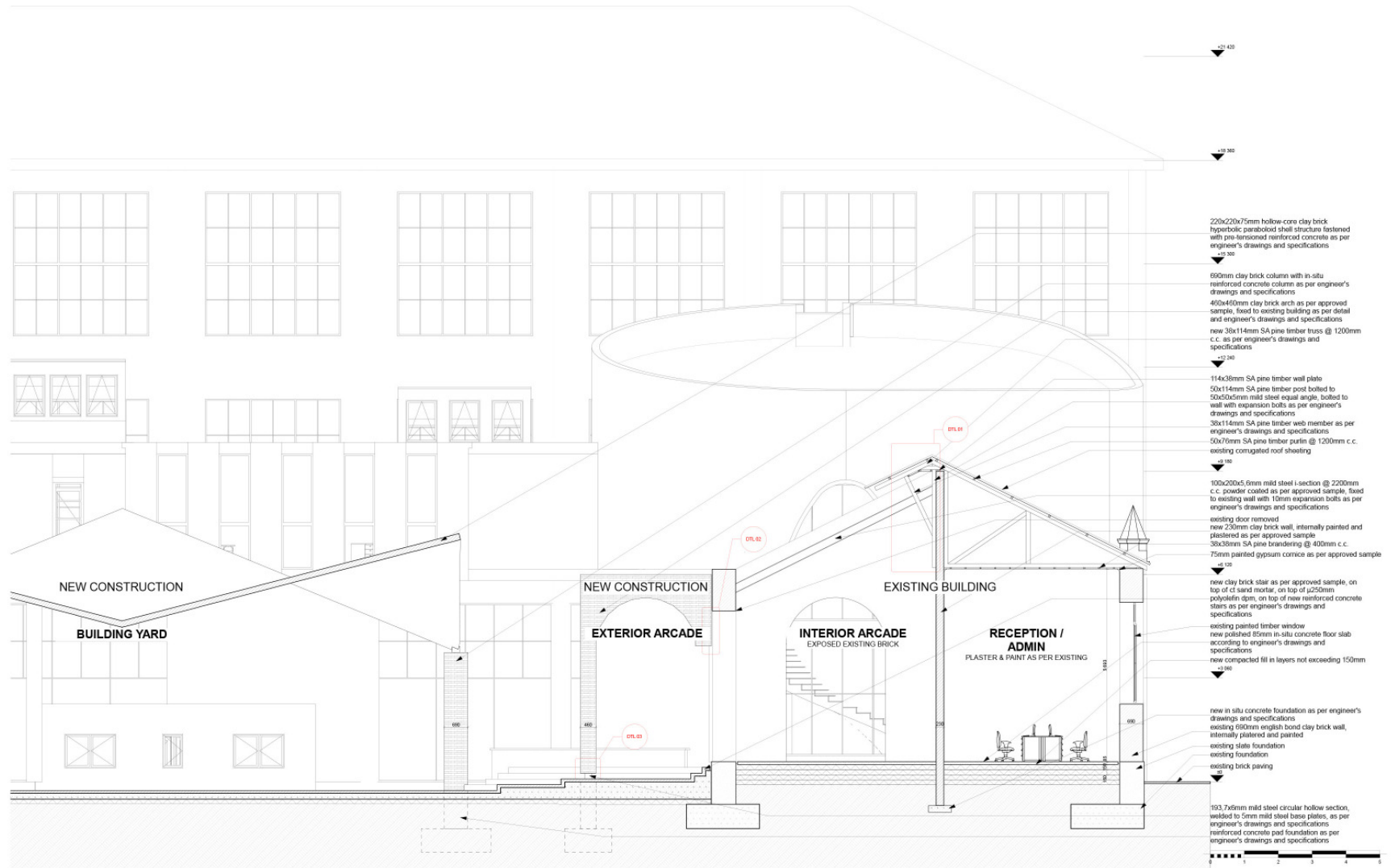


Figure 91 _ South elevation (Author, 2022)



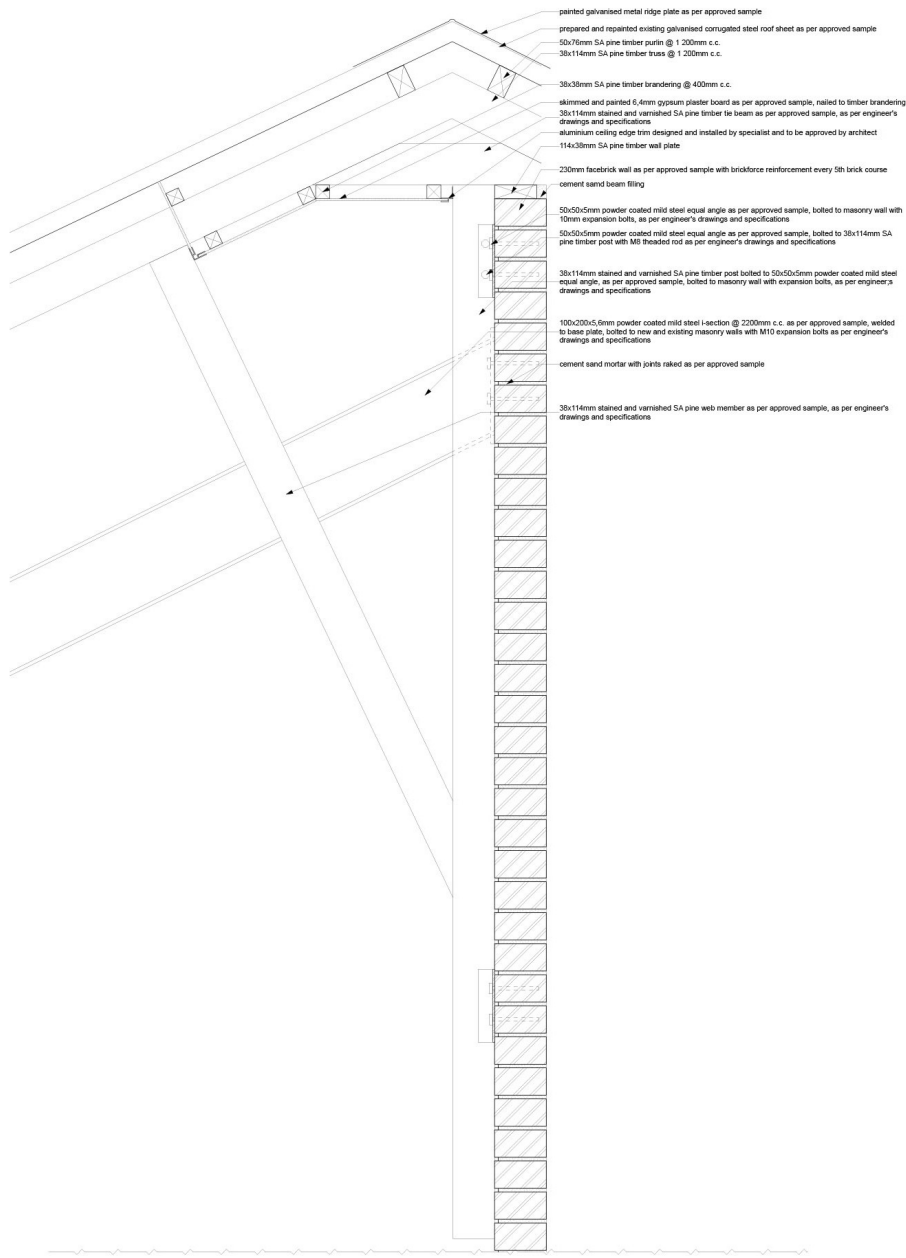
Figure 92 _ East elevation (Author, 2022)



SECTION BB
SCALE 1:50

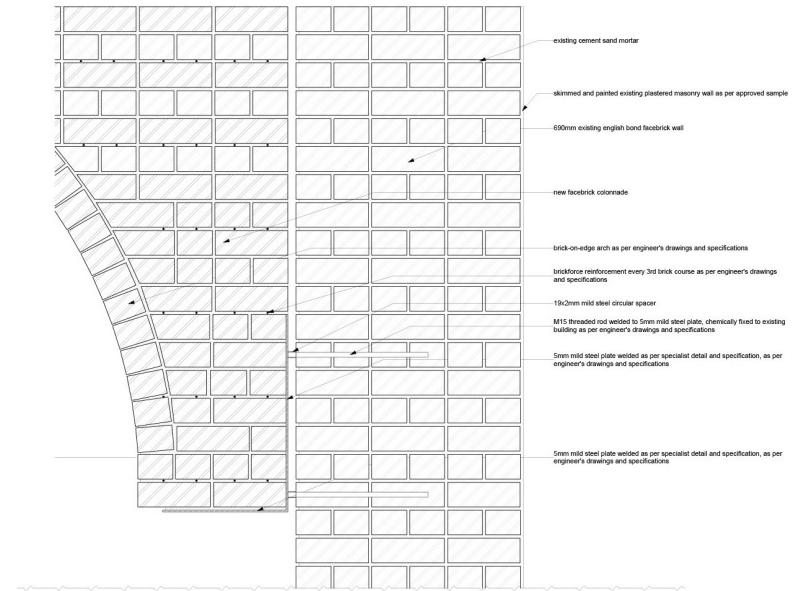
Wessel J Ebersohn
u25024915

Figure 93 _ Section BB (Author, 2022)



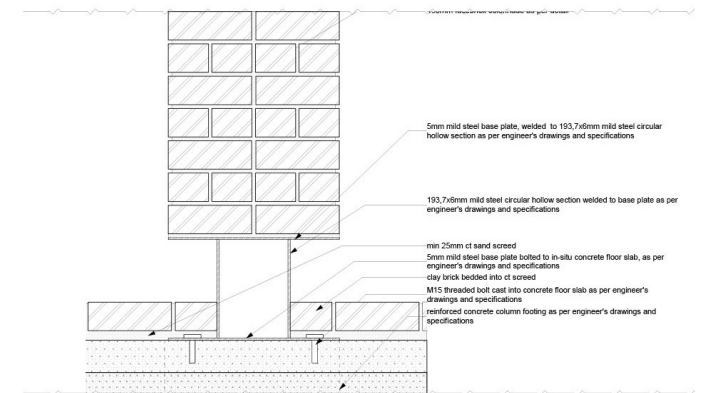
DTL 01
SCALE 1:5

Figure 94 _ Detail of the internal arcade and roof opening of the existing building (Author, 2022)



DTL 02
SCALE 1:5

Figure 95 _ Detail of the new colonnade attached to the existing building (Author, 2022)



DTL 03
SCALE 1:5

Figure 96 _ Detail of the footing of the new colonnade (Author, 2022)

3.5_Water harvesting

The traditional management of stormwater within the inner city of Pretoria was achieved by channelling it into stormwater drains that would empty into the river systems of the city. These river systems were canalised to effectively deal with the increase in water supply during the summer months. As a result of stormwater being channelled away, groundwater sources are not being replenished, resulting in the desertification of our cities. As water is more and more seen as a critical resource, and in order to limit the requirement for potable water on the campus, stormwater will be collected, filtered and then used for irrigation and sanitation (i.e. flushing of toilets).

Water collection and demand calculations were conducted. These calculations reveal that more than enough water can potentially be collected to flush all the toilets and to water the landscaping of the campus. The large surplus of water could be used for the irrigation requirements of the plantings in the public square and could also provide for the flushing of future public sanitation facilities.

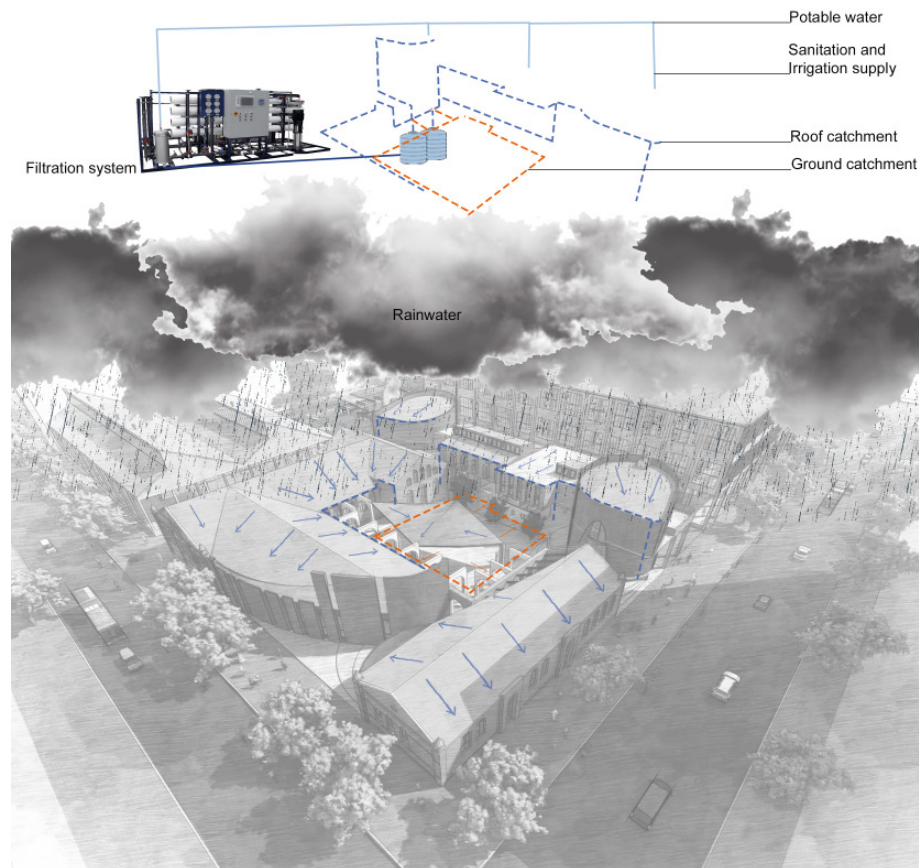


Figure 97 _ Water harvesting diagram (Author, 2022)

Table 6 _ Calculations of the effective rainwater collection area (Author, 2022)

Effective rainwater collection area			
Surface	Area (m ²)	Runoff coefficient	Effective collection area (m ²)
Metal roofing	2277.32	0.8	1821.86
Concrete roofing	344.92	0.8	275.94
Brick roofing	199.61	0.7	139.73
Paving	1104.23	0.7	772.96
Total effective collection area (m²)			3010.48

Table 7 _ Water collection calculations (Author, 2022)

Annual rainwater collection			
Month	Average rainfall (m)	Effective collection area (m ²)	Total collection (m ³)
January	0.1	3010.48	301.05
February	0.12	3010.48	361.26
March	0.07	3010.48	210.73
April	0.04	3010.48	120.42
May	0.01	3010.48	30.10
June	0.004	3010.48	12.04
July	0.001	3010.48	3.01
August	0.003	3010.48	9.03
September	0.009	3010.48	27.09
October	0.06	3010.48	180.63
November	0.098	3010.48	295.03
December	0.11	3010.48	331.15
Total annual rainwater collection (m³)			1881.55

Table 8 _ Irrigation demand calculations (Author, 2022)

Irrigation demand calculations						
Irrigation requirements		Medium - 20mm/week				
Irrigation system efficiency		Sprinklers, night - 75% efficiency (addition of 33% of demand to compensate)				
Planted area		25m ²				
Plant density factor		Normal - 1				
Microclimate factor		Normal - 1				
Irrigation schedule		25% rainy season, 100% dry season				
Month	Irrigation requirements (m/m ² /day)	Days	Irrigation schedule	Planted area (m ²)	Efficiency factor	Monthly demand
January	0.003	31	25%	25	1.33	0.77
February	0.003	28	25%	25	1.33	0.70
March	0.003	31	25%	25	1.33	0.77
April	0.003	30	100%	25	1.33	2.99
May	0.003	31	100%	25	1.33	3.09
June	0.003	30	100%	25	1.33	2.99
July	0.003	31	100%	25	1.33	3.09
August	0.003	31	100%	25	1.33	3.09
September	0.003	30	100%	25	1.33	2.99
October	0.003	31	25%	25	1.33	0.77
November	0.003	30	25%	25	1.33	0.75
December	0.003	31	25%	25	1.33	0.77
Total irrigation demand (m ³)						22.79

Table 9 _ Sanitation demand calculations, adapted by the author from the Green Star assessment tool (Author, 2022)

Sanitation demand calculations		
Occupancy	Occupants	Active days per week
Classrooms, offices and reading room	120	5
Workshops	90	5
Workshop offices	30	5
Sanitary fixture		
		Flow rate
WC	4.5 litres per flush	
Wash hand basin	4 litres per min	
Sanitary fixture		
		Annual water demand (m ³)
WC	216	
Wash hand basin	96	

Table 10 _ Total water demand calculations (Author, 2022)

Month	Toilet flushing demand (m ³)	Wash hand basin demand (m ³)	Irrigation demand (m ³)	Total monthly demand (m ³)
January	18	8	0.77	26.77
February	18	8	0.70	26.70
March	18	8	0.77	26.77
April	18	8	2.99	28.99
May	18	8	3.09	29.09
June	18	8	2.99	28.99
July	18	8	3.09	29.09
August	18	8	3.09	29.09
September	18	8	2.99	28.99
October	18	8	0.77	26.77
November	18	8	0.75	26.75
December	18	8	0.77	26.77
Total demand (m ³)				334.77

Table 11 _ Water supply and demand calculations (Author, 2022)

Month	Supply (m ³)	Demand (m ³)	Balance (m ³)	Cumulative balance (m ³)
January	301.05	26.77	274.28	274.28
February	361.26	26.70	334.56	608.84
March	210.73	26.77	183.96	792.80
April	120.42	28.99	91.43	884.23
May	30.10	29.09	1.01	885.24
June	12.04	28.99	-16.95	868.29
July	3.01	29.09	-26.08	842.21
August	9.03	29.09	-20.06	822.15
September	27.09	28.99	-1.90	820.25
October	180.69	26.77	153.86	974.11
November	295.03	26.75	268.28	1242.39
December	331.15	26.77	304.38	1546.77
Total surplus / shortage (m ³)				1546.77

3.6_Solar harvesting

The large roovescape of the old GPW has enormous potential for solar harvesting, although the workshops of the construction campus and the envisioned small-scale manufacturers could require a higher supply capacity and more stable energy than can be provided through renewables. However, the offices and required back-up generation, along with the other programmes on the precinct, could benefit greatly from this alternative energy source. The potential area of solar harvesting was investigated by a determining of the possible area for collection. Due to shadows cast by the administration block on its north-east corner, the new intervention was omitted from the calculation. Furthermore, due to the intricacy of the roof and dormer windows of the Wierda building, it was decided to also exclude this building from the calculations. Calculations were performed to establish the number of PV (photovoltaic) panels that could potentially be provided, and a determination was made as to the possible maximum generation capacity.

The calculations however revealed that, realistically, complete independence from the national grid might not be possible. The impact of loadshedding and fluctuating power supply might be mitigated through the system.

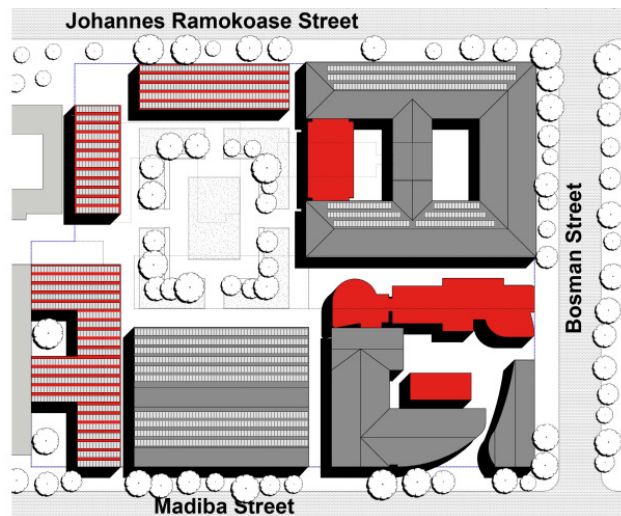


Figure 97 _ Roofscape with potential number of PV panels (Author, 2022)

Table 12 _ Energy supply calculations, adapted by the author from the Climatebiz Solar Calculator (Author, 2022)

Effective solar collection area		
Roof area (m ²)	Possible number of PV panels	Max possible output (kW/m ²)
1360	458	1088.00
2555	570	2044.00
526	168	420.80
709	245	567.20
3179	305	2543.20
Total max possible output (kW/m ²)		6663.20

Table 13 _ Energy supply calculations, adapted by the author from the Climatebiz Solar Calculator (Author, 2022)

Energy supply calculation				
Potential area (m ²)	Possible number of PV panels	Watt per panel	Efficiency factor	Potential kW solar system
1360	458	530	1.2	291.29
2555	570	530	1.2	362.52
526	168	530	1.2	106.85
709	245	530	1.2	155.82
3179	305	530	1.2	193.98
Potential solar system (kW)				1110.46
Potential supply @ avg 5.5 peak sun hours per day				6107.51

Table 14 _ Energy demand calculations, adapted by the author from the Green Star assessment tool (Author, 2022)

Energy demand calculation		
GLA (m ²)	Avg EUI (kW/m ²)	Avg kWh/year
7095.66	187	1326888.42
2221.74	206	457678.44
1829.52	187	342120.24
1849.56	187	345867.72
8293.05	187	1550800.35
2561.90	206	527751.40
Total annual kWh demand		4551106.57

Table 15 _ Energy supply and demand calculations (Author, 2022)

Month	Demand (kWh)	Supply (kWh)	Balance (kWh)	Cumulative balance (kWh)
January	386532.49	189332.75	197199.74	197199.74
February	349126.12	171010.22	178115.90	375315.64
March	386532.49	189332.75	197199.74	572515.38
April	374063.70	183225.24	190838.46	763353.84
May	386532.49	189332.75	197199.74	960553.58
June	374063.70	183225.24	190838.46	1151392.04
July	386532.49	189332.75	197199.74	1348591.78
August	386532.49	189332.75	197199.74	1545791.53
September	374063.70	183225.24	190838.46	1736629.99
October	386532.49	189332.75	197199.74	1933829.73
November	374063.70	183225.24	190838.46	2124668.19
December	386532.49	189332.75	197199.74	2321867.93
Total surplus / shortage (m ³)				2321867.93
Total energy savings				2229240.42

3.7_Light

To reduce the load on the solar system, sufficient natural light should be provided to the various spaces within the building. The height of the adjacent administration building poses a challenge to the provision of sufficient natural light, as it casts a shadow over the new intervention for most of the day. This is further exacerbated during the low-sun winter months in Pretoria. The main space that was selected for a daylighting case study was one of the classrooms on the north side of the building. The classrooms are the areas most subjected to the shadow of the adjacent building. Several daylighting strategies were tested to provide a minimum of 400 lux to these classrooms to reduce the use of artificial lighting. A Sefaira daylight analysis was conducted using a model of the classrooms, and this base model was iterated until the desired result was achieved. This Sefaira analysis allowed for the quantitative testing of the various iterations. The iterative process resulted in major improvements to the quality of natural light in these classrooms during the occupied hours, whilst achieving the 400-lux target.

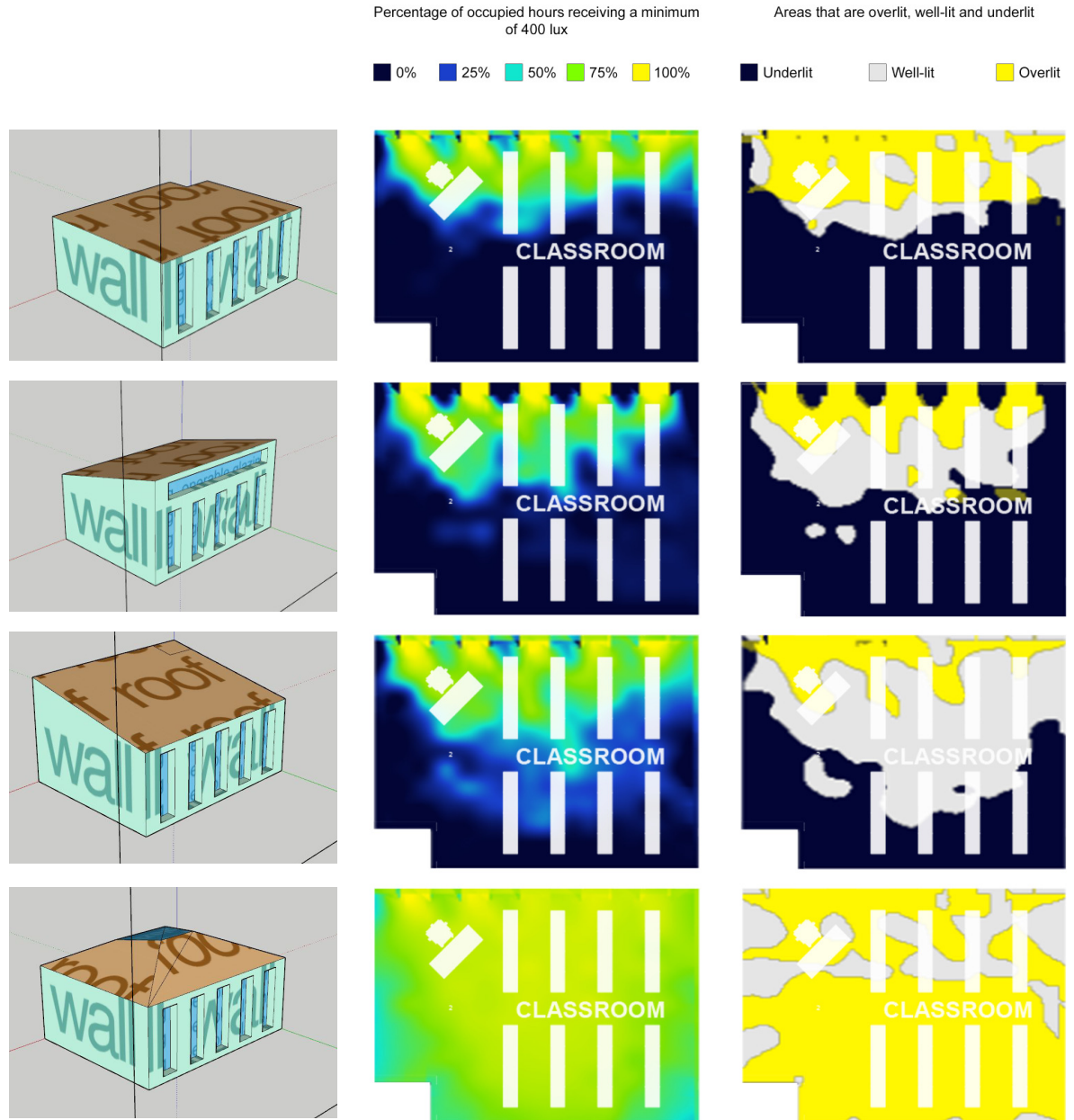


Figure 98 _ Daylighting analysis, adapted by the author from Sefaira (Author, 2022)

3.8_Sustainability

The preliminary Sustainable Building Assessment Tool (SBAT) report indicates that a score of 4.5 out of a possible 5 has been achieved. The location of the site within the CBD of Pretoria is the primary factor contributing to this high score. The site is well serviced with regard to access to transport, educational, and health facilities and other resources. The high levels of renewable energy provision and the harvesting of rainwater for sanitation, further contribute to the score. In addition to the employment of these renewable systems, it is also suggested that the brick from the demolished buildings be upcycled into the new construction; this will serve to further reduce the environmental impact of the new construction. Biocapacity is rather low and can be ascribed to the fact that the site is currently completely paved and devoid of vegetation. The introduction of a planted public square does address this to some extent; however, if the green areas were larger and hosted a more diverse planting palette, the score could be improved substantially. The low waste score is due to the fact that sewage is not treated on site or within the neighbourhood, which could have provided useful by-products. The high score achieved, is therefore indicative of the fact that the intervention and the proposed precinct development will contribute meaningfully to the city.

It is also important to note that the SBAT toolkit is primarily focussed on residential development and, as a result, the scores could be amended if the toolkit were to also focus on other functions such as educational facilities.

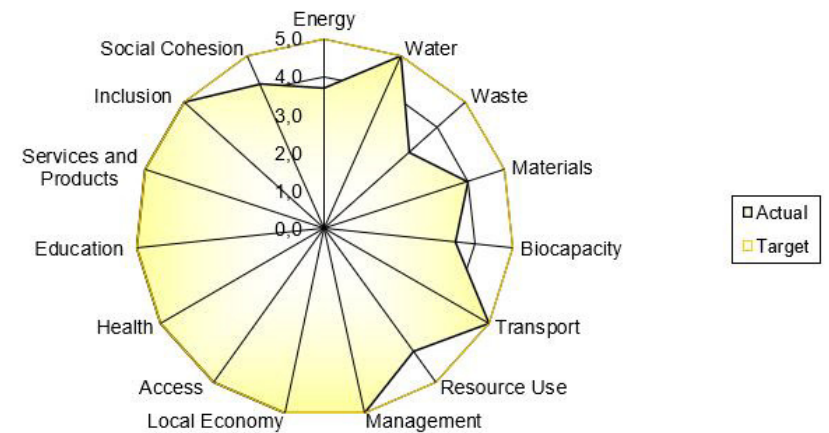


Figure 99_ SBAT report, adapted by author from the SBAT toolkit (Author, 2022)

3.9_Conclusion

The old Government Printing Works precinct stands as an isolated island within the urban fabric of Pretoria's capital core. This secluded National Key Point requires the reconsideration of its urban role within the city, especially as it has been earmarked for retail development. The first steps in reconsidering this inaccessible urban block are its reconnection to the city, the fostering of greater urbanity, and the democratisation of public space. This has been attempted through the various interventions on the terrain. The contemporary application of a truly regionalist building material further aids the democratisation of the precinct by reintroducing the human hand to its construction – representing a technology of its place and used by its people and rethinking its contemporary potential. The success of this scheme, however, is predicated on its ability to mediate between the past and the present and between the traditional and the contemporary in function, design and technology.



Figure 100 _ Aerial view of the proposed intervention (Author, 2022)

4_Critical reflection

4.1_Initiation

The introduction of industrialised brickmaking by Kirkness in 1888 transformed Pretoria from a Cape Dutch stylistic transplant into a “city of brick” (Fisher, 1997:78). This dissertation was initialised as an investigation into the contemporary potentialities of brickwork, as it was brick that gave rise to the city’s regionalist aesthetic. In order to focus the dissertation, the theories of Regionalism, Craft, Tectonics and Heritage were investigated to establish a framework within which the study could be positioned. These theories hold particular interest for the author, whose normative position can be distilled as follows: the honest expression of material in the pursuit of contextually sensitive and appropriate architecture as the primary means for place-making.



Figure 101 _ Un-urbane street barrier (Author, 2022)

4.3_Application

The rethinking of brickwork as a contemporary technology revealed the wealth of research that seeks to enliven this age-old technology. The design development could, however, not only focus on demonstrating the prowess of the brick, but also had to contribute meaningfully to the experience of its envisioned users and the city at large. Desktop studies, precedent studies and research on architectural and urban design theory were undertaken in an attempt to create a public, urban construction campus, whilst also democratising the isolationist GPW precinct and thereby contributing meaningfully to its future role within the City of Tshwane.

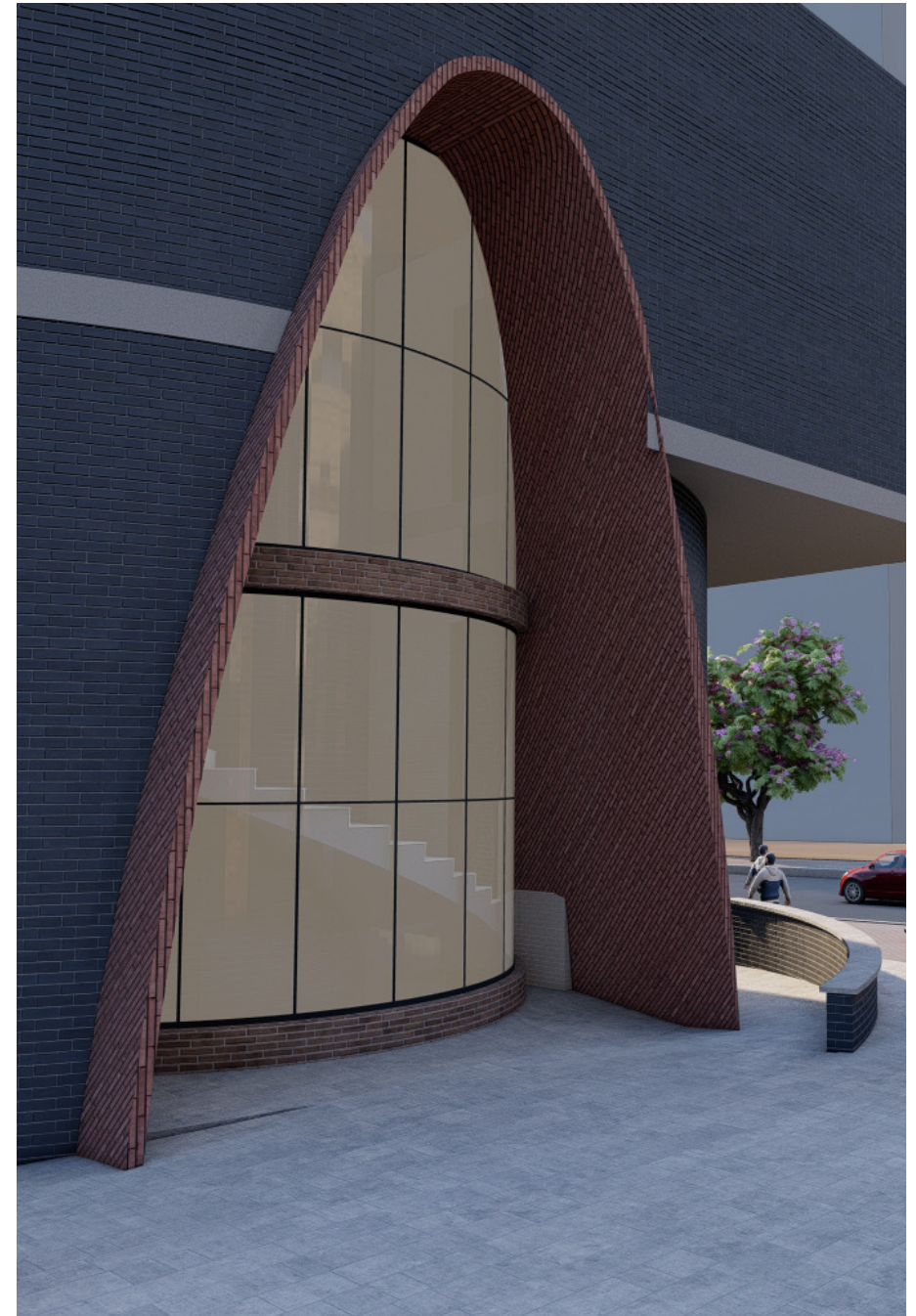


Figure 103 _ Applied research (Author, 2022)

4.4_Reflection and extension

The rethinking of brickwork as a contemporary technology initiated the dissertation, and the role of technological advances – even in a traditional material such as brick – was investigated. A normative position, predicated on a love of materials and their associated characteristics, underlie the technological investigation undertaken in this dissertation.

Technology was found to be a difficult initiator for architecture and its resultant form-giving, resulting in a continual re-evaluation of the author's design process throughout the year. A normative position that favours contextually sensitive and appropriate architecture was continuously re-assessed in an attempt to avoid object architecture. In previous years, the urban role of architecture was rarely examined by the author. The public nature and urban role of the proposed project, which is also focussed on in this dissertation, necessitated a thorough investigation of architecture's role in the making of meaningful urban spaces.

In transitioning to practice, the following adjustment to the author's design approach is believed to be valuable: the plan should act as the generator of form, and form should respond contextually and ultimately be manifested in technology.

To avoid stagnation in the use of materials, traditional and new material applications should continuously be reconsidered. This reconsideration becomes increasingly more achievable through advances in research, design tools and construction skills. It would, however, require that the architect becomes more involved in the manifestation of the design, thus removing the levels of separation seen in modern architectural practice, enabling a return of the *archi* (master) *tekon* (builder / craftsman).

This is the vision and normative position in accordance with which the author would pursue architectural practice.

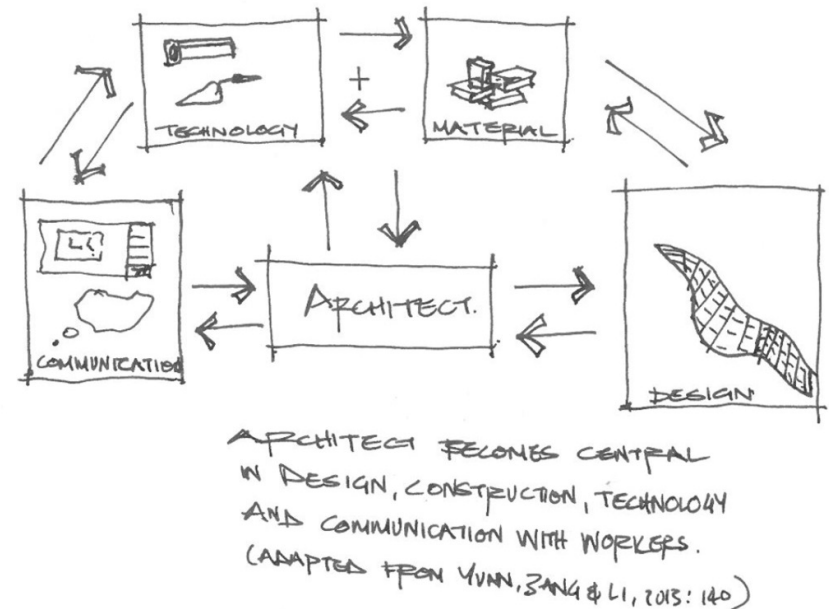


Figure 104 _ Diagram illustrating envisioned architectural practice, adapted from Yuan, Zhang & Li, 2013:140 (Author, 2022)

5_References

List of references

Abrahamse, J.E. & Clarke, N.J. 2014. The lure of the 'Golden Republic'. In: Bakker, K.A., Clarke, N.J. & Fisher, R.C. (eds). 2014. *Eclectic ZA Wilhelmiens: a shared Dutch built heritage in South Africa*: 25-48. Pretoria: Visual Books.

Abrahamse, J.E. 2014. The making of an architect. In: Bakker, K.A., Clarke, N.J. & Fisher, R.C. (eds). 2014. *Eclectic ZA Wilhelmiens: a shared Dutch built heritage in South Africa*: 7-23. Pretoria: Visual Books.

Adamson, G. 2010. *The craft reader*. English edition. Oxford: Berg.

ArchDaily. 2016. *Chi She / Archi-Union Architects*. [Online]. Available from: <https://www.archdaily.com/797505/chi-she-archi-union-architects> > ISSN 0719-8884 [Accessed: 1 June 2022].

ArchDaily. 2018. *Fjordenhus / Olafur Eliasson and Sebastian Behman with Studio Olafur Eliasson*. [Online]. Available from: <https://www.archdaily.com/896091/fjordenhus-studio-olafur-eliason-plus-sebastian-behmann> [Accessed 28 August 2022].

ArchDaily. 2021. *18 Unmissable projects by Eladio Dieste in Uruguay*. [Online]. Available from: <https://www.archdaily.com/966838/18-unmissable-projects-by-eladio-dieste-in-uruguay> [Accessed: 5 July 2022].

ArchDaily. 2008-2022. *Mapungubwe Interpretation Centre / Peter Rich Architects*. [Online]. Available from: <https://www.archdaily.com/57106/mapungubwe-interpretation-centre-peter-rich-architects> [Accessed: 2 September 2022].

Artefacts.co.za. n.d. Kirkness Bricks. [Online]. Available from: https://www.artefacts.co.za/main/Buildings/style_det.php?styleid=608 [Accessed: 14 April 2022].

Artefacts.co.za. n.d. Kirkness, John Johnston. [Online]. Available from: <https://www.artefacts.co.za/main/Buildings/archframes.php?archid=2671> [Accessed: 22 April 2022].

Auret, H. 2010. Toward the poetic in architecture. *South African Journal of Art History*, 25(2): 97-111. Available from: <http://hdl.handle.net/2263/17576>

Baan, I. 2008-2022. *Mapungubwe Interpretation Centre / Peter Rich*. [Image]. Available from: <https://www.archdaily.com/57106/mapungubwe-interpretation-centre-peter-rich-architects/5008ea7328ba0d27a7000c4b-mapungubwe-interpretation-centre-peter-rich-architects-photo> [Downloaded: 21 September 2022].

Baan, I. 2016. *Tate modern Switch House / Herzog & De Meuron*. [Image]. Available from: <https://www.archdaily.com/788076/tate-modern-switch-house-herzog-and-de-meuron/57430f3fe58eced183000027-tate-modern-switch-house-herzog-and-de-meuron-photo> [Downloaded: 17 October 2022].

Bakker, K.A. (ed.). 2012. *The African city centre: [Re]sourced. Proceedings of the African perspectives conference at the University of Pretoria, South Africa, 25-28 September 2009*. Pretoria: Department of Architecture, University of Pretoria.

Bakker, K.A. 2014. The 'Departement Publieke Werken'. In: Bakker, K.A., Clarke, N.J. & Fisher, R.C. (eds). 2014. *Eclectic ZA Wilhelmiens: a shared Dutch built heritage in South Africa*: 67-89. Pretoria: Visual Books.

Bakker, K.A., Clarke, N.J. & Fisher, R.C. (eds). 2014. *Eclectic ZA Wilhelmiens: a shared Dutch built heritage in South Africa*. Pretoria: Visual Books.

Barker, A. 2013. Craft and intellect: Materiality in the domestic architecture of Gawie Fagan. *South African Journal of Art History*, 28(2): 1-17. Available from: <http://hdl.handle.net/2263/39878>

Barker, A. 2014. The genesis and development of type: NZASM buildings and structures (1890-1900). In: Bakker, K.A., Clarke, N.J. & Fisher, R.C. (eds). 2014. *Eclectic ZA Wilhelmiens: a shared Dutch built heritage in South Africa*. Pretoria: Visual Books.

Barker, A. 2015. *Identity in South African Architecture*. DOI: 10.13140/RG.2.1.1151.9127.

Barker, A. 2016. *Memory in South African Architecture*. DOI: 10.13140/RG.2.1.4821.9283.

Barker, A. 2015. *Legacy in South African Architecture*. DOI: 10.13140/RG.2.1.3773.3527.

Barker, A.A.J. 2012. *Heterotrophic syntheses: Mediation in the domestic architecture of Gabriel (Gawie) Fagan* (Unpublished Doctoral Thesis). Pretoria: University of Pretoria. Available from: <http://hdl.handle.net/2263/28137>

Barker, A.A.J. 2020. Limiting binary thinking: Architectural design in historic urban contexts. *South African Journal of Art History*, 35(2): 121-149. Available from: <http://hdl.handle.net/2263/82115>

Basch, S.J. 2019. Meesterbouer van Pretoria. *Familia*, 56(3): 42-48. Available from: <https://hdl.handle.net/10520/ejc-familia-v56-n3-a6>

Borden, I. & Ray, K. R. 2006. *The dissertation: an architecture student's handbook*. 2nd edition. Amsterdam: Architectural Press.

Brink, B. 2012. Built with Sand, Rock and Broederbond: Brian Sandrock's buildings for the University of Pretoria and the University of South Africa. *South African Journal of Art History*, 27(3): 1-27. Available from: <https://hdl.handle.net/10520/EJC130692>

Canizaro, V.B. (ed.). 2007. *Architectural regionalism: Collected writings on place, identity, modernity, and tradition*. New York: Princeton Architectural Press.

Castro, A. 2021. The modelling process of the Tate Modern brick facade by Herzog & de Meuron. *Nexus network journal*, 23(4): 1039-1053. DOI: <https://doi.org/10.1007/s00004-021-00572-x>

César Martinell & Associates. Wine cellar in Pinell de Brai. [Online]. Available from: <http://cesarmartinell.com/projects/wine-cellar-pinell-de-brai-spain-1918/> [Downloaded: 21 September 2022].

City of Tshwane. Department of Economic Planning and Spatial Development. 2021. *Tshwane Metropolitan Spatial Development Framework, 2030*. [Online]. Available from: <https://www.tshwane.gov.za/sites/Departments/Economic%20Development%20and%20Spatial%20Planning/Pages/MSDF.aspx> [Accessed: 23 March 2022].

Clarke, N.J. & De Villiers, A. 2015. Church Square, the Old Synagogue and the Old Government Printing Works: Three historic places for testing strategic intervention. In: Clarke, N.J. & Kuipers, M.C. (eds). 2015. *Re-centring Tshwane: urban heritage strategies for a resilient capital*: 63-83. [Online]. Pretoria: Visual Books. Available from: <http://hdl.handle.net/2263/49734> [Accessed: 14 April 2022].

Clarke, N.J. & Kuipers, M.C. (eds). 2015. *Re-centring Tshwane: urban heritage strategies for a resilient capital*. [Online]. Pretoria: Visual Books. Available from: <http://hdl.handle.net/2263/49734> [Accessed: 14 April 2022].

Clarke, N.J. & Lourens, F. 2015. Urban planning in Tshwane: addressing the legacy of the past. In: Clarke, N.J. & Kuipers, M.C. (eds). 2015. *Re-centring Tshwane: urban heritage strategies for a resilient capital*: 39-51. [Online]. Pretoria: Visual Books. Available from: <http://hdl.handle.net/2263/49734> [Accessed: 14 April 2022].

De Larrea Remiro, D. 2018. *Fjordenhus / Olafur Eliasson and Sebastian Behmann with Studio Olafur Eliasson*. [Image]. Available from: https://www.archdaily.com/896091/fjordenhus-studio-olafur-eliason-plus-sebastian-behmann/5b1d9181f197cc1a81000036-fjordenhus-studio-olafur-eliason-plus-sebastian-behmann-photo?next_project=no [Downloaded: 28 August 2022].

Department of Environmental Affairs. 2016. *Cultural heritage survey guidelines and assessment tools for protected areas in South Africa*. [Online]. Available from: https://www.dfe.gov.za/sites/default/files/legislations/culturalheritagesurveyguidelines_protectedareas2016_0.pdf (Accessed: 5 May 2022).

Department of Higher Education and Training. 2022. Skills Development Act, 1998 (Act no. 97 of 1998) National Apprenticeship and Artisan Development Strategy 2030. *Government Gazette*. (No. 47061). Available from: <https://www.dhet.gov.za/Skills%20Development/National%20Apprenticeship%20and%20Artisan%20Development%20Strategy%202030.pdf> [Accessed: 23 July 2022].

Dunston, L & Dunston, T. 1975. *Young Pretoria, 1889-1913*. Pretoria: publisher not identified.

Fisher, R.C. 1997. Norman Eaton – Some influences on his insights. *South African Journal of Cultural History*, 11(2): 68-83. Available from: <http://hdl.handle.net/2263/8027>

Fisher, R.C. 1998. The native heart: The architecture of the University of Pretoria campus. In: Judin, H., Vladislavic I. & Nederlands Architectuurinstituut (eds.). 1998. *Blank--: architecture, apartheid and after*: 220-235. Rotterdam: NAI. Available from: <http://hdl.handle.net/2263/7348>

Frampton, K. 1983. Towards a critical regionalism: Six points for an architecture of resistance. In: Foster, H. (ed.) 1983. *The anti-aesthetic: Essays on post-modern culture*: 16-30. Port Townsend, Washington: Bay Press.

Frampton, K. 1990. Rappel a l'ordre, the case for the tectonic. In: Nesbitt, K. (ed.). 1996. *Theorizing a New Agenda for Architecture an Anthology of Architectural Theory 1965-1995*: 516-528. New York: Princeton Architectural Press.

Frampton, K. 2007. Critical regionalism: Modern architecture and cultural identity. In: Frampton, K. 2007. *Modern architecture: A critical history*: 314-327. 4th edition. London: Thames and Hudson Ltd.

Frampton, K., Cava, J. & Graham Foundation for Advanced Studies in the Fine Arts. 1995. *Studies in tectonic culture: the poetics of construction in nineteenth and twentieth century architecture*. Cambridge, Massachusetts: MIT Press.

Fraser, M. (ed). 2014. *Design research in architecture: An overview*. Burlington, Vermont: Ashgate Publishing Company.

Freeman, C.G. 2020. Unhistoric Townhouse [Tribeca, New York, USA]: System Architects. Akin to "fabric that twists and flows in the wind," the audacious brick facade of this townhouse spearheads a new urban language for the historic New York district of Tribeca by drawing on its past. *Architecture Australia*, 109(1): 90-95. Available from: *Avery Index to Architectural Periodicals* database: <https://web-s-ebSCOhost-com.uplib.idm.oclc.org/ehost/pdfviewer/pdfviewer?vid=1&sid=d2478d12-b749-43ca-897c-356e2fbbdc33%40redis> [Accessed: 21 May 2022].

Gehl, J. 1987. *Life between buildings: Using public space*. Translated by J Koch. New York: Van Nostrand Reinhold.

Green Building Council South Africa. GBCSA energy and water benchmark methodology – final report. Available from: <https://gbcSA.org.za/wp-content/uploads/2017/12/Methodology-Report.pdf> [Accessed: 26 September 2022].

Groat, L.N. & Wang, D. 2013. *Architectural Research Methods*. [ProQuest Ebook Central]. Somerset: John Wiley & Sons Incorporated. Available from: <https://ebookcentral-proquest-com.uplib.idm.oclc.org/lib/pretoria-ebooks/detail.action?docID=1166322#>

Hansen, L.C. 2009. Urban interventions: Approach to urban regeneration in South Africa since 1994. In: Bakker, K.A. (ed.). 2012. *The African city centre: [Re]sourced. Proceedings of the African perspectives conference at the University of Pretoria, South Africa, 25-28 September 2009*. Pretoria: Department of Architecture, University of Pretoria.

Harris, H.H. 1958. Regionalism and Nationalism in Architecture. In: Canizaro, V.B. (ed.). 2007. *Architectural regionalism: collected writings on place, identity, modernity, and tradition*: 57-64. New York: Princeton Architectural Press.

Harris, H.H. 1978. Regionalism. In: Canizaro, V.B. (ed.). 2007. *Architectural regionalism: Collected writings on place, identity, modernity, and tradition*: 67-69. New York: Princeton Architectural Press.

Hensel, D.S. & Bover, G.B. 2015. A developmental route to local specificity: Nested catenaries. *Architectural Design*, 85(2): 120-127. Available from: *Avery Index to Architectural Periodicals* database: <https://search-ebSCOhost-com.uplib.idm.oclc.org/login.aspx?direct=true&db=bvh&AN=729733&site=ehost-live&scope=site> [Accessed: 1 July 2022].

Hensel, D.S. 2008. Complex brick assemblies. *Architectural Design*, 78(2): 64-73. Available from: *Avery Index to Architectural Periodicals* database: <https://search-ebSCOhost-com.uplib.idm.oclc.org/login.aspx?direct=true&db=bvh&AN=698746&site=ehost-live&scope=site> [Accessed: 1 July 2022].

Hofstee, E. 2006. *Constructing a good dissertation: a practical guide to finishing a master's, mba or phd on schedule*. Sandton, South Africa: EPE.

Hudson, J. 2012. *Architecture from commission to construction*. London: Laurence King Publishing Ltd. Available from: <https://search-ebSCOhost-com.uplib.idm.oclc.org/login.aspx?direct=true&db=nlebk&AN=926145&site=ehost-live&scope=site> [Accessed: 29 August 2022].

Hudson, J. 2012. Peter Rich Architects with Michael Ramage and John Ochsendorf – Mapungubwe Interpretation Centre, Mapungubwe National Park, Limpopo Province, South Africa, 2010. In: Hudson, J. 2012. *Architecture from commission to construction*. London: Laurence King Publishing Ltd. Available from: <https://search-ebSCOhost-com.uplib.idm.oclc.org/login.aspx?direct=true&db=nlebk&AN=926145&site=ehost-live&scope=site> [Accessed: 29 August 2022].

Hurcombe, L. 2007. A Sense of Materials and Sensory Perception in Concepts of Materiality. *World Archaeology*, 39(4): 532-545. Available from <http://www.jstor.org/stable/40026147> [Accessed: 10 April 2022].

Hurst, R. 2017. Research through Design. *Architecture Australia*, 106(2):17-18. Available from: *Avery Index to Architectural Periodicals* database: <https://web-s-ebSCOhost-com.uplib.idm.oclc.org/ehost/pdfviewer/pdfviewer?vid=0&sid=aecb9452-4d0d-416a-b4b0-10c5f50e8f62%40redis> [Accessed 18 May 2022].

Hutchinson, M. 2017. Strange tangents. *Oz / College of Architecture and Design Kansas State University*, 39: 12-19. DOI: <http://dx.doi.org/10.4148/2378-5853.1563>

Imbern, M. 2014. (Re)thinking the brick: Digital tectonic masonry systems. *Proceedings of the 19th International Conference on Computer-Aided Architectural Design Research in Asia*. DOI: 10.52842/conf.caadria.2014.211

Klinger, K. 2001. Making digital architecture: Historical, formal, and structural implications of computer controlled fabrication and expressive form. *Architectural Information Management [19th eCAADe Conference Proceedings / ISBN 0-9523687-8-1] Helsinki (Finland), 29-31 August 2001*: 239-244. DOI: <https://doi.org/10.52842/conf.ecaade.2001.239>

Kotze, P. 2016. Craft in architecture. *Architecture South Africa. Journal of the South African Institute of Architects*, 82:2.

Le Roux, S.W. & Botes, N. 1991. *Plekke en geboue van Pretoria: 'n Oorsig van hulle argitektoniese en stedelike belang*. (Volume 2). Pretoria: Stadsraad van Pretoria. Available from: <http://hdl.handle.net/2263/11328>

LeCuyer, A. 2001 *Radical tectonics*. London: Thames & Hudson (4 x 4 Series).

Lefavre, L. & Tzonis, A. 2003. *Critical regionalism: Architecture and identity in a globalized world*. Munich: Prestel (Architecture in focus).

Lipman, A. 2004. Architecture, heritage, history, memory. *Acta Structilia*, 11(1&2): 44-60. Available from: <https://journals.ufs.ac.za/index.php/as/article/view/1925>

Louw, M.P. 2021. *The search for hybrid tectonics in contemporary African architecture: encounters between the global and the local* (Doctoral Thesis). Cape Town: University of Cape Town. Available from: <http://hdl.handle.net/11427/35893>

Louwrens, L.J. 2006. The origin and Meaning of the place name Tshwane. *South African Journal of Cultural History*, 20(1):100-124. Available from: <https://hdl.handle.net/10520/EJC30654>

McCarter, R. and Pallasmaa, J. 2012. *Understanding architecture: A primer on architecture as experience*. London: Phaidon Press Limited.

McCullough, M. 1997. Abstracting craft: The practiced hand. In: Adamson, G. 2010. *The craft reader*. English edition. Oxford: Berg. pp. 310-316.

Mehta, V. 2013. Making sociable streets: Guidelines and application. In: Mehta, V. 2013. *The street: A quintessential social public space*. Abingdon, Oxon: Routledge (Earthscan). DOI: 10.4324/9780203067635

Mehta, V. 2013. *The street: A quintessential social public space*. Abingdon, Oxon: Routledge (Earthscan). DOI: 10.4324/9780203067635

National Heritage Resources Act 25 of 1999. 1999. *Government Gazette*. (No19974). Available from: https://www.gov.za/sites/default/files/gcis_document/201409/a25-99.pdf [Accessed: 5 May 2022].

Naude, M. 1991 Pretoria se eie braak. In: Le Roux, S.W. & Botes, N. 1991. *Plekke en geboue van Pretoria: 'n Oorsig van hulle argitektoniese belang*. (Volume 2). Pretoria: Stadsraad van Pretoria. Available from: <http://hdl.handle.net/2263/11328>

Oke, A. Ngwenya, L. Aigbavboa¹, C. & Khangale, T. 2019. Mitigating Skills Shortage in the South African Construction Industry. *Proceedings of the Construction in the 21st Century 11th International Conference (CITC11) held in London*. [Online]. Available from: https://www.researchgate.net/publication/335831226_Mitigating_Skills_Shortage_in_the_South_African_Construction_Industry [Accessed: 25 April 2022].

Oliveira, R. n.d. *Cristo Obrero church*. [Image]. Available from: <https://befrontmag.com/2016/10/17/inside-iglesia-del-cristo-obrero/> [Downloaded: 6 May 2022].

Orbaşlı, A. 2008. *Architectural conservation: Principles and practice*. Malden, MA: Blackwell Science.

Overall, S., Rysavy, J.P., Miller, C., Sharples, W., Sharples, C., Kumar, S., Vittadini, A. & Saby, V. 2018. Made-to-measure: Automated drawing and material craft. *Technology|Architecture + Design*, (2)2: 172-185. DOI: 10.1080/24751448.2018.1497365

Ozkan, S. 1985. Regionalism within Modernism. In: Canizaro, V.B. (ed.). 2007. *Architectural regionalism: Collected writings on place, identity, modernity, and tradition*: 103-109. New York: Princeton Architectural Press.

Palacio, J. 2012. Material tour de force: The work of Eladio Dieste. [Online]. *The architectural league NY*. Available from: <https://archleague.org/article/material-tour-de-force-the-work-of-eladio-dieste/> [Accessed: 5 May 2022].

Pallasmaa, J. & MacKeith, P.B. 2006. (eds.). *Archipelago: essays on architecture: For Juhani Pallasmaa*. Helsinki: Rakennustieto.

Pallasmaa, J. 2000. Hapticity and Time: Notes on Fragile Architecture. *Architectural Review*, (1239): 78-84.

Picton, L.J. 1969. *Being some account of the history of the printing, packaging and newspaper industry of South Africa, and of the National Industrial Council for Printing, prepared to mark the Jubilee of the Council 1919-1969* (Masters Dissertation). Cape Town: University of Cape Town. Available from: <http://hdl.handle.net/11427/28911>

Ponce de Leon, M. 2011. Digital craft. *Oz / College of Architecture and Design Kansas State University*, 33: 68-73. DOI: <https://doi.org/10.4148/2378-5853.1494>

Ramage, M.H., Ochsendorf, J.A., Block, P. & Rich, P. 2008. Advanced geometry, rudimentary construction: Structural form finding for unreinforced thin-shell masonry vaults. *Proceedings of the Advances in Architectural Geometry Conference*. Available from: <https://block.arch.ethz.ch/brg/files/ramage.pdf> [Accessed: 29 August 2022].

Sekler, E.F. 1965. *Structure, construction and tectonics*. [Online]. Available at: https://610f13.files.wordpress.com/2013/10/sekler_structure-construction-tectonics.pdf [Accessed 20 April 2022].

Smith, A. & Warke, V.K. 2014. *The language of architecture: 26 principles every architect should know*. Beverly, Massachusetts: Rockport.

Sobejano, E., Gabriel, A. & Fuchs, C. 2011. "Architecture must react to what is already there" - a conversation with Enrique Sobejano. *Detail (English ed.)*, 2: 122-128. Available from: *Avery Index to Architectural Periodicals* database: <https://web-s-ebscohost-com.uplib.idm.oclc.org/ehost/pdfviewer/pdfviewer?vid=0&sid=75ca9f77-1866-47a6-bb23-3571bd5e7e18%40redis> [Accessed: 15 March 2022].

South African Association of Consulting Engineers 2015. *Annual review*. Available from: <https://www.cesa.co.za/AnnualReview2015/mobile/index.html#p=1> [Accessed: 26 April 2022].

Stein, J.G. 2011. Speculative Artisanry: The Expanding Scale of Craft within Architecture. *The Journal of Modern Craft*, 4(1): 49-63. DOI: 10.2752/174967811X12949160068811

Steyn, G. & Nkambule, E. 2017. An assessment of Henri Comrie's aspiration to achieve well-crafted architecture. *South African Journal of Art History*, 32(2): 174-189. Available from: <https://hdl.handle.net/10520/EJC-daadf3839>

Su, S. 2016. *Chi She / Archi-Union Architects*. [Image]. Available from: <https://www.archdaily.com/797505/chi-she-archi-union-architects/5804c858e58ece9e4e000007-chi-she-archi-union-architects-photo> [Downloaded: 1 June 2022].

Swanepoel, R. (2010, April). [Electronic newsletter]. Rosa Swanepoel Collection. [Online]. Architecture Archtves. Department of Architecture. University of Pretoria, Hatfield, Pretoria. Available from: <http://hdl.handle.net/2263/13915> [Accessed: 24 June 2022].

Swanepoel, R. (2013, August). [Electronic newsletter]. Rosa Swanepoel Collection. [Online]. Architecture Archives. Department of Architecture. University of Pretoria, Hatfield, Pretoria. Available from: <http://hdl.handle.net/2263/22056> [Accessed: 24 June 2022].

System Architects. n.d. *Unhistoric townhouse*. [Online]. Available from: <https://systemarchitects.com/Franklin> [Accessed: 5 May 2022].

University of Pretoria. 2012. *Code of ethics for scholarly activities S 4755/12*. Pretoria: University of Pretoria. Available from: https://www.up.ac.za/media/shared/206/code-of-ethics_2012.zp146788.pdf

Van Diemen, P., Heijdra, T., Koers, N., Van de Leeden, C., Pater, R. & Wansing, R. 2018. *A work of art in brick: significance and restoration of Het Schip, Amsterdam, an icon of social housing and architecture, 1919-1921*. Translated by T. Koers and A. Goldstein. Amsterdam: Amsterdam School Museum Het Schip.

Van Vollenhoven, A.C. 2005. Die eerste blanke bewoner van die Pretoria omgewing. *South African Journal of Cultural History*, 19(2):17-45. Available from: <https://hdl.handle.net/10520/EJC30636>

Van Vollenhoven, A.C. 2006. Die prehistoriese en vroeë historiese tydvak in Pretoria. *South African Journal of Cultural History*, (20)2:176-200. Available from: <https://hdl.handle.net/10520/EJC30667>

Verbeke, J. 2014. This is Research by Design. In: Fraser, M. (ed). 2014. *Design research in architecture: An overview*: 137-159. Burlington, Vermont: Ashgate Publishing Company.

Whyte, J. 2015. Towards a new craft of architecture. *Building Research & Information*, 43(2): 263-265. DOI: 10.1080/09613218.2015.962240

Wu, J., Wei, H. & Peng, L. 2019. Research on the evolution of building technology based on regional revitalization. *Buildings*, 9(7): 165. DOI: 10.3390/buildings9070165

Yuan, P. & Keke, L. 2020. Novel bricks: A scenario of human-machine collaboration. *Architectural Design*, 90(5): 22-29. DOI: 10.1002/ad.2607

Yuan, P.F., Zhang, M. & Han, L. 2013. Low-tech digital fabrication: Traditional brick as material in digital practice. *Proceedings of the International Conference on Computer-Aided Architectural Design Futures*. DOI: 10.1007/978-3-642-38974-0_13

Zhonghai, S. J-Office & silk wall. [Image]. Available from: <http://www.archi-union.com/Homes/Projectshow/index/pageid/4/id/47> [Downloaded: 2 June 2022].

Zhonghai, S. n.d. Silk wall. [Image]. Available from: <https://www.area-arch.it/en/silk-wall/> [Downloaded: 1 June 2022].

6_Addendum



Figure 106_ Site plan (Author, 2022)

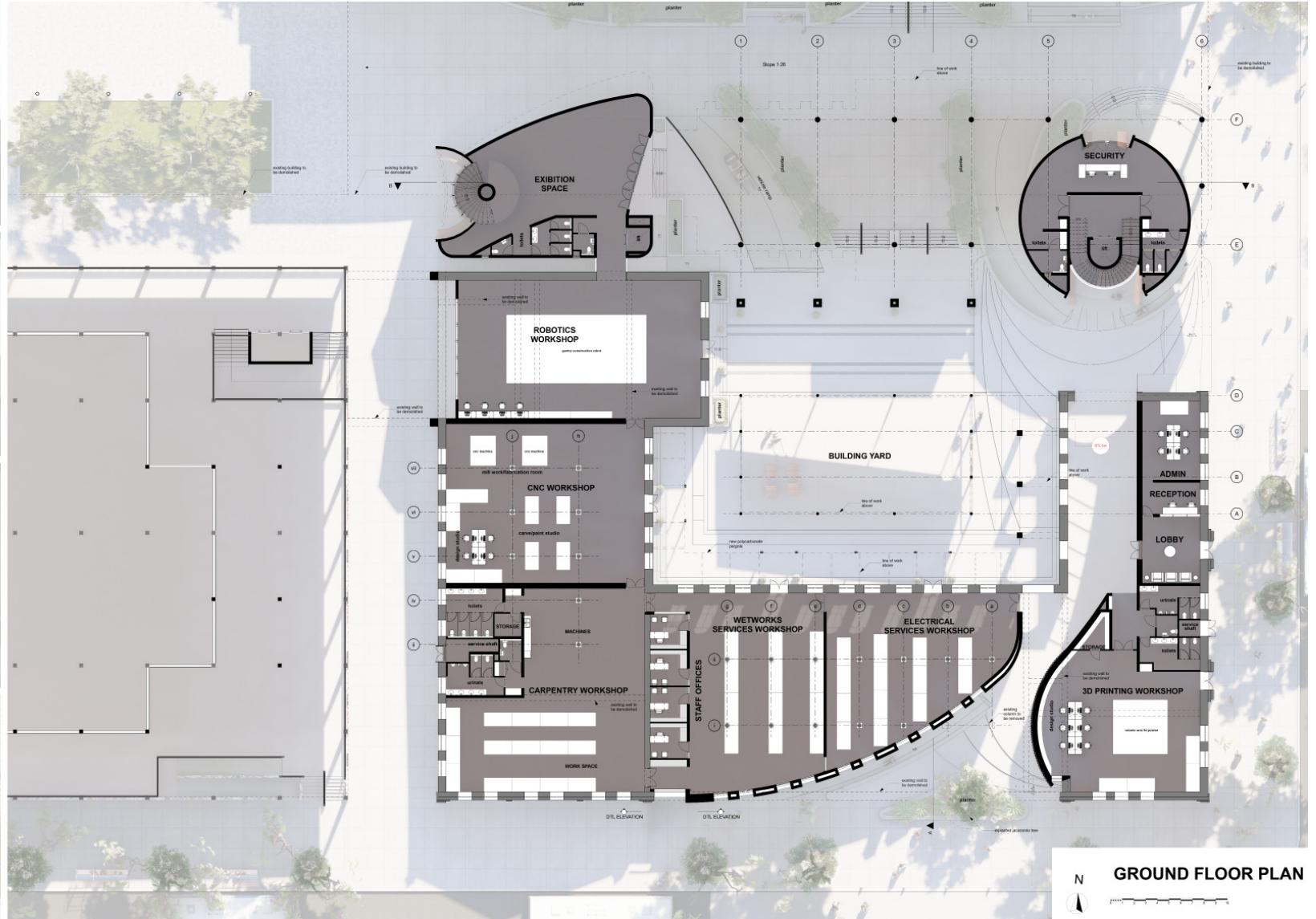


Figure 107 _ Ground floor plan (Author, 2022)

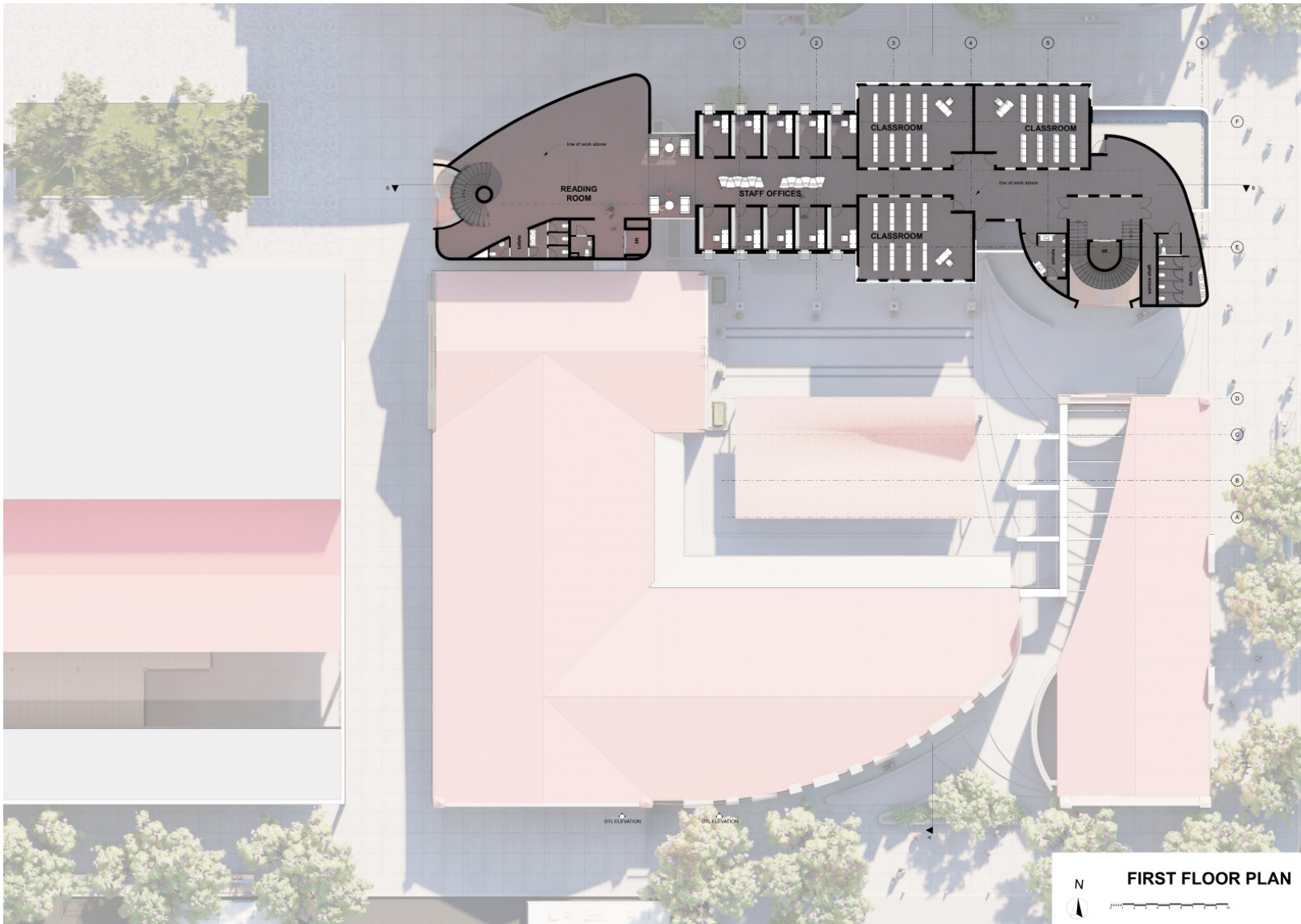


Figure 108 _ First floor plan (Author, 2022)

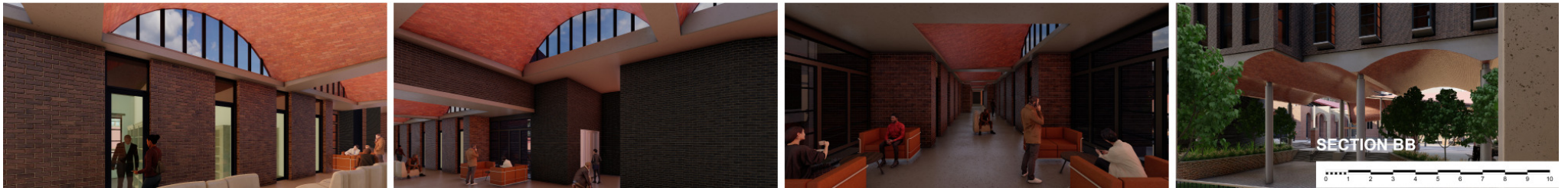
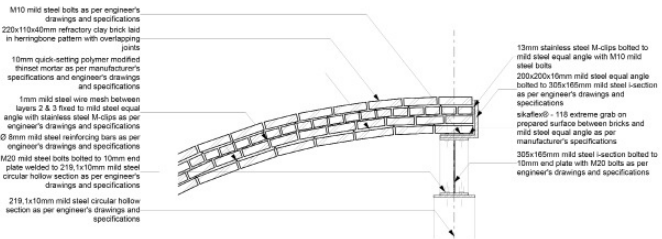
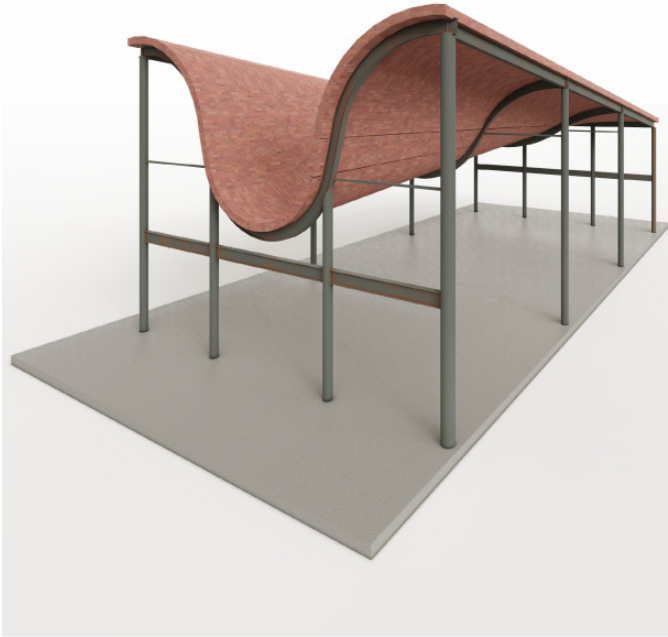


Figure 110_ Section BB (Author, 2022)



Ruled Surface Shell Detail



Elevation Detail

Figure 111 _ Key details (Author, 2022)

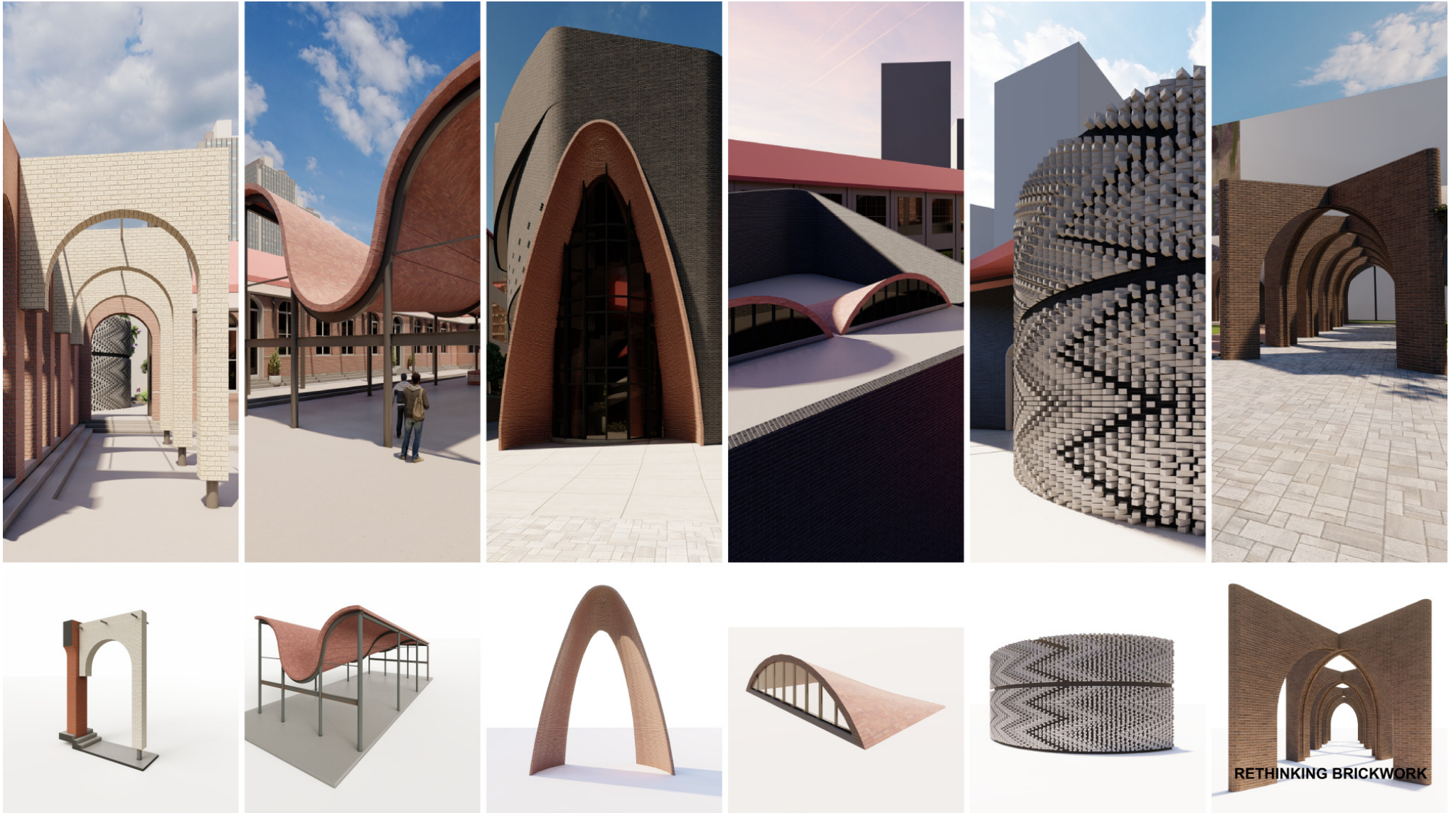


Figure 112_ Key brick technologies (Author, 2022)