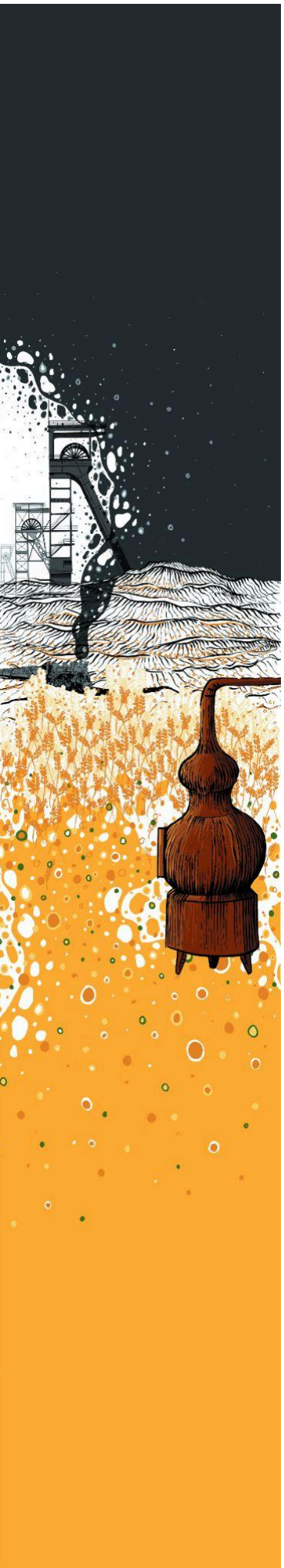

Converging Motions:

A Civic space for Reactivating Middelburg's Low-tech Industrial Crafts

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Abstract

This project is located in a small town in the Mpumalanga Highveld region. Middelburg is a farming and coal-mining community that has faced neglect because of the recent mine closures and ongoing pollution generated from the mines. This is not only an economic issue, with jobs being lost, but also an environmental one, as the abandoned mines have yet to be rehabilitated. Historically, Middelburg grew into an economic hub as its railway tracks connected Gauteng with the South African border. The Nederlandse Zuid-Afrikaanse Spoorweg Maatschappij (NZASM) structures formed part of the first South African railway system, operating independently of British lines. Over time, however, the reliance on rail decreased, as coal transport shifted to trucks, leaving many of these once-crucial structures abandoned. The NZASM Middelburg Railway Station acts as the leading site for this project as the railway station connects all of the rehabilitated mine sites through the railway lines. It is based in the old industrial area of Middelburg where hand-based manufacturing is still utilised. The primary client of this project is Johan Jansen van Rensburg, the Middelburg Railway Station's conservator. The stakeholders are the Passenger Rail Agency of South Africa and TRANSNET as the station grounds are owned by these entities.

In previous years, Middelburg had many culturally diverse small-scale economic activities. Many of these activities involved hand-based crafted elements but later faded as mass production became the norm. Some crafts still reside in the old industrial area, including carpentry and metal smithery. This project seeks to revive Middelburg's “economic hub” role by rehabilitating the surrounding open-cast coal mines through grain agriculture. Grain farming, particularly wheat, is known for restoring degraded soil, including former mining sites. It will allow for the end product to be utilised on-site as building materials and programmes on-site. Initially, the wheat produced will be too contaminated for consumption and will have to go through a “cleaning process”. The chosen process for this initiative is distilling as it has been researched to remove toxic chemicals from produce. Wheat produces neutral grain spirits that serve as the base of products, such as Gin or Mampoer. Secondary programmes consist of hand-based crafting workshops and a craft market to act as a catalyst for physical and economic growth. The entire site will act as a civic or gathering space for the people of Middelburg as the site is placed in an economically prominent and heritage-filled area. The railway station consists of two main buildings: the NZASM Middelburg Station and the adjacent NZASM Workshop. After years of abandonment, the station has been restored and now houses a railway museum and restaurant. Weekend markets on-site bring local street vendors together to showcase and sell handmade crafts, and even sell products from businesses in the old industrial area. The workshop, meanwhile, served as a storage area for railway equipment but intends to be reused as a workshop for the local craftspeople. The project proposes interventions to reinstate Middelburg as a craft-based economic hub as many of these products can be distributed via the railway tracks or traded on-site.

Building technology for this project draws inspiration from the history of NZASM structures, addressing how site-specific construction methods can be applied. Originally, NZASM buildings were erected swiftly to capitalize on the economic growth driven by the railway. Temporary structures were designed for quick assembly and disassembly using prefabricated, modular timber and metal components—a method aligned with the craft traditions of the local industrial area. In contrast, the final permanent structures were crafted through meticulous carving of locally mined sandstone blocks. Each craftsperson marked their blocks with a unique pattern as a record of their day's work, adding a distinct, patterned beauty to the sandstone surfaces and reflecting individual craftsmanship. This juxtaposition between temporary and permanent forms the technological basis for this project. This project aims to revitalize degraded spaces, particularly in smaller towns like Middelburg. Just as mine sites are rehabilitated into agricultural land to improve air and soil quality while producing crops, this project reimagines other neglected sites, notably the historic Middelburg Railway Station, breathing new life into structures rich in heritage and community significance. Its primary objective is to create a civic space where Middelburg's residents can gather to engage with local crafts. The project also integrates diverse scales of craftsmanship within the industrial district, with each scale informing adaptable design solutions. The site's historical context, along with local skills and emerging technologies, has influenced the project conceptually and contributed to the design's success.

Project details

Title	Converging Motions: A Civic for Reactivating Middelburg's Low-tech Industrial Crafts
Type of building/programme	**Main:** Distillery **Secondary:** Carpentry, metalsmiths, weaving and glass blowing workshops (*workshops relate to the existing old industrial and indigenous crafts in the area*)
Address	Cnr Weeber and Meyer St, Central, Middelburg, 1055
Context and GPS coordinates	Middelburg Railway Station based in the Old Industrial area 25°46'24"S 29°28'13"E
Departmental research field	**Broader chosen study field:** Memory, legacy and identity **Specific focus within study field:** The use of Emerging Building Technologies in South African architecture. Focused on indigenous technologies and participatory design
Client	PRASA, Steve Tshwete Local Municipality and Johan Jansen van Rensburg
Theoretical premise	The value of involving craft and community in the design and construction process. (*The site has a rich history of craft in the form of the NZASM railway structures and the old industrial crafts still practiced*)

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Project Brief and background

Project issues

Middelburg is a small town located in the Mpumalanga Highveld region. It is a coal-mining and grain-farming community that has faced neglect because of the recent mine closures and ongoing pollution generated from the mines. This is not only an economic issue, with jobs being lost, but also an environmental one, as the abandoned mines have yet to be rehabilitated. Historically, Middelburg thrived as an economic hub, facilitating coal distribution between Gauteng and Mozambique via the eastern Nederlandse Zuid-Afrikaanse Spoorweg Maatschappij (NZASM) Railway line. These railway structures formed part of the first South African railway system, operating independently of British lines. Over time, however, the reliance on rail decreased, as coal transport shifted to trucks. This has drastically decreased the use of the railway lines although all are still in working order. This provides the opportunity for South Africa to reestablish the railway lines for the transportation of goods and passengers.

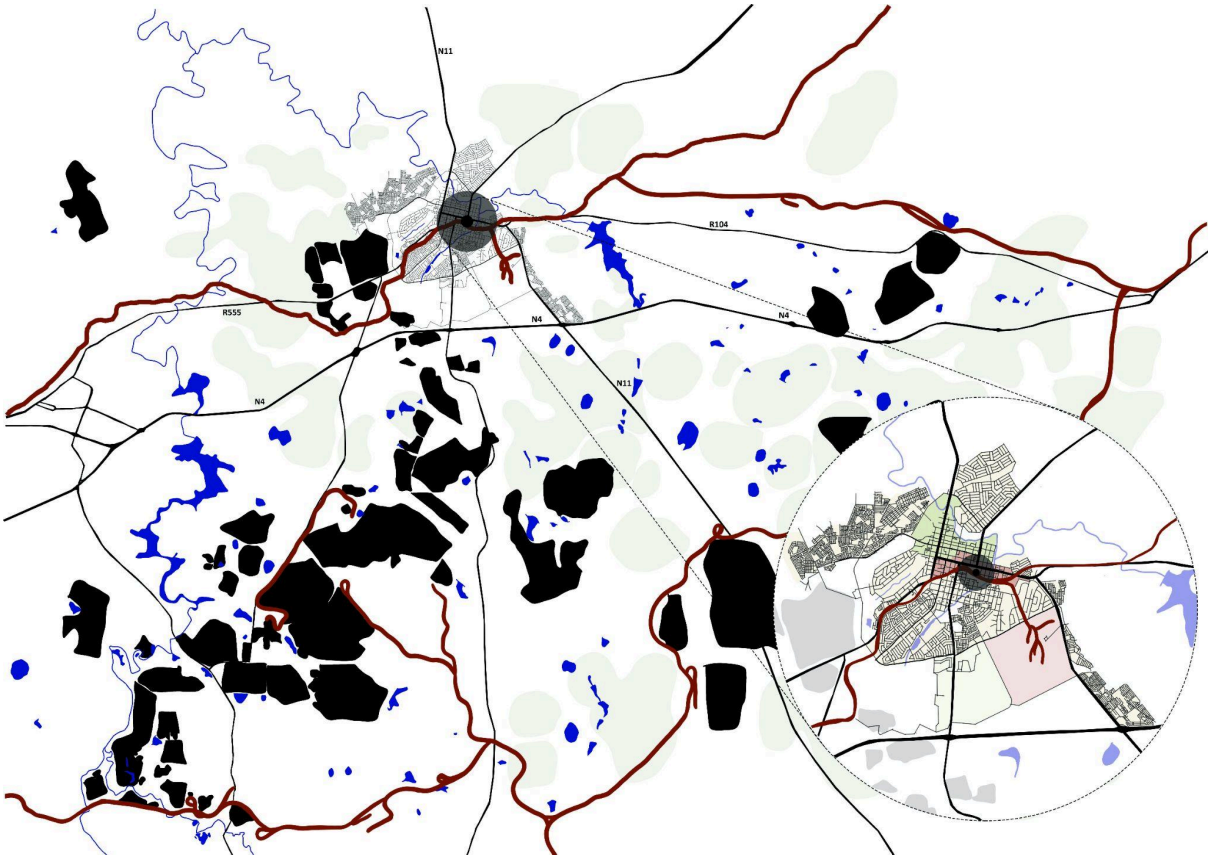


Fig 1: Mines surrounding Middelburg

Programme and users

This project seeks to revive Middelburg's “economic hub” role by rehabilitating the surrounding open-cast coal mines through grain agriculture. Grain farming, particularly

wheat, is known for restoring degraded soil, including former mining sites (Engineeringnews, 2022). The process involves returning topsoil, adding nutrients and organic matter, planting deep-rooted grasses, and eventually sowing wheat. Over time, as the wheat grows, it helps draw toxic chemicals from the soil, facilitating the land's future usability for other purposes. Initially, the wheat produced will be too contaminated for consumption and will have to go through a “cleaning process”. The chosen process for this initiative is distilling as it has been researched to remove toxic chemicals from produce. The distillation process involves milling, fermenting, distilling as the cleaning process, condensing and infusion. Wheat produces neutral grain spirits that serve as the base of products, such as Gin or Mampoer.

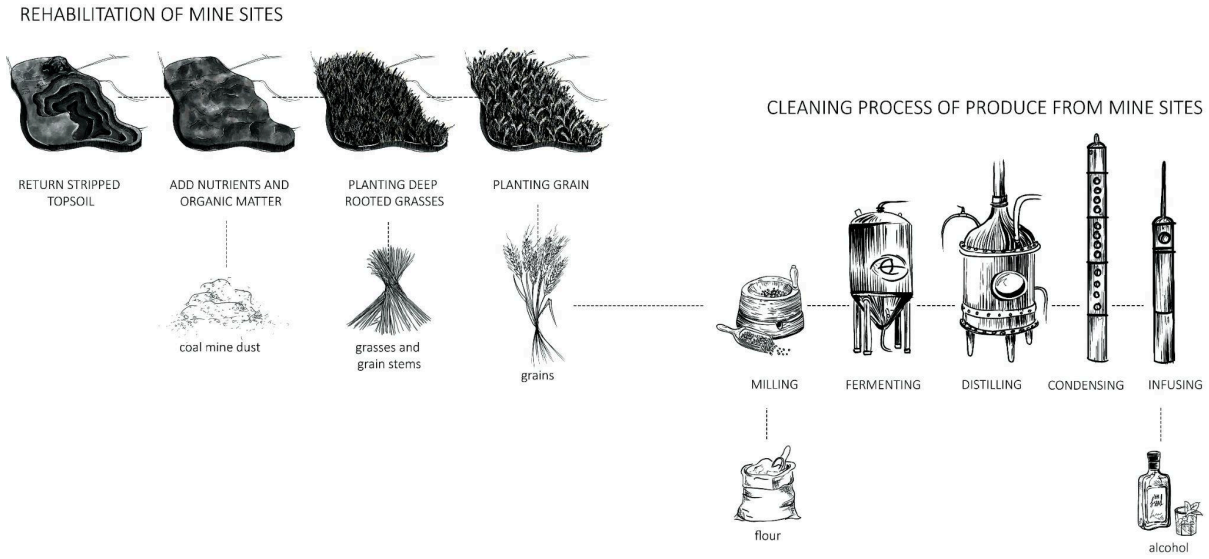


Fig 2: Mine rehabilitation and Distilling process

The NZASM Middelburg Railway Station is connected to the rehabilitated mine sites through the existing railway lines, which will serve as the production hub for distilling alcohol. Located in the old industrial area, this station is surrounded by craftspeople skilled in carpentry, weaving, metal smithery, and boiler-making (notably mampoer distillers). Unused silos nearby offer space for wheat storage, and the involvement of local informal traders and a technical school could provide further benefits to the community.

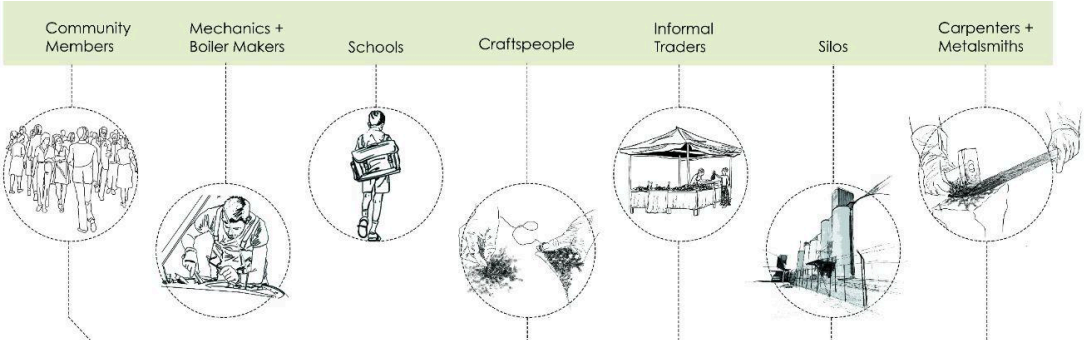


Fig 3: Users

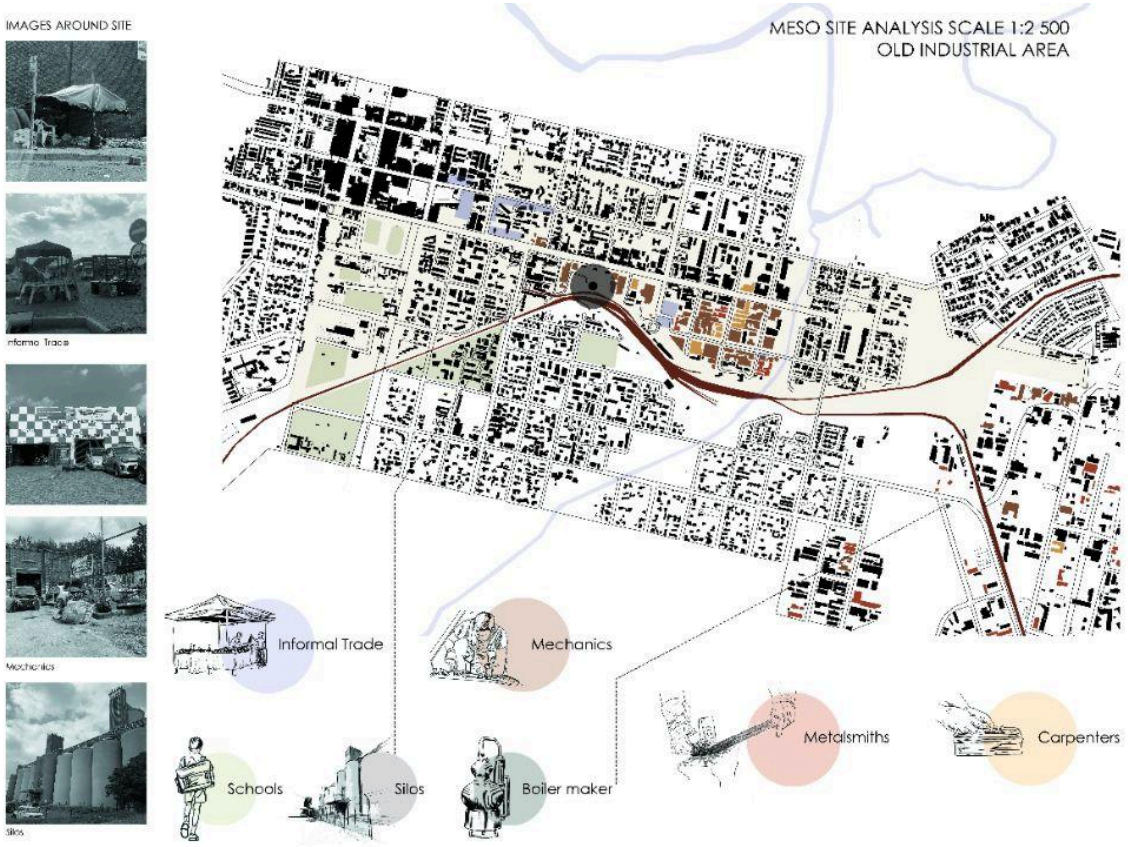


Fig 4: Old Industrial area activities

Context

The railway station has two main buildings: the NZASM Middelburg Station and the adjacent NZASM Workshop. After years of abandonment, the station has been restored and now houses a railway museum and restaurant. On-site weekend markets bring local street vendors together to showcase and sell handmade crafts, and even sell products from businesses in the old industrial area. The workshop, meanwhile, serves as a storage area for railway equipment but has potential for further development. The entire site is owned by PRASA but was restored by Johan Jansen van Rensburg, alongside other members of the Middelburg community, as part of an initiative to revive the railway lines for goods and passenger transport.

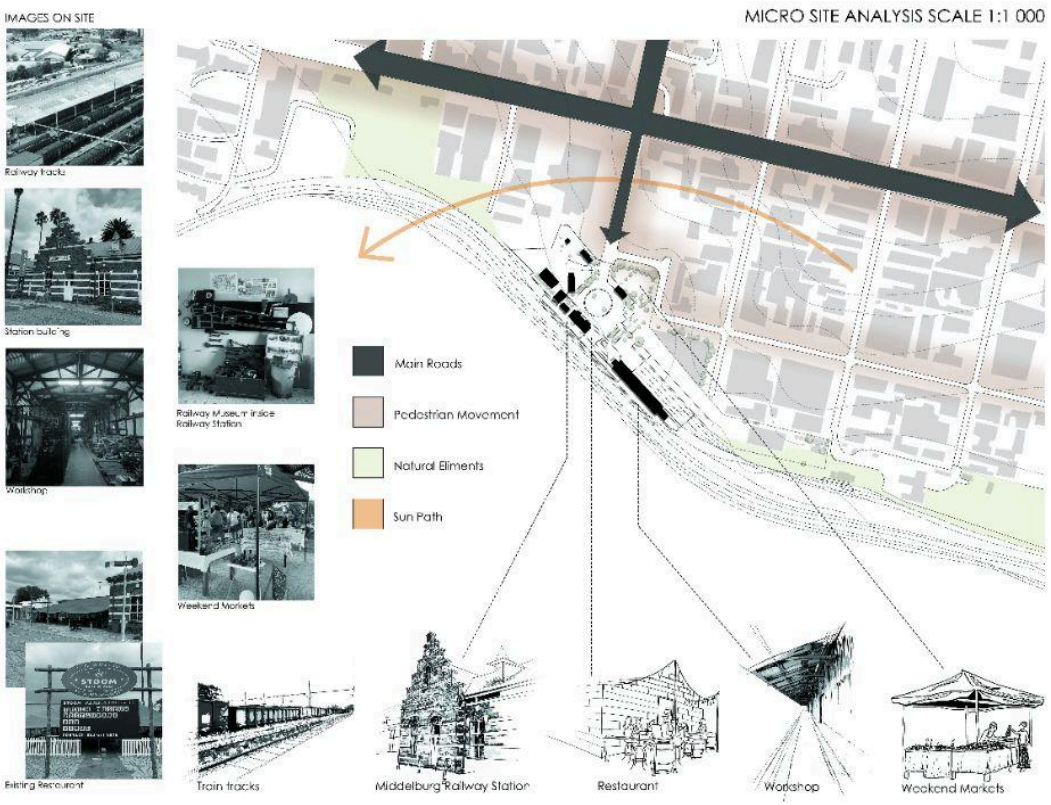


Fig 5: Site Activities

The NZASM Railway structures hold a significant place in South African architectural history as they form part of a large amount of our railway architecture. The buildings were originally constructed at a very fast pace to capitalize on the economic booms sparked by the railway. For this reason, temporary structures were prefabricated, modular, and designed to be easily assembled and disassembled, with timber, metal, and corrugated iron facades. When the final structure was built these buildings were disassembled and used for workers housing. In the case of the Middelburg station, however, the temporary structure was never dismantled but repurposed as a workshop as the Middelburg railway station was a prominent intersection at the time. The final station building followed a standardized design, offering a selection of NZASM structures from which the builder could choose. The builder had the flexibility to decide on the most suitable materials and construction methods for the site, based primarily on locally available resources and the existing skills of the workforce. As a result, the Middelburg railway station was constructed using hand-carved sandstone blocks sourced from local mines. Each craftsperson marked their block with a unique pattern as proof of their day's work, ensuring they were paid accordingly. This process produced a beautiful variety of patterns on the sandstone, reflecting the individual style of each craftsperson. This juxtaposition between temporary and permanent construction techniques forms the technological basis for this project. The railway station and existing workshop structures will remain on-site and be expanded upon with the commencement of new construction.

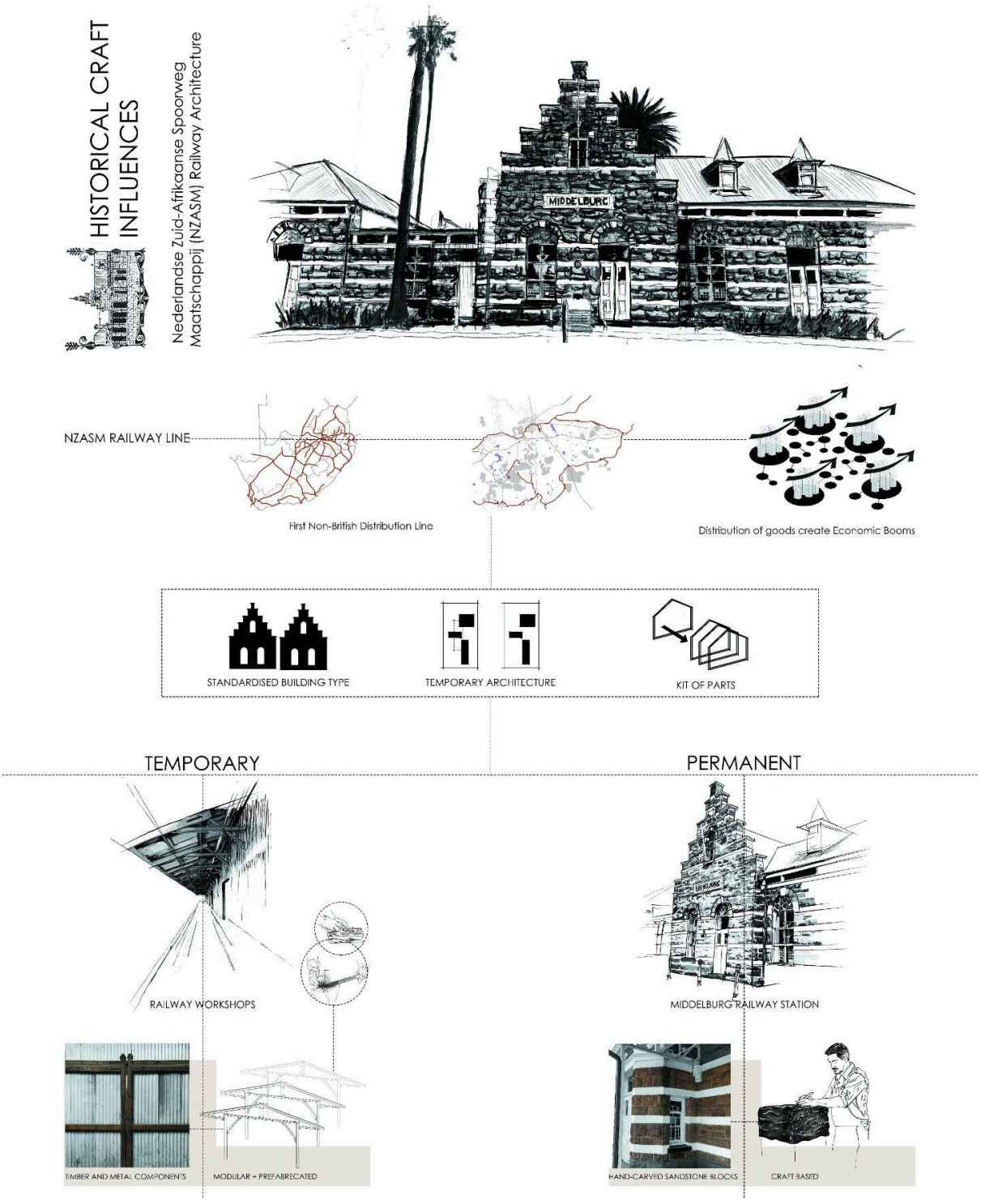


Fig 6: NZASM Railway Structures History

Research integration

The research conducted investigates the impact of industrialisation on architects' roles, proposing a shift towards incorporating craft based low-tech building technologies

through participatory design processes. The research aims to re-establish architects as integral to the entire building process by emphasising sustainable, community-based, and culturally resonant construction methods.

Emerging building technology is a technology that does not fall into “standardised” construction and is usually created where there is a gap in current building practices (Mahachi, 2019:6). It falls out of the modern-day mainstream building practice, especially in South Africa (Mahachi, 2019:6). Historically, building technologies have undergone significant transformations, influenced by socio-economic changes and technological revolutions (Louw, 2021:9). The Industrial Revolution marked a pivotal shift, introducing mass production, new materials, and mechanised construction processes. Despite the advancements brought about by industrialisation, there is a growing recognition of the value of indigenous and emerging building technologies like timber and earthen construction (Louw, 2021:22). These methods emphasise using local materials, sustainability, and community participation, often resulting in more environmentally friendly and culturally resonant structures.

This study analysed case studies from South African architecture that utilise emerging building technologies, examining them through specific themes within an emerging building technology catalogue. The most valuable data found through this study is the entries in the catalogue. The catalogue was created to better understand the use of emerging building technologies in South Africa. Each entry falls under some or all of the following categories: Building Materials, Construction Techniques (how the building is built) and Structural Systems. (Whether it is low-tech or high-tech the developmental status of the technologies was also documented.) The results show that the largest number of existing projects in South Africa utilise earth and timber construction as emerging building technologies. Thus the understanding of material use, construction techniques and structural systems are most known in these emerging technologies and elevates the relevance of the use of these in the design.

	Project	**Architect**	**Emerging Building Technology**		
			Building Material	**Con Technique**	**Structural Systems**
	Lapalala Wilderness School	Local studio	**Earthen construction**	**Rammed earth,** a construction technique that involves compacting a mixture of earth, sand, gravel, and stabilizers within a formwork to	

				create solid walls.	
	Future Africa Campus	Earthworld Architects	**Timber (Plywood)**	**Prefabrication**: Different sections of pine timber are glued together (off-site) in a factory that specialise in gluing and pressing of beams. The plywood beams are then installed on site according to assembly drawings.	Mass Timber Construction: The CNC-cut birch plywood members are used as a broken portal frame in the dining hall. It is emerging due to the fact that these thick profiles of birch plywood have not been used at this scale many times before. The birch plywood is also extensively used for furniture, cladding and acoustic panels.

Table 1: Example case studies

Spatial design development and technological investigation

Spatial design development

Spatially this project aims to create a central social hub for Middelburg's community—a place to experience the town's rich history and crafts. Accessible by foot, vehicle, or train, visitors are welcomed by pop-up market spaces that guide them into a central courtyard, with the distillery forming a scenic backdrop. From this courtyard, they can explore the workshop, train platform, or the Mampoer Hall, connected to the railway museum.

The workshop area offers flexible craft spaces, accommodating a range of crafts, from carpentry and metalwork to local traditional crafts like weaving. Visitors can view workshops in action and purchase items along the shopfront-lined walkway. Smaller workshops are accessible from the platform, providing an interactive experience for those awaiting the train.

Inside, the distilling process is on display, with milling and fermentation equipment visible from the workshop. As visitors move toward the Mampoer Hall, they pass by distillers, condensers, and infusers, gaining insight into the process behind local beverages. At the Mampoer Hall, guests can engage with distillers crafting traditional

drinks like mampoer before reaching storage tanks, where they can enjoy a tasting. The hall connects to the Middelburg Railway Station's existing restaurant and museum, allowing visitors to explore local heritage after witnessing the distilling process. Additionally, the site can be accessed directly through the museum, further integrating history with the space's active craft culture.

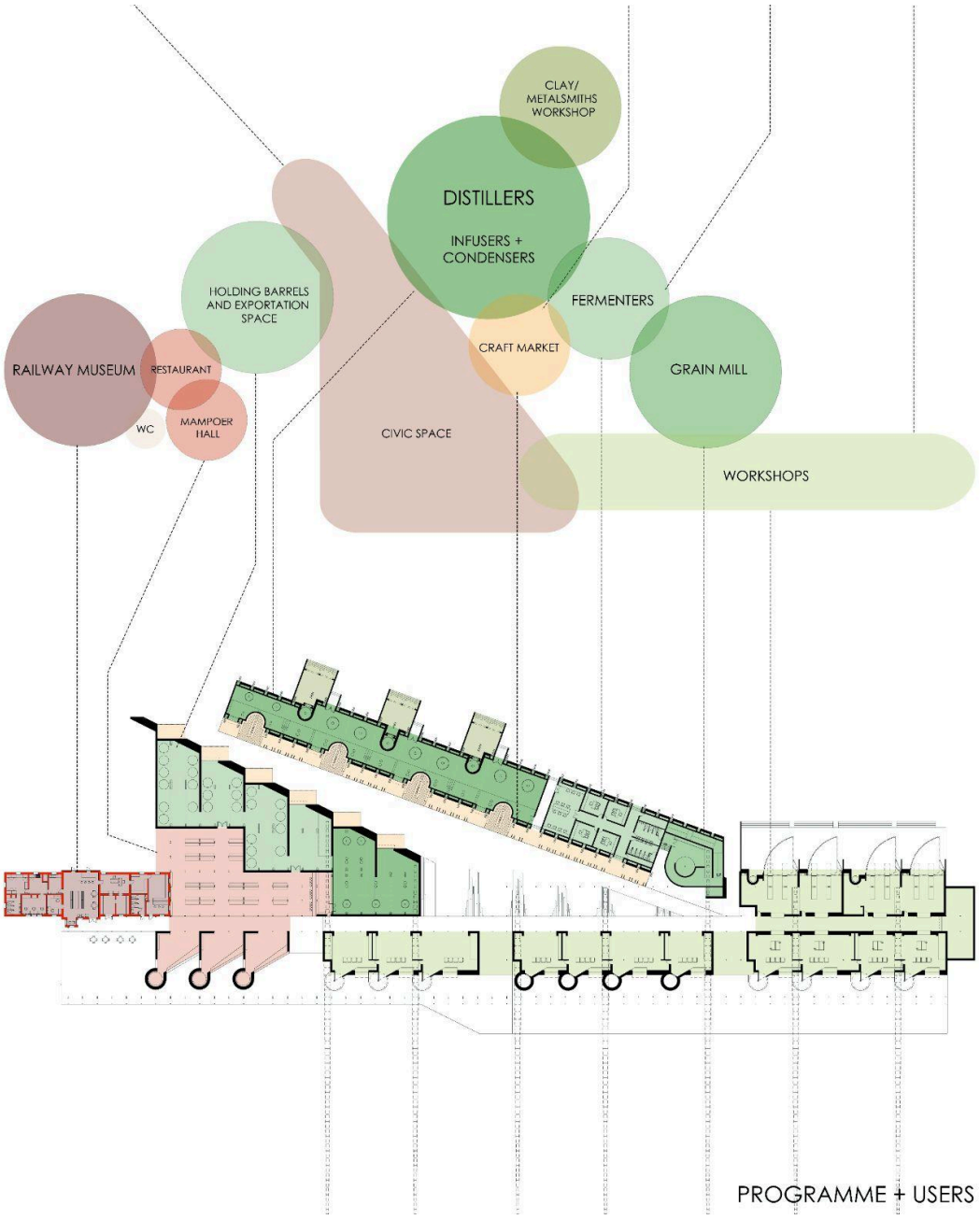


Fig 7: Spatial design and programme

Technological concept

The building technologies in this project aim to showcase the skills of Middelburg's local craftspeople, especially those based in the old industrial areas and those linked to the

site's history. Many of the structural elements are therefore designed with high craftsmanship, using timber and steel in a harmonious structural system as primary structures. The existing steel and timber structures from the workshop will be added to, to create new craft spaces. Local expertise in brickmaking and earthen construction will also be leveraged as non load bearing, secondary structure. Coal-based clay bricks, and adobe walls will serve as crafted, non-load-bearing features. This creates a juxtaposition between temporary and permanent technologies.

Inspired by NZASM Railway structures, this project balances temporary, kit-of-parts components with permanent crafted features across the site. Temporary structures, made of timber and steel, will support flexible use in pop-up market areas, designed for easy assembly and disassembly by hand. The craft workshops incorporate similarly adaptable structures that can adjust to various needs. Crafted components include clay-fired bricks infused with coal dust, containing cavities for air and water passage. Adobe walls, shaped for each space, are crafted from the non-arable soil of former mine sites, tapping into the well-honed adobe skills of Middelburg’s craftspeople. These walls will primarily feature in the workshop areas and Mampoer Hall, enhancing local character through their distinctive, crafted forms.

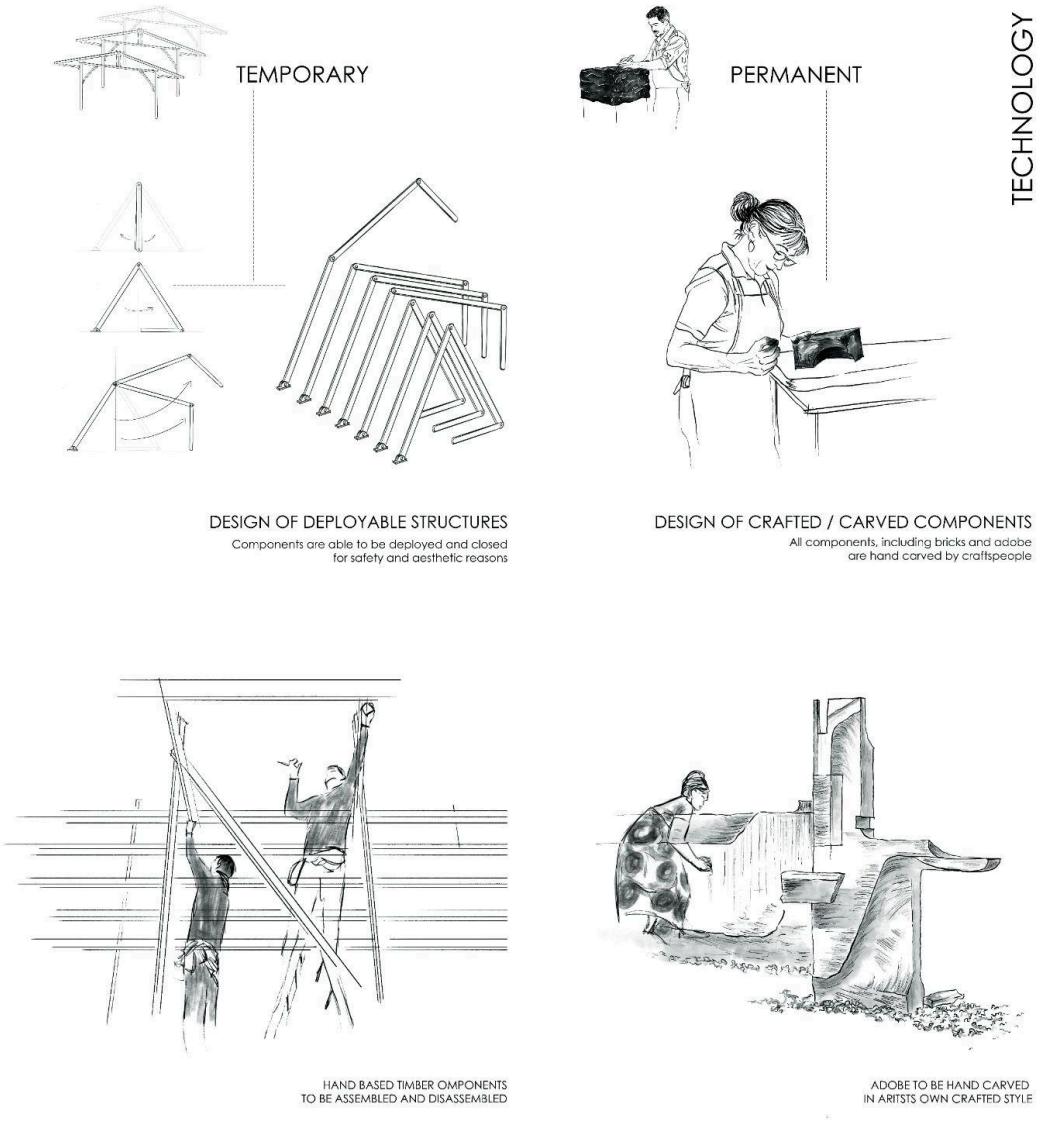


Fig 8: Technological approach consisting of permanent and temporary space/buildings

Passive cooling systems

The primary distilling areas in this project incorporate passive cooling systems to manage the substantial heat generated by the distillers. Clay bricks containing coal dust, a byproduct of local coal mining, have been prototyped and tested to enhance thermal performance. It has been researched to be effective in improving the thermal performance of the bricks (Yu, Kharel, Lau & Ng, 2023:2). Physical tests done indicate that bricks with a 10% coal dust composition offer the most effective insulation. These bricks contain cavities that allow air and water to pass through, creating a cooling stack effect as warm air rises and exits through higher openings (WhereistheNorth, 2024) .

These upper openings are fitted with movable timber and steel louvres operated by a pneumatic system, giving the impression of a “breathing” building. The pneumatic system is powered by excess pressure generated at the start and end of each distillation

cycle, a byproduct of alcohol production that otherwise would go unused. This approach not only cools the distillery naturally but also optimizes local resources to create an environmentally responsive structure.

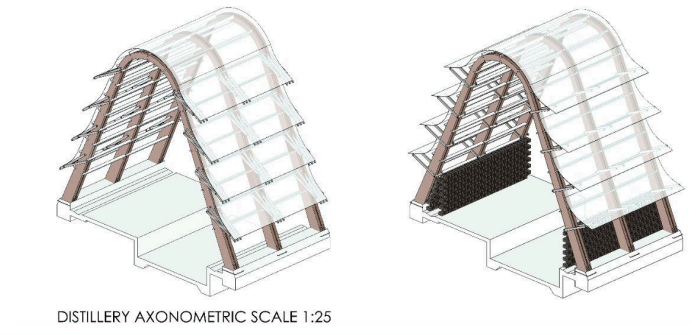


Fig 9: Breathing building

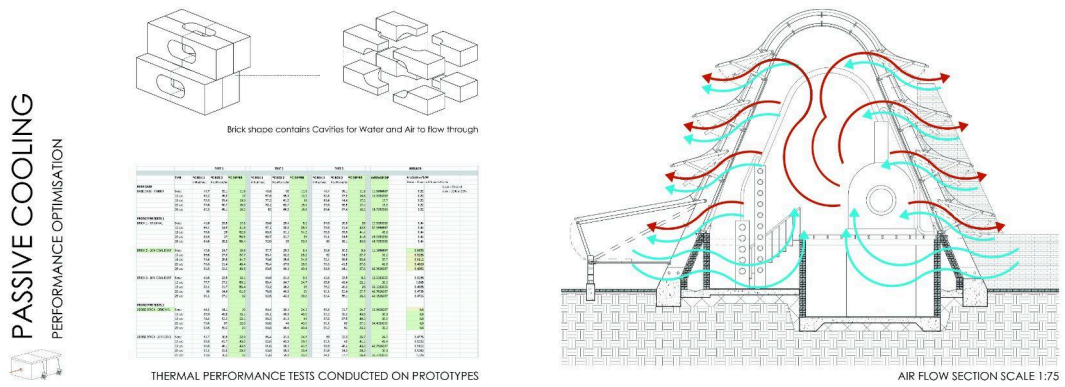
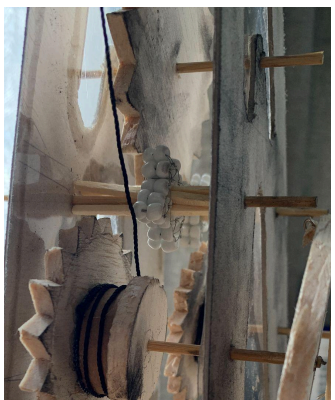


Fig 10: Passive Cooling System

Iterations

This project's primary goal was to create a space where the Middelburg community could gather and experience the diverse crafts rooted in the town's old industrial area. Additionally, the site serves as a central hub where produce from rehabilitated mine lands is processed and distilled into alcohol, integrating both community and industry in a shared space.



Iteration 1

A conceptualisation exercise was conducted to explore what the building could be. This model explored how mechanical/

industrial systems can be explored in construction. This concept was later refined in creating adaptable architecture.

Fig: 11: Initial conceptual exploration

Iteration 2

The initial iterations focused on abstract forms as responses to the urban environment, exploring how users would enter the site and engage with the distilling and craft processes. different options had to be given for the first iteration to explore different ideas.

Option 1: Exploring connection nodes in and around the site

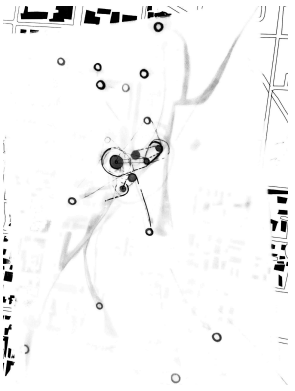
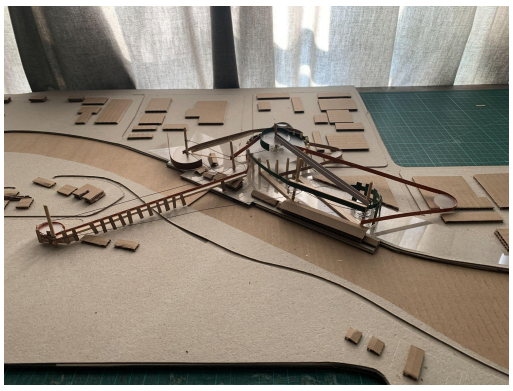




Fig: 12, 13 & 14: connection nodes in and around the site

Option 2: Exploring how elements can connect to existing structures



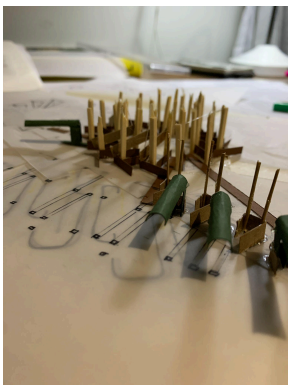
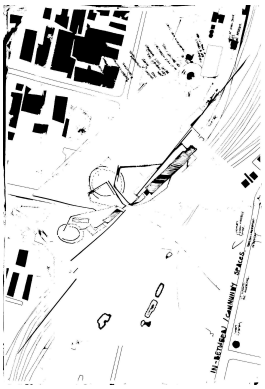


Fig: 15, 16 & 17: how elements can connect to existing structures

Option 3: Exploring the design of civic spaces



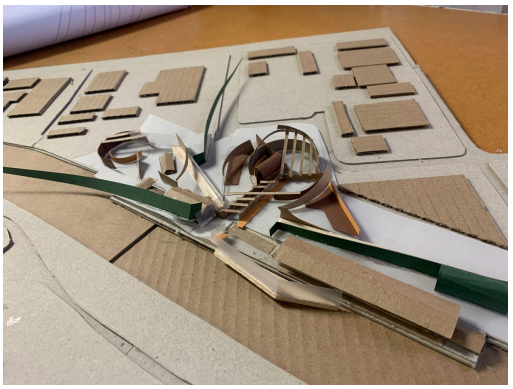
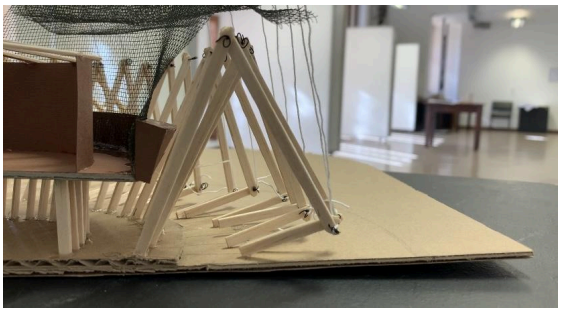
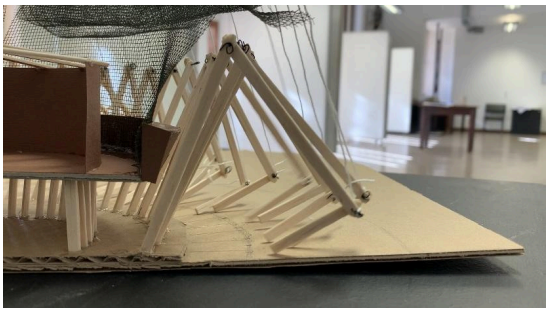


Fig: 18, 19 & 20: the design of civic spaces

Iteration 3

Initial form making was conducted on a plan scale. The concept of adaptable architecture was also explored.

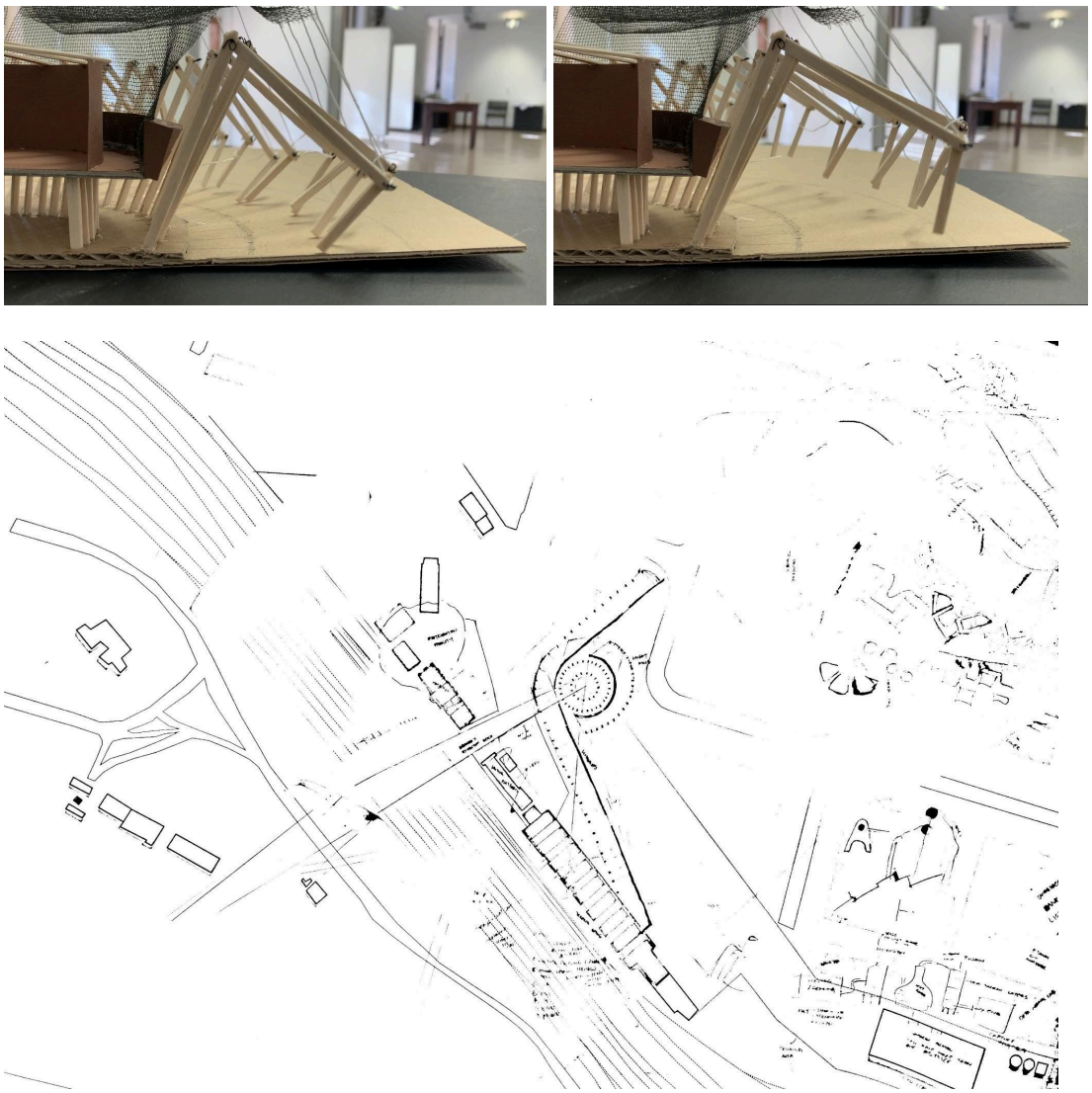


Fig: 21 & 22: adaptable architecture

Iteration 4

Placement and size of different programmes are taken into consideration. Spaces are examined sectionally, considering the height requirements for industrial distillers and the spatial needs for craft workshops.

Fig 23: programmes layout and size exploration

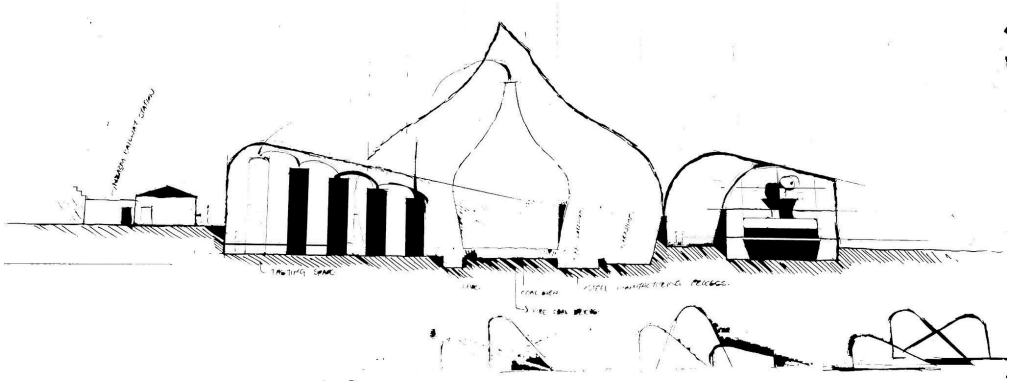


Fig 24: building size

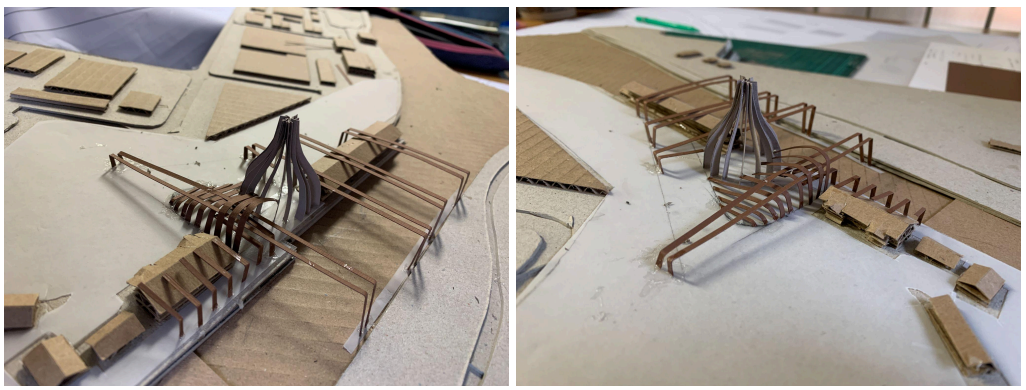


Fig 25 & 26: building size

Iteration 5

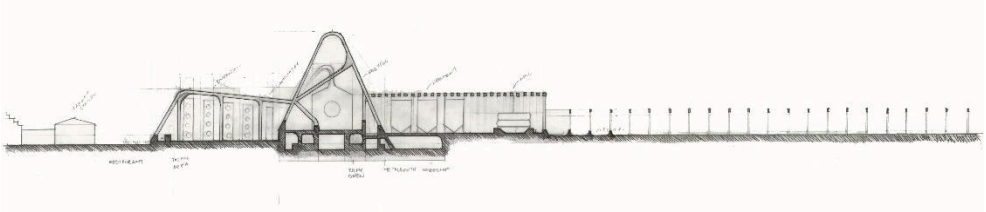
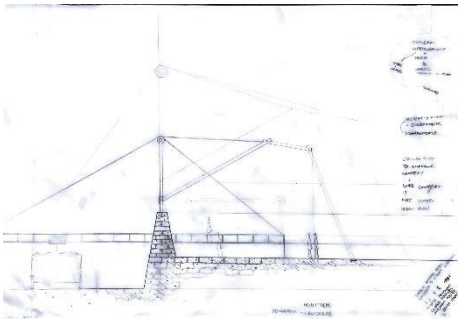


Fig 27: initial abstract form making



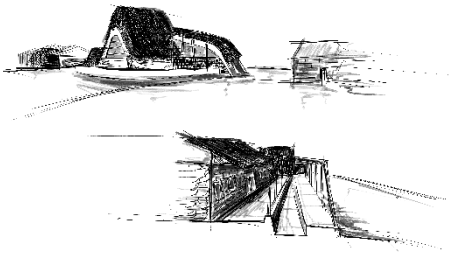


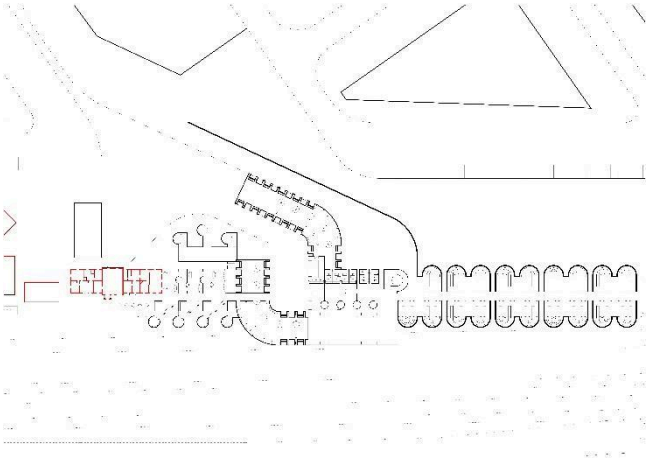
Fig 28: exploring how gantries connect to the existing structure

Fig 29: initial perspectives

Fig 30: initial 3D exploration

Iteration 6

Each space's specific needs, such as size, adaptability and placement, are examined in greater detail.



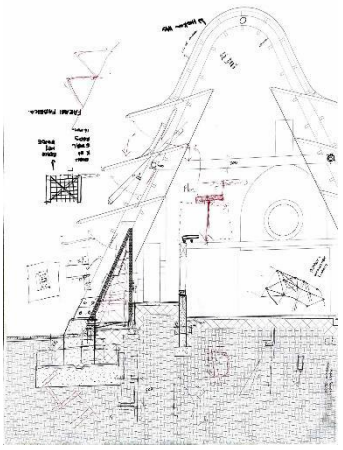


Fig 31 & 32: an exploration of spatial needs

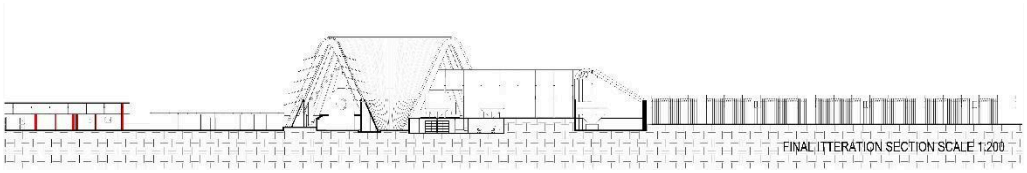
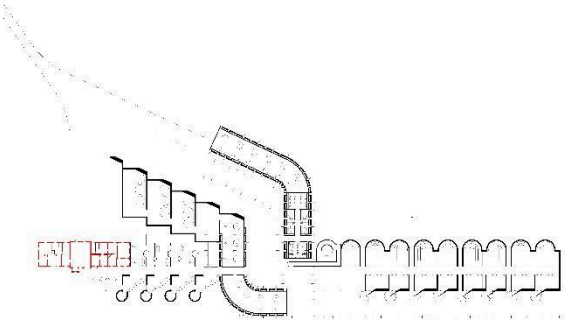


Fig 33: an exploration of spatial needs

Iteration 7

The semi-final designs were explored in more detail and three-dimensionally.



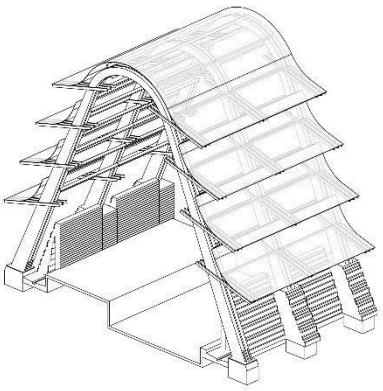
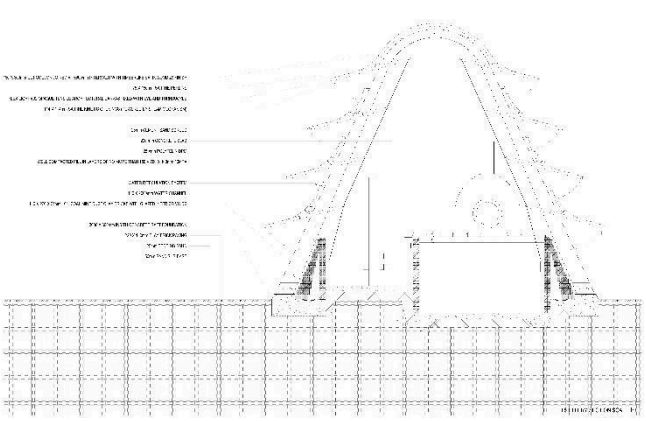


Fig 34 & 35: semi-final explorations of space and 3D explorations of how spaces would look



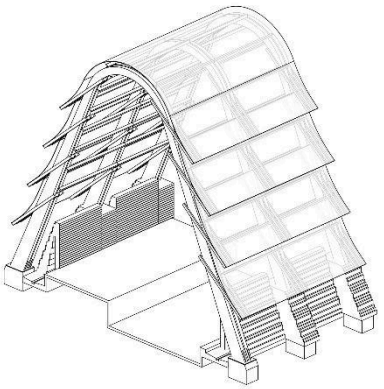


Fig 36 & 37: semi-final explorations of space and 3D explorations of how spaces would look

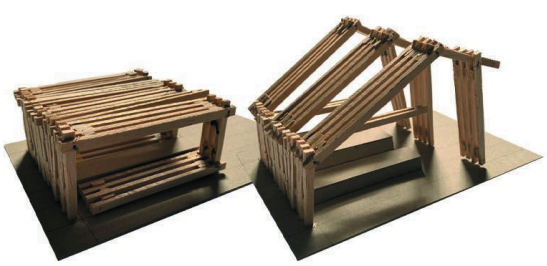


Fig 38 & 39: detail explorations

Fig 40: detail exploration

Final

Plan

The ground floor plan is organized into three main areas: the **Middelburg Railway Station**, housing the restaurant and Mampoer Hall; the **Distillery**; and the **Workshop spaces**. These primary areas are complemented by secondary outdoor spaces, the market area, courtyard, and train platform, designed to guide visitors along a central

axis toward the heart of the site, where they can explore areas that capture their interest.

Upon entering the market area, visitors are drawn deeper into the site, with the distillery as a focal backdrop. They can gather in the courtyard, and then proceed through the workshops to observe the distilling process firsthand. The experience culminates in a tasting area, where visitors can enjoy the finished products and a view of the entire site along the main axis.

The layout concept is inspired by creating a community gathering space for Middelburg, showcasing local crafts and industry. The workshops, along with key distilling points, are strategically positioned for easy access to the train and structure, facilitating the transport of raw materials, like wheat, and finished products. The distillery layout is designed for clear visibility into each step of the distilling process, aiming to offer a transparent, engaging display of Middelburg's crafts and local expertise.

Fig 41: plan

Section

The section illustrates the entire distilling process, from the arrival of raw produce via the gantry to serving the final product in the Mampoer Hall, making each step clear and accessible. It also highlights the versatility of the workshops, showing how these spaces

can adapt to various craft needs. Additionally, it depicts how users interact with the market and communal areas, emphasizing the flow and connectivity of the site.

Details

The detailed sections showcase the construction of different structures. Firstly the distillery is constructed from mass timber and brick. Where the timber acts as the adaptable structure where louvres open and close for passive cooling. The bricks act as the permanent structure.

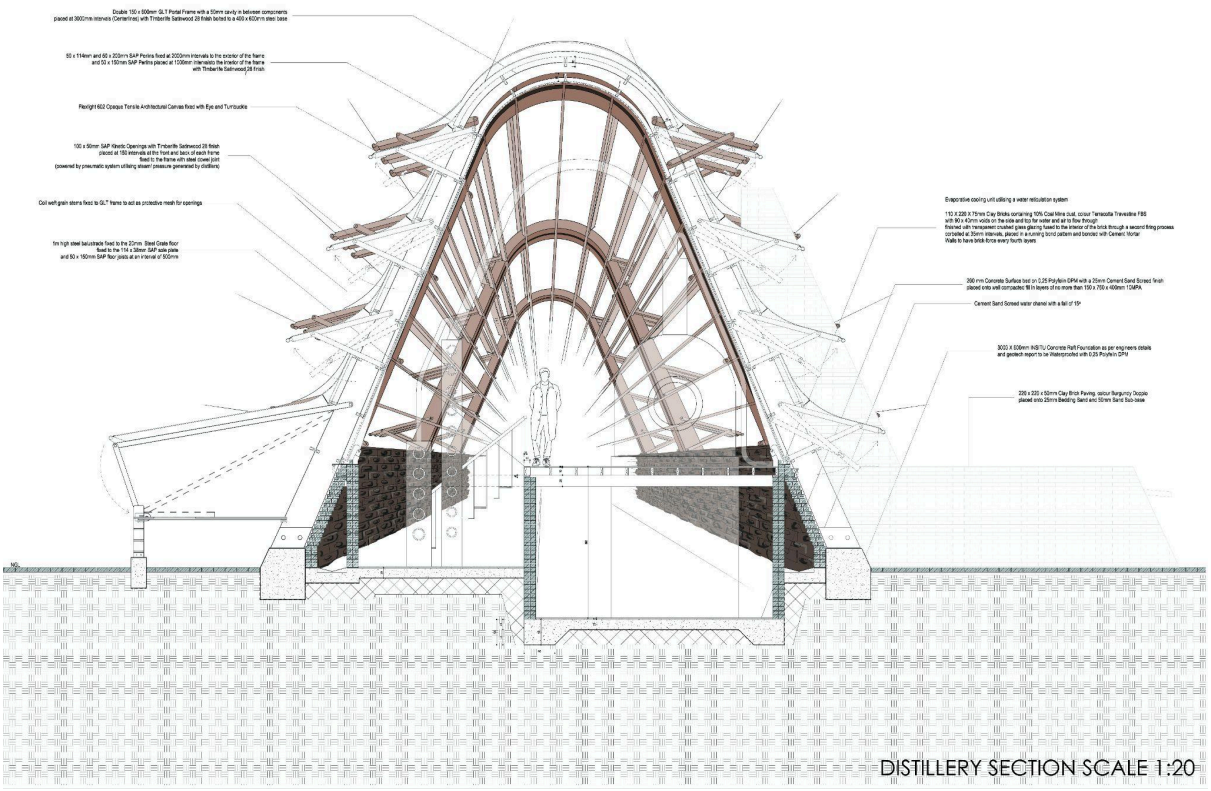


Fig 42: distillery section

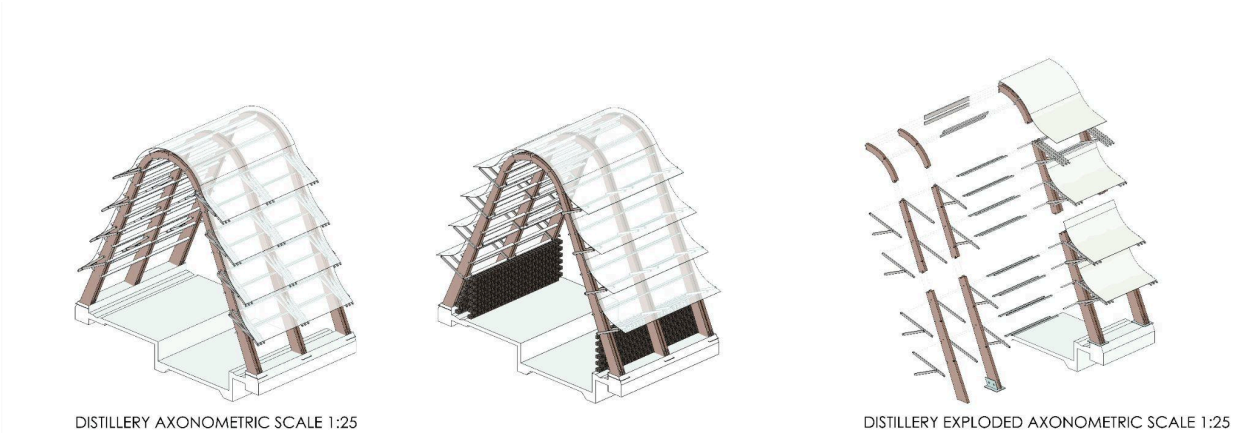


Fig 43: distillery axonometric

Secondly the workshops are designed in such a manner that it can be adapted and personalised by its user.

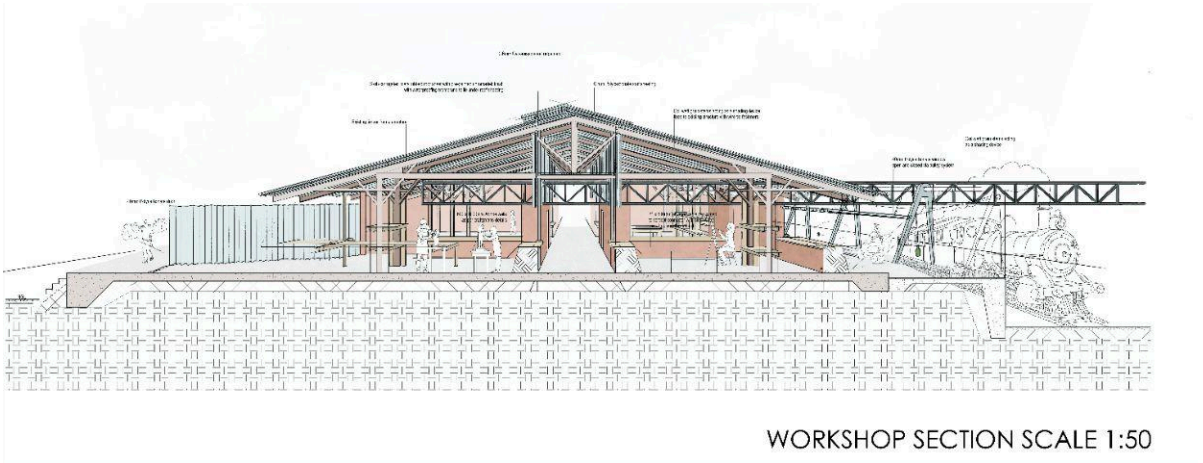


Fig 44: workshops section

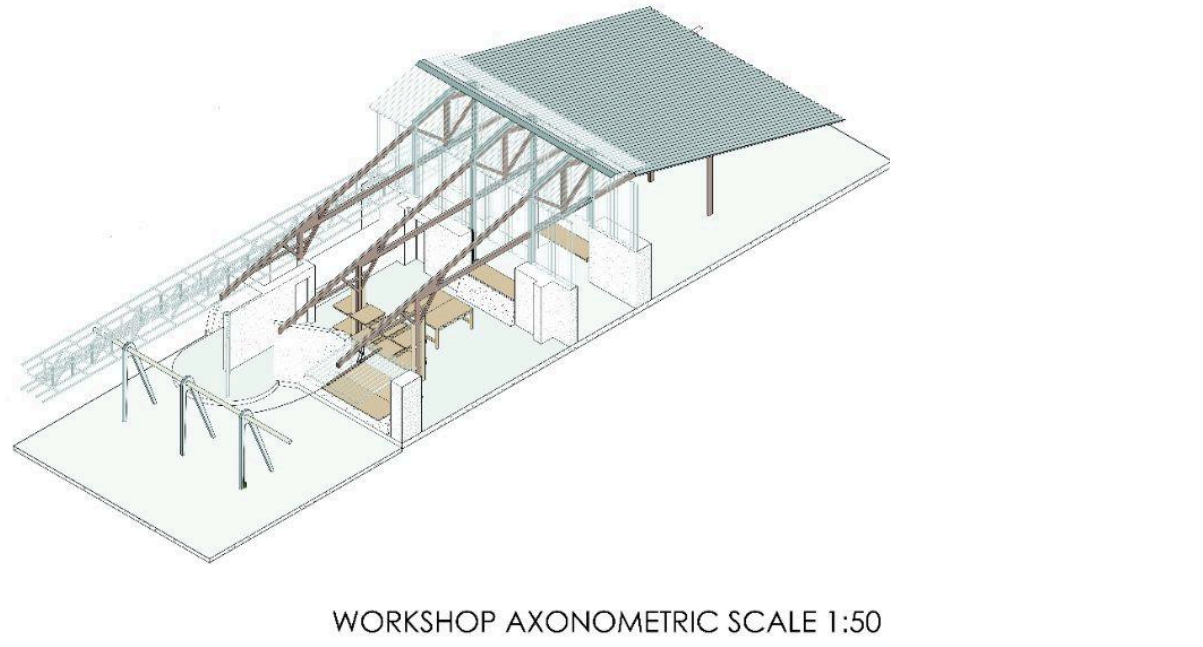


Fig 45: workshops axonometric

Thirdly the mampoer hall shows how it connects to the storage tanks and niche distillers (connection of smaller structures to large distillery structure).

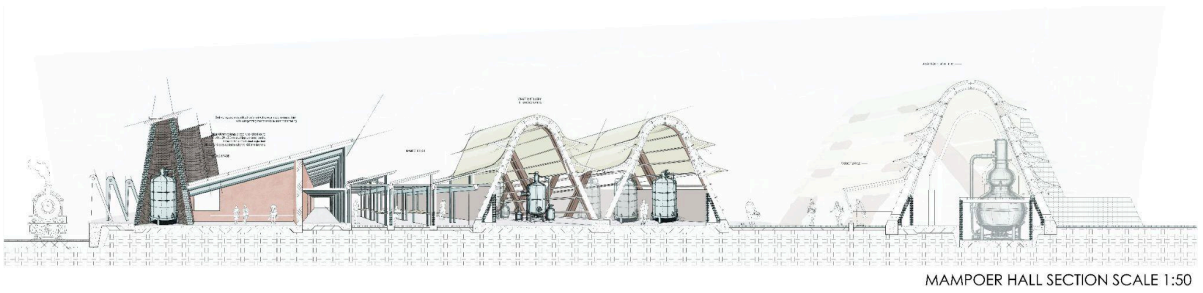


Fig 46: mampoer hall section

Critical reflection

Throughout the year, numerous iterations have refined this project, ensuring a thoughtful response to each requirement down to the finest details. The design has followed a continuous feedback loop, addressing multiple scales, from the urban context to intricate details, creating a circular design process. This design process has been circular with constant iterating loops as feedback and research have influenced it.

The project's primary goal has been to create a civic space where Middelburg's community can come together to engage with the area's varied crafts. Secondly, it integrates the distinct scales of craftsmanship in the old industrial district, with each scale shaping design solutions and reinforcing the concept of adaptable spaces. Finally, the site's historical context, along with local skills and emerging technologies, has influenced the project conceptually and contributed to the design's success.

The design intends to evolve through the construction process, allowing each craftsperson's unique skills and interests to shape it further, creating a truly circular design and construction process. This approach aims to produce an architectural style unique to Middelburg, developing additional layers of craftsmanship that will only be fully realized once the structure is built.

The project's main purpose has been to explore how degraded spaces can be revitalised, especially in smaller towns like Middelburg. Just as mine sites are being converted into agricultural land to improve air and soil quality while delivering produce, this project seeks to renew other neglected sites, such as the historic Middelburg Railway Station. Breathing new life into existing structures with rich histories and existing social connections to the community. This project creates a model for revitalising similar sites across South Africa and beyond.

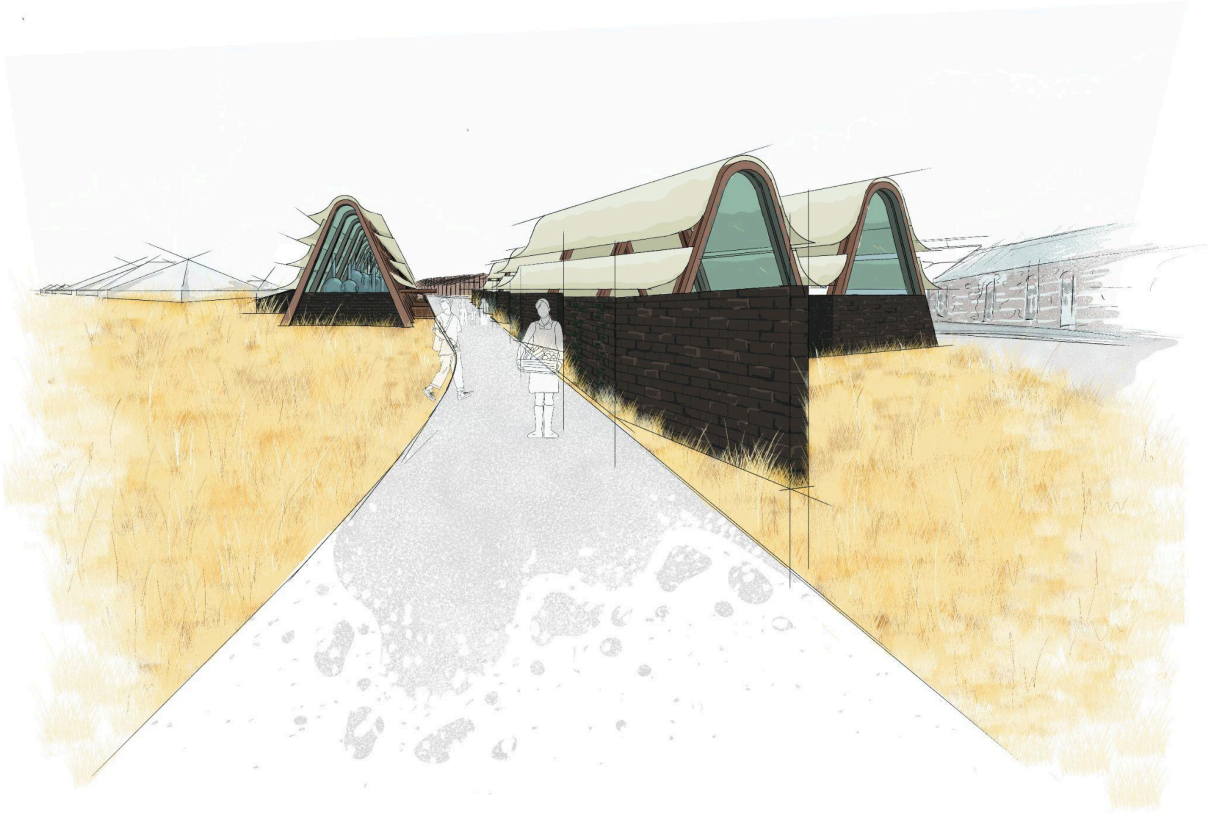


Fig 47: site entrance

Conclusion

This project reimagines Middelburg's industrial heritage by transforming its mined landscapes into productive and culturally rich spaces, connecting soil restoration with community revitalisation. Through grain farming on rehabilitated lands, once-polluted areas can be cleansed and repurposed, linking agriculture with economic opportunity by distilling wheat into alcohol. The NZASM Railway Station becomes the site’s central hub, housing distillery operations alongside spaces for craft workshops, markets, and social gatherings. Rooted in participatory and low-tech construction methods, the project celebrates local craftspeople, fostering sustainability through locally sourced materials and traditional skills. This approach not only acknowledges Middelburg’s historical significance but also empowers the community, creating a sustainable, adaptable model for reviving post-industrial towns. Ultimately, this project proposes a replicable model for rehabilitating both land and community, demonstrating how small towns can forge pathways to resilience and cultural renewal.

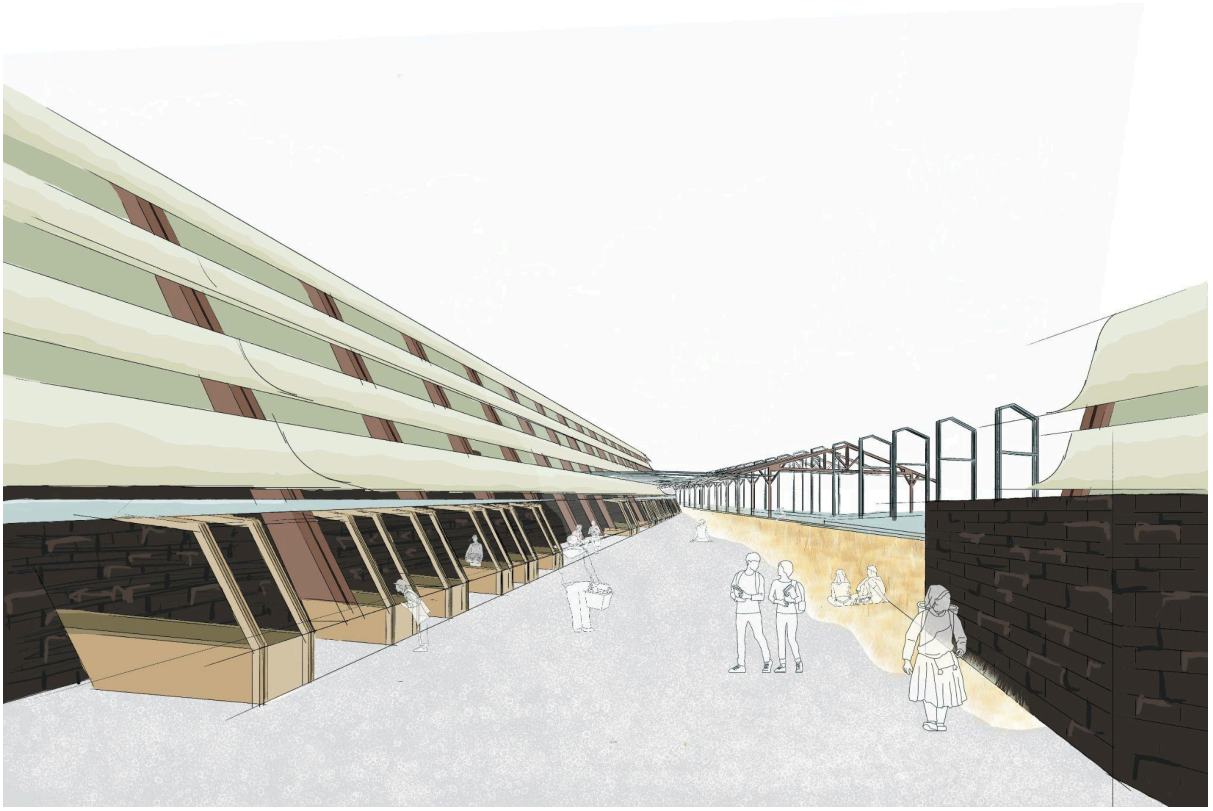
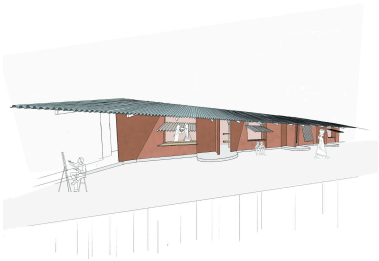
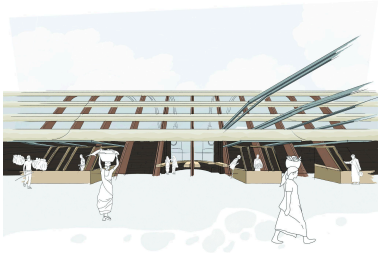


Fig 48: civic space





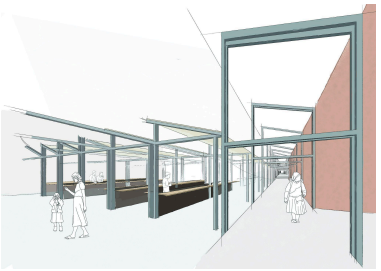


Fig 49-51: site experience

References

Ahmad, S., Iqbal, Y., Muhammad, R. 2017. Effects of coal and wheat husk additives on the physical, thermal and mechanical properties of clay bricks. *Elsevier*, 56(3): 131–138.

Ahmed, S., El Attar, M.E., Zouli, N., Abutaleb, A., Maafa, I.M., Ahmed, M.M., Yousef, A., Ragab, A. 2023. Improving the Thermal Performance and Energy Efficiency of Buildings by Incorporating Biomass Waste into Clay Bricks. *Materials*, 16(7): 1-21

Ait Elallem, K., Sobeh, M., Boularbah, A., Yasri, A. 2021. Chemically degraded soil rehabilitation process using medicinal and aromatic plants: review. *Environmental Science and Pollution Research*, 28(1): 73–93.

Designboom. 2017. *Ant-studio develops terracotta 'beehive', an energy-efficient alternative to air conditioning*. [Online] Available from: https://www.designboom.com/design/ant-studio-deki-cooling-installation-09-28-2017/ [Accessed: 11-09-2024]

Designwanted. 2023. *An inventive architectural solution designed to address urban heat challenges*. [Online] Available from: https://designwanted.com/terracool-ceramic-passive-cooling-evaporation/ [Accessed: 11-09-2024]

Engineering news. 2022. Is it possible to convert old coal mines into successful farms? [Online] Available from: https://www.engineeringnews.co.za/article/is-it-possible-to-convert-old-coal-mines-into-successful-farms-2022-06-24 [Accessed: 2024-10-27].

Gupta, S.R., Dagar, J.C., Teketay, D., 2020. Agroforestry for Rehabilitation of Degraded Landscapes: Achieving Livelihood and Environmental Security, 1(1): 1-14

Harika, R., Faber, M., Samuel, F., Mulugeta, A., Kimiywe, J., Eilander, A. 2017. Are Low Intakes and Deficiencies in Iron, Vitamin A, Zinc, and Iodine of Public Health Concern in

Ethiopian, Kenyan, Nigerian, and South African Children and Adolescents? *Food Nutr Bull,* 38(1): 405–427.

Jekot, B.P. 2007. The coexistence of the “third” and “first” world in South African architecture: the inclusion of the “underdeveloped” in “developed” technologies in the age of globalisation. *SAJAH*, 22(2): 66-78.

Louw, M. 2021. The search for hybrid tectonics in contemporary African architecture: Encounters between the global and the local. *University of Cape Town*, 1(1): 1-231.

Louw, M. & Elkin, D. 2021. Tectonic agency in Africa: reinvigorating collective making through repair. *South African Journal of Art History*, 36(2):1-14.

Mahachi, J. 2019. Challenges in Implementing Innovative Building Technologies: Housing Case Studies in South Africa. *University of Johannesburg*, 1(1): 1-16.

Riaz, M.H., Khitab, A., Ahmed, S. 2019. Evaluation of sustainable clay bricks incorporating Brick Kiln Dust. *Elsevier*, 24(1): 1-8.

Vasić, M.V., Goel, G., Vasić, M., Radojević, Z., 2021. Recycling of waste coal dust for the energy-efficient fabrication of bricks: *Elsevier*, 21(1): 1-15.

Weyer, V.D., Truter, W.F., Lechner, A.M., Unger, C.J. 2017. Surface-strip coal mine land rehabilitation planning in South Africa and Australia: Maturity and opportunities for improvement. *Resources Policy,* 54(1): 117–129.

WhereistheNorth. 2024. *7 Types Of Passive Building Cooling Systems Without AC*. [Online] Available from: https://www.whereisthenorth.com/article/7-types-of-passive-building-cooling-systems-without-ac [Accessed: 12-09-2024]

WhereistheNorth. 2024. *12 Passive Cooling Strategies for Hot Climate Architecture*. [Online] Available from: https://www.whereisthenorth.com/article/%2012-passive-cooling-strategies-for-hot-climate-architecture [Accessed: 12-09-2024]

Xu, H., Song, W., Cao, W., Shao, G., Lu, H., Yang, D., Chen, D., Zhang, R. 2017. Utilization of coal gangue for the production of brick. *J Mater Cycles Waste Manag*, 19(3): 1270-1278.

Yao, X., Cui, X. 2021. Agricultural suitability assessment and rehabilitation of subsided coal mines: a case study of the Dawu coal mine in Jiangsu, Eastern China. *Geoscience Letters*, 8(1): 1-28.

Yu, H., Ng, K., Lau, C. 2023. New coal char-based bricks: Effects of curing temperature, humidity, pressing pressure, and addition of superplasticizer on the physical, mechanical, and thermal properties. *Elsevier*, 19(1): 1-14.

Yu, H., Kharel, S., Lau, C., Ng, K. 2023. Development of high-strength and durable coal char-based building bricks. *Elsevier*, 74(1): 1-12.