

M.ARCH (Prof)

DPD 801

DESIGN REPORT

*Embers to Safety: A
Community-Centric Fire
Station*

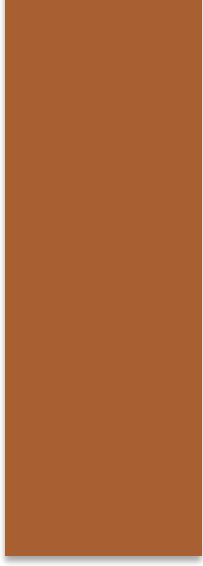
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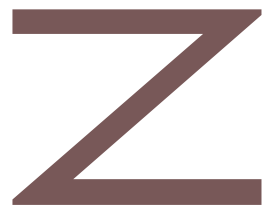
Coordinator: Jan Hugo





01. PROJECT INTRODUCTION..... 03

- ABSTRACT
- PROJECT BREIF



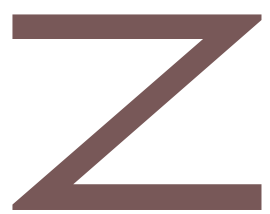
02. PROJECT LOCATION..... 04



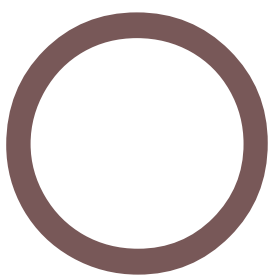
03. PROJECT INFORMANTS..... 05



04. PROJECT DOCUMENTATION..... 06

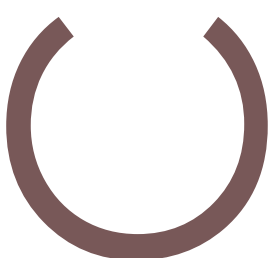


05. TECHNICAL INVESTIGATION..... 10



06. CRITICAL REFELCTION..... 13

- IMPACT OF MINI-PROJECT
- MAJOR-PROJECT OUTCOME



07. CONCLUSION..... 14

08. REFERENCES..... 15

S E R V I C E S

FIGURE 2.1: MAP SHOWING RELATION OF REFILWE TO PRETORIA, 40KM DISTANCE VIA N4 + R515.	4
FIGURE 2.2: MAP SHOWING REFILWE, CITY OF TSHWANE METROPOLITON, GAUTENG, SOUTH AFRICA	4
FIGURE 2.3: PROJECT SITE LOCATION IN REFILWE	4
FIGURE 3.1: GRAPHIC DISPLAYING INFORMANTS THAT LEAD TO THE CONCEPTUAL APPROACH	5
FIGURE 3.2: DIAGRAMS EXPLAINING HOW THE FIRE FIGHTER'S MOVEMENTS ARE TRANSLATED ARCHITECTURALLY INTO SPATIAL VOLUMES	5
FIGURE 4.1: DESIGN ITERATIONS	6
FIGURE 4.2: SITE PLAN	7
FIGURE 4.3: GROUND FLOOR PLAN	8
FIGURE 4.4: FIRST FLOOR PLAN	8
FIGURE 4.5: ELEVATION AND SECTION DRAWINGS	9
FIGURE 5.1: IMAGE OF VARIOUS ADOBE BRICKS REVEALING COLOUR OF SOIL USED.	10
FIGURE 5.2: PRIMARY STRUCTURE	10
FIGURE 5.3: SECONDARY STRUCTURE	10
FIGURE 5.4: COLUMN SPAN ACCORDING TO FIRE TRUCK PARKING BAY SIZE	10
FIGURE 5.5: DIAGRAM SHOWING PROCESSION OF THE CONCEPT OF SPEED INTO THE FORM OF THE BUILDING	11
FIGURE 5.6: SECTION SHOWING VARYING HEIGHTS EMPHASIZING HEIRACHY OVER MAIN PROGRAMS	11
(left) FIGURE 5.7: TECHNICAL ASPECT OF THICK ADOBE WALLS GENERATE A DESIGN OPPORTUNITY FOR BOX WINDOW DESIGN	11
FIGURE 5.8: DESIGN SKETCH OF BOX WINDOW OPPORTUNITY	14

Embers to Safety: A Community-Centric Fire Station

Abstract:

In response to the critical imperatives of sustainable architecture and global issues, the design project culminates in an innovative and resilient fire station situated in Refilwe, Gauteng, South Africa. Anchored in a foundation of community-centric engagement, the station marries traditional building techniques with innovation, utilizing locally sourced adobe bricks. This integration empowers the local community, fusing skilled craftsmanship with the station's core infrastructure. The emphasis on fire safety is woven throughout the project, ensuring that the station not only serves as a beacon of emergency response but also stands as a symbol of proactive resilience against fire hazards in the region.

Central to this narrative is the dynamic interplay between urgency and repose. The fire station, exemplifying speed and efficiency in emergency response stands in juxtaposition with a park, a space of serenity and reflection. This symbiotic relationship underscores the station's role not only as a place of action for safety but also as a civic anchor, enriching the daily lives of residents.

The sporting facility emerges as a connection of training and recreation. It marries the training requirements of firefighters with the aspirations of the wider community. An indoor-outdoor design aims to join the firemen training alongside citizens pursuing their fitness goals in a shared space.

Embracing a rationale of community-centric design the station hosts a small library, a study room, and a classroom open to the public. It also serves as a platform for school outings, offering youths a firsthand experience in firefighting to educate potential future paths. Moreover, this space is utilized by firemen for conferences and meetings, exemplifying the station's multifaceted role within the community.

The project envisions an integration of tradition and innovation, creating a beacon of safety in Refilwe. Beyond safeguarding lives and property, it aims to cultivate a vibrant and empowered community, demonstrating the potential for positive transformation through sustainable design and community engagement.

Project brief:

In South Africa, fires are a major threat to human lives, livelihoods, and property, resulting in significant losses annually. The rising impact of climate change further exacerbates this risk, as rising temperatures, prolonged periods between rainfall events, and an increase in high to extreme fire danger days heighten the potential for wildfires. Among the vulnerable areas, townships in Pretoria, such as Refilwe, stand out due to the high fire risks associated with their informal settlements.

In informal settlements, residents are particularly susceptible to the devastating consequences of fires, as an entire community's possessions and homes can be quickly destroyed. However, an emergency risk profile conducted by the CSIR's accessibility analysis and social facility planning report indicates that these areas lack sufficient coverage.

According to the Tshwane Emergency Services Department, while the existing fire stations were strategically positioned to ensure swift response times to fires, the evolving dynamics of population growth and urban development underscore the pressing need for additional stations, especially in densely populated townships. As reported by Rekord in 2022, "Tshwane Emergency Services Department says although the existing stations were strategically built to respond promptly to fires, overtime factors such as population growth and development have shown a need for more stations to be built in more communities." (Rekord, 2022).

Furthermore, statistics stated by Chief Fireman Charles Mabaso, as cited in Rekord (2022), emphasize the urgency of establishing more fire stations in Tshwane, particularly in townships, which bear the brunt of fire incidents. This critical gap requires urgent intervention to safeguard the lives and assets of the community through community-centric fire safety solutions in Refilwe and similar townships. Thus, the design project responds to this need by proposing an innovative and resilient fire station responding to the unique challenges and requirements of the Refilwe community. Rooted in principles of sustainable architecture, this project not only aims to provide efficient emergency response but also seeks to empower the local community through engagement, skill-building, and the integration of traditional building techniques with cutting-edge innovation.

02.

PROJECT LOCATION

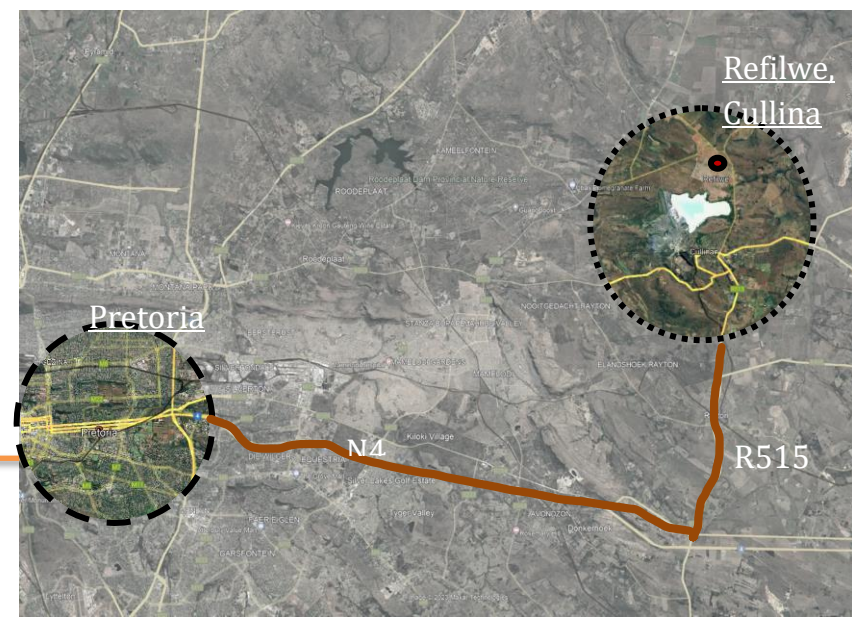


FIGURE 2.1: MAP SHOWING RELATION OF REFILWE TO PRETORIA, 40KM DISTANCE VIA N4 + R515.

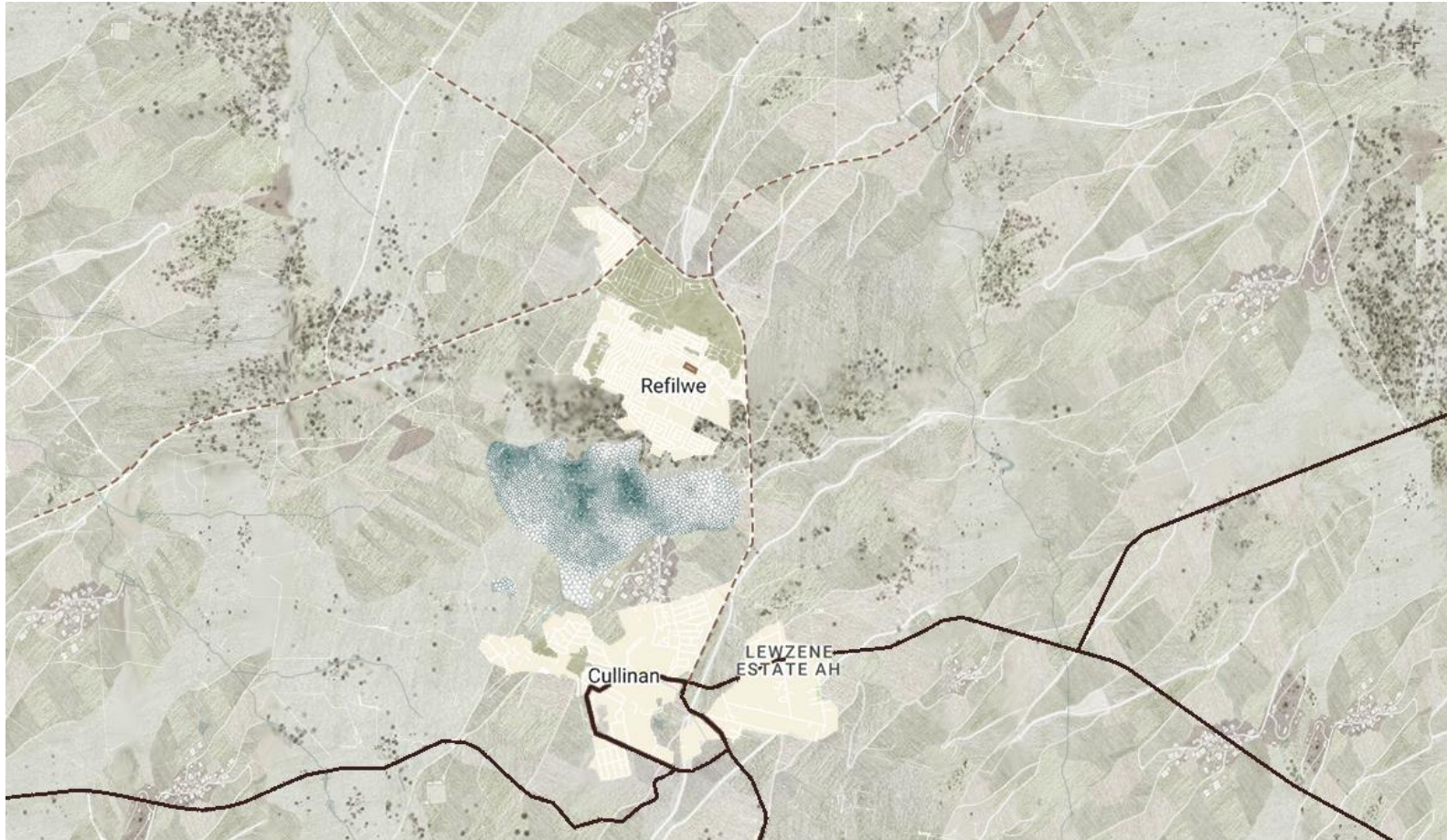


FIGURE 2.2: MAP SHOWING REFILWE, CITY OF TSHWANE METROPOLITON, GAUTENG, SOUTH AFRICA



FIGURE 2.3: PROJECT SITE LOCATION IN REFILWE

03.

PROJECT INFORMANTS

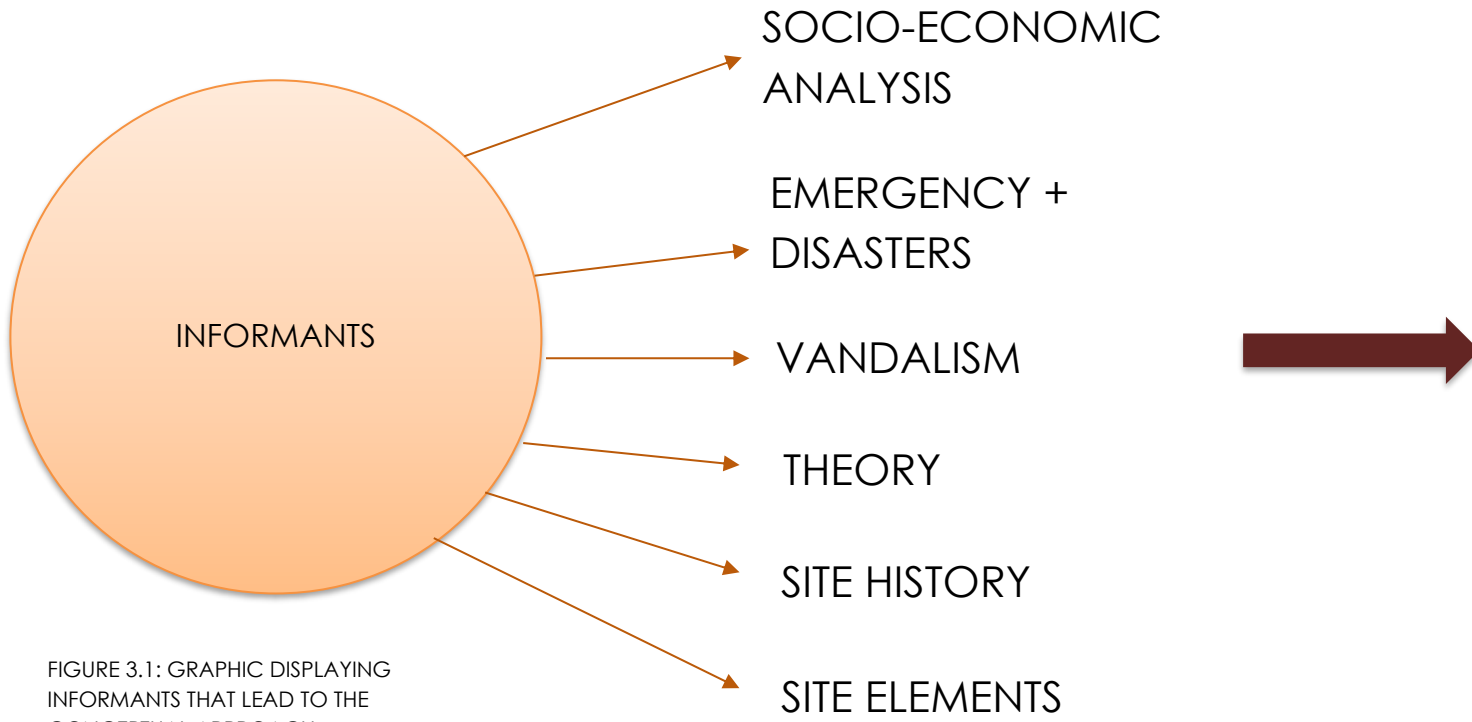


FIGURE 3.1: GRAPHIC DISPLAYING INFORMANTS THAT LEAD TO THE CONCEPTUAL APPROACH

CONCEPTUAL APPROACH

FAST RESPONSE TO DISASTER THROUGH INNOVATIVE DESIGN STRATEGIES, WITH INTENTION OF RENEWING SITE HISTORIES, PREVENTING ISSUE OF VANDALISM AND PROMOTING SAFETY AND WELL-BEING TO COMMUNITY OF REFILWE.

KEY THEMES

RESILIENCE + RELEVANCE

Multi-functional
Adaptive capacity
Social networks & collaboration
To overcome vandalism

COMMUNITY-CENTRIC DESIGN

Prioritizing the needs and engagement of the local community in every aspect of the fire station's design and functionality.
Sense of safety, security, pride

MATERIAL INNOVATION

EBTs
Traditional building techniques
Locally sourced adobe
Social, environmental, economic sustainability



CIRCULATION
BUILDING PROCESS +
MULTI-FUNCTIONALITY
BEACON OF SAEFTY
STRATEGY



REPRESENTATION OF FIRE FIGHTER'S DAILY MOVEMENT

URGENCY
- SPEED

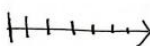


VOLUME



APPARATUS
BAY

CALM
- RELAX



INTIMATE



LIBRARY
LIVING RM

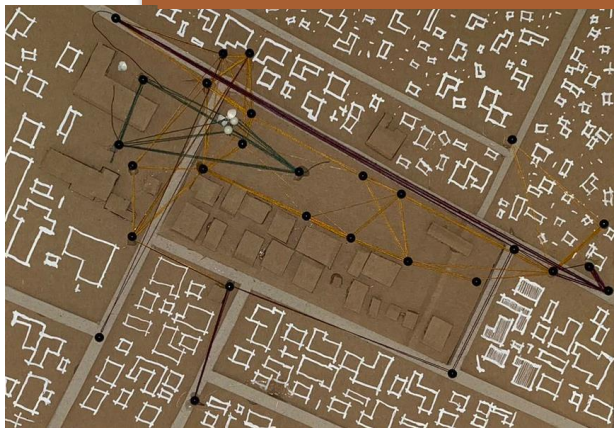
FIGURE 3.2: DIAGRAMS EXPLAINING HOW THE FIRE FIGHTER'S MOVEMENTS ARE TRANSLATED ARCHITECTURALLY INTO SPATIAL VOLUMES

The user's journey through a space, surpasses the mere physical structure of a building. This notion became integral in choreographing the experience within the fire station. It required envisioning how firefighters would navigate through the station, fostering feelings of safety, inspiration, and engagement.

This approach encapsulated the urgency and speed inherent in emergency response, while also providing moments of respite for reflection and rejuvenation.

04.

PROJECT DOCUMENTATION



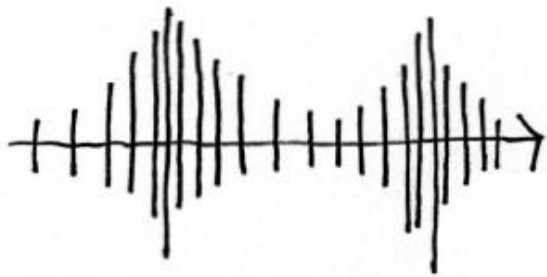
- GREEN NODES OPPORTUNITY
- PEDESTRIAN MOVEMENT
- VEHICULAR MOVEMENT



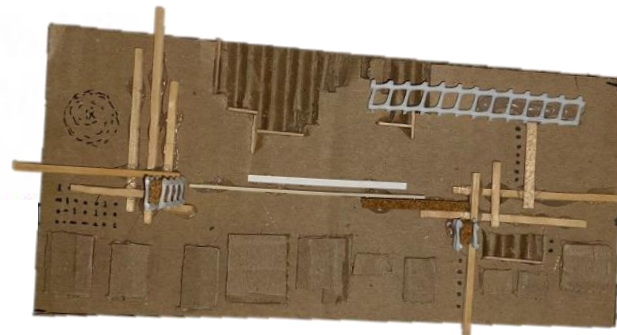
PARK HISTORY: CONNECTING GREEN ZONES

ITERATION 1

Exploration responding to conversations with local community members.
Responding to site history and physical conditions.



VISUAL REPRESENTATION OF RUSH + RELAX:
LONG LINES = FAST MOVEMENT
SHORT LINES = SLOW MOVEMENT



MODEL SHOWING THE 2 TYPES OF MOVEMENT

ITERATION 2

Taking the concept of rush and relax + dividing the site according to possible best locations for fast/ easy fire truck exits.



ZONING + MASSING ON EAST PORTION



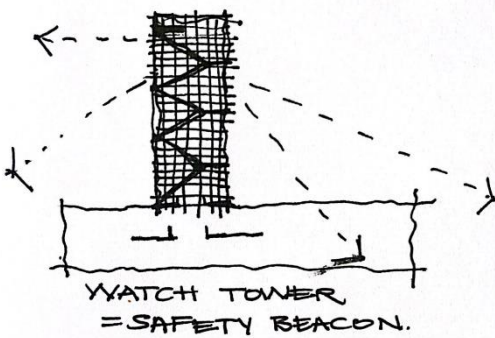
MASSING ON EAST PORTION

ITERATION 3

Massing exploration of the fire station and park.

Exploring the different programs within the station as well as the street interface to the park and the building.

- Watch tower
- Apparatus
- Public multifunctionality
- Private quarters



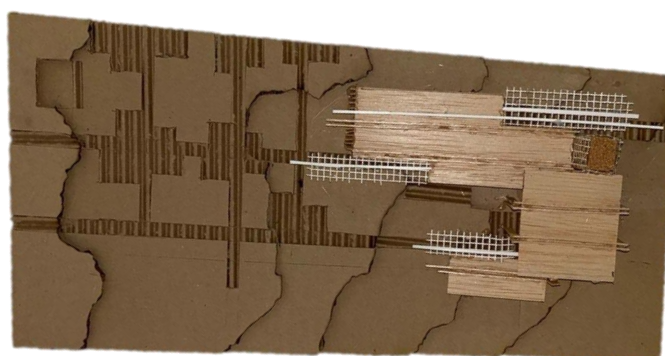
ITERATION 4

Further programming the site to accommodate for multifunctionality + archetypes.

- Public: gym + library
- Apparatus
- Pvt quarters
- Shopfront promenade
- Sports mile
- Children marabaraba



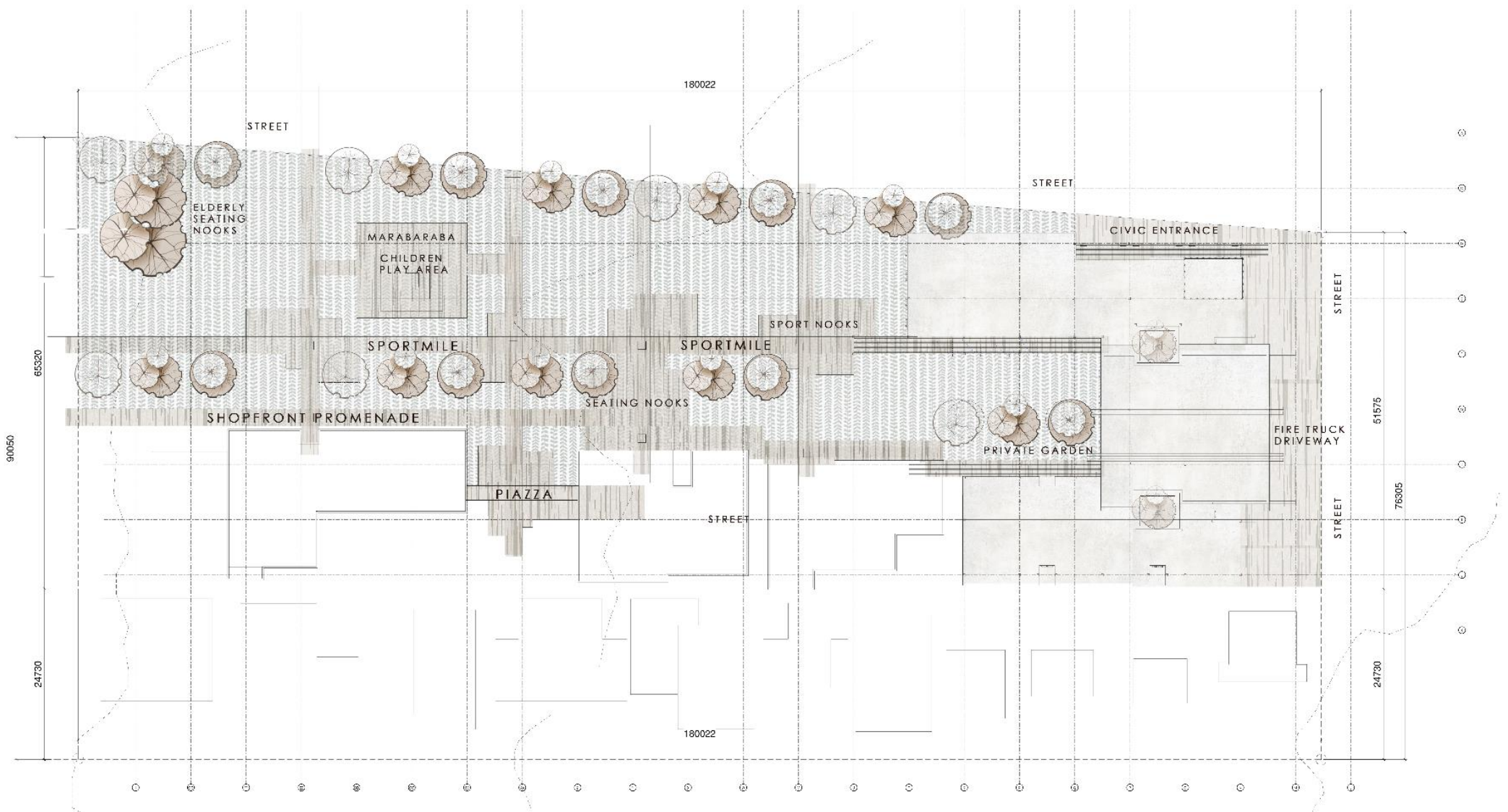
DESIRE LINES OF PED. MOVEMENT FORMING CORRIDOORS



MODEL SHOWING FIRE STATION EXTENDING INTO PUBLIC PROMENADES AND PARK

FIGURE 4.1: DESIGN ITERATIONS

04. PROJECT DOCUMENTATION



▲ SITE PLAN 1:200

FIGURE 4.2: SITE PLAN

The result of the exploration is a 3-part building organised around the apparatus bay, where the northern portion of the building is public-orientated, and the southern is private-orientated. These “separations” are demarcated according to interior courtyard spaces, acting as a threshold between the 3 main programs.

The building extends into the landscape to form one continuous flow of movement, connecting people of all ages across the entire site. The existing buildings along the southern portions of the site are connected through a promenade, accommodating for ease of movement and seating areas. The public gym becomes an inside-outside space that extends into a sports mile running horizontally across the site. The sports mile has spill out spaces that connect to the shopfront promenade, emphasizing the project themes of social networks & collaboration, safety, and supervision.

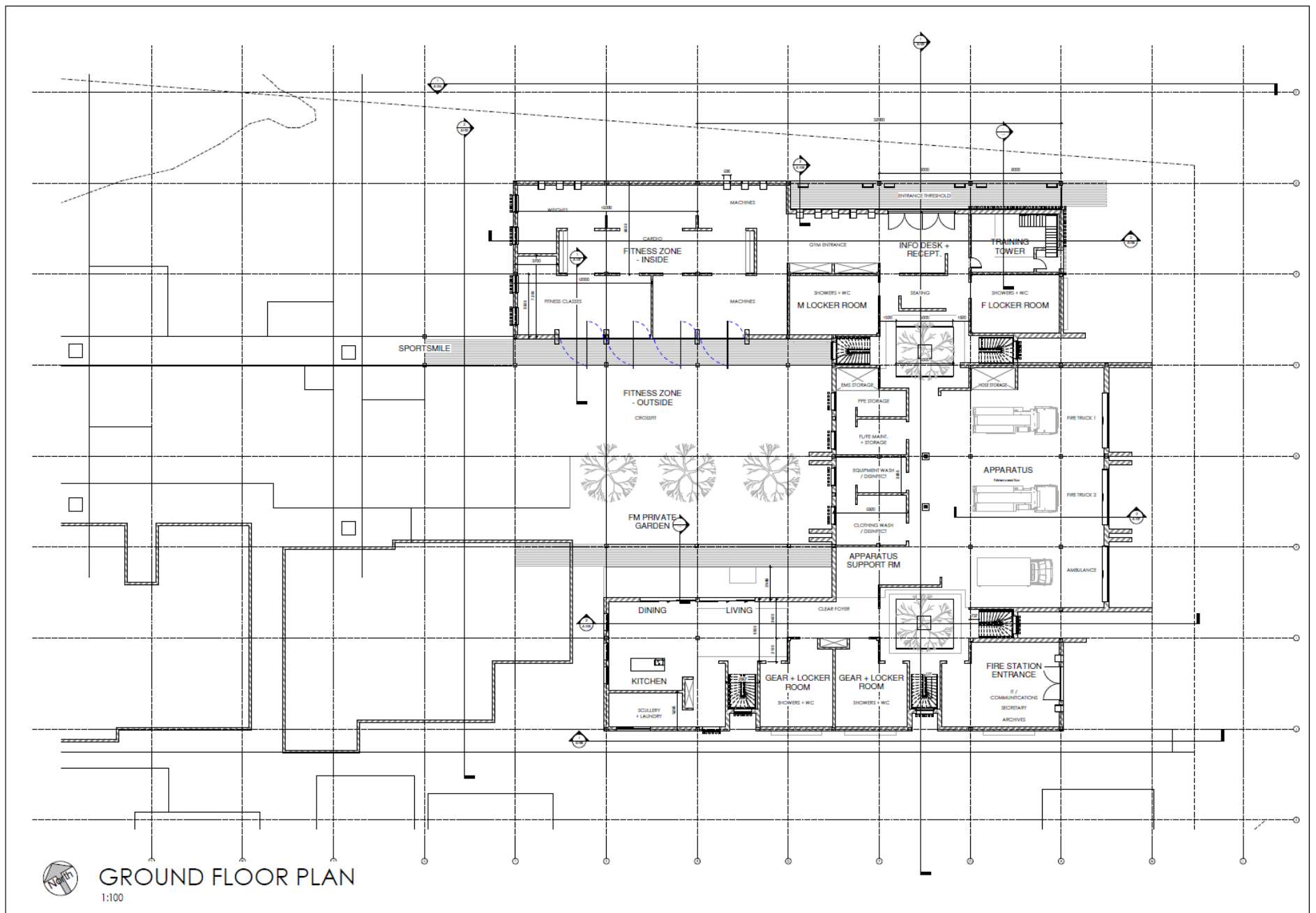


FIGURE 4.3: GROUND FLOOR PLAN

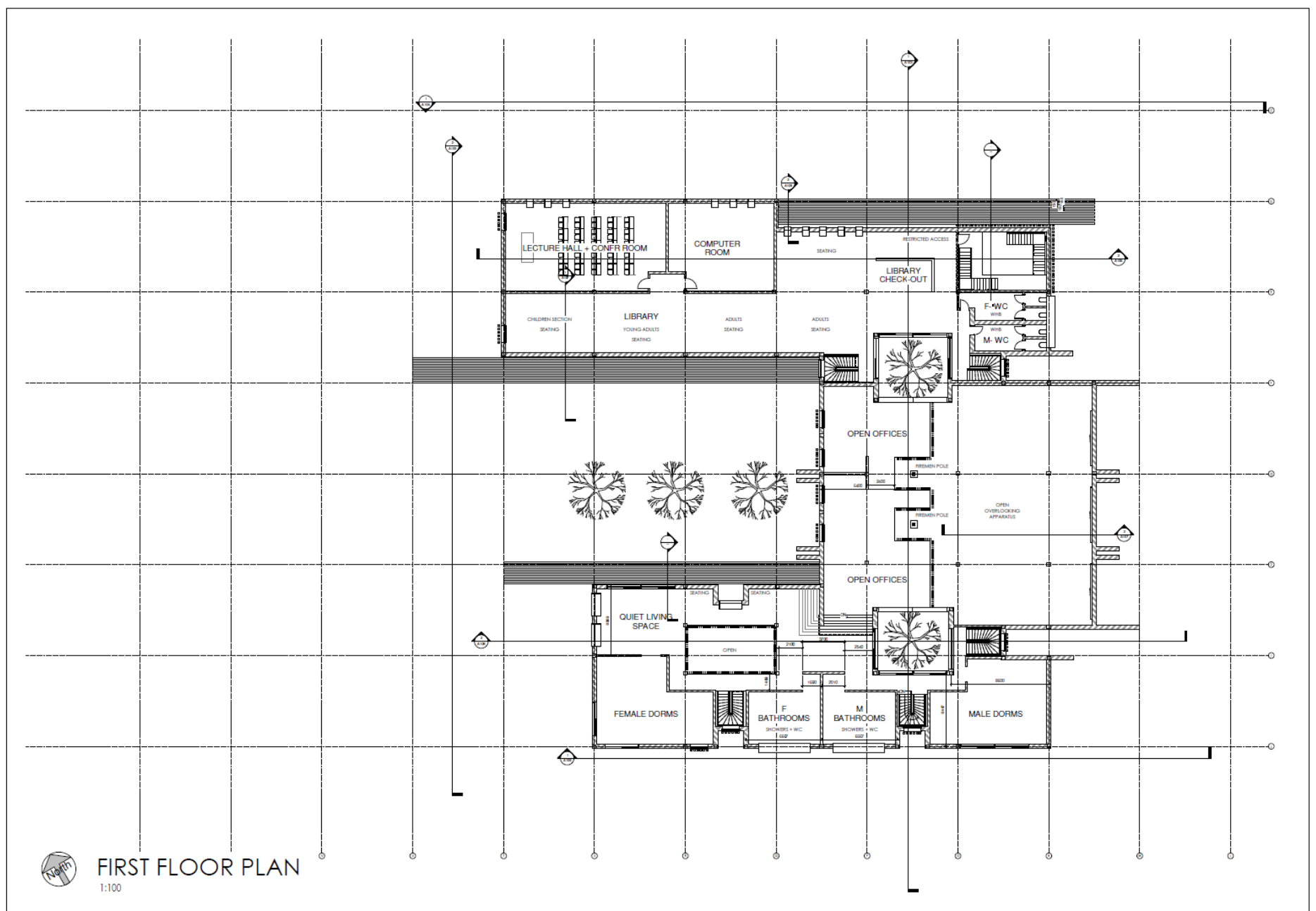


FIGURE 4.4: FIRST FLOOR PLAN



FIGURE 4.5: ELEVATION AND SECTION DRAWINGS

05.

TECHNICAL INVESTIGATION

The Cullinan Premier Mine is located 3km from the site. This is an opportunity to use the material extracted from the mine, bringing an imperative sustainable approach to the project. Rocks, soil, clay will be used directly to form the material integrity of the project. The rocks can also undergo a crushing process, forming the key elements in concrete.

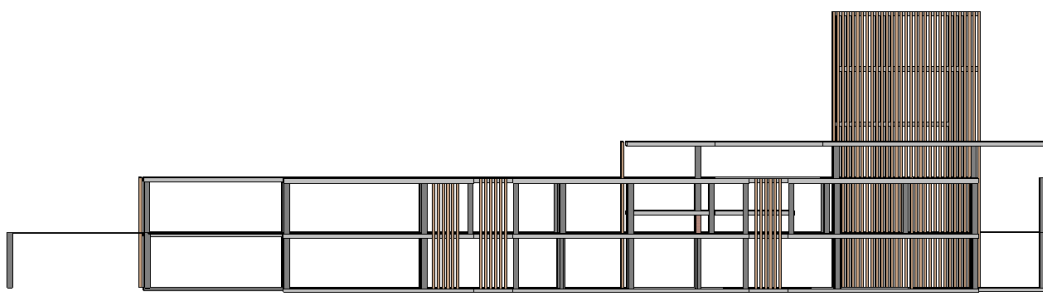
The agricultural surrounding of Refilwe is also used to its advantage as straw can be directly used as a building material as well.

The Refilwe Fire Station project therefore integrates all the above mentioned locally sourced materials to create adobe bricks, each measuring 400x400x280mm, as a fundamental component. Notably, these bricks are meticulously handcrafted on-site by the community, using earth, clay, and straw all obtained within a 3km radius. This approach not only fosters a sense of ownership and skill development within the community but also significantly reduces transportation costs and minimizes the project's environmental impact.

Thus, the Refilwe Fire Station project adopts a column-post-and-beam structural system, featuring 250mm by 250mm concrete columns spaced at 8-meter intervals. This configuration establishes an organized 8x8 grid, providing structural stability and influencing the overall layout of the building.

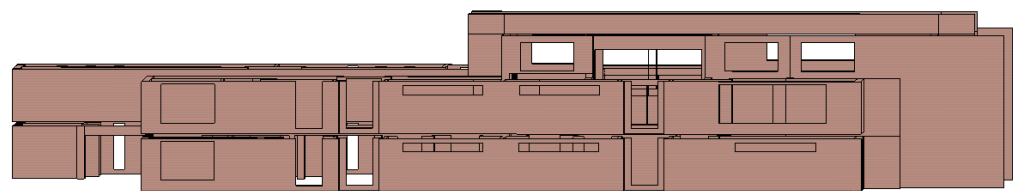


FIGURE 5.1: IMAGE OF VARIOUS ADOBE BRICKS REVEALING COLOUR OF SOIL USED.



View showing skeleton or primary structure of the building: concrete columns and concrete floors.

FIGURE 5.2: PRIMARY STRUCTURE



View showing secondary structure of the building: Adobe bricks.

FIGURE 5.3: SECONDARY STRUCTURE

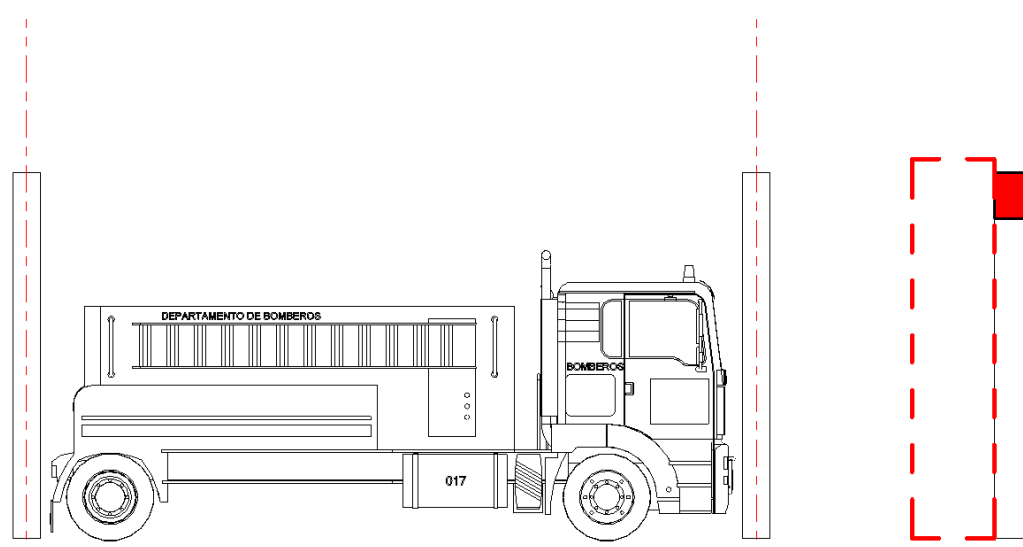


FIGURE 5.4: COLUMN SPAN ACCORDING TO FIRE TRUCK PARKING BAY SIZE

An 8m x 8m grid is employed to direct the positioning of the 250mm x 250mm concrete columns. The grid is based on the fire truck parking bay sizing, emphasizing the design orbiting around the fire trucks, a symbol for safety.

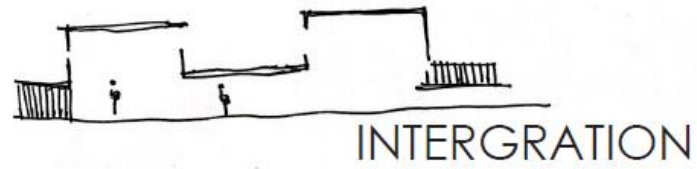
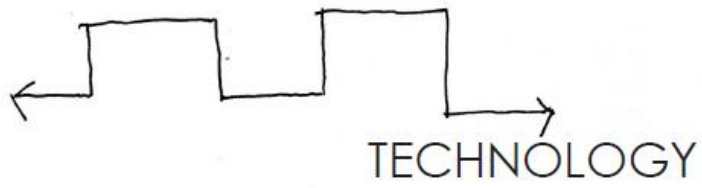
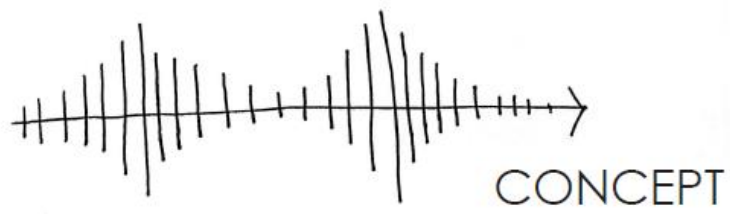


FIGURE 5.5: DIAGRAM SHOWING PROCESSION OF THE CONCEPT OF SPEED INTO THE FORM OF THE BUILDING

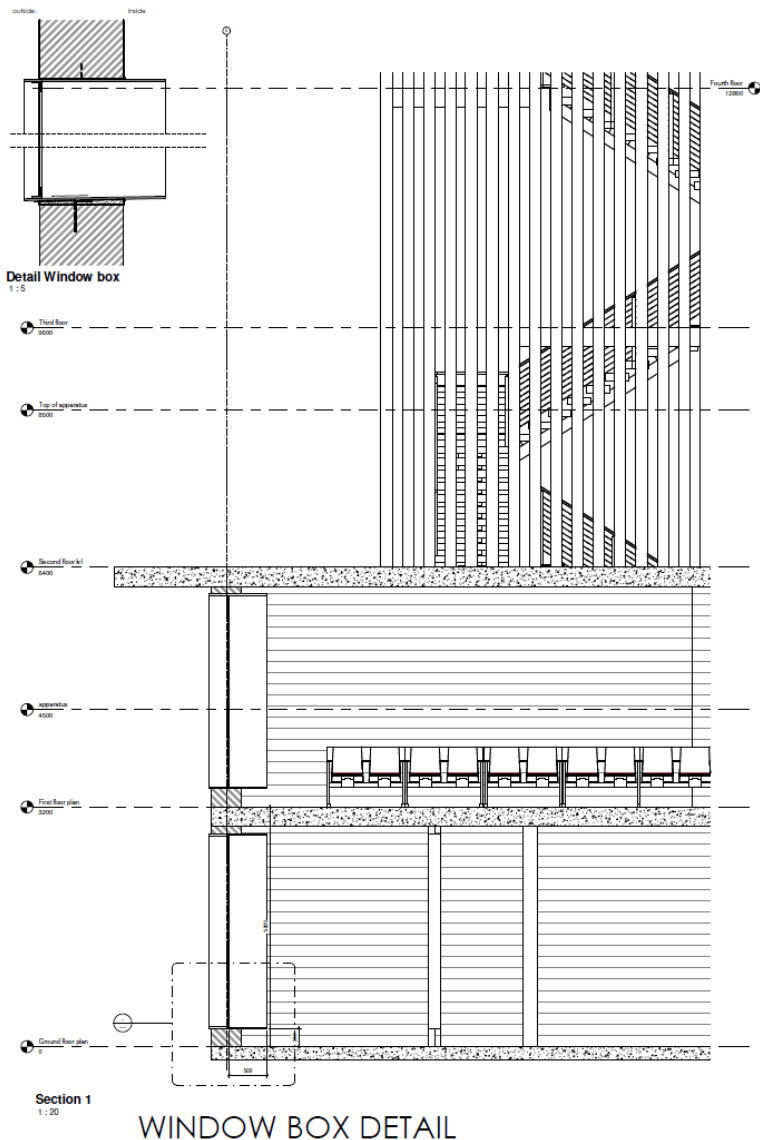
The design employs varying roof heights to communicate the level of urgency and speed needed in different areas. Higher roofs insinuate the space is meant for quick and urgent activities. Lower roofs indicate spaces where a slower and more relaxed pace is appropriate.

Varying roof heights is used further used to indicate hierarchy: attention given to the watch tower, then to the fire truck apparatus, and finally to the public spaces and private spaces. The dramatic height of the watch tower, which doubles in program as the firemen training tower, becomes a beacon within the site, to be seen from any location in Refilwe. This is to insinuate this building is a place of safety and promoting well-being.

This deliberate choice in heights helps to create distinct atmospheres tailored to the specific functions of each area within the fire station.



FIGURE 5.6: SECTION SHOWING VARYING HEIGHTS EMPHASIZING HEIRACHY OVER MAIN PROGRAMS



(left) FIGURE 5.7: TECHNICAL ASPECT OF THICK ADOBE WALLS GENERATE A DESIGN OPPORTUNITY FOR BOX WINDOW DESIGN

The 400mm-thick adobe walls serve a dual purpose, functioning as load-bearing elements and offering design opportunities for built-in seating areas. These seating solutions contribute to the creation of intimate spaces within the fire station, emphasizing the importance of comfort and relaxation within the facility.

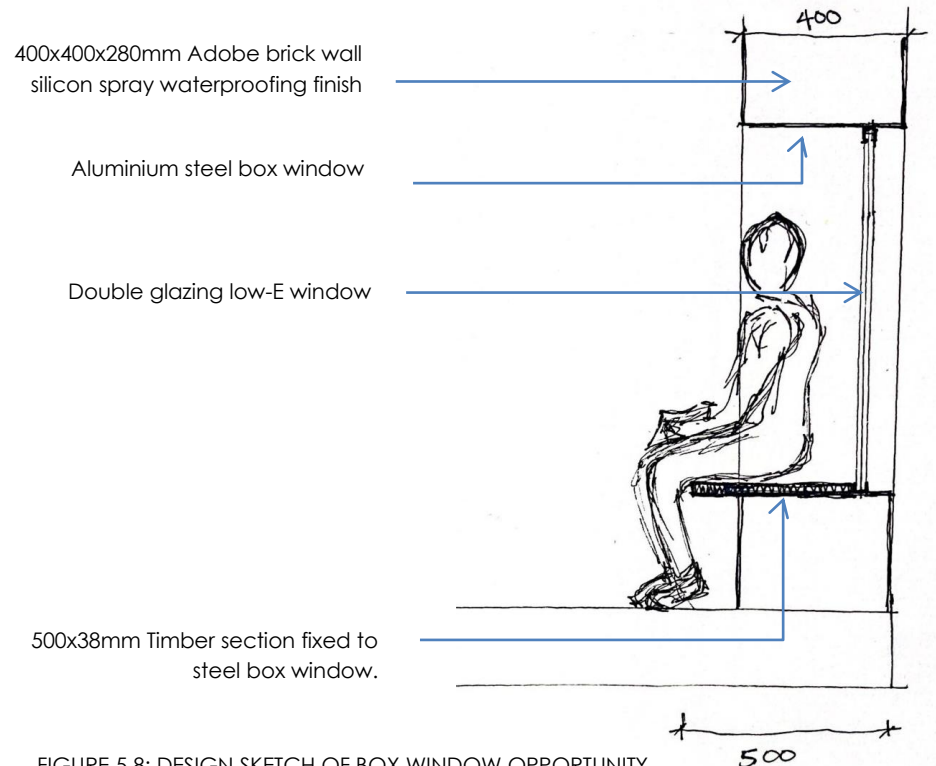
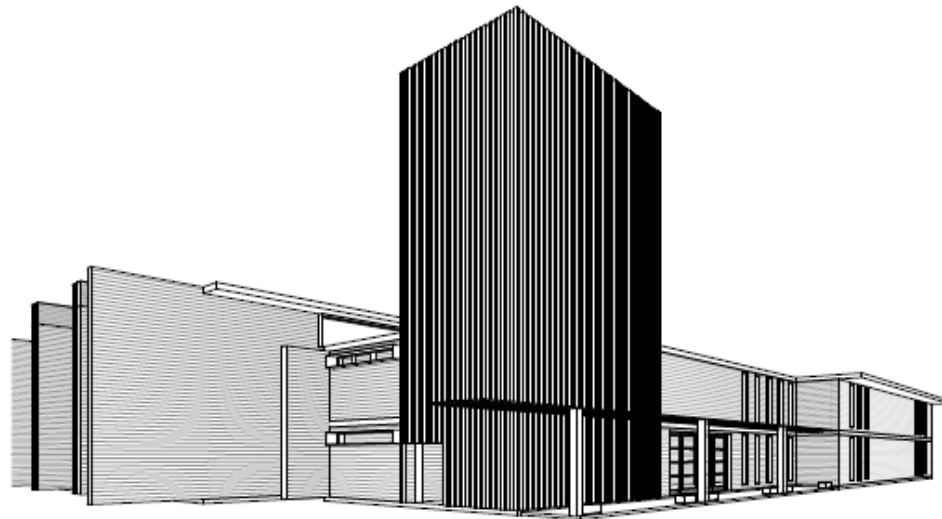


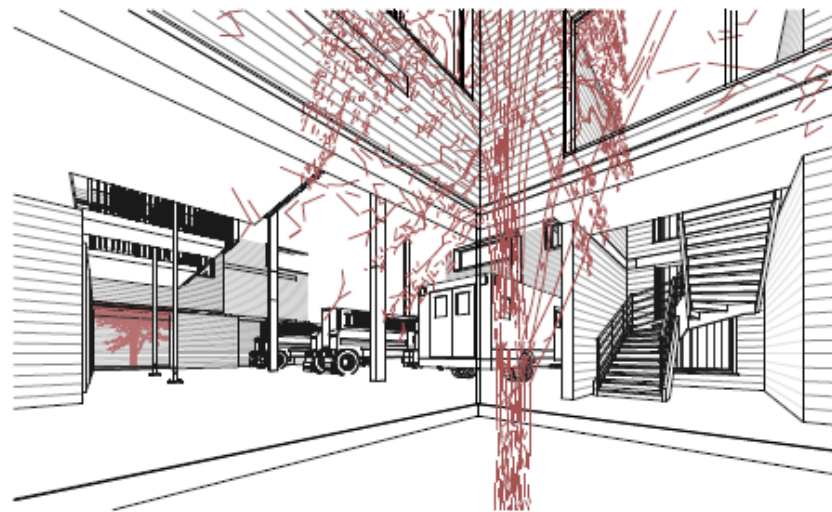
FIGURE 5.8: DESIGN SKETCH OF BOX WINDOW OPPORTUNITY



STREET EDGE VIEW



WEST VIEW



COURTYARD INTERIOR VIEW

FIGURE 5.9: MODEL PERSPECTIVES

06. CRITICAL REFLECTION

IMPACT OF MINI-PROJECT:

BEYOND MINDSCAPES

The concept of cognitive emotional design, as explored in the mini design project involving a sculpted clay face and significant books, had a profound impact on shaping the design approach for the fire station project. This reflection delves into how the principles of cognitive emotional design influenced and enriched the development of the fire station's architectural concept.

Cognitive emotional design emphasizes the creation of spaces that engage users on both emotional and intellectual levels. It aims to stimulate the mind and evoke a profound emotional response while fostering a meaningful connection between the user and the space. The concept of cognitive emotional design has intricately woven its influence into the development of the fire station project. It profoundly resonated with the project's mission to design a fire station in Refilwe, Gauteng, where urgency, speed, and moments of respite were of paramount importance.

At its core, cognitive emotional design places emphasis on the user's journey through a space, surpassing the mere physical structure of a building. This notion became integral in choreographing the experience within the fire station. It required envisioning how firefighters and the local community would navigate through the station, fostering feelings of safety, inspiration, and engagement. This approach aptly encapsulated the urgency and speed inherent in emergency response, while also providing moments of respite for reflection and rejuvenation.

In conclusion, the principles of cognitive emotional design have significantly shaped the fire station project. They have been instrumental in crafting an environment that caters to the urgency and speed of emergency response, while also providing spaces for rest and reflection. By fostering a deep connection between users and the space, the fire station stands as a testament to the power of design in enhancing safety, community engagement, and overall well-being.

MAJOR PROJECT OUTCOME

EMBERS TO SAFETY: A COMMUNITY-CENTRIC FIRE STATION

The culmination of the fire station design project is a multifaceted and community-centric outcome that stands as a testament to innovation, resilience, and sustainability. At its core, the project delivers a state-of-the-art fire station situated in Refilwe, Gauteng, South Africa. Anchored in principles of sustainable architecture and global awareness, the fire station integrates traditional building techniques with modern innovations, utilizing locally sourced adobe bricks.

The building itself is a manifestation of community empowerment, engaging residents in the production of adobe bricks on-site. This not only creates a sense of ownership but also fosters skill development within the community. The 400mm-thick adobe walls, meticulously crafted by local hands, serve both structural and design purposes, offering excellent thermal mass properties that contribute to the building's energy efficiency.

The project, however, transcends its role as a fire station. It's a dynamic interplay of urgency and repose, symbolized by the architectural juxtaposition of the fire station and the adjacent park. This relationship underscores the fire station not merely as a functional necessity but as a civic anchor, enriching the daily lives of residents. The sporting facility further enhances this synergy by marrying the training needs of firefighters with the recreational aspirations of the wider community.

Embracing a community-centric rationale, the fire station becomes a hub of learning and collaboration. Educational spaces, including a small library and classrooms, open their doors to the public, providing a platform for school outings and community gatherings. The design ingeniously accommodates both the need for firefighting-related conferences and meetings for firemen and a conducive environment for youths to explore firefighting as a potential career path.

07. CONCLUSION

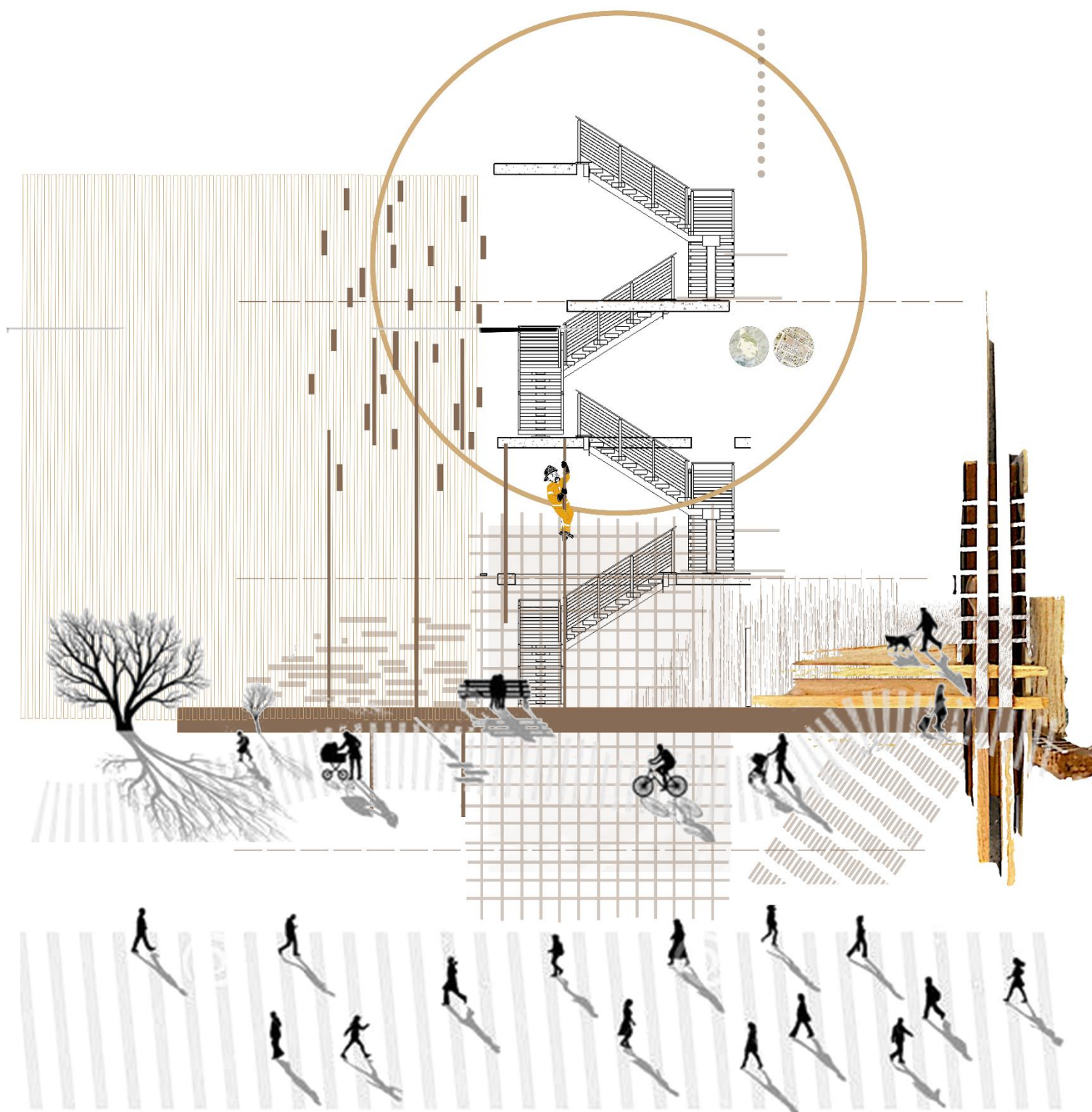
The Refilwe Fire Station project embodies a holistic approach to architectural design, addressing critical community needs and emphasizing sustainable principles. By seamlessly integrating traditional craftsmanship with innovative solutions, the fire station becomes not just a symbol of safety but a testament to the power of community-centric engagement.

The project's success lies in its multifaceted design that extends beyond the functional requirements of a fire station. The inclusion of educational spaces, the dynamic interplay of urgency and repose, and the integration of passive design strategies showcase a commitment to creating a resilient and empowering community hub.

Through meticulous iterations and technical investigations, the project achieves optimal building performance, as evidenced by improvements in daylighting, energy efficiency, and thermal comfort. The engagement of the local community in adobe brick production adds a layer of sustainability and community empowerment, aligning with the project's ethos.

The Refilwe Fire Station stands not just as a physical structure but as a living testament to the possibilities of marrying tradition with innovation, urgency with repose, and functionality with community enrichment. As it takes its place in the heart of Refilwe, this architectural endeavour demonstrates that safety, sustainability, and community empowerment are not just aspirations but achievable realities through thoughtful and purpose-driven design.

FIGURE 7.1: GRAPHIC OF PROJECT DESCRIPTION



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