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Designing a public train station shelter to minimise anti-social behaviour and crime in Melbourne's metropolitan rail environment

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ABSTRACT

The Melbourne metropolitan train network has experienced incidents of anti-social behaviour and crime across the network over recent years. Identification of this problem has lead to design research aimed at exploring ways to minimise anti-social behaviour, improve passenger security and the perceptions of Melbourne's railway system.

A literature review has revealed that good sightlines and visibility, minimised obstructions, sufficient lighting solutions, and controlled access are the principal factors that contribute to a safe and successful station environment. The key findings, used as guidelines, are intended to inform a design process in developing a potential design solution that is novel and adaptable.

This paper examines the design and function of a shelter system design concept emerging from the research, and how it might be implemented into Melbourne's train network in the near future. It is proposed that the system not only deters anti-social behaviour and crime, but also improves the quality of life of patrons at varying railway stations.

Keywords: train, design, railway station, shelter, anti-social behaviour, crime prevention

1. INTRODUCTION

The Melbourne metropolitan train network has experienced incidents of anti-social behaviour and crime among the three tiers of stations over the recent years (Kennedy, 2008). Anti-social behaviour can be defined as intimidating or threatening activity that irritates or frightens people, as well as negatively impacting the quality of life in an environment. It can range from minor public nuisance and misdemeanour such as speaking boisterously, playing music loudly, litter, and skylarking, to the more serious criminal acts such as graffiti, vandalism, harassment, assault, and drug use.

The identification of this problem led to design research aimed to explore ways that may minimise anti-social behaviour and crime, improving passenger security and the perception of Melbourne's train network. A literature review emerged from the research and revealed that a pleasant and well-maintained environment, in conjunction with a range of specific design factors, contribute to a safe and successful train station. A design specification for the development of a new train shelter for Melbourne's metropolitan railway was formed according to the literature findings. From there, design experiments were carried out to find a potential shelter solution that will not only minimise anti-social behaviour and crime, but to

also improve the quality of life of patrons on varying suburban train stations and platforms.

Several potential concepts have surfaced from the design exploration. The second half of this paper examines the design and function of a particular shelter system design concept that has emerged from the research, and how it might be implemented into Melbourne's train system effectively in the near future.

2. BACKGROUND: STATION TIERS IN THE NETWORK

Observations from a number of site visits within the Melbourne train network provided an insight into the three railway stations tiers – *premium, host and unmanned stations.* Premium (large) stations usually have a dense or constant flow of commuters and are staffed from the first to last train seven days a week. Facilities on most premises include: indoor and/or sheltered waiting areas, toilets, and customer service centres where assistance, train tickets and timetables are available. Host (medium) stations are not as busy as premium stations but have a sufficient stream of people to employ customer service officers during the Monday to Friday 6am to 9am rush. When unstaffed, the nearest premium station can be contacted through the emergency alarm intercom in the event of an urgent situation. Ticket vending machines are available near platform entrances and some shelter and seating are also available. Unmanned (small) stations have no permanent customer service officers stationed on premises, and generally have limited shelter and seating on the platforms. A number of the smaller unmanned stations have the one shared platform for both inbound and outbound rolling stock, and the nearest premium station can be contacted in the event of an emergency.

Recently, restorations have been implemented in an attempt to make Melbourne's station environment safer and more comfortable. However, the authors note that the stations undergoing these improvements tend to be the premium or larger stations, such as North Melbourne and Footscray, and smaller host or unmanned stations that require the same attention seem to be overlooked for the moment.

Figure 1: Newly restored North Melbourne station (left) and the entrance of Footscray station (right) under reconstruction

3. LITERATURE REVIEW

A wide body of literature contends that anti-social behaviour and crime is problematic in public train systems (Cozens et al. 2004; Kennedy, 2008). The combination of a poorly

designed railway environment, the presence of uncivil people, the lack of apparent security measures, and negative media exposure have heavily influenced passenger insecurities when travelling. Kennedy's (2008) study indicates that the three key situations in which people feel most unsafe in the railway environment are: (1) waiting at stations or platforms, (2) walking to and from the station or platform and (3) using the available toilets and waiting rooms. It also reveals that many public transport users tend have an aversion to stations or stops that make them feel enclosed, trapped, or vulnerable to danger. Stafford and Pettersson (2004; in Kennedy, 2008, p.25) found that the main factors influencing these three situations are:

- isolated or secluded areas around train stations or stops with no, or very minimal opportunity for informal surveillance (i.e. being seen and assisted by other people in close proximity when in trouble)
- obstructions such as pillars, trees, or buses that can potentially impede a clear view for informal surveillance or serve as hiding spots for offenders to hide behind,
- poor lighting or shadows, and
- subways, alcoves, obstructions or long flights of stairs that are badly lit and dirty.

In addition, it is suggested by Hiss (1990) that the built environment influences people's behaviour and perceptions significantly, and areas with potential criminal opportunities and inadequate security measures tend to attract offenders in carrying out varying degrees of social disorder or crime (Colquhoun, 2004).

Based on the literature review, it was found that a combination of good regulations, policing, security measures, and management mixed with a pleasant and well-designed environment; contribute to a safe and successful rail system (Diec et al., 2009). Effective crime control or policing schemes adopted at a number of railway systems around the world include: 'Broken Windows[1]' policing, Crime Prevention Through Environmental Design (CPTED) and Situational Crime Prevention techniques. Furthermore, aside from security personnel, there are a number of existing tangible measures designed to counter certain forms of delinquency, crime and passenger insecurities in rail environments. These remedies range from:

- *Integrated security technology* to protect the safety and security of passengers ie. closed circuit television (CCTV) systems, emergency alarms and electronic ticket barriers.
- *Quality environments and design* to discourage delinquency and bolster passenger confidence in the railway environment ie. having clear sightlines, ample effective lighting, and safety zones.
- *Asset management and protection of the built environment* to ensure clean and well-maintained rail stations ie. using silicon based paints that dissolve graffiti, and integration of public art.

Progressive benchmark rail systems such as Washington Metro, MTR Hong Kong, and Paris Metro's Line 14 are some of the leading examples of well-designed and managed networks in the world that provide top class passenger safety and crime control through their multiple designed strategies and management techniques (Gaylord and Galliher 1991; Myhre and Rosso 1996; La Vigne 1997). All three systems had their stations carefully planned and designed with the use of CPTED evident. Washington Metro's architects opt for an identical layout for all railway stations across the network to achieve a sense of familiarity and easy

[1] James Q. Wilson and George L. Kelling's *Broken Windows* theory is based on the idea that 'if a window... is broken and is left unrepaired, all the rest of the windows will soon be broken' (Wilson and Kelling, 1982, p.30). It is suggested that serious crimes in a community are often encouraged by the overlooked minor misdemeanours such as graffiti, vandalism and litter.

navigation for the users, integrating wide arched ceilings conveying a strong sense of openness with little opportunity for delinquency or crime (Myhre and Rosso, 1996). For the design of the Hong Kong MTR system, the architects consulted with the Hong Kong police and the 'design out crime' approach was taken. As a result, all stations have maximised lighting, controlled access and movement, minimised alcoves and obstructions, and been designed in a way that discourages loitering as 'the general atmosphere [created] …is businesslike and brisk' (Gaylord and Galliher, 1991, p.19). Line 14 of Paris Metro utilises natural light most efficiently with the multiple windows and abundant use of glass in some station designs. The ample open spaces, clear lines of sight and innovative lighting solutions suggest that the designers intended to not only minimise crime, but to also enhance surveillance, reduce insecurities and provide better comfort in the system (Myhre and Rosso, 1996).

The review determined visibility as a key factor in occurrences of anti-social behaviour and fear of crime at railway station environments. Thus, to improve the quality of life of patrons and deter anti-social behaviour, the key focus for the design research project was to *enhance visibility* in Melbourne's railway station environment. Strategies recommended by a range of literature (Colquhoun, 2004; Kennedy, 2008; Wekerle & Whitzman, 1995), as illustrated in Figure 2, include: increased visibility or clear sightlines, ample well-designed lighting, limited entrances or exits, controlled access, maintaining a clean environment, and eliminating potential hiding areas, isolation and excessive shrubbery.

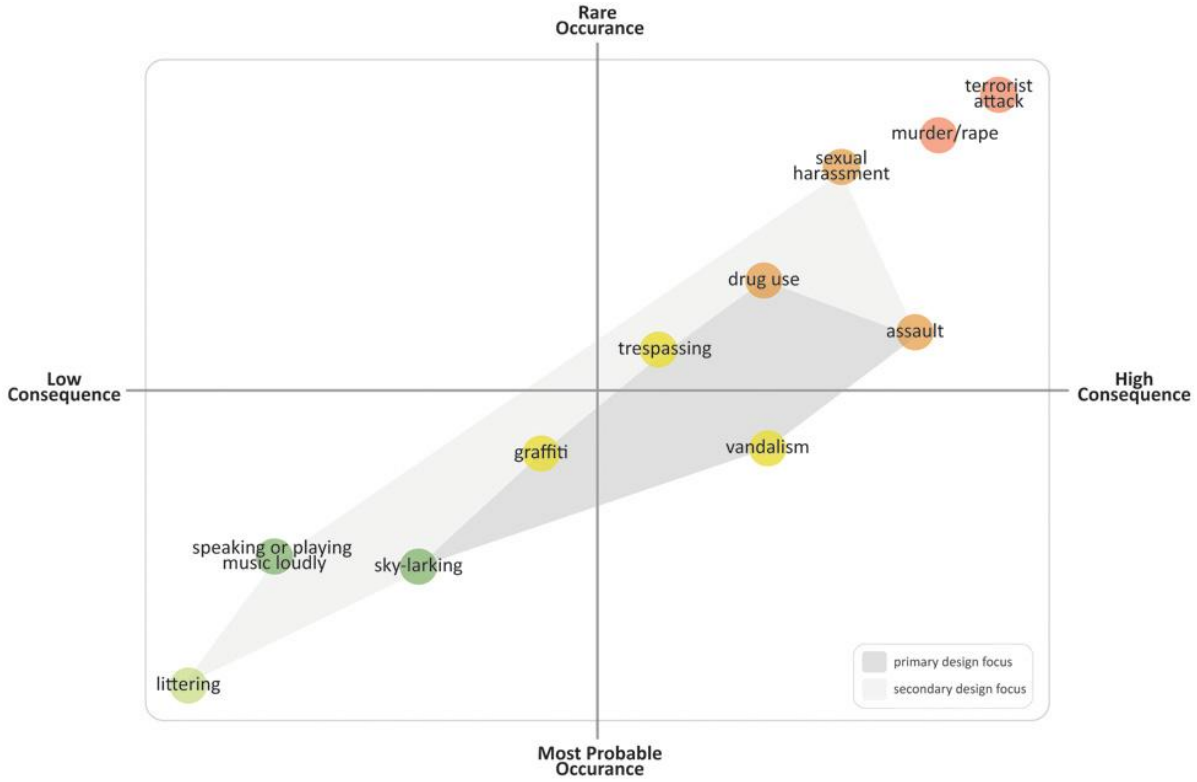
Figure 2: Design strategies – visual representation

4. SCOPE

Due to the varying consequences and likelihood of anti-social behaviour and crime, it was important to establish design parameters when developing a public train station shelter to minimise misdemeanour and criminal acts at Melbourne suburban stations. A perceived risk assessment was carried out and it was decided that for this particular research project, the primary design focus is to address the delinquency and crime classed as *medium to high severity* with a *probable* possibility of occurrence. As Diagram 1 indicates, this encompasses sky-larking, graffiti, vandalism, trespassing, drug use, and assault. The authors believe that although littering, speaking or playing music loudly and sexual harassment are just outside the key focus area, the design outcome may potentially have an impact on them as well.

Serious crimes such as terrorist attacks, murder or rape are all extreme criminal acts that are beyond the scope of this research project due to the broader social or geopolitical factors involved.

Diagram 1: Risk Assessment: A Perception Diagram



5. DESIGN SPECIFICATION

The development of new shelter to be implemented at Melbourne suburban railway stations required set design boundaries. Therefore, it was vital to formulate a design specification early in the design process so that the final outcome will effectively respond to the anti-social behaviour and crime problems outlined by the research.

The design specification should inform a solution improving the quality of life of patrons and deterring anti-social behaviour and crime at Melbourne train stations. To achieve this, both the shelter interior and the structure itself should be designed and assessed accordingly with this specification's outlined functional requirements, minimal performance requirements and any Australian regulations or standards.

5.1 Shelter interior

The shelter interior must:

a) *offer adequate physical comfort within the set parameters for people standing and sitting in it while they wait for their train*

Users expect to sit or stand comfortably under shelter while waiting for their train. The International Association of Public Transport (UITP) (2006) found that the lack of

comfortable seating or space significantly increases physical discomfort in public transport. Thus, it is important that the new shelter design provides up to 30 minutes[2] of physical comfort in ordinary circumstances for sitting and standing users waiting in peak or off-peak hours with the possibility of light luggage. From the literature search, the authors found no specific data related to the density of people within a space on a train platform. However, comparable statistics reveal that the density of standing users on a bus should be 4 passengers per a square metre and the recommended minimum surface area of single seat is 375 x 375mm (ibid). These findings offer designers a general indication of the required space for a new train station shelter. Pheasant and Haslegrave (2006) also advises a maximum seat height of 400mm to cater for most users comfortably.

b) *allow fluid and comfortable human circulation within it*

Good circulation impacts user comfort significantly. Hindered flows of passage can cause discontent amongst passengers. Overcrowding and restricted movement may even spark anti-social behaviour such as pushing and shoving, pick pocketing, and harassment. Thus, the shelter structure should allow people to move around it at ease under regular conditions. The minimum space requirement for adequate circulation, enabling a wheelchair user or two people walking side by side in the shelter, is 1350mm in width according to Pheasant & Haslegrave (2006). Designers should also refer to *AS 1428.1-2009 – Design for access and mobility: General requirements for access - New building work*.

c) *provide users with clear lines of sight of their outside surroundings, and allow them to be seen from the outside*

A clear view of the surroundings from the shelter's interior provides users with a better sense of safety and security. At the same time, visibility into the shelter from the outside is highly beneficial as it enable inspectors or police officers to identify any anti-social behaviour or crime in the shelter at a distance (UITP, 2006). The shelter should allow people to see if there are vacant seats or human presence from the outside, and in turn, prevent delinquent people from hiding inside the enclosures, or claiming ownership of them and intimidating others. Technical recommendations include: ample use of transparent materials, eliminating obstructions near the shelter, and where there is strong sun glare, transparent surfaces should be tinted or fitted with suitable filters.

d) *offer users a pleasant and clean environment*

The shelter interior should be easy to maintain, well lit and appear inviting to the users on a day-to-day basis. Choice of materials should be carefully considered to minimise excessive grime, mould, dirt and dust accumulation, and appropriate lighting levels must be implemented. Any indication of vandalism, graffiti, grime and deterioration in and on the shelter structure should be easily removed, repaired or replaced quickly and cost effectively in line with the 'Broken Windows' theory.

e) *provide ample lighting*

Comfort is closely linked to the quality of ambient light, particularly outside daylight hours (UITP, 2006), as people primarily rely on sight to perceive their surroundings and circumstances. Sufficient natural light must reach into the train shelter interior during the daytime and enable people to see clearly around them. At night, the

[2] Scheduled trains in the Melbourne network typically arrive within 20 minutes or less of one another, and 30 minutes after 7pm. (Metro Trains Melbourne timetables, http://www.metrotrains.com.au/Timetables-Planning/Overview.html)

shelter must provide adequate levels of artificial light both inside and around the exterior. Light plays a key role in setting the scene in an enclosure, restricting certain areas, influencing people's behaviour, and providing a hierarchy to different passenger information displays (PIDs). Designers should also refer to *AS/NZS 1680.0:2009 Interior Lighting – Safe Movement.*

f) provide users with a sense of safety and security

Uncertainty often sparks fear and vulnerability among people. In railway environments, uncertainty is largely initiated by impaired visibility, the lack of travel information and security measures, and the presence of anti-social people. The shelter must contain a range of integrated security strategies, some hidden and others more obvious to the human eye, to discourage anti-social behaviour, criminal acts and fear among users. It should: provide users with visual assurance that security measures are in place to protect them; enable people to contact station staff or authorities if they are in danger from the inside of the shelter; and have sufficient integrated PIDs that provide users with accurate timetabling and real-time information. Designers should also refer to *AS4852.1-2009 Variable Message Signs – Fixed Signs.*

5.2 Shelter structure

The shelter structure must:

a) protect users from the varying weather conditions in Melbourne within the determined parameters

The shelter structure must withstand the typical day-to-day rain, sun, and wind elements in Melbourne throughout the year. If the shelter design is closed, the interior temperature should be adjusted to remain 18°C to 24°C, between outdoor temperatures of 8°C and 35°C. The shelter must deflect strong sunrays from flooding into the interior, thus prevent the whole structure from heating up and causing discomfort among the users. In addition, the interior must be well ventilated, and should keep users relatively dry from rain. Technical recommended by UITP (2006) include: the use of tinted, filtered, or electro-chromatic glass, a careful choice of robust construction materials, implementing innovative ventilation measures, and integration of a rain water drainage or collection system.

b) withstand certain levels of vandalism or wear

Anti-social behaviour or crimes committed at railway stations are often encouraged from the physical appearance of a neglected or susceptible environment (Wilson and Kelling, 1982). Thus, the shelter must be designed and fabricated in a way that enables it to endure mild to medium levels of deliberate force or impact, graffiti, damage and wear, without the need to replace the whole structure over short periods of time. Consequently, this will minimise maintenance, repairs or replacement costs. Technical recommendations include: applying paints that allows graffiti to be cleaned off quickly and thoroughly, using plastic films on glass planes or structures, and where damage is inevitable, shelter parts should be systematically designed so that it allows easy repair or replacement.

6. DESIGN EXPLORATION

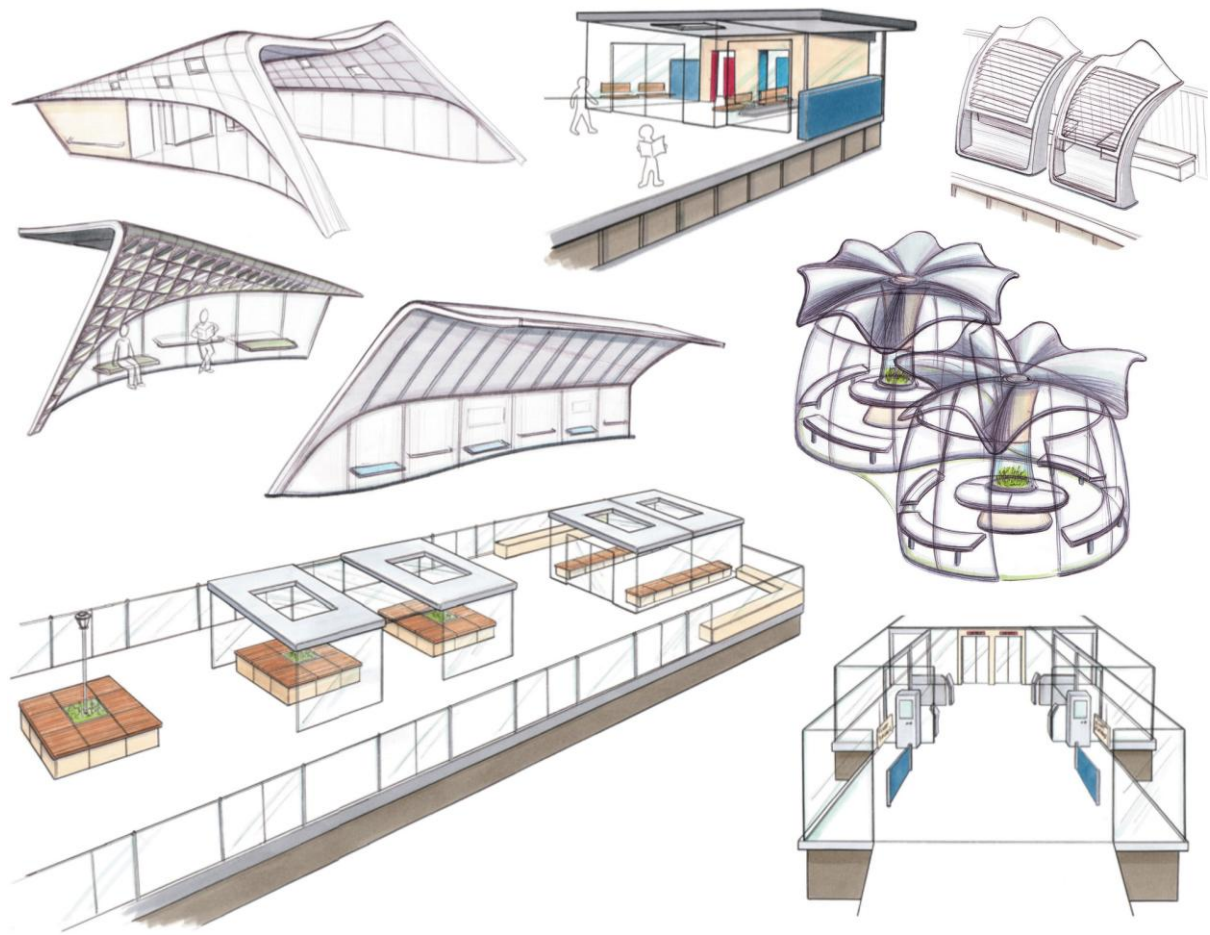
This section of the paper looks closely at the design development of a particular innovative and adaptable train shelter concept, derived from design experiments informed by the research findings and design specification for Melbourne suburban stations.

6.1 Preliminary concepts

Initial ideas (Figure 3) were explored in the first stage of studio research and design. The authors focused on the fear of crime and criminal opportunity issues outlined by the literature search, in conjunction to the station areas where commuters feel most apprehensive and vulnerable for their own safety – particularly in waiting rooms and toilets.

Research revealed that the combination of limited access, a higher level of visibility and natural surveillance in a train station environment, provides a heightened sense of security amongst travellers, discouraging misconduct (Colquhoun, 2004). Thus, several early concepts were aimed to regulate access and maximise visibility by incorporating those findings into the designs. An increased use of transparent materials enables ample natural light in sheltered areas and removes any potential hiding areas or blind spots, particularly around ticket machines where money handling is involved. Rational planning of entrances and exits provide railway stations a more orderly flow of people with minimal opportunities for trouble.

Figure 3: Initial concepts



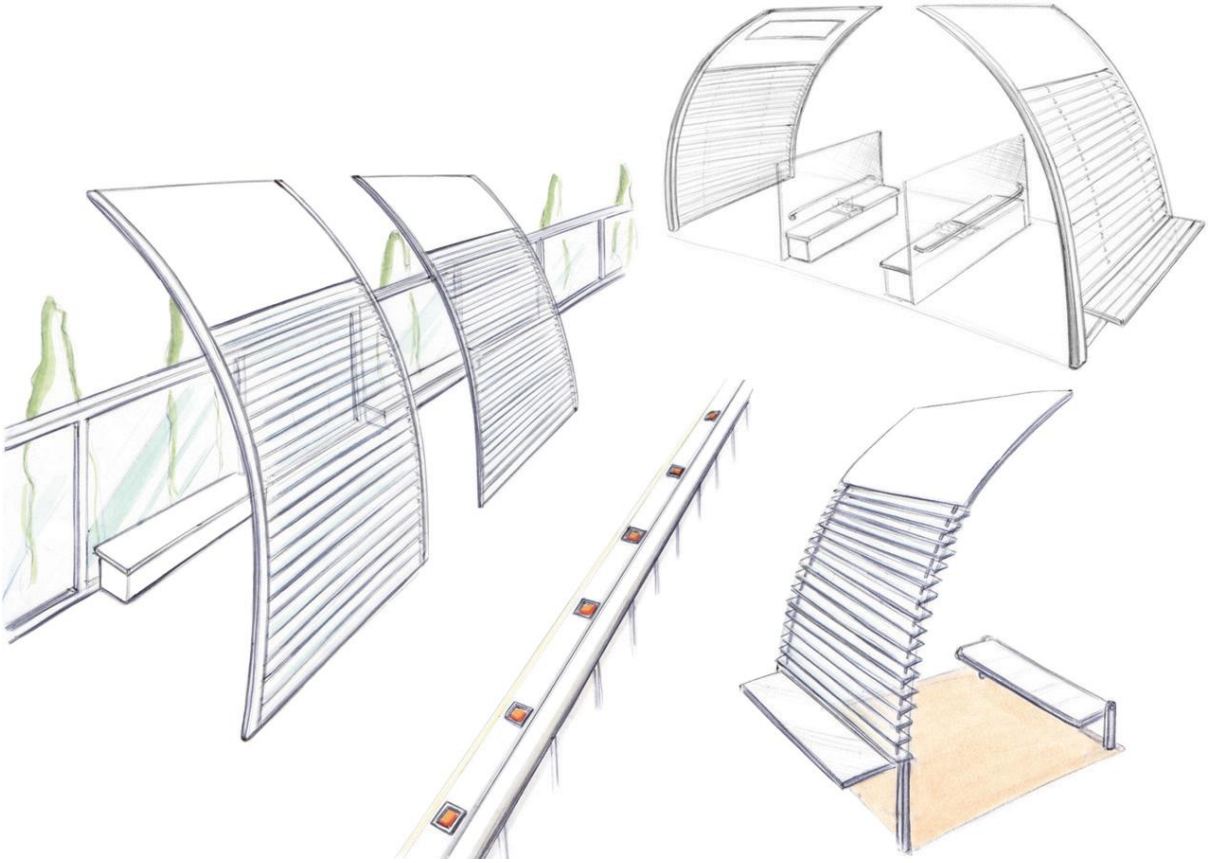
Waiting rooms were to be completely see-through with added surveillance measures, and it was suggested that access into them during off-peak hours would require a registered user swipe card. A particular concept proposed that passengers must enter the waiting room if they wish to use connecting toilet facilities. This two-level access procedure creates a safer environment, as opportunistic offenders are generally wary of areas with clear lines of sight and registered access where user details are recorded. Food kiosks or newspaper stands can also be integrated near waiting rooms to keep the space and surroundings animated.

6.2 Development of the *Louvre* shelter concept

Research and the visual exploration of ideas validates that train station shelters require increased visibility and comfort to make users feel more safe and secure. Having excessive enclosed spaces may encourage antisocial people to take ownership or act inappropriately in, and thus create more fear among other passengers.

For the *Louvre* shelter system (Figures 4 and 5), one of the more promising concepts that emerged from the design exploration exercise, the authors were mindful of the need to enhance visibility. Several strategies outlined by the research were employed in the design process to create a shelter that will effectively minimise anti-social behaviour and crime at Melbourne suburban railway stations. The shelter is principally designed to deter opportunistic anti-social behaviour and crime within the predetermined scope in section 4. Ultimately, it may not be able to withstand extreme deliberate or planned damage, such as gangs equipped with tools or weapons, or terrorist attacks.

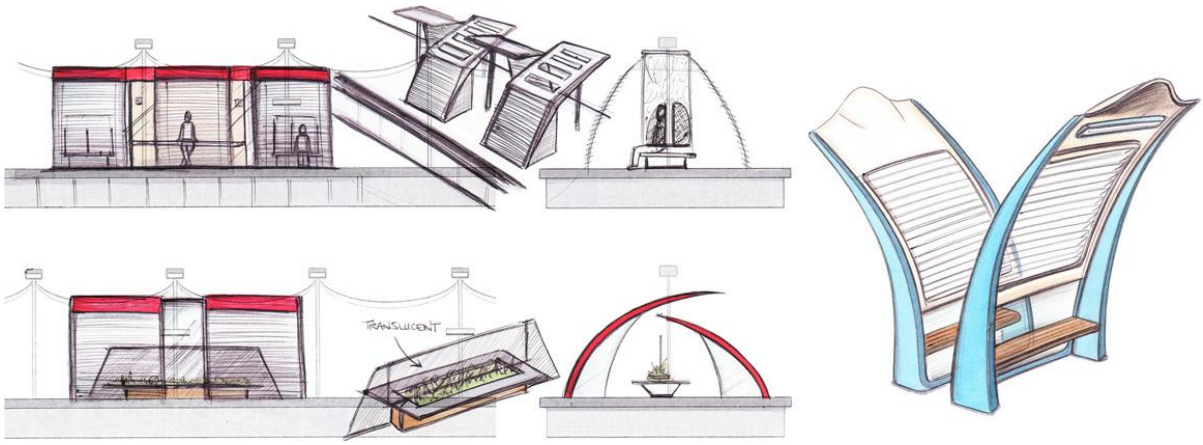
Figure 4: Conceptual sketches of the *Louvre* shelter



6.2.1 The design process

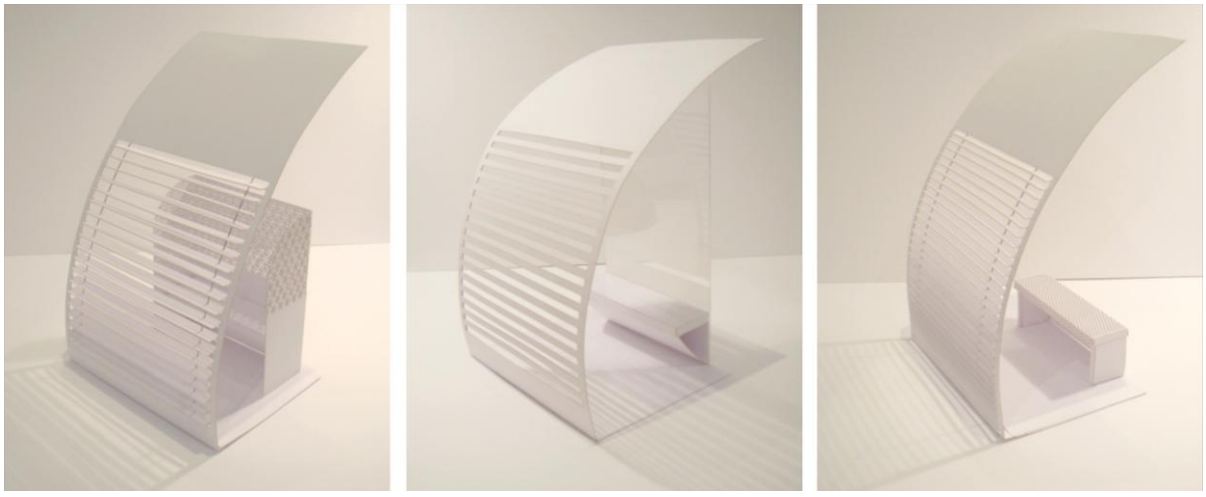
The authors commenced the design process with a range of initial sketches portraying several different shelter forms and structures in response to the research and design specification, before selecting an innovative and practicable idea. It was eventually decided that the curved *Louvre* concept showed the most potential for further development with its increased visibility and adaptable modular structure that can be customised or arranged for various station types or layouts.

Figure 5: Early sketch work of the *Louvre* shelter concept



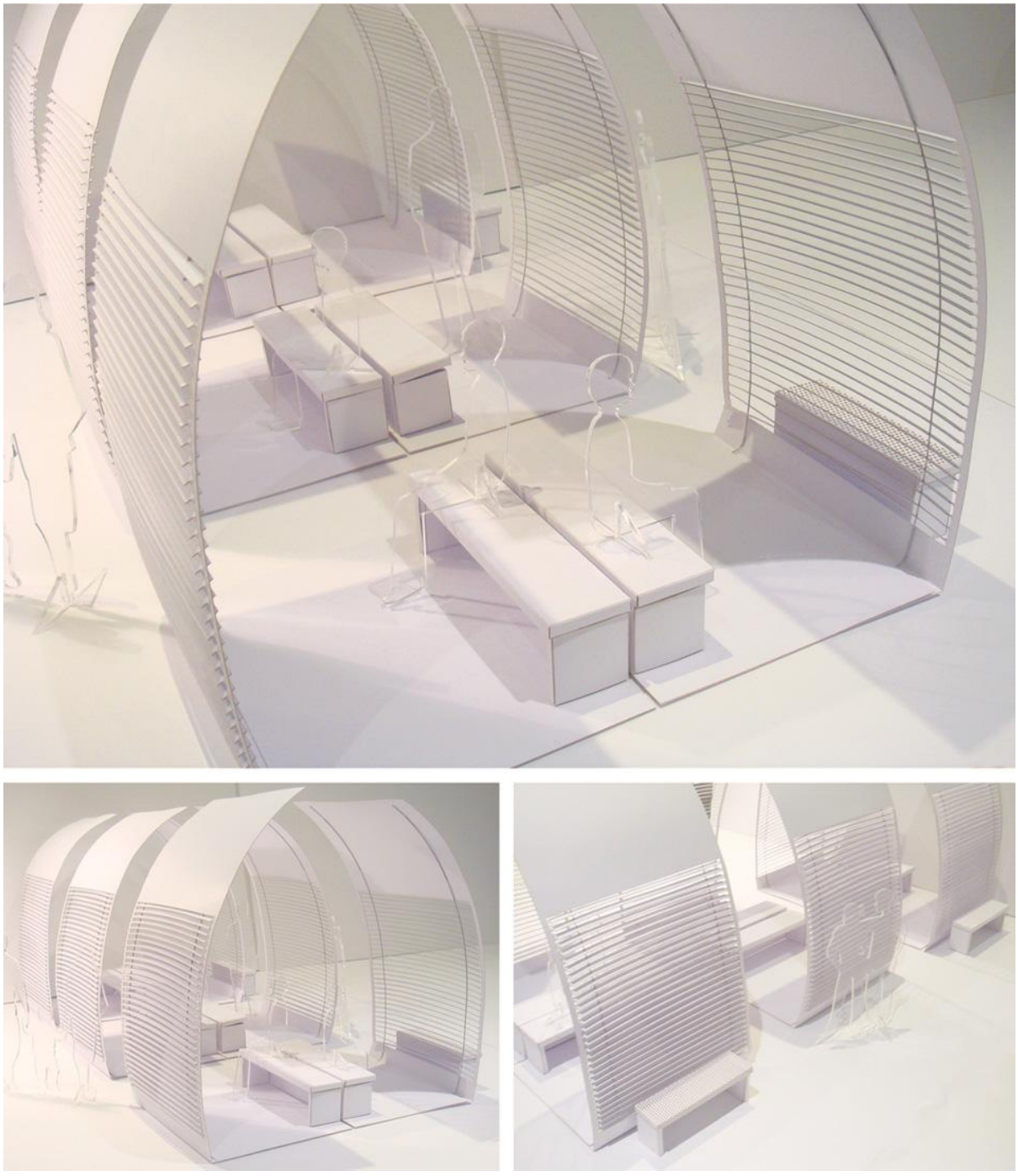
Several scaled cardboard mock ups of the concept with varying differences were produced to obtain three-dimensional understanding of the shelter forms and sizes, and to evaluate some of the integrated design features. During this stage, the authors were able to identify the features most likely to prevent anti-social behaviour and crime, and ones that may fail to do so. For instance, refering to the three mock up models in Figure 6, a delinquent could potentially hide behind the seating in the conceptual model on the left, or smash the glass panel in the middle mock up despite the intention to increase visibility. Conversely, the authors believe that the model on the right would be ideal for the railway station environment as there is little to encourage reckless or unlawful behaviour. For that reason, it was chosen to be futher refined.

Figure 6: Mock ups of shelter concept variations



Multiple 1:10 scaled card models of the chosen mock-up shelter concept were produced to acquire a general idea of sizes and possible system layouts or arrangements. Scaled human figures, such as the 95th percentile standing man, were placed under and around the curved modules (Figure 7) and used to perfect the shelter structure measurements. 3-dimensional models were also generated to illustrate how the *Louvre* shelter could be implemented on Melbourne suburban platforms.

Figure 7: Soft model of the chosen *Louvre* shelter concept

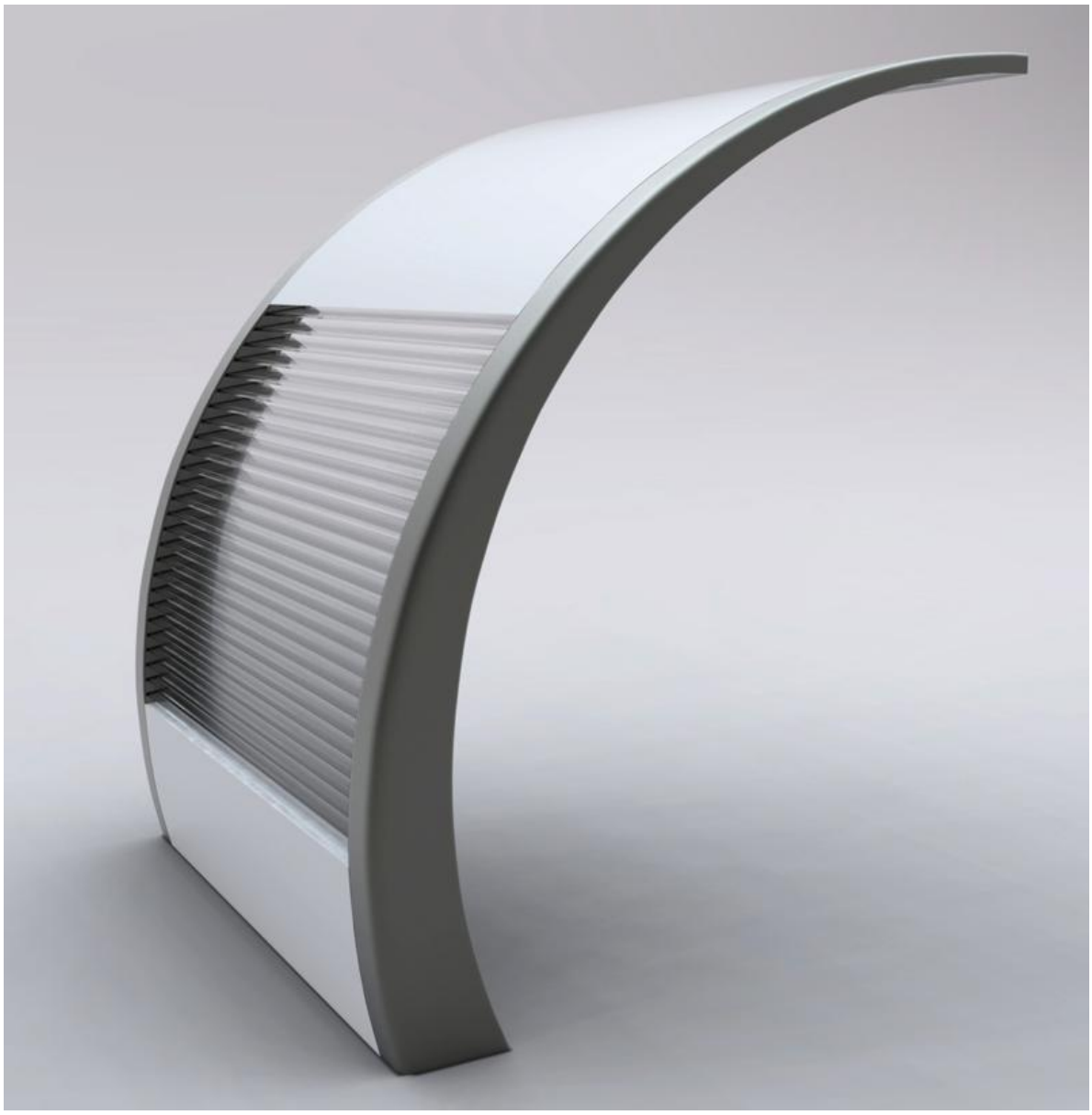


6.2.2 Design functions and features

The main design element of the shelter is the curved freestanding form with seating and standing areas underneath it. In addition, several CPTED and crime prevention tactics are built into each structure. They include:

- replacing the opaque walls of a conventional shelter structure with louvres to enhance visibility and to take full advantage of natural light,
- omitting any potential hiding spots or gaps,
- eliminating any large areas of flat surface that are vulnerable to graffiti or vandalism, and
- integrating various PIDs into the interior of the design.

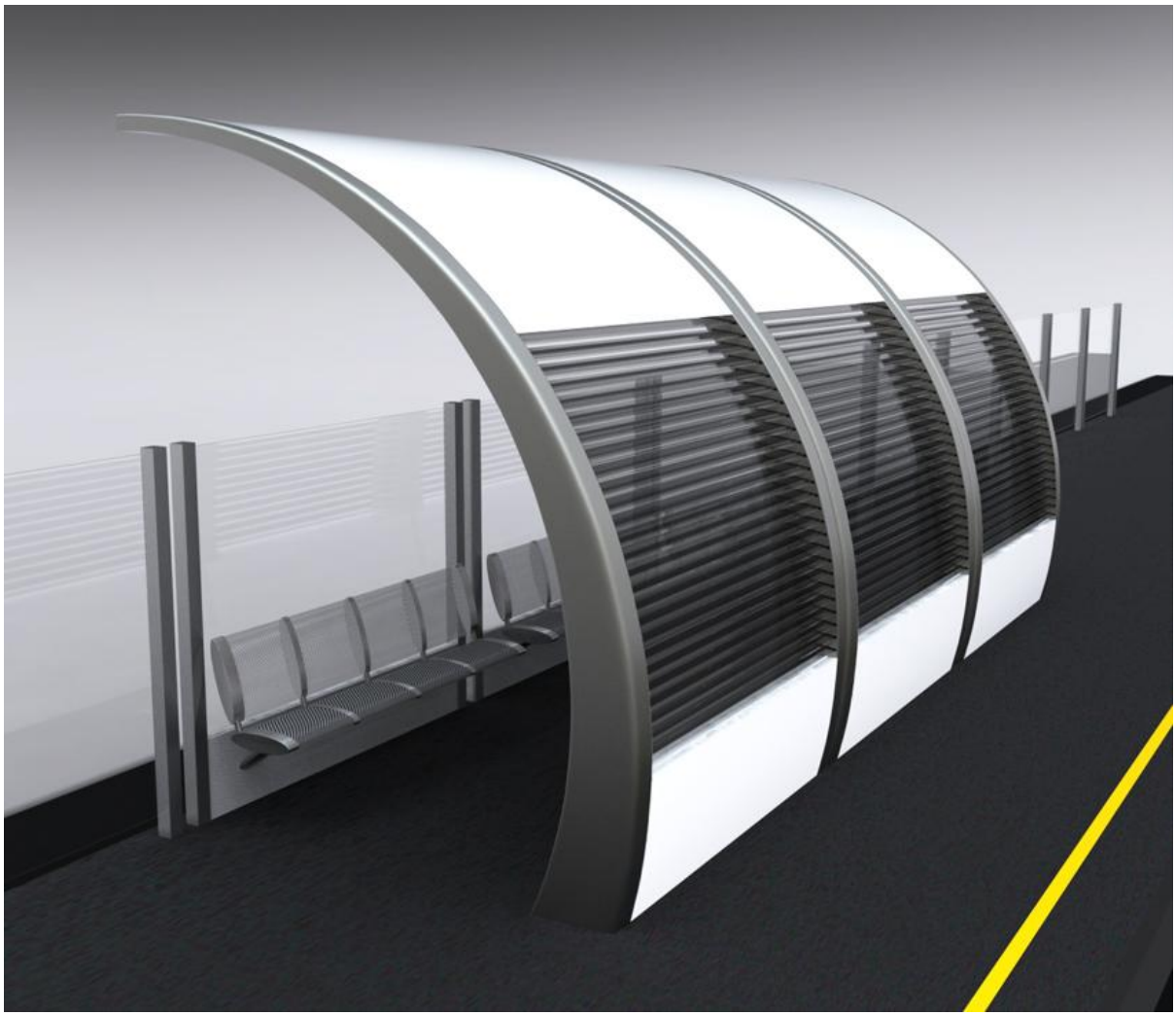
Figure 8: *Louvre* shelter concept – single module



A single *Louvre* module is projected to be 2000mm in width and 2750mm in height, seating a maximum of four people. The structure will accommodate the average 95th percentile man aged between 19-65 with a stature of 1855mm (Pheasant & Haslegrave, 2006, p. 244). It is

smaller than most of the current waiting rooms or areas at Melbourne train stations. However, several of them grouped together or lined side-by-side along the train platforms will form larger sheltered areas. Clusters of them can either remain open, or be transformed into fully enclosed spaces.

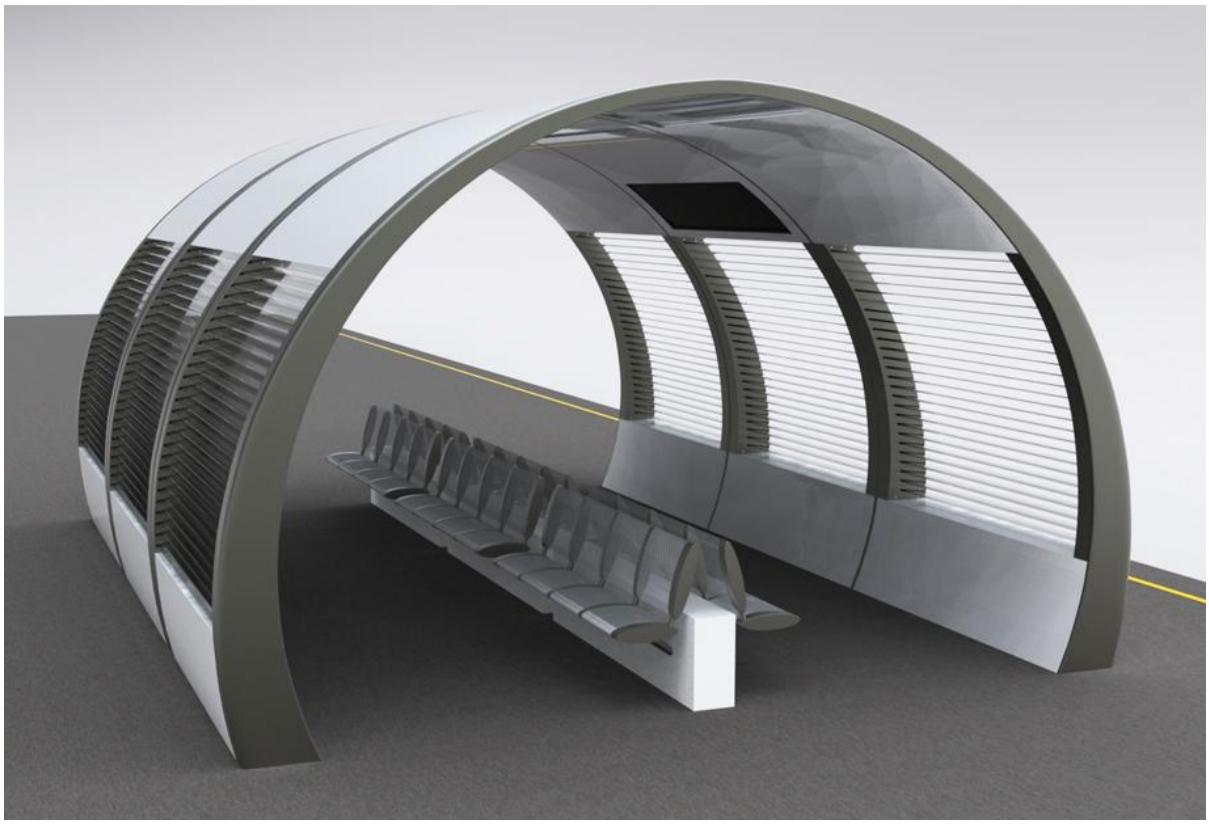
Figure 9: *Louvre* shelter concept – side-by-side arrangement for one-sided platforms

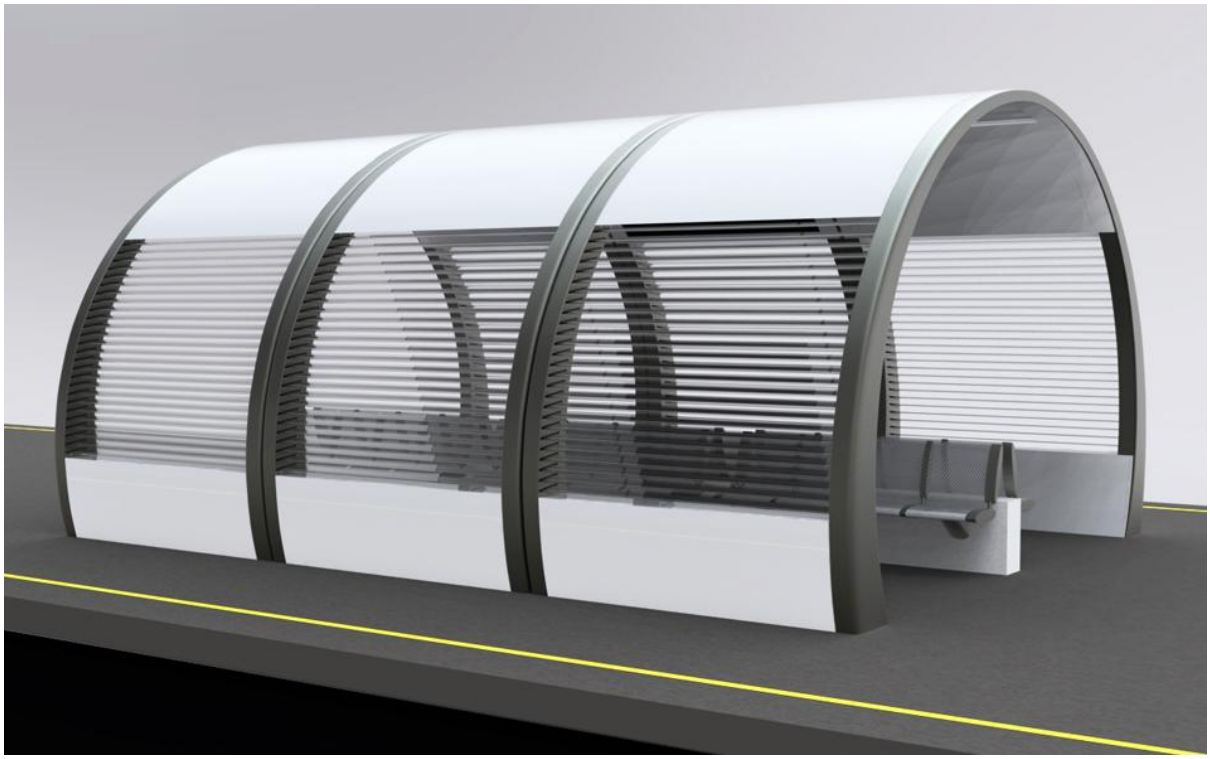


The louvres on the shelter provide users on the inside with a degree of solitude and a clear view of the outside surroundings without having large transparent glass planes that are vulnerable to damage by vandals. At the same time, they allow people from the outside to identify human presence and movement within the structure. With increased visibility and the elimination of potential hiding spots recommended by literature, opportunistic misdemeanour and crime would be minimised as the likelihood of being watched and apprehended is higher.

Depending on the level and type of anti-social behaviour and crime that typically exists on each individual station, the *Louvre* shelter could potentially be fabricated accordingly to counter those specific problems. For instance, the louvres may be angled and densely spaced so that sky-larkers will not be able to climb on the structure. The louvres themselves may be extruded out of steel or, for maximised visibility – produced out of a clear but tinted durable material with a cast steel core. The support beams or framework for the structure would be produced out of steel, and bolted securely onto the platform.

Figures 10 and 11: *Louvre* shelter concept – grouped arrangement for two-sided platforms

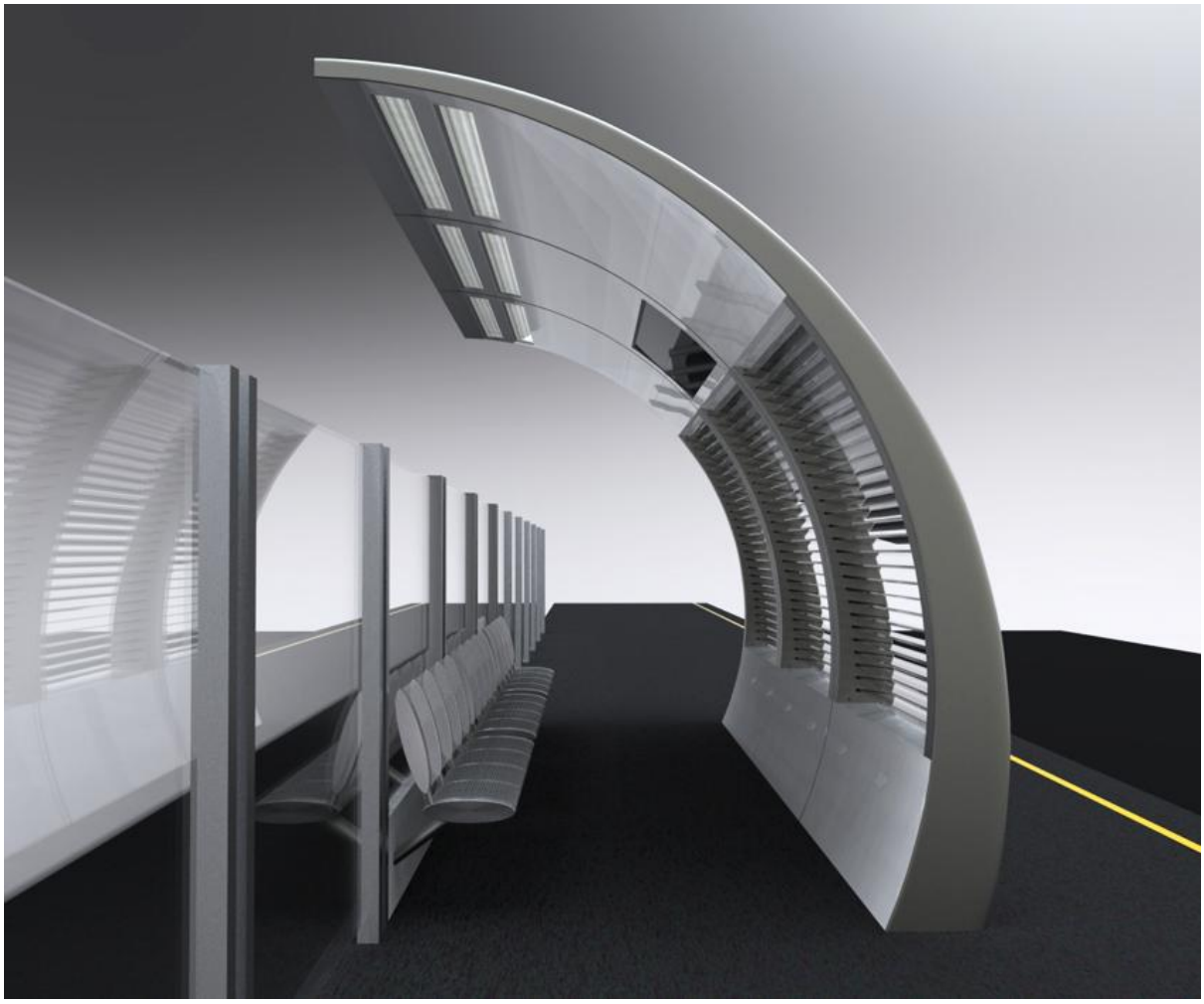




It is intended that the interior of the shelter structure will be fitted out with surveillance and security measures, which include: CCTV cameras, emergency alarms and intercoms. The authors note that swipe card access into enclosed shelter areas and restrooms afterhours may be worth investigating and implemented into the system. PIDs would be mounted at the top of the shelter's interior, providing users with real-time information and updates on the

status of the next couple of scheduled trains. When a train is approaching, audible and visual indicators near the base of the shelter would notify the users in advance. In addition, ambient lighting would be installed at the top of each *Louvre* module.

Figure 12: *Louvre* shelter concept – interior



The base shelter structure will be produced with common dimensions that will enable interconnection between modules to form a larger sheltered space, or integration with other station facilities such as restrooms, kiosks and bike storage. This creates a flexible 'mix and match' system that can be adopted in the three different tiers of stations in Melbourne. This approach is highly advantageous, as the operator can tailor specifically to the individual needs of each station. Likewise, the seating installed in the *Louvre* shelter can be customised. Operators can choose to have fixed seating, fold-up seats, or even just something to lean on, depending on the needs, space, or patronage of the station.

The shelter modules are to be installed in a way that makes them also function like platform screen doors along the edges of railway platforms (Figure 12), affording some protection in-between users and rolling stock. Further investigation and analysis of passenger flows on platforms may be required for busier Melbourne train stations.

7. CONCLUSION

It was found that a number of people fear for their personal safety while waiting or departing from railway stations, especially in or near secluded areas where opportunistic criminals tend to hide or linger around (Kennedy, 2008). Research also reveals that increased visibility and comfort tend to make people feel more safe and secure. Conversely, excessive enclosed spaces may encourage delinquents to take ownership or act inappropriately in, creating added fear among other passengers. Hence, when designing to maximise visibility in railway environments, essential design strategies to consider include: implementing clear sightlines, installing ample well-designed lighting, and eliminating any obstructions, potential hiding areas or excessive shrubbery.

Both the key findings outlined by the literature and the formulated design specification were used as guidelines to inform the *Louvre* shelter design concept. The authors believe that the shelter system will heighten the sense of security among users as: 1) the users have a clear view of their outside surroundings through the louvres; 2) people can identify human presence and movement in the shelter from the outside; and 3) there are a number of built-in security technologies in each module, such as PIDs with real time information and updates. The curved shelter structure aims to increase visibility with its profile and transparency, eliminating obstructions, dark corners, blind spots and hiding areas, thus creating a safer and more secure railway environment with less criminal opportunities.

Further refinement of the *Louvre* shelter system is underway, and a more developed and sophisticated outcome is expected in the near future. The authors will continue to look into more innovative ways to incorporate the many strategies recommended from the research, particularly focusing on enhancing visibility. The finished result at the end of this research project will encompass a new shelter system that complies with the research findings and design specification. It is projected that the shelter will minimise anti-social behaviour and crime outlined in the scope, improve the safety and security of people waiting at or leaving the train platforms, and bolster people's confidence in Melbourne's railway system.

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