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Shared Space and Naked Intersections

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CONTENTS

1.0 INTRODUCTION

The principles of Shared Space have been developed in the Netherlands as a result of work by the late Hans Monderman. There would be few engineers in Australia that would have heard of Hans Monderman and his work. There has been limited discussion of Shared Space principles in Australia. Often good ideas have a habit of breaking out in several places at once. It is instructive to examine the work of others to build on their work and avoid reinventing the wheel. Examples of what could be regarded as Shared Space have been constructed, and I am aware of work undertaken in Bendigo, Ballarat, and Port Macquarie and recently in Maryborough Victoria.

I was honoured to be offered a fellowship by the Municipal Engineers Foundation (Victoria) to take part in the 2008 international study tour and travelled with local government engineers, selected from across Australia, on the Institute of Publics Works Engineers (IPWEA) national study tour. I am most grateful for that opportunity to travel and experience engineering practices in 5 countries (USA, Finland, United Kingdom, The Netherlands and Hong Kong).

I took the opportunity to investigate the work of Hans Monderman and his Shared Space and Naked Intersections whilst on the tour. This report is the findings of that investigation.

2.0 BACKGROUND

Shared Space and Naked Intersections have their origins in the Dutch Woonerf (Home zones in UK). The late Hans Monderman was a Dutch Traffic Engineer who applied the Woonerf concept to commercial shopping strips and intersections and Monderman is accepted as the founder of the Shared Space movement.

Monderman believed the traditional concept of separating traffic from bicycles and pedestrians as well as over use of traffic signs and controls was:

- Absolving drivers of the responsibility to think, adapt to their environment and behave in a social manner towards other vehicles, cyclists and pedestrians: Which is in turn creating greater safety problem...

- Destroying the community's relationship with their surroundings space and making the space less enjoyable.

In contrast to traditional engineering practices, Monderman sought to provide places people enjoyed visiting, maintaining the functional operation of streets and improved safety, by making users more accountable for their actions. This involved removing the delineation of roads, traffic control and restructuring the street environment.

His objective has been to create a road environment where pedestrians and vehicles can coexist with tolerance and allow the pedestrian, bicycle and motor vehicle traffic to work out their own rules "by eye contact negotiation".

The results of his experiments have received wide attention in Europe and have spurned projects across Europe. The reporting has largely been by urban designers and the media. There is considerable hype around the projects, but to date, I have been unable to examine any examination by a traffic engineer.

Shared Space has received some publicity within Australia and projects have been constructed with a similar feel to the Dutch "Shared Space" although these are likely to have developed as a local innovative solution to problems, rather than drawing from Monderman's experience.

They are also likely to have been developed using the VicRoads **(*4)** and the Austroads' guidelines for "Shared Zones". These seek to achieve quite similar outcomes as Dutch "Shared Space" and provide good design principles. However in comparison with my observations in the Netherlands, the traffic capacity of Shared Space is far greater than specified in the "Shared Zone" guidelines.

In addition, Monderman has promoted the concept that risk is something that should exist in a traffic environment. Whereas traditional traffic engineering principles are to separate and eliminate risk as much as possible, he has maintained risk provides a behavior moderating factor for all street users.

The object of this paper is to provide background to the concepts, examine the Monderman projects, identify the observed key functional components of Shared Space and perhaps be a little provocative to challenge current thinking. This report will also suggest modification to existing design guidelines.

3.0 THE CONCEPT OF SHARED SPACE

I have not found a satisfactory definition for "Shared Space" so I propose the following definition:

A constructed environment where vehicles and pedestrians are able to share a common area and where the right of way is negotiated by way of eye contact, courtesy and human interaction, rather than by road rules and traffic controls.

3.1 History of Shared Space

The Shared Space movement can be traced back to the mid 1970's in the Netherlands where the Woonerf (Woonerven – "living playground") rapidly took root. Residential streets were remodelled to remove the linearity of roads, play ground equipment and park seats were installed and children encouraged to play in the streets. Vehicle parking was intermittent. There are over 6,000 Woonerven in the Netherlands. Figure 1 shows a typical Woonerf.

Figure 1 – Dutch Woonerf


Figure 2 – Shared Space retail street

3.2 Key Requirements for Woonerven

Donald Appleyard in his 1981 book "Livable Streets" [(#1)] determined there were 5 key criteria for a Woonerf as follows:

- Entrance Gateways – to announce the driver has entered the Woonerf (Figure 3). This can be a road alignment change, a vertical rise, specific paving treatment or landscaping treatment.
- Curves to slow vehicles. (Figure 3 & 4).
- Amenities such as trees and play equipment that serve the dual purpose of forcing vehicles to slow down. (Figure 4 & 5).
- No curbs (Figure 4 & 5).
- Intermittent parking so that cars do not form a wall of steel between the roadway and houses. (Figure 5 & 6).

3.3 Key Requirements for Shared Space

Having examined several of Monderman's "Shared Space" projects, the 5 criteria established by Appleyard were present in different degrees in all of his projects. It is concluded that the same 5 criteria are important in achieving an effective Shared Space outcome.

Shared Space differs from a mall in that a mall excludes vehicles. Figure 2 shows a typical Shared Space.

3.4 Tradition Engineering Principles

What Monderman has proposed in his work is that in the right engineered (or de-engineered) environment, the various road users can share a common space. He has used subtle design elements, thrown all road users together to let them "sort it out by negotiation". This approach challenges engineers training and experience. Indeed may be a confronting concept to both engineers and the community. The traditional engineering approach has been to separate pedestrians, cyclists and motor vehicles and as much as possible control their movements.

The separation of user type is based on the belief that if the vehicles, cyclists and motor cars are separated and only cross paths at controlled locations, the opportunity for accidents is limited.

Two problems with this approach are:

- There is not enough funding to build all of the separation and crossings required.
- People are not robots and do not always use the facilities provided anyway e.g. We have all see the pedestrians crossing 50 metres from a signalised crossing.

Shared Space approach seeks to create a lower speed environment where the pedestrians take care and the motorist drive with caution and at a speed they can stop quickly.

A traditional approach may seek to reduce the speed limit in a shopping centre to 50 kph by installing signs or constructing raised pedestrian crossing points. A Shared Space proponent would construct an environment so the driver would feel uncertain about the environment and travel no greater than 30 kph. (Refer to Figures 3 &4). Figure 4 demonstrated the lack of clarity of the street environment which Monderman exploits to moderate vehicle speeds.

Figure 3 - Threshold entry to Shared Space

Figure 4 – curve-linear alignment and furniture

Figure 5 - Trees and no kerbs

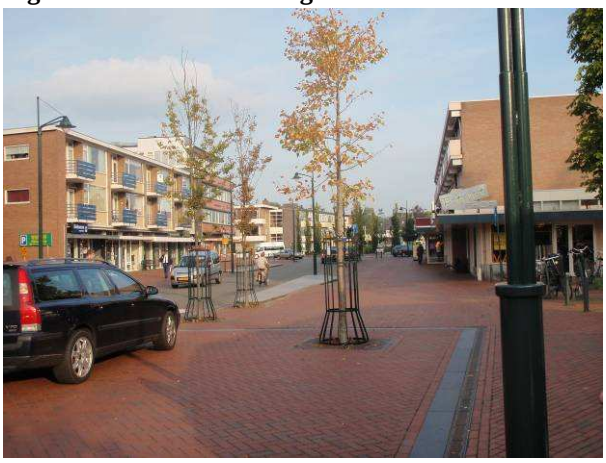

Figure 6 - Intermittent parking

3.5 Driver Behaviour Modes

David Engwicht in his book, Mental Speed Bumps, [#2] writes about the "social connection" people have to their streets and surroundings.

David has experimented by encouraging people to use their streets and has shown that driver's behavior changed when they became aware of the human element. He argues that the social connection of the street and that context modifies the behavior of the drivers. It is the withdrawal of people from their streets that has allowed them to become a car domain.

Norman W. Garrick, Center for Transportation and Urban Planning, University of Connecticut, [#3] has postulated of "System Time" versus "Context Time" as follows:

Context Time - Social behavior governs

- Multi-functional
- Culturally defined
- Personal
- Diverse
- Unpredictable

Figure 7 - Context time

System Time – Traffic behavior governs

- Single purpose
- Regulated
- Impersonal
- Uniform
- Predictable

Figure 8 - System time

In a "Context Time" space, the driver is aware of the environment, children playing, risk of hitting pedestrians animals etc. Drivers are most likely to exhibit this behavior in their own residential street, where the people are well known to the driver.

Norman W. Garrick postulated that a driver starts a journey in "Context Time" moves to "System Time" and ends the journey in "Context Time

Once a driver leaves their "Context Time" context, they behave in a "System Time" mode. The driver's objective is to reach the end of the journey as quickly as possible. Red lights, traffic jams and pedestrians are all frustrations to the driver. In this mode the driver is more likely to display a socially unfriendly behavior towards others. A green traffic light is to be run to avoid getting the red light or the roundabout is to be entered while there is a gap. Pedestrians and cyclists are superfluous to the driver's context and unwanted intrusions into their environment and likely to be threatened. In this environment pedestrians have difficulty crossing roundabouts or roads.

In essence then, the objective of a Shared Space is to keep the driver:

- Socially connected
- Behaving as a "considerate" member of society,

- Functioning in a "Context Time".

It is evident that the degree of uncertainty of the environment and even the sense of risk, contributes to drivers behaving cautiously. This is not a foreign concept to Australian Traffic Engineers who know that a long straight wide road with excellent sight distance is likely to become a speedway. Engineers use various tricks to reduce the driver's perception of sight distance or road width to reduce vehicle speeds in residential streets, often in conjunction with traffic management devices.

In Australia, strip shopping centres always present a traffic problem as they are almost always constructed on key collector or arterial roads. A conflict exists between providing for vehicle through capacity and pedestrian's ability to cross the road and shop. The shoppers want an attractive and safe environment to shop and the through traffic wants to move through unhindered. This is essentially a clash between "Context Time" and "System Time". The traditional approach to this problem is to:

- Divert traffic around the strip shopping centre; A traffic bypass, Even convert the street to a mall (separation),
- Install pedestrian crossing points along the road at several locations,
- Provide clearways during peak periods, if possible,
- Provide a central pedestrian median and allow traffic to cross anywhere along the road; accepting they will anyway and providing a safety refuge for them.

The essential problem using the "separation" approach for roads through is the signal given to motorists is the road is their sole domain.

Shared Space deals with the problem using a different set of rules. It creates an environment where;

- pedestrians are able to cross at any point,
- Motorists are clear they are in a "different zone" and drive with more caution.
- Vehicle speeds are limited (but not with any physical means alone) to around 20 to 30 kph.

The experience in Rijksstraatweg, Haren, Netherlands, is that traffic volumes as high as 8,200 vpd can still be accommodated without controlled pedestrian crossings.

3.6 Shared Space applicability to various road hierarchies

Shared Space philosophy advocates vehicle speeds to be around 30 kph, which of course rules out its application to major arterials and freeways where through traffic volume is the objective.

The Shared Space concept essentially relates to a mixed traffic/pedestrian environments, where vehicle speeds can or should be no faster than 20 kph to 30 kph and there is a desire for significant numbers of people to cross streets on foot or bicycles. These are typically

residential streets, car parks, historic precincts and strip shopping centres. These environments could be called “social spaces”, where there is a high demand for social interaction.

There are natural forms of Shared Space that we are all familiar with. Figures 9 & 10 show low use residential streets without footpaths. A pedestrian or cyclist would use such a street without expecting to be run down and a motorist is likely to drive cautiously because of the narrow road and limited sight distances.

Figure 9 - Low use street without footpath

Figure 10 - Gravel road

4.0 SHARED SPACE STREETS IN THE NETHERLANDS

I visited 4 examples described within the Shared Space movement as the best examples of Shared Space as follows:

- 4.1 - Shared space retail street - Rijksstraatweg, Haren, Netherlands
- 4.2 - Shared space retail street – Oosterwolde, Netherlands
- 4.3 - Shared space retail street – De Kaden, Drachten, Netherlands
- 4.4 - Shared space roundabout - Laweiplein, Drachten, Netherlands

Each of these projects were conceived and constructed by the late Hans Monderman.

4.1 Shared space Rijksstraatweg, Haren

Photos of Rijksstraatweg, Haren are shown in Figures 11 – 22.

The traffic signals, separated bicycle lanes, kerbs were removed in 2002. Figure 11 shows the street before the reconstruction. There originally was a narrow pedestrian walkway, separate bicycle paths and the road had a centre line. Rijksstraatweg is an 800 m long segment of strip shopping centre and is the main shopping centre in Haren. The street had deteriorated and council had determined to reconstruct it. The objective was to make the street environment more attractive to residents and shoppers.

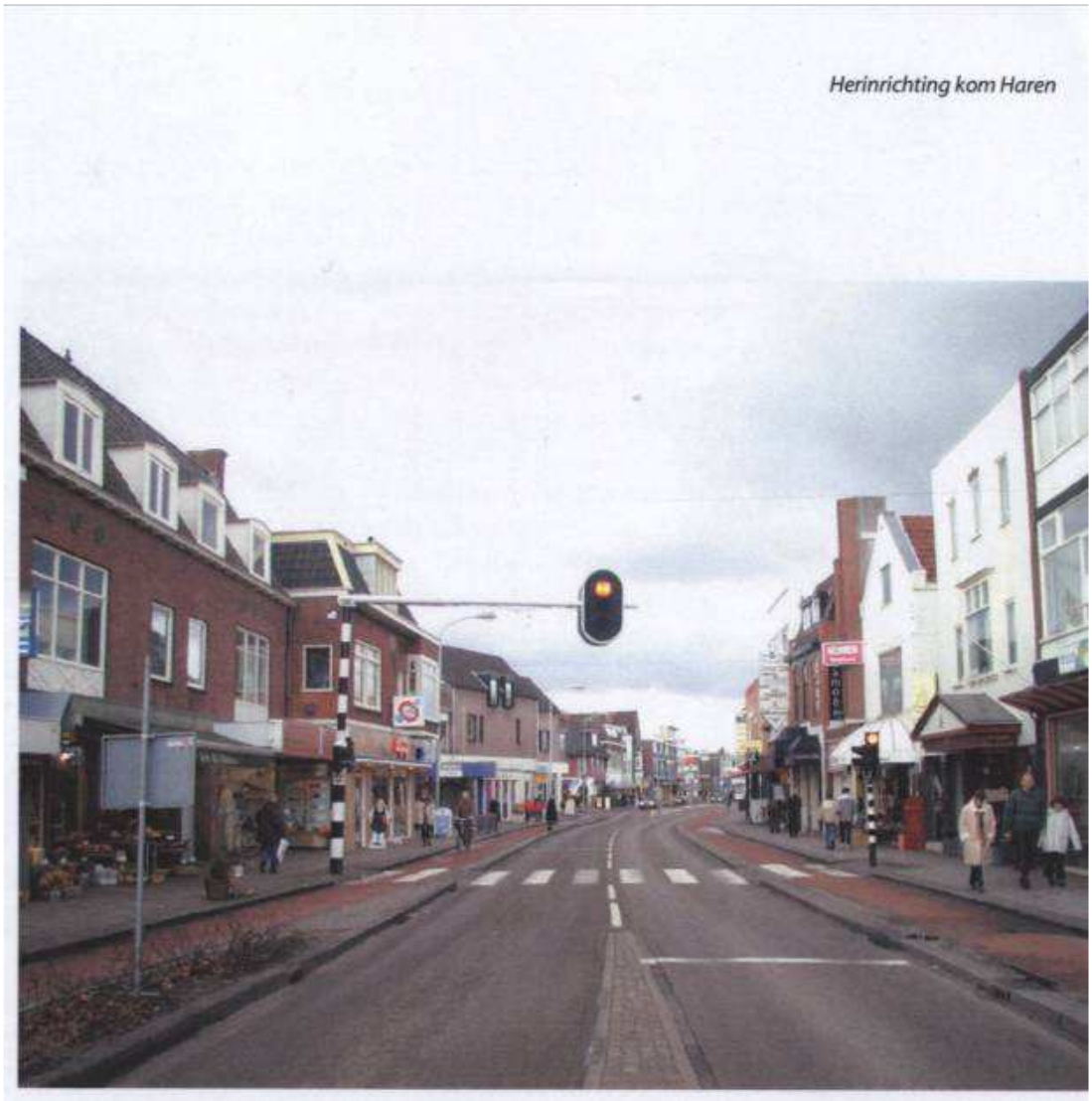

Figure 11 - Rijksstraatweg, Haren before reconstruction. Separate cycle ways, narrow footpaths, two way road with white line.

Figure 12 - Rijksstraatweg, Haren - Shared Space

Figure 13 - Rijksstraatweg, Haren - Shared Space

Figure 14 - Rijksstraatweg, Haren - Shared Space

Figure 15 - Rijksstraatweg, Haren - Shared Space

Figure 16 - Rijksstraatweg, Haren - Shared Space

Figure 17 _ Rijksstraatweg, Haren – Shared Space

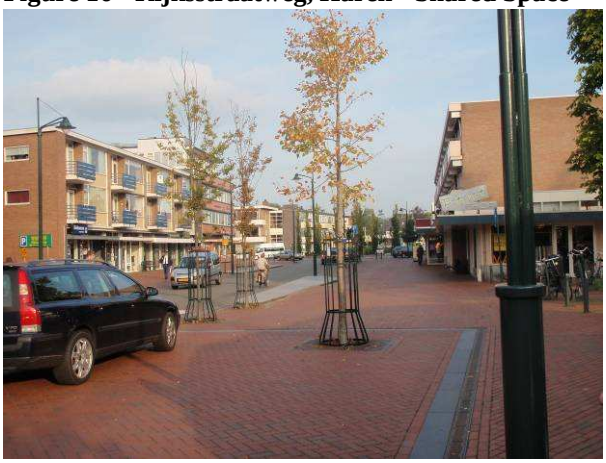

Figure 18 - Rijksstraatweg, Haren - Shared Space

Figure 19 - Rijksstraatweg, Haren - Shared Space

Rijksstraatweg is now constructed as a 6 m wide carriage way, with what may be describe as a town square with restaurants and out door seating located in the mid point. (Figures 16 – 19). The footpaths are wide and there is no separation of bicycles and pedestrians. It was observed that the cyclists use both the footpath and the road.

Since reconstruction, the traffic volume is 8,200 vpd which is just 3.5% less than the traffic volume before the street was modified. Rijksstraatweg is a bus route with frequent buses. It

also has considerable volumes of bicycle traffic. Parking in the street is limited to shop keepers loading and unloading. Buses were observed stopping on the 6 m wide pavement. The cars were observed to patiently wait while the bus picked up and dropped customers. Bus stops are a simple raised platform, on the side of the road and can be seen in Figure 20.

Figure 20 - Raised concrete bus stop

Figure 21 - Cyclist impeding vehicle

Figure 22 - Pedestrian crossing

The traffic volumes accommodated at Rijksstraatweg, Haren, suggest that Shared Space streets can accommodate significant high through traffic.

I observed that the pedestrians, bicycle and vehicle in the street were tolerant of one another. Pedestrians crossed where they wished. Pedestrians generally waited for the cars and were observed weaving across judging gaps. There were two pedestrian crossings consisting of lines on the road. These were not equipped with any pedestrian signals and were added to satisfy community expectations. When pedestrians crossed at the marked crossing s the cars stopped and gave way.

The ambiance of the street was pleasant. In the square located at the mid point of the street there was a restaurant with people happily eating while traffic passed. This section of the road was wide but it also had the social context which acted as a restraint on vehicle speeds. From data provided by the local council, vehicle speeds averaged 29 kph with an 85 percentile of 38 kph.

Accident figures made available for Haren indicate that the accident rates have halved post the introduction of Shared Space. The major accident type before the work was head to tail accidents which have now reduced to 20% of the 2002 figure.

The Municipality of Haren has undertaken an after study of Rijksstraatweg.post construction. The investigation included a telephone survey of residents. The general consensus of those surveyed was that the street was more attractive (85%) and it is easier to get into the town and move about.

The major complaint is that the bicycles use the footpath and the pedestrians feel unsafe and 90% of those surveyed, believed this was the biggest issue and needed to be resolved. The public have asked that the council either require the bicycles to use the road or provide a separate bicycle path. It is interesting that separated bicycle paths are common in Holland (Figure 11) and they existed prior to the reconstruction of Rijksstraatweg. An important observation and one that was encouraging the council to have cyclists use the road was that the vehicle speeds were moderated by the bicycles. This was observed where drivers were caught behind cyclists (Figure 21), unable to overtake. While I observed the street I saw no conflicts between cyclists and pedestrian and most cyclists appeared to use the road. However some did use the footpath.

4.2 Shared space De Kaden, Drachten

Photos of De Kaden, Drachten are shown in Figures 23 – 29.

Similar to Rijksstraatweg, De Kaden has a 6 m road without kerb, leading to a central town square built on and intersection. The street at the northern end is connected to the De Kaden Naked Intersection which s discussed later in this report. The street has limited through traffic capacity due to the southern end of the street being constructed to limit access.

Like Rijksstraatweg, Haren, De Kaden, Drachten is an attractive shopping street with low traffic speeds and pedestrians can cross at any location. Figure 23 and 24 indicate the relative narrow width. The pavement from building line to building line is generally at one grade to the centre, with sufficient fall for drainage. There is extensive use of paving colours and patterns to break up the expanses of paving. Figure 27 and 29 demonstrate the attempt to break up the linearity with a structure over an intersection shown in Figure 27 and a paved square with a restaurant in it shown in Figure 29.

No traffic data is available but by observation it is a low traffic road servicing abutting businesses.

Figure 23

Figure 24

Figure 25

Figure 26

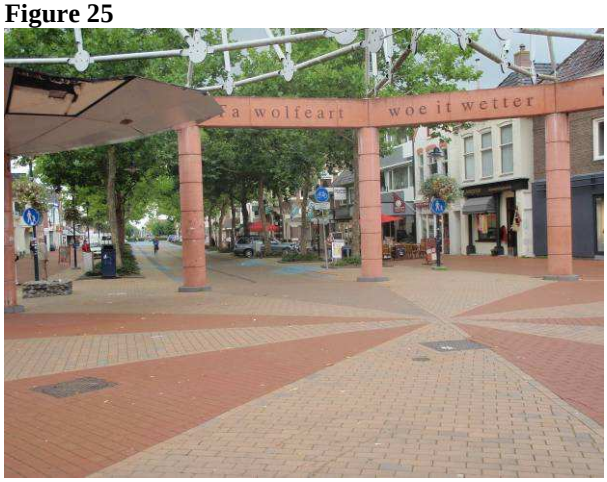

Figure 27

Figure 28

Figure 29

4.3 Shared space Oosterwolde

Photos of Oosterwolde are shown in Figures 30 – 35.

Small rural town of Oosterwolde has remodeled the retail street and a major cross road.
The retail area is brick paved from building line to building line. The road is delineated by a windy black brick but there is no kerbing to prevent vehicles from straying off the dark paving.

In comparison to other Shared Space considered in this paper, the traffic volumes are very low.

The street demonstrates the wide flat pavement with flush kerbs. The dark coloured brick road pavement is provided for effect as there is no kerb or differential in levels to the rest of the paving. Unlike Rijksstraatweg, Haren, this street is also a lightly traffic road.
Again no traffic data is available.

Figure 30

Figure 31

Figure 32

Figure 33

Figure 34

Figure 35

5.0 CONCLUSIONS ON SHARED SPACE

From the examples examined it has been noted that the impact of the work undertaken is a more attractive space much as is achieved with a mall conversion of a street. The difference is that the functionality of the through road can be achieved as is seen in Rijksstraatweg, Haren where 8,200 vehicles per day use the road, along with high numbers of cyclists and Pedestrians.

VicRoads Guidelines for Shared Zones are a good starting point for the design of a Shared Space environment, but appear somewhat conservative when compared to Rijksstraatweg, Haren. VicRoads traffic volume guideline is:

"*On streets that carry over 200 vehicles per hour in peak periods, or over 1,000 vehicles between 7 am and 7 pm."*

Whereas a mall will provide the safety for pedestrians and an attractive environment, the Shared Space Street maintains the traffic functionality. In each case it was noticed that there was limited parking along the streets. This has the effect to open up the streets and provide wider footpath areas.

The ability to achieve high traffic through volumes in a shopping centre and improve pedestrian safety, ambiance and eliminate the need for formal crossings is very attractive objective.
It is important however when designing a Shared Space environment, the principles set out in Section 3.2 are followed.

As discussed in Rijksstraatweg, there has been considerable comment by the community of the bicycles using footpaths. While bicycle use is relatively low in Australia, never the less the conflict between cyclist and pedestrian has been experienced in Australia, particularly with shared bicycle paths. In Haren, the council has discovered that the cyclists slow down the traffic to below 30 klm when using the road. This is the maximum desirable vehicle speed through a shopping centre, the balance of the Shared Space, pedestrians wandered across the road where ever they wanted and generally judged the cars and waited for them.

Free flowing traffic did appear to be faster than 30 kph by observation and the council's Figures advise an 85 percentile of 38 kph in the Rijksstraatweg. The design objective maws a maximum speed of 30 kph maximum. This would indicate that Dutch drivers push speed limits as do many Australian drivers and this was certainly my impression while touring Holland. This would tend to rule out the common comment that Dutch drivers were very courteous and cautious drivers. I remained impressed that in the case of Rijksstraatweg, the traffic speeds were moderated by the environment as postulated by Hans Monderman and the pedestrians, cyclist and vehicles interacted in a very positive and safe way.

While there are at least two pedestrian crossings in Rijksstraatweg Haren, they were not the sole crossing points and were not signalized. They were provided as an afterthought to satisfy community requests. They are only painted lines, however drivers seemed to stop to allow

pedestrians across. Unsignalised crossings would present a crossing problem for sight impaired people because they would not be an audible crossing.

Sight impaired people may also have difficulty because there are no kerbs that define the street edges. No kerb is of course a benefit for wheelchair bound people. Disability compliance for streets remains a difficult and costly exercise and Shared Space has the same requirements to meet as conventional streets. The lower vehicle speeds, more courteous environment should also be beneficial for all users... Crossing busy roads will always be difficult for the sight impaired without audible crossings. The reality is that there will never be enough pedestrian crossings provided for the convenient crossing of sight impaired people because of the cost of signals, available funding, their impact on road capacity and the loss of parking in a shopping centre. In the case of the unsignalised crossing in Rijksstraatweg, and audible signal with flashing lights would have made the crossing more functional for the sight impaired. This may require the development of a new style of pedestrian crossing. The use of tactile strips along the street is an option that could be used to define the street alignment similar to those seen at the Haren station in Figure36 and 37 below.

Figure 36 – Tactile strips

Figure 37 - Tactile strips

In summary I am convinced the Shared Space streets I examine had achieved the stated objectives.

Anyone designing a Shared Space street should ensure they consider the criteria set out in section 3.2 of this report to ensure the design achieves the Shares Space objective.

It is clear from my inspection of the Shared Space roads that there was an element of perceived risk by all users, which was moderating behavior. This is considered a good thing as the overall environment was perceived to be safer that a conventional kerbed street and this has been born out by experience in the reduced recorded accidents.

6.0 NAKED INTERSECTIONS IN THE NETHERLANDS

Naked intersections are an intersection form of Shared Space. Another initiative by Hans Monderman, Naked Intersections do not have any obvious traffic control signs. In the Netherlands there is an underlying "Give Way to the Right" rule applicable. Drivers are required to give way to pedestrians. All of the intersections inspected had painted pedestrian crossings markings with very limited signing. On this basis, the nakedness of the intersection would have to be defined as the absence of traffic signs.

A claim of the proponents of Naked intersections is that they are response to an over regulated and over signed environment. In articles on Shared Space in Europe, there are often good examples of heavily signed intersections. In Australia the signing of intersections has been strictly controlled and a proliferation of signs is less common. The concept of providing traffic signals and traffic signs is to provide motorists a secure environment, and guide the motorist. (as most road signing is provided for motorists)

Driver behavior is modified by the signals and signs and a good example is a driver racing traffic lights on green and orange. In this event the driver is fixated on the traffic equipment and making it across the intersection rather that the space around and in this environment the pedestrian or cyclist is at risk as are other motorists. Referring to Section 3.5, a driver running lights is operating in a "Context Time" mode rather than a "Social Mode".

The concept of the Naked Intersection is that removal of the traffic control elements requires the driver to approach the intersection with caution and make judgements about other vehicles. A good practical example of this effect would be cars passing though an intersection where two cars have collided and the drivers have to negotiate the available space. The drivers adapt the rules and their speed to move through the space. Instinctively, caution requires them to travel slowly. This is the effect that Hans Monderman sought to achieve by removing intersection control from intersections.

The three notable intersections that I examined in the Netherlands all constructed under the direction of Hans Monderman were:

- 6.1 - Laweiplein, Drachten, Netherlands.
- 6.2 - De Kaden, Drachten, Netherlands.

6.1 Laweiplein roundabout, Drachten, Netherlands

Photos of Laweiplein, Drachten are shown in Figures 38 – 50.

Laweiplein is a major intersection in Drachten, Netherlands. The traffic lights were replaced in 2003 with a roundabout that services around 22,000 vpd. It is reported there have been no accidents since the conversion but in the period between 1998 and 2002 there had been 8 recorded accidents, 5 involving injury (4 minor 1 serious).

It cannot be described as a Naked Intersection because clearly it has roundabout traffic control. However it is included in this section because it is an intersection rather than a shopping street, it had all of the elements of shared space with the exception of parking for obvious reasons.

Laweiplein is worth examining because it is substantially different to any roundabout that I have observed or Australian roundabout design requirements. For example it has flush kerbs, a ramped entry, no splitter islands and a bicycle lane around the outside. I believe it is the most pedestrian friendly roundabout I have observed.

What makes it special is:

- A ramped entry (see Figure 49 & 51) prior to the pedestrian crossing. This was observed to slow cars into the crossing and intersection. This feature is very much like other "Shared Space" observed in the Netherlands.
- There are no splitter islands at the entry exit of the roundabout. The author observed vehicles swinging wide out of the roundabout as they were exiting. This seemed to be well anticipated by entering drivers and appeared to be a factor in controlling the entry speeds.
- The roundabout was constructed higher then the abutting footpaths;
- The roundabout has flush kerbing which technically allows vehicles to seeing wide, but that was not observed.
- It has large pedestrian crossing (similar to our pelican crossing at the entrance to each leg of the roundabout but without flashing lights).

As an architectural feature to improve the quality of the space there are fountains which react to the traffic volume.

Laweiplein is such a novel design, and the elements seem that effective that it is recommended that it be trialed in an Australian context.

Figure 38 shows the intersection before conversion and Figure 39 shows the roundabout. Figures 40 to 43 show the flush kerb, narrow entrance exit road,
Unlike Australian roundabouts that flare into the roundabout the entrance flair is quite tight. Figures 44 to 46 show the narrowness of the entry/exit road. It was noted that buses swung wide into the oncoming path. This did not cause and accident while I was observing it as other vehicles clearly anticipated this.

There were separate crossings for pedestrians and cyclists. Some cyclists used he road but many used the apron on the side of the roundabout. It was notices that cars always stopped to give way to pedestrians on the crossing. The cyclists seemed to judge their speed and trajectory to pass over roads without delay.

The roundabout was observed to operate very smoothly and without and significant delays.

Figure 38 -Laweiplein, Drachten, Netherlands – Before

Figure 39 -Laweiplein, Drachten, Netherlands – After

Figure 40 - Laweiplein, Drachten - flush kerb

Figure 41 - Laweiplein, Drachten - fountain, pedestrian crossing, lighting and ramped entry

There have been no accidents at the intersection since February 2004. In the period between 1998 and 2002, when it was still an intersection with traffic lights, signs and lanes, 8 accidents were registered, 5 of which involved injuries (4 minor and 1 serious).

Figure 42 Laweiplein, Drachten - flush kerb

Figure 43 - Laweiplein, Drachten - no splitter island

Figure 44 - Laweiplein, bus swinging wide

Figure 45 - Laweiplein - cars exiting

Figure 46 Laweiplein = bus hogging 6 m lane

Figure 47 - Laweiplein - cars exiting

When compared to the key criteria for Shared Spaces (Woonerven) I n Section 3.2, it complies with four of the criteria with the exception of parking for obvious reasons.

Figure 48 - Laweiplein - Pedestrians crossing

Figure 49 - Laweiplein - no splitter islands

Figure 50 Laweiplein roundabout

Figure 51 - Laweiplein - roundabout entry ramp

6.2 De Kaden, Drachten

De Kaden is a genuine Naked Intersection and probably the best know. There is no intersection control for traffic although as an afterthought and following public pressure Hans Monderman installed painted pedestrian crossing markings. It was very busy cross road on three legs with the southern De Bring shopping centre leg relatively low traffic. While being observed it was seen to taking a full mix of traffic including buses, trucks, cars, bicycles and pedestrians.

Figure 52 DE Kaden prior to converting to Naked Intersection

Figure 51 shows the intersection prior to reconstruction.

The observed traffic behavior at De Kaden intersection was in many cases the vehicles tended to merge through the space without stopping by judging their speed. Some cars would give way to the right. In one instance I observed a vehicle reverse into an intersection and the traffic within the intersection tolerated and accommodated this unusual manoeuvre. (This was captured on video and is available as a supplement to this paper for viewing).

Figure 53 - De Kaden looking west

Figure 54 - De Kaden Western arm of intersection

Figure 55 - De Kaden pedestrian crossing

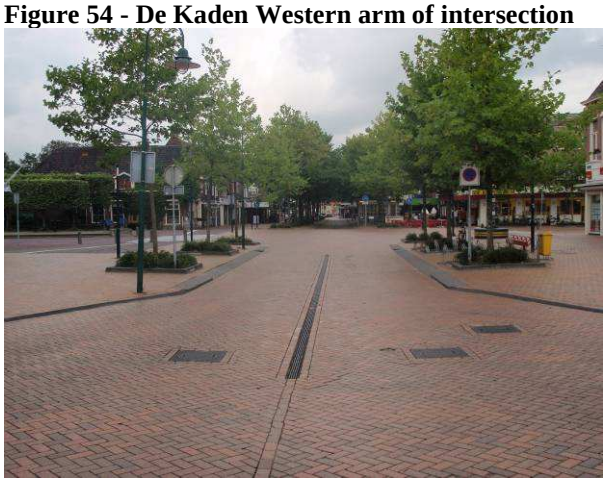

Figure 56 - De Kaden northern intersection approach looking at the De Kaden shopping centre

Some commentators on Shared Space suggest that a Naked Intersection operates a bit like a skating rink where people maneuver around one another by adjusting speed and path. This can be observed in the video of the De Kaden intersection.

Naked Intersections have their applicability to “social spaces” like Shared Space. Typically in a business district or shopping centre with high pedestrian and bicycle volumes.

7.0 REPORTED PROBLEMS WITH SHARED SPACE

Shared space relies on pedestrians, cyclists and motorists working in harmony with one another and being able to visualise, make judgments and respond to their surroundings.

The Guide Dogs for the Blind Association in the UK, undertook a study by interviewing focus groups on their experience with Shared Space streets. Focus groups were negative to the concept. It is reasonable to say that there are few examples of shared space in Brittan. There is little experience and it is a concept that will require time for the community to become accustomed to, given their experience has been more regulated environments.

Concern has been expressed for children and sight impaired people unable to perceive the risk and make appropriate judgments. Similarly sight impaired people would have difficulty judging gaps and making eye contact with motorists. They said they are reliant on the kerb and channel to delineate a street. In reality, sight impaired people will have trouble crossing any street unless there is a signalized crossing with audible signals.

Ideally there should be provision made within the Shared Space for audible signalized crossings along with tactile strips leading to safe crossing points. A proliferation of crossings could negate the objective of the Shared Space environment. On the other hand, the construction of the streets without kerbs makes the streets very pedestrian and wheel chair friendly. A kerb is not likely to deter a child from running onto the road.

It was noticed that in the Netherlands, drivers would stop and gave way to crossing pedestrians on marked crossing points.

If the Shared Space design is effective, and vehicle speeds are kept to less than 30 kph, the likelihood of a serious injury is significantly reduced.

Given there are few Shared Space streets in the UK there is little experience by the community in the concept. It is now a requirement for consideration to be given to people with disabilities in Australia and the use of tactile strips along with provision of audible crossing signals at strategic points could provide a solution, albeit defeating the concept of Shared Space.

8.0 CURRENT AUSTRALIAN DESIGN GUIDELINES FOR SHARED SPACE

VicRoads Traffic Engineering Manual Vol. 1 Section 4.8 - Shared Zones States a shared zone is a length of road where pedestrians, cyclist and cars have “equal rights”.
Appropriate locations are:

- *Low volume streets where pedestrians out number motor cars and where pedestrian needs are best met by walking on a roadway, and*
- *Where the street has been constructed or reconstructed to a sufficient degree to ensure significant visual interruption and where speed is physically restrained, and*
- *There is not cross motor traffic.*

Locations may include lanes and streets in central business districts, selected residential streets, shopping centres and caravan parks.

Section 4.8.1 – Design Guidelines (*VicRoads Traffic Engineering Manual Vol. 1)*

- *The road should be discontinuous and kerb should be removed to enhance the sense of equality between pedestrians and vehicles.*
- *Speed reduction devices should be installed at a spacing of approximately 40 m and these devices should be staggered on opposite sides of the reserve to require weaving alignment through the shared zone.*
- *A maximum design speed should be 20 kph. (The speed limit is normally 10 kph).*

- *All entry and exit points to shared zones should be clearly signed.*
- *A minimum trafficable width of 2.8 m should be maintained throughout the zone.*
- *Straight lengths of roadway should not exceed 50 m.*
- *Parking spaces should be provided to the trafficable paths.*
- *There should be no provision for traffic across the zone.*
- *It is desirable to create a surface texture difference between the shared zone and the surrounding road network.*
- *Bollards with reflectors may be used to delineate the shape of the roadway from the approach side and to protect landscaping.*

Shared zones are not suitable for the following locations:

- *On streets that carry over 200 vehicles per hour in peak periods, or over 1,000 vehicles between 7 am and 7 pm.*
- *On streets with a history of speeding problems.*
- *On unprotected locations where approach speeds exceed 40 – 50 kph.*

Austroads – Guide to Traffic Engineering Practice – pedestrians - Section 8.4 [*5] is less definitive but generally agrees with the VicRoads guidelines with the exceptions:

- *Recommends that straights greater than 25 m should be avoided.*
- *Considers them an "access place" under table 1.4 Characteristics of street types – Footpath requirements. The recommendation for a Access Place is 300 vpd maximum traffic volume, single 3.5 – 3.7 m lane, 1 hard standing verge space, 2 per allotment, no footpath, no cycle path and flush layback.*

There are no current guidelines for Naked Intersections that the Author is aware of, although Australia still has the "give way to the right" rule in place for situations where there may be not traffic signs.

8.1 Experience in the Netherlands

In the Netherlands, Shared Space in Rijksstraatweg, Haren operates with traffic volumes in excess of 8,200 vpd. Road widths of 6 m are normal for Shared Space in the Netherlands. De Kaden, Drachten shopping precinct is also 6 m wide and has substantial traffic volumes. The Naked Intersection at De Kaden has more than 22,000 vpd.

The Dutch experience would indicate the VicRoads and Austroads Guidelines are very conservative both in traffic volume capacity and road width.

It is recommended that they be reviewed to take into account the work undertaken in the Netherlands.

9.0 LIABILITY ISSUES

The experience in the Netherlands with Shared Space has been positive with a reported reduction in accident rates.

Engineers in Australia designing Shared Space projects operate within a different legal framework than Europe. In determining fault for an accident the court would consider whether the design was in accordance with Australian Design Standards and Guidelines. Current Guidelines do not recommend the use of Shared Zones with traffic volumes in excess of 1,000 vpd. The Dutch Shared Space projects take considerably more traffic. Also pedestrians have right of way which is different to Australia.

It is imperative that the standards and codes are reviewed and timely to consider giving pedestrians, right of way at all intersections.

10.0 CONCLUSIONS

10.1 *Trailing a revised roundabout Design*

Laweiplein roundabout appears to have been a significant step towards pedestrian friendly roundabout design. Australian roundabout design produces roundabouts that are generally recognised as pedestrian unfriendly possibly because:

- They are constructed for vehicles and from a motorist perception are the exclusive domain of cars.
- Pedestrian crossings are largely a compromise to the design.
- Australian Road Rules give cars priority in a roundabout over pedestrians which encourages the driver's perception.
- The roundabout design and function requires the motorists to focus on traffic gaps within the roundabout with lesser regard for pedestrians.

One solution is to introduce a second control on the roundabout by installing walking legs signs to give pedestrians priority. This leads to capacity concerns.

The Laweiplein roundabout design departs from the Australian design approach by:

- Ramping traffic into the roundabout which has the impact of slowing down vehicles.
- Removing much of the delineation by using flush kerbing within the roundabout. His provides a generous strip for cyclists
- Providing very pronounced pedestrian crossing line work well back from the roundabout.
- Providing a separate bicycle crossing point.
- Eliminating splitter islands at each entry and tightening up the entrance to the roundabout which controls entry and exit speeds.

- Providing an entry road of 6 m width causing vehicles entering and leaving the roundabout to be cautious.

These design differences appear to result in a more cautious entry and exit and movement through the roundabout with consideration given to pedestrians and cyclists crossing the entry legs of the roundabout. Drivers have to be on their guard as the road is narrow and there is a possibility of an exiting large vehicle occupying some of the opposing lane as they swing. While this may appear as a risk to drivers, it appears to have a significant impact on driver behavior. The comparison is protected paths provides with generous plays in Australian roundabouts.

It is hoped that a roundabout with the same characteristics could be trialed in an Australian environment for evaluation.

10.2 *Review of Shared Zones Design Guidelines*

Current VicRoads and Austroads guidelines for Shared Zones are conservative with regard to traffic volumes capable of being passed through Shared Space environments.

REFERENCES

(#1) Appleyard, Donald. “Livable Streets” Berkeley: University of California Press, c1981

(#2) David Engwicht, “Mental Speed Bumps – A smarter way to tame traffic” Envirobook, 2005\

(#3) Norman W. Garrick, Center for Transportation and Urban Planning, University of Connecticut.

(#4) VicRoads Design Guidelines “VicRoads Traffic Engineering Manual Vol. 1”

(#5) Austroads – Guide to Traffic Engineering Practice – pedestrians - Section 8.4)