

THE IMPLEMENTATION OF TRAFFIC CALMING MEASURES IN THE CRADLE OF HUMANKIND, SOUTH AFRICA

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ABSTRACT

This paper presents the results of an on-going study and research into the work being carried out by the Gauteng Department of Roads and Transport in the Cradle of Humankind World Heritage Site (COH WHS) in South Africa. The work entails the implementation of traffic calming measures on the roads traversing the COH and an attempt to balance nature versus human needs. The main objective of this paper is to record the successes witnessed, the lessons learnt and to determine the suitability of the various Traffic Calming applications to the local (South African) conditions. It is hoped that the results will stimulate further research and assist engineers in achieving practical applications of traffic calming measures and deduce an acceptable integration of motorized and non-motorized transport in a rural setting. The paper was compiled using a combination of methods which included

Literature Review – review of the investigation reports on traffic calming and the implications to the road network, a look at international experiences as far as management of traffic around heritage sites is concerned,

Interviews and **Questionnaires** distributed to mostly bicycle clubs who utilize the facilities within the Cradle of Humankind to measure the effectiveness of the measures implemented. This paper discusses some of the practical experiences encountered in the implementation of traffic calming measures in the Cradle of Humankind. It highlights the process followed from the status quo, identified possible traffic calming measures, positioning of measures, challenges encountered before, during and after construction, practical issues like road signs, speed restrictions, access control, surface treatments etc. The results indicate that the process was partly iterative as some solutions had to be revised after implementation due to user reaction. The paper highlights the cornerstones of the Civil Engineering profession where the protection of human interests and the natural environment takes precedence over the user system. The paper concludes that while there were challenges encountered, the work is largely successful and that there is room for further research to determine the potential for wider use of the traffic calming measures on rural roads.

1.1. INTRODUCTION

Background

A World Heritage Site is an area that is deemed to have outstanding universal value and is therefore worthy of protection. In 1997, the South African Government signed the World Heritage Convention. At the end of June 1998, the Government submitted nominations to the UNESCO World Heritage Committee for the listing of three sites in South Africa as World Heritage Sites. The Gauteng Provincial Government was responsible for the preparation of the nomination of the fossil hominid sites of Sterkfontein, Swartkrans, Kromdraai and Environs as a World Heritage Site.

The COH WHS was listed as a World Heritage Site in December 1999 and the Gauteng Provincial Government is the Management Authority for the COH WHS, appointed in terms of Section 8 of the World Heritage Convention Act, Act 49 of 1999 (the Act). The Cradle of Humankind World Heritage Site (COH WHS) is a geospatial tourism project in Gauteng covering an area of 52 000 hectares in the north west of Gauteng Province, with 10% extending into North West Province. It extends across approximately 30 farms, many of which have been sub-divided, in the north western quadrant of Gauteng. The COH WHS is made up almost entirely of privately-owned land, with the exception of a portion of land owned by the West Rand District Municipality.

In addition, the COH WHS is developing a network of visitor facilities for the COH WHS. The main visitor facility, the Interpretation Centre Complex is co-located at the Sterkfontein Caves site, and on a site 7 km from Sterkfontein Caves known as Mohale's Gate

METHODOLOGY

The methods used to compile this paper comprised a combination of the following:

- A literature review;
- An interview with the implementing authority; and
- Questionnaires distributed to bicycle clubs.

1.3. Literature Review

The following literature was reviewed pertaining to the Traffic Calming Project in the Cradle of Humankind World Heritage Site:

2.1.1 *COHWHS: Development & Transportation Infrastructure Implications.*

PWV Consortium (BL 02/02). This report considers the impact of the Cradle on the surrounding road network. It strives to find means to manage the impact in a responsible manner which satisfies all relevant stakeholders. The report recommends cooperation between the roads authority (then Gautrans) and the Department of Agriculture, Conservation, Environment and Land (DACEL) to ensure a balance between the need for roads infrastructure and the protection of the environment.

2.1.2 *Traffic Calming Investigation within the COHWHS – BKS – August 2005.*

This report starts by quoting Thomas Moore, the author of *Care of the Soul*. “*Often we take the beauty out of roads to save time. But for what? Why the speed? Why focus on getting somewhere rather than enjoying the ride? The only answer I came up with is that speed is an emotional complex related to the philosophy of modernism. Fast food is an obvious instance of the syndrome, and so are roads built for speed*”.

The report was compiled by BKS in 2005 with the intention of proposing appropriate measures to be implemented in the Cradle of Humankind to calm down traffic. The report cites the Chilterns in the United Kingdom. The area is classified as an Area of Natural Beauty which is environmentally sensitive. The geometric design of roads in such an area is a sensitive issue as the users of the road network and their trip purposes are different.

Some would require an aesthetically pleasing road where they can enjoy the sights while others would prefer to get to their destination as quickly as possible. A common phenomenon has been the rigidity of geometric design standards and the way these guidelines do not differentiate between specially protected areas like the Cradle of Humankind and the wider rural setting.

Some of the general guiding principles taken from the Chilterns project are as follows
Unless there is an overriding safety consideration, do as little as possible
Ensure that the road belongs in the landscape rather than impose upon it;
Some roads may have additional, particular environmental qualities which must be recognised and conserved.

2.1.3 *Various correspondences and records of meetings held pertaining to this project.*

2.1.4 *Environmental Impacts of Tourism and Recreation – Stephen. M. Turton and Nigel. E. Stork.*

The authors focused on the tropical rainforests of Australia. It is recorded that a number of direct and underlying threats to the tropical rainforests included internal fragmentation by community infrastructure among others. Tourism and Recreational activities have been noted to exacerbate the threats as a consequence of increased visitor activities in the World Heritage Area and the increased demand for infrastructure to service the needs of the tourism industry. To manage some of the impacts caused by increased numbers of visitors, the Wet Tropics Management Authority had to put measures in place which included closure of some roads during the breeding season for rare and threatened fauna as well as the introduction of traffic-calming measures to reduce penetration of noise into the forest. The challenge that emerges is the creation of a balance between sustainable tourism and recreation and environmental protection and preservation

Interview

Record of interview with Mr. Pienaar – Cradle Management Authority. A discussion held with Mr. Pienaar from the Cradle Management Authority held on the 21st of January 2014, shed light on a number of issues. Some of the issues discussed are listed below with brief responses and explanations:

1.3.1. Dealing with the community - public participation:

The first and probably the biggest issue that was mentioned is Community participation and buy-in. The Cradle of Humankind comprises mostly privately-owned land which posed a challenge to the Government of South Africa to proclaim the World Heritage Site. The only way to proclaim was going to be through discussion and persuasion of the property owners and to make them see the benefits of the new status. As such, property owners wanted the land proclaimed but without too much change (rural rustic appearance with gravel roads). Some existing activities related to the area were meant to remain unchanged for example roadside hawkers and farm stalls. When the roads upgrades came along there was an outcry which was pacified by the argument that the area had now become a Tourist attraction center which required accessibility and good roads. With the road upgrades came complications as traffic increased and speeds also increased, hence the need for Traffic Calming measures. At the date of compilation of this report, there were still some property owners who have always opposed the change to the Cradle and are willing to stay that way with very little compromise as the projects unfold. Some of the compromises which have been proposed include:

- Management of heavy vehicles. Suggestions going as far as banning them through the Cradle. The challenge is the presence of conference facilities which require deliveries from time to time.
- Consider road closures - access control (boom gates). The challenge with that is the Cradle of Humankind is classified as an Open Access World Heritage Site by UNESCO which implies that all and sundry are allowed unhindered access to the sites.

1.3.2. *Street lighting*

Because of the rural nature of the Cradle of Humankind it was recommended that no street lighting be allowed along the road network. The Cradle Management Authority was working towards a dark sky appearance, a natural appearance which the property owners wanted anyway. The current project for Mountain Bike trails will recommend riding times to avoid a situation where cyclists will request for night lights. This situation does show however the effects of diverging interests in that the Department of Roads and Transport would have preferred to have lighting at night for safety reasons especially around the speed tables and traffic circles.

1.3.3. *Future plans*

Mr. Pienaar highlighted further plans to expand the traffic calming to other roads like the D374. An important aspect to consider here is the attempts by the Government to show that they listen to community concerns. Once the current project on the Mountain Bike Trail is completed there are also plans to hold extensive Road Safety campaigns on road sharing. A concern that was highlighted is the increase in the number of vehicles traversing tourist areas. An engineering solution to manage Traffic could be park and rides or tour facilities for the future.

Questionnaires

Summary of results from questionnaire sent to the cycling Clubs. The questionnaire was designed with the intention of ascertaining the cycling experience, the perceptions, the comfort and the quality of the efforts made to provide facilities for road sharing within the Cradle of Humankind. The questionnaire was distributed to cycle clubs using the Cradle of Humankind for their club rides. Detailed graphical results are available upon request.

1.3.4. *Results*

56 responses were received from the various groups of cyclists. Of those, 46 (82%) are male and 10 (18%) are female. The ages were ranging between 26 and 66. Results show that 53 respondents use a road bike, 29 respondents use a mountain bike, 1 respondent uses a time-trial bike and 1 uses a Hybrid - touring bike with special needs trailer for disabled child. The numbers indicate that about 26 people ride both road and mountain bikes. Cyclists were also asked whether they cycled elsewhere other than the Cradle of Humankind. The responses indicate that all who responded use the Cradle of Humankind as part of the full route of their cycling experience.

Safety

The majority of cyclists have indicated that they take their safety on the roads quite serious. 100% of the respondents indicated that they always wear a helmet when they go out cycling. In the same vein, high visibility clothing has been considered important with 58% of the respondents indicating that they always wear high visibility clothing when they go cycling. 9% indicated only at night, 24% indicated sometimes and 9% indicated that they never wear high visibility clothing. When asked how safe they felt about cycling in different facilities the responses indicate that roads without cycle lanes are considered unsafe by 60% of the respondents. Segregated cycle paths are considered safe by 56% of the respondents. Cycle lanes in roads similar to the situation within the Cradle of Humankind were considered safe by 49% of the respondents while another 49% considered them okay and yet another 2% considering them unsafe. Asked whether they use and strictly adhere to the facilities as provided within the Cradle, the majority (88%) of responses indicated that they do use the cycle lanes wherever possible/available. 11% said sometimes while 1% said they rarely use the facilities provided. It was assumed they are likely to be mountain bikers. To stress the importance of safety, the cyclists were asked whether they found different provisions like clear road signage, continuous routes, hard riding surfaces, route maintenance etc. important for their safety. 91% of the respondents highlighted that maintenance of routes (clearing of stones, rubble, glass, sand etc) as well as hard riding surfaces in good condition have very high importance in the quality and safety of their rides. Wide cycle paths also drew quite a lot of positive responses with 90% choosing high importance. From an engineering perspective, reduction of vehicle speed received a 77% response indicating how important the Traffic Calming project is. It however looks like road signage did not carry as much weight with 61% of respondents considering it to be of high importance. It is important to consider that may be as cyclists the most important is the provided facility, its width and whether it is properly maintained or not. Things like road signage would apply more to motorists as they serve as a guide to drivers mostly. As such, 9% (5 out of 56) of the cyclists considered road signage of low importance. The cyclists were also asked to indicate the effects of various other road users and road condition on their cycling experience in the Cradle of Humankind. Things like Pedestrians, Lack of Parking and Lack of Facilities on the route were considered to have No Effect on the cycling experience. Interestingly, trucks have been indicated to have the biggest negative impact with 56% of the respondents indicating that they are put off from cycling by Trucks. Lack of Maintenance also tops the charts with 53% being put off from cycling. Taxis follow at 47% mainly due to their tendency to stop anywhere and blocking the cycle route and also the lack of courtesy to other road users. Cars follow at 44% while motorcycles also contribute negatively at 24%.

From the comments received when the cyclists were asked what would encourage them to use the Cradle facilities even more it would seem like what is standing out is the maintenance of the existing facilities. Most cyclists complain of the sand, the broken glass, the encroaching trees as well as the uneven surface. A few are happy with the current facilities. There are also requests for the extension of the cycle route to enable cyclists to ride for longer distances. Of interest is also the Traffic Management component especially relating to the Motorbike speeds along the road. It would seem that generally where there are traffic calming measures along the D540, there is a sizeable safety component to the users sharing the road space. A few complaints maybe to be passed over to the Cradle Management Authority relates to Visible policing as some cyclists have been robbed and also facilities like water taps for refilling of water bottles as well as more coffee bars even. Some of the recommendations made were the addition of dedicated Mountain Bike Trails which the Cradle Management Authority was busy implementing.

INTERNATIONAL EXPERIENCES ON TRAFFIC MANAGEMENT AROUND HERITAGE SITES

To manage some of the impacts caused by increased numbers of visitors, the Wet Tropics Management Authority of Australia had to put measures in place which included closure of some roads during the breeding season for rare and threatened fauna as well as the introduction of traffic-calming measures to reduce penetration of noise into the forest.

1.4. The Chilterns in the United Kingdom is a very pertinent example where the Government decided to intervene by producing separate guidelines for the treatment of roads and traffic operations in an Area of Natural Beauty. Some of the guidelines were employed in the Cradle of Humankind as captured in the BKS report (2005).

1.4.1. TRAFFIC CALMING IN THE CRADLE OF HUMANKIND

1.4.2. Traffic calming theory

1.4.3. *Definition*

1.4.4. The *Institute of Transportation Engineers (ITE)* defines traffic calming as: *“The combination of mainly physical measures that reduce the negative effects of motor vehicle use, alter driver behaviour and improve conditions for non-motorised street users”*

The Objective of traffic calming is defined in ***South African Guidelines for Traffic Calming:*** *“Traffic calming has the objective of moderating traffic behaviour through physical and legislative measures aimed at the reduction of vehicle speeds or traffic volumes*

1.4.5. Discussion

(i) Traffic controls like stop signs, speed limits etc are regulatory measures that require enforcement whereas traffic calming is self-enforcing.

Speed control measures include:

- Speed humps (most commonly used traffic calming measure); Speed tables (higher speeds enabled where they are correctly constructed); Raised intersections; Textured pavements; Mini traffic circles; Traffic circles (roundabouts) – design determine negotiating speed; Chicanes (s-curves); Re-aligned intersections; Roadway width reduction – intersections/chokers and Gateways.

(ii) Traffic calming measures rely on laws of physics rather than human psychology i.e. street trees, and street furniture are complimentary but do not directly compel drivers to slow down;

(iii) Route modification measures such as diverters, street closures, turn restrictions do not change driver behaviour (speed) but modify driver routing options resulting in traffic volume reductions.

(iv) Traffic calming measures should be evaluated with extreme care considering:

- Concerns of residents / road users; Internal versus external traffic; Construction costs; Traffic volume and road hierarchy; Emergency vehicles; Public transport vehicles and Road Safety.

1.5. Proposed traffic calming measures

Considering the unique environment, the World Heritage Status of the area and the restriction on further development apart from limited tourism development it was concluded that the identified CoHWHS sensitive roads can be treated differently to any other rural provincial road. The Road network that was considered as sensitive consisted of: **D1701, D540, D374 and D101** which also formed the proposed cycle route.

The proposed traffic calming measures took the following constraints into account:

- Existing vertical and horizontal road alignment;
- Significant costs to change the existing alignments;
- Significant costs associated with the majority of the proposals;

The proposed traffic calming measures were decided as follows:

- (i) Introduction of Gateways where the following work was carried out:
 - Narrowing of paved road to 6m; Change in road texture and colour as well as COHWHS branded obelisk/tower;
- (ii) Reduction of the speed limit to between 60 km/h and 80 km/hr depending on the specific road section;
- (iii) Protection of cyclists/pedestrians using the paved shoulder through selected areas. The following was carried out:
 - Separation of road & cycle lane, Rumble strips, Paint markings, Change in texture of surface, Change in colour of road surface.
- (iv) Narrowing of road by:
 - Indigenous tree “tunnels” and Reduction in lane width.
- (v) Traffic calming circles at the following intersections:
 - D1701 / D540, D540 / D374, D1496 / D374, D374 / D101, D1027 / D101
 - Selected accesses to increase frequency

2. Chokers - the narrow bridge over Blaauwbankspruit was retained and it became a natural choker.

3. CHALLENGES AND SOLUTIONS - PRACTICAL ISSUES AND EXPERIENCES

This section describes some of the practical issues that emerged during implementation, the nature of the challenges and proposed solutions which were then implemented. The challenges encountered were brought forward both from the community side as part of Consultation and the implementing Authorities as a result of experience and sometimes research. Most challenges were however as a result of community participation and resistance to the changes that were being proposed which had what was perceived to be negative impacts to their community. The list below is by no means exhaustive but seeks to express the successes and the not so successful attempts to conclude the project in a Professional and amicable manner.

3.1. Geometric design challenges

Some Road alignments (D374) were already fixed as the earthworks had been done according to Provincial design standards for rural roads; it was considered to change this high standard vertical and horizontal alignment but proved to be too costly.

- Geometric design in an environmentally sensitive area is a sensitive issue as road users and their trip purposes differ. A balance had to be found to cater for Users requiring narrow, slow driving aesthetic pleasing road as opposed to Users who want to travel as quickly as possible between points. To address this challenge the following guiding principles adopted from the Chilterns Design Guidelines were applied:
 - *Do as little as possible.* The roads were designed to follow natural contours in a manner that enabled the road to belong to the landscape instead of imposing on it;
 - *Reduction of the design speed of road.* The existing gravel roads had been designed and constructed on 100km/h standard except road D540. D540 was still on old gravel road standard of 60km/hr. In the end a design speed of 80km/hr was applied. Road D540 was surfaced on the existing alignment and like all the other roads followed the existing constructed road prism.
 - *Retain trees immediately adjacent to road.* This created a natural traffic calming measure through the tunnel effect.

- **Surface or Not???**

The local community deeply objected to the surfacing of the existing gravel roads. They foresaw an increase in the volumes of through traffic due to the attractiveness of the surfaced roads. They also complained of the potential hazard of speeding. As accurately predicted by the community, there were challenges relating to speeding incidents as well as motorbike brigades seemingly testing how fast their bikes could go on weekends after the roads were surfaced. This made for a sound motivation for the implementation of traffic calming measures within the Cradle of Humankind.

- **Heavy vehicle consideration**

One of the most important considerations in the geometric design of the roads in the Cradle of Humankind was the treatment of Heavy Goods Vehicles. The community was advocating for the restriction/banning of heavy vehicles within the Cradle. It was however agreed that due to the presence of Conference facilities and restaurants which required deliveries, it was not possible to ban heavy vehicles. The compromise was that of the introduction of traffic calming measures to at least slow down the traffic and ensure the safety of those traversing the length and breadth of the Cradle.

- **Lane Widths**

The lane widths decided on were 3m coming from the 3,7m which is the Provincial design standard. This reduction in lane widths was implemented as a calming measure with the benefit of obtaining sizable shoulders without incurring huge financial costs.

The only challenge was keeping the vehicles off the dedicated shoulders which were achieved by the implemented flaps and delineators.

Rumble strips

The noise factor. While rumble strips are effective as a traffic calming measure and as an advance warning physical system, they have the disadvantage of noise especially at night time. At one of the meetings with the community the noise issue was raised and it was suggested to replace rumble strips and try rumble surfaces (area of course stone) which was better accepted. In the end however, what was implemented was the option of the painting of the road surface as recommended by BKS as a viable alternative to the installation of further rumble strips, particularly with the intended installation of raised platforms along the road network

Accidents at roundabouts

A catch-22 situation arose when the authorities realized the potential of accidents at roundabouts. The question arose on whether it would not be prudent to implement rumble strips in advance of the traffic circle to alert approaching drivers especially at night and where there was no street lighting. With the rumble strips challenged and the need to improve the safety of the travelling public it became quite a headache. The final verdict however was that the rumble strips will be implemented but with an amended design

3.2. Community opposition regarding locations and measures.

The community was opposed to the implementation of the proposed changes to the road network in and around the Cradle of Humankind. Most roads within the Cradle were gravel, which deterred any unnecessary traffic from entering and passing through. The suggestion of paving roads drew widespread indignation and opposition as it was viewed as a way of attracting unwelcome through traffic. As it were the community was correct as the new roads were now used as race tracks by some bikers and as through roads by truckers running away from the weighbridge on the N14 south of the COHWS. A comprehensive consultation process was then implemented to ensure community buy-in and also ensure the right intervention for the right location. Of course not everybody agreed but the majority of the property owners gave the authorities a chance. Several correspondence and meetings held proved to be useless as some members refused to be swayed. In the end democracy won with majority rule being followed

Systems Approach and Methodology

The implementing authorities had foreseen from inception that implementing measures piecemeal would not be effective. A systems engineering approach was required to ensure that an area-wide implementation would be carried out. That way the conditions around the identified area and roads would be uniform and predictable for the road user. And the correct sense of place in the environment is created supporting the rationale of calming measures.

Funding / procurement challenges.

The Cradle Management Authority budget was used for funding the implementation of all road upgrades. Most of the roads are provincial roads and the upgrading of the roads and Traffic Calming measures were implemented by DRT (then Gautrans) in terms of an Inter - Agency agreement through contracts procured by DRT. The management of the projects, reporting and payment arrangements required good cooperation and team spirit, which was the case

Protection of Bicycle lanes

To separate bicycle lanes it was initially proposed to use plastic rumble strips. The challenge however was that they did not stick to the road surface. Upon further investigation it was discovered that due to reduction in lane widths a lot of trucks drove on the edge and over the plastic rumble strips causing them to bend and ultimately to dislodge. Their other disadvantage was that the way they were implemented meant a sizeable portion would take the space of the road shoulder with a number of cyclists either hitting the strips or falling and others almost hit and injured as they came off when a car passes.

As a result the plastic strips were then removed and replaced with rubber flaps. Cyclists are, however, still unhappy with the flaps although they occupy the same area as the cat eyes installed. Site visits conducted on the 21st of January 2014 have revealed that some of the flaps have been damaged as a result of trucks riding over them. The majority are however holding strong although the colour seems to be fading as a result of continued exposure to the sun.

3.3. Pedestrians – farm schools in area: lower speed limits, warning signs, education, provide scholar transport

From the traffic circle on the D540/D374 towards the Sterkfontein, a lot of pedestrian activity has been observed. This is due to the informal settlement and school near Kromdraai. Public Transport (Taxi) activity is also significant on the same section. It is crucial that the conflict between pedestrians and cyclists be further investigated and minimized.

3.4. Road signage

An extensive exercise was done by the implementing authorities to design and implement tourism signage. This was also a pilot project and a first in the COHWS. The challenge that remains is the installation of illegal signs by property owners to try and advertise their facilities

4. CONCLUSION AND FURTHER RESEARCH

Literature on traffic calming measures is mostly focused on the urban situation. Traffic Calming in a rural context brings to the fore quite different dynamics.

It is believed that some valuable lessons have been learnt and are still to be learnt as the implementation and management of the heritage site proceeds.

Most important is to consult with all stakeholders from the onset and throughout a project.

There is scope for further research, not so much on implemented measures with predictable outcomes but rather the unpredicted outcomes regarding traffic safety and impacts on the environment.

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