

Queen Street, Dunraven Place, Market Street Access Study April 2016



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1. Introduction

Bridgend County Borough Council (BCBC) have commissioned Capita to undertake a study to review methods and assess risks of increasing vehicular access to parts of Bridgend Town Centre.

The area under consideration commences at the southern end of Queen Street, continues along Dunraven Place and Market Street up to the junction with Quarella Road. These roads are to remain one-way north bound to the Cenotaph and then one way eastbound to its junction with Quarella Road.

Town centre traders have reported significant reductions in footfall since the pedestrianisation scheme was completed in 2004. The key reason for this study is to review and risk assess ways to make the town centre more accessible for shoppers and visitors, as well as service vehicles with the aim to increase trade within the town.

The following scenarios have been assessed:

- Suspending the pedestrianisation at all times;
- Limit the pedestrianisation period to between 11am and 3pm, and allow full vehicular access at all other times;
- Consideration of reversing the existing one way system on Wyndham Street and Caroline Street.

The study considers the following options:

- Signing and lining scheme with no physical changes to the existing street characteristics;
- Increasing the kerb upstand from the existing 0 to 20mm to at least 60mm;
- Provision of tactile paving to demarcate carriageway;
- Provision of bollards and / or pedestrian guardrail to demarcate carriageway.

The study has been undertaken in consideration of the following key factors:

- Collision data analysis comparing pre and post pedestrianisation information;
- Risk assessments for reintroducing traffic including an assessment of the likely maintenance issues, safety issues etc together with an implications for each option utilising pre / post pedestrianisation data. The safety assessment gives particular consideration to the needs of vulnerable road users;
- Changes required to existing parking/loading bays;
- Pedestrian crossing locations and type;
- Signing / lining requirements;
- Suitability of existing construction and budget cost estimates of physical changes required to achieve an acceptable level of public safety;

- Town centre traders request that times of the pedestrianisation scheme be revisited to mitigate footfall and trade reduction since the pedestrianisation scheme was introduced and the more recent closure of The Rhiw Car Park.

2. Town Centre Characteristics

Bridgend (Pen-y-bont) is located approximately equal distance between the cities of Cardiff and Swansea in South Wales. As the principal town within the Bridgend County Borough its population is approximately 35,000 residents which is about 25% of the overall County Borough population of 134,800.

The town itself benefits from access by a variety of forms of transport. It can be accessed by three junctions on the M4 i.e. 35, 36 and 37. Junction 36 is less than 2 miles to the north of the town centre offering an average journey time of 35 minutes to both Cardiff in the east and Swansea in the west. The railway and bus stations are both within the town centre. In terms of rail, the station services the local area with journey times of approximately 20 minutes to Cardiff and on a national perspective sits on the London Paddington to Swansea strategic east west rail link.

Previous investment in the road infrastructure has forced road users around the town centre on the inner relief road, and as a consequence, the town centre lacks visibility from the main road corridors.

Bridgend Town Centre Conservation Area is characterised by Georgian, Victorian and Edwardian buildings. It includes the site of the former medieval market in Dunraven Place, Market Street, Wyndham Street, Derwen Road, Station Hill, Adare Street, Caroline Street and Elder Street, along with the area encompassed by Court Road Conservation Area that is situated along the eastern side of the town centre.

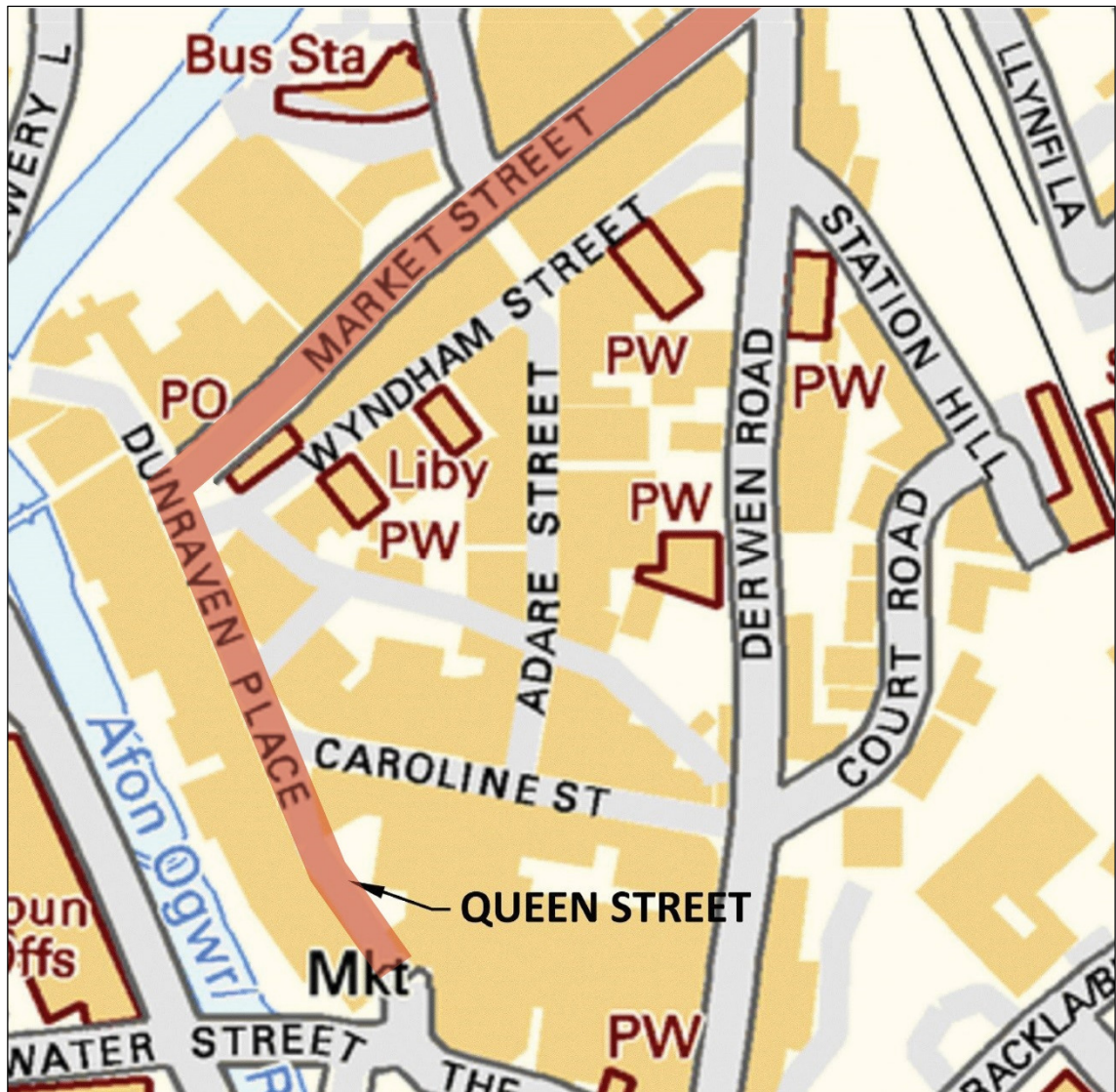
The War Memorial, centralised in Dunraven Place and adjacent to the Post Office Building (site of the former Town hall prior to its demolition in 1974), is an important feature in the area.

Bridgend has a high number of independent retailers which give the town centre a unique feel and provide diversity and interest to the shopping core. The town centre is also host to an indoor market which opens every weekday and on a Saturday.

The streets being considered in this study are:

- Queen Street from its junction with Water Street / The Rhiw;
- Dunraven Place;
- Market Street up to its junction with Quarella Road.

Figure 3.1 – Town Centre Street Map



The pedestrianisation scheme of these one way streets was introduced in November 2004. Traffic orders designate the streets a Pedestrian Zone with the exception of loading vehicles between the hours of 6pm to 10am. Motorists are physically excluded from entering the town centre by a rising bollard located at the southern end of Queen Street.

The streets within the study area are narrow and enclosed by buildings. The characteristics of the streets are very different pre and post pedestrianisation.

Prior to pedestrianisation and the enhancement works, carriageways and footways were segregated by standard 100 / 125mm high kerbs. Roads and traffic were far more dominant, pedestrian facilities were of secondary importance with narrow footways made of a variety of materials ranging from small element concrete paving block to large concrete flag paving. In areas, pedestrians were contained to narrow footways by guardrail. A zebra crossing was provided at the Wyndham Arms to assist pedestrians to cross the road.

The appearance of the streets have been significantly improved by the pedestrianisation / enhancement works. The highway is now characterised by a narrow mainly tarmac carriageway typically measuring 3m to 3.5m wide. Footways are generally segregated from carriageways by

a wide silver grey conservation kerb with a flush to 0 to 20mm upstand. Footways utilise Caithness natural stone flags which have a riven finish.

Pre-Pedestrianisation Photos

Post Pedestrianisation Photos

Market Street



Queen Street / Caroline Street Junction



Footways widths within the study area vary significantly from a maximum of circa 12m at the bus station entrance to a minimum of circa 0.9m on the western footway at number 20 Queen Street. Informal pedestrian crossing locations with buff coloured tactile paving are provided at the following locations:

- Southern Queen Street immediately north of Boots rear car park / loading bay;
- Queen Street at the Wyndham Arms;
- Market Street by the post office
- Market Street immediately west of Quarella Road.

Key places / interchanges are distinguished by a different treatment indicating areas of special importance. These are found at the following locations:

- Queen Street. The carriageway immediately north of its junction with Water Street / The Rhiw utilises a stone sett surfacing material to signify the start of the pedestrian zone.
- Queen Street. Stone sett paving laid in a circular pattern is provided at its junction with Carline Street – one of the main shopping streets in the town centre. Bespoke benches are provided on the periphery of this feature;

- Queen Street. Immediately south of the Wyndham Arms stone setts are laid in a circular pattern designating a minor side road;
- Dunraven Place. The War Memorial is a key feature within the town centre. This area has been given special treatment with a circular paved footway area framed by narrow stone sett carriageways providing access to Wyndam Street and Market Street.
- Market Street. Stone setts laid in a circular pattern have been laid in the carriageway immediately adjacent to The Star public house;
- Market Street – Immediately west of the Quarella Street junction a mixture of stone setts and flag paving are provided in the carriageway creating a stripped appearance inside a wider circular frame. This area signifies the end of the pedestrian zone.

3. Pre and Post Pedestrianisation Collision Data

The pedestrianisation scheme was introduced in November 2004. It has been assumed the construction phase was circa 1 year, this however is unconfirmed. To avoid collision data being influenced by disruption during the construction phase, any collisions between November 2003 (assumed start of construction) and November 2004 (opening date) have been omitted from the analysis below.

Refer to Appendix A – Collision Data Plan and Details for locations of Collisions.

In a 3 year 11 month period leading up to the start of the pedestrianisation construction phase there were 13 relevant collisions that occurred on Queen Street, Dunraven Place, Market Street and the junction of Market Street / Derwen Road.

In a 10 year period (2004 to 2014) since the pedestrianisation scheme was opened there have been 3 collisions. All of these occurred during times that loading vehicles are permitted to access the streets. There are no relevant collisions during the periods at which the Pedestrian Zone is fully operating i.e. the times when all vehicle access is prohibited.

Based on figures from “Reported Road Casualties in Great Britain: 2012 Annual Report the average cost of a slight accident in a built up area is £22,773. These cost are made up from various components e.g. damage to property, lost output, emergency services insurance costs.

Note - these are not costs to BCBC.

3.1 Pre-Pedestrianisation Collisions January 2000 to November 2003 (Queen Street / Dunraven Place / Market Street)

Ref	1	2	3	4	5	6	7	8	9	10	11	12	13
Casualty	1P	1P	1Dr	2P	1P	1P	1Dr	1Dr	1DR	1Pas	1P	1Cy	1P
Type	VP	VP	VV	VP	VP	VP	V	VM	VV	VV	VP	VC	VP
Causation	PC	REV	S	Rev/CBV	CBV	RevF	LC	CD	CD	S	PC	CC	PC
Day / Night	N	D	D	D	N	N	N	D	D	D	N	D	N

Casualty P=Pedestrian / Dr=Driver / Pas=Passenger / Cy=Cyclist

Type VP=Vehicle to Pedestrian / VV=Vehicle to Vehicle / V= Vehicle / VM = Car to Motorcycle / VC=Vehicle to Cyclist

Causation PC=Pedestrian Crossing / REV=Reversing Vehicle / RevF=Reversed onto footway / S=Shunt / CBV=Crossing Between Vehicles / LC=Loss of Control / CD=Careless Driving / CC=Cyclist crossing

Night time collisions	Day time collisions	Vehicle to Pedestrian collisions
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The 13 collisions resulted in 14 casualties. All collisions resulted in slight injuries.

Of the 13 collisions, 7 were as a consequence of vehicular to pedestrian conflict resulting in 8 pedestrian casualties and 1 was a collision between a car and a cyclist.

Of the 8 pedestrian casualties, 3 occurred between 11:00 and 14:30, 5 occurred during night time between 20:30 and 3:00 (note description states Daylight on all collisions – this is assumed to be an error).

The casualties occurred in the following ways:

- 2 pedestrian crossing carriageway resulting in vehicular conflict.
- 4 vehicles reversed into pedestrian or pedestrians. 2 of these pedestrians were struck by the same vehicle when crossing between parked cars. 1 was struck by a vehicle that reversed onto the footway. The other pedestrian stepped out into the road and was struck by a reversing vehicle.
- 1 pedestrians walked out into the carriageway from between parked vehicles.
- 1 pedestrian fell into the carriageway.
- 1 cyclist struck by vehicle turning left from Market Street to Derwen Road at traffic signal junction.

3.2 Post Pedestrianisation Collisions November 2004 to December 2014 (Queen Street / Dunraven Place / Market Street)

Ref	14	15	16
Casualty	1P	1P	1P
Type	VP	VP	VP
Causation	REV	CD	PC
Day / Night	D	D	N

Type VP=Vehicle to Pedestrian

Causation PC=Pedestrian Crossing / REV=Reversing Vehicle / CD=Careless Driving.

Night time collisions	Day time collisions	Vehicle to Pedestrian collisions
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The 3 collisions resulted in 3 pedestrian casualties. All collisions resulted in slight injuries. Two collisions occurred in the morning at 9:15 and the third occurred at 1:25 in the morning when loading vehicles are permitted to enter the town centre.

There are no collisions during the periods at which the Pedestrian Zone is fully operating, therefore collisions that occurred post pedestrianisation are not considered to be relevant when assessing the existing pedestrianised street.

The collisions occurred in the following ways:

- 1 vehicle reversed into pedestrian.
- 1 Pedestrian struck when emptying boot of car.
- 1 Pedestrian struck while crossing the road.

3.3 Nolton Street Between Court Road and Brackla Street Junction (January 2010 to December 2014)

BCBC requested this assessment be undertaken to provide a comparison between the number of collisions on the streets within the study area and a section of Nolton Street. The streets were considered to be similar in as much as having low kerbs.

During the 5 year period reviewed there was 1 relevant collision on this section of carriageway.

Ref	17
Casualty	2Dr
Type	VV
Causation	CD
Day / Night	D

Type VV=Vehicle to Vehicle

Causation CD=Careless Driving.



The collision occurred as a consequence of a motorists jumping the signals and colliding with a vehicle travelling in the opposite direction through the signal controlled junction.

4. Options

The four options under considerations are:

- Option 1 - Signing and Road Marking Carriageway Demarcation.
- Option 2 – Tactile Paving Carriageway Demarcation.
- Option 3 - Bollard / Street Furniture Carriageway Demarcation
- Option 4 – Kerb Upstand 60mm (Minimum) Carriageway Demarcation

To assist pedestrian movement and to promote low vehicular speed all Options will operate within a 20mph speed limit or 20mph zone. To aid pedestrians to cross the carriageway provision of 2 signal controlled crossings could be given. Refer to para 7.1.6 for further details on controlled crossings.

4.1 Option 1 Signing and Road Marking Carriageway Demarcation

This option would minimise the physical changes to the existing street. Signing and road markings would be amended to reflect the changed status of the carriageway. Vertical speed control systems such as speed cushions, road humps or speed tables are the most effective way to control speed. However, because this option is almost flush in cross section, it would be very difficult to provide this type of control successfully.

Therefore the following features could be considered:

- provision of additional pedestrian crossing facilities;
- rumble strips;
- use of coloured surfacing;
- carriageway narrowing
- additional bands of stone in the carriageway;

The addition of road markings will make the carriageway look more like a road and provide a form of visual demarcation.

This solution could meet opposition from the visually impaired because the 0 to 20mm kerb upstand would not provide demarcation that can be reliably detected by them. Research undertaken for the Guide Dogs Association by University College London (UCL) has concluded that the minimum height for a kerb to be reliably detectable by blind and partially sighted people is 60mm.

Of the options under consideration this would have the lowest cost to implement. It would also have the shortest construction period causing less disruption to the town during the transition / conversion period.

An initial budget construction estimate indicates costs of £211k and an estimated construction period of 3 months would be required to implement this Option. Design and construction supervision costs based on a simple percentage of 10% and 7% respectively of the construction costs are £36k.

An indicative budget of £247k (excluding Client fees) would be required to implement Option 1

Note: the estimate has been developed in a very basic way without any design information. Refer to Section 8 for further details on cost estimates. The estimate includes for changes to signs and road markings and provision of 2 puffin crossings. It does not include costs of other traffic calming features such as rumble strips, road narrowing features, etc. The estimate does not include for the construction of additional parking areas.

4.2 Option 2 Tactile Paving Carriageway Demarcation

Option 2 proposals are inclusive of the signing, road markings and puffin crossing measures provided under Option 1.

Option 2 would provide guidance or warning tactile paving at the interface of the carriageway and footway. This surface would provide additional warning of the footway / carriageway interface for all pedestrians but would be most beneficial to the visually impaired.

Tactile paving is one of the most commonly used methods to assist the visually impaired to navigate safely along streets. It is used extensively at carriageway crossing areas and has been used on streets to demarcate the edge of carriageway where there is limited or no vertical segregation. Tactile paving is not however intended to be used to demarcate the edge of carriageway. Current guidelines advise it should only be used to guide pedestrians within “safe” areas. Department for Transport (DfT) document Guidance on the Use of Tactile Paving advises that:

“Where an extensive area of the carriageway has been raised then it will not be appropriate to install the tactile surface along the full length. In those circumstances the tactile surface should be limited to the ‘crossing’ area (Figure 15 page 49), and the remaining raised carriageway either side of the tactile surface should maintain a level difference with the footway of at least 25mm high or have a continuous physical barrier, for example, planters, railings” 1.5.5.1 (p48) [...] “Where the carriageway has been raised to the level of the footway around an entire junction, it is essential that visually impaired pedestrians are kept away from the radius by the use of continuous physical barriers, for example, guard railings (Figure 17 page 50).” 1.5.5.3 (p48)”

DfT are currently consulting on updates to this document. The current guidance is based on research carried out in the 1980s and the aim is to ensure that tactile paving is easier for people with visual impairments to understand and that it can be applied consistently. DfT are striving to make tactile paving work better as a navigational tool and warning system for people with visual impairments, while ensuring designs are safer and more comfortable for mobility impaired people.

Within the consultation document DfT are assessing the following relevant change *“Wherever there is no level change between carriageway and footway, or a level change of less than 60mm, the boundary between footway and carriageway should be delineated with a tactile surface of at least 800mm in depth. This rule should apply to any continuous barrier-free surface occupied by pedestrians and vehicles be that a flat top road hump, a raised side road or junction, or an extended level surface area.”*

Existing guidelines therefore do not recommend using tactile paving as a means of demarcating the edge of carriageway. Furthermore, should the proposed changes to the document (currently under consultation) be implemented it would not be practical to provide tactile paving at the recommended 800mm depth within the majority of the areas under consideration.

The uneven surface of tactile paving can cause difficulties or discomfort for pedestrians e.g. those with pushchairs / prams, pedestrians using walking aids, pedestrians with arthritis and pedestrians with unsuitable footwear such as high heeled shoes. These pedestrian groups would avoid contact (as much as possible) with the tactile surface which would in essence reduce the effective footway width for them throughout the town centre.

Provision of an 800mm band of tactile surface along the streets within the study area would sterilise large areas of the effective footway width. In some areas, pedestrians would be confined to very narrow footways or forced to walk along the tactile surfacing.

Should this option be selected, BCBC would have to accept a complete departure to the existing guidance and a reduction to the 800mm depth of tactile paving that is recommended under the consultation document (should the proposed updates within the consultation document be accepted).

Research undertaken by UCL achieved the following results when testing a 400mm wide tactile surface in a safe space:

- 80% of the visually impaired sample group could easily detect it;
- 70% felt confident using this surface within the safe space;
- 73% felt safe using it within the safe space.
- 60% of mobility impaired pedestrians found it easy to cross,
- 0% failed to cross the surface,
- 53% of mobility impaired pedestrians found it to be acceptable.

The UCL study concluded that while a 400mm depth of tactile surface may be suitable to provide guidance within a pedestrian area, it would not be suitable to delineate the edge between the “safe space” and the area for vehicles.

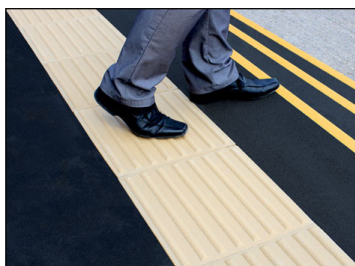
Should BCBC accept the risks of providing a narrower depth of tactile surface the following systems to install it could be considered:

- Concrete paving blocks. This is the most commonly used method, however the appearance of these would not be consistent with the high quality paving specification within the town centre;
- Stone units. A high quality finish could be provided by grinding the required finish into stone material to compliment other materials used in the town centre;
- Surface Mounted systems. These are basically adhesive tiles or bolt down strips.

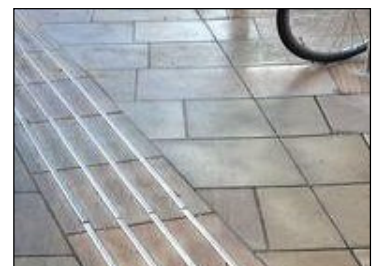
Stone System



Adhesive Tile System



Bolt Down System



The Option 2 cost estimate is inclusive of the Option 1 costs to change signing, road markings and provide 2 puffin crossings.

An initial budget construction estimate indicates costs of £298k and an estimated construction period of 4 months would be required to implement this Option. Design and construction supervision costs based on a simple percentage of 10% and 7% respectively of the construction costs are £51k.

An indicative budget of £349k (excluding Client fees) would be required to implement Option 2.

Note: the estimate has been developed in a very basic way without any design information and has assumed an 800mm wide concrete band of tactile paving along both sides of the carriageway through the town centre. It is assumed the existing foundation is acceptable and there will only be a need to excavate the existing stone and bedding mortar layers. Stone paving even if reduced to 200mm to 400mm wide would be significantly more costly. Adhesive systems would be less costly and less disruptive during construction; however, they are less durable and are not recommended as a permanent solution. Bolt down systems are likely to be comparable cost wise to concrete solutions however disruption during construction would be significantly reduced. Refer to Section 8 for further details on cost estimates.

4.3 Option 3 Bollard / Street Furniture Carriageway Demarcation

The Option 3 proposals are inclusive of the signing road markings and puffin crossing measures provided under Option 1.

Option 3 would provide bollards and / or street furniture along the edge of the footway to demarcate the interface between carriageway and footway. These measures would physically prevent vehicles from mounting the footways and would also provide an additional form of visual segregation between the footway and carriageway areas. This option would facilitate pedestrian movement across the street with pedestrians being able to walk between bollards or street furniture installations. While this will be advantageous for the majority of pedestrians it could be opposed by the visually impaired because there would be a risk of them walking unintentionally between bollards into the carriageway. The bollards also create obstacles along the entire route with a risk of visually impaired pedestrians walking into them.

Design guidance recommends that bollards are set back at least 450mm from the edge of carriageway to minimise the risk of them being struck by passing vehicles. In addition, the selected bollard is likely to be approximately 100mm wide. In essence therefore, the effective footway width will be reduced by approximately 550mm and pedestrians will be channelled along narrower footways. Reducing the offset could be considered but this would increase the likelihood of them being struck by passing vehicles.

The following photos show typical street scenes where bollards have been used to prevent vehicles from accessing footways.

Chertsey Road, Woking**King Street, St Peters**

In terms of construction, the bollards could be installed by traditional methods whereby the area is excavated and the bollard is cast in a foundation. Alternatively, the existing construction appears to be suitable for core drilling resin bond method. This would be less disruptive and would provide a superior finish as there would be no requirement to take up and cut the existing paving units. Core drilling would however be subject to detailed examination of utilities apparatus locations.

The Option 3 cost estimate is inclusive of the Option 1 costs to change signing, road markings and provide 2 puffin crossings.

An initial budget construction estimate indicates costs of £471k and an estimated construction period of 3 months would be required to implement this Option. Design and construction supervision costs based on a simple percentage of 10% and 7% respectively of the construction costs are £81k.

An indicative budget of £552k (excluding Client fees) would be required to implement Option 3.

Note: the estimate has been developed in a very basic way without any design information. The estimate is based on a Glasdon Victory type bollard spaced at 2m intervals based on Framework rates. There is no inclusion for other types of street furniture such as benches / bins. Refer to Section 8 for further details on cost estimates.

4.4 Option 4 Kerb Upstand 60mm (Minimum) Carriageway Demarcation

The Option 4 proposals are inclusive of the signing road markings and puffin crossing measures provided under Option 1.

This option increases the kerb up-stand from the existing 0 to 20mm to at least 60mm. This option would provide the street with a more traditional footway / carriageway appearance, with the footway being segregated by a vertical kerb face. The option would enable proven physical traffic calming measures such as speed tables to be provided within the carriageway leading to the most robust speed control measures out of the options considered.

The option is likely to be favoured by the visually impaired because it will provide a reliable and familiar means to detect the edge of carriageway. However, because the street has been almost flush for more 10 years, increasing the kerb upstand will create a high initial risk of pedestrian trip type accidents. The visually impaired would be most at risk. This option is likely to be opposed

by mobility impaired pedestrians because it re-introduces physical barriers to movement across the street.

Several ways in which a kerb up-stand of at least 60mm could be implemented have been considered:

- Raising the footway. An initial assessment considers this solution to be inappropriate because it would result in surface water being directed to the back of footway leading to potential flooding issues. This option is not considered further in the details below.
- Back to back kerbs. The method is not considered appropriate because it would result in significant physical barrier between carriageway and footway and could result in pedestrian tripping issues. This option is not considered further in the details below.
- Lowering of the carriageway to create the upstand. This would be the preferred method because it would provide a traditional street layout, would not incur back of footway drainage issues and would limit as much as possible the potential for tripping issues.

There are several ways the carriageway could be lowered to achieve the 60mm (minimum) kerb upstand i.e. excavate to existing foundation and reconstruct; excavate to sub-formation by 60mm (minimum) and reconstruct; excavate bituminous layers only and reconstruct using a geogrid reinforced construction method. The later method would be the least disruptive but could create significant future maintenance issues. For example, utilities companies would sever the geogrid layers when undertaking trench excavations during maintenance works resulting in a carriageway weak areas.

Irrespective of the selected construction method, this option would be the most disruptive and costly to implement. It is also likely to result in the most significant changes to the way pedestrians and motorists perceive the street because the carriageway would be more like a traditional road. This would be returning the street to more of a vehicle priority environment.

The impact on existing underground services (gas, electric, Welsh water and BT) is not currently known. However this option is likely to result in the greatest impact on utilities because the cover to apparatus would be reduced and utility companies are likely to request diversions and / or protection work which could result in very high construction costs. The drainage infrastructure including carriageway gullies etc will need to be adjusted to accommodate the changes.

The Option 4 cost estimate is inclusive of the Option 1 costs to change signing, road markings and provide 2 puffin crossings.

An initial budget construction estimate indicates that costs of £731k and an estimated minimum construction period of 12 months would be required to implement this Option causing severe disruption during the construction period.

Design and construction supervision costs based on a simple percentage of 10% and 7% respectively of the construction costs are £124k.

An indicative budget of £855k (excluding Client fees) would be required to implement Option 3.

Note: the estimate has been developed in a very basic way without any design information. The estimate has assumed full depth sub formation excavation and reconstruction and that kerbs can be reused throughout and there is no requirement to take them up and relay kerbs. The existing

stone carriageway features within the town centre will remain in place providing speed table traffic calming features.

4.5 Shared Space Comparison

It is not proposed to create a shared space environment. It is worth noting however that the appearance of the existing streets within in the study area have some common characteristics associated to a shared space environment. In the right situation there are many benefits to a shared space design. There are examples of schemes that have been designed as shared space that have significantly reduced the number of collisions in an area. The difference is that the streets normally under consideration have a vehicular dominance and relatively high collision rate whereas vehicles within this assessment are currently prohibited from accessing the streets under review and the collision base line is zero.

Dft Shared Space Transport Note 1/11 defines a shared space as “*a street or place designed to improve pedestrian movement and comfort by reducing the dominance of motor vehicles and enabling all users to share the space rather than allow the clearly defined rules implied by more conventional designs.*”

In conventional streets motorists’ behaviour is largely governed by the highway infrastructure. Although pedestrians and motorists are equally entitled to occupy the carriageway, pedestrians generally exercise little control over vehicular traffic other than at controlled crossing.


In shared space the messages are more subtle – the environment provides less formal indication as to how drivers are supposed to behave, thus making their progress within the street more reliant on interpreting pedestrians’ movement and behaviour.

Research shows that, as the level of demarcation between pedestrians and drivers is reduced, the amount of interaction taking place between these modes increases. Reducing demarcation indicates that the street is meant to be shared equally by all users of the street. Implied priority for vehicles is reduced, as are physical and psychological barriers to pedestrians using the street.

Demarcation and other physical features alone do not dictate the level of sharing that takes place, but they can give a broad indication of what might be expected. Table 2.1 shows the general effect of particular features on sharing. A combination of features is generally more influential on user behaviour than the sum of the effects of individual features. As the degree of ‘sharedness’ (i.e. the physical aspects of a street that encourage sharing) increases, vehicle speeds tend to reduce.

Incorporating features from Table 2.1 into a design does not necessarily mean that a particular level of sharing will be achieved. Other factors have an influence such as street layout, frontage activity, pedestrian composition (e.g. shoppers, tourists etc.) and pedestrian activity (e.g. sitting and chatting, using street cafes, etc.).”

Table 2.1 Influence of typical features on sharing

Less shared design		More shared design
Kerbs	Low kerbs, chamfered kerbs	No kerbs
Pedestrian barriers		No pedestrian barriers
Vehicles restricted to parts of street, e.g. by bollards, street trees, etc.	Implied vehicle paths using surface materials, for example	No barriers to vehicle movement
Poor quality or unwelcoming public space characteristics	A few places where people can rest and chat	Presence of features such as cafes, markets, abundant seating, planting, public art, et
Conventional road markings	Limited road markings	No road markings
Traffic signals		No traffic signals
Signal controlled crossings	Zebra crossings	Courtesy crossings or no crossings

Queen Street, Dunraven Place and Market Street all have many characteristics of a shared space environment. The carriageway throughout the study area is narrow and while it is generally visually distinguishable from footways, there are exceptions at key intersections / junctions. In these areas stone make up the carriageway surface course and there is no level difference between the footway. In addition, there is a low kerb up-stand and no conventional physical barrier to pedestrian movement. The characteristics of the streets should also reduce the psychological barrier to pedestrian movement. Low kerbs can indicate to motorists that pedestrians are not confined to footways and they can expect to encounter them in carriageways which in certain environments can help to reduce speed.

The following table compares the “less shared design / more shared design” characteristics of the Options assessed against Table 2.1 Influence of Typical Features on Sharing:

Features	Op 1	Op 2	Op 3	Op 4
Kerb Type				
Conventional Kerbs				
Low Kerbs				
No Kerbs				
Pedestrian Barriers				
Pedestrian barriers				
No Pedestrian barriers				
Vehicle Barriers				
Vehicle contained to carriageways				
Implied Vehicle route using surface materials				
No vehicle barrier				
Quality of Space				
Poor quality space				
A few places where people can rest / chat				
Presence of Cafes, Markets planting etc				

	Op 1	Op 2	Op 3	Op 4
Road Markings				
Conventional road markings				
Limited Road Markings				
No Road Markings				
To Be Confirmed				
Vehicular Signal Control				
Traffic Signals				
No Traffic Signals				
Pedestrian Crossings				
Signal Controlled Crossings				
Zebra Crossings				
Courtesy or no crossings				
To Be Confirmed				
	Op 1	Op 2	Op 3	Op 4
Less Shared Design	0	0	1	2
More Shared Design	3	3	3	3
Neither Less or More Shared Design	2	2	1	0
To be Confirmed	2	2	2	2

Options 1 and 2 have the same number of Less Shared / More Shared Design characteristics as defined in table 2.1:

- 0 characteristics are categorised as “less shared space”
- 3 characteristics are categorised as “more shared designs”;
- 2 characteristics are categorised as “neither more shared or less shared”.
- 2 characteristics are still to be confirmed.

Option 3 has the following Less Shared / More Shared Design characteristics as defined in table 2.1:

- 1 characteristics are categorised as “less shared space”
- 3 characteristics are categorised as “more shared designs”;
- 1 characteristics are categorised as “neither more shared or less shared”.
- 2 characteristics are still to be confirmed.

Option 4 has the following Less Shared / More Shared Design characteristics as defined in table 2.1:

- 2 characteristics are categorised as “less shared space”
- 3 characteristics are categorised as “more shared designs”;
- 0 characteristics are categorised as “neither more shared or less shared”.
- 2 characteristics are still to be confirmed.

5. Safety / Risk Evaluation

Analysis of the collision data has identified 13 relevant collisions in a 3 year 11 month period leading up to pedestrianisation. On review of the period since pedestrianisation was implemented (2004 to 2014) there were 3 collisions. During the times at which the Pedestrian Zone is fully operational there have been no relevant collisions. The type of collision pre pedestrianisation is typical for a town centre environment. All resulted in slight injuries and the vast majority were caused by parking vehicles or pedestrians stepping out into the path of vehicles.

It is not possible to predict the level of collisions that could occur should traffic be reintroduced. The appearance of the streets are significantly different now to the wide carriageways, narrow footways of pre-pedestrianisation. Carriageways are now narrow, and the footway width has been maximised. In addition, pedestrian footfall together with the likely traffic volumes and speed is unknown.

Despite this, simple analysis of the pre / post pedestrianisation collisions data strongly indicates that collisions will increase if the town centre is reopened to traffic. The majority of collisions, based on pre-pedestrianisation data, are likely to be minor conflicts resulting in slight injuries, however, more serious injuries cannot be ruled out.

This section reviews what are considered to be the main safety risk for pedestrianisation.

The pedestrianisation scheme was opened in November 2004. Regular visitors to the town centre will have become familiar with a traffic free environment where they where they can safely step into the carriageway and / or walk in the carriageway. Because of this there will be a high initial risk of pedestrians stepping out into the carriageway without looking which could result in vehicular conflict. This risk is likely to reduce as pedestrians become more familiar with the traffic conditions, and behaviour changes. This risk will apply to all options but the risk would be highest for Option 1.

Initially, because of the nature of the streets, it is reasonable to assume that vehicular speed will be low. However, as motorists become familiar with the environment and as pedestrian become more contained to footways, speed may increase. There is however no evidence from the pre-pedestrianisation data that vehicle speed was a major contributor to collisions on these roads. This risk will apply to all Options.

A greater number of vehicles will be present during peak pedestrian times. Pedestrians are likely to cross between parked vehicles where visibility is reduced. This would increase the risk of conflict between pedestrians and vehicles. This risk will apply to all options.

There is likely to be an increase in pedestrians incurring slight injuries because of conflict with vehicles manoeuvring into parking spaces. This is likely to be the one of the most common type of collisions and is typical of areas where vehicles are present in areas of high pedestrian activity. This risk will apply to all options.

Vehicles are likely to park on footways causing an obstruction and forcing pedestrians into the carriageway creating a risk of collisions between vehicles and pedestrians. This risk will apply to Options 1 and 2. This was a cause of slight injuries, in the pre-pedestrianisation period.

There is an initial risk of pedestrians incurring injuries from walking into bollards, in particular the visually impaired. This risk is likely to occur initially and reduce as pedestrians become familiar with the new layout. This risk will apply to Options 3 only. This risk is similar to any other areas where bollards have been provided.

There is a risk of pedestrians tripping over kerbs. The visually impaired would be most at risk. This risk is likely to be high initially and should reduce as pedestrians become familiar with the new layout. This risk will apply to Option 4.

Extensive use of tactile paving could create drainage issues in the town centre. Water could pond in the corduroy pattern tactile paving profile because of the shallow long falls and possible silt accumulation. Ice could form during freezing conditions creating a slip type risk for pedestrians. This would be a risk for Option 2.

6. Maintenance Issues

The street was designed for low vehicular activity with a narrow carriageway. The carriageway design appears to be robust and in addition, the footway has been designed for low level vehicular over-run and is made up of a stone paving surface jointed and bedded on a high strength proprietary mortar system laid on a bituminous base coarse and sub-base.

Increased vehicular activity is likely to result in the following maintenance issues:

Kerbs have not been laid on high strength bedding mortar. Damage is currently being caused to kerbs that are being over-run by vehicles. Increasing the traffic levels is likely to result in increased frequency of damage. This would be an issue for all options. While the bollards under Option 3 would minimise over-run, because of the narrow road it will still occur. The risk of kerbs being dislodged by side impact type contact would be applicable to Option 4 because of the reduced cover to the kerbs. It should be noted that the carriageway, kerbs and footways work as a system. Movement in the kerbs would be transferred into footways resulting in increased maintenance requirements to footways.

The narrow carriageway will result in vehicles movements being channelised. The increased vehicular loading could result in carriageway rutting and subsequent ponding issues. This would be applicable to all options.

Paving slabs are likely to be damaged more frequently due to increased over-run and / or parking issues. Options 1 and 2 would be most at risk. It would also be a risk to a lesser extent for Option 4.

Infill chambers are unlikely to be suitable for vehicular loading. These could collapse and may need to be replaced with heavy duty covers. Options 1 and 2 would be most at risk. It would also be a risk to a lesser extent for Option 4.

The increased traffic and in particular footway loading could result in early failure of the pavements in areas where utility companies have been working. This issue would be applicable to all options, but is likely to be more frequent for Option 1 and 2 where footway parking is likely to be more widespread.

Collisions with street furniture including benches, signs, bollards and street lighting etc would increase. More frequent replacement and / or repair would be required as a result. This would apply to all Options but Option 3 would have the highest risk.

Damage to tactile paving could occur due to inconsiderate vehicular loading. Tactile paving, particularly if made of stone material can be brittle. There is a risk the surface of the tactile paving could become damaged if over-run by vehicles. This would apply to Options 1 and 2. Option 2 would be most at risk because of the extensive use of the material.

Extensive use of tactile paving could create drainage issues in the town centre. Water could pond in the corduroy pattern tactile paving profile because of the shallow long falls and possible silt accumulation. Frequent cleaning of the surface would be required to prevent ponding issues. This would be a risk for Option 2.

Trench excavations will sever carriageway geogrid reinforcement creating weak spots in the construction. This would be a risk for Option 4 (depending on the type of construction method).

6.1 Additional Considerations

6.1.1 *Revoking the Pedestrianisation Status*

The decision to either allow vehicles to enter the town during all times of the day or to restrict the times to those outside of the peak shopping times is important and could influence the risk of and type of collisions. There are advantages and disadvantages of either option.

Retaining the pedestrianised status during peak periods of 11am to 3pm would make the shopping experience more pleasant and removes the risk of conflict with vehicles during these times. It may also be more conducive to promoting a low speed environment because motorists will associate the street with pedestrianisation. Due to the reduced opportunity, it is also likely to reduce the occurrence of typical town centre collisions such as pedestrians being struck by vehicles performing parking manoeuvres. Conversely, particularly at the start and end of the pedestrianisation period, there would be uncertainty over the road status which could increase the risk of pedestrians stepping into the carriageway outside of the pedestrianised times,.

Revoking the pedestrianisation on a full time basis will have some benefits in terms of safety over the part time scenario. It will remove any uncertainty relating to pedestrianisation periods and pedestrians should, in time, become familiar with vehicles travelling through the town at all times of the day. This is likely in the long term to result in safer pedestrian behaviour.

Unfortunately due to the unique environment of each street, it is not possible to predict which of the above 2 scenarios would result in the least number of collisions.

Local authorities that have reintroduced traffic into town centre streets have been consulted and the following feedback has been received:

- Renfrewshire Council – Paisley High Street.

The high street had been subject to a full time pedestrianisation except for loading. The pedestrianisation was revoked in July 2015 between 18:30 and 6:00 to encourage a night time economy. The proposal received objections from disabled groups. No collision data was available however the council were not aware of any collisions since the scheme was introduced.

- Blaenau Gwent – Ebbw Vale Town Centre

The scheme revoked a part time 11:00 to 16:00 vehicle prohibition order in 2009. Initially undertaken on an experimental order but permanent orders are now in place. There are ongoing issues with inconsiderate / footway parking. There is no data available however the officer consulted was not aware of any collisions since the changes have been made.

6.1.2 *Reversing Traffic Flows - Wyndham Street and Caroline Street*

Wyndham Street and Caroline Street are pedestrianised one way streets. Access is permitted for loading vehicles only between the hours of 6pm to 10am. Loading vehicles enter from Queen Street and Dunraven Place and travel in an easterly direction to exit onto Derwen Road / Nolton Street. Currently the prohibition of access is physically supported by the rising bollard located at the southern end of Queen Street.

The pedestrianised status of Wyndham Street and Caroline Street will remain unchanged. If the pedestrianised status is revoked along Queen Street and Dunraven Place the risk of unauthorised vehicles entering Caroline Street and Wyndham Street will increase. Reversing the one way along Wyndham Street and Caroline Street would help mitigate this issue as motorists are less likely to travel against a one way system.

6.1.3 *Changes to Parking Bays*

Currently all bays within the town centre are designated for loading only. If the pedestrianised status is revoked there will be a need to provide parking for the general public. The existing loading bays could be reserved for loading vehicles outside of the shopping times. Traffic orders could be changed however to enable the general public to use the bays during shopping times. Limited parking times of say 30 minutes would ensure frequent turn over to maximise potential short stay customers within the town centre.

There is currently 119m of loading bay within the town centre which would be accommodate approximately 18 cars. There is limited opportunity within the town centre to increase the parking capacity without significant detriment to footway widths.

An initial assessment of the space available in the town centre has identified the following areas as being worthy of further investigation for parking opportunities:

- 24m (4 spaces) on Queen Street;
- 43m (7spaces) on Market Street.

Provision of the additional spaces would be subject to further investigation to ensure there are no cellars in these areas and to ascertain the impact on buried services.

6.1.4 *Speed Limit*

The existing town centre speed limit is 30mph. To promote a low speed environment a 20mph zone or speed limit is recommended should the pedestrianised status be revoked.

A 20mph zone needs to be self-enforcing to ensure that motorists drive at appropriate speed i.e. measures placed along the street that physically restrict motorists to 20mph. Such measures include as road narrowings, speed tables, speed cushions, horizontal deflection etc. This is because the Police will not enforce the speed limit.

20mph speed limits do not require physical measures to enforce the speed limit however they are most appropriate where average speeds are already low i.e. less than 24mph.

There is no speed data available to indicate average speed either pre or post pedestrianisation. Even though there is limited vehicular access in the town centre currently, speed data may provide a guide as to which measure would be appropriate.

The narrow carriageway and imposing buildings along the street corridor will contribute to a low speed environment. In addition, the 90 degree bend at Dunraven Place, street furniture, stone features and offset carriageway alignment through the stone features will all contribute to a low speed environment.

Note - a road narrowing is not considered a speed reducing feature in itself, but it can be a reminder or encouragement to drive slowly or calmly.

Vertical deflection is the most effective and reliable speed control measure currently available. As it is not possible to provide vertical deflection within Options 1, 2 and 3, the success of these solutions would to a certain degree rely on the behaviour of motorists. Inconsiderate motorists could travel along the street at a speed higher than 20mph, as they can in any other town centre location without vertical deflection. This is however likely to be an infrequent occurrence.

Option 4 would enable vertical speed control measures to be incorporated, ensuring the 20mph zone is self-enforcing.

6.1.5 *Signing / Lining*

Currently the streets within the study area have very limited signing and lining. This adds to the pedestrianised feel and the attractiveness of the areas. The more signs and lines that are provided within the street the more it will look like a typical road and be treated as a road by motorists.

To maintain a street that limits the requirement for road markings a restricted parking zone could be considered. There would however still need to be additional signing to inform motorists clearly of the speed and prohibitions within the town centre. Extents of parking bays would need to be clearly distinguishable to ensure that enforcement can be applied without challenge. At least one new sign will be required for each loading / parking bay to provide information on the shared status and the times at which parking / loading / disabled persons can use the bays.

6.1.6 *Pedestrian Crossing Facilities*

The following existing crossing facilities are provided within the study area:

- Uncontrolled tactile crossing at the Southern end of Queens Street outside 'Clive International'. Buff blister tactiles 1.6m wide by 0.4m deep.
- Uncontrolled tactile crossing on Dunraven Place outside 'The Wyndam Arms'. Buff blister tactiles 1.8m wide by 0.8m deep.
- Uncontrolled tactile crossing on the start of Market Street outside 'Butterfingers Boutique'. Buff blister tactiles 1.6m wide by 0.8m deep.
- Uncontrolled tactile crossing towards the middle of Market Street outside 'Ty Coffi'. Buff blister tactiles 1.6m wide by 1.2m deep.
- Controlled tactile crossing towards end of Market Street outside 'Hair Associates/The Roof'. Red blister tactiles 2.4m wide.

If the pedestrianised status is revoked it may be necessary to provide some additional controlled crossings. There are several factors which are used to determine the requirement for controlled crossings:

- Pedestrian desire lines and numbers of pedestrians;
- Traffic volumes;
- Traffic speed.

This information is used to determine if sufficient gaps are available for pedestrians to cross safely in uncontrolled conditions. Unfortunately this information is not available and if taken now, is unlikely to be representative of traffic conditions if vehicles are allowed to enter.

Irrespective of this, the strong pedestrian desire lines are likely to occur at the Caroline Street and Wyndham Street junctions together with the bus station. It is noted that prior to pedestrianisation, a controlled crossing was provided in the vicinity of the Wyndham Arms is indicative of an historic pre pedestrianisation desire line.

6.1.7 *Consultation*

A local town centre relies on the support and patronage of local residents. The Council will need to consult local residents together with traders to determine their views when selecting a final scheme.

The requirements of disabled / vulnerable road users will need to be given careful consideration when selecting a final scheme. An acceptable balance between the various disabled groups can be difficult to achieve. For example, mobility impaired pedestrians would prefer a flush surface whereas the visually impaired prefer vertical segregation between carriageways and footways. It is recommended that local access groups are consulted if the streets are reopened to traffic.

A significant benefit for disabled pedestrians would be the ability to park in the town centre providing easy access to the shops and facilities. An element of the parking / loading bays should be designated for disabled use.

7. Cost Estimates

Initial Budget schemes costs have been prepared for each Option. There was no design information available at the time of preparing the estimates so they should be regarded as very basic assessments at this stage. Items such as impact on utilities apparatus could have a significant bearing on the costs, particularly for Options 3 and 4. Because of the very early stage at which estimates have been provided, a 44% Optimism Bias has been added in line with Government recommendations.

The South East Wales Highways Framework has been used to develop the cost estimates.

Note - the estimates do not include areas of additional parking. If provided, parking areas will have significant bearing on all of the estimates, particularly if a stone surfacing material is used.

Before reporting estimates it is recommended the preferred solution is developed to provide and a detailed cost estimate is undertaken to provide a greater level of confidence when securing funds.

7.1 Option 1 Signing / Lining Carriageway Demarcation

Preliminaries	£57,699
Site Clearance	£460
Kerbs, Footways and Kerbed Areas	£165
Traffic Signs, Road Markings & 2 Controlled Crossings	£8,143
2 Puffin Crossing Installations	£80,000
44% Optimism Bias	£64,445
	Sub Total £210,912
Design Fees (10% allowance)	£21,091
Construction Supervision Fees (7% allowance)	£14,763
	Sub Total £35,854
	Sub Total £246,766

Note: the estimate includes for changes to signs and road markings and provision of 2 puffin crossings. It does not include costs of other traffic calming features such as rumble strips, road narrowing features, etc.

7.2 Option 2 Tactile Paving Carriageway Demarcation

Preliminaries	£81,645
Site Clearance	£460
Earthworks	£5,418
Kerbs, Footways and Kerbed Areas	£24,347
Traffic Signs, Road Markings & 2 Controlled Crossings	£9,403
2 Puffin Crossing Installations	£80,000
Stats Diversions (low risk)	£5,891
44% Optimism Bias	£91,192
	Sub Total £298,367
Design Fees (10% allowance)	£29,836
Construction Supervision Fees (7% allowance)	£20,885
	Sub Total £50,721
	Sub Total £349,088

Note: the estimate has been developed in a very basic way without any design information and has assumed an 800mm wide concrete band of tactile paving along both sides of the carriageway through the town centre. It is assumed the existing foundation is acceptable and there will only be a need to excavate the existing stone and bedding mortar layers. Stone paving even if reduced to 200mm to 400mm wide would be significantly more costly. Adhesive systems would be less costly and less disruptive during construction; however, they are less durable and are not recommended as a permanent solution. Bolt down systems are likely to be comparable cost wise to concrete solutions however disruption during construction would be significantly reduced.

7.3 Option 3 Bollard / Street Furniture Carriageway Demarcation

Preliminaries	£128,380
Site Clearance	£460
Kerbs, Footways and Kerbed Areas	£4,965
Traffic Signs, Road Markings	£8,143
2 Puffin Crossing Installations	£80,000
Bollards	£96,000
Stats Diversions (low risk)	£9,478
44% Optimism Bias	£143,882
	Sub Total £470,888
Design Fees (10% allowance)	£47,880
Construction Supervision Fees (7% allowance)	£32,962
	Sub Total £80,842
	Sub Total £551,730

Note: the estimate is based on a Glasdon Victory type bollard spaced at 2m intervals based on Framework rates. There is no inclusion for other types of street furniture such as benches / bins. There are several factors which will influence the cost in the final scheme (should this option be selected). The type of bollard, the spacing of the bollard, how bollards are fitted i.e. excavate to locate foundations or core drilled and fixed with resin bond. Traditional excavation methods have been used in this cost estimate.

7.4 Option 4 Kerb Upstand 60mm (Minimum) Carriageway Demarcation

Preliminaries	£260,024
Site Clearance	£460
Drainage	£3,000
Earthworks	£22,271
Pavements	£35,396
Kerbs, Footways and Kerbed Areas	£96,915
Traffic Signs, Road Markings	£8,143
2 Puffin Crossing Installations	£80,000
Stats Diversions (low risk)	£61,546
44% Optimism Bias	£223,413
Total	£731,000
	Sub Total £731,000
Design Fees (10% allowance)	£73,100
Construction Supervision Fees (7% allowance)	£51,170
	Sub Total £124,270
	Sub Total £855,270

Note: the estimate has assumed full depth sub formation excavation and reconstruction and that kerbs can be salvaged and reused throughout. The existing stone carriageway features within the town centre will remain insitu providing speed table traffic calming features.

8. Conclusions

Naturally the risk of collisions will increase if vehicles are allowed back into Queen Street, Dunraven Place and Market Street. There were 13 relevant collisions in a 3 year 11 month period pre-pedestrianisation and no relevant collisions during 10 years post pedestrianisation. From the perspective of road safety and future maintenance costs alone, it is a natural recommendation to maintain the current pedestrianised situation

However, it is BCBC's objective to improve access and footfall within the town centre by reintroducing vehicular access whilst maintaining a reasonable outcome of the consequential effects. BCBC acknowledge and accept that a rationalised approach has risks associated with road safety and future maintenance cost in delivering their objectives.

The Options assessed to facilitate vehicular access range from the simplest solution of changing the traffic signs and road markings to more expansive solutions that utilise either warning / guidance paving, bollards / street furniture or reintroduction of a higher kerb upstand.

While it is easy to conclude that the risk of collisions will increase, it is not possible to predict the number of collisions that are likely to occur. This is partly because of the lack of baseline data:

- the town centre appearance is significantly different now to what it was before pedestrianisation therefore pre-pedestrian collision data is to a certain degree unreliable;
- there is no pedestrian data available either pre or post pedestrianisation;
- the appearance and characteristics of the periphery roads have changed significantly during the wider regeneration / pedestrianisation project;
- there is no reliable way to predict the number of vehicles that will use the town centre in the future and there is no pre pedestrianisation traffic data available.

Speed does not appear to have been a major contributory factor to collisions either before or after pedestrianisation. It is therefore reasonable to assume that most motorists will travel along the roads at appropriately low speed no matter what Option is selected. The appearance of the street should be conducive to low speeds. Based on pre and post collision data it is a reasonable assumption that should collisions occur, the majority will be slight in nature, however, more serious collisions cannot be dismissed as is the case in most streets which mix pedestrians and vehicles.

It is reasonable to assume that the risk of collisions will be initially higher as pedestrians and motorists adjust to the changes. It is not possible to predict with any certainty the period of time over which this risk will reduce to the norm for these particular streets. Traffic Signs Regulations and General Directions recommend that temporary traffic signs remain in place for a period of 3 months on normal highway improvement schemes. These signs however are for motorists who by virtue of driving a vehicle will be more alert to road conditions than pedestrians undertaking social activities or shopping for example.

It is unlikely that any of the proposals will totally satisfy the needs of disabled groups. Visually impaired usually prefer vertical segregation in streets that have vehicular activity, but mobility impaired would usually favour a flush surface. The proposal will however offer a benefit to some disabled pedestrians by allowing them to park close to the amenities.

Option 1 proposes signing / road marking changes and would be the most cost effective solution. It would have the shortest construction period and least amount of financial risk during construction. This option would however have the greatest operational risk in terms of public safety. The Option does not provide physical barriers to prevent motorists from parking on footways and there would be no reliable way for visually impaired pedestrians to detect the carriageway / footway interface.

Option 2 proposes a system of tactile paving to provide warning for the visually impaired. This system does not however comply with DfT Guidelines on the use of Tactile Paving document. The current document advises that tactile paving should not be used to segregate footways and carriageways. The document is currently under a consultation to permit such a system with a minimum depth of 800mm. It would not be viable in BCBC to provide tactile paving at an 800mm depth throughout the town centre. 200mm to 400mm would be more realistic, however, research has concluded that reduced depth system cannot be reliably detected by the visually impaired. In addition the Option does not provide physical barriers to prevent motorists from parking on footways.

Option 3 proposes a system of bollards possibly in combination with other street furniture items to demarcate the edge of carriageway and footway. While this proposal would physically prevent motorists from accessing footways, pedestrian movement across the street would not however be compromised. It would also provide clear visual demarcation of the edge of carriageway. The system would however reduce footway widths by approximately 550mm and is likely to require frequent maintenance to repair or replace bollards that will be at risk from passing vehicles. The bollards will provide visually impaired pedestrians with an unconventional method to navigate longitudinally along the street. There would however be a risk of visually impaired walking into the bollards and they could also unintentionally walk between bollards into the carriageway.

Options 4 which provides a kerb upstand of at least 60mm would appear to be the typical way to implement the changes because the street would revert to a standard form of segregation between footways and carriageways. It would also provide the basis to provide vertical deflection which is the most reliable system to achieve low speeds. In addition motorists would be less likely to park on footways because of the vertical segregation. The street has however been almost flush for more than 10 years, therefore, there would be an initial high risk of pedestrians tripping if this option is provided. The elderly and visually impaired would be most at risk. Mobility impaired pedestrians would not favour this solution because of the physical barrier it creates across the street. In addition this option would be the most costly to implement and would cause significantly greater disruption to the town centre for a period that is likely to take a year to complete.

Option 1 to 3 would rely on more subtle interventions to control traffic. Proposals within these options would be more akin to a shared space solution than those within Option 4. There are examples of schemes that have been designed as shared space that have significantly reduced the number of collisions in an area. The difference is that streets normally under consideration have a vehicular dominance and a high collision rate whereas the streets under review in Bridgend currently operate under a vehicle prohibition and the collision base line is zero.

Controlled puffin crossings could be provided for all options. There is however no reliable way to justify their requirement without having the data to undertake an assessment under LTN1/95 the Assessment of Pedestrian Crossings. Should controlled crossing be provided, they offer safe crossing opportunities for all pedestrians and are likely to be favoured by the visually and mobility impaired.

There will be an increase in the maintenance requirement within the town centre no matter which option is selected e.g. increased frequency of collisions with street furniture; increased damage to kerbs and paving units etc.

The initial cost to convert the scheme varies significantly across the various solutions. Option 1 would have the lowest cost and would be least disruptive during construction. A ballpark estimate of £247k inclusive of design and construction costs has been calculated for Option 1 and a construction period of 3 months is considered to be appropriate. Option 4 would cause the greatest amount of disruption during construction and would be the most costly Option. An initial budget estimate of circa £855k inclusive of design and construction costs has been calculated for Option 4 and construction period of 1 year is considered to be a minimum requirement.

The decision to either allow vehicles to enter the town during all times of the day or to restrict the times to those outside of the peak shopping times could influence the number and / or type of collisions that occur. There have been no relevant collisions during the times at which the Pedestrian Zone has been operating over a 10 year period and this would suggest prohibiting vehicles during the peak pedestrian periods would reduce the risk of collisions. Conversely a part time prohibition will create uncertainty about the prohibition times which could increase the risk of “pedestrians stepping out” type collisions. Data which would normally influence such decisions is not available e.g. vehicle numbers, vehicle speed, pedestrian numbers and peak pedestrian times. It is therefore recommended that an experimental phase be considered to gather more information to inform decisions to make the right choices for the long term.

The existing loading bays within the streets could be shared enabling approximately 18 cars to park outside a designated loading period. A basic visual assessment has indicated there is potential to increase this by a maximum of 11 further spaces based on a 6m bay length required for cars. This would however be subject to several factors such as location of cellars, project funds and conflict with potential features such as the possible puffin crossing locations. The existing allocation of 18 spaces is low for the number of commercial premises they service, so increasing the parking would contribute to accessibility and footfall. Naturally however there will be a greater risk of collisions caused by parking vehicles and reduced visibility. Providing additional parking bays will be a costly operation and the initial decision will therefore be guided by budget. *Note – additional spaces are not included in the cost estimates.*

There is insufficient space to have separate loading and parking bays therefore it is recommended that bays are shared with signs indicating the times that loading and parking are permitted. This will require rigorous enforcement to ensure vehicles are parked correctly. On the assumption that loading provision is currently satisfied, any additional bays can be allocated to parking only. It is recommended that loading times of between 6pm and 10am remain unchanged to minimise the amount of large vehicles in the town centre during peak pedestrian periods and to maximise parking opportunities for visitors during the daytime. One of the main operational risk is that loading bays could become occupied by the general public because Civil Enforcement Officers would not be present throughout most of the 6pm to 10am loading period.

Regardless of the scheme to be provided, a speed limit of 20mph is advised to reinforce low speeds through the streets.

In summary, it is considered Option 3 would probably provide the most balanced scheme in terms of road safety, implementation cost, impact on existing infrastructure (subject to utilities liaison) and protecting footways from vehicular damage.

The basis of Option 2 using tactile paving demarcation could be considered as a supplementary measure for Option 3 to reinforce the edge of carriageway for the visually impaired. BCBC should note that the limited tactile paving width would be a departure from the DfT guidelines, however, the use in combination with the bollards would help support a variation.

9. Recommendations

These Recommendations should be read in conjunction with the Conclusions of this report.

From the perspective of road safety and future maintenance costs alone, it is a natural recommendation to maintain the current pedestrianised situation. However, it is BCBCs objective to improve access and footfall within the town centre by reintroducing vehicular access whilst maintaining a reasonable outcome of the consequential effects. BCBC acknowledge and accept that a rationalised approach has risks associated with road safety and future maintenance cost in delivering their objectives.

Option 3 using bollards and street furniture proposals appears to provide the most appropriate solution in terms of balancing pedestrian safety concerns and movement with cost benefits. It is however unlikely to be favoured by the visually impaired and therefore may benefit by including tactile paving as a supplementary measure to reinforce the edge of carriageway in some areas.

In addition to the principle of implementing the Option 3 scheme, the following additional measures are recommended:

- Engage disabled groups (at the earliest opportunity) for initial feedback on the proposals;
- Consider implementing an advanced experimental phase to assess traffic and pedestrian volumes, vehicle speeds, collisions and near-misses, and overall operational problems;
- Introduce a 20mph zone;
- Engage maintenance teams. Reducing the setback of bollards would be conducive to low speeds, would limit the risk of damage to kerbs / footways and would maximise the footway widths. The risk of them being struck by passing vehicles would however be increased;
- Reverse flows on Wyndham Street and Caroline Street to deter motorists from entering these pedestrians area from Queen Street and Dunraven Place. Further design will need to be undertaken to ensure that suitable access can be gained from Derwen Road;
- Assess loading needs for shops and provide time shared loading / parking bays. Initial consultation with Parking Enforcement Officers would benefit this process to ensure that measures are clear and enforceable;
- Undertake detailed design and accordingly revisit the cost estimate to improve certainty for funding control.
- Undertake a robust and sustained advertising campaign through local papers, radio stations and social media channels. This will help to prepare members of the public for the proposed changes and help to mitigate safety risks. Provide temporary signing throughout the town centre to further inform the general public of the changes.

10. References

- Guidance on the use of Tactile Paving Surfaces – Department for Transport;
- Interim Changes to the Guidance on the use of Tactile Paving Surfaces – Department for Transport.
- Effective Kerb Heights for Blind and Partially Sighted People - Accessibility Research Group Civil, Environmental, and Geomatic Engineering, University College London.
- DfT Local Transport Note 1/11 Shared Space.
- Manual for Streets.

Appendix A

Collision Data

Table Key

Collisions on route pre-pedestrianisation (January 2000 – November 2003)
Collisions on route post-pedestrianisation (Nov 2004 – December 2014)
Collisions on Adjacent Streets (January 2010 – December 2014)

Summary Table

Location	Number of collisions	Pedestrian Casualties	Severity
Collisions on route pre-pedestrianisation	13	8	Slight
Collisions on route post-pedestrianisation	3	3	Slight
Collisions Nolton Street	1	0	Slight



Collisions on Route Pre-pedestrianisation (Jan 2000 – Nov 2003)

Reference	1	2	3	4	5
Collision no	0013894	0021558	0033567	0027019	0038026
Year	2000	2000	2000	2000	2001
Month	April	September	October	December	April
Date	15	07	12	12	29
Day	Saturday	Thursday	Thursday	Tuesday	Sunday
Time	23:15	11:05	12:00	11:00	00:50
Severity	Slight	Slight	Slight	Slight	Slight
Dark / Light	Daylight	Daylight	Daylight	Daylight	Daylight
Weather	Fine	Fine	Fine	Fine	Fine
Road Surface	Dry	Dry	Dry	Wet	Dry
No of Vehicles	1	1	2	1	1
Vehicle 1	Car	Car	Van	Car	Car
Vehicle 2			Car		
No of Casualties	1	1	1	2	1
Casualties	Pedestrian Male 39	Pedestrian Female 69	Driver or Rider Male 30	Pedestrian Female 34 Pedestrian Female 36	Pedestrian Male 41
Causation	Crossing the Road he was struck by vehicle	Pedestrian stepped out into road and Veh1 reversed into pedestrian	Veh1 Collided with Veh2 injuring car occupant	Walking between parked taxi's when vehicle reversed in pedestrians	Pedestrian walked out between stationary vehicles and into the path of Veh1
Manoeuvre		Reversing vehicle		Reversing vehicle	
Location	Queen Street J/W the Rhiw	Queen Street J/W Caroline Street	Dunraven Place Bridgend	Outside Hyper Value on Market Street	Market Street

Collisions on Route Pre-pedestrianisation (Jan 2000 – Nov 2003)

Reference	6	7	8	9	10
Collision no	0038041	0069845	0019955	0030297	0050874
Year	2001	2002	2000	2001	2001
Month	May	September	August	January	November
Date	12	15	6	26	16
Day	Saturday	Sunday	Sunday	Friday	Friday
Time	03:00	23:09	15:43	09:45	14:18
Severity	Slight	Slight	Slight	Slight	Slight
Dark / Light	Daylight	Daylight	Daylight	Daylight	Daylight
Weather	Fine	Fine	Fine	Fine	Fine
Road Surface	Dry	Dry	Dry	Wet	Dry
No of Vehicles	1	1	2	2	2
Vehicle 1	Car	Car	M/Cycle 125 – 500 cc	Car	Car
Vehicle 2			Car	Bus or Coach	Car
No of Casualties	1	1	1	1	1
Casualties	Pedestrian Male 28	Driver or rider male 17	Driver or Rider Male 22	Driver or Rider Male 25	Passenger Female 36
Causation	Veh1 reversed onto pavement collided with pedestrian	Veh1 collided with kerb toppling over and colliding with property	Veh 1 was Trav the Wrong Way Along a One Way Street. Veh 2 Pulled out of Junction to Turn right into Derwen Road the Correct Way but Collided with Veh 1	Veh1 Had Insufficient View of the Road and Pulled out into Path of Veh 2	V1 Collided with Rear of V2
Manoeuvre	Reversing vehicle				
Location	Market Street, 100 Yards East of Dunraven Place	Queen Street Outside Three Horseshoes	Derwen Road J/W Market Street, Bridgend	Derwen Road J/W Market Street, Bridgend	Market Street, Bridgend 100 Yds South of Jct with Derwen Road

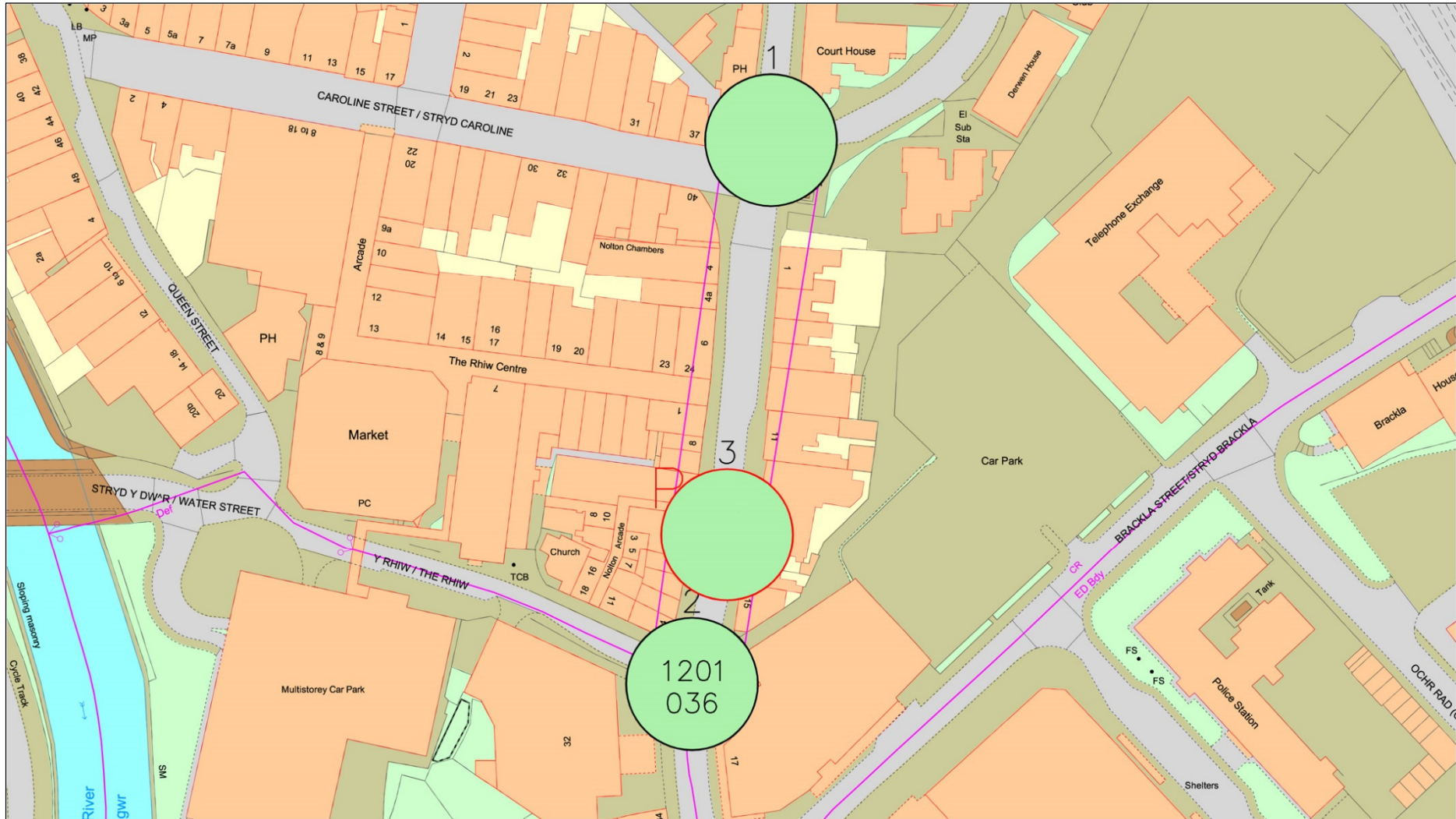
Collisions on Route Pre-pedestrianisation (Jan 2000 – Nov 2003)

Reference	11	12	13
Collision no	0063047	0069925	0092810
Year	2002	2002	2003
Month	June	October	September
Date	21	1	21
Day	Friday	Tuesday	Sunday
Time	20:30	16:30	01:05
Severity	Slight	Slight	Slight
Dark / Light	Daylight	Daylight	Daylight
Weather	Fine	Rain	Fine
Road Surface	Dry	Wet	Dry
No of Vehicles	1	2	1
Vehicle 1	Unknown	Car	Car
Vehicle 2		Pedal Cycle	
No of Casualties	1	1	1
Casualties	Pedestrian Male 19	Driver or Rider Male 13	Pedestrian Male 50
Causation	I.P. Crossing Rd and Veh 1 Unknown Veh Struck I.P	Veh 1 Turned left. into Derwen Rd and Child Cycled off Pavement from N/S into Side of Veh 1 . Child Stated That the Brakes on his Bike Didn't Work when he Applied then Because They Were Wet	V1 Driving Along Market Street when a Male Person Fell in Front of V1 Causing the Vehicle to Drive over the Males Foot
Manoeuvre			
Location	Market Street, Bridgend Between Monroes and the Hyper Night	Derwen Road 20 Yards North J/W Market Street, Bridgend	on U/C Road Opposite the Impact Shop on Market Street Bridgend

Collisions on Route Post-pedestrianisation (Nov 2004 – Dec 2014)

Reference	14	15	16
Collision no	0131352	0190757	1301699
Year	2005	2009	2013
Month	May	June	September
Date	10	8	22
Day	Tuesday	Monday	Sunday
Time	09:15	9:15	01:25
Severity	Slight	Slight	Slight
Dark / Light	Daylight	Daylight	Dark/ Lights Lit
Weather	Fine	Unknown	Rain
Road Surface	Dry	Dry	Wet
No of Vehicles	1	2	1
Vehicle 1	Van	Goods >7.5	Taxi
Vehicle 2			
No of Casualties	1	1	1
Casualties	Pedestrian Male 48	Pedestrian Female 52	Pedestrian Male 25
Causation	Veh1 reversed into pedestrian	V1 Has Collided with Pedestrian Who was Getting Bags out of the Rear of Vehicle 2	C1 Has Stepped onto Road into Path of V1
Manoeuvre			
Location	Dunraven Place	Caroline Street Junction with Queen Street Bridgend	Derwen Road Junction with Market Street, Bridgend

Norton Street Between Court Road to Brackla Street Junctions (January 2010 to December 2014)



Nolton Street Between Court Road and Brackla Street Junctions (January 2000 – December 2014)

Reference	17
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Collision no	1201036
Year	2012
Month	October
Date	2
Day	Tuesday
Time	15:40
Severity	Slight
Dark / Light	Daylight
Weather	Rain
Road Surface	Wet
No of Vehicles	2
Vehicle 1	Car
Vehicle 2	Car
No of Casualties	2
Casualties	Driver or Rider Male 44 Driver or Rider Female 36
Causation	Vehicle Two Proceeded to Drive Through Set of Green Lights at Location and Collided with Vehicle One Who Had Just Manovered Through the Junction as the Lights Turned Green for Vehicle Two. Vehicle One was Initially Stationary in a Safe Location and Had Passed Set of Traffic Lights Controlling his Lane. the Driver of Vehicle One Drove Through the Junction into the Path of Vehicle One Causing the Collision
Manoeuvre	
Location	Nolton Street, Bridgend

Appendix B

Risk Assessments

Risk Assessments

Option 1 Signing and Lining Residual Risks

Significant Hazard	People at risk and what is the risk	Risk rating				Comments
		Likelihood	Severity	Multiply (L) x (S) to produce Risk Rating (RR)		
		L	S	RR	L/M/H	
Moving Vehicles	The general public being struck by moving vehicle	3	1	3	L	Pedestrians are familiar with a traffic free environment and initially there will be a risk of them stepping into the carriageway without looking for traffic. In time it is expected that members of the general public would gain increased awareness of the vehicular traffic within the town and act more accordingly. It is not possible to predict how long the risk will remain, however, on general road schemes guidance within TSRGD recommends that temporary signing of changed road conditions is erected for 3 months.
Moving Vehicles	The vulnerable being struck by moving vehicle	3	2	6	H	Allowing traffic into of the town would affect vulnerable users, including the visually impaired, as they may step into road without realising traffic has been re-introduced. This option does not provide them with a clear demarcation between footway and carriageway. Vulnerable road users such as visually impaired, mobility impaired, elderly and children for example would be at increased risk.
Vehicles mounting Footways	All pedestrians at risk of being struck by vehicles mounting footways	3	1	3	M	Kerb upstands will remain low, vehicles would be able to gain easy access to footways. Motorists may drive onto the footway whereas a traditional kerb would deter this behaviour. Feedback from Blaenau Gwent and Pontypridd Councils has indicated that footway parking in flush areas (or areas where access is easily gained) is widespread and may require heightened levels of enforcement or management measures

Vehicles speeds	Pedestrians at risk of being hit by vehicles moving at speed	1	2	2	L	There is a risk that as motorists get used to travelling through the town their speeds will increase. The overall risk rating is low however based on evidence that speed does not appear to have been a factor on the collisions reviewed. There are limited ways to physically enforce speeds limits given the low kerb upstands, however, opportunity may be provided through the use of controlled crossing points.
Narrowing footways	All pedestrians at risk of being forced to walk on the carriageway	2	1	2	L	Pedestrian movements will be restricted to the footways (some of which are narrow). During periods of high pedestrian volumes they may be forced into the carriageway, increasing the risk of conflict with vehicles.
Reduced Visibility	Pedestrians crossing between parked vehicles where intervisibility is reduced creating a risk of conflict	3	1	3	M	This type of crossing behaviour contributed to several casualties pre-pedestrianisation. The more parking provision that is provided the greater the risk will become and consideration would be needed to balance the need of the pedestrians and on-street parking provision.
Inconsiderate Parking	Parked vehicles could obstruct footways forcing pedestrians into the carriageway at risk of conflict with vehicles	3	1	3	M	Footway parking is highly likely to occur with this option. Feedback from Blaenau Gwent and Pontypridd Councils has indicated that footway parking in flush areas (or areas where access is easily gained) is widespread.

Option 2: Provision of Tactile Paving to Demarcate Carriageway - Residual Risks

Significant Hazard	People at risk and what is the risk	Risk rating				Comments
		Likelihood	Severity	Multiply (L) x (S) to produce Risk Rating (RR)		
		L	S	RR	L/M/H	
Moving Vehicles	The general public being struck by moving vehicle	3/2	1	3/2	L/M	Pedestrians are familiar with a traffic free environment and initially there will be a risk of them stepping into the carriageway without looking for traffic. Hazard paving would help to demarcate the carriageway and footway for the general public. This will improve both driver and pedestrian awareness of the limits of the footways and carriageway. This along with the signing and lining with reduce the likelihood of an accident occurring. It is not possible to predict how long the risk will remain, however, on general road schemes guidance within TSRGD recommends that temporary signing of changed road conditions is erected for 3 months.
Moving Vehicles	The vulnerable user groups being struck by moving vehicle	3/2	2	6/4	M/H	The addition of hazard paving at the kerb edge would help to demarcate the interface between footway and carriageway for vulnerable user groups (including visually impaired). The use of tactile paving would need consideration as to its type and size to maximise its benefits within the restricted town centre footway widths.
Vehicles mounting footways	All pedestrians at risk of being struck by vehicles mounting footways	3	1	3	M	Kerb upstands will remain low, vehicles would be able to gain easy access to footways. Motorists may drive onto the footway whereas a traditional kerb would deter this behaviour. Feedback from Blaenau Gwent and Pontypridd Councils has indicated that footway parking in flush areas (or areas where access is easily gained) is widespread and may require heightened levels of enforcement or management measures
Vehicles speeds	Pedestrians at risk of being hit by vehicles moving at speed	1	2	2	L	There is a risk that as motorists get used to travelling through the town their speeds will increase. The overall risk rating is low however based on evidence that speed does not appear to have been a factor on the collisions reviewed. There are limited ways to physically enforce speeds limits given the low kerb upstands, however, opportunity may be provided through the use of controlled crossing points.

Narrowing footways	All pedestrians at risk of being forced to walk on the carriageway	3	1	3	M	Effective footway widths will be reduced by the tactile surface. Some pedestrian groups will avoid walking on the surface because they find it difficult / uncomfortable. During peak periods pedestrian may be forced into the carriageway to pass one another, increasing the risk of conflict with a vehicles.
Reduced Visibility	Pedestrians crossing between parked vehicles where intervisibility is reduced	3	1	3	M	This type of crossing behaviour contributed to several casualties pre-pedestrianisation. The more parking provision that is provided the greater the risk will become and consideration would be needed to balance the need of the pedestrians and on-street parking provision.
Inconsiderate Parking	Parked vehicles could obstruct footways forcing pedestrians into the carriageway	3	1	3	M	Footway parking is highly likely to occur with this option. Feedback from Blaenau Gwent and Pontypridd Councils has indicated that footway parking in flush areas (or areas where access is easily gained) is widespread.

Option 3: Provision of Bollards to Demarcate the Carriageway - Residual Risks

Significant Hazard	People at risk and what is the risk	Risk rating				Comments
		Likelihood	Severity	Multiply (L) x (S) to produce Risk Rating (RR)		
		L	S	RR	L/M/H	
Moving Vehicles	The general public being struck by a moving vehicle	3/2	1	3/2	L/M	Pedestrians are familiar with a traffic free environment and initially there will be a risk of them stepping into the carriageway without looking for traffic. The bollards will provide additional demarcation between footway and carriageways. However the initial risk would remain. In time it is expected that members of the general public would gain increased awareness of the vehicular traffic within the town and act more accordingly. It is not possible to predict how long the risk will remain, however, on general road schemes guidance within TSRGD recommends that temporary signing of changed road conditions is erected for 3 months.
Moving Vehicles	The vulnerable being struck by moving vehicle	3/2	2	4/6	M/H	Bollards would assist to demarcate where the footway as visually impaired pedestrians travel along it parallel to the carriageway. If walking perpendicular to the kerbs it would however be possible for visually impaired to walk between bollards without them being detected.
Walking into street furniture (bollards)	Visually impaired walking into bollards	3	1	3	M	Street furniture such as bollards creates an obstruction in the footway and there would be a risk of pedestrians walking into them. The visually impaired would be most at risk. By introducing bollards into the town there is an increased likelihood that accidents of this nature will occur.
Vehicles speeds	Pedestrians at risk of being hit by vehicles moving at speed	1	2	2	L	There is a risk that as motorists get used to travelling through the town their speeds will increase. The overall risk rating is low however based on evidence that speed does not appear to have been a factor on the collisions reviewed. There are limited ways to physically enforce speeds limits given the low kerb upstands, however, opportunity may be provided through the use of controlled crossing points.
Reduced footway Width	All pedestrians at risk of being forced into the carriageway	3	1	3	M	Bollards will reduce the effective footway width by circa 500mm. During peak periods pedestrian may be forced into the carriageway to pass one another, increasing the risk of a conflict with vehicles.

Reduced Visibility	Pedestrians crossing between parked vehicles where intervisibility is reduced	3	1	3	M	This type of crossing behaviour contributed to several casualties pre-pedestrianisation. The more parking provision that is provided the greater the risk will become and consideration would be needed to balance the need of the pedestrians and on-street parking provision.
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Option 4: Increasing Kerb Up-stand to at Least 60mm - Residual Risks

Significant Hazard	People at risk and what is the risk	Risk rating				Comments
		Likelihood	Severity	Multiply (L) x (S) to produce Risk Rating (RR)		
		L	S	RR	L/M/H	
Moving Vehicles	The general public being struck by moving vehicle	2	1	2	L	Pedestrians are familiar with a traffic free environment and initially there will be a risk of them stepping into the carriageway without looking for traffic. Increasing the kerb up-stand to at least 60mm will provide demarcation between footway and carriageways. However the initial risk would remain. In time it is expected that members of the general public would gain increased awareness of the vehicular traffic within the town and act more accordingly. It is not possible to predict how long the risk will remain, however, on general road schemes guidance within TSRGD recommends that temporary signing of changed road conditions is erected for 3 months.
Moving Vehicles	The vulnerable being struck by moving vehicle	3/2	3/2	6/4	M/H	A kerb with an up-stand of at least 60mm will enable the visually impaired to identify the change in level between footway and carriageway. This would provide a means to identify the edge of carriageway that is common in a traditional street arrangement. Because pedestrians are familiar with the existing arrangement there would still be an initial risk of them stepping into the carriageway in conflict with vehicles.
Slips and Trips	All pedestrians in particular the vulnerable slipping off or tripping over the kerb	2	2	4	M	Pedestrians are familiar with a street with very few physical barriers. A kerb with an upstand of at least 60mm will create a new barrier between carriageway and footway and there will be an initial risk of pedestrians tripping over it. The visually impaired will be most at risk. In time pedestrians will become accustomed to the changes and the risk should reduce to the same level as any other street with kerb segregation.
Vehicles mounting kerbs	All pedestrians at risk of being struck by vehicles mounting kerbs	1	1	1	L	There will be a low risk of vehicles mounting footways if a kerb is reintroduced. It is noted that two of the pre-pedestrianisation schemes involved vehicles that mounted footways.

Narrowing footways	All pedestrians at risk of being forced to walk on the carriageway	2	1	2	L	As pedestrian movements will be restricted to the footways (some of which fall below the required standard minimum widths). During peak periods pedestrian may be forced into the carriageway to pass one another increasing the risk of a conflict with vehicles.
Reduced Visibility	Pedestrians crossing between parked vehicles where intervisibility is reduced	3	1	3	M	This type of crossing behaviour contributed to several casualties pre-pedestrianisation. The more parking provision that is provided the greater the risk will become and consideration would be needed to balance the need of the pedestrians and on-street parking provision.

Likelihood	Severity	Risk Level
Unlikely = 1	Slight = 1	1-2 = Low
Likely = 2	Serious = 2	3-4=Medium
Very Likely = 3	Fatality = 3	6-9 = High