Bondgate Tower, Alnwick

Traffic Management Study

Northumberland County Council

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Quality information

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1. Project Overview

1.1 Bondgate Tower (also known as Hotspur Tower) is a 15th Century stone gatehouse, founded by the Earl of Northumberland, and now privately owned by the Northumberland Estates, which spans the public highway in Alnwick. This tower is of significant historical interest and is a nationally important heritage asset but is now listed on Historic England's 'Heritage at Risk Register', as a result of being classified as being in "very bad condition". The main cause of this condition is damage to the archway of the tower from being struck by large/high vehicles attempting to pass through the tower and striking the stonework in the process. Further impacts from vehicles on the tower could cause a serious collapse to occur, which would threaten the future of the structure. They could also result in serious injury and/or death, as well as significant disruption to the highway network, and therefore economy, of Alnwick. Bondgate Tower is shown below in **Figure 1**.

Figure 1 – Bondgate Tower

1.2 The tower is located on Bondgate (forming the boundary between Bondgate Within and Bondgate Without), which is a busy shopping street in the heart of Alnwick. It also forms part of the B6346, which is one of the main roads through Alnwick, and provides a key link as part of the wider road network, leading to the A697 at Wooperton, to the north-west of the town. The B6346 also takes traffic from other main roads including the A1, A1068, B1340 and B6341, and overall forms a critical part of the road network in the town. The tower has a 9'3" height restriction, with diversion routes in force for taller vehicles, via Hotspur Street / Green Batt / Tower Lane or Prudhoe Street / Lisburn Terrace. These diversion routes are narrow and residential in places, with a large amount of on-street parking, and are generally considered unsuitable for large volumes of through traffic, though Green Batt does carry buses on various routes.

1.3 The height limit for the highway through the tower is signed at the point of restriction in each direction and there is some limited advance signage, though some of this is non-specific (e.g. "avoiding low arch" rather than stating the actual height limit). Some longer distance routes e.g. to Rothbury via the B6341 from the south are signed via the diversion routes, but the route via Bondgate forms the most obvious and direct route through the town centre. Traffic passing through the tower is obliged to do so in single file, with a signed shuttle arrangement, with priority for vehicles travelling southeast, away from the town centre.

1.4 Information provided by Northumberland Estates suggests that the tower has been struck by vehicles at least seven times between 2003 and 2021, suffering damage during six of these incidents. It is however stated to be extremely likely that a significant number of further, more minor, impacts occur on a frequent basis, as evidenced by scoring, spalling and other minor damage to the stonework of the arches.

1.5 As a result of the above damage, the tower has been closed at various points, and for differing periods, while repairs have been undertaken. These closures cause significant disruption to the road network through the town, as all traffic is forced to use the diversion routes.

1.6 This study focuses on first establishing a baseline of the existing situation in terms of the safety, traffic flow patterns, and information provision. The study will then leverage this into an informed consideration of potential improvement options to remedy the issues described above.

1.7 In order to achieve this several steps were taken to help inform proper analysis of the various aspects of the study. These include site visits, a cataloguing and assessment of the existing signage provision, a traffic flow survey taken at relevant points of the network, collation and analysis of available collision data, workshopped consideration of a wide variety of potential options for improvement, option sifting and development, and appraisals.

1.8 This report sets out the various stages of work undertaken, provides a considered appraisal of the options that have been developed, and sets out conclusions and recommendations for further work to protect the tower from vehicle strikes.

2. Site Visit

2.1 A site visit was undertaken by members of the AECOM project team specialising in Traffic Engineering and Heritage on 2nd November 2021 in order to obtain on the ground insights and determine elements such as signage provision and how the immediate and wider areas operate.

2.2 The conditions on the day of the site visit were good with sunny weather and clear visibility. Christmas lighting and decorations had recently been installed in preparation for the seasonal period, including fixtures on the Tower itself. Routes throughout were well-trafficked and on the date of the site visit no specific COVID related restrictions on travel or otherwise were in place.

2.3 The Tower area was first and foremostly observed to gain an appreciation of the operation of the junction in this area. It was noted that though the southbound traffic through the Tower was indicated as having priority, in practice the junction behaved with the southbound only infrequently acting upon this. Often, the northbound traffic flowed through in such a way as to force the southbound traffic to acquiesce priority. This behaviour is shown below in **Figure 2**.Though this did not appear to cause any safety issues, it was clear that it contributed to some degree of uncertainty and cognitive load for drivers at the junction.

Figure 2 – NB Vehicles Pressuring SB out of Right of Way

2.4 The road markings for northbound traffic led to a high degree of variance in the point at which vehicles stopped. This caused some minor issues for the swept path of large vehicles exiting Hotspur Street to the B6346. **Figure 3** below shows the road markings at this point.

Figure 3 – NB Road Markings at Bondgate Tower

2.5 No issues involving large vehicles passing through the Tower were observed during the site visit, though damage from previous strikes was visible. A northbound HGV was, however, observed diverting right at the junction with Hotspur Street.

2.6 A walk-through of routes around the study area, including those potentially being considered for diversion options, was undertaken.

2.7 Generally the two routes of interest in terms of potential for diversion were Prudhoe Street / Lisburn Street / Lisburn Terrace, and Hotspur Street / Green Batt.

2.8 Both of these routes are primarily residential in nature, with relatively narrow streets and heritage architecture. The Hotspur Street / Green Batt route was narrow in places, albeit other parts were straighter and wider, with limited on-street parking. This route is currently trafficked by buses. Some notable pinch points in street width, specifically at the junctions with Hotspur Place and Howick Street, were observed, as shown in **Figure 4** below.

Figure 4 – Green Batt Pinch Point

2.9 The Prudhoe Street / Lisburn Street / Lisburn Terrace route was generally straighter, though featured dense on-street parking in places, such as the arrangement shown in **Figure 5**. No bus routes appeared to traverse this part of the network.

Figure 5 – Prudhoe Street On-Street Parking

2.10 A drive-through was completed for each of the approaches to the Town Centre to observe conditions and level of information provision for each approach. This included:

- B6341 southbound approach crossing the bridge over the River Aln;
- B6346 Cannongate southbound similarly crossing over the River Aln;
- B6341 eastbound approach to the Town over Alnwick Moor;
- B1340 south westbound from the A1 passing by Alnwick Gardens and the primary signed exit for Alnwick from the A1 southbound
- A1068 northbound passing by Willowburn Industrial Estate and the primary signed exit for Alnwick from the A1 northbound;
- A1068 Alnmouth Road northbound from the A1068 south of the A1; and
- Willowburn Avenue, St James Estate & Wagon Way Road northbound from the A1.

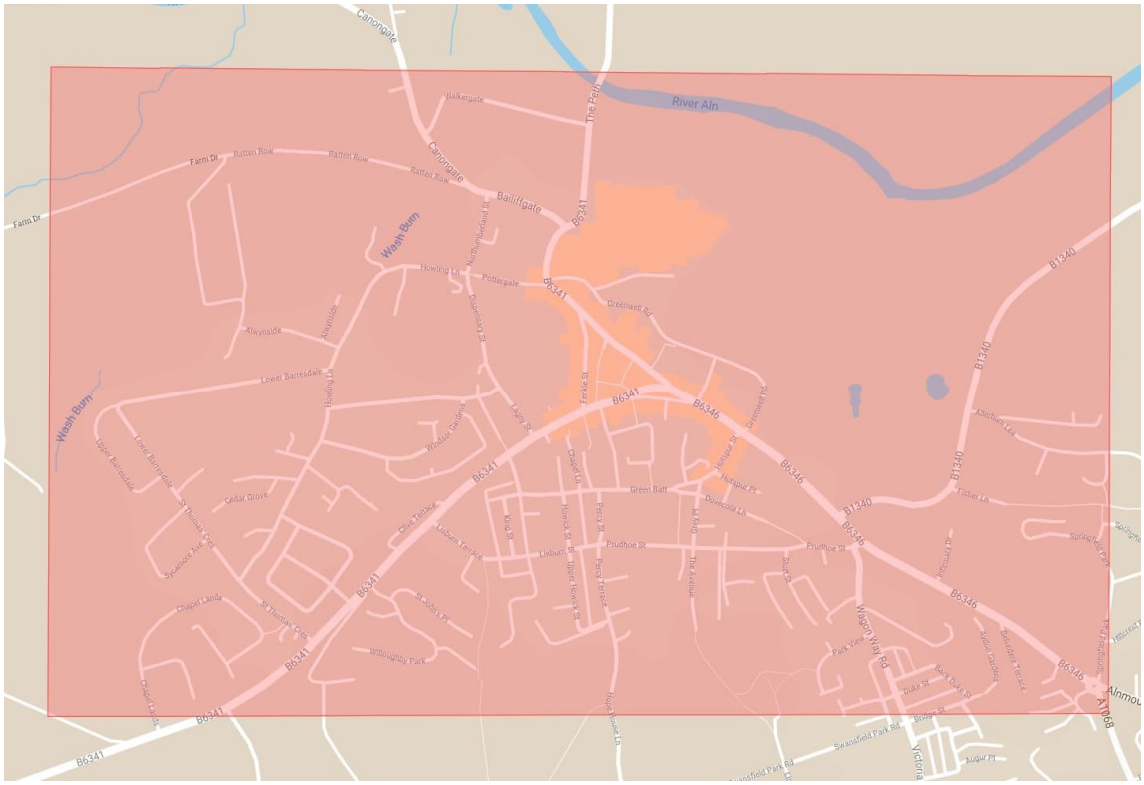
2.11 Throughout the site visit, existing signage provision was noted for further analysis, and is described in more detail in Section 5 of this report.

3. Collision Analysis

3.1 Collision analysis was undertaken for the period beginning June 2016 to November 2021, giving a 5-year collision dataset. This section will summarise key findings of this analysis.

3.2 The 5-year dataset covered the extents of Alnwick town centre. The extent of the coverage is shown in red below in **Figure 6**.

Figure 6 – Collision Data Coverage Extents



3.3 During the entire period 28 collisions were recorded by police as personal injury collisions. This consisted of 0 fatal collisions, 4 serious collisions and 24 slight collisions.

3.4 The vast majority of the coverage area, and the vast majority of collision locations, can be described as roads in a built-up area. Comparing collision severity of the recorded data to average severity of collisions occurring in built-up areas (taken from Reported Road Casualties GB (RRCGB) RAS10001 2020) shows that average severity of a collision within the study area is significantly lower than the national average. This is detailed below in **Table 1**.

Table 1 – Study Area Collision Severity Vs National Average

	Study Area	National Average
Fatal	0.00%	0.92%
Serious	14.29%	20.46%
Slight	85.71%	78.62%

3.5 4 of these collisions took place during the hours of darkness, with the remaining 24 during daylight hours. This puts the % of collisions occurring during the hours of darkness at 14.29%, lower than the national average for built up roads of 27.11% (based on an average taken from the RRCGB national dataset of the same time period). This suggests that the existing lighting provision does not present as an issue in the collision dataset.

3.6 When examining the figures for vulnerable road users, it is observed that vulnerable road users are overrepresented in the dataset, with pedestrians making up 32% of casualties, while the average is closer

to 20% for urban roads nationwide. Pedal cyclists appear slightly overrepresented also, involved in 21% of collisions in urban roads nationwide but featuring in 28% of collisions in the dataset. Scheme proposals impacting pedestrian and vulnerable road user safety will therefore need to consider this during design and optioneering.

3.7 Collision frequency is a more complex figure to analyse and would require a more exhaustive dataset than is available. We can, however, undertake analysis to identify any specific hotspots within the dataset.

3.8 There were very few areas that could constitute a strong cluster of collisions within the dataset, with the majority appearing as isolated incidents. The junction with B6346 / Prudhoe St / Wagon Way Rd (Barter Books' pedestrian access junction) presented the strongest case with 4 slight collisions, however upon analysis there does not appear to be a commonality between the causes of these collisions. The high volume of traffic this junction receives, especially from tourism traffic unfamiliar with the roads, and the layout with 2 give ways in close proximity, could potentially explain the slightly higher showing of collisions here.

3.9 The junction of specific interest to this study, at the Tower itself between Hotspur St / B6346 Bondgate Without, did not present as a significant contributor to collisions. One slight collision was recorded here, involving a vehicle failing to give way out of Hotspur Street. Though the dataset indicates no significant collision issue here, it must of course be noted that collisions involving the low arch occur with high frequency, though are not reflected in the dataset analysed in this section due to them being damage-only collisions, and there being no associated personal injuries.

3.10 Of the 4 serious collisions that occurred, none took place at a junction, and all were at separate locations. Each of these will be considered separately.

3.11 The first was located on Prudhoe Street, and involved a pedestrian stepping out from between parked cars in this area. Prudhoe Street notably has a strong presence of on-street parking, making the road relatively narrow at some points with reduced visibility. This street is one of the potential diversion routes when considering diversion as an option in this study, and as such this collision should be of some consideration. No other collisions appear to have taken place on the diversion route along Prudhoe Street/Lisburn Street/Lisburn Terrace, however.

3.12 Another serious collision took place on the bridge to the north of Alnwick, over the River Aln. This is noted as being caused by driver error due to inexperience.

3.13 The next serious collision took place on the B6346 outside the Infirmary at a set of pedestrian signals. The collision is noted to have been precipitated by a pedestrian error as they began to cross during the beginning of the traffic phase of the crossing's operation.

3.14 The final serious collision within the dataset is located along the slightly more rural Denwick Lane during the early hours of the morning. The collision record notes that a pedestrian was reported to have been lying in the carriageway unconscious for unknown reasons, which caused the vehicle to strike them.

3.15 No consistent theme was identified in analysis of the above serious collisions on record.

3.16 From the above data, it does not appear that Alnwick town centre suffers from a poor collision history at the present time. The proportion of collisions involving vulnerable road users, the collision history at the B6346/Prudhoe St/Wagon Way Road junction, and the serious collision which occurred on Prudhoe Street are worthy of further consideration however when developing and analysing improvement options.

4. Traffic Flow Analysis

4.1 Manual classified turning counts for eight junctions around the study area were commissioned by AECOM in order to capture a complete picture of the level of traffic moving through Alnwick.

4.2 Junctions were selected based on several criteria, including counts at the junction with the tower itself, all approaches to the tower and specifically any which may function as existing diversion routes for vehicles affected by the height restriction, as well as junctions which may form potential options for diversion as part of any proposed remediation.

4.3 These junctions are as follows:

1. B6346 Bondgate Without / Prudhoe Street / Wagon Way Road;
2. B6346 Bondgate Without / B1340 Denwick Lane;
3. Prudhoe Street / Lisburn Street / Percy Terrace;
4. B6341 Clayport Bank / Lisburn Terrace;
5. B6341 Clayport Street / Tower Lane;
6. B6341 Clayport Street / B6341 Lagny Street;
7. B6346 Narrowgate / Bondgate Within / Fenkle Street; and,
8. B6346 Bondgate Within / Hotspur Street / Greenwell Road.

4.4 Counts were specified to be undertaken for 12 hours a day between the hours of 7am and 7pm on Wednesday 03/11/2021, Thursday 04/11/2021, and Saturday 06/11/2021. This enabled capture of a neutral weekday in the Wednesday, as well as the two market days that take place on a Thursday and a Saturday.

4.5 During the setup of equipment for the survey, it was found that due to the layout of signage at Site 7 engineers had been unable to place equipment at ideal locations during site set up, and subsequently experienced problems with the mounting of the camera. Because of this, Site 7's surveys were undertaken as usual on Saturday 06/11/2021, but for the remaining two surveys the site was filmed from an adjacent site (at the junction of Fenkle Street and Market Street) on Wednesday 10/11/2021, and Thursday 11/11/2021.

4.6 Upon recovery of the equipment post-survey, it was discovered that equipment at Site 8 had become dislodged in such a way that data for the Thursday 04/11/2021 period and Saturday 06/11/2021 period was deemed unreliable. The equipment had remained firmly in place during the Wednesday 03/11/2021 period, and as such it was decided that only the Thursday and Saturday counts were required to be re-surveyed. This site was therefore surveyed again during Thursday 11/11/2021, and Saturday 13/11/2021.

4.7 The traffic survey data has been analysed by AECOM, and diagrams created to show the traffic flows at each junction for each peak period (Wednesday and Thursday AM and PM Peaks and Saturday Interpeak (Lunchtime)). Interpretation of the traffic flows has then taken place, and a summary of the general distribution of traffic during each peak, and any noteworthy patterns, is set out below.

4.7.1 **Wednesday AM Peak (08:15-09:15).** On approach to Bondgate Tower from the south, a total of 282 PCUs were counted travelling northbound through the tower in the Wednesday AM peak hour. In addition, the majority of these traffic flows continued to travel along the B6346 Bondgate Within to Clayport St (206 PCUs), with 42.5 PCUs turning right onto Fenkle St. Furthermore, at Junction 6 roughly 60% of the westbound traffic, travelling along Clayport St, turns right onto Lagny St (119 PCUs), continuing to travel northbound. It is assumed that the lost PCUs northbound between Junctions 8 and 7 were as a result of parking within the town centre. A total of 420 PCUs were observed travelling southbound through the tower, with 90% (383 PCUs) continuing to travel southbound along B6346 Bondgate Without.

Regarding the potential diversion routes along Lisburn Terrace (between Junctions 1 to 3), and Hotspur St (between Junctions 5 and 8), traffic flows varied over different parts of the routes. The

diversion route from Junction 1 to 3, westbound along Prudhoe St, had 185 PCUs travelling along it, however only 109 PCUs continued to travel along to Lisburn Terrace at Junction 3. It could be assumed that traffic reduces between the two Junctions as road users turn off into residential areas and to Swansfield school to the south. Likewise, between Junctions 8 and 5 a large change in traffic flows was observed. At Junction 8, 81 PCUs turned to travel westbound along Hotspur St, however at Junction 5 126 PCUs were calculated on the westbound approach. These additional PCUs are assumed to come from residential areas to the north/south of Green Batt. Both diversion routes are quieter travelling eastbound, with a maximum of 90 PCUs on the route via Hotspur St, and 126 eastbound on the route via Prudhoe St. Far fewer vehicles are using the diversion routes compared to travelling through the tower at present in the AM peak hour. These numbers again vary across the route.

In regard to HGVs and buses/coaches travelling through the tower, 2 vehicles were observed for both vehicle classes travelling northbound. However, 9 HGVs were then observed on the westbound approach to Junction 7, with the increase assumed to come from within the town centre itself. On the other hand, on the westbound approach to Junction 7, no buses/coaches were observed and therefore it could be said buses/coaches stop in the town along Bondgate Within or in the Market Place. Southbound, 4 HGVs and 4 buses/coaches travelled through the tower, continuing to travel southbound along B6346 Bondgate Within. Concerning the potential diversion routes, HGVs were observed using both Prudhoe St (4 eastbound and 8 westbound) and Hotspur St (8 eastbound / 5 westbound), whereas buses/coaches tended to use the Green Batt diversion route (9 eastbound & 7 westbound), in line with the bus routes. 2 buses/coaches travelled eastbound on the Prudhoe St route, with one travelling westbound. It must be noted that the data collected for buses / coaches will include both public and private vehicles.

4.7.2 **Wednesday PM Peak (14:45-15:45).** In the Wednesday PM peak similar traffic movements were observed through and around Bondgate Tower. 345 PCUs travelled north through the tower, of which 296 PCUs proceeded to Junction 7 along B6346 Bondgate Within. Again, it could be assumed traffic is lost to parking within the town centre. Of the 296 PCUs that arrive at Junction 7, much of this traffic continues westbound along Clayport St to Junction 6 where there was roughly a 50:50 split of traffic turning right onto Lagny St and continuing along the B6341. All vehicles travelling southbound through the tower accumulated to 462 PCUs, with 97% of the traffic continuing to travel southbound along B6346 Bondgate Without.

Of the traffic using the potential diversion routes, at Junction 8, 357 PCUs turn onto Hotspur St. However, at the westbound approach at Junction 5 there was nearly a 70% reduction in traffic flows and only 108 PCUs arrive westbound. Again, like the AM peak the differences in traffic flows are assumed to arise due to residential areas to the north/south of Green Batt. Regarding the second diversion route along Prudhoe St and Lisburn Terrace, reductions in traffic flows were observed towards the west end of the route. Westbound, 213 PCUs left Junction 1 along Prudhoe St. of which 201 reached Junction 3. From Junction 3 to 4 there was a further reduction to 168 PCUs. Again, it can be assumed that traffic flows are lost to residential areas and parking to the south of the town centre. A maximum of 71 PCUs use the eastbound diversion via Green Batt, while 137 PCUs use Prudhoe St in that direction.

Regarding HGVs and buses/coaches, there is a reduction in vehicle counts travelling through Bondgate Tower and on the approach to the tower in the PM peak. Regarding HGVs alone, only one HGV was observed northbound and southbound through the tower, and no buses/coaches were observed travelling through the tower in either direction. Like the AM peak an increase in vehicle counts was observed at the westbound approach at Junction 7, again it can be assumed the traffic comes from within/north of the town centre itself. At Junction 8, travelling northbound towards the tower it was observed both HGVs (4) and buses/coaches (3) turned left onto Hotspur St towards Junction 5, avoiding travelling through the tower. In the opposite direction, 5 HGVs and 5 buses/coaches used Green Batt/Hotspur St eastbound. 2 HGVs and 2 buses/coaches were observed to use the Prudhoe St route.

4.7.3 **Thursday AM Peak (08:15-09:15).** In the Thursday AM peak, similar traffic count movements to the Wednesday AM peak were observed. The northbound approach at Junction 8 saw 287 PCUs travel through the tower, with 270 PCUs arriving at the westbound approach at Junction 7 along B6346 Bondgate Within. Like the Wednesday AM peak the majority (80%) of this traffic at Junction 7 continued along Clayport St to Junction 6. 60% of the traffic on the westbound approach to Junction 6

then turned right onto Lagny St. Losses in traffic flows are again assumed to be due to parking. Comparatively, the southbound traffic through Bondgate Tower saw much higher traffic flows on the Thursday, with 421 PCUs travelling through between 08:15-09:15, with 90% continuing to travel south along B6346 Bondgate Without.

The diversion route along Prudhoe St to Lisburn Terrace saw a maximum westbound flow of 196 PCUs, reducing to 145 PCUs at the approach to Junction 4. The diversion route along Hotspur St saw 71 PCUs departing Junction 8 westbound, increasing to 113 PCUs at the Junction 5 westbound approach. A maximum of 84 PCUs use the eastbound route via Green Batt, with 139 PCUs travelling eastbound on Prudhoe St.

Both HGVs and buses/coaches were observed to travel through Bondgate Tower. Northbound, 3 HGVs travelled through the tower, however 5 HGVs were observed travelling westbound at Junction 7. No buses were observed travelling through the tower northbound, however 1 was observed travelling westbound to Junction 7. In regard to the diversion routes, it was observed 8 buses/coaches turned left onto Hotspur St before the tower, travelling westbound to Junction 5. Similarly, 3 HGVs made the same movement. 8 HGVs and 9 PCUs used the Green Batt route eastbound. 8 HGVs were observed to use the Prudhoe St diversion, and 2 buses/coaches travelled in each direction on that route.

4.7.4 **Thursday PM Peak (14:45-15:45).** Thursday's PM peak saw similar traffic movements to that of its AM peak and Wednesday's traffic flow movements. 323 PCUs travelled northbound through the tower, with 314 PCUs arriving at the approach to Junction 7, travelling westbound along B6346 Bondgate Within. Again, far greater traffic flows were observed travelling southbound through the tower, with 475 PCUs travelling through. 96% of these traffic flows continued to travel southbound along B6346 Bondgate Without. Losses in traffic flows again are assumed to be due to parking in the town centre.

The proposed diversion routes, like in the AM peak, had observable variations in traffic flow movements. The westbound diversion route along Prudhoe St had a 34% decrease in traffic flows along its length, reducing from 279 PCUs to 184 PCUs. Contrastingly, the second diversion route along Hotspur St saw a 50% increase in traffic flows travelling westbound, increasing to 110 PCUs from 74 PCUs. Eastbound traffic on the diversion routes was a maximum of 98 PCUs on Green Batt, and 129 PCUs on Prudhoe St.

The vehicle counts for HGVs and buses/coaches were like those identified in the Wednesday PM peak. There is a slight reduction in their numbers travelling through the tower between 15:45 and 16:45. Northbound through the tower, 1 HGV travelled through whilst no buses/coaches did. Southbound 1 HGV and 1 bus/coach travelled through. However, larger number of these vehicle classes were observed travelling along the diversion routes, avoiding the tower. 11 HGVs travelled along Hotspur St, whilst 14 buses/coaches did this also within the peak PM hour. 8 HGVs and 3 buses/coaches meanwhile used the Prudhoe St route.

4.7.5 **Saturday Lunchtime Peak (12:00-13:00).** The second largest traffic flow northbound through Bondgate Tower was observed in the interpeak on Saturday. 331 PCUs travelled through the tower northbound along B6346 Bondgate Within. Due to issues with the traffic flow data collection, traffic counts on approach to Junction 7 could not be observed and therefore it is unclear how much traffic was lost to parking on Bondgate and the market Place, however 80 PCUs turned north up Fenkle St, and 289 PCUs reached Junction 6 westbound on Clayport St, of which 50% turned into Lagny St. In the southbound direction, 537 PCUs travelled through the tower, of which 508 PCUs (95%) continued to travel southbound along B6346 Bondgate Within, leaving the town centre.

The diversion route along Prudhoe St at Junction 1, to Lisburn Terrace at Junction 3 to 4 saw a maximum of 286 PCUs leaving Junction 1, reducing to 172 PCUs at Junction 4. As outlined in the Wednesday and Thursday traffic flow analysis, traffic flows will have reduced due to residential areas to the north/south of Lisburn Terrace. Like the Thursday PM peak, there was an increase in traffic flows westbound from Junction 8 to Junction 5 along Hotspur St. These increased from 69 PCUs to 142 PCUs. Again, this is due to residential areas lying north/south of the road. In the eastbound direction, a maximum of 87 PCUs used the Green Batt route, while 115 PCUs were observed on Prudhoe St.

Referencing the HGV and buses/coaches vehicle classes, 1 HGV travelled northbound through Bondgate tower, whilst 2 travelled southbound through it. In terms of buses/coaches, no buses/coaches travelled northbound through the tower, whilst 1 travelled southbound. 1 HGV travelled down Hotspur St, while 13 buses/coaches used the route. 3 HGVs and 0 buses/coaches used the

Prudhoe St route, which could suggest that the buses/coaches which are observed on that route during the week may be associated with the school.

4.8 Traffic Flow Analysis Conclusions

4.8.1 There are several key points drawn from the traffic flow analysis:

- The largest traffic flows are southbound through the tower.
- Northbound traffic flows through Bondgate Tower reduce before reaching junction 7. It is assumed that these traffic flows are lost to parking in Bondgate within and the Market Place.
- Far fewer vehicles are using the diversion routes compared to travelling through the tower at present.
- Some HGVs and buses/coaches currently travel through the tower; however, it is observed that a larger number use the diversion routes, particularly via Green Batt/Hotspur St.

4.9 It is important to note that the traffic count data was recorded during November 2021. To enable an estimation to be made of the likely traffic levels during the Summer Holiday peak, a flow uplift was calculated using data from August to October 2019, which was collected via cordon traffic volume and speed surveys at three sites around the town centre over the period of 14 weeks and supplied to AECOM by NCC at the start of this study. It was calculated that in the summer peak there is a 7.5%-8% increase in traffic flow data in Alnwick compared to the off-season period. Therefore, it is anticipated that there will be roughly an 8% greater demand on the routes within and around the town centre in the Summer months.

5. Review of Signage

5.1 This section will cover a description of the existing signage provision, provide some information on relevant guidance and standards, and comment on the suitability of the existing provision in relation to them. Finally, comment will be made on potential improvements to the existing provision. The information contained within this section was provided to NCC under separate cover, in advance of completion of the final reporting.

Existing Provision

5.2 The existing height restriction signage consists entirely of legacy variants of the graphic, depicting only the imperial units. This is no longer prescribed, with the newer version displaying both imperial and metric units, though the previous version does not need to be replaced until time expired. Terminal signs at either end of the restriction are present, with some limited advance signage integrated on directional signage to the north and south. Mention of the 'low arch' is made on three further directional signs. These signs are shown below.

5.3 At the restriction itself terminal signs are located either side of the tower placed only at the nearside. These are shown below in **Figure 7** and **Figure 8**.

Figure 7 – Northbound Restriction Terminal Sign

Figure 8 – Southbound Restriction Terminal Sign

5.4 150yds south of the restriction, a directional sign on B6346 Bondgate warns of the upcoming restriction via the integrated 530A warning triangle, shown in **Figure 9**.

Figure 9 – B6346 Bondgate Northbound Directional Signage Integration

5.5 Further north past the restriction, on Lagny Street, on its approach and just prior to B6341 Clayport Street, another directional sign contains an integrated 530A warning triangle, shown below in **Figure 10**. This sign shows the route to Morpeth via the A1 as being to the left (through the Tower), with an alternative route "avoiding low arch" being signed to the right via Clayport Street.

Figure 10 – Lagny Street Directional Signage Integration

5.6 Traffic following the route to Morpeth via the A1, avoiding the low arch, as advised by the sign **in Figure 10**, are then directed to continue along their route via Lisburn Terrace, at its junction with the B6341 Clayport Street. This sign continues the use of the "avoiding low arch" text, but now lists the associated destination as Newcastle rather than Morpeth. This sign is shown below in **Figure 11**.

Figure 11 – Lisburn Terrace Westbound Directional Signage

5.7 Back-to-back with the above sign in **Figure 11**, a further sign directs eastbound motorists heading towards the A1 and Newcastle that they should divert away from the low arch, down Lisburn Terrace at its junction, shown in **Figure 12**. This uses the "avoiding low arch" text, as with Figures 10 and 11, but is not reinforced with any signage showing the height restriction on the straight-ahead route as was the case with the signage on Lagny Street.

Figure 12 – Lisburn Terrace Eastbound Directional Signage

5.8 Further west along Clayport Bank is an advance direction sign (ADS) for eastbound traffic, which contains a 530A warning triangle for the ahead movement, with the route to the right via Lisburn Terrace being signed with the “avoiding low arch” legend, but with the destination this time being “Newcastle A1”. This is shown in **Figure 13** below.

Figure 13 – Clayport Bank Eastbound ADS with Height Warning

5.9 Approaching from the north along the B6341, directly after crossing the bridge over the River Aln, is an ADS with a 530A warning triangle integrated. This is shown in **Figure 14**. There is then no further signage as traffic progresses towards the town centre from the north.

Figure 14 – Southbound ADS with Height Warning

5.10 No signage warning of the height restriction is encountered on the B6346 approaching Alnwick from the direction of Eglingham.

5.11 There is also no additional signage providing reminders of the restrictions, or warnings at the final turning points within the town centre, which are considered to be the junctions of Market Street with Fenkle Street and Bondgate.

Standards and Guidance

5.12 The height restriction at Bondgate Tower has been signed with warning signage similar to that used at an arch bridge. Arch bridges are signed uniquely due to the height restriction varying across the structure, and therefore are subject to warning rather than regulatory signage.

5.13 Though the tower's portal is an arch, the makeup of the structure is too narrow for the restriction to vary by a large amount. Traffic Signs Manual (TSM) Chapter 3 section suggests that the mandatory signage should be used at non-arch bridges **and other structures with a headroom less than 16'-6" (5.03m)**, as is the case with Bondgate Tower. Arch bridge signage is more suitable where the main risk of collision is to the shoulders of the arch, where the central section is significantly higher. The collisions which have occurred at Bondgate Tower include strikes to the keystone of the arch itself, therefore suggesting that warning signage as used at an arch bridge is less appropriate. Bondgate Tower would therefore be better suited to be signed as a mandatory height restriction, which would allow use of the associated mandatory signage, giving enforceability via Section 36 of the Road Traffic Act and a more effective message to drivers. Implementation of mandatory signage for this type of restriction is exempt from requiring a traffic regulation order.

5.14 Section 5.16 of Chapter 3 of the TSM sets out a summary of information for signing of structures with a headroom of below 16'-6"/5.03m, which includes a terminal sign Diagram 629.2A (Height Limit Roundel), TSRGD Ref S2-4-5, to be placed as close as practicable to the restriction's commencement. Diagram 629.2A includes both metric and imperial units in its most up to date version. The imperial units only version of the sign is now no longer prescribed, though existing signs of this variant are not currently required to be replaced until they are life expired.

5.15 Section 7 of Chapter 4 of the TSM sets out more detail on the signage of bridges and structures than the summary contained in Chapter 3. This notes that at non-arch bridges, the sign to Diagram 629.2A should be mounted on the bridge but may also be placed on the roadside in advance. It will not be appropriate to place signs on the Tower itself, therefore the restriction signage will need to be mounted at the roadside, similar to the existing sign positioning.

5.16 Although no requirement is made to include a terminal sign on both sides of the road, TSM does make mention of ensuring visibility such that it does not give rise to enforcement or safety issues relating to the restriction, and that having a terminal sign on both sides of the road may be preferable. Specific mention is given in TSM to situations where the restriction is located at a junction, in which case further signs may be required to clarify which arm the restriction applies to. Drivers should not be placed in a situation where they may not see the sign before beginning their turning manoeuvre.

5.17 In accordance with TSM Chapter 4 section 1.13.2, signs to both Diagram 530A and 629.2A must be illuminated throughout the hours of darkness by internal or external lighting when sited within 50 metres of a streetlamp which forms part of a system of street lighting, which appears to be the case here, unless in a 20mph speed limit, which this location is not. The existing signs at the restriction do not appear to currently be illuminated, and any replacement/updated signs will need to incorporate lighting.

5.18 TSM Chapter 4 7.4 & 7.5 include instructions for measuring the imperial and metric heights to be shown on height restriction signage (both to diagrams 530A and 629.2A). It is important that the height displayed on any replacement/updated signs show both imperial and metric heights and that they are remeasured as per the TSM instructions to ensure they are providing sufficient protection to the tower. The heights displayed should be taken from the location with the lowest headroom within the arch i.e. towards a side rather than the centre, with the appropriate rounding down and safety factors applied.

5.19 TSM Chapter 3 5.1.3 and TSM Chapter 4 7.6 describes how advance warning signs of restrictions are able to be incorporated into directional signage. Diagram 629.2A is one such restriction stipulated as being allowable in this way and would in that case use TSRGD ref S12-20-34. TSM Chapter 3 5.1.3 makes recommendation that except where the directional signage is located directly at the restriction being referenced, this should be accompanied by a supplementary distance plate in order to allow the driver to make more informed decisions regarding their routes.

5.20 TSM Chapter 3 5.1.4 and TSM Chapter 4 7.6 describes an alternative to incorporation of restriction signage to advance direction signage in the form of Diagram 818.4, TSRGD ref S12-28-22, a standalone sign which should be located upstream of the advance direction signage. The benefit of this arrangement is described as being the ability to reduce the size of the advance directional signage and reduce

overload. Further supplementary information should be supplied on the sign as recommended in TSM Chapter 4 Figure 7-8 and 7-10.

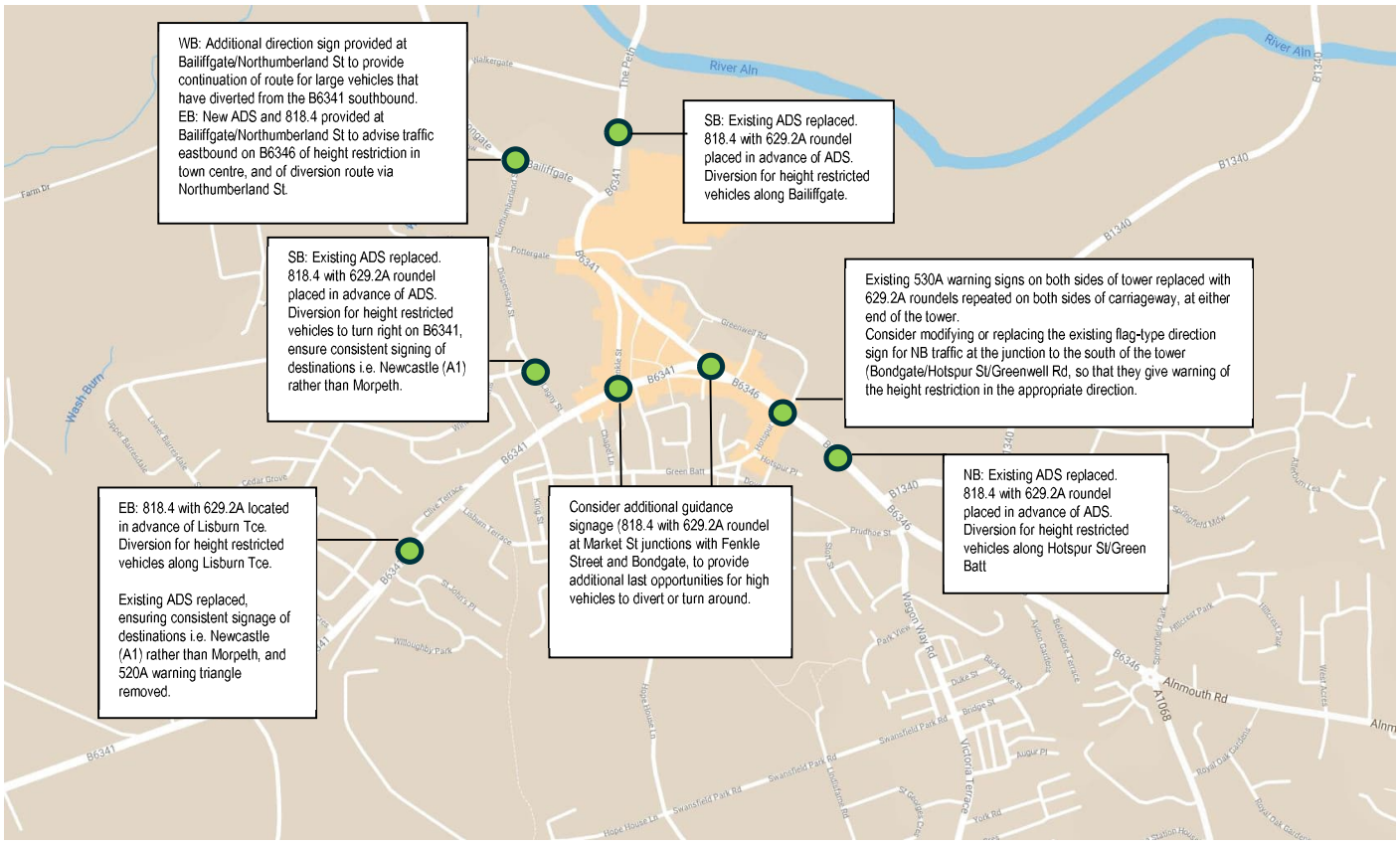
5.21 TSM Chapter 4 7.7.5 contains an example plan of the advanced and terminal signage to be used on the approach to a mandatory height restriction.

5.22 TSM Chapter 4 7.10 contains guidance about using diagram 530A warning signs for overhanging buildings, but this is only used when the restriction is over part of the carriageway, so is not relevant for this location.

Recommendations

5.23 In order to bring signage in line with guidance and standards, the changes outlined in **Figure 15** could be implemented.

Figure 15 – Signage Proposals



5.24 This includes the existing 530A warning triangle terminal signs at the tower being replaced with illuminated 629.2A roundels repeated on both sides of the carriageway, on both the north and south facing side of the tower. The terminal signs will need to show the remeasured/checked height restriction in both imperial and metric.

5.25 Additionally, all ADS that currently display the 530A warning triangle should be replaced with new ADS omitting this. Each of these ADS should be accompanied by a new 818.4 + 629.2A sign including relevant diversion information for height restricted vehicles, placed at an appropriate distance in advance of the ADS. The diagram 629.2A signs could also be included within the ADS, in addition to the separate 818.4 signs, to provide maximum notification of the restriction, but these could also be excluded to reduce sign sizes as required. In all cases these signs should also be updated to show the remeasured height restriction, in both imperial and metric.

5.26 The flag-type direction signs for northbound traffic at the Bondgate/Hotspur Street junction to the south of the tower currently do not warn of the height restriction ahead. Consideration should be given to either modifying or replacing these signs, to include the (remeasured/checked) height restriction on the ahead arm, with the direction for overheight vehicles turning left onto Hotspur Street.

5.27 Currently, it is possible to reach the tower from the B6346 Canongate without passing a single sign warning of the height restriction. An additional ADS sign, possibly supplemented with a new 818.4 and 629.2A sign should be provided at the Canongate / Bailiffgate / Northumberland Street Junction, to divert high vehicles along Northumberland Street, to the updated signage on Lagny Street. Additionally, a direction sign should be provided for traffic that has been diverted westbound along Bailiffgate from the B6341.

5.28 In addition, it is suggested that additional advance signage for the restrictions could be placed at further junctions within the town centre where traffic has the opportunity to divert or turn around away from the

tower (i.e., Market Street/Fenkle Street and Market Street/Bondgate, to act as reminders, and in accordance with TSM guidance (in Chapter 4 Figure 7-13) to have advisory signage in advance of the last turning opportunity. This would also close the existing gaps in the signage and prevent large vehicles from reaching the tower without passing advance signage. A wider signage scheme incorporating these junctions is included within the main option development section of this report, as Option 1.

5.29 Consideration should also be given to whether any other locations within the town would benefit from signage e.g. the junction of Wagon Way Road with Prudhoe Street. This has been further considered during the option analysis work and incorporated into Option 1.

5.30 Opportunity should be taken to ensure other signage is illuminated where required. The only categories of signs which must be illuminated throughout the hours of darkness by internal or external lighting when placed within a street lit area (except when in a 20mph speed limit or zone or mounted on self-righting bollards) are as follows:

- Warning and regulatory signs for railway and tramway level crossings;
- Height restrictions and warnings at low bridges or structures;
- Warning of requirement to “Stop” or “Give Way” ahead (diagram 501);
- Speed limit terminal signs on trunk or principal roads;
- Regulatory signs including “stop”, “give way”, “no entry”, compulsory / banned manoeuvres, vehicle restrictions (including for low and narrow bridges) and terminal signs indicating vehicle restrictions or bus / tram only”; and,
- Motorway entry, exit and cantilever / gantry-mounted signs.

5.31 With the exception of the height restriction signs at the tower itself, it is not anticipated that any of the above types of signs will need to be installed as a result of these recommendations, and therefore there should not be a requirement for directly illuminating any of the other signs. All of the signs to be installed must however be reflectorised.

5.32 The benefits of the above arrangements are:

- Clear and comprehensive information for height restricted vehicles on all approaches;
- Closing existing “gaps” by which high vehicles could find themselves at the tower without passing a warning sign, and providing additional signs as reminders at the last turning points;
- Reduction of cognitive overload risk via additional warnings of the height restriction separate from ADS;
- Replacement of warning signage with enforceable and unambiguous regulatory signage; and,
- Opportunity to update superseded imperial unit only signage with current imperial + metric layout, which may be of use to foreign coaches and HGVs visiting Alnwick.

6. Option Selection, Development & Analysis

6.1 Following completion of the baseline analysis work regarding the existing situation in Alnwick, attention turned to developing potential improvement options, following a methodology discussed and agreed with NCC. This section of the report summarises the process followed and provides details of the options that have been developed and appraised.

6.2 A list of potential options for traffic management schemes in the vicinity of Bondgate tower, Alnwick, were shared with internal AECOM colleagues on Wednesday 24/11/21. Following this, an internal Options Workshop was held, and discussions held between AECOM Streets, Transport Planning and Heritage representatives.

6.3 This section details the initial options considered and outlines the 3 options that were then taken forward for further consideration.

Initial Sift

6.4 At the outset this study considered a wide range of possible options, which were guided by a review of solutions used in other locations, and consideration of innovative approaches. Through further discussion these were then refined into a subset of viable options that were taken forward for further study. During the initial sift, options that were considered included:

- Do Nothing;
- Small Scale Signing Scheme;
- Larger Scale Redirection Signing Scheme;
- Close Bondgate Tower to Traffic in One Direction;
- “Soft Closure” Using Rise-Fall Bollards or Similar;
- Full Closure of Bondgate Tower to Traffic/Motor Vehicles;
- Additional/Add-On Option A – Signalise Junction to South of Tower & Shuttle Working; and,
- Additional/Add-On Option B – Use Physical Measures to Prevent Vehicle Strikes e.g. “sacrificial” arches.

6.5 During the course of the workshop and subsequent discussions, three further options were also put forward and discussed, as follows:

- Use of Height Detection Technology and Variable Message Signs to Reinforce Restriction Signage;
- Improve the lighting of the tower, in order to increase visibility of the height limit during the hours of darkness; and,
- Realign Kerbs on Approach to Arch, to Channel Traffic towards Centre of Arch.

6.6 **Appendix A** contains a technical note which details the option sifting process, summaries of the discussions held, and a commentary on each of the initial options.

6.7 Following the initial sift the options selected to be taken forward for further analysis were:

- **Option 1 -** A signing scheme to improve signage of the height restriction, encourage traffic to use the diversion routes and potentially rationalise signing to improve amenity;
- **Option 2 -** A closure of the tower to traffic in one direction, most probably northbound, supported by signage improvements and junction changes as required, enabling some urban realm improvements;

- **Option 3 -** A full closure of the tower to traffic, with rerouting onto alternative routes within the town, supported by signage improvements and junction changes as required, and enabling urban realm improvements.

6.8 In addition to these three main options, some add-on options were also agreed to be taken forward, either as part of one of the main options, or potentially as stand-alone elements, which could be mixed and matched as required to produce the best final option for protecting the tower and managing traffic in the area. These add on options are:

- Height detection technology and vehicle activated signs;
- Arches to prevent large vehicles approaching the tower;
- Improved lighting of the tower; and,
- Kerb realignment either side of the tower.

6.9 The options and add-ons selected were then presented to NCC on 6th December 2021 and were agreed to provide a good range of potential interventions.

6.10 These options are discussed below in further detail.

Option 1

Option 1 Description

6.11 Option 1 is a proposed larger redirection signing scheme, within, and around Alnwick's town centre. Whilst Bondgate Tower would remain open to traffic in both directions, the alternative routes would be signed more clearly, informing drivers of the upcoming height restrictions at the tower. This option builds on the recommendations covered in the review of signage in Section 5, which have been developed further into a full option. A sketch showing details of this proposal, and an overview sheet providing a key to the zoomed in plans, can be found in **Appendix B**.

6.12 Illuminated mandatory height restriction signs would be placed at both ends of the tower, on both sides of the road, ensuring the height restriction is clearly indicated, with further mandatory height restriction information being placed on advance warning signage on all approaches to the tower. This would ensure drivers are informed of the restrictions ahead of Bondgate Tower and the alternative diversion routes they can take instead.

6.13 There would be several alternative routes provided to drivers of large vehicles. Those travelling northbound, on the B6346, would be warned of the mandatory height restrictions well in advance of the tower. There would be several diagram 818.4 sign with 629.2A roundel positioned along routes from the south. Two shall be positioned at the junction with Prudhoe Street and Wagon Way Road. Here, a diversion route would be promoted for larger vehicles, such as HGVs and buses, to use Prudhoe Street, then following rerouting signage to the tower centre along the B6341 eastbound. Similar signage would be placed at the junction between B1340 and the B6346. Signage would indicate there are height restrictions ahead for drivers turning right from the B1340 onto the B6346. A further diagram 818.4 sign with 629.2A roundel would be placed further north along the B6346, showing a second diversion route for larger vehicles along Green Batt and Hotspur Street. This would be applied in conjunction with the existing ADS being replaced.

6.14 On the immediate southern approach to Bondgate Tower, several signs would be replaced, along with the introduction of new signs. Adjacent to the junction with Hotspur Street, the existing direction signs would be replaced. The new signs would outline the alternative route along Hotspur Street for larger vehicles to take. In addition to this, the mandatory height restriction would be displayed in a 629.2A roundel with ahead arrow as part of the direction signage. At the tower itself, all existing 530A warning signs would be replaced with illuminated mandatory 629.2A roundels on both sides of the tower. Two additional illuminated roundels would be placed on either side of Bondgate Tower, on opposite sides of the carriageway to the existing poles already in place. This would aim to ensure that the height restriction is clearly displayed.

6.15 On the north side of the tower, on Bondgate Within at the junction with the B6341 Market Street, again a diagram 818.4 sign with 629.2A roundel would be installed. This would warn drivers in advance of the tower of the height restrictions and allow larger vehicles to divert westbound along Market Street.

6.16 To the north of the town centre, two diagram 818.4 with 629.2A roundels would be installed. One southbound on The Peth and the other eastbound on Canongate. These would be positioned in conjunction a new ADS sign and two new direction signs, replacing the current ADS, and improving the signage on the diversion route and the approach to the town from the north and north-west. At present on The Peth, a 530A warning triangle is in place on the ADS. This would need to be modified and replaced with a 629.2A roundel, ensuring the height restrictions are clearly understood. The signage for the diversion route via Bailiffgate and Northumberland Street would also be strengthened by these amendments.

6.17 Lagny Street and Fenkle Street would each have the installation of a diagram 818.4 sign with 629.2A roundel. The signage would indicate the height restriction and the alternative diversion routes for larger vehicles to avoid Bondgate Tower and divert away along the B6341 westbound. Lagny Street's new sign would be positioned prior to and in associated with the existing ADS on the southbound exit. The ADS currently in position would be replaced. The 530A warning sign that is currently shown would need to be replaced with a 629.2A roundel to reiterate the mandatory height restrictions going through the tower via the town centre. Furthermore, the ADS would have the destination on the sign updated to Newcastle (A1) rather than Morpeth, to be consistent with other signage. The sign on Fenkle Street would be positioned at

the junction where it meets Market Street. Again, this would display the mandatory height restriction at Bondgate Tower and the diversion route for large vehicles along the B6341.

6.18 Finally, eastbound, on Clayport Street, two 818.4 signs with 629.2A roundel would be installed. The signs would display the mandatory height restriction at the tower and show the diversion route for larger vehicles to take along either Lisburn Terrace or Green Batt. The first sign would be installed in advance of the existing eastbound ADS. The existing ADS would need to be modified and replaced, with a mandatory 629.2A displayed for the ahead movement. Again, like the ADS on Lagny Street, the direction signage would be changed to Newcastle (A1) rather than Morpeth to ensure destination signage is consistent. These amended signs would complement the existing direction signs at the junction itself, which display the route via Lisburn Terrace, with the “avoiding low arch” legend towards the A1 and Newcastle. Further east along Clayport Street, beyond Lisburn Terrace, on the approach to the turning into Tower Lane, the second diagram 818.4 sign with 629.2A roundel would be installed, displaying the diversion route along Tower Lane and Green Batt.

6.19 Overall, 23 new signs of various types would be required to be installed for this scheme, with 7 existing signs being removed.

6.20 From a heritage perspective Option 1 offers the opportunity to direct unsuitable traffic away from the tower scheduled monument, lowering the opportunity for vehicle strikes, whilst still allowing normal traffic to pass through the arch on entry and exit to the town. Driving through the arch is considered to be an important aspect of the experience of visiting Alnwick Conservation Area and it provides a key element of understanding of the depth of history in the town, its character, and the calibre of its heritage assets. It maintains the asset in something approaching its original use and as such contributes to understanding of heritage significance. This option would introduce new signage at a distance from the tower, so the impact of this option upon the setting of the heritage assets is minimal. It also provides the opportunity for wider rationalisation of signage within the town which could remove some detracting elements of street clutter from within the conservation area.

Option 1 Rerouting

6.21 A limited amount of traffic rerouting may occur as a result of the signage scheme. It has been assumed that due to the introduction of the improved height restriction signage at the tower, and advance signage, all large vehicles will divert away from the tower, even if they may be small enough to pass through. It has therefore been assumed that the limited number of HGVs that were observed to travel through the tower during the traffic counts would instead use alternative routes.

6.22 **Table 2** below outlines the number of HGVs that would divert at the tower for the AM and PM peaks following the above assumptions:

Table 2 – Option 1 Traffic Rerouting

Peak		WB Diversion (Vehicle Counts)	EB Diversion (Vehicle Counts)
Wednesday	**AM**	2	4
	PM	1	1
Thursday	**AM**	3	5
	PM	1	5
Saturday	**IP**	1	2

6.23 As seen in the table, there were low levels of HGVs that were passing through the tower as identified by the traffic turning counts, so the impacts of the signage on rerouting in the town would likely be limited.

6.24 The HGVs that would have previously travelled southbound through the tower would be mostly encouraged to divert along the route via Lisburn Terrace and Prudhoe Street, being the first route reached when approaching the town from the west, and the route that is proposed to be signed for large vehicles diverting from the north of the town. The northbound HGVs would be predominantly guided to travel westbound along Hotspur Street and Green Batt, though some would undoubtedly use the alternative

route via Prudhoe Street and Lisburn Terrace. Prudhoe Street and Lisburn Terrace contain several designated listed buildings lining the route where an increase in HGV traffic would be noted as a result of this option. This may impact upon the setting of these heritage assets, although all are currently situated adjacent to a town centre route, so the impacts may be minimal in terms of how they affect heritage significance. The impact to the Church of St Paul Grade II* listed building and its churchyard setting would require consideration.

Option 1 Road Safety Impacts

6.25 It is likely that Option 1 would have a neutral impact on road safety. The junction in the immediate vicinity of the tower does not have a significant road safety problem, and the option would not lead to any large-scale redirection of traffic onto other routes. Any minor impacts are likely to be positive, as a result of hopefully preventing collisions between vehicles and the structure of the tower.

Option 1 Mitigation

6.26 Given the relatively low level of redirection expected as a result of this proposal, it is unlikely that any mitigation would be required on roads or junctions away from the tower.

Option 1 Costing

6.27 Using a costing spreadsheet developed by AECOM, ballpark costs have been estimated for this option. The estimate breaks down the costs into several series/categories which have been estimated using the CAD drawing, Google Street View, and site visit observations. These include works costs, for series such as site clearance, pavement, kerbing, and signs and markings (excluding items where not relevant for a particular option). Other elements are then added, including preliminaries and contingencies for additional works, design and project management, contract management and supervision, land, and a risk contingency of 40%, which has been set at this relatively high level due to the preliminary nature of the option designs.

6.28 Option 1 is expected to be the cheapest of all the developed proposals. The estimated cost is £39,145. **Appendix E** provides a breakdown of the costs for all three options.

Option 2

Option 2 Description

6.29 The Option 2 proposal is the closure of Bondgate Tower to all northbound traffic, only allowing southbound traffic to pass through the tower. The key rationale behind this option is to simplify the highway arrangement using the tower, thereby simplifying the driving task, reducing confusion, and allowing drivers to focus more closely on the height restriction. In addition, removing one direction of traffic from the tower could probably be expected to approximately half the number of collisions with the tower itself, simply by physically removing one of the traffic streams that currently passes through. The northbound direction was selected for closure in this option due to a number of factors. Northbound traffic has an easier "escape" from the area via Hotspur Street than southbound traffic, which would need to make a U-turn within a constrained space on Bondgate Within. Closing the tower to northbound traffic would also hopefully contribute to more free-flowing traffic southbound through Bondgate Within and therefore potentially lead to air quality benefits. Finally, a northbound closure affords more opportunity for public realm improvements on the more decorative south-eastern face of the tower. This option would also incorporate amendments to signage to ensure that southbound traffic (which remains able to use the tower), are adequately warned of the height restriction. A sketch showing details of this proposal can be found in **Appendix C**, and photomontage visualisations showing how the layout could look are shown in **Appendix F**.

6.30 Physical highway changes would need to be made to the highway layout both north and south of the tower in order to accommodate this option. This would improve the function of the junction and allow for the northbound closure to be as beneficial as feasibly possible, without having a significantly negative impact on the operation of the junction and immediate highway area. As part of this, it is suggested that the priority of the junction should be changed. Southbound traffic would now give way to traffic passing through the junction from Hotspur Street to Bondgate Without. The rearranged junction arrangement would allow the movement between the alternative route via Hotspur Street and Bondgate Without to be made with minimal delay.

6.31 The physical changes to the junction layout would see the kerb lines of both the north side, and south-west side of Bondgate Tower to be built out. The aim of this is to ensure that traffic is guided when travelling through the tower and remain as central within the lane as possible. This would minimise the likelihood of a strike on the tower as the highest part of the vehicles would be directed towards the highest part of the archway. Additionally, the build out of the kerb line to the south – west side of the tower would prevent traffic from attempting to turn left from Hotspur Street to travel illegally northbound through the tower. The kerb line on the south-east side of the tower would be maintained as existing.

6.32 Parking would be maintained down both sides of Bondgate Within, allowing traffic to still park on both sides of the carriageway. The proposed changes would result in the loss of only one vehicle's worth of parking each side of the road, therefore having a minimal impact on parking within the town centre. The proposal also envisages maintaining two-way traffic along the length of Bondgate Within between Market Street and immediately north of the tower, to enable traffic to leave the parking areas in either direction.

6.33 On the south side of the tower, on the northbound approach along Bondgate Without, the existing pedestrian crossing would be maintained, along with its associated road markings. In conjunction with this the centre line would be continued from the north side of the crossing, onto Hotspur Street, guiding traffic along the highway via the new junction layout.

6.34 Regarding signage around Bondgate Tower, two "Ahead only" arrows would be placed on the north side of the tower, whilst two 'no entry' signs would be placed on the south side to provide as clear a message as possible that traffic can no longer go north through the tower. Consideration should also be given to providing give way ahead signage to the north of the tower for southbound traffic, in order to ensure that the amended priorities south of the tower are as clear as possible to road users. This would be supplemented by wider signage throughout the town, in order to ensure that the height restriction is clearly understood where required, and that the alternative routes, both for large vehicles and diverted northbound traffic, are suitably signed. This would be in line with the signing proposals set out in Option 1, suitably modified to reflect the northbound closure, and amended routing.

6.35 From a heritage perspective the closure of the northbound route through the tower into Alnwick town centre removes an aspect of the experience of entering the Alnwick Conservation Area in that cars would

longer drive through the arch to enter the town. It is noted, however, that the diversion westbound could take place along Hotspur Street whereby drivers arriving at the town would still experience the key view of the asset on approach along Bondgate Within before turning left at the tower. Its presence and dominance in the street view would therefore still be felt. Its function as a town gate would also continue through the continued use of the arch for southbound traffic, contributing to understanding of its heritage significance. The reworking of the junction in front of the tower likely offers the opportunity for some limited urban realm enhancement which would be of benefit to the setting of the tower and the appearance of the conservation area. The addition of signage to the front and rear of the tower should be carried out sensitively to the design of the tower and its symmetrical facades.

Option 2 Rerouting

6.36 Due to the northbound closure of Bondgate tower to traffic, significant numbers of vehicles would need to reroute. The rerouting figures set out in this section assume that all traffic that currently travels north through the tower would be rerouted, in addition to southbound large vehicles as a result of signage changes, as set out in Option 1.

Table 3 – Option 2 Traffic Rerouting

		Westbound			
Peak Hour		Current Vehicles	Vehicles Diverted	Total Vehicles	% Increase
Wednesday	AM	311	282	593	91%
	PM	321	347	668	108%
Thursday	AM	309	287	596	93%
	PM	389	323	712	83%
Saturday IP		428	332	760	78%

6.37 **Table 3** outlines the levels of traffic that are currently travelling northbound through the tower (using November 2021 Classified turning counts). Using the data, predictions have been able to be made as to how many vehicles will have to divert westbound (then north to reach the northern side of the town centre) due to the northbound closure.

6.38 As outlined in the table, a significant increase in westbound traffic is expected in all peak hours. The traffic is expected to have been travelling northbound along the B6346 and will have to divert westbound along Hotspur Street at the tower, or Prudhoe Street further south of the centre. The percentage increase shown represents the change to traffic flows on these alternative routes, in comparison to the total flows that they currently carry. The largest increase in westbound traffic flows is in the Wednesday PM peak, with an 108% increase in the westbound traffic flows. The smallest increase is expected in the Saturday interpeak with a reduced increase of 78% westbound traffic, meaning that flows are still almost doubling with this smallest increase. As noted in section 4, this was based on traffic flows collected in November, and flows in the peak holiday period are likely to be higher, potentially in the region of around an 8% uplift. The likely impacts of this increase in traffic flows would need to be carefully considered. Changes may need to be made at other junctions on the alternative routes in order to mitigate against the changes to traffic flows. Extensive consultation with local residents and businesses would be required in order to enable this option to progress.

6.39 The split of diverted traffic between the two alternative routes will be impacted by any final sign design implemented, however it is anticipated that it would lead to a larger impact on Hotspur Street, Green Batt and Tower Lane, with drivers choosing not to divert until they reach the closure point itself. This is an existing bus route and is fairly wide and straight with parking restrictions along much of its length but has a restricted tight section between the junctions with Bondgate Within and Roxbro Place, which would likely reflect a significant pinch point on the route.

6.40 Hotspur Street, Prudhoe Street and Lisburn Terrace contain several designated listed buildings lining the route where an increase in traffic would be noted as a result of this option. This may impact upon the setting of these heritage assets, although all are currently situated adjacent to a town centre route, so the

impacts may be minimal in terms of how they affect heritage significance. The impact to the Church of St Paul Grade II* listed building and its churchyard setting would require consideration.

Option 2 Road Safety Impacts

6.41 The redirection of large numbers of vehicles onto alternative routes away from the tower may lead to additional collisions on those routes, and at junctions along them. Conversely however, it may lead to fewer collisions taking place in the vicinity of the tower and would be expected to prevent approximately half the number of collisions with the tower itself. It must be noted that none of the junctions and routes that would see large amounts of additional traffic currently have a poor road safety record. The mitigation measures set out below should be targeted at reducing any negative road safety impacts related to redirection, as well as mitigating against the capacity issues that would result.

Option 2 Mitigation

6.42 In order to mitigate for the high levels of redirection associated with this scheme, changes may be required to junctions and parts of the road network further afield from the tower itself. With the redirected flows expected to predominantly divert onto the Hotspur Street/Green Batt route this will be where mitigation needs to be focussed. The junction of Tower Lane with Clayport Street is likely to form a pinch point at the end of the diversion route, with traffic from the current minor arm (Tower Lane) needing to give way to traffic on the main road. If this option were to be taken forward, consideration would therefore need to be given to making changes at this junction, potentially via signalisation, to enable Tower Lane to receive an appropriate amount of opportunity to discharge onto Clayport Street.

6.43 The eastern end of Hotspur Street is narrow and has poor horizontal alignment and visibility. Due to the proximity to properties this is unlikely to be able to be mitigated against fully, however consideration should be given to implementing a section of shuttle working where the road is the narrowest, in the vicinity of the junction with Hotspur Place. Thought was given to suggesting that Hotspur Street be made one-way westbound, however this would lead to significant disruption to bus routes, so is not considered to be feasible without significant further thought.

6.44 Some traffic will also inevitably divert onto the other alternative route via Lisburn Terrace and Prudhoe Street. In order to mitigate against this, there may be a need to implement parking restrictions along sections of this route, to allow for more passing places to be available for the increased traffic flows.

6.45 In order to enable the alternative routes to operate at a reasonable level of capacity, it may be necessary to consider the implementation of wider traffic management measures to try to reduce the amount of traffic approaching the tower from the south. This could include the implementation of wider parking guidance signage to encourage the use of car parks located on the side of the town centre that traffic is approaching from. Other measures that could be considered may include improving pedestrian and cycle facilities as it has been noted that these facilities are currently limited, and Alnwick has a higher proportion of collisions involving these road users than the national average. A subjective assessment of the current walking routes in Alnwick among the project team suggested that it is currently less attractive for walking than other market towns in Northumberland e.g. Morpeth and Hexham, but some of the more impactful options suggested for Bondgate Tower may help to unlock the opportunity for wider improvements to the urban realm and to reclaim footways more widely. Currently Bondgate Within and Market Street feel dominated by motor traffic, both moving and parked which will dissuade some potential pedestrians and cyclists from walking and cycling and encourage car usage. There does not appear to be much scope to reduce through traffic using the roads through Alnwick to access wider rural areas, but measures to reduce intra-town journeys may have a significant impact on the acceptability of the more impactful proposals at the tower itself.

6.46 Only a high-level consideration of potential mitigation measures is possible at this stage. In order to fully determine what mitigation is required in particular locations traffic modelling (including potentially a full network model) would be required, which is outside the scope of this study.

Option 2 Costing

6.47 Using a costing spreadsheet developed by AECOM, ballpark costs have been estimated for this option. The estimate breaks down the costs into several series/categories which have been estimated using the CAD drawing, Google Street View, and site visit observations. These include works costs, for series such

as site clearance, pavement, kerbing, and signs and markings (excluding items where not relevant for a particular option). Other elements are then added, including preliminaries and contingencies for additional works, design and project management, contract management and supervision, land, and a risk contingency of 40%, which has been set at this relatively high level due to the preliminary nature of the option designs.

6.48 Option 2 is expected to be the mid-range of all the developed proposals in terms of costs. The estimated cost is £190,820. **Appendix E** provides a breakdown of the costs for all three options.

6.49 Note that these costs do not account for mitigation works which may be required at wider locations within the town. If mitigation were required as set out earlier in this section, it would be expected to cost in the region of a further £125,000 to £175,000, however these are very initial high-level elements which have not been formally costed.

Option 3

Option 3 Description

6.50 The proposal for Option 3 is the full closure of the tower to traffic in both directions. Physical highway changes would be made to the junction layout, on both the north and south side of the tower, with changes to kerb lines, carriageway alignment, and the introduction of a turning circle to the north of the tower, to allow for smaller vehicles to turn around and exit Bondgate Within (larger vehicles would have to three-point turn). This would be further supported through the introduction of a signing strategy within the proximity of Bondgate Tower and around the town centre, warning drivers of the tower closure and the alternative routes they can take. This option is considered to be the ultimate approach to preventing further vehicle strikes to the tower but will have the greatest impact on other traffic within the town. A sketch showing details of the proposal can be found in **Appendix D**, and photomontage visualisations of how the layout could look are shown in **Appendix G**.

6.51 As with Option 2, the arrangement of the Hotspur Street/Bondgate Without/Greenwell Road junction to the south-east of the tower would be amended by implementing this proposal. Priority would be given to the movement between Hotspur Street and Bondgate Without, with Greenwell Road being the minor arm and giving way to the other movements. The tower itself would become pedestrianised via this proposal with bollards being implemented at the carriageway edge either side to ensure that vehicles are stopped from attempting to travel through the tower. In addition, the existing carriageway surface through the tower would be replaced with paving, tying into the existing footway, though it would also be possible to undertake wholesale changes to the streetscape within the area, and replace all of the paving with high quality heritage materials. It may also be possible and desirable within this option to allow cycles to use the tower (or one or both of the side passages) to allow them to pass through and continue towards the town centre, in effect acting as a modal filter. If this were to be desired, further consideration would need to be given to the highway arrangements each side of the tower, to allow cyclists to join and leave the carriageway safely.

6.52 On the north side a turning circle would be introduced. This would ensure that traffic on the north side can turn around on Bondgate Within prior to reaching the tower, and maintain access to the parking on either side of the road, and to businesses for loading etc. It is not possible to provide a turning circle that is large enough for vehicles larger than cars and vans to turn around in one movement, and larger vehicles would need to make multi-point turns. It would therefore be important that clear signage is installed on Market Street, Fenkle Street and Bondgate Within, so that drivers are aware of the dead end prior to the tower.

6.53 The physical changes to the junction would see significant changes to kerb lines at the tower. The kerb line at the south-west side of the tower would be built out. This is to guide traffic from Hotspur Street round onto Bondgate Without and prohibit traffic from turning northbound through the tower. This kerb line would be continued over to the opposite side of the carriageway beside the tower, meeting the south-eastern existing kerb line. On the north side of the tower, the kerb line would also be built out. The edge of the kerb line would again guide traffic to turn at the turning circle and ensure that traffic does not travel through the tower.

6.54 Parking would be maintained down both sides of Bondgate Within, allowing traffic to still park on both sides of the carriageway. The proposed changes would however result in the loss of a small number of parking spaces, to allow the turning circle to be implemented. The proposal also envisages maintaining two-way traffic along the length of Bondgate Within between Market Street and the turning circle, to enable traffic to leave the parking areas in either direction.

6.55 Greenwell Road, the eastern approach to the junction, would maintain its original kerb lines, with updates to just be made to existing road markings and signage where appropriate. Likewise, the existing pedestrian crossing on Bondgate Without would be maintained, along with its existing road markings.

6.56 Existing signage adjacent to the faces of the tower would be able to be removed in order to improve the visual presentation of the tower, albeit consideration would need to be given as to whether any signage would be required in order to emphasise the change in highway alignment. Direction signage at the junction immediately to the south of the tower would need to be amended as a result of the layout change. This would be supplemented by wider signage throughout the town, in order to ensure that the alternative routes for diverted traffic are suitably signed.

6.57 From a heritage perspective this option provides the greatest opportunity to limit damage to the tower through vehicle strikes by reducing to an absolute minimum the use of the tower for any vehicles. Whilst this is a positive step in protecting the tower, the closure of the vehicle route through the tower into and out of Alnwick town centre removes an aspect of the experience of the Alnwick Conservation Area in that cars would longer drive through the arch to enter or exit the town. It is noted, however, that the diversion westbound could take place along Hotspur Street whereby drivers arriving at the town would still experience the key view of the asset on approach along Bondgate Within before turning left at the tower. The same is unlikely to be true of those exiting the town, although views of the rear face of the tower can be appreciated on foot within the town and it is the less impressive face of the structure through design, where the architectural embellishments are almost exclusively reserved for its outward face. The tower's presence and dominance in the street view on both sides would still therefore be felt. The tower's function as a town gate would be limited to pedestrians and cyclists and their experience of it, and Alnwick conservation area would be positively changed as result of this option. The experiences lost to drivers would be gained by pedestrians and cyclists who have more opportunity to stop and appreciate the structure and its historic significance than drivers and any other users currently do due to the level of traffic.

6.58 The closure of the tower to vehicle traffic also offers the opportunity for significant urban realm enhancement which would be of benefit to the setting of the tower and the appearance of the conservation area. It may also have the indirect effect of encouraging restoration and active use of the tower. This could introduce new views within the conservation area from the tower's upper room and enhance understanding and appreciation of the monument. The addition of any signage adjacent to the front and rear of the tower should be caried out sensitively to the design of the tower and its symmetrical facades.

Option 3 Rerouting

6.59 As a result of the full tower closure, all traffic that currently uses it would have to reroute. Rerouting would need to occur for traffic flows both northbound and southbound through Bondgate Tower. Those travelling northbound will need to reroute to travel westbound, along Prudhoe Street or Hotspur Street, whilst southbound traffic will need to reroute to travel along Clayport Street, and eventually either onto Green Batt or Lisburn Terrace.

Table 4 – Option 3 Traffic Rerouting

		Westbound				Eastbound			
Peak Hour		Current Vehicles	Vehicles Diverted	Total Vehicles	% Increase	Current Vehicles	Vehicles Diverted	Total Vehicles	% Increase
Wednesday	AM	311	282	593	91%	216	420	636	194%
	PM	321	347	668	108%	202	462	664	229%
Thursday	AM	309	287	596	93%	192	421	613	219%
	PM	389	323	712	83%	179	475	654	265%
Saturday IP		428	332	760	78%	155	537	692	346%

6.60 As shown in **Table 4**, there would be an extremely large increase in both westbound and eastbound traffic using the alternative routes due to the closure and associate rerouting. The largest westbound traffic flow rerouting will occur in the Wednesday PM (108%), whilst eastbound will see the largest traffic flows in the Saturday interpeak of 346%. In other words, traffic travelling westbound would more than double, and traffic travelling eastbound would more than quadruple in some peaks. Again it must be noted that these are based on November traffic counts, and Summer flows would be around 8% higher based on our analysis.

6.61 Eastbound rerouting compared to the westbound has significantly higher increases in traffic flows. This may be due to the majority of traffic flows coming from the north of the town centre, leaving Alnwick to get to major road networks such as the A1 which lies to the south of the town.

6.62 Very careful consideration would need to be given as to whether this level of traffic flow increase would be acceptable or would put unacceptable strain onto the wider road network. The alternative routes both have narrow sections and are residential, so there may be significant concerns around their use to carry large volumes of traffic across the town. Changes may need to be made at other junctions on the

alternative routes in order to mitigate against the changes to traffic flows. Extensive consultation with local residents and businesses would also be required in order to enable this option to progress.

6.63 The split of diverted traffic between the two alternative routes will be impacted by any final sign design implemented, however it is anticipated that westbound traffic would be more likely to divert via Hotspur Street, Green Batt and Tower Lane, with drivers choosing not to divert until they reach the closure point itself. This is an existing bus route and is fairly wide and straight with parking restrictions along much of its length but has a restricted tight section between the junctions with Bondgate Within and Roxbro Place, which would likely reflect a significant pinch point on the route.

6.64 Conversely it is expected that with suitably robust signage, more eastbound traffic would be likely to use the Lisburn Terrace and Prudhoe Street route, with the junction of Clayport Street and Lisburn Terrace presenting a more suitable appearance as a through route than the narrow junction of Tower Lane with Clayport Street. Suitable early signage for eastbound through traffic, and robust diversion signage for traffic arriving from the north would lead to more eastbound traffic using this route. This route is quite straight and wide in places but has significant parking on both sides of the road, and is fronted by residential houses, a church and leisure facilities. It is the current signed alternative route for eastbound traffic but may not be suitable to carry the volumes anticipated as a result of the tower closure.

6.65 Hotspur Street, Prudhoe Street, Clayport Street, Green Batt, Lisburn Terrace and Lisburn Street contain several designated listed buildings lining the route where an increase in traffic would be noted as a result of this option. This may impact upon the setting of these heritage assets, although all are currently situated adjacent to a town centre route, so the impacts may be minimal in terms of how they affect heritage significance. The impact to the Church of St Paul Grade II* listed building and its churchyard setting would require consideration.

Option 3 Road Safety Impacts

6.66 The redirection of large numbers of vehicles onto alternative routes away from the tower may lead to additional collisions on those routes, and at junctions along them. Conversely however, it may lead to fewer collisions taking place in the vicinity of the tower and would physically prevent any collisions taking place with the tower itself. It must be noted that none of the junctions and routes that would see large amounts of additional traffic currently have a poor road safety record. The mitigation measures set out below should be targeted at reducing any negative road safety impacts related to redirection, as well as mitigating against the capacity issues that would result.

Option 3 Mitigation

6.67 In order to mitigate for the extremely high levels of redirection associated with this scheme, changes may be required to junctions and parts of the road network further afield from the tower itself. With the redirected flows expected to be split between the Hotspur Street / Green Batt and Lisburn Terrace / Prudhoe Street routes, mitigation would be expected to be required on both of these corridors.

6.68 The junction of Tower Lane with Clayport Street is likely to form a pinch point at the end of the Hotspur Street/Green Batt diversion route, with traffic from the current minor arm (Tower Lane) needing to give way to traffic on the main road. If this option were to be taken forward, consideration would therefore need to be given to making changes at this junction, potentially via signalisation, to enable Tower Lane to receive an appropriate amount of opportunity to discharge onto Clayport Street.

6.69 The eastern end of Hotspur Street is narrow and has poor horizontal alignment and visibility. Due to the proximity to properties this is unlikely to be able to be mitigated against fully, however consideration should be given to implementing a section of shuttle working where the road is the narrowest, in the vicinity of the junction with Hotspur Place. Thought was given to suggesting that Hotspur Street be made one-way westbound, however this would lead to significant disruption to bus routes, so is not considered to be feasible without significant further consideration.

6.70 A large amount of traffic will also be expected to divert onto the other alternative route via Lisburn Terrace and Prudhoe Street. Again, the junctions at either end of the route are likely to be pinch points given the extensive additional flow on what are currently the minor arms. In order to mitigate against this, both the Lisburn Terrace junction with the B6341 Clayport Street / Clayport Bank, and the Prudhoe Street junction with the B6346 Bondgate Without would need amending to account for the redirected flows. It is likely that traffic signals may be needed in each case, which for the latter junction may also require the signalisation

of the junction between Bondgate Without and the B1340 Denwick Lane, along with the Prudhoe Street/Wagon Way Road junction. This would therefore require very significant works.

6.71 In addition, there may be a need to implement parking restrictions along sections of the Lisburn Terrace/Prudhoe Street route, to allow for more passing places to be available for the increased traffic flows.

6.72 Implementing a one-way system along the two diversion routes, whereby the Hotspur Street route is one-way westbound, and Prudhoe Street route is eastbound only was also considered but discounted at this stage given the distance this would require eastbound buses to be from the town centre, and the negative impacts on access for residents. It would also likely increase vehicle speeds within a residential area.

6.73 Once again, as with the northbound only closure, it may be necessary to consider the implementation of wider traffic management measures to try to reduce the amount of traffic approaching the tower and using the alternative routes, and thereby mitigating the impacts of redirection. This could include the implementation of wider parking guidance signage to encourage the use of car parks located on the side of the town centre that traffic is approaching from. Other measures that could be considered may include improving pedestrian and cycle facilities as it has been noted that these are currently limited within the town, and Alnwick has a higher proportion of collisions involving these road users than the national average. A subjective assessment of the current walking routes in Alnwick among the project team suggested that it is currently less attractive for walking than other market towns in Northumberland e.g. Morpeth and Hexham, but some of the more impactful options suggested for Bondgate Tower may help to unlock the opportunity for wider improvements to the urban realm and to reclaim footways more widely. Currently Bondgate Within and Market Street feel dominated by motor traffic, both moving and parked which will dissuade some potential pedestrians and cyclists from walking and cycling and encourage car usage. There does not appear to be much scope to reduce through traffic using the roads through Alnwick to access wider rural areas, but measures to reduce intra-town journeys may have a significant impact on the acceptability of the more impactful proposals at the tower itself.

6.74 Only a high-level consideration of potential mitigation measures is possible at this stage. In order to fully determine what mitigation is required in particular locations traffic modelling (including potentially a full network model) would be required, which is outside the scope of this study.

Option 3 Costing

6.75 Using a costing spreadsheet developed by AECOM, ballpark costs have been estimated for this option. The estimate breaks down the costs into several series/categories which have been estimated using the CAD drawing, Google Street View, and site visit observations. These include works costs, for series such as site clearance, pavement, kerbing, and signs and markings (excluding items where not relevant for a particular option). Other elements are then added, including preliminaries and contingencies for additional works, design and project management, contract management and supervision, land, and a risk contingency of 40%, which has been set at this relatively high level due to the preliminary nature of the option designs.

6.76 Please note that the cost estimate for this option does not account for any more significant public realm improvements e.g. the use of particular heritage materials, landscaping or any artistic or sculptural elements. It is intended to serve as a cost estimate for a basic highways scheme to close the tower, which streetscape improvements could then be added onto.

6.77 Option 3 is expected to most expensive of all the developed proposals. The estimated cost is £308,407. **Appendix E** provides a breakdown of the costs for all three options.

6.78 Note that these costs do not account for mitigation works which may be required on wider locations within the town. If mitigation were required as set out earlier in this section, it would be expected to cost in the region of a further £350,000 to £400,000, however these are very initial high-level elements which have not been formally costed.

Review of Car Parking

6.79 Alnwick town centre offers large numbers of car parking spaces within and around the town centre through many car parks of varying nature. These include long stay, short stay, and on-street parking. Using the WYG Transport Planning report into Alnwick, Hexham and Morpeth town centre parking, car park use and availability has been outlined and conclusions have been able to be made as to how each proposed option would impact car park use in the town centre. Furthermore, the Alnwick Parking Action Plan has been examined to identify if the proposals have a direct impact on this study, and how this will need to be considered when implementing each proposed option.

6.80 Data collected and used by Northumberland County Council (NCC) was provided to WYG to complete the study. The data investigated existing car park locations, use and capacity within Alnwick town centre. The car parking study identified parking trends in August 2017. As this is the peak month in Alnwick, trends have been able to be directly compared to this study. It is of note the study deemed 85% use of a given car park as overcapacity.

6.81 Eighteen car parks and on-street parking areas are available. Much of the parking within Alnwick's town centre is managed by NCC, enforcing the restrictions. Most of the public car parking is provided along Greenwell Road, immediately south of Bondgate Tower, along with some on street parking in the central area classed as car parks. Private car parks include Morrison's, Lidl, and Alnwick Gardens. There are an estimated 1389 off-street parking spaces in the town centre study area. Additionally, the streets included in the study area contain roughly 225 parking spaces. Therefore, the total town centre parking capacity is estimated to be 1614 spaces.

6.82 Regarding the car park use in and around the town centre, several car parks hit capacity most days, with the majority hitting capacity between 10am-12pm. They remain within capacity throughout the day. The car parks are busiest over "lunch time" hours (10am – 2pm), with some car parks such as Dispensary Street, Pottergate New Row, and Roxburgh Place hitting above 100%.

6.83 Of all the car parks, three hit capacity most days, earlier than other car parks. They hit capacity between 10am-11am. They included the five Greenwell Road car parks, immediately south of the tower, Pottergate New Row, north-west of the tower, and Roxburgh Place, east of the tower. All these car parks are within proximity of the town centre and offer 264 car parking spaces. Of the private car parks such as Morrison's, which is north -west of the tower, is virtually full every day at midday, hitting 107% from 12pm-1pm, with 115 spaces available. In addition, Alnwick Garden car park, south-east of the town centre, is also virtually full at midday (96% from 11am-12pm, and 94% form 12pm-1pm). This offers 600 car parking spaces with a further 250 overflow spaces available.

6.84 In terms of on-street parking, many spaces are available within and around the town centre. On-street parking on Bailiffgate, north of the town centre, has 55 spaces, hitting a peak of 85% capacity from 11am-12pm, with the largest on-street parking availability on Bondgate Within (78 spaces). However, the largest levels of vehicles on Bondgate Within have a peak of 69% between 12pm-1pm. Capacity is hit on Market Street (27 spaces) from 11am-1pm, and Pottergate (12 spaces) from 12pm-1pm, and 6pm-7pm. Additionally, capacity is hit on Clayport Street from 9am-3pm, and Bondgate Without from 9am-7pm. However, it should be noted they have very few spaces, with Clayport Street only having 7 spaces, whilst Bondgate Without only has 3, and therefore capacity is more than likely to be filled.

6.85 Significantly the study found that there is an expected growth in parking demand due to further development in the surrounding area. It was concluded by the study that the demand for parking is assumed to increase by approximately 1.1% per year in the future based on growth forecast. It is expected car parks will reach over capacity, leading to further overspill of parking into other locations, including both on-street and private car parks. This will also lead to additional traffic as more people seek to find spare parking spaces. There could be a possible reduction in demand as people are put off by the difficulty in parking. From further discussions with stakeholders, there are at present significant traffic problems at the junction south of the tower, with Greenwell Road. The junction is to be amended in two of the three Bondgate Tower development options and those options would be anticipated to have a positive impact on the existing traffic problems.

Car Park Impacts

6.86 From assessing the NCC car parking study, **Table 5** outlines how each of the car parks in Alnwick's town centre will be impacted by the proposed options and where traffic will most likely travel from.

Table 5 – Impacts of Proposed Options on Car Parks

Car Park	Signing Strategy	NB Closure	Full Closure
Bondgate Hill Cobbles	Levels unlikely to change. Warning of height restriction at tower may cause traffic to reroute. NB may park before reaching the tower. SB traffic unaffected.	May be a reduction in use as no NB traffic will travel through the tower and along Market Street.	Overall reduction expected. No NB traffic use. Could see an increase in use as SB traffic using turning circle will drive past when travelling along Bondgate within.
Fenkle Street	Levels unlikely to change. Warning of height restriction at tower may cause traffic to reroute. NB park before reaching the tower. SB traffic unaffected.	May be a reduction in use as no NB traffic will travel through the tower and along Market Street.	Overall reduction expected. Could see an increase from SB traffic as unlikely to park other side of tower. Likely to see decrease in traffic coming from South of the tower.
Dispensary Street	Little change expected. SB traffic will continue to use it. NB traffic use may increase due to promoted diversion.	May be increase in use as NB closure at tower means traffic will divert onto Hotspur St and travel close to car park to travel North.	Increase in traffic use expected. Lies along/close to promoted diversion route.
Greenwell Road A	Could increase. Due to warning of height restriction at tower, NB traffic park before tower therefore park along Greenwell Road. SB traffic may follow diversion/warnings and park elsewhere.	May be increase in use, NB traffic is more likely to park south of the tower, not having to divert.	Increase in use expected. Majority of stopping NB traffic is expected to park in the Greenwell road car parks due to closure of tower.
Greenwell Road B	Could increase. Due to warning of height restriction at tower, NB traffic park before tower therefore park along Greenwell Road. SB traffic may follow diversion/warnings and park elsewhere.	May be increase in use, NB traffic is more likely to park south of the tower, not having to divert.	Increase in use expected. Majority of stopping NB traffic is expected to park in the Greenwell road car parks due to closure of tower.
Greenwell Road C	Could increase. Due to warning of height restriction at tower, NB traffic park before tower therefore park along Greenwell Road. SB traffic may follow diversion/warnings and park elsewhere.	May be increase in use, NB traffic is more likely to park south of the tower, not having to divert.	Increase in use expected. Majority of stopping NB traffic is expected to park in the Greenwell road car parks due to closure of tower.
Greenwell Road D	Could increase. Due to warning of height restriction at tower, NB traffic park before tower therefore park along Greenwell Road. SB traffic may follow diversion/warnings and park elsewhere.	May be increase in use, NB traffic is more likely to park south of the tower, not having to divert.	Increase in use expected. Majority of stopping NB traffic is expected to park in the Greenwell road car parks due to closure of tower.
Greenwell Road E	Could increase. Due to warning of height restriction at tower, NB traffic park before tower therefore park along Greenwell Road. SB traffic may follow diversion/warnings and park elsewhere.	May be increase in use, NB traffic is more likely to park south of the tower, not having to divert.	Increase in use expected. Majority of stopping NB traffic is expected to park in the Greenwell road car parks due to closure of tower.
Pottergate New Row	Unlikely to see changes in parking numbers as it is located away from the diversion routes.	Unlikely to be a change in use as traffic levels in proximity to the car park is unlikely to	As the car park is located away from the tower closure points and the promoted

		change. The car park is located away from the westbound diversion route and from the northbound closure point.	diversion routes, the levels in use are probably unlikely to change at all.
Roxburgh Place	May be an increase in usage as lies along a promoted diversion route for NB traffic. May be a reduction in SB traffic use.	Increase in use expected. NB traffic, diverting at tower likely to use car park as lies close to access town centre.	Increase in NB traffic use expected. Lies along promoted diversion route when traffic reaches the tower.
Morrison's	Likely to remain unaffected. More NB traffic may come from the West as opposed to travelling through the tower.	Likely to remain unaffected. More NB traffic may come from the West due to NB tower closure.	Likely to remain unaffected. More NB traffic may come from the West due to NB tower closure.
Lidl	Unlikely to be affected.	Unlikely to be affected.	Unlikely to be affected.
Alnwick Gardens Disabled	Unlikely to be affected.	Unlikely to be affected.	Unlikely to be affected.
Alnwick Gardens	Unlikely to be affected.	Unlikely to be affected.	Unlikely to be affected.
On-Street Parking	Majority of on-street parking lies within the town centre. Signing strategy unlikely to see large change in parking numbers using the town centre.	A reduction in the NB traffic using the on-street parking is expected. This may see an overall reduction in the use of on-street parking in the town centre.	An overall reduction in on-street parking could be seen due to no traffic travelling NB through the tower. However, the levels of SB traffic using on-street parking could increase as they are able to use the turning circle on Bondgate Within.

Action Plan

6.87 From reviewing the Alnwick Parking Study Action Plan, key suggestions have been identified that will have a direct impact on the Bondgate Tower traffic management proposals and will need to be considered, both in terms of their impacts on traffic flows through the tower, but also the impacts of the proposals at the Tower on access to key car parks and on-street parking. There were fifteen recommendations made in the Action Plan, and most would have some relevance, but the two that appears to have the greatest links with this study have been set out below.

6.88 One of the suggested interventions from the Action plan was the conversion of long stay car parks to short stay parking. At present the numerous long stay car parks are restricting the capacity for short stay trips to the town centre, and visitors are struggling to park. The proposed changes include the conversion of Greenwell Road A car park to short stay (which appears to have been completed), along with investigating alternative locations for the long stay parking. This was all to be done with the aim of reducing overnight and long stay parking by residents and business workers by limiting the appropriate car parks to a maximum stay of 24-hours. Any further changes which are to be implemented in this regard should be reviewed in the context of the changes in traffic flows that would be generated through Bondgate Tower, or on surrounding alternative routes.

6.89 The Action Plan set out that a review of fixed direction signage would be required. A review of car park signage would be needed alongside any proposed signage scheme for interventions at the Tower. As examples, signs at the Greenwell Road junction will need to provide better directions to alternative car parks when Greenwell Road hits capacity, including signs to the larger Alnwick Garden car park, given Greenwell Road would see an uplift in demand from either of the more impactful options in this study. Consideration should also be given to the use of fixed and variable message signs to robustly manage traffic in the town and reduce cross-town journeys. Overall, a more widespread review of the parking guidance signage in the town will be required, in conjunction with whichever option is implemented at Bondgate Tower.

Impacts on Businesses

6.90 Further to the above analysis of likely impacts on parking from the proposals, any of the options which involve closure, be it northbound only or complete, will need to consider the impacts on businesses which are located within the town centre, particularly those on Bondgate Within. It is considered that the impacts can likely be significantly mitigated by the provision of a comprehensive signing strategy, which directs visitors (tourists, shoppers, leisure visitors and those on business) to relevant car parks and on-street parking and ensures that there is adequate wayfinding signage from the parking areas to the town centre.

6.91 While by-passing traffic would be reduced through either of the closure options it is likely that this would make Bondgate Within a more pleasant location to walk and cycle and thereby encourage visitors to linger longer within the area, thereby having a positive impact on footfall. This would particularly be the case if the tower were fully closed and able to be developed into a destination in its own right through sympathetic restoration and urban realm treatments.

6.92 Finally, it is noted that both closure options seek to minimise the loss of parking on Bondgate Within, meaning that those drivers who wish/need to park in close proximity to their destinations, including disabled drivers, would still be able to do so.

6.93 Overall, it is considered that each of the options would likely have a neutral impact on businesses, but this would need to be further considered as any options are delivered, and extensive consultation will be required.

Add-On Options

6.94 In addition to the development of the main three options for protecting the tower, several potential add-ons have also been considered. These do not form part of one of the main options as described in the rest of this section but rather would be optional additions that could be considered further at a more detailed design stage and could potentially be mixed-and-matched to provide the most optimal solution for protecting the tower.

6.95 Brief details of each of these add-on options are summarised in the following sections.

Height Detection Technology & Vehicle Activated Signs

6.96 While the option 1 signing proposals aim to provide a comprehensive signing strategy in order to ensure that drivers are aware of the height restrictions at the tower, signage can only go so far to provide protection from vehicle strikes. Some drivers may still ignore signage or miss it if focussing on navigation, congestion, or other distractions. Consideration has therefore been given to ways of targeting overheight vehicles for specific additional signage.

6.97 An option could be the introduction of height detection technology set up to trigger a vehicle activated sign when a vehicle over a certain height is approaching the tower. This technology is increasingly being used to provide additional warning ahead of bridges that have been subject to repeated strikes, where other options such as additional fixed signage have been implemented but have not resolved the issues. An example is Leeman Road railway bridge in York, where this technology was installed by Network Rail, in conjunction with AECOM and City of York Council.

6.98 The solution in York consists of a fixed detector on each approach to the bridge which is set at a height slightly lower than the restriction, and a small sign on a single pole on each approach to the bridge, which is illuminated if the beam from the detector is broken by an overheight vehicle, and displays a message showing the height restriction and the diversion direction. Such a solution would appear to be a good option for Alnwick, in conjunction with either Option 1 or Option 2, and it should be feasible to position the signage and detector in a suitable location to detect and warn vehicles without detracting from the heritage setting. **Figure 16** below shows a screenshot from Google Street View of one of the signs.

Figure 16 – Google Street View Screenshot of Leeman Road Overheight Vehicle VAS, York

6.99 This technology is becoming increasingly commonplace and is able to be supplied relatively off-the-shelf by companies such as Swarco and Coeval. A power supply would be required to each sign location, but in a street-lit urban location this should be relatively straightforward and fairly inexpensive. While the York signage lights up when only overheight vehicles are detected, another option would be to illuminate the sign for every vehicle, but this may dilute the targeted message. Other solutions are potentially available which could combine overheight vehicle signage with speed indication or other messages, but again it may be better to focus on the height messaging.

6.100 It appears that this add-on may be able to provide a good level of benefit in Alnwick and should be given consideration if either Option 1 or 2 are progressed. A high-level budgetary estimation for a two-sign system would be in the region of £20,000 to £30,000. Ongoing maintenance costs of the assets would also need to be considered.

Improved Lighting of the Tower

6.101 It has been noted during the site visits for this project, and flagged up by online discussions regarding the tower, that the current extent to which the tower is lit is probably insufficient, and this may lead to increased risk of the tower being struck during the hours of darkness, with drivers being unaware of, or misjudging, the limited headroom. It has already been noted that the height restriction signage at the tower is unlit, and that this should be rectified, regardless of any other options taken forward. It is likely that the tower itself would also benefit from lighting, particularly under options 1 or 2, where traffic continues to pass through, but also potentially under option 3, to help enhance the place making of the area around the tower.

6.102 In addition to lighting of the signage, external lighting of the tower could also be considered, which should be designed in such a way that it not only highlights the fact that the tower is there, and that the archway through it is of low height, but also helps to enhance the visual presentation of the tower itself. Clearly, placing floodlights on the structure of the tower itself would likely be unacceptable, and any lighting installed needs to be sympathetic to the setting of the town centre, but ensure the tower face and/or archway is well lit to reduce the likelihood on the tower being hit. Potential solutions include uplighting, with floodlights being placed in discrete locations (so as not to impact the daytime view) adjacent to or within the planters on either side of the tower, lighting from adjacent buildings or street furniture, potentially lighting placed within the archway itself e.g. via LED strip lighting which would not further erode the headroom, and which would ensure the archway was particularly highlighted, or a combination of some or all of the above.

6.103 Historic England provide detailed guidance on their website regarding the issues to be considered when designing or installing external lighting, which can be found, here: https://historicengland.org.uk/advice/technical-advice/building-services-engineering/external-lighting-of-historic-buildings/. It is beyond the scope of this report to consider all aspects of the feasibility of installing lighting, however the Historic England guidance, alongside that of heritage specialists and planners should be considered when deciding the viability of lighting of the tower. The guidance makes the very salient point that lighting, and architecture have long been important to each other, and that lighting can augment and elevate the presence of a heritage structure but will also have impacts on neighbouring properties and people, and if done badly can produce unflattering results. From a purely traffic management perspective, it appears that such lighting would be beneficial, and should be given serious consideration.

6.104 A similar example within the UK is the illumination of the Wellington Arch in Hyde Park Corner, London. This is illuminated, as shown in the image below, taken from the Historic England guidance. This is not a directly comparable example, as the arch is not located over a roadway (though it was historically), but the image below in **Figure 17** gives an indication of some of the types of lighting that could be considered.

Figure 17 – Image of Wellington Arch, London, Illuminated at Night (Image Copyright Historic England Archive)

6.105 As noted above, there are many considerations that would need to be taken into account in determining whether lighting the archway is an option that should be taken forward, however it would likely have benefits from the perspective of protecting the tower and should be given careful consideration. Given the wide range of possible solutions, it is not possible at this stage to give an estimation of capital or ongoing maintenance costs.

Physical Height Restriction Measures

6.106 Consideration has been given as to whether physical measures could be installed over the highway in Alnwick in order to physically prevent or strongly dissuade high vehicles from approaching the tower. If a solution for this could be found, it would potentially provide a strong level of protection, without the extreme measure of closing the tower to traffic.

6.107 The usual measures that would be used to protect structures such as low railway bridges over the public highway from traffic, and which are used to, for example, prevent high vehicles from accessing multi-storey car parks, do not appear to be feasible in this case. These solutions, which include “boxing-in” vulnerable elements of the structure using a sacrificial material, PVC piping height restrictions, hanging chains, or high visibility retroreflective “wasp stripe” road markings, are visually unattractive, and very intrusive to the streetscape (for obvious reasons), and therefore are not considered to be suitable for use in the immediate vicinity of the tower, and even less suitable for use attached to the tower itself. They would also likely have an unacceptably negative impact on the wider conservation area if used further afield, and in any case could likely not be used at a greater distance from the tower as they would prevent legitimate use of other parts of the road network by larger vehicles e.g. those servicing local businesses.

6.108 Investigation has therefore been undertaken into the possibility of providing a more decorative archway type structure, more in keeping with the conservation area and vicinity of the tower, which would nonetheless act as a deterrent to large vehicles reaching the tower itself. Examples of decorative archways located over roads in the UK have been located, which vary greatly in scope, design, and price, depending on their size, location, and designer. Several examples of these arches are shown in **Figure 18** below, namely (from left to right) Sunny Bar Gateway, Doncaster, Roman Road Market Arch, London and China Town Archway, Manchester.

Figure 18 – Examples of Decorative Arches over Roadways in the UK (Photos Courtesy Sebastien Boyesen Design and Wikipedia)

6.109 Such an arch, if mounted at a suitable height, could act in a “sacrificial” way if used in Alnwick, in that they should prevent larger vehicles from reaching Bondgate Tower, and if they are struck themselves then have at least prevented the large vehicle from doing the same thing to the tower.

6.110 Considering the close proximity of the Bondgate Without / Greenwell Road / Hotspur Street junction to the south-eastern portal of Bondgate Tower, and the likely need to allow large vehicles to reach as far as this junction, there probably isn’t scope to provide an archway on that side of the tower. There may however be an opportunity to do so on Bondgate Within, on the tower’s north-western approach.

6.111 An archway to be used in Alnwick Town Centre could be designed in such a way that it ties to other elements of the town’s heritage and/or culture e.g. by using plants on the archway to link to Alnwick Gardens.

6.112 While this does present a possibility for helping to protect the tower, it is not considered that it is a particularly strong option. If an arch is to provide a positive contribution to the setting of the tower and the conservation area more generally, it would need to be decorative and sympathetically designed. If it is therefore acting almost as an artwork in and of itself, and with associated high design costs, it is unlikely that it would be acceptable to use in a “sacrificial” way. On the other hand, if it were more plain and easily replaceable it would probably have a negative impact on its wider setting. Finding a suitable location on Bondgate Within where large vehicles could turn around to escape, and which would still allow access for servicing, large emergency vehicles etc. would also likely be highly problematic.

6.113 In addition, the use of an archway in a sacrificial way would introduce additional risks into the urban environment. They would be acting as deliberate obstructions to tall vehicles, and if struck may lead to part of the archway collapsing, potentially injuring members of the public, or leading to secondary collisions with other vehicles. Any such archways would likely be positioned in close proximity to footways and therefore may lead to a higher risk to third parties than current vehicle strikes on Bondgate Tower.

6.114 Overall therefore, it is recommended that this option should only be considered once other higher priority elements have been developed. Given the range of options and unknowns around design fees, it is not possible to provide a cost estimate at this stage.

Kerb Realignment

6.115 The final add-on option that has been considered is a small change to the highway arrangement at either end of the tower. This would amend the kerblines to guide vehicles such that they approach and pass through the tower completely straight, and that the tallest part of the vehicle is underneath the highest part of the archway. This has been incorporated into the Option 2 design, is not relevant for Option 3, but could be installed as an add-on for Option 1, or as a stand-alone scheme.

6.116 This kerb realignment could be installed without any major changes to the operation of the rest of the road layout. It would likely only have a very minor impact on the risk of collisions with the tower, but nonetheless should be considered, especially if one of the more major physical layout changes is not taken forward. A high-level costing exercise has been undertaken to determine an approximate cost for this add-on option, which has resulted in estimated works costs of approximately £22,000, for a total cost, including all fees and contingencies (which could be potentially be reduced by combining with other options) of around £52,000.

7. Option Assessment

Option Assessment Methodology

7.1 Following the production of the various improvement options, as set out in Section 6, an exercise has been undertaken to assess the three main options against a series of criteria that were considered to be the most important elements in determining the suitability of a scheme. These were determined via discussion between representatives from AECOM's Streets (Traffic Engineering), Heritage and Transport Planning teams, to try to ensure that they were sufficiently broad to reflect the wider impacts of each option, not just the traffic impacts.

7.2 Following these discussions, nine criteria were selected, and were taken forward for the scoring exercise as described in later sections. The criteria increased from those included in the Option Development & Sifting Technical Note in **Appendix A**, with two additional areas. The nine criteria are as followed:

- Effectiveness of Protecting the Tower from Vehicle Strikes;
- Impacts on Traffic Flows on Alternative Routes;
- Impacts on Road Safety;
- Buildability;
- Scheme Cost;
- Aesthetic Impact to Tower and Wider Conservation Area;
- Opportunity for Urban Realm Improvements;
- Public Perception; and,
- Impact on Non-Motorised Users (NMUs) i.e. pedestrians, cyclists, and horse riders.

7.3 These criteria have been selected to try to cover the major impacts of the proposals as fully as possible, but it is not possible to select criteria that cover absolutely every possible outcome. They are however considered to be a representative selection and have been shared and agreed with NCC.

7.4 Following selection of the criteria, it was determined that the most appropriate methodology for appraising the options and moving towards a point where recommendations could be made was to undertake a scoring exercise, whereby each option would be independently scored by a selection of AECOM team members, in order to obtain a ranking between the three main options. This would allow the objective information available to be incorporated into the process.

7.5 While all of the criteria included are important when considering the acceptability of, and preference between, the options, there are clearly some which are of greater standing than others, and which are likely to hold more sway in determining which is the preferred approach. A level of importance was therefore discussed and agreed for each of the nine criteria, whereby those which were identified as the key areas for consideration within the brief for this project (e.g. effectiveness at protecting the tower) and those that are otherwise very important (e.g. road safety) were given a "High" importance rating. In contrast, those which were not identified as being key objectives of the project (e.g. opportunity for urban realm improvements) were given a "Low" importance rating. Everything else was rated as "Medium".

7.6 **Table 6** below lists the importance that was applied to the criteria.

Table 6 – Importance Ratings of Option Scoring Criteria

Scoring Criteria	Importance Rating
A. Effectiveness of Protecting the Tower from Vehicle Strikes	High
B. Impacts on Traffic Flows on Alternative Routes	Medium
C. Impacts on Road Safety	High
D. Buildability	Low
E. Scheme Cost	Low
F. Aesthetic Impact to Tower and Wider Conservation Area	Medium
G. Opportunity for Urban Realm Improvements	Low
H. Public Perception	Medium
I. Impact on NMUs	Medium

7.7 Each of the criteria was then scored against a scoring system that was devised in order to provide guidance to the individual scorers, but still allow for the varied elements that were being scored. As advised by project team members with significant experience of option scoring, the possible scores were limited as far as possible, and no negative scoring was used, with 0 representing an option that would have a negative impact on the individual criterion or be detrimental to the wider scheme objectives. **Table 7** below contains this scoring system.

Table 7 – Scoring System for Option Assessment

Score	Impact of Option on Criteria/Contribution to Scheme Objectives
0	Negative Impact/Detrimental to Scheme Objectives
1	Neutral Impact/No Contribution to Scheme Objectives
2	Slightly Positive Impact/Some Contribution to Scheme Objectives
3	Strongly Positive Impact/Good Contribution to Scheme Objectives

7.8 Each option was scored against the nine criteria by five members of the project team, independently of each other. There was a fairly good level of agreement between the scores for a number of the criteria, whereas a small number had a larger range. Following the individual scoring, key project team members discussed and agreed a final score for each of the options against each of the criteria. This then provided the final option scoring, which is discussed later in this section.

7.9 Given the criteria being assessed, and the wide variety of options and impacts, there is clearly a level of subjectivity attached to the methodology being used to compare the three schemes. It is however considered to be the best approach at this stage of option development and is sufficiently rigorous to allow conclusions and recommendations to be drawn.

Option Assessment Criteria

7.10 Further detail regarding the criteria, and the elements that were considered within their scoring is provided in the below sub-paragraphs:

7.10.1 **Effectiveness of Protecting the Tower from Vehicle Strikes:** This criterion considers the extent to which large vehicles would be prevented from striking the tower by the option being scored, with the higher scores associated with better levels of protection. Options that physically prevent large vehicles from approaching the tower would therefore score higher than the signage only approach.

7.10.2 **Impacts of Traffic Flows on Alternative Routes:** This criterion is designed to reflect the fact that large numbers of vehicles diverting away from the tower onto alternative routes would have a negative impact on those that live along those routes, congestion, and the junctions along and at the end of each route. The rerouting traffic is considered a negative, and therefore the highest rerouting would lead to the lowest scores.

7.10.3 **Impacts on Road Safety:** This criterion was used to capture the fact that displacing large volumes of traffic on other parts of the network could lead to collision or other road safety problems elsewhere. Larger redirected flows therefore led towards lower scores. It must be noted that the collision data currently points towards there being no significant road safety problems in Alnwick, therefore it was considered through the option development that none of the redirection would exacerbate any existing safety issues, but may lead to new unforeseen problems, which would need mitigating.

7.10.4 **Buildability:** This criterion aimed to capture the ease with which each option could be constructed, with significant civil engineering works leading to more difficult construction, and therefore a slightly lower score.

7.10.5 **Scheme Cost:** This was drawn directly from the cost estimates as set out in Section 6, and the options were ranked accordingly, with the cheapest scoring 3, and the most expensive 1.

7.10.6 **Aesthetic Impact to Tower and Wider Conservation Area:** This criterion sought to capture the extent to which each option would have an impact on the visual presentation and setting of Bondgate Tower, which is clearly of importance given the tower's status as a scheduled monument and listed building. The options that would have the most positive impact on the appearance and setting (i.e. by removing vehicles from the tower) scored highest.

7.10.7 **Opportunity for Urban Realm Improvements:** This criterion aimed to reflect which option would have the potential to be supplemented, and contribute towards, wider urban realm improvements in the vicinity of the tower. Options that would allow the greatest opportunity for wider improvements would score highest.

7.10.8 **Public Perception:** This criterion sought to consider the very important but tricky topic of how each of the options would be welcomed or otherwise by the wider public. The scoring for this element aimed to consider how the option would be perceived by local residents (including those on the alternative routes), local businesses and visitors. It was considered that, overall, the options that have the greater impact would be slightly more positively received and receive slightly higher scores.

7.10.9 **Impact on NMUs:** Finally, this criterion considered how each option would impact (both positively and negatively) on pedestrians, cyclists, and horse-riders. Overall, it was considered that the most impactful option, which would reduce through motorised traffic in the busy area north of the tower, would have the most positive impact on NMUs and therefore receive the highest score.

Option Assessment Scores

7.11 Following the methodology set out above, each option was scored individually, then final scores for each criterion were agreed. **Table 8** sets out these scores, which at this stage are unweighted.

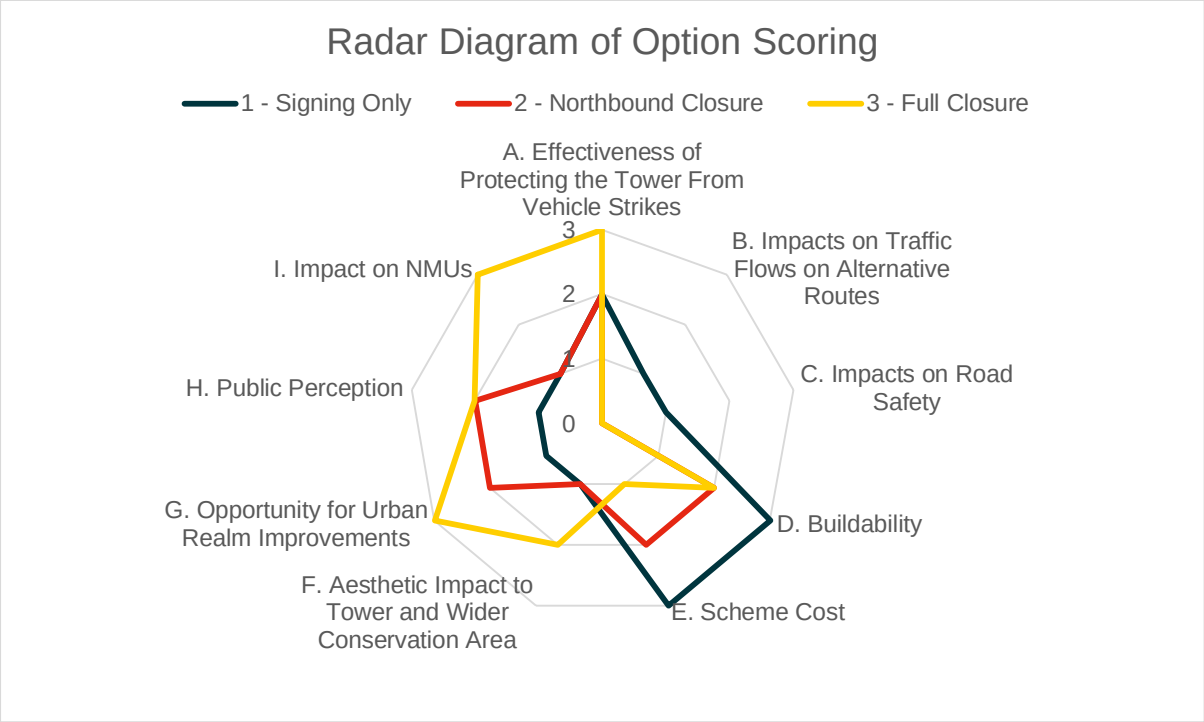
Table 8 – Initial Unweighted Agreed Option Scores

Scoring Criteria	Scheme Option		
	1 - Signing Only	2 - Northbound Closure	3 - Full Closure
	Agreed Score	Agreed Score	Agreed Score
A. Effectiveness of Protecting the Tower from Vehicle Strikes	2	2	3
B. Impacts on Traffic Flows on Alternative Routes	1	0	0
C. Impacts on Road Safety	1	0	0
D. Buildability	3	2	2
E. Scheme Cost	3	2	1
F. Aesthetic Impact to Tower and Wider Conservation Area	1	1	2
G. Opportunity for Urban Realm Improvements	1	2	3
H. Public Perception	1	2	2
I. Impact on NMUs	1	1	3
Total	14	12	16

7.12 As can be seen from the table, this scoring showed that the preferred option across all of the criteria would be the full closure to traffic, with the signing only option being the second choice, and the Northbound only closure being the least favoured. It must however be noted that there were only small gaps between the total scores.

7.13 **Figure 19** below shows a “radar diagram” which seeks to demonstrate at a glance how well each option scored against each criterion, when compared to the other two. The further the line is from the centre of the diagram for each criterion, the higher the option scored.

Figure 19 – Radar Diagram of Option Scoring



7.14 Each option has areas where they have scored highly, and others where they were weaker than the alternatives. In general, the closure options scored higher on the effectiveness of protecting the tower, the public perception, and aesthetic impacts, while the signing only option scored higher for buildability and costs. Conversely, the closure options score poorly for their impacts on the alternative routes and road safety, while the signing option has no scores of 0, but lots of neutral scores.

7.15 The importance scoring of each criterion was then applied to the scores, implemented by applying a multiplication weighting to each score, as follows:

- "High" importance = 2 x criteria score;
- "Medium" importance = 1 x criteria score; and,
- "Low" importance = 0.5 x criteria score.

7.16 Once these multipliers were applied to the criteria scores, final scores for each option were achieved, as per **Table 9** below.

Table 9 – Final Weighted Agreed Option Scores

Scoring Criteria	Scheme Option		
	1 - Signing Only	2 - Northbound Closure	3 - Full Closure
	Agreed Weighted Score	Agreed Weighted Score	Agreed Weighted Score
A. Effectiveness of Protecting the Tower from Vehicle Strikes	4	4	6
B. Impacts on Traffic Flows on Alternative Routes	1	0	0
C. Impacts on Road Safety	2	0	0
D. Buildability	1.5	1	1
E. Scheme Cost	1.5	1	0.5
F. Aesthetic Impact to Tower and Wider Conservation Area	1	1	2
G. Opportunity for Urban Realm Improvements	0.5	1	1.5
H. Public Perception	1	2	2
I. Impact on NMUs	1	1	3
Total	13.5	11	16

7.17 Following this exercise, it was therefore concluded that, as with the unweighted scores, the preferred option came out as the full closure design (Option 3), with the signing only (Option 1) being second, and the northbound closure design (Option 2) being third. The key criteria that swung the scoring in favour of the full closure were its effectiveness at protecting the tower (being the only option that fully prevents large vehicles from striking it) and the impact on NMUs, with the full closure allowing a step-change in pedestrian provision in the immediate vicinity of the tower, and potentially in the wider town centre.

7.18 Clearly, very careful consideration would need to be given as to whether this option is ultimately taken forward, given the negative impacts it would have on the alternative routes, and the risks that it would have a negative road safety impact (due to traffic diverting through other junctions).

7.19 The signing only option is a fairly close second place and may be considered to be a good interim or compromise solution, if a closure was unable to be taken forward. It does not have any top scores on high or medium importance criteria, but on the other hand it has no negative impact (0) scores either.

7.20 The northbound only closure effectively suffers from being a middle ground between the other two options, as it has the negative impacts of the full closure, but without the positives, since it would lead to significant redirection but not physically prevent large vehicles from striking the tower.

7.21 It must once again be noted that this scoring exercise is subjective and cannot take into account all possible impacts of all of the options. It is considered to be a useful tool to help determine the conclusions and recommendations for this study, but further appraisal would be required prior to any scheme being fully designed and implemented.

8. Conclusions & Recommendations

8.1 This section will summarise the key findings from the study, together with the options recommended to be taken forward for further consideration.

Key Findings

8.2 Traffic flows show the road route through the tower is very well-used, with the northbound and southbound flows through the Tower appearing as the dominant movements at the junction to the south, according to the traffic flow data collected. Diverting traffic away from the Tower portal would therefore result in a significant number of vehicles requiring their routes to be altered on both the south and north approaches, and therefore have wide-ranging impacts across the town.

8.3 In the busiest peak hour observed via the November 2021 traffic counts (Saturday lunchtime), over 850 vehicles passed through the tower in the hour. It has been determined that in the busiest Summer months, traffic levels are approximately 8% higher on average, so a busy Summer Saturday could see over 900, possibly approaching 1,000 vehicles passing through.

8.4 The existing signage provision warning drivers of the height restriction at the tower has room for improvement, with low penetration to drivers of advanced warnings of the hazard likely acting as a primary factor in the collisions and resultant damage to the tower's arch. Improvements to signage are predicted to have a cost-effective, positive result in reducing the occurrences of such incidents. Whether or not any additional options are taken forward at the tower, it is strongly recommended that the existing signage be improved, preferably by implementing a mandatory height restriction, ensuring terminal signs are correctly lit where required, and providing robust advance signage. Any gaps where vehicles can reach the tower without passing an advanced warning sign should also be rectified.

8.5 The collision record was not suggestive of any specific causality that may relate to the issue of vehicle strikes at the Tower. A stronger than average showing of incidents involving pedestrian injury may suggest that pedestrian safety should be a key concern when considering any redirection of traffic through primarily residential streets, however. Overall, there does not appear to be any specific collision problem in Alnwick town centre.

8.6 It would be useful, regardless of the option selected, for parking guidance signage throughout the town to be reviewed, and updated where required, to encourage the use of car parks on the same side of the town centre that traffic is approaching from. This would reduce the requirement for vehicular traffic to pass through the tower and reduce the impact of any redirection resulting from one of the closure options being taken forward.

8.7 There are very limited opportunities for updated signage on the wider National Highways/NCC network to try to reduce through traffic using Alnwick town centre. There are very few if any alternative diversion routes of sufficient quality to allow for more strategic diversion of traffic. Improvement options have therefore been focussed on Alnwick itself.

8.8 A subjective assessment of the current walking routes in Alnwick among the project team suggested that it is currently less attractive for walking than other market towns in Northumberland e.g. Morpeth and Hexham, and Alnwick has a higher proportion of collisions involving these road users than the national average. Some of the more impactful options for Bondgate Tower may help to unlock the opportunity for wider improvements to the urban realm and to reclaim footways more widely. Currently Bondgate Within and Market Street feel dominated by motor traffic, both moving and parked which will dissuade some potential pedestrians and cyclists from walking and cycling and encourage car usage. Measures to reduce intra-town journeys may have a significant impact on the acceptability of the more impactful proposals at the tower itself.

8.9 There are clear possibilities for making highway network changes in order to mitigate against vehicle strikes on the tower. The impacts that would provide the strongest protection would however have the most significant impacts on traffic redirection and would need careful further consideration. Options related to the closure of the tower to traffic (either in one direction or completely) would require significant mitigation to be implemented.

Option Summary & Assessment Conclusions

8.10 A range of options were considered, as set out in Section 6, with three options developed further and analysed in detail.

8.11 A comprehensive signage improvement scheme was put forward as the low-cost option and is likely to provide a positive contribution towards reducing rates of vehicle strikes at the Tower. Recommendations centre on ensuring signage is provided along every possible approach, located such that motorists are given ample opportunity and information to divert in time, and arranged such that it does not negatively interact with adjacent signage so as to cause information overload to a driver.

8.12 The second option is a partial closure of the tower to traffic, with northbound vehicles being diverted, and the tower becoming southbound only. This option would likely reduce driver workload and confusion at the tower and should result in a reduction in strikes on the tower, when combined with signage improvements. It would however result in significant traffic flow diversions, albeit the northbound direction is currently the quieter one using the tower.

8.13 The final option is a full closure of the tower to traffic, with all vehicles being diverted, and the tower becoming pedestrianised. This option should fully remove the risk of vehicle strikes to the tower and provides the best opportunity for heritage enhancements and wider improvements to the immediate area to be realised. It would however lead to significant traffic redirection, and large-scale impacts across the town's highway network. Impacts on residents and businesses would need to be carefully considered.

8.14 Following an option assessment and scoring process being undertaken, as described in Section 7, the following key conclusions have been reached:

- The preferred option overall is the full closure of the tower to traffic. This scored highest within the appraisal exercise and best meets the key objectives of this project i.e. the protection of the tower from further vehicle strikes. It would however have a very significant impact on traffic redirection, and on the wider use of the highway network in the town. This option would provide a step-change to the character and use of Alnwick town centre.
- The signing only option scored second in the option appraisal process. It does not provide the same level of protection to the tower as the full closure, but if done well should reduce the risk of strikes to the tower, without leading to widespread redirection and wider impacts. This may well provide a sensible compromise approach if the full closure cannot be implemented or be a useful "stop-gap" scheme in the interim before a more extensive intervention.
- The northbound closure was the lowest scored option based on the criteria applied. It suffers in comparison to the other two as it does not provide the same level of protection to the tower as a full closure, and still leads to widespread redirection and large-scale impacts in the town. This option therefore appears to be the least worthy of further study, albeit the scoring was fairly close.

8.15 Other add-on options have also been considered, and of these, some appear to be worthy of further consideration.

- If a signing only option, or northbound only closure is to be taken forward, consideration should be given to the implementation of height-detection technology, along with Vehicle Activated Signs, to bolster the information provided by the standard signs.
- Improved lighting of the tower should also be carefully considered, in discussion with heritage professionals, the Northumberland Estates and Historic England.
- Kerb realignment to ensure vehicles pass through the tower centrally has been incorporated into the Option 2 design, it could also be considered as an add-on to the signing improvements, or as a stand-alone scheme.
- The use of physical height restriction measures appears to come with some very impactful problems, and therefore would only be suitable for further consideration after other interventions have been developed in preference.

Recommendations

8.16 Following a full assessment of the baseline data, and the options for improvement, the following recommendations are made to NCC, for discussion and implementation in conjunction with Northumberland Estates, and other parties as required:

- The traffic signage associated with the height restriction at the tower should be improved. Preferably this should be achieved by the implementation of the full signing scheme set out in Option 1. If this full scheme is unachievable, the slightly smaller scheme set out in Section 5, or more minor improvements focussed on the key aspects as set out in Paragraph 8.4 should be implemented.
- Detailed design of the signing improvements should be commenced as soon as possible. It is understood that the signing improvements set out could be implemented without the requirement for traffic regulation orders or public consultation, however some engagement with key stakeholders and heritage specialists would be useful, especially with regard to the siting of signs.
- Option 3, for the full closure of the tower, should be taken forward for further consideration. This should include more detailed design work on the proposed road layout, and development of detailed traffic models to be able to fully understand the impacts of this option.
- Following the development of the above modelling, design work should be undertaken regarding any mitigation that would be required on the alternative routes, to try to manage the impacts on capacity, and mitigate against any negative road safety impacts.
- Further study should also be undertaken to understand the impacts of the closure option on car parking, residents and businesses, and consultation should be undertaken with affected residents and stakeholders prior to the option being taken forward to detailed design. This should be in addition to any statutory consultation that would be required at a later stage.
- Option 2 (the northbound closure) appears to provide the fewest benefits, and it is recommended that this option be de-prioritised for further consideration at this stage, compared to the signage only and full closure proposals. If further development work determines that the full closure is not feasible, the northbound only closure may provide a fall-back with more limited benefits and reduced negative impacts.
- Further consideration should be given to the proposals to use height detection technology with vehicle activated signs alongside any scheme that does not result in full closure of the tower.
- All parties should liaise to review the options for improved lighting of the tower, particularly if it is to remain open to traffic. There is currently no evidence of a major problem with vehicle strikes taking place at night, but improved lighting would reduce this risk. Any improved lighting should be designed in accordance with Historic England's guidance, and support from heritage specialists.
- Where possible, the kerblines on each approach to the tower should be realigned, to ensure vehicles pass centrally through the arch. This should be subject to more detailed design if one of the larger-scale options (2 or 3) are not going to be taken forward and could provide a useful interim intervention.
- Further consideration of physical height restriction measures should be de-prioritised compared to the other proposals set out.
- In order to fully recognise the benefits of any improvement scheme at the tower, a full review of signage to car parking in the town should be undertaken, to minimise cross-town car journeys, and reduce the impacts of any redirection.
- A review should be undertaken regarding the current levels of pedestrian and cycle provision in the town, aimed at improving facilities, treating the higher proportion of collisions involving these road users, reducing reliance on cars, and mitigating the impacts from any redirection.
- A review of existing signage within the main shopping area of the town centre should be carried out, aimed at reducing street clutter and improving the pedestrian experience.

Appendix A – Option Development & Sifting Technical Note

Alnwick Bondgate Tower – Summary of Options Workshop and Sifting

Date
03/12/2021

Revision History

Revision	Revision date	Details	Authorised	Name	Position
P01	03/12/2021	FIRST ISSUE	JS	James Smith	Principal Engineer

Summary of Discussions Held

A list of potential options for traffic management schemes in the vicinity of Bondgate tower, Alnwick, were shared with internal colleagues on Wednesday 24/11/21.

An internal Options Workshop was held on the morning of Thursday 25/11/21, with representatives from the AECOM Streets and Transport Planning teams.

James Smith (JS – AECOM Project Manager) had a call with Garry Dawson (GD – AECOM Lead Verifier) on the afternoon of Thursday 25/11/21, to summarise the outcomes of the workshop, and seek agreement of the options to be presented to NCC and taken forward for assessment.

A further call was held between JS and Gillian Scott (GS – AECOM Heritage Team) on the morning of Monday 29/11/21, to summarise the outcomes of the workshop (as GS was unable to attend), seek Heritage support for the options to be presented, and gain any further comments from a Heritage perspective.

This document seeks to set out the outcomes of these discussions in summary detail, to support further work on the project, and the discussions between AECOM and Northumberland County Council (NCC).

Work Undertaken to Date

Prior to the options workshop, site visits had been undertaken to review the existing situation around the tower, existing signage in and around Alnwick, and the suitability of alternative routes for traffic avoiding the tower. Analysis of personal injury collision data received from NCC had also taken place. Finally, an assessment of the existing traffic signage for the height restriction and diversion routes had been undertaken, and a draft technical note setting out this assessment and high-level proposals for improving the signage had been created. Since the workshop, traffic survey data has been received and analysis is ongoing.

Option Proposals

The “Alnwick Bondgate Tower: Initial Options for Discussion” document attached in Appendix A was created ahead of the workshop and circulated to all invitees. This document was used to provide structure for the Options Workshop. In summary, the options contained in the proposal were as follows:

- Option 1 – Do Nothing;
- Option 2 – Small Scale Signing Scheme;
- Option 3 – Larger Scale Redirection Signing Scheme;
- Option 4 – Close Bondgate Tower to Traffic in One Direction;
- Option 5 – “Soft Closure” Using Rise-Fall Bollards or Similar;
- Option 6 – Full Closure of Bondgate Tower to Traffic/Motor Vehicles;

- Additional/Add-On Option A – Signalise Junction to South of Tower & Shuttle Working; and,
- Additional/Add-On Option B – Use Physical Measures to Prevent Vehicle Strikes e.g. “sacrificial” arches.

During the course of the workshop and subsequent discussions, three further options were also put forward and discussed, as follows:

- Use of Height Detection Technology and Variable Message Signs to Reinforce Restriction Signage;
- Improve the lighting of the tower, in order to increase visibility of the height limit during the hours of darkness; and,
- Realign Kerbs on Approach to Arch, to Channel Traffic towards Centre of Arch.

Option Discussions / Sifting

A summary of the discussions around each option us contained in the following table:

Option	Option Commentary	Option to be Taken forward for Appraisal?
Option 1: Do Nothing	It was considered that doing nothing was probably not an option, given the existing problems with vehicle strikes on the arch. This was especially the case as shortcomings with the existing signage had been identified, and simple small-scale improvements would provide a benefit compared to leaving the status quo.	No
Option 2: Small Scale Signing Scheme	The workshop quickly concluded that, given the assessment of existing signage showed that there are shortcomings with the existing traffic signage, it appeared very sensible that one of the options to be assessed should be a signing scheme. It was felt that the best approach would be to look at combining options 2 and 3 into one signing scheme. This was concluded as simply improving the height warning signage without any other changes would miss opportunities to improve usage of the alternative routes and investigating opportunities for reducing through-traffic usage of the Tower and Bondgate Within. It was suggested that a signing option could be a "quick win" while a more permanent larger-scale solution is developed and considered. It was also suggested that reviewing and amending the signage could be combined with a more general look at rationalising traffic signing within the central area of Alnwick, to provide improvements from an amenity perspective, and tying in with national drives to "declutter" streets.	Options 2 and 3 combined into one signing option to be taken forward.
Option 3: Larger Scale Redirection Signing Scheme	As per Option 2 above, it was decided that one of the options for investigation should be a signage proposal, combining elements of Options 2 and 3. Assessment undertaken to date suggests that there would be limited viability or utility in amending the wider signage beyond Alnwick e.g. on the A1, given the lack of strategic diversion routes, therefore the signing option would focus more on signage within Alnwick itself.	
Option 4: One-Direction Closure to Traffic	This was assessed to be a sensible "middle option" in between a full closure and a signing-only approach, which may be more acceptable to NCC, residents and businesses in Alnwick, and may form a sensible balance between protecting the tower and limiting the impact on traffic flows. If the tower is to be closed in one direction, it was recommended that the preference be to close it to northbound traffic, as this approach has an easier "escape" from the area (via Hotspur Street) than southbound traffic. This closure would also help with maintaining free-flowing traffic on Bondgate Within, potentially leading to Air Quality benefits, and provide a better opportunity for place-making than a southbound closure. The impacts of additional traffic on the diversion routes, and on access to parking would however need to be considered. It was suggested that as part of a one-direction northbound closure through the tower, there could be an opportunity for the priorities of the junction to the south of the tower to be rearranged, in order to improve visibility of southbound traffic from Hotspur Street. From a Heritage perspective, it was felt that a northbound closure would be better, which still provides visitors with the experience of driving up towards the tower and appreciating it in its setting, before being diverted away. It was also felt that this option would help improve the experience of the Conservation Area more generally, and that improving the amenity "in front" i.e. to the southeast more decorative face of the tower would be a heritage "win".	Yes

Option	Option Commentary	Option to be Taken forward for Appraisal?
	It was noted that collisions with the tower appear to have been caused by vehicles travelling in both directions, and there is not currently evidence showing that one direction is more problematic than the other from the perspective of protecting the tower.	
Option 5: "Soft Closure"	This option was discounted following discussion, as being too difficult to implement, and that there were better/simpler options to achieve the same goals. This approach would probably not be conducive to a good heritage setting of the tower, with unsightly equipment in close proximity to the tower. This approach may also not be understandable to visitors, and it is understood that such restrictions have proved controversial when implemented elsewhere.	No
Option 6: Full Closure of Tower to Traffic/Motor Vehicles	This option is proposed to be analysed as the largest scale/most expensive/most disruptive option. This option would provide the best level of protection to the tower and should prevent further vehicle strikes. It would however be the most disruptive to traffic within the town and would lead to significant redirection onto the diversion routes. The impacts of the proposed closure would need to be assessed in the context of the amount of traffic displaced, and therefore look at the disbenefits to the diversion routes as well as the benefits to the Tower. This is also the case for Option 4, but to a lesser extent. There would also be impacts on the access to parking within the town centre, and for deliveries to businesses. A full closure of the tower would provide significant scope for wider urban realm benefits within the immediate vicinity of the tower, and also possibly in the town centre more broadly. From a heritage perspective, the full closure of the tower would definitely be the best option for protecting the structure and gives the greatest opportunity for wider urban realm improvements. There may be some loss of visitor experience from not being able to drive through the tower, however this may allow pedestrians to gain access and get the experience that drivers/vehicle passengers currently get.	Yes
Additional Option A: Signalisation	The option of signalising the shuttle running and junction to the south of the tower was discounted as it would likely not provide the benefits for protection of the tower and would lead to an obtrusive visual impact on the tower. From a heritage perspective this option would cause significant concerns. The benefits are unlikely to outweigh the disbenefits.	No
Additional Option B: Physical Protection Measures e.g. "Sacrificial Arches"	The idea of using physical arches to protect the tower would need further thought, as anything cheap enough to be sacrificial would probably not fit the heritage context of the tower, while something more decorative would probably be too expensive to be sacrificial. The arches may be particularly problematic for northbound traffic seeking to access Hotspur Street/Greenwell Road. There is however the option of linking arches to the Alnwick Gardens e.g. through use of vegetation on the arches. This will not be considered as a stand-alone option but could be considered as a potential add-on to either the signing or one-direction closure scheme, however a technological solution would probably be preferred.	To be considered as "add-on" option to signing or one-direction closure.
Additional Suggestion i.: Height Detection Technology	During the workshop it was noted that an option implemented elsewhere has been to use height detection technology (laser/microwave detectors) to detect overheight vehicles and flash up a warning on a Variable Message/Vehicle Activated Sign e.g. Leeman Road railway bridge, York. These signs can be small and unobtrusive when unlit but eye-catching for drivers when activated. There appear to be opportunities to use such signage on the wider approaches to the tower (i.e. not at the restrictions themselves) as advance warning of the need to divert. This will not be considered as a stand-alone option but could be considered as a potential add-on to either the signing or one-direction closure scheme.	To be considered as "add-on" option to signing or one-direction closure.

Option	Option Commentary	Option to be Taken forward for Appraisal?
Additional Suggestion ii: Improve Lighting of Tower	It has been suggested that improved lighting of the tower archway itself could help draw attention to the height restriction, particularly during the hours of darkness. The type of lighting to be used would need to be sympathetic to the setting but could consist of uplighting of the tower face/lighting within the arch itself, in order to improve the visual impact of the tower as well as protect from impacts. This will not be considered as a stand-alone option but could be considered as a potential add-on to either the signing or one-direction closure scheme.	To be considered as “add-on” option to signing or one-direction closure.
Additional Suggestion iii.: Kerb Realignment	It was suggested that realigning the kerblines and increasing kerb height on the immediate approach(es) to the tower may help guide higher vehicles towards the tallest part of the arch and protect against strikes to the lower parts of the arch. There appear to be potential benefits to this approach for relatively low cost, therefore while this will not be considered as a stand-alone option but could be considered as a potential add-on to the signing scheme or incorporated into the one-direction closure scheme.	To be considered as “add-on” option to signing or incorporated into the one-direction closure.

Criteria for Option Assessment

Following selection of the proposed options for assessment, a discussion took place seeking to clarify some of the ways that the options could be assessed. The final methodology will be confirmed as part of the next stage of work; however some key elements are considered to be:

- An assessment of the traffic impacts of each proposal will need to be undertaken, in order to quantify the approximate level of impact from redirection of traffic onto alternative routes. This will also be considered alongside road safety aspect, through looking at any existing collision patterns at junctions and on links which will see increased traffic flows.
- The methodology of presenting the results of the assessments and a comparison of the proposals was discussed, and it was noted that the use of "Spider Diagrams" as a visual representation has been successful elsewhere and could be employed here. This approach will be taken forward.
- The criteria for option assessment were also discussed, and it was agreed that the following would need to form part of the overall assessment, though there may also be others which will be added as part of the work:
  - Effectiveness of Protecting the Tower from further Vehicle Strikes;
  - Impacts on Traffic Flows;
  - Impacts on Road Safety;
  - Deliverability;
  - Cost;
  - Aesthetic Impact; and,
  - Opportunities for Wider Urban Realm Improvements.
- It was also suggested, and agreed, that simple annotated plans summarising the impacts of each option will probably be useful deliverables, alongside any more detailed plans or visuals produced.

Other Discussions

It was noted during the meeting that Alnwick is currently less attractive for walking than other market towns in Northumberland e.g. Morpeth and Hexham, and that some of the bigger proposals may help to unlock the opportunity for wider improvements to the urban realm and to reclaim footways more widely. Currently Bondgate Within and Market Street feel dominated by motor traffic, both moving and parked.

The double stagger junction near the Tenantry Column, War Memorial and Barter Books was also highlighted as a problematic junction for pedestrian movements. Again, improvements in the vicinity of Bondgate Tower could potentially be used as a catalyst for wider pedestrian improvements in future.

The focus of this study will remain on Bondgate Tower and the need for improvements in the immediate area.

A further discussion has also subsequently taken place between JS and a colleague who was involved in implementing the height detection technology and associated signage in York, and an improved understanding of the potential of this opportunity has therefore been gained, as represented in the options table above.

Conclusions/Recommendations

The three options which are recommended for further analysis as part of this study are as per the below:

- A signing scheme to improve signage of the height restriction, encourage traffic to use the diversion routes and potentially rationalise signing to improve amenity;
- A closure of the tower to traffic in one direction, most probably northbound, supported by signage improvements and junction changes as required, enabling some urban realm improvements;
- A full closure of the tower to traffic, with rerouting onto alternative routes within the town, supported by signage improvements and junction changes as required, and enabling urban realm improvements.

In addition to the three main options, four "add-ons" could be bolted on as required, namely:

- “Sacrificial Arches” to physically deter overheight vehicles from approaching the tower;
- Height detection technology and vehicle actuated/variable message signs;
- Improved lighting of the tower;
- Kerb realignment on the vehicular approaches.

It is recommended that NCC review these proposed options and, if happy, agree to AECOM continuing to develop them in more detail and undertake assessment and comparison of the proposals.

Appendix A: Alnwick Bondgate Tower: Initial Options for Discussion

1. Do Nothing

- Probably not an option, given existing problems with vehicle strikes on arches, and identification of potential quick wins on signing.

2. Small Scale Signing Scheme

- Implement a small-scale scheme to "beef up" existing height warning signage and/or convert to mandatory height restriction, as per signing technical note being produced at this point.

3. Larger Scale Redirection Signing Scheme

- Comprehensive programme of re-signing within town centre, leaving Bondgate Arch open to traffic in both directions, but not signed as a main route – potentially just signed as access to parking.
- Sign cross-town traffic via Prudhoe St/Lisburn St and/or Hotspur Street/Green Batt diversion routes. Need to make assessment/decision whether these are appropriate.
- Possible need for wider signage on NH/NCC network so Alnwick isn't a through route wherever possible, but lack of alternate routes.

4. Close Bondgate Tower to Traffic in One Direction

- Close the tower to traffic in one direction (probably northbound), will still have traffic travelling through in one direction, but removing the "distraction" of the shuttle may encourage better driver behaviour and better compliance with height restriction.
- Preference probably to close northbound, as there is a clear escape route via Hotspur Street, and probably easier to sign, whereas southbound has no clear escape. Also may help simplify junction to south of tower.
- Would also require Option 3 to be implemented, with strategic rerouting as appropriate.
- Adds pressure to diversion routes/alternate, but opportunity to sign more deliberately with route through tower closed.

5. "Soft Closure"

- Use of rise-fall bollards or similar to only allow vehicles of below max height to pass through tower via "white-listing" or height detecting system.
- Allows access for suitable vehicles and physically prevents vehicle strikes.
- Problematic due to potentially unsightly equipment in close proximity to tower.
- May not be understandable to visitor.
- If large/non-white listed vehicles reach tower, then needing to divert may lead to traffic management issues and congestion – need to have escape routes.
- Would also require Option 3 to be implemented, with strategic rerouting as appropriate.

6. Full Closure of Bondgate Tower to Traffic / Motor Vehicles

- Removes risk of tower being struck by vehicles, but disruptive to traffic possibly to businesses and puts much pressure on diversion routes. Tower provides strong visual gateway to town centre, and driving through may be seen as part of visit, so closure may have negative impact on this.
- Would also require Option 3 to be implemented, with strategic rerouting as appropriate.
- Need to consider “escape” from Bondgate Within, especially for deliveries.
- Impacts on parking demand, and attractiveness for visitors needs to be considered. Ease of parking in town centre via direct route is probably attractive.
- Could still allow access for cycles, would need to consider impact on junction to south of tower.
- Creates opportunities for wider pedestrianisation and urban realm connected to closure – with associated benefits to town centre.

Additional Options / Potential Add-Ons

Signalise Junction South of Tower & Shuttle Working

- May help with control of traffic and enable greater appreciation of height restriction.
- Visually intrusive in close proximity to tower.
- Possibly not cost effective.

Use Physical Measures to Prevent Vehicle Strikes

- Height restricting barriers/arches at distance from tower that will enable vehicles to escape and/or be “sacrificial”.
- Would act as robust deterrent, but also potentially moves disruption to site of barriers.
- If cheap, would not fit in with heritage setting, if expensive would not want to be struck.
- Assuming nothing visually intrusive could be installed in close proximity of tower, which heavily restricts options.

Appendix B – Option 1 (Signing Scheme) Sketches

Project Management Initials: Designer: HA Checked: JDS Approved: GD ISO A1 594mm x 841mm

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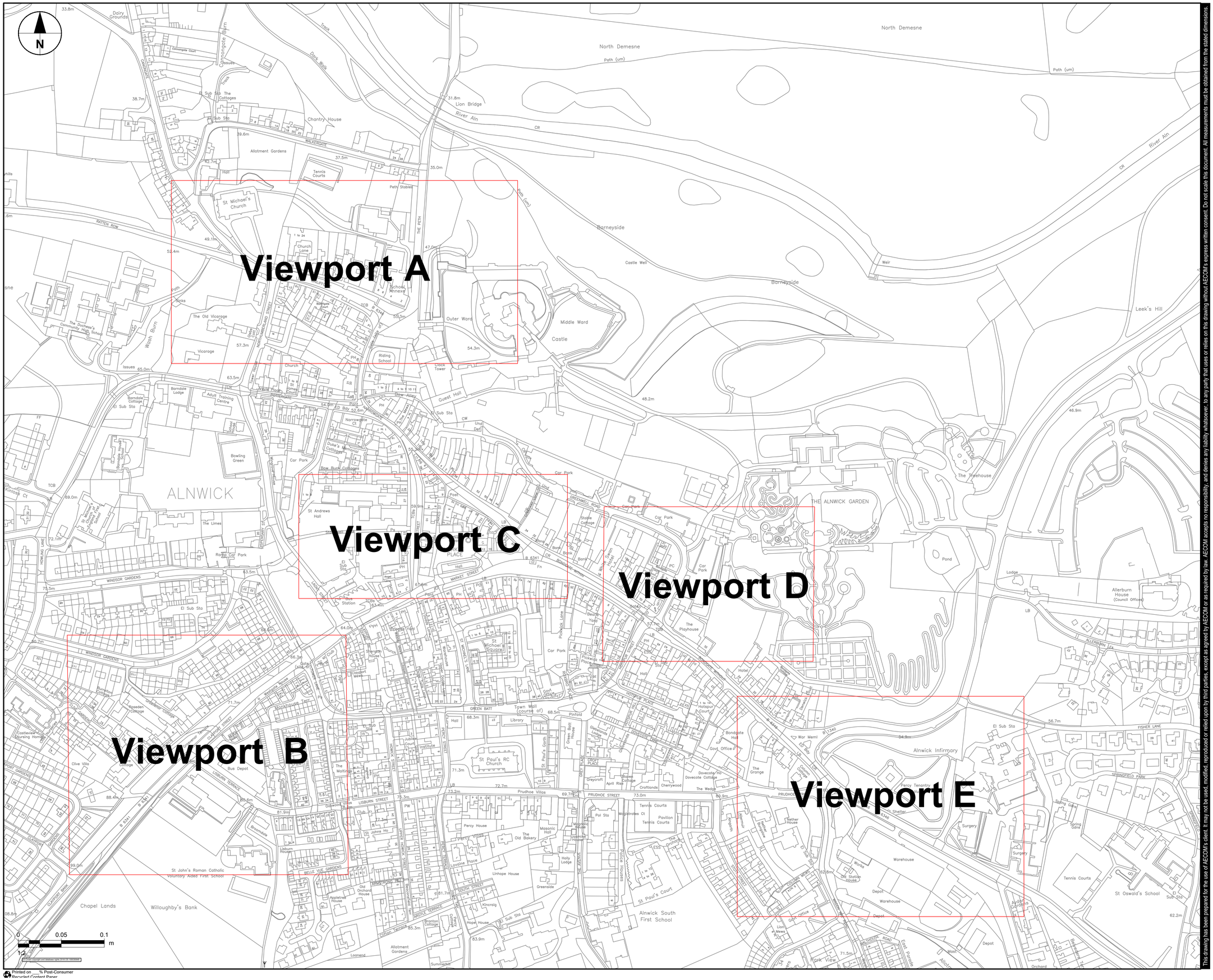

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to see details of viewports.

ISSUE/REVISION

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CLIENT

Northumberland County Council

Northumberland County Council
County Hall,
A197,
Morpeth
NE61 2EF

PROJECT

Alnwick Bondgate Tower

SHEET TITLE

Option 1: Signing Scheme Overview

CONSULTANT

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One Trinity Gardens
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Tel: +44 (0) 191 224 6500
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SHEET NUMBER

60669736-AEC-HGN-L0-DR-CH-01_001

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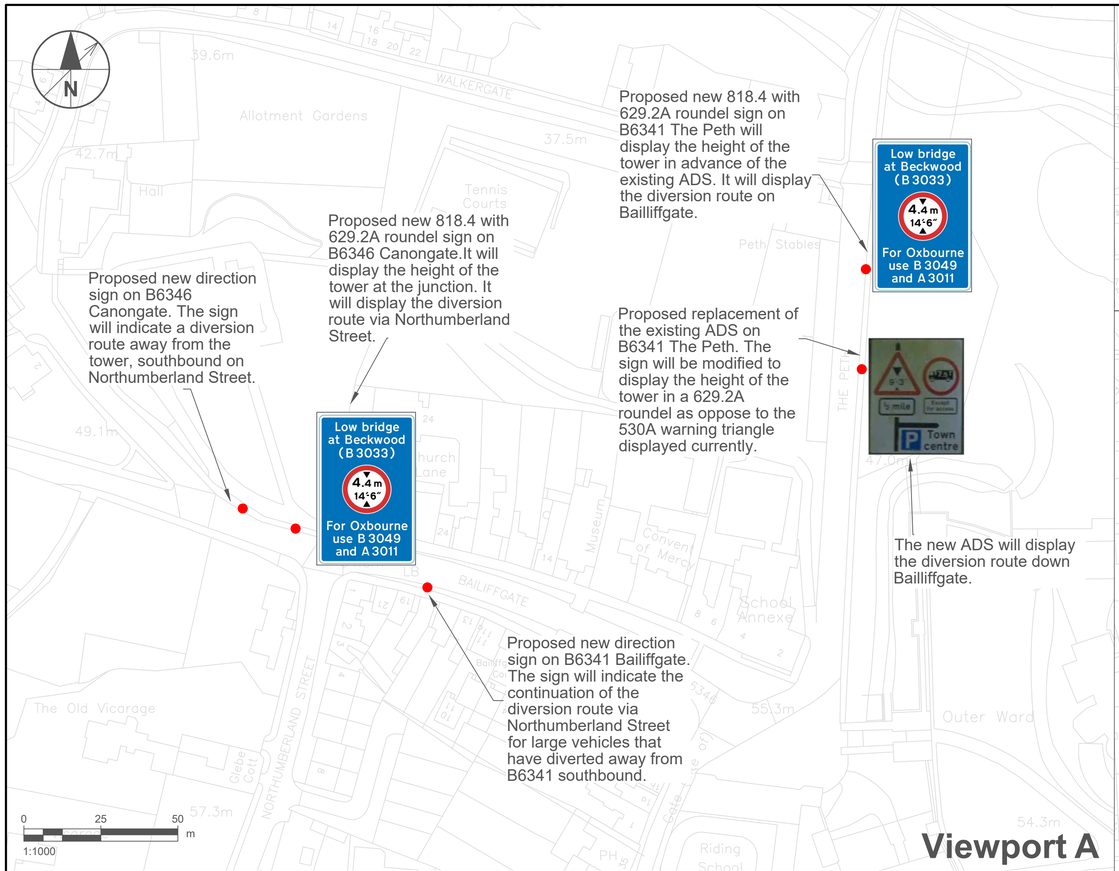

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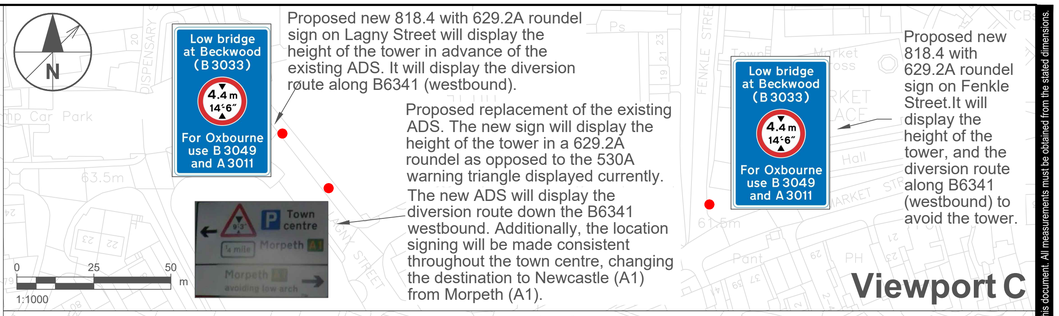

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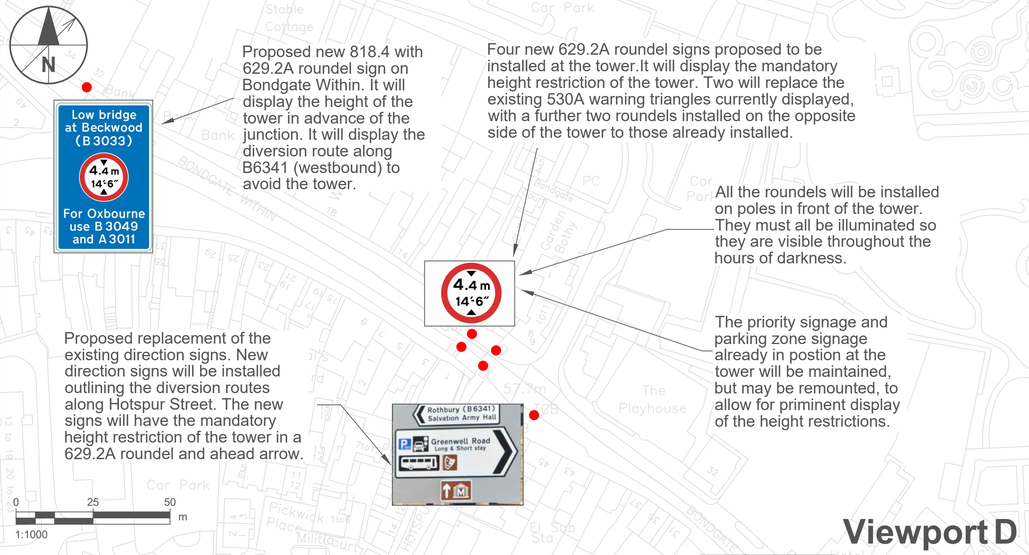

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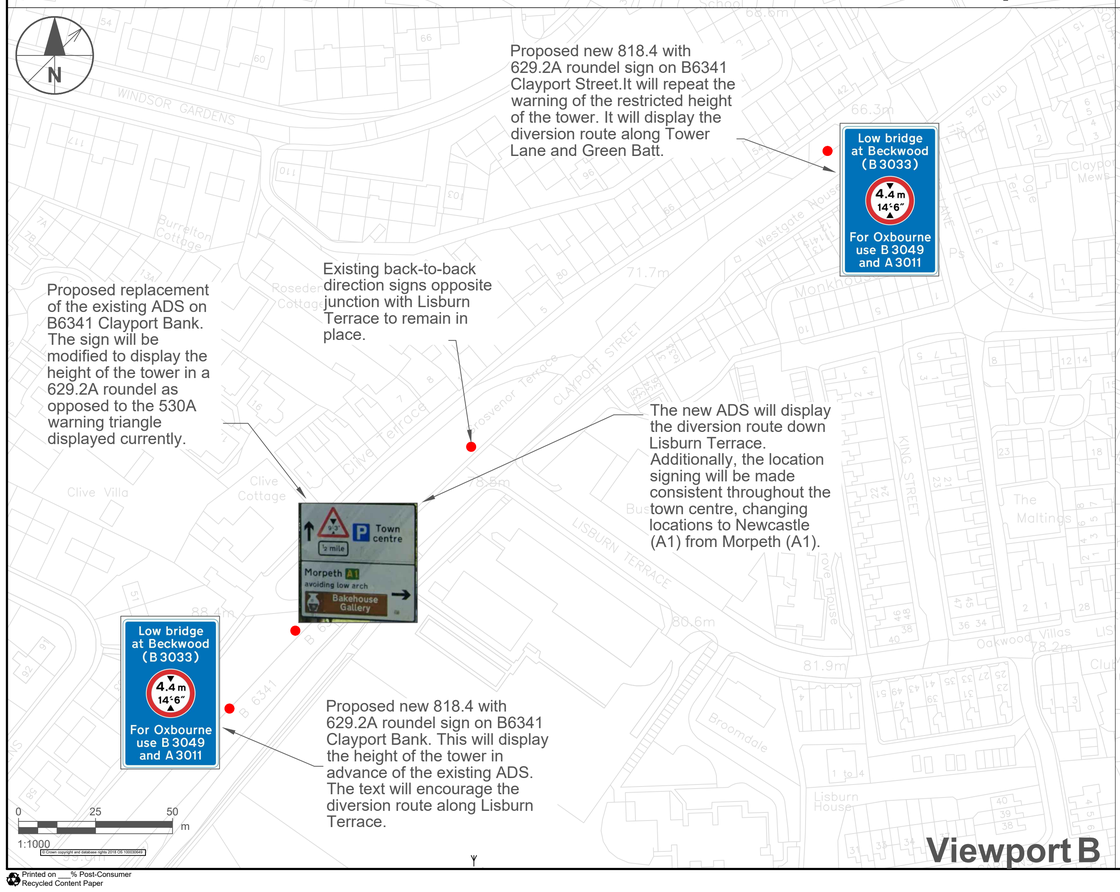

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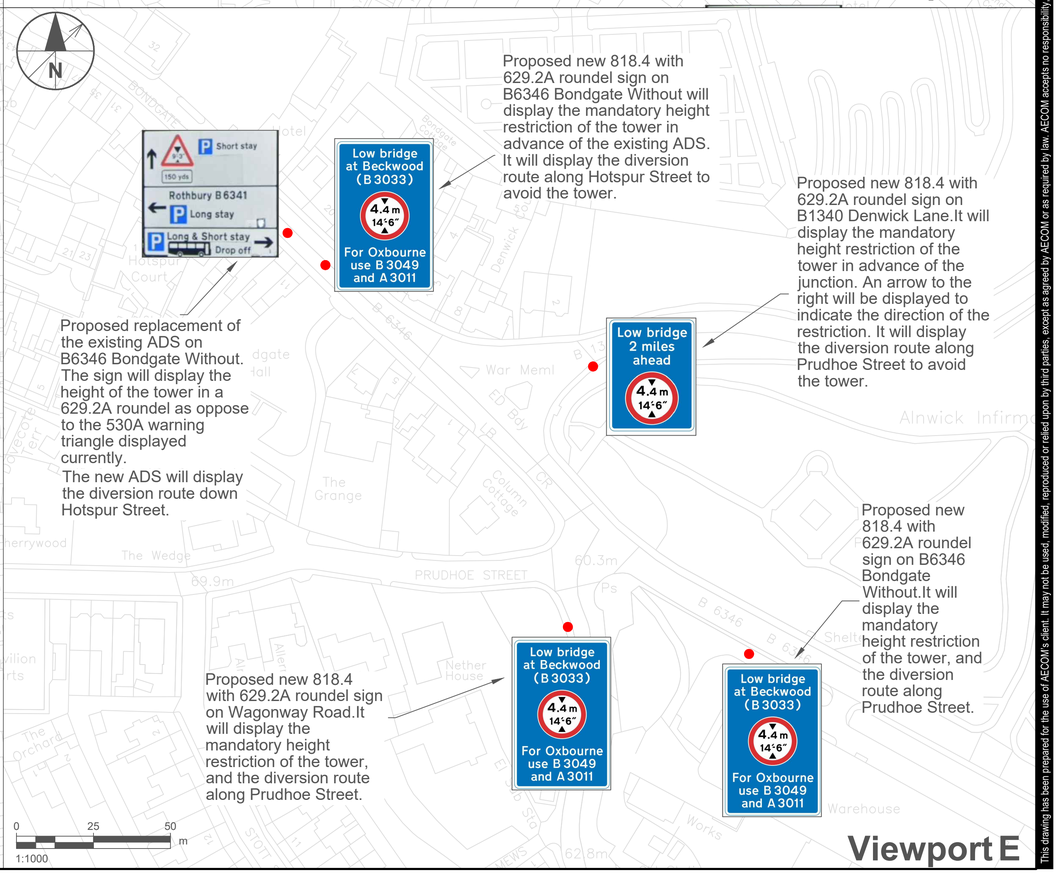

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NOTES

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Northumberland County Council

Northumberland County Council
County Hall,
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PROJECT

Alnwick Bondgate Tower

SHEET TITLE

Option 1: Signing Scheme Detail

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SHEET NUMBER

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Appendix C – Option 2 (Northbound Closure) Sketch

Parking is maintained down both sides of Bondgate Within.

Southbound traffic gives way when exiting the tower.

Kerb line built out to ensure vehicles travel through the tower centrally.

Priority of the junction changed. The main movement is Bondgate Without to/from Hotspur Street.

Kerb line built out to guide vehicles round the new junction layout. This also prevents traffic turning to travel northbound through the tower.

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ISO A1 594mm x 841mm

Project Management Initials: Designer: HA Checked: JDS Approved: GD

Filename: L:\LEGACY\V1TP\PROJECTS\TRAFFIC - ALNWICK BONDGATE TOWER\900_CAD_GIS\910_CAD\M2\60669736-AEC-GEN-L0-M2-CH-01_000-P01 ALNWICK BONDGATE TOWER OPTION 2 NB TOWER CLOSURE V2.DWG Last saved by: JAMES.SMITH01 Last Plotted: 2022-03-02

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NOTES

Key

- Existing Kerbline
- Proposed Kerbline
- Existing Footway
- Proposed Footway
- Bondgate Tower
- Planters

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Alnwick Bondgate Tower

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Option 2: Northbound Closure

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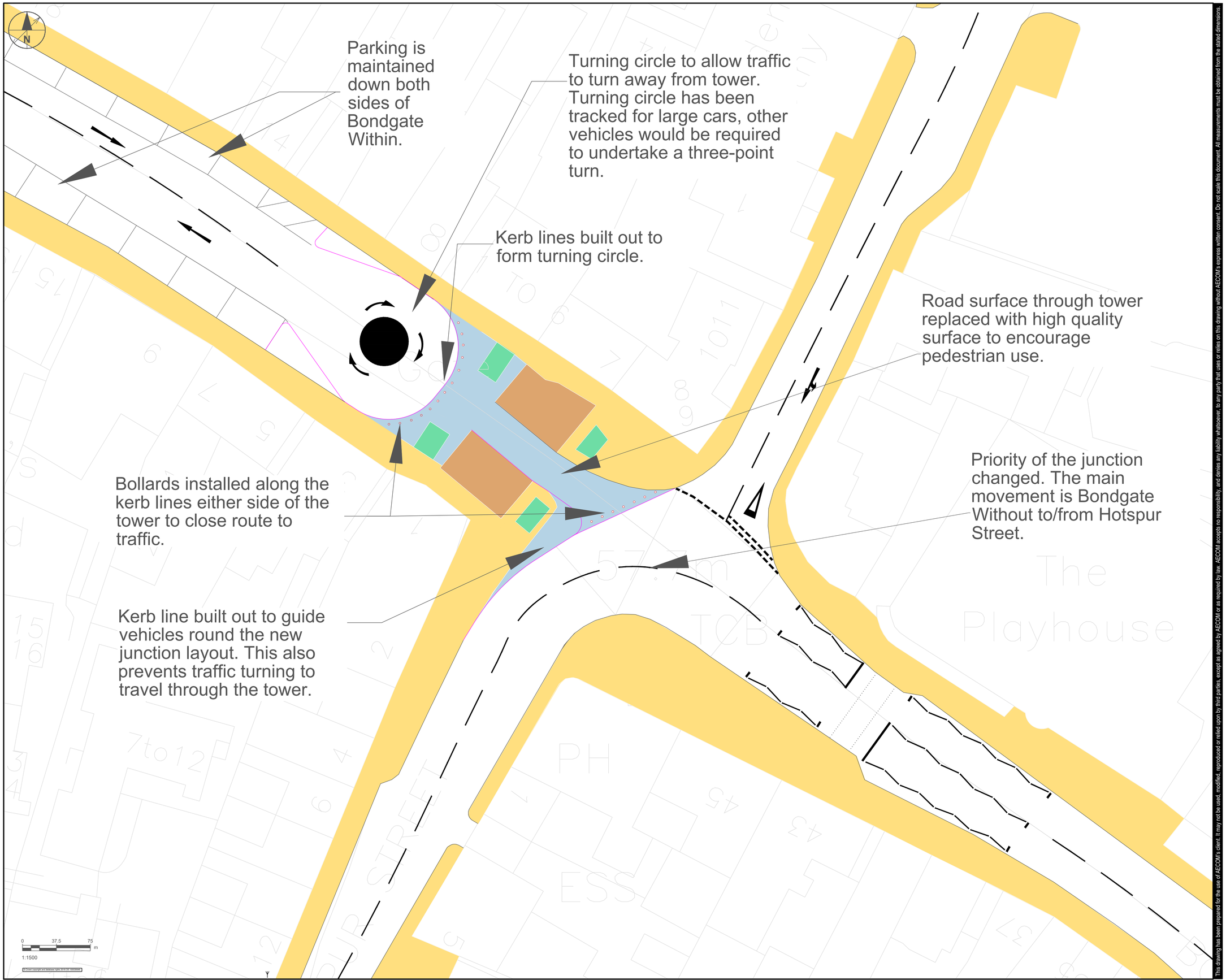
60669736-AEC-HGN-L0-DR-CH-01_003

Appendix D – Option 3 (Full Closure) Sketch



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ISO A1 594mm x 841mm
Approved: GD
Checked: JDS
Designer: HA
Project Management Initials:

AECOM

NOTES

Key

- Existing Kerbline
- Proposed Kerbline
- Existing Footway
- Proposed Footway
- Bondgate Tower
- Planters
- Bollards

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NE61 2EF

PROJECT

Alnwick Bondgate Tower

SHEET TITLE

Option 3: Full Closure

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SHEET NUMBER

60669736-AEC-HGN-L0-DR-CH-01_004

Appendix E – Option Cost Estimates

Alnwick Bondgate Tower - Cost Estimate: Option 1 - Signing Only

		TOTAL
Total Roadworks	£	16,565
TOTAL ROADWORKS (inc. Inflation)	**£**	**16,565**
TOTAL STRUCTURES (inc. Inflation)	**£**	**-**
OTHER HIGHWAY COSTS		
Works contingency allowance of 10%	£	1,656
Utilities allowance of 25%	£	4,141
Temporary Traffic Management & Contractor Prelims allowance of 25%	£	4,141
SUBTOTAL PRELIMINARIES	**£**	**9,938**
TOTAL OF ROADWORKS + OTHER HIGHWAY COSTS	**£**	**26,503**
FEES (DESIGN AND ADMINISTRATION)		
DESIGN (at 7% of costs, including inflation)	£	1,160
CONTRACT MANAGEMENT & SITE SUPERVISION (at 1.8% of costs, including inflation)	£	298
SUBTOTAL FEES (DESIGN AND ADMINISTRATION)	**£**	**1,458**
TOTAL OF ROADWORKS + OTHER HIGHWAY COSTS + FEES	**£**	**27,961**
LAND	**£**	**-**
SUB TOTAL	**£**	**27,961**
RISK		
Risk Contingency (40%)	£	11,184
TOTAL	**£**	**39,145**

Revision	Date	Issue	Prepared By	Reviewed By	Verified By	Approved By
1	09/03/2022	01	HA	LAB	GD	JDS

Alnwick Bondgate Tower - Cost Estimate: Option 1 - Signing Only

Highways

ROADWORKS	Unit	Rate	Section 1 Quantity	Cost	
SITE CLEARANCE					
TAKE UP & REMOVE TO TIP SIGNS INCLUDING POSTS	no.	86.21	7.00	603.48	
TAKE UP & REMOVE TO TIP PAVING	m2	10.40	0.00	0.00	
				Sub Total	**603.48**
SIGNS & MARKINGS					
MEDIUM SIGNS [reflectorized to one side of 2 x new steel posts, plus external illumination and C30/20 foundations]	no.	848.37	15.0	12,725.49	
SMALL SIGNS [reflectorized to one side of 1 x new steel post, plus external illumination and C30/20 foundation]	no.	462.25	7.0	3,235.76	
				Sub Total	**15,961.25**
TOTAL ROADWORKS (INCLUDING INFLATION)					**16,564.73**
STRUCTURES					
-	m2	1.00		0.00	
				Sub Total	**0.00**
SUBTOTAL STRUCTURES					**0.00**
TOTAL OF ROADWORKS AND STRUCTURES					**16,564.73**
PRELIMINARIES / CONTINGENCIES					
Works contingency allowance of 10%	Item	10%		1,656.00	
Utilities allowance of 25%	Item	25%		4,141.00	
Temporary Traffic Management & Contractor Prelims allowance of 25%	Item	25%		4,141.00	
SUBTOTAL PRELIMINARIES/CONTINGENCIES					**9,938.00**
TOTAL OF ROADWORKS, STRUCTURES including PRELIMINARIES		1.000			**26,502.73**
DESIGN					
Taken as 7% of the Total Roadworks and Structures cost [including IAF]	Item	7%		1,160.00	
CONTRACT MANAGEMENT & SITE SUPERVISION					
Taken as 1.8% of the Total Roadworks and Structures cost [including IAF]	Item	1.8%		298.00	
SUBTOTAL FEES (DESIGN AND ADMINISTRATION)					**1,458.00**
TOTAL OF ROADWORKS, STRUCTURES, PRELIMINARIES AND FEES					**27,960.73**
LAND					
Land based on £850,000 per Ha	Ha	850,000		0.00	
SUBTOTAL LAND COSTS					**0.00**
Quantified Risk Allowance					**0.00**
Risk Contingency (40%)	Item	40%		11,184.00	**11,184.00**
SCHEME TOTAL					**39,144.73**

Alnwick Bondgate Tower - Cost Estimate: Option 2 - Northbound Closure

		TOTAL
Total Roadworks	£	80,746
TOTAL ROADWORKS (inc. Inflation)	**£**	**80,746**
TOTAL STRUCTURES (inc. Inflation)	**£**	**-**
OTHER HIGHWAY COSTS		
Works contingency allowance of 10%	£	8,075
Utilities allowance of 25%	£	20,187
Temporary Traffic Management & Contractor Prelims allowance of 25%	£	20,187
SUBTOTAL PRELIMINARIES	**£**	**48,449**
TOTAL OF ROADWORKS + OTHER HIGHWAY COSTS	**£**	**129,195**
FEES (DESIGN AND ADMINISTRATION)		
DESIGN (at 7% of costs, including inflation)	£	5,652
CONTRACT MANAGEMENT & SITE SUPERVISION (at 1.8% of costs, including inflation)	£	1,453
SUBTOTAL FEES (DESIGN AND ADMINISTRATION)	**£**	**7,105**
TOTAL OF ROADWORKS + OTHER HIGHWAY COSTS + FEES	**£**	**136,300**
LAND	**£**	**-**
SUB TOTAL	**£**	**136,300**
RISK		
Risk Contingency (40%)	£	54,520
TOTAL	**£**	**190,820**

Revision	Date	Issue	Prepared By	Reviewed By	Verified By	Approved By
1	09/03/2022	01	HA	LAB	GD	JDS

Alnwick Bondgate Tower - Cost Estimate: Option 2 - Northbound Closure

Highways

ROADWORKS	Unit	Rate	Section 1 Quantity	Cost	
SITE CLEARANCE					
GENERAL URBAN AREA	Ha	12900.00	0.3	3,483.00	
TAKE UP & REMOVE TO TIP KERBS	lin.m	7.80	41.9	327.23	
TAKE UP & REMOVE TO TIP SIGNS INCLUDING POSTS	no.	86.21	11.0	948.33	
				Sub Total	**4,758.56**
DRAINAGE					
REMOVAL OF ROAD GULLIES	no.	159.24	3.0	477.73	
ROAD GULLIES [450mm Ø x 900mm deep]	no.	746.40	3.0	2,239.21	
PRECAST CONCRETE CHAMBER [1800 DIA INVERT 2m (average size assumed)]	no.	3990.18	3.0	11,970.53	
CONNECTION TO EXISTING DRAINAGE	no.	598.61	3.0	1,795.84	
				Sub Total	**16,483.31**
PAVEMENT					
GENERAL 450mm [based on 200 Type 1 Subbase, 150 DBM Base, 50 DBM Binder, 50 Surface]	m2	116.30	18.5	2,148.16	
RESURFACED CARRIAGEWAY	m2	30.00	882.8	26,484.75	
COLOURED SURFACING	m2	23.31	286.4	6,675.85	
				Sub Total	**35,308.76**
KERBS & FOOTWAYS					
HB KERBS [125 x 255mm laid straight or curved exceeding 12m radius, plus concrete foundation and haunch]	lin. m	36.80	56.5	2,080.18	
FOOTWAY (OVER EXISTING CARRIAGEWAY)	m2	62.95	59.5	3,745.76	
				Sub Total	**5,825.95**
SIGNS & MARKINGS					
MEDIUM SIGNS [reflectorized to one side of 2 x new steel posts, plus external illumination and C30/20 foundations]	no.	848.37	12.0	10,180.39	
SMALL SIGNS [reflectorized to one side of 1 x new steel post, plus external illumination and C30/20 foundation]	no.	462.25	7.0	3,235.76	
ROAD MARKINGS [intermittent 0.15 x 6.0 with 3.0 gap]	lin. m	3.38	166.9	564.26	
ROAD MARKINGS [solid 0.15]	lin. m	2.08	176.4	366.87	
MEDIUM MARKING [Includes 4m arrow road markings and 1023A markings]	no.	40.01	4.0	160.04	
ROAD LIGHTING [based on 10m steel columns, 1.0m projection arm, plus 250W lantern unit]	no.	1931.13	2.0	3,862.25	
				Sub Total	**18,369.57**
TOTAL ROADWORKS (INCLUDING INFLATION)					**80,746.15**
STRUCTURES					
-	m2	1.00		0.00	
				Sub Total	**0.00**
SUBTOTAL STRUCTURES					**0.00**
TOTAL OF ROADWORKS AND STRUCTURES					**80,746.15**
PRELIMINARIES / CONTINGENCIES					
Works contingency allowance of 10%	Item	10%		8,075.00	
Utilities allowance of 25%	Item	25%		20,187.00	
Temporary Traffic Management & Contractor Prelims allowance of 25%	Item	25%		20,187.00	
SUBTOTAL PRELIMINARIES/CONTINGENCIES					**48,449.00**
TOTAL OF ROADWORKS, STRUCTURES including PRELIMINARIES		1.000			**129,195.15**
DESIGN					
Taken as 7% of the Total Roadworks and Structures cost [including IAF]	Item	7%		5,652.00	
CONTRACT MANAGEMENT & SITE SUPERVISION					
Taken as 1.8% of the Total Roadworks and Structures cost [including IAF]	Item	1.8%		1,453.00	
SUBTOTAL FEES (DESIGN AND ADMINISTRATION)					**7,105.00**
TOTAL OF ROADWORKS, STRUCTURES, PRELIMINARIES AND FEES					**136,300.15**
LAND					
Land based on £850,000 per Ha	Ha	850,000		0.00	
SUBTOTAL LAND COSTS					**0.00**
Quantified Risk Allowance					**0.00**
Risk Contingency (40%)	Item	40%		54,520.00	**54,520.00**
SCHEME TOTAL					**190,820.15**

Alnwick Bondgate Tower - Cost Estimate: Option 3 - Full Closure

		TOTAL
Total Roadworks	£	130,505
TOTAL ROADWORKS (inc. Inflation)	**£**	**130,505**
TOTAL STRUCTURES (inc. Inflation)	**£**	**-**
OTHER HIGHWAY COSTS		
Works contingency allowance of 10%	£	13,050
Utilities allowance of 25%	£	32,626
Temporary Traffic Management & Contractor Prelims allowance of 25%	£	32,626
SUBTOTAL PRELIMINARIES	**£**	**78,302**
TOTAL OF ROADWORKS + OTHER HIGHWAY COSTS	**£**	**208,807**
FEES (DESIGN AND ADMINISTRATION)		
DESIGN (at 7% of costs, including inflation)	£	9,135
CONTRACT MANAGEMENT & SITE SUPERVISION (at 1.8% of costs, including inflation)	£	2,349
SUBTOTAL FEES (DESIGN AND ADMINISTRATION)	**£**	**11,484**
TOTAL OF ROADWORKS + OTHER HIGHWAY COSTS + FEES	**£**	**220,291**
LAND	**£**	**-**
SUB TOTAL	**£**	**220,291**
RISK		
Risk Contingency (40%)	£	88,116
TOTAL	**£**	**308,407**

Revision	Date	Issue	Prepared By	Reviewed By	Verified By	Approved By
1	09/03/2022	01	HA	LAB	GD	JDS

Alnwick Bondgate Tower - Cost Estimate: Option 3 - Full Closure

Highways

ROADWORKS	Unit	Rate	Section 1 Quantity	Cost	
SITE CLEARANCE					
GENERAL URBAN AREA	Ha	12900.00	0.28	3,612.00	
TAKE UP & REMOVE TO TIP KERBS	m2	7.80	84.63	660.25	
TAKE UP & REMOVE TO TIP SIGNS INCLUDING POSTS	m2	86.21	15.00	1,293.18	
				Sub Total	**5,565.43**
FENCING/BARRIERS/WALLS					
BOLLARD (Heritage)	No	190.73	16.0	3,051.68	
BOLLARD (Cycle roundels)	No	313.00	4.0	1,252.00	
				Sub Total	**3,051.68**
DRAINAGE					
REMOVAL OF ROAD GULLIES	No	159.24	5.0	796.22	
ROAD GULLIES [450mm Ø x 900mm deep]	No	746.40	5.0	3,732.02	
PRECAST CONCRETE CHAMBER [1800 DIA INVERT 2m (average size assumed)]	No	3990.18	5.0	19,950.88	
CONNECTION TO EXISTING DRAINAGE	No	598.61	5.0	2,993.07	
				Sub Total	**27,472.19**
PAVEMENT					
GENERAL 450mm [based on 200 Type 1 Subbase, 150 DBM Base, 50 DBM Binder, 50 Surface]	m2	116.30	36.3	4,226.81	
OVER EXISTING FOOTWAY	m2	124.76	86.0	10,723.22	
EXTRA OVER EXCAVATION [for excavation in hard material in cutting and other excavation]	m2	36.40	86.0	3,128.69	
RESURFACED CARRIAGEWAY	m2	30.00	1141.1	34,234.09	
COLOURED SURFACING	m2	23.31	664.4	15,485.44	
				Sub Total	**67,798.25**
KERBS & FOOTWAYS					
HB KERBS [125 x 255mm laid straight or curved exceeding 12m radius, plus concrete foundation and haunch]	lin. m	36.80	72.0	2,650.52	
FOOTWAY (OVER EXISTING CARRIAGEWAY)	m2	62.95	180.2	11,346.27	
				Sub Total	**13,996.79**
SIGNS & MARKINGS					
MEDIUM SIGNS [reflectorized to one side of 2 x new steel posts, plus external illumination and C30/	Item	848.37	7.0	5,938.56	
SMALL SIGNS [reflectorized to one side of 1 x new steel post, plus external illumination and C30/20	Item	462.25	3.0	1,386.75	
ROAD MARKINGS [intermittent 0.15 x 6.0 with 3.0 gap]	lin.m	3.38	180.7	610.83	
ROAD MARKINGS [solid 0.15]	lin.m	2.08	260.5	541.82	
MEDIUM MARKING [Includes 4m arrow road markings and 1023A markings]	No	40.01	7.0	280.07	
ROAD LIGHTING [based on 10m steel columns, 1.0m projection arm, plus 250W lantern unit]	Item	1931.13	2.0	3,862.25	
				Sub Total	**12,620.29**
TOTAL ROADWORKS (INCLUDING INFLATION)					**130,504.64**
STRUCTURES					
-	m2	1.00		0.00	
				Sub Total	**0.00**
SUBTOTAL STRUCTURES					**0.00**
TOTAL OF ROADWORKS AND STRUCTURES					**130,504.64**
PRELIMINARIES / CONTINGENCIES					
Works contingency allowance of 10%	Item	10%		13,050.00	
Utilities allowance of 25%	Item	25%		32,626.00	
Temporary Traffic Management & Contractor Prelims allowance of 25%	Item	25%		32,626.00	
SUBTOTAL PRELIMINARIES/CONTINGENCIES					**78,302.00**
TOTAL OF ROADWORKS, STRUCTURES including PRELIMINARIES			1.000		**208,806.64**
DESIGN					
Taken as 7% of the Total Roadworks and Structures cost [including IAF]	Item	7%		9,135.00	
CONTRACT MANAGEMENT & SITE SUPERVISION					
Taken as 1.8% of the Total Roadworks and Structures cost [including IAF]	Item	1.8%		2,349.00	
SUBTOTAL FEES (DESIGN AND ADMINISTRATION)					**11,484.00**
TOTAL OF ROADWORKS, STRUCTURES, PRELIMINARIES AND FEES					**220,290.64**
LAND					
Land based on £850,000 per Ha	Ha	850,000		0.00	
SUBTOTAL LAND COSTS					**0.00**
Quantified Risk Allowance					**0.00**
Risk Contingency (40%)	Item	40%		88,116.00	**88,116.00**
SCHEME TOTAL					**308,406.64**

Appendix F – Option 2 (Northbound Closure) Visualisations


Rothbury (B6341)
Salvation Army Hall
Greenwell Road
Long & Short stay
Long & Short Stay
Coach Park
Long Stay
GREENWELL ROAD


TAKE AWAY
CANTONESE
RAM'S RESTAURANT

Appendix G – Option 3 (Full Closure) Visualisations


Rothbury (B6341)
Salvation Army Hall
Greenwell Road
Long & Short stay
Long & Short Stay
Coach Park
Long Stay
GREENWELL ROAD


TAKE AWAY
CANTONESE RAM'S RESTAURANT

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