APPENDIX D

The Birmingham City Council Permit Scheme for Road & Street Activities

CBA Update 2022

February 2022

Report:	The Birmingham Permit Scheme for Road & Street Activities, CBA Update 2022
Client:	Birmingham City Council
Authors:	Gary Kyle
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Produced by:

GK Traffic Consultancy Ltd,
Mount Lomond,
Burnfoot,
Kilbucho,
Biggar
ML12 6JH

Email: gary.kyle@gk-tc.com

Website: www.gk-tc.com

1 INTRODUCTION

Background

1.1 Birmingham City Council (BCC) is planning to implement a permit scheme in October 2022. The scheme will be known as The Birmingham City Council Permit Scheme for Road and Street Activities.

1.2 A Cost Benefit Assessment (CBA) evaluating the potential benefits of the permit scheme was reported in 2016, *'The Birmingham City Council Permit Scheme for Road and Street Activities – CBA Report', September 2016*.

1.3 The CBA demonstrated that significant benefits in terms of reductions in delay and operating costs to road users can be achieved through the implementation of the Scheme. The value for money threshold (Benefit to Cost Ration, BCR) of 2.0 could be achieved with a 3% reduction in the delays to road users. This is below the reduction of 5% recommended in the appropriate guidance documents and advice notes.

1.4 A 5% reduction in impact to road users due to a reduction in occupancy would achieve a BCR of 3.5.

CBA Update

1.5 The 2016 evaluation used noticing records reported between 2012 and 2015. Due to the time elapsed since the CBA was reported in 2016, it was decided that an updated assessment of the number of the likely number of permit applications should be undertaken.

1.6 This updated forecast would inform the structure and size of permits team required and recalculate the permit fees structure for the first year of the scheme.

1.7 This report presents the renewed permit activity forecast and the updated CBA results and conclusions.

Methodology

1.8 The recalculation of Permit Scheme benefits uses the 2016 CBA methodology. A bottom-up approach, undertaking the evaluation of delays at typical roadwork sites using the Department for Transport (DfT) software 'Quadro' and Paramics microsimulation modelling.

1.9 This assessment considers the cost of road and street works to road users (travel time costs, fuel and other vehicle operating costs), accident and fuel carbon emission costs. The cost of vehicles diverting onto alternative diversion routes as a result of road closures or excessive delays approaching the works has been included in the Quadro evaluations.

1.10 The Council's Confirm street works database provides a record of the location, type and duration of all works requiring a notice under The New Road and Street Works Act 1991 (NRSWA). These records provide a detailed inventory of the type of works, traffic control, duration of works and location across the road network.

1.11 The Quadro assessment has considered the impact of works at traffic-sensitive and non traffic-sensitive roads involving temporary road closures and diversions or temporary traffic

signal control. The cost of Give & Take and Priority Flow works across the authority's road network has been modelled with Paramics microsimulation and PEARS software.

1.12 The assessment has been carried out for the 2022 base year and a design year 25 years hence (2046).

1.13 The benefits of the Permit Scheme are estimated from a specified 5% reduction in occupancy.

2 DATA SOURCES

Data Update

2.1 The forecast permit activity has been calculated from a review of Confirm notices recorded between January 2018 and December 2021. This updates the 2016 forecast using Confirm records collected between 2012 and 2015.

2.2 A detailed analysis of the data recorded in each year has been carried out to allow the selection of a suitable forecast for the number and breakdown of permit applications likely in a typical year under the Permit Scheme.

Notice Records

2.3 The Confirm query provided a record of all notices recorded over the four-year period.

2.4 The report was analysed to identify the number of works stopped notices for utility works promoters and highway authority works. The number of works recorded in each year is shown in Table 1.

Table 1: Notice works stopped records, 2018 - 2021

	2018	2019	2020	2021
Utility Notices	22,007	27,850	22,841	21,848
Highway Notices	36,508	29,873	18,486	32,614
Total	**58,515**	**57,723**	**41,327**	**54,462**

2.5 The number of utility works notices recorded in each year are broadly similar, other than a large increase in the 2019 records. This is primarily a result of an increase in the number of works completed by a telecoms promoter. The number of works completed in the other years varies by less than 4%.

2.6 There is a larger variation in the number of highway works recorded, from a high of more than 36,500 in 2018 to a low of less than 18,500 in 2020.

Works Promoter

2.7 The year-on-year variation in the number of works in the following groupings is shown in Figure 1;

- Highway
- Gas
- Water
- Electricity
- Telecoms.
- Other

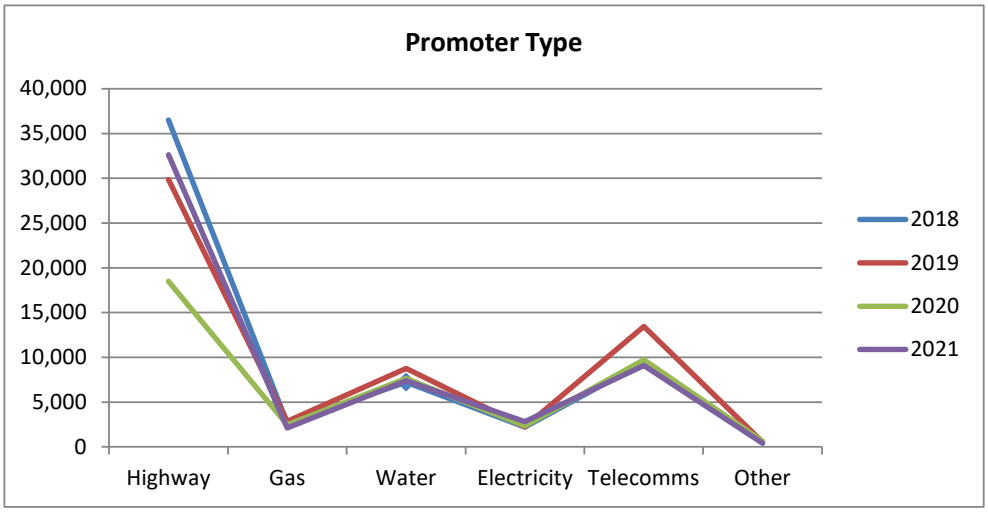

Figure 1: Works Promoter Type

2.8 The figure shows the only significant deviation is highway works in year 2020 and a peak in Telecoms. in 2019. Other than these variations, the number of works for other groupings are very consistent in each year.

Works Type

2.9 The category of works recorded is compared for each year in the following; Figure 2 Utility Works Promoter, Works Type and Figure 3 Highway Authority Works Type.

2.10 The number of Major, Standard and Immediate works completed by utility works promoters is very similar in each year. The peak in the 2019 data record is primarily an increase in the number of Minor works.

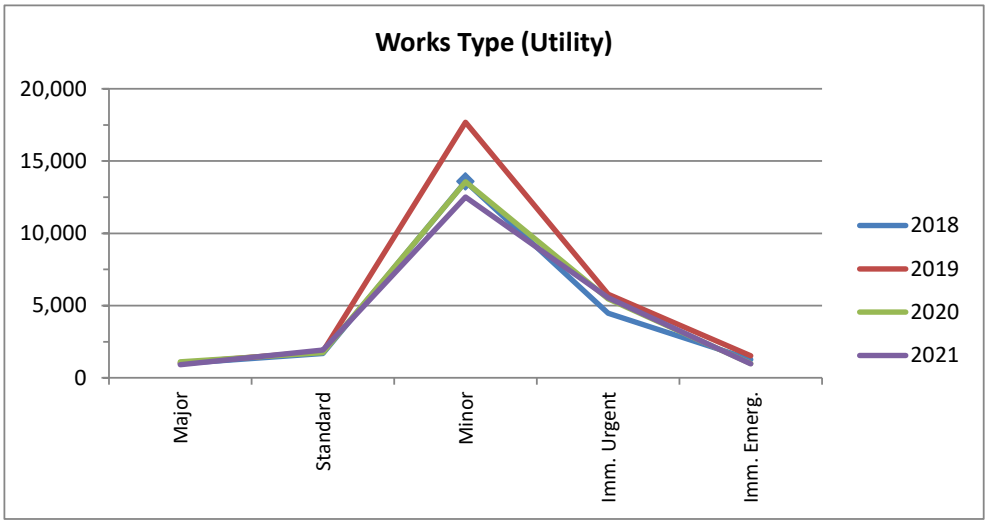

Figure 2: Utility Works Promoter, Works Type

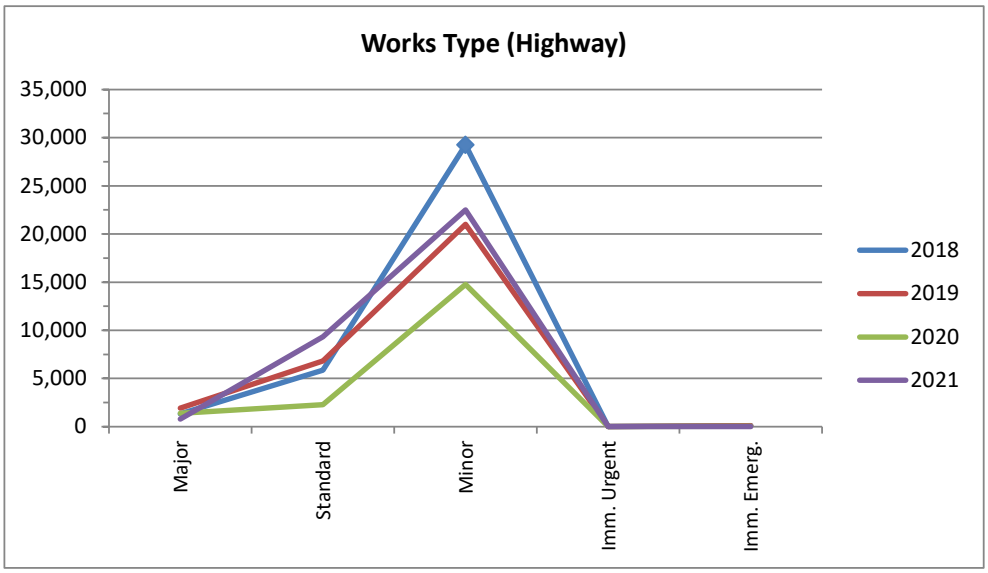

Figure 3: Highway Authority Works Type

2.11 The highway works numbers show more variation between years, with large differences in the number of Minor and Standard works recorded. Major works numbers are relatively consistent in each year.

Highway Works Duration

2.12 The total number of works and number of works by category is shown in Table 2.

Table 2: Works duration highway notices

	2018	2019	2020	2021
1 day	31,079	23,749	15,291	27720
2-3 days	2,710	2,625	1,679	2018
4-10 days	1,785	1,383	895	1282
10-30 days	715	415	392	696
30-90 days	165	60	133	491
90-180 days	36	16	45	219
180-365 days	13	23	21	96
>365 days	4	10	2	4
Average	**2.1**	**2.1**	**2.6**	**4.0**

2.13 The above table shows the majority of highway works are completed within 1 day; between 80% and 85% in all years. Many of these works will be very short duration reactive maintenance repairs, for example, pothole repairs.

2.14 Less than 1,000 works combined have a duration of more than 10 days.

2.15 Not all of the short duration repair works will require a unique permit application under then Permit Scheme, therefore an adjustment has to be made to the highway notice numbers to avoid over-estimating the number of highway authority permits likely.

Traffic Sensitivity

2.16 The split between works on traffic sensitive and non-traffic sensitive streets is shown in Table 3.

Table 3: Works on Traffic Sensitive Streets

	2018	2019	2020	2021
Traffic Sensitive streets	28,155	29,060	20,707	26,360
Non-Traffic Sensitive streets	29,584	28,006	20,049	27,370
Other	776	657	571	732
TOTAL	**58,515**	**57,723**	**41,327**	**54,462**
% Traffic Sensitive	**48%**	**50%**	**50%**	**48%**

2.17 The data analysis shows that almost 50% of all works recorded take place on a street designated as traffic sensitive in the National Streets Gazetteer (NSG).

2.18 It is important to accurately represent this statistic in the forecast as the time taken to process permit applications for works on traffic sensitive streets is longer, requiring more staff, and therefore the permit fee charged is correspondingly higher.

Traffic Management

2.19 The number of works recorded by traffic management type is shown in Figure 4.

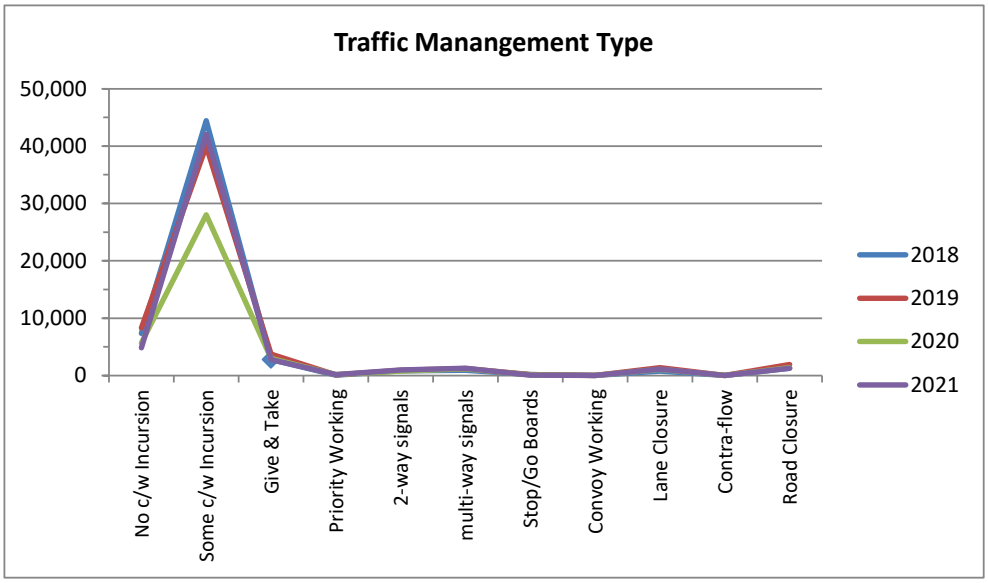

Figure 4: Traffic Management Type

2.20 There is very little variation in all traffic management types in each year, other than works operating with some carriageway incursion.

2.21 Combining the analysis in previous sections, this suggests that the elements contributing to the greatest variation in each year are;

- Highway works activities
- Telecoms. activities in 2019
- Short duration Minor works of 1 day or less
- Works operating with Some carriageway incursion

2.22 The steps taken to produce a reliable and conservative estimate of the number of permit applications likely to be received in a typical year should take all of the above factors into account.

3 PERMIT FORECAST

3.1 The forecast for the number of permit applications likely to be received in atypical year under the Permit Scheme is presented below.

3.2 A conservative estimate for the number of permit applications likely to be received in the first year of the scheme has been agreed, to avoid over-recruiting of staff to the new permit team.

3.3 2019 has been excluded as an outlier within the 4 years for which noticing records were provided, due to the higher-than-normal telecoms. activities recorded.

3.4 Of the remaining 3 years, 2020 provides the closest to average figures for utility works and the lowest number of highway authority notices.

3.5 Therefore, an adjusted form of the 2020 records has been used to provide a forecast of year 1 permit activity.

Utility works

3.6 22,841 works stopped notices were recorded in 2020 for utility works promoters.

3.7 The number of notices recorded for each of the promoters with more than 1,000 completed in a year – BT, Cadent Gas, Western Power Distribution, Severn Trent Water and Virgin Media – is near the mid-point of the range of works in all cases.

3.8 The 2020 data records have therefore been used directly in the permit forecast.

Highway works

3.9 Historically, the number of notices for highway authority works has been high. More than 50,000 notices were recorded by highway authority works promoters in the pre-2015 data. This number has reduced in recent years, however, there is a large variation in the number of works recorded year-on-year.

3.10 2020 provides the lowest number of highway authority works recorded in a year and has therefore been used as the basis for the forecast.

3.11 However, experience of other schemes where the highway authority accounted for more than 50% of the works notices has shown that this would result in an over-estimate of the number of highway authority permits received.

3.12 Evidence from permit schemes across the country suggests that a 30:70 split in permits between highway and utility works promoters is typical when a scheme goes live.

3.13 The following adjustments have been made to the data record to provide a robust estimate of the number of works that would translate to requiring an individual permit under the Permit Scheme;

- Reduce highway notices to achieve a 30:70 split
- Remove a proportion of notices with;
    - Minor works classification
    - 1-day actual duration

- Some carriageway incursion tm
- Remove any notice records for works not recorded on a Category 0 to 4 street

3.14 This process avoids reducing the number of Major and Standard highway works notices.

3.15 The 18,486 highway authority notices have been reduced by just over 8,000 to produce 10,132 highway works as an appropriate forecast for highway authority permit activity.

Permit Forecast

3.16 The forecast permit activity following the introduction of the Permit Scheme is shown in Table 4 below.

Table 4: 2022 Forecast Permit Activity

	Highway	Utility
Major, TS	774	434
Standard, TS	716	710
Minor, TS	2,362	5,511
Immediate - Urgent, TS	499	2,204
Immediate - Emergency, TS	11	385
Major, TS	618	624
Standard, TS	1,207	1,022
Minor, TS	3,399	7,930
Immediate - Urgent, TS	530	3,171
Immediate - Emergency, TS	16	553
Total	**10,132**	**22,544**
Sub-total Utility	*4,362*	*9,244*
Sub-total Highway	*5,770*	*13,300*

4 FEES MATRIX

Introduction

4.1 The calculation of Permit Fees has been carried out in accordance with the guidance set out in "Traffic Management Act 2004, Permit Fees Guidance" July 2008 and the guidance contained in the "Statutory Guidance for Highway Authority Permit Schemes" July 2020.

4.2 The DfT produced a Fees Matrix spreadsheet listing permit forecast, staff costs and resources required to undertake the activities to evaluate submitted permits.

4.3 The staff cost inputs set the permit fees for each category of permit to balance the operating costs to process utility works promoter permit applications with the fee income billed for permits granted.

4.4 This spreadsheet has been used as the basis for calculating staff resource requirements, scheme operating costs, forecasting annual permit fee income and setting permit fee charges.

Fees Matrix

4.5 The Fees Matrix spreadsheet inputs include;

- Number of works p.a. by category for Traffic Sensitive and non-Traffic Sensitive streets
- Personnel salaries, employer National Insurance (NI) & pension contributions and a staff cost multiplier to cover other Council overheads
- Time requirement to process each permit task, by staff level and by permit type
- Reduction factor to account for time already incurred in noticing permit applications under NRSWA
- Surcharge to permit fee to recover the utility works promoters share of the allowable operating costs

4.6 The time estimates for each permit task are adjusted to discount the time required to complete work already carried out under NRSWA Noticing and ensure only the cost of undertaking additional activities under the Permit Scheme are charged.

4.7 The Notice Regime Reduction percentages applied reduce the activity timescales by approximately 30% overall.

Number of Works

4.8 The forecast number of permit applications received is shown in Table 4 in Chapter 3.

4.9 The Fees Matrix also requires an estimate of the number of variations to granted permits. These variations include; early start requests, duration extension requests and a modification to the permit or conditions.

4.10 The Confirm noticing record contained between 3,000 and 3,700 notice variations in each year. This amounts to a variation rate of approximately 13% of works stopped notices.

4.11 The Fees Matrix contains an estimated 3,204 permit variations submitted by utility works promoters, out of a total of 22,544 permits. There are a further 10,132 highway authority permits included.

Personnel

4.12 The Fees Matrix lists 3 staff designations;

- Street Works Officer; normally day to day permit application activities (office based).
- Street Works Co-ordinator; supervise Officer team, oversee all permit decisions, responsible for co-ordination activities, responsible for decisions on complex or major permit applications, include site visits to discuss major schemes (mainly office based) - input will be received from SW Inspectors regarding suitability of tm proposals and co-ordination issues (site based).
- Traffic Manager; manage the permit scheme and Officer/Co-ordinator group, overall responsibility for decisions on Major scheme applications, senior co-ordinators will provide much of the day to day decision making (mainly office based).

4.13 The breakdown of personnel required to process permit applications is shown in Table 5.

Table 5: Fees matrix calculatedpersonnel requirement

PERSONNEL LEVEL	All Works	Highway Authority	Public Utilities
Street Works Officer	10.0	3.7	6.3
Street Works Co-ordinator	8.4	3.3	5.1
Traffic Manager	4.0	1.7	2.3
Total employees	**22.4**	**8.7**	**13.7**

4.14 22.4 full-time equivalent (fte) staff would be required to process all permit applications forecast (Table 4, page 9). This is split approximately 40:60 between highways and utility works.

4.15 These designations are a composite of the grades proposed within the BCC permits team; proposed at GR4, GR5, GR6 and GR7 and shown in Figure 5.

4.16 The proposed permit team structure shows 28 staff working under the Highway Network Manager and 3 area teams each working under an area Traffic Manager.

4.17 The structure includes Highway Inspectors and Management staff who will not be involved in decisions regarding processing permit applications on a full-time basis.

4.18 The composite calculation allocates responsibility for day to day functions to the appropriate grade; for example, GR4 grades will work 100% of their time on processing permit applications at SW Officer level, Inspectors 50% of their time at SW Co-ordinator or Traffic Manager level, Traffic Managers 75% of their time at TM level and Highway Network Manager 10% of their time at TM level.

4.19 This ensures the allocation of salary costs to each Fees Matrix level matches the resource allocated with the permit team structure.

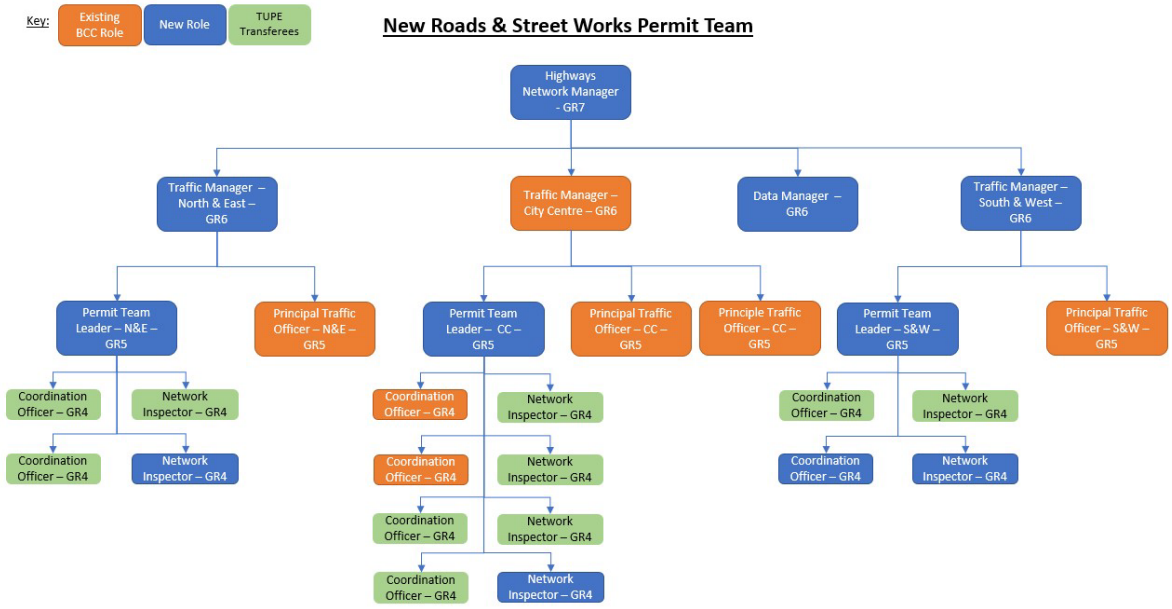

Figure 5: New Road & Street Works Permit Team Structure

4.20 The remainder of each grades time will be undertaking, supervising or managing other street works functions undertaken by the team.

Fee Income

4.21 The scheme operating cost and forecast fee income is shown in Table 6.

4.22 The operating cost to process all permit applications is forecast to be £1,1944,308. The operating cost to process utility works promoter permit applications is forecast to be £1,192,383. The permit fees are set for the scheme to be cost neutral, therefore the estimated annual fee income is also £1,192,383.

Table 6: Forecast permit fee income

	NUMBER OF STAFF	OPERATING COST	EMPLOYEE COSTS		OTHER COSTS
			PERMITS	VARIATIONS	OVERHEADS
All works	22.4	**£1,944,308**	£1,566,781	£166,772	£210,755
Utility works	13.7	**£1,192,383**	£952,722	£110,294	£129,367

4.23 Approximately 80% of the £1,192,383 operating cost to process utility permits is allocated to employee costs (salary, NI, pension and a cost multiplier to cover other Council overheads).

4.24 9% of the costs are allocated to processing permit variation applications (estimated at 13% of permits granted using 2018-2021 noticing records).

4.25 The remaining 11% of cost is allocated to contribute the utilities share of the allowable overheads required to run the scheme; recovered via a surcharge applied to all permit fees. This is forecast to recover almost £130,000 towards the estimated £200,000 annual costs attributed to the allowable overheads.

4.26 The Fees Matrix input parameters used to calculate costs are;

- Salaries, a composite calculation based on each grades anticipated contribution to each level designated in the Fees Matrix
- NI, 10% to 11.5%, depending upon base salary
- Pension contributions, 35.4%
- Corporate overheads 30%
- Allowable overhead fee surcharge, 12%

Operating Cost

4.27 For the purpose of the CBA, the Permit Scheme annual operating cost is calculated from the time required to process all permit applications (inclusive of Council works). The total revenue that can be generated by operating the Scheme is calculated from the Permit Fees and total number of works (excluding Council works).

4.28 The costs derived from the Fees Matrix are;

- Permit Scheme annual operating cost, £1,944,308
- Permit Scheme annual revenue, £1,192,383

4.29 These cost have been input to the CBA calculation at 2022 Q3 prices.

5 TRAFFIC MODELLING

Methodology

5.1 The 2-stage modelling process used for the 2016 CBA has been used in this update.

5.2 The Quadro software has been used to assess the user costs and indirect costs for the following traffic management types:

- road closure (with suitable diversion route)
- overnight road closure (with suitable diversion route) as above with traffic flow maintained through works between 07:00 – 19:00
- lane closure (dual c/w only)
- 2-way temporary signals (dual c/w excluded) with suitable diversion route available when large delays encountered
- 3-way & 4-way temporary signals (dual c/w excluded) with suitable diversion route available when large delays encountered
- stop / go boards (NSL dual c/w excluded) as 2-way temporary signals, but operating weekdays only between 08:00 – 17:00

5.3 A work duration of 1 week was selected in each test to provide the user costs for each day type and the market price to user cost factor.

5.4 Paramics microsimulation models have been used to calculate the user costs of the following street works:

- Give & Take and Priority Working, at works requiring excavation of the carriageway or footway on traffic sensitive and non-traffic sensitive roads
- Some Incursion, give & take control assumed for a proportion of these works (see below) to model the impact of carriageway excavation, signing, plant and machinery on traffic flow.

5.5 The breakdown of the number of the above works assumed to have an impact on traffic delays is:

- Give & Take, 3,196 works, all modelled
- Some Incursion, 6,344 works (31%), modelled
- Some Incursion, 13,853 works (69%), not modelled
- No Incursion, 5,549 works, not modelled

5.6 This equates to approximately 33% of all works classified as ‘Give & Take’ or ‘No/Some Incursion’ being modelled as having some disruption to traffic flow.

5.7 No impact has been assumed at works categorised as No Carriageway Incursion.

Traffic Flow Data

5.8 The West Midlands Spectrum data base provided access to processed automatic traffic count (ATC) data across the City Council area. A search of all records with data available from 2014-16 identified 521 suitable sites.

5.9 This data was extracted from the database and processed to identify suitable sites for modelling the impacts of road works using Quadro and Paramics microsimulation.

5.10 These data records provide a comprehensive overview of traffic volumes across all types of road category within the City Council network.

5.11 The location of these sites across the road network is shown in Figure 6.

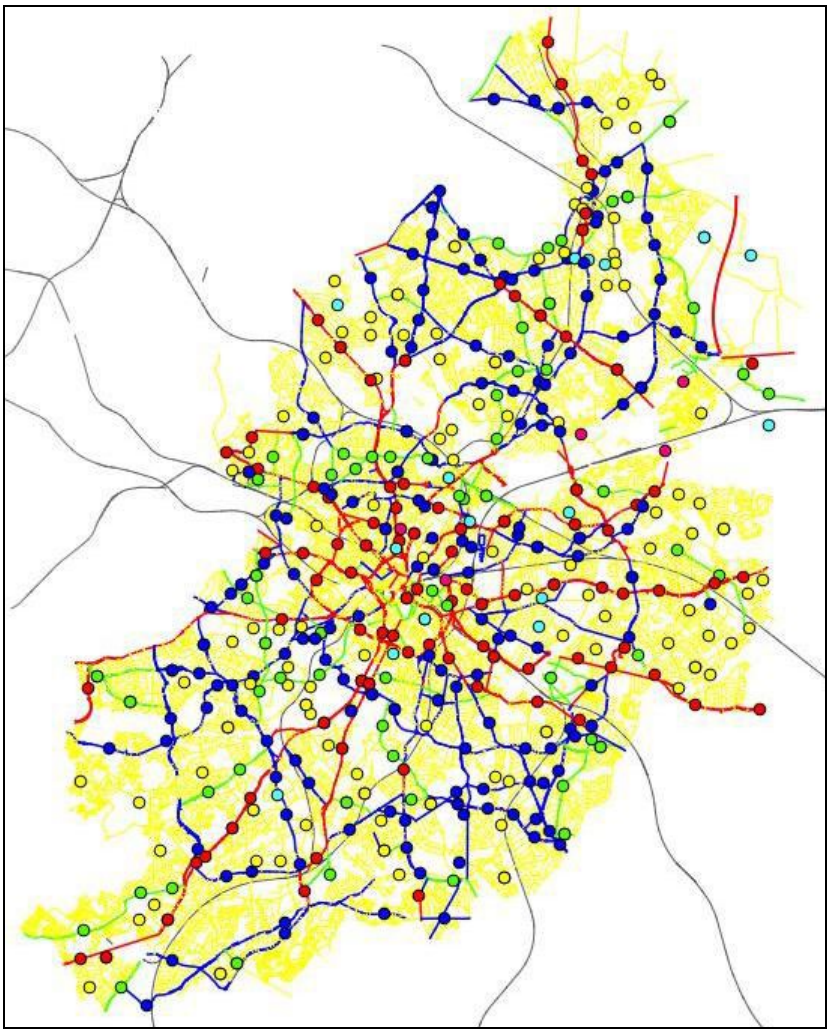

Figure 6: Location of ATC sites

5.12 Sites on roads of reinstatement category 0 are shown in magenta, category 1 red, category 2 dark blue, category 3 in green, category 4 TS in yellow and category 4 Non-TS pale blue.

5.13 The underlying mapping shows the reinstatement category for each street in the Gazetteer using the same colour coding.

Site Selection

5.14 Modelling the impact of works across the network requires a sample of these sites to reflect the distribution of road types and traffic flow levels encountered.

5.15 Site selection criteria have been used to ensure a representative site is tested in each area and a suitable number of Quadro tests is achieved for each category and works type, to produce statistically reliable average works costs. The criteria applied are:

- Location – mix of City Centre, urban and suburban roads to represent the full network
- Road type – both single and dual carriageway roads (where appropriate)
- Diversion – suitable diversion route (or multiple routes) available & a mix of diversion route lengths
- Traffic volumes – range of traffic flows for each category to be representative of the full City Council network

5.16 Where the data for a large number of ATC sites was available for a road type, the most suitable sites providing the full range of criteria listed above were selected. In some cases, there was insufficient data and therefore all available sites were used.

5.17 41 sites were modelled across four road category types.

5.18 The selection of suitable ATC records for inclusion in Quadro traffic modelling is summarised in Table 7. The distribution of ATC sites by Reinstatement Category and Traffic Sensitivity is shown.

Table 7: Distribution of selected sites by Reinstatement Category

Type	Traffic Sensitive				Non-TS
	0	1	2	3 & 4	3 & 4
All Records	5	110	186	190	20
Selected		8	8	15	10

5.19 The distribution of site by flow range (AADT) is shown in Table 8.

Table 8: Distribution of ATC records by AADT

Type	AADT					
	< 5,000	5,000-10,000	10,000-20,000	20,000-30,000	30,000-40,000	> 40,000
All Records	54	112	242	75	26	11
Selected	13	8	14	4	2	

5.20 The site selection process was determined by Reinstatement Category and Traffic Sensitive status. The resulting distribution of traffic volumes is representative of the recorded proportions.

5.21 The sites have been selected to achieve a distribution and traffic volumes that are representative for each reinstatement category type. The sites have also been selected to produce a representative spread across the Council road network.

5.22 The location of the selected sites across the road network is shown in Figure 7.

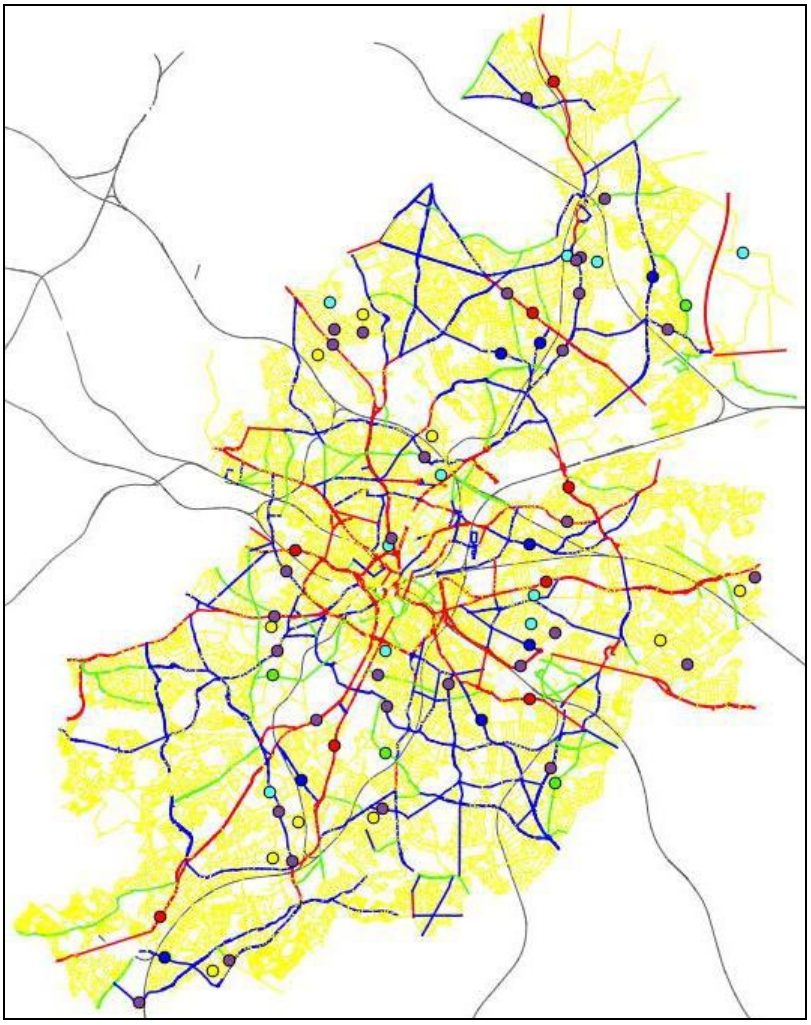

Figure 7: Selected ATC sites

5.23 The network plot shows the selected sites are distributed across the road network (reinstatement category 0 are shown in magenta, category 1 red, category 2 dark blue, category 3 in green, category 4 TS in yellow and category 4 Non-TS pale blue).

5.24 The Quadro software can model up to 4 flow groups - by default;

1. Monday – Thursday
2. Friday
3. Saturday
4. Sunday

5.25 The selected ATC data has been formatted to produce a Quadro compatible data entry format defining the directional flow in hourly intervals for each day type. The flow for suitable alternative or diversion routes has also been input in the same format.

5.26 The number of sites modelled in Quadro for each works and reinstatement category type is shown in Table 9.

Table 9: Number of locations modelled

Works Type	Cat.	Number of Sites Modelled
Road Closure (all day)	1 TS	1
	2 TS	8
	3-4 TS	15
	Non- TS	10
Road Closure (overnight)	1 TS	3
	2 TS	8
	3-4 TS	15
	Non- TS	10
Lane Closure	1 TS	2
	2 TS	
	3-4 TS	
	Non- TS	
Temporary Traffic Signals (two-way signals)	1 TS	6
	2 TS	8
	3-4 TS	15
	Non- TS	10
Temporary Traffic Signals (multi-phase)	1 TS	6
	2 TS	8
	3-4 TS	15
	Non- TS	10
Traffic Control (stop/go)	1 TS	6
	2 TS	8
	3-4 TS	15
	Non- TS	10
	SUB-TOTAL QUADRO	189

5.27 A large number of locations for each traffic management type and reinstatement category have been modelled, where appropriate ATC datasets were available.

5.28 8 locations each were selected for Cat 1 and 2 roads, to provide a range of traffic flows and diversion route lengths. 25 locations for Cat 3 and 4 roads were selected to ensure the variation in traffic volumes on these road types and length of diversion onto suitable roads is adequately represented. 15 of the locations are on Traffic Sensitive routes, the remaining 10 sites are on non-TS routes.

Input Assumptions

5.29 To ensure a consistent approach to the modelling, the following assumptions were applied to the roadwork models:

- Site length; 0.5 km dual carriageway and single carriageway, or 0.25 km where traffic signal control or stop / go boards in operation (0.1 km site length in urban areas on links of length < 0.5 km)
- Works duration; 1 week for all (to obtain costs for each day type)
- Speed limit for works site; 50 mph for 60 & 70 mph roads, 30 mph for all other speeds and all urban locations
- Lane width; 2.75 metres per lane for Chapter 8 miscellaneous works
- Speed/flow curve for diversion route; aggregate calculated with QDiv module to obtain a curve representative of the combination of links on the diversion route(s)
- Incidents; delays due to incidents not modelled since the works duration is relatively short

5.30 To avoid over-stating the modelled delays as a result of road closures on heavily trafficked routes (as several alternative routes may be available) the following assumptions have been applied:

- Category 0 & 1 streets, overnight works only, temporary running permitted through site during peak periods – affects 82 road closures
- Category 2 streets, 50% of works full road closure and 50% overnight works only, with temporary running permitted through site during peak periods – affects 156 road closures overall

6 MODELLED IMPACTS

Quadro Outputs

6.1 The Quadro user costs for each day type and non-exchequer impacts are taken directly from the output files.

6.2 The latest version of the software - Quadro 4 2021 (v4.20.0.1) - has been used for the updated assessment. All prices are quoted at 2010 base prices and discounted from the 2022 opening year of the cost-benefit analysis to 2010.

6.3 A spreadsheet was used to derive the arithmetic average costs for each road type modelled. The average duration for each works type was used to select suitable days for the works to take place, with the assumption that all works of a duration less than or equal to 5 days take place on weekdays. Any works of duration greater than 5 days are assumed to continue into the weekend.

6.4 The number of works assumed per annum in the first year of operation of the Permit Scheme and the average user cost by works type is shown in Table 10.

6.5 The high average cost of multi-phase traffic control on Category 1 and 2 roads is a result of the high traffic volumes on these roads and the long cycle times and low capacity for this traffic management type.

Table 10: Modelled annual user costs by tm type (Quadro)

Works Type	Cat.	Number Works p.a.	Ave. Cost per Work
Road Closure (all day)	1 TS	0	£ -
	2 TS	78	£ 100,010
	3-4 TS	491	£ 28,839
	Non- TS	545	£ 5,012
Road Closure (overnight)	1 TS	82	£ 20,583
	2 TS	78	£ 13,743
	3-4 TS	0	£ -
	Non- TS	0	£ -
Lane Closure	1 TS	616	£ 19,897
	2 TS	156	£ 19,897
	3-4 TS		£ -
	Non- TS		£ -
Temporary Traffic Signals (two-way signals)	1 TS	72	£ 53,119
	2 TS	231	£ 10,625
	3-4 TS	276	£ 5,514
	Non- TS	95	£ 1,101
Temporary Traffic Signals (multi-phase)	1 TS	98	£ 154,095
	2 TS	220	£ 40,891
	3-4 TS	421	£ 10,862
	Non- TS	318	£ 1,096
Traffic Control (stop/go)	1 TS	3	£ 33,587
	2 TS	13	£ 5,932
	3-4 TS	21	£ 3,039
	Non- TS	25	£ 394
	SUB-TOTAL QUADRO	3,839	£ 20,836

Note: all prices quoted at 2010 values.

6.6 The opening year summarised costs calculated for each works type and reinstatement category are shown in Table 11.

Table 11: Single year analysis of works cost (opening year)

Works Type	Cat.	Total Impact Market Prices	Net Cons Impact	Net Bus Impact	Accident Costs	Fuel & Emiss.	Indirect Tax Rev	Cumulative User Costs
Road Closure (all day)	1 TS	£ -	£ -	£ -	£ -	£ -	£ -	£ -
	2 TS	£ 10,152	£ 6,122	£ 3,793	£ 125	£ 113	-£ 335	£ 7,801
	3-4 TS	£ 18,817	£ 11,139	£ 7,028	£ 339	£ 311	-£ 628	£ 14,160
	Non- TS	£ 3,720	£ 2,166	£ 1,354	£ 93	£ 107	-£ 165	£ 2,732
Road Closure (overnight)	1 TS	£ 2,332	£ 1,398	£ 816	£ 62	£ 55	-£ 116	£ 1,688
	2 TS	£ 1,451	£ 888	£ 507	£ 30	£ 26	-£ 68	£ 1,072
	3-4 TS	£ -	£ -	£ -	£ -	£ -	£ -	£ -
	Non- TS	£ -	£ -	£ -	£ -	£ -	£ -	£ -
Lane Closure	1 TS	£ 15,264	£ 9,466	£ 5,800	£ -	-£ 2	-£ 388	£ 12,256
	2 TS	£ 3,865	£ 2,397	£ 1,469	£ -	-£ 0	-£ 98	£ 3,104
	3-4 TS	£ -	£ -	£ -	£ -	£ -	£ -	£ -
	Non- TS	£ -	£ -	£ -	£ -	£ -	£ -	£ -
Temporary Traffic Signals	1 TS	£ 4,603	£ 2,833	£ 1,740	£ 15	£ 15	-£ 107	£ 3,825
(two-way signals)	2 TS	£ 3,113	£ 1,897	£ 1,182	£ 18	£ 17	-£ 90	£ 2,454
	3-4 TS	£ 1,901	£ 1,156	£ 740	£ 3	£ 3	-£ 49	£ 1,522
	Non- TS	£ 131	£ 81	£ 50	£ -	£ -	-£ 4	£ 105
Temporary Traffic Signals	1 TS	£ 18,695	£ 11,410	£ 7,124	£ 106	£ 54	-£ 356	£ 15,101
(multi-phase)	2 TS	£ 11,443	£ 6,952	£ 4,296	£ 110	£ 85	-£ 236	£ 8,996
	3-4 TS	£ 5,808	£ 3,467	£ 2,231	£ 57	£ 52	-£ 148	£ 4,573
	Non- TS	£ 439	£ 270	£ 169	£ -	£ -	-£ 13	£ 348
Traffic Control	1 TS	£ 125	£ 68	£ 56	£ 0	£ 0	-£ 3	£ 101
(stop/go)	2 TS	£ 98	£ 53	£ 43	£ 1	£ 1	-£ 3	£ 77
	3-4 TS	£ 101	£ 66	£ 35	£ 0	£ 0	-£ 2	£ 64
	Non- TS	£ 12	£ 7	£ 5	£ -	£ -	-£ 0	£ 10
SUB-TOTAL QUADRO		£ 102,072	£ 61,836	£ 38,439	£ 961	£ 836	-£ 2,808	£ 79,988

Note: all prices quoted at 2010 values and £000's.

6.7 The majority of costs are incurred with full road closures and temporary traffic signal control, which make up around 31% and 46% of the total annual impact, respectively.

6.8 19% of the delays modelled are incurred at the 772 lane closures on Category 0-2 dual carriageways.

6.9 Impacts at overnight road closures and daytime stop/go control incur less than 5% of the total delay combined.

6.10 The average diversion length for sites modelled in Quadro is 0.7 km. For Category 1 and 2 roads (which make up the A-class and primary B-class routes) the average diversion length is 1.1 km. The longest diversion route modelled is a closure on the A5127 Lichfield Road requiring a diversion via A454 Walsall Road, a diversion length of 1.9 km.

6.11 These relatively low diversion route lengths are appropriate for a predominantly urban network.

Microsimulation Outputs

6.12 The economic assessment of the model outputs has been carried out using the PEARS software (Programme for the Economic Assessment of Road Schemes version 15). PEARS is an economic assessment package that has been specifically designed for use with the output from traffic microsimulation models.

6.13 The economic concepts in PEARS are consistent with the Fixed Trip Matrix methodologies of COBA and NESA (as detailed in DMRB Volumes 13 and 15, respectively). The methodologies and costs are derived from TAG Unit 3.5.6 - Values of Time and Operating Costs.

6.14 The model was run for base year traffic flows and a future year using the TEMPRO traffic growth projection. The additional delays to vehicles travelling through the works site were identified by running the same base model with no incident vehicles with the resulting model outputs providing the input to the PEARS economic assessment.

6.15 The number of works and calculated average cost is shown in Table 12.

Table 12: Users costs by traffic volume give & take works

Works Type	Cat.	Number Works p.a.	Ave. Cost per Work
Traffic Control (give & take)	High flow	1,167	£ 586
	Medium flow	1,395	£ 312
	Low flow	6,979	£ 130
			£ -
	SUB-TOTAL MICROSIM	9,540	£ 212

Note: all prices quoted at 2010 values.

6.16 The table shows that the average cost of works in high flow locations is £586, reducing to £312 and £130 for medium and low flow locations. The average duration of works is 4 days on Traffic Sensitive and Non-TS streets.

6.17 The summary costs by works type evaluated are shown in Table 13.

Table 13: Microsimulation single year analysis of works cost (opening year)

Works Type	Cat.	Total Impact Market Prices	Net Cons Impact	Net Bus Impact
Traffic Control (give & take)	High flow	£ 683	£ 373	£ 467
	Medium flow	£ 436	£ 312	£ 223
	Low flow	£ 908	£ 558	£ 558
	SUB-TOTAL MICROSIM	£ 2,027	£ 1,244	£ 1,248

Note: all prices quoted at 2010 values and £000's.

6.18 'Give & Take' traffic control amounts to approximately £2M annually, and represents around 2% of the total cost of all works.

Combined Impacts

6.19 The summarised annual impact of works for the Quadro and microsimulation modelling is shown in Table 14.

Table 14: Summary single year analysis (opening year)

	Total Impact Market Prices	Net Cons Impact	Net Bus Impact	Accident Costs	Fuel & Emiss.	Indirect Tax Rev	Cumulative User Costs
Sub-total Quadro	£ 102,072	£ 61,836	£ 38,439	£ 961	£ 836	-£ 2,808	£ 79,988
Sub-total Microsim	£ 2,027	£ 1,244	£ 1,248	£ -	£ -	£ -	£ -
TOTAL	£ 104,099	£ 63,080	£ 39,687	£ 961	£ 836	-£ 2,808	£ 79,988

Note: all prices quoted at 2010 values and £000's.

6.20 The CBA spreadsheet was set-up to carry out an assessment of the 25-year economic impacts using the model outputs for 2022 base year and 2046 future year traffic flows. The costs for intermediate years are interpolated within the spreadsheet.

6.21 The summarised impact for the 25-year assessment period is shown in Table 15.

Table 15: 25 years analysis of works cost, all works (2022-2046)

	Total Impact Market Prices (2022)	Total Impact Market Prices (2046)	25 Year Cumulative Costs
Sub-total Quadro	£ 102,072	£ 94,169	£ 2,453,006
Sub-total Microsim	£ 2,027	£ 2,257	£ 29,464
TOTAL	£ 104,099	£ 96,425	£ 2,482,469

Note: all prices quoted at 2010 values and £000's.

6.22 The total economic impact of street works across the Birmingham City network over the 25-year assessment period is just under £2,500M. The annual cost in the first year is calculated at £104M.

7 COST BENEFIT ANALYSIS

Modelled User Costs

7.1 The cumulative annual costs occurring from road and street works – aggregate of the modelled impacts presented in Chapters 4, 5 and 6 - are presented below (all 2010 price base):

- 2022 base year costs, total market prices £104M;
  - Quadro assessment £102M (Table 11, page 21)
  - Microsimulation assessment £2M (Table 13, page 22)
- 25-year cumulative costs, total market prices £2,482M;
  - Quadro assessment £2,453M (Table 15, page 23)
  - Microsimulation assessment £29M (Table 15, page 23)

7.2 The inclusion of the costs associated with works requiring Give & Take traffic management or not listed as requiring active traffic management but involving occupancy of the carriageway or footway (9,540 works), constitutes 2% of the modelled total user costs.

7.3 The significant majority of the costs are derived from the 3,839 works per annum – assessed in Quadro for road closures, lane closures, temporary traffic signal control and stop/go boards.

7.4 No impacts have been assumed for the remaining 19,402 works classified as No or Some Incursion and do not require excavation of the carriageway or create an impact on traffic flow while the works are carried out.

Public Accounts

7.5 The assessment of the impact on the cost to public accounts includes the annual scheme operating costs, revenue generated by operating the Permit Scheme and indirect tax revenues obtained from the Quadro modelling.

7.6 A 38% uplift has been applied to the operating cost estimates (15% optimism bias plus 20% risk adjustment uplift). The first year Present Value of Costs (PVC) for the scheme are shown in Table 16.

Table 16: Public Accounts

	Costs
Local Government Funding;	
Revenue (-)	£747,841
Operating Costs	£1,367,663
First Year Investment Costs	£0
Developer and Other Contributions	-
Grant/Subsidy Payments	-
NET IMPACT	**£619,822**
Central Government Funding;	
Revenue	-
Operating costs	-
Investment Costs	-
Developer and Other Contributions	-
Grant/Subsidy Payments	-
Indirect Tax Revenues	£140,396
NET IMPACT	**£140,396**
TOTAL PRESENT VALUE OF COSTS (PVC)	**£760,218**

Note: all prices quoted at 2010 values.

7.7 The first year Present Value of Costs (PVC) is £0.76M.

Transport Economic Efficiency

7.8 The cost benefit analysis of the projected benefits accruing from the operation of the Permits Scheme has been carried out for a single year assessment and over the 25-year operational period.

7.9 The cost benefit is based on the following assumptions:

- 5% scheme benefit assumed (from reduction in delay and costs of works)
- First year scheme operational cost £1.68M (2010 prices)
- Scheme operational costs increase at 2% year on year over 25-year period

7.10 In the absence of any direct evidence of Permit Scheme benefits, it is standard practice to apply a 5% reduction in the works user costs as the benefit expected to be achieved through the operation of the scheme.

7.11 A 2% year on year increase in scheme operating costs was included to ensure the on-going costs are not under-estimated over the period of the assessment. The value was selected to broadly represent inflation targets and be representative of the anticipated year on year increase in staff costs.

7.12 Assuming a 5% reduction in the impact of works the net benefit to consumer users and business users and private sector providers, in terms of Transport Economic Efficiency, will be of the order of £4.4M per year.

7.13 The business user and private sector provider impacts are calculated on the basis of the following (all prices expressed at 2010 values):

- Business User Travel Time & Vehicle Operating Cost Benefits £1,984,369
- Less the cost to industry of permit fees charged £747,841

7.14 Table 17 shows the breakdown of benefits by consumer and businesses/private sector.

Table 17: Economic Efficiency of the Transport System (TEE)

	Benefits
Consumer User; Travel Time & Vehicle Operating Cost Benefits	£3,153,992
Business; Business User Travel Time & Vehicle Operating Cost Benefits & Private Sector Provider Impacts	£1,236,528
Present Value of Transport Economic Efficiency Benefits (PVB)	£4,390,519

Note: all prices quoted at 2010 values.

Scheme Benefits

7.15 The single year scheme benefits have been derived from the 2022 base year calculated scheme costs. The analysis is presented in Table 18.

Table 18: Single year cost benefit analysis (2022 Base)

	Costs
Noise	-
Local Air Quality	-
Greenhouse Gases *	£41,809
Journey Ambience	-
Accidents *	£48,040
Consumer Users	£3,153,992
Business Users and Providers	£1,236,528
Reliability	-
Option Values	-
Present Value of Benefits (PVB)	£4,480,368
Public Accounts; **Present Value of Costs (PVC)**	£1,075,375
Overall Impacts; **Net Present Value (NPV)**	£3,404,993
Benefit to Cost Ratio (BCR)	4.2

Note: all prices quoted at 2010 values.

7.16 Assuming a 5% reduction in delay and an annual cost of £1.9M to operate the Permit Scheme, the single year assessment produces an annual benefit of approximately £4.5M, a Net Present Value (NPV) of £3.4M and a Benefit to Cost Ratio (BCR) of 4.2.

7.17 The 25-year assessment of scheme benefits is derived from the 25-year cumulative costs (interpolated from the 2022 base and 2046 future year assessment). The analysis is presented in Table 19.

Table 19: 25 year cost benefit analysis (2022-2046)

	Costs
Noise	-
Local Air Quality	-
Greenhouse Gases *	£1,478,016
Journey Ambience	-
Accidents *	£957,979
Consumer Users	£75,197,700
Business Users and Providers	£34,464,030
Reliability	-
Option Values	-
Present Value of Benefits (PVB)	£112,097,725
Public Accounts; **Present Value of Costs (PVC)**	£25,521,360
Overall Impacts; **Net Present Value (NPV)**	£86,576,364
Benefit to Cost Ratio (BCR)	4.4

Note: all prices quoted at 2010 values.

7.18 The assessment of scheme benefit over a 25-year operational period produces an overall benefit of £112M, a Net Present Value of £86.5M and a BCR of 4.4.

7.19 The annual operating costs are assumed to increase at 2% year on year for the 25-year assessment period.

Sensitivity Tests

7.20 To identify the sensitivity of the cost benefit to the assumed scheme benefit, the assessment has been repeated assuming a reduction in total cost of works of 2.5% and 7.5%. The results of the sensitivity test are shown in Table 20.

Table 20: Sensitivity testing of scheme benefit assumption

Assumed scheme operational benefit	2.5%	5.0%	7.5%
Single Year Appraisal;			
Present Value of Benefits (PVB)	£1,866,263	£4,480,368	£7,094,472
Present Value of Costs (PVC)	£1,145,573	£1,075,375	£1,215,771
Net Present Value (NPV)	£720,691	£3,404,993	£5,878,702
Benefit to Cost Ratio single year (BCR)	1.6	4.2	5.8
25 Year Appraisal;			
Present Value of Benefits (PVB)	£49,670,388	£112,097,725	£174,525,061
Present Value of Costs (PVC)	£26,907,609	£25,521,360	£28,293,858
Net Present Value (NPV)	£22,762,779	£86,576,364	£146,231,203
Benefit to Cost Ratio 25 year (BCR)	1.8	4.4	6.2

Note: all prices quoted at 2010 values.

7.21 A net reduction in total delay and user costs of 7.5% would result in the single year and 25-year BCR of around 6. The NPV would increase by a factor of 1.5 to 1.7 to £5.9M and £146M, respectively.

7.22 A 2.5% reduction in delay as a result of running the Permit Scheme would reduce the BCR to 1.6 for the single year and 1.8 for the 25-year cost benefit analysis, with the NPV reducing by approximately a factor of 4 compared with the 5% scenario.

7.23 A lower scheme benefit would reduce the BCR. Break even in the first year would occur at a 1.7% overall scheme benefit. Over the 25-year assessment period, break even would occur from a 1.5% overall scheme benefit.

7.24 A BCR of 2.0 would be achieved with a 2.5% to 2.7% reduction in the total cost of works.

8 SUMMARY

Objectives

8.1 This report presents an update to the original 2016 Cost Benefit Analysis to identify the anticipated savings in road user costs that could be realised by the introduction of a Permit Scheme, to be known as The Birmingham City Council Permit Scheme for Road and Street Activities.

8.2 The analysis uses the latest version of the Quadro software, an updated estimate of permit activity and revised operating costs, to present the anticipated Benefit to Cost Ratio and Net Present Value for a single year and a 25-year assessment period.

Scheme Benefit

8.3 The benefits of the Permit Scheme are estimated from an agreed reduction in delay and therefore annual cost of works and the scheme Net Present Value and Benefit to Cost Ratio presented for the first year and 25-year analysis. The assessment assumes a 5% reduction in delays and overall costs will be achieved following the introduction of the Permit Scheme.

8.4 The annual cost of works at 2010 prices and values is £104M. The cumulative cost forecast over a 25-year period is £2,482M.

8.5 Assuming a 5% reduction in delay and an annual cost of £1.9M to operate the Permit Scheme, the single year assessment produces an annual benefit of approximately £4.5M, a Net Present Value (NPV) of £3.4M and a Benefit to Cost Ratio (BCR) of 4.2. The assessment of scheme benefit over a 25-year operational period produces an overall benefit of £112M, a Net Present Value of £86.5M and a BCR of 4.4.

8.6 Break even in the first year would occur at a 1.7% overall scheme benefit. Over the 25-year assessment period, break even would occur from a 1.5% overall scheme benefit.

8.7 A BCR of 2.0 would be achieved with a 2.5% to 2.7% reduction in the total cost of works.

Conclusions

8.8 This 2022 CBA update shows that the scheme continues to show the potential to deliver significant economic benefits throughout the 25-year evaluation period. The modelled delays have reduced due to a reduction in the duration of works in the noticing record and a change in how full road closures are modelled on Category 0-2 streets.

8.9 However, the BCR for the scheme has increased slightly from 3.5 in the opening year in the 2016 assessment to 4.2 in the 2022 update. This is a result of an increase in the estimated annual fee income and a reduction in the overall scheme operating cost as a result of the revised permit activity forecast (Chapter 3).

8.10 The value for money threshold (BCR) of 2.0 can be achieved with a 3% reduction in the delays to road users as a result of traffic management associated with the street works.

8.11 This is below the reduction of 5% recommended in the appropriate guidance documents and advice notes. A 5% reduction in impact to road users as a result of street works operation would achieve a BCR of 3.5.