

1 **EVALUATING TRANSPORT DEMAND MANAGEMENT INTERVENTIONS**
2 **USING THEORETICAL EVALUATION**

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4 **Authors: Mr Simon Dale^{a,b,*}, Dr Matthew Frost^a, Prof. Stephen Ison^a and Mr**
5 **Peter Warren^b**

6

7 ^a Centre for Innovative and Collaborative Construction Engineering, Loughborough
8 University, Loughborough, Leicestershire, UK, LE11 3TU, Tel +441509222605,
9 S.G.Ison@lboro.ac.uk, M.W.Frost@lboro.ac.uk, s.dale@lboro.ac.uk

10

11 ^b Highway Metrics Team, Nottingham City Council Loxley House ,Station Street,
12 Nottingham, UK, NG2 3NG, Tel +441158765271,
13 peter.warren@nottinghamcity.gov.uk, simon.dale@nottinghamcity.gov.uk

14

15 * Corresponding author: Centre for Innovative and Collaborative Construction
16 Engineering, Loughborough University, Loughborough, Leicestershire, UK, LE11
17 3TU, Tel +447795055149, s.dale@lboro.ac.uk

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27 **ABSTRACT**

28

29 Theoretical approaches to evaluating public policy initiatives seek to account for the
30 effect of factors external to the initiative which could impact on the outcome of that
31 initiative. The application of this approach within the transport sector is relatively new
32 despite current government Department for Transport guidance advocating its use.

33 Nottingham is the first City in the UK to implement a Workplace Parking Levy
34 (WPL) which places a levy on private non-domestic off street parking provided by
35 employers. The scheme acts as a transport demand management measure with the
36 revenue hypothecated for funding a package of transport improvements.

37 This paper analyses the application of a theoretical evaluation approach, using the
38 example of the Nottingham WPL package as a case study. The analysis includes a
39 logic map based on stakeholder consensus and literature, explaining how the package
40 is expected to meet its stated objectives.

41 The paper concludes that a combination of two theoretical approaches, ‘Theory of
42 Change approach strengthened by elements of ‘Realistic Evaluation, as an appropriate
43 framework for evaluating transport interventions and that this has established a
44 plausible model for change and expected outcomes and impacts for the Nottingham
45 WPL Package. Additionally, it concludes that the available data supports the validity
46 of the established Theory of Change for the Nottingham WPL package with regards to
47 shorter term outcomes. This will be invaluable to any authority which chooses to
48 pursue a similar approach.

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55 INTRODUCTION

56 It is common for local authorities introducing new transport initiatives in the UK to
57 monitor a set of indicators upon which the intervention is intended to cause change.
58 Large or complex interventions however, which are implemented and assessed over a
59 period of time may result in incorrect conclusions, since factors such as economic
60 conditions may change over time. Thus monitoring must be considered against the
61 overall background of change which is external to the intervention. This is generally
62 referred to as the 'context' in evaluation literature (see 1 and 2). Thus ideally the aim
63 is to research evidence in order to indicate that it is the intervention in question that is
64 causing any observed change, anticipated or otherwise, rather other unrelated
65 contextual factors. This is termed attribution (3). This wider consideration of context
66 leading to attributing the medium and long term changes in indicators to the
67 intervention being studied is termed evaluation (1).

68 In recent years UK government best practice guidance for evaluating major transport
69 interventions has advocated Theoretical Evaluation approaches to address the issue of
70 achieving attribution of affects to the scheme being evaluated. (3 and 4). Theoretical
71 Evaluation is common in assessment of issues related to public health and social
72 programs however there is little published on the use of such approaches in transport
73 evaluation. The Nottingham Workplace Parking Levy (WPL) package is an example
74 of a major transport intervention recently implemented in a medium sized UK City
75 being used to manage transport demand and raise capital for public transport
76 improvements. The effectiveness of the WPL package in meeting its stated objectives
77 has to be evaluated and theory of change has been proposed for such evaluations.

78 This paper introduces the WPL and provides a literature review to explore the options
79 for tailoring Theoretical Evaluation to evaluating a transport intervention. It then
80 develops a theory of change for the Nottingham Workplace Parking Levy package
81 which is a required component of a theoretical evaluation approach. This leads to the
82 production of a logic model of how the WPL package can be expected to meet its key
83 scheme objectives. The extent to which this theory is operating as expected is
84 assessed against the latest available data. From this key elements required of such an
85 approach are identified that can, in future, be applied to the planning stage of any
86 similar intervention to aid scheme evaluation.

87

88 BACKGROUND TO THE WPL

89 In April 2012 Nottingham City Council introduced the WPL which uses the
90 provisions of the Transport Act 2000 to levy a charge on occupied private non-
91 domestic off street parking places that is Workplace Parking Places (WPP) occupied
92 by employees, regular business visitors or students. It is the first charge of its type in
93 the UK, and indeed in Europe. Currently the charge per WPP is £334 (\$571) per year.
94 Employers apply for a licence for each of their premises where such places are
95 provided which states the number of WPP they wish to use and then pay the
96 appropriate levy. Currently a third of Workplace Parking places have the charge
97 passed onto employees via employer run workplace parking charging schemes.

98

99 The WPL therefore has a dual role to act as a transport demand management measure
100 and also to raise hypothecated funds for transport improvements. The money raised

101 by the WPL is funding two new tram lines, improvements to Nottingham Railway
 102 Station and additional bus services. The WPL scheme and the above mentioned public
 103 transport improvements comprise the overall “WPL package” and are intended to
 104 complement each other to enhance the transport demand management effect.

105 As part of the approval for the scheme a business case was prepared and submitted to
 106 government in 2008 (5), within this 6 key objectives of the WPL were identified
 107 (further discussed below) together with a commitment to evaluate these. For those
 108 interested in further detail on the Nottingham WPL and its implementation, Dale et al
 109 2014 (30) provide a detailed case study of the scheme which provides further
 110 background information to support this paper.

111

112 **THEORETICAL APPROACHES TO EVALUATION**

113 Theoretical approaches to evaluation have evolved to address acknowledged
 114 weaknesses of experimental design fully accounting for context and attribution.
 115 Pawson and Tilley (1997) (2) introduced Realistic Evaluation, while in 1998 work
 116 carried out by the Aspen Institute put forward an alternative theory based approach;
 117 the Theory of Change (6). These approaches take into account contextual changes, as
 118 and when, they occur by incorporating them into a theory which describes the process
 119 of change the intervention is intended to achieve (7). Additionally theory based
 120 techniques, where a lack of data mitigates against experimental proof, are intended to
 121 have the ability to fall back on the underlying theory so as to make credible
 122 attributions in the absence of experimental evidence (8). It is important to stress that
 123 the term ‘theoretical’ is used to articulate that the evaluation uses a theory based on
 124 previous experience and is tested by collecting evidence prior to any conclusions
 125 being provided, rather being purely theoretical in that it is untested or unreal.

126

127 **Theory of Change Approach**

128 A Theory of Change Approach (ToC) describes the causal relationships between the
 129 events linked to an intervention which aim to meet a set of stated scheme objectives,
 130 in doing so it seeks to take into account context and any likely changes to this that can
 131 be foreseen. These events are commonly identified as follows (9 and 4):

- 132 • Context/setting – this describes the problem the action will attempt to mitigate
 133 and also any relevant contextual factors, Thus it could also be seen as setting
 134 the scene;
- 135 • Inputs – This describes the nature of the intervention and the resources
 136 required to implement it;
- 137 • Outputs – This describes what those resources deliver on the ground e.g. a
 138 new tram line;
- 139 • Outcomes – This refers to the immediate effect of the intervention in the short
 140 and medium term;
- 141 • Impacts - this is longer term strategic changes which the intervention has
 142 effected or contributed to.

143

144 A distinctive aspect of a ToC evaluation is that it relies on this causality being
 145 developed based on existing evidence from stakeholders, good practice elsewhere,
 146 previous evaluations, and academic studies leading to a consensus on the theory of
 147 change. Where knowledge gaps are identified bespoke research may be necessary.
 148 Modern applications of this approach have used logic maps to articulate and
 149 understand the theory (6, 9 and 3). Thus the theory proposes that if, given setting X,
 150 resources are committed then Y will be delivered. Given that Y is now in place this
 151 will result in Z outcomes which in turn will achieve W impacts. While clearly the
 152 larger the evidence base in terms of previous experience the better, this form of
 153 evaluation is effective in dealing with complex or innovative schemes due to the
 154 flexibility of evidence gathering in developing the theory.

155 Literature on how a ToC approach achieves attribution is somewhat general in nature.
 156 Connell and Kubisch (1998) (10) while recognizing that there is no guarantee that
 157 observed change is due to factors other than the intervention, argue that often, if the
 158 observed change is commensurate with the theory then stakeholders may be willing to
 159 accept that it is attributable to that intervention. They identify four points which they
 160 believe could be sufficient to demonstrate attribution when adopting a ToC approach,
 161 namely that the:

- 162 • theory is plausible;
- 163 • intervention was implemented as expected;
- 164 • magnitude of the outcomes following the above was as predicted by the
 165 theory;
- 166 • absence of any contextual shift that could account for the above outcomes.

167

168 **Realistic Evaluation**

169 Realistic Evaluation (RE) is a theoretical evaluation approach which is rooted in the
 170 realist philosophy of science and views the world as a series of open systems subject
 171 to causal factors that vary over time (2) i.e. they recognise that if intervention A has
 172 previously lead to outcome B it may not necessarily be the case in the future or in a
 173 different location because external causal factors may not be the same. In other words
 174 they embrace the concept that the outcomes to actions will depend on the wider
 175 context (11). RE can therefore be said to have a base formula for exploring this
 176 explanatory aim:

177
$$\text{Mechanism} + \text{Context} = \text{Outcome}$$

178 These 3 elements are explained as follows (12):

- 179 1. Mechanisms (M): That evaluators need to explore the mechanism that is
 180 intended to operate to make the programme effect the intended change. A
 181 mechanism is, therefore, a mini theory which says how an intervention will
 182 achieve change, e.g. a WPL, where it is passed on will raise the cost of
 183 travelling to work by private car thus utilising basic economic theory to reduce
 184 the percentage of people choosing that mode.
- 185 2. Context (C): It's important to explore the context in which it is intended to
 186 operate and identify what factors will impact on the intended mechanisms.

187 3. Outcome Patterns (O): This is a postulation as to what outcomes will occur to
 188 whom and where. It includes an appreciation that the mechanisms and
 189 therefore the outcomes may not operate in a uniform fashion due to
 190 differences between contextual factors.

191 A realist theory therefore comprises a series of postulated Context-Mechanism-
 192 Outcome Theories (CMOs) and the output of the evaluation is refined and tested
 193 CMOs. Pawson and Tilley (2004) (12) provide a straightforward account of how
 194 realist evaluators approach attribution by identifying mechanisms and proceeding to
 195 test them empirically. They recognize that in complex programs potential mechanisms
 196 may be almost infinite and that the evaluator can only go so far. While the two
 197 approaches outlined above developed independently it is debateable if they are
 198 distinct and mutually exclusive. Pawson and Tilley (2004) (12) give a number of
 199 examples of the applications of RE to real life evaluations. It is important to that
 200 these were applied to a relatively narrow area of study with easily definable
 201 consequences, a far cry from a major transport intervention which can, arguably
 202 pervade many policy areas. Laws (2009) (11) used RE to evaluate Publicly Funded
 203 Demand Responsive Travel (DRT) Schemes in the UK. Laws (11) concluded that
 204 although the approach generated a reasonable level of knowledge the approach was
 205 extremely time consuming and the findings could lack precision. She recommended
 206 that such evaluation methods be limited to key areas of the scheme rather than
 207 adopted as an overall evaluation approach. Blamey and Mackenzie (2007) (7)
 208 conclude that it may be desirable to include an element of RE within an overall ToC
 209 evaluation framework in order to examine the cause of change in more detail.

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211 **THEORETICAL EVALUATION APPLIED TO TRANSPORT**

212 To date there are very few published examples of how these approaches have been
 213 applied to the evaluation of transport projects. In general, as suggested by the
 214 literature it is considered that the basic methodologies for ToC or RE can be directly
 215 applied to transport interventions without major modification, however there are some
 216 points specific to transport interventions that should be considered:

- 217 1. Scale of the intervention - Theoretical approaches lend themselves to schemes
 218 or packages that are complex and innovative as these approaches, while
 219 stronger for an existing evidence base, do not rely on this and are capable of
 220 generating conclusions from incomplete or sparse base and monitoring data.
 221 This is relevant to large scale transport initiatives as they are likely to
 222 influence whole conurbations with unique characteristics making traditional
 223 experimental comparative approaches difficult to design and implement.
- 224 2. Utility of a logic map - The current guidance on evaluating major transport
 225 interventions from the UK Department for Transport (3) strongly advocates
 226 the use of a logic map to express the theory of change, in doing so they are
 227 nudging evaluators towards a ToC approach.
- 228 3. Combining ToC and RE approaches - Given the discussion above it can be
 229 seen that an element of realistic evaluation can be used to strengthen the ToC
 230 approach. If the evaluator chooses this option then it will be important to limit
 231 the number of CMO theories or limit themselves to identifying key
 232 mechanisms and contextual factors.

233 The above issues are expanded in the discussion on the chosen approach to evaluate
 234 the WPL package in the following section.

235

236 **A THEORETICAL EVALUATION APPROACH APPLIED TO THE WPL** 237 **PACKAGE**

238 Considering the above discussion, it is possible to make key statements about the
 239 characteristics of the WPL package relevant to the choice of evaluation approach:

- 240 1. The WPL package will be implemented over a 4 year time span during which
 241 both local and national context is liable to change.
- 242 2. The WPL package is unique in a European context and even the Australian
 243 schemes have significant differences to the Nottingham Package. It can
 244 therefore be considered to be an innovative and untested intervention.
- 245 3. The WPL and the schemes which it funds is a package, as it is a number of
 246 complementary interventions designed to act and interact to attain common
 247 objectives.
- 248 4. The presence of competitor cities within the region and other Core Cities of a
 249 similar size and socio-economic profile facilitates the identification of a
 250 comparator group for many indicators. It is not possible to identify a random
 251 control group as the WPL is area wide.

252 The above statements will be true for many large scale transport initiatives which
 253 incorporate innovative or new approaches where the existing evidence for their
 254 effectiveness is limited. Clearly because of the area wide nature of the package which
 255 mitigates against the availability of a random control group a true experimental
 256 approach is not possible. While other similar cities provide an acceptable comparator
 257 group only some of the chosen indicator monitoring data is available for those cities.
 258 This means that a quasi-experimental approach is feasible for some objectives but
 259 cannot be the complete answer.

260 Another consideration is that the WPL is an innovative measure that is untested in a
 261 UK or indeed European context, thus it is desirable not merely to report that change
 262 has occurred relative to the comparator cities but to understand why and how
 263 rendering information as to how specific context has contributed to that change. From
 264 the above it can be seen this kind of knowledge generation is only possible by
 265 adopting a theoretical evaluation approach. Neither before and after monitoring nor
 266 quasi-experimental evaluation approaches provide an understanding of how change is
 267 achieved and are not able to take into account changing contextual factors over time.

268 Additionally the formulation of a theory based on logic mapping would also be useful
 269 where no comparable data is available, for example bespoke business investment
 270 research, as attribution can be achieved by answering the questions. Based on (10):

- 271 • Is the theory is plausible?
- 272 • Was the intervention implemented as expected?
- 273 • Is the magnitude of the observed changes to the indicator as predicted by the
 274 theory?
- 275 • The absence of any contextual shift that could account for the above outcomes
 276 or if there was, has this been taken into account.

277 The above discussion clearly points to the desirability of an approach whereby a
278 Theory of Change is articulated by producing a logic map based on the knowledge of
279 stakeholders and key documentary evidence. Where feasible a quasi-experimental
280 component to the evaluation will strengthen this.

281 Six objectives have been identified by stakeholders based on the WPL Business Case
282 (see 13). In this paper the evaluation of the three most important objectives in terms of
283 the packages long term aims and transferability are considered:

284 O1 - Constrain congestion in the AM and PM peak periods.

285 O2 - Encourage sustainable travel and mode choice.

286 O3 - Enhance the attractiveness of Nottingham as a location for business
287 investment.

288 To develop an evaluation framework, a logic map (Figure 1) has been developed
289 which represents, a theory of change for the WPL package against these objectives.
290 This logic map is based on the 5 events inherent in a theory of change approach as
291 described earlier. It is thus chronological in nature and identifies the stages and
292 linkages flowing from the initial context to the inputs outputs, outcomes and eventual
293 longer term impacts. It also shows which outcomes and impacts contribute towards
294 which objectives. An element of a realistic evaluation approach has been used to add
295 further explanatory detail to the theory presented in the logic map by identifying
296 individual mechanisms of change and where within the logic flow each mechanism is
297 anticipated to operate.

298 The mechanisms that have been identified try to balance the need for them to be
299 defined and discrete with, a recognition, that if they were broken down into the
300 smallest unit there could be double or triple the number. Thus individual mechanisms
301 occur at more than one place within the logic map. Contextual factors that are relevant
302 at the schemes inception are identified within the background and context box in
303 Figure 1. Table 1 identifies a series of discrete contextual factors which are
304 anticipated to impact on the effectiveness of the WPL package. Table 2 details the
305 individual mechanisms which are anticipated to operate.

306 .

307

308 **TABLE 1 Context of the WPL Package**

	Context	Evidence base to support context
C1	Socio-economic characteristics	Nottingham is a medium sized English city with a population of 308,000 (645,000 in the primary urban area). It ranks 20th out of 326 Local Authority areas for deprivation and should, therefore, be considered deprived. 90% of its GVA is accounted for by the service sector.
C2	Relevant Transport Policies	The Local Transport Policy background features extensive bus priority measures, activities to encourage green modes of travel including workplace travel planning, Park and Ride, 1 existing Tram Line and a general presumption against catering for growth in travel via road improvements.
C3	National Economic Conditions	The WPL package is being implemented in a period when the national economy is emerging from recession with associated improving economic growth figures.
C4	Cost of fuel	Standard unleaded fuel prices rose by 17% between January 2010 and December 2013 while diesel prices rose by 22% in the same period. (14)
C5	The Nottingham Offer	Key operational costs are lower in Nottingham than other comparable cities in the UK, with office costs at £19.00 per sq. ft. for Grade A office space (compared to £35-400 in Birmingham and Manchester, £30.00 in Leeds, £25 in Milton Keynes and £25 in Cardiff) – (15) and salary costs on average 10% lower than the national average (16). These are the main costs that a business will focus on when deciding on a new location and are key in terms of what Nottingham has to offer as a location.
C6	Existing Congestion Problem	Nottingham City Council estimates that congestion, mainly in the AM and PM peak period, costs the City's economy £160m pa (5), this will manifest itself as a cost to business in lost time, increased transport costs, difficulties in access for qualified workforce etc.
C7	Presumption of Growth	Population projected to grow by 9% 2011-2026 (17)
C9	Short term disruption to network by construction phase of WPL Package, Ring Rd Improvement scheme and Improvements to A453	Journey Time per Vehicle mile on Radial Routes into the City in the AM peak period affected by these road works rose by 31% between 2010/11 and 2013/14 while those isolated from them rose by 5.4%, less growth than in 3 out of 4 of the comparator cities

310 TABLE 2 Mechanisms Activated by the WPL Package

	Mechanism	Evidence base to support mechanism
M1	WPL funds Improved public transport (PT) options.	The parking space schemes in the Australian deliver stable hypothecated revenue for transport (5). The Nottingham WPL scheme has raised approx. £14 million to date (13)
M2	Improved PT options result in increased capacity , this will encourage new trips generated by growth to choose PT rather than the car.	In Nottingham the introduction a tram increased PT trips from 68,000 in 2003/4 to 74,000 in 2005/6. (18).
M3	Improved PT options result in better connectivity, image and convenience when using PT , encouraging modal switch from the car to PT.	
M4	WPL funds business support measures to encourage workplace travel plans, car park management and cycle infrastructure improvements which encourage employees to switch from car to PT, cycling or walking.	Studies show that Travel Planning is effective in encouraging mode shift (19 and 20). Concern for WPL is imposing a cost on business discouraging inward investment (21 and 22). Passing cost to employees via parking charges may address this concern and there is evidence that this is taking place (13).
M5	Direct increase in cost in commuting to work by car due to Workplace Parking Charges. Some employers choose to pass on the cost of the provision of these places to their employees, thus effectively increasing the cost of commuting to work by car. According to basic economic theory this should decrease the demand for this mode of travel.	Evidence from long standing parking space levy schemes in Australia suggests that they can contribute towards modal shift (23 and 24). The London Congestion charge prompted an initial drop in congestion, although it did later rebound, possibly due to external economic factors (25). A report on the economic and business impact of the WPL produced by Price Waterhouse Cooper on behalf of Nottingham City Council (21) predicted that a significant number of employers would choose to pass the charge onto their employees.
M6	Indirect increase in cost of commuting to work by car. WPL causes a contraction in the supply of workplace parking resulting in an additional cost to commuting by car as paid for non-workplace parking is used thus decreasing the demand for this mode of travel.	There is evidence that the introduction of the Nottingham WPL has prompted a contraction in the supply of workplace parking places. (13).
M7	Decrease the supply of Workplace Parking. The WPL prompts employers to 'ration' the workplace parking places (WPP) they provide to employees causing a contraction in the supply of WPP in places where there is no alternative supply other modes will need to be utilised.	

M8	Enhanced effect of WPL package. The combined effect of the WPL Package: The WPL, NET Phase 2, the refurbishment of Nottingham Station and provision of Linkbus Services act as a combined package to greater effect than the individual schemes to encourage mode shift.	It is generally accepted that to be most effective Transport Demand Management measures need to be provided in an integrated package (26 and 27).
M9	Congestion Constraint. The improved PT quality and capacity combines with the increase in cost of commuting by car to prompt modal shift away from the car and thus reduces or constrains traffic congestion.	Evidence from long standing parking space levy schemes in Australia, which also use revenues generated to improve PT, suggest that they can contribute towards congestion constraint (23 and 24). The London Congestion charge prompted an initial drop in congestion although it did later rebound possibly due to external economic factors (25).
M10	Transport demand management effect of the WPL package reduces cost of congestion to businesses making Nottingham more attractive as a business location.	A study by the Core Cities Group showed that the availability of an efficient transport system is a prerequisite for business location; however it is not the most important factor (28). Nottingham City Council estimates that congestion costs the City's economy £160 million pa (5), this will manifest as a cost to business in lost time, increased transport costs, difficulties in access for qualified workforce etc. The 2005 study carried out by PwC on behalf of Nottingham City Council (21) showed that employers recognised that congestion represented a cost to them.
M11	Increased PT capacity and efficiency makes Nottingham more attractive as a business location due to workforce mobility.	
M12	Employers choose to pass on the cost of the WPL to their employees via parking management thus mitigating the WPL as a cost to business.	A number of larger employers now actively manage their car park and use this to pass on the cost of the WPL to their employees. (13).
M13	Increase in cost of operating a business in Nottingham. The WPL charge is absorbed by employers thus placing an additional cost burden on local businesses which risks a reduction in inward investment.	Studies carried out before and after the implementation of WPL show that businesses cite this as a key mechanism (21 and 22), although the 2005 study (20) concluded that it was debateable as to whether they would act on this as the WPL charge formed less than 1% of turnover for most.
M14	Suppressed demand for travel by private car. As congestion decreases demand suppressed by the capacity of the network is released thus no real congestion benefit is derived.	This is the well documented effect of induced traffic in response to increased road capacity (29),

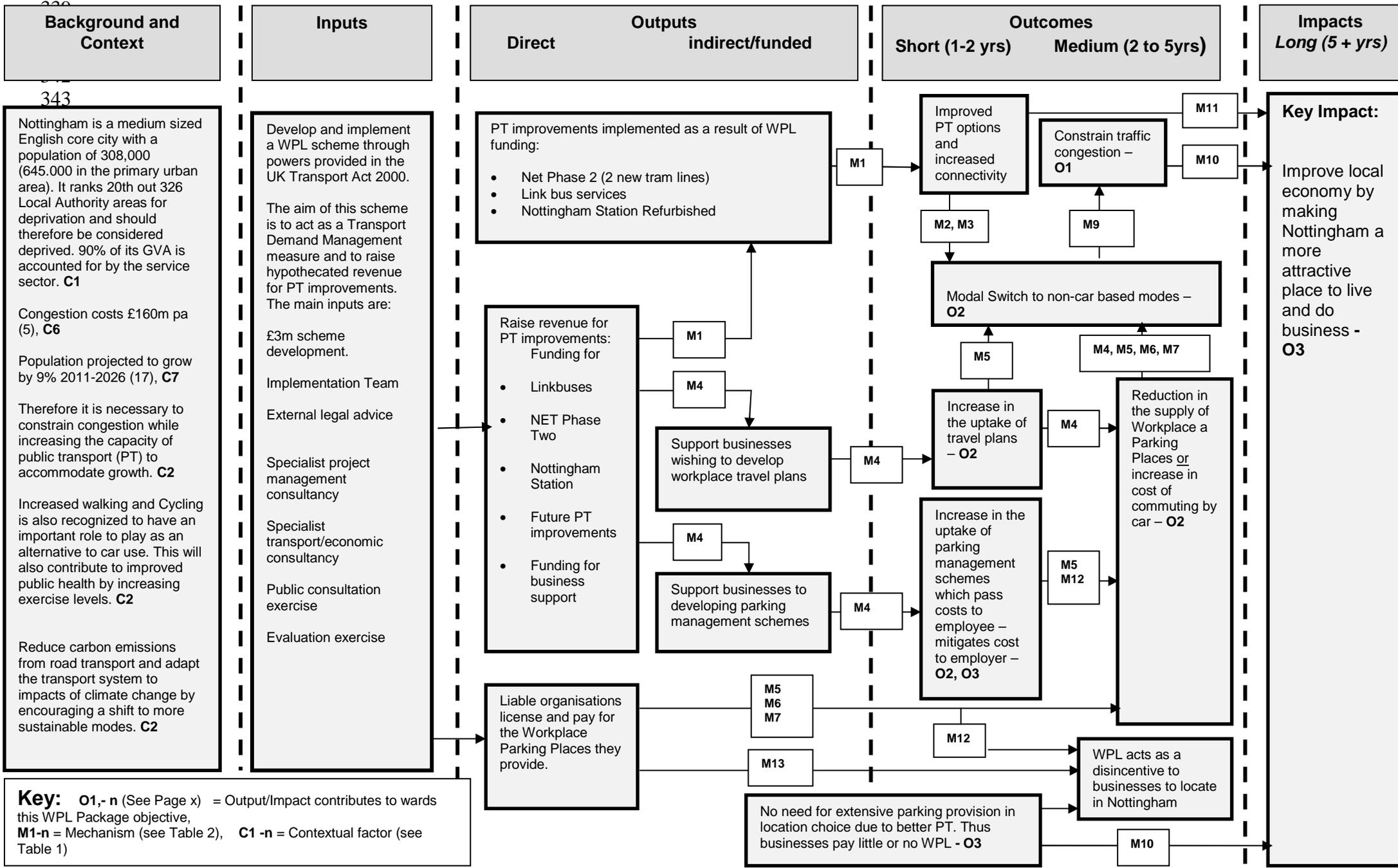
312 While Table 2 describes each mechanism it is important to understand how the
313 contextual factors itemised in Table 1 are likely to impact on these mechanisms. The
314 ability of the WPL to deliver the required revenue stream (M1) relative to commuters
315 opting to switch mode due to an increase in costs/reduction in WPP supply (M5, M6
316 and M7) will be dependent primarily on C3, the National economic situation and on
317 local economic factors, C1, determining to what extent employers and employees are
318 prepared to bear the cost of the WPL and also how buoyant the economy is delivering
319 growth to offset, M7, the reduction in Workplace Parking supply. Additionally the
320 availability of PT alternatives is also a factor affecting these mechanisms, C2.
321 Mechanisms 2, 3 and 4 will interact with C1, socioeconomic factors. As this will
322 affect the propensity for use of different modes, it is likely that the more deprived the
323 area the greater the propensity to use PT. C3 economic conditions, including C4, fuel
324 prices will also play a part in perceived attraction of different modal choices. In
325 general historic trends from Nottingham show that the less favourable the economic
326 conditions and the higher the cost of fuel the greater the propensity for the use of PT.

327 As M8 is a secondary mechanism, recognising the combined effects of M1 to M7 the
328 contextual factors affecting this mechanism are the same as the individual
329 mechanisms. Mechanisms 10 through to 13 which describe how the benefits of
330 reduced congestion and less car use encourage inward investment will be heavily
331 influenced by C5 the Nottingham Offer and its competitiveness with other locations.
332 An additional factor will be the national and local labour market C2, and how the
333 better PT acts as a positive for recruitment. It is anticipated that C6 and C7 are pre-
334 existing conditions that are unlikely to vary sufficiently in the evaluation period to
335 impact on the mechanisms.

336

337

FIGURE 1 Logic Map for Workplace Parking Levy Scheme



349 **TESTING THE THEORY**

350 Having developed a logic map and a theory of change this needs to be measured
351 against the key metrics to assess its effectiveness as an evaluation tool. Dale et al
352 2013 (13) presented a table (Table 3 in Dale et al 2013 (13)) which describes the
353 indicators that had been earmarked for tracking the WPL package's progress towards
354 its stated objectives which have been linked to the original WPL business case.
355 Monitoring these indicators, benchmarking them against other cities where possible
356 and assessing if the direction of change and magnitude is commensurate with the
357 theory of change will be an important part of the scheme's evaluation. Four UK Cities
358 have been selected as comparator areas based on their similarity to Nottingham with
359 respect to size, socio-economic and transport characteristics. These cities are:

- 360 • Leicester
- 361 • Liverpool
- 362 • Newcastle
- 363 • Sheffield

364 However comparative data from these Cities is only available for some of the relevant
365 indicators which limits this approach. Where comparative data is not available, the
366 evaluation must rely on comparison with the direction and magnitude of change
367 predicted by the ToC for indicators.

368 However, in order to understand why change has occurred in more detail, these
369 indicators must be used to assess if the mechanisms are activating as predicted by the
370 theory and to what extent they are impacted by changes to the contextual factors.

371 Table 3 outlines how each mechanism can be evaluated, the available data to date
372 (2013/14) and to what extent that indicates each mechanism is activated as predicted
373 by the theory. Most of the contextual factors identified in Table 3 are currently static,
374 however where this is not the case they are highlighted. With regard to current
375 assessment of progress it has to be considered that the WPL has only been in place a
376 short while and the PT improvements are currently being implemented many of the
377 medium and longer term aspirations of the scheme will be difficult to evaluate at the
378 moment. However assessment of short term aims can be made.

379

380

TABLE 3 Evidence of the operation of mechanisms

	Summary of Mechanism	Indicator	Evidence Attribution for	Evidence suggesting mechanism is active including relevant contextual changes	Active as predicted
M1	Improved PT options funded.	Provision of planned PT improvements. Annual WPL net revenue.	None required	Linkbus services and the refurbishment to Nottingham Station have been implemented. NET Phase 2 is under construction and is due to open in 2015. WPL raised over £7 million in its first full year of operation.	YES
M2	Increased PT capacity	PT Satisfaction Surveys.	None required	No PT satisfaction surveys yet planned. Direct interview surveys of commuters planned for 2015/16.	?
M3	Improved PT options result better connectivity and convenience an image	PT mode share at Inner Traffic Area cordon	Direct interview surveys of commuters asking if they have switched mode and why	Linkbus services and the refurbishment to Nottingham Station have been implemented. NET phase 2 is under construction and is due to open late 2014.	?
M4	WPL funds workplace travel plans, car park management and cycle infrastructure improvements	PT Patronage Number of employees/WPP covered by parking management or workplace travel plans.		Both PT mode share and patronage have declined slightly since 2010. However the main PT improvements are not yet complete. In 2010 25% of employees in Nottingham were covered by workplace travel plans, this has risen by 2013 to 33% almost certainly as a result of the WPL package	YES
M5	Direct increase in cost in commuting to work by car	% of WPP where the employer passes on the WPL charge to the employee. Commuter parking in NCC public car parks.	Direct interview surveys of commuters asking if they have switched mode and why	There was no data prior to 2012/13 however at present for 38.9% of WPP are covered by parking management schemes which pass on the cost to employees, certainly this has occurred as a result of the introduction of WPL	YES
M6	Indirect increase in cost of commuting to work by car.			A weekday average of approximately 426 vehicles are parked using the "Early Bird" parking deal for a Council City Centre car park, this deal is aimed at commuter parking and, when considered in the context of a reduction in the number of Workplace Parking Places, demonstrates that this mechanism is active.	YES
M7	Decrease the supply of Workplace Parking.	Number of licenced WPP	Comparison with comparator cities	The number of WPP fell by 18% from a pre implementation estimate of 32225 to 26464 following the introduction of the WPL and by a further 4% between 2012 and 2013 to 25320. NET Phase 2 not yet complete so it is not yet possible to assess the combined effect of the package Journey time per Vehicle Mile has risen by 3.8% between 2010/11 and 2013/14. However this is also the case within some of the other medium sized cities i.e. Sheffield, and Leicester and may be due to the emergence of the national economy from recession (C3). Additionally, in Nottingham the disruption caused by the construction phases of the major transport improvements are also a factor. (C9)	YES
M8	Enhanced effect of WPL package.	Decrease in the number of WPP			YES
M9	Congestion Constraint.	Modal shift Journey time per vehicle mile			?
M10	Reduced cost of congestion to businesses.	Journey time per Vehicle Mile	Comparison to other core cities		NO NO
M11	Increased PT capacity and efficiency makes Nottingham more attractive as a business location due to workforce mobility	Level of inquiries to NCC Inward Investment Team and subsequent successes. Volume of rental deals done by commercial estate agents Evidence from case studies of inward investors. Macroeconomic indicators	Case study based evidence from businesses. Indicators, when triangulated, move in the direction and magnitude commensurate with the theory of change.	Investment enquiries and subsequent successes have increased in 2012/13 and 2013/14 when compared to the previous 4 years, The number of deals done by commercial estate agents has also increased which supports this data. Nottingham has fared better than the other 4 comparator cities with respect to employment and output (GVA). Although it needs to be accepted that this could be due to the emergence from recession (C3) as much as any effect of the WPL package. However, the comparison to the comparator cities as well as the magnitude of the increases suggests that this mechanism may be active. This, strongly suggests that the cost element of WPL is not having a detrimental effect and case study data demonstrates that the availability of good PT options especially towards the city centre are an attraction to inward investors. The above fits with the Theory of Change but more case study data is required to confirm attribution.	?
M12	Employers choose to pass on the cost of the WPL mitigating the impact on employers	% of WPP whereby the employer passes/absorbs the WPL charge to the employee.	NA	There was no data prior to 2012/13 however in 2013 39% of WPP were covered by parking management which passes on the cost to employees; anecdotal accounts from employers enables us to be certain that this is a recent development in response to the introduction of WPL.	?
M13	Increase in cost of operating a business in Nottingham.	Level of investment inquiries to NCC and subsequent successes.		Inward investment market buoyant, see M11, this suggests that overall business costs are not a barrier to business location in Nottingham.	YES
M14	Suppressed demand for travel by private car.	Enabling Mechanisms operate but congestion does not decrease, no. of trips on all modes increase	None required	None at this time	NO

382 Table 3 reveals that the mechanisms that facilitate the short term outcomes appear to
 383 be operating as predicted by the theory. There is strong evidence that the supply of
 384 WPP is reducing while the revenue remains stable due to the pre-planned increase to
 385 the WPL charge enabling the planned PT improvements to be implemented.
 386 Additionally employers are increasingly passing on the cost of the WPL to their
 387 employees and taking up workplace travel plans. Congestion and mode switch
 388 appears to be moving in a direction similar to other similar cities. However the
 389 following contextual factors must be considered:

- 390 • the national economy is emerging from recession and traffic volumes are
 391 increasing nationally
- 392 • the key PT improvement, the provision of two extra tramlines, are not yet
 393 open.
- 394 • the construction phase of the above and other non WPL package schemes have
 395 created considerable disruption on the network.

396 These factors will all mitigate against mode switch and a subsequent reduction in
 397 congestion and therefore it should be concluded that, given the current context
 398 external to the WPL package, it would not be expected to see progress towards the
 399 longer term scheme objectives as the important mechanisms cannot be activated at
 400 this point in time. The project to evaluate the WPL is due to conclude in Spring 2017
 401 by which time these contextual issues should be resolved and travel patterns
 402 normalised given the new PT options.

403

404 **LESSONS FOR FUTURE EVALUATIONS OF TRANSPORT INITIATIVES**

405 The process of deriving a theory of change is extremely resource intensive due to the
 406 iterative process of formulating and refining the theory via stakeholder engagement.
 407 For many transport interventions however this is implicit in scheme justification and
 408 this was the case with the WPL because of its innovative nature. The bulk of this
 409 process occurred in formulating the business case (5) via an extensive public
 410 engagement culminating in a public examination. Thus for the WPL there was little
 411 additional expense involved in creating the theory of change over and above the
 412 scheme justification. This however may not be the case for all transport interventions
 413 depending on the statutory requirements for scheme appraisal.

414 Data availability is a key area of concern when carrying out a Theoretical Evaluation
 415 (12) Issues have been experienced with the following areas of data:

- 416 • Obtaining equivalent indicator data from other comparable cities can prove
 417 difficult, and where data is provided it may not be in a comparable format.
- 418 • The process of identifying contextual factors and key mechanisms has proved
 419 illuminating. It requires a more detailed thought process from the evaluators as
 420 to how and why change occurred by breaking down the broad logic into stages
 421 that are measurable. This will be of advantage to any evaluation project.

422 Originally the authors generated 23 mechanisms for the WPL Package and these
 423 could be subdivided further. If these were then cross referenced with contextual
 424 factors it would have generated large numbers of CMO theories, this issue was
 425 predicted by the literature but seems to be a particular problem for the WPL Package.
 426 This is likely to be equally true when evaluating any area wide transport intervention.

427 This is because transport impacts permeate many policy areas. For this reason it is
 428 suggested that a policy of identifying key mechanisms only is adopted when applying
 429 this evaluation approach, however evaluators need to accept that this may result in
 430 some loss of detail a balance must be struck depending on the audience and aims of
 431 the evaluation in question.

432

433 **CONCLUSIONS**

434 Theoretical Evaluation is being proposed as a tool to evaluate complex and innovative
 435 transport projects where there are many influences external to the scheme. The UK
 436 Department for Transport guidance advocates this approach, yet there is little
 437 published information as to how this has been applied to transport projects. The two
 438 main theoretical evaluation approaches, Theory of Change and Realistic Evaluation
 439 have been reviewed with their potential practical application to the transport sector in
 440 mind. This showed that:

- 441 • a full RE approach is likely to be impractical due to the complexity and
 442 resource requirements.
- 443 • a ToC approach is potentially more suitable due to its more generalised nature
 444 whereby an agreed theory of change can be derived.
- 445 • a ToC approach may not fully identify the mechanisms by which the desired
 446 impacts will be achieved. However, mechanisms that achieve the objectives to
 447 be evaluated together with influencing contextual factors can be used to
 448 strengthen a Theory of Change approach. This is therefore advocating
 449 including an element of RE.

450 It is concluded that a ToC Evaluation approach strengthened with elements of RE are
 451 an appropriate approach to evaluating major transport interventions. This is suggested
 452 for use to evaluate the Nottingham WPL Package and is presented as a practical
 453 example of the application of this approach. A review of relevant literature reveals
 454 that interventions of this nature require an evaluation approach which:

- 455 • takes into account changing context
- 456 • achieve causal attribution
- 457 • allows partial data

458 The above are seen a key features to be considered in any use of theoretical evaluation
 459 of transport projects. Using this approach a Logic Map summarising how the
 460 Nottingham WPL is intended to achieve its stated objectives has been produced. Such
 461 maps are seen as a vital element in developing theoretical evaluation of transport
 462 schemes. The logic maps should include -

- 463 • A model to explain how the intervention can contribute to any integrated
 464 transport demand management policy
- 465 • A framework in order to understand and evaluate any observed changes in key
 466 indicators relevant to the interventions main objectives.

467 The latest data from the WPL model reveals that whilst the mechanisms relevant to
 468 the shorter term outcomes for the scheme are operating as predicted by the Theory of

469 Change, however it is too early at this stage to assess whether this will follow through
470 to the longer term intended impacts.

471

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481

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