

Low Emission Strategies for Local Transport - Building the Case for Action

Appendix 2: Scenario Analysis for LES Partnership and LG Regulation National Case Projections

Report Tables, Method Notes and Data sources (version 3)

Scenario Names

Scenario A: Low Emission Fleet Management of Council Vehicles

Scenario B: Low Emission Planning and Development Control

Scenario C: Area Wide Transport Emissions Management

6th April 2011

Low Emission Scenario Analysis – Method Overview

Aim

Provide a simple flexible emission based impacts analysis for low emission transport policies.

Provide an approximate answer to the question: 'What level of emission reductions will the policies and measures achieve in terms of :

(a) % reduction against baseline, (b) absolute tonnes of pollutant, (c) monetised benefits as damage costs avoided'

Structure & Outputs

Ref	Method	Output	Parameters (scope for NCP)	Notes
M1	National Reference	Summary of total emissions for use as overall reference point to aid interpretation of scenario based emission savings	Country (England and Wales) Year (approx '2010') [1] Source category (Mobile, Stationary) Vehicle types (Car, Van, Trucks, Bus) Pollutants (CO2, PM10, NOx) [2]	[1] Input data is drawn from various datasets for years 2008 to 2010. thereby providing an 'approximate 2010 base year' [2] PM includes tailpipe and tyre/brake
M2	Scenario Baseline	Estimated annual emissions associated with the policy scenario before any interventions are taken.	Geography (England and Wales) Activity (Scenario Specific) Year (approx '2010') [1] Vehicle Type (Car, Van, Trucks, Bus) Pollutants (CO2, PM10, NOx) [2]	
M3	Relative Contributions	Estimation of relative contributions for baseline emissions from vehicle types	Matrix estimating % of total emissions allocated by pollutant and vehicle type	
M4	Impact Factors	Estimate of % reduction achieved against baseline for each pollutant and for each vehicle type	Matrix estimating % reduction against baseline emissions allocated by pollutant and vehicle type	
M5	Scenario Analysis	Projected emission reduction achieved by the policy scenario.	Reported as: (i) absolute emission reduction (t), (ii) % emission reduction, and (iii) damage costs avoided (DCA/£). Results are reported as total and also broken down by pollutant and vehicle type.	

Low Emission Scenario Analysis – Method Notes

Method Notes

The results presented in this report are derived from a developmental method and some input data, derived from crude approximations. Pending further testing and refinement they should be treated as illustrative rather than definitive. The results for the development control scenario in particular are subject to high uncertainty (and may be conservative in the potential emission savings and benefits they predict)

Method: The method is designed as a simple application for exploring and comparing potential emission benefits arising from different policies and interventions. It is an approximate approach and derivation of input data has required use of some crude estimates. The method is flexible and each step of the analysis can be adjusted, to incorporate improved evidence, data and assumptions as and when they become available.

Additionality: The method estimates the impact of local action as absolute emission reductions relative to national trends (i.e. 'additional reductions as a result of local intervention'). This 'additionality requirement' is important both to help simplify the analysis and also, in practice, to increase local accountability. Emission reductions are reported as absolute values in tonnes and as percentages of the relevant baselines.

Emission Reductions: Reductions are estimated by combining complementary emission reduction mechanisms and assigning impact factors to each. Assigned factors are based on summary review of known quantified studies. There is more quantitative data available for fuel or CO2 savings than for air quality pollutants. It has therefore been necessary to extrapolate PM and NOx savings from those for fuel and CO2. There is no simple relationship between the two, however in the context of the approximate nature of this study, it is considered to be a reasonable (and in some cases conservative) assumption to assume that a linear relationship exists.

Damage Costs: Absolute emission reductions are translated into 'damage costs avoided' – reflecting the environmental and health impacts of the associated emissions. The values applied are consistent with DECC and Defra guidelines. None the less, damage costing is a controversial approach and care is needed in its interpretation. In particular, it should be emphasised that these figures, as representations of social benefits, do not reflect potential direct financial savings to the local authorities nor to local people and organisations. (see also note on separate sheet)

Timescales: The analysis does not impose a specific timescale for achieving the indicated reductions. They will begin to accrue as soon as action is taken. An ambitious yet achievable timescale for achieving the scenario reductions is proposed as 2015.

Costs of Implementation: The analysis focuses by design on the 'benefits case for action.' Potential barriers associated for example with implementation costs and public acceptability are considered indirectly by drawing on case studies to demonstrate what has already been found achievable in specific circumstances. None the less, further work to understand potential barriers, especially with regards costs would be desirable.

Data Quality: The method was developed through the course of this study and remains experimental. Further development, testing and assurance is required before either the method or the results can be relied on with confidence. Specifically, there is a list of known QA issues, which are still to be addressed.

Acknowledgments: Emission baselines are derived from national emission datasets, with additional fleet composition/activity estimates provided respectively by TTR and RPS. Method development, baseline definition, scenario definition and scenario analysis were completed by Green Sphere. Impacts are based upon examination of known cases studies, completed by Green Sphere drawing on LES Partnership reports, projects and network contacts. These were supplemented with additional case study information provided by TTR. In some places, Green Sphere has utilised the LES Partnership's proto-type Low Emission Toolkit (LET), which has been developed to support emission based analysis for transport interventions (http://www.lowemissionstrategies.org/les_toolkit.html).

Low Emission Scenario Analysis – Damage costs

[Text from LET user Manual] One technique for objective comparison between the costs of a low emission measure and its benefits is to assign a monetary value to the wider benefits to society of the emissions reduction for direct comparison with costs: cost-benefit analysis. The LET contains damage cost data, giving a cost per mass of emissions for NOx, PM10 and CO2e that represent the damage to the environment and human health due to the emissions. The LET damage cost values for CO2e are based on the UK DECC recommendations. The LET damage cost values for NOx and PM10 are based on the UK IGCB recommendations. Costs are allocated to a particular region of the country and geography type, as selected during the scenario definition elements of the Toolkit. The geography type/location and population sizes are based on National Travel Survey areas, and defined in the DfT document “National Transport Model High Level Overview”. The final report on the LET gives more details on the data sources and decisions reached during the development process, and therefore the implications of choosing different geographies.

Pollutant	Location	Year	Min (£/t)	Max (£/t)	Mid (£/t)
CO2e (2015)	all locations	2010	26	78	52
		2015	28	85	
NOx	all locations	all years	681	993	837
PM10	central London	all years	158,820	230,508	194,664
	inner London	all years	163,338	237,065	200,202
	outer London	all years	106,691	154,849	130,770
	Inner conurbation	all years	84,449	122,568	103,509
	Outer conurbation	all years	52,478	76,163	64,321
	Urban big > 250K population	all years	62,555	91,791	77,173
	Urban large > 100K population	all years	50,391	73,137	61,764
	Urban medium > 25K population	all years	39,618	57,501	48,560
	Urban small > 10K population	all years	25,022	36,316	30,669
	Rural	all years	10,773	15,636	13,205
Average			75,414	109,553	92,483

=> Assumptions used in NCP (i.e. single point approximations, consistent with LET (and hence DECC/IGCB) via the following assumptions)

Pollutant	Mid (£/t)	Justification / Comments
CO2	50	approx midrange
PM	62,000	midrange for urban large (below midrange for all values)
NOx	840	approx midrange

Notes

[1] These values are consistent with the values recommended in Defra Practice Guidance 1: (Economic Principles for the Assessment of Local Measures to Improve Air Quality) The approach applied is more simplistic (e.g. it takes a single representative value, and ignore discounting effects, and only considers the benefit side of the equation).

[2] Also important to note that central gov approach CBA approach has received criticism from some (including the EAC) for undervaluing effects such as morbidity and environmental impacts (see extracts of EAC report and Defra response to it)

Total Baseline Damage	All Sources			Transport		
Tonnes of Pollutant =>	CO2	PM	NOx	CO2	PM	NOx
Total UK / Combined LA	470,000,000	120,000	1,200,000	100,000,000	21,000	400,000
Combined LA Own Estate	8,800,000	545	16,000	1,100,000	104	2,800
Total Development Quanta	-	-	-	740,000	33	800

Total Baseline Damage	All Sources			Transport		
Damage £/t =>	50	62,000	840	50	62,000	840
Total UK / Combined LA	23,500,000,000	7,440,000,000	1,008,000,000	5,000,000,000	1,302,000,000	336,000,000
Combined LA Own Estate	440,000,000	33,790,000	13,440,000	55,000,000	6,448,000	2,352,000
Total Development Quanta	-	-	-	37,000,000	2,046,000	672,000

Note that damage costing is a controversial topic and care is needed in interpreting the figures. In particular, it should be emphasised that they include social benefits, so do not represent potential financial savings either to the local authorities or to the local area. See also associated discussion and references in section 1 of main report.

Low Emission Scenario Analysis – National Reference and Scenario Baselines

Baseline Emissions (tonnes)	All Sources			Transport		
	CO2	PM	NOx	CO2	PM	NOx
Tonnes of Pollutant =>						
Total UK / Combined LA	470,000,000	120,000	1,200,000	100,000,000	21,000	400,000
Combined LA Own Estate	8,800,000	545	16,000	1,100,000	104	2,800
Total Development Quanta	-	-	-	740,000	33	800

All Sources			Transport		
CO2	PM	NOx	CO2	PM	NOx
% contributions to combined LA total					
1.9	0.5	1.3	1.1	0.5	0.7
-	-	-	0.7	0.2	0.2

Eng & Wales Nat Ref

Derived from NAEI 2008 summary tables for UK. England and Wales component is estimated by scaling to 2009 population (i.e. 89%)

Area Wide

Area wide baseline was assumed to equate to total national emissions, so again derived from NAEI summary tables.

Notes:

[3] Total PM and Total transport PM include tyre and brake wear (~8kt/y) Therefore although allocation by vehicle type doesn't, when emissions are 'spread' by scenario calc, tyre and brake PM10 is included, albeit assumed to arise by source pro-rata to exhaust pm.

[4] PM data does not include contributions from resuspension.

[5] Using NAEI summary tables for both Nat Ref and Area wide provided PM/NOx data (CF NI186 - CO2 only) and detailed source break down. It also helped to simplify the analysis.

[6] Comparison of total national to equivalent NI186 data indicates reasonable correlation within context of the study (i.e. +/- 10-20%).

Own Fleets

Derived from NI185 & 194 data for England (0809 - provisional, Jul 2010) - scaled for England and Wales based on 2009 population (i.e. Eng 84%, Wales 5% of UK total)
Data includes: Business Travel using public transport, Business Travel using council owned or employee vehicles, Fleet vehicles, refuse trucks and road sweepers, Off-road vehicles (industrial mobile machinery), Gardening and Grounds maintenance equipment. It excludes staff commuting to and from work each day

Development Control

Derived from RPS estimation of total annual development quanta in England & Wales for Office, Retail and residential (see RPS report)

Inputs analysed using LET(v0.9) - calculated for car and bus travel only (i.e. [Excl goods & service vehicles](#))

QA review of v3 held up. V4 focused on interrogating the LET scenario to extract relative emission contributions of Cars/buses (see contributions)

Also drafted scenario summary - identifying key input assumptions ([QA issue 6 - for review /refinement](#))

[7] this is the most complex and least well checked/developed baseline. It relies on (i) novel approximation of development quanta, (ii) broad supplementary assumptions, (iii) the relatively untested emissions calculation functionality of the LET. (=> i.e. makes it a very interesting projection, but best to treat figures as illustrative and treat with caution) Further development/testing desirable

Low Emission Scenario Analysis – Source Contributions (Cars - Vans - Truck - Buses)

Relative Contributions Matrix (RCM)	Scenario A: Council Fleet			Scenario B: Development Control			Scenario C: Area Wide		
	CO2	PM	NOx	CO2	PM	NOx	CO2	PM	NOx
=> check 100	100	100	100	100	100	100	100	100	100
Cars	5.2	2.1	1.2	97	98	82	62	43	39
Vans	40	54	23	0	0	0	13	31	12
Trucks	54	44	76	0	0	0	19	20	37
Buses	0	0	0	3	2	18	6	6	12

Basis for Allocation of Contributions

Area wide Emissions

Based on breakdown of NAEI data.

[8] NAEI data provides by vehicle size, so no differentiation between trucks and buses. An arbitrary split of 3:1 was applied (trucks:buses) - since impact est. for both categories is the same, doesn't affect overall outcome, but is a key (uncertain) assumption, further testing is desirable

Development control

DC emission baseline (by design) only covers buses and cars. Interrogation of LET scenarios used to translate RPS data into estimated emissions provides reported car/bus emission ratios. There are significant uncertainties associated with each step along this process. High/Low sensitivity cases also show a range of absolute values and ratios.

[9] This is a novel and illuminating analysis, it is also highly uncertain. TREAT WITH CAUTION

Own Fleet Emissions

TTR has made an approximation of LA fleet make up. Green Sphere inputted this into the LET to obtain bottom up emissions estimate and bottom up source contributions. For scenario analysis only the relative contributions have been used (i.e. these were then 'applied' to the top down derived scenario baseline).

[10] Bottom up emission estimate is approx. 40-60% of top down figure, which is reasonably (surprisingly?) good. Especially since TTR suggest that their fleet figures are likely to be an under estimate.

Scenario A: Management of Local Authority Own Estate Transport Emissions

Baseline Emissions	Total LA fleet emissions are derived from National Indicator dataset (see sheet 'M1&2-emissions') Scenario fleet includes: (i) Council owned and managed car fleets and (ii) Council owned and managed light and heavy vehicles It excludes:(i) Public bus operations (NI dataset is not consistent in its coverage of bus fleets, nor given local contractual/management variations is it easy to do so in a consistent way), (ii) 'Plant' vehicles (which comprise a small proportion of overall LA fleet and so have been excluded to simplify the analysis), (iii) Staff Commuting => Fleet comprises a mixture of CARS, VANS and TRUCKS
Relative Contributions	Relative emission contributions are derived from TTR estimate of LA fleet composition and activity(main report Ref 12) using LET (v0.9) to translate these data into emission contributions. (i.e. Only the relative contributions are taken from LET output, these are then applied to the NI derived baseline).
Intervention Summary	The scenario assume that all authorities in England and Wales maintain or develop ambitious yet achievable policies and plans to achieve significant cost effective reductions in local transport emissions. In order to do so, they also assume that effective management, delivery and financing mechanisms are maintained or established. The council vehicles scenario explores the use of low emission fleet management and transformation practices for vehicles directly under council control. (i) Fleet policy reviews and re-organisation of fleets and services (ii) Improvements to fleet operations and management, including use of equipment such as on-board data gathering and speed/power limiters. (iii) Comprehensive driver skills training, reinforced through ongoing driver support. (iv) Modification and improved maintenance to existing vehicles (e.g. energy efficient tyres, wheel alignment, also where appropriate retrofit of exhaust after treatment) (v) Accelerated replacement of existing fleet with lower emitting technologies, vehicles and fuels (e.g. smaller/lighter, electric, bio-methane, hybrid, dual-fuel) The structure of emission reduction mechanisms and impact factors assigned to each are explained and justified below, making reference to real world case studies and highlighting relevant quantitative impacts data, where it is known. The impact factors are subject to significant uncertainty arising in large part due to (i) limitations in the robustness and coverage of underlying case examples, (ii) broad approximations required in translating these case study data into impact factors, (iii) uncertainties surrounding the current starting point (i.e. the extent to which interventions have/are already being deployed), and (iv) the complexity of issues with potential to affect the scale, speed and overall response by local authorities, including potential economic and political barriers/inertia. => The scenario is intended to illustrate an ambitious yet plausible path, and crucially to show that by combing complimentary interventions together it is possible to build up significant beneficial impacts. The challenges in achieving such concerted action, should not be underestimated and the analysis and its outputs need to be considered firmly within the context and discussion presented within the main project report,
Notes on Data Quality and Underlying Assumptions	[1] With exception of 'fleet reduction', the evidence base for scenario interventions is relatively good. There are a range of established approaches, which are broadly applicable across local authority fleets. [2] Quantified benefits for known case studies vary both above and below the proposed impacts for the scenario. [3] Case studies commonly report reduction per vehicle rather than per fleet. Therefore to achieve the reductions indicated, the interventions need to be applied to a high proportion of the entire local authority fleet. [4] There is more quantitative data available for fuel or CO2 savings than for air quality pollutants. It has therefore been necessary to extrapolate PM/NOx savings from fuel/CO2. There is no simple relationship between the two, however in the context of the high level nature of the analysis, it is a reasonable (and in some cases conservative) assumption to assume that a linear relationship does hold true. [5] One reason for the lack of fleet reduction data may be that this is considered part and parcel of 'standard fleet management', which in turn would imply that there may not be significant potential for further improvements in this category. Alternatively, and especially in the current economic climate, it may be that 'simply travelling/transporting less' is a highly cost-effective 'un-intervention' which may have renewed appeal (clearly it is also one which needs to be well planned in order to avoid adverse impact on services/performance). [6] fleet vehicle replacement is a key measure and a number of good quantified case studies are known. Reductions per vehicle range from 10-100% depending on the technology employed. A further step in the analysis is critical here, in order to estimate an achievable penetration of these vehicles into the local authority fleet. This proved beyond the scope of the current study. None the less, the 5% figure adopted is considered achievable, and potentially conservative.

Intervention Categories			Outline Approach	Proposed Scenario Impact	Database Examples	Evidence Base
A	Fleet Reduction	A1 Fleet Policy Review	Consideration of needs addressed by the fleet and opportunities for alternative policies and approaches which service these needs requiring smaller or less active fleet.	5% reduction distance travelled across fleet	F2	Limited
B	Efficient Operations	B1 Fleet Performance Management	Efficiency savings arising for example from improved organisation, journey planning and fuel management. Potentially supported by the use of telematics or equipment such as speed limiters or power management systems	5% reduction in distance travelled 5% reduction in tail pipe emissions	F3-7	reasonable
		B2 Driver Skills Development	Efficiency savings arising from improve driver skills can be encouraged by a variety of mechanisms including Smarter/SAFED training. Also anti-idling policies/training.	5% reduction in fuel consumed	F8-11	reasonable
C	Improved Technology	C1 Vehicle Modification & Maintenance	Improved vehicle and emissions performance arising from improved maintenance (e.g. wheel alignment) and vehicle modification (e.g. Energy efficient tyres). Also in this category is retro-fitting of after treatment devices.	5% reduction of tail pipe emissions	F13-16	reasonable
		C2 Fleet Vehicle Replacement	Accelerated adoption of new technologies through strategic investment and fleet renewal. Key technologies include: electric cars (urban), hybrid cars (longer distances), BM/gas/electric vans, BM/gas/dual fuel/hybrid heavy vehicles.	5% reduction on tail pipe emissions	TBC	TBC
Overall Package			Fleet Management is likely to be conducted by application of a package of complementary and reinforcing interventions. Quantification of overall impacts is likely to be more robust than doing so intervention by intervention.	30% reduction in car, van and truck emissions	F1	reasonable

Scenario B: Low Emission Planning Policies - Low Emission Developments

Baseline Emissions	Total LA fleet emissions are derived from estimated annual development quanta for England (main text Ref 11). Projection is subject to high uncertainty though is likely to be conservative, assuming rate of development recovers to normal (i.e. pre-crash) levels. Scenario fleet <u>includes</u> : car and bus travel associated with retail, office and residential development only. <u>It excludes</u> : (i) Emissions from goods and service vehicles associated with retail, office and residential development, and (ii) all emissions generated from other types of development, such as industrial and warehousing. The exclusions arise from a combination of (i) lack of data and (ii) desire to restrict LET scenario testing to the more robust/tested elements of the tool. => Fleet comprises a mixture of CARS and BUSES
Relative Contributions	Relative emission contributions are derived from RPS estimate of development quanta using LET (v0.9) to estimate associated 'geo-fleet' composition, activity and emissions.
Intervention Summary	<p>The scenario assume that all authorities in England and Wales maintain or develop ambitious yet achievable policies and plans to achieve significant cost effective reductions in local transport emissions. In order to do so, they also assume that effective management, delivery and financing mechanisms are maintained or established. The development control scenario assumes that all local authorities adopt and implement Low Emission Planning Policies, as promoted by the Low Emission Strategies Partnership. For simplicity it only considers residential, office and retail developments. It also only considers emissions from car and bus journeys associated with these sites, i.e. excluding goods and service vehicles (note: these simplifications mean that projected benefits are smaller than would otherwise be the case).</p> <p>The scenario assumes deployment of a full range of measures to tackle emission from cars, including:</p> <ul style="list-style-type: none"> (i) Personalised Support: Site based travel plans, including advice/information, training, incentives and introduction of management/information systems/equipment, driver training, and encouragement of improved maintenance of vehicles. (ii) Traditional 'Hard' Interventions: parking re-allocation/charges, vehicle share/rental schemes (e.g. car club, bike rental), improved cycling and walking infrastructure and enhanced public transport. Also potentially more stringent responses could include interventions such as site-based congestion/user charging. (iii) Low Emission Technology Interventions: provide additional emission savings by accelerating adoption of lower emitting technologies through emission based parking allocation/charging, low emission vehicle share/rental schemes, emission based entry or use controls and charges financial support for greener vehicles and provision of supporting low emission infrastructure (e.g. electric charging points and biomethane refuelling). <p>The scenario includes options to reduce emission from bus travel. These rely on similar mechanisms to those described for council owned vehicles (i.e. improved service design, efficient management and operations, improved driver skills, modification and maintenance and introduction of lower emission vehicles). It also assumes that additional proportionate off-setting contributions are pursued to enhance and de-risk site based emission reduction and mitigation. These contributions are assumed to be deployed in pursuit of strategic area wide measures to further reduce local transport emissions. (Note: see LES Partnership guidance for further information on off-setting approaches).</p> <p>The structure of emission reduction mechanisms and impact factors assigned to each are explained and justified below, making reference to real world case studies and highlighting relevant quantitative impacts data, where it is known. The impact factors are subject to significant uncertainty arising in large part due to (i) limitations in the robustness and coverage of underlying case examples, (ii) broad approximations required in translating these case study data into impact factors, (iii) uncertainties surrounding the current starting point (i.e. the extent to which interventions have/are already being deployed), and (iv) the complexity of issues with potential to affect the scale, speed and overall response by local authorities, including potential economic and political barriers/inertia.</p> <p>=> The scenario is intended to illustrate an ambitious yet plausible path, and crucially to show that by combing complimentary interventions together it is possible to build up significant beneficial impacts. The challenges in achieving such concerted action, should not be underestimated and the analysis and its outputs need to be considered firmly within the context and discussion presented within the main project report,</p>
Notes on Data Quality and Assumptions	<p>Implementation of travel plan type measures is a well established planning practice. There are numerous examples to draw on and the quantitative evidence base is improving. Beyond this type of measure the evidence base remains patchy. Partly because the practices themselves are relatively new, especially when taking in the time lag between agreement and implementation of this kind of measure. And partly because quantification/assessment of these planning measures is still in its early stages of development. Publication of the LES Partnership's Low Emission Toolkit (and other equivalent assessments) should help to strengthen understanding and drive a standardisation of approaches.</p> <p>Another key feature of planning based Low Emission Strategies is that they are mitigation driven (i.e. the developer is expected to 'make good' on the impacts of the proposed development). This allows local authorities to turn the equation on its head by setting their target impact and requiring this set level of mitigation (albeit potentially tailored depending on the economic viability and otherwise desirability of the development). Mitigation of detrimental impacts is a well established principle in planning (albeit one which is only starting to gain wider adoption in relation to transport emissions). The priority is to reduce impacts through design and on-site measures as far as possible. Once these options are exhausted, it may be appropriate for an authority to seek off-setting contributions as well to make good any residual impacts. In the context of transport emissions, this approach can be applied effectively to seek contributions for strategic investment in other local low emission transport measures (thereby helping to reduce area wide emissions, and indirectly offsetting the impact of the development)</p> <p>This combination of mitigation driven planning agreements with the option of seeking contribution for local off-sets, means that despite the limited evidence base, it is still possible to propose realistic emission reductions for this scenario. Further analysis and quantification of real world agreements and their resulting benefits is urgently needed to ground test the projections (and once in-hand it is possible that the proposed impacts are conservative). The LES Partnership's Low Emission Toolkit provides a useful vehicle for progressing such work.</p>

Intervention Categories			Outline Approach	Proposed Scenario Impact	Database Examples	Evidence Base
A	Reduce car travel	A1 Reduce/Shift personal car trips	<p>Requirement of site based travel plans is well established practice within the planning system. Typical interventions include advice/information, training, incentives and introduction of management/information systems/equipment.</p> <p>Hard supporting interventions may include travel plan officer, parking re-allocation/charges, vehicle share/rental schemes (e.g. car club, bike rental), improved cycling and walking infrastructure and enhanced public transport. More stringently interventions such as congestion charging or user charging have potential to drive mode shift and reduce overall travel more strongly.</p> <p>Studies indicate good trip reduction and mode shift providing plans are well designed, implemented, monitored and enforced. Results are considerably improved when accompanied by hard supporting interventions.</p>	10% reduction on car travel	<p>Travel Plans S13-322</p> <p>Hard Support S34, S41, S4, S5,</p>	Reasonable
B	Reduce car residual emissions	B1 Improve individual driving behaviour	<p>Driver training and use of in-car telematics may be considered either as a standalone intervention or as part of a traditional travel plan. Improved driving skills provide additional fuel and emission savings beyond any provided by reduced overall travel.</p>	5% reduction in fuel consumed	Examples from managed fleet studies only: F8-111	Limited

		B2	Improve car technology	<p>Improving the technology of fleet vehicles will reduce fuel consumption and emissions. This occurs gradually through natural fleet renewal and may be accelerated by the use of low emission planning measures, which nudge drivers more or less forcefully to choose lower emitting vehicles.</p> <p>Potential interventions include: emission based parking allocation/charging, entry or use controls and charges, financial support for greener vehicles and provision of supporting infrastructure (e.g. electric charging points).</p> <p>Installation of electric charging points is an increasingly popular intervention, though quantifying associated emission reductions is difficult since they only reduce emissions indirectly, according to the extent that they put electric vehicles onto the road. Examples of the other types of intervention are less common and less well understood, though parallels can be drawn from similar transformation of managed fleets.</p> <p>In addition, vehicle share/rental schemes may provide effective mechanisms for introducing low emission vehicles into the fleet and also exposing potential individual purchasers to the technologies building understanding and confidence. Again the potential of this approach is not yet well understood practical examples are limited. The Low Emission Strategies Partnership is currently sponsoring evaluation work in this area.</p> <p>Overall it seems likely that good emission reductions can be achieved via encouraging the choice of lower emitting vehicles. Further practical examples and impact quantification is required to fully understand the potential of the approach and how best to achieve it.</p>	5% reduction on tailpipe emissions	S4-7, S12, S34	Limited
C	Reduce bus emissions	C1	Improve fleet management/operations	<p>As part of one or more managed fleets, bus trip and emission reductions may be achieved via improved policy, management and operations. Also by improved driver skills. Achieving these benefits via planning agreement requires thought and coordination, both in delivery and in demonstrating transparent benefits.</p> <p>Practice examples where this has been achieved are not known. It may be more practical for an authority to pursue site specific off-setting contributions, which can then be deployed area-wide to improve bus operations and achieve the same effect more easily and more cost effectively.</p>	5% reduction in distance travelled 5% reduction in tail pipe emissions	Examples from managed fleet studies only: F2-11	Limited
		C2	Improve bus technology	<p>As part of one or more managed fleets, bus emission reductions may be achieved via deployment of improved vehicle technology (e.g. biomethane/gas/dual fuel/hybrid/electric depending on vehicle size and duty cycle). Achieving these benefits via planning agreement requires thought and coordination, both in delivery and in demonstrating transparent benefits.</p> <p>Practice examples where this has been achieved are not known. It may be more practical for an authority to pursue site specific off-setting contributions, which can then be deployed area-wide to accelerate deployment of low emission bus technology to achieve the same effect more easily and more cost effectively.</p>	10% reduction on tail pipe emissions (a more aggressive figure is proposed, to compensate for the fact that given desire to see mode shift, it is unlikely that significant vehicle trip reduction will be possible)	Examples from managed fleet studies only: F2-11	Limited
D	Financial Contributions	A1	Contribution to strategic invest. fund	<p>The planning system encourages authorities to ensure that developers design out and provide on-site mitigation for detrimental impacts as far as is reasonably possible. Where this fails to make an application acceptable they may also consider off-site mitigation and off-setting strategies. Providing this approach is applied via well thought through planning policies and associated contributions are deployed in a cost-effective and transparent manner. This approach provides an attractive supplementary mechanism for reducing transport emissions.</p> <p>The LES Partnership's guidance on planning based low emission strategies identifies a cycle for considering mitigation whereby: Associated trips are reduced as far as possible, then residual emissions are address via available site-based measures and then contributions are sought for any remaining 'untreated' emissions. Variations on this approach allow refinements to reflect local policies on reference point emissions, charging rate, charging formulae and mechanisms for discounting to reflect wider socio-economic factors.</p> <p>The approach is gaining wider adoption by authorities. However, few structured case studies or quantified impact basements are available.</p>	20% off set cars, 20% off set buses (assume flexibility to provide buffer on uncertainties associated with site-based interventions)	S1, S41	Limited
Overall Package				<p>Review of known case studies suggests that transport emission reduction via planning agreements remains a relatively undeveloped area. This represents a major opportunity for planning authorities, though at the same time means that the evidence base is still poorly developed.</p> <p>In making these observations, it is inevitable that the case studies and impact assessment lags behind the best of current practice. Practical work by the LES Partnerships indicates that practice is evolving rapidly with new case studies becoming available and ongoing extension/standardisation of agreements and practice occurring.</p>	40% reduction on car & bus emissions (note: up to 100% is possible if 'full' off-set is pursued on 'untreated' residual emissions)	Examples of area wide planning policies: 17-10	

Scenario C: Area wide Emissions Management				
Baseline Emissions		Scenario baseline is derived from NAEI 2008 summary data (see sheet 'M1&2-emissions') and assumes England & Wales total is approx same as LA combined total (not a perfect assumption, but within +/-10-20%) => Fleet comprises a mixture of CARS, BUSES TRUCKS and VANS		
Relative Contributions		Relative contributions are derived directly from the same NAEI data used to derive baseline emissions.		
Intervention Summary		<p>The scenario assume that all authorities in England and Wales maintain or develop ambitious yet achievable policies and plans to achieve significant cost effective reductions in local transport emissions. In order to do so, they also assume that effective management, delivery and financing mechanisms are maintained or established. The area-wide scenario assumes that all local authorities pursue widespread deployment of a series of integrated low emission transport interventions, which in combination are capable of influencing the breadth of vehicle activity within the local area. It assumes that councils take full advantage of the powers and opportunities available to them both for acting directly, and also in encouraging, facilitating, and in some cases requiring local people and organisations to play their part as well. Direct interventions are assumed to include travel planning, improved fleet management, better public transport, installation of low emission fuelling/charging infrastructure and investment in low emission fleets, vehicles and technologies. Indirect influence is assumed to be exerted via a range of mechanisms including transport planning, spatial planning, public procurement, strategic finance partnership working and local communications.</p> <p>The area wide scenario was developed conceptually, by combining and scaling up the development control and council fleet scenarios. Scaling up interventions in this way opens up the opportunity of affecting a much higher proportion of local emissions, thereby achieving greater benefits. At the same time this undertaking will bring greater logistical, political and financial challenges, compared say to own estate and planning based action. To reflect this, the scenario assumes more conservative impact factors across the target fleet. None the less, the ambition implied by this scenario should not be understated. Bulk emission reductions of this scale, would only arise from significant, coherent and determined action.</p> <p>The proposed impact factors are subject to significant uncertainty arising in large part due to (i) limitations in the robustness and coverage of underlying case examples, (ii) broad approximations required in translating these case study data into impact factors, (iii) uncertainties surrounding the current starting point (i.e. the extent to which interventions have/are already being deployed), and (iv) the complexity of issues with potential to affect the scale, speed and overall response by local authorities, including potential economic and political barriers/inertia.</p> <p>=> The scenario is intended to illustrate an ambitious yet plausible path, and crucially to show that by combing complimentary interventions together it is possible to build up significant beneficial impacts. The challenges in achieving such concerted action, should not be underestimated and the analysis and its outputs need to be considered firmly within the context and discussion presented within the main project report,</p>		
Data Quality and Assumptions		As explained above the area wide scenario is developed by combining and extrapolating the council fleet and development control scenarios. As such it is a broad, yet illuminating, approximation. Ideally it would have been possible to cross correlate the impacts against existing case studies either of single large interventions (e.g. London LEZ), or impact assessment of strategic area based plans (e.g. Liverpool LTP). In the event this proved beyond the scope of the study, but remains an important step to consider as potential future work.		
Intervention Categories		Outline Approach		Proposed Scenario Impact
A	Reduce car travel	A1	Reduce/Shift personal car trips	10% reduction in distance travelled
			<p>Interventions include advice/information, training, incentives and introduction of management/information systems/equipment. Also area wide campaigns, education and training initiatives.</p> <p>Hard supporting interventions may include community support officers, parking re-allocation/charges, vehicle share/rental schemes (e.g. car club, bike rental), improved cycling and walking infrastructure and enhanced public transport. More stringently interventions such as congestion charging, emission based parking charges and user charging have significant potential to drive mode shift and reduce overall travel.</p> <p>Studies indicate good trip reduction and mode shift providing plans are well designed, implemented, monitored and enforced. Results are considerably improved when accompanied by hard supporting interventions.</p>	
B	Reduce car res. emissions	B1	Improve individual driving behaviour	5% reduction in fuel consumed
			<p>Driver training and use of in-car telematics have potential to provide fuel and emission savings. Delivery of these interventions area wide poses a significant logistical challenge.</p>	

		B2	Improve car technology	<p>Improving the technology of fleet vehicles will reduce fuel consumption and emissions. This occurs gradually through natural fleet renewal and may be accelerated by the use of area wide measures, which push drivers more or less forcefully to choose lower emitting vehicles.</p> <p>Potential interventions include: emission based parking allocation/charging, entry or use controls and charges, financial support for greener vehicles and provision of supporting infrastructure (e.g. electric charging points).</p> <p>Installation of electric charging points is an increasingly popular intervention, though quantifying associated emission reductions is difficult since they only reduce emissions indirectly, according to the extent that they put electric vehicles onto the road. Examples of the other types of intervention are less common and less well understood, though parallels can be drawn from similar transformation of managed fleets.</p> <p>In addition, vehicle share/rental schemes may provide effective mechanisms for introducing low emission vehicles into the fleet and also exposing potential individual purchasers to the technologies building understanding and confidence. Again the potential of this approach is not yet well understood practical examples are limited. The Low Emission Strategies Partnership is currently sponsoring evaluation work in this area.</p> <p>Overall it seems likely that good emission reductions can be achieved via encouraging the choice of lower emitting vehicles. Further practical examples and impact quantification is required to fully understand the potential of the approach and how best to achieve it.</p>	5% reduction on tailpipe emissions
C	Reduce bus emissions	C1	Improve fleet management/operations	<p>As part of one or more managed fleets, bus trip and emission reductions may be achieved via improved policy, management and operations. Also by improved driver skills.</p> <p>While, the nature of public transport provision varies between authorities, there exists a range of intervention options which enable influence over emissions performance. These range, for example, from Quality Bus Partnerships through to full on Low Emission Zones. Incentivisation is also possible via fleet recognitions schemes and/or supported investment programmes. A key challenge for local authorities in cleaning up local bus fleets is to ensure that quality and coverage of service is not adversely affected by any additional costs or changed practices imposed.</p>	5% reduction in distance travelled 5% reduction in tail pipe emissions
		C2	Improve bus technology	<p>As part of one or more managed fleets, bus emission reductions may be achieved via deployment of improved vehicle technology (e.g. biomethane/gas/dual fuel/hybrid/electric depending on vehicle size and duty cycle).</p> <p>While, the nature of public transport provision varies between authorities, there exists a range of intervention options which enable influence over emissions performance. These range, for example, from Quality Bus Partnerships through to full on Low Emission Zones. Incentivisation is also possible via fleet recognitions schemes and/or supported investment programmes. A key challenge for local authorities in cleaning up local bus fleets is to ensure that quality and coverage of service is not adversely affected by any additional costs or changed practices imposed.</p>	10% reduction on tail pipe emissions (a more aggressive figure is proposed, to compensate for the fact that given desire to see mode shift, it is unlikely that significant vehicle trip reduction will be possible)
D	Reduce G&S geo-fleet	D1	Goods & Service Fleet Reduction	<p>Consideration of needs addressed by the fleet and opportunities for alternative policies and approaches which service these needs requiring smaller or less active fleet. Interventions with potential to achieve this aim include the development of quality freight partnerships and freight consolidation schemes.</p>	5% reduction in distance travelled
E	Improve efficiency of G&S geo-fleet	E1	Efficient fleet operations & drivers	<p>Efficiency savings arising for example from improved organisation, journey planning and fuel management. Potentially supported by the use of telematics or equipment such as speed limiters or power management systems. Efficiency savings may also arising from improve driver skills can be encouraged by a variety of mechanisms including Smarter/SAFED training. Also anti-idling policies/training.</p>	5% reduction in distance travelled 5% reduction in tail pipe emissions

		E2	Maintenance & improved technology	Interventions with potential to achieve these aims include: low emission zones, fleet recognition schemes (especially where linked to procurement policies), Improved vehicle and emissions performance arising from improved maintenance (e.g. wheel alignment) and vehicle modification (e.g. Energy efficient tyres). Also in this category is retro-fitting of after treatment devices. Accelerated adoption of new technologies through strategic investment and fleet renewal. Key technologies include: electric cars (urban), hybrid cars (longer distances), BM/gas/electric vans, BM/gas/dual fuel/hybrid heavy vehicles.	5% reduction on tail pipe emissions
F	Off-set & mitigation by polluters	F1	Contribution to strategic invest. fund	In principle, contributions could be pursued from operators of polluting vehicles to off-set 'untreated' emissions. Local mechanisms to implement this principle are unknown at this time.	Considered beyond current scope
Overall Package					

National Case Projections - Scenario Analysis	Scenario A: Council Vehicles	Scenario B: Development Control	Scenario C: Area Wide
Relative Contributions Matrix (RCM)	CO2 PM NOx	CO2 PM NOx	CO2 PM NOx
=> check 100	100 100 100	100 100 100	100 100 100
Cars	5 2 1	97 98 82	62 43 39
Vans	40 54 23	0 0 0	13 31 12
Trucks	54 44 76	0 0 0	19 20 37
Buses	0 0 0	3 2 18	6 6 12
Baseline Line Emissions Matrix (BEM)	CO2 PM NOx	CO2 PM NOx	CO2 PM NOx
=> Baseline Emissions (BE)	1,100,000 104 2,800	740,000 33 800	100,000,000 21,000 400,000
Cars	57432 2 34	717,800 32 656	62,000,000 9,030 156,000
Vans	443969 56 631	0 0 0	13,000,000 6,510 48,000
Trucks	598599 46 2135	0 0 0	19,000,000 4200 148,000
Buses	0 0 0	22200 0.66 144	6000000 1260 48000
Scenario Impact Matrix (IM)	CO2 PM NOx	CO2 PM NOx	CO2 PM NOx
Cars	30 30 30	40 40 40	20 20 20
Vans	30 30 30	0 0 0	20 20 20
Trucks	30 30 30	0 0 0	20 20 20
Buses	0 0 0	40 40 40	20 20 20
Emissions Reduction Matrix (ERM)	CO2 PM NOx	CO2 PM NOx	CO2 PM NOx
Cars	17,230 0.6 10	287,120 12.9 262	12,400,000 1806 31,200
Vans	133,191 16.9 189	0 0.0 0	2,600,000 1302 9,600
Trucks	179,580 13.7 640.4	0 0.0 0	3,800,000 840 29600
Buses	0 0.0 0	8880 0.3 57.6	1200000 252 9600
=> Scenario emission reduction by pollutant (ERP)	330,000 31.2 840	296,000 13.2 320	20,000,000 4200 80000
Scenario Emissions Matrix (SEM)	CO2 PM NOx	CO2 PM NOx	CO2 PM NOx
Cars	40,202 2 24	430,680 19 394	49,600,000 7,224 124,800
Vans	310,779 39.37 442	0 0 0	10,400,000 5208 38,400
Trucks	419,019 31.9 1494.3	0 0 0	15,200,000 3360 118400
Buses	0 0.00 0	13320 0.396 86.4	4800000 1008 38400
=> Scenario Emissions by pollutant (SEP)	770,000 72.80 1960	444,000 19.8 480	80,000,000 16800 320000
=> Scenario Impact by Pollutant (SIP)	30 30 30	40 40 40	20 20 20
Damage Costs Avoided Matrix (DCAM)	CO2 PM NOx	CO2 PM NOx	CO2 PM NOx
=> Est. Damage Cost (£/tonne)	50 62000 840	50 62000 840	50 62000 840
Cars	861,478 40,002 8,597	14,356,000 802,032 220,416	620,000,000 111,972,000 26,208,000
Vans	6,659,542 1,046,163 159,058	0 0 0	130,000,000 80,724,000 8,064,000
Trucks	8,978,980 848,234 537,945	0 0 0	190,000,000 52,080,000 24,864,000
Buses	0 0 0	444,000 16,368 48,384	60,000,000 15,624,000 8,064,000
=> Annual Damage Costs Avoided by Pollutant (DCAP)	16,500,000 1,934,400 705,600	14,800,000 818,400 268,800	1,000,000,000 260,400,000 67,200,000
=>Annual Damage Costs Avoided by Scenario (DCAS)			1,327,600,000