SOLUTIONS – Tool Summary

Authors

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Info

Date:
2004-2009

Place of origin:
UK

Homepage:
http://www.suburbansolutions.ac.uk/me-assessment.aspx

References:

- Barton, H. et al., 2009. *SOLUTIONS - London Local Case Study - Final Report*, Bristol. UK: University of the West of England.
- Lundqvist, L., 2007. Comments on SOLUTIONS sustainability assessment.
- Mitchell, G., 2005. Sustainability of Land Use and Transport in Outer Neighbourhoods (SOLUTIONS): A Proposed Appraisal Framework. In EPSRC SOLUTIONS conference. Cambridge, UK: Cambridge University, p. 17.
- Mitchell, G., Gawthorpe, S. & Namdeo, A., 2005. *Evaluation Criteria for SOLUTIONS*, UK: EPSRC.
- SOLUTIONS Team, 2009. *SOLUTIONS - Final Report - Strategic Scale*, UK: EPSRC.

Latest use:
2008 - In the case studies during the research project

Download:
http://www.suburbansolutions.ac.uk/findings.aspx

Description

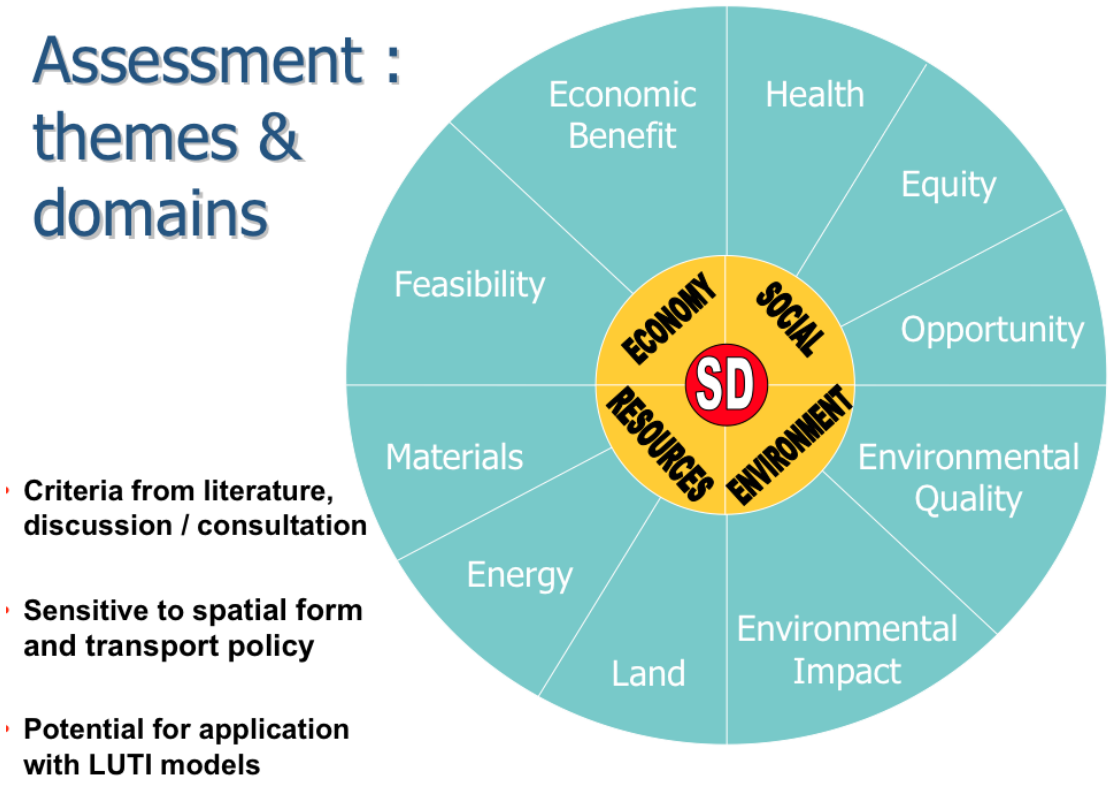
"The SOLUTIONS project was formed to examine the key question of how far, and by what means, can towns and cities be planned so they are economically efficient, socially inclusive and environmentally sustainable. For this purpose, an interdisciplinary team from five universities was assembled to systematically study the impacts of different urban planning and transport policies at both the city region and neighbourhood scales. These policies produce observable development patterns that determine the long term sustainability of cities. The trend and policy alternatives have been tested within the context of case study cities of different sizes and characteristics and the outcomes compared to produce findings that can be generalised to other areas."
"[The SOLUTIONS] Assessment aims to provide a sustainability evaluation of the different options tested within the wider SOLUTIONS programme. This work package contains three main elements. First, criteria relevant to urban sustainable development and which are sensitive to the urban land use-transport options under investigation are to be identified and organised within a logical structure, the assessment framework. It is envisaged that the main assessment domains will address economic, social, environmental impact and resource use

criteria. After evaluation criteria have been agreed within the consortium, a technical feasibility assessment will be conducted to determine the practicality of quantitative assessment. Assessment of individual criteria will be conducted using a range of extant mapping and modelling tools (eg, for energy use, emissions), whilst in the case of some criteria, new techniques may need to be developed. Using these tools, and inputs describing land use and transport characteristics drawn from the preceding work packages, the assessment criteria will be quantified for each option and case study city. Finally, assessments of individual criteria will be integrated to permit identification of the more sustainable land-use transport design. An appropriate integrative technique has not yet been selected, but a multi-criteria analysis (MCA) technique, such as the analytical hierarchy process or sustainability threshold analysis, may be chosen. In order to aid transparency, and support preparation of the best practice guidance, results will also be reported for individual criteria."

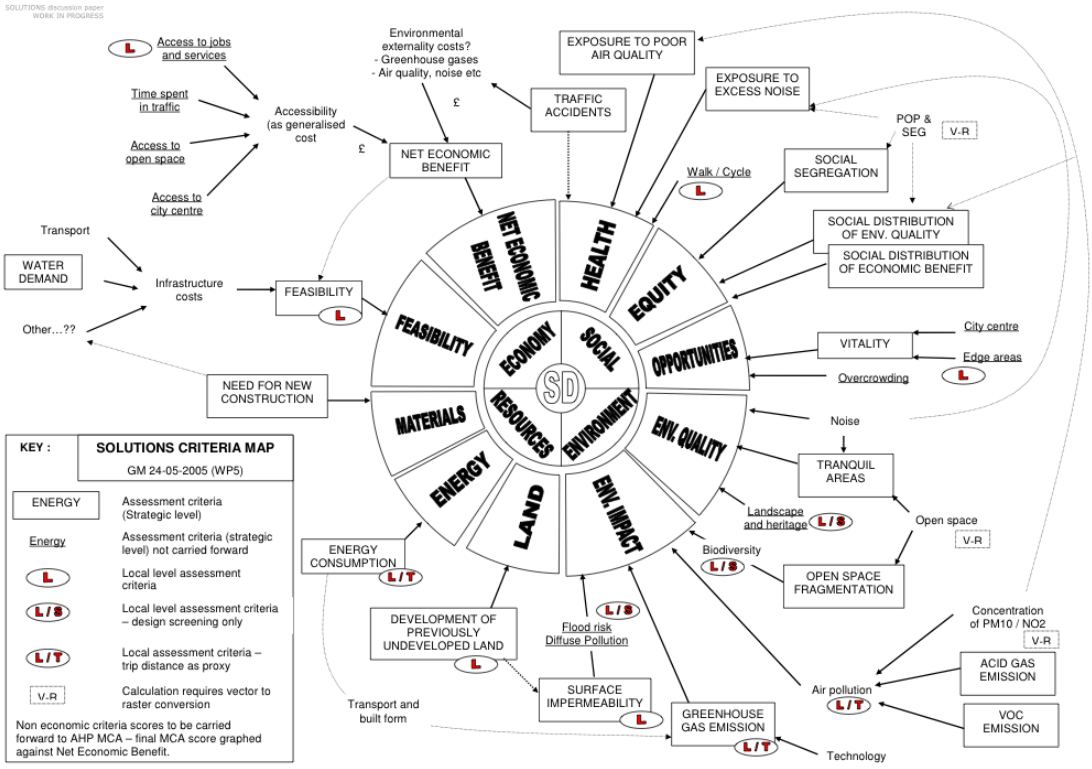
Key Theoretical Background

"A preliminary list of criteria (Table 1) was identified in the "Appraisal Framework" (Mitchell, 2004) which also describes a proposal for an overall approach to assessment within the SOLUTIONS project. This list of evaluation criteria were identified through a literature review that included national guidance on sustainable development indicators, guidance on SEA and sustainability appraisal of development plans, and national and local guidance on evaluation of transport plans. This preliminary list was circulated within the SOLUTIONS team for discussion, and subsequently to the SOLUTIONS reference group at the Cambridge Symposium (December 2004). The SUE DISTILLATE survey of local authority transport indicators was also examined (see Appendix I). Subsequent discussion has taken place amongst the SOLUTIONS team, and is ongoing."

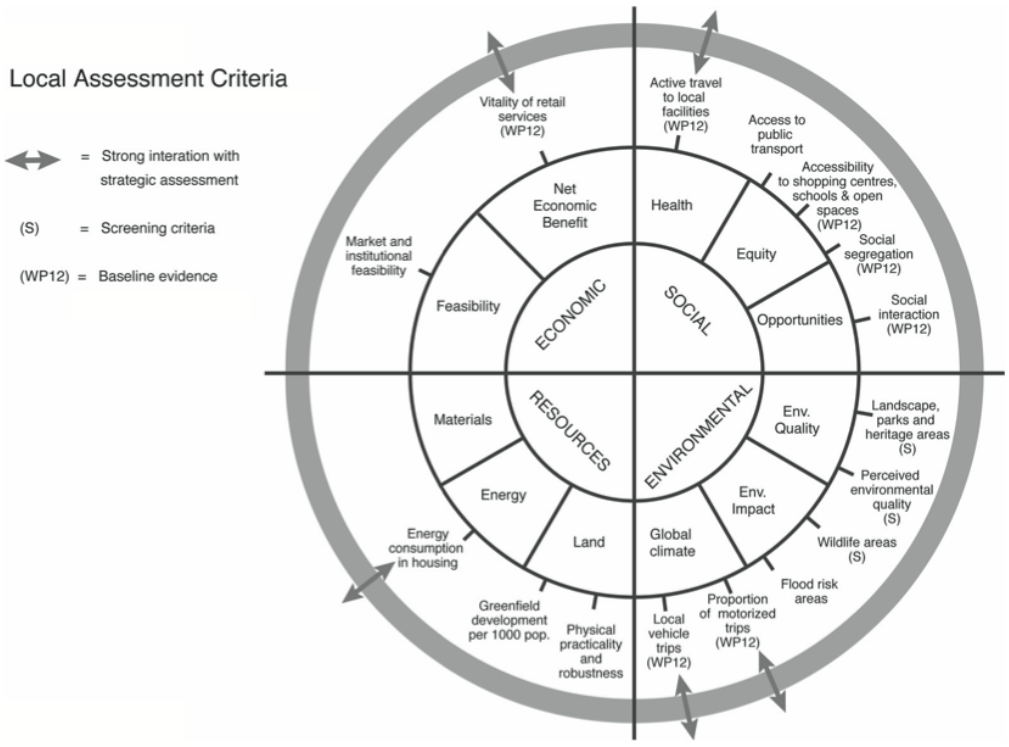
SUD Framework



Strategic level (4):
"The selected sustainability indicators include the following:
• **Economic** sustainability which is assessed through a calculation of net economic benefit that estimates the amount of money that can be taken away from or given to the affected agents to leave them in the same position as before introducing the policy. Also, a more conventional cost-benefit analysis applied only (to avoid double counting) to transport users, operators and government has been estimated.
• **Resource** use. Although some of these are implicitly included in the other indicators they are nevertheless explicitly estimated. These include land take, consumption of energy and construction materials.
• **Environmental** sustainability is assessed with the use of a number of indicators such as CO_2 emission, emission of noxious gases and particulates from transport, and 'surface sealing' (impermeability) that affects flood risk and biodiversity.
• **Social** sustainability is assessed in a number of ways including dwelling space crowding, traffic noise, traffic severance and measures of spatial segregation."

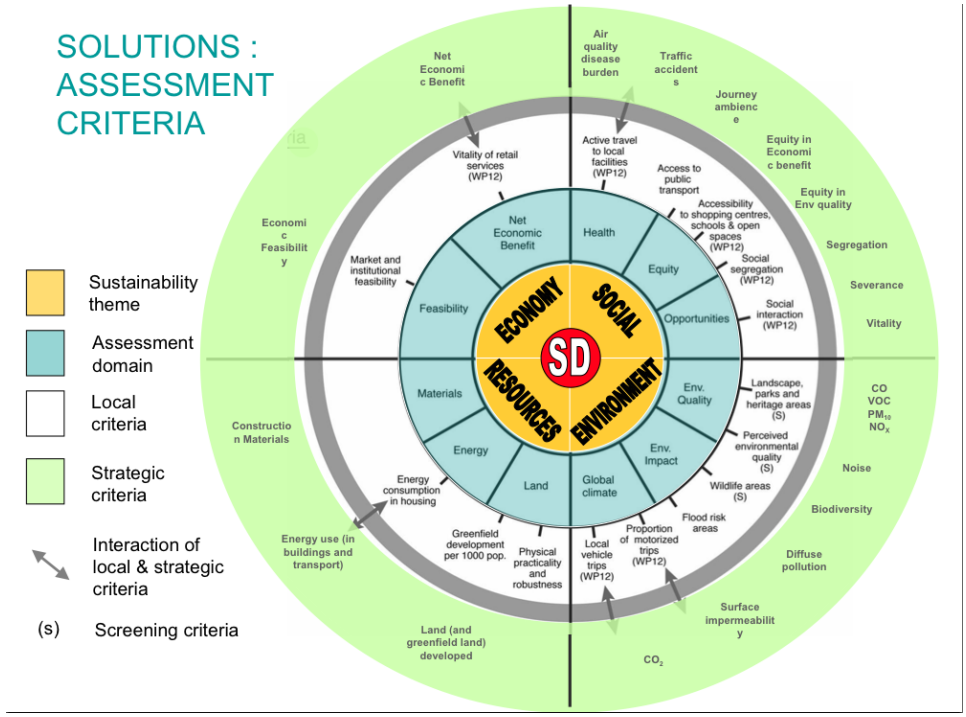


Local level (3):
"**Economic**: The ability of a neighbourhood or district to support a local economy through viable local catchments and access to passing trade.
Environmental: The opportunity for a local area to function without reliance on the private car for access to local facilities and shops. Urban form that supports a quality pedestrian and cycling network and supports viability of public transport.
Social: The propensity for a specific local form to support social capital through provision of accessible local facilities and shops supporting informal networks and regular informal social interactions for a variety of demographic types."



Input

There are two levels of assessment criteria: city-region and local.



Strategic level:

"The assessment draws on the LUTI model transport network outputs (e.g. road location, road type, traffic flow, speeds), or the LUTI model land use outputs per zone, such as employment by activity type, households by socio-economic group, dwelling numbers and densities, etc. Some indicators, such as CO2 emissions, are driven by both transport network and land use data because both transport and building types affect energy consumption. Where possible, the techniques applied are those widely recognised within the relevant assessment profession."

Local level:

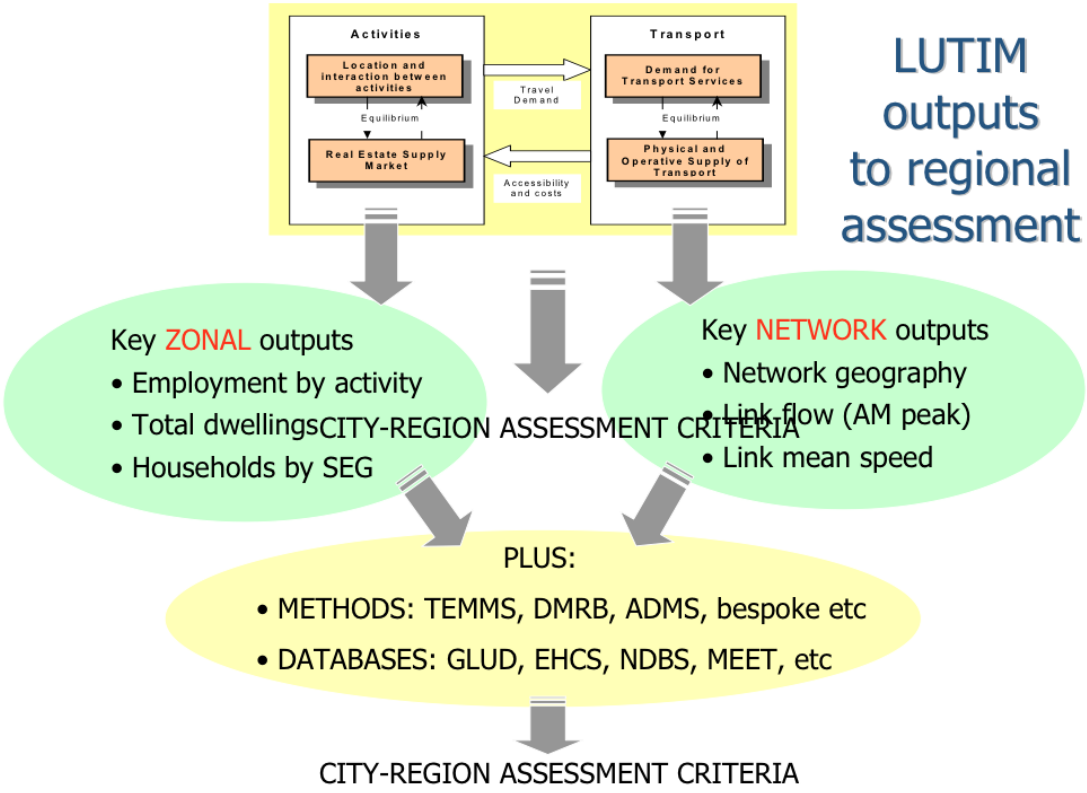
"The SOLUTIONS project is using an integrated evaluation framework to assess sustainability of the future options across the strategic and local scales. This work is being led by the School of Geography and Institute for Transport Studies at the University of Leeds. As part of the overall framework the local scenarios are being tested against a series of assessment criteria.

The diagram to the right [above] shows the entire assessment framework across the entire SOLUTIONS project. The role of the local and strategic assessment criteria in assessing sustainability is indicated by the mapping. On their own, the local criteria are not a coherent set but are designed to complement strategic data giving rise then to a complete picture of option performance. The integrated evaluation for Cambridge will be completed later in the programme, once further work on the strategic options has been carried out.

This diagram indicating the relationships of the local and strategic criteria is draft and maybe subject to change."

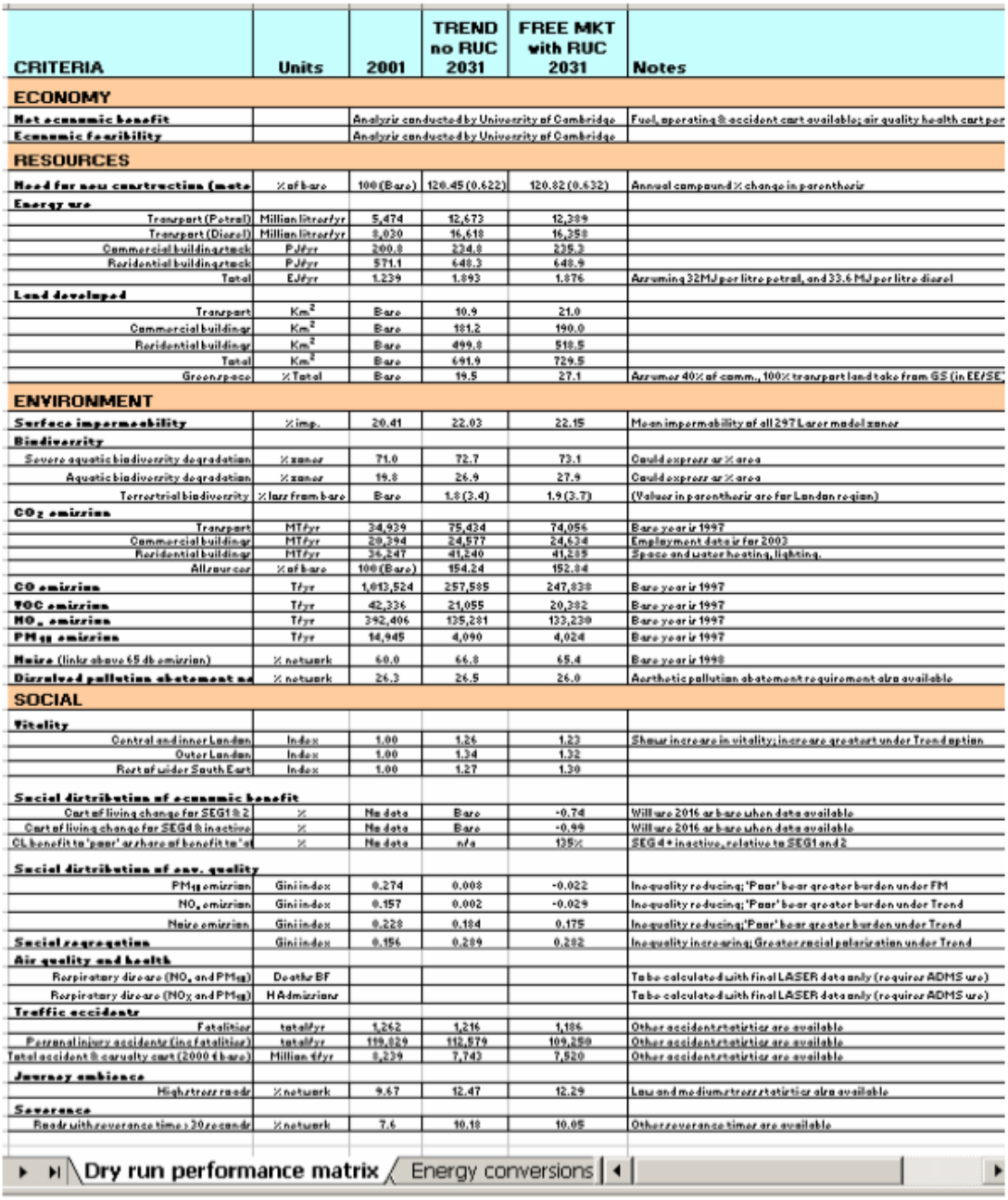
"Although this set of criteria are described as individual criteria relating to a single aspect of sustainability, it must be remembered that they belong to a holistic system that embodies an understanding of sustainability of urban form. They interact both with each other and with other factors affecting sustainable urban living. For example, access to 'good' public transport not only directly affects viability and usage levels of public transport. It can also effect levels of car ownership and use, and through this air quality, noise and other aspects of liveability. Similarly, accessible local centres can not only stimulate cycling and walking (activity is linked to physical health) but also, through repetition of informal social interaction, increase social capital (reducing isolation is linked to mental well-being)."

Methods



"The transport sustainability indicators are evaluated using SMARTNET (System for Multi-criteria modelling and Appraisal of Road Transport NETworks) (Mitchell and Namdeo, 2008)" After the simulations values are aggregated in a performance matrix and summarised using a MCA approach.

MCA summary, using weights and aggregation (not transparent or explained)



CRITERIA	Units	2001	TREND no RUC 2031	FREE MKT with RUC 2031	Notes
ECONOMY					
Net economic benefit		Analysis conducted by University of Cambridge			Fuel, operating & accident cost available; air quality health cost per
Economic feasibility		Analysis conducted by University of Cambridge			
RESOURCES					
Need for new construction (mate	% of base	100 (Base)	120.45 (0.622)	120.82 (0.632)	Annual compound % change in parenthesis
Energy use					
Transport (Petrol)	Million litres/yr	5,474	12,673	12,389	
Transport (Diesel)	Million litres/yr	8,020	16,618	16,358	
Commercial building stock	PJ/yr	200.8	224.8	225.3	
Residential building stock	PJ/yr	571.1	648.3	648.9	
Total	EJ/yr	1.239	1.893	1.876	Assuming 32MJ per litre petrol, and 33.6 MJ per litre diesel
Land developed					
Transport	Km^2	Base	10.9	21.0	
Commercial building	Km^2	Base	181.2	190.0	
Residential building	Km^2	Base	499.8	518.5	
Total	Km^2	Base	691.9	729.5	
Green space	% Total	Base	19.5	27.1	Assumes 40% of comm., 100% transport land take from GS (in EE/SE
ENVIRONMENT					
Surface impermeability	% imp.	20.41	22.03	22.15	Mean impermability of all 297 Laser model zones
Biodiversity					
Severe aquatic biodiversity degradation	% zones	71.0	72.7	73.1	Could express as % area
Aquatic biodiversity degradation	% zones	19.8	26.9	27.9	Could express as % area
Terrestrial biodiversity	% loss from base	Base	1.8 (3.4)	1.9 (3.7)	(Values in parenthesis are for London region)
CO_2 emission					
Transport	MT/yr	34,929	75,424	74,056	Base year is 1997
Commercial building	MT/yr	20,294	24,577	24,624	Employment data is for 2003
Residential building	MT/yr	36,247	41,240	41,295	Space and water heating, lighting.
All sources	% of base	100 (Base)	154.24	152.84	
CO emission	T/yr	1,613,524	257,585	247,838	Base year is 1997
VOC emission	T/yr	42,336	21,055	20,382	Base year is 1997
NO_x emission	T/yr	342,406	135,281	133,230	Base year is 1997
PM_{10} emission	T/yr	14,945	4,090	4,024	Base year is 1997
Noise (links above 65 db emission)	% network	60.0	66.8	65.4	Base year is 1998
Diffused pollution abatement ne	% network	26.3	26.5	26.0	Aesthetic pollution abatement requirement also available
SOCIAL					
Vitality					
Central and inner London	Index	1.00	1.26	1.23	Shows increase in vitality; increase greatest under Trend option
Outer London	Index	1.00	1.34	1.32	
Rest of wider South East	Index	1.00	1.27	1.30	
Social distribution of economic benefit					
Cost of living change for SEG1 & 2	%	No data	Base	-0.74	Will use 2016 as base when data available
Cost of living change for SEG4 & inactive	%	No data	Base	-0.99	Will use 2016 as base when data available
CL benefit to 'poor' as share of benefit to 'al	%	No data	n/a	135%	SEG 4 + inactive, relative to SEG1 and 2
Social distribution of env. quality					
PM_{10} emission	Gini index	0.274	0.008	-0.022	Inequality reducing; 'Poor' bear greater burden under FM
NO_x emission	Gini index	0.157	0.002	-0.029	Inequality reducing; 'Poor' bear greater burden under Trend
Noise emission	Gini index	0.228	0.184	0.175	Inequality reducing; 'Poor' bear greater burden under Trend
Social segregation	Gini index	0.156	0.289	0.282	Inequality increasing; Greater racial polarisation under Trend
Air quality and health					
Respiratory disease (NO_x and PM_{10})	Deaths BF				To be calculated with final LASER data only (requires ADMS use)
Respiratory disease (NO_x and PM_{10})	HAdmissions				To be calculated with final LASER data only (requires ADMS use)
Traffic accidents					
Fatalities	total/yr	1,262	1,216	1,186	Other accident statistics are available
Personal injury accidents (inc fatalities)	total/yr	119,829	112,579	109,259	Other accident statistics are available
Total accident & casualty cost (2000 £ base)	Million £/yr	8,239	7,743	7,520	Other accident statistics are available
Journey ambience					
High stress roads	% network	9.67	12.47	12.29	Low and medium stress statistics also available
Severance					
Roads with severance time > 20 seconds	% network	7.6	10.18	10.05	Other severance times are available

Dry run performance matrix | Energy conversions

Criteria performance matrix

Output

"Overall summary

Two indicators have been selected from each of the main domains of economic (net economic cost and transport costs), resources (land and energy), environment (impermeability and NOx emission) and social (crowding and segregation) to illustrate the performance of each option with respect to the base year. These diagrams are constructed by translating criteria natural values to a common unit-less scale, with the reference case set to zero. The diagrams are an illustrative aid to comparison only and are presented in a spider / radar type graph for easy of comprehension."

Table 4.17: Total land requirements (km^2) under each spatial option

Development	Trend				2031 + RUC		
	2001*	2016	2031	2031 +RUC	Compaction	Dispersal	Expansion
Main highways	265.8	10.9	22.4	22.4	10.9	33.3	22.4
Commercial and industrial	467.0	74.7	118.0	118.2	102.4	128.3	123.6
Residential	3135.0	307.2	538.8	538.8	288.5	747.0	658.4
All	3867.8	392.8	679.2	679.4	401.8	908.6	804.4
% WSE developed	11.14	12.14	12.87	12.87	12.16	13.45	13.18

Note. 2001 is observed land cover. Other data denote additional land requirement, except final row, which denotes share of all wider south east region under development.

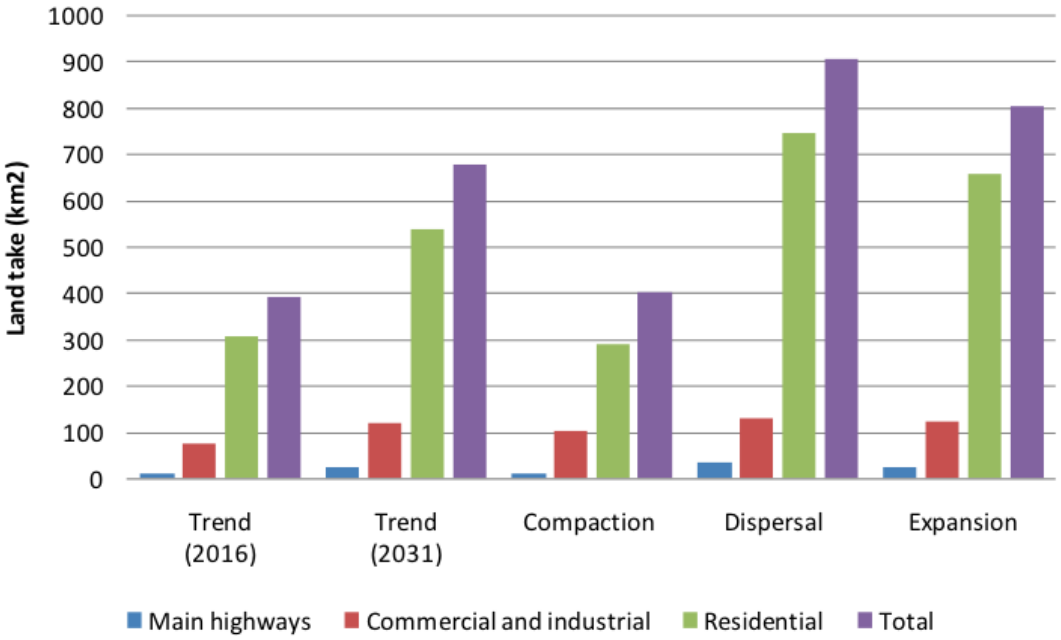


Figure 4.30 Land requirement under SOLUTIONS spatial options

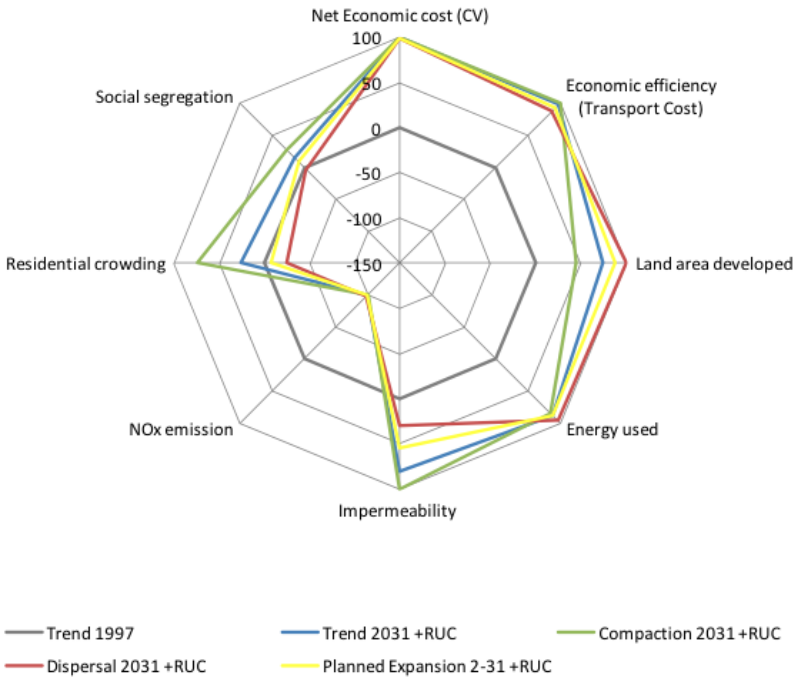


Figure 4.41: Comparison of key indicators to illustrate the performance of each option with respect to the base year (1997) in the main domains of economic (net economic cost and transport costs), resources (land and energy), environment (impermeability and NOx emission) and social (crowding and segregation)

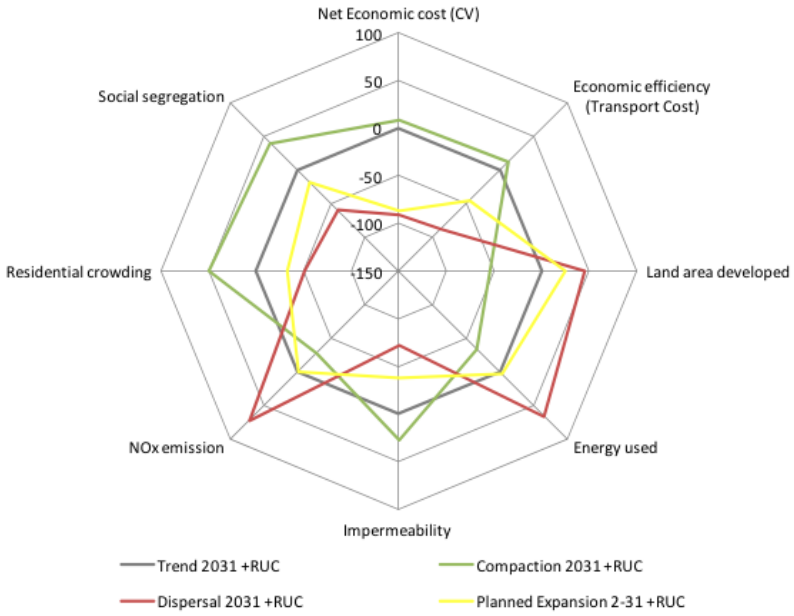


Figure 4.42: Comparison of key indicators to illustrate the performance of each option with respect to the 2031 Trend with road user charges year in the main areas of economic (net economic cost and transport costs), resources (land and energy), environment (impermeability and NO_x emission) and social (crowding and segregation).

Local level:
"In order to feed into this process without pre-judging the issue of the value put on different criteria, the Local design study will use an evaluation tool that avoids weighting, but does give a good indication of the seriousness of any particular impact. This tool is Sustainability Threshold Analysis (STA) (Barton 2004).
An advantage of STA is that can usefully summarise measurements and judgements on diverse criteria, for example substantive criteria such as public transport accessibility and process criteria such as market feasibility. It identifies the key problems (i.e. grades orange and red) which will need to be confronted if a proposal is to give any chance of success."

Grading access to:							
	facilities				open space	Score	
Facility	Primary School	Secondary School	Local Shops	Public Transport Good quality	average distance		
Threshold	live within 600m	live within 1500m	live within 800m	live within 400/600m			
Percentage of population meeting the threshold	80 - 100 %				<400m	EXCELLENT	
	60 - 79 %				400-600m	GOOD	
	40 - 59 %				600-800m	NEGOTIABLE	
	20 - 39 %				800-1100m	PROBLEMATIC	
	0 - 19 %				1100m <	UNACCEPTABLE	

The standard benchmark values for the accessibility criteria

Trend 2016 assessment criteria				Baseline	2016
1.	Population			65 700	70 300
2.	Households			25 900	27 900
3.	Household size			2.54	2.51
4.	% pop. with access to facilities:		primary schools	43 %	43 %
			secondary schools	68 %	69 %
			local shops	64 %	65 %
5.	% pop. with access to public transport:	Bus	excellent	28 %	28 %
			good	23 %	25 %
			mediocre	18 %	16 %
			poor	3 %	4 %
			Train	39 %	40 %
6.	Average distance to nearest open space km			0.42	0.42

STA summary assessment at the local level

SOLUTIONS – Tool Review

General

Background
The strategic assessment criteria are an evolution of the Propolis project, here with the addition of a local level of assessment contributed by Hugh Barton.
The whole process of compiling the indicators and in particular trying to merge the strategic and the local framework is carefully documented in Mitchell et al. 2005.

Application (Scale and Design Phase)
It is meant to be assessing strategic and local scales, integrated. However the whole weight is on the strategic as the local detail is not modelled as it's "too site specific" and more abstract and generic cases are sought to produce guidance, the ultimate aim of the project.
This assessment method is not made to assess designs.

Sustainability Principles
The strategic set draws mostly from PROPOLIS and is very transport oriented. The local set draws from Hugh Barton's work. There is very little interaction.
Clear reference to the SPeAR model.

Assessment Criteria
SOLUTIONS is to assess generic designs, not real designs. The output of solutions is guidance, not assessment of the design, so they go and "skip" many local criteria that are too specific.
In reality there are two evaluation frameworks that were never integrated: strategic and local. Links are few and weak as approaches are very different.

Indicators and Calculation Methods
The strategic ones draw heavily from data coming from LTU model simulations. The local is quite qualitative.

Output
No standard output of note. In fact several options are considered but not a clear decision is made.