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Sustainability of Land Use and
Transport in Outer Neighbourhoods

EVALUATION CRITERIA FOR SOLUTIONS

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1 Background and aims

The challenge of sustainable development is arguably greatest in urban areas, where most people are concentrated. The challenge is to deliver a vibrant economy, promote healthy living and reduce social inequality, and do so within the environmental limits of the natural world, the basic support system for all economic and social systems. The UK currently has a significant housing shortage (ODPM, 2003), and this has placed many peri-urban areas under significant development pressure. Accommodating this pressure in a sustainable manner requires that effective designs (addressing spatial, regulatory and fiscal policies) for land use and transport systems be identified. This is the particular focus of the SOLUTIONS project.

The purpose of this document is to further describe the criteria to be used in the sustainability evaluation of the SOLUTIONS land use-transport designs. 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. This document is intended to support and further that discussion by:

- Presenting a revised list of proposed evaluation criteria for application with SOLUTIONS, addressing feedback on the Appraisal Framework document, and considering several other relevant sources;
- Identifying the relevance of the proposed criteria to (urban) sustainability;
- Identifying how the criteria is sensitive to the design of land use and transport systems;
- Identifying potential methods for quantifying criteria at the appropriate spatial scale (strategic / city and local /neighbourhood scales).
- Specifying in more detail, where possible, the methods to be used (addressing the method, data availability and needs, resource implications and outstanding issues).

The document is **A WORK IN PROGRESS**, and will require further input from SOLUTIONS team members.

Table 1. SOLUTIONS evaluation criteria proposed in Appraisal Framework

Criteria	Assessment level		Comments
	Strategic	Local	
ECONOMIC			
Net economic benefit	Yes, QN	No?	Local incorporated in strategic (?)
Transport economic efficiency	Yes, QN	No?	Local incorporated in strategic (?)
Journey reliability	Yes, QN	No?	Local incorporated in strategic (?)
ENVIRONMENT (Natural)			
Noxious emissions	Yes, QN	Yes?, QN	Addresses networks but not land use
Greenhouse gas emission	Yes, QN	Yes?, QN	Addresses networks but not land use
Exposure to noise	Yes, QN	Yes?, QN	
Biodiversity	No	Yes, QL	Designated sites addressed by STA
Green space area and pattern	Yes, QN?	Yes, QL	Strategic level biodiversity surrogate; Local level design quality criteria?
Landscape	No	Yes, QL	Sufficiently relevant to generic guide?
Diffuse water pollution	Yes, QN	Yes? QN	
Properties (value) at flood risk	Yes, QN	Yes, QL	
ENVIRONMENT (Resources)			
Productive land lost to development	Yes, QN	Yes, QN	Surrogate for soil conservation
Energy use	Yes, QN	No?	Addresses networks but not land use
Water use	Yes?, QN	Yes? QN	Sufficiently relevant to spatial plans?
Brownfield land use	Yes? QN?	Yes, QN	
ENVIRONMENT (Built)			
Heritage	No?	Yes, QL	Sufficiently relevant to generic guide?
Townscape	No?	Yes, QL	Sufficiently relevant to generic guide?
SOCIAL NEEDS & PROGRESS			
Physical fitness	Yes, QN	Yes, QN?	As walk / bike model share
Traffic accidents	Yes, QN	Yes? QN?	
Security? (pending more info)			
Journey ambience	Yes, QN	No? QN?	
Access to jobs and services	Yes, QN	?	
Access to public transport	Yes, QN	Yes, QN	
Severance	Yes, QN	Yes?, QN	Relevant at local level?
Option value? (pending more info)			
Equity in access to public transport	Yes, QN	Yes? QN?	
Equity in severance	Yes, QN	No?	
Equity in emissions exposure	Yes, QN	No?	
Equity in noise exposure	Yes, QN	No?	
SUPPORTING OBJECTIVES			
Transport interchanges	Yes? QL	Yes? QL	
Integration of LU and T policy	No	No	Addressed in generic guidance?
Integration of T and other policy	No	No	Addressed in generic guidance?
Scheme practicality & acceptability	No	No	Addressed in generic guidance?

Key: QL = Qualitative assessment; QN = Quantitative assessment

2 Revision of evaluation criteria

2.1 Initial refinement

Table 2 identifies Table 1 criteria that, following discussion, are not considered suitable for SOLUTIONS assessment. These criteria refer to issues that are context specific. That is, whilst SOLUTIONS designs could, in principle, be assessed with respect to these criteria, no generic guidance could be distilled from their assessment, as this would be highly specific to the case study. However, in drawing up local designs for subsequent assessment, efforts can be made to ensure that the designs are acceptable with respect to the listed criteria. That is, these criteria can be used to screen out local designs that would not normally be considered acceptable, as judged against one or more of these criteria.

Note that:

- In developing local designs for subsequent assessment in SOLUTIONS, the priority is to ensure a representative set of designs is carried forward for further assessment. This may mean that, in our theoretical exercise, local designs are ‘built’ and tested that would not normally be implemented, as a critical threshold is exceeded (e.g. design causes loss of SSSI); and
- In a real world application, any assessment of a local design would have to include those criteria listed in Table 2 (these are subject to various planning policy guidance, and are addressed in the 1999 EIA regulations). A real world assessment is concerned only with the suitability of the design in the specific local context, and is not concerned with the distillation of generic design guidance.

Table 2. Criteria applicable to screening of local design, but not assessment

CRITERIA	COMMENT
Flood risk	<p>The local design plan will seek to avoid areas within recognised flood risk zones (e.g. defined by EA indicative flood map).</p> <p>Flood risk is not a local assessment criterion as, at the local level, flood risk is highly location specific (e.g. there is an inherently higher risk of flooding in the Thames Gateway, than in North Bristol, hence the locational context masks any sensitivity to the spatial design under assessment.</p> <p>Flood risk is in principle sensitive to spatial form – e.g. densification will raise flood risk relative to the same level of development dispersed over an area. Change in the extent of impervious cover (assessed as part of diffuse pollution loads) may be an appropriate proxy for change in flood risk.</p>
Biodiversity	<p>The local design plan seeks to avoid protected sites (e.g. SSSI’s, SSI’s, LNR’s etc). Very site specific. At strategic level biodiversity is addressed in a proxy manner by loss of productive land and fragmentation of green space (both indicative of loss of habitat and potentially species).</p>
Heritage	<p>The local design plan seeks to avoid protected sites (e.g. scheduled monuments, listed buildings, conservation areas). Site specific.</p>
Landscape & townscape	<p>Site specific. Possibly relevant to local environmental quality indicator.</p>

By implication, the Sustainability Threshold Analysis technique (STA) proposed for the assessment of local designs should only include criteria that are sensitive to the design, regardless of where the development takes place (excepting the strategic land use – transport context). Criteria that would result in a design being rejected (deemed unsustainable) in one location, but accepted in another (e.g. presence, absence respectively of a SSSI), should be excluded from the assessment. These factors could be included in a STA screening (to ensure designs are as realistic as possible), so long as this does not compromise the development of a representative set of design options to test.

Note that the design of the strategic options will also, to some extent, take into account the acceptability of developing areas at the strategic level by avoiding development in areas with protected status for environmental or heritage reasons (e.g., SSSI's, National Parks, areas of outstanding natural beauty). Hence, some of the potential evaluation criteria (heritage, landscape, biodiversity), will have been taken into account during option design.

Table 3 presents a further sub-set of excluded Table 1 criteria. The table summarises comments received from those consulted on the original list (most comments are from SOLUTIONS team members), and should be considered carefully. There may be cause to include some of these criteria after all (e.g. as important at one scale but not the other).

Table 3. Criteria considered and currently excluded

CRITERIA	REASON FOR EXCLUSION
Journey reliability	<p>The reliability of public transport compared to car travel will be part of the inputs to the model split assumptions rather than an output from the option testing. These journey time reliability assumptions should be described in the research report as part of the description of the transport options. They will relate to the design of the transport measures, such as the amount of segregation of public transport from traffic (TH).</p> <p><i>Comment:</i> Under NATA, journey reliability is a proxy measure of route stress (i.e. congestion, measured as AADT as proportion of road capacity – the congestion reference flow – see Volume 5, Part 1, Section 13 of the DMRB). Is this the same as the inputs to the strategic model?</p> <p>We should consider whether we need a congestion measure – this would be relatively simple to measure at the strategic level. Note that PROPOLIS included a congestion measure (time spent in traffic per inhabitant), so as to represent a lost opportunity – time available to do other things.</p>

CRITERIA	REASON FOR EXCLUSION
Brownfield land use	<p>Combine with the ‘Productive land lost’ indicator (TH, JK)</p> <p><i>Comment:</i> Yes, this is essentially one input to our productive land lost criteria.</p>
Access to public transport	<p>Not for strategic assessment – walking and waiting times will be incorporated into the modal split assumptions and generalised cost of travel. At the local level, this could possibly be part of an accessibility indicator for people without access to a car (TH).</p> <p><i>Comment:</i> Is this required at the local level? (Proximity does not imply use – what other local access measure might be used?)</p>
Equity in access to public transport	<p>At the strategic level this could be part of a social equity indicator but there is a need to make sure this is not double counted by accessibility assessment (TH).</p> <p><i>Comment:</i> Agreed. Have developed three distinct equity criteria – see Table 4 below. New proposals (drawn from PROPOLIS) that seem particularly relevant to SOLUTIONS include access to city centre and access to open space, which would be a preferable substitute.</p>
Transport security	<p>Possibly part of a local environmental quality indicator if a quantitative relationship has been established between land use and transport design and security (TH).</p> <p><i>Comment:</i> Not aware of such a relationship. Best excluded unless strong reason for local inclusion?</p>
Severance	<p>Not for strategic assessment. At the local level, this could possibly be part of an accessibility indicator (TH).</p> <p><i>Comment:</i> Can be assessed at strategic level with network data, but should not be included if not considered relevant. At local level, would require network data (traffic flow).</p>
Option value	<p><i>Comment:</i> A NATA criteria that implies a consideration of alternatives. Therefore can be excluded as SOLUTIONS is assessing these alternatives explicitly?</p>

CRITERIA	REASON FOR EXCLUSION
Journey ambience	<p>The technology of vehicles will change so it is difficult to estimate the future ambience of different modes or for different journeys (TH).</p> <p><i>Comment:</i> Driver stress under NATA is not technology related but has three main components: frustration, fear of potential accidents, and uncertainty relating to the route being followed. Available research evidence does not permit a finely graded assessment of driver stress, and hence a 3 point descriptive scale – Low, Moderate or High is used. This grade is determined according to the road type, peak flow per lane and average journey speed, and can be relatively easily assessed at the strategic scale. Reason for exclusion may more justifiably be that it is not sufficiently relevant to (social) sustainability and addresses aspects that may be better addressed via a congestion measure.</p>
Transport interchanges	This is considered a process indicator (i.e. achieving this is intended to deliver progress towards other criteria). (SM/TH)
Integration of LU and T policy	This is considered a process indicator (i.e. achieving this is intended to deliver progress towards other criteria). (SM/TH)
Integration of T and other policy	This is considered a process indicator (i.e. achieving this is intended to deliver progress towards other criteria). (SM/TH)
Scheme practicality and acceptability	Not a dedicated indicator - this is addressed via the infrastructure economic efficiency criterion (TH)

2.2 Mapping local criteria to the appraisal framework

The UWE team have proposed a list of indicators for measuring sustainability of the local urban designs to be tested within SOLUTIONS. A draft list of local level indicators was circulated in September 2004 in response to the Leeds Appraisal Framework document, and a further revision circulated in November 2004 (some modifications have since been suggested by UWE). In the November 2004 list, the local scale indicators are organised into four themes, each described by a measurement aim (see Box 1).

Box 1. UWE proposed local level sustainability indicator themes and aims

<p>1. 'Responsiveness' to the natural environment <i>Aim:</i> to identify environmental issues, and enable development types to be assessed in terms of flood risk and impact on biodiversity. Indicators here address wildlife areas, tress, habitat, water bodies and flood risk.</p> <p>2. Efficiency of transport systems <i>Aim:</i> to assess transport and accessibility as a system. Mapping land uses and transport provides an indication of whether land uses and transport are integrated. Indicators address public transport accessibility/equity, integration issues, local trip lengths, travel time, accidents and traffic volumes (to indicate how efficiently the system functions).</p> <p>3. Accessibility and equity for local residents <i>Aim:</i> to assess accessibility for local residents. Indicators address population proximity to local services, population within pedshed of retail services (retail vitality), the social mix of the area; and access to services for different housing types.</p> <p>4 Local character, cultural and stakeholder issues <i>Aim:</i> to consider cultural and political issues. Mapping significant features enables the impact of the development to be assessed. Addresses issues such as protection of conservation areas, marketability (development profit), public/political feasibility, and integration with other government policies (assessed via stakeholder workshops).</p>
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The indicators specified within this list have been mapped on to the more hierarchical and resolved structure specified by the appraisal framework (Table 4). Note that, whilst the four themes of the local level have now been lost, the issues they represent are addressed by the appraisal framework and all the individual indicators have been retained at this stage.

Table 4 was then reviewed (see comments in Table 5) with the aim of producing a more robust and streamlined indicator list (summarised in Table 7). This includes removing potential duplication amongst indicators; ensuring a focus on sustainability outcome indicators where ever possible (rather than process or state indicators); and strengthening consistency of local and strategic level indicators.

In reviewing the criteria, attention was given to previous discussion with SOLUTIONS team members, the preliminary results of the DISTILLATE review of sustainability indicators in use for local transport planning, and the objectives of PPG note 3 on housing (see Appendices 7.1 and 7.2 respectively).

Note that the list remains open for further discussion amongst SOLUTIONS team members, but that work is already underway to identify how criteria can best be measured; hence opportunities for further revision are becoming limited.

Table 4. UWE local level indicators mapped on to the Appraisal Framework

THEME	STRATEGIC CRITERIA	LOCAL CRITERIA ^{1,2}
ECONOMIC		
	Net Economic Benefit	
ENVIRONMENT		
Resource consumption	Productive land lost to development	Brownfield land use (S/A)
	Energy consumption	See 'other' below for proxies (A)
	Water consumption	Water consumption (A)
	Need for new construction	
Heritage		Conservation areas (S) Listed buildings (S) Images of built form (A)
Climate change	Greenhouse gas emission	Greenhouse gas emission (A)
Air pollution	Acidifying gas emission (NO _x SO _x)	Noxious emissions (A) See 'other' below for proxies (A)
	VOC emission	
Water Pollution	Diffuse heavy metal loading	Diffuse water pollution (A)
Environmental Quality	Fragmentation of open space	Trees (S) Significant wildlife areas (S) Green space (S)
	Quality of open space (tranquil areas)	Landscape quality (S) Rivers, streams and lakes ³ (S)
SOCIAL		
Accessibility	Access to jobs and services	% pop in walk/cycle distance of key facilities ⁸ (S / A) % pop near PT service (A)
	Accessibility to city centre	
	Accessibility to open space	
	Time spent in traffic	Average travel time (A)
Health	Traffic accidents (deaths / injury)	Traffic accidents (A)
	Exposure to noise	Exposure to noise (A)
	Exposure to air pollution (NO ₂ , PM ₁₀)	

THEME	STRATEGIC CRITERIA	LOCAL CRITERIA ^{1, 2}
	Flood risk (Impervious area)	Drainage ³ (S) Properties at risk of flood (S)
	Trip share by walk / cycle	Physical fitness ⁴ (A)
Equity	Social distribution of economic benefit	
	Social distribution of environmental quality (noise +open space +air quality index)	
	Social segregation	Distribution of housing type (A) Social mix (A)
		Pop in walk/cycle distance of key facilities by house type/tenure (A)
Opportunities	Housing standard (overcrowding)	
	Vitality of city centre	
	Vitality of suburbs	Potential for passing trade (A) Households in retail catchments (A)
OTHER		
Integration		Of transport interchanges (A)
		With other policies (A)
		Cycle route / PT integration (A)
		Correlation of LU and T (A) ⁶
Other		Modal split ⁵
		Local vehicle trip length ⁷
		No. of vehicles on major roads ^{5, 7}
		Walk /cycle network images ³ (A)
		House price range (A)
Marketability and feasibility	Infrastructure Economic Efficiency	Marketability (A) ⁹ Public / political feasibility (A)

Notes:

1. UWE list of local indicators (February 2005).
2. S = Screening indicator; A = Assessment indicator
3. Not understood what this is measuring
4. Not clear how this can be measured
5. Not an outcome indicator (is measuring a state or process)
6. Proportion of businesses and high density housing located in 400m radii of good transport stops; proportion of these radii not developed/developed for other uses
7. As a proxy for transport energy use and emissions
8. Key services defined as: schools, shops, sports grounds and allotments
9. Defined as likely development profit

Table 5. Further derivation of local criteria

THEME	STRATEGIC CRITERIA	LOCAL CRITERIA ^{1,2}	RESPONSE TO LOCAL CRITERIA PROPOSAL	CONCLUSION (re local criteria)
ECONOMIC				
	Net economic benefit		HB view that these should be assessed at the strategic level. However, there should be an estimate of local service viability (especially retail) reflecting location, catchment population and design (see suburban vitality below)	Addressed under other theme (suburban vitality)
ENVIRONMENT				
Resource consumption	Productive land lost to development	Brownfield land use (S/A) <i>(HB prime indicator – green space).</i> <i>(HB criteria to be considered – local food production potential).</i>	Brownfield use is a key PPG3 issue. Only to be assessed at strategic level as “development is transferable between locations”(HB). Too site specific for local assessment /screening (ditto re strategic level?) Productive land loss to be assessed at strategic level- loss of back gardens, allotments etc also a major health issue. Retention of green space at local level is an important issue. Could be measured directly (or use impermeability as a crude proxy). Loss of greenfield land is a PPG3 issue.	Brownfield not suited to local assessment. Loss of ‘green field’ land should be assessed
	Energy consumption	See ‘other’ below for proxies (A)	Energy efficiency of neighbourhood layouts is a PPG3 issue. Energy use from transport can be determined given inputs on traffic flow, fleet mix etc. This will be done at the strategic level, but only the microsimulation model can produce required data at the local level. Vehicle kms travelled at the local level will however, be a suitable <i>proxy</i> for energy use and emissions (GHG, noxious, noise). Strong view (TH; PROPOLIS) that energy use in buildings is strongly related to form, and should be addressed (e.g. linking density/building type to energy use), albeit crudely.	Vehicle kms travelled a proxy for energy use, emissions and noise Energy use from building stock should be assessed

THEME	STRATEGIC CRITERIA	LOCAL CRITERIA 1,2	RESPONSE TO LOCAL CRITERIA PROPOSAL	CONCLUSION (re local criteria)
	Water consumption	Water consumption (A)	<p>Water use varies by building type, but building type is likely a surrogate for other more direct influences (garden size; SEG which affects ownership of dishwashers; number of bathrooms etc.</p> <p>Designs at both strategic and local levels will affect population density, which is a key determinant on water use, and which could be measured at both levels. The WaND DCM (water use database) can provide water use values per capita for house size / type / SEG combinations.</p> <p>Water use at strategic level is important as addresses pressure on supplies and need for new infrastructure (water supply and waste water). This is a PPG3 issue.</p>	<p>Required at strategic level.</p> <p>Local water use should be possible given house type and household SEG.</p>
	Need for new construction		Building resource efficiency is a PPG3 issue that has not so far been proposed as a local level indicator. However, construction material consumption is design sensitive (e.g. building form; extent of road network and other services), and merits consideration.	Consider a construction materials use index
Heritage		<p>Conservation areas (S) Listed buildings (S) Images of built form (A)</p> <p><i>(HB criteria to be considered – heritage and townscape)</i></p>	Landscape and townscape are identified as important design considerations by PPG3. These criteria, and associated features, such as built heritage, are important to stakeholders in specific locations, but not when generalising. Local heritage features can be recognised in developing local designs, so long as the urban form of interest to the generic study is not compromised. (i.e. not relevant to assessment; some relevance to local level screening).	Too site specific – discard (but consider in screening sites)

THEME	STRATEGIC CRITERIA	LOCAL CRITERIA 1,2	RESPONSE TO LOCAL CRITERIA PROPOSAL	CONCLUSION (re local criteria)
Climate change	Greenhouse gas emission	Greenhouse gas emission (A) (Energy efficiency is a PPG3 issue)	Estimating local level GHG means addressing travelled kms by mode, building energy use, and in both cases, fuel type used. CO ₂ emission will be estimated at the strategic level, but at the local level it is sufficient to address building energy use and vehicle kms travelled as proxies. A rough local emission estimate (i.e. considering both travel and built form) could be determined if basic assumptions on vehicle speeds, fuel type etc are made.	No, building energy use and vehicle kms travelled used as proxies. Possible aggregate value given basic assumptions.
Air pollution	Acidifying gas emission (NO _x SO _x)	Noxious emissions (A) See 'other' below for proxies (A) (Pollution is a PPG3 issue)	Emissions from transport can be determined given inputs on traffic flow, fleet mix etc. This will be done at the strategic level, but only the microsimulation model can produce required data at the local level. Local level emissions will be determined by representing the local design in the strategic model, and using those outputs to estimate local (aggregate) emissions. An alternative would be to use vehicle kms travelled as a proxy (see under accessibility – trip length below). Analysis may be able to account for local level modal split, congestion etc, using data provided by the LUTI Model (Possible microsimulation application)	Use a vehicle kms travelled indicator as proxy for local transport energy use and emissions (see below) with modal split enhancement
	VOC emission		Can be explicitly modelled at strategic level, but a trip distance indicator will act as proxy measure (see acid gas emission above)	No, see above

THEME	STRATEGIC CRITERIA	LOCAL CRITERIA 1,2	RESPONSE TO LOCAL CRITERIA PROPOSAL	CONCLUSION (re local criteria)
Water Pollution	Diffuse heavy metal loading	Diffuse water pollution (A) (Pollution is a PPG3 issue)	Diffuse water pollution is sensitive to land use change and traffic flow. However, HB considers that SUDS would be universally employed in new developments, and hence diffuse pollution is effectively a constant. Note, however, that SUDS are less likely to be implemented for some development types (e.g. densification); that all development will increase loadings even if SUDS are used; and that some developments will deliver greater loads, depending upon land use (e.g. mix of commercial, housing, road). Diffuse loadings at the local level are to some extent site specific (i.e. will they threaten the quality of receiving waters?). It may then, be more appropriate to consider surface impermeability as a proxy for change in pollutant load (although this ignores actual land use) and change in flood risk. See also flood risk below.	Not at local level – use impermeability as a proxy (see flood risk)
Environmental Quality	Fragmentation of open space (As a proxy for biodiversity)	Trees (S) Significant wildlife areas (S) Green space (S) (<i>HB prime criterion - biodiversity</i>).	These are assumed to be proxies for biodiversity, although they may also be important to open space quality. Designated wildlife areas and trees are too site specific, but have a role to play in defining the local design, so long as the urban form of interest to the generic study is not compromised. (i.e. not relevant to assessment; relevance to local level screening). Loss of green space is also assessed under resource consumption (see above). Greening of residential neighbourhoods is a PP3 issue (contribute to biodiversity, local environmental quality).	Relevant to screening of local design, not assessment. Green space loss assessed under resource use above.
	Quality of open space (tranquil areas)	Landscape quality (S) Rivers, streams and lakes ³ (S)	Landscape quality and water bodies are too site specific for a generic assessment. These criteria have relevance to screening of local designs (see above), but not in their formal assessment. Local designs will impact upon land/townscape quality, but this is site specific, and would be very arbitrary to assess. PPG3 issues.	Relevant to screening of local design, not assessment.

THEME	STRATEGIC CRITERIA	LOCAL CRITERIA 1,2	RESPONSE TO LOCAL CRITERIA PROPOSAL	CONCLUSION (re local criteria)
SOCIAL				
Accessibility	Access to jobs and services	% pop in walk/cycle distance of key facilities (S / A) <i>(HB prime criterion)</i>	A key local criterion (HB) and a PPG3 issue. Probable service indicators are (a) schools, (b) shops and (c) green space. Walking distance, route quality and service quality will all be taken into account. WP12 should assist with baseline data and forecasting. (PPG3 issue - gives preference to movement of people over traffic).	Yes, access to schools, shops and green space
		% pop near public transport service (A) <i>(HB prime criterion)</i>	A key local criterion (HB) and a PPG3 issue. Will be assessed on the basis of walking distance to public transport stops, and the quality of service. Can consider social equity in terms of areas well/ poorly served.	Yes, access to public transport
	Accessibility to city centre		No local proposal – addressed via access to public transport	No
	Accessibility to green open space	Accessibility to green open space	Key local criterion – see access to jobs and services above. A PPG3 issue.	Yes, access to green space
	Time spent in traffic	Average travel time (A)	Average travel time is likely to duplicate other local indicators (accessibility to local services; local trip length), and so should be dropped. It is relevant at the strategic level. Capacity of public transport infrastructure is a PPG3 issue.	No, - duplicates trip length and access to local services
Health and safety	Traffic accidents (deaths / injury)	Traffic accidents (A) <i>(HB criterion to consider)</i>	Local forecasts will be spurious due to detailed design influences. Forecasts should be restricted to the strategic level (HB). Safe pedestrian environment is a PPG3 issue.	Exclude
	Exposure to noise	Exposure to noise (A)	Not at the local level – vehicle trip length to be used as a proxy (see under air quality)	No, proxy is used

THEME	STRATEGIC CRITERIA	LOCAL CRITERIA 1,2	RESPONSE TO LOCAL CRITERIA PROPOSAL	CONCLUSION (re local criteria)
	Exposure to air pollution (NO ₂ , PM ₁₀)		Not at the local level – vehicle trip length to be used as a proxy (see under air quality)	No, proxy is used
	Flood risk	Flooding (Properties at risk of flood?) (S) <i>(HB prime indicator)</i> (PPG3 issue) Drainage (S)	<p>Proportion of new development within a recognised flood area would be a relevant criterion. However, this is site specific, and does not relate well to the local design (e.g. same design might score well in Bristol but very poorly in Thames gateway). Therefore development in flood risk area is suitable in terms of screening of local designs (making them realistic), but not in assessment terms.</p> <p>Development contributes to elevated flood risk via surface sealing and creating more rapid surface runoff / higher peak discharge. The degree of surface impermeability is an appropriate proxy for change in flood risk.</p> <p>Not clear what ‘drainage’ is measuring – this is dropped</p>	<p>Yes – use impervious area as a proxy</p> <p>Use new properties in flood zone in screening assessment</p>
	Modal split by walk / cycle	Physical fitness (A) <i>(HB prime indicator)</i>	<p>HB view that physical fitness is a critical issue, and that walk/bike modal share is an appropriate proxy. There is however, evidently uncertainty over how this can be measured. For example, is walk/cycle modal share an assumed value of the LUTI model, and is it sensitive to policy / plan inputs?</p> <p>High notes that “Initially, local values may be derived from LUTI zone predictions, although there are question marks over the sensitivity of the models. Later we may hope to have empirical base-line data in some study areas (via WP12) which can not only help calibrate the strategic models but also provide a basis for local forecasts”</p>	<p>Desirable criterion that requires discussion re feasibility</p>

THEME	STRATEGIC CRITERIA	LOCAL CRITERIA 1,2	RESPONSE TO LOCAL CRITERIA PROPOSAL	CONCLUSION (re local criteria)
Equity	Social distribution of economic benefit		Assessed at the strategic level only.	No
	Social distribution of environmental quality (see above)		Assessed at the strategic level only.	No
	Social segregation	Distribution of housing type (A) Social mix (A) <i>(HB criteria to be considered – local social mix)</i>	HB view that estimates of the local social mix can be provided by the strategic models (social segregation was a measure used by PROPOLIS to assess whether interventions increased social polarisation). The social mix will also vary according to government policy (e.g. on provision of social housing), which is exogenous to SOLUTIONS and could apply equally to any design.	Merits assessment at strategic level, but not local.
		Pop in walk/cycle distance of key facilities by house type/tenure (A)	Access to facilities by walk/cycle is addressed elsewhere, and it is unlikely that equity in access by house type / tenure is of sufficient importance to address. Difficult to generalise as designs unlikely to be constant with respect to house type / tenure distribution.	Exclude.
Opportunities	Housing standard (overcrowding)		This measure was used by PROPOLIS. It conveys residential floor space per inhabitant to critical minimum threshold levels. Probably not relevant to local design, as minimum standards are addressed in the design.	No
	Vitality of city centre		Not relevant at local level - designs are for outer city areas only.	No

THEME	STRATEGIC CRITERIA	LOCAL CRITERIA 1,2	RESPONSE TO LOCAL CRITERIA PROPOSAL	CONCLUSION (re local criteria)
	Vitality of suburbs	Households in retail catchments (A) <i>(HB prime indicator)</i> . Passing trade potential (A)	At the local level, the viability of local services can be determined by an assessment of the number of households within defined areas (pedsheds?) around services. PPG3 promotes mixed use (type of housing; housing, commercial and employment), particularly via efficient land use (housing above shops; convert vacant commercial space to housing etc), but this is considered a process rather than outcome indicator. Duplicated by passing trade criterion to some extent. This is also difficult to measure, and is dropped.	Yes, viability of local retail services
OTHER				
Integration		..of transport interchanges (A) ..of LU and T (A) ..of cycle route and ..of public transport (A) ..with other policies (A) <i>(HB criteria to be considered – integrated local strategies)</i>	No integration measures at the strategic level – comments received here consider integration to address process, not outcomes. HB view is that integration issues are important at local level (and strategic) and can be measured qualitatively.	Requires discussion (presumably would need to be addressed at both levels for consistency).
		Local vehicle trip length <i>(HB prime indicator)</i>	Vehicle kms travelled (or degree of diversion from ‘optimum’ route) at the local level will be a reasonable <i>proxy</i> for energy use and emissions (GHG, noxious, noise). Trip lengths can be assessed on a sample basis, and different local designs compared (SM able to provide values based on local network archetypes?).	Yes - as a proxy for emission criteria

THEME	STRATEGIC CRITERIA	LOCAL CRITERIA 1,2	RESPONSE TO LOCAL CRITERIA PROPOSAL	CONCLUSION (re local criteria)
Other		No. of vehicles on major roads	Not an outcome indicator (it is measuring a state or process), and difficult to measure in local design exercise. Trip distance Congestion is addressed elsewhere (time spent in traffic)	Exclude
		Walk /cycle network images (A)	It is not clear what this is measuring	Exclude
		House price range (A)	It is not clear what this is measuring. Segregation (see equity) and issues associated with mixed use (see vitality of suburbs) are addressed elsewhere.	Exclude.
Marketability, feasibility and acceptability	Infrastructure economic efficiency	Marketability (A) Public / political feasibility (A) <i>(HB prime indicator)</i>	HB view that feasibility of designs is a key criterion. Assessment of local level design feasibility will be via stakeholder forum (pilot exercise was run at Cambridge conference in December 2004). Intention is to distinguish between physical practicality, market feasibility, and public / political acceptability. Note: The screening STA application should aid in the identification of (un)acceptable designs.	Desirable, but requires attention to practicality of measurement

Notes.

1. An empty box in the strategic or local column indicates that the issue is not being measured at that level
2. HB references are to Hugh's note of 16/8/04 on the SOLUTIONS appraisal framework
3. **Bold text** in the final column indicates that the criterion merits inclusion in the final list (or needs further discussion)
4. See table 7.2 for further details on objectives identified by PPG3 Housing

3 Selected criteria – summary and reporting format

This section first summarises the evaluation criteria proposed for SOLUTIONS, before presenting a reporting format for a more detailed subsequent consideration of the proposed criteria. Table 6 presents criteria designed for use at the local level, which are intended for use in **screening** of local designs. That is, they are considered too site specific for inclusion in an assessment process intended to support production of generic design guidance, but nevertheless merit consideration in applying the theoretical designs to the case study areas. Recognition of issues addressed by the screening criteria ensures that the case studies are grounded in reality. However, it is important that the ability to distil generic guidance is not compromised by application of the screening criteria (see 2.1 above).

Table 6. Criteria for screening of local designs

THEME	Screening aims to recognise....	Possible criteria (based on UWE proposals)
ENVIRONMENT		
Heritage	Valued townscape and built heritage in case study site	Designs should recognise importance of any local conservation areas, listed buildings
Environmental Quality	Valued landscape in case study site	Designs should recognise importance of local natural features valued for aesthetic and recreational purposes (but which may have low biodiversity value). This may include trees, water features, and green open spaces (but measurement merits further definition?)
	Valued biodiversity in case study site	Designs should recognise importance of local sites of wildlife importance. This may include designated (SSSI, SSI, LNR etc) and other wildlife sites.
SOCIAL		
Health and safety	Flood risk in case study site	This could address change in flood risk for area due to development (increasing runoff rate), but this is better addressed in the <i>assessment</i> of changing flood risk (which uses impermeability as a proxy) Screening assessment should seek to recognise the risk to properties in the new development from flooding, and hence should seek to ensure that local designs avoid developing in known flood risk areas.

Table 7 presents the current proposed list of **assessment** criteria for application in SOLUTIONS. The table excludes those criteria detailed in Table 2 and Table 3, and includes some additional criteria at the strategic level, drawn from the PROPOLIS project (note that there is therefore some experience in quantifying these criteria at the strategic level to draw on). These additional criteria appear useful in terms of simplifying and improving some of the criteria previously discussed, and in addressing issues that appear particularly relevant to land use transport design with respect to peri-urban developments. These additional criteria, which have not been discussed within the SOLUTIONS team to date, are described further below (sections 5 and 6), and are:

- *Need for new construction* – this addresses natural resource use with respect to a wide range of materials;
- *Quality of open space* – an environmental quality indicator that is relevant to biodiversity and recreation;
- *Accessibility to the city centre* – a measure of access to special services available only in the city centre
- *Time spent in traffic* – a measure of lost opportunity. There may be an alternative preferred measure addressing congestion (see e.g. discussion above re journey ambience);
- *Social segregation* – a high degree of social interaction is considered desirable, and may be reduced if an area becomes socially polarised;
- *Housing standard (crowding)* - a minimum level of space per person is considered desirable. Some policies may reduce household floor area
- *Vitality of (a) city centre and (b) suburbs* – vitality is an attractiveness measure determined with reference to the number of inhabitants and service jobs in an area.

All the criteria listed in Table 7 are described in further detail throughout the remainder of this document. A standard reporting format has been adopted (see Table 9 below, with a limited example in parenthesis) that describes:

- What is to be measured;
- The rationale for criteria selection;
- The particular focus of the assessment (strategic / local; transport / land use); and
- How criteria could be measured.

Table 7. Current proposal for SOLUTIONS assessment criteria

THEMES & CRITERIA	STRATEGIC (CITY)		LOCAL (NEIGHBOURHOOD)	
	Address criteria?	Comment	Address criteria?	Comment
ECONOMIC				
Net Economic Benefit	YES	Addresses direct and externality costs and transport benefits?	No	See vitality of suburbs
ENVIRONMENT				
Resource consumption				
Productive land lost to development	YES	Productive = not previously developed	YES	
Energy consumption	POSSIBLY	Yes from transport & possibly land use if clear relationship to built form	PROBABLY	If clear relationship with built form; Trip distance a proxy for energy use in transport
Water consumption	PROBABLY	Sensitive to households (size, SEG); economic activity (type, employment)	POSSIBLY	Demand sufficiently sensitive to spatial form of local level designs?
Need for new construction	YES	Proxy for material consumption	POSSIBLY	Construction materials index possible?
Climate change				
Greenhouse gas emission	YES		YES – by proxy	Trip distance a proxy for transport emissions; Energy use in buildings (consider fuel mix).
Air pollution				
Acid gas emission (NO _x SO _x)	YES		YES – by proxy	Trip distance a proxy for emissions
VOC emission	YES		YES – by proxy	Trip distance a proxy for emissions
Water Pollution				
Diffuse heavy metal loading	POSSIBLY	Impervious area (see flood) as a crude proxy? (but this ignores land use)	YES	Impervious area as crude proxy. SUDS would mitigate but not negate diffuse pollution)

THEMES & CRITERIA	STRATEGIC (CITY)		LOCAL (NEIGHBOURHOOD)	
	Address criteria?	Comment	Address criteria?	Comment
Environmental Quality				
Fragmentation of open space	YES	Proxy for biodiversity	No	Local biodiversity addressed via screening and loss of green space
Quality of open spaces (tranquil areas)	YES	Open spaces with low noise levels (and good air quality?)	No	
SOCIAL				
Accessibility				
Access to jobs and services	YES		YES	As access to local schools and shops
Accessibility to city centre	YES	City centre houses some key services not available elsewhere	YES – by proxy	As access to local public transport
Accessibility to open space	PROBABLY	Opportunity for recreation proxy	YES	
Time spent in traffic	PROBABLY	Congestion proxy – included in NEB?	No	
Health and safety				
Traffic accidents (deaths / injury)	YES		No	
Exposure to noise	YES		YES – by proxy	Trip distance a proxy for emissions
Exposure to air pollution (NO ₂ , PM ₁₀)	YES	Requires modelling of concentration not just emission (simple box model?)	NO	
Flood risk	YES	Change in imperviousness of area as proxy for change in flood risk	YES	As change in impervious area
Trip share by walk / cycle	POSSIBLY	As proxy for physical activity - High uncertainty over measurement issues	POSSIBLY	As proxy for physical activity - High uncertainty over measurement issues

THEMES & CRITERIA	STRATEGIC (CITY)		LOCAL (NEIGHBOURHOOD)	
	Address criteria?	Comment	Address criteria?	Comment
Equity				
Social distribution of economic benefit	YES	Assumes net economic benefit can be described spatially as well as city total	No	
Social distribution of environmental quality (open space +noise+ air quality?)	YES	This would examine how the social distribution of EQ changes (not simply identifying an existing pattern)	No	
Social segregation	YES	Measures extent of social polarisation / social mix	No	
Opportunities				
Housing standard (overcrowding)	POSSIBLY	Policies affecting density could lead to per capita household space below critical levels (PROPOLIS indicator)	No	
Vitality of city centre	YES	Based on index of number of inhabitants and service jobs (PROPOLIS indicator)	No	
Vitality of suburbs	YES	Based on index of number of inhabitants and service jobs (PROPOLIS indicator)	YES	As vitality of local retail services, measured as population with defined catchment ('pedsheds')
OTHER				
Feasibility	YES	TH proposes holding capital investment constant for all options, and measuring feasibility as Infrastructure Economic Efficiency as a feasibility measure.	YES	Assessed via stakeholder forum – process requires refinement

Table 8. At a glance summary of criteria proposals

A. Screening – Local

- Valued built heritage – conservation areas and listed buildings
- Valued landscape features – trees, green space, rivers and wetland
- Biodiversity – recognised wildlife sites (designated and other)
- Flood risk – properties in flood zone

B. Assessment – Local

- Productive (previously undeveloped) land lost to development
- Energy use (from building stock)?
- Water consumption?
- Materials used in construction (mass index?)
- Trip distance (proxy for transport emissions and energy use)
- Surface impermeability (diffuse pollution and flood risk proxy)

- Mean distance to (a) local schools; (b) local shops
- Access to local public transport
- Accessibility to open space
- Trips by walk or cycle? (physical activity proxy)
- Vitality of retail services, as population within defined catchment
- Feasibility (practicality/marketability/ acceptability) – by stakeholder forum

C. Assessment - Strategic

- Net economic benefit

- Productive (previously undeveloped) land lost to development
- Energy use (from land use and transport)?
- Water consumption?
- Need for new construction
- Greenhouse gas (CO₂) emission
- Acid gas (NO_x SO_x) emission
- VOC emission
- Surface impermeability (flood risk proxy; crude diffuse pollution proxy)
- Fragmentation of open space (biodiversity proxy)
- Quality of open space (green space with low noise and good air quality)

- Accessibility to jobs and services
- Accessibility to city centre
- Accessibility to open space
- Time spent in traffic
- Traffic accidents
- Exposure to noise
- Exposure to air pollution (NO₂ and PM₁₀)
- Walk / cycle modal split?
- Social distribution of economic benefit
- Social distribution of environmental quality
- Social segregation
- Housing standard?
- Vitality of city centre
- Vitality of suburbs
- Feasibility (infrastructure economic efficiency)

Table 9. Reporting format adopted for selected criteria

A. What is to be measured?	
Detail the:	
▪ Theme area and sub area	(e.g. Social: Health)
▪ Criteria name (and units if possible at this stage)	(e.g. road traffic accidents /million vehicle kilometres)
▪ Reference (a unique identifier)	(e.g. SHTA)

B. Rationale: Describe why this issue is important
Explain:
▪ Why the issue is important and relevant to sustainable development
▪ How the issue is sensitive / relevant to transport and/or land use change

C. Identify what Scale and Activity should be addressed using the table below

Scale and Activity	Should the issue be addressed at this scale for this activity? [If yes, identify a potential calculation method]
<i>Strategic / Transport</i>	Yes – Traffic accidents are
<i>Strategic / Land Use</i>	
<i>Local / Transport</i>	
<i>Local / Land Use</i>	

D. Describe possible calculation procedure for issues identified under C above.

(a) *Strategic – Transport...*

Calculation attribute	Description
<i>Identify existing quantification capability, a method described in the literature, or a possible approach</i>	DMRB Volume 13
<i>Data input from the strategic LUTI model (type, spatial and temporal scale, units)</i>	Link based flow (AADT), length and road type
<i>Supplementary data required (type, spatial and temporal scale, source)</i>	Base year accident rate data from DMRB
<i>Data output (type, spatial and temporal scale, units)</i>	Personal Injury Accidents (PIA) per million vehicle kilometres. Can also be valued in £ with standard data.
<i>Describe any issues, difficulties, uncertainties etc</i>	None known at present
<i>Resource implications (time, cost, expertise).</i>	Relatively straightforward. Potential problem with very large networks.

4 Economic Criteria

4.1 Net economic benefit

5 Environmental Criteria

5.1 Productive land lost to development

5.2 Energy consumption

5.3 Water Consumption

5.4 Need for new construction / construction materials

5.5 Greenhouse gas emission

5.6 Acidifying gas emissions

5.7 VOC emission

5.8 Impermeability (Diffuse pollution and flood risk)

5.9 Fragmentation of green space

5.10 Quality of open space

6 Social Criteria

6.1 Access to jobs and services

6.2 Access to city centre / public transport

6.3 Access to open space

- 6.4 Time spent in traffic**
- 6.5 Traffic accidents**
- 6.6 Exposure to noise**
- 6.7 Exposure to air pollution (NO₂, PM₁₀)**
- 6.8 Physical Fitness (walking and cycling)**
- 6.9 Equity in distribution of economic benefit**
- 6.10 Equity in environmental quality**
- 6.11 Segregation**
- 6.12 Housing Standard**
- 6.13 Vitality of city centre and suburbs**

- 7 Other**
 - 7.1 Feasibility**

8 Criteria weighting

- (TH) It would be useful if stakeholders could be asked to explain the reasons for their scoring (sic) (Weighting?) of each indicator. For example, these indicators probably relate to more basic underlying values, such as health, amenity, economy, quality, and social equity.

- (TH) It was agreed that setting up an on line questionnaire and AHP value elicitation programme on our website would be a useful way of collecting a wide range of data for the assessment. Gordon will send Cambridge a trial questionnaire and software within next few months so that we can get an internal trial version working on our website, (our website developer will only be available until August). NOT THAT SIMPLE – NEED TO :
 - Agree criteria to include
 - Identify appropriate value function curves for new criteria
 - Rewrite software (A VB application)
 - Check whether it can be published on-line

LEEDS MAY BE ABLE TO MOUNT SOFTWARE HERE (linked to solutions web site)

9 References

Marsden, G. (2005). Local Authority Indicators Survey: Indicator Specification. EPSRC SUE DISTILLATE project. ITS, University of Leeds. Unpublished 12 pp.

10 Appendices

10.1 DISTILLATE sustainability indicators survey

The EPSRC SUE DISTILLATE consortium has conducted a survey of local authorities to determine which indicators they thought were important for measuring sustainability. The survey sought views on 23 indicators commonly used in local transport plans and in major scheme appraisal. Respondents, believed to have been mostly transport planning or policy officers, were given the opportunity to add to the list, but no additional sustainability related indicators were proposed (Marsden, 2005).

Results of the survey are shown below, sorted in descending order of mean reported importance. The indicators that are not explicitly addressed by the proposed SOLUTIONS criteria are highlighted in bold. Note that many of the indicators considered most important by LA transport staff are not explicitly addressed within the current SOLUTIONS list. However, this does not mean that the SOLUTIONS criteria are considered inadequate by comparison, for two principle reasons.

Firstly, note that in measuring sustainability it is desirable to have a focus on outcomes. LA officers are measuring the success of transport plans using input indicators (i.e. inputs required to run a transport service - e.g. costs), outputs indicators (e.g. PT patronage, traffic levels) as well as outcomes (economic benefits, environmental impacts etc). Many of the indicators detailed below are not identified as sustainability performance measures (outcomes), but are included as process measures (e.g. traffic levels, assumptions on public transport patronage etc.).

Secondly, of the indicators classed as measuring outcomes, most are considered relatively unimportant. Accessibility, congestion and air quality were considered to be fairly - very important; carbon dioxide emission, health, economy, noise, street environment, townscape and biodiversity were considered to be not – fairly important; and heritage, water pollution from transport and the social distribution of benefits were considered to be not – not at all important. When asked why criteria were given their respective weighting, respondents reported that the most important indicator selection criteria were consistency with the local transport plan, relevance to targets and cost. Consistency with sustainable development ranked as only ninth in a list of 14 indicator selection criteria.

These results suggest that the indicators that local authority transport officers consider important in measuring the success of a local transport plan or scheme are not necessarily those that should be adopted by SOLUTIONS (although some are). Several of the indicators considered important are likely to be addressed by SOLUTIONS, but as process indicators within the models, not outcome measures. Many outcome indicators included in the SOLUTIONS list are considered unimportant by the local authority officers surveyed. However, these officers do not consider sustainability an important concern when selecting transport indicators.

Table 7.1. Importance of sustainability indicators in local transport planning

Sustainability Indicator	Importance (N = 15)*	Comment re SOLUTIONS
Public transport patronage	3.87	Not included – an assumption in the strategic model re modal split; Relevant to local level?
Accessibility	3.67	Yes, currently included
Traffic levels	3.67	No, a process not output variable
Congestion	3.50	No, too similar to time spent in traffic
Road safety	3.47	Yes, currently included (as accidents)
Walking	3.47	Not included – an assumption in the strategic model re modal split; Relevant to local level?
Travel time	3.43	Yes, time spent in traffic currently included
Cycle use	3.40	Not included – an assumption in the strategic model re modal split; Relevant to local level?
Public transport satisfaction	3.33	No
Air quality	3.20	Yes, currently included
Local economic activity	2.93	No. Related variables included are net economic benefit and city centre / suburban vitality
Quality of street environment	2.78	Not specifically – there is a proposed quality of open space.
Health (excluding road safety)	2.69	Not separately. This is addressed by air quality, noise etc.
Operating Cost	2.69	Yes, included under net economic benefit
Townscape	2.69	Excluded as too site specific
CO ₂	2.64	Yes, currently included
Noise	2.53	Yes, currently included
Construction cost	2.38	Yes, included under infrastructure economic efficiency
Land take	2.15	Yes, currently included
Biodiversity	2.08	Yes – open space fragmentation a proxy.
Heritage	1.92	No, excluded as too site specific
Distribution of benefits by income	1.80	Yes, currently included
Water pollution from transport	1.75	Yes, currently included

* Importance is the mean of 15 responses, based on the following scale:

- 4 Very important
- 3 Fairly important
- 2 Not important
- 1 Not at all important
- 0 Don't know

10.2 Issues and objectives of PPG3 on Housing

Table 7.2 Current planning guidance on housing: Links to evaluation criteria

OBJECTIVES OF PPG3 AND RPG12 ON HOUSING	SPECIFIC ISSUES CITED IN PPG3 (These suggest evaluation criteria)
Meet community housing need (inc. for affordable housing and special needs)	A given – it is assumed that housing demand is to be accommodated through management of supply.
Provide a better mix of size, type and location (to accommodate new households and bring life to urban areas)	<p><i>Promotion of mixed use:</i></p> <ul style="list-style-type: none"> ▪ Extent of mixed use in new development (housing, employment, shops, services) ▪ Conversion of vacant commercial space to housing; ▪ Use of upper storey commercial floor space for housing ▪ Limitation of car parking in areas with good access to public transport
Prioritise re-use of developed land in urban areas in preference to greenfield sites (brownfield land use)	<ul style="list-style-type: none"> ▪ Proportion of new housing on previously developed land or by re-use of existing buildings
Create more sustainable movement patterns by ensuring housing is linked by public transport and other non-car modes, to employment, education and health facilities, shopping, leisure and local services (location & accessibility)	<p><i>Accessibility of site to jobs and services:</i></p> <ul style="list-style-type: none"> ▪ Reduce need for car travel: population with access to public transport nodes and corridors ▪ Reduce need for car travel: population with access to local services (social infrastructure – schools and health services; retail services) <p>(PPG13 on transport provides details on transport assessment)</p> <p><i>Capacity of existing infrastructure:</i></p> <ul style="list-style-type: none"> ▪ Public transport ▪ Water and sewerage
Make more efficient use of land (e.g. increase density)	<ul style="list-style-type: none"> ▪ Loss of green field land ▪ Average density of new build (England average is 25 dph but half of new build is < 20dph. PPG3 aims to avoid development <30dph, and encourage development at 30-50dph) ▪ High density at public transport nodes and corridors ▪ Car park space per dwelling (PPG aims for <1.5)

OBJECTIVES OF PPG3 AND RPG12 ON HOUSING	SPECIFIC ISSUES CITED IN PPG3 (These suggest evaluation criteria)
<p>Give preference to movement of people over traffic in residential developments</p>	<ul style="list-style-type: none"> ▪ Preference to non-car modes (space for walking cycling, as priority of car parking space)
<p>Promote good design and energy efficiency in new housing to create attractive high quality environments where people will choose to live</p>	<p><i>Recognise physical constraints:</i></p> <ul style="list-style-type: none"> ▪ Pollution; ▪ Flood risk <p><i>Greening of residential neighbourhoods</i></p> <ul style="list-style-type: none"> ▪ Permeability of land surface (flood control) ▪ Contribution to biodiversity ▪ Landscaping / local environmental quality ▪ Access to green space <p><i>Energy efficiency:</i></p> <ul style="list-style-type: none"> ▪ Neighbourhood layouts promote energy efficiency <p><i>Other design considerations:</i></p> <ul style="list-style-type: none"> ▪ Landscape and townscape ▪ Building resource use efficiency (energy, materials) ▪ Local ecology ▪ Impact on public health ▪ Impact on crime and public safety ▪ Safer environments for pedestrians