INDEX – Tool Summary

Authors

Name	Organisation	Origin
-	Criterion Planners	IND

Info

Date:
1994 - first version
2008 – latest version, 9.3

Place of origin:
US

Homepage:
http://www.crit.com/index.htm

References:

- Allen, E., 2008. Clicking Toward Better Outcomes - Experience with INDEX, 1994 to 2006. In *Planning Support Systems for Cities and Regions*. Lincoln Institute of Land Policy, pp. 139-166.
- Criterion Planners, Frequently Asked INDEX Questions. Available at: http://www.crit.com/documents/index_faqs.pdf.
- Criterion Planners, INDEX - An Interactive Scenario Designer & Evaluator. Available at: http://www.crit.com/documents/INDEX_InteractiveDesigner.pdf.
- Criterion Planners, 2008. *INDEX PlanBuilder User Notebook*, USA: Criterion Planners. Available at: http://www.crit.com/documents/planuserguide.pdf.

Latest use:
Probably in many of the latest LEED-ND projects, as it's the obvious support tool for that.

Download:
http://www.crit.com/evaluation/license.htm

Description

"INDEX is a suite of GIS planning tools that support digital charretting, and use of indicators to measure the performance of communities and their plans. The software is used to benchmark existing conditions, create alternative scenarios, evaluate alternatives, and monitor change over time.
Applications often begin with benchmark measurements of existing conditions to create a frame of reference and to identify problems and opportunities that merit attention in plans. INDEX can then be used to interactively design alternative scenarios, analyze and score their performance, and compare and rank the alternatives according to achievement of user objectives. Once plans are adopted, INDEX supports implementation by evaluating the consistency of development proposals against plan goals. Over time, goal achievement can be periodically measured with progress reports.
INDEX has over 80 indicators available for community application. Their topical scope includes land-use, transportation, housing, employment, infrastructure, and the natural environment. New indicators are often designed in collaboration with local stakeholders. Geographically, INDEX can be applied to single neighborhoods, entire communities, and multi-jurisdiction regions. Its indicator measurements can be calculated at either the parcel level or at a user-defined area level, such as census blocks or traffic analysis zones."

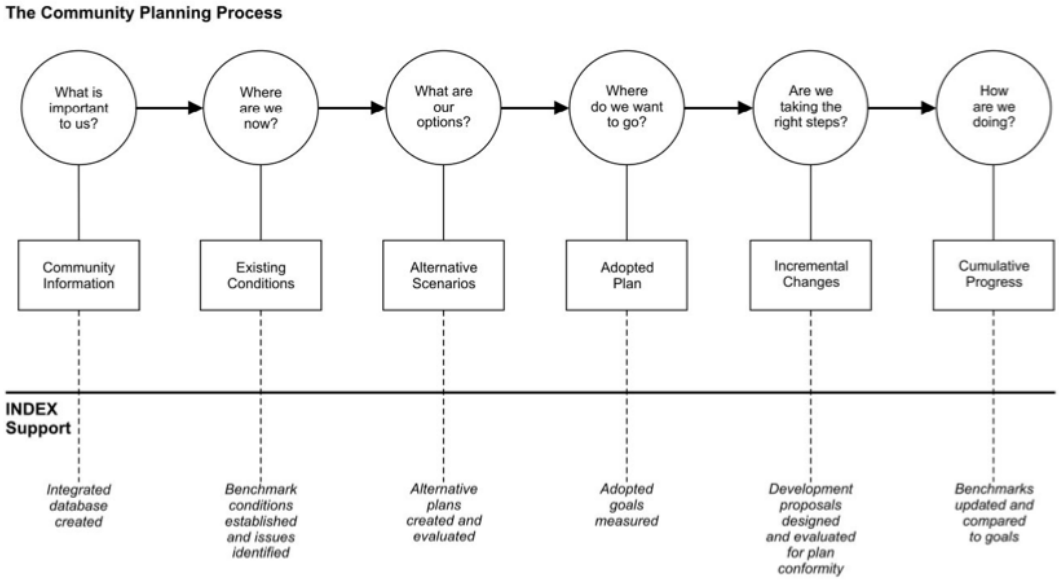
Key Theoretical Background

Not for the general tool/system, only for the advanced simulation modules. In the travel demand model many references to TOD and Cervero's work is very present.
New urbanism and smart growth are obvious references.

SUD Framework

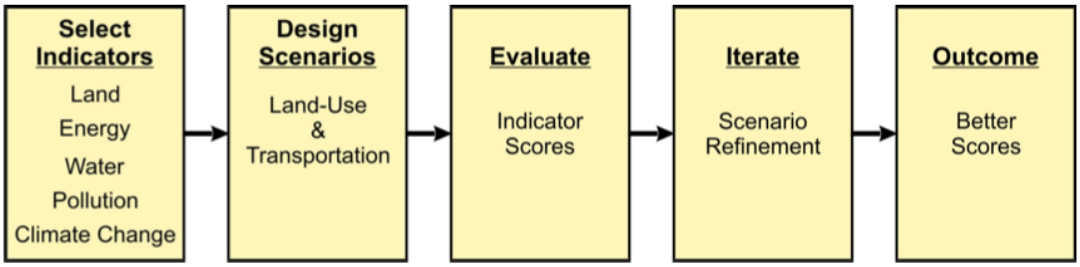
There is none explicitly based on sustainability dimensions and issues. There is however a very clear community planning and charrette based participation process.

Figure 1
SUPPORT OF COMMUNITY PLANNING WITH INDEX PLANBUILDER



Input

Figure 2
MAJOR FUNCTIONS OF INDEX

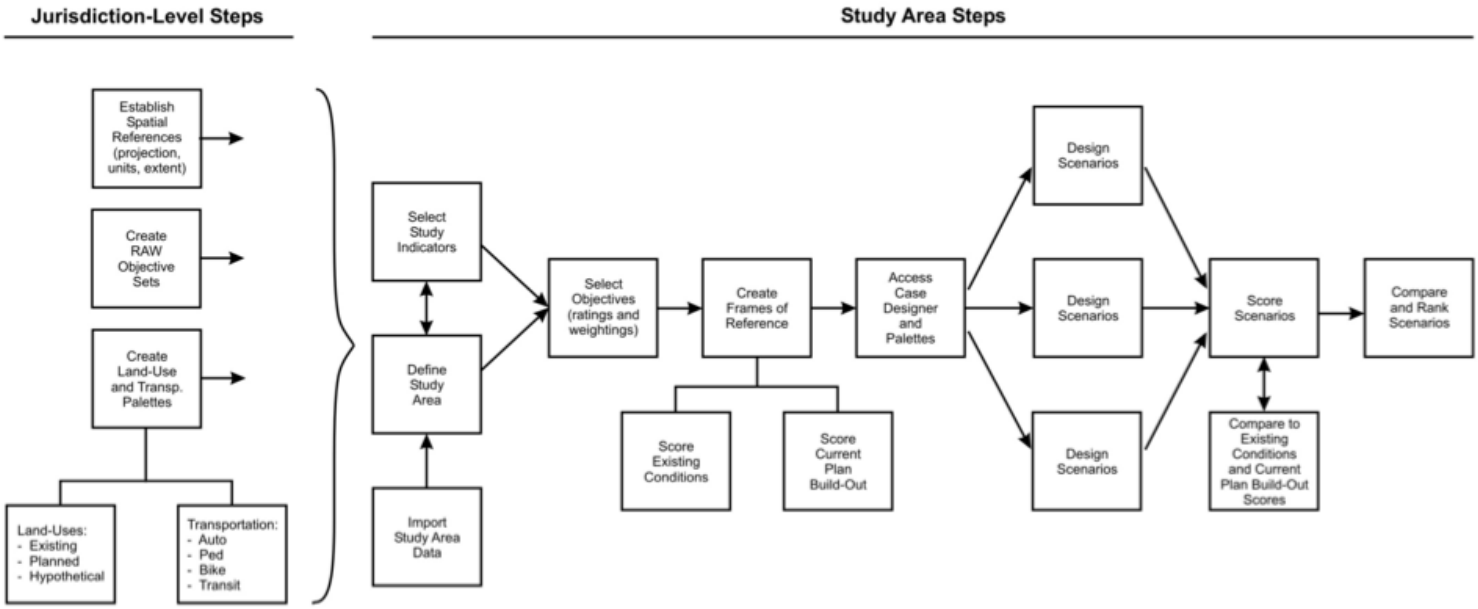


"Case data must either be loaded or created within INDEX. Case data can only be loaded from shape files. […]
Data must be obtained or created for feature classes inside a case boundary, and for a reasonable distance surrounding the case boundary in order to account for nearby features relied upon by study area residents and workers, e.g. a nearby park that residents walk to."
"Data needs are determined by the scope and number of indicators in a given customization. Typically this includes parcel-level GIS coverages of land-use, housing, employment, transportation, infrastructure, natural environment, and related community data. Data availability is a key consideration in designing custom versions of INDEX to insure its compatibility with local conditions."
"it can import and export data files to create linkages to other models, e.g. fiscal impact, travel demand, stormwater runoff, etc."

Methods

"*Indicator Dictionary.* This details each indicator by definition, units of measurement, calculation formula, required data, and applicable user-defined parameters."
It has some advanced odels for traffic estimation (5D methodology), water usage, CO2 emissions.
The steps for applying the tool to the data are detailed in the diagram below.

Figure 4
BASIC STEPS IN APPLYING INDEX



"INDEX contains a rating and weighting (RAW) tool that allows users to specify their planning objectives and priorities according to major policy topics and desired outcomes. Existing conditions and planning scenarios can then be evaluated and ranked according to achievement of stakeholder goals."

Figure 6
HYPOTHETICAL RAW EXAMPLE

	SET UP						APPLICATION								
	Weighting		Rating												
Indicator	*Overall Topic Importance*	*Allocation to Indicators*	*Positive Movement of Score*	*Worst Indicator Scores (Get 0)*	*Mediocre Indicator Scores (Get 0.5)*	*Best Indicator Scores (Get 1)*	*Indicator Score*	→	*Equivalent Rating (0 to 1)*	x	*Indicator Weight*	=	*Indicator RAW Score*		
Housing	50	- - -													
Dwelling Density	- - -	20	Up	10-	15	20+	16	→	0.6	x	20	=	12		
Distance to Transit	- - -	30	Down	2640+	1170	300-	1250	→	0.4	x	30	=	12		
Employment	25	- - -													
Employee Density	- - -	10	Up	20-	35	50+	37	→	0.6	x	10	=	6		
Distance to Transit	- - -	15	Down	2640+	1170	300-	863	→	0.2	x	15	=	4		
Parks	25	- - -													
Distance to Housing	- - -	25	Down	2640+	1170	300-	2300	→	0.9	x	25	=	21		
	100	100													
													Overall Sketch Score (0-100 scale)		55

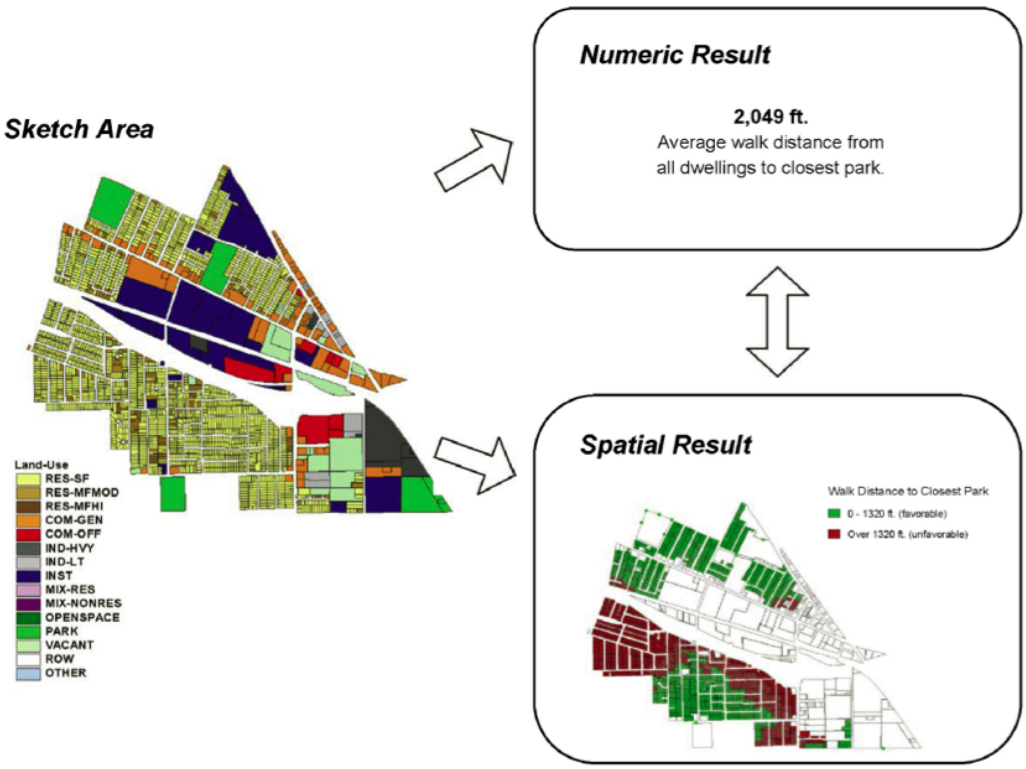
Output

"INDEX results include indicator scores in numeric and spatial form; comparative charting of multiple case results; and documentation of all input parameters. Optionally, scenarios can be visualized using 3-D modeling, photography, video, and drawings."
It has standard output for each individual indicator, summary tables for the scores of all indicators in the scenario, aggregate scores at the level of indicator category and a single

aggregate score for the full scenario to facilitate scenario comparison.

Figure 5

INDICATOR EXAMPLE: HOUSING PROXIMITY TO PARKS

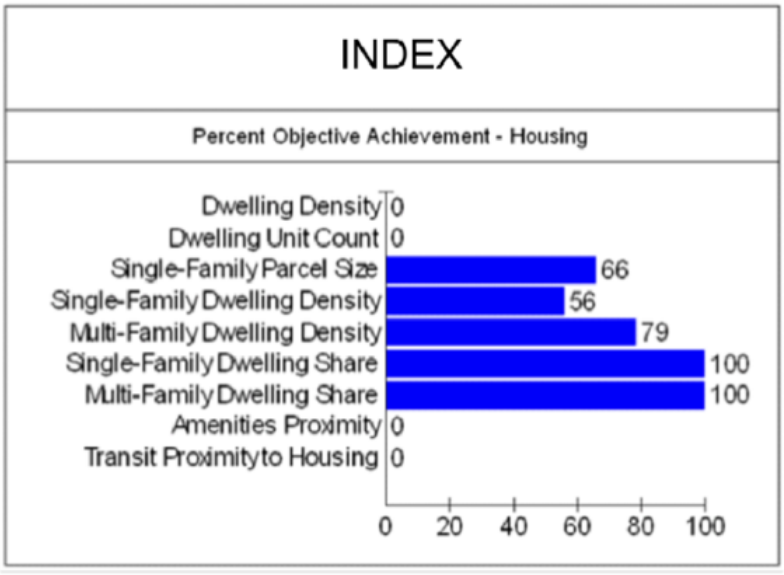


Indicator Results

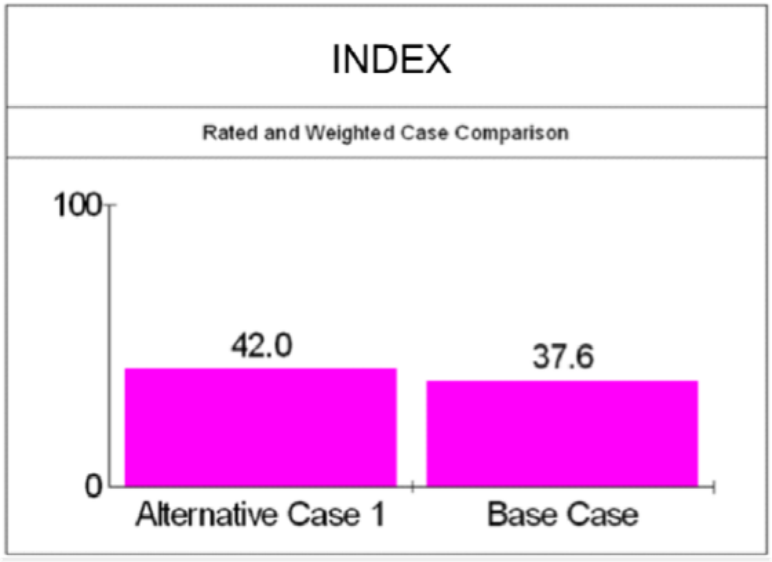
Collapse the nodes to hide Elements. Use the map column (e.g., M0) button to show indicator maps.

Definition				Base	
IID	Indicator	Units	Objective	Score0	M.
Element : [0] Demographics					
2	Population	residents	none	8,345	
3	Employment	employees	none	1,038	
4	Population Density	residents/gross acre	8.00 or more	2.78	
Element : [1] Land-Use					
74	Study Area Acreage	total acres	none	3,006.9	
5	Residential Parcel Size	avg square feet	6,000 or less	7,695	
7	Use Mix	0-1 scale	0.50 or more	0.03	
8	Use Balance	0-1 scale	0.60 or more	0.72	
Element : [2] Housing					
75	Dwelling Density	DU/gross acre	12.00 or more	1.07	
73	Dwelling Unit Count	total DU	none	3,227	
11	Student Enrollment Level	% student capacity fulfi...	88.0 to 98.0	233.6	
12	Single-Family Housing Owners...	% sf DU owner-occupi...	100.0 or more	–	
13	Residential Footprint	net acres/1000 reside...	100.0 or more	52.8	
14	Single-Family Parcel Size	avg square feet	none	6,984	
15	Single-Family Dwelling Density	DU/net acre	12.00 or more	6.24	
16	Multi-Family Dwelling Density	DU/net acre	20.00 or more	17.85	
17	Single-Family Dwelling Share	% total DU	60.0 to 80.0	77.2	
18	Multi-Family Dwelling Share	% total DU	20.0 to 40.0	22.8	
19	Amenities Adjacency	% DUs w/i 1/4 mi buffer	100.0 or more	0.0	

OK



Ultimately INDEX provides a single value for each scenario based on the sum of the RAW tool rating values.



There is no standard evaluation output, but below is a chart that exemplifies how one can summarise and visualise the benchmark values of different scenarios, based on the rating each indicator achieves in relation to the three benchmark levels.

Using INDEX Sustainability Ratings to Improve Neighborhood Design

Much of Criterion's green rating work is provided as feedback to neighborhood designers and planners who are working with stakeholders to find the strongest possible sustainable design. This example of a 1,000-acre Massachusetts project demonstrates the positive influence of integrating Criterion's ratings into the unfolding design process.

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		South Weymouth Design Scenarios													
Indicators	Units	First		Second		Third		Fourth		Fifth		Sixth		Pre-Final		Final	
Population	residents	1,540		1,540		10,211		9,468		8,924		6,955		5,958		7,218	
Employment	employees	7,078		7,214		4,372		4,825		4,988		2,137		2,438		4,720	
Population Density	res/net ac	41.62		21.42		50.73		79.84		60.58		41.27		56.09		82.39	
Use Mix	0-1 scale	0.04		0.03		0.14		0.15		0.15		0.27		0.14		0.28	
Use Balance	0-1 scale	0.51		0.71		0.70		0.80		0.81		0.91		0.76		0.86	
Single-Family Dwelling Density	DU/net ac	--		--		7.78		--		9.13		4.57		7.72		8.82	
Multi-Family Dwelling Density	DU/net ac	18.92		9.74		27.54		36.32		33.67		22.86		38.28		53.35	
Single-Family Dwelling Share	% total	0.0		0.0		8.7		0.0		9.4		6.0		10.1		14.1	
Multi-Family Dwelling Share	% total	100.0		100.0		91.3		100.0		90.6		94.0		88.1		85.8	
Amenities Proximity	avg walk ft	1,732		5,021		2,083		1,244		1,081		655		1,266		1,525	
Transit Proximity to Housing	feet	5,298		5,702		910		884		849		743		452		448	
Jobs to Housing Balance	jobs/DU	10.11		10.31		0.96		1.12		1.26		0.69		0.78		1.36	
Employment Density	emps/net ac	24.12		24.46		55.40		45.78		40.85		19.77		87.54		148.19	
Transit Proximity to Employment	feet	8,171		5,579		758		781		1,339		768		584		673	
Park Space Supply	ac/1000 pers	114.9		45.0		4.3		6.5		0.6		6.1		16.1		12.6	
Park Proximity	avg walk ft	8,173		4,382		1,239		991		2,121		677		610		568	
Open Space Share	% total area	53.5		64.7		69.9		75.4		74.2		71.1		68.5		72.7	
Open Space Connectivity	0-1 scale	0.90		0.93		0.95		0.96		0.94		0.95		0.94		0.91	
Stormwater Runoff	cubic ft/ac/year	27,713		30,937		20,204		16,984		20,385		22,262		21,083		17,383	
Nonpoint Pollution	kilograms/ac/year	50.9		54.5		36.8		30.7		38.1		42.3		38.9		31.0	
Imperviousness	%	28.49		35.40		17.30		16.12		17.62		18.63		16.21		13.86	
Internal Street Connectivity	ratio	0.43		0.71		0.97		0.95		0.96		0.97		0.94		0.84	
External Street Connectivity	feet	9,047		11,309		5,654		9,047		5,654		4,523		5,654		9,047	
Street Segment Length	ft	3,619		854		378		544		431		408		229		229	
Street Centerline Distance	total ft	32,301		64,317		93,428		69,035		98,719		117,111		124,692		111,365	
Street Network Density	st mi/sq mi	2.7		5.4		7.9		5.8		8.3		9.9		10.5		9.4	
Pedestrian Network Coverage	% of streets	100.0		100.0		100.0		100.0		100.0		100.0		100.0		100.00	
Pedestrian Crossing Distance	feet	68		47		41		45		41		40		34		36	
Street Route Directness	walk/air ratio	1.71		1.43		1.50		1.44		1.52		1.24		1.28		1.38	
Pedestrian Accessibilities	% w/i 15 min	91.5		99.2		98.9		99.9		97.3		100.0		93.6		99.4	
Home Based Vehicle Mi. Traveled	mi/day/capita	19.9		20.0		18.6		18.5		18.4		19.7		19.6		18.1	

Indicator Ratings

Favorable	6	7	16	16	14	15	19	18
Fair	5	3	5	4	6	6	3	4
Unfavorable	13	14	4	4	5	4	3	3

INDEX – Tool Review

General

Background
This tool has a long track record, however it was only used in specific situations: regional plans, public consultation charrettes, LEED-ND project's support. This is based on specific strengths of the tool, respectively GIS based, interactivity and simple (simplistic?) outputs, a large and tailored indicator set.

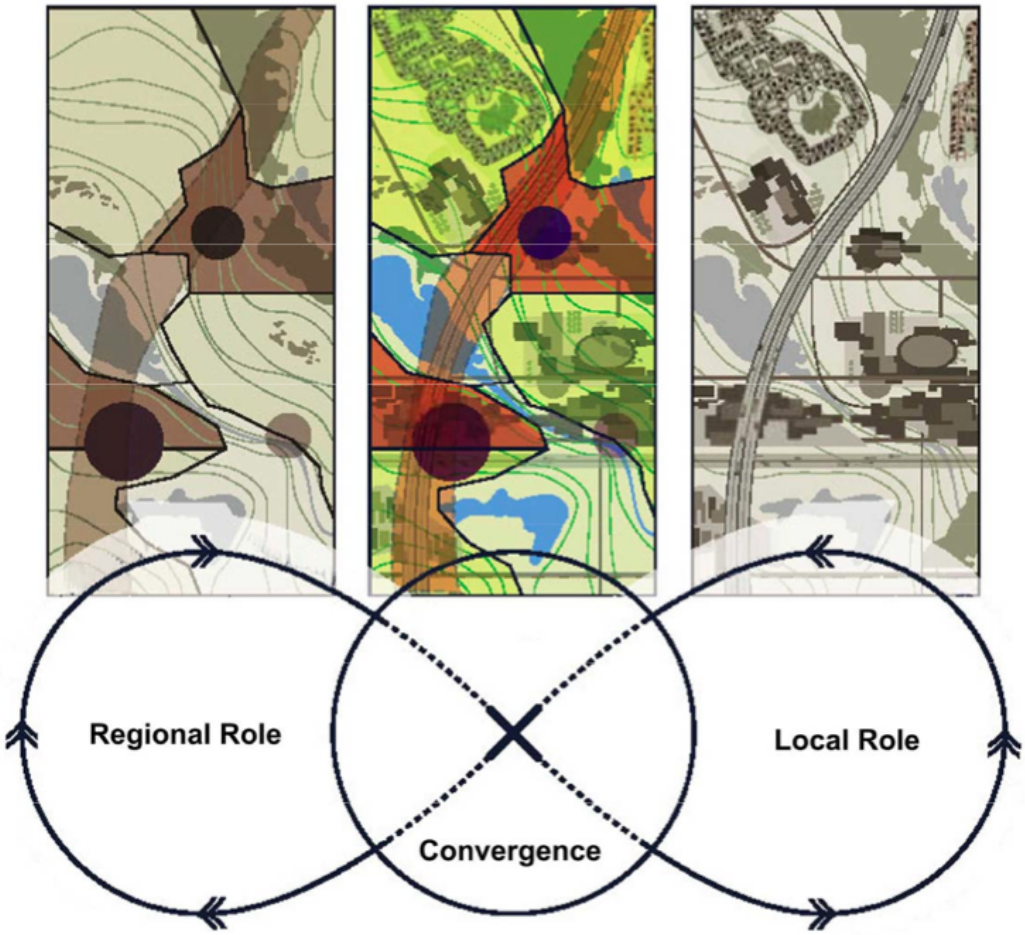
Application (Scale and Design Phase)
It can be applied at various scales, from the site to the region, integrating both, which is positive. The building design scale is not addressed, only at the level of building type.
It can be used as a decision support tool in various stages of the development process. The user manual clearly describes these stages and provides tutorials to understand how they work with the tool.

Sustainability Principles
The scientific basis for the selection of indicators is not clear as there are no sustainability principles described anywhere. But from what can be seen at the issue and indicator levels most of it comes from experience of the authors and their involvement with new urbanism, smart growth and transit oriented development practice, and from national policy.
I don't think it can be used by uninformed practitioners, and there's a lot to be asked about the indicators that have been included, and the ones that have been left out.

Assessment Criteria
The list of indicators has a large proportion of what can be measured by the simulation models and what can be calculated in a GIS based on the input data. It doesn't seem to be a balanced set of what is relevant/meaningful, rather a comprehensive set of what is possible/available.
Selecting the indicators at the start is certainly an important step. It should not however be just based on what data is available to the user. It's not the case that any combination of indicators will provide useful information.

Indicators and Calculation Methods
It doesn't "impose" and evaluation framework but suggests and explains the use of benchmarks and weights. This is to be defined by the users.
The travel simulation models are well documented and explained, which is very important, but I have my reservations in principle. It's a purely mathematical model based on the principle of elasticities, i.e. a vehicle travel factor assigned to the urban form dimensions (density, diversity, design, destinations (accessibility)), which assumes that there is a causal relation between travel behaviour and urban design characteristics. It extracts urban form values from the GIS and a regional transportation model and applies them in simple multivariate equations to calculate the four dimensions. The %change in these dimensions from the baseline scenario is multiplied by a fixed elasticity factor to give the %change in travel behaviour.
This just can't be right and so simple, it's simplistic. The elasticity values should not be fixed for every context (local, regional, national, historical) as there infinite conditions that affect such behaviour and are not accounted for by the model. Having said this, which simulation can claim to be right? Wouldn't any value that gives an indication be useful? In this case, the answer is too linear and obvious to be insightful. It's more a means of supporting "scientifically" specific design principles that one wants to push through.

It uses a gravity regional transportation model to provide baseline estimates. It is multi-modal but at the regional scale the information is aggregated in zones. The different networks are represented but ultimately their use is very limited.



The GIS is obviously capable of operating with both regional and local data sets simultaneously, and as such the tool offers the convergence between the two scales.

Output

It's a tool that provides both quantitative and map output, which is important for design support. For evaluation it also provides simple summary charts (not as striking visually as the multi-level pie charts). The evaluation is dependent on the user's definition of the RAW values, which is a prerequisite for using the tool and ensures that the evaluation is project specific. In fact the comparison is largely to check against a baseline scenario and see how different designs improve on it.
The numeric output of the tool can be used to feed data into a LEED-ND evaluation, as there is a large convergence of the indicators. LEED-ND already provides an indicator selection and weights, if there is interest.