



Some Measures of Sustainability of Urban Neighbourhoods: a Case Study in Hamilton, Ontario

by Don McLean and Bob Korol

Summary

A community organization in Hamilton has tested a method of assessing the relative sustainability of individual neighbourhoods utilizing easily accessible data. This approach grows out of the ecological footprint work pioneered by Dr. Bill Rees. The study found dramatic differences between six widely-scattered urban and suburban areas in Hamilton, with older and more central neighbourhoods registering higher sustainability scores than newer areas on the outskirts of the City.

Sommaire

Un organisme communautaire de Hamilton a mis à l'essai une méthode d'évaluation de la durabilité relative des quartiers individuels, méthode qui se fonde sur des données facilement accessibles. Cette approche est dérivée des travaux liés à l'empreinte écologique amorcés par Bill Rees. L'étude a révélé des différences dramatiques entre six zones urbaines et suburbaines largement disséminées de Hamilton, les quartiers plus vieux et centraux ayant obtenu une cote de durabilité supérieure par rapport aux zones d'établissement plus récent situées en périphérie de la ville.



"Sustainable" forms of transportation in Hamilton.

In the early 1990s, Hamilton, Ontario (formerly the Region of Hamilton-Wentworth), established the Task Force on Sustainable Development and developed *Vision 2020*¹ to guide the municipal planning process. This attracted international attention, and Hamilton was acknowledged as one of the United Nations Agenda 21 communities. Unfortunately, these gains have been whittling away, and Hamilton City Council recently adopted a policy of "allocating all available resources for economic development."

Created by former members of the Task Force, Citizens for a Sustainable Community has continued to foster awareness within the community of the consequences of pursuing growth policies without regard for the environmental and social consequences. The ecological footprint concepts developed by Dr. Bill Rees at the University of British Columbia^{2,3} recently inspired us to investigate the relative footprints of neighbourhoods in Hamilton, using

information that is available to community organizations. While the data necessary for conducting a full footprint analysis at the neighbourhood level are not available, a variety of sources supplemented by our own investigations permitted us to compare the relative environmental sustainability of six Hamilton neighbourhoods.

Neighbourhoods Examined in the Study

The largest single source of information at the level of neighbourhoods is provided in the census tract data compiled by Statistics Canada for urban areas.⁴ The most recent complete data set is from the 1996 census. We examined six of the 120 census tracts in the amalgamated City of Hamilton. We chose urban tracts that were primarily residential with a majority of owner-occupied households, but which had variable ages of housing construction and widely spaced geographic locations.

Hamilton is geographically divided by the 40-metre high Niagara Escarpment running generally east to west across the city. The “lower city” is sandwiched between Lake Ontario and the escarpment, while the remaining “mountain” portion of the urban area is located on top of the escarpment. Three of the tracts chosen were from the lower city, and the other three were from the mountain (see map). Table 1 provides descriptions of the six selected tracts.

Indicators of Sustainability

The indicators that we examined are listed in table 2. The first three indicators used 1996 census data; the next three relied on data collected in the 1996 *Transportation Tomorrow Survey*,⁵ while indicators seven to 10 were determined from municipal maps and aerial photos. A windshield survey provided the number of vehicles per household and permitted their division into five categories determined by fuel efficiency. This information was then used to calculate the 12th indicator (with the assumption that all vehicles travelled the 17,000 kilometres/annum Canadian average).

By knowing the actual value of a particular indicator, we were able to give each tract a sustainability score (high value is desirable). Hence, in the

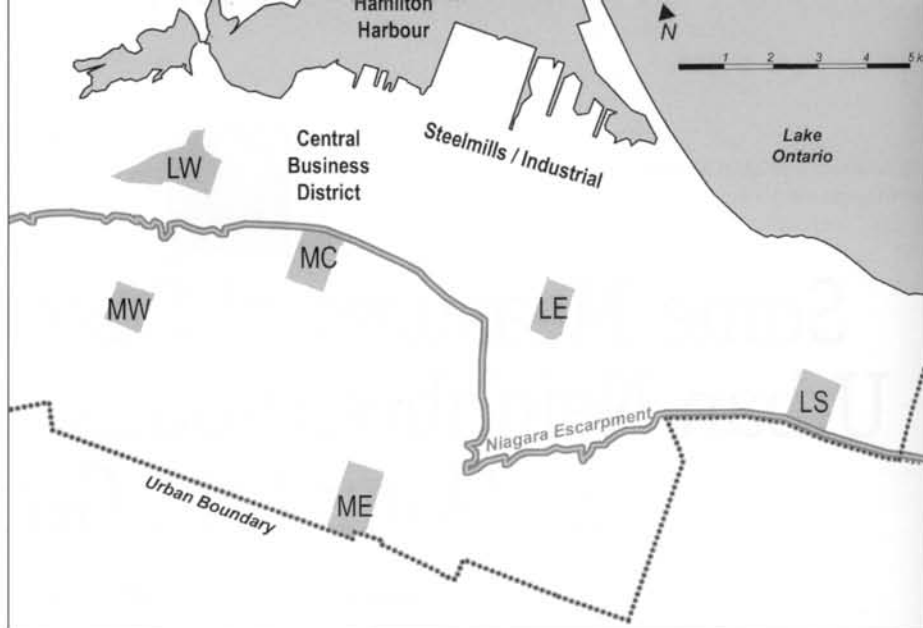


TABLE ONE: NEIGHBOURHOODS EXAMINED IN THE STUDY

Census Tract	Main Period of Construction	Family Income	Persons/Family	Main Housing Types
Lower West End (LW)	pre-1946	\$50,021	2.3	Single-family detached and low-rise apartments
Mountain Central (MC)	pre-1960	\$51,703	2.9	Single-family detached and low-rise apartments
Lower East End (LE)	1946-1960	\$49,820	2.8	Mainly single-family detached
Mountain West (MW)	1961-1981	\$55,410	3.4	Single-family detached and townhouses
Lower Suburban (LS)	1971-1991	\$65,100	3.4	Nearly all single-family detached
Mountain East (ME)	1981-1996	\$51,836	3.5	Single-family detached and townhouses

case of indicator 1, we identified the number of residential units per hectare. For neighbourhood LS, we obtained a value of 10.31, while LW had a value of 23.78. Other neighbourhoods had intermediate values. After normalizing, we obtained values for LS and LW of 1 and 2.31 (=23.78/10.31) respectively. For each indicator, we were thus able to ascertain which neighbourhood scored best, second best and so on, and thus determine an assemblage of sustainability scores that could be tallied for any neighbourhood.

LW ranked first on six indicators and second on three others. LE had three firsts, four seconds and five thirds. ME had two firsts, one second, and two thirds. At the other end of the scale, LS had no scores above a fourth and ranked last on nine indicators. Preparing a composite score that compared the six neighbourhoods directly posed a

TABLE 2: INDICATORS OF SUSTAINABILITY INVESTIGATED IN THE STUDY

- number of households/residential hectare
- number of rooms/adult/household
- percent of employees who cycle or walk to work or work at home
- vehicle kilometres travelled/day/household
- length of average commute by private vehicle/household
- percent of daily trips using transit
- transit availability in neighbourhood/household
- length of neighbourhood roads/household
- neighbourhood stores weighted by type and location
- distance from centre of neighbourhood to nearest food supermarket
- number of vehicles/household
- litres of vehicle fuel used/annum/household

challenge because of the obvious disparity in the significance of the 12 indicators.

Composite Scoring

The approach we adopted was to seek the advice of individuals with strong experience in sustainability issues, including professional planners, university faculty and leaders of non-government organizations. Fifteen of these individuals ranked the 12 indicators according to their estimation of how well each might be expected to reflect the relative sustainability of a neighbourhood. They were instructed to assign the number 12 to the indicator that they felt would best indicate high sustainability, 11 to the second best, and so on down to 1 for the least important one. Then the respondents were asked to square each term. Double weighting the element values is a technique that has been advocated by Graedel and Allenby⁶ for doing life cycle assessments of options based on environmental sustainability criteria. However, it was found useful to allow assessors to modify numerical values if they wished, up or down (without changing the order). Thus, the indicator they scored as 6 (squared to 36), could be altered to any number between 49 and 25. All scores were then totaled and divided by the lowest score to establish a composite factor for each indicator. If all respondents were identical in their thinking, the weightings would have ranged from 1 to 144. However, they clearly made different judgments, because the composite weighting factors were compressed to the range 1 to 5. Perhaps this result reflects a lack of a commonly accepted definition of sustainability.

Vehicle kilometres travelled per day per household was ranked highest. Litres of vehicle fuel used and number of

households per residential hectare came in second and third respectively.

Results of Composite Scores

The three older and more central neighbourhoods scored significantly better than their suburban counterparts. The highest composite neighbourhood score was garnered by LE, closely followed by LW. Meanwhile, third place went to the other older neighbourhood on the lip of the escarpment, MC, followed closely by ME. Not surprisingly, MW and LS ranked fifth and sixth with the latter achieving a composite score of hardly a third of the highest ranking neighbourhood.

Major Findings and Conclusions

The study found quite dramatic differences in the sustainability factors examined. For example, annual vehicle fuel consumption per household ranged from 2,006 to 3,738 litres. This suggests that the footprint of individual urban neighbourhoods can vary substantially, at least in the categories of transportation and housing. To examine the footprint categories of food and goods and services will require a more comprehensive set of data than what was available to this research project.

It was found that older inner city neighbourhoods (LE, LW, MC) are more sustainable than the newer subdivisions being built on the outskirts of the city. The inner city neighbourhoods swept the top three positions in seven of the 12 indicators, and two of the top three positions in the other five. Comparing the composite scores of the three older inner-city neighbourhoods with the three outer suburban ones, we found that the former may be twice as sustainable as the latter.

Overall, the study⁷ suggests that residential development trends in Hamilton over the past several decades appear to have generated neighbourhoods of decreasing sustainability. Municipal transit policies, zoning and neighbourhood planning appear to be somewhat responsible for this decline. On the other hand, this also suggests that local decision makers may be capable of significantly improving the sustainability of neighbourhoods, and consequently of the city as a whole. ■

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References and Notes

1. Task Force on Sustainable Development. Vision 2020. City of Hamilton; 1993.
2. The ecological footprint methodology pioneered by Dr. William Rees attempts to measure the impact of a specified population on the planet's resources. The ecological footprint is defined as the area of land and water ecosystems required to produce the resources that the population consumes, and to assimilate the wastes that the population produces, wherever on earth the relevant land and water may be located. According to 1996 data, the average Canadian's ecological footprint was 7.7 ha (compared with an average of only 2 ha available for each human on the planet). The Canadian footprint can be divided into four broad categories: food (37 percent), housing (19 percent), transportation (22 percent) and goods and services (22 percent). Our indicators captured some parts of the housing and transportation components.
3. Rees W. Reducing Hamilton's ecological footprint: individual and community actions. Lecture delivered at a conference in Hamilton, Ontario, on November 24, 2001. An audio of the lecture, together with Dr. Rees' overheads, is available on-line on the Web site of Citizens for A Sustainable Community at: <http://www.sustainablehamilton.org/conference.htm#reesmovie>
4. Statistics Canada. Profile of census tracts in Hamilton. Catalogue No. 95-202-XPB. Ottawa; 1999.
5. University of Toronto. The 1996 Transportation tomorrow survey: Regional Municipality of Hamilton-Wentworth. 2002. Available on-line on the Web site of the Joint Program in Transportation at: <http://www.jpint.utoronto.ca/tts96/region6.html>
6. Graedel TE, Allenby BR. Industrial ecology and the automobile. Upper Saddle River (NJ): Prentice-Hall, Inc.; 1998.
7. A copy of the full study is available on the Web site of Citizens for a Sustainable Community at: www.sustainablehamilton.org

Plan Canada is the official publication of:
Canadian Institute of Planners
Plan Canada est le journal officiel de :
Institut canadien des urbanistes
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Ottawa, ON K1P 5G3
Tel/Tél. : (800) 207-2138 (613) 237-7526
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Plan Canada is published for
The Canadian Institute of Planners by:
Plan Canada est publié au nom de
l'Institut canadien des urbanistes par :
McCormick & Associates
9 5^e Avenue
Chateaugay, QC J6K 5L5
Tel/Tél. : (450) 691-9515
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Advertising/Publicité
Michelle Garneau
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Publications Mail/Registration #/n° de
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Canadian Institute of Planners
Abstracted in the Journal of Planning Literature.
Institut canadien des urbanistes
Abrégé dans le Journal of Planning Literature.

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