

Evolving suburban form: dispersion or recentralization?

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Abstract. *Transformations in both the approach to suburban growth expressed in planning documents and the reality of suburban development are examined. The North American suburban model, characterized by near universal reliance on the automobile, abundant land consumption, rigorous functional specialization and a dispersal of employment, retail and services, was pieced together between the late 1940s and the early 1960s. While plans from this period concentrated on the infrastructure and regulatory fundamentals of this emerging model, subsequent plans expressed growing disenchantment with this form of development, culminating in the formulation of a new vision of the suburb that breaks with the early post-war model. Examination of a Toronto suburban transect, with layers of development dating from the late 1940s to the present, reveals a mismatch between the profound suburban transformations proposed in plans and actual suburban form. The paper concludes with an assessment of the relative importance of land-use inertia and change. The possibility of an intensified, recentralized suburb that is less automobile dependent is considered.*

Key Words: post-war plans, suburbs, street patterns, land use, retailing, housing, Toronto

The building blocks of the North American suburban model were devised in a relatively short period from the late 1940s to the early 1960s. Across the continent suburbs took a low-density and fully automobile-oriented form, marked by rigid functional segregation and a dispersal of employment, retailing and institutions. The paper investigates the prevalence of this pattern of suburban development in the face of changing economic and social circumstances and mounting calls by planners for replacement of the early post-war suburban model.

The object of study is a transect of Toronto suburban development that incorporates the former municipality of Scarborough and most of the present municipality of Markham, containing features of suburban development

from the late 1940s to the present. The focus is on the evolution of the content of planning documents and the actual form of suburban sectors over the past 65 years. The paper hypothesizes the existence from the late 1940s of three distinct periods regarding planning attitudes towards suburban development and planning interventions in suburban areas. The first period consists of the formulation and implementation of the early post-war suburban model. The second is shaped by the rise of criticism of this model and efforts to correct its more problematic aspects. Finally, the third period is marked by the emergence of an alternative suburban model. The paper examines the extent to which plans pertaining to Scarborough and Markham and the evolution of land use in these two jurisdictions

conform to this pattern. The findings suggest agreement between the content of the plans and the hypothesized sequence. However, the actual evolution of suburban form has been different: the fundamental features of the suburb devised and adopted over the 15-20 years following the Second World War have remained and still shape suburban form.

The early post-war suburban model and its criticism

A new form of development in the early years following the Second World War quickly set the norm for suburban growth. Affecting a variety of aspects of development, it was a marked break from previous urban patterns (Fishman, 1987). The entrenchment of this suburban model was aided by post-war societal trends and the rise of a transportation-land use dynamic based on near universal reliance on the car. First, the formulation and actualization of the early post-war suburban model was driven by a widespread desire for relaxation of the space constraints of traditional urban settings and, following severe restrictions during the Great Depression and the Second World War, a pent-up appetite for consumer goods (Aglietta, 1979; Silk, 1976). Demand for new housing burgeoned as household formation and birth rates peaked. There was pressure for development standardization and replication: two features of the early post-war suburban model (Checkoway, 1980; Gottdiener, 1977; Knox, 2008, pp. 25-30).

The emergence of a new urban form was further aided by reliance on Keynesian stimuli and a period of generally healthy public sector budgets. Conditions were thus favourable to the building of elaborate infrastructures, notably expressways and arterials, and to programmes encouraging home ownership (Hayden, 2006; Wolfe, 1994). Suburban development, portrayed as the 'spatial fix' of Fordism, fuelled consumer demand, thus moderating economic downturns (Bacher, 1993; Checkoway, 1980; Harvey, 1985; Knox, 2008, pp. 25-7).

It was primarily changes in accessibility patterns resulting from growing reliance on the automobile, along with the need for all aspects of urban development to accommodate increasing numbers of cars, that account for the radical break in urban development. Reduced accessibility gradients encouraged more consumption of space (Brown *et al.*, 2009; Friedman, 2002, p. 30; Institute of Traffic Engineers, 1965; Southworth and Ben-Joseph, 1997). Enhanced mobility caused the physical distance to lose much of its significance, which made it possible to emphasize other locational considerations such as tranquility and a taste for homogeneity (Webber, 1964, p. 109). Improved access fostered mono-functional zones, interconnected mainly by car journeys. It was possible for structuring activities (employment, retailing and services) to opt for a variety of locations with good highway or arterial connections; hence their dispersion throughout the suburban landscape. Dispersion was seen as the opposite of centralization, a defining feature of previous urban forms. The suburb was organized by the super-grid (the outcome of regularly spaced arterials) and resulting super-blocks, as well as by strict zoning. Meanwhile, thanks to automobile-induced accessibility and the capacity of super-blocks to insulate land uses from each other, any given location could theoretically be zoned for any activity (Dear, 2000; Dear and Flusty, 2002; Knox, 1992, p. 207; Lewis, 1983; Rowe, 1991).

Favourable circumstances associated with the original formulation and materialization of the early post-war suburban model did not last. Criticism of the suburb was fanned by awareness of the disadvantages of this form of development as it came to represent an ever larger share of metropolitan North America (Flint, 2006). An urban form conceived at a time of cheap energy was vulnerable to rising oil prices (Newman *et al.*, 2009). Closely related to energy preoccupations was mounting environmental awareness, first concerning air quality and, more recently, contributions to greenhouse gases. From the mid-1990s the environmental movement coalesced around the

sustainable development concept, which inspired visions of higher-density cities with much reduced reliance on the automobile (Knox, 2008, pp. 32-5; Myers and Gearin, 2001; Speir and Stephenson, 2002). A recentralization of activities in mixed-use nodes and a tight co-ordination between land use and public transit development was called for (Moudon and Hess, 2000).

As the traditional family, the market typically associated with suburban development, ceased to be the norm, the societal context deviated from the one that prevailed when the early post-war suburban model was first framed and adopted (Haugen *et al.*, 2010). In addition, the public sector lost some of its capacity to engage in important infrastructure expenditure, especially that needed to abate traffic congestion, essential to the functioning of suburbs (Mauro, 2011). Finally, there was a growing view that rising congestion was causing a deterioration in the suburban quality of life, and studies were linking obesity and its health consequences to the sedentary suburban lifestyle (Frank *et al.*, 2003).

The question is then whether or not these changing circumstances are mirrored in planning documents and actual suburban form. Did suburban planning and development adapt to these societal changes, or has it remained impervious to them? Can both plan-making and actual suburban development be segmented, as we have postulated, into: (1) the formulation and actualization of the early post-war suburban model; (2) critiques of and corrections to this model; (3) the emergence of an alternative vision of suburban development.

Case study and method

The present study focuses on a transect of suburban Toronto running northwards from Lake Ontario to the edge of the Markham urbanized perimeter. It covers Scarborough in its entirety and most of Markham, that is, those parts of the municipality that are aligned broadly with the boundaries of Scarborough (Figure 1). The population of the 292 km² study area was 807 382 in 2006 (Statistics

Canada, 2007). The transect is well suited to our object of study, for growth in this area began in its southern portions during the early post-war years and spread northward over time. Easternmost parts of Scarborough were also the object of more recent urbanization.

During its period of development Scarborough shared planning responsibilities with Metro Toronto, a regional government in place from 1954 to 1997. After this Scarborough was amalgamated into the new City of Toronto with the other municipalities that made up Metro Toronto. Although Metro Toronto provided public transit services to Scarborough (primarily bus routes, but also three subway stations and one light rail transit line) and assured the presence of pockets of high residential density, Scarborough mostly conforms to the defining features of the typical post-war North American suburb: automobile reliance, specialized land use, dispersion and low overall density.

From the early 1970s to the present, Markham has been administered by a regional (York Region) and a local government. The development of Markham has taken place over two distinct periods from a planning perspective. From the early 1970s to the early 1990s it adhered to conventional post-war suburban planning norms but subsequently its municipal administration has become a promoter of New Urbanism planning principles.

The remainder of this paper is divided into two parts, both of which examine changes over the last 65 years. The first part consists of a survey of plans pertaining to the two suburban municipalities, concentrating on the succession of suburban planning models in these plans. To identify changes in suburban form, the second part concentrates on street layouts and the distribution of activities within the transect. It also examines the evolution of five major types of land use that together account for much of the transect's surface: residential areas, retailing, workplaces, public institutions and green space (Table 1). The focus is on changes affecting the built environment over time in order to establish whether each observed variable has followed the trends set

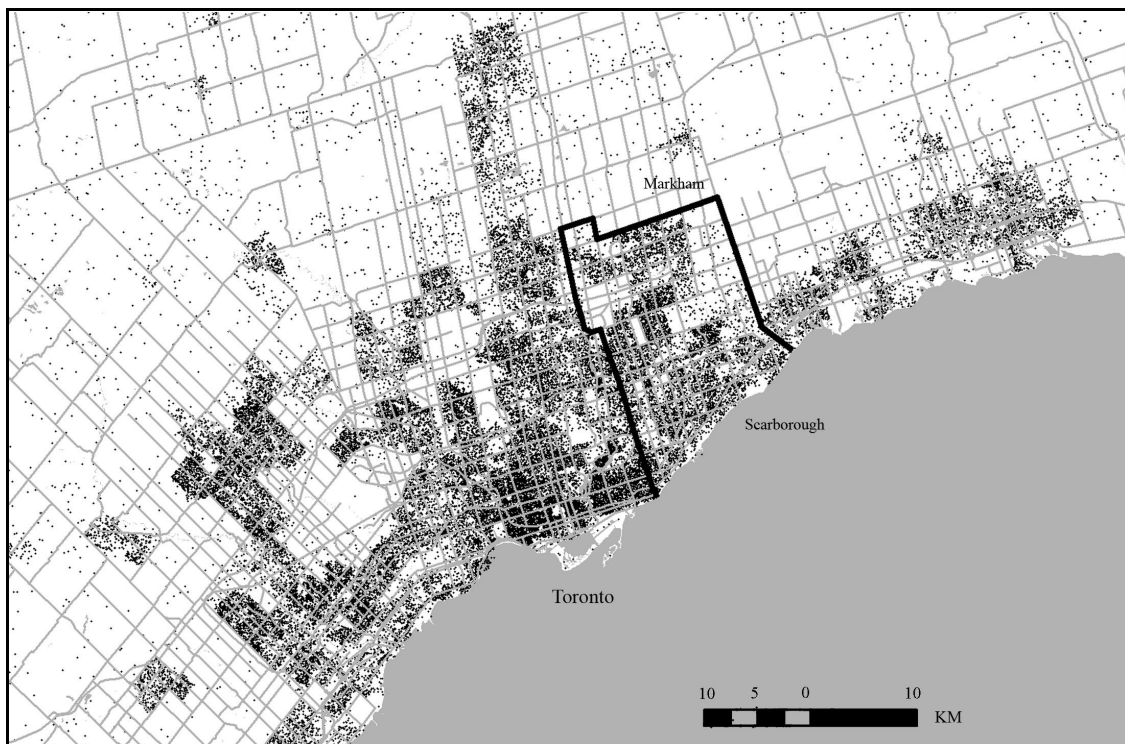


Figure 1. Study area within the extended Toronto region: residential density.

in motion in the 1950s and early 1960s, or whether there is evidence of departure from the early post-war suburban planning model.

To facilitate a longitudinal perspective on the morphological features under consideration, the transect is divided into three sectors, each of which corresponds roughly to a distinct period of development. Sector A includes the southern part of Scarborough (from Lake Ontario to Highway 401); Sector B comprises the remainder of Scarborough, that is, its portion located between Highway 401 and Steeles Avenue (the municipal border between Scarborough, now the City of Toronto, and Markham); and Sector C consists of the urbanized portion of Markham aligned with the transect (Figure 2). Table 2 shows the percentage of housing units built in each of the three sectors in three periods.

Changing planning objectives

The first period of plan making, the 1950s and 1960s, was devoted to the formulation of the

suburban model. Zoning and building codes redefined all built forms according to the requirements of near universal automobile reliance and suburban development was structured by the super-grid, which provided means for efficient automobile circulation while sheltering low-density residential areas from heavy traffic. Another planning innovation was the segmentation of suburban space into large mono-functional zones, generally delineated by the super-grid/super-block structure (Township of Markham Planning Board, 1964, p. 10; Township of Scarborough, 1957, pp. 3, 8).

As expected, plans from this period proposed infrastructures and regulations essential to the implementation of the early post-war suburban model. For example, they defined different categories of retailing, all adapted to near universal car use (neighbourhood and community shopping, major business subcentres, highway commercial uses), and proposed locations for these facilities that took advantage of new suburban accessibility patterns (Borough of Scarborough Planning

Table 1. Classification and measurement of land uses

Object of study	Method
Street pattern and land use distribution	Identification of street layouts and activity distribution within super-blocks. Classification of super-blocks into categories and according to the three sectors.
Residential density	Population per km ² in residential portions of the three sectors (exclusive of non-residential uses such as retailing, institutions and arterial roads). Difference in housing type distribution in the three sectors. Changes in residential density in four sample detached-housing neighbourhoods.
Retail configurations	Observations in each sector of different configurations as a proportion of all retailing. Ratio of surface parking area to building footprint in each sector. Total retail area (building footprint and surface parking) per capita for each configuration in each sector.
Workplaces	Nature of the layout and percentage of total space occupied by the footprint of buildings in sample employment areas in each sector. Proportion of urbanized land in each sector occupied by employment areas. Office buildings with 10 000 m ² or more in each sector: number of buildings and total floor space within this category of buildings.
Public institutions	Observation of the location of schools. Footprint of schools: number of schools relative to the surface of residential areas and population in each sector.
Green space	Percentage of developed areas within each sector devoted to different categories of green space (excluding private yards).

Table 2. Percentage of housing units built in the three sectors in three periods

	1946-1970	1971-1990	1991-2006
Sector A: Scarborough south of Highway 401	58.98	27.88	13.13
Sector B: Scarborough between Highway 401 and Steeles Avenue	17.35	63.44	19.21
Sector C: Markham (apart from areas west of Highway 404)	6.08	41.42	53.68

Source: Statistics Canada, 2007.

Board, 1968; MacLaren, 1976). This first generation of plans set rules defining the early post-war suburban model, made necessary by the haphazard nature of rural fringe urban-

ization and the need to accommodate accelerated growth (Beckett, 1958; Culham, 1949; Harris, 1996).

Plans prepared over the second period (from

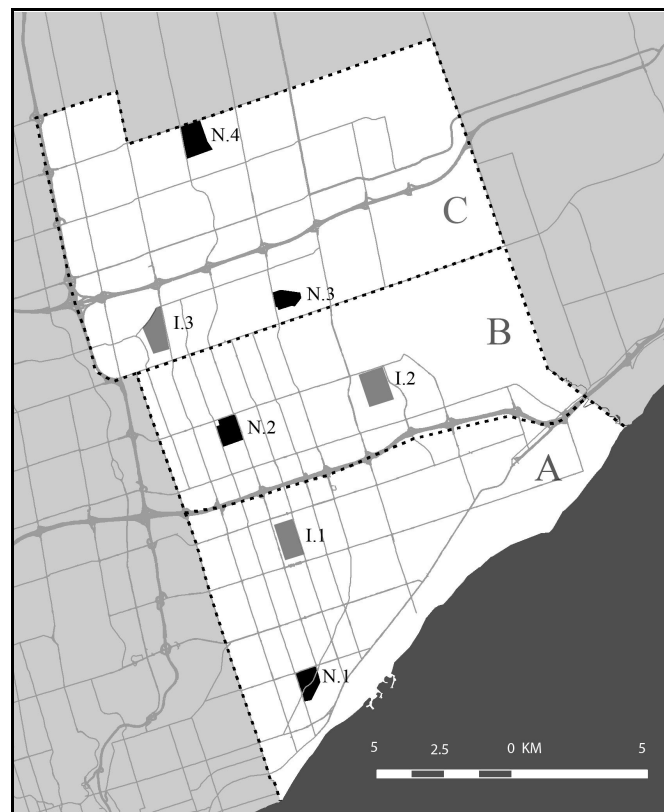


Figure 2. Three sectors (A, B and C), four neighbourhoods of detached and semi-detached houses (N. 1-4) and three industrial areas (I. 1-3).

the 1970s to the mid-1990s) proposed changes to the previous model (Borough of Scarborough Planning and Buildings Department, 1991; Short, 2006, pp. 85-99, 127-9). Some plans attempted to soften the rough edges of that model, as in the case of the improvement in the safety and appearance of strip-like environments (Malik and Associates, 1975). Others put forward more pronounced deviations from the model, such as intensification, mixed-use and alternatives to automobile travel (Town of Markham, 1976, pp. 10-11). Under the influence of the environmental movement, this generation of plans emphasized the preservation of green space, especially when of high ecological significance, such as wetlands, riparian zones and woodlands (Borough of Scarborough Works Department, 1983; Town of Markham, 1976, p. xvii, para. 5.12, 1997). The official plan of Markham went so far as to protect the

municipality's remaining agricultural land (Town of Markham, 1976, p. xiv). The most conspicuous shift away from the dispersion inherent in the early post-war model was the proposal for a Scarborough multi-functional city centre with a rail transit connection.

From the mid-1990s, the 'smart growth' perspective was reflected in proposals for forms of development that correct suburban deficiencies – those relating to the environment, energy conservation, sense of place, cost of development, quality of life and health (Ye *et al.*, 2005). The effects of reduced economic performance on the capacity for public sector intervention have exacerbated financial concerns about prevailing suburban development and further fuelled calls for an alternative suburban model. Expanding regions like Toronto face a mismatch between rapid growth, the brunt of it in suburbs, and lagging transportation investment.

Alternatives to the prevailing suburban form are clearly portrayed in the 2009 City of Toronto Official Plan (first adopted in 2002), which relates to the entire city, including Scarborough, and in the 2010 York Region Official Plan, which embraces Markham along with the other York Region municipalities (City of Toronto City Planning, 2009; York Region, 2010). The Toronto Official Plan offers a blueprint for the accommodation of 544 000 more jobs and 537 000 more residents within its City of Toronto territory, which is fully built-up, so as to help contain sprawl (City of Toronto City Planning, 2009, pp. 2–11). In the Toronto plan, intensification and new public transit investments are key elements in fostering an urban form structured by density, public transit corridors and a network of high-density multi-functional nodes.

The York Region Official Plan also subscribes to an intensification agenda relying on nodes, corridors and much increased public transit use. ‘The approach combines the Region’s significant investments in rapid transit with a land-use planning system that creates sustainable and people-oriented places, bolsters the Region’s economic competitiveness, and preserves natural heritage and agricultural areas’ (York Region, 2010, p. 63). Inherent in the corridors and nodes concept as understood by the City of Toronto and York Region official plans is the promotion of a form of land use that is pedestrian friendly with buildings oriented to the street (York Region, 2010, p. 64).

These objectives are mirrored in Markham, which is in the process of preparing a new official plan. Background reports and early discussions of the content of the official plan suggest an aggressive intensification approach, which would result in a departure from the conventional suburban form. The goal in Markham is to direct as much expected growth as possible to the current settlement area (Town of Markham Development Services Committee, 2011a). Most major intensification areas are to be located along one highway (Highway 7), destined to become Markham’s main rapid transit spine, as well as

close to commuter train stations. The proposed shift in planning trajectory is best illustrated by anticipated changes in housing types. Whereas between 2000 and 2009, 53 per cent of new residential units were detached houses and only 14 per cent were apartments, planners foresee that between 2006 and 2031 the corresponding percentages will be 21 and 54 (Baird, 2011; Town of Markham Development Services Committee, 2011a, 2011b).

Forms of development advanced by this new generation of plans break with the fundamentals of the post-war suburban model. The corridors and nodes strategy challenges the dispersed type of development that has shaped Scarborough and Markham. Attention now turns to the actual morphological evolution of the transect from the late 1940s to the present.

Suburban form since the Second World War

The super-grid/super-block structure plays a determining role in defining suburban accessibility and setting the scale at which development takes place and how it is regulated. The shift from the grid and the block to the super-grid and super-block is a primary feature of the early post-war suburban model. While all streets, irrespective of their position in the road hierarchy, make up the grid, the super-grid is delineated exclusively by arterials (Southworth and Ben-Joseph, 1995; Southworth and Owens, 1993).

As is customary in post-war suburbs, the super-grid/super-block structure sets the pattern for the entire transect. The study area is made of 149 super-blocks, whose average size is approximately 2 km² (but with wide variations) (Figure 2). The super-grid has been an organizing force across time and space within the study area, but road patterns and land-use distributions in super-blocks have varied over time.

Eleven street- and land-use configurations have been identified within super-blocks (Table 3). The first six listed are exclusively or primarily residential and are distinguished

Table 3. Layout of super-blocks in the three sectors

Number (and percentage) of super-blocks	Sector A	Sector B	Sector C
1. Grid or modified grid: contrasts between interior and edge of super-block	10 (17.5)		
2. Curvilinear: contrasts between interior and edge of super-block	28 (49.1)	16 (39)	13 (25.5)
3. Curvilinear: entirely low-density residential	4 (7)	2 (4.9)	7 (13.7)
4. Curvilinear: integration of super-blocks around a common centre		11 (26.8)	
5. Contemporary street pattern (modified grid with a radial presence): contrasts between interior and edge of super-block			5 (9.8)
6. Contemporary street pattern: entirely low-density residential			4 (7.8)
7. Employment	5 (8.8)	6 (14.6)	12 (23.5)
8. Multi-functional nodes	1 (1.8)		1 (2)
9. Shared land use: predominately residential	4 (7)	3 (7.3)	7 (13.7)
10. Shared land-use: predominately employment	4 (7)	3 (7.3)	1 (2)
11. Shared land use: predominately green space	1 (1.8)		1 (2)
Total	57 (100)	41 (100)	51 (100)

Source: 2006 Canadian Census (Statistics Canada, 2007) and aerial photographic analysis and measurements.

from each other by their street layout, the nature of their housing and the presence or absence of retailing and its location within the super-blocks. The first category includes older sectors, built in the late 1940s and the 1950s, where streets either conform to the grid pattern, consistent with configurations pre-dating the early post-war suburban model, or begin to be distinguished from this layout by adopting a modified grid configuration. This category is also characterized by a distinction between on the one hand the inner portions of the super-block, which are occupied by low-density housing, schools and parks, and on the other, edges along arterials taken up by retailing and medium- or high-density housing. The next three categories (2-4) are residential super-blocks with curvilinear street configurations. Category 2 super-blocks share with those belonging to Category 1 the contrast

between a low-density and residential interior (with schools and parks) and the presence of retailing and/or medium- or high-density housing at the edges. Category 3 comprises super-blocks that are uniformly residential and low-density, and Category 4, the last curvilinear residential category, is made of super-blocks that are grouped around a common centre of activity (mostly composed of retailing and civic services). The two remaining residential categories (5-6) include super-blocks adopting contemporary street patterns. In both instances, there has been a return to modified grid configurations, occasionally with a radial component. What differentiates the two categories from each other is that, as in some of the above instances, super-blocks in Category 5 exhibit contrasting land-use patterns between their interior and outer parts, whereas Category 6 super-blocks

have a homogenous configuration made of low-density housing, schools and parks.

Category 7 consists of employment areas, for the most part industrial/business parks which generally adopt a grid or modified-grid road pattern, and Category 8, large multi-functional nodes. One multi-functional node is in place and the other is under development. The last three categories include super-blocks with shared land uses, that is, where at least one quarter of the area is taken by a land use that is not the dominant one. Category 9 comprises shared land use super-blocks that are predominantly residential, Category 10, those that are mainly occupied by workplaces, and Category 11, super-blocks that are mostly green space. Residential super-block categories that include retailing along arterials do not qualify as shared land use super-blocks because these non-residential uses comprise less than 25 per cent of their area.

Table 3 shows the distribution of the different categories of super-blocks within each sector of the transect. There is a clear preponderance of functionally specialized super-blocks, which demonstrates that zoning does indeed take place within the framework provided by this spatial structure. What is more, the table reveals little inter-sector variation in the proportion of super-blocks registering shared land use, which indicates stability over time in the balance between functionally specialized super-blocks and those where land use is shared. There is also a high incidence of residential super-block configurations with retail and medium- or high-density housing along or close to arterials. This pattern dominates irrespective of the super-block's street layout. Low-density housing occupies the inner parts of all residential super-block categories.

In relation to the evolution of the super-block street layout, the rapid disappearance of the traditional grid (and early versions of the modified grid) is evident. It is found only in Sector A and even within this sector constitutes a small minority. These layouts are rapidly replaced by curvilinear configurations, which are the dominant form of residential super-blocks within each sector. Sector B

shows evidence of a fleeting fashion in the 1970s and early 1980s for the integration of two to four super-blocks around a common centre. In the most recent super-blocks (those found in the northern part of Markham) there is a return to the modified grid under the influence of New Urbanism. Figure 3 depicts the four road patterns present in the categories of super-blocks. Finally, there are two departures from the specialized zoning that prevails across the transect: the multi-functional nodes.

Table 4 shows population and household density statistics for each sector's entire urbanized territory and for its residential areas only. For all these measurements, except that for households within the urbanized area of Sector A, it is Sector B that registers the highest density. The difference from Sector A is in part related to the larger average household size in Sector B. The most remarkable finding is the fall in density between the first two sectors and Sector C, despite the fact that it has the largest households. The inter-sector distribution of housing types provides much of the explanation for this phenomenon. The proportion of units consisting of apartments in buildings with five or more storeys declines from Sector A to Sector B, and then falls very sharply between Sector B and Sector C. The proportion of such units in Sector C is negligible. Trends affecting other forms of multiples are less dramatic and take a number of different directions. As expected, the decline in medium- and high-rise apartments is echoed in a sharp increase in the proportion of detached houses in Sector C in comparison with Sector B. Household size and changes in housing types do not, however, account for all the inter-sector variations in residential density. The effect that the decline in the proportion of apartments has on density is to a small extent compensated for by more compact detached-house developments. This is confirmed by the measurement of per unit land consumption in four detached-house neighbourhoods developed at different times (Figure 2 and Table 4). Land consumption is highest in Neighbourhood 2 where most

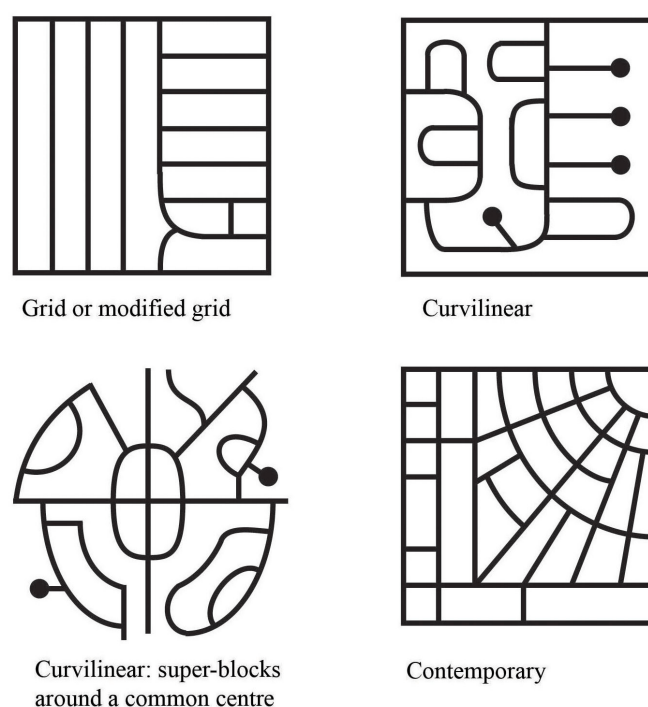


Figure 3. Super-block street patterns.

residential building occurred between 1961 and 1980, and lowest in Neighbourhood 3 where most of it dates from 1986-1990. It has increased somewhat in the neighbourhood developed for the most part in 2001-2006, Neighbourhood 4, while remaining much lower than it was in the two older neighbourhoods, Neighbourhoods 1 and 2 (Table 4).

Table 5 shows the proportion of developed retail land (building footprint, parking, outdoor storage and attendant landscaping) occupied by different retail configurations (see Table 4, note 2 for a description of the configurations). There are very low proportions of street-facing retailing, which was the predominant form of retailing before the Second World War. In fact, the presence of this configuration within the transect is associated in all except one case with the few areas predating the War: the main streets of old Sector A neighbourhoods and the commercial streets of two Sector C villages now engulfed by suburbanization. The only new development adopting this type of retailing is the commercial centre of a New Urbanism development, which contains

approximately ten shops.

The automobile-age version of the traditional main street is the retail strip consisting mostly of small, car-oriented retailing. The percentage of retail land devoted to small, car-oriented retailing declines between Sector A and Sector C. Meanwhile, the proportion of retail land allocated to medium and large plazas and indoor malls is higher in Sector B than Sector A and somewhat lower in Sector C than Sector B.

The most recent retail format – big box stores, power malls and mega-supermarkets – which has burgeoned over the last 20 years, is strongly represented in all three sectors. Contrary to expectations, the second highest proportion of retail land occupied by this category is in Sector A, the oldest sector. The explanation lies in the development of such retailing on former brownfield sites. As expected, it is in Sector C that this configuration occupies the largest proportion of retail land, more than any other configuration. Part of the reason for a lesser prevalence of big-box stores, power malls and mega-supermarkets in Sector B is the fact that, when these retail

Table 4. Residential density and housing types in the three sectors

Residential density and housing types	Sector A	Sector B	Sector C
Population	344 012	254 544	208 826
Households	129 889	79 369	61 661
Population/households	2.7	3.2	3.4
Population/total urbanized area (km ²)	3 251.5	3 743.3	2 148.4
Households/total urbanized area (km ²)	1 227.7	1 167.2	634.4
Population/total residential areas (km ²) ¹	6 075.8	7 999.5	4 502.5
Households/total residential areas (km ²) ¹	2 294	2 494.3	1 711.3
Detached and semi-detached (%)	42.3	44.4	77
Row houses (%)	5.2	14.4	9.8
Apartments, duplexes (%)	8.1	6.1	8.4
Apartments ≥ 5-floor building (%)	37.2	29.1	2.6
Apartments < 5-floor building (%)	7	6.1	2.1
Other (%)	0.3	0.1	0

Neighbourhood area (m²)/number of houses in four sample detached-housing neighbourhoods²
 Neighbourhood 1: 690.5 Neighbourhood 2: 952.3 Neighbourhood 3: 473.8
 Neighbourhood 4: 532.4

Source: 2006 Canadian Census (Statistics Canada, 2007) and aerial photographic analysis and measurements.

Notes

1. The denominator consists of the areas of developed residential lots (including the footprints of buildings) and local streets.
2. Neighbourhood area used to calculate square metres per housing unit includes developed residential lots (including building footprint) and local streets.
 Neighbourhood 1: St. Clair-Birchmount, 67.1% of housing built 1946-1970.
 Neighbourhood 2: Finch-Birchmount, 63.4% of housing built 1961-1980.
 Neighbourhood 3: McCowan-Denison, 61.9% of housing built 1986-1990.
 Neighbourhood 4: Kennedy-Major Mackenzie, 68.7% of housing built 2001-2006.
 See Figure 2 for location of neighbourhoods.

types became popular, this sector was already mostly developed, though too recently to contain large brownfield sites ripe for redevelopment.

The ratio of parking area to building footprint for different retail configurations (Table 5) reflects an adaptation to rising automobile use as we move from Sector A to the two other sectors. The ratio rises for all configurations. However, it is the same for Sectors B and C. The amount of developed retail land per capita is similar in Sector A and Sector C, despite variations in the distribution of different retail configurations. The presence

of small, car-oriented retailing is much higher in Sector A than Sector C, while the reverse holds for configurations of big-box stores, power malls and mega-supermarkets. A lesser presence of these formats in Sector B accounts largely for its lesser retail land per capita.

With respect to workplaces, the industrial/business park formula was established in the 1950s with mostly single-storey buildings surrounded by space for storage, truck access, employee parking and some landscaping, and a modified-grid road pattern. From a morphological perspective, very little change in these employment areas took place over the

Table 5. Retailing in the three sectors

	Sector A	Sector B	Sector C
Building footprint, parking and landscaped area as percentage of all retail categories¹			
Street-facing retailing ²	1.5	0	3.2
Small, car-oriented retailing ²	53.6	47.9	34
Medium and large plazas ²	2.7	7.3	6.1
Indoor malls ²	13.7	19.3	17.9
Big box stores, power malls and mega-supermarkets ²	28.5	25.4	38.9
Ratio parking area/building footprint¹			
Street-facing retailing ²	0.9	0	1.7
Small, car-oriented retailing ²	1.8	2.3	2.3
Medium and large plazas ²	1.3	1.9	1.8
Indoor malls ²	1.8	2	2.3
Big box stores, power malls and mega-supermarkets ²	1.7	1.9	1.9
All retailing	1.7	2.1	2.1
Retail area (building footprint, m²) per person¹			
Street-facing retailing ²	0.08	0	0.13
Small, car-oriented retailing ²	1.91	1.08	1.17
Medium and large plazas ²	0.12	0.19	0.25
Indoor malls ²	0.5	0.48	0.62
Big box stores, power malls and mega-supermarkets ²	1.07	0.65	1.51
All retailing	3.68	2.41	3.69

Source: 2006 Canadian Census (Statistics Canada, 2007) and aerial photographic analysis and measurements.

Notes

1. Retail area does not refer to floor space but to the surface of the land occupied by building footprint, parking and attendant landscaping. Note that the vast majority of retailing in the transect is in single-floor structures.
2. *Street-facing retailing* includes various types of stores built to the sidewalk in a traditional main street fashion. *Small, car-oriented retailing* comprises self-standing stores with a building footprint below 4000 m² and outdoor malls with a footprint under 10 000 m². In all instances within this configuration, there is parking space between structures and the street and often beside and behind buildings as well. *Medium and large plazas* are outdoor, car-oriented shopping malls with a footprint of 10 000 m² or more, whose stores are generally smaller than those found in power malls. Within the transect, the footprint of *indoor malls* ranges from 30 000 m² to 70 000 m². The *big-box store, power mall and mega-supermarket* category refers to retail formats that have become popular over the last 2 decades. Big-box stores are large automobile-oriented (in their suburban variant) structures, which are either medium- or low-cost department stores or specialize in one type of products. Power malls present an assemblage of such stores. Mega-supermarkets are defined as food outlets with a footprint of 4000 m² or more.

period under investigation. Table 6 indicates only very slight variation in overall building coverage in three sample industrial areas selected from each sector, despite recorded differences in the size of structures. There are, however, considerable inter-sector differences

in the proportion of urbanized land occupied by employment areas, which generally take the form of large mono-functional zones.

Variations in the presence of office buildings also distinguish the three sectors. Traditionally concentrated in Downtown

Table 6. Workplaces in the three sectors

	Sector A	Sector B	Sector C
Sample industrial areas: average size of buildings (m ²) ¹	3207	5475	3789
Sample industrial areas: percentage of areas occupied by building footprints	46.2	48.8	44.6
Percentage of urbanized space occupied by employment areas	9.72	20.39	13.24
Office buildings ($\geq 10\,000$ m ² floor space): number of buildings	12 (8 of which in Scarborough town centre)	6	26
Office buildings ($\geq 10\,000$ m ² floor space): total floor space	255 763 (of which 215 777 in Scarborough town centre)	91 891	602 181

Source: 2006 Canadian Census (Statistics Canada, 2007) and aerial photographic analysis and measurements.

Note

1. See Figure 2 for location of sample industrial areas.

Toronto, office space began to decentralize in the early 1980s. Planning policies of the time encouraged office space construction in suburban nodes, one of which is Sector A's Scarborough Town Centre, in order to moderate what was perceived as an over-concentration of employment in the downtown (Metro Toronto, 1981). The vast majority of Sector A office space in buildings with 10 000 m² or more of floor space is concentrated in Scarborough Town Centre (Table 6). There is little office space in Sector B, but a large amount in Sector C, reflecting the growing attraction of office space in automobile-accessible suburban locations. The appeal of suburbs was further enhanced by lower business taxes (Canadian Urban Institute, 2005; Lang, 2003). Downtown Toronto office development nearly stalled as office growth in developing suburbs gathered momentum from the early 1990s to the late 2000s.

The investigation of public institutions is limited to schools, of which there are 281 – primary, middle and secondary – in the transect, because hospitals and college campuses are too few (four hospitals, one community college and one satellite university campus) to provide the basis for valid

comparisons. From the early post-war years suburban schools opted for locations within super-blocks, generally on sites backing on to parks. The size of schools (as defined by their footprint) is constant across the three sectors as is population per school (Table 7). But the ratio of residential surface area to number of schools varies in step with inter-sector residential density differences.

Regarding green space, there has been a tendency across the continent for there to be fewer and smaller playgrounds and for greater attention to be given to the preservation of natural land and the protection of environmentally sensitive areas (Bengston *et al.*, 2004; Maruani and Amit-Cohen, 2007). Toronto does not fully conform to this tendency owing to the adoption of strict restrictions on flood plain development in the wake of the casualties and damages inflicted by Hurricane Hazel in 1954: early in the study period creeks became spines of linear green space systems. There is a stronger presence of natural conservation areas than of park space in Sector A.

Sector B has a lesser proportion of natural conservation areas and more parks and other green space, and overall a higher proportion

Table 7. Schools and green spaces in the three sectors

	Sector A	Sector B	Sector C
Schools			
Average footprint of schools (m ²)	4509	4311	4665
Surface of residential areas ¹ /schools (km ²)	0.46	0.37	0.66
Population per school	2774	2926	2983
Green space (percentage of urbanized area)			
Parks	4.0	9.3	6.2
Nature conservation areas	6.0	1.7	6.4
Other green spaces (excluding private yards)	3.9	9.9	2.2
Total	13.9	20.9	14.8

Source: 2006 Canadian Census (Statistics Canada, 2007) and aerial photographic analysis and measurements.

Note

1. The numerator consists of the areas of developed residential lots (including the footprints of buildings) and local streets.

of green space than other sectors (Table 7). The canalizing or piping of creeks accounts for the near absence of natural conservation areas on floodplains in Sector B, but conventional park space is abundant in that sector, as are other green spaces, principally comprising utility corridors, a golf course and fallow land within urbanized areas. A return to the natural conservation area conformations occurring in Sector A is evident in Sector C: here creeks are maintained in their natural condition and natural conservation areas are sited along hydrological features.

Planning and suburban form trajectories

The hypothesized suburban planning and development phases since the Second World War are faithfully mirrored in plans relating to the transect since the 1950s (Table 8). Plans first adopted the development norms of the early post-war model. Then, as criticisms developed of the resulting suburban form, plans incorporated modifications, recently advancing an alternative vision that emphasized recentralization and alternatives to car use. However, analysis of the way in which

suburban form has actually developed within the study area reveals a different pattern from that in the plans. Some land uses in fact perpetuated development patterns associated with the early post-war suburban model. The super-grid contributed to an evening out of accessibility gradients and, thereby, to a dispersion of activities, while promoting land-use specialization. While it is at the scale of the super-block that innovations in road pattern and land-use distribution have taken place, these innovations have generally remained compatible with defining features of the early post-war model. And in the sole instance in which an innovation departed from dispersion and land-use specialization – the case of the Scarborough multi-functional node – the super-block structure and its role as a framework for zoning prevented the diffusion of the land-use effects of this innovation to adjacent areas. Finally, in a context of heavy reliance on the car and overall dispersion, green space gaps in the suburban texture do not greatly hinder interconnections between different land uses.

Rather than following the new planning vision, the evolution of variables observed in the study perpetuated and accentuated features

Table 8. Trajectory of plans and land-use features in the study area

	Nature of evolution	Trajectory
Plans	The evolution of the content of plans conforms to the three hypothesized periods: (1) plans formulate and provide the conditions for the adoption of the early post-war suburban model; (2) proposal of modifications of the suburban model; (3) plans put forth an alternative version of suburban development.	⇓
Super-grid	The super-grid provides the land-use structure of the suburb and results in a flattened automobile-oriented accessibility pattern favouring dispersion.	⇒
Super-block	The layout of super-blocks and land-use distribution therein have experienced substantial change, but within the context set by the super-grid. Land-use innovations take place at the scale of super-blocks; these innovations do not challenge the super-grid.	⇒
Population density	Major fall in population density between Sector C and the other sectors due to housing type distribution.	⇑
Retailing	Rise in the amount of parking and growing presence of big-box stores, power malls and mega-supermarkets, which are types of retailing that rely on extended catchment areas of automobile users.	⇑
Workplaces	Industrial areas do not experience much change but offices are increasingly present in newer suburban areas. Suburbanization of office space results in shorter commuter journeys but much higher reliance on the car relative to downtown office location.	⇑
Public institutions (schools)	Larger catchment area for Sector C schools encourages more driving of students to schools.	⇑
Green space	The return to natural conservation areas in Sector C is consistent with accessibility and land-use patterns in an automobile dominated environment.	⇒

⇓ Departure from the early post-war suburban model (automobile orientation, land-use specialization, low density).
 ⇒ Perpetuation of the early post-war suburban model.
 ⇑ Accentuation of the features of the early post-war suburban model.

of the early post-war model; more specifically they increased automobile orientation, land-use specialization and dispersion and lessened density. Much lower population density in Sector C than in other sectors represents an

impediment to the delivery of public transit and results in additional and/or longer car journeys in an environment where activities are more distant from each other. What is more, lower Sector C density is the outcome of

a much higher presence of detached and semi-detached houses and increased house-type homogeneity, thereby perpetuating the residential forms characteristic of the early post-war model. Retailing has quickly adapted to growing reliance on the car and the accessibility that ensues: configurations with large parking surfaces as well as formats – indoor malls and now big-box stores, power malls and mega-supermarkets – that draw upon the large catchment areas of automobile users, thus augmenting car reliance. There are two distinct tendencies regarding workplaces. Though industrial areas have undergone limited change since the 1950s, this has not been the case for office buildings. As the historical downtown concentration of offices gave way to suburban decentralization, the tendency was for commuting to become shorter but far more car-reliant (Clark and Kuijpers-Linde, 1994; Lee *et al.*, 2006). The contribution of schools to the advancement of the early post-war model relates to larger service areas in Sector C and, one can assume, to more children being driven to school.

Findings thus emphasize a glaring discrepancy between the trajectory of plans and that of actual suburban development. While the content of plans conforms to the hypothesis, the development reality is strongly at odds with the expected departure from the early post-war suburban model. Why is there such a gap between proposals voiced in plans and the reality of suburban development? The answer lies in the circumstances responsible for the deepening entrenchment of the early post-war model and limitations on the capacity to shift development tendencies.

A major factor in the lack of change in the nature of suburban development is the existence of a transportation-land use dynamic, which results in continuing adaptation of the built environment to the space requirements of the automobile and to the car-induced reduction of accessibility gradients. Meanwhile, such land uses encourage further reliance on the car and thereby contribute to the reciprocal nature of the dynamic. There is, in addition, the influence of interest groups coalesced around prevailing forms of development. Likewise, existing patterns are

perpetuated by mutual expectations of producers and consumers of the built environment and by the habits of the public. Also hampering urban change is the difficulty for many residents to contemplate alternative forms of development, especially when they clash with their values and what they are accustomed to.

The Toronto mayoral campaign of 2010 highlights the resistance to urban transformation. During the campaign, one of the main platforms of Rob Ford, the successful candidate, was to favour subways rather than light rail transit in order to avoid taking road space away from automobiles (he opposed cycle lanes for the same reason) (Warren, 2010). Naturally, this approach would require far fewer rail transit kilometres to be paid for out of public transit capital budgets. His preferred subway line was to run through Scarborough's primarily dispersed and low-density environment, whose limited potential patronage and plentiful road surface make it better suited to surface light rail transit. The pro-automobile message resonated with suburban constituencies, which rallied around candidate Ford and assured his victory (Siddiqui, 2010).

Only large-scale and well co-ordinated interventions have the potential for overcoming the deep entrenchment of the early post-war model. Modest, localized actions have little effect on urban structure and dynamic because of their limited ability to simultaneously improve public transit and intensify land use, and thus initiate a mutually reinforcing interrelation. Interventions must be well co-ordinated over time and space and be of a sufficient magnitude to launch an alternative dynamic of transportation and land use and help bring to reality the vision of a recentralized and less automobile reliant suburb.

Attempts at departing from the early post-war model collide with diminished state intervention capacity in matters of infrastructure development at a time of sluggish economic growth, heavy public sector debt and harsh competition from other government spending priorities (especially health care). Gone are the favourable investment conditions that

prevailed from the 1950s to the 1980s when the majority of Toronto's highway and public transit networks (with more emphasis on the former in suburban parts) were built.

Yet we cannot overlook signs – such as rising energy prices, the growing popularity of high-density living and the success across North America of new public transit systems – that point to a possible urban transition. Presently, large parts of the study area are undergoing deep socio-economic change, challenging aspects of the early post-war suburban model. The settlement of low-income immigrants in parts of Scarborough is, indeed, raising residential density and reliance on public transit (Hulchanski, 2010). To foster an urban environment that is both better adapted to the needs of this new population and corresponds to the recentralization and public transit-focused vision, governments must channel their regulatory and limited financial capacity to the creation of concentrated realms within the suburban environment. These realms would be made of interconnected nodes and dense public transit corridors. It would be possible thereby to reach daily activities by walking or using efficient public transit. When successful, such a strategy would launch an alternative suburban dynamic of transportation and land use whereby the built environment would adapt to the presence of quality public transit and to additional walking, and thus contribute to the animation of sidewalks while generating additional transit riders.

What is the relevance of the findings reported in this paper beyond Toronto? In spite of the dispersion, automobile orientation and lower density in its latest layer of development, suburban Toronto registers higher density and less automobile reliance than most of its North American counterparts (Filion *et al.*, 2004). At the same time, a review of metropolitan-scale planning documents across North America has revealed a widely-shared interest in public transit system expansion and recentralization objectives (Filion and Kramer, 2010). It follows that the striking gap between planning visions and suburban reality in Toronto may actually be less pronounced than in most other North American metropolitan regions.

Conclusion

This paper has shown how changes to suburban form since the late 1940s in a Toronto transect have either conformed to the early post-war model or further accentuated some of its key features. There has been a loss of residential density, rising automobile dependence of retailing and offices, and only sporadic departures from the early post-war model. Meanwhile, recent plans advance an alternative to that model, substituting concentrated development structured around corridors and nodes for low density and dispersion, and replacing near universal car use by additional reliance on public transit and walking. The gap between planning proposals and the reality of suburban development can be accounted for by resistance to change stemming from the continuing momentum of patterns of development inherited from the early post-war model and from interests and habits perpetuating these patterns.

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Infrastructure and the rebuilt post-war city

A one-day workshop on this theme is being organized at Birmingham City University on 25 March 2013. Contributions are invited on transport

and communications, retail, administrative, services and other infrastructure: please contact Professor Peter Larkham, email peter.larkham@bcu.ac.uk.