ST. MICHAEL'S HOSPITAL
CENTRE FOR RESEARCH ON INNER CITY HEALTH

McMaster University

Final Report

Peel Healthy Development Index

Prepared for Peel Public Health by
The Centre for Research on Inner City Health at St. Michael's Hospital
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1. Executive Summary

In 2005 Peel Health Services staff became engaged in reviewing planning development applications received by the Region. Although the Health Services comments were well received by planning staff, health staff recognized a need for evidence-based criteria to provide ongoing, transparent, and consistent health rationale to the review process.

In 2009, Peel Health retained the services of a research team from St. Michael's Hospital Centre for Research on Inner City Health to build a Healthy Development Index for assessing the health impacts associated with development proposals. The proposed Peel Healthy Development Index (HDI) is a framework to provide consistent, quantifiable standards to inform planning decisions.

The proposed HDI consists of seven *elements* – these are categories of built environment characteristics that are known to be associated with health. These elements include: Density, Service Proximity, Land Use Mix, Street Connectivity, Road Network & Sidewalk Characteristics, Parking, and Aesthetics & Human Scale. Each of the HDI elements are further refined into *measures*. Measures are quantifiable components of each element that are statistically associated with specific physical activity outcomes.

The following process was followed to develop the Index:

1. Comprehensive review of the literature linking the built environment and health

The researchers performed a review of research articles and best practices from the grey literature. Evidence from this review was used to establish the Index elements and measures.

2. ***Strength of evidence analysis***

Those measures with the greatest strength of evidence were compiled into a Healthy Development Index with associated numerical targets and ranges. The measures consist of prerequisite and credit development targets.

3. ***Stakeholder consultation***

A series of consultation sessions were held to elicit feedback on the Index elements' relevance and feasibility from the perspective of Regional planners, municipal planners and development consultants.

4. ***Policy gap analysis***

The Index standards were compared with existing standards given in Regional and municipal Official Plans, Secondary Plans, zoning bylaws and design guidelines to identify the policy documents relevant to each element, and to assess the degree of change required.

5. ***Geographic Information Systems (GIS)-based validation analysis***

The researchers selected three communities in Peel (one each in Brampton, Caledon and Missisauga) that are widely considered to be 'walkable'. Index element measures for each community were compared with prerequisites. This analysis allowed the researchers to determine whether the elements and corresponding standards in the Index accurately capture built form characteristics that promote walkability, and whether the Index targets are achievable in Peel.

The results from this assessment process suggest that the feasibility of achieving the HDI standards may vary significantly within and among Peel's three area municipalities, and that development of a single tool to be applied indiscriminately to all development in the Region may not be appropriate. Furthermore, while developers and builders have some discretion over the built environment elements that contribute to healthy development, other elements are under the jurisdiction of the municipalities and/or Region. Therefore, the researchers have identified the steps needed to be undertaken to support implementation of the proposed HDI tool and the development of health-promoting communities. Key recommendations are:

1. Develop a business case that demonstrates the benefits of healthy urban design to other agendas such as environmental sustainability, transit-oriented development, and age-friendly design.
2. Revise municipal and Regional planning and transportation standards to be consistent with recommended prerequisites – allowing developers to meet health and policy standards simultaneously, without an appeal process;
3. Use a comprehensive, multi-sectoral approach to resolve the inconsistencies between levels of government, between municipalities, between departments, and between sectors that restrict healthier development;
4. Adapt future versions of the Index to account for the significant differences between small intensification projects and larger, greenfield development;
5. Encourage the prioritization of public health in both transportation and urban planning, avoiding policies that serve private vehicular travel at the

expense of the active transport network (e.g., walking, cycling, public transit).

Development of a preliminary Healthy Development Index represents an essential step in identifying changes to policy and practice that could lead to healthier development patterns within Peel. The standards of the HDI, as well as the many lessons learned throughout its development, will strongly inform future direction for promoting healthy built environments in Peel Region.

Part A: Context & Consultation

Contents:

2. Introduction

Across Canada, rates of obesity and chronic disease are alarmingly high (Haydon et al., 2006), and the Region of Peel is no exception: In 2005, 47% of Peel adults were either overweight or obese, and 9% suffered from diabetes (Peel Public Health, 2008). Despite scientific evidence that physical activity can reduce the risk of obesity, type 2 diabetes, cardiovascular disease, and certain forms of cancer by up to 50% (Healthy Living Unit, 2008), 54% percent of Peel adults were inactive in 2003 (Statistics Canada, 2005), and the region has some of the lowest active transport rates in Canada (Bray et al., 2005).

Supported by a growing body of international literature, the *State of the Region's Health Report* (Peel Public Health, 2005) suggests that sprawling, auto-oriented development patterns – which characterize a significant portion of the Region of Peel – are a potential cause of the high prevalence of obesity and low rates of physical activity in the region. As a result, Peel council approved Resolution 2005-1395, which directed Peel Public Health to examine and make planning recommendations that provide greater opportunity for active living.

In response, Peel Public Health contracted researchers at the Centre for Research on Inner City Health (CRICH) at St. Michael's Hospital to study the relationship between the built environment and active living and, in turn, create an evidence-based planning Index that would encourage future development in a form more conducive to active living.

As an initial step, an extensive review was conducted of the scientific and best practices literature on health and the built environment. The findings were used to

identify *elements* – general categories (e.g., density) of the built environment for which there was evidence of an association with better health outcomes among residents. For each element, *measures* – specific quantifiable components of each element that were associated with physical activity outcomes (e.g., net residential density) – were identified. With the literature as a guide, an initial Index was formulated using these elements and measures, combining prerequisite (required for approval) and bonus credit (award system, only) development targets in a design informed by the LEED for Neighbourhood Development Rating System (2008). See Section 3 for more detail on the development of the initial Peel Health Development Index (simply referred to as "the Index" throughout this report) and Appendix A for the Index itself.

Following the initial literature review and development of the Index, a consultation and assessment process began. The research team, along with Peel Public Health, sought feedback from both Peel municipal and regional planners as well as local private planning firms in a series of meetings and a roundtable discussion. These on-going consultations were the basis for assessing the practicality and feasibility of the Index and its implementation and are discussed further in Section 4 "Consultation Process & Feedback".

The assessment process was also augmented by two additional analyses. The first of these was a gap analysis, which compared the Index's standards with existing regional and municipal standards and is discussed in section 6. Secondly, a quantitative validation and feasibility study was conducted using Geographic Information Systems, which quantitatively compared a small selection of existing Peel communities to the prerequisite targets of the Index. This analysis is discussed in detail in section 7.

From the consultation and assessment process, it was established that further development of an evaluation Index was neither appropriate nor sufficient to accomplish the Region's objectives. Instead, the research team determined that it was necessary to review the public policy, standards, and by-laws first, in order to better understand the implementation process and its context. However, the team still elected to engage the private sector at these early stages, in order to develop cooperation and goodwill between the two sectors and so increase the probability of success in the future.

As a result, this report does not include a final version of the Index, but rather a set of guidelines for an Index, should the Region choose to adopt one. In addition, we endeavour to provide a roadmap of the changes and steps the Region of Peel will need to make in order to implement many of the requirements for healthy development outlined in the Index. In Section 9 "Healthy Development Assessment – Detailed Findings & Recommendations ", specific reference is made to measurement challenges (e.g., lack of universality across and within municipalities); relevance of the Index to different development application types (e.g., greenfield vs. intensification); the policies and operating context within which the Index must be implemented (e.g., municipal by-laws, Official Plan Design Guidelines, and other standards); other barriers to implementation (e.g., the feasibility of health targets in comparison to existing standards); and action steps for moving forward.

3. Development of Elements, Measures, and Targets

In order to establish which aspects of the built environment positively affect health, an extensive literature review of the relevant scientific and best practices literature was conducted. This review was conducted by searching several online journal databases using health and built environment key words and further expanded using the 'snowball' technique. The search extensively covered the urban planning, geography, preventative medicine, epidemiology, public health, and population health literatures with a focus on chronic disease, obesity, and change in physical activity as the primary health outcomes. A broad selection of 'grey' literature was also included from the areas of public health and urban planning to identify local and regional standards and best practices.

Based on a consensus in the literature, we identified seven *elements* – built environment categories that are associated with healthy communities – and constructed the Index around them. The elements are: Density, Service Proximity, Land Use Mix, Street Connectivity, Road Network and Sidewalk Characteristics, Parking, and Aesthetics and Human Scale. For each of the elements we identified or developed specific *measures* – quantifiable components of each element that have significant, positive associations with physical activity and health (e.g., net residential density, proximity to employment).

It is important to note that the Index was developed primarily based on quantitative research evidence. As a result, case studies, qualitative anecdotes, and expert justifications were only incorporated into the elements and measures in a limited fashion. However, the importance of built environment variables that are difficult to quantify should not be dismissed. Limited quantitative evidence exists for some highly important elements and measures simply because they are difficult to quantify (e.g., Aesthetics and

Human Scale). In situations where strong qualitative and expert opinion support existed for these types of measures, but quantifiable targets and ranges were not found in the scientific literature, we sought guidance from the quantitative targets specified in LEED for Neighbourhood Development (2008) to include such measures in the Index (LEED-ND is an acronym for Leadership in Energy and Environmental Design for Neighbourhood Development). Furthermore, the prerequisite and credit system used in the Index was influenced by the LEED-ND format.

Although there were a large number of studies in the published and grey literature showing an association between elements of the built environment and physical activity or other health measures, some of these studies were of higher quality, or more rigorous, than others. Therefore, for each measure, we conducted a strength of evidence analysis (with emphasis on the scientific literature) in order to determine the amount and quality of support for each element. This was accomplished through an assessment of the number of studies looking at a particular measure, as well as each individual study's quality based on the type of analysis, calculation methods, whether or not potential confounding factors were controlled for, sample size, and statistical significance of the results. We used the resulting strength of evidence of each measure to determine a) its inclusion in the Index and b) its designation as a prerequisite (necessary for approval) or credit (contributes to certification level) requirement.

Once the measures and their level of inclusion were established, research-based benchmarks, expert recommendations, and similar planning Indexes (e.g., LEED-ND) were used to set target ranges and benchmarks for each prerequisite and credit measure.

Greater credit was given to ranges that have shown a stronger positive impact on health in the empirical literature.

Following the development of the Index, a consultation and assessment process was undertaken to collect feedback on the feasibility of implementation of the Index and to test its validity in existing communities in the Region of Peel. Based on our analyses and the feedback received, we feel that significant policy work is still required by a variety of actors in the Region of Peel and its municipalities before an appropriate, amended Index can be finalized and implemented. The results of these processes can be found in sections 4, 6, and 7 of this report (and their related appendices) and are incorporated into the set of recommendations and discussion in sections 8 and 9

4. Consultation Process & Feedback

Upon completion of a first draft of the Peel Healthy Development Index, the project team sought feedback from a number of stakeholders. This consultation process was conducted over a series of meetings with three primary stakeholder groups: a) Peel regional planners, b) Peel municipal planners from the municipalities of Mississauga, Brampton, and Caledon, and c) private planning consulting firms. Furthermore, the research team hired urban designer and planner Daniel Leeming of The Planning Partnership to provide on-going expert counsel throughout the consultation and assessment process and to review the final report.

For all three stakeholder groups, meetings were held with senior-level planners and administrators who were asked to go through the Index measure-by-measure and give feedback on a) the inclusion of the measure, itself, b) the appropriateness and feasibility of the targets or ranges recommended, and c) the various barriers to implementation. These meetings also allowed us to identify key players in the development process (e.g., transportation engineers), who not only offered a different perspective on the Index but also provided greater insight into barriers that may be faced in its implementation.

An overall synthesis of the results of the consultation process suggests that, although the Index incorporates several important and necessary suggested changes to development standards, many roadblocks stand in the way of implementation. The primary barriers that have been identified are: A) Many of the measures in the Index are largely prescribed by existing municipal, regional, provincial, and transportation standards and by-laws that do not currently allow the Index's health targets to be achieved; therefore, developers cannot meet the health requirements under existing

standards. B) Moreover, existing Urban Design Guidelines, which dictate new zoning and by-laws, may have been developed with priorities other than health in mind; so, even new standards are not necessarily directed towards healthy development. C) A collaborative approach that establishes common, agreed upon goals with other sectors and levels of government in the development process is needed for effective implementation of all measures. D) Conflicts with transportation and road design standards (e.g., auto safety vs. pedestrian and cyclist safety; increased vehicular collisions vs. increased activity-friendliness) need to be reconciled and a process put in place to reconcile differences between various departments within municipal planning. E) Adaptations to account for the significant differences between smaller, intensification redevelopment (characterized by Mississauga) and larger greenfield subdivision development (characterized by Brampton and Caledon) must be built into the Index. F) For some measures, the Index needs to show that the health requirements will translate into wider benefits (e.g., public safety, economic, environmental) in addition to walkability.

Using the feedback from the consultation process, the Index has been modified into a set of discussions and recommendations in which these key issues are addressed: the health importance of each measure, challenges to calculating the measures, a comparison of targets and ranges, differences in intensification vs. greenfield implementation, other barriers to implementation (e.g., jurisdiction, feasibility of health targets), and recommendations and action steps for moving forward. See sections 5, 8, and 9 for a discussion of these issues.

5. Application to Greenfield vs. Intensification Development

Due to the nature of the Index and its measures, the Index is most applicable to larger, greenfield developments in which most of the relevant built environment characteristics can still be modified or incorporated and then properly evaluated. This limitation stems from the availability of scientific evidence used to construct the Index: researchers almost exclusively analyse variables and health outcomes within large, existing communities. In turn, the Index is geared towards developments large enough to provide most or all of the built environment elements needed to achieve a healthy community, and it does not incorporate tailoring of its targets and measures towards other application types – namely smaller intensification. As a result, in certain development contexts, some of the measures a) are not as applicable, and may need to be amended or excluded, b) lose accuracy in their calculation, or c) lose feasibility in their targets. Therefore, the Index and its health measures will need careful modification in order to be fully applicable to all intensification and greenfield developments.

Note that the term 'development' is used in this report to refer to both greenfield and intensification projects, even though 'community' is used in the Index. This is meant to indicate that we are referring to *new* development projects (whether greenfield or intensification) rather than *existing* communities/neighbourhoods.

The remainder of this section uses specific examples to illustrate the lack of applicability and calculation problems of some measures as they related to greenfield vs. intensification developments. Emphasis is placed on the prerequisites in the Index.

Further discussion and assessment of the measures can be found in sections 8 and 9 of this report.

Lack of Applicability

The measures in the Index were validated and developed with a focus on application to large, greenfield development and its characteristics and may therefore not be applicable to certain developments due to either the developments' geographic size or their status as intensification or greenfield. This is seen most prominently in the following examples:

1) The prerequisites for Service Proximity lack applicability for many small, intensification development contexts. Any primarily residential development would need to be located within or near a primarily non-residential area in order to meet both service and employment proximity targets – and vice versa for small, primarily non-residential developments. This could be an important benefit of the Index, as it guides existing communities towards a health-promoting mix of land uses. However, much of Peel Region is characterized by low density communities in which most intensification development would struggle to be nearby enough services, jobs, *or* residents to meet any proximity targets.

Therefore, Service Proximity requirements may need to take into account differences between developments that tap into well-established communities versus developments that need to encourage their surrounding communities (through zoning and other methods) to move towards meeting the health targets as they mature and can increasingly support a better land use mix.

2) The Street Connectivity prerequisite is not applicable to any smaller developments that do not include new public roads; therefore, only developers of large – likely greenfield – developments could be expected to have the control to meet street connectivity health targets. An amendment to the measure could allow such developments to incorporate an increase in pedestrian and cycle connectivity, which impacts connectivity as a whole, in order to satisfy the prerequisite.

3) A number of the Land Use Mix credit requirements could only be achieved by larger intensification or greenfield developments, because smaller developments would not be able to accommodate enough new services or housing types to receive any credit scores.

4) The prerequisites and credit scores for Road Network and Sidewalk Characteristics are only practically applicable to very large greenfield developments. All other developments would already have preexisting road and sidewalk networks, and so developer control would be minimal.

Problems with Calculations

Some of the measures in the Index require formulas that may lack accuracy and applicability when applied to particularly small or particularly large development. This is primarily seen in these Density and Service Proximity examples:

1) Residential density is calculated as average dwelling units per hectare. This method of calculation is very effective for multi-hectare developments containing many lots and dwelling units. However, for particularly small developments (e.g., single lot urban infill), the results of the calculation will not be in context with the immediate

surrounding areas. This is not inherently a problem, but the calculation would be more effective and informative should it include the impact of a new development on the existing community.

2) The Service Proximity measure has three problems in its calculations:

First, although the Index encourages mixed use buildings, the Service Proximity measure actually restricts the inclusion of a residential component to primarily non-residential developments in some locations: Any residential units in a single use residential community (i.e., common suburbs), where mixed use buildings should be encouraged, would virtually never be within 800m of enough neighbourhood services or jobs to meet the health targets. Similarly, primarily non-residential developments within existing commercial zones would find it virtually impossible to be within 800m of sufficient residential units.

Second, the employment proximity calculations lose their validity as they are applied to increasingly large developments or communities. This is because the calculations compare the number of dwelling units (or jobs) within 800m of a development's centre with the number of jobs (or dwellings units) within the *entire* development. Therefore, if the entire development extends significantly beyond an 800m radius of its centre, then the calculation may misrepresent the development's land use distribution as a whole. For example, all of the residential units could be located near the perimeter of the development, far from the nearest service or job (located within the centre), and so eliminate the mix of uses that the Index is attempting to achieve while still meeting the health target. The measure and its calculation need to be altered in order to

capture a more walkable distribution of land uses when applied to particularly large developments or existing communities (as in our validation process).

Third, calculating number of jobs in a future development is virtually impossible at the Secondary or even Block Plan levels, as the employment characteristics of any given lot or building are yet to be established. Therefore, this measure is a challenge to implement, particularly for larger and primarily non-residential developments.

Part B: Analyses

Contents:

6. Gap Analysis

In order to further assess the Index and the context of its implementation, a gap analysis was used to examine discrepancies between the existing regulatory system and the Index. The analysis was conducted by reviewing all municipal, regional, and provincial regulatory documents (e.g., zoning by-laws, Design Guidelines, Official Plans) and then recording the relevant standards, measures, and calculation methods for the purpose of comparison with the Index. Additionally, the gap analysis established the level at which a given measure is regulated during the application process (e.g., lot level, Block Plan, Secondary Plan).

The results of the gap analysis were then used to a) supplement and contextualize the feedback from the consultation process, and b) better understand and assess the Index and its context; i.e., barriers and limitations, policy, the existing regulatory framework, and c) opportunities for action.

Two key findings from the gap analysis should be noted here: First, a notable lack of unity is present among the existing standards – between the municipalities, between each municipality and the Region, between planning and other related departments (e.g., transportation), and between sectors (e.g., planning and health). Second, although important and influential, by-laws are malleable standards – they can be amended for any given plan. Together, these findings call for the establishment of common goals within the development process. These goals need to be inter-sectoral (i.e., agreed upon by public health, transportation, etc.), and consistent across regulatory bodies and in official documents, so that the subsequent by-laws, their amendments, and all related planning

decisions are directed towards a unified vision of the built environment – one that includes public health and walkability.

7. Summary of Validation Analysis for the Peel Healthy Development Index

7.1. Introduction

Rationale

Validation analyses were conducted for three communities perceived as 'walkable' in the Region of Peel to evaluate whether: a) our prerequisite requirements accurately captured aspects of the built environment that influence physical activity in existing communities; b) our targets were reasonably achievable; and c) communities planned under such targets would fit with the existing urban landscape. The validation analyses serve to illustrate that the Index does effectively measure aspects of the built environment that are related to walking and that walkable, activity-friendly communities do exist in the Region of Peel. Developers of future communities should strive to capture aspects of urban design and planning found within these existing, relatively walkable areas.

Selection of walkable communities

One 'walkable' community in each of the municipalities of Mississauga, Brampton, and Caledon was identified by municipal and regional planning representatives in those municipalities. The selected communities were Port Credit, Downtown Brampton, and Bolton, respectively. Their locations and boundaries are displayed in Figure 1. These communities were identified based on their *perceived* walkability according to the planners, but should not be considered representative of the municipalities as a whole. Moreover, the conclusions of this validation cannot be generalized to other communities or areas beyond these test sites. Due to time and

resource constraints only one validation community was chosen from each municipality. Prior to adopting this or any other Index, it must be validated in multiple communities that were developed at different points in time in different areas of the municipality.

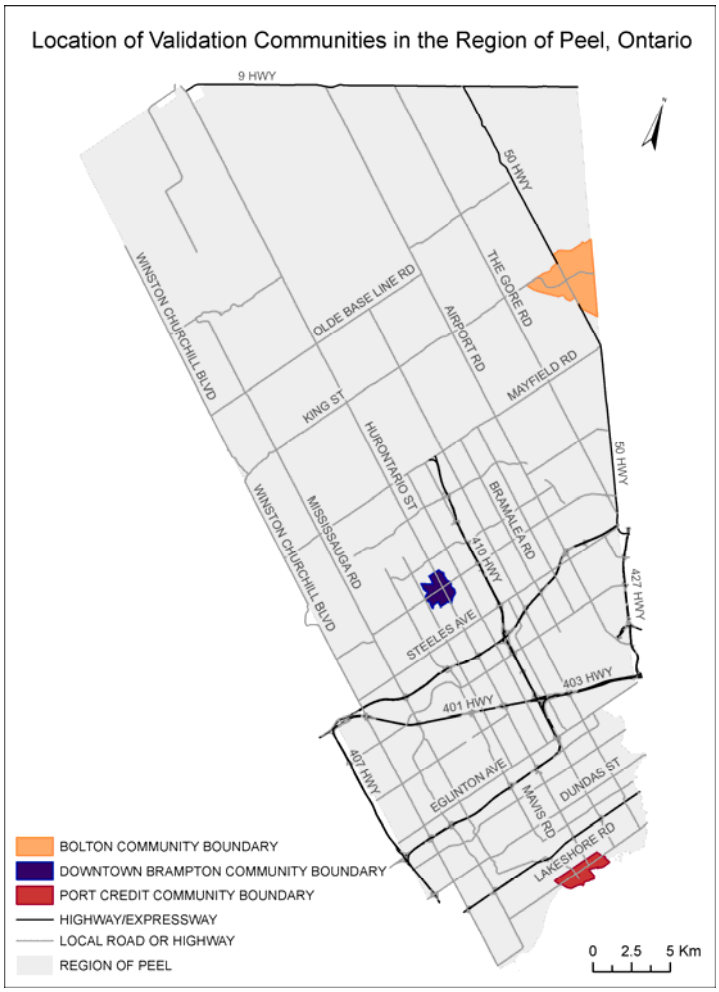

Figure 1. Location of Validation Communities in the Region of Peel.

It should also be acknowledged that the selected communities each have an historic development component which was constructed prior to the proliferation of existing automobile-oriented suburban styles of development in the Region of Peel. This component likely has a direct effect on their walkability, as much of the built environment elements we are trying to capture in the Index are generally present in historic (pre-World War II) styles of development. However, it is not impossible to

reproduce the walkable urban forms found in these communities in a contemporary development context. Instead, elements of their compact, dense, walkable, mixed-use designs should be incorporated into current and future developments in an effort to improve the walkability and the activity-friendly nature of future communities.

Detailed land use maps of each of the validation communities, based on assessed zoning data from the Municipal Property Assessment Corporation, are presented below. Following is a discussion of the validation results and the insights they provide into further development of the Index.

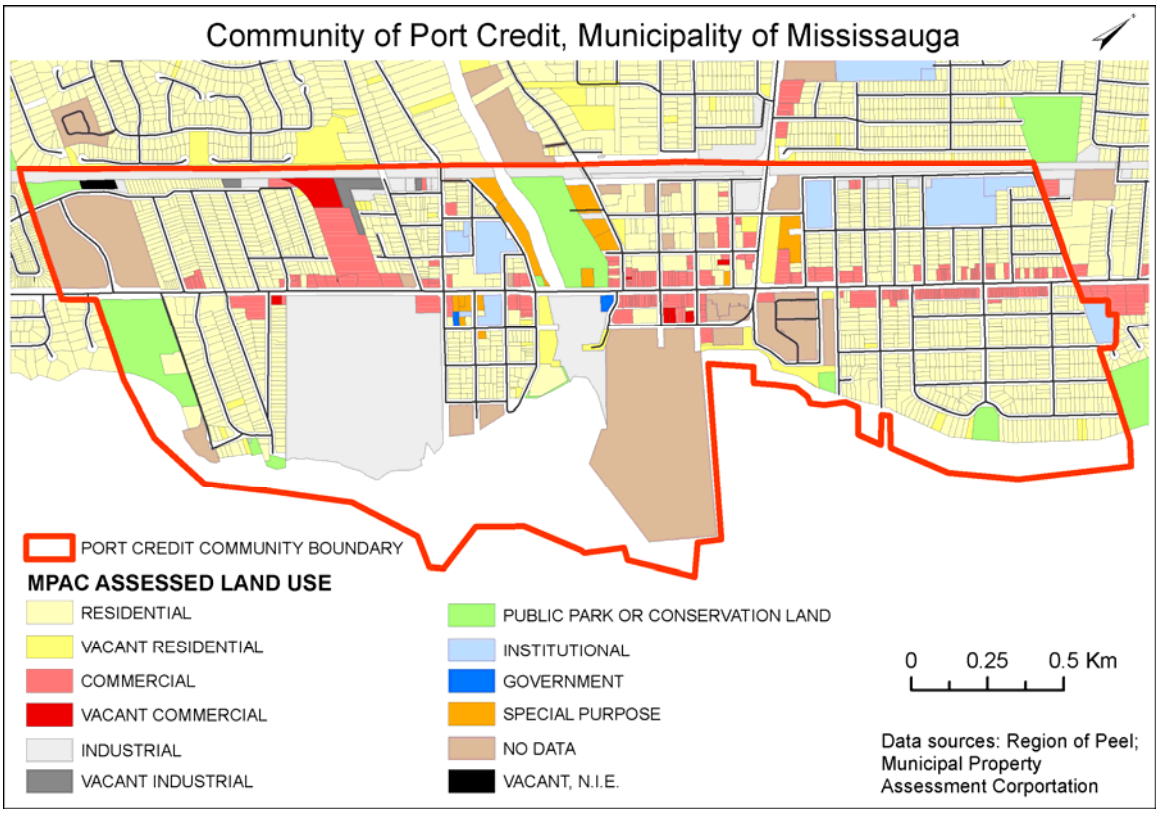

Figure 2. Community boundary and detailed assessed land uses in Port Credit, Mississauga.

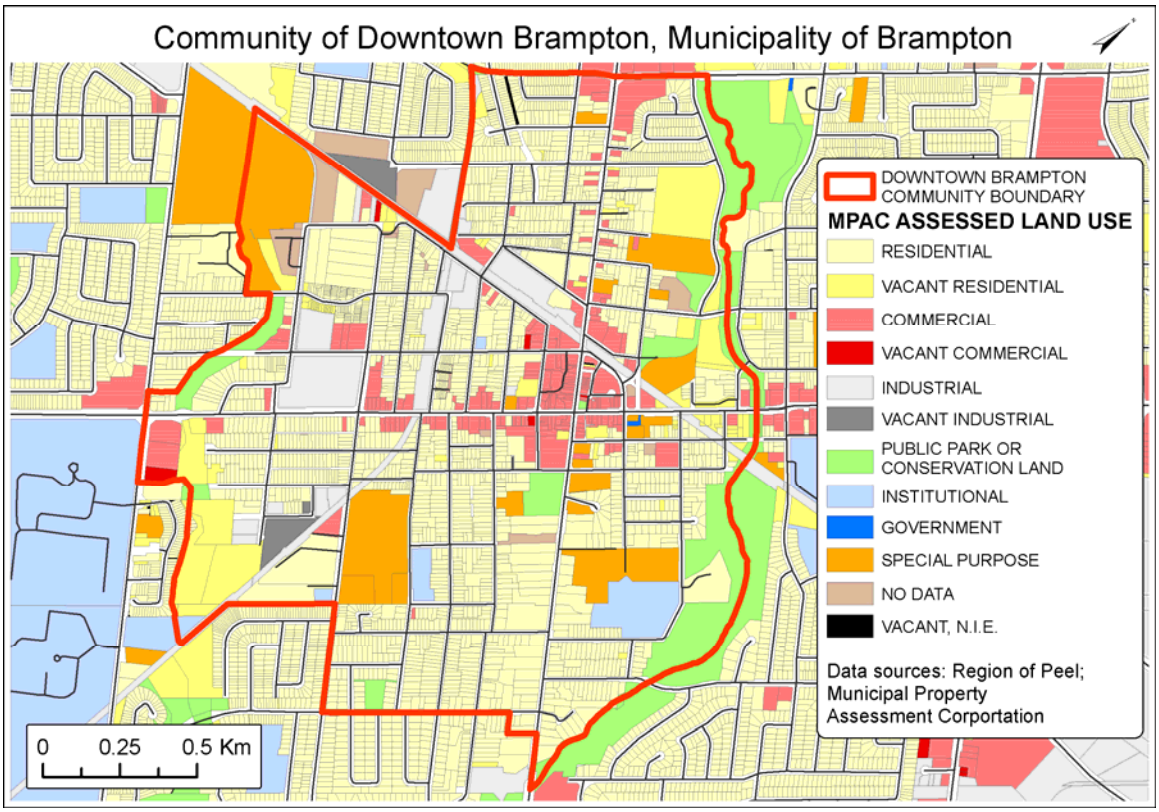

Figure 3. Community boundary and detailed assessed land uses in Downtown Brampton, Brampton.

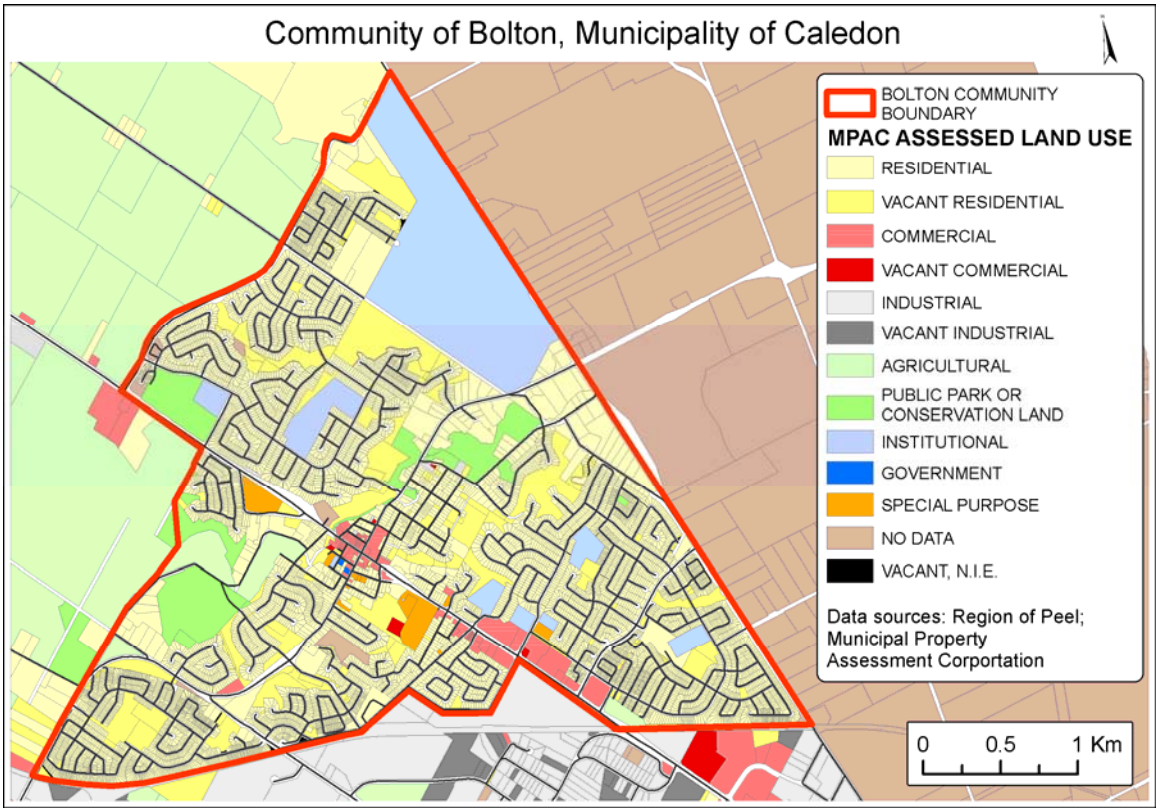

Figure 4. Community boundary and detailed assessed land uses in Bolton, Caledon.

7.2. Results

Below is a summary and discussion of the results of the validation analysis. For each of the measures validated, we discuss: 1) the results for each validation community; 2) possible reasons for a community passing or failing the measure; and 3) any insights from the validation process which may inform future revisions of the measure, as part of the ongoing development of the Index.

7.2.1. Minimum Density (Residential and Non-Residential)

The community of Port Credit, in Mississauga, meets and exceeds the minimum residential density prerequisite measure of 35 dwelling units per net hectare (du/net Ha), with a score of 41.71 du/net Ha. This density is achieved in large part through a combination of mixed-use retail/residential zones, as well as high, medium, and low residential density zones throughout the community. The fact that Port Credit exceeds the prerequisite requirements of the residential density measure, while containing a variety of types of residential, mixed-use, and commercial zones, illustrates that it is possible for the health standard of 35 du/net Ha to be met, while concurrently offering a variety of housing types to suit consumer and marketplace preferences.

The community of Downtown Brampton, in Brampton, does not meet the residential density prerequisite, with a score of 24.32 du/net Ha. It is likely that this community does not meet the health requirement of 35 du/net Ha because of its higher proportion of low density single family dwellings and vacant (undeveloped) residential lots in comparison to Port Credit. It also appears that the central area of Downtown Brampton is primarily retail and commercial focused, with only a few mixed-use

residential/commercial structures. With that said, newer medium and high-density developments do exist in some areas of Downtown Brampton; though, greater effort should be made to encourage mixed-use development.

The community of Bolton, in Caledon, does not meet the residential density health prerequisite, with a score of 12.49 du/net Ha. Similarly to Downtown Brampton, it is likely that this community does not meet the health prerequisite because of its very high proportion of single family detached dwellings (some on very large lots) and large parcels of vacant (undeveloped) residential land.

The net residential dwelling density validation results illustrate one potential issue with the current method of measurement, and one potential issue with the health requirement of 35 du/net Ha, itself.

The net Ha value used in the validation analysis includes all residential, mixed-use, and commercials lots, including those which are currently vacant but zoned for one of these uses. The reasoning behind this is to encourage mixed-use residential/commercial development on lots that are zoned as "commercial." Accordingly, commercial land that is not mixed-use, and so has no residential structures, will reduce the net residential density score for a given community. This is a possible reason for why Downtown Brampton did not meet the current health requirement. These results illustrate that the current net residential density measure effectively encourages the creation of mixed-use structures in commercially-zoned areas. However, change to existing zoning by-law may be necessary in order to ensure that future mixed-use residential/commercial development is allowed on commercially zoned lots.

While the health requirement of 35du/net Ha was met in Port Credit, and was not met in Downtown Brampton and Bolton, all of these areas have been deemed relatively 'walkable' by municipal planners. Additionally, as was found in the validation of other prerequisite measures, Downtown Brampton (and possibly Bolton) may encourage walking and active transport in ways other than through meeting the health requirement of 35du/net Ha. With this in mind, it is suggested that future iterations of the Index allow for a phased or weighted density approach where, for example, average densities as low as 25 or 30 du/net Ha may be permitted if other requirements of the Index are met or exceeded to compensate, or if density is expected to increase sufficiently to meet the requirement throughout the course of development.

Due to data limitations, we were unable to evaluate the FAR/FSI requirements for any of the validation communities. We did, however, evaluate "percent lot coverage" as a proxy. There is no data available in the Public Health literature that would indicate a suitable percent lot coverage threshold for improving health or physical activity. Therefore, we chose an *a priori* lot coverage value of 50% and required it of all commercial, mixed-use, and high-density residential lots in the validation communities. This value was chosen, because it is approximately midway between the lot coverage values associated with 1 and 2 storey structures having a FAR/FSI of 0.7, which is the health requirement in the Index.

None of the validation communities met the requirement that 100% of eligible lots have a lot coverage of 50% or more. In Bolton, 15.84% of all eligible lots met the requirement; in Downtown Brampton, 31.50% of all eligible lots met the requirement; and, in Port Credit, 31.16% of all eligible lots met the requirement. The inability of all

three communities to meet this requirement is likely due to the fact that features such as parking, private trails, and other open spaces on privately owned lots (e.g.,. parks/open spaces associated with condominium residences) are found in all three communities and contribute to the lower percent lot coverage values on associated lots.

These results illustrate three main points. Firstly, percent lot coverage may not be an accurate substitute for FAR/FSI, because FAR/FSI allows for greater flexibility in building design and, when combined with other measures such as lowered parking requirements and maximum building setbacks, can be an effective measure for creating a walkable aesthetic in communities. Secondly, the chosen validation requirement of 50% may not be the correct lot coverage value to require for walkable communities. It is possible that a lower (or higher) value would be more suitable. Thirdly, it may not be appropriate to include high density residential lots and structures within the FAR/FSI requirement of the Index, because they are already encouraged in the residential density requirement, and because there are more suitable measures for avoiding issues such as the "tower in the park" associated with poorly designed high density residential development.

Data that lists the building height or number of stories, as well as the gross floor area (excluding parking facilities), of each eligible building would be an asset for future validation of the Index, as it would allow for calculation of the FAR/FSI requirement as required in the Index and eliminate the need for validation using a proxy measure.

7.2.2. Proximity to a Variety of Services and Employment

The communities of Port Credit and Downtown Brampton both meet and exceed the prerequisite requirements of proximity to neighbourhood public services and

neighbourhood retail services. Over 99% of all residential dwellings in each community are located within an 800m walking distance of 5 or more neighbourhood public services, and 7 or more neighbourhood retail services. This well exceeds the health prerequisite of having ≥75% of dwelling units meeting the proximity requirements.

The community of Bolton, in Caledon, does not meet the prerequisite requirements for service proximity to either neighbourhood public services or neighbourhood retail services. Only 31.83% of all residential dwellings in the community are located within an 800m walking distance of 5 or more neighbourhood public services, and only 14.1% of all dwellings are located within the same distance of 7 or more neighbourhood retail services. This does not meet the health prerequisite for Service Proximity.

The communities of Port Credit and Downtown Brampton are able to meet and exceed this requirement for several reasons. Firstly, the design of each of these communities has a distinct commercial/mixed-use center that is accessible from a variety of residential dwellings in nearby high, medium, and low density areas because of its location in the *center* of the community – not on the *periphery,* as is often seen in less walkable, auto-oriented styles of development. This design means that sufficient numbers of residents are located in close enough proximity to the center to support a wide variety of public and retail services. Secondly, the permeable, grid-like street network in both Port Credit and Downtown Brampton creates a variety of route options for travel between any given dwelling unit and any given neighbourhood service. This network design also shortens the distance between any two destinations by allowing for more direct routes of travel.

The community of Bolton does not meet the health prerequisite for reasons similar to why the other communities do: Although Bolton has a distinct commercial centre, there are relatively few medium- and high-density mixed-use structures located in close proximity to the centre. The majority of surrounding dwellings are single-family detached homes. This, combined with the circuitous, highly impermeable street network found in Bolton, severely limits the number of dwellings that can access service and retail resources located in the commercial centre within an 800m walking distance.

These results provide insight into the importance of the service proximity prerequisite, while illustrating that the prerequisite can be met, and greatly exceeded, through efficient street-network design, central location of services within a community, and supportive higher residential densities located near the center. It is also apparent that the service proximity prerequisite is most accurately measured using a *network* distance (distances as they are traveled along the walkable network of roads, trails, and paths in a community), not using a *Euclidean* (straight-line, "as the crow flies") distance. This is because Euclidean distance does not account for the actual travel routes available to residents and instead assumes that one can travel easily, in a straight line, in all directions.

It should also be noted that these results indicate that the Service Proximity prerequisite, in its current form, is a valid measure of a walkable environment in the Region of Peel. We cannot yet determine, however, whether the actual *values* required in the current Service Proximity measures are valid in and can feasibly be applied to new greenfield development. This is because it was necessary to validate the measure in existing well-developed core-area communities to initially assess how well it captures

this important element of walkability. Therefore, further validation of the measure using newer walkable areas that have been developed on greenfield or intensification sites are necessary to determine the feasibility of implementing the Service Proximity requirements in future developments.

The communities of Port Credit, Downtown Brampton, and Bolton were all considered to be "primarily residential" for the proximity to employment validation. The health requirement associated with proximity to employment for this type of community is having a total number of full- and part-time jobs within an 800m walk of the community "center" that is equal to at least 50% of the total number of dwellings units in the entire community. Port Credit had a score of 49.88%, and thus received a "soft fail" for this measure; Downtown Brampton received a score of 200.89%, resulting in a "pass;" and Bolton received a score of 8.60%, resulting in a "fail."

The former two communities likely meet (or nearly meet) this requirement because of the variety of employment opportunities, in addition to the variety of mixed-use and medium-to-high density dwelling options, in their central community areas. Whereas, Bolton fails to meet this requirement because most of the employment opportunities in the community are concentrated in an "employment area" that is located on the edge of the community, more than two kilometers away from the nodal centre – beyond walking distance for most residents..

The "soft fail" result for Port Credit also indicates the difficulties that a community can face in meeting a "hard" cutoff for a measure like proximity to employment. With this in mind, some consideration in future iterations of the Index may need to be given to phasing in employment proximity requirements in stages. For

example, an initial requirement of 25% could be used, with the developer agreeing to increase the value to 50% within the next 5 years. Another option could also be added where a percentage of the employment proximity requirement could be met within a 10-, 20-, or 30-minute public transit trip from places of residence. It should also be acknowledged that economic factors outside the control of municipalities and developers can influence the location and availability of employment opportunities. Future revision to the Index should consider this, while at the same time recognizing the role that appropriate zoning has in creating the type of mixed-use development that makes locating employment near residential dwellings and commercial uses a viable economic option.

In the process of validating the proximity to employment measure, it became apparent that further revision is required in order to clarify how employment proximity is calculated in the Index. In particular, it is necessary to better describe how the community "center" should be defined and located and how users of the Index are to determine whether a community should be evaluated based on the "primarily residential" or the "primarily non-residential" requirement. Furthermore, this measure does not currently account for the fact that communities can vary widely in size and population. For example, a community of 275 gross hectares could contain 4,800 residential units, while a 500 gross ha community of equal residential density would contain 8,750 residential units. Using the current methodology, the former community would be required to have 2,400 jobs within an 800m walk of its "center," while the latter community would be required to have 4,375 jobs within the same 800m walking distance of its "center." To account for this discrepancy, it is suggested that future revisions of the proximity to employment measure also incorporate a component that requires a

"minimum number of centers per gross community area." Then, the measure could instead require that the sum of all full- and part-time jobs within an 800m walk of each of these community "centers" be equal to at least 50% of the total number of residential dwelling units in the entire community. Regardless. the process and results of this validation illustrate that further pilot testing, revision, and validation of this measure are necessary in order to effectively implement it and achieve the intended result.

7.2.3. Intersection Density and Block Size

The community of Bolton received a "fail" for its score of 45.31 intersections/gross km^2 and Port Credit received a "soft fail" for its score of 71.45 intersections/gross km^2, while Downtown Brampton met and exceeded the health requirement of 75 intersections/gross km^2 with a passing score of 128.43 intersection/km^2.

Bolton does not meet this credit because of its relatively circuitous, impermeable street network with many cul-de-sacs and dead-ends. Areas throughout the community often have only one or two entry/exit points along the road network, and few local roads connect directly to arterials. Bolton also has a variety of parks and conservation lands containing trails; yet, these trails do not appear to provide much additional connectivity, as they are largely recreational.

Conversely, the communities of Downtown Brampton and Port Credit generally have a well-connected, relatively compact, grid-like network of streets and pedestrian paths, which offer a variety of efficient walkable routes between destinations. The large difference in intersection density scores between these two communities can, however, be

attributed mostly to the large areas of parkland and industrial land found in the lakeshore and Credit River regions of Port Credit. These large areas are generally uninterrupted by roadways, sidewalks, or other pedestrian paths, and as such lower the overall intersection density of an area that would otherwise meet the health requirement of this measure.

The maximum block size results are similarly affected. None of the validation communities satisfied the related maximum block size measure, which requires that 100% of blocks within a community have a maximum net area of 1.5ha. In Port Credit, Downtown Brampton, and Bolton respectively: 79.31%, 67.61%, and 63.76% of all blocks were less than or equal to 1.5ha in size. These results are likely due to both the limitations of the methodology and data used (specifically, the lack of connectivity between roadway and pedestrian path/trail data, which resulted in the creation of larger blocks in the validation analyses than may occur in reality) and the fact that parks and industrial lots may be larger than 1.5ha, which lowers the overall score of the community.

These results indicate that further revision of the intersection density and maximum block size prerequisites should consider excluding large parks (>1.5 Ha in area), conservation areas, and heavy industrial lands from their requirements. This is justifiable for large parks as they are often traversable regardless of the presence of pedestrian paths, with the exception of forested conservation lands, ravines, and other types of parkland that act as a barrier to pedestrian movement. This issue could be further addressed through the addition of a requirement that all large parks (>1.5 Ha in area) which act as barriers to the pedestrian transportation network (e.g., ravines) must have appropriate pedestrian walkways, bridges, or cut-throughs within a suitable spacing distance (e.g., every 250-400m) to ensure maintenance of appropriate pedestrian

connectivity. Small parks of less than 1.5Ha in area could still be included in the intersection density requirement, while the above new requirements could apply to larger parks (> 1.5 Ha).

We are uncertain at this point whether or not industrial lands should be excluded from the requirements of these measures, as they are not traversable in the same fashion that an urban park (open space) generally is. It should be acknowledged, however, that it may not be feasible to have sufficient connectivity in large-scale, heavy industrial areas which may require a lot area greater than 1.5 net Ha; though, smaller block sizes and a higher intersection density may be achievable in light industrial areas. Additionally, existing zoning separation requirements likely restrict the location and placement of industrial areas in relation to commercial, residential, and mixed-use areas. Further validation and pilot testing would be required to ensure the suggested revisions to these measures are calculated and implemented effectively in a final version of the Index. Subsequent iterations of the Index should also attempt to incorporate other measures which address the need for a permeable and well-connected network of parks and open spaces, in order to encourage recreation while simultaneously providing additional route options for active transport.

7.2.4. Building Setbacks

None of the validation communities fully met any of the building setbacks prerequisite measures. This is in large part due to the fact that the maximum setback values are required of 100% of buildings of a given type (e.g., detached residential). Both Port Credit and Downtown Brampton did, however, receive a “soft fail”

classification for the detached residential and the commercial and light industrial setback requirements, with Port Credit having scores of 70.38% and 86.67%, and Downtown Brampton having scores of 79.16% and 69.27%, respectively. Bolton also received a "soft fail" for the commercial and light industrial structure setback requirement, with a score of 76.19%.

These results indicate that future iterations of the Index may need to allow for a small percentage (e.g., 5-10%) of a given structure type to have some leeway in the maximum building setbacks requirement. For example, there are a variety of detached residential structures in Downtown Brampton that have building setbacks greater than 7.6m, but less than 10m. Yet, the overall feel of the community in these areas is still relatively walkable, in part because the community scores high on other prerequisites, such as intersection density and service proximity. Additionally, the community of Downtown Brampton has a variety of other aesthetic features (streets trees, benches, unique design and architecture) that enhance the walkable environment of the community beyond the requirement of maximum building setbacks. Therefore, future iterations of the Index should also consider allowing for some flexibility in the maximum building setback requirements if other Aesthetics and Human Scale elements are included to compensate accordingly. It is also important to note that the current building setback prerequisite does not effectively capture many of the aesthetic qualities associated with a walkable community and that communities can not be expected to have a suitable aesthetic environment and associated human scale simply through meeting this prerequisite.

7.3. Conclusions

Overall, the validation results provide a few key insights into both the achievability of the prerequisite measures and issues associated with the calculation of measures as currently specified in the Index. It is apparent from the validation process and methodology that additional work is required to fully clarify some of the calculations in the Index and to further evaluate and test their ability to measure activity-friendliness through pilot testing and validation. We recommend that this work be conducted concurrently with the suggested public policy review and amendments found in Section 9 of this report, in order to ensure compatibility between the Index and supporting policies and documentation (see Section 6 Gap Analysis and sections 8 & 9 Detailed Assessment of Measures). Furthermore, additional work is needed to fully understand at which stages of the development process each requirement of the Index should be enforced and evaluated.

The validation results also illustrate that the concept of *walkability* is relative, in both a) how various people perceive communities as 'walkable' or 'non-walkable', and b) how the concept applies to different types of urban environments. Though Bolton was designated (by municipal planners) as a relatively 'walkable' community, the validation results have indicated that there are many potential design issues that hinder this community from being considered a truly activity-friendly, walkable one. Chiefly, three factors contribute to the "fail" results received by Bolton in this validation: first, the lack of: a medium to high density mixed-used (employment, commercial, and residential) nodal core; second, the lack of a well-connected, permeable street network with short distances between blocks and a variety of connections betweens local and arterial roads;

and, third, the separation of residential, employment, and commercial zones into largely single-use areas (with the exception of the small mixed-use center) that are not well connected to each other.

We must consider the possibility, however, that residents of small urban centers (such as Bolton) that are situated in largely rural municipalities may participate in forms of physical activity other than, for example, walking and bicycling as a means of active transport. Residents of such a community may utilize conservation areas, hiking or cycling trails, and other rural venues for recreation. And, although all of these destinations may require motorized transport to reach, they nonetheless offer excellent options for physical activity which are not currently captured in the Index. Therefore, in its current form, the applicability (and perhaps validity) of the Index is relatively limited outside of urban environments. Additional research and testing are undoubtedly necessary to determine optimal prerequisite and credit requirements for small urban-rural communities such as Bolton.

This validation has, however, shown that many of the important prerequisite requirements of the Index have been met, or nearly met, in existing relatively walkable communities in the municipalities of Brampton and Mississauga. The communities of Downtown Brampton and Port Credit illustrate that it is generally possible to achieve the prerequisite requirements (in an urban area) while simultaneously offering a variety of housing types and options for the marketplace and residents. The results also provide strong evidential support – in the form of validated targets and ranges based on empirical health research – for the desirability of some of the characteristics that are often present in qualitatively-idealized quaint and walkable communities, such as those examined here.

It is suggested that future development should look to Port Credit and Downtown Brampton, in combination with a variety of other sources (such as the Index, the Urban Form Case Studies that illustrate key policies in the GPGGH, LEED for Neighbourhood Development, and related research literature) as inspiration for designing healthy, walkable, activity-friendly communities.

Part C: Summary & Recommendations

Contents:

8. Healthy Development Assessment – Summary Table

This section summarizes the key factors in our healthy development assessment process. Table 1 presents each element (column 1) and its related health targets/ranges from the Index (column 2), existing standards (column 3), feedback from the consultation process (column 4), and feasibility of implementation (column 5). Furthermore, the table notes (in italics) the level at which each measure is both established by the developer (and so is measurable) and regulated during the development process (e.g., by municipal by-law).

A more detailed assessment of the Index and a roadmap for implementation is presented in Section 9.

Table 1. Summary of Healthy Development Assessment

Table Key: 'Bramp' = Brampton, 'Miss' = Mississauga, 'Cal' = Caledon; grey font = related to credit measures, black font = related to prerequisite measures; *italics* = level of development process in which measures are established by developers (and so measurable) or regulated by policy.

Element	Health Targets/Ranges*	Existing Standards	Feedback	Feasibility
1. Density	<u>Residential Density</u> • 35 dwelling units/ha • 35 to 85+ units/ha for credits	• Ranges depend on zone and/or use. • Miss: depends on district as well; e.g., maximum of 17 units/ha (low) up to ≤ 50 units/ha (med); high density uses FSI. • Bramp: city wide target of 35 units/ha. Maximum of 30 units/ha (low) to ≤ 200 units/ha (high). • Cal: Maximum of 16 units/ha to ≤ 87units/ha.	• Municipalities may have to change how they set density requirements. • Made easier if calculations coincide with current standards (e.g., GPGGH). • All regions must conform to Places to Grow (50 people + jobs per hectare). • 35 units/ha may be too low. • Difficult to measure mixed use. • *Developers determine actual density (to be evaluated) in block plans in accordance to the density ranges in the secondary plan.*	• Implementing the health target for density is largely feasible, as an average. • Currently, all regions must conform to Places to Grow. If health measure coincided with the Places to Grow requirements, then it becomes administratively easier to not only meet (for private and public sector) but also regulate. • Bill 51 allows setting minimum density requirements, which opens the door for this. • An average of at least the 35 units/ha health target seems feasible. • However, clarifying the calculation as it relates to greenfield vs. intensification is needed. • *Standards are set for each zone in Municipal zoning by-laws. Zones are then laid out at the secondary plan level for any given area.*
	<u>Commercial & Mixed-use Density</u> • 0.7 FSI/FAR • 0.7 to 3.0+ FSI/FAR for credits	• Cal: variation according to zone & area. Mixed use in Bolton Core encouraged to have > 1.5 FSI; must be ≤ 3.0 FSI. • Miss: commercial/office zones not at nodes have maximums as low as 0.5 FSI; other areas allow higher; some zones use gross floor area with other measures, instead. • Bramp: 0.5 FSI for some office up to 3.0+ FSI for mixed use zones.	• FSI may not accomplish our goals, in terms of eliminating 'towers in the park'. • Suggestions: percentage of lot coverage; percentage of streetwall along with a height maximum (and possibly minimum). • Others say FSI in conjunction with other health criteria better address our goals. • *Actual density established at lot level.*	• Somewhat feasible to implement, as FSI does appear in some municipal guidelines. • However, some suggest using an easier measure to calculate (e.g., % of lot coverage) or working with existing by-laws (e.g., 0m setbacks and height restrictions). • FSI with our other health criteria may be most effective, though – particularly for non-residential and maybe mixed use. • *Standards set in Official Plan.*

*See Appendix A. for the complete original Scoring Guide and Score Card for the Peel Healthy Development Index.

2. Service Proximity	<u>Proximity to Services</u> • At least 75% of residential units must be within ≤ 800m of ≥ 5 neighbourhood public services and ≥ 7 neighbourhood retail services	• No proximity standards exist.	. • Incorporate service proximities of 400m, as that reflects a residents' more immediate neighbourhood. • Clarity in wording of measure required to understand applicability to greenfield vs. intensification. • *Established at secondary plan (distribution of zones) and block plan level.*	• Different proximity health ranges are more feasible to implement than others. • The health range for proximity to public and retail neighbourhood services is the most feasible, as adding or requiring new services in an existing or new community is often viable. • All health targets would need to be reduced or altered to be feasible across the region. • Adjusting the measure for greenfield vs. intensification is necessary to be practical region-wide. • *No standards exist for proximity measures.*
	<u>Proximity to Employment</u> • Centre of primarily residential communities must be within ≤ 800m of the same number of full-time jobs as 50% of the number of dwelling units. • Centre of primarily non-residential communities must be within ≤ 800m of the same number of dwelling units as 50% of the number of full-time jobs.	• No proximity to employment standards exist.	• Employment proximity may be one of the most difficult to implement and meet. • Need design guidelines that will become key drivers in block plan design. • We may want to consider allowing part of this requirement be met within a certain transit time to employment from residents. • *Established throughout as well as after the development process.*	• The health range for proximity to employment is the least feasible prerequisite for two reasons: 1) requiring the addition or inclusion of large amounts of employment in some areas is simply not viable and so poses a challenge to developers, and 2) the number of jobs would be unknown at the block plan level, where this would most likely be assessed, particularly for greenfield. • Assumed projections of development characteristics could be used to roughly assess employment numbers. • Places to Grow has guidelines for assessing this preliminary level. • *No standard exists for employment proximity.*
	<u>Other Service Proximity Measures</u> • Consideration: access to sufficient number of jobs via transit. • Credits address higher targets for the prerequisite measures as well as proximity to transit stops and % of dwellings within a 30-minute transit trip of 60,000-140,000+ jobs.	• No other proximity standards exist.	• Transit stop placement and service frequency are not determined by planning, which is a challenge. • Transit type and convenience are important and affect behaviour (15 min. door to door vs. 10 min walk, 10 min ride, 5 min wait, 10 min ride, 15 min walk).	• Transit stops are not determined by planners; so, this would require coordination with other departments to be more practical. • However, Caledons' OP does include consideration to proximity to transit but no guidelines or set standards. Alternatively, Canadian Institute of Transportation Engineers and the Ontario Ministry of Transportation both recommend a walking distance of 400m. • *No standard exists for other types of service proximity.*

3. Land Use Mix	<u>Heterogeneity of Land Use</u> • Credit earned for providing new neighbourhood services, outdoor public space, and a mix of housing types within 1km of the community centre;	• Bramp & Miss: standards do not exist; however, mixed uses are encouraged and provided for within particular by-law zones and in certain districts (e.g., city centres). • All: different housing mixes are encouraged according to zone (e.g., more multifamily near nodes) but not enforced.	• Surprised this is not a prerequisite – we need to encourage mixed use structures even more. • Make language consistent with OP terminology. • Affected by minimum zone separations. • *Established at secondary plan (distribution of zoning) and block plan levels..*	• These health ranges are feasible, at least in greenfield. • Does not really apply to smaller intensification development; measure could be altered to do so, though. • Limiting zoning allowance for mixed use is problematic. • Consistent terminology (with other standards) is important for implementation. • *Relevant standards set in Official Plan and zoning by-laws.*
	<u>Heterogeneity of Parcel/Building Use</u> • Credit earned for providing pedestrian uses in commercial buildings, mixed-use buildings, and multifamily residential buildings.	• Miss: mix use buildings encouraged in mix use zones near nodes. • Bramp: percentage of uses within buildings contingent on location; however, ground floor retail below residential is permitted in mid-rise buildings.	• Offer weighted credit scores to further encourage mixed use buildings. • Could use a more extensive set of criteria to better define healthy development and apply in varying contexts. • *Established at secondary plan and block plan levels.*	• *Relevant standards set in Official Plan and zoning by-laws.*
	<u>Mixed Housing Types</u> • Credit earned for providing a mix of housing types while limiting large lot detached homes.	• All: different housing types and their mixes are encouraged according to zone. Zoning by-law determines which type is permitted. Segregation by housing type is discouraged.	• Could limit large lot houses even more (lot length and %). • *Established at secondary plan and block plan levels.*	• *Standards set in zoning by-laws.*
4. Street Connectivity	<u>Intersection Density</u> • 75 intersections/km^2 (average) • 75-150+ intersections/km^2 (average) <u>Block Size</u> • Max. block size: 1.5ha (not an average)	• Bramp: intersections discouraged between local roads and minor arterials up to a max spacing of 400m between transit stops. • Cal: limit intersections & driveways to protect traffic capacity.	• Opposition from traffic engineers (safety) and developers (expense). • Main problem: permeability and eliminating 'superblocks'. • Need 'intent' intro blurb. • *Established at secondary and block plan levels as well as by transportation departments.*	• A challenge to implement at current health range. • Does not apply to intensification as is. • Could emphasize bike/walk connectivity to offset a reduction in street connectivity. • Explicitly addressing permeability may provide more feasible (initial) standards. • *Standards set in Official Plans, influenced by traffic engineers/transportation departments.*

5. Road Network & Sidewalk Characteristics	<u>Complete Streets</u> • All new local roads ≤ 40km/h • All new non-local roads ≤ 50km/h • According to traffic speed, communities must meet the requirement for number and width of sidewalks, vehicular lanes, and bike lanes.	• All: sidewalks usually required. No association with traffic speed, though. • Bramp: master plan encourages cycle lanes where off-road routes are lacking; lane width is 1.5-1.8m. • Standards generally do not correspond with health ranges.	• Will face lots of opposition. • Requires higher-level policy change for traffic speed, road width, etc. • Public health vs. auto safety. • Cost–benefit analysis; prove this is for the 'greater good'. • Very important. Don't let it go. • Consider emergency vehicles. • Appropriate for intensification? • *Mostly established by transportation dept; however, local roads can be established under approval in secondary and block plans.*	• Not easily implemented. • Best dealt with using a comprehensive approach and multiple policy adjustments. • Would need to negotiate by-law change, as well as work with transportation engineers. • Need to adjust for most intensification developments. • Aligning these measures with current design standards would improve feasibility. • Good urban design can also calm traffic. • The Region has authority over regional roads and the municipality over local roads. • *Most standards set by transportation depts.* • *Standards for road widths are included in Official Plans (regional roads and major arterials given in a schedule) and secondary plans (local road width).*
	<u>Other Road/Sidewalk Characteristics Measures</u> • Credits earned for traffic calming, lowering traffic speed and creating woonerfs, implementing various cycle-friendly designs, and incorporating pedestrian-friendly (safe & aesthetically-pleasing) lighting.	• All: lighting requirements exist but do not correspond with the health ranges. • No current planning standards for other measures. • Bramp & Miss have Community Safety Zones where speeding fines are increased.	• Traffic calming currently is prescriptive, not preventative. • Should be incorporated from the beginning. • *May be established at secondary or block plan levels or, in some cases, after development (e.g., traffic calming).*	• See above feasibility comments. • *Some relevant standards are set in Official Plans and by-laws.*
6. Parking	<u>Parking: Key Recommendation</u> • Recommendation to eliminate minimum parking requirements.	• All: Municipal zoning by-laws require a variety of parking minimums based on zoning and/or land use designation. • Miss: can approve in-lieu fees or reduced requirements in some areas. • Bramp: may allow exemptions to standards when existing facilities are sufficient.	• Developers will love the recommendation, but some may try to take advantage of it. • We would also need to provide alternatives (to driving and parking). • Why not just reduce minimums?	• A new standard but potentially feasible. • Would have to work with municipalities to change by-laws. • Reducing the minimums is a feasible initial step, if suitable. • Alternatively, simply eliminate in-lieu fees for developers to build less parking. • Must provide alternatives to driving. • *Standard set in zoning by-laws.*

		• Cal: can approve in-lieu fees in Bolton Core.		
6. Parking con't…	Other Parking Measures • Credits earned for unbundled parking, shared parking, market rate parking zones, increased parking difficulty, parking location in rear and side of buildings, and limiting parking in front setbacks, in particular.	• Rear parking permitted in some contexts or may be considered for approval – subject to an engineering and design study.	• All credit measures are challenging to implement. • Unbundled and shared parking are established after the development process, not by the developer, and so could not be evaluated, as is.	• Requires further input from a knowledgeable traffic engineer. • *Standards regarding parking location and difficulty are addressed in zoning by-laws*.
7. Aesthetics & Human Scale	Setbacks • Note that setback requirements in the Index are expressed as *maximums*; whereas, setbacks in zoning by-laws are set as *minimums.* • *Maximum* setback ≤ 7.6m for detached and semi-detached residential structures. • Setback ≤ 4.6m for attached and multifamily residential structures. • Setback ≤ 3m for commercial and light industrial structures. • ≥ 70% of front façades and main entrances of commercial/mixed use are flush with sidewalk. • Main entrances of residential, commercial, and light industrial cannot front onto parking lots.	Residential • Miss: *minimum* setback of 3.5m up to min. of 9m, depending on zone and dwelling type. • Bramp: min. of 1.2m • Cal: min. setback of 7.5m up to min. of 18m, depending on zone Commercial. • Miss: min. 4.5m, except 'main street' min. of 3m. • Bramp: 2m or less (downtown) up to 21m. • Cal: no min. for core commercial zone; other zones range 9-18m min.	. • Need to change by-law setback minimums and zoning separations. • May be able to increase streetwall requirements. • Conflict with hydro easements needs to be considered. • "Flush with sidewalk" requirement could limit the availability of sidewalk and adjacent space for café patios, etc. • *Established at property level.*	• Setback prerequisite is very feasible. May even be able to set higher standards. • Setbacks need to work in conjunction with block plan development. Define expectations in design guidelines.. • May be able to use new *development permit system* to create standards that developer agrees to meet within their block plan. • *Standards set in zoning by-laws.*
	Other Aesthetics & Human Scale Measures • Credits earned for building height to street width ratios between 1:3 and 3:1, limiting blank walls, encouraging transparent glass facing public space, encouraging streetwalls, and having a high percentage of streets with street trees.	• All: building height restrictions exist in some zones/districts, but not building height to street width ratio. • However, Mississauga's OP allows for greater building heights to achieve enclosure on roads wider than 20m. • No standards that apply to blank walls or the planting of street trees. However, all have by-laws for the preservation of existing streets.	• Developers currently pay for street trees. • May be able to increase streetwall requirements. • Established at block plan and lot level.	• Need comprehensive Design Guidelines to address these issues. • Feasible: Should prepare comprehensive standards, such as a zoning standards schedule, so that the following by-laws work in accordance. • *Standards set in zoning by-laws.*

9. Healthy Development Assessment – Detailed Findings & Recommendations

In order to create improved public health through built form intervention (i.e., 'healthy development'), the goal should be to develop policies that a) prescribe quality development and good urban design to comprehensively satisfy the needs of public health and b) can be realistically implemented through private initiatives. The Index was initially developed in the context of applying new policies and initiatives to large greenfield developments[1], where an entire community may be built from scratch. However, in order to be applicable across the region, policy development needs to be examined from the perspective of both greenfield and intensification development. This is necessary, because while change may occur rapidly as part of comprehensive revitalization plans within some existing communities, it may be slow and achieved in a patchwork manner in others. Therefore, policies for intensification development that maintain high densities and encourage new destinations, services, and other healthy development aspects of the built environment, need to be established.

In light of the necessity to address both intensification and greenfield development contexts, this section provides a detailed assessment of the Index and offers suggestions for achieving healthy development in both intensification and greenfield development contexts. Each element (with a focus on prerequisite measures) is discussed in relation to its health importance; a comparison of calculation methods; targets and ranges with respect to health and current policy, while establishing where the existing

[1] Note that the term 'development' is used throughout this section to refer to both greenfield and intensification development projects, and replaces the term 'community' that was used in the presentation of the Tool, itself, in Appendix A. The term 'development' is more appropriate in this context as it differentiates between *new* developments (which are the focus of this report) and *existing* communities/neighbourhoods in general.

policy is regulated; and any barriers to implementation, including the feasibility of health targets. Additionally, using the findings from the consultation and assessment processes, along with input from Dan Leeming, we present a series of recommendations and action steps for each element.

Furthermore, Section 10 synthesizes these actions steps into a series of general and specific key recommendations for the Region of Peel and its development contexts.

9.1. Density

9.1.1. Health Importance

Density interacts closely with service proximity and land use mix to determine the concentration and distribution of people and destinations in the built environment. Communities with higher residential densities are better able to support a variety of services, employment, and other destinations within walking distance of where people live. A review of the research literature shows that both residential and population density generally have significant positive associations with walking and physical activity outcomes (e.g., Filion et al., 2006; Frank & co., 2005; Lee & Moudon, 2006). Greater population density is also significantly associated with lower BMI (Body Mass Index, a measure of obesity) (Rundle et al., 2007), obesity rates (Fleissig & Jacobsen, 2002), and vehicle ownership (Litman, 2009).

9.1.2. Calculation of Measures

Residential density is calculated in a similar way in both the Healthy Development Index and in existing by-laws and guidelines within Peel. All use

residential dwelling units per net hectare as the measure. In the Index, the net area (Ha) value includes all vacant and developed residential, mixed-use, and commercial land but excludes public spaces, streets, other public rights of way, and lands with zoning designations other than those specified above (e.g., industrial). In existing municipal policies, the net area measurement differs slightly from how it is measured in the Index. In Mississauga, the net area value for dwelling types with individual frontages (e.g., detached, townhomes) includes all land for residential lots, excluding public and other forms of private roadways. For condominiums and apartments, Mississauga includes all land for residential units, private internal roads and parking, landscaped areas, private open space, and other associated amenities in the net area value. Brampton and Caledon include all land within a Secondary or Block plan excluding perimeter boundary roads.

Commercial density is sometimes measured as FSI/FAR in existing municipal policies, but not consistently. For example, in Brampton and Mississauga, a combination of building height, gross floor area, and other measures are used to set standards for commercial lots in nodal zones.

In regards to residential density, it is important to note that all regions must now conform to Ontario's *Places to Grow: Growth Plan for the Greater Golden Horseshoe* targets. For greenfield, this is no less than 50 people plus jobs per hectare measured as gross density; however, higher minimums (e.g., 150/ha) are set for urban centres and intensification corridors, as found in areas of Mississauga and Brampton. Incorporating this calculation of population and employment density into the Index's density measures may increase the ease of implementation and acceptance.

During the stakeholder process, it was recommended that building height restrictions that were part of the FSI/FAR requirements in the initial draft Index – to prevent such problems as the 'tower in the park' (i.e., density without proximity) – were removed. The following alternatives have been suggested: 1) percentage of lot coverage; 2) a minimum streetwall (0-2m setback) percentage in conjunction with a height restriction (as recommended in the Hurontario Main Street Study); and 3) FSI/FAR in combination with other walkable streets criteria (e.g., building height, frontage, streetscape, setback).

Existing municipal density expectations and policies are defined by land uses that are set out in the Official Plan and Secondary Plan. Zoning then follows with relevant by-laws for specific density maximums in each zone (e.g., Residential 1, Residential 2). These zones are assigned to a given area of land at the Secondary Plan level and used to regulate development applications. Density standards do exist elsewhere, however, such as those present in provincial mandates (e.g., *Places to Grow*).

9.1.3. Targets and Ranges

The health prerequisite for residential density is 35 dwelling units per net hectare, including residential, mixed-use, and commercial zones but excluding public spaces, streets, other public rights of way, and other land uses other than those specified above (e.g., industrial). Mississauga, Brampton, and Caledon all have existing zoning by-laws and policies for densities to meet or exceed this health prerequisite at a municipal level. For example, Brampton has a city-wide target of 35 dwelling units per hectare – the same as the health prerequisite – and its high density residential zones allow densities up to 200

units/net ha, easily accommodating the highest credit score in the Index (80+ units/ha). However, existing standards vary greatly according to zone (e.g., high vs. low density residential) and location (e.g., rural service centres vs. hamlets) within each municipality. Despite Brampton's city-wide target of 35 dwelling units per hectare, the *maximum* density for low density residential zones is only 30 units/ha total. Similarly, in the rural service centre of Bolton, low density residential restricts *maximum* densities to 16.6 units/ha, while medium density zones stretch that *maximum* to merely 30 units/ha.

In other words, even though the health targets can be reached across the municipalities, areas exist in which the maximum density allowed in a given development would be less than the minimum health prerequisite. The challenge, then, is to increase the lowest maximums (e.g., 12 units/ha, 16.6 units/ha) to the health minimum of 35 units/ha. A higher-level discussion will need to take place in order to consider health needs in conjunction with sustainability and other issues. Moreover, a diverse mix of development will need to be encouraged.

The health prerequisite target for non-residential density is 0.7 FSI/FAR for commercial and mixed-use buildings. Mississauga, Brampton, and Caledon all use FSI in their planning standards; however, use of FSI varies across zones and districts so greatly that the measure is too inconsistent across municipalities to be immediately applicable. For example, in Caledon, non-residential buildings in the Bolton Core area are encouraged to have 1.5 to 3.0 FSI, which allows buildings to meet and exceed the health prerequisite. Yet, this is not a municipality-wide policy, and, in other districts, the measure is not used or restricts building to a value below the FSI health target. Meanwhile, Mississauga and Brampton only apply the measure to specific office and

mixed-use zones (some of which allow the health target), using different measures for commercial zones (including building height and gross floor area). Therefore, the non-residential density target is a challenge to implement, simply because of the lack of region-wide policy to complement it. The challenges and need for discussion are the same as for residential density (previous paragraph), including the need for a diverse development mix.

9.1.4. Barriers to Implementation

The major challenges facing the implementation of density health targets are 1) the lack of universality within health, municipal, regional, and provincial residential and non-residential density standards and between those standards and the prevailing market conditions; 2) Official Plans that do not sufficiently address the health and built environment relationship; 3) lack of clarity and information provided in the Index's density calculations; and 4) the absence of a common non-residential density measure, used throughout the Region and at all levels of the development process.

Currently, neither region- nor municipality-wide standards exist that require, encourage, or even permit developers to meet health targets throughout all three municipalities. This lack of universality means that each municipality offers its own challenges to applying the health targets, as only certain areas and zones within the municipalities accommodate densities high enough to meet the density prerequisites. For example, in Caledon, only medium or high density residential zones within designated *rural service centres* allow residential densities to meet the minimum health target (35 units/ha). Other zones have maximum densities as low as 16.6 units/ha, well below the

minimum health target. As a result, in these lower-density zones, developers would need to negotiate an amendment to the existing maximum density by-laws in order to exceed current standards and meet health targets. Moreover, even though the municipalities may be willing and able to amend the by-laws in such cases, a developer who lacks incentive to meet the health target may simply not seek an amendment, satisfy the by-laws, and not build to the density health targets – without repercussions from existing policy.

Furthermore, the prevailing market conditions that reflect demand for low, medium, and high density housing need to be addressed. The rationale for higher density development needs to be emphasized and encouraged through initiatives related to public health, climate change, ageing populations, etc. – using mandatory policies *and* voluntary educational programs.

Residential and non-residential land uses and then by-law zones are assigned at the Secondary Plan level and must conform to guidelines set out in the Municipal Primary Official Plan. Because Official Plans can be difficult and time-consuming to change and because Secondary Plans are a challenge to amend at later stages of the development process, this creates a significant barrier: Development applications may be submitted for developments within land use zones that have been long established in a Secondary Plan which was originally designed without healthy communities in mind (or in the Official Plan). As a result, the new developments are subject to the density maximums of that zoning, and so developers would have to have the area rezoned or the by-laws amended in order to freely meet health targets. As described above, this makes enforcing the health targets a much greater challenge, as developers can easily meet existing standards in many areas without even approaching health targets.

The Index's density calculations require revision in order to clarify their application to both mixed-use buildings (e.g., must the residential component of a single mixed-use building meet residential density targets?); and to small areas of intensification development (e.g., does calculating the density for a building on a very small lot provide a fair health score for that development?). Moreover, the calculations fail to provide information about or account for whether the existing neighbourhoods which surround new intensification developments should be included or excluded from the measure. And currently, the measure does not accurately reward or encourage intensification such as infill development, redevelopment, development of vacant and/or underutilized lots, and expansion or conversion of existing buildings that would contribute to the maturation of those existing neighbourhoods.

Finally, the lack of a common non-residential density measure complicates implementing health targets across municipalities, districts, and zones. Without a common measure, an unnecessary conversion process must be in place in order to calculate, compare, and then regulate development applications in relation to existing standards and to health targets. In some cases, comparable measures do not even exist.

9.1.5. Recommendations and Action Steps

We make the following recommendations regarding the implementation of Density health targets in the Region of Peel.

a. *Establish a comprehensive plan that addresses Density at all levels of the development process (e.g., Official Plan, Secondary Plan, Zoning, Site Plan, Guidelines).* If emphasis is placed on just one level of the process (e.g.,

zoning by-law), then a) the strength and consistency of regulation is diminished as health targets for density are only being enforced at one stage of the development process; and b) future standards may not be developed in accordance with public health needs, as they are dictated by the policies that reside over them (i.e., new by-laws are created in accordance with Official Plan Design Guidelines). The subsequent recommendations are all individual aspects of this comprehensive approach.

b. *Create universal targets (and measures) that require and encourage developers to meet both health and policy standards, simultaneously*, and that allow developers to meet health targets with ease – without an appeal process. This should be done by setting region-wide standards that correspond with health targets and reside over municipal standards, guiding the creation of future municipal Official Plans and so by-laws. And, where possible, direct change should be made to municipal documents (e.g., Official Plans, zoning by-laws) to accommodate density health targets in all applicable areas within the region.

c. *Make the rezoning process easier for developers.* This is useful for implementing density targets in two ways: First, if by-laws remain unchanged, then developers could apply to rezone an area to one that better accommodates increased densities. Second, changed by-laws or not, a clearer and more responsive rezoning process would allow developers to increase residential densities in primarily non-residential areas and increase

employment in primarily residential areas –helping to achieve healthy Density, Service Proximity, and Land Use Mix.

d. *Increase intensification opportunities in intensification areas defined in the Provincial Growth Plan* . In other words, encourage higher density redevelopment in urban growth centres, intensification corridors,transit hubs, and other areas of opportunity such as infill, redevelopment and brownfield sites). This would require not only policy change that allows or enforces this design but also guidelines that dictate how it is implemented. .

e. *Emphasize the rationale for higher density development through various policy-based (mandatory) and educational (voluntary) programs.* This could be achieved through initiatives related to healthy communities, climate change, aging populations, transportation, affordable housing, community engagement, etc.

f. Find a common non-residential density measure (such as FSI) that can be applied across the region and incorporated into all existing policy. Existing non-residential density standards are inconsistent (in their measure, calculation, and targets) across the region. A common measure will increase the ease of implementing health targets.

Without higher density development, nearby services are not economically viable, meaning that Service Proximity and its targets are not achievable without supportive density. Furthermore, without nearby services, land use mix is minimized, and residents must travel long distances – most likely by car – to fulfill their daily needs. Thus, the

implementation of the health requirements for Density is essential to ensure Service Proximity and Land Use Mix can be achieved and maintained.

9.2. Service Proximity

9.2.1. Health Importance

Service and employment proximity affect the travel distance to any given destination and interact closely with density and land use mix in the creation of walkable environments. Communities having a variety of services and opportunities for employment within close proximity of their residents encourage walking or cycling trips to and between daily destinations. The research literature shows that proximity to community services, commercial retail establishments, schools, and parks are all positively associated with a variety of walking outcomes (Berke et al., 2006; Larsen et al. 2009; Lee & Moudon, 2006; Moudon et al. 2006). Grocery stores, schools, workplaces, and parks tended to have the strongest associations (e.g., Cerin et al., 2007; Frank & Co. 2005).

9.2.2. Calculation of Measures

Service Proximity consists of a variety of measures and calculations. The prerequisite consists of two types of proximity – proximity to services and proximity to employment. Proximity to services is measured as the percentage of residential units within an 800m walk (i.e., by the street and path network, not straight-line distance) of at least 12 neighbourhood services – including neighbourhood *public* services (e.g., schools, parks) and neighbourhood *retail* services (e.g., grocery, barber). Proximity to

employment, on the other hand, measures the ratio of jobs to residents (and residents to jobs) within the development – with the greater component (measured as the total within the development) not exceeding a 2:1 ratio of the lesser component (measured as the total within an 800m straight-line buffer distance of the centre of the development).

Although none of these calculations exist in current municipal, regional, or provincial policies, feedback suggests that the service proximity targets are feasible for larger greenfield and certain areas of intensification (e.g., near nodal centres) development. However, the health standards would need to be approved and in place prior to the preparation of associated Block and Secondary Plans.

Standards that indirectly determine Service Proximity are found at all levels of policy. For example, at the municipal by-law level, densities affect the economic viability of nearby services; setbacks and permitted building uses affect distances to and location of neighbourhood services. Moreover, the Secondary Plan level establishes the location of zones in relation to one another and thus the separation (or mixing) of residential, mixed use, commercial, and employment zones, which in turn affects the distances to both services and employment.

9.2.3. Targets and Ranges

The prerequisite for service proximity has two types of targets: proximity to neighbourhood services and proximity to employment. Specific municipal zoning by-laws and regional standards and guidelines do not exist for either of these targets in the Region of Peel. However, a multitude of existing by-laws affect proximity (e.g., minimum zone separations; permitted land uses; minimum setbacks). Yet, these existing

standards do not complement the health targets; e.g., large minimum setbacks increase the distances between buildings within any given zone; minimum zone separations often extend the gap between uses (e.g., residential and employment) beyond walking distance; and minimal mixed use allowance restricts the opportunity to locate neighbourhood centres within walking distance of most residents.

Stakeholder feedback suggests that the service proximity targets (≥ 75% of residential units having ≥ 12 neighbourhood services within an 800m walk) are more feasible than the employment proximity targets (primarily residential development: centre of development within 800m of the same number of full- and part-time jobs as 50% of the number of dwelling units in the entire development; primarily non-residential development: centre of development within 800m of the same number of dwelling units as 50% of the number of full- and part-time jobs in the entire development), particularly for larger greenfield developments and intensification within urban centres, where nearby services already exist. However, both targets and their measures would need to be altered to be feasible in all three municipalities and to accommodate all types of intensification and greenfield development.

Furthermore, expert opinion (Dan Leeming, 2009) suggests including 400m (or 5 minute walk) distances along with the 800m (or 10 minute walk) targets, since most neighbourhood activity occurs within 400m of the home, particularly for the young and old. An 800m distance is best applied to higher order transit, schools, employment, etc.

9.2.4. Barriers to Implementation

The primary barriers to implementing Service Proximity health targets are a) the limited ability of developers to predict and control the future business and employment opportunities in a development that is yet to be built; b) the lack of any existing standards that sufficiently require or encourage healthy service and employment proximity; c) the difficulty in applying the health targets to all new developments and, with that, the inability of the prerequisites to encourage greater service proximity where the prerequisites are not feasible; d) a flaw in the proximity to employment calculation method which skews results for large developments; and e) the challenge of applying the Index throughout the development process, particularly as it relates to a new development being built within an existing Secondary Plan.

The creation of jobs and, to some extent, services is not in the control of the developer. Municipalities exert control by designating land uses and zones that only allow certain uses. Additionally, greater economic and social forces determine the viability of employment and business in a given area. As a result, in most cases, the number of jobs that a new development will provide cannot be known – and so calculated for our measure – prior to construction. That said, municipal and regional standards can be improved to encourage the location of employment and services near to residents, creating mixed use areas that foster an economic environment in which services and subsequent employment opportunities are viable. For example, some existing Official Plans, such as that of the Municipality of East Gwillimbury (Town of East Gwillimbury, 2009), require a ratio of employment (to residents) be built before any new residential can be built.

Regional or municipal standards that specifically address service proximity are not clearly defined. In fact, existing by-laws indirectly restrict a development's ability to meet the health targets for proximity, because they generally encourage a separation of residents and their daily destinations – employment and neighbourhood services. As a result, only a minority of residents are within a reasonable 5-10 minute walking distance of any daily destinations – perhaps just an elementary school or convenient store – and so must drive for most, if not all, trips. Therefore, the lack of existing proximity standards and measures that complement health targets means that, in order to effectively meet the health targets, developers are forced to overcome a variety of indirectly-related policies, as opposed to working with one, health-related standard. In turn, one would not expect a developer to meet the health target until the incentive exceeded the cost involved. Even with such incentives, higher levels of proximity could only be achieved with a cooperative municipality (both staff and politicians), supportive infrastructure (e.g., school boards, public transit board), and health standards that were set and approved prior to development in order to guide the entire process.

The current prerequisites are inherently biased towards intensification and greenfield development located near existing service and/or employment centres (e.g., intensification in downtown Mississauga), as well as towards greenfield development large enough and with enough nearby residents to support and include the required neighbourhood services. This is not inherently negative, as it encourages adjacent development instead of 'leapfrogging'. However, nearly all intensification developments in either large existing single use communities (e.g., residential suburbs) or areas with low density surroundings will not meet the proximity health prerequisites, due to the lack

of services and employment opportunities in these existing areas. This is problematic, because the Index needs to be able to encourage long- and short-term routes to satisfying the health targets in both intensification and greenfield development. In many cases, this will need to happen in a patchwork – piece by piece – kind of way. In other words, many small intensification projects will gradually add up to create a large, walkable community. Therefore, measures which allow developments to meet health standards by, for example, providing a number of new services to an existing neighbourhood (e.g., the Heterogeneity of Land Use Mix credit score in the Index) should be incorporated into the prerequisites and applied where appropriate.

The proximity to employment calculations also lose validity when they are applied to increasingly large developments or communities. This is because the calculations compare the number of dwellings units (or jobs) within 800m of a development's centre with the number of jobs (or dwellings units) within the *entire* development. Therefore, if the entire development extends significantly beyond an 800m radius of its centre, then the calculation may misrepresent the development's land use distribution as a whole. For example, all of the residential units could be located near the perimeter of the development, far from the nearest service or job (located within the centre), and so eliminate the mix of uses that the Index is attempting to achieve while still meeting the health target. The measure and its calculation need to be altered in order to capture a more walkable distribution of land uses when applied to particularly large developments or existing communities (as in our validation process).

Lastly, Service Proximity and other measures that are affected by land use policies are particularly challenging to implement in intensification contexts. This is

because existing Official Plans and Secondary Plans were likely created without the knowledge of factors that promote healthy communities, such as proximity to services and employment. As a result, retrofitting existing built form to incorporate proximity targets cannot happen without significant upheaval that addresses not only zoning by-laws and Secondary Plans, but also individual existing property rights, often on an extensive scale.

9.2.5. Recommendations and Action Steps

As with the Density recommendations, above, we recommend a comprehensive approach to implementing Service Proximity that addresses changes to planning and guideline documents at all levels of the development process. Addressing policy from a regional or municipal level will minimize the obstacles faced by developers in achieving Service Proximity and will maximize the potential of future Secondary and Block Plans leading to healthy communities. The following recommendations all reflect this approach.

- *Create clearer Service Proximity design criteria in municipal Official Plans and through Urban Design Guidelines.* This will result in the creation of future Secondary and Block Plan designs as well as new by-laws that are favourable to public health goals.
- *Address Employment Proximity targets at a high level.* Municipal and regional policies need to be in place that allow and encourage employment opportunities near all residents – not just in centralized commercial zones. This could be achieved by establishing live-work ratio standards (the

proportion of people to jobs in a given area) and, in turn, by creating multiple neighbourhood centres and activity nodes within each municipality.

- *Amend by-laws that indirectly restrict proximity.* Policies such as minimum zone separations and, in particular, the existence of so few mixed use zones are in need of immediate attention, as they pose major challenges to achieving proximity.
- *Make policy change that encourages or requires intensification development that provides neighbourhood services within primarily residential areas, and residential dwellings within primarily commercial areas.* Currently, this is inconvenient and difficult for developers to achieve, should they want to, because of the need to have by-laws amended, zoning changed, etc.. A similar target should be incorporated into any future versions of the Index – similar to the Heterogeneity of Land Use Mix credit score – and applied where appropriate (e.g., for intensification development in single-use or low density neighbourhoods).
- *Address several drawbacks to the existing Index's Service Proximity requirements.* In general, the requirements need to be altered in order to be more inclusive of various development contexts – small-scale intensification in particular. Recommended changes include: adding a 400m walking distance destination requirement to the 800m proximity distance; incorporate a transit trip option in the employment proximity standards; and consider using employment projections (i.e. estimates) to determine employment numbers at earlier stages in the development process;

9.3. Land Use Mix

9.3.1. Health Importance

Land use mix directly affects distance between, and availability of, a variety of services and destinations in a community. Communities with a heterogeneous mix of residential, service, and employment areas allow their residents to fulfill daily needs on foot or bicycle. The research shows land use mix to have a generally positive association with walking frequency and distance (Frank et al. 2007; Hurvitz, 2005; Lee & Moudon, 2006; Li et al., 2008; Saelens et al., 2003), amount of physical activity (Frank et al., 2005; Li et al., 2008; Saelens et al., 2003), lower BMI (Rundle et al., 2007; Saelens et al., 2003), and lower obesity rates (Li et al., 2008; Saelens et al., 2003)). And, land use mix within a 1.6km buffer of school was significantly associated with children walking to and from school (Larsen et al., 2009).

Because it is determined by the relative mix of dwellings, services, and employment in an area, and because there is no "ideal" proportion for each type of land use for health in the literature, land use mix does not contain a prerequisite in the Index. Instead, factors that affect and encourage land use mix are captured in the service proximity and density prerequisites of the Index.

9.3.2. Calculation of Measures

Currently, the Index does not use any one measure for capturing land use mix. Instead, the Index uses a series of credit score measures to reward the inclusion of factors

that contribute to an effective mix of land uses (e.g., providing a variety of new services to an existing community; containing a variety of housing types that accommodate varying densities, incomes, and housing needs) and provides a narrative describing what constitutes an appropriate land use mix for healthy developments.

The lack of a prerequisite for land use mix is not a reflection of it being a non-essential element – in fact, the opposite is true. Because no validated measure exists in the literature that adequately captures an ideal land use mix, the Index a) encourages an effective land use mix by presenting a corroborated vision of it in our narrative and b) requires an effective land use mix by capturing the functional purpose of it (people and their daily destinations located in the same neighbourhood) in our service proximity and density prerequisites.

In the literature, the most common measure of land use mix is the land entropy equation (Frank & Pivo, 1994), which calculates the evenness of distribution of built square footage among several land uses. We chose not to use this measure, because it assumes that an exactly equal distribution of square footage among land uses is optimal, despite a lack of empirical scientific evidence to support such a distribution. As no other ideal proportion of land use mix has been determined in the health literature, the Index focuses on residents' proximity to their daily destination, which acts as a precursor to a healthy land use mix.

Land Use Mix is regulated by the Official Plans and zoning by-laws. However, the inclusion and layout of mixed use zones are established at the Secondary Plan level. Furthermore, qualitative descriptions of appropriate land use mix in Urban Design and

Sustainability Guidelines can dictate amendments to zoning and Secondary Plans later on.

9.3.3. Targets and Ranges

As stated above, the Index does not include a Land Use Mix prerequisite. For a better understanding of targets and ranges related to achieving a healthy mix of land uses, see the appropriate subsections for Density and Service Proximity.

The Index's credit score requirements for Land Use Mix are not aligned with any current standards. Additionally, the credit requirements are heavily biased towards developments large enough to provide several new services and/or housing types to an existing area. Options should to be added to better encourage mixing of land uses in smaller-scale intensification developments and their adjacent areas.

The land entropy value, described above, calculates the evenness of distribution of several land uses over a given area (often 1 km^2). Its value ranges from 0 (a single, homogenous use – no mix) to 1 (a perfectly equal, heterogeneous mix of uses), with higher scores considered to be more walkable. Although the land entropy value is commonly used in the literature and effective for some purposes, it is too crude a measure to be used in this context.

9.3.4. Barriers to Implementation

See the corresponding subsections for Density and Service Proximity above, as their prerequisites are intended to capture land use mix and therefore many of the same barriers apply. In short, the primary barriers include: incompatible by-laws, minimum

zone separations, few mixed use allowances outside of mixed use zones, current restriction of mixed use zones to select downtown and core areas in municipalities, and existing Secondary Plans that do not account for a mix of land uses conducive to health.

Three additional challenges that are specific to Land Use Mix exist. First, no single measure captures healthy land use mix effectively. This is both a quantitative/logistical problem as well as a qualitative one: Logistically, having a tangible land use mix measure to implement at the early stages of the development process (e.g., Secondary Plan, Block Plan) allows it to be implemented further along through zoning and guideline documents. Qualitatively, Land Use Mix is an integral aspect of activity-friendly communities and should be represented as such; yet, even though other elements properly address land use mix in the Index, the element's significance may seem undermined when not designated with a prerequisite measure. Second, the current credit scores do not properly accommodate small developments that cannot incorporate several services or housing types into their built form. And, third, relating closely to the first and second challenge, no *prerequisite* measure exists that rewards small and large developments for contributing to the maturation of existing communities towards healthy land use mixes.

9.3.5. Recommendations and Action Steps

Due to the lack of a single comprehensive land use mix measure that is applicable across Peel region, we have attempted to capture the health policy issues related to land use mix in the Service Proximity and Density elements. Therefore, in order to achieve a land use mix that is beneficial for health, the recommendations for the latter two elements

need to be met. In other words, a comprehensive approach that encourages mixed land uses at each level of the development process needs to be in place. This should include better terminology and descriptions of healthy Land Use Mix in the Urban Design Guidelines of each municipality's Official Plan. Such Design Guidelines will not only define and shape healthy mixed use neighbourhoods for the municipality but also have a trickle down effect, eliminating many of the barriers to implementation. The resulting Secondary and Block Plans will establish a framework for compact neighbourhoods with a variety of services and employment within, and the resulting by-laws and guidelines will permit and encourage mixed use buildings and higher density dwellings. Moreover, we recommend several other action steps that are more specific to the Land Use Mix element:

a. *Make rezoning easier and mixed use zones more common.* Rezoning land within single use neighbourhoods is difficult and time-consuming for developers; and, mixed use zones are rare and often only permitted within city centres. Policies need to encourage – not discourage – developers that wish to improve the mix of land uses in a given area by, for example, providing new services to a primarily residential neighbourhood or residential dwellings to a primarily non-residential area.
b. *Create a prerequisite for Land Use Mix or integrate it into Service Proximity.* Currently, this element is not explicitly emphasized, because it does not contain a prerequisite measure. Land Use Mix is a vital aspect of healthy development, but there is currently no optimal measure to capture it apart from Density and Service Proximity requirements. One way to emphasize it's

importance in the healthy development planning process would be to change Service Proximity into 'Service Proximity and Land Use Mix'.

c. *Create a prerequisite for mixed building use.* Require developers to incorporate mixed use buildings into their developments.

d. *Create a prerequisite to encourage a healthier ratio of services-to-residents in primarily single use areas.* We recommend a prerequisite that encourages adding dwelling units to appropriate, primarily non-residential areas and services to primarily residential areas, thereby contributing to proximity, density, and so a healthy mix of land uses.

e. *Revisit the relationship between mixed housing types and healthy communities.* In light of recent projects that incorporate a mix of housing types (e.g., Regent Park revitalization in Toronto, the Cornell community in Markham, and the Uptown Core in Oakville), stronger evidence may be increasingly available regarding the relationship between mixed housing types and healthy development.

9.4. Street Connectivity

9.4.1. Health Importance

Street connectivity affects the directness of travel and the number of routes between any two destinations. Creating communities with high street connectivity reduces route distances, increases non-motorized route options and convenience, and dissipates vehicular traffic throughout the network. In the research literature, street connectivity generally had significant positive associations with walking frequency

and/or distance walked (Carver et al., 2008; Frank & Co. 2005; Frank et al., 2006; Frank et al., 2007; Larsen et al., 2009; Li et al., 2008) and physical activity (Frank et al., 2005). Also, smaller block size, in combination with other built environment variables, was associated with lower BMI, lower obesity rates, lower blood pressure, and higher walking frequency (McCann & Ewing, 2003; Moudon et al., 2006).

9.4.2. Calculation of Measures

The prerequisite for Street Connectivity includes both an intersection density and a block size component. Intersection density is measured as the number of publicly-accessible three- or more point intersections per square kilometer, averaged across the development. However, intersections with bike/walk cut-throughs to immediately adjacent roads (i.e., forces cars to turn but not pedestrians/cyclists) can count for up to 20% of the total intersections; and intersections between roads and bike/multiuse paths can also count for up to 20% of the total intersections. Intersections on expressways and highways with speed limits of 80km/h or greater are excluded.

Maximum block size is measured as the total land area of a block, excluding public rights of way. The block size requirement is not an average and applies to each block in a development.

Current regional and municipal standards do not address intersection density or block size using the same calculations as the Index. However, the Brampton and Caledon Official Plans both contain recommendations that *discourage* higher intersection densities with the intent of increasing traffic safety and/or maximizing traffic efficiency.

Although relevant guidelines are set in these Official Plans, actual intersection density is first established at the Secondary and Block Plan levels, as well as by transportation engineers and associated departments. Yet, these plans are often left to the interpretation of the design team at later levels of the development process. To complicate matters further, although municipal departments have jurisdiction over the local road network, the Region generally controls the arterial road network. Therefore, only strong, clear design principles – that are verified before the process is complete – can and should be implemented consistently across the entire Region.

9.4.3. Targets and Ranges

The health target for intersection density is a minimum of 75 intersections per square kilometre averaged across a development. The health target for block size is a maximum of 1.5ha for any given block in a development.

Existing standards are not directly applicable to these ranges; however, within Official Plans, some guidelines do exist. For example, as referred to above, the Brampton Official Plan states that the intersections between local and minor arterial roads should be minimized in order to enhance the highway, arterial, and collector systems. This runs contrary to the Index's health goals, which intend to dissipate traffic throughout the network and offer more direct and various routes between any given starting point and destination.

In regards to feasibility, the Street Connectivity targets can only reasonably be applied to greenfield development and intensification areas large enough to include their

own local road network. That aside, the targets are a challenge to meet without significant changes to the current approach to street network design.

9.4.4. Barriers to Implementation

Five main barriers exist for implementing the Street Connectivity prerequisites. First, existing standards and guidelines are primarily directed towards enhancing motorized vehicular traffic safety and efficiency. These current design principles attempt to maximize traffic safety and convenience, while public transit, cyclist, and pedestrian movement – which promote public health – play a secondary role.

Second, the Index's measures only reasonably apply to very large greenfield developments or intensification areas – where new comprehensive plans can achieve, with guidance, better health benefits – or to existing communities, such as in our validation process. Smaller greenfield developments may not incorporate enough new roads to be practically applicable to the Index's calculations. Additionally, most intensification development is constructed on existing road networks and so would not be applicable. Because of this, the health measures fail to recognize and reward more subtle ways of contributing to overall connectivity – such as incorporating paths and cut-throughs to enhance the bike/walk connectivity of surrounding communities or ensuring that the new road network is properly connected to and continuous with the existing roads in adjacent communities.

Third, municipal and regional planning departments do not always collaborate effectively on the creation of a comprehensive regional and local road network. As a

result, the two networks are not optimally integrated, limiting both the connectivity and overall efficiency of the street network.

Fourth, intersections use up valuable land which makes them costly to developers.

And, fifth, the current Index does not adequately: a) accommodate parks (and so blocks) larger than 1.5ha, b) consider natural barriers to bike/walk connectivity in such green spaces (e.g., ravines), and c) reward a connected system of parks and public open spaces, which in itself is an important feature of a walkable environment.

9.4.5. Recommendations and Action Steps

We recommend several action steps in order to improve the Street Connectivity element and increase the feasibility of its implementation.

a. *Prioritize overall public health in both transportation and urban planning.* Public health criteria and/or impact assessments that include all aspects of health – including walkability – need to be incorporated into all future planning and transportation policies and then implemented through good urban design principles. These design strategies should be crafted to reduce the conflicts between traffic safety and public health priorities.

b. *Initiate a collaborative approach between regional and municipal transportation planning, public health, and planning departments.* This is necessary in order to better understand and prioritize the health needs of all users (not just drivers), and to improve the integration of the local and arterial/regional road networks.

c. *Incorporate strategies to resolve the conflict between greater intersection density and developer expense.* In order to avoid opposition, connectivity requirements and design principles must be able to overcome or provide rationale to justify increased costs to developers. Possible solutions include: a) a primary focus on bike-/walk-connectivity (increases active transportation opportunities at relatively low costs); and b) a range of road widths and traffic calming (less land given to rights of way and a more comfortable pedestrian environment).

d. *Consider green spaces and parks within the Street Connectivity requirements.* Green spaces and parks need to be better considered in three ways: 1) the block size prerequisite should accommodate a full range of park sizes – from urban squares to regional parks – and not prevent spaces larger than 1.5ha; 2) the permeability of such large green spaces needs to be incorporated in order to ensure pedestrian access is not overly restricted by natural obstacles such as ravines; 3) a prerequisite or credit requirement should be in place in order to encourage a connected network of trails and parks.

e. *Better accommodate and reward contributions from intensification development.* The contribution that intensification development can make to Street Connectivity and the active transport network is considerable. Policy and Design Guidelines should encourage developers of intensification projects to make contributions in any number of ways; e.g., eliminating superblocks and/or enhancing permeability with new roads, small laneways, pedestrian cut-throughs, or indoor arcades.

9.5. Road Network and Sidewalk Characteristics

9.5.1. Health Importance

Road network and sidewalk characteristics directly influence the degree of comfort and convenience for walking and cycling, as well as the separation of all users of roadway allowances, including pedestrians, cyclists and motorists. For example, narrow traffic-calmed streets with wide sidewalks and cycle-friendly designs provide a safe, convenient environment for pedestrians and cyclists while also reducing interactions with vehicles. A number of previously published studies demonstrate a significant association between road network (and sidewalk) design and health outcomes, including levels of physical activity (Kamphuis et al., 2008; Larsen et al., 2009; Lee & Moudon et al., 2006; Li et al., 2005; Macbeth, 1999; Moudon et al., 2006), safety (Litman, 1999; Swift, 1998 as cited by Litman, 1999), and risk of injury. For example, studies have found that the presence of sidewalks and traffic calming features (such as speeds humps) was associated with increased walking and cycling (Carver et al., 2008); having traffic circles at residential intersections (Mundell, 1998 as cited by Litman 1999) and maintaining a maximum vehicular speed of 40 km/h (Roberts et al., 1995) both significantly reduced pedestrian injury and, in the latter case, the likelihood of an injury being fatal (Anderson et al., 1997; IWGAM, 1986, as cited in Anderson et al., 1997; Walz et al., 1983, as cited in Anderson et al., 1997); and lighting upgrades on streets and walkways increased pedestrian traffic by 51% and decreased incidents of crime by 79% (Painter, 1996).

9.5.2. Calculation of Measures

The Complete Streets prerequisite is calculated simply by noting the posted traffic speed along with the associated number of traffic lanes and lane width, number of bike lanes and lane width, and number of sidewalks.

Existing standards address all of these road network characteristics in some way; however, current policies do not specifically tailor road network and sidewalk characteristics according to traffic speed in order to encourage (more) 'complete' streets. Nonetheless, the calculations in the Index are the same as in existing standards (e.g., traffic speed in kilometres per hour, lane width in metres).

Each municipality – namely its engineering department – has jurisdiction over its own 'Public Works Standards' which dictate the local road and sidewalk characteristics. These standards are further influenced by input from other departments regarding emergency vehicle use, 'Operations' (e.g., snow removal, waste collection, etc.), and other important considerations. Alternatively, regional departments set standards for regional roads (e.g., major arterials and cross-boundary roads). Some of these standards (e.g., road width, sidewalk placement) appear at the Official Plan (for regional roads and major arterials) and Secondary Plan (local roads) levels. It is also important to note that negotiations between traffic engineers and those promoting other directives (e.g., walkability) can be an important part of the road network design process.

9.5.3. Targets and Ranges

The health target for Complete Streets requires a specific number of vehicular lanes, sidewalks, and bike lanes (and their associated widths) according to different

traffic speeds. For example, roads with a traffic speed of 31-40km/h must have 1-2 vehicular lanes no more than 3.2m wide, a sidewalk on each side, and 1-2 bike lanes no less than 1.2m wide. Additionally, all new local roads must have a posted traffic speed of no more than 40km/h, and all new non-local (arterial) roads no more than 50km/h. This measure does not include expressways, which are necessary for moving high-speed traffic in an environment isolated from the pedestrian and cycling networks.

Across Peel, all local roads currently have a speed limit of 50km/h (unless posted otherwise) but are built for 60km/h. Additionally, some standards exist for sidewalks (width and inclusion), bike lanes (width but not inclusion), and so on. These standards are not generally implemented in combination in order to meet multiple users' needs.

Therefore, although existing standards can mostly accommodate the health targets, a significant gap in intent prevails which significantly reduces feasibility. Only a comprehensive approach that tackles multiple issues, including reconciling traffic efficiency and safety with other needs (e.g., walkability, public transit efficiency and viability, sustainability), is feasible.

9.5.4. Barriers to Implementation

Several barriers exist to implementing the Complete Streets health prerequisite. First, there is a large gap between the policies and perspectives on traffic safety and efficiency (favoured in the existing regulatory system) versus complete streets and activity-friendliness (favoured in the Index). Current standards are directed to a great extent toward enhancing the movement of privately-owned vehicles. Second, most infill intensification is built within existing street networks, and so this prerequisite is not

particularly applicable to them in its current form. Considerations for such developments need to be made in order to encourage their contribution to more complete streets. And, finally, much of the road network is often established in isolation from broader comprehensive criteria that attempt to balance function with longer-term public health and urban design goals.

9.5.5. Recommendations and Action Steps

Our recommendations for Road Network and Sidewalk Characteristics are similar to those for Street Connectivity, as both share similar barriers and routes to implementation.

a. *Use a comprehensive, collaborative approach that addresses multiple needs (e.g., vehicular and pedestrian safety, comfort, and convenience).* Addressing one issue at a time will not work because of the many factors involved that fall under the jurisdiction and expertise of different departments. Instead, we recommend an approach in which public health, planning, and transportation departments collaborate in order to define and find solutions for the multiple (user) needs involved in the road network (e.g., traffic flow and safety, pedestrian safety, walkability, sustainability and the environment, bike routes, public transit viability). Such collaboration will allow high-level policy change that addresses important factors such as traffic speed and road width, in order to integrate public health targets with existing engineering standards.

b. *Develop Urban Design Guidelines and Transportation policies to address the needs of multiple users.* Once defined, transportation and design solutions can

address multiple user needs through joint understanding and more inclusive cost-benefit assessments (e.g., the cost to build sidewalks may be more than offset by the health care savings of further encouraging active transport). These needs and the resulting solutions (e.g., our prerequisites) should then be added to municipal Urban Design Guidelines as well as to transportation policy, in order to be implemented at all levels of the design and construction process.

c. *Include alternative/additional urban design principles that indirectly calm traffic and enhance walkability in future planning and transportation policies.* In some cases, our Complete Streets prerequisite will be very difficult and/or expensive to achieve on an existing street network. However, good urban design (i.e., the creation of desirable streetscapes) can also influence traffic and encourage walkability. Therefore, such design principles should be integrated into future prerequisites and then municipal Urban Design Guidelines to improve feasibility, offer alternative options for calming traffic, and reduce the need for prescriptive treatments later on – which are often inadequate and more expensive.

d. *Make a case for public health and livability while assessing traffic safety and efficiency, including a cost-benefit analysis to show that policies aimed at improving overall public health are for the greater good.* Planning and transportation policies that prioritize traffic safety with little regard for overall, long-term public health need to be redressed. Public health criteria and sustainability goals need to be integrated into improved urban design

principles and transportation policies – that still account for traffic flow and safety – in order to enhance livability. Additional efforts to demonstrate the economic, social, health, and functional advantages of such people- and health-oriented policies and practices will increase acceptance of the change.

e. *Improve the Index's requirements to better encourage walkable areas of intensification.* The existing Road Network & Sidewalk Characteristics prerequisite and credit requirements do not accommodate intensification development very effectively. However, intensification presents opportunities for enhancing the street network by, for example, incorporating pedestrian cut-throughs, multi-use paths, pedestrian-only areas that connect to the existing network, street trees, street furniture, public art, and wider sidewalks.

9.6. Parking

9.6.1. Health Importance

Parking requirements and characteristics have a direct impact on proximity, density, and aesthetics in the built environment as well as on social and economic factors that indirectly affect healthy development. For example, large parking lots – particularly those in the front setbacks of buildings – directly create unappealing, uninviting, unsafe pedestrian environments. However, this ample (often free) parking also encourages driving, which in turn indirectly degrades the active transport network by placing more cars on the road and so reducing comfort and safety for pedestrians and cyclists, slowing public transit and making it less viable, requiring an increase in motorized vehicular

infrastructure and its related public costs, and further contributing to the various environmental degradations brought on by the automobile.

Furthermore, enforced parking minimums increase the cost of land to developers, as more land is required for each lot. Shoup (1997) suggests that requiring even just one space per dwelling unit increases development costs by 18%. This added expense reaches beyond developers, increasing real estate fees for retailers, price of goods for consumers, and rental and purchase costs for residents. This results in an unjust economic burden being placed on the non-motoring and less-motoring users – who often have a lower socio-economic status to begin with and/or are unable to drive (such as the young and the elderly).

As a result of their increased land requirements and the associated cost increases for developers and consumers, minimum parking requirements generate a cycle that significantly reduces service proximity and density while perpetuating an auto-oriented built form (see Litman, 2000; Shoup, 1997). Increased costs encourage development on the periphery, where land is less expensive, and increased land requirements decrease density per hectare. It is likely that this reduction in proximity and density is further driven by an excess supply of parking spaces.

That said, the quantitative literature contains few articles which analyze relationships between parking and health outcomes; however, the strong link between parking and other built environment elements that have been shown to affect health outcomes (Density, Service Proximity, Aesthetics and Human Scale) suggests, at the least, an indirect association. Furthermore, both the expert literature (e.g., Litman, 2000; Litman, 2009; Shoup, 1997) and other reputed development Indexes (e.g., Duany et al.,

2008; LEED-ND, 2008) support a major reduction or elimination of parking minimums or, in some cases, the use of maximum parking allowances instead. Moreover, one study did find that higher perceived parking difficulty at local shopping areas was significantly positively associated with active transport and overall walking (Rodriguez et al., 2008).

9.6.2. Calculation of Measures

In the Index and in existing standards, parking requirements are calculated as the (minimum or maximum) number of parking spaces allotted per dwelling unit (residential) or per gross floor area (non-residential).

For existing residential standards, minimum parking requirements are typically set according to unit type (e.g., studio, 1-bedroom, 2-bedroom, detached home). Generally, a specific number of spaces must be allocated to each unit or, in some cases, according to an average (e.g., 1.5 spaces per unit) to be met throughout a building or development.

For existing non-residential standards, minimum parking requirements are typically determined using transportation surveys which evaluate parking occupancy during peak periods at a particular location of each land use – usually a location that offers ample free parking and lacks public transit. These *parking generation rates* are generalized to all locations of each land use and are used to set minimum parking requirements in zoning by-law – regardless of public transit access or walkabilty in the areas they are being applied to. The result is an excess supply of mostly-free parking that results in the economic and built environment problems expressed in the Health Importance subsection above (Shoup, 1997).

Our recommendation is to eliminate parking minimums and, possibly, use maximum requirements instead. This would allow developers to calculate and then supply the number of parking spaces that would allow parking fee revenue to cover the cost of the spaces. In turn, this should encourage car-free housing, unbundled parking, shared parking, public transit, and other activity-friendly initiatives.

Parking minimum requirements are currently regulated by municipal zoning by-law.

9.6.3. Targets and Ranges

The health target for parking is the elimination of minimum parking requirements, along with the subsequent reduction in parking supply and, in turn, reduction of the negative effects (e.g., economic, environmental, social) of parking. Alternatively, a health target of parking maximums is considered. Such maximums would be set at 25-100% less than existing minimums, depending on the relative density and service proximity of the location (i.e., greater density and proximity requires less parking).

Current municipal requirements are set as minimums according to use or dwelling type. For example, in Mississauga, a night club requires 25.2 spaces and a restaurant requires 16.0 spaces per 100m² of non-residential gross floor area. Detached, semi-detached, and street townhouse dwellings require a minimum of 2.0 parking spaces per residential unit. That said, requirements can also differ according to zone: Mixed-use or urban core zones may have reduced minimums or may permit reduced parking when existing infrastructure suffices. However, even in these situations, developers are often required to pay costly in-lieu fees in order to supply fewer spaces.

9.6.4. Barriers to Implementation

Three major challenges to implementing the Index's health recommendation exist. First, the primary barrier is that reducing or eliminating parking can only be fairly done if adequate alternatives to driving are readily available. Existing parking and driving infrastructure in the Region of Peel contribute to reduced density and proximity, making public transit less viable and walking/cycling less practical, safe, and convenient. Furthermore, the vast majority of transportation tax dollars go to road and highway infrastructure maintenance and improvements, leaving minimal amounts for public transit and walk/bike networks. As a result, most people choose to drive, because distances are so great and existing alternatives are inconvenient, inefficient, unsafe, and/or uncomfortable.

Second, setting maximum limits on the number of parking spaces is a completely new standard and direction. However feasible it is to implement, opposition to this change will be prevalent. Therefore, a comprehensive approach that enhances and promotes other modes of travel is essential.

Third, in-lieu of parking fees are not a sufficient mechanism to permit or promote reduced parking supply. Currently, a developer desiring to supply fewer spaces than the minimum required – e.g., in the hopes of constructing a walkable community – must pay an in-lieu fee to the municipality for each space not built. The total cost of fees can be equivalent to the cost of simply building the spaces instead, providing a strong disincentive for developers to create less parking than required in municipal zoning by-law.

9.6.5. Recommendations and Action Steps

In the Index, Parking is addressed as a key recommendation rather than a prerequisite measure. That recommendation is the elimination of minimum parking requirements. The following action steps relate to this key recommendation as well as the Parking credit measures in the Index.

It is important to note, however, that parking can only justifiably be reduced as active transport becomes more efficient. This is of particular relevance in peripheralareas, low density areas and areas lacking mixed uses where driving is often the only viable option for residents. Therefore, all of the action steps below need to be undertaken in conjunction with an inter-sectoral approach – between transportation, planning, and public health – to the improvement of public transit and other travel networks.

- *Work with municipalities to change parking by-laws.* This could initially be in the form of a) reduced parking minimums, eventually phasing them out altogether, and b) the elimination of in-lieu of parking fees, allowing approved developments to provide fewer spaces than required. Approval could be dependent on developers demonstrating the existence of alternative choices for commuters (e.g., having a sufficient number of residents/customers within walking distance or having nearby higher-order transit stops).
- *Initiate a discussion of car dependence at an economic, social, environmental, and functional level.* Currently, the vast majority of transportation funds are allocated to motorized transport infrastructure. Therefore, a comprehensive cost-benefit analysis needs to reveal the 'greater good' served by a more

holistic approach to transportation planning (and funding) that provides adequately for all users.

- *Incorporate phasing strategies into new developments that are not currently served by alternative modes of travel.* New plans for large scale developments should include parking phasing strategies whereby, in the short term, ground level parking is provided but plans must be in place to reduce parking while adding pedestrian uses as transit improves and/or density increases in the area. This ensures a transition towards healthy development, while simultaneously notifying developers of future needs in conjunction with their changing land economics and phased development.
- *Work with municipalities to establish parking management strategies.* Parking management strategies such as market rate pricing for public on- and off-street parking in core areas, shorter-term and high-priced parking, employee cash outs (for not driving), and parking benefit districts all discourage driving, encourage active transport, and can create funds to enhance the local pedestrian environment.
- *Place greater emphasis on good parking design and parking location.* Currently, the Index includes credit requirements relating to the use of rear laneways, locating parking at the rear or side of buildings, preventing parking and garages in the front façade, and providing on-street parking. However, greater emphasis should be placed on these design techniques as well as a description of where parking *is* suitable.

9.7. Aesthetics and Human Scale

9.7.1. Health Importance

Aesthetics and Human Scale is a diverse element that primarily affects health through the creation of safe, inviting, and physically- and visually-pleasing pedestrian and recreational environments. The term 'human scale' refers to building communities at a size relative and appropriate to the average human and their physical and sensory capabilities – not to much larger, much faster motorized vehicles. For example, commercial buildings that are built against the sidewalk with little blank wall space contribute to the visual interest of the streetscape, offer a safe and comfortable setting for pedestrians, provide greater window-shopping and social interaction opportunities, and may be built on a human scale. In the relevant literature: poor aesthetics resulted in lower rates of cycling (Kamphuis et al., 2008); higher objective and subjective measures of green cover had significant positive associations with frequency of walking to school and of general walk trips, as well as with lower BMI (Tilt et al., 2007); and, housing built pre-1973 (characterized by small setbacks, high density, narrower streets, and with less garages in the front façade) was significantly associated with increased walking compared to post-1973 structures (Berrigan & Troiano, 2002).

9.7.2. Calculation of Measures

The Index and existing standards both calculate front setbacks in the same way: by measuring from the bottom of a building's front façade at a right angle to the edge of the property line or public right of way (sidewalk or road) in metres. It is important to

note, however, that the health targets are set as *maximums*; whereas, nearly all existing standards and policies enforce *minimums*.

Setbacks are regulated in municipal by-law but determined at the property level by builders. Moreover, setbacks to the front façade, garage, etc. are also often set out in Urban Design Guidelines (Official Plan) with the intent that zoning will be written in accordance, afterward.

9.7.3. Targets and Ranges

The following health targets for front setbacks are expressed as *maximums*: 7.6m for detached residential; 4.6m for attached and multifamily residential; and 3m for commercial and light industrial. Additionally, 70% or more of commercial and mixed-use structures must be flush with the sidewalk (0m setback); and, main entrances of residential, commercial, and light industrial buildings cannot front onto parking lots.

Existing municipal standards for residential zones are expressed as *minimums* and range from 1.2m (across Brampton) to 4.5m (condos in Mississauga) to 18m (estates in Caledon). Non-residential setbacks, also expressed as *minimums*, range from 0m (commercial core zones in Caledon and Brampton) to 4.5m (convenience commercial zones in Mississauga) to 18m+ (non-core commercial in Caledon and Brampton). Despite primarily using minimums, maximum setbacks also exist in Peel Region: Main street commercial zones in Mississauga have a 3m *maximum* front setback.

The health targets for front setbacks are feasible to implement in the Region of Peel. Our consultations suggest that the health maximums for certain building types could even be reduced further. Such a precedent has been set by new progressive

communities (e.g., Port Credit Village in Peel, Cornell and Angus Glen in Markham, and Oak Park in Oakville) that are using standards that are similar in nature to neighbourhoods built in the 1920-30s: These developments include 3-4.5m residential front setbacks with allowance for a 2m front porch intrusion and rear laneways that move the car to the back of the lot. Such standards allow and encourage a much higher quality streetscape and building architecture.

9.7.4. Barriers to Implementation

Three primary barriers to implementation exist for our Aesthetics and Human Scale prerequisite. First, setbacks are regulated at the municipal by-law level yet not determined until lot development. As a result, for large developments, actual setbacks may be determined well after a developer's Block Plan has been approved. Therefore, standards that can be enforced in each design phase are needed.

Secondly, developers must often appeal for an amendment in order to be progressive with community aesthetics – a disincentive to healthy development.

Third, front setbacks are the only prerequisite measure for Aesthetics and Human Scale in the Index. This is because nearly all other measures of aesthetics are extremely challenging to objectively quantify. Therefore, a development that meets the Index's front setback prerequisite will not necessarily be built with other aesthetic elements that encourage walking nor be constructed on a human scale. Although setbacks are an important indicator of Aesthetics and Human Scale, many other factors are involved. Considerations need to be made to better encourage other Aesthetic and Human Scale factors.

9.7.5. Recommendations and Action Steps

Below are our recommendations for implementing and improving the Index's Aesthetics & Human Scale requirements.

a. *Define setbacks and other components of Aesthetics & Human Scale in Urban Design Guidelines.* Establishing comprehensive Urban Design Guidelines (e.g., with a zoning standards schedule) will help ensure that future Block and Secondary Plans and new by-laws are created in accordance with healthy development standards.

b. *Use the new Development Permit System to create standards for developers to agree to meet throughout their Block Plan.* Many aesthetic measures are currently established at the lot level – outside of the developer's discretion. Therefore, such a system could ensure enforcement throughout the development process and offer a feasible route to implementation.

c. *Encourage inter-departmental co-ordination to ensure that prerequisites and recommendations for Aesthetics & Human Scale and Road Network & Sidewalk Characteristics are aligned and complimentary.* These two elements interact and build upon one another in the built environment yet are controlled by multiple departments. Therefore, the implementation of any one measure must be done with consideration for accommodating and complementing others.

d. Eliminate minimum zone separations in order to discourage large setbacks that take away from a more walkable environment.

e. *Reduce setback maximums even further or, alternatively, increase streetwall requirements.* Feedback suggests that the requirements in the Index could be even more progressive while remaining feasible. However, accommodations should be made for café patios and other pedestrian-friendly uses of the front setback.

f. *Strongly encourage other Aesthetics & Human Scale factors.* Front setbacks are the prerequisite measure for this element because of their strength of evidence in the literature and the ease with which they are objectively measured; however, front setbacks are just one part of a much larger equation. Other examples of characteristics that promote improved aesthetics include street trees, sidewalk characteristics, and street enclosure.

10. Conclusion & Key Recommendations

The Region of Peel is to be congratulated for its efforts to develop mechanisms for healthy urban planning. As far as we know, Peel is the first municipality in North America to undertake an initiative such as this. As indicated in previous sections, our initial impression was that it would be fairly straightforward to develop a rating tool that could be implemented to allow Peel Public Health to review development applications submitted to the Region.

The results of the process we undertook to develop an evidence-based Index for rating new urban development plans has proved to be more challenging than originally expected, however, because of two important, unanticipated outcomes of the process: First, many of the elements of urban built environments that make communities more or less health-promoting are not at the discretion of the private developers and planners who are submitting development applications. Rather, many of the most important characteristics of healthy (or unhealthy) urban planning are prescribed in existing by-laws, zoning regulations, and other public agency standards and policies (such as transportation engineering standards, public transit agencies, and school boards). And, second, many features of a walkable built environment are not easily measured or objectively quantified as development targets. Therefore, since the Index is evidence based, some important aspects of the built environment were reduced to being credit measures, or not included at all.

Consequently, as described above, we stop short of providing a refined and recommended Index for use as originally envisioned. Instead, we offer a draft Index, initially developed using evidence-based health literature, that could be refined and

implemented in the future and a series of recommendations that emerge from three sources: a) a stakeholder consultation and expert review process; b) our analysis of selected areas of the current built environment in Peel; and, c) a gap analysis of policies, regulations, by-laws, and other standards that constrain the Region of Peel and its constituent municipalities from achieving the kinds of healthy urban development targets outlined in the draft Index.

Although a formula for how to develop such an Index and implement it does not exist, we find support for the process we undertook in a study by Allender et al. (2008) who offer two relevant suggestions: First, competing mandates from local government offices/departments often take priority over public health concerns, therefore evidence-based, health policy can be used to offer planners decision-making leverage; Second, 'field testing' draft recommendations with potential users (e.g., planners) is an effective way to check the relevance of new policies and their implementation.

Furthermore, it is worth underlining three key findings from the consultation process and analyses. First, there are a significant number of inconsistencies and contradictions between the municipalities, between each municipality and the Region, between planning and other related departments (e.g., transportation), and between sectors (e.g., planning and health) on a number of important elements that must be incorporated in order to produce healthy built environments. The matter of public health forms the basis of important new criteria that must be learned and implemented in the design of community plans. Second, as noted above, developers' and builders' have limited discretion regarding most of the healthy development measures. Instead, most measures are directly controlled or restricted by the existing regulatory systems, so that

health targets can only be met through a lengthy appeal process or not met at all. And, third, implementing a one-size-fits-all Index is very difficult because of the many different development contexts (e.g., intensification and greenfield, local and regional) in Peel Region. Future versions of an Index must offer the necessary flexibility to ensure that all development types are able to meet and exceed the Index requirements. Though, that said, it is important to note that flexibility should not be equated with a reduction of the health requirements, and the original intent of the Index should be maintained.

The key general recommendations that we offer follow below. Note that we advise establishing a bases for and providing an overview of the importance of public health matters and their relevance to community design at the outset of each of the following recommendations:

1) revise by-laws, official plans, transportation planning standards, urban design guidelines, and other standards and regulations, so that they are consistent with recommended prerequisites, at both the regional and local municipality level;
2) ensure that the inconsistencies and contradictions that restrict healthy development between the municipalities, between each municipality and the Region, between planning and other related departments (e.g., transportation), and between sectors (e.g., planning and health) are reconciled and resolved through a comprehensive, multi-sectoral approach;
3) engage in consultation with a wider set of stakeholders than the current process was able to, in order to decide upon precise prerequisites and targets desired,

bearing in mind that any easing of the recommended prerequisites and targets made in this report will compromise the health-promoting potential;

4) ensure that these new prerequisites and targets conform with all relevant provincial legislation and other relevant regulations and standards;
5) develop data sources that allow for optimal measurement of elements of the Index and make these widely available, so that they may be used by a variety of users (private developers, private planning firms, municipalities and regional staff);
6) upon successfully addressing recommendations 1-3, revise the Index so that it may be implemented as routine practice in the Region of Peel, and so that those elements of health-promoting built environments which *are* at the discretion of builders and developers can be assessed and subsequently refined in development applications in order to optimize the health-promoting potential of the built environment in Peel;
7) adapt the revised Index to account for the significant differences between smaller, intensification redevelopment (characterized by Mississauga) and larger greenfield subdivision development (characterized by Brampton and Caledon).

In addition, we offer a number of specific recommendations to, namely, the Region of Peel, its constituent municipalities, and other relevant stakeholders:

a) Make a commitment to healthier urban development as a 'greater good'. As an over-arching principle, it is important that the Region of Peel be able to show that all actions

taken towards achieving healthy urban development standards are for the 'greater good' (e.g., public safety, economic, environmental) – and not just for walkability.

b) Adopt an integrated and comprehensive approach to increase density at all levels of the development process (e.g., Official Plan, Secondary Plan, Zoning, Site Plan, Guidelines). Addressing density with anything but such an approach is unadvisable..

c) Create universal targets (and measures) that require developers to meet both health and policy standards, simultaneously. These targets and measures should allow developers to meet health targets with ease – without an appeal process. This should be done by setting region-wide standards that correspond with health targets and reside over municipal standards, guiding the creation of future municipal Official Plans and so by-laws. And, where possible, direct change should be made to municipal documents (e.g., Official Plans, zoning by-laws) for consistency and comprehensiveness.

d) Find a common non-residential density measure (such as FSI) that can be applied across the Region and incorporated into all existing policy to deal with inconsistencies in existing non-residential density standards. A common measure is necessary to implement health targets.

e) Make rezoning and intensification easier and more rewarding for developers in order to increase density and make mixed use zones more common. Policies need to encourage developers that wish to improve the mix of land uses in a given area by, for example,

providing new services to a primarily residential neighbourhood or residential dwellings to a primarily non-residential area. Intensification development should encourage street connectivity, density, and the active transportation network.

f) Define components of Aesthetics & Human Scale in Urban Design Guidelines. Establishing comprehensive guidelines will determine the shape of future Block and Secondary Plans and the creation of new by-laws in accordance with healthy development standards.

g) Prioritize overall public health in both transportation and urban planning using a comprehensive approach. Current transportation planning prioritizes vehicular efficiency and safety, consequently reducing the efficiency, affordability, comfort, and safety of walking, biking, and using public transit. Public health criteria that include all aspects of health – including increased walkability – need to be incorporated into future planning and transportation policies and then implemented with good urban design principles. In order to accomplish this, it is necessary to resolve the conflicts between traffic safety, greater intersection density, developer expense, and overall public health priorities. Moreover, it is only feasible to achieve this via a comprehensive approach that incorporates and aligns all levels of the regulatory system.

Part D: Works Cited & Appendices

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Appendix A. Peel Healthy Development Index – Initial Scoring Guide and Scorecard

How to use the Peel Healthy Development Index

The Peel Healthy Development Index is divided into seven built environment elements, each containing a combination of *prerequisite* and *credit* requirements. These requirements are further broken down into specific measures, which have been constructed from the relevant scientific and theoretical literature, that will be used to evaluate a development proposal. A community must meet all prerequisite requirements in order to receive approval from Peel Public Health. And, additional certifications (Gold, Silver, Bronze) can be achieved by obtaining a particular number of credits.

The Healthy Development Index consists of two documents that are designed to be used in tandem for evaluating proposed community throughout all stages of the planning process.

The Scorecard is a two-page evaluation document used to record a community's progress in satisfying both prerequisites and credit requirements. The user will check off prerequisites as they have been achieved and record credit values. At the end, satisfying all of the prerequisites will determine approval (or not), and the total credit score will determine the level of certification (Certified, Bronze, Silver, or Gold).

The Scoring Guide provides detailed descriptions of how to evaluate the prerequisite and credit requirements for a given community. In the case of credits, communities can earn more credits by implementing thresholds or ranges that have a stronger positive association with creating activity-friendly environments. The Scoring Guide should be referred to throughout the planning and evaluation process, with resulting achievements recorded on the Scorecard.

Note that the term 'community' is used throughout this Index in order to refer to any greenfield or intensification development projects.

Peel Healthy Development Index Elements

1. Density

1. a. Minimum Density (Residential and Non-Residential) – Prerequisite:

- ❖ Minimum net residential dwelling density = 35 residential units/hectare
- ❖ Minimum average Floor Area Ratio (FAR) for non-residential, mixed use, and multifamily structures = 0.7

Description:

Communities must achieve a minimum net residential dwelling density of 35 units/hectare. This value is to be averaged across the community, and the net area used in the calculation shall include all buildable land, excluding public spaces, streets, and other public rights of way. Rental units such as basement apartments, 'granny flats,' and other accessory apartments shall count as additional dwelling units and should be included in this calculation. Mixed use buildings (e.g., residential on top of commercial) are strongly encouraged in order to achieve both density and proximity target

And…

Communities must achieve a minimum average Floor Area Ratio (FAR) of 0.7 for all non-residential, mixed-use, and multifamily structures in the community. The FAR is calculated as the gross building area (excluding any parking facilities) divided by the total lot area (excluding any public rights of way including but not limited to: parks; outdoor recreational spaces; public squares). This FAR prerequisite is not an average and must be met by every applicable building.

We recommend that buildings greater than 6 stories in height are restricted to transit nodes. Ideally, density and FAR requirements should be met through compact low-rise communities. This is recommended, because tall buildings can degrade the environment, in terms of energy consumption (to build and to maintain), forces of nature (e.g., wind, sun), social and psychological interactions, and aesthetics.
One way to discourage high-rises is to only count the first 6 floors for density and FAR measurements.

1. b. Net Residential Dwelling Density – Credit:

- 35-44 residential units/hectare (1 credit)
- 45-64 residential units/hectare (4 credits)
- 65-84 residential units/hectare (7 credits)
- 85+ residential units/hectare (10 credits)

Description:

Communities can earn credits by meeting the above target ranges of net residential dwelling density. This value is to be averaged across the community, and the net area

used in the calculation shall include all buildable land, excluding public spaces, streets, and other public rights of way. Rental units such as basement apartments, 'granny flats,' and other accessory apartments shall count as additional dwelling units, and should be included in this calculation. See section 1.a. for our building height recommendation

1. c. Average Floor Area Ratio (non-residential-only structures) – Credit:

- FAR = 0.70-0.80 (1 credit)
- FAR = 0.81-0.95 (2 credits)
- FAR = 0.96-1.25 (4 credits)
- FAR = 1.26-1.75 (6 credits)
- FAR = 1.76-2.5 (8 credits)
- FAR > 2.5 (10 credits)

Description:

Communities can earn credits by meeting the above target ranges of average Floor Area Ratio (FAR) for all non-residential, mixed-use, and multifamily structures in the community. The FAR is calculated as the gross building area (excluding any parking facilities) divided by the total lot area (excluding any public rights of way including but not limited to: parks; outdoor recreational spaces; public squares). The FAR value shall be calculated as an average for the entire community, with the FAR value of each non-residential and/or mixed-use structure being weighted equally. See section 1.a. for our building height recommendation.

2. Service Proximity

2. a. Proximity to a Variety of Services and Employment – Prerequisite:

- ≥ 75% of residential units must be within ≤ 800m of ≥ 5 neighbourhood public services*
- ≥ 75% of residential units must be within ≤ 800m of ≥ 7 neighbourhood retail services**
- The centre of primarily residential communities must be within ≤ 800m of the same number of full- and part-time jobs as 50% of the total number of residential dwelling units in the community.
- The centre of primarily non-residential communities must be within ≤ 800m of the same number of residential units as 50% of the total number of full- and part-time jobs in the community.
- *We may want to include another option of being able to access sufficient numbers of jobs using transit.*

*Neighbourhood public services include but are not limited to: childcare, community garden, hospital or health clinic, public library, plaza, playing field, park or natural open space of ≥ 1/3 hectare, performance/cultural space, post office, recreation centre, and public school.

**Neighbourhood retail services include but are not limited to: bank, beauty salon or barber, bike shop, convenience stores not located at gas stations, dry cleaner, restaurants and cafes, gym/fitness centre, hardware store, laundromat, pharmacy, retail food market (including supermarket, produce store, butcher), entertainment (e.g., video store or movie theater), and a suitable transit stop (see 2.c. for the definition of a suitable transit stop). Gas stations are *not* included.

Description:

A minimum of 75% of residential dwelling units in the community must be located within a maximum walking distance of 800m of at least 5 neighbourhood public services and 7 neighbourhood retail services. It is necessary to calculate this measure for each individual dwelling in the community to determine if the percentage requirement is met. The same type of service can be counted more than once per dwelling if multiple locations exist. However, a maximum of 2 transit stops may counted, per dwelling.

And…

Communities that are primarily residential must locate the centre of their residential component within 800m of the same number of full- and part-time jobs as 50% of the total number of residential dwelling units in the community (i.e., a primarily residential community of 100 dwelling units has 50 full- and part-time jobs within an 800m walk of it's centre).

Or…

Communities that are primarily non-residential must locate the centre of their non-residential component within 800m of the same number of residential units as 50% of the total number of full- and part-time jobs in the community (i.e., a primarily non-residential community with 100 full- and part-time jobs has 50 dwelling units within an 800m walk of it's centre).

Note: When possible, all proximity requirement distances should be measured along the network of walkable streets and paths in the community, not as Euclidean (straight-line) distance. If Euclidean distance must be used, barriers such as ravines, expressways, and water bodies must be taken into consideration.

2. b. Proximity to a Variety of Services – Credit::

- ≥ 75% of residential units within ≤ 800m of ≥ 13 neighbourhood services* (1 credit)
- ≥ 75% of residential units within ≤ 800m of ≥ 16 neighbourhood services* (3 credits)
- ≥ 75% of residential units within ≤ 800m of ≥ 20 neighbourhood services,* including at least 3 food markets,** and at least 1 park ≥ 1/3 hectare (10 credits)
- 100% of residential units within ≤ 800m of ≥ 20 neighbourhood services,* including at least 3 food markets,** and at least 1 park ≥ 1/3 hectare (15 credits)

Description:

Communities can earn credits by meeting the above service proximity target ranges. Distances are measured along the network of walkable streets and paths in the community, where possible.

*Neighbourhood services include both the public and retail services listed in 2.a., and multiple locations of the same service can be counted. A maximum of 2 transit stops per dwelling may be counted towards the above credit measures.

**Food markets include grocery stores, supermarkets, produce markets, and butchers; however, they exclude convenience stores.

2. c. Proximity to Transit – Credit::

- ≥ 60% of residential units within ≤ 800m of a suitable transit stop* (1 credits)
- ≥ 75% of residential units within ≤ 800m of a suitable transit stop* (3 credits)
- As above *and* ≥ 60% of residential units within ≤ 400m of a suitable transit stop* (7 credits)
- ≥ 90% of residential units within ≤ 800m and ≥ 70% of residential units within ≤ 400m of a suitable transit stop* (10 credits)

Description:

Communities can earn credits by meeting the above targets for proximity to local and regional transit. All distances are measured along the network of walkable streets and paths in the community, where possible.

* A suitable transit stop is defined as a public transit stop that provides a direct route to a Regional Urban Node, Intensification Corridor, or similar higher-density, mixed-use, transit-supportive activity centre within a maximum transit trip of 30 minutes.

2. d. Proximity to Employment -- Credit::

- ≥ 75% of residential units with a 30-minute transit trip* of ≥ 60,000 jobs (1 credits)
- ≥ 75% of residential units with a 30-minute transit trip* of ≥ 80,000 jobs (3 credits)
- ≥ 75% of residential units with a 30-minute transit trip* of ≥ 100,000 jobs (5 credits)
- ≥ 75% of residential units with a 30-minute transit trip* of ≥ 120,000 jobs (7 credits)
- ≥ 75% of residential units with a 30-minute transit trip* of ≥ 140,000 jobs (10 credits)

Description:

Communities can earn credits by meeting the above targets for proximity to employment.

*A transit trip is defined as the total travel time between a residential dwelling unit's front door to a workplace's front door, without the use of private motorized vehicles for transport (i.e., walking, cycling, and public transit are the only included transport modes).

3. Land Use Mix

Despite its vital importance to walkable communities, this Index does not include a Land Use Mix prerequisite. Why? Land use mix is created through the combination of density and proximity: It is determined by the relative distribution and concentration of people and services in a given area. Through the density prerequisite, communities must have high residential densities that are capable of supporting nearby services. Through the proximity prerequisite, communities must provide a variety of both public and retail services nearby those residences, thus creating an effective mix of land uses.

Development in the past half-century is characterized by the segregation of residential and non-residential uses, leading to car-oriented sprawl in which one drives to even the most basic services. Land use mix encourages daily destinations (e.g., grocery, workplace) within walking/cycling distance to local residences.

Many recent attempts at mixed-use communities have failed. The prerequisite and credit requirements in this Index attempt to address these failures; e.g., parking requirements that limit density, affordability, and human scale; isolation from all but a few daily services and amenities; setbacks and other aesthetic problems that limit pedestrian comfort and convenience.. Therefore, healthy communities are those that possess a land use mix that provides: a) a sufficient density of residents to support a variety of public and private services, as well as full- and part-time jobs (i.e., prerequisite 1.a.); b) a relative balance of residential and employment densities (i.e., prerequisite 2.a.), so that walking and cycling to work is an option for most residents/employees; and c) a wide variety of public (e.g., schools, parks) and retail (e.g., grocery, pharmacy) services within walking distance of most residents (prerequisite 2.a.), so that daily needs and activities can be satisfied without the use of a car. Additionally, this mix of land uses should be accompanied by pedestrian-friendly design, as captured in Key Recommendation 6.a. and prerequisites 5.a. and 7.a..

3. a. Heterogeneity of Land Use Mix – Credit:

Up to 10 credits total can be earned from the below Heterogeneity of Land Use Mix measures:

- ≥ 5% of total community land is outdoor public space (3 points)
- Community provides ≥ 4 new services* to an existing neighbourhood (within a 1km radius of the community centre) (3 points)
- There is a mix of 3 housing types*, 6 different services*, a public school, and a park ≥ 0.4/ha within 800m of the community centre (5 points)

Description:

Communities can earn credits by meeting the above targets for heterogeneity of land use mix. An outdoor public space is defined as a plaza, square, park, or green space on public land.

*See 2.a. for a description of services and 3.c. for housing types.

3.b. Heterogeneity of Parcel/Building Use – Credit:

Up to 10 credits total can be earned from the below Heterogeneity of Parcel/Building Use measures:

- ≥ 60% of commercial buildings include a ground floor pedestrian use along ≥ 60% of their street façades (4 points)
- 100% of mixed-use buildings include ground floor retail, live/work spaces, or residential dwellings along ≥ 60% of their street façade (4 points)
- ≥ 50% of multifamily residential buildings have a pedestrian use on the ground floor (4 points)

Description:

Communities can earn credits by meeting the above targets for heterogeneity of parcel use. Pedestrian uses include but are not limited to the neighbourhood retail and public services as described in 2.a. A multifamily residential building refers to an apartment-style building, in this case, not town homes or row houses.

3. c. Mixed Housing Types – Credit:

- ≤ 30% of housing is large lot detached homes (3 points)
- As above and the community includes ≥ 3 housing types, with none making up less than 20% of the total residential units (5 points)

Description:

Communities can earn credits by meeting the above targets for mixed housing types. Large lots are those greater than 15m wide (street side). Housing types include detached, semi-detached, town home or row house, multifamily (apartment), and co-operative. Pedestrian uses include but are not limited to the neighbourhood retail and public services as described in 2.a.

4. Street Connectivity

4. a. Intersection Density or Block Size – Prerequisite:

- ❖ Minimum average intersection density = 75 intersections/km^2
- ❖ Maximum single block size = 1.5ha (not an average)

Description:

Communities must achieve a minimum average intersection density of 75 intersections/km^2. Intersection density is averaged across the community. An intersection is defined as any publicly-accessible 3- or 4-point intersection. Intersections at cut-throughs for pedestrians and/or cyclists to immediately adjacent roads (i.e., an

intersection that forces cars to turn or turn around but allows pedestrians and/or cyclists to travel through) can count for up to 20% of the total intersections in the community. Intersections between streets and bike or multiuse paths can count for up to 20% of the total intersections.

And…

All blocks within a community must have a block size of no more than 1.5ha. The maximum block size measurement is not an average and is measured as the total land area of a block, excluding right-of-ways.

Exceptions need to be made for parks, so that they are not limited to 1.5ha or smaller. However, encouraging or requiring bike/walk connectivity within those parks larger than 1.5ha is an important consideration – particularly for areas with natural obstructions (e.g., ravines).

4. b. Intersection Density – Credit:

- 75-114 intersections/km^2 (1 point)
- 115-149 intersections/km^2 (5 points)
- 150+ intersections/km^2 (10 points)

Description:

Communities can earn credits by meeting the above target ranges for intersection density. Intersection density is measured as described above in 4.a.

5. Road Network and Sidewalk Characteristics

5. a. Complete Streets (sidewalks, bike lanes, traffic speed) – Prerequisite:

Streets must be 'complete' based on the following requirements:

- ❖ 00-15km/h Lanes: 1-2. Lane width: ≤ 3.2m*. Sidewalks: 0-2. Bike lanes: 0-2.
- ❖ 16-30km/h Lanes: 1-2. Lane width: ≤ 3.2m*. Sidewalks: 1-2. Bike lanes: 0-2.
- ❖ 31-40km/h Lanes: 1-2. Lane width: ≤ 3.2m. Sidewalks: 2. Bike lanes: 1-2**.
- ❖ 41-50km/h Lanes: 2-4. Lane width: ≤ 3.2m. Sidewalks: 2. Bike lanes: 2
- ❖ All new local roads ≤ 40km/h
- ❖ All new non-local roads ≤ 50km/h

*A single lane road (e.g., woonerf) may be up to 5m wide when it's shared by two-way vehicular traffic.

**A single bike lane is suitable when the vehicular lane is one-way, either to give cyclists a safe route 'against' or with traffic. Also, a single bike lane with two directions (two lanes) on one side of the road may be suitable for certain road designs.

Description:

Community streets must include the above features that match their speed limit. Number of lanes is equivalent to the number of motorized vehicular travel lanes, including central turning lanes but excluding bike and curb/parking lanes. Lane width is the motorized travel lane width, excluding bike and curb/parking lanes. Bike lanes must be at least 1.2m wide. Allowance for curb lanes should only be made when used for on-street parking.

And…

All local roads within a community must have a speed limit of 40km/h or less, and the associated design features listed above. All new non-local roads (excluding expressways) within a community must have a speed limit of 50km/h or less, and the associated design features listed above.

5. b. Traffic Calming – Credit:

- 4-6 traffic calming measures*/hectare (1 credit)
- 7-10 traffic calming measures*/hectare (3 credits)
- 11-13 traffic calming measures*/hectare (5 credits)
- 14+ traffic calming measures*/hectare (7 credits)
- 1 or more pedestrian-priority streets*/hectare (3 *additional* credits to the above credit scores)

Description:

Communities can earn credits by meeting the above target ranges for traffic calming measures. All traffic calming measure target ranges are calculated as an average across the entire community.

And…

A maximum of two features of the same type of traffic calming measure can be counted for each individual hectare in the community (e.g., a maximum of two speed bumps, for each individual hectare, may be counted).

*Suitable types of traffic calming measures include, but *may* not be limited to:

- 'pedestrian-priority' streets or 'woonerfs' or 'home zones' (speed limit under 15km/h, vehicles must yield to pedestrians and cyclists)
- traffic circle or roundabouts
- speed hump
- bollards (short vertical posts)
- channelization island (raised islands that force traffic to turn in a particular direction)
- chicane (curb bulges or planters on alternating sides, forcing motorists to slow down)
- choker (raised islands in parking zones that narrow a roadway)
- curb extension, planter, or centerline traffic island that narrows traffic lanes
- horizontal shift (a lane centerline that curves or shifts)
- parking restrictions for on-street parking such as residential permit parking
- pavement treatments and markings at intersections (e.g., brick paving)
- 'zebra' crosswalk
- rumble or warning strip
- semi-diverter or partial closure (restricts entry and limits traffic flow at intersections)
- signal timing to reduce traffic speeds
- radar trailer that shows drivers their current speed and the posted speed limit
- speed limit sign
- speed table or raised crosswalk
- street trees planted between road and sidewalk for an entire block (< 9m apart)
- corner radii ≤ 3.2m for local roads (increase curb lane on roads with a bus route)

.

5. c. Traffic Speed and Pedestrian-priority – Credit:

- 10-19% of local roads are ≤ 15km/h with pedestrian-priority* (1 credit)
- 20-29% of local roads are ≤ 15km/h with pedestrian-priority* (3 credits)
- 30-39% of local roads are ≤ 15km/h with pedestrian-priority* (6 credits)
- ≥ 40% of local roads are ≤ 15km/h with pedestrian-priority* (10 credits)

Description:

Communities can earn credits by meeting the above traffic speed and pedestrian-priority target ranges. The speed of 15km/h refers to the posted speed limit.

*'Pedestrian-priority' refers to a street or neighbourhood designation in which motorized vehicles must yield to non-motorized traffic (e.g., walking, cycling, playing children) and cyclists must yield to pedestrians -- also known as a 'woonerf' or 'home zone'. Car-free streets also count as pedestrian-priority.

5. d. Sidewalks and Buffer Strips – Credit:

- Average sidewalk width ≥ 2.5m on all mixed-use streets (1 credit)
- As above *and* buffer strips and/or curbside parking on both sides of all roads > 30km/h (3 credits)
- As above *and* buffer strips with physical barriers on both sides of all roads ≥ 50km/h (5 credits)

Description:

Communities can earn credits by including the above sidewalk and buffer strip features. Averages are calculated across the entire community area. Mixed-use streets are defined as those containing both residential and commercial uses. All speeds listed above are the posted speed limit. Buffer strips must be a minimum of 1m wide, and could simply be an extension of the sidewalk, though grass strips with natural features are preferred. Buffer strips including trees should be wide enough to ensure tree health. Physical barriers include but are not limited to planters, trees, hedging, garbage/recycle bins, lamp posts, and public art. Physical barriers should not block the pedestrians' view of the roadway, and must be placed a maximum of 10m apart. Trees are highly recommended.

5. e. Cycle-friendly Design – Credit:

Up to 10 credits total can be earned from the below Cycle-friendly Design measures:

- dedicated raised bike lanes, as an extension of the sidewalk (5 credits)
- bicycle-priority streets (cars must yield to cyclists; speed ≤ 30km/h) (5 credits)
- streets that are one-way for cars; two-way for cyclists; speed ≤ 30km/h (2 credits)
- cul-de-sacs with bicycle cut-throughs (2 credits)
- advance green lights for cyclists (1 credit)

- off-street pedestrian and cyclist shortcuts (2 credits)
- right-hand turn short cuts for cycles (1 credit)
- 1 bicycle rack per ten car parking spots (includes on- and off-street spots) (3 credits)

Description:

Communities can earn up to 10 credits by including combinations of the above cycle-friendly design measures. In order to receive credit for a given measure the design must occur once per hectare, on average, across the community.

5. f. Lighting – Credit:

Up to 5 credits can be earned from the below Lighting measures:

- All mixed-use streets have an average luminance of 10 lux, with a minimum of 5 lux (3 credits)
- Provide ≤ 4.6m tall street lamps spaced no more than 30m apart on both sides of 80% of mixed-use streets (3 credits)
- Provide ≤ 4.6m tall aesthetically-pleasing (artistically-designed) lamp posts on both sides of 100% of mixed-use 'core' streets (2 credits).

Description:

Communities can earn up to 5 credits by including combinations of the above Lighting measures. All averages are calculated across the community (with streets segments weighted accordingly to their length)

Note: Lighting may be used to deter crime in unlit enclave or sections of street.

Right now, residential is excluded because of a recommendation about the peacefulness of less lighting and the stars, but we may want to re-evaluate this.

6. Parking

6. a. Eliminate Parking Minimums – Key Recommendation:

We strongly recommend the elimination of minimum parking requirements in all zoning by-laws applying to development in the Region of Peel, particularly near mixed-use centres and transit facilities. If requirements exist, then they should be in the form of *maximums*.

Why? Parking minimums lead to increased land requirements per building, which greatly decreases densities, increases development costs, encourages development on the periphery (where land is less expensive), and decreases housing affordability. Furthermore, large parking lots degrade the pedestrian-environment, contribute to the urban heat sink problem, and increase demand on storm water infrastructure.

Instead, we recommend the use of parking *maximums*. Developers should supply spaces to match average (*not* peak) demand, and/or to where revenue will cover costs. This will decrease development costs, increase housing affordability, and encourage activity-friendly initiatives such as car-free housing, car-sharing, and public transit use.

6. b. Unbundled and Shared Parking – Credit:

Communities can earn up to 7 credits by meeting one of the below measures:

- Provide unbundled parking for 50% of multifamily dwellings (1 credit)
- Provide unbundled parking for 75% of multifamily dwellings (5 credits)
- Provide unbundled parking for 100% of multifamily dwellings (7 credits)

And communities can earn an additional 3 credits by meeting the below requirement:

- Allow shared parking so that parking spaces can count towards the requirements of two separate uses', such as a civic building and a restaurant, or a place of worship and an office building (3 credits).

Description:

Communities can earn credits by meeting the above unbundled and shared parking requirements. 'Unbundled' parking refers to parking that is sold or rented separately from associated residential units, with costs made explicit. Shared parking refers to parking spaces that are shared by users with different peak periods of demand, allowing one space to count towards more than one structure's parking requirements (if they exist). Examples of sharing combinations: office (weekday) and restaurant (nights and weekend); civic building (weekday) and place of worship (weekend); retail stores (day) and movie theatre (night).

6. c. Parking Price and Difficulty – Credit:

Up to 10 credits can be earned from the below Parking Price and Difficulty measures:

- Charge the market rate* for off- and on-street parking for all mixed-use and retail streets (4 credits)
- Designated 'Parking Meter Zones' in which parking revenues go back into the zone for pedestrian-friendly and aesthetic improvements, such as public art, paving, street furniture, lighting, trees, cleaning, and painting/maintenance (3 credits)
- Use variable parking pricing, so that costs increase with the length of stay, or limit the length of stay to ≤ 2 hours (2 credits)
- Maximum 2-hour on-street parking for non-residents *or* resident-only parking on all streets within 200m of a mixed-use centre (2 credits)
- Require employers to *cash-out* non-driving employees when employee parking is free (2 credits)

*the market rate is the price that results in 85-90% utilization during peak hours.

Description:

We need to determine how some of these credits will be measured.

6. c. Parking Location and Alleys – Credit:

Up to 10 credits can be earned from the below Parking Location and Alleys measures:

- All residential driveways* are ≤ 3m wide (2 credits)
- ≥ 70% of residential dwellings have either no parking *or* access their parking via rear alleys or lanes and have no parking in their front setbacks (4 credits)
- All parking lots are placed at the rear or side of buildings (4 credits)
- ≥ 90% of residential lots do not have parking garages in their front façade (4 credits)
- Provide on-street parking on both sides of ≥ 70% of new streets, excluding 'woonerfs' (2 credits)

Description:

Communities can earn up to a total of 10 credits by including combinations of the above parking location and alley credit requirements. Note that all percentages are averaged across the entire community.

*Residential driveways include parking spots in the front setback, and driveways to rear or side parking. Shared driveways are encouraged.

Here or elsewhere: Do we want to include something about permeable lanes/alleys/woonerfs (gravel (not woonerfs), paving stones with grass, brick, etc., which are better for storm water infrastructure, etc.)?

]7. Aesthetics and Human Scale

7. a. Building Setbacks – Prerequisite:

- ❖ Detached residential structures must have ≤ 7.6m building setback
- ❖ Attached and multifamily residential structures must have ≤ 4.6m building setback
- ❖ Commercial and light industrial structures must have ≤ 3m building setback
- ❖ ≥ 70% of commercial and/or mixed-use structures must have their front façade flush with the sidewalk
- ❖ Main entrances of residential, commercial, and light industrial buildings cannot front onto parking lots

Description:

Communities must meet the building setback targets outlined above. Building setbacks shall be measured at a right angle from the front façade of the proposed structure to the edge of the public right-of-way (road or sidewalk), not necessarily the property line.

And…

A minimum of 70% of commercial (and mixed-use?) structures must have their front façade flush with the sidewalk (0m setback) or street (in the case of pedestrian-priority streets without sidewalks). Structures at street intersections (corners) must have all of their street-facing facades flush with the sidewalk to be included in this calculation.

And…

Main entrances of residential, commercial, and light industrial buildings must face onto a public right-of-way (e.g., road, sidewalk) or public space (e.g., plaza, square), not a parking lot. A main entrance is defined as the primary pedestrian entranceway.

7. b. Building Height to Street Width Ratio – Credit:

- Average building height to street-width ratio between 1:3 and 1:2.1 (1 credit)
- Average building height to street-width ratio between 1:2 and 1:1.1 (3 credits)
- Average building height to street-width ratio between 1:1 and 3:1 (7 credits)

Description:

Communities can earn credits by meeting the above target ranges for building height to street width ratio. Building height shall be measured from the ground to the eave or roof deck, not the peak of the roof. For buildings exceeding 6 stories, only the height up to the top of the sixth story shall be counted. The average will be calculated across the entire community, with each building weighted equally. *In order to receive credit, direct sunlight must reach the street at all times of year (for X hours per day?).*

7. c. Setbacks and Streetwalls – Credit:

Up to 8 credits can be earned from the below Setbacks and Streetwalls requirements:

- ≥ 80% of commercial structures are flush to the sidewalk or street (3 credits)
- ≥ 80% of commercial lots that face public space* have clear glass on ≥ 60% of their façades, 1-2.4m above grade (3 credits)
- ≥ 80% of commercial lots do not have blank walls (no doors or windows) longer than 40%, or 15m, of a façade facing a sidewalk, front street, or plaza (2 credits)

Description:

Communities can earn up to a total of 5 credits by including combinations of the above setback and streetwall requirements. Setbacks shall be measured as described in 7.a. *Public spaces include but are not limited to sidewalks, front streets, and plazas.

7. c. Tree Placement and Characteristics – Credit:

Up to 10 credits can be earned from the below Tree Placement and Characteristics requirements:

- ≥ 75% of new and existing residential streets in a community have ≥ 1 tree for every 10m of lot frontage on both sides of the street (4 credits)
- ≥ 75% of new and existing mixed-use streets have ≥ 1 tree for every 10m of lot frontage on both sides of the street (4 credits)
- ≥ 75% of streets with a speed limit of ≥ 50km/h have ≥ 1 tree for every 10m of lot frontage on both sides of the street, with the trees placed between the sidewalk and road (4 credits)

Description:

Communities can up to a total of 10 credits for including combinations of the above tree placement and characteristics requirements. Only trees that will grow ≥ 8m in height at maturity are included in the calculations. Pedestrian-priority streets are exempt from, but can be included in calculations. Large broadleaf shade streets that will grow to ≥ 15m tall at maturity and form a street-tree canopy are encouraged.

7. d. Outdoor Open Spaces – Credit:

- Communities give ≥ 5% of land to public outdoor spaces, such as parks and plazas (0 credits)

Description:

This is currently in the Land Use Mix section, as most other related credits are already in the Proximity section. Perhaps, however, we want to require that every house needs to be within 800m of a park, playground, or other activity-friendly outdoor space.

Peel Healthy Development Evaluation Tool: DRAFT Scorecard for Discussion

1. Density						
	a.	Minimum Density (residential and non-residential)	Prerequisite	Y	?	N
	b.	Net Residential Dwelling Density	Credit	/10		
	c.	Average Floor Area Ratio (non-residential structures)	Credit	/10		
Notes:			Total Credits:	/20		
			Credit Requirement:	5/20		
			Meets Both Criteria:	Y	?	N
2. Service Proximity						
	a.	Proximity to a Variety of Services and Employment	Prerequisite	Y	?	N
	b.	Proximity to a Variety of Services	Credit	/15		
	c.	Proximity to Local and Regional Transit	Credit	/10		
	d.	Proximity to Employment	Credit	/10		
Notes:			Total Credits:	/35		
			Credit Requirement:	7/35		
			Meets Both Criteria:	Y	?	N
3. Land Use Mix						
	a.	Heterogeneity of Land Use Mix	Credit	/10		
	b.	Heterogeneity of Parcel/Building Use	Credit	/10		
	c.	Mixed Housing Types	Credit	/5		
Notes:			Total Credits:	/25		
			Credit Requirement:	9/25		
			Meets Criteria:	Y	?	N
4. Street Connectivity						
	a.	Intersection Density or Block Size	Prerequisite	Y	?	N
	b.	Intersection Density	Credit	/10		
Notes:			Total Credits:	/10		
			Credit Requirement:	1/10		
			Meets Both Criteria:	Y	?	N

5. Road Network and Sidewalk Characteristics

a.	Complete Streets (sidewalks, bike lanes, traffic speed)	Prerequisite	Y ? N	
b.	Traffic Calming	Credit	/10	
c.	Traffic Speed and Pedestrian-priority	Credit	/10	
d.	Sidewalks and Buffer Strips	Credit	/10	
e.	Cycle-friendly Design	Credit	/5	
f.	Lighting	Credit	/5	

Notes:

Total Credits: /40

Credit Requirement: 15/40

Meets Both Criteria: Y ? N

6. Parking

a.	Eliminate Parking Minimums	Key Recommendation	
b.	Unbundled and Shared Parking	Credit	/10
c.	Parking Price and Difficulty	Credit	/10
d.	Parking Location and Alleys	Credit	/10

Notes:

Total Credits: /30

Credit Requirement: 13/30

Meets Criteria: Y ? N

7. Aesthetics and Human Scale

a.	Building Setbacks	Prerequisite	Y ? N	
b.	Building Height to Street Width Ratio	Credit	/7	
c.	Setbacks and Streetwalls	Credit	/8	
d.	Tree Placement and Characteristics	Credit	/10	
e.	Open Outdoor Spaces	Credit	/0	

Notes:

Total Credits: /25

Credit Requirement: 10/25

Meets Both Criteria: Y ? N

8. Scoring Summary

Notes:

Total Credits: /195

Approved: Y ? N

Certified: 60-84 **Bronze:** 85-124 **Silver:** 125-164 **Gold:** 165-195

Certification: _____

Appendix B. Literature Review

Literature Review

Peel Healthy Development Evaluation Tool

Prepared for Peel Public Health by
The Centre for Research on Inner City Health at St. Michael's Hospital
With support from the Ministry of Healthy Promotion
September, 2009

Table of Contents

1. Context and Background

Across Canada, rates of obesity and chronic disease are alarmingly high (Haydon et al., 2006), and the Region of Peel is no exception: In 2005, 47% of Peel adults were either overweight or obese, and 9% suffered from diabetes (Peel Public Health, 2008). Despite scientific evidence that physical activity can reduce the risk of obesity, type 2 diabetes, cardiovascular disease, and certain forms of cancer by up to 50% (Health Living Unit, 2008), 54% percent of Peel adults were inactive in 2003 (Statistics Canada, 2005), and the region has some of the lowest active transport rates in Canada (Bray et al., 2005).

The *State of the Region's Health Report* (Peel Public Health, 2005) suggests that sprawling, auto-oriented development patterns -- which very much characterize Peel -- are a potential cause of the high prevalence of obesity and low rates of physical activity in the region. As a result, Peel council approved Resolution 2005-1395, which directed Peel Public Health to examine and make planning recommendations that provide greater opportunities for active living.

In response to this Resolution, Peel Public Health has contracted the Centre for Research on Inner City Health (CRICH) at St. Michael's Hospital to study the relationship between the built environment and active living and, in turn, create an evidence-based planning tool that will encourage future development in a form more conducive to active living.

This report is the first stage of that process: a summary of the current research, best practices, and theoretical recommendations regarding active living and the built environment. This review will not only contribute to the tool's development but also guide CRICH's original research specific to the Peel region. It is important to note that this report focuses on practical recommendations, and includes only limited qualitative,

The findings in this report are separated by 'elements' of the built environment. Each element is meant to capture a primary factor of the built environment that influences physical activity, as found in the literature. Furthermore, we have grouped the most interrelated elements into two categories: 1) Population and Service Distribution, whose elements determine both the location and density of people and destinations; and, 2) Urban Design, whose elements determine the dimensions, aesthetics, and scale of the environment.

However, it is important to note the overlap and interrelationships between all seven elements. Altering the degree or presence of one will directly or indirectly affect another. Therefore, an individual element (and its related thresholds and recommendations) should not be viewed in isolation from the others. Similarly, a combination and balance of all of the elements is ideal, not extremes of one or another. Grouping measures into elements and elements into categories is simply for organizational purposes. Further amendments may be necessary.

2. Population and Service Distribution Elements

Introduction

Density, Service Proximity, and Land Use Mix are quantified using a variety of unique measures which closely interact to determine the distribution of people and destinations across a given area. In combination, these elements strongly affect how easily people can access a number and variety of services.

For example, higher densities place more people in a specific area, improving the area's ability to support nearby services (e.g., transit, grocery, retail). In turn, having services and employment in close proximity to residences reduces the distance between people and destinations, increasing the likelihood of nonmotorized trips. Lastly, greater land use mix allows the simultaneous presence of higher residential densities and proximal services through the integration of a variety of land uses in a given area. This mixing reduces not only the distance between residents and destinations but also the distance between any two destinations, encouraging residents to make non-motorized trips to clusters of services where they can complete a variety of daily errands.

Sections 2.a., 2.b., and 2.c. and their accompanying tables review the literature on Density, Service Proximity, and Land Use Mix.

2. a. Density

Density is most commonly measured as residential density or population density but can also be measured as employment density, floor area ratio (FAR), or service density. Density interacts closely with Service Proximity and Land Use Mix to affect the concentration and distribution of people and destinations in the built environment. On the one hand, areas with high residential and population density can better support the location of a variety of services, jobs, and other destinations within walking and/or cycling distance of where people live. On the other hand, low density areas often have homogenous land uses with few services, destinations, or employment opportunities located within walking or cycling distance of where people live. Therefore, high densities, in combination with the close proximity of a variety of destinations and employment opportunities to residential areas, and to each other, are generally regarded as more conducive to active transport.

Results of the literature review on Density are presented in Table 1. Below is a summary of these results:

Summary of Quantitative Evidence:

- Residential density (units/area) generally has significant positive associations with walking frequency, walking distance, and moderate physical activity. One study found thresholds of 15+ units/acre (37+/ha) and 21+ units/acre (54+/ha).

- Population density (people/area) generally has significant positive associations with walking outcomes and significant inverse associations with BMI (or Body Mass Index, which determines amount of body fat), obesity rates, and vehicle ownership.

- Residential density is the most commonly examined density measure and is the strongest predictor of associations between density and active transport.

Summary of Best Practices and Recommendations:

- Cluster areas of high residential density around nodes of retail and/or transit services. High density without services in close proximity is not sufficient to encourage walking.

- LEED Neighbourhood Development requires residential areas without high transit service to have a density of 7+ dwelling units/acre (17.3/ha) of buildable land; and any non-residential components to have a density of 0.50+ FAR of buildable land.

- Experts recommend densities from 12 to 100 units/acre (30-247/ha) for urban 'livability'.

- CNU-EPA (a collaboration between the Congress for New Urbanism and the Environmental Protection Agency) Smart Scorecard gives an 'excellent' score to office buildings with a 1.0 FAR and commercial buildings with a 0.75 FAR.

Table 1. Density

Residential Density (units per area) Currently Quantifiable in Peel: Yes		
Quantitative Evidence (Sorted by Outcome)	• In a multiple regression, including income, mean household size, and a public transit index, net residential density was the strongest predictor of walking (R^2 = 0.35).[a]	[a]Fillon et al. 2006
	• For each quartile increase in the level of net residential density, there was a 23% increase in the odds of walking for non-work travel.[b]	[b]Frank & co. 2005
	• Increased residential density was significantly associated with increased daily walk trips: 0-3.99 units/acre (0-9.86 units/ha) = 0.32 walk trips/day; 4-6.99/ac (9.88-17.27/ha) = 0.74; 7-9.99/ac (17.29-24.68/ha) = 1.15; 10-14.99/ac (24.7-37/ha) = 1.08; 15-19.99/ac (37.05-49.38/ha) = 2.32; 20+/ac (49.4+/ha) = 2.09.[c]	[c]Frank 2004
	• Parcel density (units/ft^2 in household parcel) was significantly associated with frequency of transportation walking for frequent walkers, OR (CI 95%) 2.11 (1.147, 3.882).[d]	[d]Lee and Moudon 2006
	• Area density (units/ft^2 in 1km network buffer) was associated with walking at least once/week for rec or transport, OR (95% CI) = 0.14 (0.036, 0.511).[d]	
	• Parcel & area density were not significantly related for all other transportation and rec walking relationships for moderate and frequent walkers.[d]	
	• Household density was significantly associated with neighbourhood walking (likert responses to physical activity in neighbourhood), path coefficient 0.047 (0.001 to 0.094), SE = 0.024, t = 1.998, p < 0.05.[e]	[e]Li et al. 2005
	• Natural log of the minutes of moderate physical activity per day (controlling for age, education attainment, and gender) had a correlation of r=0.179 (p<0.01) with residential density.[f]	[f]Frank et al. 2005
	• Density of household parcel (threshold > 21.7 residential units/acre [53.6/ha]) and net residential density within a 1km euclidean buffer of home (threshold < 15.5 residential units/acre [38.3/ha]) was significantly related to walking 150mins/week or more. Note that these thresholds are contradictory.[g]	[g]Moudon et al. 2006
	• Net residential density in home neighbourhood (500m buffer) had a significant relationship for nonmotorized travel *from* school to home (P<0.001; OR = 0.26 (0.123, 0.547), but not *to* school.[h]	[h]Larsen et al. 2009
	• Net residential density in school neighbourhood (1.6km buffer) and walking *to* or *from* school was not significant.[h]	
	• More dense urban zones had a higher proportion (19%) of trips via transit, walking, or biking than less dense suburban zones (4%).[i]	[i]Parsons * co. 1993
	• Net residential density was included in a walkability index that was significantly associated with minutes devoted to active transportation and with BMI. (8.35% variance explained for active transportation; 1.14% variance explained for BMI). Index also incl. street connectivity, land use mix, and retail floor area ratio (FAR).[j]	[j]Frank et al. 2006
	• High walkability (incl. res. Density) areas had greater amounts of physical activity (p = .010), lower rates of overweight (p = .043).[k]	[k]Saelens et al. 2003
	•When controlling for neighbourhood preferences, odds of walking (CL 90%) in the most walkable (incl. net res. Density) parts of Atlanta were 1.62 (for any purpose); 1.72 (for non-discretionary travel); and 2.14 (for discretionary travel) times more than in the least walkable.f	[f]Frank et al. 2005
	• Each quartile increase in walkability was associated with a 5.5 mile (8.85km) reduction in vehicle miles traveled when adjusting for demographic co-variates and for neighbourhood preference.[f]	

Residential Density - Continued		
Quantitative Evidence	• Increased surface parking requirements reduce the maximum potential development density; e.g., increasing requirements from 1 to 2 spaces/unit decreased development density by 37% for 500ft^2 and 13% for 2000ft^2 townhomes.[l]	[l]Litman 2009
Best Practices & Recommendations	• For projects with relatively high transit service: build all residential components of a project at a density of 12+ units/acre [30+/ha) of buildable land. For other projects: density of 7+ dwelling units/acre (17.3/ha) of buildable land.[m]	[m]LEED-ND 2008
	• Minimum densities for urban "livability": 100 units/acre (247/ha) (J. Jacobs); 12-20 units/acre (30-49/ha) (Lynch); 15 units/acre (37/ha) (A. Jacobs & Appleyard); 10-15 units/acre (25-37/ha) (Calthorpe).[n]	[n]Ewing 1996
	• Increase units/acre as you approach the core and transit zones, varying from 1 unit/acre (2.5/ha) in rural to 96 units/acre (237/ha) in urban cores.[o]	[o]Duany et al. 2008
	• Minimum for low density = 15 units/ha (6 units/acre) using mixed housing types. Density related to active transport methods due to reduced distance.[p]	[p]Bergeron et al. 2007
	• Achieve an average net residential density of 6-7 units/acre (14.8-17.3/ha) without the appearance of crowding.	
	• 'Survery suggest' residents are as happy with 6-7 units/acre (14.8-17.3/ha) as they are at 3-4 units/acre (7.4-9.9/ha). However, higher density can offer greater affordability.[q]	[q]Ewing 1998
	• Reducing lot size while maintaining conventional density levels can reduce development costs by up to 1/3. Less site prep and grading costs, shorter distances for roads and utilities; less drainage and irrigation, less heating and cooling; more natural features and open space, which enhance community.[q]	
	• Place higher density housing near commercial centers, transit lines, and parks.[q]	
	• The likelihood of walking increases most when density is combined with a variety of destinations close to home and greater street connectivity.[b]	
	• Extenstive literature review suggests that density is positively correlated with PA but is likely a proxy for accessibility (service proximity and density).[r]	[r]TRB 2005
	• Density seems to require proximity to efficient public transit, employment centres, or interesting commercial streets to encourage walking, such as in the older neighbourhoods of downtown Toronto.[t]	[t]Fillon et al. 2006
	• Encourage density in activity centres and near transit facilities; gradually decrease density away from centres.[u]	[u]Corbett 1996
	• Encourage density to shorten distances through 1) reduce lot sizes, 2) density bonuses to developers, or 3) allowing 'garden apartments' (above garage, in basement, etc.).[v]	[v]Fenton 2003
	• Population density is very important in transit-supportive development, but housing must provide convenient access to transit and faciilitate its use.[w]	[w]Miller 2003
	• Encourage compact development with diverse housing types.[x]	[x]Litman 2008
	• Encourage development and utility fees that reflect increased costs of low density development.[x]	

Population Density (people per area) Currently Quantifiable in Peel: Yes		
Quantitative Evidence (Sorted by Outcome)	• Population density (residents/km^2;Beta = - .25, p < 0.001) was significantly inversely associated with BMI.[y] • Comparing the 90th to 10th percentile, the predicted adjusted difference in BMI with increased population density was - .86 units.[y] • Higher gross density (in 805m^2 study area) was significantly associated with walking for various participant groups (ORs range: 1.78–2.45), including the less healthy.[y] • Increased pop. density (1km network buffer around home) significantly associated with walking at least once in past two days and with walking 0.5 miles/day (0.8km/day) (3rd tertile: OR of 2.4 (1.8-3.2) and 1.7 (1.1-2.3), respectively, compared to 1st tertile.[z] • In a multivariate model (controlling for density, connectivity, land use mix, recreation space, age, household income, white vs. nonwhite, and car ownership) pop. density had OR of 1.7 (1.1-2.3)** and 1.8(1.0-3.1)*).[z] • A County Sprawl Index (including population density) was signficantly associated (coefficient, p) with more minutes walked (0.275, 0.004), lower BMI (-0.00344, 0.005), and lower obesity rates (-0.00212, <0.001).[2] • Gross population density (persons/mile^2); % population living at densities < 1500 persons/mile^2 (577 persons/km^2); % population at densities > 12,500 persons/mile^2 (4808 persons/km^2); and county population/mile^2 of urban land were all significant factors in sprawl index.[1] • For every 50-point increase in sprawl, resident BMI expected to rise by .17 points; odds of obesity rise by 10%; amount of exercise decrease by 14mins/month; and odds of high blood pressure increase by 6%.[1] • Regardless of walking in leisure time, BMI and obesity levels were higher in more sprawling counties.[1] • Vehicle ownership starts to decline more rapidly when density increases beyond 15,000 persons/mi^2 (577 persons/km^2).[l]	[y]Rundle et al. 2007 [z]Frank et al. 2007 [1]Ewing et al. 2003a & Ewing et al. 2003b [l]Litman 2009
Floor Area Ratio (total building floor area divided by total site area) Currently Quantifiable in Peel: Uncertain		
Best Practices & Recommendations	• For office property (FAR excluding structured parking and right of way): Excellent = 1.0, Preferred = .76-1.0, Acceptable - .51-.75, Minimal - .4-.5.[2] • For retail property (FAR excluding structured parking and right of way): Excellent = .75, Preferred = .46-.75, Acceptable = .36-.45, Minimal = .3-.35.[2] • For projects with relatively high transit service, build any non-residential components of the project at a density of 0.80+ FAR/acre of buildable land, and for all other projects, build any non-residential components at a density of 0.50+ FAR of buildable land.[m] • .35 FAR within a density corridors, .5 FAR in downtown	[2]Fleissig & Jacobsen 2002 [m]LEED-ND 2008 [3]City of Austin 2001

Employment Density (number of places of employment per unit area) Currently Quantifiable in Peel: Uncertain		
Quantitative Evidence	• Employment density was significantly associated with neighbourhood walking (likert responses to PA in neighbourhood), path coefficient 0.187 (0.061 to 0.313), SE = 0.06, t =2.901, p = 0.05[e]	[e]Li et al. 2005
Best Practices & Recommendations	• Both the location and density of employment are critical components of transit-supportive development. Higher densities of employment near transit stops and stations generally mean that the non-home end of the trip to work will be only a short walk.[w]	[w]Miller 2003
See Appendix B. Service Proximity - Measure: "Employment Opportunities Within a Fixed Distance or Travel Time 'Buffer' Around Study Participants' Homes" for measures of employment proximity and availability.		
Service Density (number of locations of a given service per unit area) Currently Quantifiable in Peel: Yes		
Quantitative Evidence (Sorted by Outcome)	• Density of bus stops (Adjusted β = -0.01, *p* =0. 01) and density of subway stops (Adjusted β =-0.06, *p* =0.01) within New York City census tracts were significantly inversely associated with BMI after adjustment for individual- and neighborhood-level sociodemographic characteristics. Comparing the 90th to the 10th percentile of each built environment variable, the predicted adjusted difference in BMI was: a) -0.33 BMI units with increased bus stop density;[y] b) -0.34 BMI units with increased subway stop density.[y]	[y]Rundle et al. 2007
	• In multilevel analyses, controlling for neighbourhood and individual-level covariates (including but not limited to income, ethnicity, age, gender, and health), a 1-SD increase in public transit station density was associated with the following in predominantly white, middle aged, married, high SES people: a) 15% increase in walking for transportation (p=0.011); b) 7% increase in meeting physical activity recommendations (p=0.03). [7]	[7]Li et al. 2008
	• Highest quintile of observer-rated density of destinations in a census tract was significantly associated with greater likelihood of walking for any reason at least 5 days per week for at least 30 minutes, OR (95% CI) = 1.53 (1.21-1.94) (compared to middle [second, third, and fourth] quintiles). Associations were attenuated but remained statistically significant after controlling for SES, health, lifestyle, and other physical activity characteristics, Adjusted OR (95% CI) = 1.48 (1.16-1.89). [4]	[4]Gauvin et al. 2008
	• Lowest quintile of observer-rated density of destinations in a census tract was significantly associated with lower likelihood of walking for any reason at least 5 days per week for at least 30 minutes, when controlling for SES, health, lifestyle, and other physical activity characteristics, Adjusted OR (95% CI) = 0.69 (0.55-0.88) (compared to middle [second, third, and fourth] quintiles). [4]	
	• Per capita density of chain supermarkets had a statistically significant inverse relationship with adolescent BMI and overweight status. Each additional chain supermarket outlet per 10,000 persons was estimated to reduce BMI by 0.11 units and to reduce the prevalence of overweight by 0.6%. [5]	
	• BMI and overweight were significantly higher in areas with more convenience stores; an additional convenience store per 10,000 persons was associated with a 0.03 unit increase in BMI and a 0.15% increase in overweight.[5]	[5]Powell et al. 2007
	• The per capita density of nonchain supermarkets and general grocery stores was not statistically significantly associated with adolescent BMI, although increased per capita density of grocery stores had a very small positive and statistically weak association with overweight.[5]	
See Appendix B. Service Proximity for related measures, including service proximity and availability.		

2. b. Service Proximity

Service Proximity is most commonly measured as the objective or subjective distance or travel time to a given service, destination, or workplace from one's area of residence. This element affects the distance traveled to a given destination and interacts closely with land use mix, density, and street connectivity in the creation of a walkable built environment. For example, a residential area with grocery stores, schools, workplaces, parks, and transit nearby encourages shorter daily trips to frequently used destinations, promoting walking, cycling, recreational physical activity, and transit use. However, an area lacking nearby services, including transit, forces residents to travel greater distances, usually by car, to visit frequently-visited destinations. Therefore, high levels of service proximity are generally regarded as more conducive to walking and active transport.

Results of the literature review on Service Proximity are presented in Table 2. Below is a summary of these results:

Summary of Quantitative Evidence:

- Proximity of commercial retail and services, schools, and parks were all generally positively associated with walking outcomes. Grocery stores, schools, workplaces, and parks tended to have the strongest association.

- Euclidean distance thresholds of proximity that were significantly associated with walking sufficiently to meet health recommendations:
    - Distance to grocery store or market: < 440m
    - Distance to eating or drinking establishment: < 262m.

- Having > 13.5 grocery stores or markets in a 1km radius of home was significantly associated with walking sufficiently to meet health recommendations.

Continues on page next page…

Summary of Quantitative Evidence continued…

- Having 80,000-160,000+ jobs located within a 30-minute transit trip of home increased the modal share of active transport to work, with a 12% increase in walk/bike trips from the lowest employment category (0-40,000 jobs) to the highest employment category (160,000+ jobs).strongest predictor of associations between density and active transport.

Summary of Best Practices and Recommendations:

- Commercial centers, transit lines, and community facilities should be 1/4 mile (400m) or less from target housing if walking is expected.
- LEED-ND projects can meet location requirements by having ≥ 50% of dwelling units and businesses within < 400m walk of existing or planned adequate transit service[§] or by having their project boundary within a 400m walk of 5, or a 800m walk of 7, diverse uses.
- LEED-ND residential projects receive points for locating the geographic center of the project within an 800m walk of the same number of pre-project full-time jobs as there are dwelling units in the project.
- LEED-ND projects receive points for locating 90% of dwelling units and businesses within both a) a 400m walk of a schoolyard or plaza greater than 1/6 acre (.07ha), and/or b) an 800m walk of active public facilities (e.g., sports fields) totaling at least 1 acre (0.4ha), or an indoor recreational facility.

Table 2. Service Proximity and Availability

Walking or Cycling Distance to the Nearest Location of a Given Service (euclidean [straight-line] distance to the nearest location; road network distance to the nearest location) Currently Quantifiable in Peel: Yes		
Quantitative Evidence (Sorted by Outcome)	• Assessed straight-line (euclidean) distance from study participants homes to the location of their managed-care fitness benefit program (each participant was assigned to a structured or unstructured fitness program at their respective facility).[a] • For a 1km increase in distance of participants home from the structured fitness program, participation decreased by 14.4%, OR (95% CI) = 0.856, (0.8288-0.8834)[a] • Distance from the facility had a weak significant association with frequency of program use for the unstructured program (β=-0.039), and an insignificant assocation with frequency of use for the structured program.[a] • Shortest travel distance to participants school along the road network, walking and biking paths was significantly associated with: a) "nonmotorized travel *to* school" (Coefficient [SE] = -0.647 [0.123]; OR [95% CI] = 0.523 [0.412-0.666]);[b] b) "nonmotorized travel *from* school" (Coefficient [SE] = -0.816 [0.123]; OR [95% CI] = 0.442 [0.348-0.562]).[b] • Empirical thresholds of service proximity significantly related to the probability of study participants walking sufficiently to meet recommendations for health (>=150 mins/week): a) Euclidean distance to closest grocery store or market, threshold < 1445 feet (440 metres)[c] b) Euclidean distance to eating or drinking place, threshold < 861 feet (262m)[c] c) Route directness (ratio) between euclidean and network distance to the closest school, threshold > 74.5 percent[c] • Significant and insignificant associations between proximity of different types of services and several walking frequency outcomes (moderate vs. non-walker and frequent vs. non-walker, both for transportation and recreational walking) were found. Only those relationships that were significant for at least one outcome are shown below, OR (95% CI): 1) Outcome - Frequency of walking for transportation (moderate-walker vs. non-walker, and frequent-walker vs. non-walker): a) Road network distance to nearest grocery store (100 ft [30.5m] increments) not significant (NS) for moderate; 0.953 (0.916-0.990) for frequent;[d] b) Road network distance to nearest restaurant (log-feet) NS for moderate; 0.362 (0.181-0.725) for frequent;[d] c) Road network distance to nearest post office (categorical: 11 = up to 1 km, every half-km increments through 16 = 3+km) NS for moderate; 0.704 (0.506-0.979) for frequent;[d] d) Road network distance to the nearest bank (100 foot [30.5m] increments) 0.976 (0.955-0.977) for moderate; 0.968 (0.940-0.996) for frequent.[d] e) Ratio between euclidean and network distances to the closest church (%) 1.027 (1.007-1.047) for moderate; NS for frequent.[d] 2) Outcome - Frequency of walking for recreation model (moderate-walker vs. non-walker, and frequent-walker vs. non-walker): a) Road network distance to the nearest day care center (categories 11 = < 0.25 miles [0.4km], every quarter mile [0.4km] increment through 18 = 1.75+miles [2.82+km]) 0.704 (0.596-0.832) for moderate; 0.628 (0.509-0.774) for frequent.[d]	[a]Berke et al. 2006 [b]Larsen et al. 2009 [c]Moudon et al. 2006 [d]Lee & Moudon 2006

Walking or Cycling Distance to the Nearest Location of a Given Service - Continued		
Quantitative Evidence (Sorted by Outcome)	• Tabulation of results from the 1990 Nationwide Personal Transportation Survey (NPTS) indicates that the median distance people are willing to walk to and from a bus stop is 0.28 miles (450 m). Therefore, bus stops should be placed approximately every half-mile (800m), to ensure access for transit users within an approximately 400m or less walk. To accomplish this efficiently would require half-mile spacing of higher-order streets and transit routes. Otherwise, to achieve this network density in a curvilinear network with irregularly spaced streets would require 4.0 miles of through street for every mile^2 of land area.[e] • Note that people may be willing to walk further than 400-450m to premium transit stops (e.g. rapid rail service).[e]	[e]Ewing 1996
	• Proximity of neighbourhood-scale (<100,000ft^2 retail area) retail establishments; commercial office buildings; restaurants and taverns; educational facilities; grocery stores; and civic uses were most strongly (compared to all other uses) and significantly correlated with household walk trips, when measured by number of attractions (uses within ¼ mile [500m] walk distance), rentable building area, and total parcel area. All $p < .0001$ • Only high-tech industrial and office park uses failed to have any significant relationships with household walk trips.[f] • Note that the likelihood of walking increased most when a variety of destinations close to home are combined with greater street connectivity (intersection density) and greater residential density.[f]	[f]Frank & Co. 2005
	• The proximity of 15 types of service destinations within a 0.4 mile (644m) road network distance of residential parcels was significantly associated with walking trips, Adjusted $R^2 = 0.122$, Unstandardized $\beta = 2.269$ (SE 0.312).[g]	[g]Tilt et al. 2007
Best Practices & Recommendations	• Edge lots of the Traditional Neighbourhood District (TND) must be within a ¼ mile (400m) walking distance of retail and recreational services.[h] • Commercial centers, transit lines, and community facilities should be no more than ¼ mile (400m) from target housing if we expect anyone to walk to them.[i]	[h]Belmont 1995 [i]Ewing 1998
	• Recommend that 90% of dwellings be located within a 450m or 5-6 min walk from an existing or future bus stop.[j] • LEED-ND has 5 options for required project siting. Two of these options directly stipulate proximity of services: 1) Locate the project near existing or planned adequate transit service[§] so that at least 50% of dwelling units and business entrances in the project are within a ¼ mile (400 m) walking distance of bus or streetcar stops, or within a ½ mile (800m) walking distance of bus rapid transit stops, light or heavy passenger rail stations, ferry terminals, or tram terminals. See footnote for description of "adequate transit service."[k]	[j]Bergeron et al. 2007 [k]LEED-ND 2008

Walking or Cycling Distance to the Nearest Location of a Given Service - Continued		
Best Practices & Recommendations	2) Locate the project near existing shops, services, and facilities. The project boundary must be within ¼ mile (400m) walking distance of at least 5, or within ½ mile (800m) walking distance of at least 7, of the diverse uses defined below¶, including at least one use from each of the three categories (retail, services, civic) with the following limitations: [k] a) uses may not be counted in two categories, e.g. a school or place of worship may be counted only once even if it also contains a daycare facility; [k] b) a mixed use building containing several uses as distinctly operated enterprises with separate exterior entrances may count each as a separate use, but no more than half of the minimum number of diverse uses can be situated in a single building or under a common roof; [k] c) a single retail store of any type may only be counted once even if it sells products associated with multiple use types."[k]	
	• LEED-ND projects can earn a credit by ensuring 50% of residential units in the project are within a ½ mile (800m) walk of the entrance to a planned or existing school, AND that routes to schools within the project include pedestrian, bike and traffic calming features. [k]	kLEED-ND 2008
	• LEED-ND projects can earn credit for locating a diversity of uses within a ½ mile (800m)walk distance from all residential dwelling units. The specifics of the requirement are as follows: The project must have a residential component that constitutes at least 25% of the project's total building square footage, residents of the dwelling units should be within a ½ mile (800m) walk distance of a number of diverse uses and should not have to cross a street with speed limits greater than 25 mph without signals or stops signs at crosswalks. The number of credit points is determined on a sliding scale based on the number of diverse uses¶ within the ½ mile (800m) walk distance--with at least one from each category (retail, services, civic) being required. [±,k]	
	• Residents placed the highest importance on parks and grocery stores/markets when asked to evaluate the importance of proximity for a variety of destination types. [L]	[L]Tilt et al. 2007
	• Mix uses in close proximity, so that services are within walking/biking distance of each other. [m]	[m]Fenton 2003
	• Proximity and directness (connectivity) lead to shorter trips; if short enough, walk trips will begin being substituted for driving trips. [n]	[n]Frank (lit review)
	• A "snowball" strategy review of *n*= 54 relevant research studies found that "Research suggests that neighborhood residents who have better access to supermarkets and limited access to convenience stores tend to have healthier diets and lower levels of obesity. Results from studies examining the accessibility of restaurants are less consistent, but there is some evidence to suggest that residents with limited access to fast-food restaurants have healthier diets and lower levels of obesity." [o]	[o]Larson et al 2009
	• Build complete communities by, for example, locating shops, schools, and parks within neighbourhoods. [p]	[p]Litman 2008
	• Handy's (2005) extensive literature review suggests that 'accessibility' (service proximity and density) is the greatest correlate to physical activity. [q]	[q]Handy 2005

Perceived Walking Distance to the Nearest Location of a Given Service or Employment Opportunity (Survey measure) Currently Quantifiable in Peel: No		
Quantitative Evidence (Sorted by Outcome)	• Study participants' perceived walking proximity of their workplace was the greatest indicator of weekly minutes of transport-related walking (strongest significant assocation): a) unadjusted for neighbourhood selection *b* =16.0 (95% CI = 4.6-27.5);[r] b) adjusted for neighbourhood selection *b* =15.0 (95% CI = 3.3-26.7). (gender and education were moderators in both cases).[r]	[r]Cerin et al. 2007
	• Perceived walking proximity of commercial destinations (local shops, supermarket, greengrocer, laundry/dry cleaners, etc.) had a significant assocation with weekly minutes of transport-related walking, when unadjusted for neighbourhood selection, *b* =12.4 (95% CI = 0.2-28.8). The association became insignificant when adjusting for neighbourhood selection. (no moderators).[r]	
	• Residents perceived proximity to recreational facilities (based on their response to the statement "there are playgrounds, parks, or gyms, close by that I can get to easily") was not significantly associated with neighbourhood-level self-reported walking.[s]	[s]Li et al. 2005
	• The only statistically significant association between perceived or objective measures of distance to the nearest Physical Activity (PA) resource (school; gym or recreation center; park) and minutes of Moderate-to-Vigorous intensity Physical Activity (MVPA) was for perceived distance to gyms, when both perceived and objectively measured distance were included in a model that explained 15% of the variance in minutes of MVPA. Standardized parameter estimates for perceived distance: Crude = –0.24 (*p* =.01); Adjusted (for Age and BMI)= –0.19 (*p* =.05)[t]	[t]Jilcott et al. 2007
Service Locations Within a Fixed Distance "Buffer" Around Study Participants' Homes (number of services within a 1km radius [euclidean buffer]; number of services within a fixed distance road network buffer; kernel density of services within a 1km network buffer) Currently Quantifiable in Peel: Yes		
Quantitative Evidence (Sorted by Outcome)	• Empirical thresholds of service availability significantly related to the probability of study participants walking sufficiently to meet recommendations for health (>=150 mins/week): a) Total number of grocery stores or markets within a 1km radius (euclidean buffer) of residents' homes, threshold >13.5 (categorical, category 13 = 2, category 14 = 3-4)[c] b) Total number of education land uses within 1km radius of residents' homes, threshold <5.1 (count)[c] c) Total number of neighbourhood centers with grocery + restaurant + retail combination within 1km buffer of residents' homes, threshold >1.8 (count) [c] d) Size of the closest Neighborhood Center with 3 or more offices, within a 3km euclidean buffer of residents homes, threshold < 9.8 (acres)[c]	[c]Moudon et al. 2006
	• Number of recreational facilities within a 0.5 mile (800m) radius of particiapnts' homes was a significant predictor of neighbourhood walking, t = 5.921, p= 0.001. [s]	[s]Li et al. 2005

Service Locations Within a Fixed Distance "Buffer" Around Study Participants' Homes - Continued		
Quantitative Evidence (Sorted by Outcome)	• A kernel density measure of supermarket density within a 1 mile (1.6km) radius of participants' residences[l] had significant associations with the relative probability of having a healthy diet, measured in two ways. Results are shown below as relative probability (95% CI), all are as compared to the referent "high supermarket density" (fourth quartile): a) Outcome - Having a healthy diet, as measured by the Alternate Healthy Eating Index (AHEI) i) Lowest quartile of supermarket density, 0.75 (0.59-0.95);[u] ii) Third quartile of supermarket density, 0.74 (0.58-0.94);[u] b) Outcome - Having a healthy diet, as measured by "Fats and processed meats" dietary pattern i) Lowest quartile of supermarket density, 0.54 (0.42-0.70)[u] • Overall, participants with no supermarkets near their homes were 25-46% less likely to have a healthy diet than those with the most stores.[u]	[u]Moore et al. 2008
Employment Opportunities Within a Fixed Distance or Travel Time "Buffer" Around Study Participants' Homes (Number of jobs located within a 30-minute transit trip of participants' homes) Currently Quantifiable in Peel: No		
Quantitative Evidence (Sorted by Outcome)	• Having more jobs located within a 30-minute transit trip of home increased the modal share of active transport to work. Lowest quintile of employment availability (0-40,000 jobs within 30-minute transit trip): 93% auto, 3.3% transit, 2% walk/bike. Highest quintile of employment availability (> 160,000 jobs within 30-minute transit trip): 67% auto, 17% transit, 14% walk/bike.[v]	[v]Parsons & co. 1993
Best Practices & Recommendations	• New developments should be in proximity to a large number of employment opportunities.[v] • Businesses within the community should provide a range of job types.[x] • LEED-ND projects can earn 3 credits by fulfilling the below requirements: a) For residential projects: ensure the geographic center of the residential component of the project is within a ½ mile (800m) walk distance to a specific number of pre-project full-time equivalent jobs. The specific number of jobs is determined by the number of dwelling units in the project, and must be equal to or greater than that number.[k] OR b) For infill projects with non-residential components: ensure the geographic center of the non-residential component of the project is within a ½ mile (800m) walk distance of an existing rail transit, ferry, or tram stop and within a ½ mile (800m) walk distance to a specific number of existing dwelling units. The specific number of existing dwelling units is based on the number of new jobs and must be equal to or greater than 50% of the number of new full-time equivalent jobs created by the project.[k]	[v]Parsons & co. 1993 [x]Calthorpe 1991 [k]LEED-ND 2008

Resources for Outdoor Activity Within a Fixed Distance Euclidean or Road Network "Buffer" (park area per 1km buffer, number of rec spaces or parks within 0.5 miles [800m] of home; presence of trails) Currently Quantifiable in Peel: Yes - But only for parks in Mississauga		
Quantitative Evidence (Sorted by Outcome)	• GIS area of green and open space for recreation within 0.5 miles (800m) of home was a significant predictor of neighbourhood walking. t = 2.238, p = 0.05. [s] • 1-5 acres (0.4-2ha) of rec/open space (vs. no space) within 1km network buffer of individuals (aged 5-20) home had significant association with frequency of walking, OR (95% CI) = 2.2 (1.6-2.9). [y] • Having 2-3 rec/open spaces within 1km network buffer of individuals' (aged 5-20) home had a significant association with frequency of walking, OR (95% CI) = 2.5 (1.8-3.5). [y] • Odds of walking increased by 20% for each additional park, and 21% for each additional educational facility within a 1km distance (educational facilities often have fields which can be used for outdoor PA). [f] • 98% of new exercisers and 52% of habitually active exercisers reported an increase in activity when a new trail system was created. [z] • More than twice as many new exercisers (31%) than habitually active exercisers (15%) reported that a trail was their only form of physical activity. [z]	[s]Li et al. 2005 [y]Frank et al. 2007 [f]Frank & co. 2005 [z]Gordon et al. 2004
Best Practices & Recommendations	• Locate and/or design developments so that a park, publicly-accessible schoolyard, or plaza at least 1/6 acre (.07ha) in area lies within a ¼ mile (400m) walk distance of 90% of planned and existing dwelling units and business entrances. [k] • Locate and/or design developments so that active public facilities (e.g., general playfields, soccer, baseball, basketball or other sports fields) totaling at least one acre (0.4ha), or a public indoor recreational facility, lies within 1/2 mile (800m) walk distance of 90% of dwelling units and/or business entrances (inclusive of existing buildings). [k] • Each pedestrian shed must contain at least one main civic space, located within 800 feet of the geographic center of the pedestrian shed. [1] • Provide a playground within 800 ft (245m) of every lot in residential use. [1] • The relationship between walking and availability of parks and schools is likely non-linear, with smaller increases in walking resulting as demand is approached and met. [f]	[k]LEED-ND 2008 [1]Duany et al. 2008 [f]Frank & co. 2005
Presence of a Given Service Within Residents' Census Tract (yes/no) Currently Quantifiable in Peel: Yes		
Quantitative Evidence	• The presence of supermarkets (within participants' census tract) was significantly associated with a lower Prevalence Ratio (PR) of obesity and overweight (obesity PR=0.83, 95% CI=0.75– 0.92; overweight PR=0.94, 95% CI=0.90 – 0.98). [2] • The presence of convenience stores was significantly associated with a higher prevalence of obesity and overweight (obesity PR=1.16, 95% CI=1.05–1.27; overweight PR=1.06, 95% CI=1.02–1.10). [2] • Associations for diabetes, high serum cholesterol, and hypertension [outcomes] were not consistently observed. [2]	[2]Morland et al. 2006
Best Practices & Recommendations	• Encourage healthy food sources in low-income areas. [3]	[3]Frank (Peel report)

Footnotes

[§]"Adequate Transit Service is the minimum number of daily trips in each direction that a stop must have to be counted: (1) on weekdays, at least 56 trips/day for buses (including bus rapid transit), light rail transit (including streetcars/trams) or heavy rail transit (subways/elevated), or at least 28 trips/day for commuter/regional rail or ferries; and (2) on weekends, at least 14 trips/day for buses (including bus rapid transit), light rail transit (including streetcars/trams) or heavy rail transit (subways/elevated), or at least 7 trips/day for commuter/regional rail or ferries. Commuter rail serves more than one MSA and/or the area surrounding an MSA." (LEED-ND 2008)

[¶]Diverse Uses
Retail: Convenience store; Florist; Hardware store; Pharmacy; Supermarket; Other retail
Services: Bank; Coffee shop; Hair care; Health club; Laundry/dry cleaner; Medical/dental office; Restaurant; Homeless shelter
Civic/Community Facilities: Child care (licensed); Civic/community center; Place of worship in a building; Police/fire station; Post office; Public library; Public park; School; Senior care; Social services facility. (LEED-ND 2008)

[±]This credit now places a distinction between neighborhood-scale projects and regional-scale retail centers. Neighborhood-scale projects are defined as projects with a minimum of 40 acres, and regional-scale retail centers are defined as those with substantial retail uses. In order to satisfy this credit, diverse uses must be clustered in the neighborhood center and their principle entries must be within a 300-400-foot walk distance from a single common point. Conversely, a regional-scale retail center (projects with 150,000 square feet of retail) must also earn a minimum of one point for Reduced Automobile Dependence, SLL C 3. (LEED-ND 2008)

[ł]Note that density of supermarkets within a 1 mile (1.6km) euclidean buffer of participants homes was estimated using a kernel density method. Density was weighted according to a Gaussian distribution so that resources more proximate to respondents' residences were weighted more heavily than those farther away. In the absence of an a priori theory of relevant thresholds, the local food environment measures were classified into four categories based approximately on quartiles of the observed distribution. These categories had upper cutoffs of 0, 0.5, 2.2, and 12 supermarkets per mile^2. (Moore et al. 2008)

2. c. Land Use Mix

Land Use Mix is most commonly measured as the heterogeneity of land use in a given area but can also refer to the variety of destinations in a given area and other less standard measures. This element directly affects the relative distance between and availability of a variety of services and destinations in an area. An area with highly heterogeneous land use groups residents, services, and employment within the same neighbourhood, allowing individuals to easily fulfill their daily needs on foot or bicycle. However, an area with highly homogeneous land use means that areas are separated by distinct land uses. This separation increases the distance between everyday destinations, forcing individuals to rely on motorized transport. Therefore, high levels of land use mix heterogeneity are generally regarded as more conducive to walking and active transport.

Results of the literature review on Land Use Mix are presented in Table 3. Below is a summary of these results:

Summary of Quantitative Evidence:

- Neighbourhood land use mix generally had significant positive associations with walking frequency and distance, as well as with lower BMI.
- Land use mix within a 1.6km buffer of school was significantly associated with children walking both to and from school.
- Residents of highly walkable neighbourhoods, partially defined by greater land use mix, reported greater moderate physical activity, and lower prevalence of obesity and overweight.

Summary of Best Practices and Recommendations:

- Plan in the form of complete and integrated communities, containing mixed housing, shops, workplaces, schools, parks and open space, and civic facilities, all within easy walking distance.

- Services and destinations should be placed within 400m of residents.

- LEED-ND recommends that at least 50% of office buildings include ground floor retail along 60% of the street façade. And, 100% of mixed use buildings should include ground floor retail, live/work, and/or ground floor dwelling along at least 60% of the street level facade.

- Mixing housing types can better support a variety of retail and community services.

:

Table 3. Land Use Mix

Heterogeneity of Land Use (proportion of different land uses in a given area, land use entropy value) Currently Quantifiable in Peel: Yes		
Quantitative Evidence (Sorted by Outcome)	• Within 1km network buffer of home, presence of mixed land use (yes/no) had a significant association with walking occurence and distance [OR (CI) of 1.8 (1.4-2.3) and 1.9 (1.3-2.9), respectively.[a] • Land use mix (entropy values) had a significant correlation with minutes of moderate physical activity/day (controlling for age, education, and gender). r=0.145 (p<0.01).[b] • In multilevel analyses, controlling for neighbourhood and individual-level covariates (including but not limited to income, ethnicity, age, gender, and health status), a 1-unit increase in land-use mix was associated with the following in predominantly white, middle aged, married, high SES people: a) 25% decrease in overweight/obesity (p=0.003); b) 4.1 times increase in neighbourhood walking (p<0.0001); c) 5.76 times increase in walking for transportation (p<0.001); d) 50% increase in walking for errands; and e) 46% increase in meeting physical activity recommendations (p=0.025).[3] • Mix land use variables (proximity, within buffer, and clustering) increased explained variance of walking & cycling by 12% -- from 35% (only sociodemographic variables) to 47%.[c] • Land use mix (entropy value) in school buffer (1.6km) had a significant relationship with nonmotorized travel *to* and *from* school. Upper quartile: OR (95% CI) = 2.89 (1.634, 5.117) and OR (95% CI) = 3.46 (1.600, 7.468), respectively.[d] • However, land use mix (entropy value) in home buffer (only 500m) did not.[d] • Mixed land use was significantly inversely associated with BMI (Beta 52.55, p , .01) after controlling for age, gender, race, education, census tract poverty, and race/ethnicity. Comparing the 90th to the 10th percentile, the predicted adjusted decrease in BMI with increased mixed land use was .41 units.[e] • Distance to an office/mix use centre was signficantly associated with walking for both transportation and recreation, OR (95% CI) = 2.59 (1.463, 4.587).[f] • Residents of high walkability neighbourhoods (vs. low) reported greater land use mix (p < .03), had 60+ more minutes of moderate physical activity in the past week (p = .016), had lower obesity prevalence (p = .097), and lower overweight prevalance (p = .043), when controlling for age and education).[g] • Land use mix was included in a walkability index that was significantly associated with "minutes devoted to active transportation last week" and with BMI. (8.35% variance explained for active transportation; 1.14% variance explained for BMI). Index also incl. street connectivity, net res. density, and retail floor area ratio (FAR).[h]	[a]Frank et al. 2007 [b]Frank et al. 2005 [3]Li et al. 2008 [c]Hurvitz 2005 [d]Larsen et al. 2009 [e]Rundle et al. 2007 [f]Lee & Moudon 2006 [g]Salaens et al. 2003 [h]Frank et al. 2006
Best Practices & Recommendations	• Three views of the ideal land use mix (expert opinion): a) Housing (26%), shops and restaurants (7%), community functions (15%), hotels (5%), offices (16%), manufacturing (12%), parking (19%).[i] b) Urban : housing (20-60%), commercial (30-70%), public (5-15%) Neighbourhood: housing (50-80%), commercial (10-40%), public (10-15%)[j] c) Housing (41%), commercial (10%), civic (12%), parks/open space (15%), rights-of-way (22%) (average of four 'Traditional Towns').[k] • Resources should be placed within ~ 1/4 mile (400m) walking distance to residents to ensure a high number of trips/usage.[kl]	[i]Alexander et al. 1987 [j]Calthorpe 1993 [k]Ewing 1996 [l]Ewing 1998

Heterogeneity of Land Use - Continued		
Best Practices & Recommendations	• A min. of 5% and a max. of 15% of the gross area of the neighbourhood may be designated for business.[m] • A corner store/café (subsidized if necessary) should be provided in all neighborhoods of at least 300 residences and/or jobs.[n] • Large parcels containing a single use should be prohibited.[n] • All planning should be in the form of complete and integrated communities of 40-200 acres (16-80 hectares) containing mixed housing, shops, work places, schools, parks and open space, and civic facilities essential to the daily life of the residents, all within easy walking distance.[lmo] • Public spaces should be designed to encourage the attention and presence of people at all hours of the day and night.[o] • 'Excellent' is awarded if: a) residential projects are adjacent to shopping, schools, daycare, or recreation; b) commercial projects are adjacent to housing, restaurants, or entertainment; c) project provides 4 new types of uses to an existing neighbourhood; d) project provides uses that generate street-level activity for > 18hrs/day; e) project provides street-level uses that generate more than 600 users/day.[p] • 'Preferred' is awarded if a) and b) above are within 1/3 mile (500m).[p] • Land use designated for business use shall contain office, retail, light industry, warehousing, and gas stations.[m] • Office and retail may be grouped with shopfront buildings to form town centers. All other business uses shall be grouped together outside of town and neighbourhood centers.[m] • Consider both destination accessibility and residential accessibility (i.e., clustering of destinations vs. residential proximity) in land use mix.[k] • Mixing land use is most effective where habitual uses (home, work, school) are co-located with less habitual uses (entertainment, retail).[q] • Place commercial land use within close proximity to residential areas.[klmqrs] • Make community facilities (e.g., school, library, church) the focal point of communities and located at centre of neighbourhoods.[q] • Encourage people to live and work in the same area, with mixed uses. • Make buildings adaptable/flexible for alternative future uses by both their design and proximity to transit.[r] • Locate buildings and adopt policies to encourage transformation to a new use (e.g., factory into lofts).[r] • Provide flexible licensing to encourage street cafes, outdoor performances, and other street life, day and night.[r] • Provide mix uses and dense uses so that distances to destinations are not too great for easy walking/biking.[ms] • Zone corner stores and/or small business districts in neighborhoods.[s] • Ensure a balance between jobs and housing, as well as between convenience shopping, recreational opportunities, and housing.[l] • Develop in clusters (of uses and density) and keep the clusters small.[l] • Make shopping centers and business parks into all-purpose activity centers.[l] • Make subdivisions into neighborhoods with well-defined centers and edges.[l] • Reserve school sites and donate them if necessary to attract new schools.[l] • Concentrate commercial development in compact centers or districts.[l] • Limit auto-oriented land uses, or at least separate them from pedestrian-oriented uses.[l]	[m]Belmont 1995 [n]Duany & co. 2001 [o]Calthorpe 1992 [p]Fleissig & Jacobsen 2002 [q]Bergeron 2007 [r]Cowan 1997 [s]Fenton 2003 [l]Ewing 1998

Heterogeneity of Land Use - Continued		
Best Practices & Recommendations	• Encourage mix use and pedestrian-friendly development by: a) Providing 'performance zoning', which gives developers the ability to add more square footage or rentable space if they pay for pedestrian-oriented streetscape improvements, such as housing in otherwise commercial developments or ground-floor retail and other uses designed to enhance the walkability of areas around their projects. b) Charge impact fees for specific development proposals, perhaps linked to a health impact assessment, thus internalizing costs of sprawling development. c) Provide incentives for the transfer of development rights from open space, rural, or agricultural areas to more central locations where compact walkable communities are more feasible. Incentives help overcome various barriers to more centralized development -- e.g., demolition, clean-up, land assemblage.[t]	[t]Pratt et al. 2004
Heterogeneity of Parcel Use (mix of uses within same building) Quantifiable in Peel: No		
Best Practices & Recommendations	• In non-residential or mixed use projects, 50% or more of the total number of office buildings should include ground floor retail along 60% of the length of the street façade.[u] • 100% of mixed use buildings should include ground floor retail, live/work, and/or ground floor dwelling along at least 60% of the street level facade.[u] • Encourage upper-floor apartments above first floor retail/business.[rsu] • Each use must take up at least 20% of the floor space of building.[v] • Awards points for a) including residential above the 1st floor, b) street level pedestrian use, c) two uses, d) three uses.[v] • Encourage the occupation of ground floors by uses that directly relate to the pedestrian.[r] • Create buildings with a range of activities, both day and night.[r] • Encourage live-work spaces in residential areas.[r]	[u]LEED-ND 2008 [s]Fenton 2003 [v]City of Austin 2001 [r]Cowan 1997
Variety of Destinations (numbers of attractions, rentable building area, total parcel area) Currently Quantifiable in Peel: Yes		
Quantitative Evidence	• The land uses (measured by number of attractions) most strongly correlated with household walking trips were: neighbourhood-scale retail establishments (r = 0.381), commercial office buildings (r = 0.328), restaurants and taverns (r = 0.318), educational facilities (r = 0.271), grocery stores (r = 0.251), and civic uses (r = 0.250). The same land uses measured by rentable building area and total parcel area were also correlated with walking trips. All $p < .0001$[w] • Only high-tech industrial and office parks uses failed to have any significant relationships with household walk trips.[w]	[w]Frank & co. 2005
Best Practices & Recommendations	• A higher number of unique attractions gives people more options (choice) and will increase their likelihood of walking.[w]	

Neighbourhood Structure (overall character of development area) Currently Quantifiable in Peel: No (Generally Unquantifiable)		
Best Practices & Recommendations	• Neighbourhood should be 40-200 acres (16-80 hectares). Areas larger than 200 acres (80 hectares) should be separated into multiple communites.[m] • Create site designs that encourage clustering around transit facilities.[rz] • If no transit, then create a centralized cluster in relation to residential area.[z] • Use bullseye pattern of density around transportation stations (high, medium, low, fanning out).[1] • Encourage mixed-use nodal development/compact activity centres, rather than strips.[y2] • Connect nodes/centres with dense corridors that are capable of supporting transit.[y] • Encourage walkable development by waiving development charges and planning application fees to jump-start smart development projects.[y] • In order to produce walkability, new developments need to be integrated into existing transportation and land use planning, in order to provide proximity to employment and/or adjacent pedestrian-oriented neighborhoods.[x] • Establish clearer and more strategic linkages between residential and employment uses at the regional and local levels.[y]	[m]Belmont 1995 [z]Corbett 1996 [1]Dittmar & Ohland 2004 [2]Litman 2008 [y]Blais 2003 [x]Parsons & co. 1993 [y]Blais 2003
Mixed Housing Types (percentage of each housing types in a given area) Currently Quantifiable in Peel: Uncertain		
Best Practices & Recommendations	• A min. of 15% and a max. of 30% of the gross neighbourhood area shall be designated for attached houses (multi-family) and small lot (50ft [15m] or less in width) detached houses.[m] • A maximum of 30% of the gross area of the neighborhood shall be designated for large-lot (50ft [15m] or more in width) detached homes.[m] • In general urban zones, a minimum residential mix of 3 building disposition types is required, with no type comprising < 20% of residential development.[n] • 10% of housing units should be in the "affordable housing" range.[n] • Place mixed housing types close to one another and encourage a mix of singles, semi-detached, townhouses, and low-rises.[moqy] • Mixing housing types can better support retail and community services.[y] • Over time, mixed, adaptable areas are better equipped to withstand "boom and bust" cycles associated with areas made up mostly of single detached houses and townhouses.[y] • A community should contain a diversity of housing types to enable citizens from a range of economic levels and age groups to live within its boundaries.[oy]	[m]Belmont 1995 [n]Duany et al. 2008 [q]Bergeron 2007 [y]Blais 2003 [o]Calthorpe 1992

3. Urban Design Elements

Introduction

Street Connectivity, Road Network and Sidewalk Characteristics, Parking, and Aesthetics and Human Scale are evaluated using a variety of unique measures which determine the design of the built environment. In combination, these elements affect the structure, scale, and shape of our cities, from the macro (e.g., the overall neighbourhood structure) to the micro (e.g., the placement of individual objects in the streetscape). They create the urban world that we interact with on a constant basis, affecting walkability by creating more (or less) pleasing, accessible, and convenient pedestrian realms.

For example, high street connectivity provides shorter, more direct walking routes between any two points. Narrow roads and wide sidewalks, in combination with small, disguised parking lots, welcome and protect pedestrians while calming vehicular traffic. And, aesthetically-pleasing streetscapes encourage walking for both recreation and transportation.

Sections 3.a., 3.b., 3.c., and 3.d. and their accompanying tables review the literature on Street Connectivity, Road Network and Sidewalk Characteristics, Parking, and Aesthetics and Human Scale.

3. a. Street Connectivity

Street Connectivity is most commonly measured as the density of intersections in a given area, as well as average block size, block length, and other less standard measures. This element affects the directness of travel between any two locations as well as the number of routes between any two locations. On the one hand, high connectivity provides directness and many alternative routes, reducing route distance, increasing non-motorized route options, and dissipating vehicular traffic throughout the travel network. On the other hand, low connectivity limits directness and facilitates higher traffic volumes at greater speeds on fewer roads, increasing route distance, decreasing route options, and degrading the pedestrian environment. Therefore, high levels of connectivity are generally regarded as more conducive to walking and active transport.

Results of the literature review on Street Connectivity are presented in Table 4. Below is a summary of these results:

Summary of Quantitative Evidence:

- Intersection density (intersections per area) generally had significant positive associations with both walking frequency and/or distance walked.

- Smaller block size in combination with other built environment measures was associated with lower BMI, lower obesity rates, lower blood pressure, and higher walking frequency. A threshold of less than 1.64-2ha was found.

- Intersection density seems to be the most common measure of street connectivity and the strongest predictor of the relationship between street connectivity and active transport.

Summary of Best Practices and Recommendations:

- LEED Neighbourhood Development requires a minimum of 57 intersection per kilometre^2 and most highly encourages intersection densities of > 152 intersections per kilometre^2 in new developments.

- Block lengths should not exceed 250m, and average block perimeter should not exceed 415m. Through-streets should be spaced no more than 800m apart in new developments.

- Safe and attractive mid-block passageways should be created on existing blocks longer than 250m to allow for pedestrians and cyclists to cut through.

- All streets and alleys should terminate at other streets within a new development, and connect to existing and projected through streets outside the development.

Table 4. Street Connectivity

Intersection Density (Intersections/Area) Currently Quantifiable in Peel: Yes		
Quantitative Evidence (Sorted by Outcome)	• Highest tertile (49.25-102.49 intersections/km^2) had a significant association with walking/cycling frequency in female adolescents, OR (95% CI) = 3.81 (1.68-8.66), compared to the lowest tertile.[a]	[a]Carver et al. 2008
	• Highest tertile had a significant association with the outcome "walked at least once over 2 days" among study participants, OR (95% CI) = 1.7 (1.3-2.2), compared to the lowest tertile.[b]	[b]Frank et al. 2007
	• Highest tertile had a significant association with distance walked among study participants, OR (95% CI) = 1.8 (1.2-2.7), compared to the lowest tertile. [b]	
	• Had a significant correlation with the natural log of minutes of moderate physical activity per day (controlling for age, education attainment, and gender), r = 0.111 (p<0.001)[c]	[c]Frank et al. 2005
	• Classified "more walkable" areas as those with net residential density > 6 units per acre (2.4/ha), and intersection density >= 30 intersections per square km (for the study area of Atlanta).[c]	
	• In multilevel analyses, controlling for neighbourhood and individual-level covariates (including but not limited to income, ethnicity, age, gender, and health status), a 1-SD increase in street connectivity was associated with the following in predominantly white, middle aged, married, high SES people: a) 16% increase in neighbourhood walking (p=0.034); b) 20% times increase in walking for transportation (p=0.004); c) 9% increase in walking for errands (p=0.025); and d) 18% increase in meeting physical activity recommendations (p<0.001) [z]	[z]Li et al. 2008
	• Intersection density around participants' *homes* (500m buffer) and/or around participants' *schools* (1.6km buffer) did not have a significant association with either outcome: walking to school; walking home from school. [d]	[d]Larsen et al. 2009
	• Included in a composite walkability index that explained 8.35% of the variance in predicted "log of minutes devoted to active transportation last week" in a multivariate regression model (household income had the next highest explained variance at 0.16%).[e]	[e]Frank et al. 2006
	• Included in a composite walkability index that explained 1.14% of the variance in predicted BMI in a multivariate regression model (age had the highest explained variance at 1.93%).[e]	
	• Intersection density did not have a significant association with BMI after adjustment for individual- and neighborhood-level sociodemographic characteristics, Beta* (95% CI) = -0.002 (-0.005, 0.0002). *Beta "is the mean difference in BMI for a one-unit change in the predictor variable adjusting for individual level age, race/ethnicity, gender, interactions between gender and race/ethnicity and categories of education." [f]	[f]Rundle et al. 2007
	• For each quartile increase in the number of intersections per square kilometer, there was a 14% increase in the odds of walking for non-work travel (after controlling for demographics).[g]	[g]Frank and Co. 2005
	• Nearly all of the above studies do not specify whether they measured all intersections (including, potentially, cul-de-sacs), or only 3- and 4-way intersections. Only one study (Larsen et al. 2009) measured intersection density as the number of 3-way and 4-way intersections per km^2, all others simply defined the measure as "all intersections" per km^2.	

Intersection Density - Continued		
Best Practices & Recommendations	• LEED-ND requires a minimum of 150 intersections per mile^2 (57/km^2) in new developments, and requires new developments to match or exceed the intersection density of adjacent neighbourhoods if they are higher than this requirement. • LEED-ND allots additional credits for: Connectivity of > 400 intersections per mile^2 (152/km^2) (5 credits); 300-400 per mile^2 (114-152/km^2) (3 credits); 200-300 per mile^2 (76-114/km^2) (1 credit).[h] • Classified "more walkable" areas in Atlanta as those with intersection density >=30 intersections per km^2 (and > 6 residential units per acre).[c] • Increase connectivity and include special shortcuts for nonmotorized traffic in order to improve walkability/bikeability.[i]	[h]LEED-ND 2008 [c]Frank et al. 2005 [i]Litman 2008
Number of street intersections in a neighbourhood (not standardized by area) Currently Quantifiable in Peel: Yes		
Quantitative Evidence	• Had a significant path coefficient (unstandardized β weight) with outcome "neighbourhood walking" (survey responses on Likert scale), Path coefficient (95% CI) = 0.531 (0.236-0.826).[j]	[j]Li et al. 2005
Local Road Length (sum of the length of all roads in a buffer around study participants' homes) Currently Quantifiable in Peel: Yes		
Quantitative Evidence	• Middle tertile (17.82 – 30.02 km) had significant association with the likelihood of male adolescents making seven or more walking/cycling trips per week, OR (95% CI) = 3.46 (1.26-9.50)[a]	[a]Carver et al. 2008
Local Road Index (ratio of roads with lower speed limits/traffic volume to all roads) Currently Quantifiable in Peel: Yes		
Quantitative Evidence	• Did not have significant association with the likelihood of female or male adolescents making seven or more walking/cycling trips per week[a]	[a]Carver et al. 2008
Cul-de-sac Presence (study participant living on a cul-de-sac or not) Currently Quantifiable in Peel: Yes		
Quantitative Evidence	• Live in cul-de-sac ("yes") had significant association with the likelihood of female adolescents making seven or more walking/cycling trips per week, OR (95% CI) = 0.36 (0.18-0.70)[a]	[a]Carver et al. 2008
Best Practices & Recommendations	• Avoid cul-de-sacs, unless there is no alternative.[k] • Investigate ways of creating access through existing cul-de-sacs.[k]	[k]Cowan 1997
Block Size (average areal size of city blocks within a region; block lengths or dimensions) Currently Quantifiable in Peel: Yes		
Quantitative Evidence	• Average block area was included in a County Sprawl Index (derived using Principal Components Analysis). For every 50-point increase in the sprawl index, the following outcomes were predicted: a) The BMI of county residents would be expected to rise by 0.17 points.[l] b) The odds that a county resident will be obese rise 10%.[l] c) Residents were likely to walk fourteen minutes less for exercise in a month.[l] d) The odds that a county resident will have high blood pressure increase 6%.[l] • The categorized threshold of household block size < 4.1-5 acres (1.64-2ha) was significantly associated with the probability of walking sufficiently to meet recommendations for health (walking >= 150 minutes/week).[m]	[l]McCann & Ewing 2003 [m]Moudon et al. 2006

Block Size - Continued		
Best Practices & Recommendations	• Block lengths should be 200-250m, as small block lengths and high connectivity dissipate traffic, reduce traffic speed, and reduce the need for traffic calming.[n] • In new developments, ensure through-streets (that pass through the development and connect to the existing network) at least every 800m.[o] • The average perimeter of all blocks shall not exceed 1350 feet (412m), no block face shall have a length greater than 500 feet (152m) without a dedicated al ley or pathway providing through access.[p] • Space through-streets no more than a 1/2mi (800m) apart.[m] • Design street networks with multiple connections & relatively direct routes.[q] • For high walkability, block lengths of ~300 ft. (81m) are desirable; though, 400 to 500 ft. (122 to 152m) lengths still work well.[r] • If existing blocks are already 600-800 ft. (183-244m) or more, midblock crosswalks and pass-throughs are recommended, because, as blocks grow to 600 or 800 ft. (183 or 244m) in length, adjacent blocks become isolated from each other.[r] • If existing blocks are already 600-800 ft. (183-244m) or more, midblock crosswalks and pass-throughs are recommended, because, as blocks grow to 600 or 800 ft. (183 or 244m) in length, adjacent blocks become isolated from each other.[r] • Short blocks create many corners that are ideal for small-scale commerce.[r]	[n]Bergeron et al. 2007 [o]LEED-ND 2008 [p]Belmont 1995 [q]Ewing 1998 [r]Ewing 1996
Percentage of Small Blocks [(number of small blocks / total number of blocks) X 100] Currently Quantifiable in Peel: Yes		
Quantitative Evidence	• Included in a County Sprawl Index (derived using Principal Components Analysis). For every 50-point increase in the sprawl index, the following outcomes were predicted: a) The BMI of county residents would be expected to rise by 0.17 points.[l] b) The odds that a county resident will be obese rise 10%.[l] c) Residents were likely to walk fourteen minutes less for exercise in a month.[l] d) The odds that a county resident will have high blood pressure increase 6%.[l]	[l]McCann & Ewing 2003
Walking and Cycling Networks (presence of cut-throughs for pedestrians/cyclists; presence of on-street cycle lanes) Currently Quantifiable in Peel: Uncertain		
Best Practices & Recommendations	• Create dead-ends for cars with special cut-throughs for cyclists and pedestrians.[s] • Provide pedestrians and bicyclists with shortcuts and alternatives to travel along high-volume streets.[q] • All streets and alleys shall terminate at other streets within the neighborhood and connect to existing and projected through-streets outside the development.[p,t,u] • Streets, pedestrian paths, and bike paths should contribute to a integrated system of fully connected, safe, and interesting routes to all destinations.[v,n] • Their design should encourage use by being small and spatially defined by buildings, trees, and lighting; and by discouraging high speed traffic.[v]	[s]Pucher & Dijkstra 2000 [q]Ewing 1998 [p]Belmont 1995 [t]Duany et al. 2008 [u]Dixon & Capon 2007 [n]Bergeron et al. 2007 [v]Calthorpe 1992

Walking and Cycling Networks - Continued		
Best Practices & Recommendations	• Include passageways at mid-block on long blocks for pedestrians to cut through.[r,w] Where incorporated, mid-block passageways should be active, visually interesting, and safe places (e.g., lighted and landscaped).[w] • Invest aggressively in pedestrian, bicycle and transit infrastructure.[x]	[w]Gabel-Luddy 2007 [x]Frank (Peel)
Network Pattern (relative degree of grid-like streets vs. cul-de-sacs; grid vs. fused) Currently Quantifiable in Peel: Uncertain		
Best Practices & Recommendations	• Hybrid network (i.e. fused grid) is acceptable and recommended, as it offers the quiet and security of cul-de-sacs with relatively high connectivity.[q,r] • The grid street pattern offers relatively direct pedestrian routes, many alternatives to travel along high-volume routes, gives pedestrians a clear sense of orientation, and is effective in supporting transit.[r] • The grid pattern has disadvantages related to safety and aesthetics.[r] • Empirical studies in found no relationship between transit ridership and street network design, after controlling for other variables such as urban density and transit service frequency.[r] • Consider cul-de-sac networks that have full connectivity for bikes and pedestrians, in order to have the quiet privacy of cul-de-sacs with the directness of the grid pattern.[y]	[q]Ewing 1998 [r]Ewing 1996 [y]TRB 2005

3. b. Road Network and Sidewalk Characteristics

There are a variety of common measures that relate to Road Network and Sidewalk Characteristics including traffic calming, road speeds and volume, sidewalk presence and length, buffer strips, cycle-friendly design and bicycle lanes, and street dimensions. These measures affect the degree of comfort, convenience, and separation for pedestrians, cyclists, and vehicles. Narrow, traffic-calmed streets with wide sidewalks, good lighting, and dedicated bicycle lanes provide a safe, comfortable, and convenient environment for pedestrians and cyclists, and reduce conflict with vehicles. Conversely, wide streets without sidewalks or traffic calming devices are designed to accommodate many cars traveling at high speeds, creating auto-centric environments that are uncomfortable and unsafe for pedestrians and cyclists. Therefore, road networks that cater to pedestrians and cyclists, particularly in central and residential areas, are generally regarded as more conducive to walking and active transport.

Results of the literature review on Road Network and Sidewalk Characteristics are presented in Table 5. Below is a summary of these results:

Summary of Quantitative Evidence:

- Greater presence of speed humps and traffic/pedestrian lights had a significant positive association with adolescents walking and cycling.

- Creation of traffic circles at residential intersections resulted in significant reductions in pedestrian injury and reported accidents.

- Both the probability of fatal pedestrian injury and the risk of pedestrian injury, overall, increase markedly as speeds reach beyond 40km/h.

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Summary of Quantitative Evidence continued…

- A threshold of approximately > 60,960m of total sidewalk length along all roads within a 1km Euclidean buffer of homes was significantly associated with walking sufficiently to meet health recommendations.

- Lighting upgrades on streets and walkways increased pedestrian traffic by 51% and decreased incidents of crime by 79% in a six-week period.

Summary of Best Practices and Recommendations:

- Residential streets should have speeds of 15-30km/h, and most non-residential streets should not exceed 40km/h, inside communities.

- LEED-ND requires that continuous sidewalks, or equivalent provisions for walking, are provided along both sides of 90% of streets in the project.

- Create roads with fewer lanes, keeping all streets as narrow as possible in residential and commercial areas, and never more than four lanes wide.

- Make continuous networks of walk/bike lanes, paths, and trails, so that the walk/bike travel distance is not much different than straight-line distance.

Table 5. Road Network and Sidewalk Characteristics

Traffic Calming Measures (count of speed humps, pedestrian crossings, road narrowings, etc. within buffer of participants' homes) Currently Quantifiable in Peel: No		
Quantitative Evidence (Sorted by Outcome)	• The following traffic calming measures (counts within 800m radius of participants' homes) were significantly associated with walking/cycling frequency in female and/or male adolescents, as specified below (results are shown as OR (95% CI)): a) number of speed humps: highest tertile (8-99 speed humps) for girls, 2.95 (1.34-6.51).[a] b) number of traffic/pedestrian lights: highest tertile (4-21 lights) for boys, 2.98 (1.22-7.24); highest tertile (4-21 lights) for girls, 4.98 (2.28-10.88). [a] c) Number of gates/barriers, and/or number of "slow points"/road narrowings did not have significant associations with walking/cycling frequency among either gender.[a] • Traffic calming is significantly associated with walking/cycling frequency in adolescents, however the TYPE of traffic calming is very important (e.g. speed humps [for girls] and pedestrian/traffic lights are good). [a] • Reported accidents at 119 residential intersections in Seattle declined from 187 to 11, and injuries declined from 153 to 1, after installation of traffic circles at intersections (study period was from 1991 to 1994).[b] • Accident rates (annual crashes per mile) are approximately 18 times higher on a 48-foot (14.6m) wide street compared with a 24-foot (7.3m) wide street.[c] • Traffic calming can provide safety benefits typically worth 6-12 cents per vehicle mile if it reduces crash damages by 40%.[d]	[a]Carver et al. 2008 [b]Mundell 1998 [c](Swift 1998 as cited by Litman 1999) [d]Litman 1999
Best Practices & Recommendations	• Create pedestrian islands (medians) for wide roads, four-lane streets, arterial roads and collector road 'gateways' to calm traffic and allow for pedestrian refuge half-way across the street.[e,f,g] • Raised medians lower pedestrian accident rates, and decrease crossing delays.[f] • To make roads safer, more comfortable, and more walkable: a) Design prominent crosswalks[h] b) Implement longer 'walk' signal lengths[h] c) Create refuge medians[h] d) Create roads with fewer lanes[h] • Include features to make crosswalks highly visible to motorists (markings, signage, lighting, raised crosswalks).[e,g,i] • Create pedestrian activity crossing signals[i] • Provide safe crosswalks.[j] • Place marked cross-walks every 100 feet (30.5m) on pedestrian streets.[k] • "Flaring" of sidewalks at intersections and midblock crosswalks is recommended to reduce crossing distances and slow traffic.[f]	[e]Bergeron et al. 2007 [f]Ewing 1996 [g]Gabel-Luddy 2007 [h]Frank - lit review [i]Pucher & Dijkstra 2000 [j]Dixon & Capon 2007 [k]Untermann 1990 (as cited by Ewing 1996) [f]Ewing 1996

Traffic Calming Measures - Continued		
Best Practices & Recommendations	• Federal Highway Administration guidelines, and the Florida Department of Transportation call for midblock crosswalks on "superblocks" whenever pedestrian traffic is heavy and blocks are more than 600 ft. (183m) long. But, Ewing notes, crosswalks are a poor substitute for real intersections.[f] • Special paving, such as bricks or cobbles, can be used for a crosswalk or "gateway" to a pedestrian zone, to warn drivers to slow down and look out for pedestrians. For intensive traffic calming, an entire street may be specially paved.[f]	[f]Ewing 1996
	• "If more precise modeling is not feasible, a reasonable assumption is that traffic calming which significantly improves walking and cycling conditions can increase non-motorized trips in an area by 10-20% from what would otherwise occur, and that half of these trips substitute for motor vehicle trips."[d]	[d]Litman 1999
	• In Vancouver, a series of traffic calming cases (speed humps, stop signs, traffic circles, forced turns, traffic diverters, etc.) resulted in an average decrease of 40% in frequency of collision and 38% in annual collision claim cost.[L]	[L]Zein et al. 1997
	• Review of 85 international and Greater Vancouver Area case studies found the following average reductions in collision frequency for each calming device: Traffic circles (82%), Chicanes (82%), Narrowings (74%), Speed humps (75%), Stop signs (70%), Combos (65%), Refuges (57%), Speed limit reductions (30%).L • Traffic calming case studies in the UK, Denmark, France, and Germany all show a 60-70% reduction in personal injury accident frequency.[m,n,o]	[m]Blanke and Brillon 1993; [n]Herrstedt 1994; [o]UK Dept. of Transport 1997 (all as cited by Zein et al. 1997)
	• Traffic calming measures with the greatest desired effect (decreasing volume *and* speed) are: Speed humps (standard profiles), Speed tables (long flat-topped speed humps), and Diverters/Semi-Diverters.[f]	[f]Ewing 1996
	• Traffic calming, speed reduction and vehicle restrictions reduce pedestrian-vehicle and/or cyclist-vehicle conflict and increase pedestrian comfort.[p]	[p]Litman 2008
	• Use traffic calming measures liberally.[q]	[q]Ewing 1998
Traffic Speed (roadway travel speed) Currently Quantifiable in Peel: Yes - Posted speed limit only		
Quantitative Evidence	• Risk of injury to child pedestrians was highest at sites with mean speeds 40-49 km/h, Adjusted OR (95% CI) = 2.68 (1.26-5.69) (compared to sites with mean speeds < 40km/h). Risk did not not increase further with increasing speed.[r§]	[r]Roberts et al. 1995
	• Injury Severity Scores (ISS) for pedestrians involved in pedestrian-vehicle collisions increase dramatically above a threshold of approx. 40km/h.[s]	[s]IWGAM 1986 (as cited by Anderson et al. 1997)

Traffic Speed - Continued		
Quantitative Evidence	• The probability of a pedestrian injury being fatal, as a function of ISS (determined from a sample of 952 cases), is 58% at a vehicle impact speed of 45km/h and reduces to 25% at a vehicle impact speed of 40km/h.[s,t]	[t]Walz et al. 1983 (as cited by Anderson et al. 1997)
	• Reconstruction and subsequent analysis of fatal pedestrian collisions predicted that a 5km/h reduction in urban traffic speeds would reduce pedestrian fatalities by 32%, and result in 10% of fatal accidents having been avoided altogether. This is valid only if the reduction is applied to arterial and residential roadways.[u]	[u]Anderson et al. 1997
	• Speed reductions from 50 to 30 km/h typically result in the following air and noise pollution reductions for an unaggressive driver: CO (13%); VOCs (22%); NOx (48%), and noise levels by 4-5 decibels.[d]	[d]Litman 1999
Best Practices & Recommendations	• Keep speeds on local streets within communitites down to 20 mph (32km/h) and arterials and collectors down to 35 mph (56km/h).[q]	[q]Ewing 1998
	• LEED-ND projects earn points by meeting the following criteria: a) 75% of new exclusively residential streets within a development are designed for a target speed of no more than 20 mph (32km/h).[v] b) 70% of new non-residential or mixed use streets within the project are designed for a target speed of no more than 25 mph (40km/h).[v]	[v]LEED-ND 2008
	• Speed limit goals in European "traffic calming" are as follows: 15km/h on shared surface streets; 30km/h on "quiet streets"; 50km/h on traffic-calmed arterials; and 40-50 km on intercity roads that cut through rural villages. Note that these traffic calming designs do not preclude high-volume, high-speed thoroughfares linking communities and districts within urban areas.[f]	[f]Ewing 1996
Traffic Volume (cars per hour) Currently Quantifiable in Peel: Uncertain (data availability is marked as "possible" in the data response)		
Quantitative Evidence	• Highest quartile of traffic volume (>=750 vehicles/hour) was strongly and significantly associated with the risk of injury of child pedestrians, Adjusted OR (95% CI) = 14.3 (6.98-29.2) (compared to lowest tertile, <250 vehicles/hour). Risk (OR) values also increased consistently with increasing traffic volume.	[r]Roberts et al. 1995
Sidewalk Presence and Width (sidewalk presence; sidewalk width; curb radii) Currently Quantifiable in Peel: Uncertain (Depends on Data Quality)		
Best Practices & Recommendations	• Sidewalk presence guidelines: a) Arterials/Collectors - have sidewalks on both sides;[q] b) Local Streets in Commercial Areas - both sides;[q] c) Residential Areas > 4 units/acre (1.6/ha) - both sides;[q] d) Residential Areas 1-4 units per acre (0.4-1.6/ha) - one side;[q] e) Residential Areas < 1 unit per acre (0.4/ha) -- no sidewalk[q]	[q]Ewing 1998
	• On narrow roads of 10 to 18 feet (3-5.5m) in width, with slow vehicular travel speeds and an ADT* of less than 250, sidewalks are not appropriate/necessary.[w] (*ADT is the average number of vehicles that pass a specific point on a road in a 24-hour period)	[w]Nelessen 1994
	• Extensive literature review indicates that the presence and extent of sidewalks is one of the primary transport-related (positive) corrrelates of both walking and non-motorized travel. Additional evidence suggests sidewalk conditions have a relationship with physical activity, especially among seniors where sidewalks in poor condition may act as a barrier to walking.	[x]TRB 2005

Sidewalk Presence and Width - Continued		
Best Practices & Recommendations	• LEED-ND requires that continuous sidewalks, or equivalent provisions for walking, are provided along both sides of 90% of streets within a development, including the project-side of streets bordering the project.[v] • Equivalent provisions for walking include woonerfs and all-weather surface footpaths.[v] • LEED-ND requires that new sidewalks, whether adjacent to streets or not, must be at least 4 feet [1.2m] wide on residential blocks or 8 feet [2.5m] wide on non-residential or mixed use blocks.[v] • Recommended sidewalk widths for different types of land uses: a) In residential areas where there is little street furniture, a sidewalk width of 4-5ft (1.2-1.5m) is suitable, and allows two people to walk comfortably side-by-side.[f,w] b) In residential areas where lots are larger (width of ~60m or less), sidewalks should be present but can be narrow (although not less than 3 feet [1m]).[w] c) In mixed-use and commercial areas with higher pedestrian volume, sidewalks should be a minimum of 8 feet [2.5m] wide, though 10 to 16 feet [3-5m] is more adequate to incorporate trees, awnings and other landscape features, and allow two couples to pass each other comfortably.[f,w] d) In all commercial areas (including the commercial portion of mixed-use areas), sidewalks should extend from the edge of a building to the edge of the pavement (roadway).[f] • Overall, sidewalks should be wide enough to accommodate pedestrian traffic without crowding, yet not so wide as they appear empty most of the time.[f] • Create pedestrian refuge on wide streets using wide, well-lit sidewalks, often with street furniture.[i] • Sidewalks closer to the road should be wider.[e] • Minimize curb radii.[g] • Street corners should be designed to be sharp rather than rounded.[f] • Recommends a corner radius of 5-10 feet (1.5-3m) on streets with curbside parking, and the same for low-volume residential streets without parking lanes. This shortens crossing distances for pedestrians and forces motorists to slow down.[k] • Sidewalks should be considered a separate network from roadways, paralleling them but also allowing access to interior parking lots or shopping courts, etc. on foot.[w]	[v]LEED-ND 2008 [w]Nelessen 1994; [f]Ewing 1996 [i]Pucher & Dijkstra 2000 [e]Bergeron et al. 2007 [g]Gabel-Luddy 2007 [f]Ewing 1996 [k]Untermann 1990 (as cited by Ewing 1996) [w]Nelessen 1994

Buffer Strips (grass strips; planters; trees) Currently Quantifiable in Peel: No		
Best Practices & Recommendations	• For the road design speeds listed below, the road should have the following buffer features: a) 20mph [32km/h] - sidewalks and vertical curbs.[f] b) 20 to 35 mph [32-56km/h] - sidewalks set back behind planting strips, or wide enough (>6 ft. [1.8m]) to afford equivalent separation from traffic. At this speed a parking lane can also provide sufficient separation.[f] c) >35mph [56km/h] - a physical barrier (ie row of trees between street and sidewalk) or wide separation must be provided for pedestrian comfort.[f] • A row of street trees in the planting strip b/w sidewalk and traffic is always desirable.[f] c) >35mph [56km/h] - a physical barrier (ie row of trees between street and sidewalk) or wide separation must be provided for pedestrian comfort.f • A row of street trees in the planting strip b/w sidewalk and traffic is always desirable.[f] • Separate walkways from travel lanes. For example, create a grass strip or place bollards, planters or trees between the sidewalk and on-street parking to create a buffer between the pedestrian zone and the road.[e,g]	[f]Ewing 1996 [e]Bergeron et al. 2007; [g]Gabel-Luddy 2007
Bicycle Lanes and Cycle-Friendly Design (presence of bicycle lanes; conversion of 4 lane roadways to 2 lanes + bike lanes) Currently Quantifiable in Peel: Uncertain (data availability is marked as "possible" in the data response)		
Quantitative Evidence	• Case study on 6 streets in Toronto in the mid-1990s, where 4 lane roads were converted to 2 lane roads with biking and parking, and trees were planted. Roads were converted to the following cycle-friendly design: a) Bike lanes a minimum of 1.5m in width. When bike lanes were located beside curb parking, the combined width was at least 3.8m.[y] b) Motor vehicle lanes on converted arterials were reduced to a minimum width of 3.0m, or 3.2m for those arterials with bus routes.[y] c) Speed limits were reduced to 40km/h on all streets with bicycle lanes.[y] • Study results: Average annual bicycle traffic on intervention streets increased by 23% over a roughly 2-year period. Average annual motor vehicle traffic did not change.[y] • Presence of bike lanes was the only variable that had a significant association with the likelihood of recreational cycling at least once a month (compared to "never"), OR (95% CI) = 5.40 (1.29-22.60).[z] • Aesthetic characteristics reduced the differences between SES groups in recreational cycling to non-significant.[z]	[y]Macbeth 1999 [z]Kamphuis et al. 2008
Best Practices & Recommendations	• Bikelane guidelines: a) Road volume < 10,000 vehicles/day and speed < 30 mph (48km/h) = 14' (4.3m) curb lane;[q] b) Road volume < 10,000 vehicles/day and speed 30-40 mph (48-64km/h) = 5' (1.5m) bike lane;[q] c) Road volume >= 10,000 vehicles/day = 5' (1.5m) bike lane.[q] • Create bike lanes or multi-use sidewalks, particularly on higher-speed roads.[e] • Provide networks for pedestrians and bicyclists that are as good as the network for motorists. Provide pedestrians and bicyclists with shortcuts and alternatives to travel along high-volume streets.[q]	[q]Ewing 1998 [e]Bergeron et al. 2007 [q]Ewing 1998

Bicycle Lanes and Cycle-Friendly Design - Continued		
Best Practices & Recommendations	• Make continuous networks of walk/bike lanes, paths, and trails, so that walk/bike travel distance is not much different than straightline distance.[1] • Create bicycle-priority streets, where cars must yield to bikes and pedestrians.[i] • Create streets that are restricted to one-way travel for cars, but two-way travel for bikes.[i] • Alllow reserved bus lanes to also be used by bikes.[i] • Provide bicycle parking.[p]	[1]Fenton 2003 [i]Pucher & Dijkstra 2000 [p]Litman 2008
Bike/walk Connectivity Currently Quantifiable in Peel: Uncertain		
See Appendix D. Street Connectivity		
Road Network Access and Orientation (% lots fronting thoroughfares) Currently Quantifiable in Peel: Uncertain		
Best Practices & Recommendations	• Streets shall provide access to all tracts and lots.[2] • The long axis of the street shall have appropriate termination with either a public monument, specifically designed building facade, or a gateway to the ensuing space.[2] • Each lot shall front a vehicular thoroughfare, except that 20% of the lots within each transect zone may front a passage.[3]	[2]Belmont 1995 [3]Duany et al. 2008
Alleys (presence; location; size) Currently Quantifiable in Peel: No		
Best Practices & Recommendations	• There shall generally be a continuous network of alleys to the rear of lots within the Traditional Neighbourhood District (TND).[2] • Attached homes must, and detached homes may have their lot lines coinciding with an alley 24 feet (7.3m) wide containing a vehicular pavement width of at least 10 feet (3m).[2]	[2]Belmont 1995
Street Dimensions (road width; curb radius; maximum right-of-way) Currently Quantifiable in Peel: No		
Best Practices & Recommendations	• For standard density residential areas (5-15 units per acre [2-6/ha]): Maximum ROW (right of way) ~40 feet (12m); road width ~26 feet (8m); parking = 2 sides; direction = 2-way.[d] • Attached house lots shall enfront on a street with the following characteristics: Maximum ROW of 50 feet (15m), consisting of at least two 10 foot (3m) wide travel lanes, 8 foot (2.4m) wide parallel parking on both sides, and 6 foot (2m) sidewalks. Curb radius shall not exceed 10 feet (3m).[2] • Detached house lots shall enfront on a street with the following characteristics: Maximum ROW of 40 feet (12m), consisting of at least two 10-foot (3m) travel lanes, and 5 foot (1.5m) wide sidewalks on both sides. Curb radius shall not exceed 25 feet (7.6m).[2] • Shopfront lots shall front on streets with a maximum ROW of 65 feet (20m) consisting of at least two 11 foot (3.4m) travel lanes, one 10 foot (3m) central turning lane, 8 foot (2.4m) parallel parking on both sides, and 9 foot (2.7m) sidewalks. Curb radius shall not exceed 15 feet (4.6m).[2]	[d]Litman 1999 [2]Belmont 1995

Street Dimensions - Continued		
Best Practices & Recommendations	• Create roads with fewer lanes.[h] Keep all streets as narrow as possible in residential and commercial areas[q,p], and never more than four travel lanes wide[q]. • At a minimum, 6-lane roads should be avoided in pedestrian areas[q].	[q]Ewing 1998; [p]Litman 2008; [h]Frank - lit review
Also see Appendix G. Aesthetics and Human Scale - Measure: "Ratio of Building Height to Street Width."		
Total Sidewalk Length (Total length of sidewalks within specified area) Currently Quantifiable in Peel: Uncertain (Depends on Data Quality)		
Quantitative Evidence	• Total sidewalk length around participants homes (500m buffer) and/or schools (1.6km buffer), did not have a significant association with nonmotorized travel between home and school in either direction.[4] • Total sidewalk length within 1km buffer of participants homes was not significantly associated with "moderate frequency of walking for recreation" but was significantly associated with "frequent frequency of walking for recreation", OR (95% CI) = 1.12 (1.00-1.25)[4] • The categorized threshold of total sidewalk length > 56,261 feet (17,148m) along major streets within a 1km euclidean buffer of residents homes (including collector, primary, and minor streets, excluding local streets and highways) was significantly associated with the probability of walking sufficiently to meet recommendations for health (walking >= 150 minutes/week). *It is important to note that, on average, 71.2% (ranges from 28.6% to 89.4%) of the total street network consisted of local (nonmajor) streets for which sidewalk data were unavailable. Accordingly, the threshold value for full sidewalk coverage would be just under 200,000 feet (60,960m)* [5]	[4]Larsen et al. 2009 [5]Moudon et al. 2006
Road Slope (Mean slope of road network in a given area) Currently Quantifiable in Peel: Likely		
Quantitative Evidence	• Mean slope of road network within a 1km buffer of participants homes was significantly associated with the following outcomes, OR (95% CI): a) "frequent" frequency of walking for transportation, 0.83 (0.69-0.99);[6] b) "moderate" frequency of walking for recreation, 1.14 (1.01-1.28);[6] c) "frequent" frequency of walking for recreation, 1.16 (1.00-1.34).[6]	[6]Lee & Moudon 2006
Road Safety (resident-perceived safety) Currently Quantifiable in Peel: No		
Quantitative Evidence	• "Safe to walk" (reverse-coded from residents responses to the statement "Unsafe sidewalks (obstacles to walking) are a problem" on a 5-point Likert scale) had a significant association with predicted neighbourhood walking in a multilevel model, Path coefficient - Unstandardized *B* weight (95% CI), Standard Error, *t* value, *p* value: 0.148 (0.055-0.242), 0.048, 3.101, 0.01.[7]	[7]Li et al. 2005
Best Practices & Recommendations	• Include features to allow pedestrians to see cars when crossing (curb extensions/bump outs; limit parking near crossings).[g] • Include features such as advanced stop lines for cars, crossing signals, lights, and/or push buttons, and sidewalk ramps to provide comfort and safety for pedestrians.[g]	[g]Gabel-Luddy 2007

Road Safety - Continued		
Best Practices & Recommendations	• Danger from traffic and crime can counteract the positive effect of walkable features in a neighbourhood.[8]	[8]Zhu & Lee 2008
Also see "Traffic Calming Measures" and "Traffic Speed" above for studies with injury prevention outcomes.		
Lighting (average lux, minimum lux; distance between lighting fixtures) Currently Quantifiable in Peel: Uncertain (Depends on Data Quality)		
Quantitative Evidence	• Lighting improvements were carried out on 3 study streets and one footpath in different UK cities. Lighting was upgraded to British Standard BS5489, Part 3. All study streets were upgraded to an average illuminance of 10 lux and a minimum of 5 lux, the lighting standard for "high crime risk" areas. High-pressure sodium lamps were installed to meet the code's preference for 'white' instead of 'orange' (low-pressure sodium) lamps.[9] • The above lighting improvements resulted in the following: a) Total mean net (for all study areas) increase of 51% in persons walking, after dark (both genders).[9] b) 50% (male) and 64% (female) increase in the number of persons using the footpath, after dark.[9] c) 79% average reduction in real incidents of crime.[9] • All figures above are comparisons of the 6 week period after relighting to the 6 week period before relighting.[9]	[9]Painter 1996
Best Practices & Recommendations	• If provided, street lamps shall be installed on both sides of the street no less than 100 feet (30m) apart.[2] • Include lighting for pedestrians/street furniture. For example, such lighting could be provided with bollards that are equipped with a low level light source or mounted (at a height up to 15' [4.6m]) on decorative poles.[g] • Create street lighting that provides safety and character.[e] • Improved lighting has shown crime reductions up to 30%; However, the literature is mixed, and psychosocial factors play a key role. If the lighting leads to increased pedestrian flow, then this seems to be an important factor in community identity and safety.[10]	[2]Belmont 1995 [g]Gabel-Luddy 2007 [e]Bergeron et al. 2007 [10]UBC Lighting Wiki

Footnotes

[§]Roberts et al. (1995) note that roads faster than 49 km/h "may be crossed less frequently because they are perceived as being dangerous. Because of the method of selection of controls in this study, fast roads may have been selected as control sites, but if they were crossed less frequently they would be less likely to become case sites. The risk estimates for high vehicle speed in this study might therefore be underestimates."

3. c. Parking

Parking is most commonly measured in terms of parking requirements (usually minimums) and the price of parking. Limiting parking supply and changing street-level aesthetics directly affects the utilization of active transport, while parking lot locations and dimensions have an influence on density and neighbourhood structure, both of which impact walking for transport. For example, commonly enforced minimum parking requirements lead to unappealing pedestrian environments, increased expense to developers and buyers, development on the urban periphery, and increased land requirements per building (which limits density). Alternatively, eliminating parking minimums and charging market pricing for parking allows for increased density, reduced development and housing costs, car-free housing and developments, and developers to supply spaces only where revenue will cover costs. Therefore, reduced or eliminated parking minimums, along with market parking prices, are generally regarded as more conducive to walking and active transport.

Results of the literature review on Parking are presented in Table 6. Below is a summary of these results:

Summary of Quantitative Evidence:

- Higher perceived parking difficulty at local shopping areas was significantly positively associated with active transport and overall walking.

- Greater curb parking density was associated with an increased risk of injury to child pedestrians.

Summary of Best Practices and Recommendations:

- LEED-ND recommends using 20% or less of the development footprint area for all off-street surface parking facilities, with no individual surface parking lots larger than 2 acres.

- Eliminate parking minimums and free parking. Instead, create parking benefit districts (where profits go back into the neighbourhood) and allow developers to voluntarily supply spaces where revenue will cover costs.

- Place parking lots at the rear (or side) of buildings. Encourage access to residential parking through rear alleys or lanes, when possible.

- Parking requirements significantly reduce housing affordability, decrease development density, increase development costs, and reduce land value.

Table 6. Parking

Parking Requirements (number of spaces per unit, number of spaces per sq ft of floor area) Currently Quantifiable in Peel: Yes (By-Law Requirements only)		
Best Practices & Recommendations	• In a typical affordable housing development, providing one parking space per unit increases costs by 12-15%, and providing two spaces increases costs by 25%.[a]	[a]Litman 2009
	• Minimum parking requirements are estimated to cost an average of $31 or more per ft^2 of developed building floor in typical US cities -- 4.4 times larger than all other impact fees combined.[b]	[b]Litman 2000
	• Having one spot required per dwelling unit increases development costs by 18%, reduces housing investment per acre by 18%, reduces housing density by 30%, and decreases land value by 33%.[c]	[c]Shoup 1997
	• For businesses, provide one parking space per $500ft^2$ of building space, except for office use which shall have one per $300ft^2$ (on-street parking can be used towards these requirements).[d]	[d]Belmont 1995
	• Use 20% or less of the development footprint area for all off-street surface parking facilities, with no individual surface parking lot larger than 2 acres. [e]	[e]LEED-ND 2008
	• Sell or rent parking spaces seperately for 100% of all associated multifamily dwelling units.[e]	[f]Ewing 1996
	• No more than 9% of all land should be devoted to parking, otherwise people sense the environment belongs to the automobile, not them.[f]	[o]Surrey 2003
	• Set parking maximums in new developments, with an average of 1.5 spaces per unit across the district.[o]	[g]Blais 2003
	• Set reduced parking maximums for higher density areas (e.g., 0-25% of standard for most dense areas; 25-50% for next, 50-75%, 75-100%)[o]	[h]Litman 2009
	• Reducing surface parking is a key factor in achieving higher net densities.[bcjghlo]	[i]Pucher & Dijkstra 2000
	• Count on-street parking towards fulfilling parking requirements.[adf]	[j]Litman 2008
	• Reduce land alotted to parking[bfjilmo]	[k]Corbett 1996
	• Offer share parking or unbundled parking.[bkf]	[b]Litman 2000
	• Offer share parking or unbundled parking.[bkf]	[l]Shoup 1999
	• Reduce minimums near transit[k]	[c]Shoup 1997
	• Encourage car-free housing.[b]	[m]Fenton 2003
	• Allow in-lieu development fees as an alternative to providing parking.[b]	
	• Parking minimums should not be used.[cljfmo] a) They are irrational -- generalized from peak hours at one specific location of one particular use that allows free parking to all locations at all times, while assuming that each car carries only one person.[c] b) parking management strategies will reduce demand (and supply).[j]	

Price of Parking (non-standardize; e.g., price per hour) Currently Quantifiable in Peel: No		
Best Practices & Recommendations	• As parking costs increas.e, parking demand decreases, from 6% (1$ in suburb) to 50% ($4 in CBD)[b] • Providing free parking to employees subsidizes driving, in that the free parking spot is worth more than the commute (20.9 mi [33.6km]), per day, to the employee (in 1994).[c] • Eliminate free parking and charge market rate parking prices (leaving 15% vacancy) to maximize occupancy and profit, in central locations; use all profits for local public improvements (in metred zone).[ln] • Very successful in Pasedena, CA: created a “virtuous cycle” in which parking revenue funded community improvements that attracted more visitors which increased the parking revenue, allowing further improvements. Resulted in extensive redevelopment of buildings, new businesses, and res. development.[n] • Charge employees for parking or cash out employees for free parking, in order to encourage other modes of travel.[b] • Use shorter-term and higher pricing for parking.[bio] • Have higher restrictions on parking (times, costs) for more dense versus less dense areas.[o] • Establish 'parking benefit districts' with demand pricing to reduce auto-use in and create revenue for district.[b] • Combine market pricing for parking with no parking minimums, causing developers to voluntarily supply spaces where the revenue will cover costs.[l] • Charge market price for parking as it is efficient, catering to 1) higher-occupancy vehicles (occupants share the cost); 2) those parking for less time (time savings outweighs cost); 3) those who walk/move slowly; 4) those who place a high value on reduced walking time.[l] • Charge a market price for parking as it is equitable: free parking forces everyone to pay, whereas market pricing forces only drivers/users to pay. Lower SES groups own fewer cars.[l] • Charging for parking encourages the consideration of other methods of travel, causes higher turnover in central areas, and offers flexibility to consumers and information to planners.[l]	[b]Litman 2000 [c]Shoup 1997 [n]Kolozsvari & Shoup 2003 [i]Pucher & Dijkstra 2000 [b]Litman 2000 [o]Surrey 2003 [l]Shoup 1999
Parking Difficulty (subjective measure of ease of parking) Currently Quantifiable in Peel: No		
Quantitative Evidence	• Higher perceived parking difficulty in local shopping areas was positively associated with transport walking (OR 1.40, 95% CI: 1.17, 1.67) and overall walking (OR 1.17, 95% CI: 1.02, 1.35), when controlling for population density and other walkability measures.[p]	[p]Rodriguez et al. 2008

Parking Location and Characteristics (e.g., location and access to spaces and lots) Currently Quantifiable in Peel: Uncertain		
Quantitative Evidence	• Highest tertile of curb parking density (>10% of curb area had parked cars) was significantly associated with the risk of injury of child pedestrians, Adjusted OR (95% CI) = 8.12 (3.32-19.90) (compared to <5% of curb area had parked cars).	Roberts et al. 1995
Best Practices & Recommendations	• Placing buildings close to the street with parking underneath or behind was the best potential indicator of transportation-efficient development.[q] • There was a clear relationship between regulation and implementation of such building placements. If a study area required parking to be placed behind or underneath the building, the projects followed these requirements. If such site designs were merely encouraged, they were often not implemented.[q] • Residential front driveways shall be no wider than 10 feet (3m).[r] • Provide a minimum of one bicycle rack per ten parking spaces on public and private frontage.[r] • Provide on-street parking on a minimum of 70% of both sides of all new and existing streets including the project side of bordering streets.[e] • Place parking lots at rear of building, or side if necessary.[rkst] • Access parking through rear alleys and rear lanes when possible.[rst] • If no alley, create access on sidestreet.[s] • Allow on-street parking, but do not let it block pedestrian crossings.[s] • No parking in front setbacks except on driveway.[s] • Mask open parking areas from the lot frontatef[krs] and all surface parking adjoining the street[s] with barriers (e.g., buildings), streetscreens (e.g., garden walls, fences), or landscaping (e.g., heavy landscaping, hedges) that is tall enough to at least screen car headlights. •.Disguise parking structures to look like regular buildings or hide them behind trees or landscaping so that they do not add blank wall space.[f] • Reduce driveways to/from site[bhs] -- curb cuts (for off-street parking) reduce on-street parking and create a less-safe pedestrian environment.[b] • Do not place parking lots or garages next to street intersections, civic buildings, squares, parks, or on lots which terminate a vista.[t] • Limit properties with a frontage only on a primary street to a max of two single lane-width vehicular entries separated by a minimum of twenty feet.[t] • Keep driveway widths at the requirement, not above.[s] • Connect adjacent parking lots with internal lanes.[t] • Provide easily identifiable walkways (e.g.,using lightwells, surface treatments) from parking to the sidewalk and the entrance of the building.[s] • Place all off-street parking spaces at the rear of the building with alley access, only, for attached homes and at the side or rear for detached.[t] • Keep parking lots away from main streets.[ks] • Use parking structures rather than lots.[kf] • Give bike parking the best spaces.[m] • Locate parking structures on edge of town to discourage driving and force walking, if people drive, and to free streets from heavy parking demands.[if]	[q]Kavage et al. 2002 [r]Duany et al. 2008 [e]LEED-ND 2008 [k]Corbett 1996 [s]Gabel-Luddy 2007 [h]Litman 2009 [f]Ewing 1996 [b]Litman 2000 [t]Belmont 1995 [m]Fenton 2003 [i]Pucher & Dijkstra 2000

3. d. Aesthetics and Human Scale

Aesthetics and Human Scale is a diverse element that can be measured both subjectively and objectively, and that incorporates many sub-elements; e.g., building setbacks, street enclosure, building façade characteristics, parks and open space, objects in the streetscape, and lighting. This element primarily affects health through the creation of safe, inviting, and physically- and visually-pleasing pedestrian and recreational environments. On the one hand, buildings set back behind large parking lots create unappealing, unsafe, uncomfortable pedestrian settings that cater to the car. On the other hand, buildings that are not set back from the sidewalk often contribute to the visual interest of the streetscape, offer a safe and comfortable setting for pedestrians, provide greater window-shopping and social interaction opportunities, and may be built on a human scale. Therefore, aesthetically-pleasing environments built at a human scale are generally regarded as conducive to walking and active transport.

Results of the literature review on Aesthetics and Human Scale are presented in Table 7. Below is a summary of these results:

Summary of Quantitative Evidence:

- Poor aesthetic characteristics in deprived areas resulted in lower rates of cycling for recreation.

- Building age is associated with characteristics of street design, density, and building facades, setbacks and size. Buildings built pre-1973 were significantly associated with increased frequency of walking (compared to post-1973).

- Higher objective and subjective measures of green cover were significantly associated with increased frequency of walking to school, increased frequency of general walking trips, and lower BMI.

Summary of Best Practices and Recommendations:

- Commercial areas should maintain a street wall flush to the sidewalk.

- In residential zones, ideal setbacks are no more than 15-25ft (4.6-7.6m) and ideal building height to street width ratios are between 1:1 and 1:3.

- Street furnishings (e.g., benches, planters, trees) can create both an aesthetically-pleasing environment and also buffer pedestrians from traffic.

- Trees provide a sense of enclosure, provide shade, and many other economical, ecological, and social benefits. New trees should be planted no more than 30-40 feet (9.1-12.2m) apart. Mature trees should be preserved.

- Create active and passive recreational open spaces and provide signage to promote them. Ensure open spaces are well-connected to the surrounding community and located near a mix of land uses, ensuring a range of activity throughout the day and night.

Table 7. Aesthetics and Human Scale

Street-level Aesthetics (measured subjectively in surveys) Currently Quantifiable in Peel: Not Applicable (Generally Unquantifiable)		
Quantitative Evidence (Sorted by Outcome)	• Including neighbourhood aesthetics reduced the differences between SES areas in recreational cycling to non-significant.[a] • Including neighbourhood aesthetics in a model predicting neighbourhood walking significantly attenuated the association between low SES and reduced walking.[a] • However, when including individual cognitions (attitude and intention regarding regular physical activity), the association between poor aesthetics and no recreational walking attenuated to borderline insignificance.[b]	[a]Kamphuis et al. 2008 [b]Kamphuis et al. 2009
Best Practices & Recommendations	• Replace street clutter with well-designed signage and street furniture.[c] • Design street junctions as attractive places.[c] • Bollards, planters, and other features should create a buffer between pedestrian zones and roadways.[d] • Place street furnishing so that it does not block vehicular sight lines or pedestrian circulation.[e] • "Varied, complex rooflines, balconies, and greenery in the form of planter boxes or landscaping will 'soften' the edges of an urban environment and add to the visual appeal of someone walking by.[f] • Although many (incl. Ewing's visual preference survey) suggest that street furniture has an insignificant relationship to walking and pedestrian-friendliness, street furniture can help to create a sense of place, giving streets identity and adding a level of comfort for pedestrians.[g] • Two extensive lit reviews (Handy 2004 and Hympel et al. 2002) suggest that aesthetics are an important factor in encouraging recreational physical activity but not necessarily transport-related physical activity. In the TRB review, Handy et al. (1998) was the only study that found a significant correlation between aesthetics (perceptions regarding shade, scenery, and traffic) and destination-oriented walking (walking trips for shopping).[h] • People will not walk to uninviting buildings, even with sidewalks, especially if they are set well back from the road behind parking. Buildings near the street with obvious entrances, bike parking, and many windows invite pedestrians and cyclists and also provide comfort in simply walking past.[i] • Buildings should face the street (have entrance on the street, not side) and have many windows.[g] • The principal functional entry of each new building must have a front façade that faces a public space such as a street, square, park, paseo, or plaza, but not a parking lot.[j] • Coherent signage sizing should be determined by the design speed of the street along which signs are located. (e.g. along walkable streets, design speeds are lower and signs should be scaled down).[g] • Transit users should be given comfortable and safe places to wait for service; e.g., comfort from benches, shelters, tree cover, canopy/awnings; and safety provided by street lighting and verticle curbs with setbacks from traffic.[g] • Survery about "classy" and "classless" transit facilities gave highest ratings to shelters with architectural flair and to bus stops without advertising.[g] • Transit stops should include seating, shelter, trash bins, lighting, route info.[e] • Encourage the regeneration of waterside sites.[c]	[c]Cowan 1997 [d]Gabel-Luddy 2007 [e]Bergeron et al. 2007 [f]Frank (Peel) [g]Ewing 1996 [h]TRB 2005 [i]Fenton 2003 [j]LEED-ND 2008

Ratio of Building Height to Street Width (building height:street width) Currently Quantifiable in Peel: No		
Best Practices & Recommendations	• Ratios of 1:1 and 1:2 are considered ideal and most often used.[k] • Ratios of 1:4 and 3:1 are acceptable.[k] • Beyond 1:5 the space will not be well-defined (no sense of enclosure) - this can be remedied with street trees, which help provide a sense of enclosure.[k] • Ratio of 1:infinitiy is also important (very positive), in the case of, for example, a street with water (a lake or ocean) on one side and houses on the other.[k] • The ideal minimum height-to-width ratio should be 1:3. This means that the width of the street (including building setbacks on both sides of the street) should be no wider than 3 times the building height.[g] • At least 90% of all street frontages within a development must have a minimum building-height-to-street-width ratio of 1:3, or one foot of building height for every three feet of street width.[j]	[k]Nelessen 1994 [g]Ewing 1996 [j]LEED-ND 2008
Building Setbacks (setback of structure from lot frontage line) Currently Quantifiable in Peel: No		
Best Practices & Recommendations	• Setback of 0-15 ft. 0-4.6m) for attached homes. • Setback of 0-25 ft. (0-7.6m) for detached homes. • Setback no greater than 25 ft. (7.6m) from street edge, otherwise they lose any tangible connection to the street. • Ideally buildings should be flush to the sidewalk, or have a small landscaped area or forecourt separating them from the sidwalk.[g] • LEED-ND projects can accumulate points for implementing the following: a) At least 80% of the total linear feet of street-facing building facades in the project are no more than 25 feet (7.6m) from the property line.[j] b) At least 50% the total linear feet of street-facing building facades in the project are no more than 18 feet (5.5m) from the property line.[j] c) At least 50% of the total linear feet of mixed use and non-residential street-facing building facades in the project are contiguous to the sidewalk.[j] • Set maximum setbacks, not minimums, as shorter setbacks are more comforting (from enclosure and oversight) and more inviting (from cars not dominating the landscape).[i] • "Buildings built close to the sidewalk, with parking behind or underneath them, windows on the ground floor, and awnings above will increase comfort and interest."[f]	[l]Belmont 1995 [g]Ewing 1996 [j]LEED-ND 2008 [i]Fenton 2003 [f]Frank (Peel)
Primary Facades and "Streetwalls" (build-to-line along street; % clear glass on retail and service building frontages; % blank walls) Currently Quantifiable in Peel: No		
Best Practices & Recommendations	• Streets should have a build-to-line where the majority of primary facades are a uniform distance from the curb. For retail and commercial settings this should be 12-14 feet (3.7-4.3m) from the curb (ie right against the sidewalk).[k] • Residential uses should have a build-to-line that makes a small front garden possible, setbacks in residential areas range from 10 to 35 feet (3-10.7m).[k] • In centres, locate buildings on street lines to define and enclose pedestrian path.[n]	[k]Nelessen 1994 [n]Corbett 1996

Primary Facades and "Streetwalls" - Continued		
Best Practices & Recommendations	• Consistent frontages create a clear distinction between private and public realms.[c] • A "streetwall" consists of uninterrupted building facades, providing enclosure (an "outdoor room") and a clear path for pedestrians on the sidwalk. But, many ped-friendly streets do not have streetwalls, so they are not essential.[g] • However, buildings should not be too far apart or any continuity of the streetscape will be lost. • Buildings should at least edge up to streets at the corners, trees can be used to create a sense of continuity, and driveways should be kept to an absolute minimum.[g] • Blank walls are dead space, so avoid blank walls with windows or 'soften' them with plantings or other articulations if necessary.[g] • LEED-ND projects receive points by ensuring that: a) All ground-level retail, service, and trade uses that face a public space have clear glass on at least 60% of their façades between 3 and 8 feet (1 and 2.4m) above grade. b) No blank walls (without doors or windows) longer than 40% of a façade, or more than 50 feet (15.2m) in length, occur along sidewalks.[j] • Forbid 'shutters' and other dull facades during business AND non-business hours.[c]	[c]Cowan 1997 [g]Ewing 1996 [j]LEED-ND 2008 [c]Cowan 1997
Building Height (building height in feet; building height in stories) Currently Quantifiable in Peel: No		
Best Practices & Recommendations	• Building height shall not exceed 35 feet (10.7m).[l] • Buildings should be 3 to 4 stories tall (max) in "pedestrian" areas, except on wider avenues and boulevards.[g]	[l]Belmont 1995 [g]Ewing 1996
Lot Coverage (% of lot covered by building footprint - not including parking, etc.) Quantifiable in Peel: Uncertain		
Best Practices & Recommendations	• All residential buildings shall cover no more than 50% of the lot area.[l]	[l]Belmont 1995
Building Entrances (height of residential building entrance above sidewalk) Currently Quantifiable in Peel: No		
Best Practices & Recommendations	• Entrances to residential buildings should be at least 18 inches (46cm) above the sidewalk so that they are well defined. In commercial or mixed-use areas the entrance is usually flush with the sidewalk.[k]	[k]Nelessen 1994
Building Age (average year of building construction in a given area) Currently Quantifiable in Peel: Uncertain		
Quantitative Evidence	• Was significantly associated with walking >=20 times/month for an urban/suburban study population, Adjusted OR (95% CI) = 1.36 (1.13-1.65) for buildings built 1946-1973 and 1.43 (1.03-1.98) for buildings built pre-1946 (both are compared to buildings built post-1973).[o]	[o]Berrigan and Troiano, 2002

Public Art (presence of public art) Currently Quantifiable in Peel: Not Applicable (Unquantifiable)		
Best Practices & Recommendations	• Public works of art help make certain spaces distinctive.[c] • Introducing art in public places can increase pedestrian activity through enriching and humanizing the public space and giving it a "sense of place." The art should have a vertical thrust and open design, and could be placed at the end points of streets to serve as a marker, or as a defining marker of the centers of parks and other public spaces.[g]	[c]Cowan 1997 [g]Ewing 1996
Lighting Currently Quantifiable in Peel: Uncertain		
Best Practices & Recommendations	• Use lighting to guide and orient people, exalt or hide buildings.[c]	[c]Cowan 1997
See Appendix E Road Network and Sidewalk Characteristics for additional Lighting recommendations.		
Human Scale Currently Quantifiable in Peel: Not Applicable (Generally Unquantifiable)		
Best Practices & Recommendations	• An expert panel determined human scale as the most significant element for explaining walkability, when viewing videos of streetscapes.[p] • "Human scale refers to a size, texture, and articulation of physical elements that match the size and proportions of humans and, equally important, correspond to the speed at which humans walk. Building details, pavement texture, street trees, and street furniture are all physical elements contributing to human scale."[p]	[p]Ewing et al. 2006
Driveway Presence and Location (presence of driveway at home; spacing of alleyways from lot lines) Currently Quantifiable in Peel: No		
Quantitative Evidence	• "Absence of driveway" for area homes had a significant positive association with the likelihood of recreation cycling after adjustment for Area SES, age, sex, education and occupation. Adjusted OR (95% CI) = 2.16 (1.52-3.06).[a]	[a]Kamphuis et al. 2008
Best Practices & Recommendations	• Attached homes must and detached homes may have their lot lines coinciding with an alley 24 ft. (7.3m) wide containing a vehicular pavement width of at least 10 ft (3m).[l]	[l]Belmont 1995
Urban Tree Placement and Characteristics (trees per lot frontage; presence of trees with 5m of sidewalk; tree height) Currently Quantifiable in Peel: Uncertain (Depends on Data Quality)		
Quantitative Evidence	• Presence of street trees was signifiantly associated with walking *to* (but not *from*) school, OR (95% CI) = 1.6 (1.101, 2.318).[q] • In areas with high accessibility, BMI was lower in areas that had high NDVI (an objective measure of greenness) (r^2 = .129428, p <.0001).[r] • Subjective greenness was related to walking trips per month (r^2 = .051, p < .0001).[r]	[q]Larsen et al. 2009 [r]Tilt et al. 2007
Best Practices & Recommendations	• In "suburban" zones, a minimum of 2 trees shall be planted (in the first layer) for each 30 feet (9.1m) of lot frontage or portion thereof.[s] • In general "urban" zones, a min. of 1 tree for the same specifications.[s]	[s]Duany et al. 2008

Urban Tree Placement and Characteristics - Continued		
Best Practices & Recommendations	• Plant trees that will grow to 50 to 70 ft (15.2-21.3m) in height at maturity and have canopy starting at 15 ft (4.6m) or so above the ground.[g] • Place trees between the street and the sidewalk, as close to the curb as permitted.[g] • Space trees 30 feet (9.1m) or less center to center (Henry Arnold, Trees in Urban Design) to form a continuous canopy over the sidewalk when fully grown. The more common 50 to 70 feet (15.2-21.3m) center to center is NOT sufficient.[g] • "Trees along the street leading to bus stops" was the second most highly valued feature in Ewing's visual preference survey."[g] • Provide street trees on both sides of 70% of new and existing streets within new projects and on the project-side of bordering streets, between the vehicle travel way and sidewalk, at intervals of no greater than 40 feet (12.2m), excluding driveways and utility vaults.[j] • Where trees are planted along non-residential streets, install a root-friendly medium such as structural soil.[j] • Where trees are planted along residential streets, ensure that planter strips are wide enough to provide a healthy growing area for each species.[j] • Trees larger than 18" (46cm) in caliper cannot be removed unless located in a grading area, building footprint, or drive.[l] • Preserve mature trees that create street enclosure.[e] • Include shade trees for sidewalks[d,e] and place them as close together as possible.[d] • When building dimensions are insufficient, trees can act as a substitute to provide street enclosure.[t] • As they mature, closely spaced trees will have higher, more translucent canopies that produce an uninterrupted quality of light and shade.[t] • Common practices place small ornamental and flowering trees, fruit trees, and palms far apart and set on the building/far side of the sidewalk, in order to pose less risk to errant vehicles. This is not pedestrian friendly - it is a perverse world, indeed, where errant vehicles are afforded more protection from trees than pedestrians are from errant vehicles. Used thus, trees may decorate a street or screen an unpleasant view, but contribute little to the fundamentals of good design, such as spatial definition and pedestrian safety.[t] • A better solution is to place trees between high-mass automobiles and low-mass pedestrians as a buffer, creating a more safe and comfortable pedestrian environment. The trees will also acting as a traffic calming device by limiting drivers' visibility.[t]	[g]Ewing 1996 [j]LEED-ND 2008 [l]Belmont 1995 [e]Bergeron et al. 2007 [d]Gabel-Luddy 2007 [t]Ewing 1999
Economic and Ecological Benefits of Trees (cost-benefit savings per tree; monetary benefits per % increase in tree canopy) Currently Quantifiable in Peel: No		
Quantitative Evidence	• Five cities spent an avg. of $13-65/tree annually, but the benefits ranged from $31-89/tree anually.[u] • For every dollar invested, the trees returned benefits ranging from $1.37 to $3.09.[u] • A 5% increase in tree canopy in Rochestery, NY, was estimated to have a $1.4M annual benefit to the city.[v]	[u]McPherson et al. 2005 [v]AF 2004

Economic and Ecological Benefits of Trees - Continued		
Best Practices & Recommendations	• Each city should set its own tree cover goals.[v] • Set a goal of 40% tree cover for northeastern cities (US). This percentage is an average for the entire metropolitan area. It is made up of 50% tree cover in suburban areas, 25% tree cover in urban residential areas, and 15% tree cover in the central business district.[v] • Over three quarters of the tree canopy that makes a community green comes from trees on private property.[v] • In order to improve city's tree canopy: designate trees as a public utility during the budget process; establish a tree canopy goal that is considered as part of every growth, development and maintenance project; create a formal process for tracking tree cover by creating a data layer in the city's geographic information system devoted to trees; adopt public policies, regulations and incentives to increase and protect the green infrastructure; and encourage homeowner tree planting.[v] • Urban trees not only beautify a city but also reduce stormwater and its management cost, lower summer cooling and winter heating costs, reduce air pollution, sequester carbon dioxide, improve water quality, lower temperatures in summer with cooling shade and by mitigating heat-island effects, create wildlife habitat, and decrease soil erosion.[u,v] • Urban trees also increase property values, increase in community pride, increase in recreational opportunities, reduce noise levels, build a sense of community, reduce violent crime & domestic abuse, shorten patient stays in hospitals, turn brownfields into recreational sites, attract downtown business and increase sales.[v] • City trees are an alternative to costly new electric power plants.[u] • Trees should be preserved and/or planted to block the summer sun.[w] • Trees are helpful for humidity control and as a windbreak.[w] • Trees are one of the best investments for home appreciation.[w]	[v]AF 2004 [u]McPherson et al. 2005 [w]Ewing 1998
Characteristics and Design of Outdoor Resources (e.g., length and width of parks, area, design features, relationship to surroundings) Currently Quantifiable in Peel: Yes (Park dimensions and area only)		
Quantitative Evidence	• The top five most important attributes across all participants (seniors) of open spaces/parks: Nuisance (10.7%); Facilities (10.3%); Trees/Plants (10.0%); Traffic (9.6%); Things to watch (9.3%).[x] • New exercisers of a new trail ranked enablers in the following order of importance: 1) convenience, 2) terrain, 3) safety, 4) scenery, and 5) atmosphere. In contrast, habitual exercisers ranked enablers in this order: 1) terrain, 2) convenience, 3) scenery, 4) safety, and 5) atmosphere.[y] • New exercisers rated safety (P = .03), terrain (P = .04), and convenience (P = .001) as significantly more important than habitually active exercisers.[y] • New exercisers rated unsafe conditions as a significantly higher barrier than habitually active exercisers (P = .04), although mean scores (3.1 ± 1.6) were in the middle of the five-point scale.[y]	[x]Alves et al. 2008 [y]Gordon et al. 2004

Characteristics and Design of Outdoor Resources - Continued		
Best Practices & Recommendations	• Parks less than 1 acre (0.4ha) must also have a proportion no narrower than 1 unit of width to 4 units of length[j] • Each civic space (except playgrounds) shall have a minimum of 50% of its perimeter fronting a thoroughfare.[s] • Each community unit must have civic zones (for buildings or outdoor spaces dedicated for public use).[s] • Each pedestrian shed (area centered on community activity) shall assign at least 5% of its urbanized area to civic space (public outdoor space).[s] • One civic building lot suitable for a childcare building shall be reserved within each pedestrian shed.[s] .• Create imaginative and well-maintained parks.[c] • Protect the environment during construction and incorporate natural features into the development and link it with sidewalks, pathways, or trails.[e] • Focus on walking and/or cycling accessibility in developments.[e] • Provide signage to promote trails/pathways/parks.[e] • Create active and passive recreational parklands.[e] • Communities should contain an ample supply of specialized open space in the form of squares, greens, and parks whose frequent use is encouraged through placement and design.[z] • Each community or cluster of communities should have a well-defined edge, such as agricultural greenbelts or wildlife corridors, permanently protected from development.[z] • Invest in parks, trails and other recreational facilities.[f] • "[Public] Spaces should be highly accessible to pedestrians, linked to other spaces via sight lines, and crammed with activities and sensuous elements such as tress, water, sculpture, etc."[g] • Plazas should be well-connected to the streets and sidewalks around them.[g] • Public spaces should be located where they have a variety of land uses nearby, so that they will be used throughout the day, instead of only by a similar group of people at the same time of day (eg. moms in the afternoon).[g] • Introducing art in public places can increase pedestrian activity through enriching and humanizing the public space and giving it a "sense of place." The art should have a vertical thrust and open design, and could be placed at the end points of streets to serve as a marker, or as a defining marker of the centers of parks and other public spaces.[g]	[j]LEED-ND 2008 [s]Duany et al. 2008 [c]Cowan 1997 [e]Bergeron 2007 [z]Calthorpe 1992 [f]Frank (Peel) [g]Ewing 1996

4. Conclusion

The goal of this project is to develop a tool that will encourage the development of communities that provide greater opportunities for active living. This review is the first stage in that process: a summary of the qualitative recommendations and quantitative findings in the literature.

Appendix A. is a meta-table that synthesizes the targets and ranges for each element (and its accompanying measures) found in Tables 1 to 7 of this report. The meta-table includes *quantitative* recommendations and findings, only, and also includes a subjective *strength of evidence* assessment for every measure of the seven elements. Although this assessment gives more weight to quantitative studies, greater strength of evidence does not necessarily equate to greater importance to healthy communities: Some elements are simply more easily (and so more commonly) measured objectively (e.g., intersection density within Connectivity) than others (e.g., street-level aesthetics within Aesthetics and Human Scale). That being said, ease of measuring and having quantitative support are important parts of developing and implementing this tool.

Although the literature supports our distinction between the built environment elements, it is important to reiterate both the overlap and interrelationships between all seven elements. In other words, when considering the application of a given element, always examine it in relation to the rest of the built environment – not in isolation. A combination and balance of activity-friendly measures is ideal.

Moving forward, CRICH will determine the nature and make-up of the final Healthy Development Evaluation Tool. Once established, the meta-table in conjunction with Tables 1 to 7 will guide the tool's development, lending the targets, ranges, and recommendations to be included.

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Appendix A. Summary of Elements and Measures for Inclusion in the Healthy Development Evaluation Tool..

Elements	Strength of Evidence*	Targets and Ranges	Quantifiable in T.O?	Quantifiable in Peel?
Density				
Measures::				
Residential dwelling density	High	1. a) 15+/acre (37+/ha) or 21+/acre (54+/ha) 2. a) 12+/acre (30+/ha) for high transit area; 7+/acre (17/ha) for all other b) 10-20/acre (25-49/ha) minimum for livability but up to 100/acre (247/ha) in urban c) min 15/acre (37/ha) for low density	Yes (most accurately within DAs)	Yes
Population density	Medium	1. a) 12,500+/mi^2 (4808+/km^2) b) 15,000/mi^2 (577/km^2)	Yes (most accurately within DAs)	Yes
Floor Area Ratio (FAR)	Low	2. a) Offices: 1.0 (excellent) to .4-.5 (minimal) b) Retail: .75 (excellent) to .3-.35 (minimal) c) non-res .8+ for high transit areas, .5+ for all others. d) Min: .35 - density corridors, .5 - downtown	No	Uncertain
Employment density	Medium		Uncertain	Uncertain
Service density	Medium		Yes	Yes
Service Proximity				
Measures::				
Walk or cycle distance to a given service	High	1. a) distance to grocery or market: < 440m eating or drinking place: < 262m b) ≤ 450m walk to regular transit stops 2. a) housing within 400m of services and rec b) 90% of housing within 450m of existing or future transit stop. c) ≥ 50% of dwellings and businesses within 400m walk of bus/streetcar stop or 800m of rapid transit, rail, ferry, or tram. Or, project boundary within 400m walk of 5 or 800m walk of 7 distinct services, incl. a retail, a service, and a civic use. d) points for 50% dwellings within 800m walk of future/existing school, and points for ped, bike, and traffic calming features. e) points for # of diverse uses within 800m	Yes	Yes
Perceived distance/time to a given service	Low		N/A	No
Service locations within a fixed distance buffer	Medium	1. a) > 13.5 grocery or market with 1km euclidian b) less than 5.1 educational uses c) > 1.8 centres w/ grocery, restaurant, retail.	Yes	Yes
Employment opportunities within a fixed buffer	Medium	1. a) 80,000+ and 160,000+ jobs within 30-min transit service. 2. a) centre of res components within 800m of same # of full-time jobs as dwellings units. b) centre of non-res component within 800m of transit and of same # of dwellings as 50%+ of the new full-time jobs.	Uncertain	No
Resources for outdoor activity within a fixed buffer	Medium	2. a) 90% of dwellings within 400m walk of a public park, schoolyard, or plaza ≥ 0.07ha b) 90% of dwellings within 800m of public outdoor active facility ≥ 0.4ha or of an indoor recreation facility. c) one main civic space within 245 of each community centre.	Yes	Yes - but parks are only for Mississauga
Presence of a service within census tract	Low		Yes	Yes

*Strength of evidence is based on both quantitative and qualitative findings. Although more weight was given to quantitative evidence, greater strength of evidence does not necessarily mean greater importance to healthy communities.

Elements	Strength of Evidence*	Targets and Ranges	Quantifiable in T.O?	Quantifiable in Peel?
Land Use Mix				
Measures:				
Heterogeneity of land use	High	2. a) housing 20-80% (more for residential) commertcial 5-70% (more for urban) public space 5-15% b) corner store/café in each neighbourhood of 300+ residents and/or jobs. c) communities of 16-80ha must provide mixed housing, shops, workplaces, schools, parks/open spaces, and civic facilities all within walking distance. d) projects are 'excellent' if adjacent to services (or housing) or provide 4 new types of uses to a neighbourhood. e) mix habitual and non-habitual uses f) place commercial close to residential	Yes	Yes (using DMTI land use - Peel hasn't provided their own version)
Heterogeneity of parcel use	low	2. a) non-res or mix use projects: ≥ 50% of office buildings include ground floor retail along 60% of street façade. b) 100% of mix use buildings should include ground floor retail, live/work, and/or dwelling along ≥ 60% of street facade. c) Points for residential above 1st floor commercial, or street-level pedestrian use, or two uses, or three uses. d) encourage live/work spaces in residential	No	No
Variety of destinations	Low		Yes	Yes
Neighbourhood structure	Low	2. a) communities should be 15-80ha, not more. b) encourage clustered development around transit facilities and/or mix-use nodes.	No (generally unquantifiable)	No (generally unquantifiable)
Mixed housing types	Low	2. a) > 15% and < 30% of gross area given to attached homes and small lot (≤ 15m wide) detached houses., and < 30% to large lot (>15m wide) detached homes. b) In urban, ≥ 3 housing types, none < 20% of total residential development.	Possibly - MPAC	Uncertain, would need to receive assessed zoning data from Peel
Street Connectivity				
Measures::				
Intersection density	High	1. a) 49.25-102.49 /km2 (highest tertile) 2. a) LEED: 57/km^2 minimum for new developments. - 5 points for 150+/km^2 - 3 points for 115-150/km^2 - 1 point for 75-115/km^2	Yes	Yes
Number of street intersections in a neighbourhood	Low		Yes	Yes
Local road length	Low	1. a) 17.82 – 30.02km (middle tertile) within 800m radius of home.	Yes	Yes
Local road index	Low		Yes	Yes
Cul-de-sac presence	Low		Yes	Yes
Block size	Medium	1. a) area < 4.1-5 acres (1.64-2ha) 2. a) length ≤ 200-250m in length b) length ~81m, though 122-152m is still ok c) perimetre < 412m with no length >152m w/o mid-block cut-throughs & crosswalks d) mid-block cut-throughts & crosswalks for blocks longer than 183-244m e) through-streets < 800m apart	Yes	Yes
Percentage of small blocks	Low		Yes	Yes
Walking and cycling network	Low		Uncertain	Uncertain
Network pattern	Low		Uncertain	Uncertain

Elements	Strength of Evidence*	Targets and Ranges	Quantifiable in T.O?	Quantifiable in Peel?
Road Network and Sidewalk Characteristics				
Measures::				
Traffic calming measures	High	1. a) 8+ speed humps within 800m of home b) 4+ traffic lights within 800m of home c) crosswalks ≤ 30m apart on ped streets. d) midblock xwalk for blocks > 180m.	No (To my knowledge we don't have the data)	No
Traffic speed	Medium	1. a) ≤ 40km³h reduces noise, pollution, injuries. 2. a) residential streets ≤ 30km³h b) mix-use streets ≤ 40km³h c) arterials and collectors ≤ 55km³h	Yes - posted limit only	Yes - posted limit only
Traffic volume	Low	1. a) ≤ 250 vehicles/hr safer	Possibly - EMME/2?	Uncertain (data availability is marked as "possible" in the data response)
Sidewalk presence and width	Medium	2. a) arterials and collectors: both sides density > 4 units/acre (1.6/ha): both sides density 1-4 units/acre (0.4-1.6/ha): one side density < 1 unit/acre (0.4/ha): no sides b) roads < 5.5m and ADT of < 250: no sides c) both sides of ≥ 90% new streets d) low density: width of 1.2-1.5m e) mix use or core: width of 2.5-5.5m f) corner radii of 1.5-3m for res or mix use.	Currently, no	Uncertain (depends on data quality)
Buffer strips	Low	2. a) 30km/h: sidewalks and vertical curbs b) 30-50km/h: buffer strip, 1.8m sidewalk, and/or curbside parking. c) 50km/h+: physical barrier (e.g., row of trees)	Currently, no	No
Bicycle lanes and cycle-friendly design	Medium	1. a) bike lane min 1.5m or 3.8m combined with curbside parking b) min. street width 3m or 3.2 for bus routes c) 40km/h max for cars 2. a) < 10,000 cars/day and speed < 50km/h: 4.3m curb lane; < 10,000 cars/day and speed 50-65km/h: 1.5m bike lane; ≥ 10,000 cars/day: 1.5m bike lane	Possibly	Uncertain (data availability is marked as "possible" in the data response)
Road network access and orientation	Low		No	Uncertain
Alleys	Low	2. a) attached homes must and detached homes may border an alley 7.3m wide with a vehicular pavement width of 3m+.	Currently, no	No
Street dimensions	Low	2. a) for detached res, max ROW (right of way): 12m; min 2 x 3m lanes; min 1.5m sidewalks both sides; curb radius ≤ 7.6m. b) for attached res, max ROW: 15m; min 2 x 3m lanes; 2.4m curb parking on both sides; min 2.4m sidewalks both sides; curb radius max of 3m. c) for commercial, max ROW: 20m; min 2 x 3.4m lanes and 1 z 3m central turning lane; 2.4m curb parking on both sides; min 2.7m sidewalks both sides; curb radius max of 4.6m.	Currently, no	No
Total sidewalk length	Low	1, a) ≥60,960m within 1km euclidian buffer	Currently, no	Uncertain (depends on data quality)
Road slope	Low		Likely	Likely
Safety and crime	Low		Uncertain	No
Lighting	Low/Medium	1. a) for streets in high crime risk areas: avg. illuminance of 10 lux and a minimum of 5 lux. 2. a) if provided, street lamps ≤ 30m apart on both sides, up to 4.6m tall.	No	Uncertain (depends on data quality)

Elements	Strength of Evidence*	Targets and Ranges	Quantifiable in T.O?	Quantifiable in Peel?
Parking				
Measures::				
Parking requirements	Medium	2. a) businesses: 1 spot/500ft^2, except retail 1/300ft^2 (on-street counts) b) ≤ 20% of development footprint to parking with no lot > 2 acres c) no more than 9% of all land to parking d)set maximums, avg 1.5/unit across district d) set different maximums for each zone: 0-25% of standard min. for density centre, 25-50% for next most dense, etc. c) sell or rent 100% of spots associated with multifamily housing separately. d) 1 bike rack per 10 parking spots.	Currently, no	Yes (By-Law requirements only)
Price of parking	Medium	2. a) charge market rates for parking	No	No
Parking difficulty	Low		No	No
Parking location and characteristics	Medium	2. a) residential driveways ≤ 3m wide. b) provide on-street parking on 70% of both sides of the street in new developments. c) parking lots in rear or side	Currently, no	Uncertain
Aesthetics and Human Scale				
Measures::				
Street-level aesthetics	Medium		No	N/A (generally unquantifiable)
Building height to street width ratio	Low	2. a) Ideal range: 1:3-3:1, also 1:infinity (e.g., waterfront)	No	No
Building setbacks	Low	2. a) 0-4.6m for attached 0-7.6m for detached b) max 7.6m, 50% less than 5.5m, 50% of non-residential flush with sidewalk. c) 0m (flush to sidewalk) is ideal, particularly for commercial.	Possibly - MPAC?	No
Primary facades and "streetwalls"	Low	2. a) build-to lines to create streetwall non-residential: 3.7-4.3m from curb (flush to sidewalk. Residential: 3-10.7m (room for small front garden) . b) All ground-level retail, service, and trade uses that face public space have clear glass on at least 60% of their façades 1-2.4m above grade. c) No blank walls (without doors or windows) longer than 40%, or 15.2m, of a facade along sidewalks.	No	No
Building height	Low	2. a) ≤ 3-4 stories, or 10.7m, except on avenues and boulevards.	Possibly - MPAC?	No
Lot coverage	Low	2. a) res buildings cover ≤ 50% of lot area	No	Uncertain
Building age	Low		Yes - MPAC	Uncertain
Public art	Low		No	N/A (unquantifiable)
Lighting	Low		No	Uncertain
Human scale	Low		No	N/A (generally unquantifiable)
Driveway presence and location	Low		No	No
Urban tree placement and characteristics	Medium	2. a) in suburban zones, ≥ 2 trees every 9.1m of lot frontage. Urban ≥ 1 tree/9.1m b) plant trees that will be 15-21m in height with canopy starting ≥ 4.6m high. c) place trees between street and sidewalk. d) place trees ≤ 9.1m apart for a continuous canopy. e) trees on 2 sides ≥ 70% of new and existing streets in new projects, between road and sidewalk, ≤ 12.2m apart. f) do not remove trees ≥ 46cm in caliper unless in grading area, buildnig footprint, or drive.	Currently, no (though I am sure data exists through the city of TO)	Uncertain (depends on data quality)
Economic and ecological benefits of trees	Medium	2. a) goal of 40% tree cover for northeastern cities: 50% in suburban, 25% in urban residential, and 15% in CBD.	No	No
Characeristics and design of outdoor resources	Medium	2. a) parks < .4ha must have a length:width ratio less than 4:1. b) each civic space (except playgrounds) have ≥ 50% perimetre on a thoroughfare. c) each 'pedestrian shed' have 5% of land to outdoor public space. d) reserve one suitable lot in each pedestrian shed for a childcare building..	No	Yes (park dimensions and area only)

Appendix B. Methods

A literature search was initially conducted using Papers Version 1.9.3 software, which allows the user to search multiple journal databases for citations and download the associated articles. Articles were searched for in PubMed, Google Scholar, JSTOR, CiteSeer, and Web of Science using combinations of the following keywords: walking; walkability; cycling; built environment; urban environment; neighbourhood environment; neighbourhood health; obesity; BMI; physical activity; active transportation; active transport; aesthetic; human scale; access; accessibility; land use mix; service proximity. Citations were only downloaded for articles that examined some form of relationship between the built environment and physical activity or other health-related outcomes (e.g., walking, cycling, obesity, BMI, pedestrian injury).

Using Papers Version 1.9.3, 130 citations were downloaded, 126 of which we were able to obtain the full article for. Additional literature was retrieved through examination of relevant references within these articles (the "snowball" methodology), and supplementary resources were also obtained on-line, from repositories such as the Victoria Transport Policy Institute (VTPI, 2009), SmartCode Central (DPZ & Co., 2009), and The Codes Project (Talen et al., 2009). In total, 194 journal articles, reports, and relevant documents were downloaded, and their corresponding citations were imported or entered into a Reference Manager Version 12 database.

An initial categorization of all articles was conducted through abstract and broad content examination. Two categories were established: (1) Quantitative Evidence – articles that presented empirically-defined associations or threshold relationships between built environment measures and physical activity or other health-related outcomes; and, (2) Best Practices and Recommendations – expert and/or theoretical best practices and recommendations regarding the built environment and physical activity from urban planning and design literature. It should be noted that categories

were not exclusive: One article could be classified as both Quantitative Evidence and Best Practices and Recommendations, depending on the content and study design. There were 10 articles that did not have content suitable for either category, which were removed from the review.

Each of the remaining 184 articles, reports, and documents were examined in detail to assess the following data: type of analysis; built environment measures; how measures were calculated; confounding factors controlled for; study quality; and results. This information was recorded and organized into sub-categories based on groupings of built environment measures found in the literature. We refer to these groupings as built environment elements. These element sub-categories were: Density; Service Proximity; Land Use Mix; Street Connectivity; Road Network and Sidewalk Characteristics; Parking; Resources for Outdoor Activity; and Aesthetics and Human Scale. Note that these elements are not mutually exclusive and that many articles use a variety of measures to explain different elements of the built environment.

After initial recording and organization of the data in each article, we further edited and synthesized this data into Tables 1 through 7 of this report. Resources for Outdoor Activity contained measures that were also used in other tables, so this element was dissolved into Table 2. Service Proximity and Table 7. Aesthetics and Human Scale. Appendix A. summarizes the quantitative evidence found in the tables.

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Appendix C. Summary of Consultation Feedback with Annotations from Dan Leeming

Introduction

Table 1 of this appendix presents a synthesis of the feedback received from our roundtable meetings with regional and municipal planners as well as with private planning firms. The responses from the consultation process are summarized in the left-hand column according to element and meeting date; whereas, the right-hand column provides annotations from urban planner and designer Dan Leeming from the Planning Partnership. CRICH engaged Mr. Leeming to give further feedback and insight into the interpretation and use of the comments from the stakeholder (consultation) meetings.

A summary of the consultation process is presented in section 4 of this report, and the outcomes from this on-going dialogue are used in the assessment of the Tool in sections 8 and 9.

Table 1. Synthesized Notes of Consultation Feedback with Annotations from Dan Leeming.
Peel Healthy Development Evaluation Tool

1. DENSITY (35 du/ha; FAR > 0.7)	
August 28th – regional and municipal planners from Peel	
1. Tom (Peel) doesn't think we should limit number of stories. • Thinks we eliminate 'tower in the park' in other ways.	Agreed. Limiting height does not further the density discussion or public health concern. In fact, tall and slender is often more appropriate than short and wide (review 'Tall Buildings' document and other sources).
2. Municipalities will have to change the way they require density. • May have to consider requiring some percentage above current standards.	*Please see attached Tables A-D.* Assessment: (1.) Needs some lower density entry level (but encourage ramping up) (2.) 35units/hectare can be achieved, but in a more urban condition versus greenfield (or a high-level sustainable community program, demonstration plan). Therefore, (3.) A worthy target, but it will be difficult to transform the housing market in the short term. Mandating is one approach, incentives is another. Marketplace is increasing density every year as land cost and affordability encourage multiple fares. At the end of the day we need to state what is appropriate to make public health improvements and quantify it if possible.
3. Densities established at block plan level, whereas FAR established at lot level.	
4. Bill 51 allows minimum density requirements... Previously only maximums were required in order to not overload infrastructure – opens the door for our recommendations	Yes, agreed.
September 24th (Prerequisites Only) – private planning firms and Peel regional planners	
5. All regions must conform to 'Places to Grow' (50 people + jobs/ha)	Yes, provides a good minimum threshold.
6. Multiple attendees agreed that 35du/ha was too low (should be closer to 40)	See above #2
7. Pushing targets higher may result in a middle ground that is closer to our desired standard.	Yes. It could help. Implementation and marketplace acceptance is key.
8. Could be administratively difficult if numbers don't coincide with other, legally-enforced ones (e.g., GPGGH)	Yes. Implementation is key.
9. Tool may be stronger if numbers also meets the GPGGH guidelines.	Yes. Coordinated strategy is best.
10. Need to equate with provincial gov't standards (up to Peel to do this?)	*(Not clear)*
11. FAR may be too broad of a measure – perhaps minimum lot coverage percentage, instead.	FAR ratio is preferable as is; but removing 'Multifamily Structures' might helpful as they are already covered under density.
12. FAR of 0.7 might only be good for a mixed-use development	Best if kept to non-residential and mixed use; (or even exclude residential altogether).

Table 1. Synthesized Notes of Consultation Feedback with Annotations from Dan Leeming.
Peel Healthy Development Evaluation Tool

13. One suggestion (from Hurontario Main St. Higher Order Transit Study – "HOT") was to not have minimum FAR requirements, but minimum street frontage of 90-95% of buildings with 0m setback and maximum 3 stories.	FAR and other performance criteria working together are most effective (i.e. 0.7 FAR and Walkable Streets criteria).
14. Rob Russell – may be difficult to measure density for a mixed-use building.	FAR accounts for all building floor area types.
15. How do we measure FAR and density requirements for mixed-use structures? • And still encourage mixed-use….	Combination of FAR and performance / zoning standards (i.e. 10 storey residential building at 2.0 FAR with mandated retail ground floor.
October 7th – Mississauga municipal planners	
16. Numbers may only be suitable for 'managed change' areas. • In which case they may be too low for what can be accomplished.	If an infill project *(if that is what is implied)* exceeds standards then the program is being met. These are minimum standards.
17. Need options for measuring density (so municipalities don't have to convert existing methods of measurement)	Conversion can be done, but the targets still need to be met
18. % lot coverage easier/better than FAR	FAR in conjunction with various other urban design performance criteria (i.e. height, massing, bulk, frontage, setback, doorway access, fenestration, streetscape, parking) can deliver the entire package of built form to address the standard's (goals) better than coverage.
2. SERVICE PROXIMITY	
August 28th – regional and municipal planners from Peel	
1. Tom (Peel): employment requirement could be most difficult to implement. • Difficult to calculate number of jobs before it is developed. (A) • However, people may be willing to walk further to work than retail/services. (B)	(A) Employment is difficult to define in exact numbers, but the application of assumed projections i.e.: home offices, employees, square metres of office / retail / industry, typical ratio of jobs / elementary / secondary schools etc. is a start. (B) Walk to work is probably preferable; however, walk to services depends more on the need to transport goods, than distance
2. Retail/service requirements should be achievable. • May need to find way to encourage multiple services at different locations (i.e., more options). (A) • Would be evaluated at Block Plan level, but won't know jobs, yet. (B)	(A) A variety of appropriately sized mixed use services promotes access and walkability. Density and access routes also play key role. (B) Block Plan development should respond to service proximity criteria upfront. Jobs can be assessed at a preliminary level under the same terms as 'Places to Grow' mandates and Provincial 'Projections Methodology Guidelines' document prescribes.

Table 1. Synthesized Notes of Consultation Feedback with Annotations from Dan Leeming.
Peel Healthy Development Evaluation Tool

3. 2.c. Our 'suitable transit stop' requirement may be difficult to enforce. • 'Any transit stop' would be easier to measure. (A) • Dr. Mowatt thinks 'suitable stops' is very important, however. (B) • Tom – need to consider how developers would actually get this credit. ▫ Transit is run by municipality. Need transit-supportive form first, then better service may come. – Us: Portland did the opposite – provided transit first, predicting that developers would fight to build around new stops, and it worked. (C) • Us: what about requiring developers to pay for a bulk discounted transit pass for all residents of their new community for one year – studies have shown that people continue to purchase pass afterwards, at a slightly discounted 'community' rate (VTPI.org). (D)	(A) & (B) There is a big difference between the type of transit stop and its appeal to a user. i.e.: access to high order, direct transit is highly preferred to a local bus that runs every 15 minutes and requires further connections to complete the trip. Therefore, the transit service type needs to be defined, all are worthy but weighting given by type. (C) Developer / Builder needs to work with the transit agency to define future routes and stops in conjunction with planned density, access and destination points. Needs both parties. (Portland is a good example, but U.S. federal funding for transit is not the same as in Canada.). (D) This is possible; it has been done on a voluntary basis. It is expensive: i.e. 200 unit building exceeds $500,000.00/year). These costs would be reflected in the unit cost or a 1 year tax incentive program could be issued. A large transit incentive/benefit. *Please see attached Tables E.*
September 24th (Prerequisites Only) – private planning firms and Peel regional planners	
4. Multiple people thought that this seems to apply more to the secondary-plan level – especially if done in a block plan process	Direction through the Official Plan to the Secondary/Block plan is a start. Defined design criteria to address these issues should be key drivers in Block Plan design.
5. Many worried that job proximity requirements are too high / difficult to meet • Multiple people thought job proximity should just be for credit, instead	Live-work ratio is a very important indicator of reduced car dependence and improved active transportation. If it is a credit then it could be on an incremental scale to act as a stronger incentive.
6. Could consider a minimum numbers of jobs accessible to x% of residents within a 20-minute transit trip as a prerequisite.	This could be part of a credit approach; e.g., 5min., 10 min., 20 min.
7. Dan suggests including having X number of services/retail within 400m as well as existing 800m requirements.	400m is a 5 minute walk and is often a break point in choice of distance / transportation mode and car ownership. Highest order of walking occurs within 5 minutes, and then drops off.
8. Andrea/Dan – more success if implementing these at secondary plan level. • The 'rules' need to be there from the start (of the process). • Need to figure out our scope/geographic area, though.	Agreed. Detailing through Block Plan design and Secondary plan provides measurable results.
9. Rob Russell – may require change of business practices and perceptions • E.g., a clustering of medical buildings is not a true mix of uses; however, a single medical use may not benefit the community as much.	Business responds to client needs, frequency of visits, location and costs etc. Plans can only encourage business investment through provision of matters such as, location, density, mix, transportation options and public investment.
September 28th – Brampton municipal planners	
10. Possibly change within 800m to 10min walk.	800 metre walk is 10 min. (or ½ mile); 400 metre walk is 5min. (or ¼ mile) for average adult.

Table 1. Synthesized Notes of Consultation Feedback with Annotations from Dan Leeming.
Peel Healthy Development Evaluation Tool

11. Employment proximity not realistic for Brampton; though, they are trying. • Refer to within transit distance, instead.	This would depend on the type and frequency of transit service and the distance from stops to places of work i.e.: 30 min. headway service with a further 15 min. walk to a warehouse type area from the transit stop becomes a disincentive.
12. Move transit stop to public service (from retail service).	OK.
October 7th – Mississauga municipal planners	
13. How do we calculate the employment proximity for new developments?	*See 2.(B*
3. LAND USE MIX	
August 28th – regional and municipal planners from Peel	
1. 3.a. May want to consider moving credits in this measure elsewhere, as mixed use is captured in other areas, already.	This is partially covered by 'Density, Service Proximity, Complete Streets, and Building Setback. Either expand this credit to make it more comprehensive or make sure its intent is covered by other categories.
2. 3.b. More credits for buildings with multiple uses inside them.	Need to define total credits and the proportionality / weight each credit.
3. Make language in this section consistent with OP terminology.	Language needs to be clear and concise as a standalone document.
4. Tom thinks many of the percentages are too high.	Percentages are not too high for an urban infill, but will be more challenging in a greenfield condition. An incremental scale could help differentiate and encourage different forms of development. In general, 3.b could use a more extensive set of criteria to define built form. Images would be helpful.
5. 3.c. 15m wide on street is way to high for 'large lots' • Could make it 40ft, instead and have a smaller max percentage.	Large lots in a GTA context have been getting smaller every decade based on costs of land and building. At present, 12m (40ft) to 13.7m (45ft) is considered a large lot
September 24th (Prerequisites Only) – private planning firms and Peel regional planners	
6. Why is this not a prerequisite? • Us: more difficult to measure, captured elsewhere in tool. (A) • We have not included a short narrative in the tool to describe what sort of mixed-use we want to achieve – suggested that we do so. (B) • Density without proximity is useless (C)	(A) Agreed. (B) This would help. (C) Density always works best when supported by transit and other services and is used strategically.

Table 1. Synthesized Notes of Consultation Feedback with Annotations from Dan Leeming.
Peel Healthy Development Evaluation Tool

7. Suggested minimum first floor heights of 4 meters be required so it can be converted to commercial use from residential	4.0 to 4.5 will permit / encourage retail use.
October 7th – Mississauga municipal planners	
8. MOED6 affect mixed use through minimum separations.	*Need to clarify.*
4.a. INTERSECTION DENSITY and BLOCK SIZE (75 intersections/km; 1.5ha max)	
August 28th – regional and municipal planners from Peel	
1. 4.a./4.b. Will need to rely on literature support for our connectivity requirement. • Traffic engineers want to minimize accidents = fewer intersections. • Developers see intersections as expensive and not profitable. • May have to consider cost/benefit of this (health vs. accidents/cost) ▫ Us: what about greatly emphasizing bike/walk connectivity, instead?	This prerequisite needs an introductory 'Intent' to describe need. This will help to focus the review on public health goals vs. traffic management assessment. See Table F for sample 'Intent' as provided for discussion purposes. Discussion about intersection pro's and con's can detract from the key principle of facilitating active transportation in a safe and convenient manner. Start with the principle.
September 24th (Prerequisites Only) – private planning firms and Peel regional planners	
2. Opposition to increased connectivity often comes from within the region (e.g., transportation planning)	External connectivity to a regional grid is problematic as it is often driven by stop light distance separation, i.e. 300m-500m.
3. Nick agrees that regional standards will have to be re-examined	Agreed.
4. Dan says internal connectivity is easier to achieve than external/regional connectivity. Need to eliminate 'superblocks' with only 3 ways in/out.	Agreed.
5. Would need strong top-down message to get this going – provincial, regional, municipal.	Agreed. New public health criteria in conjunction with good urban design principles need to further this agenda.
6. One planner thinks the maximums should not be so strict – e.g., 1.5ha vs. 1.6ha, 300m long vs. 250m long.	Provide acceptable minimum standard to qualify and ramp –up with additional points for improved metrics.
7. Cutler – keep block size an average or a guideline, not an absolute.	Same as above.
September 28th – Brampton municipal planners	
8. Test numbers. Main problem is limited ways in/out (permeability).	Agreed, although both internal and external connectivity still needs to achieve minimum standards.

Table 1. Synthesized Notes of Consultation Feedback with Annotations from Dan Leeming.
Peel Healthy Development Evaluation Tool

October 7th – Mississauga municipal planners	
9. Road pattern in Mississauga is not going to change much.	Change will occur over time, as well as new infill and greenfield conditions. Minimum standards still required.
10. Careful with prerequisites that only apply to Greenfield.	Prerequisites and credits apply to both urban infill and greenfield context; however, greenfield is more difficult to achieve – higher credits in comparison to an urban condition.
11. What about large blocks because of parks?	Parks, natural environment areas, etc. are helpful in supporting health goals and permit multiple active transportation routes. Cars can go around and the street system credits must make allowances.
12. Key is permeability.	Agreed, in all forms of mobility.
5.a. COMPLETE STREETS	
August 28th – regional and municipal planners from Peel	
1. 5.a. This is a big deal and we will face a lot of opposition. • E.g., a current by-law states that all local streets are designed for 50km/h, and so able to be driven at 60km/h. • Would need higher-level policy change to lower so much.	'Complete Streets' is part of a complex of many factors. The speed of automobiles is often based on empirical observations of the built environment i.e.: a local road that is too wide or straight, prohibits parking or has a poor street tree planting program, encourages speeding regardless of posted speed. Traffic calming needs many measures to make it work whether it is 40km/hr or 60km/hr.
2. Usually block plans identify roads and developers are not required to include a sidewalk plan in their block plan, but we can require it.	Can be part of Block Plan but can also be part of an Urban and Sustainable Guidelines document.
3. Will have to be evaluated from a public health benefits vs. auto safety perspective.	This would define the issues and options for a solution.
4. Will need to negotiate by-law change on this.	Maybe, depends on what the end goal is defined as.
5. 5.b. New standard here – right now, traffic calming is used to fix problem areas (not preventive, in other words). • Us: should be there from the beginning.	Traffic calming should be designed in from the beginning. It relies on many factors that need to work comprehensively. Retrofits are poor examples as the problem already exists and solutions are limited and generally disliked.

Table 1. Synthesized Notes of Consultation Feedback with Annotations from Dan Leeming.
Peel Healthy Development Evaluation Tool

6. 5.c. Getting woonerfs built on public streets could be very difficult. • e.g., because of municipal service requirements (garbage, etc.) • May only be able to offer to private roads/condo developments. • Us: Toronto is planning some woonerfs, and surely we could make them work with service requirements? • Apparently, woonerfs would not work well in Mississauga….	Woonerfs work best in core area situations with high density active transportation competing with cars. Many other solutions exist for local, public roads.
7. 5.d. Need to make sure we are being at least as progressive as Mississauga and Brampton's current streetscape guidelines.	Public health initiatives should build upon current policy to achieve necessary targets but not be limited by them.
8. Will face engineering oppositions in terms of parking on fast streets.	Usually a regional concern. It may be that the streets' posted speeds are too high for local needs. Also, new examples of lay-by parking on Regional roads exists (i.e. Walkers Line, Burlington).
9. Need to prove that this is for the greater good.	Agreed.
10. Could go to the professional engineering board of Ontario and get a mandate for this from them.	Would prefer a unified approach (i.e. MMA, MOH, MTO, Engineering Association in 1995ADS Document)
11. 5.e. Again, would likely face opposition from transportation engineering.	It depends on context; in a high density area many of these measures are already used. On a local road, the roadway may suffice if properly designed.
12. 5.f. Peel does have standards for lighting. Tom may be able to provide.	Agreed.
13. May want to consider that more lighting = increased energy consumption and greater municipal costs.	Lighting is part of a much more comprehensive process. New lighting is much more energy efficient. Also, night sky standards may require a whole new strategy.
September 24th (Prerequisites Only) – private planning firms and Peel regional planners	
14. A challenge to implement in practice.	As discussed in previous comments.
15. Engineers are not very open to planner-imposed speed limits	Depends on the engineer, experience, collaborative approach. Agreed upon, common principles should drive agenda.
16. Confusing for some because most aspects are out of planners' control – speed and road width controlled by public sector	Needs collaborative approach, i.e.: good urban design can influence speed.
17. Road network often established before or after by engineers – usually planners don't know the speed limit until the area is built – maybe secondary plan stage?	As discussed in previous comments.

Table 1. Synthesized Notes of Consultation Feedback with Annotations from Dan Leeming.
Peel Healthy Development Evaluation Tool

18. Process was confusing to us (Dan can provide insight)	This is a difficult area to cover but is usually dealt with through a comprehensive review of all built form factors.
19. Planners suggest that we may want to provide an ideal road width/design, and then have the design speed decided by what is there or going to be there (e.g., bike lanes, sidewalks)	Road width is a function multiple needs and varies a great deal. One size does not fit all.
20. May want to have 2 sidewalks required for all roads, regardless of speed (e.g., pushing stroller in snow on shoveled sidewalk vs. not-shoveled road)	This has been done in some communities, i.e.: Cornell, but is not a consistent standard.
21. Planners suggest that we need to consider: • That there probably aren't any engineering standards that accommodate bike lanes, sidewalks, cars, and street trees. • The design and function of the street (enclosure vs. bike lanes, sidewalks, street trees, etc…) • Still possible, though (us): Local roads have fewer requirements that make them wider. Main roads will gain enclosure through taller buildings, and a purpose of street trees is to provide enclosure.	Definition of multiple needs to be established first – then good urban design provides options/solutions. These goals are met through many factors – streetscape design, building criteria, roadway functional needs etc. Street trees provide multiple benefits; CO_2 absorption, heat island reductions, enhanced public realm, etc.
22. What about on-street parking? Always conflict between bike lanes and on-street parking.	Depends on traffic volume, speed and lane widths. Conflict can be reduced, but not eliminated.
23. Tom – don't let go of this! Very important and creates discussion.	Agreed.
24. About safety and encouraging active transport	Yes, this is a big part of the discussion.
25. Planners noted that our layout of 'complete streets' is not practical for implementing, currently. • Realistically, gov't needs to make changes to the guidelines.	This is best dealt with through a comprehensive approach that demonstrates needs and requires multiple adjustments to get there. One issue at a time doesn't work.
26. Rob Russell – big emergency vehicles = wide roads = faster speeds, regardless of posted limit.	Not necessarily, depends on context, 7.5m laneways in Markham handle full-sized fire trucks.
27. Need to align with current design standards!	Depends on the standards. Do they go far enough to improve public health?
28. Bob Cutler: Municipalities would have concerns over width and accommodating services and emergency vehicles.	Yes. Need for comprehensive design, but don't rely on yesterdays standards if not meeting new needs.

Table 1. Synthesized Notes of Consultation Feedback with Annotations from Dan Leeming.
Peel Healthy Development Evaluation Tool

September 28th – Brampton municipal planners	
29. Dan – not enough attention from Region to sidewalks, bike lanes etc. in their capital projects. This is not just a municipal problem. • How do we change this at the regional level?	Region needs to see evidence of need and understand rising health care costs vs. new sidewalk costs. Again, needs comprehensive approach.
30. Arterial roads are the problem.	Connectivity to arterial roads needs to be improved, yet they have a function that won't go away very soon.
October 7th – Mississauga municipal planners	
31. Can't expect every road to be everything for everyone.	Agreed but, improvements to meet minimum standards should still apply based on location and need.
32. Maybe need writing on the intent of this section.	An 'Intent' introductory paragraph is needed on all sections.
33. Not appropriate for infill.	This is equally appropriate to all sites. Depends on site needs. Often applies more effectively on infill site.
6.a. PARKING	
August 28th – regional and municipal planners from Peel	
1. 6.a. Tom says developers will love our recommendation, as it saves money!	As we continue to urbanize and provide alternatives to the car, less parking is needed.
2. Will have to take this to municipalities to get them to change by-law.	Yes, many by-laws based on older standards, but alternative to the car must be there (i.e. transit, bikeways etc.).
3. 6.b. unbundled/shared parking would have to be calculated on a property to property level, so difficult to figure out where this gets implemented.	It is complicated. Needs input from knowledgeable Traffic engineer.
4. Block plan developers are different than the people who build the buildings. • Might be easier to implement for infill.	Still needs a comprehensive approach to all levels.
5. 6.c. Pricing and difficulty are high-level policy items. Difficult to implement.	Depends on location, demand, local merchant, and employer's needs. What options are provided to reduce car dependence?

Table 1. Synthesized Notes of Consultation Feedback with Annotations from Dan Leeming.
Peel Healthy Development Evaluation Tool

6. 6.d. Municipal engineers will likely be OK with alleys, as long as they don't have to provide any municipal services for them (e.g., garbage, snow)	Opinion varies. Privatized laneways creates other issues. Various municipalities encourage public laneways.
September 24th (Prerequisites Only) – private planning firms and Peel regional planners	
7. Real issue is too high a minimum in suburban areas. • High number – lots of spots and lots of people using them.	Depends on evaluation of needs, options to the car, density and access.
8. You can't limit parking and not provide an alternative – have to have this recommendation hand-in-hand with availability of public transportation • Yet, this is happening at Bramalea Centre (Region of Peel location)	Agreed.
9. Mississauga has done some work in moving parking to back/side and bringing buildings forward (especially in HOT study).	This is a start and will help in various ways.
10. Distinguish between surface and underground parking?	This is needed as cost/benefit needs to be considered-
11. Get rid of developers having to pay cash to municipalities to build fewer parking spots than the minimum.	Other incentives/rules would help.
12. Some planners say we may just have to try lowering the minimums, not eliminating them.	Maximums are in place in some municipalities.
13. Also suggested to give a lowered range (instead of absolute minimum) and keep the maximums	Depends on the choices offered in local context.
14. Us: still eliminate – silly to require developers to appeal in order to not build parking.	Agreed, but needs demonstration of alternative choices.
15. Shared parking is not always feasible because of desire for 'ownership', as well as safety and security – but financial incentives, such as shared parking, may have a place	Agreed.
16. Us/implied: May want to include something about parking location in our recommendation about eliminating minimums.	*Need to confirm.*

Table 1. Synthesized Notes of Consultation Feedback with Annotations from Dan Leeming.
Peel Healthy Development Evaluation Tool

17. Developers could like this.	*Need to confirm.*
September 28th – Brampton municipal planners	
18. May have developers that take advantage of 'no minimums'	Depends on nature of use, residential vs. employment/retail and what options to car are available.
7.a. BUILDING SETBACKS	
August 28th – regional and municipal planners from Peel	
1. 7.a/7.c. Setbacks/streetwalls are never specified at the block plan level. • Determined at property level in accordance with zoning by-law. • May be able to use new development permit system to create standards that developer agrees to meet within their block plan. • Need to have minimum setbacks and zoning separations changed in municipal by-law.	Setbacks need to work in conjunction with the principles of the block plan development. Therefore, streetscape and built form expectations are usually defined in the urban Design Guidelines as part of the block plan exercise.
2. 7.b. Most municipal by-laws already express some type of height to width ratio. • Might be easiest to change the by-law here, rather than trying to get special approval for our requirement.	The broader agreed upon objectives and principles determined the shape and form of the plan. This is the time to prepare comprehensive standards, such as zoning standards schedule, so that the following by-law works in accordance.
3. 7.d. Why is tree placement only for credit? • Because there are little to no studies about walkability and trees, despite their extensive benefits to a community. • Already local requirements for subdivisions in Brampton. • There may be US research on MNR's website to show that apartments and workplaces overlooking nature improve people's health. • Developers pay for the trees. ▫ Us: Can we change this? Have them subsidized in some way?	Street tree, species, placement and degree of maturity should be predetermined in the streetscape guidelines in order to ensure the delivery of 'walkable streets', 'heat island reduction' and 'improved public realm'.
4. 7.e. Tom – although we don't have much evidence regarding street furniture and aesthetics, they are still very important and need to be included.	Agreed. Comprehensive street guidelines deal with this!
5. May want to include measures regarding wind speed and buildings/open spaces. • We have this noted, already, as a possible measure for inclusion.	Agreed. Especially with increased density. Should also include sun/shade considerations.
September 24th (Prerequisites Only) – private planning firms and Peel regional planners	
6. Mostly within control of city/municipality and specified in by-law.	Yes, but do they satisfy minimum healthy community criteria?

Table 1. Synthesized Notes of Consultation Feedback with Annotations from Dan Leeming.
Peel Healthy Development Evaluation Tool

7. Andrea/Dan suggest our maximum could be even lower - Our setbacks are higher than most of the current Ontario standards – ours are more like the American standards, we can lower them to be more aggressive	Agreed. We can provide further detail/examples as needed
8. Some point out that in some of their work they require 90% streetwall of 0m setback (e.g., HOT study). • May be able to increase that % in our scoring guide as well.	Depends on context, level of urbanism/density and the nature of use, i.e.: retail, office, residential.
9. May want to specify minimum commercial floor height and that space facing street must be active space. • This may require different numbers for Greenfield vs. infill.	Minimum of 4.0m to 4.5m is appropriate for both infill and greenfield if retail is the user. A ratio of front wall, doors and windows fronting public space would set a minimum and encourage incremental enhancement.
10. May need to reference section 4 (Road), here, as together they form the streetscape.	Agreed. These two must work together.
11. Dan says to talk to him about additional information that needs to be added to both 4 and 7 (which might need to be linked/referenced together).	Agreed, full range of streetscape (roads, buildings, parking, trees, etc.) prototypes can be provided.
September 28th – Brampton municipal planners	
12. Brampton has some of this in their design guidelines, not far off on residential.	This is helpful, healthy community criteria can build upon this.
13. Challenge to meet max setbacks with hydro easements (5m?).	Context to be confirmed. Buildings do not usually front onto hydro easements, safety issues will prevail.
October 7th – Mississauga municipal planners	
14. Consider that 'flush with sidewalk' requirement could limit café patios, etc.	Agreed. Streetscape/built form guidelines usually define these relationships.
OVERALL FEEDBACK	
August 28th – regional and municipal planners from Peel	
1. Need to eventually have illustrations/pictures for measures. • Andrea's department may be able to provide a lot for us.	These always help.

Table 1. Synthesized Notes of Consultation Feedback with Annotations from Dan Leeming.
Peel Healthy Development Evaluation Tool

2. Need to be able to cater to developers who want diversity in their developments. • Us: In what ways do we not offer this?	These standards do not curtail diversity; in fact, it encourages diversity.
3. Tool will have to be implemented at all stages of planning process. • Will need to advocate for strengthening of the plan at municipal level.	Agreed.
4. Will face a lot of opposition from Transportation Engineers on Road section. • Extensive literature support and cost/benefit analyses would help.	This is generally the case. <u>All</u> agencies and the public need to define community principles, design should respond. There is more and more evidence available.
September 24th (Prerequisites Only) – private planning firms and Peel regional planners	
5. Maybe municipal guidelines, themselves, need to be changed and made more mandatory to better address walkability and pedestrian connectivity. • E.g., if we allow a 3m setback for a commercial structure, then we need to ensure that what happens in those 3m accommodates pedestrians well (landscaping, benches, etc., instead of a grass strip that turns into mud as people walk across).	Agreed, excellent point.
6. What have we missed? • Discussion/prerequisites around open space. ▫ Something addressing connections between a variety of parks and linked trail systems. • Safety and perceptions of safety. ▫ E.g., how do we make connections that enhance walkability and are more safe, so that people (e.g., children to school, women alone) use them without worry? • Dan suggests walk-to-school programs, like those in Australia. ▫ Us: and other transportation demand management programs.	All of these can be developed further as required. There are various examples we can draw upon.
September 28th – Brampton municipal planners	
7. Right direction – good analytical support to back it up (defendable). • Be careful about one-size fits all – every element may not be suitable for every community. • Will need to be examined at all planning levels.	Agreed. Context and local application are very important, but key principles should transcend all forms.
8. Gayle – need people within Brampton to further implement.	Agreed. People knowledgeable in these areas are essential.
9. Would need change of perspective from traffic engineers.	This outlook is starting to change, some very good “next generation” professionals in this area.
10. Some of tool could be implemented through municipal ‘EA’ class processes, which Peel Health could have a role in.	This could help to provide a broader implementation process.

Table 1. Synthesized Notes of Consultation Feedback with Annotations from Dan Leeming.
Peel Healthy Development Evaluation Tool

October 7th – Mississauga municipal planners	
11. 90% of Mississauga development is now infill and small (2-3 lots together) • They are focused on consistency.	Infill provides many opportunities.
12. How and when/where do we implement what (requirement/guideline) for infill?	Draft plan or site plan level in conjunction with guideline requirements.
13. Current development guidelines exclude residential and employment from being near one another. • And, airport has most of the employment lands.	Within reason, mixed use should be encouraged. Major steps forward have already been made in this area. Level of industrial use will define setbacks to residential.
14. How can the Scoring Guide be applied to a small lot in an already unwalkable area? • The Guide may only apply to a certain size of development. • Or there need to be separate tools/goals for subdivisions vs. infill.	A range of development site sizes requires a variety of standards from small urban infill to large scale greenfield.
15. Need guidelines in O.P. that end up as by-law to support things such as nearby grocery stores.	Official plan should authorize the preparation of separate guidelines documents.
16. Right now, they are only pushing for mixed use at commercial nodes/'HOT' areas, not in the middle of your average community. • Framework that they work in is limited by O.P., Planning Act, by-law • How can we do this under the planning act?	Mixed use must always address issues of need, scale, built form, and separation in order to function as well as provide enhanced public health goals
17. Under new Miss. O.P., change will only occur in specified 'managed change' areas, but not in 'stable communities,' so our tool may only apply to the former areas.	Generally agreed. Existing areas respond to change much more slowly, but change does happen.
18. May need different evaluation schemes for different development types…. And possibly for different development stages and different municipalities.	Generally agreed. Overriding principles/criterion should always apply, but local application should operate within an appropriate context.
19. Should specify which elements are the most important to us for health.	Agreed. Fundamental to everyone's understanding of need.
20. Way to implement: have background document showing what you are going to do and how, then evaluate 3 times… • the original plan, the council-approved plan, the built structure.	Generally agreed. Existing areas respond to change much more slowly, but change does happen.

Appendix D. Gap Analysis Results

1. Density				
1.b. Net residential dwelling density				
Mississauga	Brampton	Caledon		**Peel Healthy Development Tool**
Density designation policies				
Density designations are outlined in *District plans*	*Official Plan:* For new Secondary Plan areas, the City shall specify the overall residential density and housing mix targets in the Secondary Plan. These targets will be based on the City-wide target of 35 units per net residential hectare	Density designations are outlined in Caledon's *Secondary Plans* or in the *Official Plan, s. 5.10 - Settlements*		**Prerequisite: Minimum net residential dwelling density = 35 residential units/hectare**
Residential Density ranges				
Density ranges differ for each *district planning area*	The *Official Plan* specifies the following three density categories:	Rural service centres* of Bolton and Mayfield West:	Rural service centre* of Caledon East:	**1 credit: 35-44 residential units/hectare**
	Low density: Maximum of 30 units per net hectare/ 12 units per net acre of single detached homes	Low density areas: Up to 30 units per net hectare of detached or multiple housing	Low-density residential area: detached and multiples at 16.6 units per hectare	**4 credits: 45-64 residential units/hectare**
	Medium density: Maximum of 50 units per net hectare/ 20 units per net acre of single-detached, semi-detached or townhouses	Medium density areas: 30-44 units per net hectare of detached or multiple housing	Medium-density residential area: 19-30 units per hectare	**7 credits: 65-84 residential units/hectare**
	High density: Maximum of 200 units per net hectare/ 80 units per net acre of townhouses, duplexes, maisonettes or apartments	High density areas: 45-87 units per net hectare of multiple or apartment housing	Apartments are permitted in mixed-use areas only	**10 credits: 85+ residential units/hectare**
	Density mix is to be outlined in each *Secondary Plan*	Note that Secondary Plan policies override the OP policies for density		

Measures and calculations (from zoning bylaw)				
Density designations are given in net density.				
Net density (detached, semi-detached, duplex, townhouse and other dwelling types with individual frontages) = # of units/(hectares of land for residential lots and common element roads - public and other forms of private roadways)	Net density = # of units/ (hectares of land proposed to be developed - roads, parks, and schools)	Net density = # of units/ (hectares of land proposed to be developed - public ROWs, parks, school sites, Environmental Policy areas, and Open Space Policy areas)		
Net density (condominium units and apartment blocks) = # of units/ hectares of land for residential units, private internal roads and parking, landscaped areas, private open space, and other associated amenities.	For executive housing, a net hectare may include the land occupied for certain upscale streetscape features and/or non-credited open space vistas in accordance with an urban design study			

* Settlement areas in Caledon are in Rural Service Centres, Villages, Hamlets and Industrial/ commercial centres. The majority of new growth and development will occur in the Rural Service Areas of Bolton, Mayfield West and Caledon East

1.c. Average Floor Space Index (non-residential structures)			
Mississauga	Brampton	Caledon	**Peel Healthy Development Tool**
Maximum density for non-residential zones			
Policies for Office zones			
Official Plan s. 3.3.2: Maximum density for business employment offices not located at nodes is 1.0 FSI	*Official Plan s. 4.3.1.2*: Office uses will be permitted through various sub-designations subject to a number of criteria, including density in the surrounding area of 0.5 FSI or less		**Prerequisite: Minimum average Floor Space Index for non-residential structures = 0.7**
Official Plan s. 3.4.2: Maximum density for industrial offices not located at nodes is 0.5 FSI			**1 credit: 0.75-1.0 FSI** **2 credits: 1.1-1.25 FSI** **4 credits: 1.26-1.75 FSI** **6 credits: 1.76-2.25 FSI** **8 credits: 2.26-3.0 FSI** **10 credits: FSI greater than 3.0** ***Does not include storeys beyond the 6th storey**
Official Plan s. 3.6.2: Maximum density for lands designated Office is 0.5 FSI			
Policies for Commercial zones (from zoning bylaws)			
Lot area, yard widths and depths, gross floor area and building heights vary by the type of commercial zone	Lot and yard widths and depths and building heights vary by the type of commercial zone	Lot area, yard widths and depths, gross floor area and building heights vary by the type of commercial zone	
		The Bolton Community Shopping Centre is divided into precincts, each with their own FSI maximums	

Policies for mixed use areas			
Different non-residential densities are provided for specific areas within the *District plans*	*Official Plan s. 4.10.3.1* Mid-rise buildings should be allowed to develop to a FSI of 3.0. A higher FSI may be considered on a site-specific basis, contingent on the merits of the quality of design and amenities of the project	*Bolton Core Secondary Plan:* buildings will be encouraged to exceed 1.5 FSI, but may not exceed 3.0 FSI	
Measures and calculations (from zoning bylaws)			
FSI* = GFA** of all buildings on lot/ area of lot			
For lands zoned commercial, density is not controlled by FSI but rather through regulation of lot area, yard widths and depths, gross floor area and building heights	For lands zoned commercial, density is not controlled by FSI but rather through regulation of lot and yard widths and depths, and building heights	For lands zoned commercial, density is not controlled by FSI but rather through regulation of lot area, yard widths and depths, gross floor area and building heights	

*FSI=Floor Space Index

** GFA= Gross Floor Area

2. Service proximity			
2.b. Proximity to a variety of services			
Mississauga	Brampton	Caledon	**Peel Healthy Development Tool**
No specific policies exist to regulate the distances between residential areas and service or employment areas. However, policies such as minimum setback distances and buffer strip requirements have some influence on distances			**Prerequisite:**
Setback and buffer requirements for lots adjacent to residential zones			**≥75% of residential units must be within ≤800m of ≥7 neighbourhood retail services**
Office zones* (from zoning bylaw)			
In all cases the interior side and rear yard widths are 7.5 m	Office commercial (OC) lot abutting a residential zone: Min interior side yard and rear yard width will be 9m		**≥75% of residential units must be within ≤800m of ≥5 neighbourhood public services**
4.5 m landscaped buffer for rear and interior side lot lines			**The centre of primarily residential projects must be within ≤800m of the same number of full-time jobs as 50% of the total number of residential dwelling units in the project**
Commercial zones* (from zoning bylaw)			
Interior side or rear yard on commercial lot abutting residential zone: min. 6m for neighbourhood, convenience and general commercial. 4.5 m for mainstreet commercial	C1 lot abutting a residential or institutional zone: Interior side and rear yards will be min. 6 m and 9 m, respectively.	CH, CHV and CHB lots abutting a residential zone: Min. interior side and rear yards will be 10.5 m	
	Interior side yard and rear yard on C2 or C3 lots abutting res/inst zones will be min. 18 m.	CC lot abutting a residential zone: Min. interior side yard will be 1.5 m	**The centre of primarily non-residential projects must be within ≤800m of the same number of residential units as 50% of the total number of full-time jobs in the project**
	Interior side yard and rear yard on SC (service commercial) lots abutting res/inst zones will be min. 5 m and 9 m.	CN lot abutting a residential zone: min interior side and rear yards will be 9 m	

		CV lot abutting a residential zone: min interior side and rear yards will be 4.5 and 10.5 m	**Credit:** **1 credit: ≥75% of residential units within ≤800m of ≥13 neighbourhood services**
		C lot abutting a residential zone: min. interior side and rear yards will be 12 and 19.5 m	**3 credits: ≥75% of residential units within ≤800m of ≥16 neighbourhood services**
4.5 m landscaped buffer measured from a lot line abutting a residential zone		C zone: 4.5 m planting strip along any portion of a rear or interior side lot line that abuts a residential zone or a lot with a residential use	**10 credits: ≥75% of residential units within ≤800m of ≥20 neighbourhood services, including at least 3 food markets, and at least 1 park ≥1/3 hectare**
		CC zone: 1.5 m planting strip along an interior side lot line and 3 m planting strip along a rear lot line that abuts a residential zone	**15 credits: ≥100% of residential units within ≤800m of ≥20 neighbourhood services, including at least 3 food markets, and at least 1 park ≥1/3 hectare**

		CH and CHV zones: 3 m buffer strip along the front, rear and exterior and interior side lot lines abutting a residential zone	
		CV and CN zones: 3 m buffer strip along any portion of a rear or interior side lot line that abuts a residential zone	
		CHB zone: 6 m buffer strip along the front, rear and exterior and interior side lot lines abutting a residential zone	
Institutional zones* (from zoning bylaw)			
7.5 m yards measured from all lot lines	7.5 m front yard; for rear and side yards, 7.5 m or half the height of the building, whichever is greater	10.5 m rear yard and 3 m interior side yard for lots abutting a residential zone	
4.5 m landscaped buffer measured from all lot lines		3 m planting strip along the rear and interior side lot lines	

Employment zones* (from zoning bylaw)			
Side and rear yards 15.0 m min for E2 (employment) and E3 (industrial) zones. No min. side yard for E1 (employment in nodes) zone, 4.5 m min rear yard	Interior side yard on lot abutting a residential or institutional zone will be min. 18 m. Rear yard of a lot abutting a residential or institutional zone will be min. 18 m		
7 m landscaped buffer measured from a lot line abutting a residential zone			
Open space zones* (from zoning bylaw)			
Min. setback of a building or structure to a lot line abutting a residential zone: 6.0 m for community (OS1) and city parks (OS2),	In all cases the setback of buildings in open space zones is 7.5m or half the height of the building, whichever is greater	All yards are 7.5 m. Minimum building separation distance is 3 m	
Min. setback of a building to a lot line abutting a residential zone: 15.0 m for a cemetery (OS3)			
Maximum 4.5 m landscaped buffer for all lot lines			

Minimum distance between specific services and residential zones (from zoning bylaw)			
60.0 m			Restaurant or take-out restaurant
800.0 m	500.0 m	100.0 m (adult video store)	Adult video store, body-rub establishment, adult entertainment establishment
800.0 m			Amusement arcade, night club

*Excludes exception zones

2.c. Proximity to transit			
Mississauga	Brampton	Caledon	**Peel Healthy Development Tool**
Brampton and Mississauga do not have guidelines or policies to require siting of transit stops within specified distances; however a number of other guidelines (e.g from the Canadian Institute of Transportation Engineers and the Ontario Ministry of Transportation) recommend a walking distance of 400 m to transit stops. Most residential areas in Mississauga and Brampton are already within 400 m of a transit stop as a result of street intersection distances		*Official Plan s. 5.9.7:* The Town may examine from time to time the need for transit service as warranted by economic feasibility and service demand, and will incorporate the transit function in the planning and devel- opment process by: ...	**1 credit: ≥60% of residential units within ≤800m of a suitable transit stop**
			3 credits: ≥75% of residential units within ≤800m of a suitable transit stop
		e) Locating high density residential or commercial developments on anticipated transit routes or within 400 metres of those routes.	**7 credits: As above and ≥60% of residential units within ≤400m of a suitable transit stop**
		f) Locating retirement homes and community facilities on anticipated transit routes or within 200 to 300 metres of those routes	**10 credits: ≥90% of residential units within ≤800m of a suitable transit stop and ≥70% of residential units within ≤400m of a suitable transit stop**

2.d. Proximity to employment			
Mississauga	Brampton	Caledon	**Peel Healthy Development Tool**
Peel municipalities do not have policies to ensure that a defined number of employment opportunities are within a 30-minute transit trip of residential areas			**1 credit: ≥75% of residential units within a 30-minute transit trip of ≥60,000 jobs**
			3 credits: ≥75% of residential units within a 30-minute transit trip of ≥80,000 jobs
			5 credits: ≥75% of residential units within a 30-minute transit trip of ≥100,000 jobs
			7 credits: ≥75% of residential units within a 30-minute transit trip of ≥120,000 jobs
			10 credits: ≥75% of residential units within a 30-minute transit trip of ≥140,000 jobs

3. Land use mix			
3.a. Heterogeneity of land use mix			**Peel Healthy Development Tool**
Mississauga	Brampton	Caledon	
General policies			**3 credits: ≥5% of total project land is outdoor public space**
Official Plan 3.2.4.2: Within the Urban Growth Centre, on lands designated Mixed Use, Retail Core Commercial, Mainstreet Retail Commercial, General Retail Commercial, Convenience Retail Commercial or Office, ground-floor retail commercial or office uses shall be provided.	*Official Plan 4.1.8* For non-ground related residential developments, the following objectives shall be encouraged in accordance with the Development Design Guidelines: ...to locate mixed use development on the ground floor.		**3 credits: project provides ≥4 new services to an existing neighbourhood (within a 1km-radius of the project centre)** **5 credits: There is a mix of 3 housing types, 6 different services, a public school, and a park ≥0.4 ha within 800m of the project centre**
Official Plan 3.13: A mix of medium and high density housing, employment, and commercial uses, including mixed use residential/retail commercial buildings and offices will be encouraged to locate in City Centre, Nodes and Corridors	*Official Plan 4.2.8.8* Mixed use development is encouraged that envisions retail and community/ institutional uses at grade, integrated with office and residential uses developed at upper storeys		

	The OP identifies the Central Area, the Bramalea City Centre Area, the Mt. Pleasant community, the Queen St. Corridor between Kennedy Rd and the 410, and the transit-supportive nodes as presenting good opportunities for mixed use development		
Mixed use zones (zoning bylaw)			
	Downtown commercial (DC & DC1) zones allow for residential alongside commercial uses	Residential uses are permitted in Core commercial (CC), Highway commercial (CH), Village commercial (CV) and Village highway commercial (CHV) zones	
	Central area mixed use (CMU1) zone allows commercial alongside institutional uses, but residential uses are not permitted		
City centre zones 1-4 (CC1-CC4) allow residential alongside commercial uses	Service commercial (SC) zone allows for group homes and lodging houses adjacent to commercial uses		
Uses permitted in various base zones are: public and private schools, places of religious assembly, day care, community centre, community athletic field, community library, community garden	Public Uses owned and/or leased by the City of Brampton are permitted in all zoning categories provided that yard, outside storage, parking, and coverage regulations required for the zone where the lands are located are complied with		

3.b. Heterogeneity of parcel/building use			Peel Healthy Development Tool
Mississauga	Brampton	Caledon	
Official Plan policies			**4 credits: ≥60% of commercial buildings include a ground floor pedestrian use along ≥60% of their street facades**
	The uses within mid-rise buildings should be contingent on the compatibility and flexibility of the uses with percentages of commercial, retail, office and residential uses specified depending on the location of the building.		**4 credits: 100% of mixed-use buildings include ground-floor retail, live/work spaces, or residential dwellings along ≥60% of their street façade**
	Mid-rise buildings should be permitted to develop to 3 FSI/FAR which generally allows four storeys with commercial uses at grade, and three storeys of residential uses above.		**4 credits: ≥50% of multifamily residential buildings have a ground floor pedestrian use**

3.c. Mixed housing types				
Mississauga	Brampton	Caledon		**Peel Healthy Development Tool**
General policies				
Official Plan s.3.2.2: Low density residential development will generally be located along local roads and collector roads	*Brampton block plan design guidelines:* To deter segregation by housing type, the predominance of any one house type or lot width within neighbourhood blocks is discouraged	*Bolton South Hill Secondary Plan:* The community will be primarily low density; however four medium-density areas are designated in order to provide a range of housing types	*Bolton Core Secondary Plan:* Residential intensification will be encouraged to provide a range of housing types, but low-density areas around the periphery of the Core will be protected from encroachment by high-density development	**3 credits: ≤30% of housing is large lot detached homes**
Medium density development will generally be located along transit routes, in or near nodes, and in areas that serve as a transition zone between low and high density areas		The ratio of low to medium and high density lands in the community will be approximately 70:30		**5 credits: As above, and the project includes ≥3 housing types, with none making up less than 20% of the total residential units**

Region of Peel housing mix targets				
In the Region of Peel's Official Plan, city- and Region-wide housing targets are given based on tenure type. Housing mix targets for individual developments are not given, however				
	Peel	Mississauga	Brampton	Caledon
Social housing	17%	15%	12%	9%
Affordable rental	3%	6%	6%	4%
Market rental and affordable ownership	35%	34%	37%	28%
Market ownership	45%	45%	44%	59%

4. Street connectivity			
4.a. Intersection density or block size			
Mississauga	Brampton	Caledon	**Peel Healthy Development Tool**
The municipalities do not have policies to measure or regulate intersection density. The layout and dimension of internal roads would be established at the plan of subdivision or block plan stage, and would be subject to any policies contained in the Official Plan or relevant Secondary or District Plan.			**Prerequisite: Minimum average intersection density = 75 intersections/km2; maximum single block size =1.5ha**
General policies			
	Official Plan: The function of the Provincial highway, arterial and collector systems shall be enhanced by minimizing the intersections of local streets with minor arterials in the design of new subdivisions, subject to the achievement of a maximum spacing of 400 metres between transit access points.	*Official Plan:* To maintain and protect the traffic capacity of all arterial and collector roadways, the Town will minimize the number and restrict the location of intersections and driveways	**1 credit: 75-114 intersections per km2**
			5 credits: 115-149 intersections per km2
			10 credits: 150 intersections per km2

5. Road network and sidewalk characteristics			
5.a. Complete streets (sidewalks, bike lanes, traffic speed)			
Mississauga	Brampton	Caledon	**Peel Healthy Development Tool**
Street right-of-way widths and number of lanes			
Right of way widths for Regional roads and major local arterials are given in a schedule to the Official Plan. Local roads widths are given in Secondary or District			**Lane widths should be ≥3.2m**
Arterials			**00-40km/h streets should have 1-2 lanes**
ROW widths for arterials are designated in Schedule 5 of the OP. Additional road allowance may be required to accommodate transit infrastructure, bike lanes, etc.	Required minimum ROW widths for the major road network are shown in schedule B1. Additional road allowance may be required to provide for transit infrastructure, daylight triangles or for envt'l considerations	High capacity: 30-50 m road allowance with 2-6 lane capability	**41-50km/h streets should have 2-4 lanes**
		Medium capacity: 20-36 m road allowance with 2-4 lane capability	
		Low capacity: 20 m road allowance with 2-lane capability	
Collectors			
ROW widths for collectors are outlined in district plans	Required minimum ROW widths for the major road network are shown in schedule B1.	20-26 m road allowance with 2-4 lane capability	

Local roads				
ROW widths for local roads are outlined in district plans	ROW requirements for the minor road network will typically be less than 30 m depending on the function of the road. This will be denoted in Secondary Plan policies or subdivision design standards	17-20 m road allowance with 2-lane capability		
	Necessary ROWs to be secured through conditions of approval, gift or expropriation	Necessary road ROWs will be secured through conditions of approval		
		Schedule K of the Official Plan designates ROW widths in Caledon		

Bicycle lanes				
Region of Peel	Mississauga	Brampton	Caledon	**Peel Healthy Development Tool**
Through traffic bylaws, the Region holds the authority to designate bike lanes on Regional roads, and the municipalities hold the authority to designate bike lanes on local roads				**Bike lanes must be at least 1.2 m wide**
The *Regional traffic bylaw* designates multi-use recreational trails along Regional roads	The *traffic bylaws* for Mississauga and Brampton list municipal roads with designated bike lanes		Caledon's traffic bylaw is not available	**Prerequisite: 0-2 bike lanes on 1-2 lane**
		Brampton Pathways Master Plan: The optimum width for bike lanes is 1.5m (range of 1.2 - 1.8m). Bike lane width should not exceed 1.8m as this may encourage drivers to use the lane for passing, stopping or parking.		**Prerequisite: 0-2 bike lanes on 1-2 lane**
The *Regional traffic bylaw* prohibits pedestrian and bicycle crossings at selected intersections and road sections				**Prerequisite: 1-2 bike lanes on 1-2 lane streets 31-40 km/h**
				Prerequisite: 2 bike lanes on 2-4 lane streets 41-50 km/h

5.b. Traffic calming			
Mississauga	Brampton	Caledon	**Peel Healthy Development Tool**
Traffic calming features in the municipalities are generally not included in planning applications. However, some general policies regarding traffic calming may be included in Secondary or District plans (e.g. see Mississauga City Centre District Plan)			**1 credit: 4-6 traffic calming measures per hectare**
			3 credits: 7-10 traffic calming measures per hectare
			5 credits: 11-13 traffic calming measures per hectare
			7 credits: 14+ traffic calming measures per hectare
			Add three credits to the above scores: 1 or more pedestrian-priority streets per hectare

5.c. Traffic speed and pedestrian priority				
Region of Peel	Mississauga	Brampton	Caledon	**Peel Healthy Development Tool**
Pedestrian-priority				
Peel's municipalities do not have policies for pedestrian-priority streets				
Traffic speeds				
All municipal and Regional roads have a speed limit of 50 km/h (built-up areas) or 80 km/h (non built-up areas) in accordance with Ontario's Highway Traffic Act, **unless** the municipality establishes a different speed limit below 100km/h by bylaw and posts a sign indicating the speed limit. The Region has authority over Regional Roads and the municipalities have authority over local roads				**1 credit: 10-19% of local roads are ≤15 km/h with pedestrian-priority**
The *Regional traffic byla*w designates speed limits on Regional roads	Mississauga and Brampton's *traffic bylaws* designate the speed limits on local roads			**3 credits: 20-29% of local roads are ≤15 km/h with pedestrian-priority**
The Regional and municipal *traffic bylaws* establish Community Safety Zones in Brampton and Mississauga. These are areas for which the speeding fines are increased.			Caledon's traffic bylaw is not available	**6 credits: 30-39% of local roads are ≤15 km/h with pedestrian-**
				10 credits: ≥40% of local roads are ≤15 km/h with pedestrian-

5.d. Sidewalks and buffer strips			
Mississauga	Brampton	Caledon	**Peel Healthy Development Tool**
The municipalities are responsible for sidewalks on local roads. For Regional road widenings, the municipalities may be responsible if they are collecting development charges, otherwise it is the responsibility of the Region.			**Prerequisite: 0-2 sidewalks on 1-2 lane streets, 00-15 km/h**
Policies and guidelines relating to sidewalks			
Subdivision servicing guidelines: Sidewalks are required in subdivisions in accordance with City standards and guidelines and where specified by the Commissioner of Transportation and	*Block plan design guidelines:* Sidewalks should be located on both sides of Primary streets, and along the North/East side wherever possible	*Development standards guidelines:* Sidewalks should be on the same side as schools, parks and other pedestrian destinations, and should be on the North or East sides wherever possible	**Prerequisite: 1-2 sidewalks on 1-2 lane streets, 16-30 km/h** **Prerequisite: 2 sidewalks on 1-2 lane streets 31-40 km/h**
Sidewalks may be required on existing streets external to new developments where the development generates the need and where the Commissioner determines it is necessary	Driveway interruptions to the sidewalk should be minimized; pairing of driveways should be encouraged	Sidewalks will be placed to minimize driveway interruptions, and in the inside of road elbows	**Prerequisite: 2 sidewalks on 2-4 lane streets 41-50 km/h**

		Sidewalk widths vary depending on the road designation; all walkways will be a minimum width of 3 m unless otherwise specified	**All new local roads have a traffic speed ≤40 km/h**
Condo townhouse design reference notes: Walkways should be located on at least one side of all internal streets	*Subdivision design manual:* No sidewalks are required on cul-de-sacs with less than 25 units fronting the roadway unless there is a walkway or path leading to another street, a school, a park or a plaza	Sidewalk required on one side of a cul-de-sac if it leads to a pedestrian node (i.e. park, school, apartment building, commercial area), or if cul-de-sac is of such a design that it requires through pedestrian travel	**All new non-local roads have a traffic speed ≤50 km/h**
1.2 m width minimum for walkways	Sidewalk required on one side of the street only for cul-de-sacs with more than 25 units fronting on the roadway	Sidewalk required on one side of a cul-de-sac if it is longer than 100m at the bulb	
	Sidewalk required on one side of the street for crescent and local through street with less than 50 units fronting on a 17 m right-of-way	Sidewalks are required along one side of local streets with Annual Average Daily Traffic of 100 and along the inside of all crescents unless specified otherwise by the Town	

Detached condo design reference notes: Walkways are required on at least one side of the street for developments with 20 or more units	Sidewalk required on both sides of the street for crescent and local through streets with more than 50 units fronting on a 20 m right-of-way	Sidewalks are required on both sides of all arterial and collector roads	
Walkways are required to mailboxes, bus stops, central amenity areas, and municipal sidewalks	Sidewalks are required on both sides of all arterial and collector roads		
1.2 m width minimum; 1.8 m width minimum if adjacent to parking spaces	Sidewalk required on one side of industrial roads, unless specified otherwise		

5.e. Cycle-friendly design			
Mississauga	Brampton	Caledon	**Peel Healthy Development Tool**
There are no policies in Peel that require cycle-friendly features to be incorporated into new developments			**5 credits: Dedicated bike lanes as an extension of the sidewalk**
			5 credits: Bicycle-priority streets (cars must yield to cyclists; speed ≤30km/h)
			2 credits: Streets that are 1-way for cars and 2-way for cyclists; speed ≤30km/h
			2 credits: Cul-de-sacs with bicycle cut-throughs
			1 credit: Advance green lights for cyclists
			2 credits: Off-street pedestrian and cyclist short cuts
			1 credit: Right-hand turn short cuts for cyclists
			3 credits: 1 bicycle rack per ten parking spoaces (includes on- and off-street spaces)

5.f. Lighting			
Mississauga	Brampton	Caledon	**Peel Healthy Development Tool**
Luminance			
Subdivision Design Specifications Manual: For park pathways: 10 lux average horizontal and vertical illuminance. Uniformity ratio max to min. shall not exceed 10:1. Uniformity ratio average to min. shall not exceed 4:1. Glare shall not exceed 40%.	Subdivision Design Manual: Street lights must be installed at a minimum on the same side as the sidewalk	Development Standards Guidelines: 6 lux @ 3:1 in full service area 4 lux @ 3:1 in part service area 2 lux @ 3:1 in local residential and walkway areas	**3 credits: All mixed-use streets have an average illuminance of 10 lux, with a minimum of 5 lux**
Lamp post characteristics and placement			
Poles are spaced 32 or 35 m apart, depending on the lamp brand	Block Plan Design Guidelines: Street lights shall be decorative and will be placed in line with street trees	45-50 m apart in full service area; 50-55 m apart in part service area; 55-60 m apart in local residential area	**3 credits: Provide ≤4.6m tall street lamps placed no more than 30m apart on both sides of 80% of mixed-use streets**
Street lamps mounted at 6.1 m		All street lamps mounted at 7m height	**2 credits: Provide ≤4.6m tall aesthetically-pleasing lamp posts on both sides of 100% of mixed-use 'core' streets**

6. Parking			
6.a. Eliminate parking minimums			
Mississauga	Brampton	Caledon	**Peel Healthy Development Tool**
Official Plan policies			
Official Plan s. 4.6.6.5: City Council may consider receiving a cash payment-in-lieu of all or part of the zoning bylaw requirements for parking, provided that: the existing parking supply in the surrounding area can accommodate the parking deficiency; there are constraints on the site preventing adherence to the bylaw; the site is not over-developed	Official Plan s. 4.2.2.8: Council may from time to time, as it deems appropriate, establish planning programs for the Central Area, including parking exemptions for either commercial or residential development where occupancy characteristics of municipal parking facilities permit	Zoning bylaw s. 5.2.9: Parking spaces required by Subsections 5.2.2 and 5.2.3 of this By-law shall not be required within the Bolton Core Area subject to the owner obtaining Minor Variance approval for the parking space defi-ciency and executing an Agreement with the Town respecting the payment of cash-in-lieu of some or all of the parking required in accordance with the applicable Town of Caledon By-law.	**Key recommendation: Elimination of minimum parking requirements in all zoning bylaws applying to development in the Region of Peel, particularly near mixed-use centres and transit facilities. If requirements exist, they should be in the form of maximums.**

Parking utilization studies terms of reference: The City of Mississauga requires a parking utilization study to justify parking reductions of generally more than 10% of current zoning bylaw standards. When the parking reduction is relatively minor (less than 10% of bylaw standards), a letter of justification may be sufficient.			
Parking utilization studies are generally done for existing development where an increase in the floor space index or introduction of a new use is proposed. In unbuilt areas where the type of tenants are unknown, the general practice is to adhere to the parking standards in the zoning bylaw.			

Residential parking minimums (from zoning bylaw)			
Housing type	Mississauga	Brampton	Caledon
Condominium apartment	1.00 resident space per bachelor unit 1.25 resident spaces per one-bedroom unit 1.40 resident spaces per two-bedroom unit 1.75 resident spaces per three-bedroom unit 0.20 visitor spaces per unit	1.25 resident spaces per one-bedroom or bachelor unit 1.40 resident spaces per two-bedroom unit 1.75 resident spaces per three-bedroom unit 0.25 visitor spaces per unit	1.50 resident spaces per unit and 0.25 visitor spaces per unit
Rental apartment	1.00 resident space per bachelor unit 1.18 resident spaces per one-bedroom unit 1.36 resident spaces per two-bedroom unit 1.50 resident spaces per three-bedroom unit 0.20 visitor spaces per unit	1.03 resident space per bachelor unit 1.21 resident spaces per one-bedroom unit 1.41 resident spaces per two-bedroom unit 1.53 resident spaces per three-bedroom unit 0.20 visitor spaces per unit	1.50 resident spaces per unit and 0.25 visitor spaces per unit
Apartments in CC1 to CC4 zones (City Centre zones, Mississauga)	1.00 resident space per unit 0.15 visitor spaces per unit	n/a	n/a
Rental detached, semi-detached or street townhouse dwelling **with** private garage/driveway	2.00 spaces per unit	2.00 spaces per unit; 0.3 visitor spaces per unit for townhouses	

Rental detached, semi-detached, multiple horizontal* or street townhouse dwelling **without** private garage/driveway	1.10 resident spaces per bachelor/one-bedroom unit 1.25 resident spaces per two-bedroom unit 1.41 resident spaces per three-bedroom unit] 1.95 resident spaces per four-bedroom unit 0.25 visitor spaces per unit	1.30 resident spaces per 2-bedroom rental unit 1.46 resident spaces per 3-bedroom rental unit 2.00 resident spaces per 4 (or more)-bedroom rental unit 0.25 visitor spaces per unit	2.00 spaces per unit; for townhouses, 0.25 visitor spaces per unit for dwellings containing four or more units
Condo detached, semi-detached, multiple horizontal* or street townhouse **with** private garage/driveway	2.00 resident spaces per unit; 0.25 visitor spaces per unit	2.00 spaces per unit; 0.3 visitor spaces per unit for townhouses	
Condo detached, semi-detached, multiple horizontal*, townhouse **without** private garage/driveway	1.10 resident spaces per bachelor/one-bedroom unit 1.5 resident spaces per two-bedroom unit 1.75 resident spaces per three-bedroom unit 2.0 resident spaces per four-bedroom unit 0.25 visitor spaces per unit	2.05 resident spaces per unit 0.25 visitor spaces per unit	
Detached, semi-detached or street townhouse dwelling	2.0 spaces per unit		
Duplex dwelling, triplex dwelling	1.25 spaces per unit	2.00 spaces per unit; 0.3 visitor spaces per unit	2.00 spaces per unit

Dwelling units located above commercial buildings with a maximum height of 3 storeys	1.25 spaces per unit		
Group home		0.5 spaces per unit, plus two spaces for the proprietor	
Lodging house	2 spaces per unit		
Retirement dwelling/ senior citizen unit	0.5 spaces per unit	0.50 resident spaces per senior citizen unit 0.25 visitor spaces per senior citizen unit	1.5 resident spaces per unit 0.25 visitor spaces per unit
Long-term care dwelling	0.33 spaces per bed		
Resident physician or dentist (also drugless practitioner or health professionals in Mississauga)	5.0 spaces for office or detached dwelling, 4.0 of which may be tandem	6.0 parking spaces for each practitioner	
Accessory dwelling unit			1.00 space per each 70m2 or portion thereof up to a maximum of two spaces
*Mississauga only			
Non-residential parking minimums			
Non-residential parking minimums vary considerably depending on the type of use. Within commercial zones, the parking requirements and the method of calculating them will depend on the type of establishment			
See Part 3 of the zoning bylaw	See section 20 of zoning bylaw	See section 5 of zoning bylaw	

6.b. Unbundled and shared parking			
Mississauga	Brampton	Caledon	**Peel Healthy Development Tool**
Shared parking			
A shared parking formula may be used for the calculation of required parking for a mixed use development. The formula (zoning bylaw section 3.1.2.3) takes into account the parking spaces required for each use within the development, accounting for varying demand at different periods of the	Parking requirements in mixed use developments shall be calculated using a schedule outlined in section 20 of the zoning bylaw (p.6). The formula takes into account the parking spaces required for each use within the development, accounting for varying demand at different periods of the day	Zoning bylaw s. 5.2.5: The parking requirements for more than one use on a single lot or for a building containing more than one use, shall be the sum total of the parking requirements for each of the component uses, unless otherwise noted.	**3 credits: Allow shared parking so that parking spaces can count towards the requirements of two separate uses, such as a civic building and a restaurant, or a place of worship and an office building**
Apartments within City Centre zones: For the visitor component, a shared parking arran-gement may be used for the calculation of required visitor/ non-residential parking			
Where any part of a public school or private school is shared with any other permitted non-residential land use, the portion of the public school or private school used for the said use shall provide the required parking in accordance with the minimum parking regulations of the respective uses.			

Unbundled parking			
There are no policies in Peel's municipalities that require unbundled parking for multifamily developments			**1 credit: provide unbundled parking for 50% of multifamily dwellings**
			5 credits: Provide unbundled parking for 75% of multifamily dwellings
			7 credits: Provide unbundled parking for 100% of multifamily dwellings

6.c. Parking price and difficulty			
Mississauga	Brampton	Caledon	**Peel Healthy Development Tool**
Parking rates and time limits			
The municipalities can regulate parking prices and time limits through local traffic bylaws.			**4 credits: Charge the market rate for off-and on-street parking for all mixed-use and retail streets**
Traffic bylaw, schedule 6: Rates and time limits for off-street parking	*Traffic bylaw, schedule XXXII*: Rates and time limits for pay-and-display street parking	Parking time limit is 5 hours on all Town roads, and 3 hours on Regional roads	
Traffic bylaw, schedule 7: Rates and time limits for street parking	*Traffic bylaw, schedule XXVI*: Streets with time-limited street parking	The Caledon traffic bylaw is not currently available	**3 credits: Designated 'parking meter zones' in which parking revenues go back into the zone for pedestrian-friendly and aesthetic improvements, such as public art, paving, street furniture, lighting, trees, cleaning, and painting/maintenance**
			2 credits: Use variable pricing so that costs increase with the length of stay, or limit the length of stay
			2 credits: Maximum 2-hour on-street parking for non-residents, or resident-only parking on all streets within 200m of a mixed-use centre

			2 credits: Require employers to cash-out non-driving employees when employee parking is free

6.d. Parking location and alleys			
Mississauga	Brampton	Caledon	**Peel Healthy Development Tool**
Residential driveway width (from zoning bylaw - excludes exception zones)			
The minimum width of a driveway shall be 2.6 m	A residential driveway shall have a **minimum width of 3.0 m**	For semi-detached, link and townhouse dwellings, maximum width is 5.2 metres.	**2 credits: All residential driveways are ≤3m wide**
For detached dwellings in R1-R4 zones: Maximum width is the lesser of 8.5 m or 50% of lot frontage	A residential driveway shall have a **maximum width** of:	For detached dwellings, having a lot frontage of 12.0 metres or less, a maximum of 6.0 metres	**Shared driveways are encouraged**
Detached dwellings in R5 zones: Maximum width of 6.0 m	4.9 metres on lots having a width less than 8.23 metres	For lots with over 12.0 metres of frontage, the maximum is the lesser of 8.5 m or 50% of the lot frontage	
Detached dwellings in R6 zones: Maximum width is the lesser of 6.1 m or 45% of lot frontage	5.2 metres on lots having a width equal to and greater than 8.23 metres but less than 9.14 metres		
Detached dwellings in R7 zones: Maximum width is the lesser of 6.5 m or 50% of lot frontage	6.71 metres on lots having a width equal to and greater than 9.14 metres but less than 15.24 metres		
Semi-detached dwellings in RM1 and RM2 zones: Maximum width of 5.1 m	7.32 metres, or the width of the garage, whichever is greater, on lots having a width equal to and greater than 15.24 metres but less than 18.3 metres		
Semi-detached dwellings in RM3 zones (condo semi-detached on a CEC private road): Maximum width of 4.3 m	9.14 metres, or the width of the garage, whichever is greater, on lots having a width equal to and greater than 18.3 metres		

Townhouse dwellings in RM4 or RM6 zone: Maximum width of 3.0 m	6.71 metres, or the width of the garage, whichever is greater, for driveways on the flankage lot line on any lot		
Street townhouse dwellings in RM5 zone: Maximum width of 5.2 m	Notwithstanding maximum driveway widths, on lots that are permitted semi-circular driveways, the surface area of the Residential Driveway shall not exceed 50 percent of the front yard area.		
Detached, semi-detached, duplex, triplex and horizontal multiple dwellings with 4 to 6 units in RM7 zones: Maximum width of 6.0 m			
Detached, semi-detached, duplex, triplex and horizontal multiple dwellings with 4 to 6 units in RM8 zones: Maximum width is the lesser of 8.5 m or 50% of lot frontage			
Horizontal multiple dwellings with more than 6 units in RM9 zone: Maximum width is 3.0 m			

Location of residential parking			
Mississauga has development standards for rear lanes in townhouse developments (*Mississauga Standard Drawing for Townhouse on rear lane*)	*Block Plan guidelines*: Rear laneways may be considered for approval when included in the Secondary Plan and are subject to submission of a detailed engineering and design study	Caledon has development standards for rear lanes (*Caledon Development Standards Guideline*s)	**4 credits: ≥70% of residential dwellings have either no parking or access their parking via rear alleys or lanes and have no parking in their front setbacks**
			4 credits: ≥90% of residential lots do not have parking garages in their front façade
Street parking			
Policies regarding street parking may be included in the municipalities' District and Secondary Plans (e.g. see Mississauga City Centre District)			
Traffic bylaw, schedule XIV: Identifies local roads on which parking is not permitted	*Traffic bylaw, schedule 3*: Identifies roads and portions of roads where parking is not permitted	*Official Plan, s. 5.9.5.4*: n-street parking is discouraged on arterials but may be permitted on collectors and local roads. Traffic bylaw is not available at this time.	**2 credits: Provide on-street parking on both sides of ≥70% of new streets**
Location of parking lots			
Policies regarding the placement of parking lots may be included in the municipalities' *District* and *Secondary Plans* (e.g. see Mississauga's Port Credit District)			**4 credits: All parking lots are placed at the rear or side of buildings**

7. Aesthetics and human scale			
7.a. Building setbacks			
Mississauga	Brampton	Caledon	**Peel healthy development Tool**
Setbacks in residential zones (from zoning bylaw - excludes exception zones)			
Detached dwellings			
Minimum front yard for detached dwellings ranges from 3.5 to 9.0 m	Minimum front yard depths range from 3m to 23m	Minimum front yard depth is 9m or 18m, depending on zone	**Prerequisite: Detached residential structures must have ≤7.6m setback**
Semi-detached, townhouse and apartment dwellings			
Minimum front yard depth for semi-detached dwellings ranges from 4.5m to 6m	Minimum front yard depth for semi-detached dwellings ranges from 3m to 7.6m	Minimum front yard depth for semi-detached dwellings is 9m	**Prerequisite: Attached and multifamily structures must have ≤4.6m building setback**
Minimum front yard for townhouse dwellings is 4.5m	Minimum front yard for townhouse dwellings ranges from 1.2m to 7.5m	Minimum front yard depth for townhouse dwellings is 7.5m	
Minimum front yard depth for apartment dwellings ranges from 7.5m to 10.5m depending on building height	Minimum front yard depth for apartment dwellings ranges from 7.5m to 15m	Minimum front yard depth for apartment dwellings is 9m	
Setbacks in commercial zones (from zoning bylaw - excludes exception zones)			
Commercial zones			
4.5 m minimum for convenience commercial, neighbourhood commercial, motor vehicle commercial and general commercial. 3.0 maximum for main street commercial	Minimum front yard depths differ by zone; for zones allowing for restaurants and retail shops, minima range from 2 m or less (downtown commercial) to 21 m	No minimum front yard depth for core commercial zone; minima for other commercial zones range from 9-18 m	**Prerequisite: Commercial and light industrial structures must have ≤3m building setback**

Mixed use zones			
City Centre zones 1-3 do not have minimum setbacks. City Centre zone 4 has a minimum setback of 1.5m	Downtown commercial zone has a minimum setback of 2m or the street line setback, whichever is the lesser. DC1 zone has no minimum setback except in certain areas designated in Schedule B2 to the zoning bylaw	Core commercial zones have no minimum front building setback. Highway commercial, village commercial and highway village commercial zones have a front setback of 18m	**Prerequisite: ≥70% of commercial and/or mixed use structures must have their front façade flush with the sidewalk**

For setbacks on lots adjacent to residential zones, please see section 2.b. - proximity to a variety of services and employment

7.b. Building height to street width ratio			
Mississauga	Brampton	Caledon	**Peel healthy development Tool**
Peel's municipalities do not have policies for regulating building height to street width ratio; however Secondary Plans may include policies relating to building height and massing, and street enclosure of particular road sections or intersections.			**1 credit: Average building height to street-width ratio between 1:3 and 1:2.1**
Building heights (from zoning bylaw)			
Residential zones			
10.7 m maximum for residential neighbourhood zones (other than exception areas)	Range of 7.6 to 13.7 m maximum for residential zones allowing detached, semi detached, duplex, multiple and townhouse dwellings; max of 10.6 m for the majority of these.	10.5 m for all residential zones	**3 credits: Average building height to street-width ratio between 1:2 and 1:1.1**
Minimum height in apartment zones ranges between 4 and 25 storeys	Range of 4 to 22 storey maximum for apartment zones, & some apartment zones have no height maximum		**7 credits: Average building height to street-width ratio between 1:1 and 3:1**

Commercial zones		
Main street commercial zone: 2.0-storey minimum 3.0-storey or 16 m (sloped roof) or 12.5 m (flat roof) max. Convenience commercial: 2.0-storey or 10.7 m (sloped roof) or 9 m (flat roof) max. Neighbourhood commercial & general commercial zones: 4.0-storey or 20 m (sloped roof) or 16.5 m (flat roof) max.	Range of 2-6 storeys, & one commercial zone has no height maximum	10.5 m for all commercial zones
Street enclosure		
Policies relating to building heights and streetwalls at particular intersections may occur in *District* or *Secondary Plans*		
Official Plan: In urban growth centres, where the right-of-way width exceeds 20 m a greater building height may be required to achieve appropriate street enclosure in relation to the right-of-way width.		

7.c. Setbacks and streetwalls			
Mississauga	Brampton	Caledon	**Peel healthy development Tool**
Streetwalls			**3 credits: ≥80% of commercial structures are flush with the**
Secondary and District Plans may include policies regarding streetwalls			
Building setbacks			
Please see section 7.a for setbacks in commercial zones			
			3 credits: ≥80% of commercial lots that face public space have clear glass on ≥60% of their facades, 1.2-4m above grade
			2 credits: ≥80% of commercial lots do not have blank walls (no doors or windows) longer than 40%, or 15m, of a façade facing a sidewalk, front street or plaza

7.d. Tree placement and characteristics			
Mississauga	Brampton	Caledon	**Peel healthy development Tool**
The municipalities do not have policies to regulate the placement or characteristics of trees in new or existing developments; however, bylaws for the preservation of existing trees are in place in all three municipalities.			**4 credits: ≥75% of new and existing residential streets in a project have ≥1 tree for every 10m of lot frontage on both sides of the street**
			4 credits: ≥75% of new and existing mixed-use streets have ≥1 tree for every 10m of lot frontage on both sides of the street
			4 credits: ≥75% of streets with a speed limit of ≥50km/h have ≥1 tree for every 10m of lot frontage on both sides of the street, with the trees placed between the sidewalk and road

Appendix E. Validation Analysis using Existing Communities within Peel Region

Introduction

Rationale

Validation analyses were conducted for three communities in the Region of Peel that are anecdotally known to be 'walkable', in order to ensure that the Tool's prerequisite requirements accurately captured aspects of the built environment that influence walkability in existing communities. Furthermore, the validation analyses serve to illustrate that walkable communities do exist in the Region of Peel and that the construction of future communities should strive to capture aspects of urban design and planning found within these areas.

Selection of walkable communities

One relatively walkable community in each of the municipalities of Mississauga, Brampton, and Caledon was identified by municipal and regional planning representatives in those municipalities. The selected communities were Port Credit, Downtown Brampton, and Bolton, respectively. These communities were identified based on their perceived walkability, but should not be taken to be representative of the municipalities as a whole nor should the conclusions of this validation be seen as generalizable to other communities or areas beyond these test sites. The scope of this validation was such that we chose one validation community from each municipality. Ideally, further work validating this tool will look at multiple communities developed at different points in time in different areas of the municipality.

It should also be acknowledged that these communities each have an historic area which was constructed prior to the proliferation of existing, auto-oriented suburban styles of development in the Region of Peel. In each case, this area likely has a direct effect on walkability, as much of the built environment elements we are trying to capture in the Tool are generally informed by historic (pre-World War II) styles of development. However, there are numerous examples from elsewhere that demonstrate that the walkable urban forms found in these communities can be reproduced in a modern development context. Elements of these historical areas' compact, dense, walkable, mixed-use designs can and should be incorporated into modern developments in an effort to improve walkability and the activity-friendly nature of future communities.

Methodology

Validation analyses were performed for each of the prerequisite measures in each of the three test communities, where suitable data was available. It was not feasible to measure the credit requirements for any of the communities, given current data and resource constraints. Below is a description of how each prerequisite measure was calculated in the validation analyses. Prerequisite measures that were excluded based on data limitations are noted accordingly.

Note that the *applied* calculation methodology described below is, in some cases, a slightly modified version of the measurement standards outlined in the Tool. This modification was necessary, because the measures laid out in the Tool are designed for evaluating *new* communities throughout the planning process, whereas in this validation analysis we are applying them to *existing* communities. These applied calculations

attempt to capture as closely as possible the standard measurements specified in the Tool but do differ in some instances as a result of existing data constraints.

Calculation of Measures

1.a. Minimum Density (Residential and Non-Residential)

Dwelling Density - Residential

Calculated as: Number of dwellings / Net Lot Area

The number of dwellings field was attributed based on information in the MPAC data zoning classifications, and the number of subordinate MPAC records associated with each primary record. For additional information on how the number of dwellings value was calculated, see Table 1 of this appendix.

Net Lot Area includes all MPAC lots (developed or vacant) that are zoned for residential, mixed-use, or commercial uses – excluding parks, industrial, institutional, government, and "special purpose" lands, ROWs, etc. Note that lots which contain schools and places of worship are generally excluded from this calculation, because they are mostly classified as "institutional" or "special purpose," respectively. However, 12.65% of schools and 15.20% of places of worship are located on MPAC lots classified as residential, commercial, or vacant, all of which are included in the net lot area value used in this calculation.

FAR/FSI – Commercial, mixed-use and high density residential

We were unable to measure FSI because we do not have data on the height or number of stories for a given structure. We have calculated "Percent Lot Coverage" instead as a proxy for FAR/FSI. It must be noted, however, that there is no evidence from the health literature of a percent lot coverage value that is associated with better walkability or improvements in health outcomes. Therefore, it may or may not be an appropriate substitute for FAR/FSI

Calculated as: Building Footprint Area / MPAC Lot Area

Building footprint area was based on PEEL_PLN_BUILDINGS polygons.

Lot Area was based on the MPAC lots.

Note that this measure was only calculated for lots classified as Commercial, Mixed-Use, or "HDSF" (High-Density Single Family) residential in the MPAC zoning data (this includes town/row houses).

2.a. Proximity to a Variety of Services and Employment

Neighbourhood Public Service Proximity

Measured as the number of "neighbourhood public services*" within an 800m network walking distance of each residential building. Each building is assigned a count of the number of public services, which is then weighted by the number of dwellings in that building. This is then used to assess the number of dwellings that have 5 or more neighbourhood public services within the 800m walking distance.

*Based on the available data, "neighbourhood public services" includes: Community and Recreation Centres; Daycares and Child Services; Transit Stops (up to a maximum of 2 per dwelling); Hospitals and Community Healthcare Centres/Clinics; Libraries; Public and Separate (eg. Catholic) Schools; Ontario Works and other Family Support Services; Museums and Art Galleries; Places of Worship; Public and Private Training or Educational Facilities; Psychiatry/Mental Health services; Senior's Health Services; Music and Dance schools; Youth drop-in services; Health Services for people with special needs; Performance or Cultural Spaces; Post Office Locations; Parks.

Neighbourhood Retail Service Proximity

Measured the same as neighbourhood service proximity as specified above, except using locations of "neighbourhood retail services**" instead.

**Based on the available data, "neighbourhood retail services" includes: Banks; Beauty and Hair Salons; Barbers; Convenience Stores; Dry Cleaners and Laundromats; Restaurants and Cafes (including Fast Food establishments); Private Gyms and other Fitness Facilities; Hardware and Home Improvement Stores; Pharmacies and Drug Stores; Grocery Stores; Supermarkets; Butchers; Specialty Food Stores; Entertainment such as Cinemas, Arcades, Bars, Pubs and Nightclubs; Clothing and Footwear Retailers; Department Stores; Other Miscellaneous Retailers.

Employment Proximity

Calculated as: (Number of jobs within 800m walk of the centre of the community / total number of dwelling units) * 100%

Requirement to be met: Result of 50% or greater.

The numerator was measured as the current number of full- and part-time jobs (from the appropriate municipal employment survey data) accessible within an 800m network walking distance of the "centre" of the community. Full- and part-time jobs were weighted equally in this calculation. Centres were defined

manually based on Official Plan Zoning Maps (where available) and other data. Generally, a "centre" was a higher-density, mixed-use node in the community. In larger communities, it may be necessary to specify several centres.

The denominator is the total number of residential dwelling units in the community, based on the NUM_SUBS field in the MPAC lot zoning data.

3. Land Use Mix – No prerequisite measures

4.a. Intersection Density and Block Size:

Intersection Density

Calculated as: Number of intersections / Community Area

Number of intersections includes all intersections that have a minimum of 3 road or trail segments (or a combination) meeting each other. This was calculated using DMTI CanMap Route Logistics v2008.3 streets, a streets file provided by the Region of Peel (SLNSPEEL) and the PEEL_PLN_SIDEWALKS sidewalks data. Due to the nature of the methodology, intersections between cul-de-sacs and walking trails or cut-throughs may be counted as 2 intersections in some instances.

Community Area includes the area covered by the entire geographic community boundary, minus any railway or expressway right-of-ways or large utility easements (e.g., hydro corridor).

Block Size

Calculated as: Total Size (area in Ha) of each city block

The area of each block was assessed by aggregating MPAC zoning lots into larger block regions and erasing any roads, cut-throughs, or walking/pedestrian trail right-of-ways. In some cases, it is possible that a pedestrian cut-through did not fully connect to the other roadways, meaning that the block would not properly be split, and size would be overestimated. Conversely, some very small blocks were created through the erasing of trail and road networks from the block polygons. Any resulting blocks less than $100m^2$ in area were removed from the results.

Note that any land zoned for parks or open spaces and any land currently characterized as "vacant" based on the MPAC lot attributes was removed from the block size calculation.

5.a. Complete Streets – NOT FEASIBLE TO MEASURE

It was not feasible to validate this measure given the currently available data from the Region of Peel. In order to validate this measure in the future, we would require spatial data including (but not limited to): Number of vehicular travel lanes on all roadways; width of vehicular travel lanes; width of roadways; posted speed limits; actual "designed" speed limits; locations and width of bicycle lanes; width of sidewalks.

6. Parking – No prerequisite measures

7.a. Building Setbacks

Building setbacks were measured for all MPAC lots, which were grouped into the following categories based on their MPAC zoning designation and the requirements presented in the Scoring Guide:

- Detached residential single-family dwellings.
- Semi-detached, attached and multifamily residential structures (including apartment buildings, condominium residences, duplex dwellings and town/row-houses).
- Commercial structures (note that the Scoring Guide require assessment of this category for commercial and light industrial lots, but the MPAC data does not distinguish between light and heavy industrial, so no industrial lots were included in this portion of the validation).
- Commercial and/or mixed-use structures.

Lastly, the building setback for each lot was calculated using the following methodology:

i. Centre-lines of roadways were buffered to expand into the front boundary of lot polygons.
ii. MPAC lot polygons were converted to lines.
iii. All MAPC lot lines falling within the buffered roadways were selected. Additional manual selection and removal was necessary to ensure only the front boundary line of the lot was selected. For side lots, both sides of the lot that were exposed to the street (e.g., all street-fronting sides) were selected.
iv. The shortest distance between the edge of the building footprint (from PEEL_PLN_BUILDINGS) and the select MPAC lot lines was automatically calculated. This value is considered to be the "building setback distance."

In the case of corner lots, it is possible that the shortest distance (assessed building setback distance) may be from the edge of the building footprint to the

side lot line instead of the front lot line. This is a limitation of the methodology and would be difficult to resolve without extensive manual data cleaning.

Note that the Scoring Guide also has a requirement that the "main entrances of residential, commercial and light industrial buildings cannot front onto parking lots." It was not feasible to validate this requirement given the current quality of the parking lot data received from the City of Mississauga.

Limitations

There are several general limitations of our methodology, not mentioned above, that should be noted. The most important limitation is likely the lack of any attribute data for approximately 10% of the records in the MPAC lot zoning data throughout the Region of Peel. It is likely that these are newer lot parcels, which have only recently been developed, and thus have not been classified by MPAC yet. All unattributed lot records in the MPAC data were excluded from analysis. It is therefore possible that newer walkable (or, conversely, unwalkable) developments may have been excluded from the analysis.

Secondly, no data was available indicating the number of dwellings on a given lot in the MPAC data. This information was necessary for calculation and weighting of a variety of measures, as outlined above. However, the MPAC field "NUM_SUBS" contains the number of subordinate entries associated with each primary record located at a given lot and was used to calculate the number of dwellings for records whose zoning classification provided no indication of this value. The following attribution scheme was used to assign the number of dwellings value to each record in the MPAC data.

Table 1. Attribution of number of dwellings value for MPAC lot data based on zoning classification and NUM_SUBS value.

MPAC classification	*Number of dwellings value attributed*
Apartment building with 7 or more units	Equal to NUM_SUBS
Residential property with six units	6
Residential property with five units	5
Residential property with four units	4
Residential property with three units	3
Duplex	2
Semi-detached residential	1
Single-family detached residential	1
Mixed-use building with 6 or fewer apartments	4
Seasonal dwelling	1, except for records that contained a NUM_SUBS value greater than 1, which was assigned instead.
Group home	1
Freehold townhouse row-house	1
Link home	1
Cooperative housing	Equal to NUM_SUBS
Rooming or board house	1
Clergy residence	1
Mobile home	1
Mobile home park	Equal to NUM_SUBS
Residence with a commercial or commercial/industrial unit	1
More than one structure used for residential purposes with at least one of the structure occupied permanently	1, except for records that contained a NUM_SUBS value greater than 1, which was assigned instead.
Common elements condominium corporation	1

Thirdly, as was noted earlier, no data regarding building height was available, so we were unable to calculate the FAR/FSI ratio for buildings in the validation communities. Percent lot coverage was calculated instead as a proxy for FAR/FSI; however, lot coverage has not previously been associated with health outcomes in the literature.

Lastly, the walking networks used to measure service and employment proximity were created on the assumption that a pedestrian can cross in any possible direction at all

intersections, regardless of whether a light or crosswalk exists. In reality, it may not be feasible for a pedestrian to cross a busy roadway where stoplights do not exist, forcing them to travel out of their way in order to cross safely. With this in mind, it should be noted that the service and employment proximity results reflect the number of resources and jobs that can be reached within a given network travel distance and that actual walking travel times to these features may vary in reality.

Additional validation of the above measures needs to be completed before we can fully establish the appropriate cutoffs and ranges for the built environment measures in the Tool.

Results

Results of the validation analyses are presented in the following tables. Each table contains the results for all three validation communities for one or more of the prerequisite measures in the Tool. The "measure" column provides a short description of the measure whose results are presented in the table, and the "prerequisite" column contains the exact prerequisite value which a community must meet or exceed in order to receive a "pass" designation for that measure. The first two columns in the "results" section contain the numerator and denominator values, respectively, that are the results of the validation analysis for a given community, and which are used to calculate the value in the third result column. The value in the third result column is derived from the previous two columns, compared to the prerequisite value in the table, and a "pass" or "fail" designation is assigned accordingly in the "pass/fail" column. In situations where the value in the third result column is very close to, but does not quite meet, the prerequisite value, a "soft fail" designation is assigned. A summary discussion of the results, and the potential reasons for a community passing or failing the prerequisite requirements for each measure validated, is presented in section 5 of the preceding report.

Prerequisite 1.a. Minimum Density (Residential and Non-Residential):

Table 2. Net residential density

Community	**Measure**	**Prerequisite**	**Results**			**Pass/Fail**
			Number of dwellings in community	*Net lot area of community**	*Net dwelling density*	
Port Credit	Net residential dwelling density	35 residential units per hectare	4643	111.30	41.71	Pass
Downtown Brampton			4065	167.16	24.32	Fail
Bolton			8201	656.71	12.49	Fail
*Net Lot Area includes the area of all MPAC lots (developed or vacant) in the community that are zoned for residential, mixed-use, or commercial uses – excluding parks, industrial lots, ROWs, etc.						

Table 3. Percent lot coverage

Community	**Measure**	**Prerequisite**	**Results**			**Pass/Fail**
			*Lots with 50% or greater lot coverage**	*Total number of applicable lots within community**	*Percent lots meeting prerequisite requirement*	
Port Credit	Percent lot coverage, as a proxy for FSI	100% of lots have lot coverage of 50%, as a proxy for FSI of 0.7*	103	327	31.50 %	Fail
Downtown Brampton			134	430	31.16 %	Fail
Bolton			109	585	18.63%	Fail
*Percent lot coverage was calculated for commercial, mixed use, and high-density residential lots only. All lots with other zoning designations were excluded, including vacant lots with the above zonings.						

Prerequisite 2.a. Proximity to a Variety of Services and Employment

Table 4. Proximity to neighbourhood public and retail services.

Community	Measure	Prerequisite	Results			Pass/Fail
			Number of residential units meeting prerequisite	*Number of residential units in community*	*Percent of residential units meeting prerequisite*	
Port Credit	Proximity to 5 or more neighbourhood public services within an 800m walk	≥ 75% of residential units in community must achieve this measure	4608	4643	99.25 %	Pass
Downtown Brampton			4036	4065	99.29 %	Pass
Bolton			8201	2610	31.83 %	Fail
Port Credit	Proximity to 7 or more neighbourhood retail services within an 800m walk	≥ 75% of residential units in community must achieve this measure	4637	4643	99.87 %	Pass
Downtown Brampton			4028	4065	99.09 %	Pass
Bolton			8201	1163	14.18 %	Fail

Table 5. Proximity to employment from community center*

Community	Measure	Prerequisite	Results			Pass/Fail
			Number of full-time jobs within 800m walk	*Number of part-time jobs within 800m walk*	*Total jobs as a % of total number of dwellings*	
Port Credit	Number of full-time and part-time jobs within an 800m walk	Total jobs equal at least 50% of the total number of dwellings	1232	1084	49.88 %	Soft Fail (very close)
Downtown Brampton			4980	3128	200.89 %	Pass
Bolton			705	8201	8.60 %	Fail
*The community center was defined manually as a mixed-used, higher-density, nodal centre within the central area of the community boundary.						

Prerequisite 4.a. Intersection Density and Block Size

Table 6. Intersection density

Community	Measure	Prerequisite	Results			Pass/Fail
			Number of intersections in community*	*Gross community area***	*Intersection Density*	
Port Credit	Number of intersections* per km^2 gross community area**	Minimum of 75 intersection per km^2	194	2.715	71.45	Soft fail (very close)
Downtown Brampton			401	3.12	128.43	Pass
Bolton			497	10.97	45.31	Fail

*****All intersections where a minimum of 3 road or trail arc segments met were included.

**Gross community area included the entire area within the community boundary, excluding any railway or expressway easements or ROWs.

Table 7. Block size

Community	Measure	Prerequisite	Results			Pass/Fail
			Number of blocks ≤ 1.5ha in area	*Total number of blocks in community***	*Percent blocks meeting prerequisite*	
Port Credit	Block size (area in hectares)*	Maximum area of 1.5ha	115	145	79.31 %	Fail
Downtown Brampton			96	46	67.61 %	Fail
Bolton			183	287	63.76 %	Fail

*****Blocks may be bound by roadways, pedestrian cut-throughs or trails, or both. In some instances there are small gaps in the connectivity of pedestrian cut-throughs and trails, which may result in the overestimation of the area of some blocks. Conversely, any slivers that result from the block creation process which are larger than 100m^2 are included in this calculation, meaning that the number of blocks meeting the prerequisite may be overestimated.

**Vacant lots and parkland (as classified by MPAC) were excluded from the block size calculation.

Prerequisite 7.a. Building Setbacks

Table 8. Building setbacks

Community	Measure	Prerequisite	Results			Pass/Fail
			Number of buildings meeting prerequisite	*Total number of buildings in category*	*Percent of buildings meeting prerequisite*	
Port Credit	Shortest distance from front of structure to lot edge	100% of Detached residential structures have ≤ 7.6m setback	682	969	70.38 %	Soft fail
Downtown Brampton			1113	1406	79.16 %	Soft fail
Bolton			4175	6288	66.40 %	Fail
Port Credit	Shortest distance from front of structure to lot edge	100% of Attached and multifamily residential structures have ≤ 4.6m building setback	83	225	36.89 %	Fail
Downtown Brampton			229	544	42.10 %	Fail
Bolton			247	1613	15.31 %	Fail
Port Credit	Shortest distance from front of structure to lot edge	100% of Commercial and light industrial structures have ≤ 3m building setback*	169	195	86.67 %	Soft fail
Downtown Brampton			124	179	69.27 %	Soft fail
Bolton			16	21	76.19 %	Soft Fail
Port Credit	Shortest distance from front of structure to lot edge (edge of sidewalk**)	≥ 70% of commercial and/or mixed-use structures have their front façade flush with the sidewalk	100	195	51.28 %	Fail
Downtown Brampton			91	179	50.84 %	Fail
Bolton			10	21	47.62 %	Fail

*The MPAC assessed zoning classifications data did not distinguish between heavy and light industrial, so for the validation this category only included buildings on commercial lots (all industrial buildings were excluded).

**Though a setback value of 0m would be an appropriate cutoff to measure whether a building is flush with the sidewalk, a cutoff value of 1m was used for this measure in the validation, due to the spatial accuracy limitations of the data.

Data Sources

Data for the validation analyses were provided almost exclusively by the Region of Peel, who in turn collected data from the municipalities of Mississauga, Brampton and Caledon. Listed below with a short description are all the datasets used in the analyses that were provided by the Region of Peel:

Property lots, with MPAC assessed zoning attributes – Shapefile containing polygons of all lots (primary MPAC records) in the Region of Peel, and attributes including assessed zoning classification, sub-classification, and number of subordinate entries associated with each primary record (NUM_SUBS). The NUM_SUBS value was used as a proxy for the number of dwellings on an MPAC lot when that information was not ascertainable from the MPAC zoning classification description. Spatial extent: Region of Peel.

Peel building footprints – Polygon shapefile of building footprints in the Region of Peel, with no attribute data. This file included secondary structures such as garages, which were removed from certain analyses (e.g., proximity from dwelling to near services) and retained for others (e.g., percent lot coverage). Spatial extent: Region of Peel.

Mississauga employment survey database – Microsoft access database containing all businesses contacted in the Mississauga employment survey, and attributes such as their NAICS code classification, number of full-time and part-time employees, parsed address fields, and X, Y point location fields in UTM NAD27 Zone 17 projection. Spatial extent: Municipality of Mississauga.

Brampton employment survey database - Microsoft access database containing all businesses contacted in the Brampton employment survey, and attributes such as their NAICS code classification, number of full-time and part-time employees, and parsed address fields. 98% of the records in the database were successfully geocoded using GeoPinpoint v6.4 (2008), the remaining approximately 150 records were excluded from analysis. Spatial extent: Municipality of Brampton.

Peel road network (SLNSPEEL) – Road network shapefile provided for the Region of Peel, containing road (arc) segments with no attributes. Road segments found in this data but not in the DMTI CanMap Route Logistics v2008.3 road network data were manually added to the walking networks. Spatial extent: Region of Peel.

Peel sidewalks (PEEL_PLN_SIDEWALK) – Shapefile consisting of discontinuous sidewalk (arc) segments representing locations of sidewalks. This file was likely created using a CAD-based approach, and has no attributes. Spatial extent: Municipalities of Brampton and Mississauga.

Brampton community boundaries – Two shapefiles each consisting of an unattributed polygon representing the boundary of a community in the Municipality of Brampton. Boundary files were received for the communities of Downtown Brampton and Fletchers Creek South.

Mississauga official zoning by-law maps – PDF maps of Municipality of Mississauga communities. Three of these maps were georeferenced and their community boundaries digitized to create polygon shapefiles of them. The communities were Central Erin Mills, Clarkson Lorne Park, and Port Credit.

Peel regional and municipal public services and features (PEELBASE_FEATURES) – Shapefile containing point locations of regional and municipal services and features, and attributes such as the service classification, and parsed address fields. Spatial extent: Region of Peel.

Brampton public transit bus stop locations (BUS_STOPS) – Shapefile containing point locations of bus stops in the Municipality of Brampton and extensive attributes including the presence of benches, bus shelters, stop accessibility, address and coordinate location. Spatial extent: Municipality of Brampton.

Additional data used in the analyses (listed below) were obtained from sources other than the Region of Peel:

DMTI CanMap Route Logistics v2008.3 – DMTI Inc. road network shapefile for the province of Ontario, including expressways, highways, local roads, and some trails. Attributes include road segment length, estimated speed limit, road type classification, road name, from address and to address. This file was used in combination with the Peel provided road network file, and the Peel sidewalks file, to create the walking networks and network buffers used in the proximity analyses. Spatial extent: Province of Ontario.

DMTI CanMap Route Logistics v2009.3 – DMTI Inc. polygon shapefile containing land use designations for urban areas throughout the province of Ontario and an attribute field listing the land use classification of each polygon. Spatial extent: Province of Ontario.

Lake Ontario boundary file – Polygon shapefile of the Lake Ontario boundary.

Mississauga public transit bus stop locations – Shapefile containing point locations of bus stops in the Municipality of Mississauga and attributes including the presence of a bus shelter, and address and coordinate location. Spatial extent: Municipality of Mississauga.