FROM CONNEXITY TO CONNECTIVITY:
ENHANCING THE EFFICIENCY OF INTERIOR WALKWAYS WITH THE
CURRENT EXTENSIONS OF THE MONTRÈAL’S INDOOR CITY

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Abstract

Downtown Montréal is currently experiencing a revival in construction which includes a significant extension of the interior walkways. The development of the indoor city brings with it opportunities which have been long-standing. Connexity in the pedestrian network will be significantly improved so much as to give to Montréal a definitive edge in this matter and although connectivity will only be slightly increased, changes in nodal accessibility should induce significant changes in the retail potential of its major shopping malls. Pedestrian linkages between the Convention Center and the major hotels should also reveal a major asset. The long-run impact on the modal split of downtown workers (shifting from private cars to mass transit) is another important issue to look at.

The Montréal’s indoor city

Visitors to Downtown Montréal are very pleased with the underground pedestrian network. This system started in 1962 with Place Ville-Marie, a one million square feet of office space, but its blossoming was and still is highly dependent on the development of the subway and other mass transit systems (Boisvert 1997). Still maximal use of indoor walkways and public transportation facilities owe a lot to retail developments, a distinctive feature of the Montréal’s indoor city. Bad weather, especially in winter time, is also responsible for its rapid growth (Besner, 2000). However public investments and guidelines played a minor role in it, given that underground space is considered private rather than public, except of course where it stands under streets, parks or other public property. Moreover even though a master plan for the downtown area has been adopted in 1992, there is no such thing as a development plan for the indoor walkway network available at City Hall. Yet planners always made sure that before delivering building permits appropriate connections to the system would be in place, dealing as cleverly as possible with the trade-off between maximum extension, when accessibility to subway stations was required, and limited additions due to the fear of negative impacts of shopping mall expansion on street-level traditional retailing (Ville de Montréal 1992a,b).

Figure 1 offers a 2D view of the indoor pedestrian network and it clearly shows the polar role played by the 7 subway stations available in the core of the downtown area. The first
linkage between stations located on each of the two subway lines first involved the eastern part of the core during the 80s when Complexe Desjardins (1976), Complexe
Figure 1 The Montréal' Indoor City
Guy Favreau (1978) and Palais des Congrès (1983) were built. The linkage between McGill and Square Victoria was completed only in 1995, when the owners of the Polaris office building agreed to add the missing link in their underground. The latest major linkage, involving this time subway stations located on the same line, is currently being completed as a major component of the project known as Montréal International District (MID). This project aims at improving the interaction between the old business district (Vieux Montréal) and the new one with a series of positive actions in a variety of ways: expanded capacity of the Convention Center, new office spaces, redesign and addition of open space, infrastructure improvements including an extended coverage of the underground highway, replacement of surface by underground parking, and the extension of the indoor pedestrian network.

This paper intends to provide a preliminary assessment of the development of the indoor city on the downtown area as a whole. We shall first present the indoor pedestrian network, using connexity and connectivity properties. Nodal accessibility of every shopping mall in the system will then be examined, highlighting the impact of the MID project. Generation effects of this development on public transportation and improved linkages between the Convention Center and the major hotels in the downtown area will also be rapidly examined.

Changes in the indoor pedestrian network

Table 1 gives some functional as well as formal information on each segment in the network, which at earlier dates were unconnected. Beside diversity across these segments, the importance of retailing must be emphasized: although it represents on average only 10% of GLA (gross leasable area) it occupies 57% of the walkways. Another major feature is the fact that about half of these walkways are located at ground or above-ground levels rather than underground, and this usually implies shopping malls.

Increasing connexity

This table also shows the importance of the MID project. From a quantitative standpoint only about a kilometer of pedestrian walkway is being added, but from a qualitative viewpoint it will significantly improve the connexity of the system. Connexity describes the linkages between subsystems (Dupuy 1985). As we mentioned earlier, the link which has been built under the Polaris office building in 1995 made possible the fusion of two major sub-systems, one which had been built around McGill and Peel stations (Line 1) and the other one around Bonaventure station (Line 2). The opening in 1999 of the new home of Les Canadiens de Montréal (professional hockey team) in the Bell Center (previously called Centre Molson) also increased the connexity of the system with a continuous link of the pedestrian network between two subway stations of Line 2 (Bonaventure and Lucien Lallier). Due to MID, three sub-systems are now being merged altogether, in such a way as to eliminate any doubt that one could have, especially in Toronto, as to the leading role of Montréal in terms of indoor city development.
Table 1. Features of the pedestrian walkway network in the Core area of downtown Montréal

<table>
<thead>
<tr>
<th>Sub-systems</th>
<th>Place-des-Arts/Place d’armes</th>
<th>Square Victoria</th>
<th>McGill/Bonaventure</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Length</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>kilometers (walkway)</td>
<td>4,7</td>
<td>5,4</td>
<td>18,3</td>
<td>28,4</td>
</tr>
<tr>
<td><strong>Retailing</strong></td>
<td>51,6%</td>
<td>31,4%</td>
<td>74,0%</td>
<td>57,0%</td>
</tr>
<tr>
<td><strong>Underground</strong></td>
<td>77,9%</td>
<td>60,0%</td>
<td>40,6%</td>
<td>47,0%</td>
</tr>
<tr>
<td><strong>Buildings with direct access a</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>7</td>
<td>9</td>
<td>32</td>
<td>48</td>
</tr>
<tr>
<td><strong>Gross leasable area (in m²)</strong></td>
<td>650 279</td>
<td>498 360</td>
<td>2 127 216</td>
<td>3 275 855</td>
</tr>
<tr>
<td>Office and Hotel</td>
<td>65,5%</td>
<td>97,9%</td>
<td>75,2%</td>
<td>84,5%</td>
</tr>
<tr>
<td>retailing</td>
<td>3,5%</td>
<td>2,1%</td>
<td>13,4%</td>
<td>9,7%</td>
</tr>
<tr>
<td>Public facilities b</td>
<td>31,0%</td>
<td>0</td>
<td>12,4%</td>
<td>5,8%</td>
</tr>
</tbody>
</table>

a: The Bell Center has been ignored because of its unique configuration as an arena and its collective usage, albeit its private ownership. The newly built head office of IATA is also omitted, due to incomplete information. Finally, given that all shopping malls are located in office buildings, they have not been treated as distinct buildings but their GLA has been isolated.

b: Excluding the area occupied by the subway stations.

Source: Length features: fieldwork, 2001; Building features: Planning department, City of Montréal and Assessment Service, Montréal Urban Community

Stable connectivity

Connectivity among the nodes of a system measures the multiplicity of links within a connex network. One such measure is the Gamma index which is defined as the ratio between the number of observed links (n) and the maximum number of such links in a network (3\( (n-1) \)), thus ranging from 0,333 to 1. A spinal network is the least connected, with m nodes and (m-1) links. In a delta network, with a Gamma index equal to 1, each node is directly connected to every other node. It is commonplace to consider any network with a Gamma index smaller than 0,5 as a spinal one, and to look at those with indices higher than 0,66 as delta ones. Figure 2 is a graph representation of the indoor pedestrian network in which subway stations, public facilities, office buildings, hotels and shopping malls have been treated as distinct nodes. The total number of 70 nodes which have been identified is quite impressive but figure 2 clearly shows the limited connectivity of the system and sub-systems. Gamma indices vary from 0,341, in the
McGill-Bonaventure segment to 0.405 in the Victoria Square segment. This latter result is a major improvement due to MID since the earlier Gamma index in this area was 0.333 that is the smallest possible figure. The entire system gets a value of 0.347 and it further stresses the spinal character of the network. Improved connectivity for the indoor city will thus require investments in additional links.

Network analysis up to now has been performed using a 2D representation of the system, as if the walkways were are built at the same level, namely underground. Table 1 emphasized that this was true of only about half the system. But one should not confuse multi-level walkways, which are rather frequent in shopping malls and have been listed as distinct corridors, with the links between nodes in the system. Aside from the investment costs involved, private interests in the indoor pedestrian system led to unique link configurations in order to keep customers within own premises as much as possible. External links like sidewalks along the street grid and open spaces do however provide numerous alternatives, in 2D as well 3D, but even though a complete treatment of the indoor city, one that would integrate relationships with outdoor space, would require such an extension, methodological problems have yet to be solved. One of them is the distinct nature of the indoor walkways where conflict with other transportation modes is eliminated while this is a permanent issue for outdoor walkways.

Figure 2. A graphic representation of the indoor pedestrian network
Impact of recent changes on retail activity

Nodal accessibility for any node in a network measures its ability to connect rapidly to every other node. Shimbel index for example is defined for any single node as the ratio between the total number of links required in order for all nodes to be connected to each other, using the shortest path for each pair of nodes – a constant numerator for all nodes in the network – and the total number of links necessary for the single node being calibrated to connect to every other node (Pumain et Saint-Julien 1997). Given that the pedestrian network that we are dealing with is very dense and that the length of each link (be it in meters or minutes) is rather small and uniform, the number of links is well suited for this relative accessibility measure. Still, whenever retailing is considered, the number of possible customers must also be taken into consideration, and a large proportion of these customers is made up of downtown workers. Gravity potentials will thus be estimated; each one is defined for a given shopping mall as the summation of ratios where numerators are the number of workers in another node and denominators are the number of links separating the shopping mall from this node.

Table 2. Gravity potentials for the shopping malls in the indoor city

<table>
<thead>
<tr>
<th>Shopping Mall</th>
<th>Until 2002 (prior to the MID project)</th>
<th>Since 2002 (extended pedestrian network, due to the MID project)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>index</td>
<td>rank</td>
</tr>
<tr>
<td>Gare centrale</td>
<td>19058</td>
<td>1</td>
</tr>
<tr>
<td>Place Ville-Marie</td>
<td>18435</td>
<td>2</td>
</tr>
<tr>
<td>Place Bonaventure</td>
<td>17021</td>
<td>3</td>
</tr>
<tr>
<td>Complex Desjardins</td>
<td>15698</td>
<td>4</td>
</tr>
<tr>
<td>Centre Eaton</td>
<td>14750</td>
<td>5</td>
</tr>
<tr>
<td>Galeries Bell-Banque</td>
<td>14271</td>
<td>6</td>
</tr>
<tr>
<td>Centre de commerce mondial</td>
<td>15083</td>
<td>7</td>
</tr>
<tr>
<td>Place Victoria</td>
<td>13774</td>
<td>8</td>
</tr>
<tr>
<td>Complex Guy-Favreau</td>
<td>12616</td>
<td>9</td>
</tr>
<tr>
<td>Eaton/Les Ailes de la mode</td>
<td>12022</td>
<td>10</td>
</tr>
<tr>
<td>Place Montréal Trust</td>
<td>11933</td>
<td>11</td>
</tr>
<tr>
<td>Promenades de la cathédrale</td>
<td>10591</td>
<td>12</td>
</tr>
<tr>
<td>2020 University</td>
<td>10172</td>
<td>13</td>
</tr>
<tr>
<td>Simon’s</td>
<td>9282</td>
<td>14</td>
</tr>
<tr>
<td>Cours Mont-Royal</td>
<td>8418</td>
<td>15</td>
</tr>
<tr>
<td>La Baie</td>
<td>7976</td>
<td>16</td>
</tr>
<tr>
<td>2001 de Maisonneuve</td>
<td>7160</td>
<td>17</td>
</tr>
</tbody>
</table>

1 In order to estimate future sales one would of course require forecasted numbers of workers as well as income levels in order to transform these into expected expenditures in those types of goods and services available in the shopping malls. In addition, as in the spatial interaction Huff-type model (Jones & Simmons 1990), GLA of each shopping mall would be introduced.
Table 2 first shows that Place Ville-Marie and Gare centrale, the place of birth for the entire indoor city, still offer the best locations in terms of accessibility to the entire Core of the downtown area via the indoor pedestrian network. Next, the MID project will significantly increase the retailing potential of nearby locations such as Centre de Commerce Mondial and Place Victoria. Finally these figures also stress the preliminary nature of our estimates insofar as the shopping malls located nearby Ste-Catherine street, the high street for the whole city, get very low scores, and declining ones after the MID project. This is largely due to our restricted definition of customers (workers in the area). Indeed such magnets as cultural centers (concert halls, museums, libraries) and good restaurants ought to be taken into account in order to properly estimate the attraction of the downtown retail sector.

Impact on other downtown activities

Transportation Modal split

Given that the MID project brings with limited office space and no shopping mall, the better connexity and slightly improved connectivity in the indoor will be felt by workers already familiar with the downtown area and very few new customers. Still this improvement in the accessibility to mass transit, in time but also in comfort terms, should help in the current efforts to promote public transportation. Moreover this project is only the most recent event in the replacement of surface parking by underground parking. This process involves a reduction in the total number of parking spaces and the resulting price increase should also help in gradually inducing such a change in the transportation modal split.

It is however very difficult to provide statistical evidence for this structural effect given the numerous forces at play and the basic trends in this area. Between 1993 and 1998, according to the information gathered during the last two origin/destination surveys conducted all across the Montréal metropolitan area, private car trips increased by 16,7% area-wide, at peak hours, while public transportation trips decreased by 7%. In the downtown area, for a 24-hour period, the figures are respectively +7,3% and –8,7%. A breakdown of the trips entering the downtown area by purpose, whatever the mode, shows an increase for study (+8,5%) and for work (+2,5%) but a sharp decrease for shopping (-33,3%). The latter can be explained partly by the spreading of retail chains, which led in the downtown area to a reduction in its uniqueness, coupled with a major centrifugal force, that is the rapid settlement of Big-Boxes in all types of residential areas (Lewis 1998). Clearly some of the high street shops were severely damaged by the development of the indoor city, since the retail chains found in shopping malls a customary location, but other such traditional retail and service facilities were able to cope with these changes and participate in the slow down of the negative trend for retail activity in the downtown area.
Pedestrian linkages between the Convention Center and the major hôtels, which were missing for the most part and unanimously considered a major deficiency, should enhance competitiveness. Other cities with important indoor pedestrian networks have indeed succeeded in proposing such linkages to their visitors.

The Minneapolis system is above ground rather than underground and is called Skywalk. Overall, 51 buildings are interconnected in a network whose total length is 8,3 kilometers (www.minneapolis.org). The Convention Center which doubled its capacity over the recent years is located at the fringe of the downtown area, as is the case in Montréal, but 8 of the major hotels can be reached using Skywalk while, until the MID project, only one could be accessed in Montréal via the indoor pedestrian network without any need to go outside. As presented in figure 2, six major hotels can now offer this alternative route to their clients. In Toronto, Path is an indoor pedestrian network, mostly underground, very similar to the one in Montréal, although its total length is only about a third of it (www.city.toronto.on.ca). Still pedestrian flows are much higher due to a larger concentration of office workers and a better orientation system (Jones 1998). Once more the Convention Center is at the fringe of the downtown area, but six major hotels can be reached by Path.

As suggested in figure 2, shortest links frequently involve a combination of indoor and outdoor segments, which suits the interests of visitors who want to discover all the facets of a city. Yet winter time can be awful and the weather-proof indoor city is well taken. A survey conducted in the summer of 1999 showed that most of the visitors located in the Wyndham Hôtel, the only one connected at that time, chose the interior walkways in order to reach the Convention Center while a majority of the participants boarded in the Delta Hôtel (then called Radisson) expressed regret for not having such an opportunity.

Apart from a long-standing deficiency in signaling, the indoor pedestrian alternative implies rather long distances. Thus an increase in the number of convention participants selecting the indoor pedestrian alternative rather than taxis or private cars will depend on extended connectivity and improved way-finding capacity.

Conclusions

The Montréal’s indoor city has been growing at a regular pace but the most recent extension in the International District brings with it a major improvement in terms of connexity in the pedestrian network. It also favors a better interaction with outdoors to the extent that a smaller proportion of it is underground and that public open space in the area have been significantly upgraded. One could expect that changes in nodal accessibility would induce retail investments in the International District, and the ever increasing vitality of the close-by Vieux Montréal (the old central business district) adds
Figure 2. Indoor and outdoor links between the Convention Center and the major hôtels
to this promise. Yet basic trends in retail trade at the level of the entire metropolitan area are rather pessimistic for downtown activity and the recent decision of Place Bonaventure to get rid of its shopping mall is another reason to be very cautious.

In order to get a better view of the real estate dynamics of the indoor city, rents or at least imputed rented values, as prepared by the municipal assessment service, could be very useful. Similarly, the behavior and opinions of indoor walkway users ought to be better known and a major survey, similar to the one which took place in 1989-1990 (Lemieux, Roy and Ass. 1990), is no doubt timely. More importantly, improvements in the architectural quality of corridors, halls and indoor places as well as better interaction with the “traditional” outdoor built environment and public open spaces must be carried on. These appear on the agenda of the Research Group on the Montréal’s Indoor City (Observatoire sur la ville intérieure) which has just been created at the Université de Montréal with the financial support of private and public stakeholders.

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