

By-law to Require and Govern the Construction of Green Roofs in Toronto

Date:	October 29, 2008
To:	Planning and Growth Management Committee
From:	Chief Building Official and Executive Director, Toronto Building and Chief Planner, Executive Director, City Planning
Wards:	All
Reference Number:	BLD2008PGM007

SUMMARY

The purpose of this report is to provide Planning and Growth Management Committee with a content summary of the proposed Green Roof By-law prior to public consultation in late November. This by-law is proposed for implementation in January 2009.

A Toronto Green Roof By-law, enacted under the authority of Section 108 of the City of Toronto Act (COTA), would require green roofs on certain types of new buildings and regulate the design and construction of green roofs in Toronto. Toronto would be the only municipality in North America to have a by-law of this nature.

In 2007, Toronto Building and City Planning reported to this committee providing an overview of the technical research completed for Toronto Building to provide design requirements for a Toronto green roof standard for renovation and new construction of residential, industrial, commercial and institutional buildings. Due to cost containment, further development and public consultations on the proposed By-law were delayed until this year.

This green roof by-law will be an integral element in the implementation of the City's Climate Change and Clean Air Action Plan and in the implementation of the Toronto Green Standard (formerly the Toronto Green Development Standard). Toronto will be the only city in North America with a by-law that both requires green roofs and establishes the construction standards they must meet.

RECOMMENDATIONS

The Chief Planner, Executive Director of the City Planning Division and the Chief Building Official, Executive Director, Toronto Building recommend that:

1. City Council direct the Chief Planner and Chief Building Official to consult with affected stakeholders about the proposed approach, to require and govern the construction of green roofs as outlined in this report; and
2. City Council direct that the Chief Planner and Chief Building Official report back to the next meeting of the Planning and Growth Management Committee with the results of the consultation and technical review and a draft by-law containing a green roof construction standard for implementation in January 2009.
3. Proposed amendments or additions to the technical requirements of the Toronto Green Roof Construction Standard undergo review by the Green Roof Technical Advisory Group prior to consideration by Council.

Implementation Points

City Planning and Toronto Building Divisions propose a focused public consultation following the Planning and Growth Management Committee's consideration of this report. The consultation will target developers, builders, the roofing industry, green roof suppliers and manufacturers, building owners and operators and green roof designers and will include focus group sessions and written submissions. The proposed content of the By-law as outlined in this report will serve as the basis for the consultation.

The Chief Building Official is establishing a Green Roof Technical Advisory Committee comprised of designers, researchers and manufacturers with expertise in green roofs and building regulation. This group will review the comments as they relate to the Toronto Green Roof Construction Standard and advise of any appropriate amendments prior to Council's consideration of the Toronto Green Roof By-law.

Financial Impact

The recommendations will have no financial impact beyond what has already been approved in the Toronto Building base budget.

Fees for green roof permits would be equivalent to the building permit fees that would otherwise apply to green roof construction.

DECISION HISTORY

Update on Green Roof Strategy

<http://www.toronto.ca/legdocs/mmis/2008/ex/bgrd/backgroundfile-10414.pdf>

Requiring and Governing the Construction of Green Roofs

<http://www.toronto.ca/legdocs/mmis/2007/pg/bgrd/backgroundfile-4973.pdf>

Green Roof Pilot Incentive Program

In 2007, Council requested the Deputy City Manager to “bring forward the necessary by-law so that green roofs become a requirement of all new large residential and community developments .”

<http://www.toronto.ca/legdocs/mmis/2007/pg/decisions/2007-05-03-pg04-dd.pdf>

2006 Ontario Building Code (The “OBC”)

In 2006, Council gave Toronto Building direction to “proceed with developing a Toronto green roof construction standard, should Council decide to enact its authority of Section 108 of the Stronger City of Toronto for a Stronger Ontario Act, 2006.”

<http://www.toronto.ca/legdocs/2006/agendas/council/cc060925/plt6rpt/cl017.pdf>

The Toronto Green Development Standard 2006

<http://www.toronto.ca/legdocs/2006/agendas/council/cc060725/pof6rpt/cl001.pdf>

Toronto’s Green Roof Strategy - “Making Green Roofs Happen”

<http://www.toronto.ca/legdocs/2006/agendas/council/cc060131/pof1rpt/cl020.pdf>

ISSUE BACKGROUND

In 2007, the Chief Building Official reported to the Planning and Growth Management Committee providing an overview of the preliminary technical research on implementing a green roof construction standard completed for Toronto Building. The purpose of that research was to provide initial design considerations for a Toronto green roof construction standard.

The 2007 report “Requiring and Governing the Construction of Green Roofs” provided background on the COTA authority and described how the Ontario Building Code (OBC) neither requires or regulates green roof construction in Ontario. Section 108 of the Act permits the City to require green roofs through a by-law and govern their construction.

Section 108 is a significant “exception” to Section 35 of the Building Code Act, 1992, which generally prohibits municipal by-laws that exceed requirements contained in the Building Code.

The COTA provides Toronto with a clear regulatory tool to implement Toronto’s green roof strategy by providing the authority for a city by-law to require green roofs. The

report titled, Green “Vegetative” Roof Building Standard for the City of Toronto”, was attached to that report and identified how potential green roof standards would support the City’s green roof policy objectives and performance criteria.

The report identified that further analysis was required in this area to determine where the use of the authority to require green roofs would be best used. Due to cost containment in 2007, this work was delayed. Staff have now conducted further analysis and have developed the framework for the By-law and a draft green roof construction standard.

COMMENTS

The proposed Toronto Green Roof By-law would be an additional chapter to the Toronto Municipal Code, under the authority of COTA. The By-law would be structured along the same lines as the authority in COTA: Part A would contain the provisions governing where green roofs would be required in the City; Part B would contain the administrative provisions for governing the construction of green roofs. The construction standard itself would be a schedule to the By-law.

The following provides a summary of the proposal under consideration for the Green Roof By-law:

Part A: Where to Require Green Roofs

Since City Council approved the Green Roof Strategy contained in the ‘Making Green Roofs Happen’ report in February 2006, the City has been successful in encouraging the construction of green roofs through application of the Green Development Standard, the Green Roof pilot incentive program and the construction of green roofs on a number of City-owned facilities. The new authority under the City of Toronto Act allows the City to require green roofs as-of-right as opposed to the current program of encouraging green roofs for new private development. Since Council approved the Green Roof Strategy, green roofs have been constructed on 3 city-owned buildings and are planned for an additional 10 city-owned facilities; green roofs have also been constructed or planned for 60 private buildings.

By exercising the authority under the City of Toronto Act, Toronto will be taking the lead among major North American cities by requiring the installation of green roofs city-wide. The City of Chicago takes a multi-faceted approach to stimulating demand for green roofs by creating policies and incentives targeted to developers, building owners and managers and homeowners. However it stops short of a city-wide requirement. The city offers awards and grants, including density bonuses for green roof construction. Green roofs in Chicago are also secured on any public or publicly funded building through its green roof and green building policy and the Green Roof Improvement Fund Tax Increment Financing program which offers up to \$100,000 to buildings that install a green roof in the downtown area of the city.

New York City does not require green roof construction and has focused on the provision of incentives to support the installation of green roofs on new and existing buildings, through a state tax abatement of \$4.50 per square foot, which is comparable to the proposed Eco-roof incentive program of approximately \$5.00 per square foot.

The proposed Eco-roof incentive program also before this committee will be providing incentives for green roofs on commercial, industrial and institutional buildings. The Eco-roof program would prioritize buildings located in the city's employment areas, recognizing that the concentration of large roofs in these areas contributes to Toronto's urban heat island and stormwater management challenges.

The 2005 study on the Environmental Benefits and Costs of Green Roof Technology for the City of Toronto documented the many benefits that green roofs provide on a city-wide basis, including urban heat island reduction; stormwater management; reduced energy consumption; improved air quality, enhancing opportunities for biodiversity and habitat creation and beautifying the city. In addition, a study to further understand the role of green roofs in biodiversity and habitat creation has been undertaken and is expected to be completed in early 2009. The 'Using Green Roofs to Enhance Biodiversity in the City of Toronto' discussion paper will examine the promotion of opportunities for biodiversity associated with green roof technologies.

The Official Plan provides additional support for "innovative energy producing options, green industry and green building designs and construction" such as green roofs in policy 3.4.18 that supports the development 'innovative green spaces that reduce the urban heat island effect'. The construction of green roofs also supports city-wide environmental policy objectives of the 'Climate Change, Clean Air and Sustainable Energy Action Plan' and the 'Wet Weather Flow Management Master Plan'.

The benefits of green roofs can accrue to the building owner (reduction in air conditioning costs) and the city as a whole (reduced energy demand, improved air quality). Staff considered both geography and building type in the development of the proposed Green Roof By-law approach and concluded that a city-wide application of the proposed By-law based on building type would ensure the benefits of green roofs are secured in all areas. City-wide application of the By-law ensures a consistent approach to requiring green roofs in all areas of the City.

Proposed Requirements for Green Roofs

The approach recommended for the proposed Green Roof By-law would require green roofs on new development city-wide based on building size and use characteristics. Minimum gross floor area (GFA) thresholds for new development have been proposed to ensure that green roofs are secured on larger scale developments where the additional cost of the green roof may be smaller relative to the total construction cost of the building. Based on experience with the Green Roof Pilot Incentive Program, which required 50% coverage of the roof area, it is proposed that where required, the target be an area equivalent to 50% of the building footprint. Determining the size of the green

roof area based on the building footprint ensures that the size of the green roof relates to the area contributing to the environmental impact of the building and that the size of the green roof is not minimized through building design.

Industrial development poses several technical and economic challenges that are specific to low-rise industrial use buildings. Through literature reviews and discussions with industry professionals, the incremental cost of an extensive green roof was estimated at \$161 to \$215 per square metre (\$15 to \$25 per square foot) above the cost of traditional roof. Industrial use buildings are typically single-storey with a roof area equal to the building footprint; and commonly contain open, unconditioned spaces with long clear roof spans in order to function for manufacturing and warehousing uses. The cost to construct industrial buildings over 9,300 square meters (100,000 square feet) in the Greater Toronto Area ranges from \$550 to \$720 per square meter (\$51-67 per square foot) which is low in relation to construction costs for other building types. Based on the above estimates, the cost of a green roof on a low-rise industrial building accounts for a higher percentage of the total construction cost than would be found in other building types, with limited opportunities for energy savings. On the other hand, it is the Employment Areas where large flat roofs and surface parking predominate, that have been identified as major contributors to the urban heat island effect in Toronto.

It is proposed that the By-law require an above grade green roof with minimum total area coverage equal to 50% of the ground floor area for buildings that exceed the minimum size thresholds in the following areas:

- Residential zones: any new residential building with a GFA of greater than 20,000 m² (215,278 sq ft) or with 5 or more stories
- Commercial or institutional zones: any new commercial or institutional building with a GFA of greater than 10,000 m² (107,639 sq ft)
- Industrial zones: Any new industrial building with a GFA of 10,000 m² (107,639 sq ft)
- Mixed-Use zones: Any new building based on the thresholds outlined above where there is more than one use in a single building, apply the threshold for the use with the largest GFA.

For industrial use buildings and schools, an alternative compliance option is proposed that achieves both urban heat island reduction and stormwater management targets at-grade and on the roof, that are consistent with the Toronto Green Standard. It is proposed that industrial buildings, as an alternative to constructing a green roof will be required to do the following:

- Install cool roofing materials for 100% for the roof area; and
- Retain stormwater on-site to the same level of annual volume of overland runoff allowable under pre-development conditions; and
- Retain at least the first 5 mm from each rainfall through onsite infiltration, and evapotranspiration **OR** Ensure that the maximum

allowable annual runoff volume from the development site is no more than 50% of the total average annual rainfall depth; and

- Use high-albedo surface materials for at least 50% of the site's non-roof hardscape **OR** Use open grid pavement for at least 50% of the site's non-roof hardscape **OR** provide shading for at least 50% of the site's non-roof hardscape; and
- Plant internal shade trees within surface parking areas at a minimum ratio of one tree planted for every five parking spaces supplied, in accordance with the specifications found in the Design Guidelines for "Greening" Surface Parking Lots; and
- Plant large growing shade trees at the equivalent of 6-8m intervals starting from the property line along all street frontages, open space frontages and public walkways, excluding driveways and easements; and
- Install a Green wall on an exterior surface that is either free-standing or part of a building to the height of at least 1-storey

Part B: Governing the Construction of Green Roofs

Due to the fact that the regulation of green roofs is an exception to the Building Code Act, the By-law must establish both the administrative framework and technical requirements that will govern the construction of green roofs in Toronto. The By-law is an exception in that the City has been granted the ability to regulate an aspect of building construction. However, the City of Toronto Act does provide the authority for the province to rescind this authority. Staff have been consulting with Ministry of Municipal Affairs and Housing staff in the development of the By-law and particularly the green roof construction standard.

Administration of Green Roof Permits

It is necessary, therefore, in the By-law to set out an administrative structure, consistent with the current system for building permits in the Building Code Act. The administrative elements of the By-law would:

- Establish a permit system whereby any person constructing a green roof would be required to apply for a green roof permit; and
- Identify that the Chief Building Official is responsible for the issuance of all green roof permits, including the review of plans and on-site inspections to ensure that the plans meet the requirements of the Toronto Green Roof Standard and construction has been completed in accordance with the plans; and
- Set out the requirements for a green roof permit application to determine compliance with the technical standard and other by-laws.

Toronto Green Roof Construction Standard

Toronto Building staff have been working with a consultant to develop a Toronto Green Roof Construction Standard (TGRCS) that provides clear requirements and recommendations for green roof construction in Toronto that are both code compliant and consistent with the City's green roof policy objectives: reduced urban heat island; storm water management; reduced energy consumption, and improved air quality.

As previous reports on this matter have discussed, the OBC does not currently contain any provisions that explicitly regulate the construction of green roofs. The Building Code Act, 1992 allows for the Chief Building Official to accept alternative designs provided that they meet the minimum requirements set out in the OBC. Currently, each building permit application containing a green roof proposal is reviewed and inspected by Toronto Building staff based on the designs which must be assessed as alternatives to the requirements of the Building Code. This can be more challenging and time consuming than assessing a building design against prescriptive requirements.

The TGRCS has been developed by Toronto Building staff to function as an appendix to the By-law setting out the minimum requirements that must be met to achieve compliance with the Green Roof By-law. The TGRCS is not intended to replace, exceed or alter any existing Code requirements that apply to other components of the building, beyond the green roof. The TGRCS is not intended to define a singular design strategy. The TGRCS is intended to provide City staff, as well as construction and design professionals, with a set of requirements for the design, evaluation, and inspection of green roofs in the City of Toronto, similar to the OBC. In keeping with the objective based format of the 2006 Ontario Building Code, the By-law will still allow applicants to provide a design alternative, if they can prove to the satisfaction of the Chief Building Official that they have met the minimum requirements of the TGRCS. The report (August 21, 2006) from the Chief Building Official on the 2006 OBC provides background on this objective based code format.

Attached to this report is a draft of the Toronto Green Roof Construction Standard, based on the recommended framework in the June 2007 report. The Standard is organized to provide information that will allow a designer to design a green roof in order to meet the City's minimum requirements while also meeting the OBC requirements for the remainder of the building.

The Ontario Building Code provides that professional designers (e.g. architects, engineers) provide reviews of certain building designs and elements. The purpose of this review is to ensure that a professional with appropriate responsibility and accountability reviews the design. Among other elements intended to replicate public safety provisions from the OBC, the green roof standard requires that design professionals review the structural design and green roof assembly.

The Green Roof Construction Standard requires certain tests to be performed to prove that the design has met certain criteria (e.g., structural loading) consistent with the

objectives of the OBC. These tests have been developed by the American Society for Testing and Materials (ASTM). Other guidelines referenced in the standard include the well known German Landscape and Landscape Development Research Society (FLL) Guidelines for the Planning, Execution and Upkeep of Green-roof Sites and the Factory Mutual Global Property Loss Prevention Data Sheets. In areas of green roof design where testing of materials would not be required, the Toronto Standard provides recommendations and best practices to provide guidance. These best practices are intended to provide designers with guidance in areas where prescriptive standards may not be appropriate. The best practices provide guidance while also allowing some flexibility and encouraging innovation.

The draft Toronto Green Roof Construction Standard is organized in the following manner:

1. Green Roof Components

This introductory section describes the typical components of a green roof including the waterproofing membrane, drainage layer, growing medium and vegetation.

2. Structural

This section of the standard addresses the increased loads that green roofs place on traditional roof systems. The standard includes requirements for structural load testing, slope stability, parapet height and scuppers, considerations on designing for water accumulation from rainfall.

3. Safety

Safety matters such as wind uplift, occupancy safety and accessibility and fire resistance are outlined in this section of the standard in addition to. Prescriptive design standards for wind uplift and fire safety are currently being developed and are anticipated for adoption by the American National Standards Institute in early-2009. In the meantime, The TGRCS would require that applicants achieve compliance with the appropriate OBC requirements.

4. Waterproofing

The proposed standard contains requirements and best practices pertaining to the key functions of a green roof, including drainage and water retention. These functions are integral to the functioning of a green roof, as one of the major potential benefits of green roofs is the capacity for storm water retention and reduction of run-off from the roof during storm events.

5. Vegetation Performance

The selection of appropriate growth media and vegetation are integral elements of the green roof system addressed by the TGRCS. To ensure a level of professional design review, the Standard requires that the green roof assembly and system be designed by a landscape architect and professional engineer.

Technical Advisory Group and Technical Amendments

To further ensure that the TGRCS is established with a level of due diligence consistent with other standards developed by standards organizations and regulatory bodies, the proposed by-law provides for a Green Roof Technical Advisory Group (TAG) consisting of experts in building engineering, design, manufacturing and green roof research.

The proposed by-law will provide a structure to ensure that any proposed technical change to the TGRCS would undergo the appropriate due diligence and analysis prior to adoption. The vehicle for this analysis is consideration by the TAG. The TAG would then provide recommendations to the Chief Building Official on the feasibility of the proposal from a technical, building science and enforcement perspective. Any addition or amendment to the Toronto Green Roof Standard would then require Council approval.

In anticipation of the public consultation, the Chief Building Official has established this group, based on a Terms of Reference to review the proposed standard and consider stakeholder comments following the public consultation.

Consultation

City Planning and Toronto Building staff are prepared to launch a focused public consultation following Committee's consideration of this report. The consultation will target developers, builders, the roofing industry, green roof suppliers and manufacturers, building owners and operators and green roof designers and will include focus group sessions and written submissions. The proposed thresholds for requiring green roofs presented in this report and the draft TGRCS largely in the form as attached to this report, would form the basis of consultation by Toronto Building and City Planning on requiring and governing green roof design and construction. Information will be posted on the City's web site: www.toronto.ca/greenroofs.

Implementation

The City of Toronto Green Roof By-law will place Toronto at the forefront of green roof implementation and design in North America. This report recommends that the Chief Building Official and Chief Planner report back to the Planning and Growth Management Committee with the by-law, reflecting public comment, for implementation in January 2009.

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ATTACHMENTS

1. Draft Toronto Green Roof Standard