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GREEN AND SUSTAINABLE CERTIFICATIONS FOR EXISTING BUILDINGS, THE EXAMPLE OF THE UPGRADING TO STANDARDS AND HERITAGE RESTORATION OF MONTREAL CITY HALL

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Abstract: The energy efficiency of new construction is increasingly valued and put at the forefront of building design. However, the built environment of cities is generally highly developed and the reconstruction of buildings is obviously not a solution. From a sustainable development and energy efficiency perspective, it is essential to consider the conversion of existing buildings of all types into efficient buildings. The objective of this project is therefore to determine the green and sustainable certification options available to date for existing buildings and to consider the application of WELL certification for health and well-being to a real project, namely the upgrading to standards and heritage restoration project for Montreal city hall.

1 INTRODUCTION

In order to actively participate in sustainable development objectives and contribute to the fight against climate change, the City of Montreal wishes to achieve carbon neutrality by 2050, with reference to its Climate plan 2020-2030. To achieve this goal, several commitments have been put in place in recent years, including the Sustainable development policy for the City of Montréal's buildings issued in 2009. This policy requires that all new construction or major renovations of its buildings meet the minimum LEED-Gold (mandatory certification) and LEED-Silver (non-mandatory certification) criteria respectively, considering that 20% of the city of Montréal's GHG emissions are attributable to the operation of buildings (Ville de Montréal, 2009). In this context of reducing greenhouse gas emissions, the upgrading to standards and heritage restoration project for Montreal city hall project is a good example of the application of the approaches put in place and the potential for green and sustainable performance of existing buildings. In addition to bringing fire, electrical and mechanical systems up to standard, restoring and enhancing heritage elements, and providing occupants and users with a healthy environment and efficient, high-performance facilities, this project aims to obtain LEED Existing buildings: operation and maintenance (LEED EBOM) v4.1 Gold certification.

Considering the Montreal city hall as a flagship building of the municipal administration, the present administration wishes to demonstrate to its various executives that such a certification based on operational performance is feasible and viable in the long term. To date, several green and sustainable certifications are offered for the improvement of building performance. Considering that this field is developing and proving its worth in the form of construction projects of multiple nature and scale, the first objective is to define and understand the possibilities offered to existing building renovation projects. New building and green performance are often linked, but LEED, BOMA BEST, Living Building Challenge, Zero Carbon and WELL certifications apply equally well to existing buildings. By defining what each of

these certifications represents (objectives, nature of the concepts, level of complexity, etc.), it will be possible to meet the second objective, which is to understand why LEED EBOM certification was considered the most suitable for the sustainable development objectives of the city hall project. Subsequently, considering the WELL certification, focused on the well-being and health of the occupants, as a very good complement to a certification aimed at ecological performance, the third objective is to conduct a preliminary analysis of this certification in order to validate its potential application to the new Montreal city hall building. Finally, in the current context of the Covid-19 pandemic, we will identify the initiatives and adaptations to the Montreal city hall project that have been put in place since last year, in order to ensure an additional level of health security for the users of the renovated building.

2 METHODOLOGY

2.1 Montreal city hall project

Since its inauguration in 1878, its reconstruction between 1923 and 1926 and following various works carried out over time, Montreal city hall no longer meets the requirements and standards of buildings. Indeed, the fire, electrical and mechanical systems have reached a significant level of obsolescence. As the City Administration's flagship building, the upgrading to standards and heritage restoration of Montreal city hall is a major project that allows for strategic management of asset maintenance, building enhancements and the integration of new sustainable development regulations and standards.

In 2015, the project management team set up the project to bring the city hall up to standard and restore its heritage. To carry out this major project, contracts were awarded to various professionals, including a first contract to the team responsible for preparing the plans and specifications (a team composed of architects, engineers and other specialists) and a second to a general contractor for construction management. In fact, for the first time for the City of Montreal, this project is being carried out in management mode in order to transfer construction management to a general contractor, considering the complexity of the project. Thus, the renovation work is subdivided into distinct lots and the realization of each one is entrusted to contractors by launching a call for tenders for each lot. These construction contracts are therefore issued by the City, but managed by the construction manager.



Figure 1: Montréal City Hall. From https://upload.wikimedia.org/wikipedia/commons/6/68/Hotel_de_ville_de_Montreal_42.JPG. Free for commercial use.

In addition to the professionals, the construction manager and specialized contractors, it is important to mention that the project integrates, from the beginning of the design, different representatives of the building users in order to optimize, according to the identified needs, the design of the new city hall. This translates into the application of the Integrated Consultation Process (ICP) to the project.

The construction's phase of the project to bring Montreal city hall up to building standards and restore its heritage began in 2019. In the spring of that same year, the occupants of city hall building moved to the neighbouring Lucien-Saulnier building. The construction then followed quickly and, to date, construction is underway and is currently scheduled for completion in 2023.

2.2 Review of certifications for existing buildings

In order to achieve the above-mentioned project objectives, the first step was to carry out research to identify and characterize the various ecological and sustainable certifications available in the field of existing buildings, based, among other things, on prior knowledge. Once the available certifications were identified and the reference documents collected, a detailed review of the reference guides and official certification websites was necessary in order to define what precisely the certifications consist of, to identify the components of each one, their criteria, their constraints to be respected to meet them and their scoring system. From this research, a global portrait of each certification was drawn, in addition to better understanding the choice of LEED EBOM certification for the Montreal city hall upgrading to standards and heritage restoration project. Subsequently, considering the nature and objectives of each of the certifications identified, it was possible to validate the potential application of WELL certification to the Montreal city hall project. Indeed, this certification stands out for its objectives of occupant health and well-being, which are closely linked, among other things, to building performance elements in terms of HVAC (heating, ventilation and air conditioning) system components, water quality and the quality of material components (architectural components, construction materials, maintenance products, etc.) (International WELL Building Institute, 2018).

2.3 Preliminary analysis of the WELL certification

WELL certification appears to be an ideal complement to the LEED existing building certification for the city hall project, however, a validation process was required to confirm whether the project is eligible for WELL certification. This is how the second step was initiated, namely the preliminary analysis. This step is composed of two parts.

2.3.1 Part 1 – Preliminary overview of WELL criteria

Part 1 consists of a preliminary overview of all the criteria of the ten WELL concepts. The objective is to carry out an overview of each of them, to carry out a first sorting of the criteria that cannot be met and, in parallel, to identify all the information to be validated. In this component, it was also necessary to identify resources who are active in the Montreal city hall project and who could answer the questions raised during the overview of the criteria. The list of these resources is presented in Table 1.

Table 1: Resources involved in the city hall project, part 1 of the preliminary analysis

| Resources |
|--|
| Employee of Montreal City Hall and the City of Montreal |
| Architect, member of the design team assigned to the city hall project |
| Mechanical engineer, member of the design team assigned to the city hall project |
| WELL and LEED certified professionals |

Once these people were identified, meetings were planned with them and the information collected was compiled from a database. This database was subdivided based on the ten WELL concepts and contains all the information necessary for the analysis, such as the criteria, the information to validate, the stakeholders to question, the answer (yes/no), the score and the information supporting the answer.

Part 2 – Detailed overview of WELL criteria

Subsequently, using the updated database, a second and more detailed overview was conducted to confirm or deny full or partial compliance with the criteria. Firstly, it should be considered that in order to obtain the minimum level of certification WELL Bronze, it is necessary to meet all of the prerequisites and confirm that they are or can be met. It was therefore necessary to study all the characteristics of the

prerequisites for each concept based on the WELL certification guide (IWBI, 2020). Considering the status of preliminary analysis, the objective is also to identify the elements to be improved or implemented for the prerequisites that the Montreal city hall project does not quite meet at the moment.

Subsequently, considering the information gathered from the stakeholders, it was possible to identify the criteria called "optimization characteristics" that the Project meets, or could potentially meet according to certain recommendations, in order to achieve a higher level of certification. Each optimization characteristic allows a certain number of points to be collected and it is these points that allow the Project under study to reach a higher level of certification. These levels of certification and associated scores are presented in Table 2. The choice of these additional criteria must be based on City of Montreal's policies and programs already in place as well as on the specifics of the improvements made to the building through the major renovations currently underway. Therefore, it is important to pay attention to the choice of optimization features, since if the Montreal city hall project is not already able to meet them, changes of nature and scope, sometimes significant, may be required.

Table 2: WELL certification levels, reference scoring system

| Total score | Minimum score per concept | Certification level |
|-------------|---------------------------|---------------------|
| 40 points | 0 | WELL Bronze |
| 50 points | 1 | WELL Argent |
| 60 points | 2 | WELL Or |
| 80 points | 3 | WELL Platine |

With reference to Table 2, the selection of the optimization characteristics to be respected must therefore ensure that the Project achieves a minimum of 1 point and a maximum of 12 points for each of the ten concepts (International WELL Building Institute, 2018). Finally, depending on the project's ability to meet all of the prerequisites and optimization characteristics, which may, at the preliminary analysis stage, be partially or partially met, it is possible to decide on a WELL certification level if Montreal City Hall ever wishes to comply with it.

3 RESULT AND DISCUSSION

3.1 Review of certifications for existing buildings

Following the literature review on green and sustainable certifications applicable to existing buildings, it is possible to see that the certifications identified are mostly certifications focused on the energy performance of buildings. It is possible to group these certifications into two categories. First, there are certifications applicable to the real estate management of existing buildings, whose main objective is to achieve the ecological efficiency of buildings through the implementation of green and sustainable policies. These certifications are LEED EBOM and BEST Sustainable Workplaces Program. We also find certifications more commonly applicable to the renovation of existing buildings or the construction of new buildings. These certifications are BOMA BEST Single Building stream, Living Building Challenge, Zero Carbon and WELL. These certifications are summarized in Table 3.

Table 3: Summary of green and sustainable certifications for existing buildings

| Certifications | Main objectives | Categories |
|--|---|--|
| LEED EBOM | Green and sustainable operation and maintenance programs and policies. | Green Operations and Maintenance |
| BOMA BEST Sustainable Workplaces Program | Sustainable property management based on environmental and procurement policies. | Environmentally friendly property management |
| BOMA BEST Single Building stream | Energy efficient property management for all types of existing buildings. | Energy efficiency |
| Living Building Challenge | Buildings that contribute to restoring the natural environment while allowing the community to reconnect with nature. | Energy efficiency |
| Zero Carbon | Buildings whose operations are low carbon, with the aim of achieving carbon neutrality. | Energy efficiency |
| WELL | Application of occupant health and well-being concepts in building design. | Health and Wellness |

LEED EBOM is a certification adapted to existing buildings and interior spaces. The certification is based on 7 categories of requirements: location and transportation, sustainable site, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality and innovation (USGBC, 2019). In order for a project to be certified, it is necessary to compile building performance data over a minimum period of 1 year. Once certification is obtained, it is valid for a period of three years. Building managers must therefore maintain their database and ensure the continuity of the measures put in place in order to obtain LEED EBOM certification again.

The BOMA BEST Sustainable Workplaces Program is also a certification for existing buildings or interior spaces and is renewable every three years (BOMA Canada, 2016). This certification is based on procurement and environmental policies. The requirements of the procurement policies in place are, for example, to demonstrate concern for the procurement of sustainable and responsible equipment through Energy Star, EcoLogo, FSC, etc. certifications. (BOMA Canada, 2016). Subsequently, through environmental policies (water, energy, waste management, etc.), BOMA BEST Sustainable Workplaces Program certification requires that the spaces evaluated be certified by an ecological certification program, which distinguishes this certification from others, since its validity depends, among other things, on prior ecological certification. In the same BOMA BEST category is the Single Building stream, which aims to certify a building on the basis of its energy performance, i.e. its energy intensity, water use intensity and Energy Star performance rating (BOMA Canada, 2020). For this certification, the building under study must have an occupancy rate greater than 70% over a consecutive 12-month period in order to be eligible for the higher levels of certification (BOMA Canada, 2020). Otherwise, only the basic level (Certified level) can be obtained.

The Living Building Challenge (LBC) certification, on the other hand, aims to demonstrate that a built environment can truly contribute to restoring the natural environment, while allowing the community to reconnect with nature. The LBC certification is applicable to all types of buildings (new construction, renovation of existing buildings, interior spaces), is built around seven categories of requirements (called petals) and is obtained only once after a 12 month commissioning period (International Living Future Institute, 2019). The LBC certification presents an interesting particularity contrary to other green certifications. The latter adapts to the regions, the environment and the social context of the projects. This adaptation is reflected in the Living Transect (International Living Future Institute, 2019), which allows exceptions to the requirements to be applied depending on the context of the projects.

For its part, the Zero Carbon Building (ZCB) certification aims to certify buildings that are efficient and low in carbon emissions. This certification offers two possibilities, Carbon Zero Design and Carbon Zero Performance. The performance certification focuses on the zero-carbon operation of existing buildings, unlike the Design certification, which covers their construction (new or renovated). The principle of ZCB certification is to achieve carbon neutral buildings by measuring intrinsic and operational carbon

emissions, while considering the carbon emissions avoided, for example through the use of green electricity, the implementation of an offset plan or other mitigation measures (Canada Green Building Council, 2020).

WELL certification aims to integrate the notions of well-being and health of occupants into a sustainable development approach, unlike known ecological certifications that put forward the energy performance of buildings (International WELL Building Institute, 2020). This translates into the quality of the design and layout, the quality of the interior environment, the building's mechanics and the well-being of the occupants in all its facets; healthy living habits, working conditions, physical activity, nutrition and more (Paradis Bolduc & Ducaine, 2020).

Considering the objectives of each of these certifications, it would have been possible to apply the majority of them to the Montreal city hall major renovation project, as can be seen from Table 4. However, the level of complexity and the concordance between their objectives and those of the project favoured the selection of LEED EBOM certification, without necessarily involving major expenditures in terms of new construction. Indeed, at the beginning of the project, there was talk of considering LEED EBOM and LBC certification. However, the LBC certification was particularly restrictive in terms of the selection of construction materials (certified materials, local suppliers, etc.), which was an important issue regarding the feasibility of this certification. On the contrary, LEED EBOM mainly targeted the building operation phase, which was more in line with the Montreal city hall project objectives.

Table 4: Validation of the application of certifications for identified existing buildings

| Certification | | Applicability to the Montreal city hall project |
|--|-----|--|
| LEED EBOM | Yes | Certification already applied to the project |
| BOMA BEST Sustainable Workplaces Program | Yes | Provided LEED EBOM certification is obtained |
| BOMA BEST Single Building stream | Yes | The objectives of this certification are oriented towards certain project objectives, but mainly focused on specific energy performance objectives |
| Living Building Challenge | Yes | The objectives of this certification are oriented towards certain project objectives, but are more restrictive and complex |
| Zero Carbon | No | The objectives of this certification are not aligned with the objectives of the project. |
| WELL | Yes | The objectives of this certification are oriented towards certain project goals and could be a complement to LEED EBOM |

Finally, it can be seen that the WELL certification is the only certification for existing buildings that focuses on the aspect of well-being and health of the users. This is why WELL certification seems to be an enlightened and innovative choice to complement the sustainable aspect of the Montreal city hall building. This complementarity offers Montreal City Hall the opportunity not only to demonstrate its ecological capabilities by improving its operations and maintenance management methods, but also its ability to optimize its performance in terms of well-being in the workplace, linked to healthy and optimal working conditions for all of its users.

3.2 Preliminary analysis of the WELL certification

Considering the added value that WELL certification seems to offer, it is essential to analyze the feasibility of applying it to the upgrading to standards and heritage restoration of Montreal city hall project. First of all, the first essential verification, as mentioned above, is the validation of compliance with the prerequisites. Following a detailed analysis of these prerequisites, it is possible to affirm that approximately 50% of the prerequisites are currently met. Indeed, the prerequisites are globally respected. However, certain criteria must necessarily be validated by carrying out tests (upstream optimization to be planned or analysis of what exists), which prevents a decision on the acquisition of these characteristics. However, there is no major doubt as to their compliance. Overall, it is considered that the prerequisites could be met in their entirety, while still considering the adjustment of certain

elements, particularly with regard to internal policies and programs in place. This would result in the achievement of the basic level of WELL certification, the WELL Bronze level. Subsequently, with a view to improving the basic certification, the performance optimization characteristics were reviewed in detail to confirm the possibility of obtaining a minimum of 1 point for each of the ten concepts. Certain optimization characteristics were therefore confirmed as having been acquired by the project and other characteristics were identified as potentially met, provided adjustments were made. These adjustments may be related, for example, to space planning, components of the various mechanical systems, or existing policies and programs. The results of the detailed preliminary analysis of each of the optimization characteristics are presented in Table 5 and all of the points identified are grouped by concept.

Table 5: Results of a detailed preliminary analysis of the WELL optimization criteria for the Montreal city hall project

| Concepts | Minimum acquired score of 1 point (yes/no) | Potential score (points) |
|-----------------|--|-----------------------------|
| Movement | yes | 5 |
| Air | yes | 1 to 3 |
| Community | yes | 1 to 2 |
| Sound | yes (after testing) | 1 to 2 |
| Thermal Comfort | yes | 2 to 6 |
| Water | yes (with improvements and/or features validation) | 1 to 2 |
| Mind | yes | 1 to 2 |
| Light | yes | 1 to 4 |
| Materials | yes | 1 to 2 |
| Nourishment | yes | 1 to 3 |
| Innovation | N/A | 1 to 5 |

From Table 5, it is possible to see two main elements. First, the Montreal city Hall project would be able to obtain a minimum of 1 point for each concept, which would allow it to reach the WELL Silver level. Reaching this level is confirmed on the basis of eight out of ten concepts with one point acquired according to known data. The Water and Acoustic concepts are the ones that could prevent the achievement of the Silver level, considering that some characteristics must necessarily be confirmed by the realization of tests. In fact, one of the last steps of the certification is the realization of tests, by a representative of the International WELL Building Institute (IWBI), directly realized in the spaces of the building being certified. These tests validate, for example, the air quality, water quality, reverberation, acoustic performance and more in order to confirm compliance with the prerequisite or optimization characteristics. However, this missing information and test results are not considered critical to their feasibility. Conversely, some concepts have a high potential score, such as the Movement and Light concepts, all of which can be justified, among other things, by the geographic location of the building, the improvements and the targeted performance objectives of the project. For the Movement concept, the main optimization characteristics that allow the achievement of 5 points are, among others:

- The Bike score (93) and Walk score (91) (Walk Score, 2021) being much higher than the minimum thresholds.
- The presence of a 103 m² bicycle room that can accommodate approximately 72 bicycles and is composed of several showers, changing rooms and numerous lockers, all of which are well within the minimum required limits.
- The geographical position of the building favouring walking and access to public transport.

For the Light concept, the Montreal city hall project stands out for the devices implemented to improve the brightness and luminous comfort of the workspaces. The project includes the following elements:

- Installation of motion detectors for the control of general lighting;

- Installation of dimmers in some rooms (offices and conference rooms);
- Centralization of open spaces, but installation of daylight sensors;
- Provision of an individual table lamp for each workstation or office;
- Installation of daylight detectors;
- Installation of a system of lighting control stations with customizable control buttons (programming according to action or conditional logic, e.g. time of day).

The concept of Materials and its various optimization features must also be emphasized. Indeed, the characteristics of this concept are not simply limited to the quality of the materials used. This concept aims to maximize the reduction in the use of materials composed of elements harmful to health and the environment (presence of lead, mercury, asbestos, etc.), to standardize the management of these elements, to limit the use of materials containing volatile organic compounds (VOCs), to sustainably improve the policies and protocols in place regarding the choice of materials and cleaning products used, and more. In the context of upgrading to standards and heritage restoration of Montreal city hall, it is still difficult to confirm the conformity of most of the optimization features, but the potential is visible, particularly in terms of the points that could be obtained for compliance with the limits on the use of VOCs in building materials, since this criterion is just as applicable to the LEED EBOM certification already applied to the project. For example, the following elements are specified in the construction specifications: use of materials without orthophthalate, added formaldehyde or heavy metal stabilizers. It is also specified that the finish of new and restored windows and architectural caulking must meet the 250 g/L VOC limit, in addition to a required environmental product declaration. In addition, WELL's optimization features for cleaning products and maintenance protocols are equally applicable to LEED EBOM certification, as are certain criteria related to the HVAC system. Thus, supporting documentary evidence and testing must be conducted to demonstrate compliance with these characteristics specific to WELL certification, but its complementarity with LEED EBOM certification significantly increases the chances of compliance with these optimization characteristics, even at this first stage of preliminary analysis.

The second piece of information that can be drawn from Table 5 is the potential possibility of attaining a certification level higher than Silver. Indeed, the potential score identified in the detailed preliminary review of each of the optimization characteristics suggests that a score of 2 points per concept would be possible. It is possible to see in column 3 that all the concepts, with improvements, modifications and/or tests to be performed, would potentially be able to obtain the 2 points required for the WELL Gold certification level.

3.3 Adaptations following the COVID-19 pandemic

Over the past year, there has been an agreement to rethink the layout of workspaces in order to respect the minimum distance of 2 m at all times between each person sitting at a workstation. This decision was made through the consultation process with user representatives of the city hall, a process that has been in place since the beginning of the design phase of the project in 2017. In addition, these same workspaces have been redesigned to allow for greater flexibility and versatility, considering that, from now on, approximately 70% of the workspaces on the new floors will be open plan with reconfigurable workstations. In addition, in order to optimize the building's air quality, the fresh air ventilation system will be decentralized without recirculation, which means that fresh air will be conveyed to each room through a separate network of ducts and 100% of the stale air will be evacuated outside the building, without mixing with the air conditioning and heating system.

4 Conclusion

Finally, LEED EBOM certification was applied to the Montreal city hall project primarily to make its operations more environmentally friendly and sustainable. In addition, the project's second objective was to demonstrate, on a city-wide scale, the feasibility of such changes to operations and maintenance policies and to demonstrate the long-term effectiveness of this certification. LEED EBOM therefore has no significant impact on the construction phase, unlike the BOMA BEST Single Building stream, Carbon Zero

and Living Building Challenge certifications. These certifications focus primarily on the energy efficiency of the building, the quality and environmental performance of building materials, mechanical systems and others, which makes the certification process much more complex and initially went beyond the scope desired by the City at the beginning of the project. Over the past few years, LEED EBOM certification has evolved into revision 4.1, which has brought a number of changes, all positive and supportive of the city hall project. Indeed, this version offers performance complements in energy efficiency, user comfort, water and transportation, while preserving. These changes could have had a negative impact on the project and its level of certification, but on the contrary, the LEED EBOM v4.1 version instead allowed the project to aim for a higher level of certification than expected (possibly Platinum). The additional constraints are partly addressed through the multiple modifications and improvements made by the project. In addition, LEED EBOM v4.1 allows more latitude and flexibility for projects to meet the criteria, making higher levels of certification more accessible.

Subsequently, it is possible to confirm that WELL certification would be a possible certification for Montreal city hall building considering the significant changes it is currently undergoing. By preliminarily evaluating each of the prerequisites and optimization features, Montreal city hall would be able to achieve the WELL Silver certification level, provided that all prerequisites are confirmed. Furthermore, if the City of Montreal were interested in pursuing this certification and further optimizing its potential, an opening could be envisaged to attain the Gold level of certification, while considering that changes to internal policies and programs would have to be reviewed and improved, all at a significant cost. However, it goes without saying that the achievement of such a certification for the City of Montreal would be a very important step in the field of green and sustainable buildings and in the development of municipal real estate management in Quebec.

Finally, initiatives to adapt to the Covid-19 pandemic context have been identified through the modification of workspace layouts and adjustments to HVAC systems. This is particularly important in a perspective of sustainability and adaptability of the building for the coming decades, which could be marked by more than one global health crisis.

5 Recommendations

The WELL certification is a unique certification in the field of green buildings. It is important to be aware of the fact that the WELL criteria are complex and very restrictive, including very high levels of employee benefits, a multitude of free services to be offered, a strong emphasis on the integration of nature and nutrition, and very precise thresholds for improvement in sound levels, air, water and lighting quality. As a result, not all projects are in a position to qualify for this certification and it would be recommended to opt for a feasibility analysis, offered by the International WELL Building Institute, before launching the certification process for a project. This would limit unnecessary expenses, as the costs associated with WELL certification should not be neglected, with reference to the professionals in the certification community who were consulted. Thereafter, it would be recommended to start the WELL certification process as early as possible in building renovation or construction projects, considering the specific performance characteristics to be considered for mechanical systems, space planning, architecture, policies and programs in place.

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