COMPARISON OF THE ACOUSTIC DESIGN REQUIREMENTS OF THE LEED, WELL AND GREEN GLOBES BUILDING RATING SYSTEMS

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1 Introduction

In Canada, green building rating system certification levels are often used to specify sustainable design requirements for new construction and major renovation projects. This paper compares the acoustic prerequisites and optional performance targets of the latest versions of the LEED, WELL, and Green Globes green building rating systems for office spaces. It also provides comment on key design considerations for achieving these requirements.

2 Discussion

2.1 LEED [1]

For direct comparison to WELL and Green Globes, only the Building Design and Construction (BD+C) for New Construction (NC) and Interior Design and Construction (ID+C) for Commercial Interiors (CI) LEED rating systems' Acoustic Performance credit is discussed in this paper. The credit includes background noise, sound insulation, reverberation time, sound reinforcement and sound masking criteria. The background noise, sound insulation and reverberation time requirements are compared to Green Globes and WELL criteria in Tables 1 through 3.

When pursuing the Acoustic Performance credit, it is important that the design team are aware of the implications of the composite sound transmission class (STCc) requirements early in the design. The STCc 50 requirement for hallway adjacencies with enclosed offices or conference rooms can be challenging to achieve; often requiring the elimination of glazing from these walls or upgrading glass constructions, acoustic door seals and acoustic rated doors. These measures can have a significant cost impact.

Another important aspect for the design team are the reverberation time (RT60) requirements, particularly for projects with large open-plan workspaces, as the requirements are independent of room volume. Several current design trends, such as exposed ceiling systems and fully-glazed partitions, reduce or eliminate areas where acoustic absorption is traditionally integrated; space and budget should be reserved for alternative methods of adding sound absorption to achieve the RT60 requirements.

The sound masking requirements only apply for projects that use sound masking. Similarly, the sound reinforcement requirements are only applicable to large conference rooms or auditoriums that seat at least 50 people.

Compliance with all of these requirements must be demonstrated through calculations or measurement, and documented for at least one room of each space type in the LEED acoustic performance spreadsheet. A noise reduction narrative is also required for documenting the background sound levels, and measurement narratives for RT60 and STCc, if measurements were conducted.

2.2 WELL Building Standard [2]

The objective of WELL is to create spaces that support the health and wellness of building occupants. The structure of WELL is quite similar to that of LEED. The six WELL features related to acoustics are: Exterior Noise Intrusion, Internally Generated Noise, Reverberation Time, Sound Masking, Sound Reducing Surfaces and Sound Barriers. The requirements of these features, are largely based on the U.S. General Services Administration (GSA) Sound Matters [3] publication.

The Exterior Noise Intrusion feature requires that sound pressure levels from exterior sources do not exceed 50 dBA in regularly occupied spaces. If the project uses windows for ventilation, this requirement applies with windows open. This feature is a precondition for core and shell, and new and existing building projects. Compliance is confirmed through on-site testing. It is important that the design team are aware of this requirement early in the design process as it may affect the ventilation design strategy, façade design and/or floor planning. There are opportunities for the design team to use space planning to setback or minimize regularly occupied spaces along louder areas of the façade.

The Internally Generated Noise feature has two parts: acoustic planning, and mechanical equipment sound levels. It is a precondition for new and existing interiors and buildings projects. Acoustic planning requires that the locations of loud and quiet zones, as well as the locations of noisy equipment be identified. The mechanical equipment sound level requirements are verified by measurements, in at least one of each space type. Every measurement location must pass in order achieve this precondition.

The remaining WELL acoustic-related features are optimizations. The reverberation time and sound masking features are verified by on-site measurements. The sound reducing surfaces and sound barrier features are documented with letters of assurance. Like LEED, the WELL reverberation targets are independent of room volume.

One notable difference between the sound insulation requirements of LEED and WELL, is that the WELL conference room requirements are specific to the walls shared between conference rooms and offices – excluding the entry/corridor walls that are often problematic to achieving the LEED credit. Although the WELL office

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Noise Isolation Class requirements apply to all walls, they are lower than the LEED requirements, and can be achieved with more common glazing and door constructions.

2.3 Green Globes [4]

The Green Globes New Construction rating system is quite different from both the LEED and WELL systems. It consists of questionnaires completed at four stages of the design, and there are no questions that are mandatory for certification. There are performance and prescriptive based requirements; in total the 28 acoustic questions account for up to 28 points, out of up to 1000 points on a project (not all questions are applicable to all projects).

The questions under the Acoustic Comfort Design category cover most of the same topics as the WELL and LEED credits, such as sound insulation, space planning, background noise, reverberation time and sound masking, but also include prescriptive questions about construction and design details. Such as, whether walls separating acoustically sensitive areas are full height, whether air flow velocities are within specified maximums, and whether low-noise ballasts are installed in quiet areas.

An advantage of the Green Globes system is that the format of the rating system lends itself to being used as a checklist of best practices. In addition, the individual question format allows for the greatest flexibility of the three systems being compared. Many of the questions reference guidance from the ANSI/ASA Standard S12.60-2010, or the ASHRAE 2007 handbook. However, the materials required for verification can vary by project.

One curiosity to note is that the question on achieving RT60 criteria is worth 5 points, whereas most of the other acoustic questions are worth 0.5 or 1 point. There is only one question on RT60, which may be why it has a higher rating; however, the design team may notice the high value and prioritize it above other acoustic design aspects.

Several of the acoustic questions relate to space planning, to achieve these points the architect should be made aware of the criteria as early as possible in the design process. The mechanical and electrical engineers should also be notified early in the design about the requirements for the duct layout, air flow velocities, piping layout and construction, equipment isolation, and light/electrical fixture noise requirements. Although these requirements are adapted from ASHRAE/ANSI design guidance, it is unique to Green Globes that such details are tracked for points.

Table 1: Comparison of Background Sound Requirements

Building Rating System:	LEED v4		Green Globes 2015	WELL v1(Q3)
Standard(s) Referenced:	AHRI 885-2008	ASHRAE 2011	ASHRAE 2007	GSA Sound Matters 2012
Space Type	RC(N)	NC/RC	RC(N)	NC
Executive and private offices	25 to 35	25 to 35	25 to 35	≤35
Conference rooms	25 to 35	25 to 35	25 to 35	≤30 *
Teleconference rooms	≤25	20 to 30	≤25	
Open plan offices – without sound masking	≤40	35 to 45	≤40	≤40
Open plan offices – with sound masking	≤35		≤35	
Corridors and lobbies	40 to 45	35 to 45	40 to 45	≤40

*25 recommended

Table 2: Comparison of Sound Insulation Requirements

Building Rating System:		LEED v4	Green Globes 2015	WELL v1(Q3)
Adjacency Combination		STCc	STC	NIC
Standard Office	Standard Office	45	45	40 (or 35 with sound masking)
Executive Office	Executive Office	50	45	40 (or 35 with sound masking)
Office	Hallway, Stairway	50	45	40 (or 35 with sound masking)
Conference Room	Conference Room	50	45	53
Conference Room	Hallway, Stairway	50	45	-
Mechanical equipment room	Occupied Area	60	-	-

Table 3: Comparison of Reverberation Time Requirements

Building Rating System:	LEED v4	Green Globes 2015	WELL v1(Q3)
Adapted from Standard(s):	ASHRAE (2007), ASA (2008), ANSI (2002), and CEN (2007)	ANSI/ASA S12.60-2010	GSA Sound Matters 2012
Space Type	RT60 at 500, 1000 & 2000 Hz (s)		RT60 at 500Hz (s)
Executive or private office	< 0.6	≤0.6*	-
Conference room	< 0.6	≤0.6 if <280m^3* ≤0.7 if 280-565 m^3*	≤0.6
Teleconference room	< 0.6		
Open-plan office without sound masking	< 0.8	-	≤0.5
Open-plan office with sound masking	0.8		

*The Green Globes reverberation time criteria are for "quiet areas and all areas where speech intelligibility is important". The author's interpretation is that offices and conference rooms meet this definition, but that open-plan offices do not.

3 Conclusion

There are advantages and disadvantages of each of these rating systems. The LEED credit is the most difficult to achieve due to all the performance requirements being combined under one credit; however, it does not restrict how the project must achieve that performance. The Green Globes system prescribes construction techniques, but allows the design team to select any combination of acoustic requirements. Whereas under the WELL system there are mandatory acoustic features in order to gain certification, and features are regularly updated with quarterly addenda.

References

[1] US Green Building Council. LEED Reference Guide for Building Design and Construction V4. Washington, D.C.: 2014.

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[4] ECD Energy and Environment Canada. Green Globes for New Construction Technical Manual. Toronto, O.N.: 2015.