INTERPRETATION IC 90.1-2007-34 OF
ANSI/ASHRAE/IESNA STANDARD 90.1-2007
Energy Standard for Buildings Except Low-Rise Residential Buildings

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Reference: This request for interpretation refers to the requirements presented in ANSI/ASHRAE/IESNA Standard 90.1-2007, Section 9.6 and Table 9.6.1, regarding Lighting Power Densities –Space by Space Method of Calculating Interior Lighting Power Allowance.

Background: The Doha Metro, Qatar, is one of the Middle East's most prominent and prestigious projects, with high levels of environment and sustainability commitment. It will serve both the capital (Doha) and the suburbs with all major locations within easy and convenient reach. Most of the Doha Metro lines will be underground, so tunneling (using tunnel boring machines) plays a major role in construction. The metro system will be built in two phases: the first will see the construction of three out of the four lines (Red, Gold, and Green) and 37 stations. These lines are expected to be open to the public in late 2019. The second phase will be completed by 2026, and will involve the expansion of the phase one lines, and the construction of an additional one – the Blue Line. Another 72 stations will also be built. Stations play an important part – both practically and culturally – of any metro system. Architecturally, the stations will reflect the heritage of the country, with a 'vaulted spaces' design inspired by traditional Bedouin tents. Msheireb station is the flagship metro station located in the 'heart' of Doha at the corner of the Msheireb development where Wadi Msheireb and Al Diwan Street meet. Msheireb Station is a deep station, marking the crossing of three metro lines with the Red and Green Lines running parallel and the Gold Line situated underneath. The station features an extravagant entrance shelter as a landmark way finding for locals and tourists alike. A strong visual connection between entrance and concourse enables a smooth passenger experience and clear direction throughout the station.

There are a number of challenges that have been encountered in trying to ensure that Msheireb station is sustainably designed, with energy efficiency a key issue. Msheireb Station is the deepest station on the network (below -30 meters) and as an underground station has many inherent environmental challenges - including high ambient climatic temperatures, minimal natural daylight, requirement for continuous artificial cooling (district cooling), and lots of artificial lighting to achieve the required lux, uniformity and safety levels. One of the challenges is developing a compliant energy model in accordance with LEED New Construction 2009 Credits on EA Prereq 2 Minimum Energy Performance and EA Cr1 Optimise Energy Performance, with the aim of achieving energy savings in excess of 10%. Within our energy model one of the important parameters impacting the energy consumption improvement is the front of house lighting design within the station public areas (e.g. concourse, mezzanine, subway tunnels and platform levels etc.). Lighting Power Density (LPD watts/m^2) performance of the luminaires is therefore critical to the overall energy savings. Sensitivity tests on the current energy model have been undertaken with different LPD levels and it has been demonstrated to effect the LEED scoring by up to 3%.

The query specifically relates to the application of ASHRAE 90.1-2007, Section 9.6, to underground train stations and to the type of building space to apply to Lighting Power Densities

using the 'Space by Space' methodology under Table 9.6.1. There are no direct comparable space type(s) for the areas within underground train spaces and depending on individual interpretation there are several possibilities could apply to comparable spaces. Site plans and rendering of the station can be provided if required to assist in the understanding of the station design.

The inherent nature of the design of an underground metro station requires the Front of House lighting to fulfill specific requirements, with safety of passengers and staff a paramount aspect. The design and functionality of an underground is more akin to that of a retail mall concourse, thus enabling transients to flow through the building whilst stopping at various destinations enroute (e.g. ticket office, rail network maps, toilets, retail areas, platforms, etc). Light provision is also similar to that of a retail mall, with limited natural daylight, high ceilings, and mezzanine levels. Areas such as station platforms are all underground with no natural daylight, with transient passenger safety a primary feature. For this reason such areas would be more comparable with Corridor Transition – For Hospitals.

There are a number of specific queries we would like to raise concerning LPDs, The applicable Authority Having Jurisdiction (AHJ) with respect to energy codes, the specified levels within ASHRAE 90.1-2007 Section 9.6, and the applicability of those levels to underground train stations. As per Table 9.6.1 of ASHRAE 90.1-2007 we are applying the LPD levels using the space by space method and have the following queries:

(1) There is no specific Lighting Power Density common space type that is referenced for train stations. In the absence of an equivalent space type can we apply space types with agreement with our Client, Qatar Rail?

(2) There is no current Authority Having Jurisdiction (AHJ) that would govern and set agreed LPD levels. The requirement to meet ASHRAE 90.1-2007 comes from the client (Qatar Rail) and not any government agency or authority. Established by Emiri decree in 2011, Qatar Rail was given the mandate to design and develop the country's rail network, and after the rail projects are completed, manage, operate, and maintain them. There is no existing rail network in Qatar and any levels therefore set would be applied to all future underground rail networks. In this case can Qatar Rail be the nominated AHJ?

(3) The lighting design for an underground station differs significantly to that of other standard building types listed for space types within ASHRAE 90.1-2007 (Table 9.6.1), and even differs with other rail structures at grade or elevated rail levels. As per Table 9.6.1 of ASHRAE 90.1-2007, the closest equivalent 'transport' equivalent space type match is either an Airport Concourse, air/train/bus baggage area, or terminal ticket counter. However, the transportation specific building types are open to individual interpretation and are not the most appropriate space types given the nature of an underground station. Comparison between these areas would therefore be incorrect. Only a small element of our station design has access to natural daylight, including the station entrances at grade level and some small portions on the mezzanine and concourse areas. The remainder of the concourse level, all platform levels, subway corridors and all back of house areas are located underground. There are other comparable space types that could also be similarly applicable to a rail station such as a Retail - Mall Concourse and Corridor Transition – For Hospitals. Our interpretation is that Retail - Mall Concourse and Corridor Transition – For Hospitals are the more applicable space types and comparable LPD levels. Please confirm this interpretation is correct.

(4) A summary of the proposed space types associated with underground train stations is provided in Table 1 below. Please can you accept if the interpretation is correct for each space type listed?

Table 1 – Interpretation of Space by Space Type areas for Underground Metro Rail Stations

STATION SPACE TYPE	**PROPOSED ASHRAE SPACE BY SPACE TYPE ***		
	Interpreted ASHRAE 90.1.2007 Comparable Space Type	**LPD W/ft2**	**COMMENTS**
Shelter Entrance – Interior (At Street Grade Level)	Retail - Mall Concourse	1.7	Shelter Entrance is more closely matched to a Mall Concourse.
Mezzanine (-4.5 Metres below Grade Level)	Retail - Mall Concourse	1.7	Mezzanine and tunnel currently combined but should be split. Retail more appropriate due to limited internal daylight beyond entrance curtain wall Also, space types that need additional lighting such as retail areas and ticketing counters are located at this level. Mezzanine Tunnel to be applied as Corridor/Transition for hospitals.
Mezzanine Tunnel (-4.5 Metres below Grade Level. Subway tunnel connecting Entrances 4 & 5 to the Mezzanine)	Corridor/Transition – For Hospital	1.0	See above and Corridors (FOH)
Concourse (-10.04 Metres below Grade Level)	Retail - Mall Concourse	1.7	Concourse receives limited natural daylight due to underground structure. Structure more closely linked to that of a retail mall rather than airport concourse.
Concourse – Public Area (-10.04 Metres below Grade Level)	Retail - Mall Concourse	1.7	As above
Platforms / Transfer Area (Red / Green Platform -16.85 Metres, and Gold Line -26.81 Metres below Grade Level)	Corridor/Transition – For Hospital	1.0	High transition zone due to passenger movement. No natural daylight and more comparable space type would be a hospital corridor or mall concourse. Lower level of hospital corridor currently proposed.
Corridors (Front of House)	Corridor/Transition – For Hospital	1.0	Separate zones for any FOH corridor/tunnels similar to Mezzanine Tunnel LPD levels. Hospital corridor transition space type applied due to transition of passengers, no natural daylight and safety requirements.
Corridors (BOH)	Corridor/Transition	0.5	BOH LPD limits
Prayer Room	Religious Building – Fellowship Hall	0.9	BOH LPD limits
Retail Areas	Retail – Sales Area	1.7	BOH LPD limits
Mechanical Room (BOH)	Electrical/Mechanical	1.5	BOH LPD limits
Store	Inactive Storage	0.3	BOH LPD limits

Is this Interpretation correct, and if not what comparable Space by Space Types can be applied for individual areas within an Underground Metro Station?

Interpretation No.1: There is no specific Lighting Power Density common space type that is referenced for train stations. In the absence of an equivalent space type we can apply space types with agreement with our Client, Qatar Rail.

Question No.1: Is this interpretation correct?

Answer No.1: Yes

Comments No.1: In the absence of a direct match of space types between the actual project and those offered in section 9 in the 90.1 Standard/code, the general application is to choose the space type in 90.1 that most closely matches the lighting design needs and principles of the space type in the project. These choices must typically be acceptable to the AHJ

Interpretation No.2: The lighting design for an underground station differs significantly to that of other standard building types listed for space types within ASHRAE 90.1-2007 (Table 9.6.1), and even differs with other rail structures at grade or elevated rail levels. Qatar Rail is therefore permitted to select the space type that most closely represents the proposed use of the space.

Question No.2: Is this interpretation correct?

Answer No.2: Yes

Comments No.2: In general, when a specific space type does not exist in Table 9.6.1 in the 90.1 Standard, the closest applicable space type LPD can be used. The 90.1-2007 Standard does include LPD values for Transportation Concourse, Baggage area, and Ticket counter which would be considered appropriate for these spaces in a rail facility. The use of Retail Concourse and Hospital Corridor LPD values would not generally be considered appropriate for transportation facilities and instead, the use of the Transportation Concourse and general Corridor LPDs would be considered more appropriate. However, the final choice of space types used to characterize the building project for compliance with the standard are subject to approval by the AHJ.