



MALAYSIA CHAPTER

GBI Professional Series on IEQ

11th Oct 2014



GBI IEQ Submission

Common Compliance & Non-Compliance

Part 4

11th Oct 2014

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NRNC IEQ CRITERIA

- EQ 7 : Air Change Effectiveness (NR)
- EQ 10 : Electrical Lighting Levels (NR)
- EQ 11 : High Frequency Ballasts (NR)
- EQ 13 : Internal Noise Levels (NR & R)

EQ7: Air Change Effectiveness

- Air change effectiveness (ACE) is a description of an air distribution system's ability to deliver ventilation air to a building, zone or space
- One common definition of ACE is the ratio of a nominal time constant to a mean age of air
- The nominal time constant is calculated as a ratio of the domain volume (m^3) to the supply air volume to that domain (m^3/s)
- ACE can sometimes be confused with ventilation effectiveness
- Ventilation effectiveness is a description of an air distribution system's ability to remove internally generated pollutants from a zone

EQ7: Air Change Effectiveness

- ACE simply indicates how well the air is distributed within the breathing height. $ACE = 1$ indicates that the air distribution system delivers air equivalent to that of a system with perfectly mixed air in the space
- An ACE value less than 1 indicates that the air distribution within the zone is less than perfect mixing
- A short-circuiting flow pattern between the air-supply diffusers and return grilles increases the room-air age and causes ACE to be less than unity
- Preferentially supplying the air to the breathing zone will cause the ACE to be greater than unity

EQ7 Air Change Effectiveness

1

Recognise innovative air side strategies.

Provide effective delivery of clean air through reduced mixing with indoor pollutants in order to promote a healthy indoor environment. Demonstrate that the Air Change Effectiveness (ACE) meets the following criteria for at least 90% of the NLA:

The ventilation systems are designed to achieve an ACE of ≥ 0.95 when measured in accordance with ASHRAE 129-1997: Measuring air change effectiveness where ACE is to be measured in the breathing zone (nominally 1.0 m from finished floor level)

1

Reference Guide

REQUIREMENTS

Demonstrate that the Air Change Effectiveness (ACE) meets the following criteria for at least 90% of the NLA:

The ventilation system is designed to achieve an $ACE \geq 0.95$ when measured in accordance with ASHRAE 129 -1997.

Measure air change effectiveness, where ACE is to be measured within the breathing zone (nominally 1.0 m from finished floor level).

APPROACH & IMPLEMENTATION

Compliance may be met either through measurement of the completed building in accordance to ASHRAE 129 or equivalent or using CFD simulations.

Article on ACE

- ACE, an indicator indoor airflow pattern, was measured in 26 lab measurements. Ventilation air was supplied through induction-type diffusers located in the ceiling and removed through a ceiling mounted return grille.
- In experiments with heated air supply at minimum VAV flow rate and 100% outside air, ACE range from 0.69 to 0.89
- When supply air is cooled ACE range from 0.99 to 1.15

by Willian J Fisk & Others
1995

Another Article on ACE

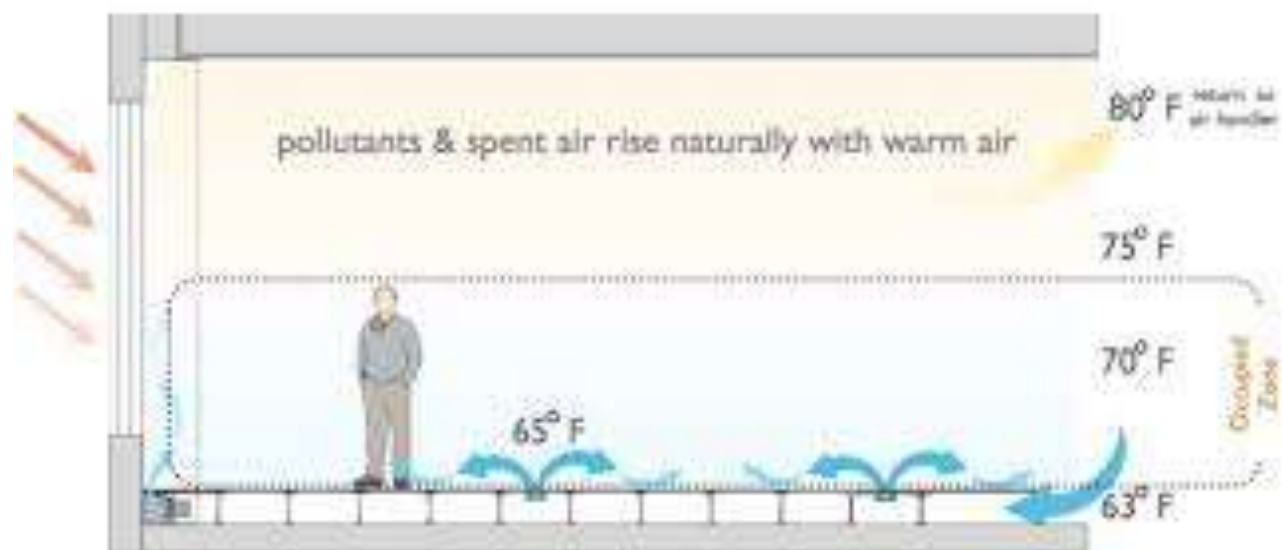
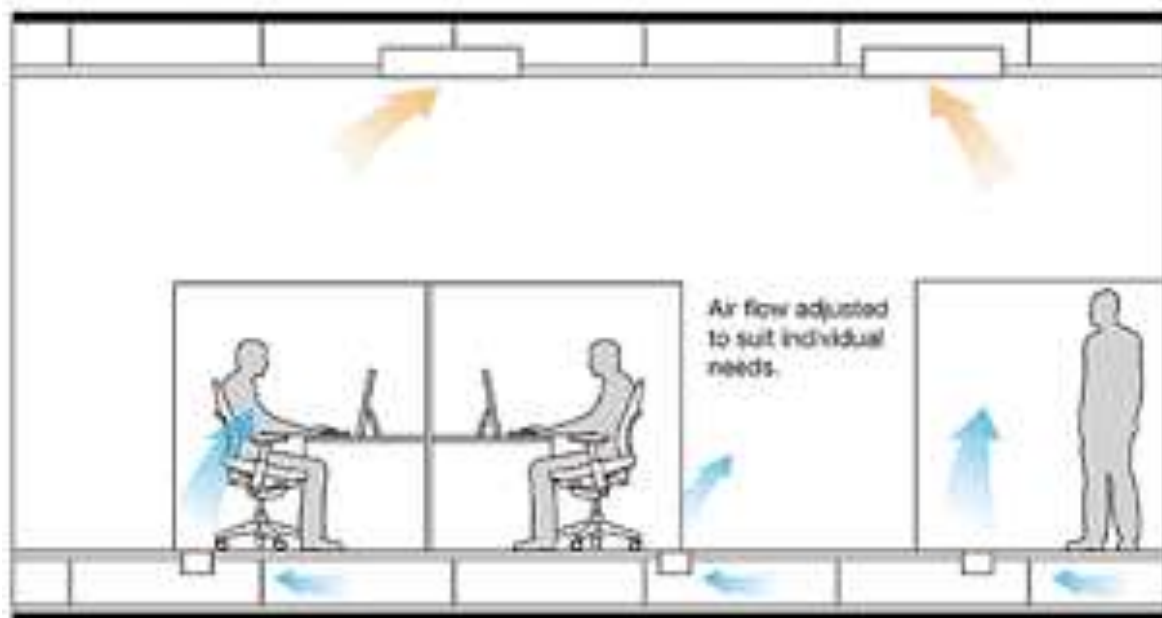
- Virtually every laboratory and field study has shown that ACE is always greater than 0.9 when supply air is cooler than room temperature regardless of diffuser location or design
- So virtually any cooling-only system earns this LEED credit inherently, regardless of the details of the air-distribution system design
- For UFAD and LLD/TDV, high ACE is true only when cooling. For heating, such strategy has low ACE, often lower than conventional overhead systems

by Steven T Taylor
ASHRAE Journal 2005

& Another Article on ACE

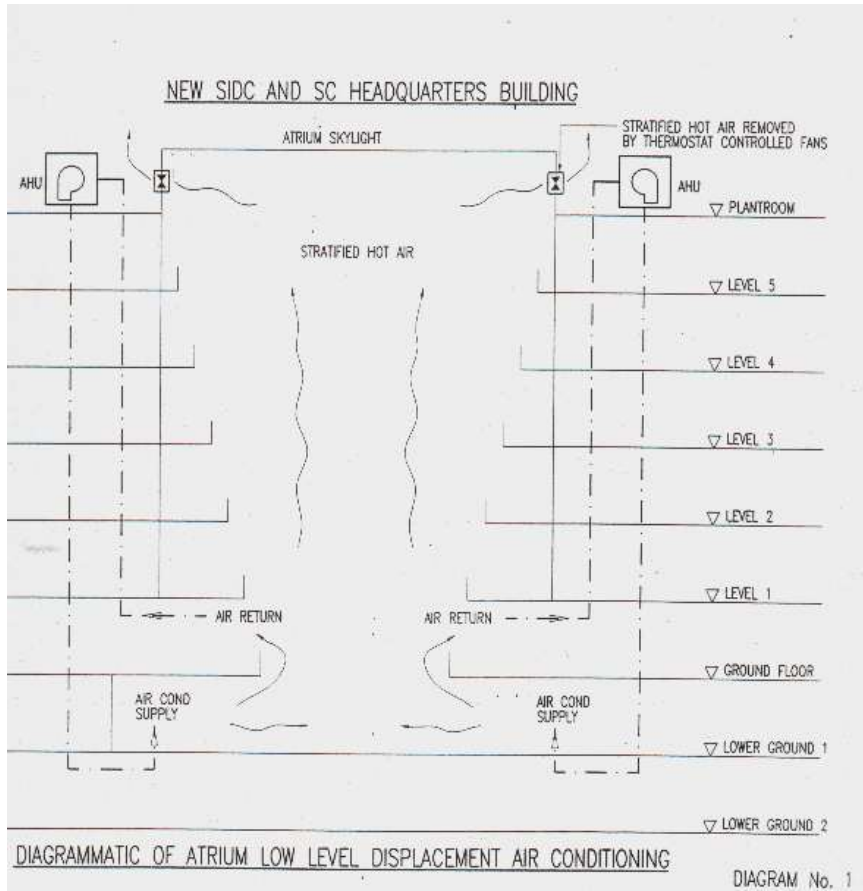
- CFD simulation is sensitive to a large number of input variables, minor changes to which can significantly affect the airflow pattern, the mean age of air and consequently ACE
- VAV systems have the highest risk factor when compared to the other ventilation systems
- In many cases it is possible, though requiring significant trial and error with the adjustment of flow rates, to achieve a Green Star-compliant solution or very close to (in accordance with ASHRAE F27-2005 methodology)

by Kemal Gungor (PhD), M.AIRAH, is an ESD consultant
March 2013 Ecolibrium





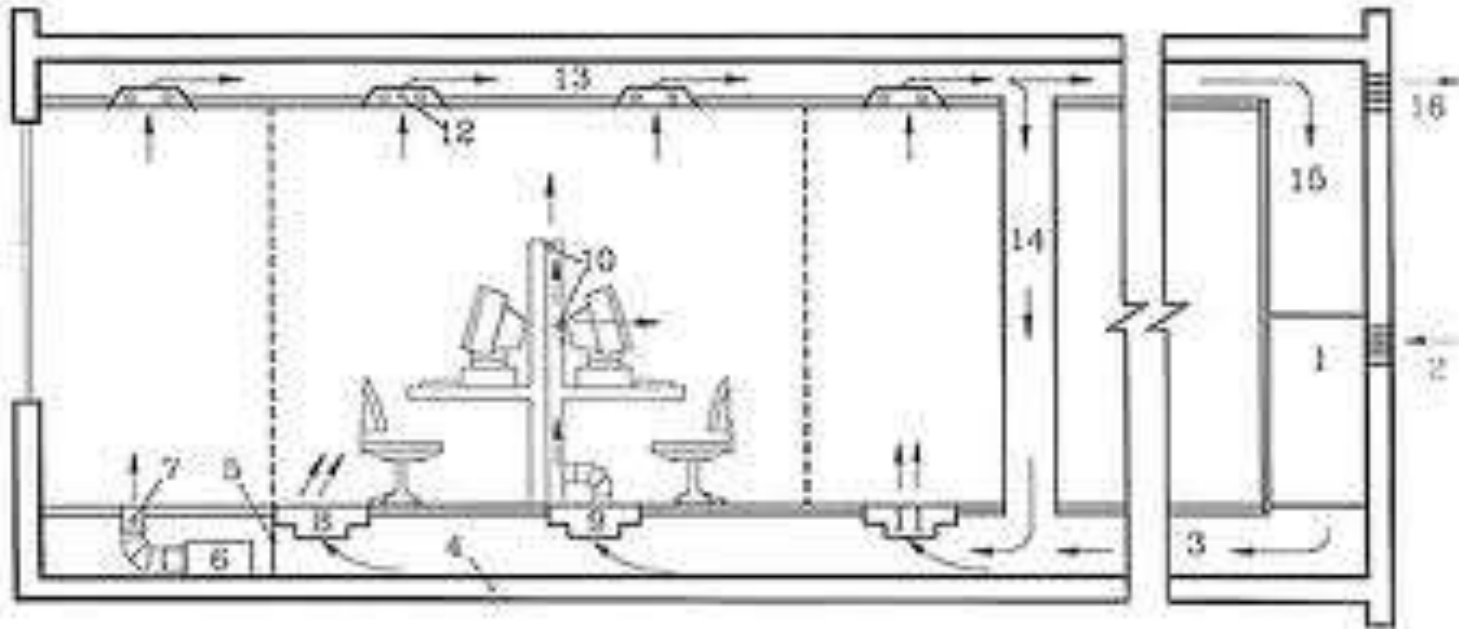
UFAD



LLD aka TDV



Dedicated Workstation Ventilation



GBI FAQs

FAQ 3.2

Q NRNC EQ7 – Air Change Effectiveness:

Will VAV system with ‘induction’ diffusers meet this credit? If not, what air-side strategy will be applicable?

A **NO**, unless air-side strategy is by means of direct tempered fresh air supply to workstation; low level displacement or UFAD.

Reference Guide

REQUIRED SUBMISSION FOR DA

1. Summary report detailing the design criteria that has been adopted for each type of space in the development.
2. Describe how the ventilation system is designed to meet the credit compliance.

REQUIRED SUBMISSION FOR CVA

1. As-Built drawings to show the ventilation system.
2. Summary report detailing the ventilation design criteria adopted for each type of space in the building.
3. Record of measurement to demonstrate compliance of this credit requirement.
4. Describe any deviation or addition to the DA submission.

DA Submission Document

1. Submit narrative (summary) page, describing air-side design ventilation strategy meeting this criteria compliance; i.e. use of UFAD, LLD or Work Station Ventilation or a combination
2. Submit typical floor plan and section/schematic showing design of system adopted
3. Provide tabulation of areas adopting such strategy and ensure this comprises **at least 90% of the total NLA**

CVA Submission Document

REQUIRED SUBMISSION FOR CVA

1. Submit narrative (summary) page, describing as-installed air-side ventilation strategy meeting this criteria compliance; i.e. use of UFAD, LLD or Work Station Ventilation or a combination
2. Submit As-Built drawings to show the ventilation system.
3. Submit tabulation of areas installed with such strategy and meeting **at least 90% of the total NLA**
4. Describe any deviation or addition to the DA submission.

EQ10**Electric Lighting Levels****1**

Discourage over provision of artificial lighting.

Baseline building office lighting not to be over designed:-

Demonstrate that office lighting design maintains a luminance level of no more than specified in MS1525 for 90% of NLA as measured at the working plane (800mm above the floor level).

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Reference Guide

REQUIREMENTS

Demonstrate that office lighting design maintains a luminance level of no more than specified in MS1525 for 90% of NLA as measured at the working plane (800 mm above the floor level).

APPROACH & IMPLEMENTATION

The ambient lighting level should be designed in accordance with the illuminance level recommended in MS1525.

Task lighting may be provided for occupants who require a higher lighting level either for their own preference or for various task needs.

Table 13. Recommended average illuminance levels

Task and Applications	Illuminance (Lux)	Minimum CRI
A) Lighting for infrequently used area		
Minimum service illuminance	20	30
Interior walkway and car-park	100	40
Hotel bedroom	100	60
Lift interior	100	40
Corridor, passageways, stairs	100	40
Escalator, traveller	150	40
Entrance and exit	100	60
Staff changing room, locker and cleaner room, cloak room, lavatories, stores.	100	60
Entrance hall, lobbies, waiting room	100	60
Inquiry desk	300	80
Gate house	200	80

Task and Applications	Illuminance (Lux)	Minimum CRI
B) Lighting for working interiors		
Infrequent reading and writing	200	80
General offices, shops and stores, reading and writing	300 – 400	80
Drawing office	300 – 400	85
Restroom	150	80
Restaurant, Canteen, Cafeteria	200	80
Kitchen	150 – 300	80
Lounge	150	60
Bathroom	150	80
Toilet	100	60
Bedroom	100	80
Class room, Library	300 – 500	80
Shop / Supermarket/Department store	200 – 750	80
Museum and gallery	300	80

Task and Applications	Illuminance (Lux)	Minimum CRI
C) Localised lighting for exacting task		
Proof reading	500	80
Exacting drawing	1000	80
Detailed and precise work	2000	80

Reference Guide

REQUIRED SUBMISSION FOR DA

1. Summary report of lighting design brief to illustrate how the credit will be met.

REQUIRED SUBMISSION FOR CVA

1. As-Built drawings showing the lighting layout plans.
2. Photometric measurements to illustrate that the lighting level fulfills the credit requirement.
3. Furnish photos of typical floor lighting installation.
4. Describe any deviation or addition to the DA submission.

DA Submission Document

1. Submit narrative (summary) page, describing how the lighting design meets this criteria compliance;
2. Submit typical lighting layout floor plans complete with **manually calculated or simulated lux levels** meeting MS 1525.

CVA Submission Document

REQUIRED SUBMISSION FOR CVA

1. Submit narrative (summary) page, describing as-installed lighting systems meeting this criteria compliance
2. Submit As-Built drawings showing lighting layout plans.
3. Submit **photometric measurements** of all typical floors to demonstrate compliance with this criteria.
4. Furnish photos of typical floor lighting installation.
5. Describe any deviation or addition to the DA submission.

Common Errors

1. At DA, failed to submit design layout plans showing lux level compliance
2. At DA, submitting simulated design layout plans with lux level exceeding MS 1525
3. At CVA, submitting measurement results of lux level exceeding MS 1525

EQ11**High Frequency Ballasts****1**

Encourage high IEQ fixtures.

Increase workplace amenity by avoiding low frequency flicker that may be associated with fluorescent lighting:-

Install high frequency ballasts in fluorescent luminaires over a minimum of 90% of NLA.

1

Reference Guide

REQUIREMENTS

Install high frequency ballasts in fluorescent luminaires over a minimum of 90% of NLA.

APPROACH & IMPLEMENTATION

Specify high frequency ballasts in fluorescent luminaires. The use of high frequency ballasts in the range of 20kHz and higher will provide smoother, non-flickering lamp operation. At this frequency, the flicker is totally undetectable to the human eye and sensory faculty

Reference Guide

REQUIRED SUBMISSION FOR DA

1. Description of design strategy to achieve installation of high frequency ballasts for minimum 90% of NLA

REQUIRED SUBMISSION FOR CVA

1. As-Built lighting plans to identify location of the 90% NLA of fluorescent luminaires installed with high frequency ballasts.
2. Manufacturer's information confirming the specifications of high frequency ballasts installed.
3. Describe any deviations or additions to the DA submission.

EQ13**Internal Noise Levels****1**

Control excessive internal noise level to assure good IEQ.

Maintain internal noise levels at an appropriate level. Demonstrate that 90% of the NLA do not exceed the following ambient internal noise levels:-

Within the entire baseline building general office, space noise from the building services does not exceed 40dBAeq.

OR

Within the baseline building office space, the sound level does not exceed 45dBAeq for open plan and not exceed 40dBAeq for closed offices

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Reference Guide

REQUIREMENTS

Demonstrate that 90% of the NLA do not exceed the following ambient internal noise level:

- Within the entire building general office, space noise does not exceed 40dBAeq OR
- Within the baseline building office space, the sound level does not exceed 45dBAeq for open plan and does not exceed 40dBAeq for closed offices.

APPROACH & IMPLEMENTATION

Excessive noise can cause discomfort to occupants. Some of the solutions to ensure acceptable noise level is maintained include:

- Specify acoustical ceiling
- Specify furniture with sound absorbing surfaces on both sides
- Locate photocopiers, fax machines away from the main office areas in a separate area
- Insulate partition cavities
- Mechanical equipment room to be located away from office and conference rooms

Reference Guide

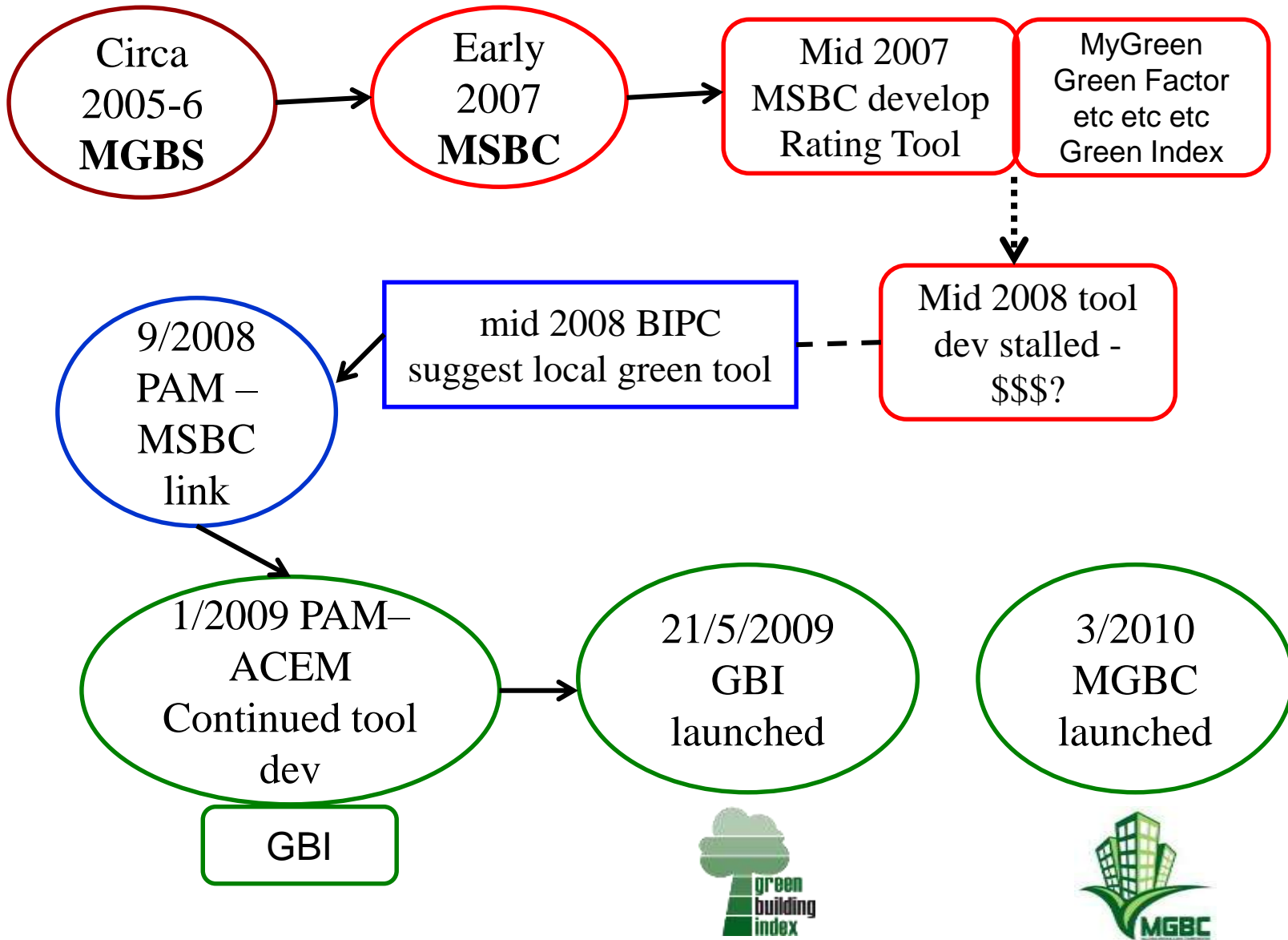
REQUIRED SUBMISSION FOR DA

1. Design report on strategies to ensure internal noise level is maintained at the prescribed levels.
2. Floor plans showing location of Core, M&E, and equipment rooms.

REQUIRED SUBMISSION FOR CVA

1. Report describing the measured internal and external noise sources and features installed to achieve required noise level.
2. As built drawings showing noise control features.
3. Manufacturer's data sheets of the acoustic materials used in building.
4. Describe any deviations or additions to the DA submission.

The GBI Story



**LEMBAGA AKITEK MALAYSIA
LEMBAGA JURUTERA MALAYSIA**

GBI



PAM + ACEM



GREENBUILDINGINDEX SDN BHD

GBI ACCREDITATION PANEL




NON-RESIDENTIAL BUILDINGS

Rating Tools	Energy Effy	IEQ	Sustainable Site	Materials & Resources	Water Effy	Innovation
BREEAM 2008	19%	*13%	*37%	*17%	5%	*9%
LEED v2.2	25%	22%	20%	19%	7%	7%
Green Mark v3	62%	5%	*20%		9%	4%
Green Star v3	20%	19%	*33%	16%	8%	4%
GBI v1.0	35%	21%	16%	11%	10%	7%
LEED v3	35%	15%	26%	14%	10%	*10%

* Denotes adjusted or amalgamated figures

Criteria	Malaysia GBI	USA LEED	Singapore Greenmark	Indonesia GreenShip	UK BREEAM	Hong Kong BEAM	Japan CASBEE	Germany DGNB-Seal	Australia Green Star	France HQE	Canada/USA Green Globes	Italy ITACA
Energy	X	X	X	X	X	X	X	X	X	X	X	X
CO2					X			X		X	X	X
Ecology	X	X	X		X	X	X	X	X	X	X	X
Economy	X							X		?	X	?
Health and Wellbeing	X				X	X	X	X	X	X	X	?
Indoor Environmental Quality	X	X	X	X	X	X	X	X	X	X	X	?
Innovation	X	X			X	X		?	X	?		?
Land Use	X	X		X	X	X		?	X	X	X	?
Management	X		X	X	X	X	X	?	X	?		?
Materials	X		X	X	X	X	X	X	X	?	X	X
Pollution	X	X	X	X	X	X	X	X	X	X	X	?
Renewable Energy	X	X	X	X	X			?	X	?	X	X
Transport	X	X	X	X	X	X		X	X	?	X	?
Waste	X		X	X	X	X		?		X	X	X
Water	X	X	X	X	X	X	X	X	X	X	X	X
Rating Classifications	Platinum Gold Silver Certified	Platinum Gold Silver Certified	Platinum Gold Plus Gold Certified	Platinum Gold Silver Certified	Excellent Very Good Good Pass	Platinum Gold Silver Bronze	3.0(Class S) 1.5(Class A) 1.0(Class B+) 0.5(Class B-)	Gold Silver Bronze	6 Star 5 Star 4 Star	High Performance Performance Base	4 Globe 3 Globe 2 Globe 1 Globe	-1 to 5 with 0 as base

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Notes:
1. Sourced and Modified from King Sturge (2009).4
2. Data for DGNB-Seal, HQE, and Protocol ITACA is not exhaustive and additional criteria may be included in the assessment.

A Broad Comparison of Rating Tools

Facts and Fiction about GBI

Myth No.1: GBI serves to enrich the individuals who own it as a registered Sendirian Berhad (Greenbuildingindex Sdn Bhd).

Greenbuildingindex Sdn Bhd (GSB) was registered on 23/2/2009, to manage GBI for the purpose of *limited liability* as a prelude to forming a Trust or Foundation in the long term.

The shares of GSB are held by ACEM (which is registered under the *Registrar of Companies Act* and are hence permitted to own other equities) and PAM through 3 appointed trustees (because PAM which is registered under the *Registrar of Society Act* with no limited liability) cannot hold business equity directly (circa 2009*).

*Note that this Society ruling has since been changed in Oct 2011 and the PAM equities is now owned directly by PAM

- The fees collected from all registered projects are being utilized for funding; day-to-day operations, training & outreach program, publicity & advertising to promote development of green buildings.
- Therefore no individuals had or will benefit from GBI.

Myth No.2: Very high and expensive GBI registration, accreditation and certification fees

This myth arose amongst other reasons, from selective misinterpretation of the following tabulated fee structure (for new construction);

SIZE OF PROJECT	TOTAL GROSS FLOOR AREA (m²)	REGISTRATION FEES (RM)
SINGLE RESIDENCE	Below 2,000	5,000.00
SMALL	Up to 4,000	8,000.00
INTERMEDIATE	4,001 to 10,000	10,000.00
MEDIUM	10,001 to 30,000	20,000.00
LARGE	30,001 to 50,000	32,000.00
EXTRA LARGE	50,001 to 100,000	45,000.00
MEGA PROJECT	Above 100,000	Assessment fee will be determined on a project-by-project basis

* Rates shown are as of the date of the application and registration and may be revised from time to time as appropriate.

* Rates shown are excluding Government Service Tax (GST)

- From the table, the fee for 1,000 units of link house residential development @ RM5,000 per unit, was misinterpreted to cost the developer a registration fee of RM5 million
- This myth has been clarified by Sabah REHDA (SHARED A) in the Borneo Post April 29 2011 as reproduced below;

- “We were misguided on GBI registration fee as the RM5,000 fee is for an individually developed bungalow unit.
- For a development of 1,000 units of double-storey terrace houses each of 172sqm, the fee is as low as RM65 per unit (under Mega Project charges).
- For 500 units, it is at RM90 per unit while the fee is RM200 each for 50 to 100 units.



- It is worthwhile to note that the GBI Registration is a one-off all-in fee that includes Certification and Site Verification visits (even to East Malaysia).
- There is also no additional charge for all rating categories be it Certified or Platinum level.
- As for GBI Facilitator services and charges, this will be market-driven and is not dissimilar to Singapore's Green Mark Manager fee which can range from a "postman service fee" to "enhanced service fee".
- The significant development since the advent of GBI in May 2009 is that LEED A/P and GMM fees have all continued to spiral downwards in tandem with GBIF fees.

Myth No.3: Obtaining GBI certification can cost 20 to 30% more.

Published data from LEED and Green Mark are remarkably similar with cost increase ranging from 0.3% (Certified level) to 8% (Platinum level).

As for GBI costs, these are beginning to become available as registered buildings reach completion and the trend appears to reflect that of LEED and Green Mark green buildings.

Certain residential high rise developers have declared insignificant cost increase to attain GBI Certified level.

- Amongst the completed commercial buildings, the world class Suruhanjaya Tenaga (Energy Commission) GBI Platinum building incurred a green cost premium of only 6% and the GBI Gold rated First Avenue Office building registered a 9% green cost premium with its Thermal Storage Air Conditioning plant accounting for over half of this green cost.
- Building a green building, regardless whether if it is GBI or any other rating, requires knowledge, foresight and good planning, which might not necessarily require additional cost.

Myth No.4: GBI certification is very difficult to achieve

GBI incorporates local by-laws and regulations such as: UBBL, MS1525, MSMA, CIDB QLASSIC, CIDB IBS etc. Therefore, minor (albeit good practice) effort would be required to achieve a basic GBI Certified rating.

Striving for GBI Certified rating will merely require designers and the project team to adopt fundamental good practice measures and awareness of a sustainable environment as aptly demonstrated by the various GBI conducted workshops.

In fact this basic rating level is comparative with most if not all available green building rating tools.

Any lower standard will veer towards green washing.

- Similarly GBI Silver rating will require the project team to adopt excellent practice measures on sustainability while achieving GBI Gold rating will put the building amongst the top 20% achievers in the country.
- Nonetheless it is true that GBI Platinum rating is indeed difficult to achieve.
- This is where GBI lives up to its reputation of international billing and will expect only a handful of such world class buildings.
- If the complaint on GBI being difficult to achieve is premised on GBI Platinum rating then GBI would have achieved its goal.

AWARD CLASSIFICATION COMPARISON BETWEEN GBI & GreenRE (%)

As misrepresented by Dr Daniele Gambero in Sunday 15 June 2014 Starproperty

Percentage score	0 - 49%	50%	55%	60%	65%	66%	70%	75%	76%	80%	85%	86%	90%	95%	100%
GBI	No	Certified				Silver			Gold			Platinum			
GreenRE	No	Bronze							Silver			Gold	Platinum		

THE TRUTH																					
	0 - 26%	27%	30%	32%	41%	46%	48%	49%	50%	52%	54%	55%	58%	65%	66%	75%	76%	85%	86%	90%	100%
GBI	No								Certified					Silver	Gold	Platinum					
GreenRE New Residential	No			Bronze			Silver			Gold		Platinum									
GreenRE New Non-Residential	No		Bronze			Silver			Gold		Platinum										
GreenRE Existing Non-Residential	No	Bronze		Silver	Gold	Platinum															

THE TRUTH

	0 - 26%	27%	30%	32%	41%	46%	48%	49%	50%	52%	54%	55%	58%	65%	66%	75%	76%	85%	86%	90%	100%
GBI	No								Certified				Silver	Gold	Platinum						
GreenRE New Residential	No			Bronze			Silver			Gold		Platinum									
GreenRE New Non-Residential	No		Bronze			Silver			Gold		Platinum										
GreenRE Existing Non-Residential	No	Bronze		Silver	Gold	Platinum															

Percentage score	0 - 49%	50%	55%	60%	65%	66%	70%	75%	76%	80%	85%	86%	90%	95%	100%
GBI points score	0 - 49	50	55	60	65	66	70	75	76	80	85	86	90	95	100

GreenRE points score

GreenRE New Residential	0 - 77	78	86	94	101		109	117		125	133		140	148	156
GreenRE New Non-Residential	0 - 81	82	90	98	107		115	123		131	139		148	156	164
GreenRE Existing Non-Residential	0 - 91	92	101	110	120		129	138		147	156		166	175	184

Available points = 158

Available points = 206

Available points = 184

GreenRE Classification in points	Points
Platinum	≥90
Gold	85 to <90
Silver	75 to <85
Bronze	50 to <75

GBI Classification in points	Points
Platinum	86 to 100
Gold	76 to 85
Silver	66 to 75
Certified	50 to 65

Myth No.5: GBI Qualifying Green Cost approval is very difficult to obtain

Myth No.6: Green Building Index is not as good as other rating tools

Myth No.7: Green Building Index is not internationally recognised, it is widely used only in Malaysia



MALAYSIA CHAPTER

THANK YOU

