

The Cream of BEAM Plus (2015)

A General Review of Platinum Green Buildings

(This paper is aimed at documenting the main points of HKGBC BEAM Pro/BEAM Affiliate
Mandatory CPD Seminar “Cream of BEAM Plus” held on 10.12.2015)

Abstract: BEAM (Building Environmental Assessment Method) Plus is Hong Kong’s green building assessment system. This study investigates the assessment results of 34 Platinum New Building projects that were generated from scheme commencement to Q1 2015. It is found that the mean score of these projects is 81 with particularly high performance in Indoor Environmental Quality (IEQ), Energy Use (EU) and Site Aspects (SA). In addition, an analysis of the adoption status of EU1 Option 2, i.e. passive design route for residential buildings, has been conducted. It is found that nearly 40% of the applicable projects have chosen this route with the majority achieving either Gold or Platinum. A brief analysis of four Platinum-rated Existing Buildings (EB) and four Platinum-rated interior fit-out projects has also been conducted. The mean total score of EB Platinum projects is also 81, with strong performance in SA and EU. For interior Platinum projects, the mean total score is 84 with strong performance in EU and Management.

INTRODUCTION

Initiated in 1996, BEAM (Building Environmental Assessment Method) Plus is the most commonly used green building rating tool in Hong Kong. Today, there are more than 700 projects registered with BEAM Plus. Assessment is divided into two stages: design stage assessment is termed “Provisional Assessment” whereas post-completion assessment is termed “Final Assessment”. For both stages, the awards available under the scheme are Platinum, Gold, Silver and Bronze. Projects meeting the prerequisite requirements in the rating scheme but not yet reaching the Bronze level are rated as “Unclassified”.

“The Cream of BEAM Plus” is a paper published regularly to disseminate the performance of Platinum-rated buildings. The first paper published in 2013 analysed the performance of 12 Platinum projects generated between scheme commencement in August 2010 and the end of 2012. In the second paper published in 2014, the total number of Platinum projects rose to 23 when the analysis was extended to the end of 2013. In this paper, the analysis period has been further extended to the end of Q1 2015. The total number of Platinum new building projects has risen from 23 to 34, which consists of 29 Provisional Platinum projects and 5 Final Platinum projects.

BACKGROUND STATISTICS

Figure 1 shows the background statistics of the registered projects, assessed projects and Platinum projects analysed in this study. Data under the current period of analysis are shown in solid black colour whereas data under the previous period are shown in light grey.

From scheme commencement to the end of Q1 2015, 641 projects had been registered for BEAM Plus assessment. A substantial percentage (43%) of the projects was from the residential sector. The next two major categories were commercial (17%) and government, institution or community (GIC) projects (17%). This composition had not significantly changed since the last analysis period. Among the 248 assessed projects, 47% were from the residential sector, 21% from commercial and 16% from GIC. Again, this profile was similar to the previous period.

Within the Platinum projects, the greatest proportion (47%) was from GIC, whereas the second and third were from residential (29%) and commercial (12%) respectively. This order of sequence was the same as the previous period. The observation here is that GIC projects are the dominant type of projects within the Platinum grade even though they are not dominant among the registered or assessed projects.

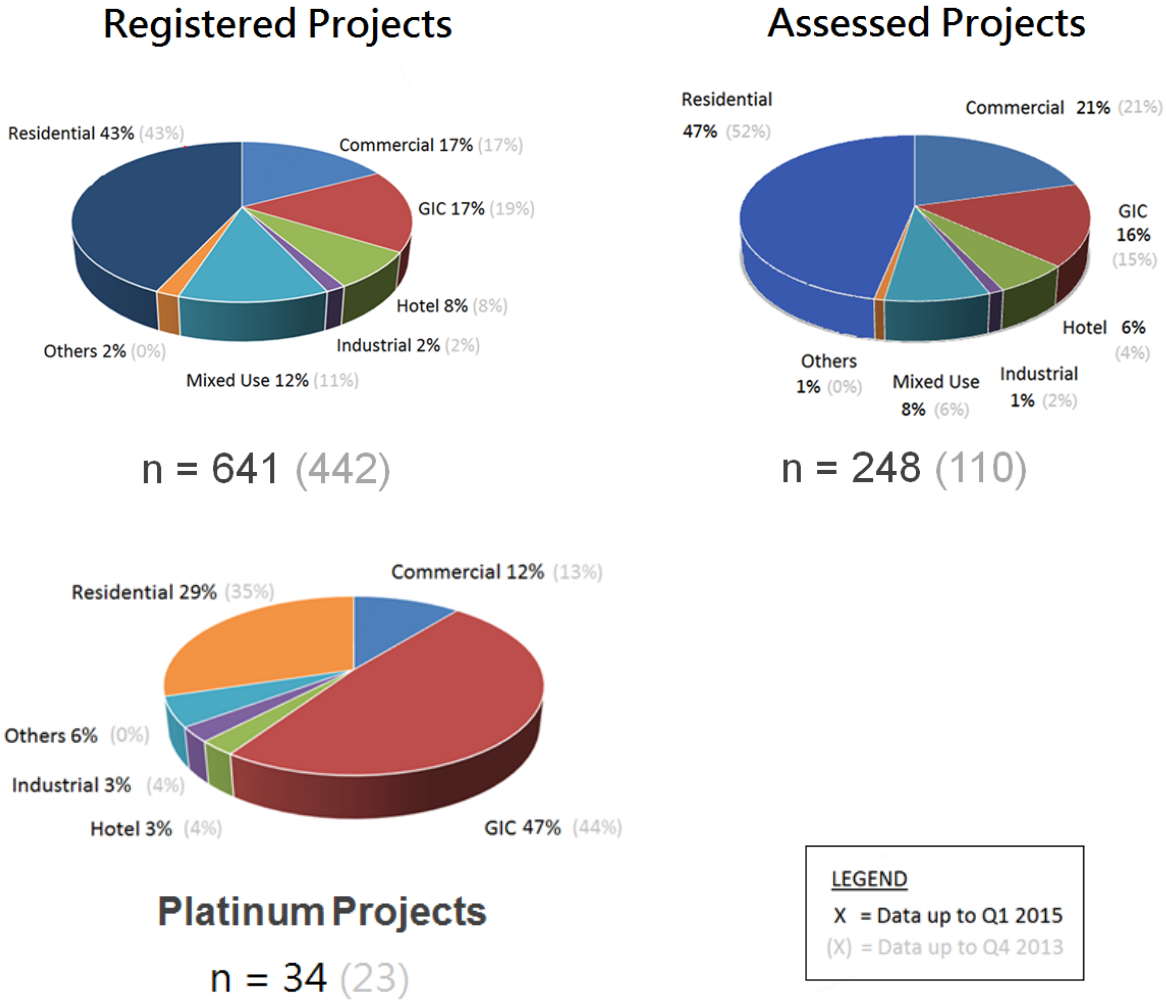


Figure 1 Background statistics about the types of projects

The proportion of projects attaining each grade is illustrated in Figure 2. Compared with the previous period, fewer projects attained the Platinum grade, i.e. the percentage dropped from 21% to 15%. At the other end, the percentage of projects obtaining Unclassified rating rose from 24% to 30%. For the other grades, the changes are not significant.

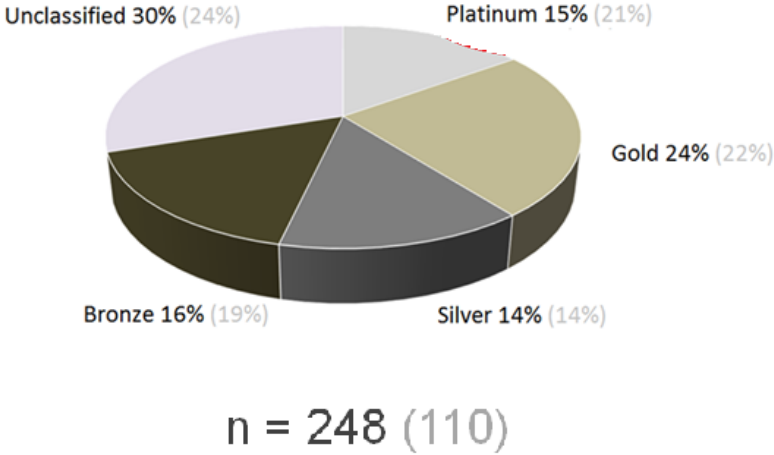


Figure 2 Proportion of projects achieving each grade
 (N.B. Numbers in grey are those presented in an earlier study.)

ANALYSIS OF PLATINUM PROJECTS (NEW BUILDINGS)

The results of analysing the 34 Platinum projects are presented below.

Project Scores

Figure 3 illustrates the individual scores of each project and the score breakdown. The projects are denoted by building types to avoid disclosing their identities. The minimum score required to achieve the Platinum rating is 75. In this sample, about 1/3 (previously 1/2) of the projects attained scores that are higher than 80. The drop in this proportion reflects that the average margin between the actual score and the minimum required score has decreased.

The top 5 highest-score projects are all GIC projects, indicating that government departments and public bodies are active in pursuing outstanding performance.

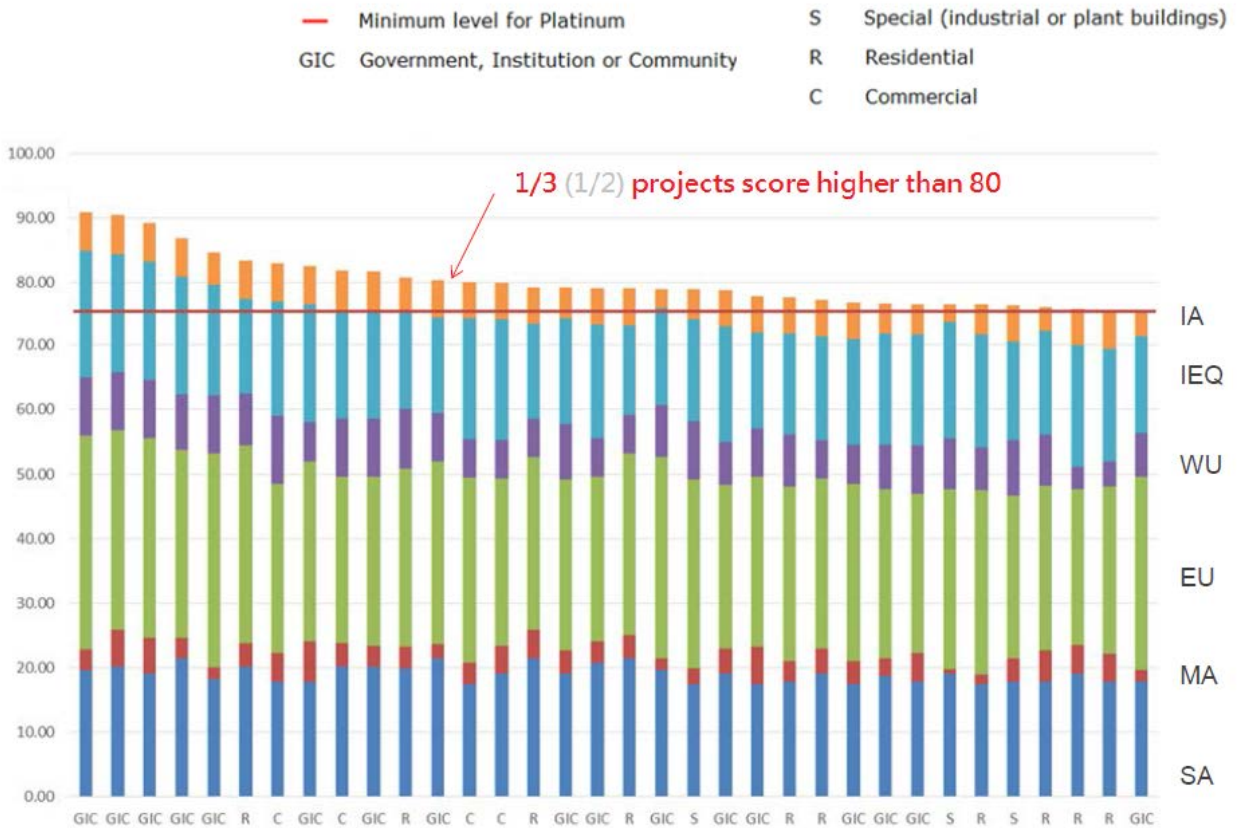


Figure 3 Individual scores of the 34 Platinum projects

(N.B. Number in grey is that presented in an earlier study.)

Category Scores

BEAM Plus scores are calculated in five performance categories, namely Site Aspects (SA), Materials Aspects (MA), Energy Use (EU), Water Use (WU) and Indoor Environmental Quality (IEQ). The number of credits received in each category is divided by the number of applicable credits to obtain a percentage score for that category. The average score achieved in each category, and the average total score, are illustrated in Figure 4 together with the portion of scores that were attempted but failed (shown in orange).

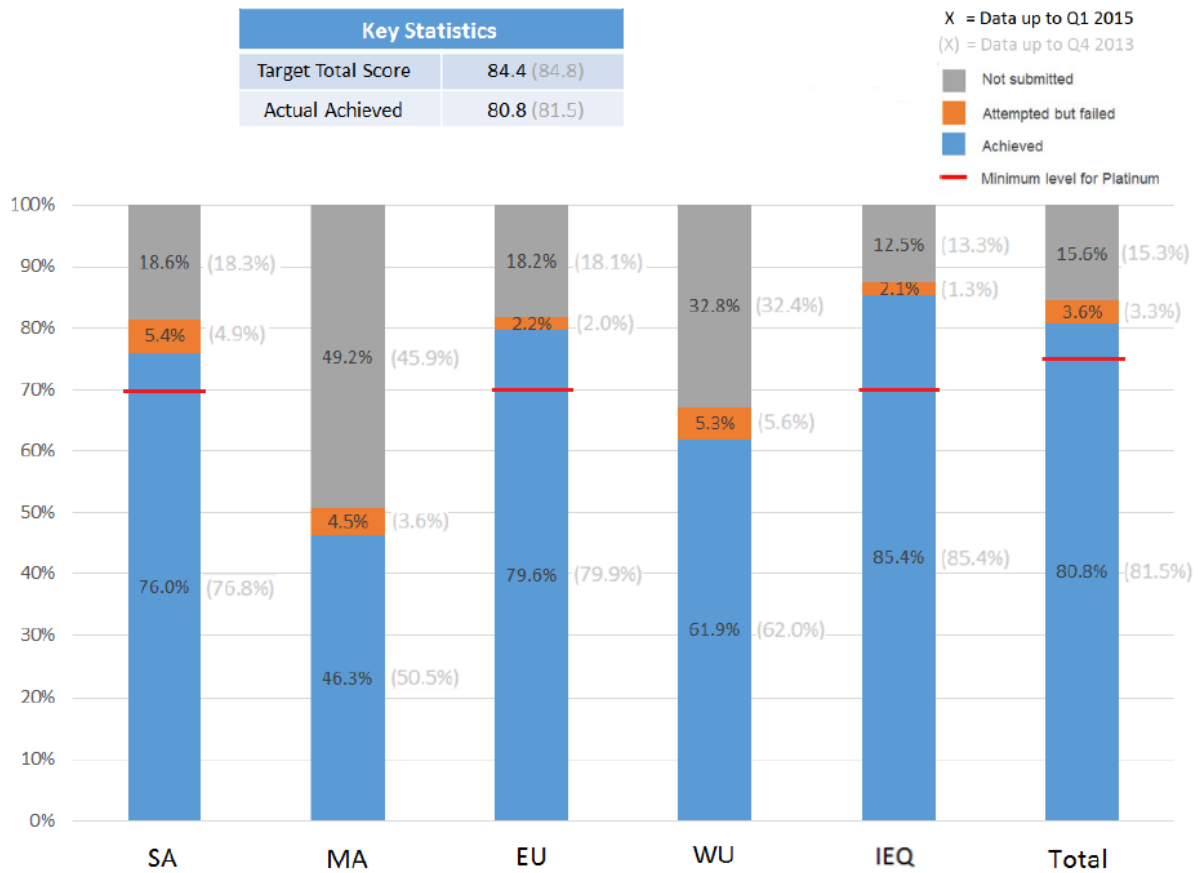


Figure 4 Average category scores and total score achieved by the Platinum projects

From the table given at the top of Figure 4, the “target total score” of the projects did not change much, i.e. 84.8 for the last period and 84.4 for the present period. The “actual achieved score” also did not change much – it slightly dropped from 81.5 to 80.8.

The Platinum projects noticeably exceeded the thresholds in SA, EU and IEQ, with the highest exceedance occurring in IEQ. The amount of score attempted but failed (i.e. the orange portion in Figure 4) was also the smallest in IEQ.

In MA and WU where there were no threshold requirements for achieving the Platinum grade, the scores achieved (in particular MA) were much lower than those obtained in SA, EU and IEQ.

Commonly Achieved Credits

Those BEAM Plus credits where more than 75% of the Platinum projects attained full marks are given in Table 1.

Table 1 Areas where more than 75% of Platinum projects achieved full marks

| Credit | Achievement Rate |
|---|------------------|
| SA2b Availability of Public Transport | 96.8% |
| SA3a Neighbourhood Basic Services | 86.7% |
| SA3b Neighbourhood Recreational Facilities | 100.0% |
| SA4a Site Design Appraisal (Normal Credit) | 100.0% |
| SA9 Neighbourhood Daylight | 78.8% |
| SA10 Construction Environmental Management Plan | 100.0% |
| SA11 Air Pollution during Construction | 100.0% |
| SA12 Noise Pollution during Construction | 97.1% |
| SA13 Water Pollution during Construction | 97.1% |
| SA14 Noise from Building Equipment | 97.0% |
| MA8a Ozone Depleting Substances - Refrigerants | 100.0% |
| MA8b Ozone Depleting Materials | 91.2% |
| MA9 Regional materials | 82.4% |
| EU2 Reduce Peak Electricity Demand | 81.3% |
| EU4 Carpark Ventilation | 81.8% |
| EU5 Carpark Lighting | 90.9% |
| EU10a Commissioning Specification | 97.1% |
| EU10b Commissioning Plan | 97.1% |
| EU10c Ensure Full Commissioning | 97.1% |
| EU10d Commissioning Report | 97.1% |
| EU11a O&M Manual | 100.0% |
| EU11b Energy Management Manual | 97.1% |
| EU11c Training and O&M Facilities | 82.4% |
| EU12 Metering | 100% |

(to be continued)

Table 1 Areas where more than 75% of Platinum projects achieved full marks (cont'd)

| Credit | Achievement Rate |
|---|------------------|
| WU6 Reducing Sewage Discharge | 94.1% |
| IEQ1 Security Design | 100.0% |
| IEQ2 Drainage Design to Avoid Transmitting Bacteria | 100.0% |
| IEQ3 Legionnaires' Disease Prevention | 95.8% |
| IEQ4 Refuse Room Deodourising | 100.0% |
| IEQ5a Construction IAQ Plan | 95.2% |
| IEQ5b Filter Replacement and Flush-out | 90.5% |
| IEQ6 Outdoor Sources of Air Pollutants | 96.7% |
| IEQ7 Indoor Sources of Air Pollutants | 85.3% |
| IEQ8 Carpark IAQ | 81.3% |
| IEQ9 Increased Ventilation | 77.3% |
| IEQ10 Natural Ventilation | 87.5% |
| IEQ11a Localized Ventilation | 97.1% |
| IEQ13a Thermal Comfort in AC Premises - Temperature | 90.5% |
| IEQ14b Thermal Comfort in NV Premises - Performance with air-conditioning | 77.8% |
| IEQ16a Interior Lighting (Occupied)(Normal Credit) | 87.0% |
| IEQ16b Daylight Sensor or Occupancy Sensor | 75.0% |
| IEQ17 Interior Lighting (Normally Not Occupied Spaces) | 88.2% |
| IEQ21 Indoor Vibration | 78.1% |
| IEQ22 Universal Access for Persons with a Disability | 94.1% |
| IEQ23a Amenity Features - Amenities for the Benefit of Bldg Users | 90.3% |
| IEQ23b Amenity Features - Amenities for Improved O&M | 85.3% |

It should be noted that some of the above items were also commonly achieved by all projects in general. These items include EU11a (O&M manuals), EU11b (energy management manuals), EU10a to d (commissioning) and SA10 (construction environmental management plan).

In summary, the Platinum projects had the following strengths:

- Availability of public transport near the site
- Neighbourhood amenities
- Site design appraisal
- Pollution management for both construction stage and operation stage
- Avoidance of ozone depleting substances
- Peak electricity demand reduction
- Carpark energy use
- Metering
- Reducing effluent discharge
- Security design
- Thermal comfort
- IAQ and ventilation
- Interior lighting
- Universal access
- Amenity features in buildings

Further statistics on the Platinum projects are provided as follows:

Site Aspects

- Greenery as a percentage of site area ranges from 11% to 65%, with an average at 39%.
- 74% of the Platinum projects adopted green roofs. Greenery as a percentage of roof area (excluding areas occupied by mechanical equipment) ranges from 23% to 100%, with an average at 57%.

Materials Aspects

- 47% of the Platinum projects received credits for the use of recycled materials in exterior paving works. The percentage of recycled content ranges from 10% to 89%, with an average at 34%.
- 53% of the Platinum projects received credits for construction waste recycling. The percentage of waste recycled ranges from 30% to 89%, with an average at 37%.

Energy Use

- For the projects with energy simulation data, the annual reduction in energy use ranges from 12% to 60%, with an average at 29%. The reduction in peak electricity demand ranges from 8% to 47%, with an average at 29%.
- Renewable energy was adopted in 68% of the Platinum projects and 39% of these renewable energy projects attained full marks in the relevant credit (EU6).
- Among the energy saving techniques frequently used in the Platinum projects are the following (number in brackets is the percentage of Platinum projects adopting the technique): building orientation (65%); shading devices (53%); low-e glass (38%), daylight/occupancy sensors (32%), demand control ventilation (32%) and hybrid ventilation (32%).

Water Use

- Low-flow water fixtures were widely adopted to reduce fresh water use. The annual reduction in water use ranges from 22% to 65%, with an average at 39%.
- Dual-flush toilets and low-flow urinals were widely adopted to reduce sewage discharge. Annual effluent reduction ranges from 20% to 63%, with an average at 43%.
- Rainwater harvesting was adopted in 59% of the Platinum projects. The resulting reduction in fresh water use ranges from 5% to 99%, with an average at 29%.
- Grey water recycling was adopted in 6% of the Platinum projects. The resulting reduction in fresh water use ranges from 8% to 13%, with an average at 11%.
- 59% of the Platinum projects adopted water-efficient irrigation. The reduction in water use for irrigation ranges from 50% to 100%, with an average at 67%.

Innovations

The innovative features adopted in recent Platinum projects are described below.

- Acoustic windows by research

- Real-time broadcast of environmental performance using Intranet
- 5D BIM
- Cycle-friendly design throughout a campus, i.e. cycling path network, sufficient bicycle racks and provision of showering facilities
- Biomechanical louvres, i.e. active green walls
- Hybrid ventilation for offices, i.e. operable louvres on external walls with interlock to the central air-conditioning system

It should be noted that some of the above features may be adopted increasingly over time in the building industry. It is thus likely that these features will no longer be counted as innovative techniques in future.

Performance Enhancements

BEAM Plus allows project designers to achieve bonus credits not only through innovation, but also by demonstrating that the performance of a project greatly exceeds the requirements of the existing credit areas. Among the performance-enhancing features of the 34 Platinum projects are the following:

- Regionally manufactured materials (73% of all materials were regionally manufactured as compared to 20% stipulated in MA9)
- Green roof and cool roof (94-100% roof area as compared to 50% in SA8b)
- Site greenery (50-65% site area as compared to 40% in SA7b)
- Hard-paved construction sites to minimise dust and enable reuse of paving panels
- Food waste handling system provided on site to minimise the volume of municipal waste
- Use of BIM to enhance environmental performance
- Twin-tank system to save water
- Two-stage lighting system in common spaces to fulfil the need of visually impaired persons while minimising energy use
- Solar desiccant dehumidification system
- Provision of charging facilities for more than 50% of car parking spaces

Less Achieved Areas

Analysis of the 34 Platinum projects also reveals that some of the BEAM Plus criteria were less commonly achieved. Table 2 lists the areas in which less than 35% of the projects attained full marks. The 35% threshold (instead of the lower quartile) was chosen to give a broader view of these weak areas.

Table 2 Credits less commonly (<35%) achieved by the Platinum projects

| Credit | Achievement Rate |
|---|------------------|
| SA1 Contaminated Land Assessment and Rehabilitation (Bonus) | 0.0% |
| SA2a Elimination of Private Car Parks | 16.1% |
| SA8b Microclimate - Elevated Temperatures | 11.8% |
| MA1a Building Reuse (Normal Credits) | 0.0% |
| MA1b Building Reuse (Bonus Credit) | 0.0% |
| MA3 Prefabrication off Site | 20.6% |
| MA5 Rapidly Renewable Materials | 0.0% |
| MA7b Recycled Materials - Building Structure | 23.5% |
| MA7c Recycled Materials - Interior Components | 14.7% |
| MA10 Demolition Waste Reduction | 22.2% |
| MA11 Construction Waste Reduction | 23.5% |
| EU3b Energy in Structural Materials (Bonus Credit) | 29.4% |
| EU6 Renewable Energy | 23.5% |
| EU13 Energy Efficient Building Layout (Passive Design) | 12.5% |
| WU2 Water Leakage Monitoring | 14.7% |
| WU4b Grey Water Recycling | 5.9% |
| IEQ11b General Exhaust for Future Tenants | 27.3% |
| IEQ12b Natural Ventilation for Common Areas | 25.8% |
| IEQ15 Natural Lighting | 34.4% |
| IEQ19b Noise Isolation between Rooms (Bonus Credit) | 9.5% |

Some of the above items had a low achievement rate because the Applicants did not pursue the credits. Examples include MA5 (rapidly renewable materials), SA1 (contaminated land assessment), WU4b (grey water recycling), MA7b & c (recycled materials – structural and interior), MA3 (prefabrication) and EU3b (use of materials with low LCA).

Contested credits are another reason for the low scores, i.e. the Applicants attempted the credits but failed. Examples include WU2 (water leakage monitoring), EU13 (energy-efficient building layout) and SA8b (microclimate - elevated temperatures). Reasons of contesting vary but typical reasons include inadequate coverage of the features, insufficient documents, incorrect interpretation of credit intents, etc.

Adoption Status of Passive Design Route

In 2012, the BEAM Plus New Buildings rating tool was updated from Version 1.1 to Version 1.2 by providing residential buildings with an alternative route to achieve EU1 (reduction of annual energy), EU2 (reduction of peak electricity demand) and EU13 (energy-efficient building layout). The route includes the adoption of various prescriptive and/or performance-based passive building design techniques to save energy. The adoption status of this route has been analysed using the data up to Q1 of 2015. The results are given in Table 3.

Table 3 Adoption rate of EU1 Option 2

| Sample | Opt 2 Adoption Rate |
|----------------------------------|---------------------|
| All v1.2 residential projects | 39 % * |
| Platinum only (v1.2 residential) | 100 % |

* Out of 31 projects, 12 adopted Opt 2, of which 5 got Platinum, 6 got Gold and 1 got Silver.

From Table 3, it can be seen that nearly 40% of the applicable projects (i.e. residential type, registered for Version 1.2) chose EU1 Option 2. The vast majority of these projects got good results i.e. Gold or Platinum. In fact, all the Platinum residential projects using Version 1.2 had adopted EU1 Option 2.

The sub-item achievement status within this alternative route has been analysed. The result is given in Table 4.

Table 4 Sub-item achievement status within EU1 Option 2

Passive Design

| | Permeability | Orientation | OTTV | Daylight |
|--------------------------|--------------|--------------|--------------|--------------|
| Average credits obtained | 1.6 out of 2 | 0.9 out of 1 | 4.6 out of 5 | 0.9 out of 1 |

Natural Ventilation

| | Prescriptive approach | Performance approach |
|--------------------------|-----------------------|----------------------|
| No. of projects pursuing | 9 | 2 |
| Average credits obtained | 1.1 out of 5 | 4 out of 5 |

Active Systems in Common Areas

| | HVAC | Lighting | Vertical transportation |
|--------------------------|--------------|--------------|-------------------------|
| Average credits obtained | 1.8 out of 2 | 2.8 out of 3 | 0.7 out of 1 |

From Table 4, it can be seen that most of the passive design requirements like orientation, OTTV and daylight were well-achieved. For natural ventilation, most projects adopted the prescriptive approach but the scores obtained were not high. A few projects adopted the performance approach and their scores were much higher than those choosing prescriptive approach. For active systems in common areas, the scoring was also quite high.

OTHER PLATINUM PROJECTS

The above part of this paper concentrates on analysis of Platinum new building (NB) projects. In the following parts, a brief account on the analysis of Platinum existing buildings (EBs) and BEAM Plus Interiors (BI) projects will be given.

EB Platinum

From scheme commencement to Dec 2015, there were four existing building developments achieving the Provisional or Final Platinum rating under BEAM Plus EB. Most of these buildings were office buildings with one exception that was a residential estate. The analysis of their average category scores is presented in Figure 5. The mean total score achieved by these projects is 81, which is 6 points higher than the minimum score required for Platinum. The two most significant high-performance areas are SA and EU. They outperformed the Platinum bars by 25~26% in these two areas.

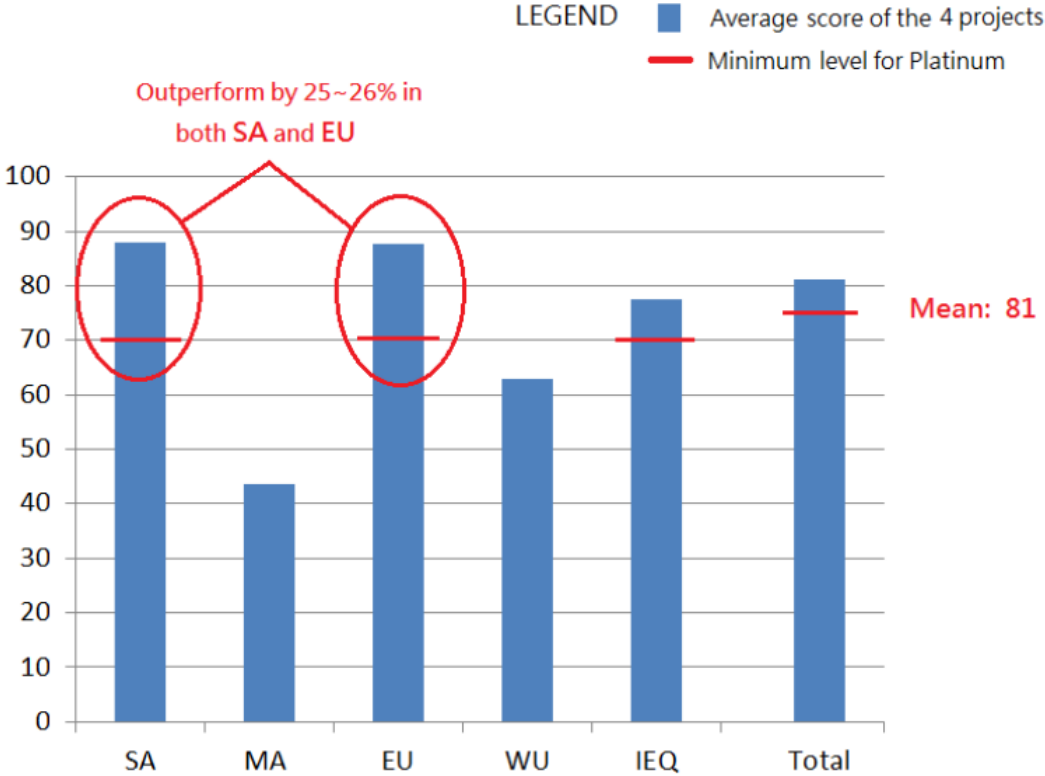


Figure 5 Average category scores and overall score achieved by the EB Platinum projects

Examples of techniques adopted by these projects in innovations and performance enhancements include:

- High-performance liquid solar control film (which is more durable than solid film)
- Proactive maintenance in tenant areas
- Tenant/visitor education (e.g. ambassadors, tours, etc.)
- Promoting the use of electric vehicles
- Long-term practice of sustainability reporting
- Extra amenities provided in the building such as clinic and mother-care room

The EB rating tool has recently been revamped. The new version i.e. Version 2.0 will include a Comprehensive Scheme A for one-step assessment, a Comprehensive Scheme B for stepwise improvement assessment and a Selective Scheme for individual category assessment. The new tool will begin to accept registrations in late March 2016. With this new scheme, it is expected that a wider range and larger number of existing buildings will participate in the rating. This will be conducive to the transformation of the large amount of existing building stock in the city.

BI Platinum

From scheme commencement to Dec 2015, there were four interior fit-out projects achieving Platinum rating under BEAM Plus Interiors. Most of these were offices with one exception that was a public exhibition space. The analysis of their average category scores is presented in Figure 6. The mean total score achieved by these projects is 84, which is 9 points higher than the minimum score required for Platinum. One notable high-performance area is EU. The projects outperformed the Platinum bar by 29% in this area. Another high-performance area is MAN (Management), the mean score of which is above 80.

Typical innovative techniques are given in Section 9.4 of the BEAM Plus Interiors Manual for Applicants to consider adopting. An analysis of the four Platinum projects reveals that the three most commonly adopted innovative techniques are:

- Real-time energy monitoring display
- ISO50001 energy management system
- Achieving IAQ Excellent Class

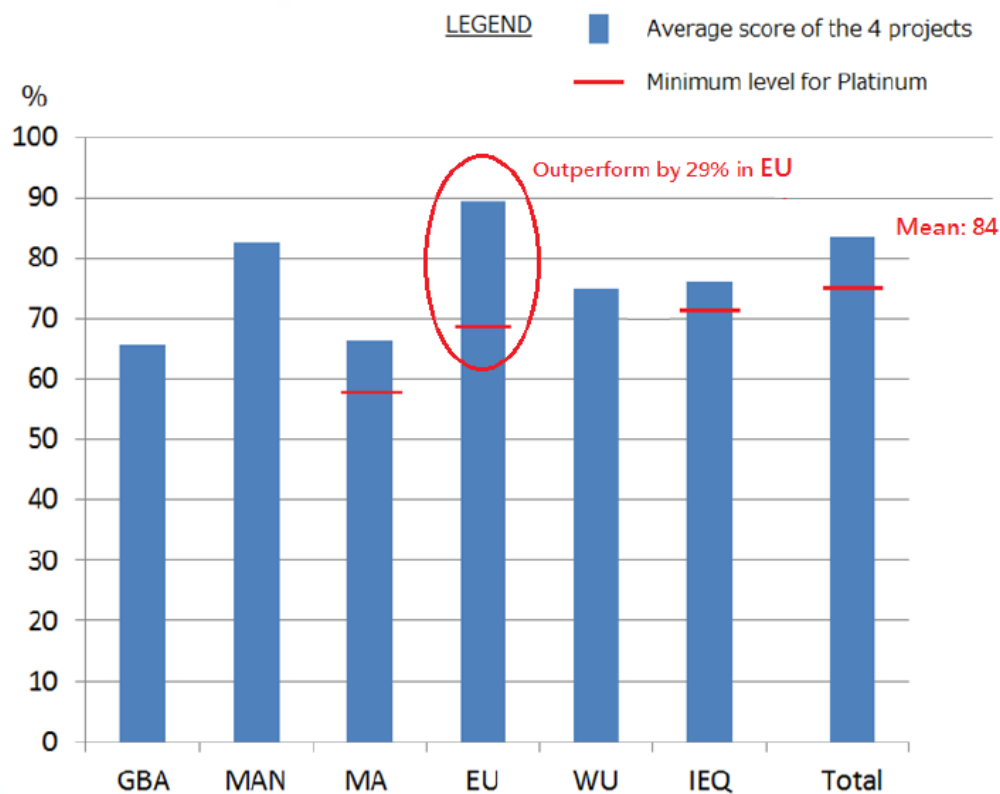


Figure 6 Average category scores and overall score achieved by the BI Platinum projects

CONCLUSION

This paper has analysed 34 Platinum New Building projects that emerged from scheme commencement to Q1 of 2015. The mean score of these projects is 81 with particularly high performance in IEQ, EU and SA. Examples of high-performance areas include neighbourhood amenities, site design appraisal, pollution management, avoidance of ozone depleting substances, peak energy demand reduction, metering, reducing effluent discharge and providing good quality in various aspects of indoor environment.

An analysis of the adoption status of EU1 Option 2, i.e. passive design route has been conducted. It is found that nearly 40% of the applicable projects have chosen EU1 Option 2, with the majority achieving either Gold or Platinum.

A brief analysis of 4 Platinum-rated existing building projects and 4 Platinum-rated interior fit-out projects has also been conducted. For existing buildings, the mean total score is 81, with particularly high performance in SA and EU. For BI, the mean total score is 84, with particularly high performance in EU and MAN.

ACKNOWLEDGEMENTS

The HKGBC Secretariat would like to thank Prof. John Ng for delivering the CPD seminar and BEAM Society Limited for providing assistance in the study. Project owners' information is also gratefully acknowledged. Video footage of the CPD seminar is available on HKGBC On-line Training Portal: <http://onlinecpdtraining.hkgbc.org.hk/>