Building and Construction Authority

We shape a **safe**, **high quality**, **sustainable** and **friendly** built environment.

Our ref : APPBCA-2016-07
Date :10/08/2016

Building Engineering Group (#12-01)
Tel : 68044613
Fax : 63342561
E-mail : woo_kwan_wye@bca.gov.sg

See Distribution List

Dear Sir/Madam,

SAFETY REQUIREMENTS WHEN ADDING GREENERY, SOLAR PANELS AND OTHER FEATURES TO BUILDING ROOFTOPS UNDER THE BUILDING CONTROL ACT

Objective

This circular serves to remind stakeholders on the safety requirements under the Building Control Act when adding greenery, solar panels and other features to existing building rooftops.

Background

2 On 20 May 2016, the entire roof structure of a Sports Hall at the City University of Hong Kong (CityU) collapsed, injuring three staff members. The roof was retrofitted with a roof greening system as part of the University's project on greening the campus. The University's Investigation Committee has identified the roof's loading capacity, impact of rain, soil materials used for the roof greening works, and the efficiency of the drainage system of the green roof system, as the contributing factors that led to the roof's collapse.

Building Control Requirements

3 Under Regulation 45(1) of the Building Control Regulations 2003, no building shall be subjected to any load beyond its design loads as indicated in the approved detailed structural plans and design calculations relating to the building. Non-compliance with Regulation 45(1) is an offence.

4 It is important that building owners, tenants and building management are aware of the roof loading restrictions and ensure that the maximum load bearing capacity of the roof must never be exceeded when greenery, solar panels and other features are added to existing rooftops.

Structural considerations before installation of rooftop greenery, solar panels and other features

5 Building owners are responsible for the installation, maintenance and safety of any features installed on their rooftops. All bracings, mounting systems and fixings required to secure the installation of any rooftop greenery elements, solar panels and other features should be properly designed and able to withstand loads from wind (including uplift) and rain. Therefore, building owners should engage a Professional Engineer (PE) for advice and assess if approvals under the Building Control Act are required. Additionally, the PE should check and certify the structural loading capacity and advise if the roof is suitable to accommodate the proposed rooftop greenery, solar panels and other features. If necessary, the PE should obtain a set of structural drawings (if available) for the purpose of this assessment.

6 The engaged PE should also check if the design capacity of the existing roof can support additional loads such as water ponding that may arise from heavy rain. If the existing roof is able to accommodate the additional loads, a copy of the PE's drawings, design calculations and certification must be given to the building owner. These documents would be needed in the future when the building owner appoints a PE to carry out the mandatory periodic structural inspection (PSI) of the building and will serve to aid the PE in assessing the condition and adequacy of the roof structure.

7 If there is a need to strengthen the structural elements of the building, the PE should submit the structural plans and design calculations to BCA for approval as required under Section 5 of the Building Control Act. Design capacity checks and strengthening proposals should include all loadings (such as the soil loading, current and future plants/trees loading and retained moisture during heavy rainfall, etc). These loading considerations should be in addition to the design imposed load for the roof which should be in accordance with the provisions of the Singapore Standard SS EN 1991-1-1 including its associated Singapore National Annex.

Advisory on rooftop maintenance

8 BCA recommends that as good practice, building owners should adopt the following when designing and installing greenery, solar panels and other features onto a building's rooftop:-

a) Drainage and waterproofing

To ensure that the roof structure is not overloaded due to water ponding, the rooftop should be provided with an effective drainage system to discharge excess water. The waterproofing integrity of the roof structure must also not be compromised by the introduction of these additional features on the roof as the waterproofing protects the roof structure against water infiltration that may result in structural deterioration.

b) Regular inspection and maintenance

(i) A regular maintenance schedule should be put in place by the building owners. Maintenance including inspections of the supporting roof structure, and the features' supporting frames and mounting systems, to check for structural defects such as loosening of bolt connections, metal corrosion and spalling concrete. As good practice, the appointed PE should also look out for such defects and recommend appropriate rectification measures to be carried out by the building owners during PSI.

(ii) Silt, sediment, plant debris and litters should be cleared so that they do not compromise the rooftop drainage systems. All drain chokages should be removed to prevent water stagnation which otherwise could lead to the build-up of water, resulting in overloading of the roof structure.

9 I would appreciate it if you could disseminate the contents of this letter to the members of your organisation.

Clarification

10 Please contact Mr Woo Kwan Wye at Tel 6804 4613 or call the hotline at 1800-3425222 (1800-DIAL BCA), or email bca_enquiry@bca.gov.sg if you need any clarification. Thank you.

Yours faithfully

CHANG BEK MEI
DIRECTOR
BUILDING ENGINEERING GROUP
for COMMISSIONER OF BUILDING CONTROL
BUILDING AND CONSTRUCTION AUTHORITY

CIRCULAR DISTRIBUTION LIST

ASSOCIATIONS / SOCIETIES

PRESIDENT
INSTITUTION OF ENGINEERS, SINGAPORE (IES)
70, BUKIT TINGGI ROAD
SINGAPORE 289758
ies@iesnet.org.sg

PRESIDENT
ASSOCIATION OF CONSULTING ENGINEERS, SINGAPORE (ACES)
18 SIN MING LANE
#06-01 MIDVIEW CITY
SINGAPORE 573960
secretariat@aces.org.sg

PRESIDENT
SINGAPORE CONTRACTORS ASSOCIATION LIMITED (SCAL)
CONSTRUCTION HOUSE
1 BUKIT MERAH LANE 2
SINGAPORE 159760
enquiry@scal.com.sg

PRESIDENT
SINGAPORE INSTITUTE OF ARCHITECTS (SIA)
79 NEIL ROAD
SINGAPORE 088904
info@sia.org.sg

PRESIDENT
SOCIETY OF PROJECT MANAGERS (SPM)
MACPHERSON ROAD P.O.BOX 1083
SINGAPORE 913412
sprojm@yahoo.com

PRESIDENT
SINGAPORE INSTITUTE OF BUILDING LIMITED (SIBL)
70 PALMER ROAD,
#03-09C PALMER HOUSE
SINGAPORE 079427
josephine@sib.com.sg

PRESIDENT
REAL ESTATE DEVELOPERS' ASSOCIATION OF SINGAPORE (REDAS)
190 CLEMENCEAU AVENUE
#07-01 SINGAPORE SHOPPING CENTRE
SINGAPORE 239924
enquiry@redas.com

PRESIDENT
SINGAPORE INSTITUTE OF SURVEYORS & VALUERS (SISV)
110 MIDDLE ROAD #09-00
CHIAT HONG BUILDING
SINGAPORE 188968
sisv.info@sisv.org.sg

PRESIDENT
SINGAPORE STRUCTURAL STEEL SOCIETY (SSSS)
1 LIANG SEAH STREET
#02-11/12 LIANG SEAH PLACE
SINGAPORE 189022
secretariat@ssss.org.sg

PRESIDENT
GEOTECHNICAL SOCIETY OF SINGAPORE
C/O PROFESSIONAL ACTIVITIES CENTRE
NUS FACULTY OF ENGINEERING
9 ENGINEERING DRIVE 1
SINGAPORE 117576
geoss@nus.edu.sg

PRESIDENT
PROFESSIONAL ENGINEERS BOARD, SINGAPORE (PEB)
52 JURONG GATEWAY ROAD, #07-03
SINGAPORE 608550
registrar@peb.gov.sg

PRESIDENT
BOARD OF ARCHITECTS (BOA)
5 MAXWELL ROAD
1ST STOREY TOWER BLOCK
MND COMPLEX
SINGAPORE 069110
boarch@singnet.com.sg

DIRECTOR
PROTECTIVE INFRASTRUCTURE & ESTATE
DEFENCE SCIENCE & TECHNOLOGY AGENCY
1 DEPOT ROAD #03-01J
SINGAPORE 109679
oyewhing@dsta.gov.sg

DEPUTY DIRECTOR
PROJECT DEVELOPMENT & MAINTENANCE BRANCH
MINISTRY OF EDUCATION
1 NORTH BUONA VISTA DRIVE
OFFICE TOWER LEVEL 9
SINGAPORE 138675
eng_wee_tong@moe.gov.sg

DIRECTOR
BEST SOURCING DEPARTMENT
PUBLIC UTILITIES BOARD
40 SCOTTS ROAD #18-01
ENVIRONMENT BUILDING
SINGAPORE 228231
koh_boon_aik@pub.gov.sg
lim_kim_tee@pub.gov.sg

DEPUTY CHIEF EXECUTIVE
INFRASTRUCTURE & DEVELOPMENT
LAND TRANSPORT AUTHORITY
1 HAMPSHIRE ROAD
BLOCK 8 LEVEL 1
SINGAPORE 219428
chong_kheng_chua@lta.gov.sg

DEPUTY DIRECTOR
PROJECT DEVT & MGT SECT 1 (C&S)
BUILDING QUALITY GROUP
HOUSING & DEVELOPMENT BOARD
HDB HUB
480 LORONG 6 TOA PAYOH
SINGAPORE 310480
low_kiang_heng@hdb.gov.sg

DIRECTOR
TECHNICAL SERVICES DIVISION
JTC CORPORATION
THE JTC SUMMIT
8 JURONG TOWN HALL ROAD
SINGAPORE 609434
chwee.koh@jtc.gov.sg

DIRECTOR
BUILDING
PEOPLE'S ASSOCIATION
9 STADIUM LINK
SINGAPORE 397750
foo_soon_leng@pa.gov.sg

PRESIDENT
THE TUNNELLING AND UNDERGROUND
CONSTRUCTION SOCIETY SINGAPORE (TUCSS)
C/O CMA INTERNATIONAL CONSULTANTS PTE LTD
1 LIANG SEAH STREET
#02-12 LIANG SEAH PLACE
SINGAPORE 189022
info@tucss.org.sg

PRESIDENT
SOCIETY OF ROCK MECHANICS AND ENGINEERING GEOLOGY
1 LIANG SEAH STREET
#02-12 LIANG SEAH PLACE
SINGAPORE 189022
srmeg@cma.sg

DEPUTY CHIEF EXECUTIVE OFFICER
SENTOSA DEVELOPMENT CORPORATION
33 ALLANBROOKE ROAD, SENTOSA
SINGAPORE 099981
agencies_circulars@sentosa.com.sg

HEAD (FIRE SAFETY AND BUILDING CONTROL)
BUILDING AND INFRASTRUCTURE
DEFENCE SCIENCE & TECHNOLOGY AGENCY
1 DEPOT ROAD
DEFENCE TECHNOLOGY TOWER A
SINGAPORE 109679
HOW AH MENG
EMAIL: HAHMENG@DSTA.GOV.SG

MANAGER (ARCHITECTURAL PLANS)
BUILDING AND INFRASTRUCTURE
DEFENCE SCIENCE & TECHNOLOGY AGENCY
1 DEPOT ROAD
DEFENCE TECHNOLOGY TOWER A
SINGAPORE 109679
SEBASTIAN LIM HAI KONG
EMAIL: LHAIKONG@DSTA.GOV.SG

PRESIDENT
SINGAPORE INSTITUTE OF LANDSCAPE ARCHITECTS (SILA)
1003 BUKIT MERAH CENTRAL
SUITE #03-13
SINGAPORE 159836
EMAIL: secretariat@sila.org.sg

CHAIRMAN
LANDSCAPE INDUSTRY ASSOCIATION OF SINGAPORE (LIAS)
1 EXPO DRIVE
#02-01
SINGAPORE 486150
EMAIL: secretariat@lias.org.sg

CHAIRMAN
SUSTAINABLE ENERGY ASSOCIATION OF SINGAPORE (SEAS)
1 Cleantech Loop
#02-16 Cleantech One
Singapore 637141
EMAIL: info@seas.org.sg

ADITI SRIDHAR
SOLAR ENERGY RESEARCH INSTITUTE OF SINGAPORE (SERIS)
NATIONAL UNIVERSITY OF SINGAPORE (NUS)
BLOCK E3A, #06-01
7 ENGINEERING DRIVE 1
SINGAPORE 117574
EMAIL: seris-info@nus.edu.sg