



# **Review of the ban on the use of combustible materials in and on the external walls of buildings including attachments**

## **Response to technical consultation paper**

### **Administrative Details:**

Name:	Dr Hywel Davies
Position:	Technical Director
Name of organisation (if applicable):	Chartered Institution of Building Services Engineers
Address:	222, Balham High Road, London, SW12 9BS
Email address:	hdavies@cibse.org
Telephone number:	07590 047086

## **The views expressed in this response are an official response to the Consultation by the Chartered Institution of Building Services Engineers**

The Chartered Institution of Building Services Engineers is the professional body that exists to:

*‘support the Science, Art and Practice of building services engineering, by providing our members and the public with first class information’*

CIBSE members are the engineers who design, install, operate, maintain and refurbish the energy using systems installed in buildings, including homes, and are specifically trained in the assessment of heat loss from building fabric and the design of energy using systems for the provision of heating and hot water, lighting, ventilation and cooling and small power distribution in homes. Many CIBSE members work in the public sector in general and in higher education in particular.

CIBSE has over 20,000 members, of whom around 75% operate in the UK and many of the remainder in the Gulf, Hong Kong and Australasia. Many are actively involved in the energy management of commercial buildings for larger businesses, and so this consultation is highly relevant to us and to our members.

As an Institution CIBSE publishes Guidance and Codes which provide best practice advice and are internationally recognised as authoritative. The CIBSE Knowledge Portal, makes our Guidance available online to all CIBSE members and is the leading systematic engineering resource for the building services sector. Over the last twentyone months it has been accessed over 200,000 times, and is used regularly by our members to access the latest guidance material for the profession. Currently we have users in over 170 countries, demonstrating the world leading position of UK engineering expertise in this field.

The Institution is pleased to respond to the technical consultation paper reviewing the ban on the use of combustible materials in and on the external walls of buildings, including attachments

### **Consultation question responses**

Questions 1 & 2 are answered in the Administrative Details and introduction above.

#### **Question 3.**

**a. Do you agree that hotels, hostels and boarding houses should be included in the definition of relevant buildings in Regulation 7(4)? Please provide evidence to support your answer.**

*Note: This question can only be answered in tandem with question 4a – it is answered here on the basis that the answer to Q4 is 11m. If a lower height threshold is adopted, we would review our position.*

Yes. We agree that the exclusion in Regulation 7(4) (a) (iii) for these buildings should be removed.

**Evidence & rationale:** These buildings should all be included as they contain sleeping accommodation with a risk that the occupants are unlikely to be familiar with the building layout and provisions for means of escape. Residents are likely to need longer to evacuate safely in the event of a fire, the Required Safe Egress Time (RSET).

**b. Should any other building types be included within the scope of the ban?**

The ban should include halls of residence.

**Evidence & rationale:** Residential buildings occupied by those in full time education need to be considered, although the height threshold needs careful consideration, and the findings of the investigation into the fire in the “Cube” building in Bolton should be carefully reviewed prior to finalizing any changes. It must be recognised that the Cube was below 18m, and that there are a number of factors other than the external cladding to be considered.

**Question 4.**

**a. Do you agree that the height threshold of the ban should be reduced to at least 11m and above?**

We support a change in the height limit in Regulation 7(4) (a) to 11m.

**Evidence & rationale:** There is still contention about the height at which fire and rescue services can operate to rescue people from higher rise buildings. It is understood that two people were rescued from the Cube. Its also not just about height, but about the access at ground level to get heavy appliances into a safe location to effect rescue, and about the occupants. The Cube fire was early on a Friday evening with young fit occupants. It is a concern that some 4-5 hours later those occupants might have been less able to be rescued.

At present there appears to a consensus view in support of changing, supported by the NFCC. If at all possible the changes should seek consistency with devolved governments to avoid confusion. Different thresholds also contribute to a reduced public confidence in the regulations, as has been amply demonstrated in recent weeks.

**b. Is there another lower height threshold that should be considered? Please provide evidence**

Yes. Considerations should be given to higher risk Residential (institutional) buildings under Purpose Group 2(a) - such as care homes, which may require lower height thresholds. There may also be a case for including other healthcare buildings which provide sleeping accommodation for patients. A risk-based approach should be considered, rather than relying only on trigger heights as the key criteria for making these decisions. For example, Rosepark Care Home was only a 2 storey building yet the fire there resulted in 14 deaths. However, this also needs to consider the implications on other aspects of the consultation, in particular in relation to shading arrangements as set out in our response to question 6.

**c. Do you agree an appropriate research project regarding building risk should be carried out to inform further review the scope of the ban?**

There is a need for further research into appropriate thresholds. This should not be limited to the concept of “building risk”. It should look at what is practical today bearing in mind modern fire fighting equipment and current thinking, training and health and safety constraints on what fire fighters can reasonably be expected to achieve. As well as building risk there may also need to be research into what degree of access is typically available around buildings and what

implications that may have for rescue operations. There is a distinct lack of up to date evidence on these issues.

**d. Please suggest the type of evidence you consider should be included in further review of the height threshold of the ban.**

- Evidence on the relationship between building height and life safety risk, including other risk factors such as number of escapes, other fire safety systems.
- Consideration of different evacuation methods required to support the fire strategy for different building types e.g. progressive horizontal evacuation, stay put, phased evacuation.
- Studies of human behaviour during an evacuation, particularly for those whose mobility is impaired for any reason, including age, physical or mental impairment or higher medical dependency.
- Likelihood that people with mobility impairment may be present and implications for human behaviour in terms of responsiveness (eg student accommodation in the early hours of Saturday morning poses different challenges to those posed at noon on Wednesday).
- Risk of alarm fatigue (e.g. Bolton Cube fire).
- Review of current FRS standard operating procedures and the degree of consistency across at least England, but ideally the UK. It is not appropriate to regulate based on practices in some areas if other areas practices would not be compatible with the proposed regulation.
- Risk of occurrences that may hinder FRS intervening (e.g. impediment of vehicular access, etc)
- FRS data from ‘post fire reviews’.
- Computational Fire Engineering studies (computer models for fire development and growth coupled with evacuation software e.g. Smartfire and Exodus)
- Use of timber. We are aware of significant concern from organisations with an interest in timber and sustainability, and how this may affect timber structural components. Timber structures are used successfully in buildings in other countries to heights well above 11m and the difference between fire risk in timber cladding and fire risk in timber structures should be fully understood before taking steps that may prohibit sustainable timber unintentionally.

**e. Please provide any evidence you believe should be considered in further review of the height threshold of the ban.**

- Evidence and learning from fatal fires (e.g. Rosepark Care Home fire 2004)
- Information from high rise fires globally. Annex A contains a list of fires in high rise buildings from 1996-2020 compiled by a leading fire engineer and Fellow of CIBSE. It shows that there have been a significant number of high rise fires in this period, but that almost all loss of life has occurred in the UK (Lakenhal House and Grenfell Tower). Any review of UK practice needs to be informed by international practice. Dubai appears to be very prone to fires, without loss of life. We need to understand the reasons for this and a desktop review of published investigations should be undertaken. The evidence from the Cube should also be considered, to understand why we were fortunate enough to avoid any further fatalities in that incident.

A review of the provenance of historic data and operating assumptions should be carried out to establish what is still appropriate in the light of current equipment, practices and procedures.

**Question 5.**

**a. Do you agree that metal composite panels with a polyethylene core should be banned from being used in external wall construction of any building regardless of height or purpose?**

Based on the test data reported by the BRE in the past three years CIBSE supports in principle the banning of metal composite panels with polyethylene core material from use in new buildings.

The BRE report for MHCLG: 'Fire Performance of Cladding Materials Research' which studied the burning behaviour of a small selection of non-ACM cladding products was published 1 April 2020. The results of this report should be considered further. Whilst concluding that none of the materials tested exhibited performance similar to polyethylene cored metal panels some further work is recommended. This should be undertaken and the results considered further, without delaying action where the evidence and the view of the Expert Group on Fire Safety supports immediate action.

**b. If no, why not? N/A**

**c. If their use was to be restricted, do you agree with the proposed definition?**

The proposed definition 'with a core composed of 30 percent or more of polyethylene by mass' would be consistent with other countries that have already restricted its use. But please see the further comments below for further comment.

*Comments and further questions in relation to Question 5.* The question appears to propose a further addition to Regulation 7 to introduce a new requirement, or prohibition, on the use of certain materials in the external walls of any building of any type. Whilst there is very clear evidence to support the banning of polyethylene core aluminium composite panels, it is not at all clear how this will work in practice. The question is framed very specifically around metal composite panels with a polyethylene core. Does that mean that there will be an additional clause that explicitly bans that particular material from the external walls of any building? Paragraph 38 of the consultation suggests that. The paragraph envisages other metal sheaths being within the scope of the ban, which seems reasonable. But what about other core materials? The proposed approach is quite prescriptive to polyethylene.

The case for banning metal sheathed composite panels with a polyethylene core is based on their performance in fire testing. The rationale for adopting the proposed specific definition of the material to be banned, instead of using the usual functional performance approach and specifying a requirement for any material included in the external wall to demonstrate acceptable performance in a prescribed test or tests is unclear.

Should the regulation set a permissible limit for the total calorific value per m<sup>2</sup> of a cladding product, based on clear peer reviewed evidence? That would be a more normal approach to this problem. If, or possibly when, evidence emerges that shows that there are other materials which are equally combustible, then they will also be banned, or not permitted, without further regulatory intervention. It would be frustrating to find that the evidence for banning another material emerges, only for that to require consultation and then further regulation. It may be considered that there is enough evidence in relation to polyethylene cored metal composite panels to ban them now pending the development of an evidence based test limit.

The implications of the proposed ban on existing buildings are a concern. It would be understandable if those who live in buildings which may have such materials incorporated in the external walls to conclude that they live in an unsafe building. If the ban applies to any building it could be quite wide ranging. Is it known how widely polyethylene cored material is used in non residential buildings? Does the proposed ban risk blighting any building suspected of having this material in its external walls?

It would also be understandable and possibly quite likely if mortgage lenders took a view on such existing properties as to render them unmortgageable. Is there a risk of that being an unintended (but perhaps entirely foreseeable) consequence of this proposal?

Where would this provision leave insurance? Would people living in buildings that have this material in the external walls find the building could not be insured? Or businesses that occupy such buildings, especially tenants and not owners? Based on current experience, those who live in apartment blocks are already struggling to get the reports that lenders require to enable them to sell their properties – properties that they bought in good faith relying on the fact that those properties were understood to meet the Building Regulations when built, and to be constructed using safe materials. Banning the use of polyethylene cored composite panels may very well be the right thing to do based on the test data available, but the potential for that ban to have implications way beyond the technical details of this consultation can neither be underestimated nor indeed ignored.

Is there any evidence on the scale of the use of this material in external walls below 11m? And whilst there may have been fires with fatalities in buildings below this height with metal composite panels, is there clear evidence that the fatality arose due to presence of the metal composite panel?

There are further issues to consider with regard to the use of combustible cladding materials. Currently there are no specific requirements for materials that can be used on the walls of buildings less than 18m high where the wall is more than 1m from the boundary beyond the need to meet the functional requirement B4, external spread of fire. Materials are limited by the need to ‘give consideration’ to the risk of fire spread, which may be inadequate.

### **Question 6.**

#### **a. Which components, if any, do you consider should be included in the list of specified attachments in Regulation 2(b) and why?**

It is understood that this question refers to Regulation 2 (6) (b). Before extending the scope of specified attachments, the current scope needs to be clarified. At present ‘a balcony attached to an external wall’ is included. There is confusion here about the status of;

- Inset balconies
- Balconies formed by a continuation of the floor slab (which are not attached, but integral)
- Juliet balconies
- Winter-gardens
- Terraces.

A ban on the use of combustible products on balconies is too simplistic. A material such as laminated glass performs a critical safety function in the event that the glass should break due to impact. Whilst combustible, it is thought to pose a much lower risk of fire spread than

something like timber decking, and possibly high pressure laminate cladding in a wall. This is recognised in question 9.

Clarification of these points would be welcomed. The British Standards Institution is due to publish a new standard on balconies very soon. MHCLG are strongly encouraged to align the regulatory requirements relating to balconies with the British Standard.

The question asks what should be included. This does not question whether the approach of specifying attachments is the most appropriate means to achieve the intended result. Alternative approaches to attachments should be considered. Functional Requirement B4 addresses external spread of fire. The MHCLG guidance following the recent judicial review of Regulation 2 (6) (b) is that this functional requirement effectively disallows external shading devices. Without robust evidence about the safety of any external attachments that is a precautionary approach. But it may not be a sustainable approach.

For example, can attachments still be fitted provided they are a sufficient distance apart to prevent the rapid spread of fire over a whole facade? Other sections of the Approved Documents specify minimum distances for safe use of certain building components (e.g. flue outlets) – has any research into the fire performance of external solar shading been made?

Government “recognise the importance of reducing overheating in residences and other buildings, and the contribution of solar shading products to this”. This is welcome, as there is peer reviewed research to suggest that by 2050 overheating may be the cause of some 4,500 additional premature deaths per annum due to overheating. It is a non-trivial life safety issue. (If a linear increase from 0 to 4,500 deaths per year is assumed over 30 years then that will amount to 67,500 deaths over a 30 year period. That is considerably more than are caused by either trips and falls or fire).

It is unfortunate that the BRE no longer has the facility of the Cardington site in which multi-storey buildings could be constructed and fire tested. If this facility was available now it would allow a number of large-scale tests to be conducted to resolve the questions around certain cladding materials, laminated glass balconies, solar shading devices and structural timber products. The hangar is still there and the airliner has vacated the old BRE hangar, so perhaps serious consideration needs to be given to recreating a large-scale fire safety test facility for a national programme of testing.

**b. Do you agree with the proposed definition of solar shading products? If no, what other definition would you propose and why?**

In the absence of evidence that solar shading devices can safely be attached in certain configurations and meet Requirement B4 then we understand the need to define all external attachments (as noted in answer 6a). The proposed definition of solar shading products may not be adequate. If it is a fabric blind that reduces the level of sunlight incident on a window does that meet the definition?

The definition should be clear with respect to the position of the shading product. Does it apply only to externally mounted blinds? Is it intended to include interstitial blinds, (e.g those inside a sealed glazing unit or within a closed cavity façade)? There seems to be no evidence that they pose a serious risk of external fire spread or of propagation of fire within the wall or façade.

It is not clear whether retractable blinds should be treated the same as fixed shading devices. If retractable blinds are fitted on higher floors then they could provide shading when needed but be

less of a risk in a fire. There is insufficient knowledge on this subject. Given the twin life safety concerns around fire and overheating there is a clear need for greater understanding of this issue.

**c. Do you agree that solar shading products need to achieve class A2,s1, d0 or A1 in line with the requirements of the Building (amendment) Regulations 2018?**

Given the current state of knowledge then that is probably the appropriate requirement.

**d. Do you agree that retractable awnings fitted to the ground storey should be exempted? If yes what restrictions, if any, should be placed on these.**

Yes. They should be of the lowest reasonable combustibility available at the time of installation, which we propose would currently be materials achieving a classification of B-s3, d0 or better. This should also be subject to where they are applied – for example, installation over any means of escape other than from the unit which they shade would not be appropriate (and would fall foul of the requirements relating to safe escape). They may be the subject of arson and result in the risk of fire spreading to the storey above, which would need to be assessed. Why is the exemption only on ground floors? What about first floor commercial premises?

**Question 7.**

**a. Which components, if any, do you consider should no longer be included in the list of exemptions in Regulation 7(3) and why?**

- a) “Cavity trays when used between two leaves of masonry;
- b) Any part of a roof (other than any part of a roof which falls within paragraph (iv) of regulations 2(6)) if that part is connected to an external wall;
- c) Door frames and doors;
- d) Electrical installations;
- e) Insulation and water proofing materials used below ground level;
- f) Intumescent and fire stopping materials where the inclusion of materials is necessary to meet the requirements of Part B of Schedule 1 of the Building Regulations;
- g) Membranes;
- h) Seals, gaskets, fixings, sealants and backer rods;
- i) Thermal break materials where the inclusion of the material is necessary to meet the thermal bridging requirements of Part L of Schedule 1 of the Building Regulations; or
- j) Window frames and glass.”

This list raises a number of questions which still need clarification. It also contains some contradictions – there are non-combustible materials available to make window and door frames, yet these exemptions allow use of wood and plastic. That may well be a perfectly reasonable decision, based on our understanding of the risk of those materials in that application, but that merely highlights the need for greater understanding of the performance of shading devices so that a similar risk assessment can be made. It is also unclear why the exemption is for window frames and glass and the two items are not separate exemptions. Clarity over the position of curtain walling frames could be provided.

Further clarification is still needed in particular for ‘membranes’, ‘seals, gaskets, fixings, sealants and backer rods’ and ‘thermal break materials where the inclusion of the material is necessary to meet the thermal bridging requirements of Part L of Schedule 1 of the Building Regulations’.

*(Note: Part L itself does not contain any such requirements – the Approved Documents contain guidance on the matter).*

**b. Which additional components, if any, should be included on the list of exemptions in Regulation 7(3) and why?**

The following items have been found in practice to create problems on projects:

Curtain wall frames in addition to window frames (and see previous answer);

DPC/DPM materials;

Weeps holes insert/covers etc.

Adhesives used in controlled quantities to bond membranes to building elements in order to form crucial air and water tight junctions/interfaces;

Minor combustible components vital to the functioning of curtain walls, window walls and window spandrels (e.g. setting/location blocks, drainage spouts, spacers, insulators and other minor sundries);

Spacers, washers, sleeves, grommets and shims to accommodate tolerance, movement, vibration and prevent rattling, drumming, provide isolation and limit water and air ingress;

Integral blinds enclosed within a sealed double glazed unit or façade element.

There is also ongoing concern about the use of laminated glass. It is being used outside the UK and there is a need to understand the evidence on which it is being banned in the UK.

**Question 8.**

**a. Do you agree that cavity trays should, by temporary relaxation for 18 months, be exempted from the requirements of Regulation 6(3) and 7(2)?**

As an interim measure, yes. The relaxation should be made in such a way that if it needs to be extended it can be. During this time consideration should be made of the actual contribution of cavity trays to either uncontrolled fire growth or fire spread. It is worth considering why cavity trays would be banned while window frames, particularly of wood or plastic, which could also promote fire spread to a cavity in a fire, would be exempt?

**b. If yes, what if any conditions should be imposed on their use?**

Conditions should only be imposed if and when justified by sufficient robust evidence.

**Question 9.**

**a. Do you agree that laminated glass in balcony construction should continue to have to achieve A2-s1, d0 classification or A1?**

We are not aware of any evidence to suggest that laminated glass used as the balustrade on a balcony poses any significant risk in the event of a fire. In the absence of any evidence it is suggested that the exemption for laminated in a frame is extended to include laminated glass on a balcony. Where is the evidence that this is a necessary requirement? An urgent review of international practice is needed.

No A2-s1,d0 laminated glass products are available that are suitable for external use. Laminated glass provides an important function in protecting building occupiers and the public, and in preventing falls from balconies. Banning of laminated glass is a significant restriction on balconies.

**b. Please provide evidence to support your answer where possible and discuss specific materials or products.**

We understand there may be a risk of the exposed laminate on cut edges being susceptible to flames, allowing it to burn in a fire and drop glass. As an interim measure edges should have a

metal or intumescent trim on all exposed edges to reduce the likelihood of this. Again, a review of evidence for this being a significant risk should be undertaken. Industry is keen to engage with government and to support and collaborate in such research.

**Question 10.**

**a. Do you agree that additional clarification in Approved Document B, that roofing membranes are not required to achieve A2-s1, d0 classification or higher when used as part of a roof connecting to an external wall, is not required?**

Additional clarification is required – we do NOT agree with the proposition as framed with a negative at the end. It is unduly onerous to require roof membranes to have an A2-s1-d0 classification.

Confirmation is needed that when a roof membrane links into or connects with an external wall for weather tightness, it is not considered as an element of the external wall and therefore does not require an A2-s1-d0 classification.

Roofing membranes are typically detailed with an upstand against the face of adjacent walls, including at terraces and balconies, to protect against water ingress and splashing. In such situations, the waterproofing becomes part of the wall construction. Instances have occurred where this has been challenged or rejected by approving bodies due to the use of combustible materials in walls.

**b. If no, please provide an explanation with evidence to support. N/A**

**Question 11.**

**a. Do you agree with the proposal of expanding the exemption of the use of water proofing and insulation material from below ground level to up to 250mm above ground level?**

Yes, although it is unclear how the 250mm dimension has been determined.

**b. If yes, what other conditions should be imposed on their use if any?**

If water proofing and insulation material continues up to 250mm above ground level, the risk of fire spread to the ground floor storey and above is low provided that the external wall system is compliant. However, a risk analysis should be included and documented to support this.

To reduce the risk of gaming in buildings constructed on sloping ground the height above ground level should be measured directly adjacent to the wall, rather than from the lowest ground level.

**Question 12.**

**a. Do you agree with the proposed expansion of classifications required for materials used horizontally to include Class A2fl-s1 and Class A1fl?**

Yes, but the scope of products covered needs to be clarified. As currently proposed, this change could have the effect of limiting all roofing materials to A1fl/ A2fl ratings, preventing design and specification of waterproofing and insulation in affected building elements. No liquid or sheet applied flat roof waterproofing membranes currently meet this standard, so the reworded regulations need to exclude membranes, noting that membranes are exempt under Regulation 7(3).

‘Horizontally’ should be defined to exclude roofing as testing of roof performance is different to non-roof applications. ‘Horizontal’ needs to be defined as being within a certain angle of true horizontal.

**b. If no, please explain why and provide evidence where possible. N/A**

**Question 13.**

**a. Do you agree that Regulations 7(2) and 6(3) should be amended to reference the current BS EN 13501-1 standard?**

Yes.

**b. If not, please explain why. N/A**

**Question 14.**

**a. Please provide any additional evidence on costs, risks and benefits which should be considered in an assessment of impacts of this consultation.**

As noted in relation to question 5 there is a significant risk that, as occurred with the ban on combustible cladding on buildings over 18m in height, proposals to lower the trigger height could have adverse implications for the valuation of existing buildings over 11m. To some extent, as MHCLG know, there is also an issue with buildings below 18m height with combustible cladding being adversely affected by the risk appetite of banks and lenders and it is very likely that the proposals contained in this consultation will exacerbate the current risk aversion.

**b. Are you aware of any particular equalities impacts for these proposals? How could any adverse impact be reduced and are there any ways we could better advance equality of opportunity or foster good relations between people who share a protected characteristic and those who do not?**

We remain concerned that in all types of buildings where there may be vulnerable people sleeping, who may have physical and/or mental disabilities, that a ban on buildings over 11m only will not take into account their needs. The 11m+ ban assumes people are able to evacuate in buildings below 11m where a Stay Put policy is unlikely. We recommend this is taken into account further.

There is a further impact which is that those who live in apartments may find themselves significantly disadvantaged when seeking to move for any reason at all unless there is very careful consideration of the implementation of the proposals set out in this consultation. The evidence for the lowering of the height to 11m and for the complete ban on polyethylene cored metal sheathed cladding is very persuasive that these measures are justified.

However, the evidence would have been there a number of years ago had it been sought and testing carried out. It is a significant inequality if those who bought properties or leases in good faith believing that the building regulatory regime had made reasonable provision for their property to be safe now find that because the regulatory regime was flawed they are now penalised. Many of those so affected may well have protected characteristics, and those who are older or have disabilities may be less able to manage the circumstances and may suffer further indirect consequences as a result of their protected characteristic.

These challenges can only be addressed if government works in concert with the financial and insurance sectors and the RICS and valuation profession to identify a clear way forward to address these matters. They are well beyond the technical scope of this consultation but are inevitable consequences of addressing the technical matters that this consultation raises.

**Cladding Fires Worldwide**

<b>No.</b>	<b>Name</b>	<b>Location</b>	<b>Date</b>
1	Apartment Building, Munich	Germany	May 1996
2	Eldorado Hotel, Reno, Nevada	USA	Sept 1997
3	Garnock Court High rise, Irvine	UK	June 1999
4	Harrow Court Stevenage (3 fatalities)	UK	Feb 2005
5	Water Club Tower hotel, Atlantic City	USA	Sept 2007
6	The Monte Carlo, Las Vegas	USA	Jan 2008
7	20 storey residential building, Harbin	China	Oct 2008
8	Shopping mall, Qiqihar	China	Nov 2008
9	Television Cultural Centre, Beijing	China	Feb 2009
10	Mandarin Oriental Hotel, Beijing	China	Feb 2009
11	50 Story International Plaza Nanjing City	China	April 2009
12	Lakanal House tower block Camberwell	UK	July 2009
13	Al Kuwait Tower, Sharjah	UAE	July 2010
14	Wooshin Golden Suites, Busan	Korea	Oct 2010
15	28-storey tower Shanghai	China	Nov 2010
16	Tower under construction	Qatar	Nov 2010
17	Dynasty Wanxin Shenyang	China	Feb 2011
18	Al Baker Tower Sharjah	UAE	Jan 2012
19	Al Tayer Tower Sharjah	UAE	April 2012
20	Mermoz Tower Roubaix,	France	May 2012
21	Polat Tower, Istanbul	Turkey	July 2012
22	Daif Belhasa, Dubai	UAE	Oct 2012
23	Tamweel Tower, Dubai	UAE	Nov 2012
24	Grozny-city complex, Chechnya	Russia	April 2013
25	Apartment Building Offenbach	Germany	Nov 2013
26	Lacrosse Building, Melbourne	Australia	Nov 2014
27	The Torch Dubai Marina (1 <sup>st</sup> time)	UAE	Feb 2015
28	Two towers Shanxi Province	China	April 2015
29	16 story building Baku	Azerbaijan	May 2015
30	Nasser Tower Sharjah	UAE	Oct 2015
31	The Address Dubai	UAE	Dec 2015
32	Ajman Towers	UAE	Mar 2016
33	Al Sulafa Tower Dubai Marina	UAE	July 2016
34	Palm Island Jumeriah	UAE	Dec 2016
35	30 Toh Guan Road, Jurong	Singapore	May 2017
36	Grenfell Tower London	UK	June 2017
37	The Torch Dubai Marina (2 <sup>nd</sup> time)	UAE	Aug 2017
38	Serviced Apartment tower Tianjin	China	Nov 2017
39	Panchmukhi Vishvkaram Tower	India	Oct 2018
40	Commercial Building, Jeddah	KSA	Jan 2019
41	Neo 200 complex, Melbourne	Australia	Feb 2019
42	Abbco Tower, Sharjah (48 floors)	UAE	May 2020