Short Summary of answers for questions for falling parts to stakeholders

The project team got 12 answers from the Stakeholder group on the questionnaire about the further development to assess falling parts in the European assessment method. Seven countries sent an answer as well as five associations.

Draft proposal for the "falling parts" performance (chapter 11.2 in the Assessment method)

11.2 Falling parts

Falling parts include all solid or liquid material falling from the test specimen.

The registered time is the time in completed minutes for which any parts falling from the test specimen do not constitute a risk for the evacuation, the rescue personnel nor the fire brigade, or for fire spread downwards. The failure of the falling parts performance is deemed to have occurred when one of the criteria below has failed.

11.2.1 Mass

The failure of mass criterion occurs when:

- any individual falling part exceeds 1 kg in mass, or

- the cumulated falling parts since the commencement of the test exceeds 20 kg in mass.

The time of failure shall be reported as the time at which the falling part touch the ground; i.e. the falling part shall have completely broken off from the façade, without being still hung somewhere.

The mass criterion is assessed by a load cell platform (still to be described in Annex A).

11.2.2 Sustained flaming

The failure of sustained flaming criterion occurs when any burning material on the ground produces a continuous flaming during a period of time greater than 10 s.

The time of failure shall be reported as the time at the end of this 10 seconds burning period; i.e. when the observation is finally made.

The sustained flaming criterion is assessed by visual observations, possibly supported by video recording.

Questions to the Steering Group

Question 1

The failure of mass criterion occurs when:

- any individual falling part exceeds 1 kg in mass, or

- the cumulated falling parts since the commencement of the test exceeds 20 kg in mass.

→ Do you agree? If not, what limiting values would you propose?

Summary for Question 1:

2 stakeholders agree to the recommendation

4 stakeholders disagree

6 stakeholders state that they are not in a position to judge or that there is need for further investigation of the topic

Several stakeholders state that the reasoning behind the limits and the performance goals are not clear.

Two possible ways forward identified:

- Agree on limits for different goals (e.g. fire fighter protection versus civilian persons protection)
- Handle it as it is in many countries now: documentation of the falling parts but the assessment is left to national regulators

Question 2

The falling part shall have completely broken off from the façade, without being still hung somewhere.

→ Do you agree? If not, how should hanging pieces (e.g. "on one screw") be assessed? How can one determine a criterion for different systems if unfallen parts should be included?

Summary for Question 2

6 stakeholders agree

1 stakeholder disagrees

5 stakeholders partially agree or think they are not in a position to judge.

One possible way forward identified:
The recommendation
The falling part shall have completely broken off from the façade, without being still hung somewhere.
should be taken into account.

Question 3

The mass criterion is assessed by a load cell platform (still to be described in Annex A).

→ The current idea would be to design a platform with dimensions 1.5 m x 3 m in front of the test rig to assess falling parts. Do you agree? If not, what would you propose?

Summary for Question 3

6 stakeholders agree

2 stakeholders disagree

2 stakeholders think they are not in a position to judge.

One possible way forward identified:
The recommendation
The mass criterion is assessed by a load cell platform (still to be described in Annex A).
should be taken into account.

Question 4

The failure of sustained flaming criterion occurs when any burning material on the ground produces a continuous flaming during a period of time greater than 10 s.

→ a. Do you agree that burning parts should be evaluated?

→ b. Do you agree with 10 s? If not, what limiting time would you propose?

Summary for Question 4

7 stakeholders agree with part a)

1 stakeholder disagrees

1 stakeholder thinks they are not in a position to judge.

4 stakeholders agree with part b)

4 stakeholders disagree

1 stakeholder thinks they are not in a position to judge.

Possible way forward identified:
The recommendation
The failure of sustained flaming criterion occurs when any burning material on the ground produces a continuous flaming during a period of time greater than 10 s.
→ a. Do you agree that burning parts should be evaluated?
should be taken into account.

The recommendation
→ b. Do you agree with 10 s? If not, what limiting time would you propose?

should be further investigated as several stakeholders wish for a longer time period and to take dropping height into account.

Question 5

The size of falling parts is not assessed.

→ a. Should the weight of the falling parts be the only criterion?

→ b. Should the area/dimensions of the falling parts be taken into account too? If yes, why is such area relevant and what limiting area/dimensions would you propose?

Summary for Question 5

3 stakeholders agree with the first part a)

5 stakeholder disagrees

1 stakeholder thinks they are not in a position to judge.

2 stakeholders agree with the first part b)

6 stakeholders disagree

1 stakeholder thinks they are not in a position to judge.

One possible way forward identified:
The recommendation
The size of falling parts is not assessed.
→ a. Should the weight of the falling parts be the only criterion?
→ b. Should the area/dimensions of the falling parts be taken into account too? If yes, why is such area relevant and what limiting area/dimensions would you propose?
has to be changed as the majority of stakeholders thinks the size and the weight are important.

Question 6

The mechanical stability of the system is not assessed.

→ Do you agree? How could the mechanical stability of the system be assessed? Should there be a criterion for the remaining surface of the façade after the test?

Summary for Question 6

5 stakeholders agree

2 stakeholders disagree

2 stakeholders partially agree or think they are not in a position to judge.

<u>One possible way forward is identified:</u>
The recommendation
The mechanical stability of the system is not assessed.
Should be taken into account.

Annex A

Answers in full:

Question 1:

We agree

We agree with the proposed limiting values.

There is no quantification, only visual assessment. It is argued that no quantitative measures are into force except in Austria. It is suggested that this is the way forward: to keep the information in the test protocol and the regulators in the countries assess the suitability for the national use.

The proposed definition of the failure criterion seems to be very hard. For example, a falling piece of a fibre cement board with dimensions 50 cm x 50 cm x 1 cm and a density of about 1800 kg/m³ has a total mass of about 4,5 kg. Thus, the definition for the "mass criterion" should offer a possibility for description of several levels, e. g. 1 kg, 5 kg and 10 kg.

In principle, the same problem concerns the criterion for "cumulated mass of falling parts". It should also offer a possibility for description of several levels, e. g. 10 kg, 25 kg and 50 kg.

The EAE basically support the efforts of the European Commission and the project team to elaborate a European test method for façade fire tests and to consider the aspect of falling parts. However, after discussions with our experts and considering the situation in different Member States we concluded that there is not sufficient information to answer the questions in particular.

From our expertise and experience the status quo can be described as follows:

- BR 135 reads: “No failure criteria have been set for mechanical performance. However, details of any system collapse, spalling, delamination or flaming debris should be included in the test report. The nature of the mechanical failure should be considered as part of the overall risk assessment, when specifying the system.” There is no quantification, only visual assessment.
- This principle as introduced in the UK has been adopted by the majority of European countries: Germany, Poland, Switzerland, Hungary, Slovakia, France, Czech Republic, Sweden (see Table 5 of “Development of a European approach to assess the fire performance of facades”, final report June 2018).
- There is only one exception in Austria: they allow for falling parts not more than a maximum of 0,4 m² and 5 kg and do not allow falling burning parts. This means that they do not allow large falling parts and burning parts. Again, no method is introduced for quantitative measurements.

- Therefore, no scientific background and practical experience is available, which would allow for the introduction of quantitative pass-fail-criteria as proposed in the questionnaire.
- There are no quantifiable measurements available and therefore pass-fail-criteria cannot be defined on the basis of existing research, experience or building regulation.
- Testing laboratories have many years of practical experience regarding the observation and assessment of these phenomena via visual observation; regulators in European countries have been able to decide on the basis of these results.
- Therefore, it is not possible to answer the questions as proposed in the questionnaire.

We think, it would be helpful at a first stage to ask Member States about the technical and historical backgrounds (e. g. national protection goals to be assessed) before thinking about possible classification schemes.

We are currently not in position to provide a justified position.

Not necessarily. What happens when you get 1 kg on your head? If not, what limiting values would you propose?
The scenarios, for what the criterions are given, should be studied. It is difficult to say, what could be the mass of the individual falling part; kinetic energy of falling part of 1 kg can cause serious injury falling in some height, but also lighter part falling from a little bit higher level.

- In our opinion, it is very difficult to confirm if the proposed limit values are acceptable or not (they are very dependent on the cladding material, panel size or fixing type), so we think that maybe we should accept those limits as a first approach and amend them as we gain more experience with the test method.
- Depending on the type of risk caused by those falling parts, e.g. the risk related to falling parts hitting people during evacuation or the risk related to falling flaming parts reaching other areas of the façade or the building, maybe those limits could be different.
- For example, composite lightweight panels may delaminate and fall into many small pieces (mass less than 1kg) that may not be dangerous for people evacuating the building but may extend the fire over the façade and surroundings.
- Conversely, glass-based panels may break into small and sharp pieces (mass less than 1kg) that may not burn but cause serious injuries to people.
- Melting and dripping of material along the façade should be also considered as failure criteria.
- In addition to the limit values for the mass criterion failure, we believe that there are many other aspects that need to be clarified in the method.
- First, a specific area for the observation of the falling parts should be clearly defined (dimensions and position regarding the specimen/crib).
- It is specified that the mass failure criteria is assessed by a load cell platform. If so, the characteristics of such platform should be also described (material, measurement range, precision, dimensions, etc.). Is it possible to use another measuring system, such as a floor scale?
- Once the measurement area and the platform are well defined, there are still missing definitions. E.g. it is not specified if parts falling apart from the load cell platform or jumping

out the platform need to be assessed or measured too. For example, placing some layers of ceramic blanket on top of the platform could help to absorb the impact, avoid bouncing parts jumping off the platform and will not contribute to an ongoing fire.

- The time at which the measurement is performed is also relevant. We mean that it should be done immediately after the crib is extinguished (so maybe the load cell platform should be movable) and not after the conclusion of the test, to avoid material to burn complete or partially.
- The 20 kg cumulated mass criteria is used for both intermediate and full scale test, but we think it could make sense to establish different limit values for both tests. Fire source is 10 times higher for the large scale test, so maybe a lower limit should be defined for the intermediate test.
- In order to avoid falling parts from the wooden crib reaching the load cell platform, we propose to place a metallic mesh in front of the crib. Otherwise this material could be mixed with the falling parts and turn into a misleading measurement.

In addition there is a guidance document available in Sweden describing how to assess falling parts, based on the following:

- More than a few drops (maximum 10) of melted burning material from the test specimen which continues to burn on the floor are not allowed. Each spot with burning material cannot exceed a diameter of 50 mm.
- Falling down of pieces of glass with thickness ≤ 7 mm with a total area of $60 \cdot 10^{-3}$ m^2 (0.2 x 0.3 m) is not allowed. For thicker glass the allowable size is scaled down linearly, i.e. an increase of the thickness of 10 % leads to a decrease of the allowable area of 10 %.
- Falling down of pieces of plaster/mortar with thickness ≤ 7 mm with a total area of $60 \cdot 10^{-3}$ m^2 (0.2 x 0.3 m) is not allowed. For thicker material the allowable size is scaled down linearly, i.e. an increase of the thickness of 10 % leads to a decrease of the allowable area of 10 %.
- Pieces of other types of material such as wood details, boards or metal profiles with an estimated weight above 1.5 kg are not allowed. If the piece falling down is assessed as sharp the acceptable weight is decreased to 1.0 kg.
- If more than one piece of material falls down each piece shall be judged separately as defined above, if it is not considered to be of danger.
- Small pieces of charred wood which falls down and continues to burn or glow is acceptable until it reaches the amount given for burning droplets above.
- Material (solid or liquid) which does not burn when falling down, and is below the definitions on size and weight above, but starts to burn when fallen down to the floor is accepted.

We do not agree with the proposal. The weight alone of the falling parts should not be considered a valid criterion. Furthermore, the limit of 1kg is not proportionate when compared to some of the tests currently performed in some countries (e.g. the Austrian standard ÖN 3800-5 for intermediate scale test allows up to 5 kg).

The total amount of falling parts is not significant for the purposes of the safe evacuation of people and safe intervention of fire fighters. As a matter of fact, it is not the total amount of falling parts that reflects danger for occupants and firefighters, but the mass by size/shape of the falling parts themselves. The mass results in the impact due to gravity. However, a larger area, e. g. 1-2 m² of textile fabric, which waves down “like a leaf” would be less dangerous than a dagger-shaped piece

having a mass of 0,5 kg. Hence, European Aluminium recommends eliminating the mass and area limitations alone and introduce a factor like mass/area instead.

Furthermore, it could be evaluated the possibility of calculating the energy of the impact (force) of the falling parts when touching the cell platform as this could provide give additional information for example about the height of the falling parts.

Considering that the falling parts criteria may exclude products for certain applications, it should be clear what is the aim of this test. The selection of a maximum weight or time seems an arbitrary decision which cannot be taken at this stage. The system to weight the debris only assess the total mass without differentiating small light debris from big pieces or the height from which the debris falls. Our experts consider falling parts must be assessed during the test and the results reported, but it is not possible to define a failure criteria.

In our opinion, the tests should take into account, first of all, the impact energy caused by the falling element and the time in which the part will be completely detached from the facade. The energy of the falling element is more important in determining the risk to health than the weight criterion itself.

On this basis, it is possible to determine the size of falling elements for a specific situation (height from the ground), which may cause injuries classified as threat to health.

In our opinion, the standard requirements for a firefighting helmet in terms of its impact resistance may be a reference point for the safety of rescue teams.

In this regard, we propose to adopt the methodology of testing and assessing the fallout of facade cladding elements used by the Building Research Institute (ITB)

In our opinion, there is no need to add up the weight of the falling parts.

In addition Building Research Institute (ITB) position:

We believe, the criterion would be more sufficient when includes at least more “classes”. Firstly because equally important factor, that needs to be also considered when assessing true examples of use of any given solution, is the total height of each part of building façade (which potentially can fall of in case of fire). Ergo the outcome energy of any individual falling part is even more important than mass value itself. So, when we test given solution, the outcome results should be sufficient to asses as much as possible.

Therefore it would be better to report actual masses that have fallen, and classes could be determined in relation to height - as energy limits.

Secondly, the time of given part falling off may be also important to ensure safety. In general, in case of fire, after the time required for the rescue teams to arrive (secure the area, navigate the evacuation), the threat is relatively less serious. Therefore 1 kg falling off in 10th minute of the fire (test) may be more dangerous than 4 kg falling off after in 20th minute. These of course are slightly different considerations, but the point is to make test procedure that allows to collect needed data. If we stick to masses, second class – 5 kg would be very helpful.

We do not see the added value in calculating cumulated mass of falling parts.

No, we do not agree. The proposal describes a threshold value for the weight of individual and cumulated falling parts but there is insufficient information to set such a threshold in historic reports

or real fire assessments. Establishing a limit value is arbitrary because it is not based on evidence and misleading because façades fulfilling the threshold are supposed to be "safer" which may not be always true. In other words, this approach may exclude some products for some applications for which they are actually safe and allow installation of certain products in other applications which may bear certain risk.
Limiting values is not the correct approach, assessment should be based on the declaration of the performance e.g. two characteristics: weight of the heaviest individual falling part in kg and cumulated weight of the falling parts in kg. In any case, this information should be complemented by other characteristics (see questions 4 and 5).
Building regulations are a competence of Member States and assessments are expected to deliver relevant information to the national regulators. Establishing threshold values is only possible if there is a scientific and regulatory consensus at European level and this is not the case for the moment.

No, see general remarks below.

Before defining the failure criteria of falling parts, a detailed risk assessment is required. What should be prevented or what level of security should be achieved?

At the present time, there is no clear scientific basis to define quantitative failure criteria for falling parts. If falling parts need to be a classification criterion, the necessary theoretical and practical scientific research has to be done before For this reason, the falling parts shall be observed during the test, documented with pictures and qualitatively commented within the test report. Falling parts shall not to be a classification criterion.

If member states, who have such classification criteria within their national test procedure, do possess of such documentation, they shall provide it to the Steering Group.

From our point of view, the large-scale failure and falling of the facade must be reliably prevented. This can be derived very well from qualitative statements and images in the test report.

Question 2:

Yes, we agree that hung pieces shall not be included in the assessment regarding falling parts

Agreement

Germany agrees that only parts are to be considered as falling parts, which are completely broken off from the façade and are fallen down on the ground.

Only parts detached from the façade should be qualified as falling façade elements. On the other hand, hanging elements should be considered as not falling off within a certain period of time.

We partially agree. The part that touches the ground should be considered as a fallen part, even if still partially attached to the facade. Hanging pieces that don't touches the ground don't be considered.

This information is relevant and should be reported in a descriptive way, but it cannot be expressed properly using numeric values and cannot be used to set pass/fail criteria at this stage.

We are currently not in position to provide a justified position.

Agree. If not, how should hanging pieces (e.g. “on one screw”) be assessed? How can one determine a criterion for different systems if unfallen parts should be included?

We agree that only completely broken parts should be counted.

We also suggest that the presence of hanging pieces could be reported as observation

No, see general remarks below.

Question 3:

Yes, we agree with the principle of the load cell platform and the proposed dimensions. Nevertheless, it is possible that proposed dimensions may not be sufficient for some test mock-ups (e.g. there could be a falling part that first hits an external feature of the façade and because of the impact it changes trajectory and falls outside of the cell platform).

Agreement

Agree

We agree, but will assessments be made only if the falling parts stop on the platform? Parts that fall off the platform should also be taken into account, possibly weighing them separately

It is one of the acceptable methods of assessing the fall of façade elements. But load cell platforms are complex, expensive and space consuming. We would rather suggest using graphic analysis or/ and weighting of falling parts(even if fragmented).

On the other hand, the question of selecting an appropriate method and apparatus for measurement should be resolved on the basis of the positions of research institutes that will conduct these tests.

We agree with the use of the load cell platform.

Note : Can the load cell be bigger to avoid that parts land beside it (i.e. in case of explosion)? Should parts that have landed beside be moved to the load cell when measuring the cumulated weight of falling parts?

The use of the proposed load cell platform means a lot of technical efforts for test labs. Additionally, you can only measure the weight of parts falling into the limited area, where the platform shall be placed. But in certain cases, parts are blasted away from the test rig with greater distances (e.g. stones being ejected by encapsulated water). Therefore, it is supposed to weigh the mass afterwards by collecting the fallen parts.

- We believe that it is very complicated to define a criteria for the assessment of hanging pieces. If these parts finally don’t fall off during the test, they should not be considered as falling parts.

- Mechanical behavior will be very different if the cladding panels are directly fixed with several screws or rivets, compared to a cladding panel fixed with railings on the back side or fixed with punctual anchors and seems hard to find a common criteria to assess so many different fixing solutions and panel types.

- We agree to place a platform or other weighing device/system in front of the rig, in order to assess the falling parts, but the features of such platform and its position should be clearly defined.
- Falling parts from the wooden crib should be retained by means of a mesh or similar system, to avoid mixing of façade material and crib material on the load cell platform.
- Otherwise, a crib collapse area should be defined, where material from the collapsed crib could fall off.
- For example, in the standard LPS 1581, a "crib collapse zone" of 2.4 x 1.2m is defined in front of the crib, and only the falling parts that fall out of this area are evaluated for the falling parts criteria. If the wooden crib does not have a mesh which prevents charred fragments to fall off, separating material in this "crib collapse zone" coming from the specimen or from the charred sticks will be too complicated.
- Additionally, falling parts could even fall out from this 1.5 x 3 m platform area, and it should be defined what to do in such case.
- In our opinion, after the end of the test, all material fallen off the specimen should be weighed (even if it is located outside the load cell platform).

We are currently not in position to provide a justified position.

No, see general remarks below.

Our experts do not have enough information to know if a load cell platform would work properly in testing conditions.

Question 4:

Yes, burning parts can be evaluated provided that the uplift of the test rig is ensured (e.g. 2000 mm) so to avoid self-ignition of items fallen on the floor.

As per the time limit, it should be acceptable the presence of burning debris inside a "control zone" for a longer time than 10/20 seconds (e.g. 60 seconds). What would pose additional risks is the presence of burning debris far away from the façade, posing additional risks to the surrounding buildings, objects, people. Thus, it is proposed to **define a control zone** (it could be the very same area of the load cell platform) and to focus the attention on burning debris outside the control zone, more than inside the control zone.

Agreement

Agreement

a) Yes, we do agree.

b) We agree with 10s sustained flaming criterion but the time criterion should depend on the drop height.

→ a. Do you agree that burning parts should be evaluated? **We agree**
→ b. Do you agree with 10 s? If not, what limiting time would you propose? **We prefer a period of time greater than 20 s**

→ a. Do you agree that burning parts should be evaluated?
Burning material on the ground should be observed and monitored.
→ b. Do you agree with 10 s? If not, what limiting time would you propose?
No, we do not agree. In line with the reply to question 1, some parts burning for longer than 10 seconds may not be relevant, in practice the size of the burning part, flame height and flame spread (secondary fire) should be considered, e.g. the effect of a burning match in the floor is not relevant in this kind of situation and could last more than 10 seconds.
A more pragmatic approach could be requesting a detailed description according to standardized parameters as mentioned before in the test report, leaving the assessment to Member States.

- We believe that burning parts should be evaluated, but maybe 10s is too short for the continuous flaming criteria (we believe it comes from the sbi test, but in this case fire power and scenario are very different).
- Assessment of burning parts is included in other international standards (failure criteria in AS 5113 is continuous flaming for 20s and in LPS 1581-1582 it is 60s). So we propose to adopt a limit within those 2 values, e.g. 40s.

The use of the proposed load cell platform means a lot of technical efforts for test labs. Additionally, you can only measure the weight of parts falling into the limited area, where the platform shall be placed. But in certain cases, parts are blasted away from the test rig with greater distances (e.g. stones being ejected by encapsulated water). Therefore, it is supposed to weigh the mass afterwards by collecting the fallen parts.

❼ a. Do you agree that burning parts should be evaluated? **Yes, but this could be separate from the mass parameter so that in national requirements it can be chosen whether both of the parameters or only one of them is used depending on the application of concern.**
❼ b. Do you agree with 10 s? **Don't agree, because this is not in balance with falling mass criteria in the sense of magnitude of hazard caused.** If not, what limiting time would you propose? **The scenario for what the criterion is given should be studied. Injuries for people, or how the burning particles spread fire for example on a lower roof construction connected to the wall.**

We agree that burning parts should be evaluated and 10s is an acceptable limit to define sustainable flaming.

Note : Can this criterion be used to evaluate the risk of down spread fire and be connected to the spread fire criteria (not only falling part criteria)?

We are currently not in position to provide a justified position.

No, see general remarks below.

Question 5:

No, the weight alone of the falling parts should not be considered a sufficient criterion.

The area/dimensions of the falling parts are also to be taken into account as they have an effect on the risk. Larger textile fabrics can reach areas of even 2 square meters; thus we would propose this as limiting value to be considered in a mass/area factor.

No, also the size of the falling part should be a criterion

Increasing the weight of falling parts to ≤ 5kg would allow larger pieces of aluminum cladding to fall down. That's why we would propose to limit the area of falling parts to ≤ 0,4 m²

a) No, the criterion should also take into account the shape of the falling element and the impact energy of the falling element. Criterion should be expressed as energy limits.

b) Yes, the area of falling part is another important factor as even relatively light falling parts may fly tens of meters away from façade when they area is big enough (e.g. metal sheet behaving like a kite). We propose 0,25 m2 as a limit. Though, according to the arguments given earlier, we should report also smaller parts (and that is also why graphic analysis seems better).

The shape of the part falling from the height is important considering people's safety, as it determines the different mechanical action on the ground (surface or point impact).

→ a. Should the weight of the falling parts be the only criterion? **Yes**
→ b. Should the area/dimensions of the falling parts be taken into account too? If yes, why is such area relevant and what limiting area/dimensions would you propose? **No**

The weight is, in sum, an aspect of the risk of being hit by falling parts. Therefore, it should be assessed. But if a complete part of the system falls, this should also be mentioned / reported. As already expressed in the German response to the questions to the Steering Group in October 2020, the size of a concerned area of the tested façade (e. g. expressed in square meters) should be considered within the assessment of falling parts (not burning) caused by mechanical collapsing. A limitation of this size to that area of the façade being directly exposed by the flames of the primary fire source might be suitable as assessment criteria.

- If there is a limit of 1kg in mass for each falling part, area or dimensions of the falling parts probably are not critical for this assessment, as those parameters will in fact be limited by the mass criteria.

- Maybe we could include the area/dimension criteria as a note or observation in the test report. In addition, we could add other characteristics of the falling parts, as the shape or the presence of sharp edges.

→ a. Should the weight of the falling parts be the only criterion?
No, it should not.
→ b. Should the area/dimensions of the falling parts be taken into account too? If yes, why is such area relevant and what limiting area/dimensions would you propose?
The area, dimensions and number of falling parts is relevant and should be reported but it should not be used to establish pass/fail criteria, e.g. a large piece of vapor barrier (lightweight foil) may fall without burning and it does not suppose any risk.
Limiting values is not the correct approach, assessment should be based on the declaration of the performance e.g. three characteristics: area of the biggest individual falling part in m_2, length of the longest falling part in m and number of falling parts of at least a minimum size. In any case, this information should be complemented by the characteristics described in question 1.

❼ a. Should the weight of the falling parts be the only criterion? **Yes, depending on the mass criteria.**
❼ b. Should the area/dimensions of the falling parts be taken into account too? If yes, why is such area relevant and what limiting area/dimensions would you propose?

→ a. Should the weight of the falling parts be the only criterion? Yes, We believe that the weight of falling parts can be the only criterion and the area/volume of pieces can be reported as observation.

→ b. Should the area/dimensions of the falling parts be taken into account too? If yes, why is such area relevant and what limiting area/dimensions would you propose? No.

If necessary, the size of falling parts can be further assessed based on the weight registered for each individual part and the material information (density, thickness, etc.) of the main components of the façade system.

We are currently not in position to provide a justified position.

No, see general remarks below.

Question 6:

Yes, the EU method for the assessment of fire performance of façades should not be extended to the mechanical stability of the façade after the test.

Agreement

We agree that the mechanical stability should not be assessed.

Yes, it does not have to be evaluated; mechanical stability is related to fire resistance evaluation

Our experts do not have enough information to know if this is a relevant issue to be reported and how it could be assessed.

The weight is, in sum, an aspect of the risk of being hit by falling parts. Therefore, it should be assessed. But if a complete part of the system falls, this should also be mentioned / reported. As already expressed in the German response to the questions to the Steering Group in October 2020, the size of a concerned area of the tested façade (e. g. expressed in square meters) should be considered within the assessment of falling parts (not burning) caused by mechanical collapsing. A limitation of this size to that area of the façade being directly exposed by the flames of the primary fire source might be suitable as assessment criteria.

- As explained before, it is difficult to define a criteria for the mechanical stability or the remaining surface of the facade. Cladding panels could be completely burnt out during the test and there may not be a vertical fire spread due to the fire barriers or the subframe design, so yet the system will be compliant with the performance criteria.
- We believe that it is already quite challenging for the façade systems to comply both with fire spread and falling parts criteria (LS1 and LS3 classifications).
- Besides, if the system only complies with the fire spread criteria (LS2 and LS4 classifications), the classification achieved already indicates a "poor" mechanical performance, so we do not feel necessary to establish additional pass/fail criteria related to mechanical stability of remaining parts.

Agree. How could the mechanical stability of the system be assessed? Should there be a criterion for the remaining surface of the façade after the test?

We think that it is important to assess the mechanical stability of the system for cases where the substrate is burnable and can lead to the formation of hollow structure.

No, see general remarks below.

<u>Any other issue (related to falling parts) you would like to comment/give input on?</u>

The tests should take into account:

• building height (energy of the falling element),

• maintaining the parameters of the facade elements not falling off within the specified time, which is necessary to ensure the proper evacuation of people from the building and the safety of rescue teams,

• the surface and location of the openings in the facade.

The first priority should be to gather the historic information and clear understanding of the basis for the flaming debris, falling parts assessment from Member States.
As explained in the introduction and in the replies to the questions, Construction Products Europe recommends the development of a clause in the assessment method related to falling parts and burning debris including observations characteristics according to certain parameters without setting any limit, restriction or class.

As already said to several questions before, it might be very difficult to find one common understanding for pass/fail criteria with regard to the sub-characteristics "falling parts (non-burning), including mechanical stability" and "burning falling parts / droplets" of façade fire performance due to different requirements and defined safety levels in the Member States with regard to this issue.

Therefore, it is proposed once again to create a matrix of several criteria and aspects which are commonly identified as appropriate parameters for the assessment of these sub-characteristics of a façade fire performance. Inside this matrix different levels should be used to describe the performance determined within the test of a specific system. Based on these data, it is checked and decided whether a tested system fulfills certain safety requirements of the Member States for the intended end-use.

- It is not clear for us if finally glazed curtain wall systems will be included in the assessment method, in order to assess their vertical fire spread behavior or their falling parts evaluation.
- We believe that EN 1364 parts 3 and 4 do not address such fire spread mechanisms, so we think they should be included there, but we know that the industry is pushing against that.
- Could you confirm us if there is a final decision for that?

Before defining the failure criteria of falling parts, a detailed risk assessment is required. What should be prevented or what level of security should be achieved?

At the present time, there is no clear scientific basis to define quantitative failure criteria for falling parts. If falling parts need to be a classification criterion, the necessary theoretical and practical scientific research has to be done before For this reason, the falling parts shall be observed during the test, documented with pictures and qualitatively commented within the test report. Falling parts shall not to be a classification criterion.

If member states, who have such classification criteria within their national test procedure, do possess of such documentation, they shall provide it to the Steering Group.

From our point of view, the large-scale failure and falling of the facade must be reliably prevented. This can be derived very well from qualitative statements and images in the test report.

We are currently not in position to provide a justified position because we don’t know the background behind the existing Member States requirements on falling parts. We would recommend to first assess the exact needs of Member States depending on the fire safety objectives in their regulation. This should allow to define which performance aspects to be tested. In the absence of it, we recommend keeping different options open.