



Handbook

Mitigation of building dwelling species

Overview of guidelines and principles applicable within most standard situations when it comes to mitigation in the context of the nature conservation and law.

Preface

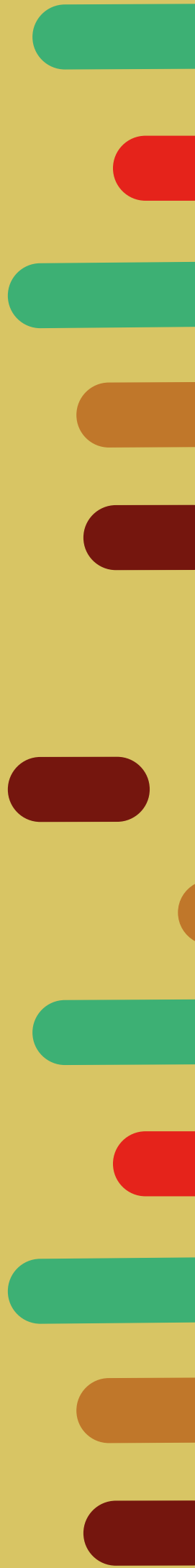
This handbook is created as an aid to ecological consultants in choosing effective mitigation measures. The document is intended as a living document. The document contains many experimental methods and products. The products and methods will be continuously improved and expanded. Ecological consultancy firms are free to incorporate texts, drawings and methods, into their own reports, when mentioning Unitura.

Datum: 23 march 2023

Door: Ir. S. Jansen

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Methods of exclusion



Exclusion of bats and birds from buildings

The last step before construction work can start

Bat and bird exclusion is a crucial step in the mitigation process. Nowadays, species-specific research is often carried out for every project, which provides detailed knowledge of the presence of habitats of certain species. In general, the more research that is done, the more precise the exclusions can be executed. However, caution must be exercised against false precision. Never focus the exclusion activities only on the encountered roosts and nests during research phase, but always address the entire building or all comparable facades in the immediate vicinity. There is a significant chance that both bats and birds will immediately use an adjacent crack or opening as an alternative if the exclusion is too specific. For this reason, any building to be renovated or demolished where roosts/nests can reasonably be expected must be cleared of all roosting/nesting possibilities.

What is the best moment for exclusions?

A building cannot be cleared of roosts/nests throughout the year. Animal exclusion should only be carried out during the "least vulnerable periods" of expected species. The optimal period for each species (group) is as follows:

- **Bats:** Roosts can best be discouraged during warm periods (> 8 °C) outside of the maternity period. In practice, this is the period from **August 1st to October 31st**. Additionally, the month of April can also be considered a possible suitable period.
- **House sparrows:** In theory, exclusions can be executed outside the breeding period from March 1st to August 15th. However, experience has shown that exclusion in the period from **September to the end of November** gives a much higher chance of success than exclusions carried out in January/February. This is because male house sparrows start preparing for the next breeding season from November. Once male house sparrows have established their territory and breeding site, it is very difficult to drive them away from their nesting site. Late exclusion (in January/February) is also unnecessarily stressful for house sparrows.
- **Swifts and other birds:** Exclusion can be carried out throughout the year, outside the period from **March 1st to August 15th**. If bird exclusion is carried out during periods where exceptional cases of species breeding may still be expected, a physical inspection* must be carried out beforehand. An example of such a period is August, during which house sparrows can still have late breeding cases.

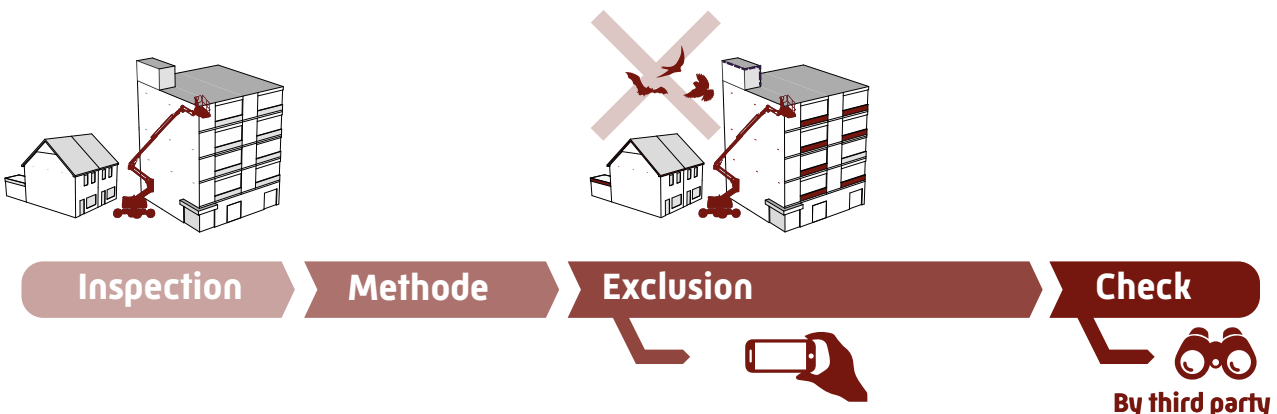
Since all treated species groups are expected in many buildings, the period from **August 15th to October 31st** is the best period for discouragement.

When is exclusion necessary?

Making buildings or building parts free of species is necessary for all activities that physically change the shell of buildings.

Exclusion is necessary at least for the following interventions:

- At demolition;
- For roof renovations;
- When insulating walls;
- When replacing facade cladding.



The exclusion process*

The process of exclusion should be carried out very carefully. If done carelessly, it can do more harm than good. The best way to make a building site nature-free is to hire a specialized contractor in collaboration with an external (independent) ecologist. Ideally, the process of making the site nature-free consists of four phases:

- Phase 1: Each building typology within the planning area is inspected carefully using a cherry picker/lifted platform. During the inspection, the contractor looks at where different species may have their roosts/nests.
- Phase 2: Based on the inspection, the contractor develops a method for making the site nature-free. The method is coordinated with the external ecologist.
- Phase 3: The exclusion process is carried out. The contractor documents all relevant steps (using a smartphone).
- Phase 4: The external ecologist assesses the work that has been carried out (checks if all species left the site). If the work is deemed sufficient, the site is released.

**This method is based on a situation with minimal information, for example in the case of an SMP (Dutch methode). If more information is available, a more streamlined method can be chosen.*

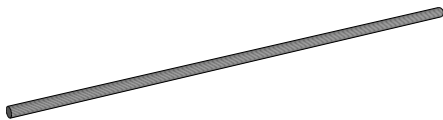
Proces natuurvrij maken bij aanwezigheid huismussen

Zoals reeds aangegeven is de huismus een lastig te ontmoedigen soort. In het geval dat in een plangebied grotere dichtheden huismussen aanwezig zijn en er door wordt gewerkt tijdens het broedseizoen, dan de volgende richtlijnen in acht nemen:

- Voer de ontmoediging uit in de periode september-november (februari is te laat!);
- Ga er vanuit dat individuen door de ontmoediging komen. Controleer de ontmoediging met regelmaat vanaf 15 februari;
- Zorg dat er alternatieve nestvoorzieningen aanwezig zijn in de directe omgeving. Het kan hierbij zelfs functioneel zijn om tijdelijke verblijfplaatsen op de ontmoedigde woning aan te brengen, als tijdens de werkzaamheden enige afstand (minimaal 2m) van de kast gehouden kan worden.

Exclusion materials

With the following materials, almost all buildings can be made unsuitable for birds and bats:

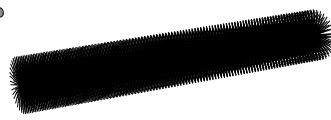


Filling foam

Voor afdichten van nauwe spleten

Eigenschappen

Material:	Polyethylene
Diameter:	20 mm
Length:	1000 mm

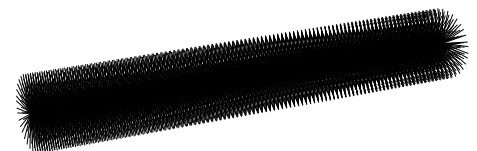


Brush small

Voor afdichting van langsijdes van pannendaken

Eigenschappen

Material:	Polyethylene
Diameter:	90 mm
Length:	1000 mm



Brush large

Voor afdichting van langsijdes van pannendaken

Eigenschappen

Material:	Polyethylene
Diameter:	150 mm
Length:	1200 mm

Exclusion flap EF1

Prefab exclusion flap that can be used in almost any situation. The flap is suitable for small bat species like the common pipistrelle.

Eigenschappen

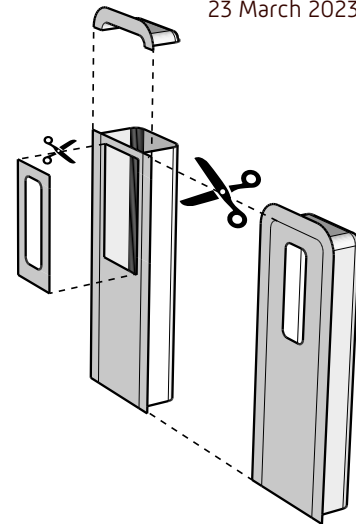
Material: Hard plastic
Entrance back: 60x20 mm
Size: 19x8x3 cm

Exclusion flap EF2 - XL

Prefab exclusion flap that can be used in almost any situation. The flap is suitable for larger bat species like *Myotis* species.

Eigenschappen

Material: Hard plastic
Entrance back: 75x50 mm
Size: 24x10x3.5 cm

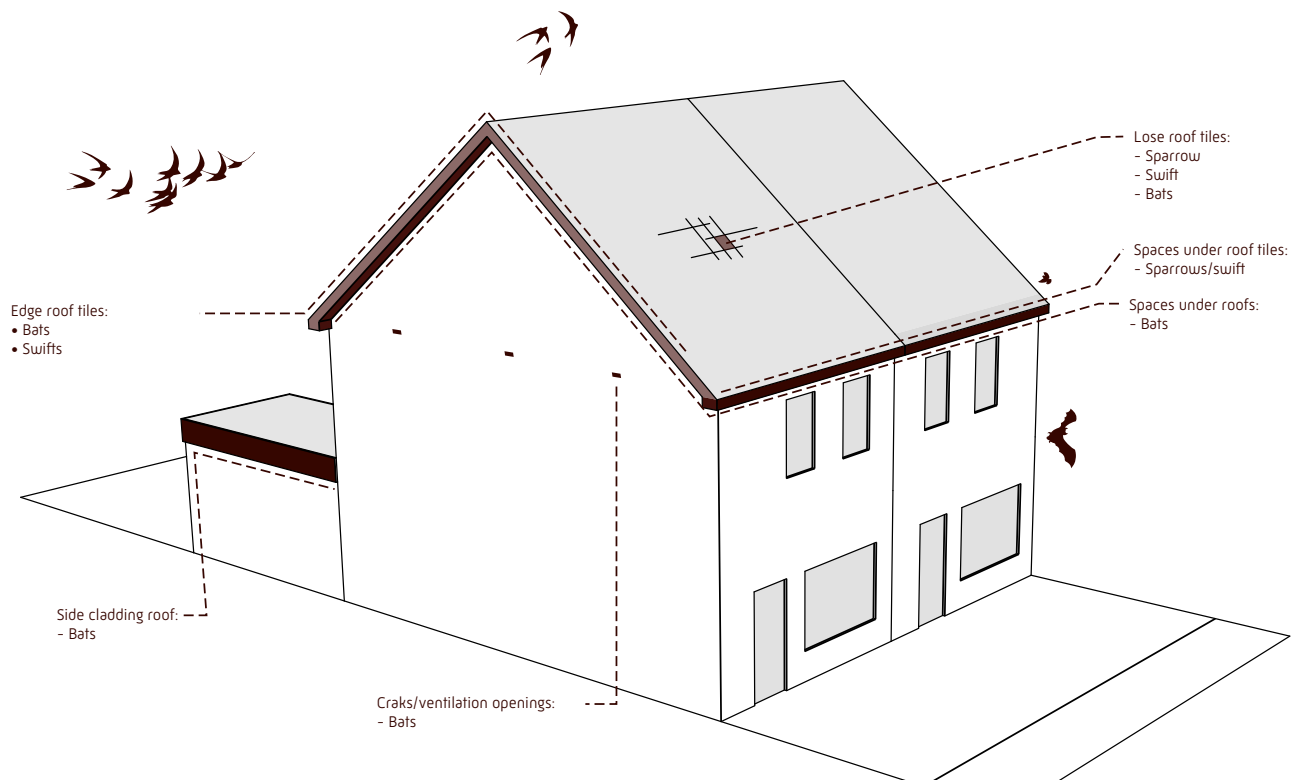
**Exclusion methodes**

Animal exclusion is a customized process. The physical inspection (or other form of research) of the building should determine which components are actually suitable for species. However, there are principles and methods that are consistently used and can be applied to almost any building type. Below is an overview of methods and approaches for the building types of ground-bound houses and (small) apartments.

Ground-bound houses

The following types of roosts/nesting places are often found. Note that these are not all possible places, but common ones. The following places are included, see also the image below:

- Spaces side cladding roofs: bats
- Spaces under roof tiles, long side: sparrow, swift
- Spaces under roof tiles, head side: bats, swift
- Spaces under loose roof tiles: bats, sparrow, swift
- Spaces under cladding: bats
- Cracks and ventilation openings in walls: bats

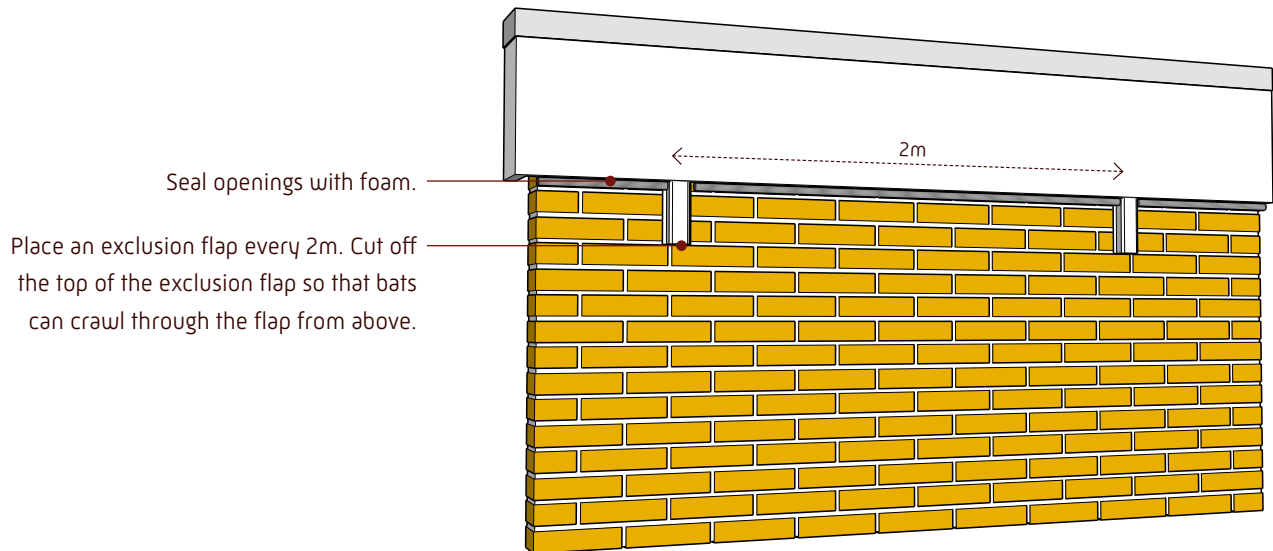


Techniques to be applied

Narrow crevices, accessible by bats

Under roof edges, fascias, and claddings, narrow gaps are often present where bats can roost behind. Bats are excluded from these slit-like spaces as follows:

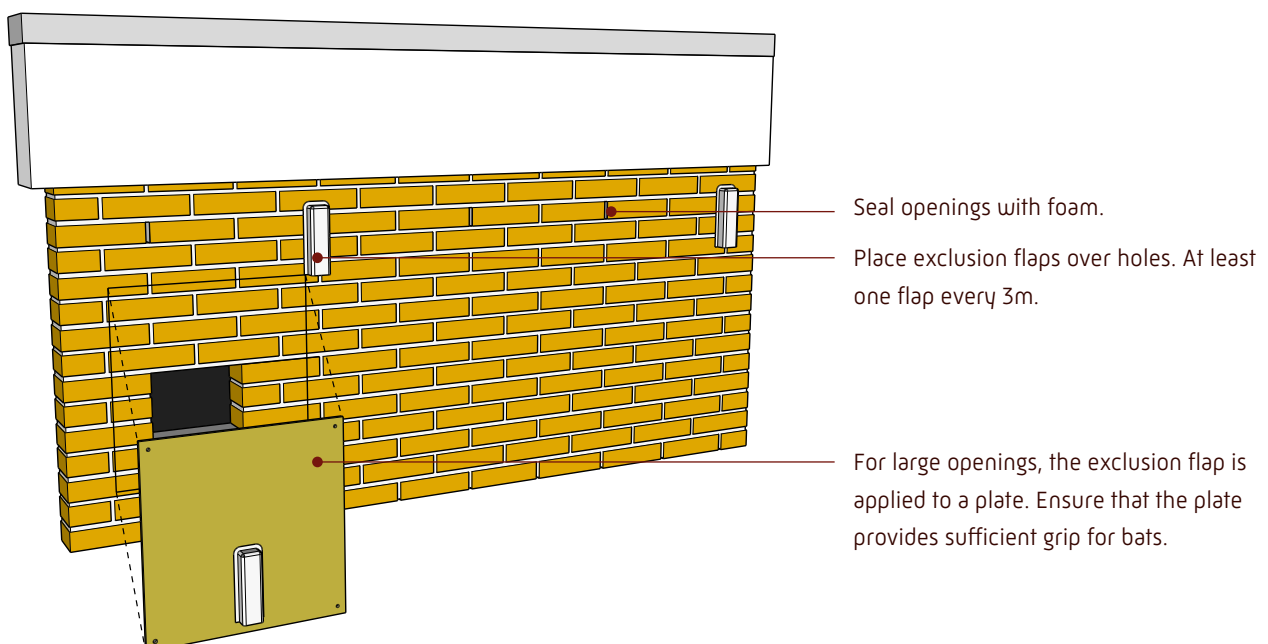
- The slit-like spaces are sealed with foam or other sealing materials;
- An exclusion flap is placed in the sealing every two meters, to ensure that bats can exit. If it is a slit-like space, as shown in the image below, then the top of the exclusion flap is cut off so that bats can crawl through the flap from above.



Openings in walls, accessible by bats

Bat exclusions when it comes to ventilation openings and other openings that provide access to the cavity wall or other spaces can be executed as follows:

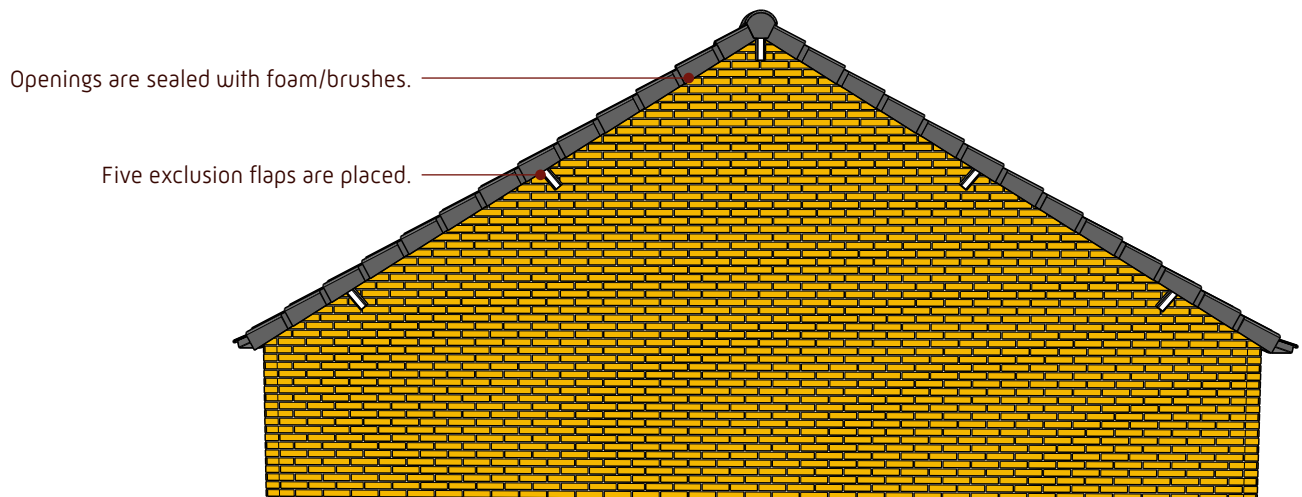
- The slit-like spaces are sealed with foam or other sealing materials;
- An exclusion flap is placed over every hole or every three meters. For large openings, the exclusion flap is applied to a plate. Ensure that the plate provides sufficient grip for bats.



Roofs with roof tiles - edge

Exclusion for bats and birds:

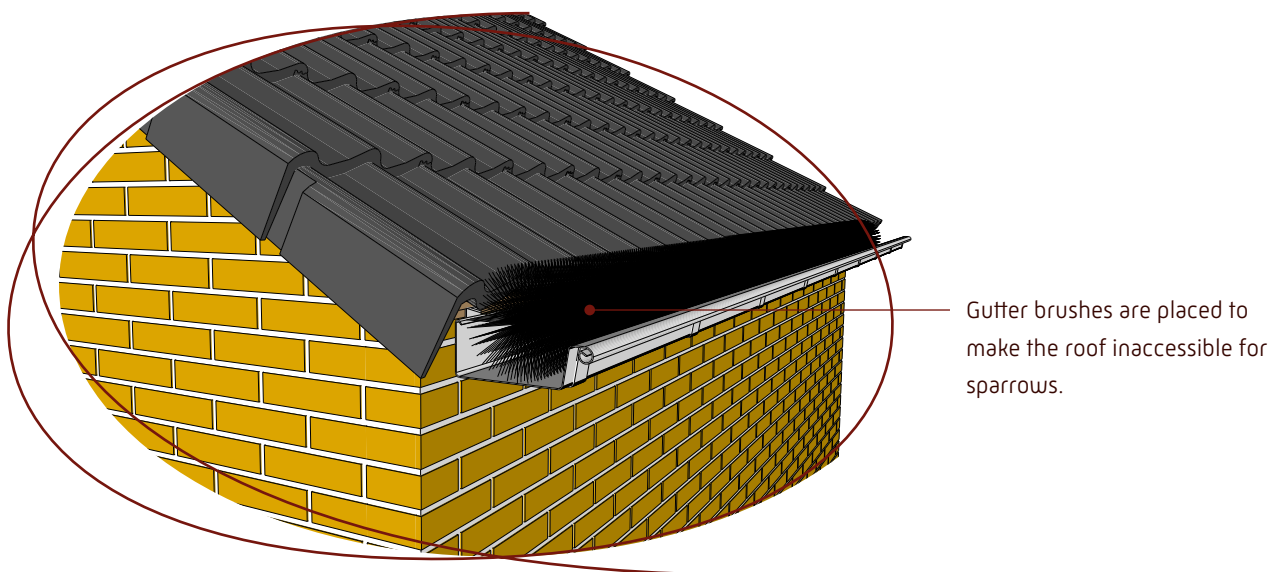
- The slit-shaped spaces are sealed with foam or small brushes;
- Five exclusion flaps are placed in the sealant to allow bats to exit. In this application, the top side of the exclusion flap is cut off so that bats can crawl through the flap from above.



Open edges of tile roofs

The long side of a tiled roof is often used by house sparrows. This space can be made unsuitable for house sparrows (and bats) in the following way:

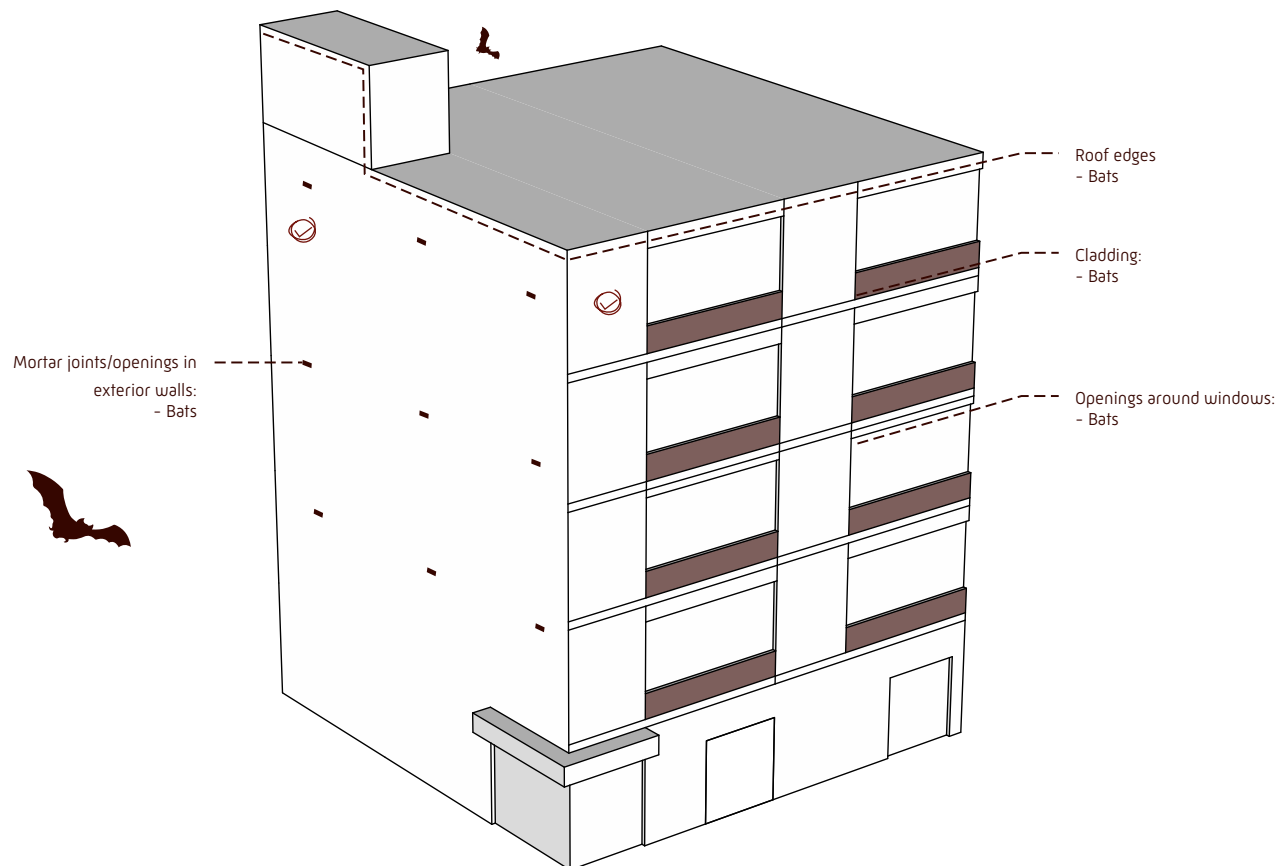
- Special gutter brushes, developed to keep birds away, are placed in the gutter. Due to the size and stiffness of the brushes, in most cases, they do not need to be placed under the tiles. Placing the brushes in the gutter is sufficient to completely keep birds out. The brushes can be easily removed just before the work begins.



Apartment buildings

The following types of roosting places are frequently encountered. Note! These are not all possible roosting places, but common ones. They are as follows, see also the image below:

- Spaces under roof edges: bats
- Spaces under cladding: bats
- Openings around windows: bats
- Mortar joints/openings in exterior walls: bats



Techniques to be applied

Narrow crevices, accessible by bats

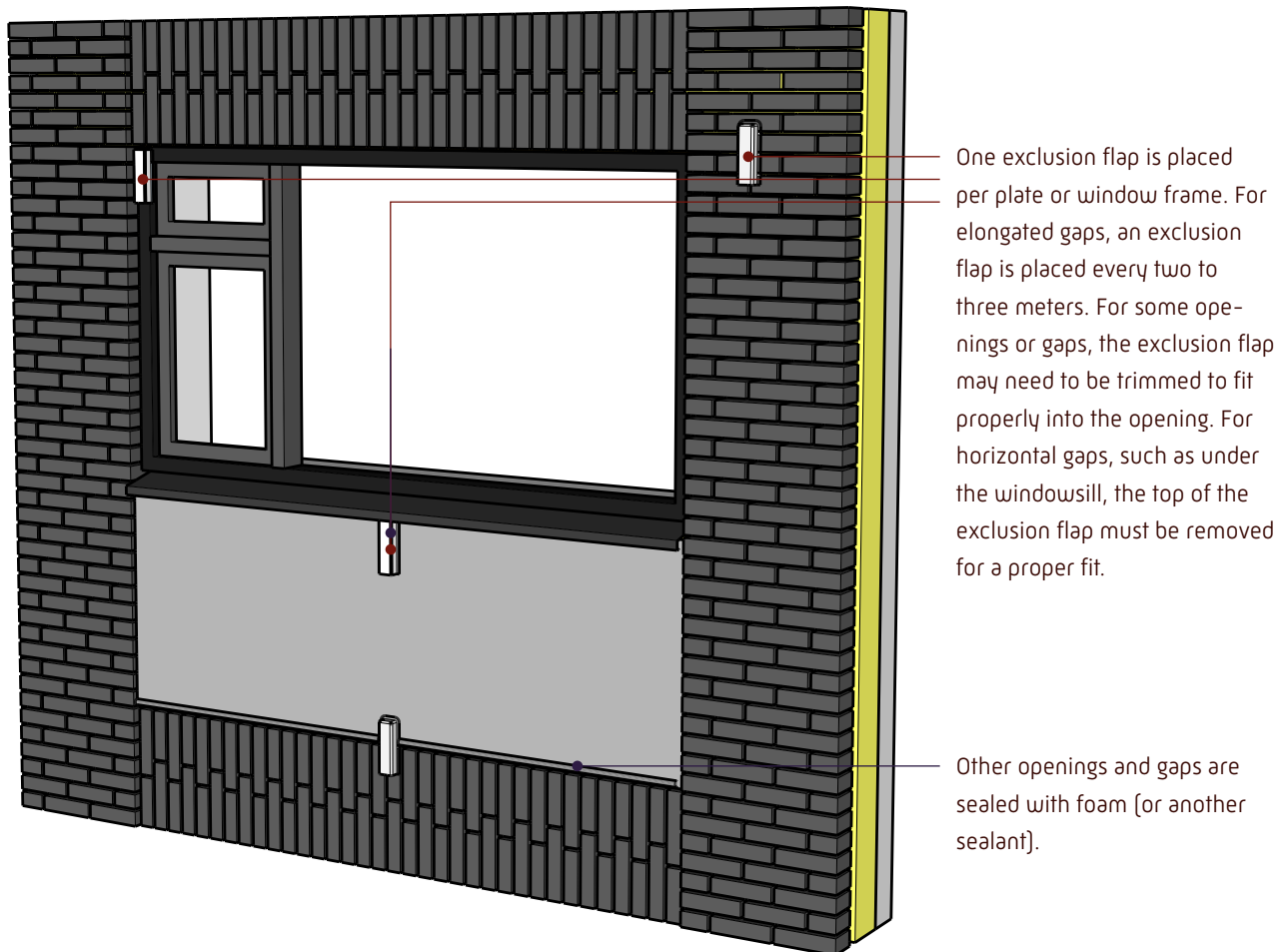
In apartment buildings, there are usually almost exclusively bat roosts present. In standard apartment complexes, various building components are present where bats hide in or behind. Usually, roosts are present in the following locations:

- In cavity walls, accessible through openings in masonry. Examples of openings are mortar joints, ventilation grilles, openings around rain pipes, and connections of window frames;
- Shallow roosts behind cladding, accessible through narrow gaps;
- Roosts in the supporting structure of the building, accessible through narrow gaps between concrete slabs.

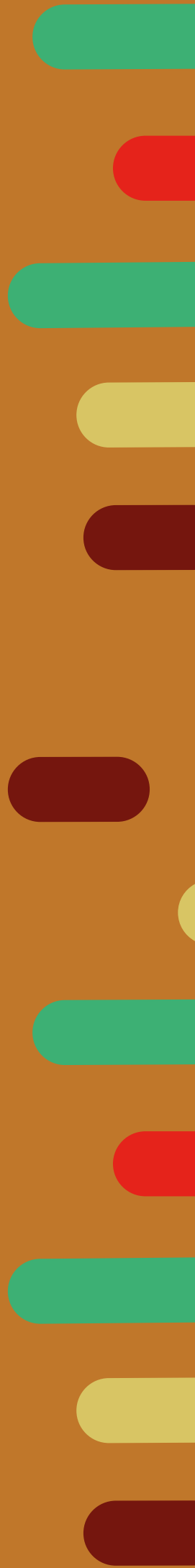
Cracks, gaps, and mortar joints

In almost all cases, roosts are accessible through narrow cracks or small openings. (Almost) all of these roosts can be made unsuitable (bats can be excluded) in the following ways:

- For easily removable cladding and molding: by removing or folding away cladding, molding, lead strips, or other strips;
- For hidden roosts (often in the cavity or spaces in the structure) accessible through narrow/small openings: by installing exclusion flaps in combination with closure using foam or another sealant.



Integrating bat boxes in buildings



Batboxes

There is not one type of solution that can be applied in all situations. The best solution depends on the building type and the type of project that is being carried out. Different solutions are chosen for renovations than for new constructions. On the following pages, you will find an overview of solutions for different building types and types of projects.

Prefab or custom-made?

In renovation projects, both bird and bat facilities are often realized in the form of prefabricated boxes. Only if building components are (re)built customized solutions are interesting. This can also be the case, for example, with roof renovations; the roof construction is being rebuilt.

What are the minimum dimensions for bat boxes (based on Dutch standards)?

Dimensions and types of bat boxes

According to the mitigation catalog of Arcadis/knowledge documents of BIJ12, bat boxes must have at least the following dimensions, but larger is better:

Type verblijfplaats	Afmetingen	Surface per layer	Total surface in roost
Bat box small	20x50 cm, 2 layers	0.1 m ²	0.2 m ²
Bat box big	40x50 cm, 2 layers	0.2 m ²	0.4 m ²
Maternity box	80x70 cm, 2 layers	0.56 m ²	1.7 m ²
Winter roost	2.5 m ² x (>2 layers)	2.5 m ²	>5.0 m ²

Dimensions and types of bird boxes

In accordance with the mitigation catalog of Arcadis/knowledge documents of BIJ12, swifts and house sparrow facilities must at least meet the following dimensions:

Sparrow boxes:

- Minimum bottom surface (inside) of 15 x 8 cm, but preferably 15 x 15 x 22 cm;
A round entrance opening with a diameter of +/- 35 mm.

Swift boxes:

- Minimum floor surface (inside) of 350 cm² and at least 13 cm high;
- An oval entrance opening with a diameter of 65 x 30 mm.

Positioning of boxes

There are a number of basic rules regarding the positioning of prefab bat/bird boxes

Terraced houses:

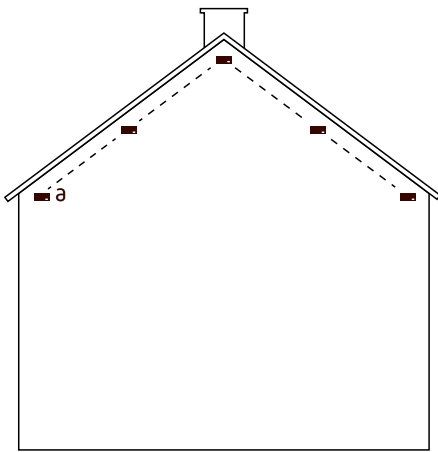
- Swift boxes on the end facades, preferably just below the roof line;
- Sparrow boxes just below the gutter, preferably in the front facade;
- Small bat boxes in the front facade or in the end facades;
- Large bat boxes in the end facades, directly along the roof line;
- Place bird boxes on north/east facades or just below the eaves, preferably place bat boxes on south/west facades;
- Keep a distance of at least 50 centimeters from windows and do not place boxes above windows or doors.

Apartment buildings:

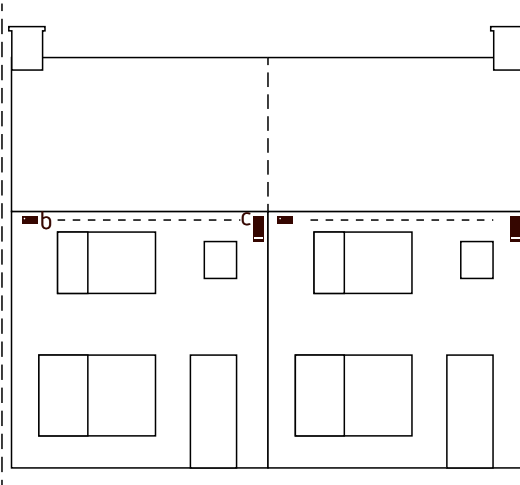
- Place bird boxes on north/east facades, preferably place bat boxes on south/west facades;
- Place sparrow boxes between the second and third storey;
- Place swift and bat boxes preferably along the roof line;
- Do not place boxes higher than the 8th floor;
- Keep a distance of at least 50 cm from windows and do not place boxes directly above windows or doors.

End facade north/east

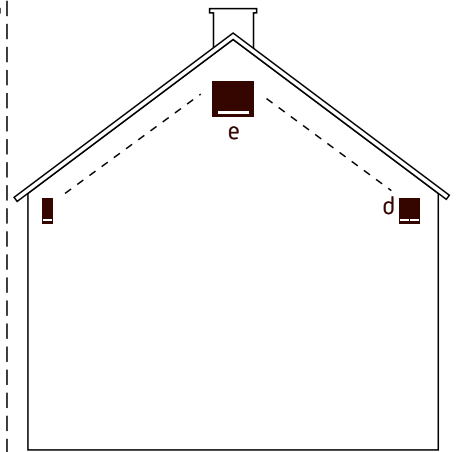
Swift

**Front facade**

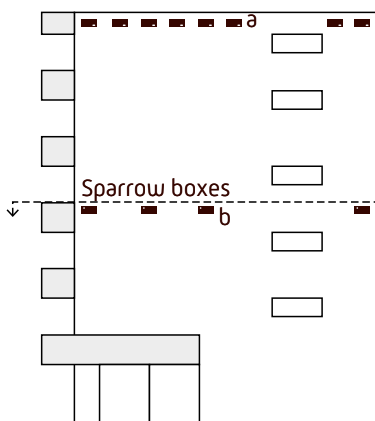
Sparrow/swift/bat box small

**End facade south/west**

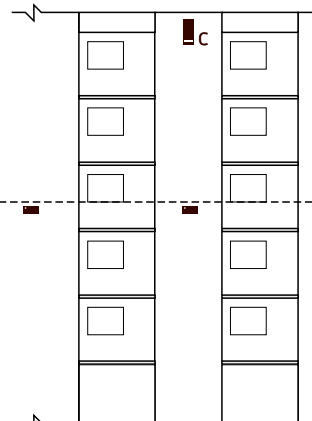
Bat box large and Maternity boxes

**Facade north**

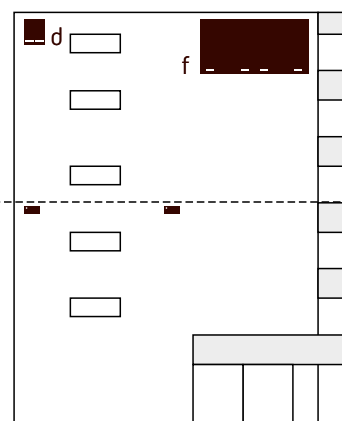
Swift/sparrow

**Facade east**

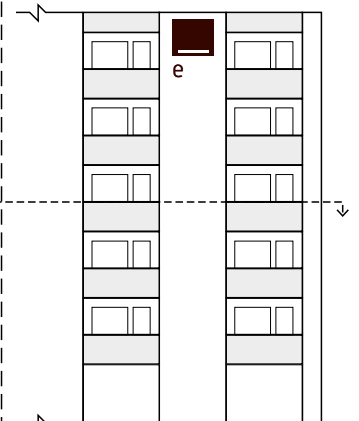
Swift/sparrow/bats

**Facade west**

Bats

**Facade south**

Bats



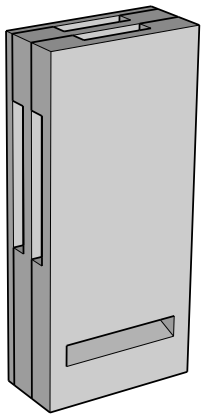
a = swift box
b = sparrow box
c = bat box small

d = bat box large
e = maternity box
f = winter roost

Prefab boxes



Bat boxes

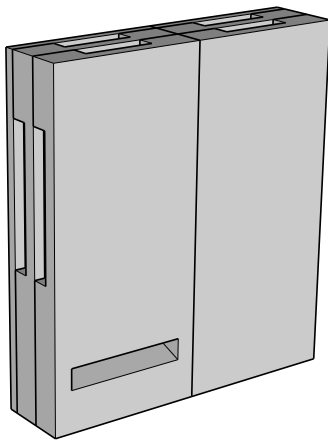


Bat box small (<10)

Box VMMP2 Unitura

Properties

Material:	Woodconcrete
Layers:	2 layers
Depth inside:	2 x 25 mm
Size:	48.7x22x10 cm

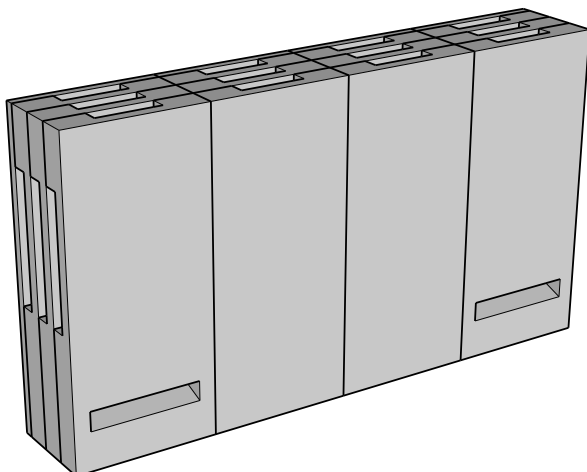


Bat box large (>10)

Bat box VMMP2 combined with box VMMP2u Unitura

Properties per part

Materiaal:	Woodconcrete
Layers:	2 layers
Depth inside:	2 x 25 mm
Size:	48.7x22x10 cm x <u>2 parts</u>

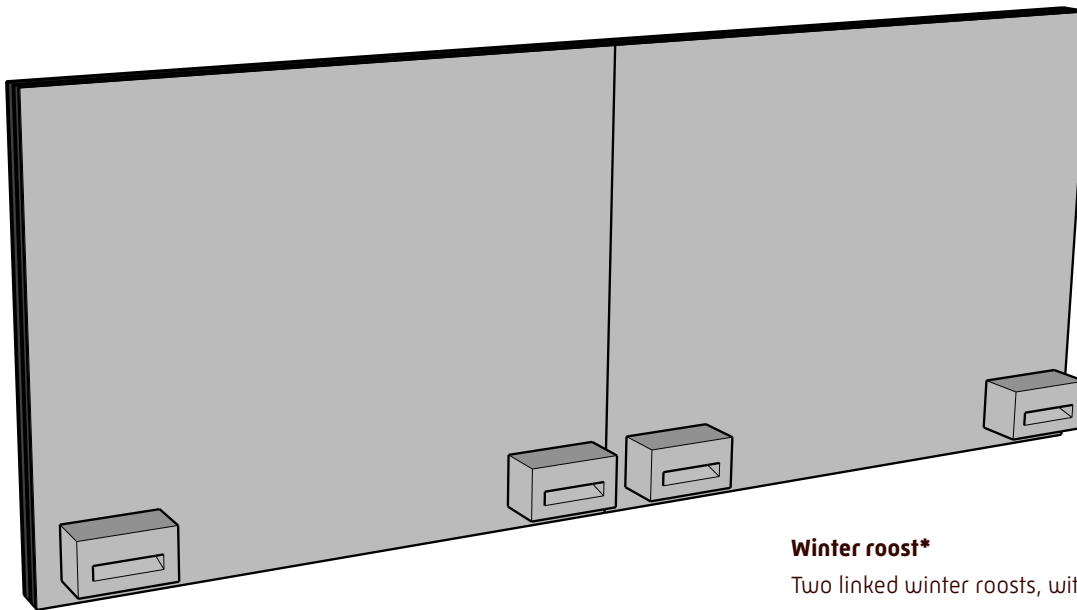


Maternity box

Bat box VMPMK1 Unitura

Properties per part

Material:	Woodconcrete
Layers:	3 layers
Depth inside:	3 x 25 mm
Size:	48.7x22x14.5 cm x <u>4 parts</u>
Weight:	12.3 kg

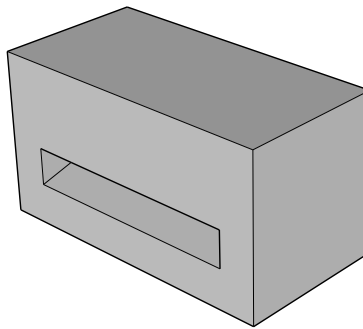


Winter roost*

Two linked winter roosts, with 4 entrance stones

Based on guide lines from the mitigation catalog of Arcadis

Entrance stone VMMP 4 Unitura
220x100x112 mm



Eigenschappen per deel

Material: XPS, plywood, organic plaster

Layers: 2 layers

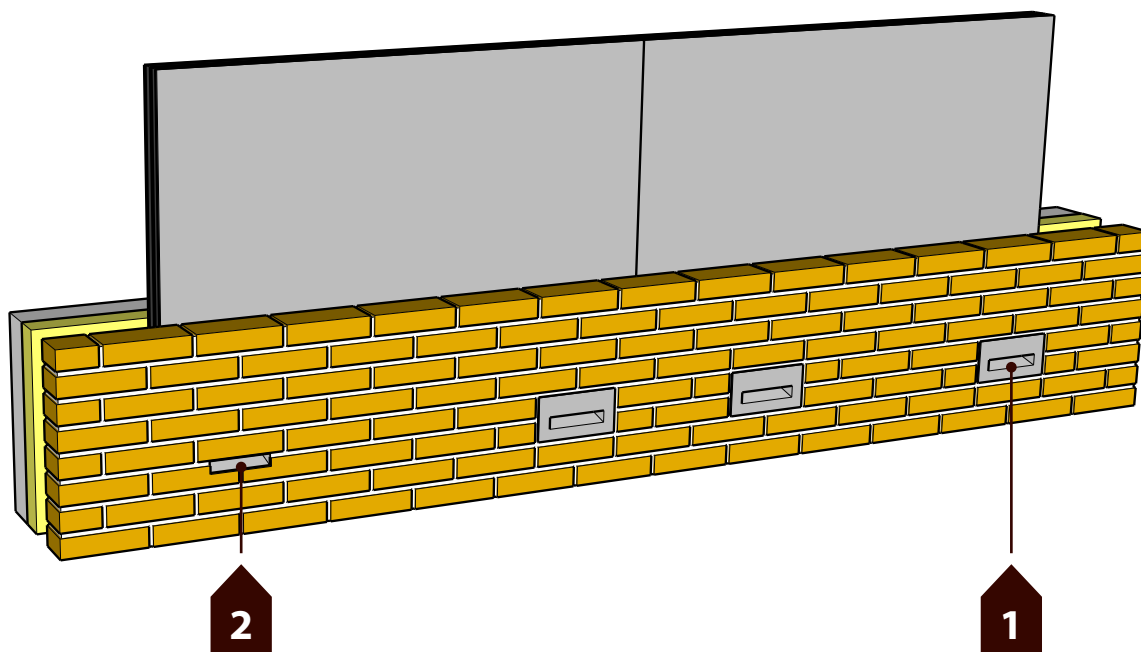
Depth inside: 25mm and 30 mm

Size: 125x100x9 cm

Weight: 25-30 kg

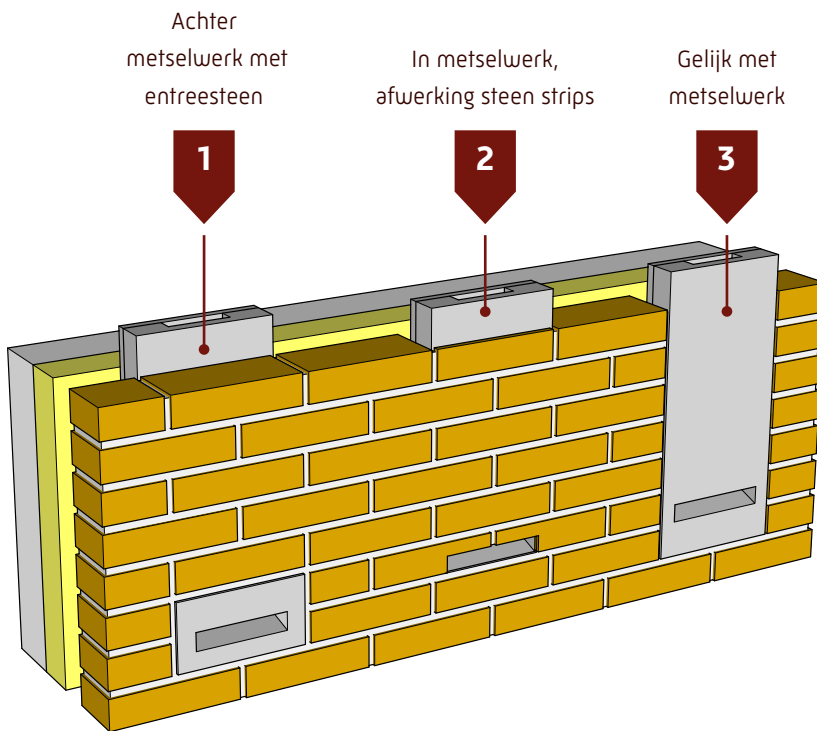
Application options

The winter roost must be placed completely behind the masonry. This to reach the required temperature buffering. Place the entrance stone in the masonry [1] or set it back slightly and finish with brick slips [2].

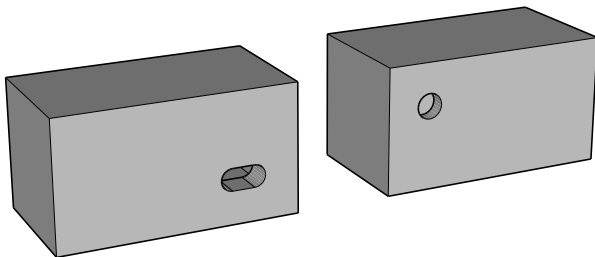


Application options bat boxes general

The boxes can be placed in different ways. Installation options 1 and 2 are most suitable for new construction situations.



Swift and sparrow boxes



Sparrow box HMP2

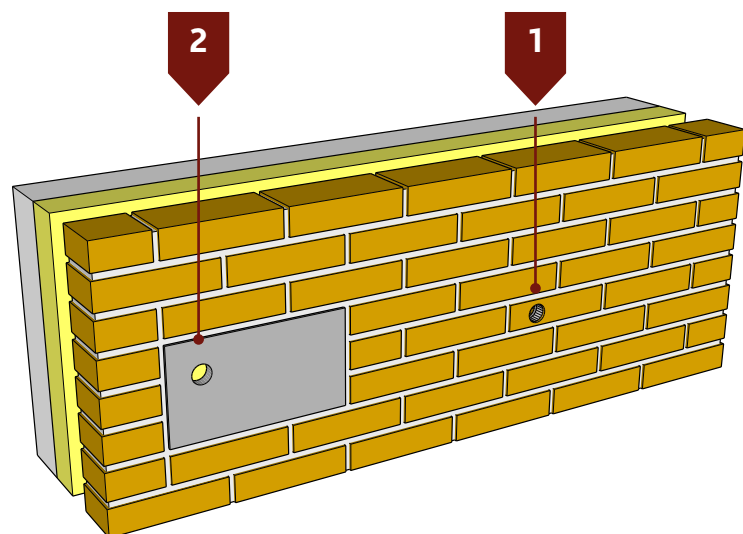
Material: Woodconcrete
 Diameter entrance: 35 mm
 Size: 32x18x18 cm
 Weight: 5.4 kg

Swift box GZP2

Material: Woodconcrete
 Diameter entrance: 33 x 66 mm
 Size: 32x18x18 cm
 Weight: 5.4 kg

In masonry

In masonry,
 finished with brick strips



Application options

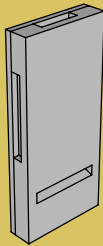
The boxes can be placed in different ways.

► Over view VMPM-series

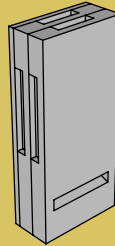
Standard options

Basis boxes

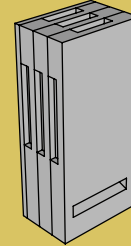
Box VMPM1
1-layer



Box VMPM2
2-layers

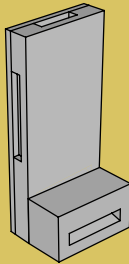


Box VMPM3
3-layers

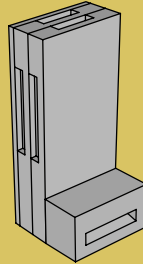


Basis boxes with entrance stone

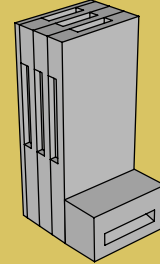
Box VMPM1e
1-layer



Box VMPM2e
2-layers

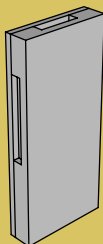


Box VMPM3e
3-layers



Extension boxes closed

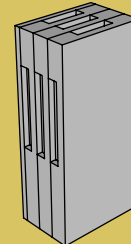
Box VMPM1u
1-layer



Box VMPM2u
2-layers

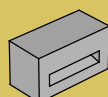


Box VMPM3u
3-layers



Entrance stone

Stone VMPM4
105mm



Stone VMPM4a
50mm



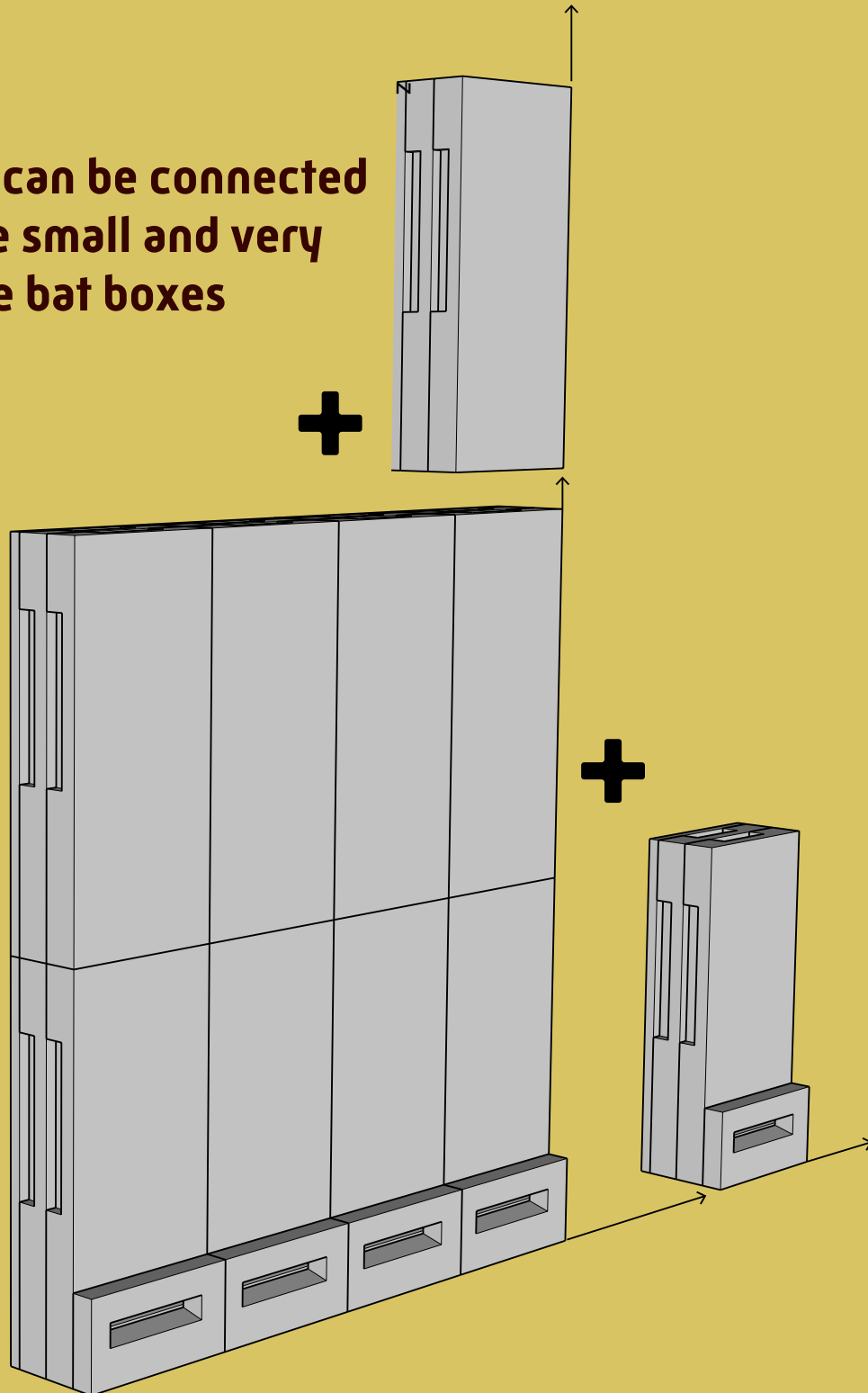
Stone VMPM4b
30mm



Modular bat boxes

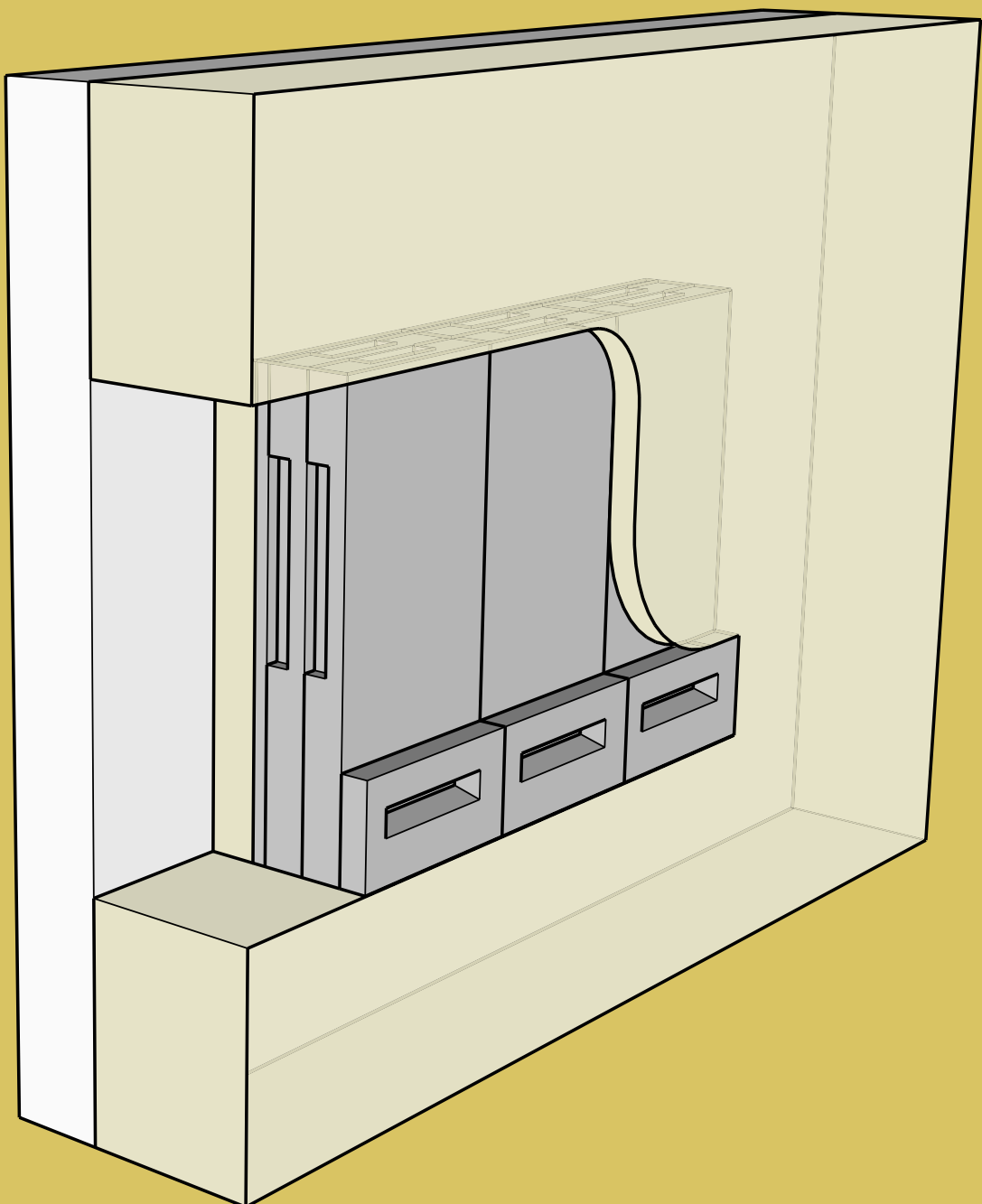
► Over view VMPM-series

The boxes can be connected to create small and very large bat boxes



► Over view VMPPM-series

Depending on the insulation depth combinations can be made. For every situation a fitting solution.

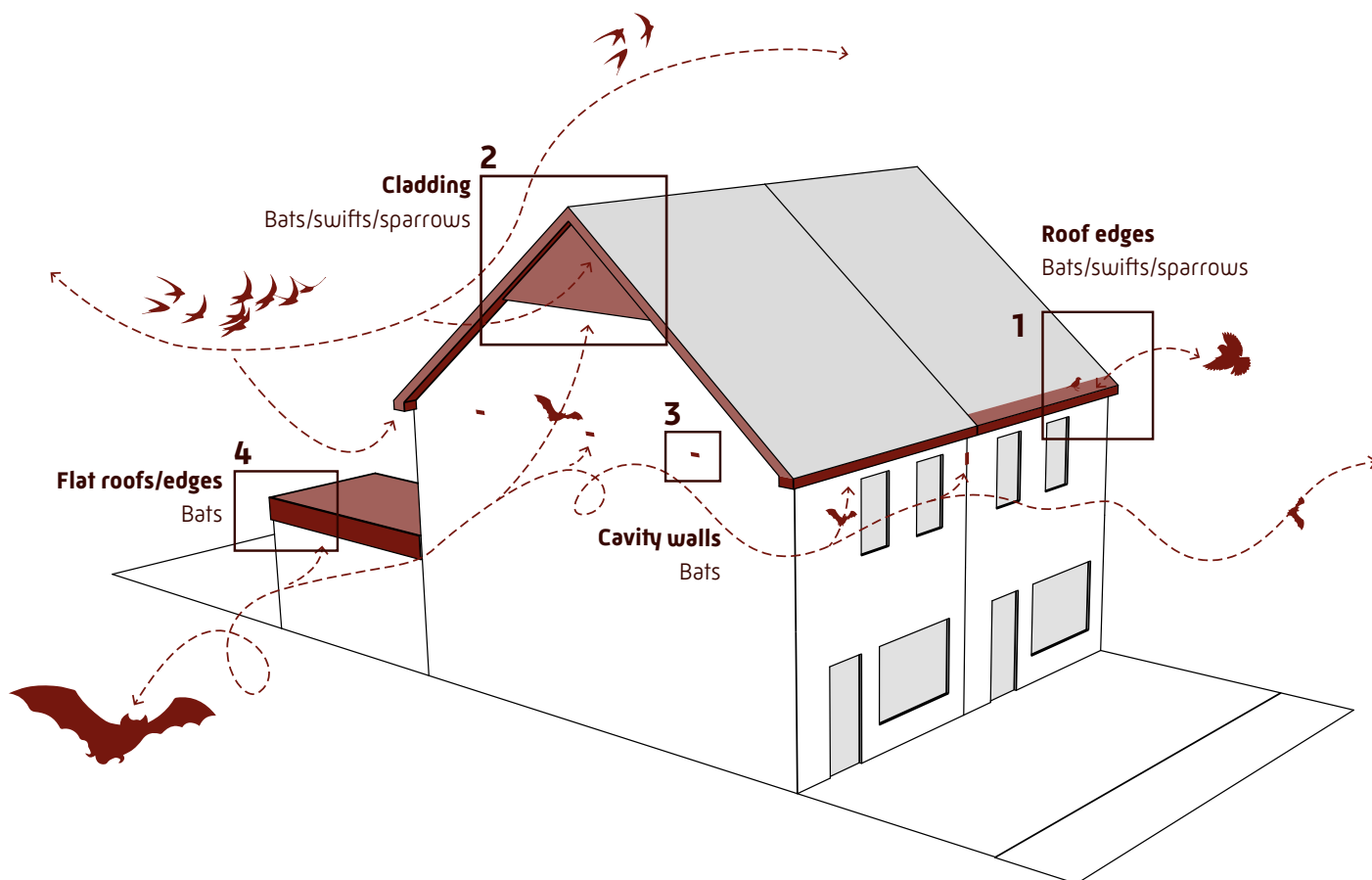


Semi-prefab and customized solutions for ground-level homes

Bats/swifts/sparrows

Ground-level homes:

Locations	Species(group)	Type of box/solution
1 Roof edges	Sparrow Swift Bats	Nestplaces under roof tiles Swift boxe Bat boxes
2 Facade cladding	Swifts Bats	Swift boxes Bat boxes
3 Flat roofs/roof edges	Bats	Bat boxes
4 Cavity wall	Bats	Bat boxes small and large



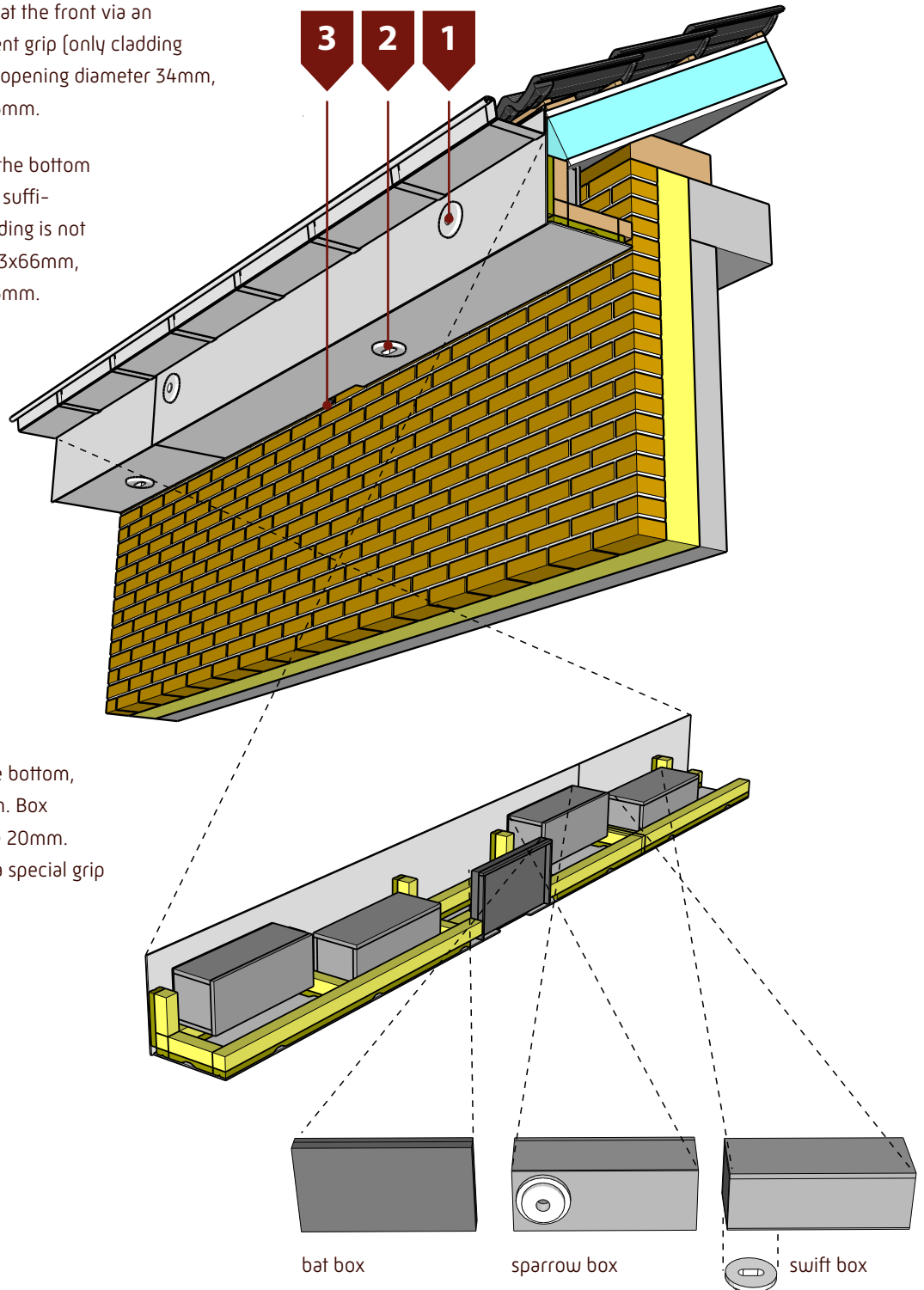
1 Gutter paneling for bats, house sparrows and swifts

Eaves are suitable locations to realize bat and bird boxes. Paneling under gutters are suitable location for swift, sparrow and bat boxes. Unitura supplies boxes for prefab paneling.

[1] Sparrow box: Opening at the front via an entrance stone for sufficient grip (only cladding material is not sufficient), opening diameter 34mm, spacious box 520x175x175mm.

[2] Swift box: Opening at the bottom via the entrance stone for sufficient grip (only sheet cladding is not sufficient), oval opening 33x66mm, spacious box 520x175x175mm.

[3] Bat box: Access via the bottom, opening below 150x20mm. Box 520x350mm, depth inside 20mm. The box is provided with a special grip layer on the inside.

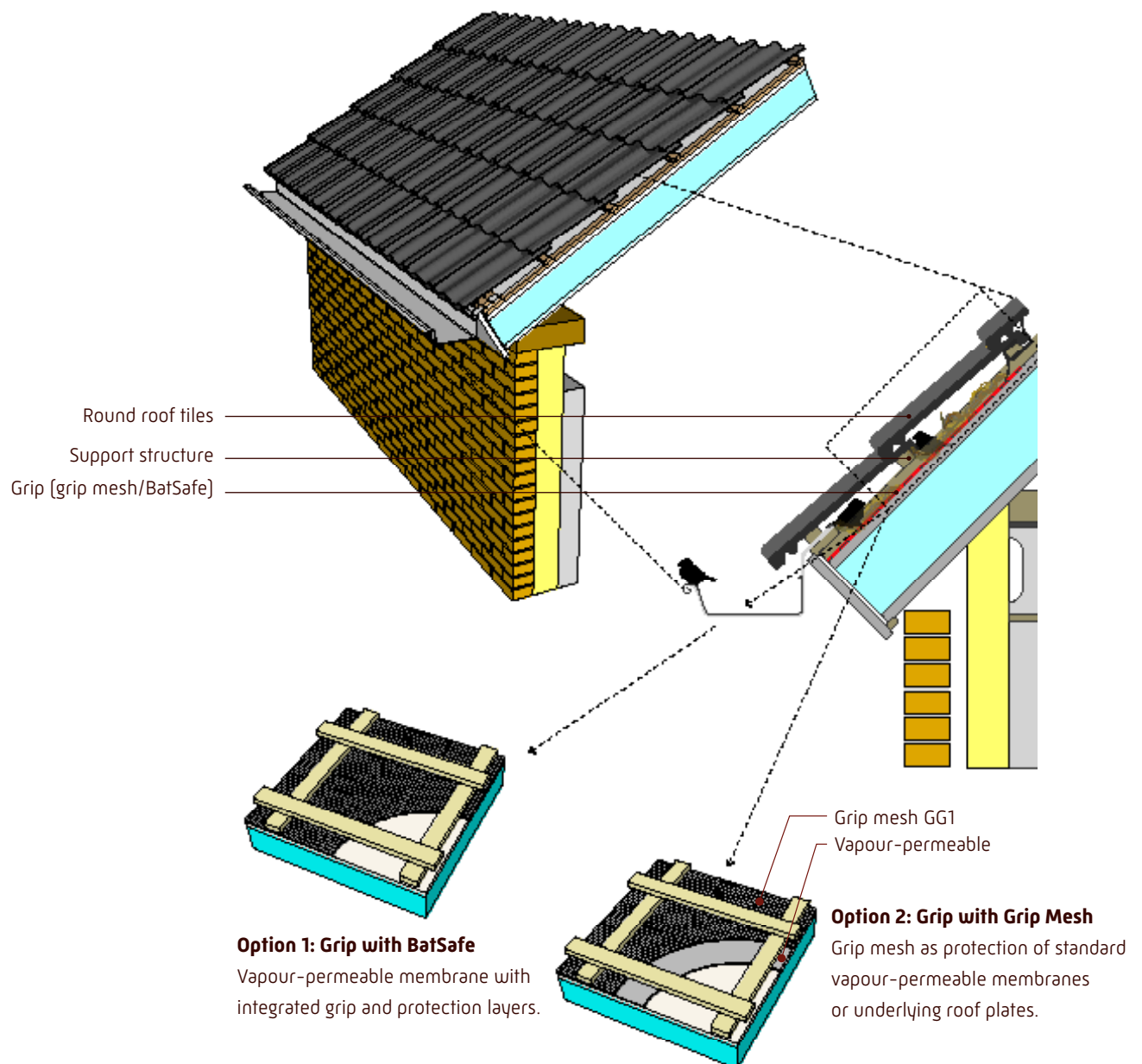


1 Accessible roof tiles for house sparrows

By providing house sparrows access to the space under the tiled roof, house sparrows can easily be accommodated. NB! Not every modern tile construction is suitable. Tiled roofs suitable for house sparrows must generally meet these requirements:

Dimensions/material:

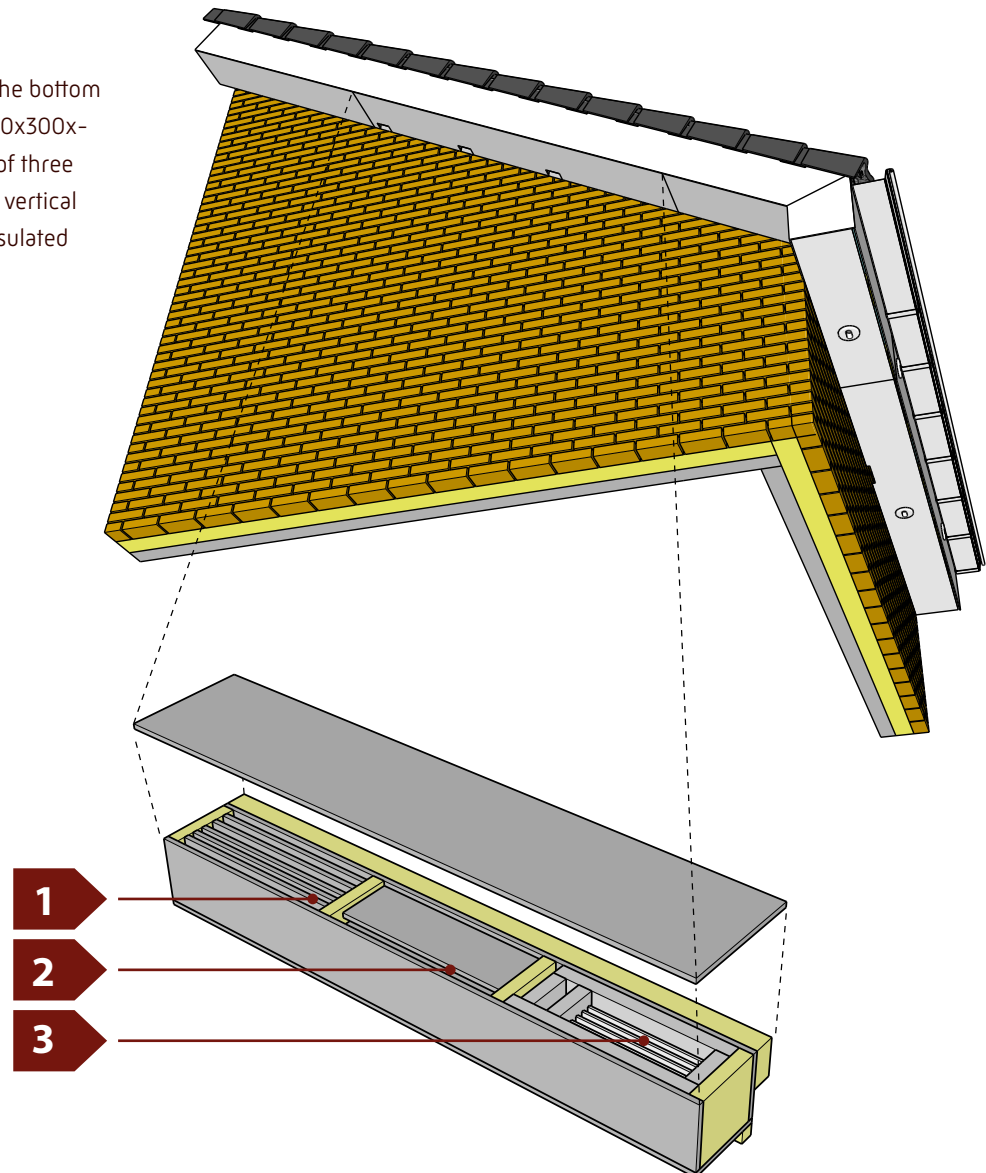
- The roof space under the first three rows of roof tiles must be accessible via the gutter or other openings;
- The entire length of the house must be accessible;
- Roof space >8cm high (vertically measured distance between roof plate and underside of roof tile);
- Cover the roof plate or vapour-permeable membrane with grip mesh or BatSafe so that house sparrows have sufficient grip.



1 Large bat box in roof cantilever

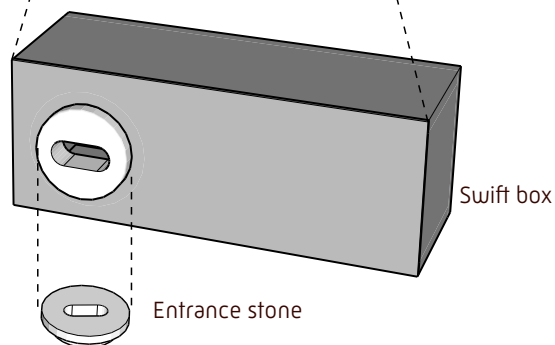
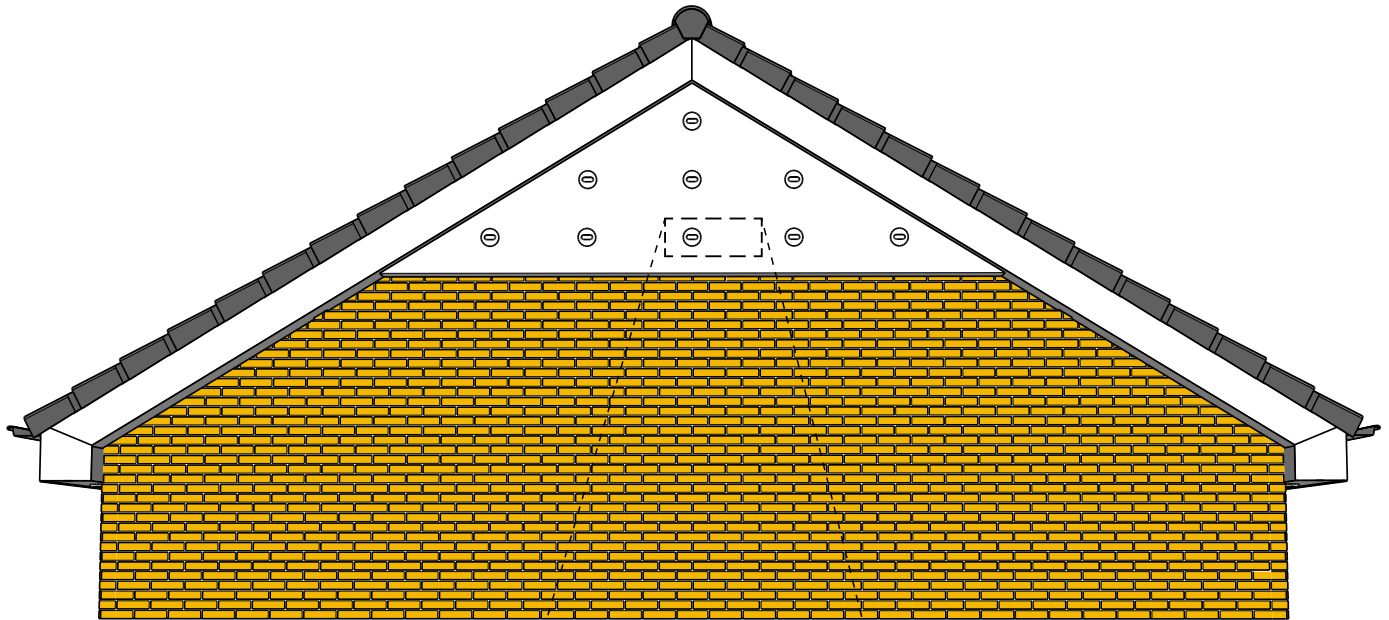
Tiled roofs of ground-level homes are popular as a nursery for common pipistrelles and serotine bats. Tiled roofs often lose their function after a roof renovation. This large bat box has been specially developed as a maternity box that can be fitted into the new roof construction. The box has been specially developed for roof cantilevers, so that insulating layers do not have to be broken. The bat box provides different climate zones, so that the box can be used during a large part of the year.

Bat box: Three accesses via the bottom along the outer wall, box 2500x300x-300mm, the box is made up of three connected compartments: [1] vertical slats [2] horizontal slats [3] insulated compartment.



2 Façade paneling for swifts

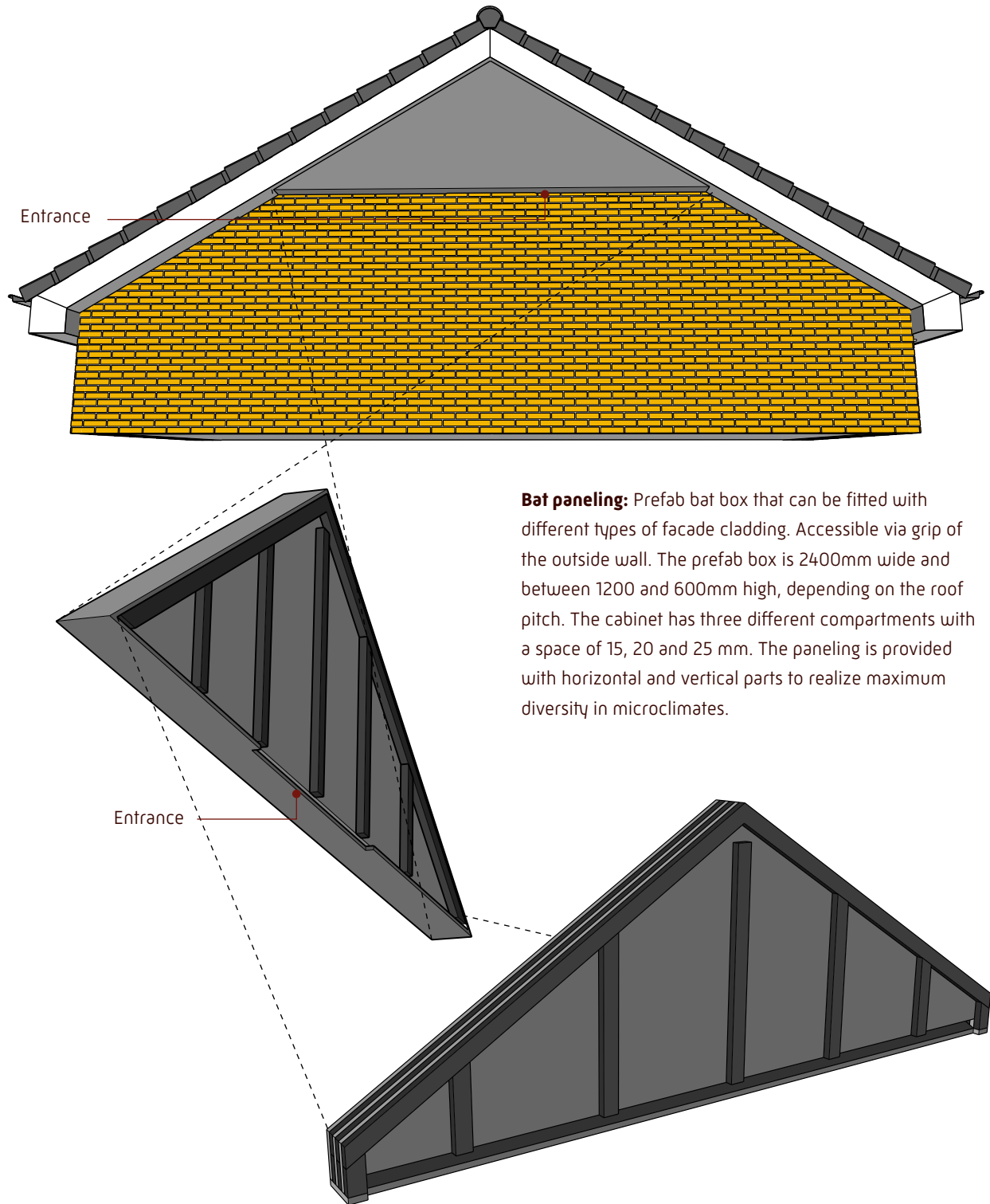
As an alternative to installing built-in swift boxes, it is also possible to opt for surface-mounted swift boxes that are concealed in facade paneling. Because the facade paneling shields the cabinets from direct sunlight, facade paneling can also be used on warmer facades, for example on west facades (provided that they are well ventilated).



Swift box: Opening at the front via entrance stone for sufficient grip (only cladding material is not sufficient), oval opening 33x66mm, spacious box 530x180x180mm.

2 Façade paneling as a large bat box

Prefab facade panelings are well suited as large bat boxes. Extensive, multi-layered facade paneling is suitable as a nursery roost for various types of bat species, including the common pipistrelle and serotine bat.



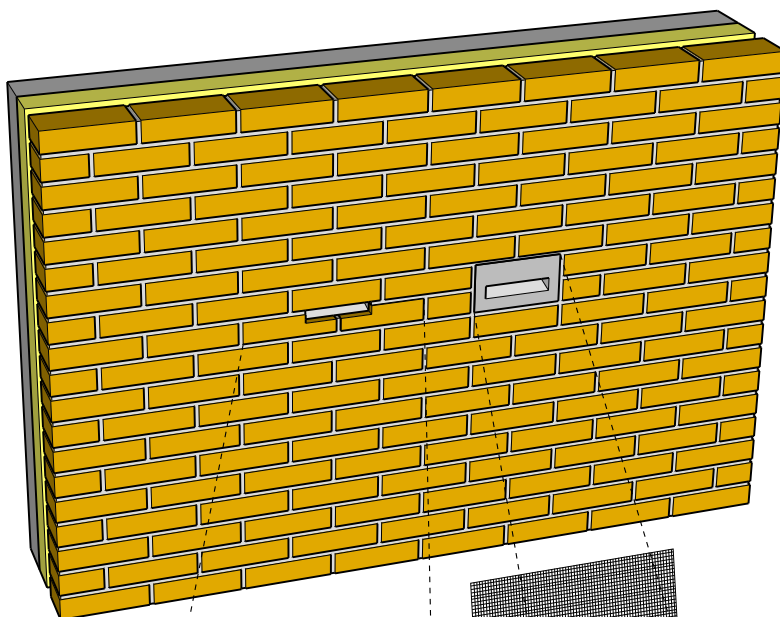
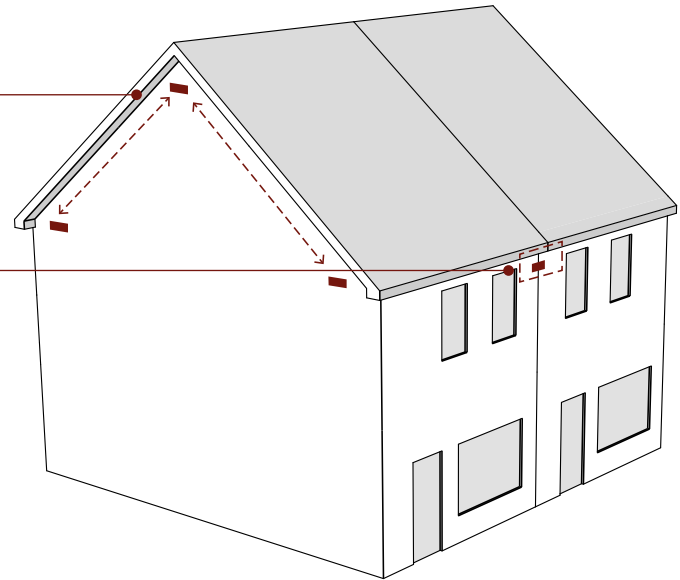
Bat paneling: Prefab bat box that can be fitted with different types of facade cladding. Accessible via grip of the outside wall. The prefab box is 2400mm wide and between 1200 and 600mm high, depending on the roof pitch. The cabinet has three different compartments with a space of 15, 20 and 25 mm. The paneling is provided with horizontal and vertical parts to realize maximum diversity in microclimates.

2 Cavity access for bats

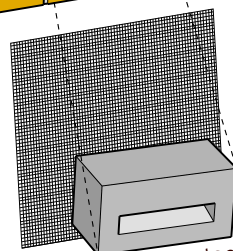
Making the cavity wall accessible is an effective and inexpensive way to create bat facilities. Cavity walls can be made accessible using entrance stones. If BRM insulation is used, this must be covered with grip mesh [see website]. Accessible cavity walls are suitable for any type of residence. Accessible intermediate cavities are also suitable as (mass) winter roosts for bats.

End facades are suitable positions to make the cavity wall accessible. Make several openings, preferably along the eaves. Bats usually look for openings along eaves.

If possible, also make the intermediate cavity accessible. These buffered areas are also suitable as a winter roost. See the next page for a detail.



Entrance stone finished with brick strips

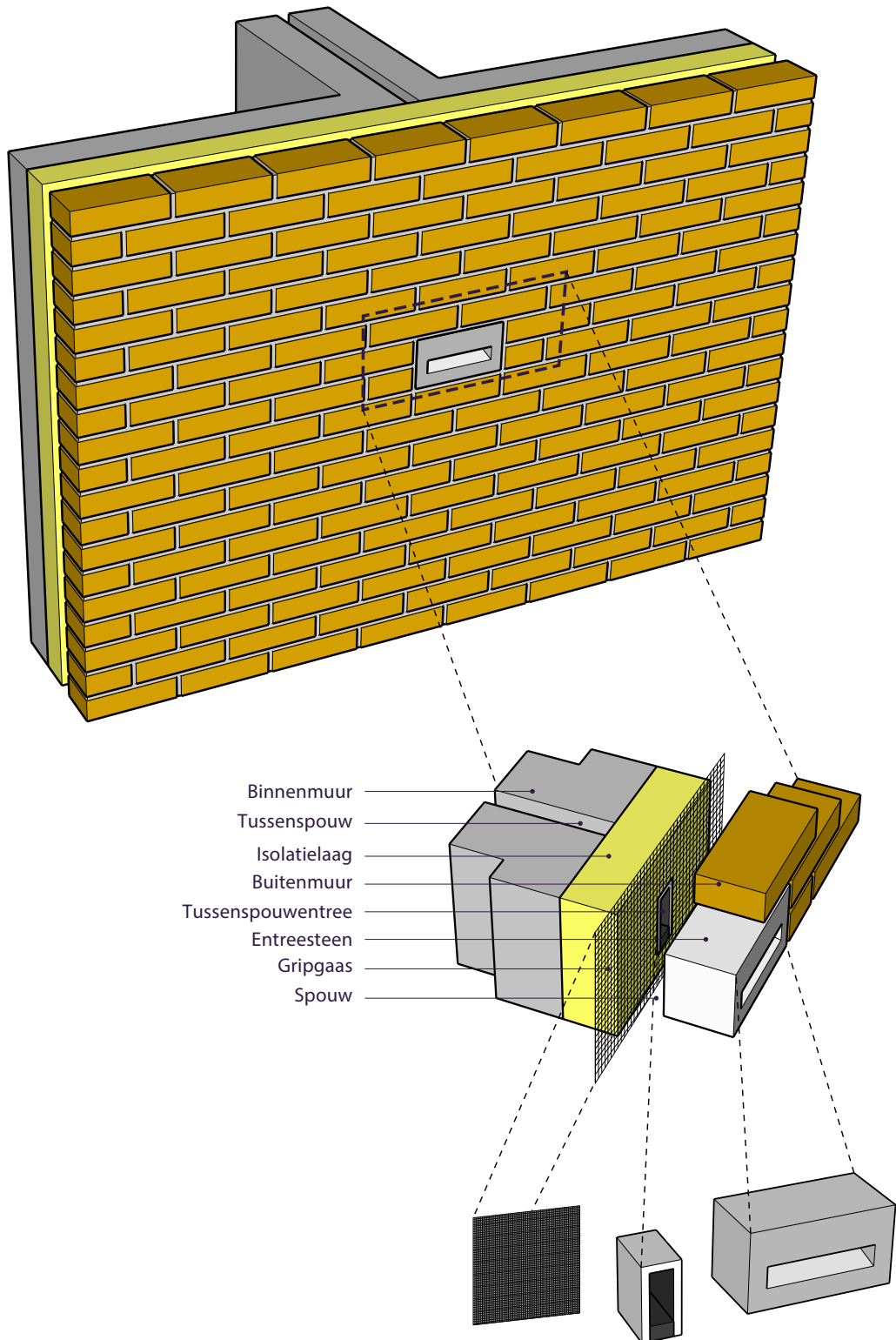


Entrance stone + grip mesh covering insulation

Entrance stones: The cavity can be made accessible with entrance stones. Entrance stones can be shortened if desired and finished with brick strips for an almost invisible application.

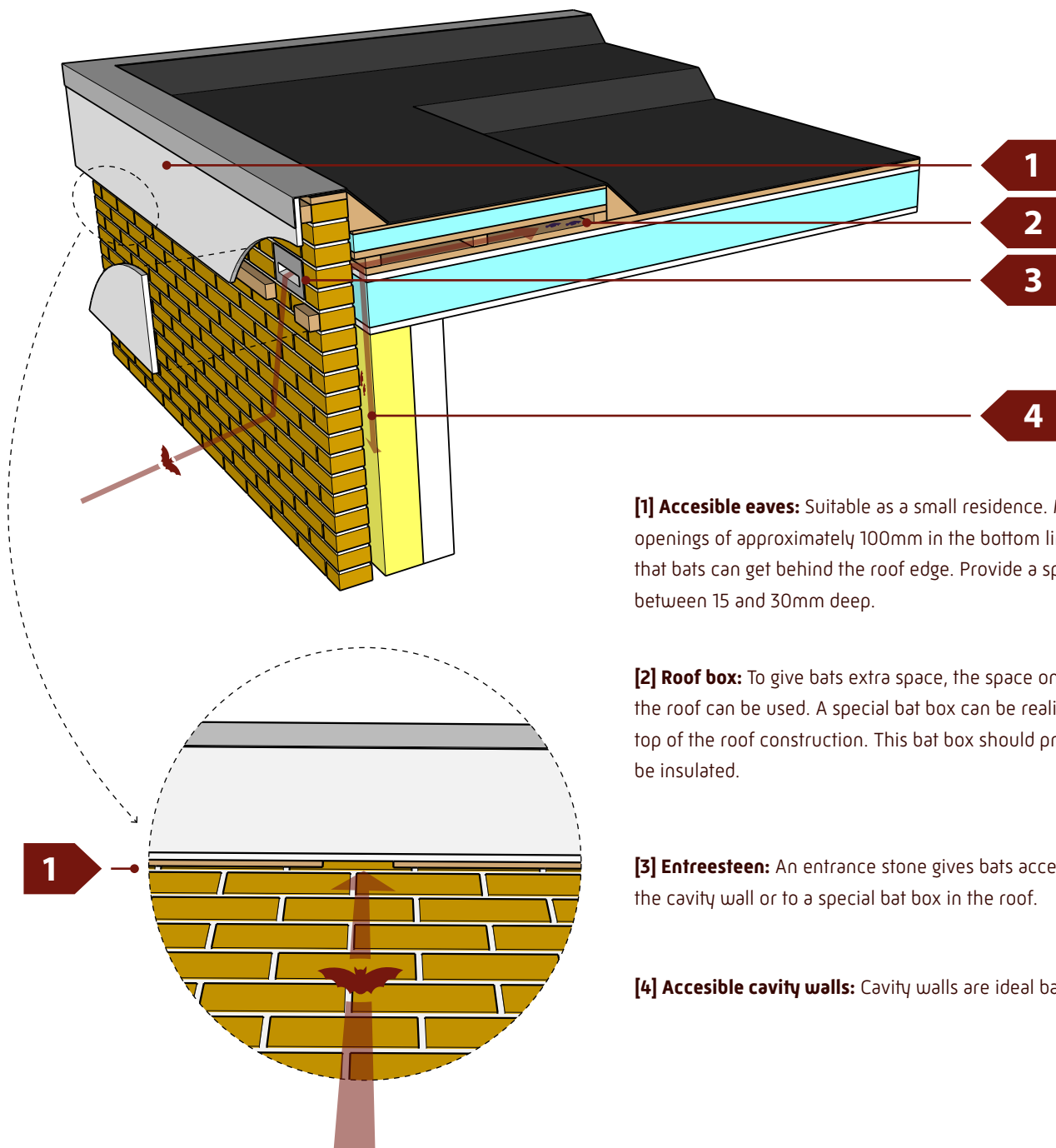
3 Give bats access to internal cavities

Accessible intermediate cavities are suitable as (mass) winter roosts for bats. Intermediate cavities can be made accessible by placing an intermediate cavity entrance in the insulation layer. The intermediate cavity entrance must be exactly the same length as the insulation layer is thick. The entrance must be cut to size during the installation. Place one entrance just below the gutter/top of the wall. If several intermediate cavity entrances are placed, a draft will be created. If insulation material is used, the material must be covered with grip mesh (see website).



4 Bats and flat roofs

Flat roof structures can be made suitable for bats in various ways. The easiest is to allow bats access under the eaves. The quality of the accommodation can be improved by also making access to the cavity wall or to a special roof box.



[1] Accessible eaves: Suitable as a small residence. Make openings of approximately 100mm in the bottom line, so that bats can get behind the roof edge. Provide a space of between 15 and 30mm deep.

[2] Roof box: To give bats extra space, the space on top of the roof can be used. A special bat box can be realized on top of the roof construction. This bat box should preferably be insulated.

[3] Entreesteen: An entrance stone gives bats access to the cavity wall or to a special bat box in the roof.

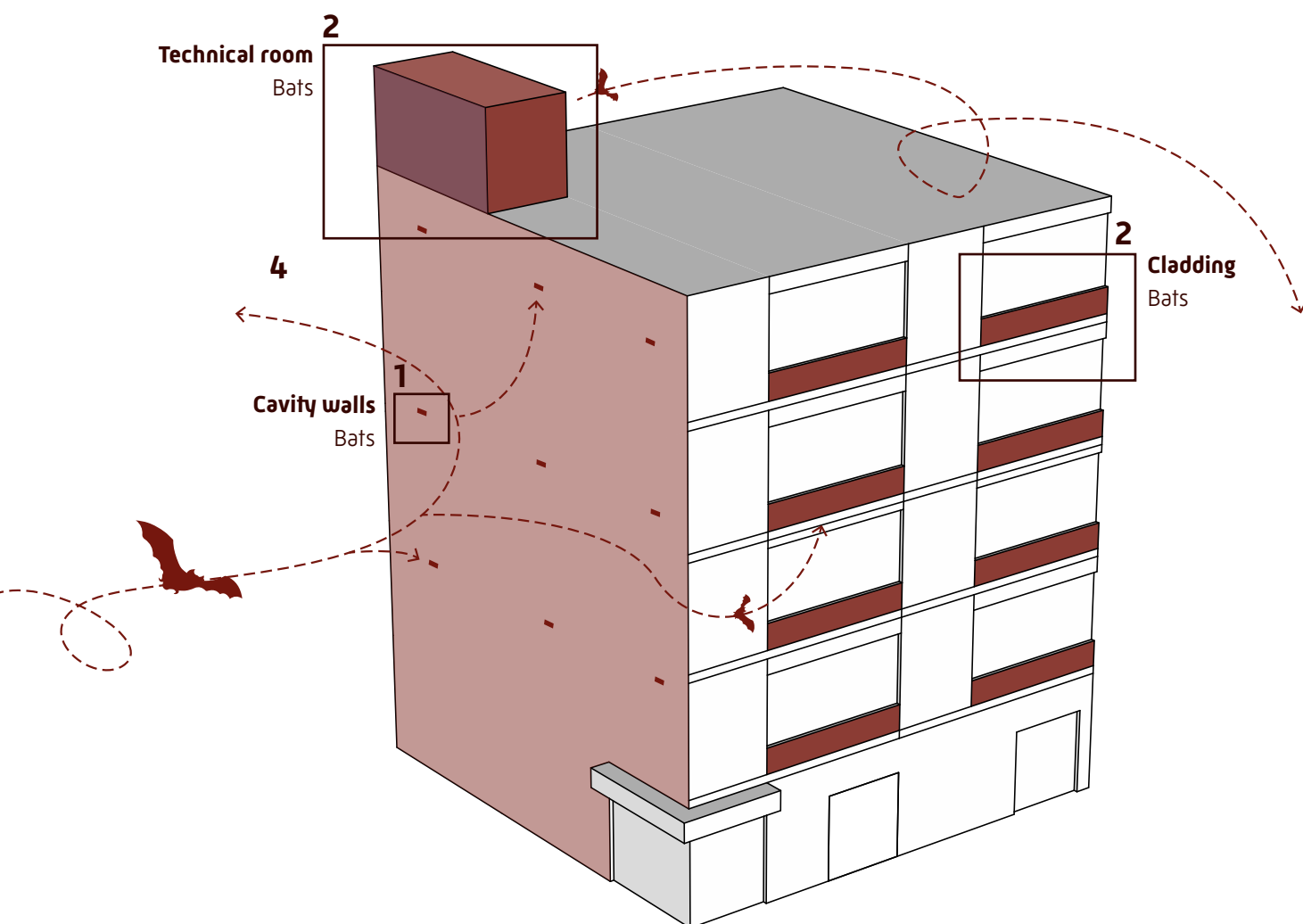
[4] Accessible cavity walls: Cavity walls are ideal bat roosts.

Semi-prefab and customized boxes for apartment buildings

Gebouwonderdelen en potentie

Appartementencomplexen:

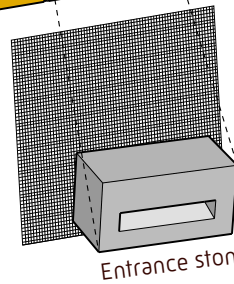
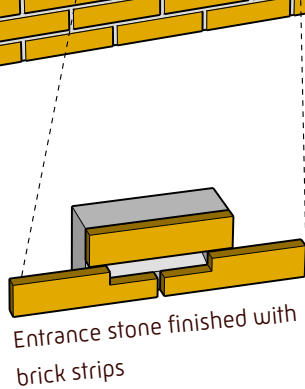
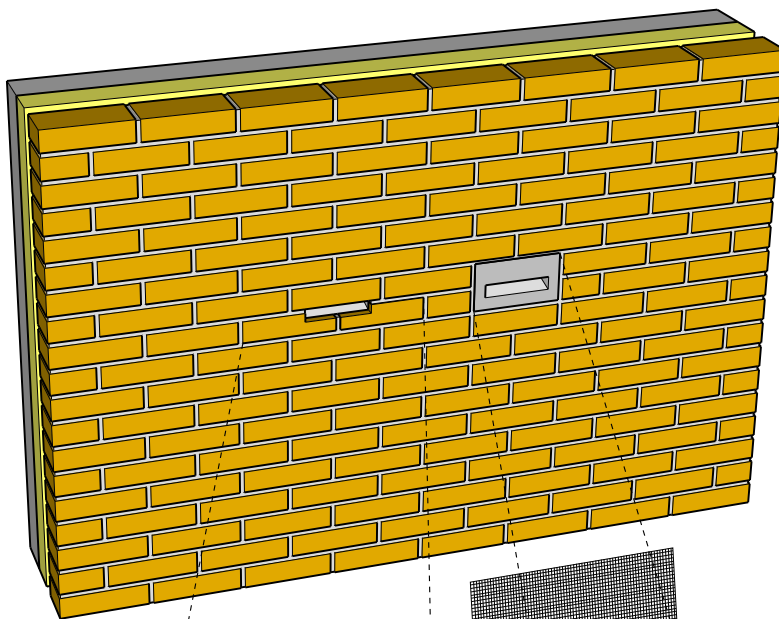
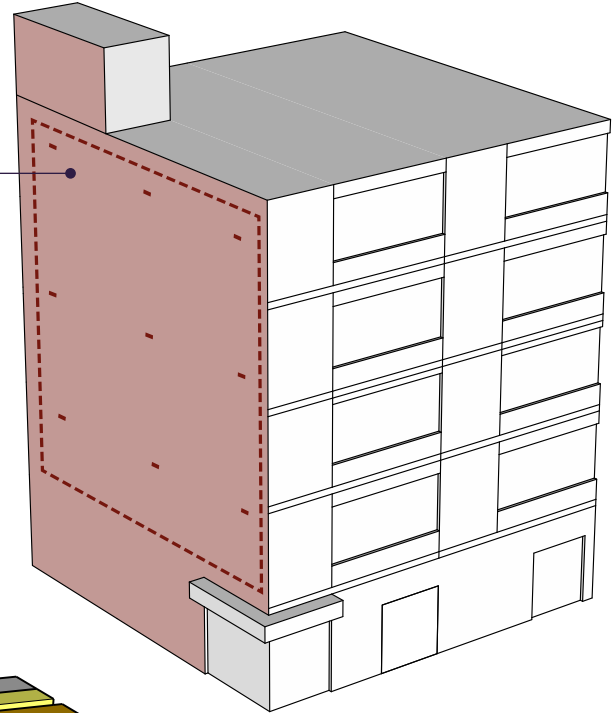
Type	Species (group)
Cavity	• Bats
Technical room	• Bats
Cladding	• Bats



1 Cavity access for bats

Making the cavity wall accessible is an effective and inexpensive way to create bat roosts. Cavity walls can be made accessible using entrance stones. If insulation is used, this must be covered with grip mesh (see website). Accessible cavity walls are suitable for any type of roost. Accessible intermediate cavities are also suitable as (mass) winter quarters for bats.

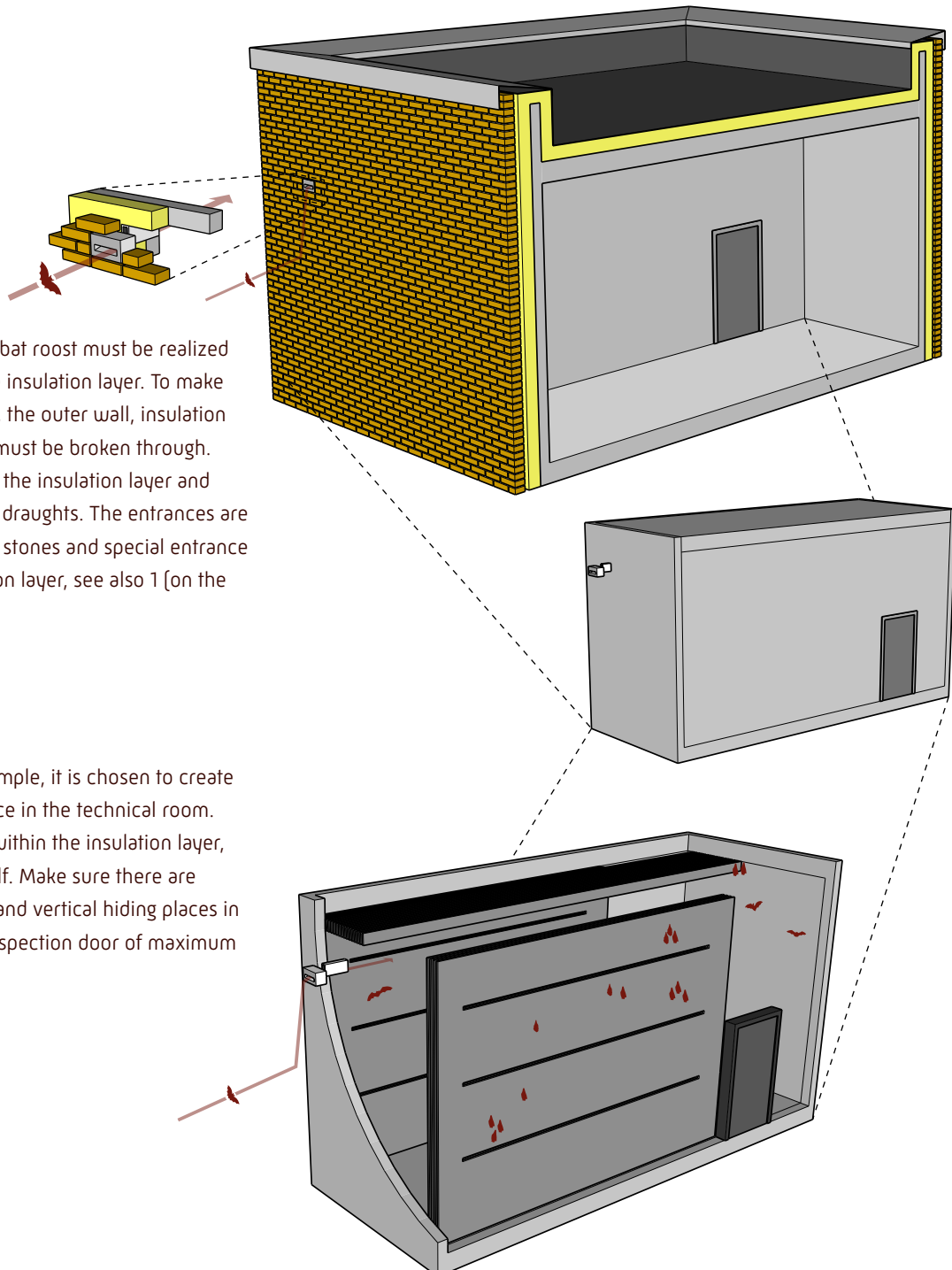
End facades are good positions to make the cavity wall accessible. Make several openings, preferably along the eaves. Bats usually look for openings along eaves. Make sure that the largest possible cavity space is accessible, preferably divided over several facade orientations.



Entrance stone: The cavity can be made accessible with an entrance stone. Entrance stones can be shortened if desired and finished with brick strips for an almost invisible installation.

2 The technical room as a large bat residence

Technical rooms in apartment complexes are often only used sporadically during inspections. These often weakly heated areas are ideal winter roosts for various bat species, including the long-eared bat. In addition to technical rooms, other unused or little-used areas, such as fake attics and storage rooms, are also suitable as bat roosts. The design of these spaces is in all cases custom-made.

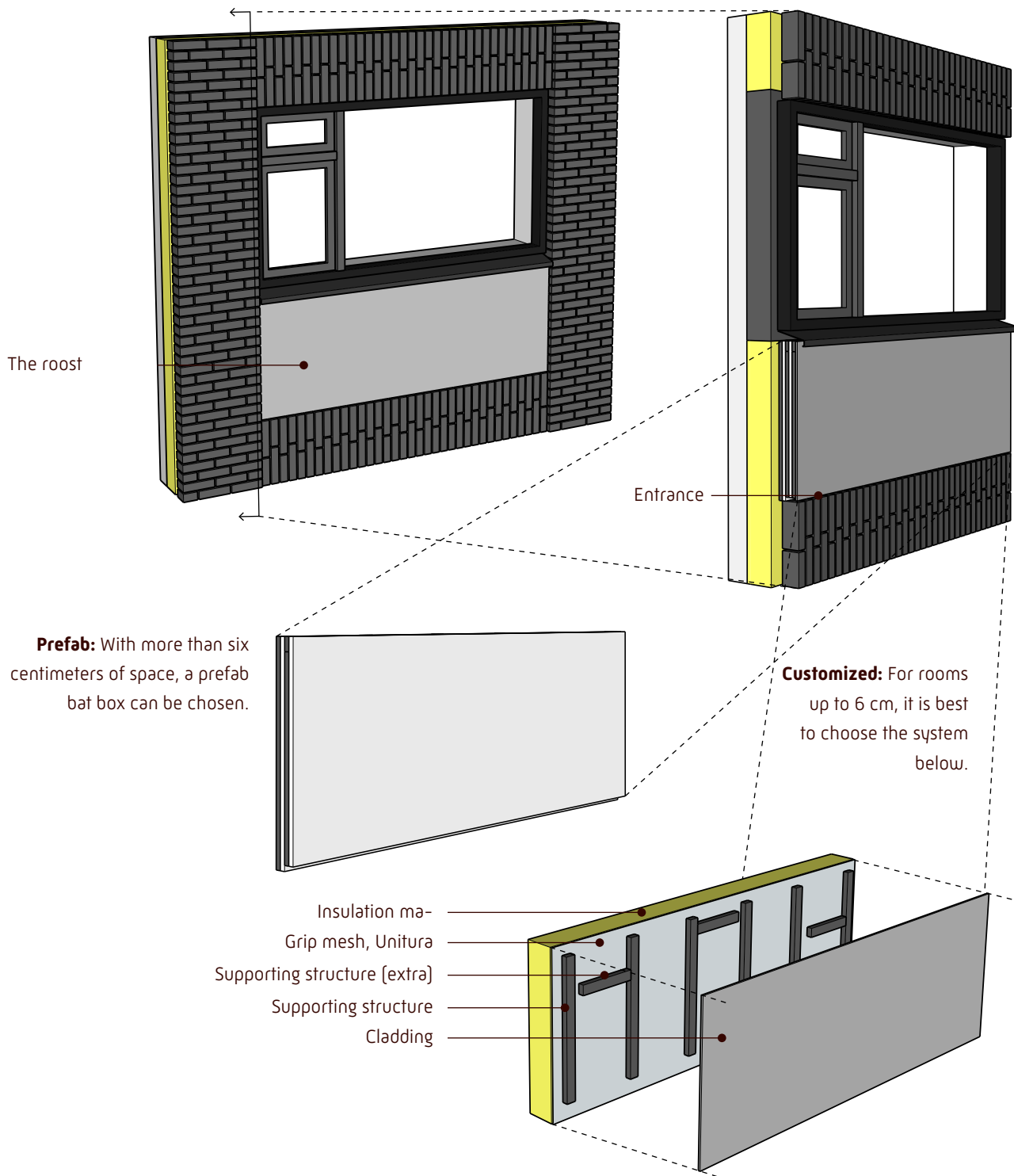


Entrance stone: The bat roost must be realized in a space behind the insulation layer. To make this space accessible, the outer wall, insulation layer and inner wall must be broken through. Make one opening in the insulation layer and inner wall to prevent draughts. The entrances are made using entrance stones and special entrance pipes for the insulation layer, see also 1 (on the previous page).

Bat roost: In this example, it is chosen to create a small enclosed space in the technical room. The roost is located within the insulation layer, but is not heated itself. Make sure there are sufficient horizontal and vertical hiding places in the roost. Make an inspection door of maximum 0.7m².

3 Bat roost behind facade panels

Facade systems constructed from sheet metal or combination facades with sheet metal are not by definition unsuitable as a roost for bats. Often with only a few adjustments, these facade systems can be made suitable as a place to stay for bats. Bats can use facade systems if the following preconditions are fulfilled: [1] an entrance opening with sufficient grip, [2] a rear wall with sufficient grip and [3] no draft behind the panels.





Spaces for people and nature



mail info@unitura.nl computer www.unitura.nl phone 085 060 50 35