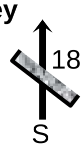
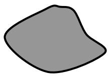
2 Survey of granite gables

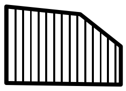
A photographic survey was made of granite gable walls on a number of mornings following overnight rain to determine the patterns of wetting on their surface relative to weather conditions, façade orientation and façade design details. Weather conditions during the previous night were obtained from the Meteorological Office (Table 2.1).

Key

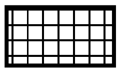


Dominant wind direction (e.g. S) during previous hours rainfall, relative orientation of gable (outlined on facing direction) and wind speed in knots (e.g. 18).

 Wetted area

 Obscured area

 Satellite dish

 Window or door

 Circular air vent

 Pipes

 Square air vent

③ Date symbol from Table 2.1

Table 2.1 Weather conditions for nights and mornings prior to photography of gable walls. Data obtained from the Meteorological Office for Aberdeen Airport.

Time (GMT)	Direction	Speed (knots)	Gusts (knots)	Weather	Time (GMT)	Direction	Speed (knots)	Gusts (knots)	Weather
6 Nov 2001		Symbol on figure ①			**7 Dec 2001**		Symbol on figure ④		
00:00	W	15	n/a	Rain showers	00:00	S	19	27	Rain
01:00	W	15	28	Partly cloudy	01:00	S	22	33	Drizzle
02:00	W	15	27	Partly cloudy	02:00	S	20	37	Drizzle
03:00	W	13	25	Partly cloudy	03:00	S	10	29	Rain
04:00	NW	8	n/a	Rain	04:00	S	11	n/a	Hazy
05:00	NW	6	n/a	Drizzle	05:00	S	10	n/a	Hazy
06:00	NW	5	n/a	Drizzle	06:00	SE	8	n/a	Hazy
07:00	NW	3	n/a	Drizzle	07:00	S	8	n/a	Overcast
08:00	NW	5	n/a	Drizzle	08:00	S	14	n/a	Hazy
09:00	NW	4	n/a	Drizzle	09:00	S	19	27	Hazy
10:00	N	5	n/a	Rain	10:00	S	19	27	Hazy
11:00	N	4	n/a	Drizzle	11:00	S	12	n/a	Hazy
					12:00	S	16	n/a	Mostly cloudy
12 Nov 2001		Symbol on figure ②			**1 Feb 2002**		Symbol on figure ⑤		
00:00	S	5	n/a	Rain	01:00	W	14	n/a	Clear
01:00	W	3	n/a	Rain	02:00	SW	12	n/a	Clear
02:00	S	2	n/a	Rain	03:00	SW	10	n/a	Clear
03:00	S	2	n/a	Rain	04:00	S	10	n/a	Mostly cloudy
04:00	N	2	n/a	Rain	05:00	SW	10	n/a	Mostly cloudy
05:00	NE	11	n/a	Drizzle	06:00	SW	6	n/a	Mostly cloudy
06:00	NE	11	n/a	Rain	07:00	S	12	n/a	Hazy
07:00	N	11	n/a	Drizzle	08:00	S	19	34	Rain
08:00	N	14	n/a	Rain	09:00	S	18	41	Rain
09:00	N	13	n/a	Drizzle	10:00	S	22	35	Rain
10:00	N	8	n/a	Rain	11:00	S	37	47	Rain
11:00	N	13	n/a	Mostly cloudy	12:00	S	31	44	Rain
					13:00	S	23	39	Rain

Table 2.1 continued...

Time (GMT)	Direction	Speed (knots)	Gusts (knots)	Weather
14 Nov 2001		Symbol on figure ③		
00:00	W	1	n/a	Rain
01:00	N	0	n/a	Drizzle
02:00	NE	2	n/a	Rain
03:00	N	3	n/a	Drizzle
04:00	NW	2	n/a	Drizzle
05:00	NW	2	n/a	Drizzle
06:00	N	0	n/a	Drizzle
07:00	W	2	n/a	Rain
08:00	N	2	n/a	Fog
09:00	N	2	n/a	Fog
10:00	SW	6	n/a	Mist

The diagrams in Figure 2.4 show the wetting patterns on a number of gables. Given a long enough period of rain any exposed gable will eventually become completely wetted. However, the wetting patterns during less severe weather provide useful information on areas most commonly affected by deterioration due to wind driven rain and to potential pathways for penetrating damp.

The granite gables studied had a range of characteristics. The most common type was 2, 3 or 4 storeys in height with no details except a slightly projecting coping at the top of the chimney (Plate 2.1). More rarely, some gables had string courses (Plate 2.2). Others had door or window openings or other projecting elements, such as satellite dishes (Plate 2.3). Windows occurred both with (Plate 2.4) and without (Plate 2.3) cills. Occasionally, gables had more decorative elements to their detailing (Plate 2.5).

In most instances, pointing was flush with the stone surface, but some gables have been repointed using ribbon (or tuck) pointing where the pointing mortar stands proud of the surface (Plate 2.5). This technique is deprecated since it slows down the run-off of rainwater over the stone surface. The projecting pointing diverts water flow along the top surface of the pointing increasing the likelihood of penetration into the joint.

In any orientation, stronger wind speeds resulted in more surface wetting (Figure 2.1). The duration of rain events clearly also influences the extent of wetness (Figure 2.2) but is a less important control on surface wetness than wind speed. There was a weak correlation between the amount of wetness on gables and the relative direction of wind driven rain during the previous hours (Figures 2.1 & 2.2). Gables that faced into the wind tended to be more wetted although the differences were not so pronounced as might have been expected. Even gables at 180º to wind driven rain can be significantly wetted, especially at higher wind speeds. It is likely that surrounding buildings have a strong influence on local wind direction so that climatic data from a weather station a few miles away (Aberdeen Airport) do not necessarily directly reflect conditions experienced on a building facade.

Plate 2.1 Typical, simple granite gable. Three storeys in height with no detailing except a slightly projecting coping at the top of the chimney. This gable shows a typical wetting pattern from moderate rainfall with wetting of chimney, wall tops and corners. Run-off from these areas gradually extends down the gable.

Plate 2.2 This granite gable has two string courses.

Plate 2.3 A simple granite gable with door and window openings. With the exception of the chimney coping and a satellite dish there are no projecting elements.

Plate 2.4 The irregularly distributed windows on this gable have projecting cills. Downpipes also project from the surface. The dry patch towards the left side is likely to indicate the presence of a working fireplace.

Plate 2.5 The more complex detailing on the coping and below the chimney is a rare feature of granite gables in Aberdeen. This gable has been repointed using ribbon (or tuck) pointing where the pointing mortar stands proud of the surface.

Plate 2.6 The projecting chimneys on this façade (which in this instance were directly facing the wind driven rain (2 knots)) have clearly influenced the impact of rain on the façade. Wind flow has been slowed by the projecting features.

Figure 2.1 Relationship between mean surface wetness of gables (% surface area), wind speed and orientation of gable relative to driving rain.

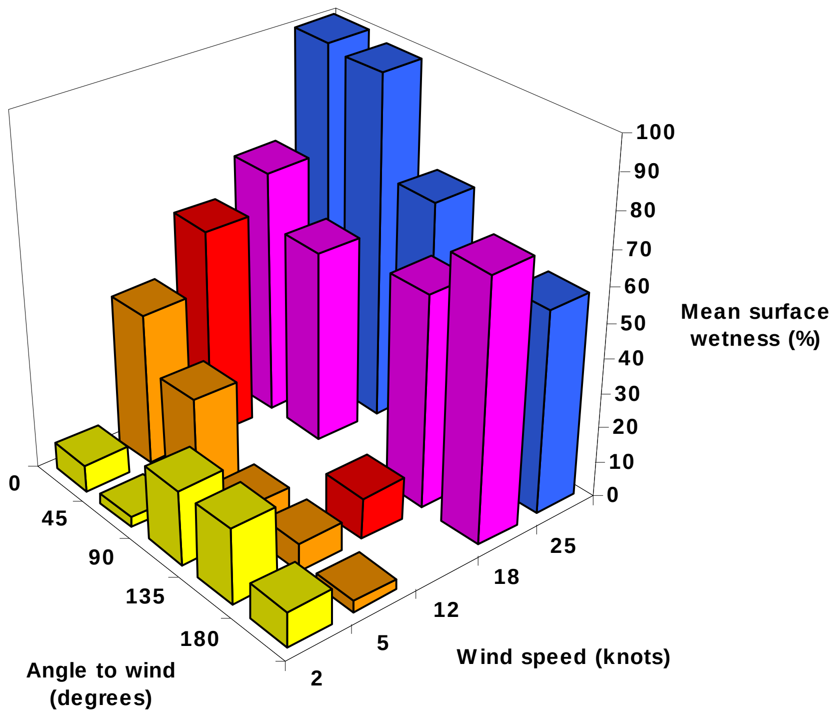
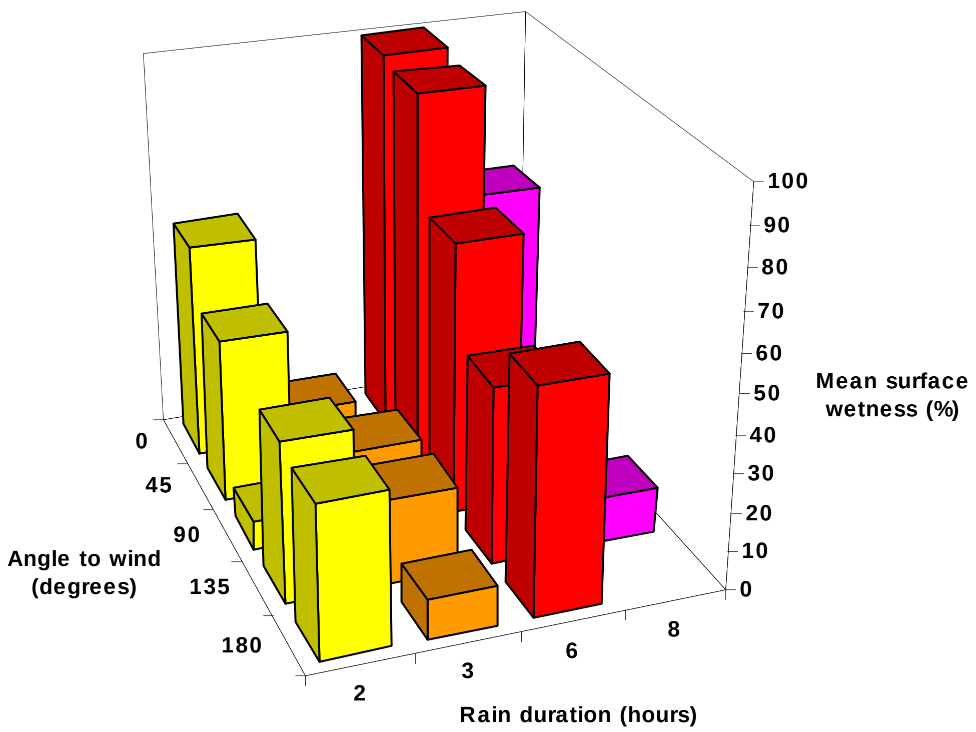


Figure 2.2 Relationship between mean surface wetness of gables (% surface area), duration of rain during the previous 12 hours and orientation of gable relative to driving rain.

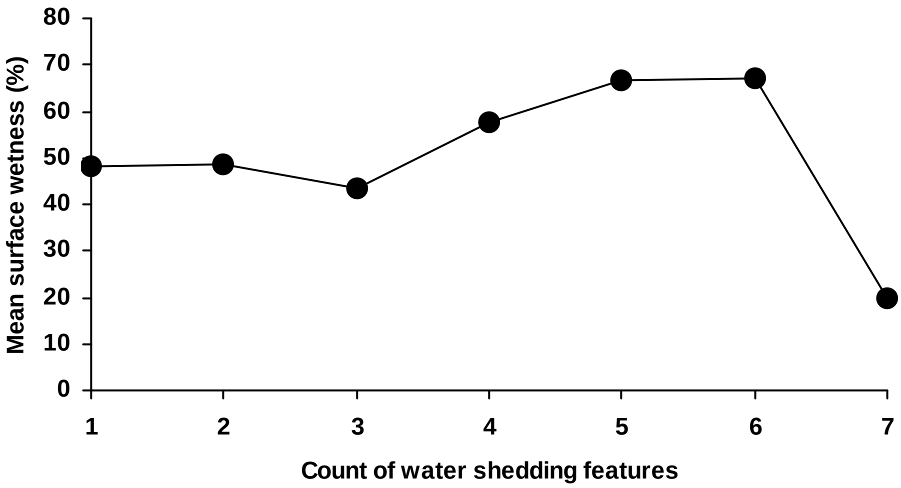


Wind driven rain most commonly impacts on façades at chimneys, corners and wall tops (Plate 2.1) because of changing patterns of air flow at these locations. However, irregularities and features on gables can affect distribution of damp patches (Plate 2.6). Many gables lack any features to control rainwater run off. Most of the gables in this study (approx. 80%) had copings flush with the wall, with only the chimney coping projecting (Plate 2.1). This is typical of many granite gables in Aberdeen. Approximately 20% of gables had projecting copings at roof level (Plate 2.2) and other features including string courses across the façade and/or at the chimney base (Plate 2.3). The features had some influence on the location of wetness although there was no difference in the mean amount of wetness observed on gables (36% for those with and without projecting copings and other details).

Gables with more detailing features showed no evidence of reduced wetting (Figure 2.3). If anything the tendency was for gables with more features to show greater degree of wetting. Features have been “counted” by the simple mechanism of counting 1 for each of the following elements:

projecting copings at chimney tops;
projecting copings at roof level;
projecting string course at chimney base;
projecting string courses (one for each);
projecting cills below windows.

Figure 2.3 The relationship between mean surface wetness and count of detailing features on gable.



Where copings project beyond the wall face, most wetting of the wall below comes from water penetration at open sub-vertical joints. While projecting attachments to a wall (e.g. pipes, satellite dishes, etc) can result in some localised run-off, there was no indication that these resulted in significantly more rainwater run-off outwith the immediate area of attachment of these features.

Wetting of gables begins from the upper surfaces and spreads downwards, wetting the sides more rapidly than the central area (Plate 2.1). If rainfall continues for a sufficiently long period, most or all of the gable will be wetted, however some areas dry relatively rapidly. Rapidly drying patches were noted on a number of gables appearing to correspond to the locations of fire places and flues (Plates 2.4 & 2.7) and or rooms (Plate 2.8) within the building. It is presumably heat loss through the wall that results in rapid drying in these locations. Outwith areas subject to rapid drying, the granite surface (due to its lower moisture capacity) dries before pointing (Plates 2.9 to 2.12). As the pointing dries it is clear that more moisture has been retained in and around cracks in the pointing.

It was noticeable on a number of buildings that the pointing was in a very poor state of repair with pointing missing from many vertical and horizontal joints (Plates 2.13 & 2.14). In some cases it appeared that there might be an association with the position of flues, which may suggest that greater temperature variations and/or attack by flues gases could cause degradation of pointing (and possibly also of bedding mortar).

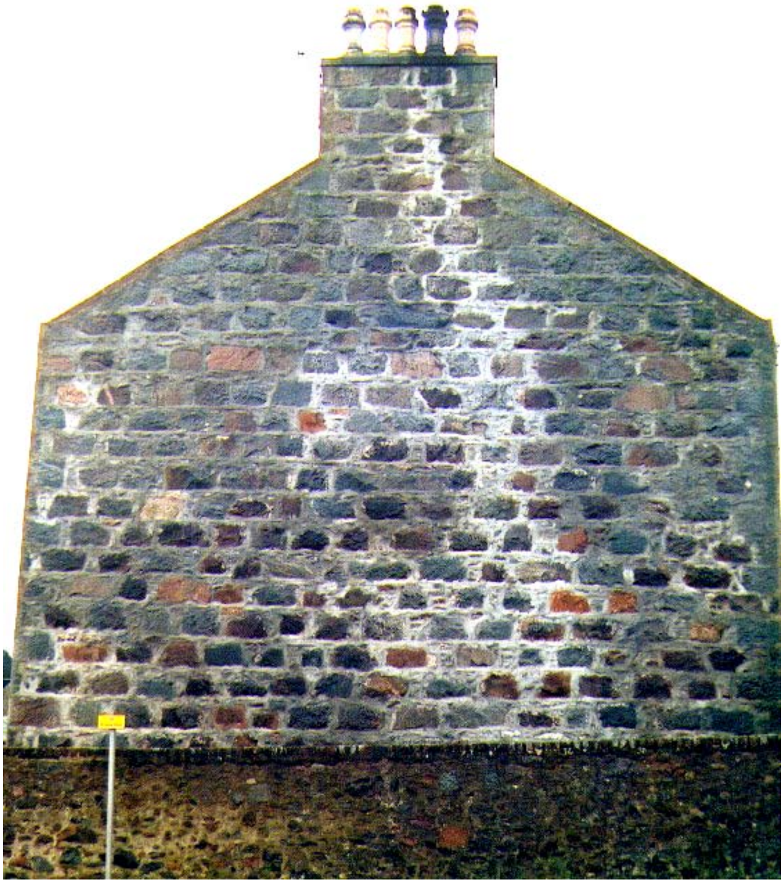


Plate 2.7 The dry patch on this gable appears to correspond to the position of fire places and flues.

Plate 2.8 Dry areas on this gable appears to correspond to the position of rooms at the first and second storeys.

Plate 2.9 The pointing mortar dries more slowly than the granite since it is more porous and permeable and holds more moisture than the granite.

Plate 2.10 Where moisture can get easier access through cracks between mortar and stone, moisture is retained for longer. In this example, the mortar around the stone remains damp after the rest of the wall has dried.

Plate 2.11 On this largely dried wall surface, remaining areas of dampness occur on the pointing, especially where it is cracked.

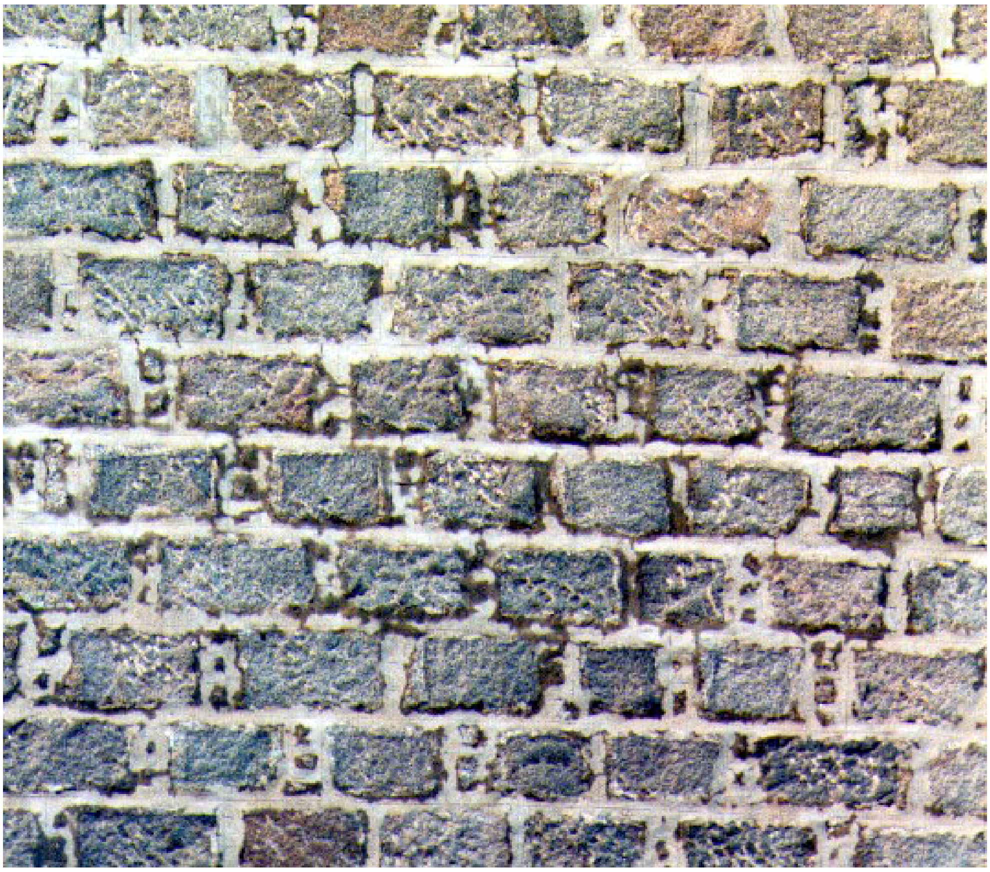


Plate 2.12 The darker features on this pointing mortar show the location of hairline cracks where more moisture has been taken up by the mortar.

Plate 2.13 Most pointing mortar has been lost from both horizontal and vertical joints in the area of the chimney and on the right half of the wall.

Plate 2.14 The pointing mortar on the upper area shown in this photograph is in very poor condition.

Figure 2.4a Facing 180º to wind direction.

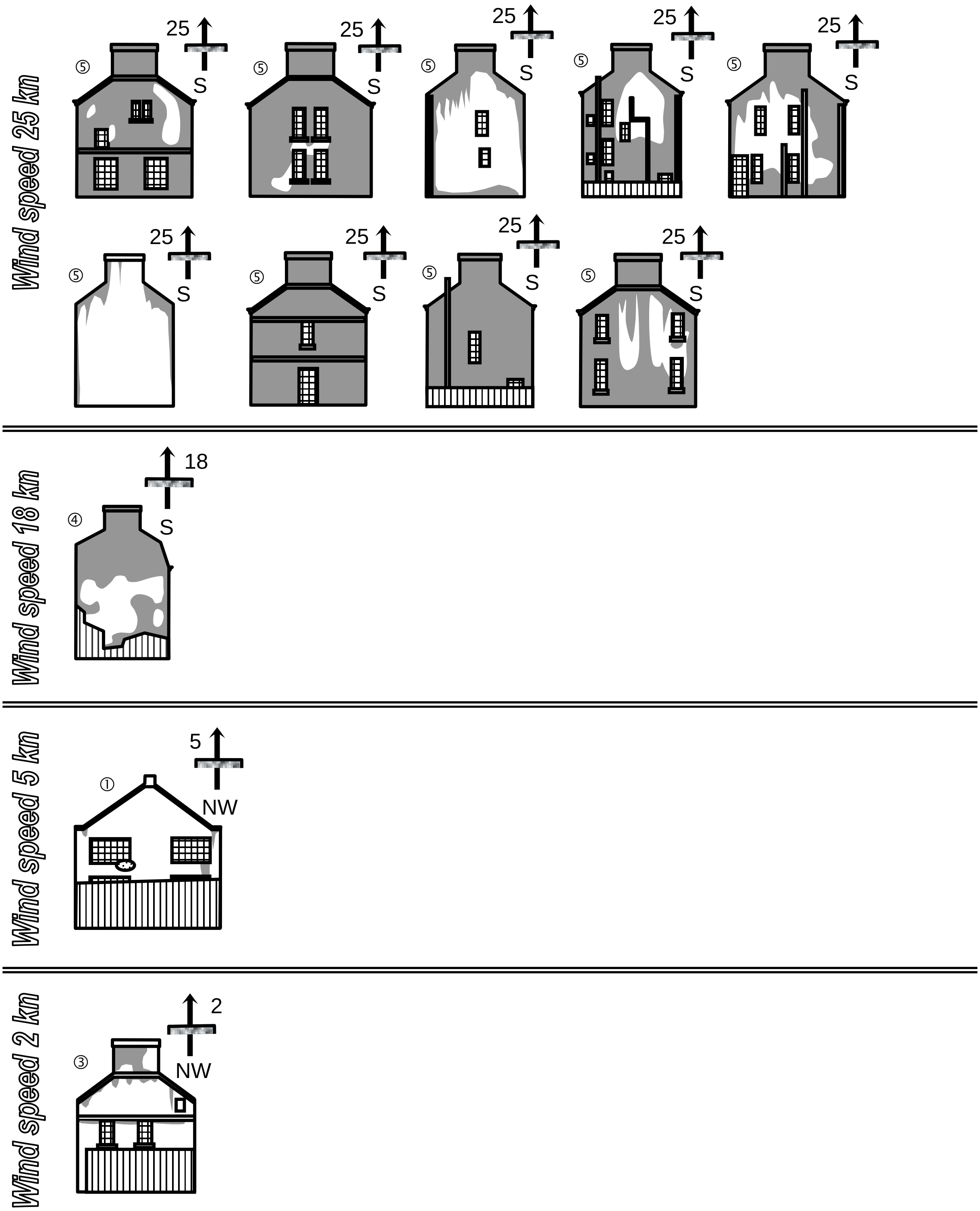


Figure 2.4b Facing 135º to wind direction.

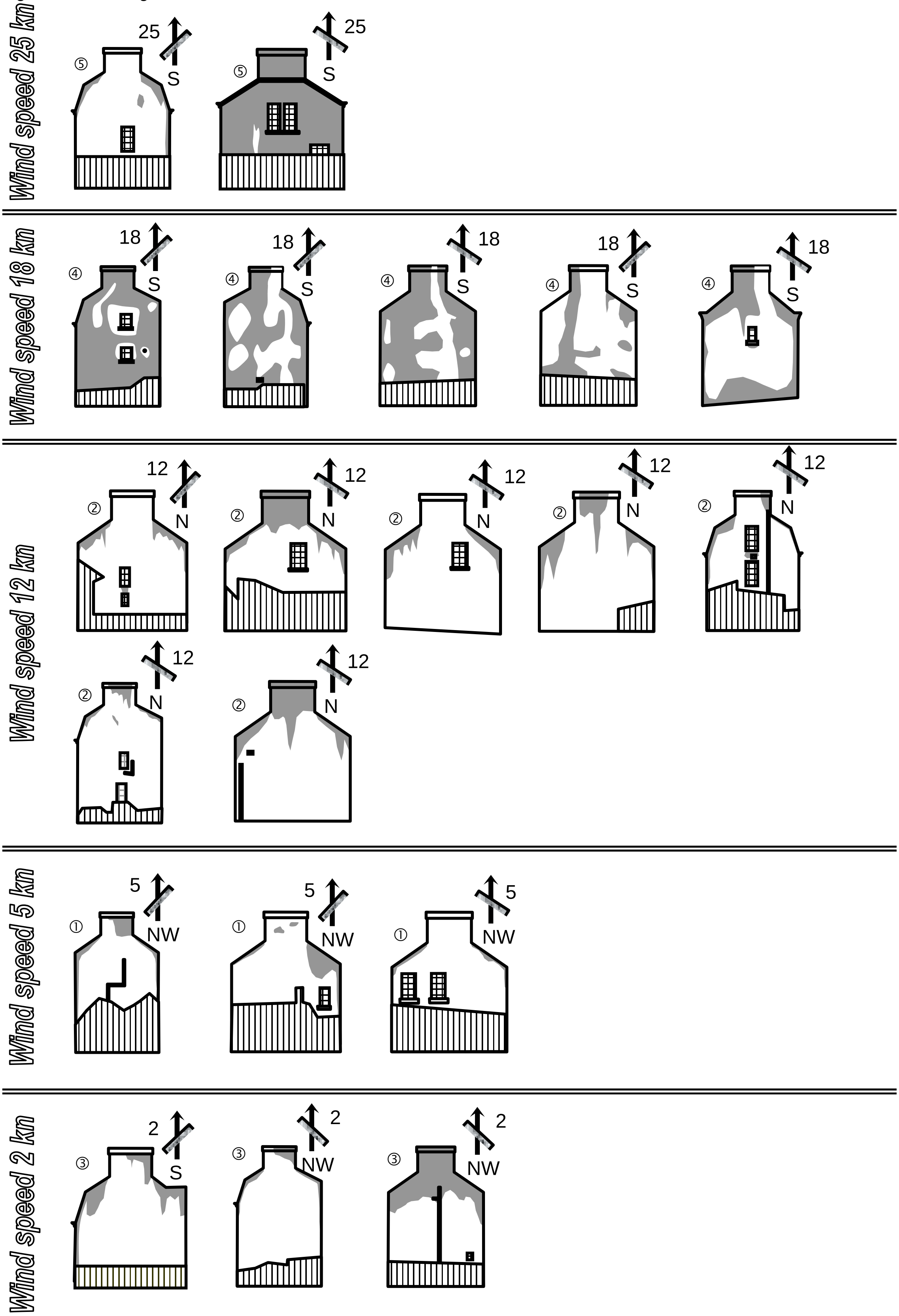


Figure 2.4c Facing 90º to wind direction.

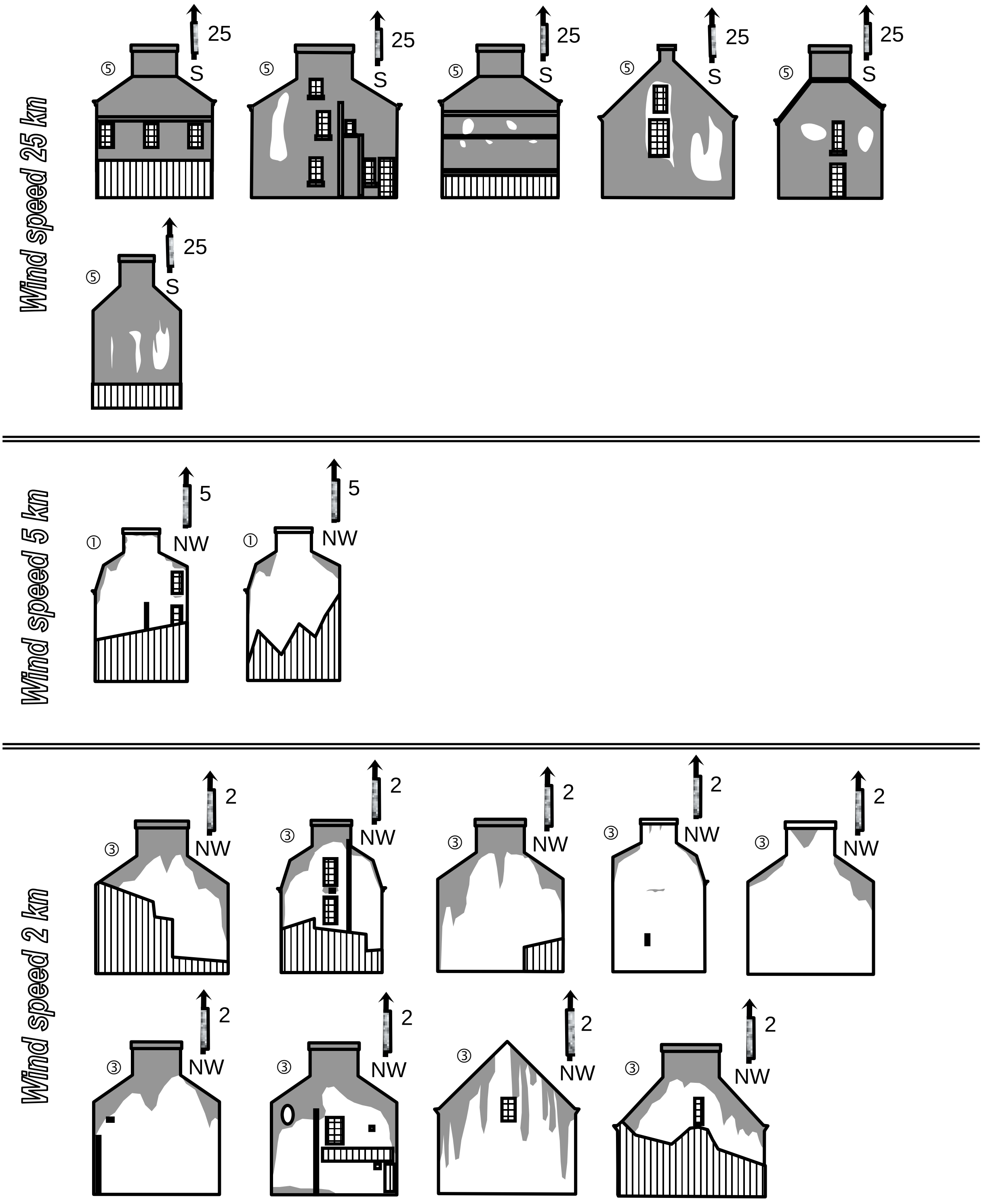


Figure 2.4d Facing 45º to wind direction.

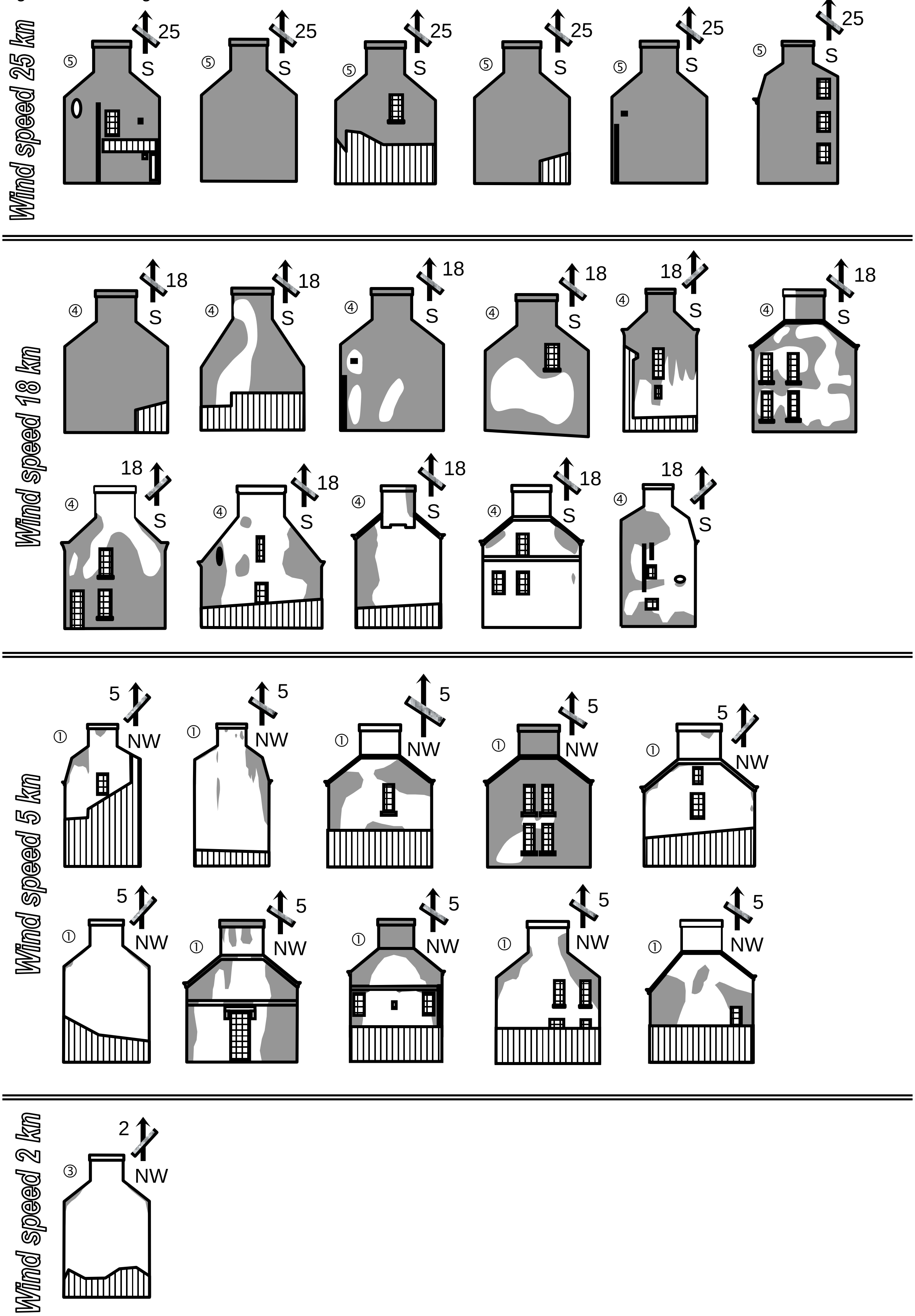


Figure 2.4e Facing directly into wind (0º).