

# **Volcanogenic hazards and resultant risks to road systems and infrastructure: preliminary assessments at Snæfellsjökull**

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Snæfellsjökull is a high ice-capped volcanic cone (1446 m) rising up from sea level to a 200 m deep summit crater infilled with ice. Three major phreatic (plinian) eruptions are understood to have occurred in the Holocene, the most recent being around 1855 radiocarbon years ago. Geological mapping indicates that over 25 eruptions have occurred in the Snæfellsjökull central volcano in the last 10,000 years producing lava, tephra and jökulhlaup or lahar events. Pyroclastic flows and wave (small-scale “tsunami”) effects may be likely events in a future eruption although no evidence of these has yet been identified in the geological record. Snæfellsjökull is the central focus of a national park and therefore a major travel destination. The communities of Snæfellsbær are home year-round to 1717 people, increasing dramatically during the main summer travelling season and at weekends. As we know from Örafajökull, the eruptions of relatively infrequently erupting stratovolcanoes can be dramatic and are worthy of assessment. Should an eruption occur here in the future, nearby communities throughout the national park, several farms, airfields, the main road and bridges may be within the most hazardous regions and the impacts of tephrafall and wave effects may be felt much farther afield.

Although excellent hazard maps exist in Iceland for frequently occurring hazards such as avalanches and extensive research has been carried out on volcanic history and volcanology, few areas of Iceland have hazard maps portraying the multiple hazards associated with volcanic terrain. It is important, of course, for true resilience to natural hazards to be prepared for future hazards with full awareness of past events and likely future events, allowing strategies for dealing with natural hazard situations to be formed with access to all possible relevant information.

New research supported by Vegagerðin over the last two years has focussed on the nature and distribution of floods/lahars and tephrafall from Snæfellsjökull. Floods/lahars have flowed in many directions from Snæfellsjökull, primarily carrying pumice clasts. These floods were relatively small in comparison with historical Katla and Grímsvötn floods due to the smaller icecap and the numerous directions of flow. Tephra distribution studies back up past studies showing that the main zone of deposition was to the east north east although evidence has now been found to show that tephrafall did also occur to the west and south of the volcano. The distribution and impact of volcanic products and processes depends upon topography, source location and meteorological conditions as well as the nature of the eruption. There is therefore variable probability of each of these events in different areas of the district and resultant variability in risk to infrastructure including roads.

Here we compile what we know about past events at Snæfellsjökull and present preliminary considerations of how this translates into hazard and risk for the district and particularly for the road system. This project aims to produce hazard maps in a manner suitable for use by a wide variety of individuals and organisations. Such maps combined with an assessment of vulnerability can be used to determine risk and to enable risk-reduction measures to be taken if required. Emphasis is placed on hazard and risk for road systems since the road network is one of the most important means of evacuation and communication and the restoration and maintenance of other lifelines depend on the movement of people and equipment to sites impacted/damaged by volcanic events.