The Norwegian Public Roads Administration`s role as a major contributor and end user of the new Norwegian avalanche bulletin

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ABSTRACT: The first national avalanche bulletin in Norway was launched the 14th of January 2013 on www.varsom.no. The bulletin is the result of a major effort, and cooperation between four different governmental agencies (The Partners). These are: the Norwegian Water Resources and Energy Directorate (NVE), the Norwegian Public Roads Administration (NPRA), the Norwegian National Rail Administration (JBV) and the Norwegian Meteorological Institute (MET). The Norwegian Geotechnical Institute (NGI) has supported the work.

The NPRA has contributed in the development of the bulletin, and also contributes on a day to day base by providing input for the bulletin. In the organization of the NPRA, there has been made a web system where the contractors can report their observations from all roads in Norway directly to the forecasting group. In the NPRA there are 18 approved observers, working with observations once a week. The NPRA has many weather stations focusing on mountain passes. A part of the work with the avalanche bulletin has been to upgrade many of the stations with specific instruments for avalanche forecasting. The data are available for both forecasting and the public through a new webpage developed by the project (www.xgeo.no).

In the daily avalanche surveillance the contractors use the bulletin to get information about avalanche danger for their roads. If the forecasted avalanche danger level reaches level 4, the NPRA`s avalanche experts work together with the leaders for both the NPRA and the contractors, to decide measures. The bulletin has led to more interaction between avalanche experts and managers in the NPRA. The NPRA is now more prepared for cycles with high avalanche danger and the knowledge about avalanches in the NPRA has improved. This is both because people have been educated during their work as observers, and the use of the bulletin adding knowledge.

KEYWORDS: Avalanche bulletin, The Norwegian Public Roads administration, Norway

1 INTRODUCTION
Norway has for the first time established a national avalanche bulletin. This bulletin provides information about avalanche danger in 23 defined regions in Norway. From January 2013, throughout May 2013, the avalanche bulletin was published four days a week (Engeset 2013). The most important information in the bulletin is the avalanche danger grade level from 1-5 (NVE 2013). In addition to the avalanche danger grade level, the bulletin provides important information about avalanche problems (Landrø, Kosberg and Müller 2013). The most avalanche exposed altitudes are highlighted, together with information about exposed slope aspects and type of terrain.

2 THE NPRA’s CONTRIBUTION TO THE NORWEGIAN AVALANCHE BULLETIN
The NPRA has contributed to the development of the expert tool XGEO (Barfod et al. 2013). 18 field observers (¼ of all observers in Norway) are working for the NPRA (Kosberg et al. 2013). The observers do observations as a part of their job in their ordinary work time.

The roads managed by the NPRA consist of about 55 000 km of highways and county roads. The NPRA use contractors for maintenance and evaluation of avalanche danger. The webpage ELRAPP (NPRA 2013), which is the web page that the contractors use for reporting data to the
NPRA, has been developed with an avalanche module. The avalanche module delivers data to REGOBS (NVE 2013), in real time. REGOBS is the system developed by the NVE with partners, for sampling of avalanche data from observers and volunteers. This means that important observational data, for example, avalanche activity, weather observations and local avalanche danger level, is available for the forecasting group from roads all of Norway in real time.

The NPRA has a net of about 250 weather stations. These stations have been built mainly to determine issues regarding operation of the roads. The stations are often located close to the roads, but never the less they are often helpful in evaluating avalanche danger. As a part of the work with the bulletin, the NPRA has made all its stations available for use in the forecasting through XGEO.

The partners work together on establishing new weather stations located in avalanche prone areas. For this purpose the NPRA shall upgrade 27 existing stations with new sensors so that they meet the specifications determined by the partners. The different sensors are: wind speed and wind direction, precipitation type and precipitation amount, humidity, snow depth and temperature. This work will be completed during 2014, and 15 stations are already upgraded (Figure 1). In addition to the upgrading of existing stations, the partners consider to install 50–60 new stations focusing on localities that are important in avalanche forecasting. The NPRA will put up three new stations in 2013.

The contractors responsible for avalanche danger forecasting are now given training in how to read and use the bulletin. Due to a stiff system with a 5 year duration period of the individual contracts, several years will pass before contractors use the forecast effectively.

At the same time the avalanche contingency plans are revised. These plans contain information about avalanche paths, average run out zones and precaution measures. The NPRA look to upgrade these plans with information about critical danger level for each avalanche path or smaller areas with several avalanche paths. This work will take some years, but in the end the goal is to have a plan that can be used more directly together with information from the bulletin. Another benefit from this work is that the avalanche contingency plans in the future will be developed with much better user friendliness, based on a GIS platform.

The winter of 2012/2013 was the first season with the new bulletin. As the bulletin was new to both contractors and the NPRA, the best way to use the bulletin had to be figured out. In certain areas the avalanche experts in NPRA issued a special bulletin only for the contractors in areas where avalanche danger was forecasted to grade 4. This helped to establish the dialog between the managers in the NPRA and the contractors. In one case the special bulletin led to road closure as a measure.

Many of the avalanche experts in the NPRA are also observers giving them a better picture of the snow and avalanche conditions from week to week. As an example, a county road that is closed during the winter season was opened later than usual (Figure 2). The reason for this was that several persistent weak layers in the snowpack caused unsafe conditions for those clearing the road. Due to the training as an observer, the responsible avalanche expert could handle the situation in a safe way, despite pressure from the public to open the road.
Late in the season (around Easter) there was a heavy period with avalanche danger level 4, and many roads blocked by avalanches in northern Norway. The bulletin helped the NPRA to decide measures and timing for reopening of closed roads (Haaland, Kvalvaagnes and Helgaas 2013).

In the season of 2012/2013 no information from the bulletin was included in the traffic reports to the public. Such use of the bulletin is something that can be included in the future. For now, the average Norwegian citizen must become more familiar with the bulletin before it is used in traffic reports.

4 CONCLUSIONS AND FURTHER WORK

The avalanche bulletin will be the foundation for how the NPRA will evaluate avalanche danger on roads. Another benefit for the NPRA in this project is the education of forecasters/observers. In addition the project has led to improved cooperation between the governmental agencies and a higher awareness on avalanche risk on roads.

It is positive for the NPRA that upgrading of weather stations and updating of avalanche contingency plans are being done through this work.

To improve the information in the bulletin on avalanche danger concerning roads, two persons employed by the NPRA will work as forecasters in the season of 2013/2014.

The authors believe that Norway in the future will use more artificial release as mitigation in avalanche prone areas (Farestveit and Skutlaberg 2012). The Norwegian avalanche bulletin will become important in decision making for when to use such measures.

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