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## Designing and Numerical Simulations of Aufeis Mitigation Structure on Cut-slope Roadway

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**Abstract:** Aufeis problem caused by cutting construction of road is widely spread in cold regions. This paper analyzed the forming process of cut slope aufeis and its mitigation strategy. A new aufeis mitigation structure was designed according to the forming mechanism. Numerical simulation tests were used to improve the structure. Results show that there is no obvious effect on temperature of the middle of the cut slope and the bottom of the ditch whether the insulation material is placed on the top of the cut slope or not; the temperature at the foot of the cut slope increased more significantly than other sites when increasing the thickness of the insulation material. The cold source cooling the ditch mainly comes from the embankment. Both raising embankment and deepening the ditch can increase the temperature and enlarge the unfrozen area in the ditch, which is good for aufeis mitigation and raising the embankment is more effective. And the 15cm thick XPS insulation material and at least 60cm high embankment were suggested for the structure under the conditions of minimum boundary temperature  $-35.0^{\circ}\text{C}$  during the winter.

**Keywords:** Cold regions; Cut slope; Aufeis; Mitigation structure; Embankment

### Introduction

Aufeis problem of roads causes heavy losses each year. In northern cold regions of China, aufeis problem is serious and dangerous to traffic. In winter, the aufeis on cut slope runs onto road surface and blocks traffic and even causes traffic accidents. In spring, the melting of aufeis induces road mudding and washout. Aufeis problem also exists in Russia, USA and Finland. Zolotarev and Nevsky (1991), Dementiev(1991), Nevsky(1991) and Daykin, and Teplovoy (1991) studied the water-heat balance of icing and the probability design method of the road with icing. The basic characteristics, preventing and controlling principles and mitigation measures were

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