A PLASTIC WAVE IN SNOW

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When snow is pushed very fast by a moving body, not only an elastic wave but also a plastic wave is generated at the head of the body. Though an elastic wave in the snow is usually invisible, plastic wave propagation through the snow can be directly observed. A large permanent strain remains after a plastic wave has passed.

In order to clarify the detailed process of the plastic wave in snow, laboratory experiments
were carried out by impacting snow at high speeds. The impact velocity applied to snow was from below 4 m/s to above 49 m/s. Snow sample densities in the range of 0.15. Mg/m3 to 0.54 Mg/m3 were tested.

High speed photography was used to observe the propagation of the plastic wave in snow directly. The analyses of these high speed photos gave values of plastic wave velocities and particle velocities. Also, a pressure transducer was either placed at the bottom of the snow specimen or buried in the specimen. By analyzing the time-pressure curves, wave pressures and wave speeds were obtained.

A relation between impact velocity Cv) and plastic wave velocity CD) is found as D = a' vb, where a and b are functions of snow density. The particle velocity decreases with distance from the snow surface where the wave is generated. This decrease is clearer in higher density snow than in lower density snow. The ratio of D to v increases very much with the increasing snow density. The observed wave pressure is compared with the theoretical values which are derived from the conservation of mass and momentum law. Good agreement is found between observed and theoretical values at the front of the plastic wave.