

## REVIEW

F. CASTLEBERG *and others*, ed. *Lawinenschutz in der Schweiz*. [Hrsg. von F. Castleberg, H. R. in der Gand, F. Pfister, B. Rageth.] *Bündnerwald. Zeitschrift des Bündnerischen Forstvereins und der SELVA, Genossenschaft der bündnerischen Holzproduzenten*, Beiheft Nr. 9, 1972, [ii], 222 p., illus. Sw. fr. 30. [Available from SELVA, Chur, Switzerland.]

THE first systematic avalanche defense system in Switzerland (and in Europe) was an array of posts and free-standing walls built by Johann Coaz in 1868 at Motta d'Alp for a cost of Sw. fr. 1603.75. From this small beginning the protection of Swiss alpine terrain from snow avalanches has grown into a major technical, economic and social safety enterprise. This whole process of avalanche defense design and construction was strongly accelerated following the catastrophic avalanche winter of 1950–51. Federal subsidy of defense systems, which ranges from 25% to 80% of the total cost according to circumstances, reached a maximum of Sw. fr. 14 000 000 per year in 1967. The statistics of avalanche defenses in Switzerland today are formidable. From 1876 until the end of 1970, 560.4 running km of earth terraces and 417.8 running km of masonry terraces had been constructed. In recent years the emphasis has shifted to supporting structures (*Stützverbau*) in the avalanche release zones. Today over 184 running km of such structures exist in the Swiss Alps, most having been built since 1939 and nearly half of these since 1964. The cost has been equally formidable. Expenditures on all avalanche defense systems from 1876 to 1970, including related cost of forestry, drainage, rockfall protection, fencing, soil stabilization and access roads is estimated to exceed Sw. fr. 318 000 000. This total includes only the physical structures. It omits the less clearly accountable costs of other avalanche protection measures such as planning, warning services, rescue organizations and the widely applied control method of artificial release through use of explosives.

It is appropriate that the pre-eminent Swiss expertise in the engineering, economic and organizational aspects of avalanche defenses is now summarized in a very informative volume which will surely join the short list of publications like Bader and others (1939) which constitute the basic references of avalanche science. "Lawinenschutz in der Schweiz" (avalanche protection in Switzerland) is a compilation of papers by leading practitioners of avalanche science and engineering in Switzerland, organized about the common theme of structural avalanche defense and sufficiently broad in scope to encompass not only technical considerations but also the complete spectrum of economic, social, political and managerial activities essential to successful execution of an avalanche defense project which may take 8–10 years to execute and in the case of very large projects may last for decades. The theme of the book is neatly summarized in its concluding sentence: "Ein Projekt, das sich nur in technischer Hinsicht rechtfertigt, ist nur ein halbes Projekt". Although there is much valuable information here for the engineer, this is not a design manual. The chapters on the fundamentals of avalanche defenses, on permanent supporting structures, on diversion barriers (including snow sheds) and on braking structures all contain highly specific engineering guidelines, but the avalanche defense designer will also need to refer to such publications as Sommerhalder (1966 [and with 1971 annotations]) and Anon. (1968). The real value of this book lies in its presentation of the broader aspects of avalanche defense system planning which heretofore have not been compiled under a single cover. Engineers, foresters, and land-use planners in other countries where experience with avalanche defenses is much less advanced will find this broader perspective invaluable.

Taken chapter by chapter, the treatment of the diverse topics is uneven, as might be expected with contributions by authors of such varied backgrounds. The technical chapters and those on the historical background, safety and effectiveness of supporting structures, and political and economic considerations are especially informative. The opening chapter on



avalanche damage is disappointingly sketchy, considering the wealth of information available on this topic in Switzerland. The treatment of windblown snow is curiously weak in an otherwise technically up-to-date publication (although the reader is warned by a disclaimer in the first paragraph). The final chapter on afforestation and the role of forestry in avalanche protection is also disappointingly limited in the light of the importance attached to this phase of avalanche defense (afforestation is a necessary condition for federal subsidy of any avalanche defense system in Switzerland). It is not easy to sort out how much the uneven treatment of various topics reflects diversity among the authors and how much reflects an actual diversity in the practice of avalanche science in Switzerland today. The authors do exhibit some differences of opinion. Bruno Salm, for instance, asserts on p. 67 that in spite of some unsolved technical problems, it is possible to build avalanche defenses with a very high degree of safety and that the present problems more often lie at the political and financial level, not at the technical. Balthasar Rageth, on the other hand, playing something of the devil's advocate in his chapter on "Die Sicherheit des Stützverbaues" (the safety of supporting structures), outlines the limitations of this defense method and presents some excellent cautionary comments for the design engineer. He concludes that "much still remains to be done" before avalanche research achieves its long-range goals.

The illustrations deserve special commendation. The carefully selected set of superb photographs (there are a total of 72) would constitute a short course in avalanche defense structures even without the text. The diagrams are clear and explicit; many convey a wealth of engineering information. This book is a welcome addition to the avalanche literature which should stand as a valuable reference source for years to come. It is to be earnestly hoped that editions in other languages will soon become available.

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## REFERENCES

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