

SECURITY OF RUNNING OF COMPETITIVE COURSE IN ALPINE SKIING ACCORDING TO ITS GEOMETRY OF SETTING

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In alpine ski disciplines there are plenty of incidents. Sometimes up to 40 % of competitors do not finish the run. The reasons are wrong preparation of skiers and wrong tactics of running. But there are also some errors in setting of gates of a course. The aim of this paper is to present some examples of those errors. One of them is a long intergate distances with small angles of deviation where skier achieves high velocity and just after that a big angle of deviation of a course with small intergate distance. The other is positioning of one gate above a downcast and the other just below a downcast. In Kvitfjel 2007 up to 10 skiers ran off the track in such a configuration.

KEY WORDS: alpine skiing, security, incidents, course, geometry

INTRODUCTION: Sport result in alpine skiing depends on fitness preparation, technique, equipment, environment conditions. At the highest level (Olympic Games, World Championships, World Cup) one can say they should not be a source of incidents (accidents, hitting a pole, missing a gate). Nevertheless there are plenty of incidents during running an alpine course. In 2006 Federation Internationale de Ski (FIS) established Injury Surveillance System in order to collect data on all incidents and to analyze a source of them.

Several authors (e.g. Blitzer et al., 1984; Ekeland et al., 1985, 1996, 1997; Ellman et al., 1989; Shealy & Ettinger, 1996, Erdmann & Giovanis, 1998, Bere et al., 2008) described classification of accidents and orthopedic treatment. Unfortunately there are small amount of papers dealing with reason and with prophylaxis against accidents. Bergstrøm et al. (2001) investigated a security problem during Junior Alpine Ski FIS Championships, Bavallen, Norway, 1995. He stated that in 998 runs (for male and female) in all alpine disciplines there were 4 accidents that ended with contusions. The most sever accident happened during the training downhill run. After that accident the position of one of the turning poles was changed. During Championships only 57 % of all runs were accomplished up to the finish. As much as 141 competitors did not finish their runs because of missing a gate or of a fall. There was no correlation between the number of accidents and a level of skiers. The most contusions happened during downhill.

Erdmann & Giovanis (1997) and Erdmann & Aschenbrenner (2002) presenting some connections between geometry of the alpine course and velocity of running revealed that more incidents happened while there was specific configuration of gates. Especially existence of a long intergate distances where skier achieved high velocity and just after that a big angle of deviation of a course with small next intergate distance was a source of the incidents.

The aim of the research was assessment of a risk of an incident of running a course in four alpine ski disciplines at the highest world level in the light of geometry of setting a course.

METHODS: Material: Competitions of four alpine ski disciplines of FIS World Cup – downhill (DH), super giant (SG), giant slalom (GS), and slalom (SL) were investigated. Altogether 12 competitions (each discipline was investigated three times) were under consideration. Within half of them (for slalom and giant slalom) two runs (two legs) were investigated. Research work was done since December 2006 until March 2007 at the following places: Val Gardena / Gröden and La Villa (Alta Badia) in Italy, Hinterstöder (Austria), Garmisch-Partenkirchen (Germany), Kranjska Gora (Slovenia), Lillehammer-Kvitfjel (Norway). The detailed data of the number of participating skiers and their incidents are presented in a Table.

Table 1. Alpine ski disciplines investigated, number of skiers appeared at the start, and number of incidents; DNF – do not finished, DSQ - disqualified

Discipline	Downhill			Super Giant		
	Place of competition	Val Gardena	Garmish-Partenkirchen	Kvitfjel	Val Gardena	Hinterstöder
At the start	57	55	62	61	63	66
DNF	4	6	3	7	9	10
DSQ	0	0	0	2	0	0
DNF+DSQ %	7.0	10.9	4.8	14.8	14.3	15.2

Discipline	Giant Slalom			Slalom		
	Place of competition	Alta Badia	Hinterstöder	Kranjska Gora	Alta Badia	Garmish-Partenkirchen
At the start	100	100	93	112	104	105
DNF	8	20	22	28	16	27
DSQ	1	0	0	3	0	1
DNF+DSQ %	9	20	23.7	27.7	15.4	26.7

Geometry of setting of alpine courses, i.e. positioning of turning poles of the gates was obtained through Differential Global Positioning System (DGPS). Testing the accuracy of DGPS straight line was recorded during ascending while riding a lift. During reconstruction a ride again a straight line was achieved. The runs shown at the big screen at the finish area were recorded with video camera. Times achieved by skiers between gates were obtained. Having displacement and time intergate velocity was calculated. The distribution of velocity is important factor in security of running but this will be described in separate paper.

RESULTS AND DISCUSSION: There were big differences between geometry of courses of particular disciplines, e.g. length of a downhill was about 3.5 km (Figure 1 and 2), while SG was about 3/5, GS 1/2, and SL 1/5 of the length of DH. Vertical drop of DH from Figure 2 was about 840 m, and vertical drops of other disciplines were about 3/5 for SG, 1/2 for GS and 1/4 for SL. There were about between 50 and 60 gates situated at the courses. Some of them were positioned in a wrong manner. This plus wrong distribution of an effort during a run which was already revealed in other papers (Aschenbrenner, 2002; Giovanis, 1998) was a reason of incidents.

Figure 3 presents examples of fragments of geometry of courses where some of the incidents happened. As it was known from our previous papers one of the worst gate configurations was that there were long distances between gates with small angles of deviation and then small distance with big angle (Figure 3 A). Another example was positioning of a gate before a downcast and then positioning the next just below the downcast. When a setter puts poles for establishing a gate he holds his body erected. In this situation he can see a gate below a downcast. While a skier is running he/she is in a squat position so his/her eyes have problem to see what is below the downcast. In particular example spotted in Kvitfjel (Figure 3 B) as much as 10 skiers ran off the course at the same gate situated below a downcast.

CONCLUSION: In order to have alpine ski runs done in more security way it is postulated that the organizers of a competition will provide geometry of a course with gates. This information would be available for all participants of a competition, including setter and a

referee for checking the correctness of a setting. Up to now competitors and coaches have one hour to check the course personally but without running. It looks like it is not enough since there are so many incidents.

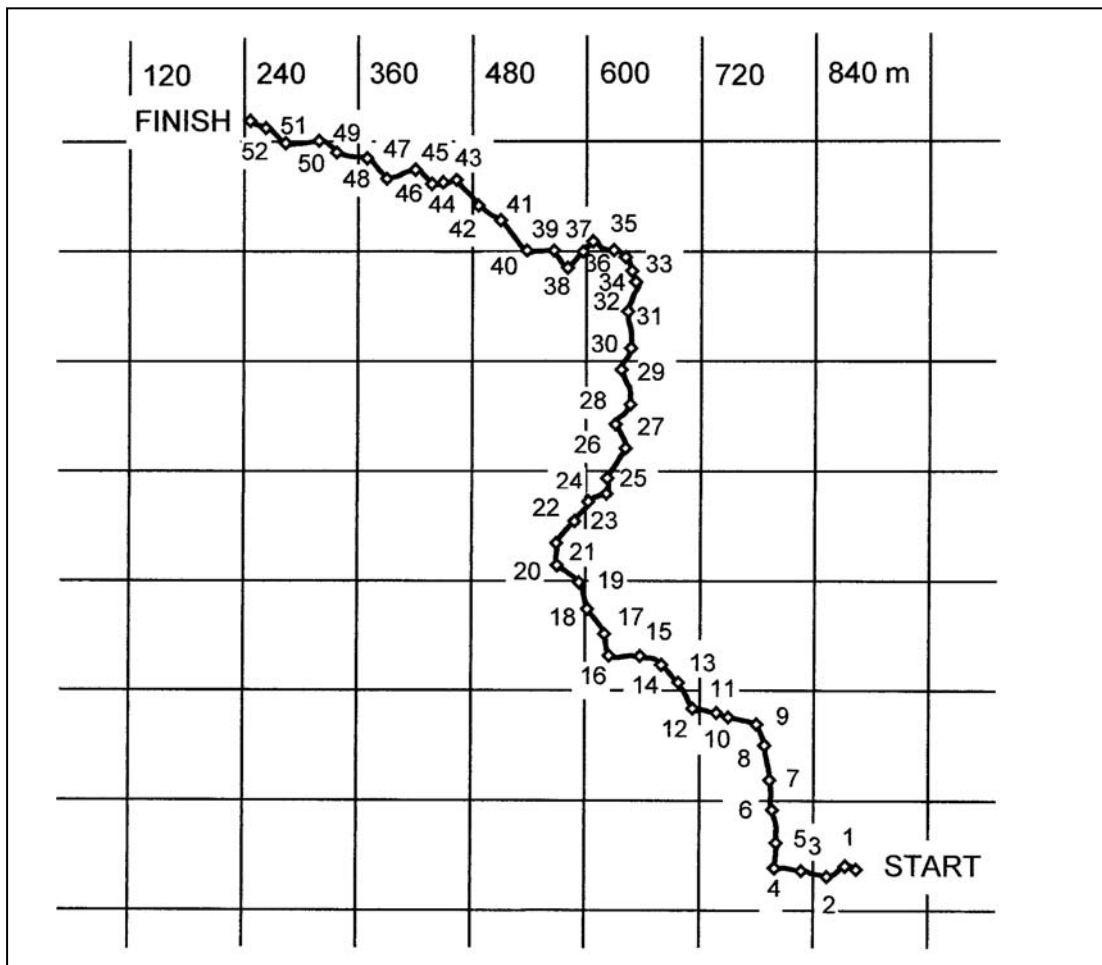


Figure 1. An example of a view perpendicular to the slope of setting of direction poles in giant slalom (Alta Badia, Italy).

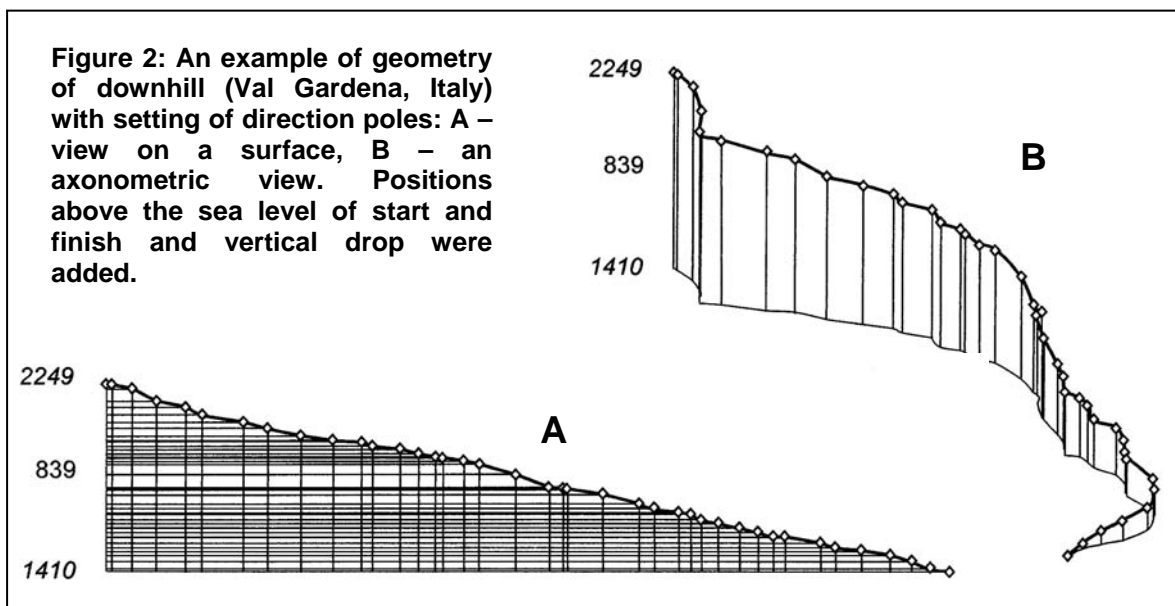


Figure 2: An example of geometry of downhill (Val Gardena, Italy) with setting of direction poles: A – view on a surface, B – an axonometric view. Positions above the sea level of start and finish and vertical drop were added.

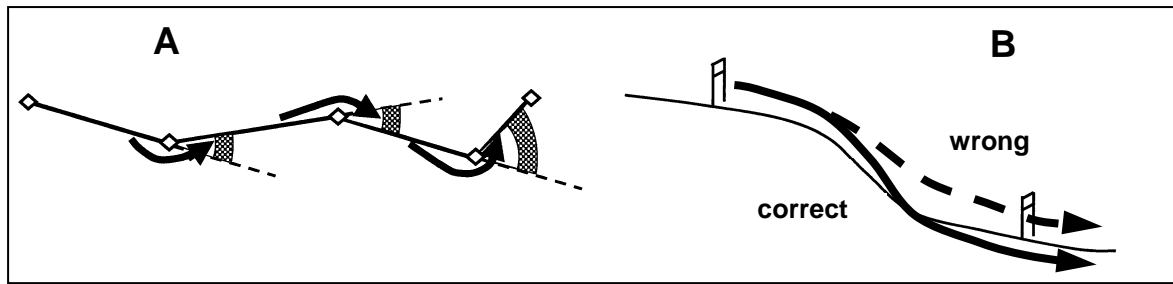


Figure 3: Examples of difficult fragments of an alpine course being a source of incidents: A – few long intergate distances with small angles of deviation and then short distance with big angle of deviation, B – one gate before a downcast, the next one just after it is a source of misguiding.

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