General conception of the luge run

by Jan Steler,
Secretary General of the FIL

The site

The ground on which the run is to be built is located in the Mount Van Hoevenberg recreation park, about 10 minutes from Lake Placid village. It is a fully wooded north-facing slope at an altitude of 2,050 to 2,450 ft. (625 to 747 m.).

The bobsleigh event will be held on the existing bobsleigh run, which since 1952 has been the pride of the Lake Placid resort. This very fine artificial run is carefullly maintained and rectified every year. However, it is not refrigerated and, in view of the ward winds which sometimes blow over the area, the Organising Committee of the 1980 Winter Olympic Games felt that the possibility of refrigerating this run should be studied within the context of the new winter sports installations and facilities.

Consequently, a single cold production plant would need to be constructed for the purposes of the new luge run and to provide sufficient power to refrigerate the existing bobsleigh run too.

Therefore, the new run would be built inside the loop formed by the present bobsleigh run and would naturally be served by the same means of access already leading to the top of the slope in question.

The plan

The plan for the new run, on the side of this hill, drawn up by Jan Steler, architect, fully in 'keeping with the requirements laid down in the regulations of the Federation Internationale de Luge de Course, has been approved by the Organising Committee of the 1980 Winter Olympic Games. The characteristics of the run :

Event	Individual Men	Women and two-man
Length	1,000.00 m	739.68 m
Vertical difference	93.47 m	59.05 m
Mean slope	9.35%	7.5%
Bends	14	11

Special feature : bends 10-11-12 forming an omega.

Choice of the transversal section offering the most scope for showing competitors' qualities

The originality of the project lies mainly in the very detailed study carried out by the designers to provide competitors with a run whose successive transversal sections afford them the required safety while at the same time giving them an opportunity of showing their true worth.

As a matter of fact, the basic mathematical model, all data concerning which is now fully known to designers of similar runs, is based mainly on the study of the theoretical line taken by the luge.

All earlier studies also agreed on two important points :

1. The theoretical line must be distinct from the theoretical slope of the run so as, on the one hand, to avoid the base of the run becoming worn at the bends and, on the other hand, in order to give competitors a run enabling them to make the most of their individual skills.
2. The most suitable transversal section in this case proved to be an ellipse.

It was necessary therefore in the light of these facts to find a complementary mathematical expression that would make it possible to introduce the notion of surface represented by the two lines of the runners. This means that for the banking calculated for a given point of the run, the runners of the toboggan should be placed in such a way that the theoretical centre of gravity of the moving object coincides with the line of theoretical passage.

Such a result is obviously possible only if the theoretical line of passage is situated at the summit of the ellipse corresponding to the minor axis. Consequently, it became necessary to introduce into the calculation,

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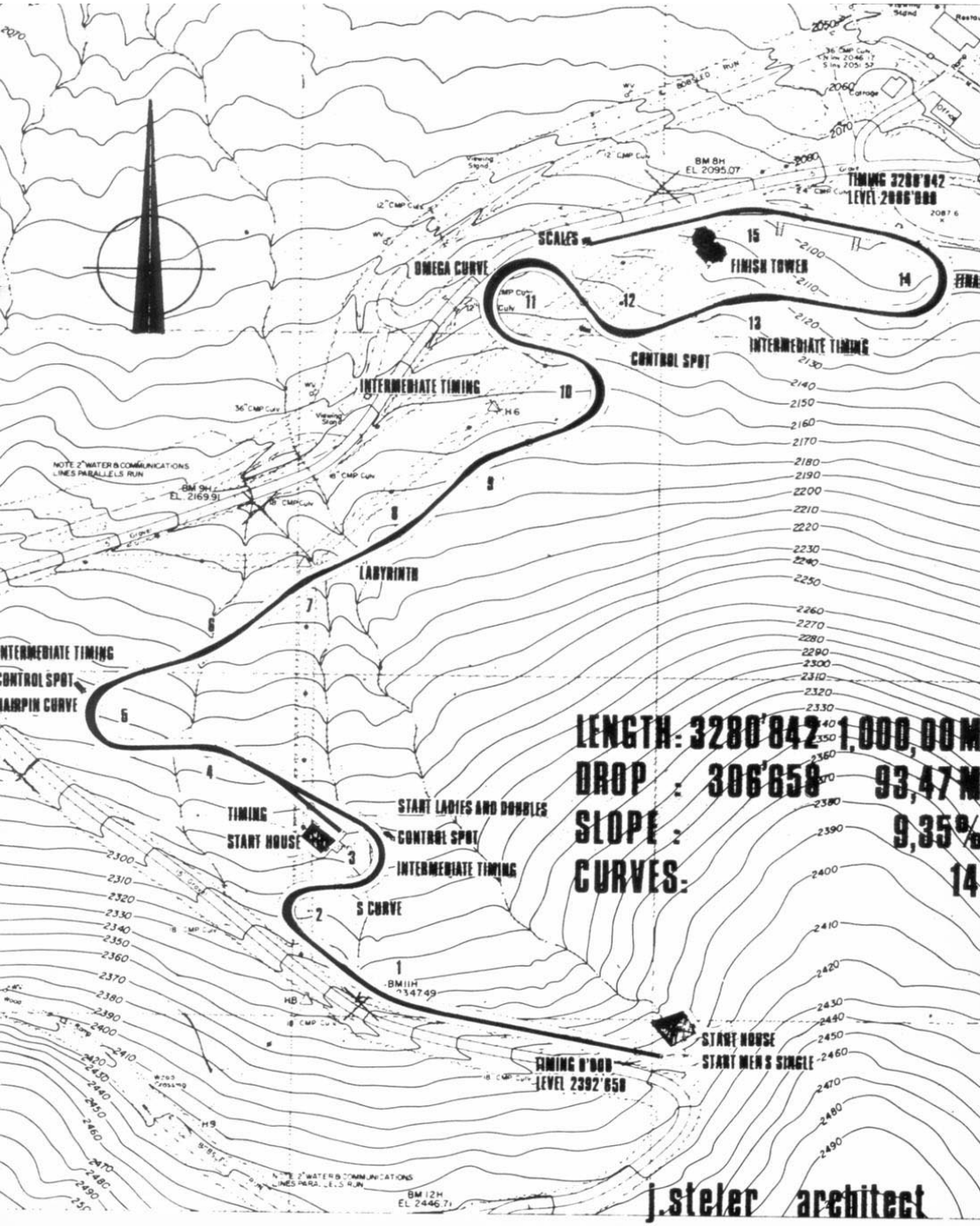
REFRIGERATED LUGE COURSE



the parameters of changes of axis for each point of the transversal acceleration calculated.

Furthermore, considerations of cost compelled the designers to set a limit to the height of the wall at the bends, bearing in mind the fact that the theoretical line would be situated 2 metres above the base of the run for the maximum value of transversal acceleration : i.e. 4.5 G. (FIL Regulations).

Based on these two hypotheses, the designers produced a programme of calculation in three distinct stages :

1. The establishment of the numerical lists needed for the work to be done on the site.

   The establishment of the theoretical numerical lists : speeds, times and transversal acceleration.

   The establishment of the numerical lists needed for the execution of the plan : altimetry, prefabrication, etc.

will be noted that using a computer made it possible to calculate the run step by step, at intervals of 0.50 m, and that this method alone enables the required geometrical picture to be defined with sufficient precision. In addition, only a computer was capable of carrying out the four iterations required to obtain the desired degree of precision, compatible with the strictest possible accuracy of the project.

Execution

The designers set themselves three main objectives :

1. An execution adhering as closely as possible to the mathematical data of the problem.
2. An aesthetic execution designed to spoil as little as possible the site selected for the run.
3. An execution that could be carried out in the shortest possible time.

First objective

The given mathematical facts of the problem. These are based on the analysis of the computer lists obtained with regard first of all to the normal precision of execution and, second, to the known criteria of the resistance of materials.

The latter resulted in the making of concrete structures about 4 metres apart.

Second objective

The environment-the site is a fully wooded area which must be kept as intact as possible. The preliminary plan already took scrupulously into account the sacrifices that would have to be made from the point of view of the inevitable felling of trees and more especially of the possible damage to the slope caused by land movement.

In making the choices at this level, every effort was made to reconcile the need to build a suitable Olympic course and at the same time fully respect the environment.

Thus, the related area—men's start, women's start, and space reserved for the tower at the finish-have been reduced to the bare minimum in spite of their absolute functional necessity. The excavations required will be studied in great detail as regards natural stability with a view to making them as small as possible. As for the embankments, they will be covered as soon as possible with vegetable soil for growing local flora to hide them. Finally the omega will be built with the greatest possible care so that this particular pole of attraction will be visited by the public as a meeting place like an open-air theater, which it could very easily be converted to within the framework of the resort's summer activities.

The run itself has been designed so that the onlooker is struck not only by its harmonious mathematical lines but also by the fact that it melts so successfully into the background thanks to its wooden facing.

Third objective

In order to meet the wishes of the Organising Committee concerning the time- limit for completion, the designers tried to plan that the major part of the construction should be prefabricated either in the factory for the concrete sections in the case of easily transported parts, or on the site itself for the larger parts, Sufficient space is in fact available at the bottom of the runs for creating the necessary prefabrication areas.

As for the run itself, guniting with a cement gun, which has already proved its effective-

ness in other projects of the kind, will be used in order to avoid the tremendous difficulties that generalised casing would inevitably have raised for the builders.

Refrigerating techniques

It will be remembered that the existing bobsleigh run, which is not refrigerated, must be fully equipped with refrigeration at least in the near future if not at the same time as the execution of the luge run. Consequently, the designers had to plan for a refrigerating power sufficient to satisfy the needs of both runs.

We have calculated that the area of artificial ice required for the luge run would be 4,043 sq.m ; while for the existing bobsleigh run, we have estimated, taking into *account* the topographical surveys that have been carried out, visits to the site and probable modifications, that it would amount to about 6,500 sq.m.

In accordance too with the dates of *use* indicated by the users :

— 1st December : opening of the luge run.

— 30th March : closing of the installations, the optimum characteristics were determined as follows :

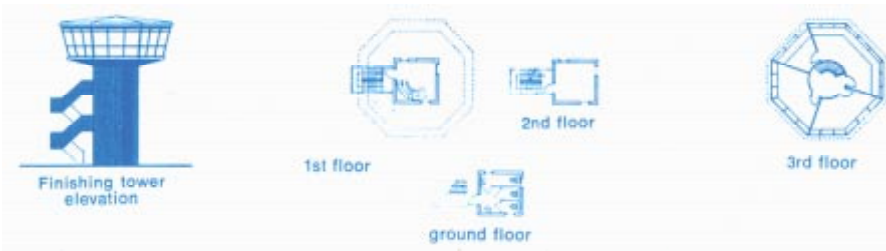
Refrigerating plant

Refrigerant	ammonia
Quantity of refrigerant	16,500 gallons
Number of tanks	3
Total refrigerating power	1,400,000 negative kilo-calories (600 tons)
Number of compressors	3
Type of compressor	screw
Number of condensers	2
Type of condenser	evaporating
Number of pumps	6
Regulation for initial putting into operation	manual

The luge run

Number of segments	46
Length of tubing	approx. 40,430 metres
Overall length of collectors	approx. 2,200 metres

With regard to the other installations, the originality of the plan lies in the fact that for the first time the finish will be controlled from a tower and not from a cabin. The purpose of this arrangement is to keep the personnel organising and supervising the race completely independent of and separate from the public, visitors, teams, etc., and to give an unobstructed view of the finishing area.



The starting cabin is planned so as to give competitors a clear view of the starting area from the waiting room.

The control positions and tower will be built using local materials and finished so as to avoid clashing with local styles. *J. S.*