

FEWER LIFTS ... BETTER PERFORMANCE

THE EVOLUTION OF TWO SYSTEMS :

FUNITEL – UNAFFECTED BY WIND

DETACHABLE DLS - VERY HIGH CAPACITY

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INTRODUCTION

Val Thorens ski resort, Savoie, France was created in 1971 in a high altitude virgin site. Its skiing terrain lies between 1,800 and 3,200 meters.

From 1971 until 1988, the resort's uphill transportation was composed of conventional devices such as surface lifts, fixed grip chair lifts, 4 and 6 place detachable gondolas, except in 1982, when the jig-back aerial ropeway of Caron, (150 places per car, the biggest in the world at that time) was brought into service.

In 1998 the company established a new master plan for both technical and economic goals for the year 2000. The purpose of the master plan was to support the bed capacity until the year 2000.

In 1999, it appears that these goals have been achieved and their effects which turned out positive, be it in terms of technical innovation or of economic profitability, seemed to justify a communication as part of the OITAF congress in San Francisco.

We do not intend to claim that our experience must be a model or that our conclusions can be applied to all resorts. But we do think that for some resorts comparable to Val Thorens, it might somehow be helpful.

GOALS SET IN 1988 FOR THE RESTRUCTURING OF THE SKI AREA

Goal #1:

Reduce the amount of lifts in the existing ski area, in order to reduce the impact on the environment: protection of the grazing grounds and the forest as well as restoring the visual aspect of the mountain.

- **Goal #2:**

Meet the demand for high uphill capacity requirements, planned with the development of the resort in terms of the capacity of tourist's beds. This should be done while respecting goal #1.

- **Goal #3:**

Improve the company's profitability by reducing maintenance and workforce costs.

- **Goal #4:**

Reduce lift closures in bad weather, snow or excessively windy conditions.

- **Goal #5:**

To free-up financial resources by reducing the amount of capital costs, ski lifts while improving the user's comfort.

THE SKI AREA RESTRUCTURING PROCESS

The maximum capacity principle

We have re-designed the ski area by assuming that a lift is profitable provided its capacity is over 3,000 p/hour with the real goal being a capacity of 4,000 p/h.

The substitution principle

We decided that, even during the development stage, a new lift could be built only if an existing one was removed.

The implementation

Year after year, we applied these two principles systematically. Considering the goal in terms of capacity, a jig-back aerial ropeway, fixed grip chair lifts and surface lifts have been removed from our technical solution. The new higher capacity lifts with the following capacities created new problems in regard to user comfort:

- Detachable 4-place chair lifts 2,400 skiers/hour
- Detachable 4 and 6-place chair lifts 2,800 skiers/ hour
- Detachable gondolas 2,800 skiers/ hour

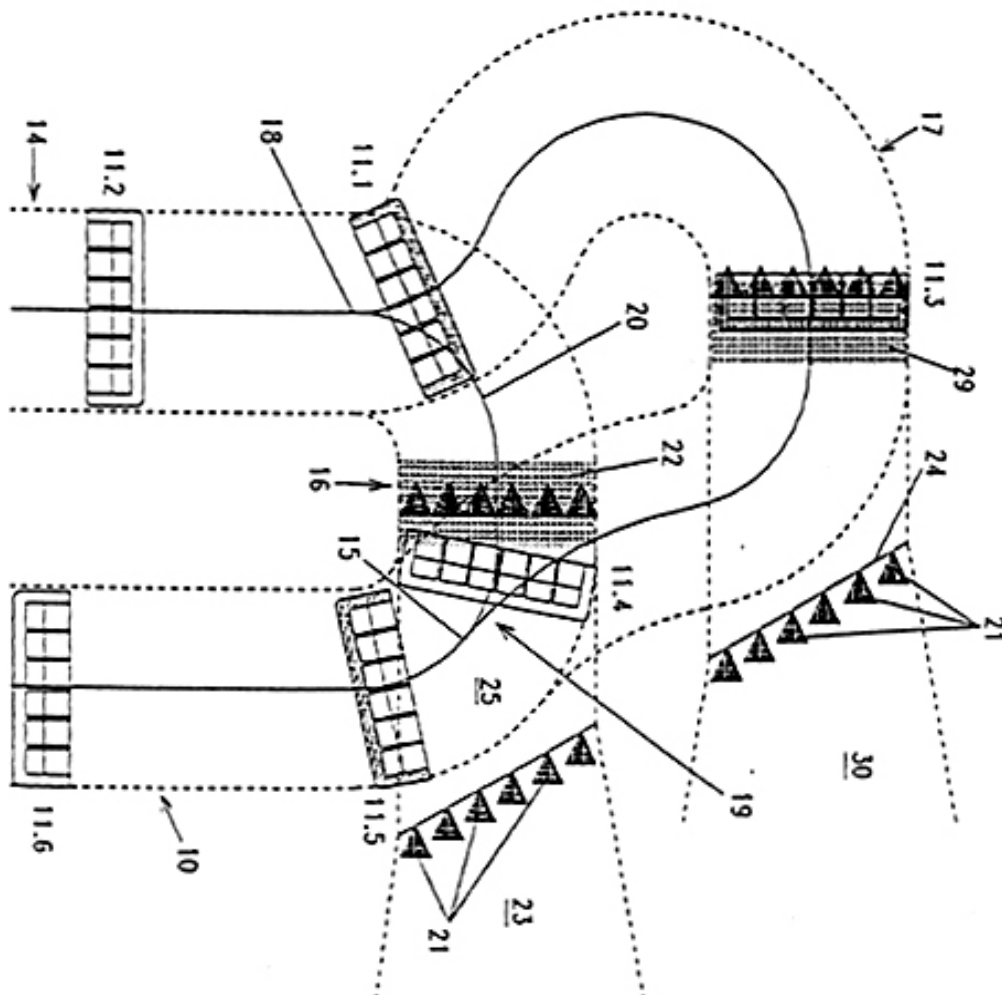
In order to improve both performance and comfort while loading a detachable chair lift, we have studied, developed and designed a new loading system, which we have named the Double Loading System (DLS).

In order to ensure that a significant amount of the ski area was open, even in case of bad weather conditions, we developed the FUNITEL concept. This development was done in collaboration with our consultant, Denis Creissels, a world renowned tramway engineer.

The DLS (Double Loading System)

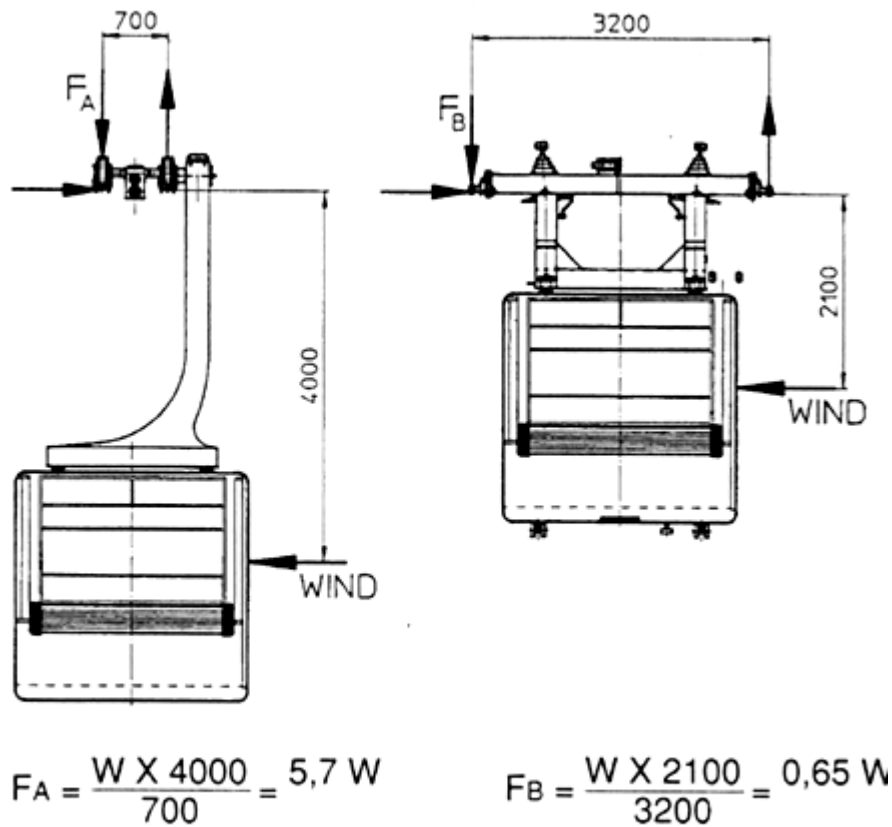
We made load capacity tests on a 6-place detachable chair lift and realized that a well designed unloading area would permit 4,500 skiers/hour to be unloaded without any difficulty. The French authorities that monitor lifts observed our tests and they concurred that an increase in the number of skiers exiting the lift did not present any safety issues.

However, we noticed that the comfort during the loading process became unsatisfactory above 2,800 skiers/hour. Because of this we designed and patented an automatic system, the Double Loading System (DLS), that permitted double the loading time. As an example on a 6 place detachable chair lift with a capacity of 4,400 skiers/hour, the loading time ranges from a 7.0 to 9.8 seconds depending on which loading path is being used.



The Funitel

In 1989, we decided to replace a 4-place detachable gondola with a capacity of 1,080 p/hour with a new lift offering a capacity of 3,000 p/hour and permitting safe operation in winds over 100 k/hr. We named the new lift Funitel. With Denis Creissels's Double Mono Cables (DMC) patents, we financed and developed and built the first Funitel on our own. It commenced service in the winter of 1990. After 8 years of operation, the Funitel has proven to be very successfully because it permitted us to operate during bad weather, high winds, when we had previously been closed. The operation revenue that has been protected by the operation of the Funitel has more than paid for the cost of the lift. Our only regret is that we didn't design our Funitel with a capacity of 4,000 p/hour.



$$F_A = 8,7 F_B$$

Technical Consequences

If a ski area is laid out with fewer but higher capacity lifts it is very important that they be very reliable. If one lift should break down it would cause significant skier congestion. Because of this we decided to double all of the key elements of each lift.

- ◆ Electric equipment
- ◆ Safety cables
- ◆ Winding gear
- ◆ Movement transfer wheel

Val Thorens is currently operation four DLS lifts:

- ◆ Three 4-place detachable chair lifts
- ◆ One 6-place detachable chair lift

Three of the DLS systems have been installed on existing lifts and one DLS was built simultaneously with a new detachable chair lift.

Our oldest DLS system has been in operation four seasons without any significant problems.

We have transported up to 24,000 persons a day on our 6 place detachable chair lift that is equipped with the DLS system.

The former Pecllet gondola was closed about 15 days a season on average, because of strong winds. The Funitel, which replaced this gondola, has been closed an average of three days a season.

Compared profitability

This table illustrates the technical and financial comparisons between a 6-place detachable DLS chair lift and two 4-place detachable chair lifts, which would provide a similar capacity, 4,000 skiers/hour, on the same line.

COMPARISON 2 X 4 place detachable chair lift – 6 place detachable DLS chair lift.

DEVICE		4 Place detachable chair lift	Two 4 Place detachable chair lift	6 Place detachable chair lift + DLS
LENGTH	m	2,000	2,000	2,000
HEIGHT VARIATION	m	400	400	400
SPEED	m/s	5.00	5.00	5.00
DISTANCE BETWEEN CHAIRS	m	36	36	27
CHAIR CAPACITY		4	4	6
AMOUNT OF CHAIRS	u	120	240	165
MAIN POWER	kW	450	900	750
AMOUNT OF TOWERS	u	20	40	23
AVERAGE HEIGHT	m	10	10	11
AMOUNT OF WHEELS	u	296	592	432
AMOUNT OF TIRES IN THE STATION	u	91	182	94
AMOUNT OF DRIVING BELTS IN THE STATION	u	90	364	188
AMOUNT OF DEVIATION WHEELS	u	20	40	20
DLS	u	0	0	1
WORK STATION EXPLOITED	u	3	6	3
RESEARCH/INSTALLED DEVICES	FFR	19,420,000	38,800,000	31,500,000
SET UP	FFR	3,370,000	6,740,000	4,450,000
CIVIL ENGINEERING	FFR	2,100,000	4,200,000	2,800,000
TOTAL TAX EXCLUSIVE	FFR	24,890,000	49,780,000	38,750,000

CONSEQUENCES

Environment

Despite the considerable increase in lift capacity and skiers between 1988 and 1999 (about the double) the amount of towers and stations on the site have been reduced by 20%.

The previous table clearly shows that the 6-place detachable chair lift requires 2 stations and 23 towers instead of 4 stations and 40 towers.

The investment costs

The previous table illustrates that the average prices of a 6-place detachable chair lift, with a DLS system and redundant key operational components and that of two conventional 4-place detachable chair lifts. These installations are supposed to have been made on the same line, without any particular difficulty, aerial machine room and standard protection. It appears that the two 4 passenger detachable chair lifts are 28% more expensive than the 6 passenger one equipped with DLS and double the key operational elements.

Regarding the Funitel, for an equal or higher capacity than 3000 skiers/hour, the extra cost compared to a conventional gondola is about 25% higher if both the top and bottom stations are identical.

Development costs

Again, the previous table shows that one 6-place chair lift with a DLS system and redundant operating systems has lower maintenance costs on the mechanical elements than two 4-place chair lifts. Additionally, the electric power is reduced from 900 kW to 750 kW, which means that the consumption is reduced in the same proportions. Finally there are half as many workstations requiring fewer employees.

The Funitel doesn't present any unusual development costs compared with conventional gondolas of similar capacity. The amount of fixed grips and wheels is almost the same per person that is loaded.

The power compared to capacity is about the same and its electric consumption in terms of vertical transported Hm is comparable to that of other lifts. However, in situations where the line is lightly loaded line, the consumption is higher because of increased friction. This increased power consumption isn't significant in light of the global economies that are realized by the installation.

RESULTS

The results of the investment strategy of the company

From 1988 to 1999

- The amount of tourist's beds has increased from 15,394 to 23,000.
- The amount of ski lifts has been reduced from 26 to 23.
- The average capacity per hour was increased from 32,325 to 48,870 skiers/hour
- The amount of recorded passengers per season has increased from 9,926,499 to 16,560,605.
- The average capacity per lift has increased from 1,243 to 2,124 per hour.
- The average capacity per bed per hour has remained the same (around 2.1).
- The amount of average passengers per lift has increased from 381,788 to 720,026.
- The cash flow has increased from 9,853,00 to 55,586,000 FF in 1998.
- The turnover has increased from 87.000.000 FF to 196.000 000 FF in 1998 .

From 1988 to 1998 the touristic beds capacity has increased of 43% , the turnover of 170 % and the cash flow of 564 %, which shows a very important increase of the ski lifts productivity.

**TECHNICAL CRITERIAS AND CASH FLOW EVOLUTION
FROM 1988 UNTIL 1999**

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Capacity in tourist beds	15,394	16,571	17,500	18,000	18,700	19,000	19,900	21,000	21,500	21,700	22,000	23,000
Amount of lifts	26	26	26	26	25	25	25	25	23	23	23	23
Total capacity per hour	32,325	32,935	32,935	34,535	39,055	39,895	41,255	42,055	43,710	43,710	44,470	48,870
Amount of passengers per season	9,926,499	10,432,069	10,146,315	12,164,994	12,696,866	16,425,130	14,789,353	13,705,346	14,753,294	15,837,741	16,560,605	
Average capacity per hour per device	1,243	1,266	1,266	1,438	1,562	1,595	1,650	1,682	1,900	1,900	1,933	2,124
Average capacity per hour per bed	2.10	1.98	1.88	1.92	2.08	2.10	2.07	2.00	2.03	2.01	2.02	2.12
Average amount of passengers per lift	381,788	401,233	390,242	467,882	507,874	657,005	591,574	548,213	641,447	688,597	720,026	
TURN OVER	87.000.000	89.500.000	96.000.000	118.000.000	123.000.000	155.500.000	163.600.000	162.000.000	170.000.000	182.000.000	196.000.000	
Cash Flow	9,853.00	15,698.000	14,930.882	23,972.809	22,529.330	45,349.354	45,178.338	46,195.332	44,398.236	45,820.369	55,586.000	

SKI LIFTS NET STATE DECEMBER 1st 1998

N°	Category	Pers / car	Name	Brought to service in	Capacity p/h	Length en m	Vertical Rise in hm	Low altitude
1	TF	150	TF CIME DE CARON	1982	1 600	2 055	9,00	2 300
2	DMC	30	FUNITEL	1990	3 000	3 000	7,04	2 240
3	TC	6	TC DE CARON	1981	1 500	1 575	2,14	2 090
4	TC	6	TC DU CAÏRN	1981	1 700	1 075	1,90	2 090
5	TSD + DLS	6	TSD DES CASCADES	1995	4 000	1 426	3,20	2 250
6	TSD + DLS	6	TSD DE LA MOUTIERE	1997	3 300	1 725	4,34	2 050
7	TSD + DLS	6	TSD DU PLEIN SUD	1998	4 000	1 765	3,77	2 208
8	TSD + T	4	TSD DES 2 LACS	1991	2 800	1 123	2,66	2 210
9	TSD	4	TSD DE BOISMINT 2	1987	2 400	1 810	5,87	2 050
10	TSD + DLS	4	TSD DE LA MORAINES	1991	3 000	2 470	4,68	2 345
11	TSD	4	TSD DU FOND 1	1991	3 000	1 590	4,09	2 360
12	TS + T	4	TS DES 3 VALLEES 1	1984	1 960	1 190	2,77	2 275
13	TS + T	4	TS DES 3 VALLEES 2	1993	2 400	850	2,87	2 550
14	TS + T	4	TS DU COL	1994	2 000	970	3,30	2 803
15	TS	4	TS DU FOND 2	1986	1 800	1 107	3,40	2 645
16	TS	4	TS DE BOISMINT 1	1988	1 200	1 258	4,32	1 815
17	TS	3	TS DU GLACIER	1983	1 100	858	3,06	2 795
18	TS	2	TS DU BOUQUETIN	1980	1 200	832	3,22	2 550
19	TK double	1	TK DES PLATEAUX	1986	1 800	996	2,30	2 480
20	TK	1	TK DU ROC	1974	760	650	1,16	2 275
21	TK	1	TK DU STADE	1982	750	1 200	3,85	2 325
22	TK double	1	TK DES RETOURS	1987	1 800	235	0,43	2 275
23	TK	-	TELECORDE MARMOTTONS	1995	1 800	213	0,20	2 075
TOTAL GENERAL					48 870	29 973	79,57	

TF : cable car DMC : Double Mono cable TC : Gondola TSD : Detachable chair lift TS : fixed grip chair lift TK : Surface lift
T : Loading carpet DLS : Double loading system