

# Operation and Maintenance of a Multibrand Cable Car

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## 1. History

The Sugar Loaf Cable Car made its first trip on 27th of October of 1912. The idea came earlier in 1908 during an exposition in foothill. After a few years the pioneer Augusto Ramos raised funds and bought the cable car in Germany in a company named Pohlig-Haeckel.

The first trip transported about 500 persons.

This first cable car operated for 60 years. We call it the “heroic period”, as the maintenance crew had to keep the equipment in operation without resources and grounded technical knowledge.

In 1972 the cable car was renewed. The initial idea was double the capacity of the original cable car, including the second cabin of the jig-back system, but finally they realized that the cable car should have higher capacity and decided to install a completely new one. Agudio, an Italian company, won the tender.

The new cable car reopened on 27th of October of 1972, with a cabin that received a design award. The capacity of the new cable car was ten times higher than the previous one.

The new cable car was much more complex. The maintenance would be much more complex. On the other hand, according to the concepts of that time, the supplier delivered the equipment and went home, in Europe, without the proper handover and training. The operation manager at that time had to learn as much as possible during the installation. Important to say that the cable car was operating 365 days a year, non stop. Bring a technician from Europe would take too much time and costs would be too high.

To do this they developed a concept of independence from the supplier. They understood how the system works as much as possible and made the maintenance themselves.

In 2008 the cabins were changed, starting then what we call Third Generation. Between 2008 and 2021 many of the main systems of the cable car were changed.

Updated systems:

- Cabins - 2008
- Controls - 2009 with upgrade in 2018
- Gearboxes - 2017
- Carriages - 2018
- Bull wheel - 2021
- Brakes - 2021

It is interesting that the medium weight of the visitors increased according to the normatives from 65 kg per person to 75 kg per person. What therefore decreased the

hour capacity. During the upgrading program the speed was increased to support part of this loss.

## **2. Multibrand**

During the works to upgrade the cable car between 2008 and 2021, we became multibrand. There are many reasons for that:

- Panoramic protection of the mountain, making difficult the licences for a whole new cable car;
- Culture of technical independence from the manufacturers and respective capacity of the operator for dealing with the technical challenges;
- Legal aspects in Brazil;
- Costs for renewing the whole cable car.

The following systems and manufacturers are part of our cable car:

- CWA Cabins;
- Frey AG Controls, working together with Rexroth hydraulic unit and ABB equipments. For both interactions we must deal with Brazilian market and local suppliers;
- Flender/Siemens gearboxes
- Leitner carriages;
- Leitner bull wheel and brakes;

## **3. Cases**

Supply from different manufactures in different time schedule bring many challenges.

### Case: Cabin and Guides

During the development of the cabin was decided to prepare it for installing new guides in the future. The old concept was with tires under the cabin, which rolls on a large guide. The new design of the cabin predicted future installation of vertical tubes that could be installed to work with the worldwide standard concept of guides.

Working now on a new guide concept with Leitner the following challenges are faced:

- Additional adaptation on the structure of the CWA Cabins;
- Changing position of the station doors, which worked itself as guides on the previous concept;
- New maximal lateral inclination demands adaptations on Frey AG controls;
- The buildings must be locally adapted by the operator; the supplier has poor details about the civil structure.

Both the adaptation on the cabin and the guides itself will be designed in Europe to be manufactured in Brazil, what demands management from the operator.

### Case: brake and controls

As widely known brake tests are one of the most critical moment on start ups and upgrades. When the controls were updated in 2009 and with the following upgrade in 2018 the brakes tests were full responsibility of the operator.

How would it be if there were no local technical knowledge?

In 2021 the brakes were changed, including new maximal speed. Therefore new adjustments on the brakes were needed.

In this last upgrade the challenge was even higher. The Leitner supervision was remote due to Covid Pandemie restrictions. This supplier allowed this remote supervision due to local technical capacity and the interaction with Frey AG was almost full supported by the operator, which was the responsible by the brake tests.

#### Case: Cabin and Carriage

The carriage was supplied in 2017 by the same supplier as the previous one on the original cable car. But the cabin and the controls were upgraded few years earlier. For the new carriage was necessary comply it with the recently updated systems: controls and cabins.

The operator had to manage communication between both Leitner and Frey AG in order to make sure that all functionalities would work properly. The same applied for the new concept for the carriage brake hydraulic, as it would not anymore be in the cabin, but in the carriage.

During the installation both suppliers were working on site. During technical conversations the operator was responsible to the final decision.

#### Case: New Bullwheel and controls

The installation of the earlier mentioned brakes was together with the bullwheel, supplied also by Leitner. The supervision of the mechanical installation was remote and the technician for the Frey AG controls had to be connected to the operator.

Particular to this situation is that the calculations for the new speed was made by Leitner, so that all the inputs for the controls had to be managed by the operator.

## **4. Maintenance Strategy**

To deal with all the new systems and its interaction the maintenance strategy had to be upgraded.

The following conditions had to be into account:

- Everyday operation;
- Night agenda in the site, as events and civil works for new attractions;
- 99,7% availability of the cable car;
- Controls with PLC`s, with restrictions to manage the software;
- Many different maintenance plans;
- Concentrated knowledge on few people;
- New company structure, with a holding structure that manage many parks.

The old maintenance concept could not anymore be acceptable. We are not anymore independent from the manufacturers. In addition, we have many manufactures to deal with.

In this condition, the following measurements were taken:

- Establishment of an Asset Management concept;
- New governance for the maintenance
  - New maintenance organization chart;
  - Spreading of the knowledge;
  - Relationship with the holding;
- Stronger connection with the manufacturers;
- New software for asset management.

To make it happen we had to make sure that all the maintenance plans from every manufacture could match properly. Some of the maintenance plans had to be adapted in order to operate 365 days per year.

## **5. Asset Management: Looking forward**

This is still not enough. For the future we must develop the asset management according to the grow of the organization.

The main challenge is that the technical knowledge is not anymore inside the park. It is concentrated in the holding, which has an office away and should manage other business unities.

It is necessary a norm based approach. Brazil has its own normatives for cable cars, despite we follow also the European normatives. ISO certifications are now required by the organization.

Based on IBM Maximo concept we need to use technology to transform our maintenance culture. Intelligent solutions are required, as AI monitoring, asset health management and failure prediction.

Everything is guided by the organization goals, balancing performance, costs and risks.

This will be achieved by three key elements:

- People
- Proccess
- Technology

The new concept bring the organization for a new level of operational eficiencie and allow us to grow for new boundaries.