AERIAL TRANSPORTATION SYSTEM FOR WATER AND DRAIN

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History

The transportation system of water and drain by aerial means was a concept developed from the need to achieve greater efficiency in providing these services with more effective costs and sustainably.

The Sugar Loaf cable car began operating in 1912. The water supply was carried out with drums that were transported by cargo cable car to the Morro da Urca and Sugar Loaf. The transport capacity of this method was sufficient to meet consumption for a long period, even with certain disabilities. From the 1970's this form of transport was not able to supply the works to the new cable car.

The demand for water at the Urca Hill, from where was the Sugar Loaf and where was the largest volume of works required the installation of a system that was the predecessor of the current system. A pipe was installed on a temporary basis along the west wall of Morro da Urca.

To supply the work at Station IV, the concrete was originally mixed at Morro da Urca and climbed into a bucket, where it was droped at the destination. This process was not appropriate, since the supply of concrete was very slow and curing of concrete occurred unevenly. Due to the difficulty of installing a system of pipes down throug the wall of the Sugar Loaf mountain, came the idea of using a steel cable to support the pipe. The system was installed on a temporary basis only to ensure the supply of the works.

The structure was adequate for the work and was efficient even after this, for the daily supply. It worked continuously for six years after the inauguration of the new cable car until it was replaced by the permanent system, which ren the idle cable of the cargo cable car and was subsequently installed on the current location. Later the solution was also adopted for the first section.

Air transport system of water

Technical Features

To support the pipe on the steel cable connecting parts were used to perform the function safely and allow to perform maintenance on the line. It consists of two clamps, one above, for fixing the cable, and a lower attachment to the tube.

The upper clamp parts, responsible for attachment to the steel, allows the truck roll cage inspection. It was developed from the same concept used for setting the support of the haul rope of Agudio Blondin system.

Set of clamps of the water transport system.

The lower clamp consists of a flat bar bent in the diameter of the tube. With a screw, it applies the necessary pressure to fix the tube. This screw also makes the connection with the upper bracket.

The cable in the first section has diameter 63.5 mm. The tube is 2.5" and galvanized due to the proximity to the sea. The sections are connected by means of threaded sleeves. Was designed to the consumption that historically had its maximum at 200’000 liters a day. Centrifugal water pumps win MWC 250 with a flow of 12 m³/h.

The cable in the second section has diameter 44 mm. It was an open cable specifically designed for this application, in order to have the required strength with the same diameter as the cable used previously, and allowing using the same clamps. The steel tube is 1.50" and galvanized also with threaded sleeves.

Drain Descent System

Unlike the Morro da Urca, where the piping system has been supported on the wall down to the utility system, the drain system of the Sugar Loaf operates waste treatment by means of

concrete cesspit. The treated water is distributed on the ground along the cover of earth available on site. With the increased amount of visitors and the infrastructure of Sugarloaf Mountain, the terrain is not able to receive increasing volume dumped.

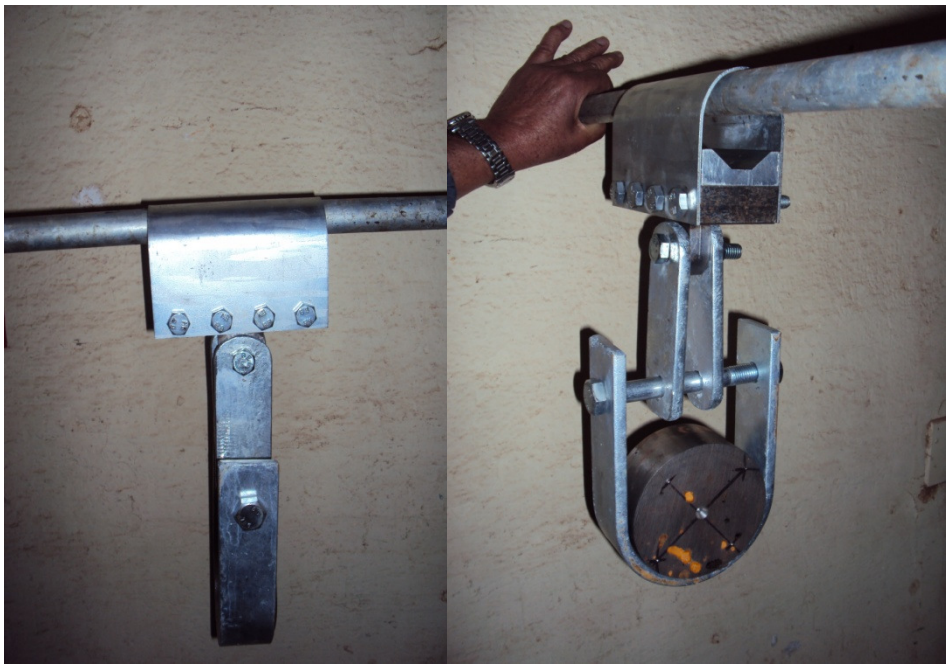
As a solution to the problem was conceptualized a system that will connect the sewer of the Sugar Loaf with the system of Urca Hill, which is connected with the public system.

Aerial Drain System – Technical Features

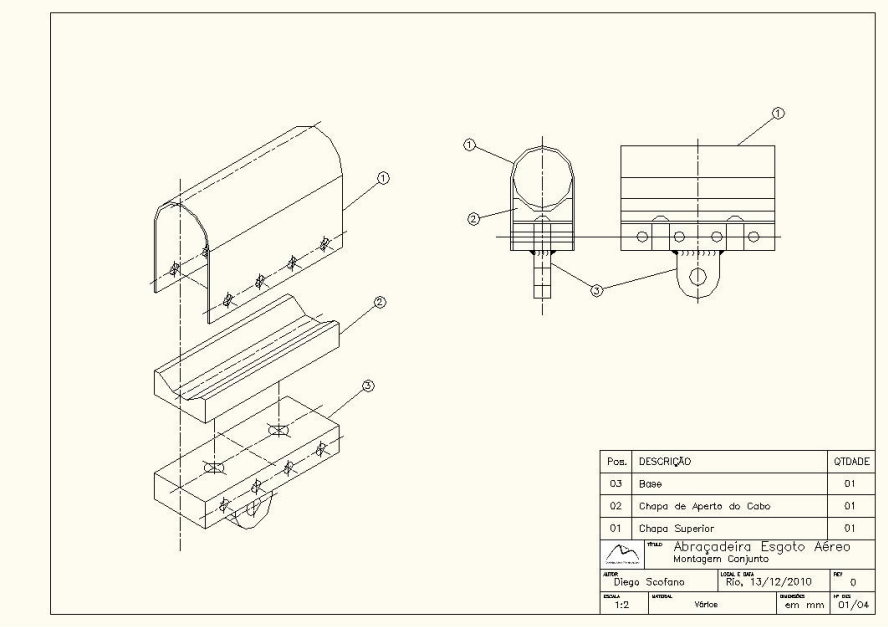
The technology used for this system is similar to the air transportation system of water, with some adjustments.

The tubing used is stainless steel A316, since it will transport a fluid that has more corrosive characteristics. It is a 4 "SCH 10 tube, with 6 meters sections joined by welding sleeves, manufactured in the workshop of the Sugar Loaf. Four thermal expansion compensators will be used to absorb thermal expansion coefficient difference between steel of the cable and stainless steel.

The connection between the pipe and cable will be similar to the water system. Due to the difference in thermal expansion, the connection between the upper and lower clamp is articulated.



Clamp Set



Schematic – Assembly of Top Clamp

The cable will be a 55 mm diameter, closed and galvanized. Was calculated to support the pipe and clamps with the tube filled with water in case of blockage of the bottom outlet.

In addition to the transportation of drain, the installation will be used as a means of communication at the facilities. The water system has currently fiber optic and phone cables fixed under the tube. The cable from the drain system has fiber optic inside it, that will replace the old ones. In the period that the company acquired it, only Swiss Fatzer produced this type of steel cable.

In the sewage structure of the Sugar Loaf there will be a coarse filter and will be installed a large blender that will prevent waste from clogging the pipe. At the under connection will be installed a shock absorber to slow the arrival speed of the drain.

Conclusion

The aerial system of water supply is continuous, has higher flow capacity, lesser operation and maintenance costs. It has operational advantages, as increases the cargo cable car availability.
It is environmentally friendly because decreases water loss.

The aerial drain descent system is environmentally friendly since its conception. Do not dump drain with primary treatment and minimize environmental impacts in an environmental protection area. With the use of steel cable with fiber optics inside it reduces the possibility of damage to the communication system.

Technical Data

	WATER SYSTEM		DRAIN SYSTEM
	First Section	Second Section	
Lower Point (see level)	4 m	200 m	205 m
Upper Point (see level)	200 m	380 m	385 m
Level Diference	196 m	180 m	180 m
Horizontal Distance	480 m	723 m	723 m
Rope Diameter	63.5 mm	44 mm	55 mm
Rope Tipe	Open	Open	Closed
Piping Diameter	2,5 in	1,5 in	4 in
Pump Flow	12 m^3/h	6 m^3/h	x
Cistern capacity before	200000 m^3	300000 m^3	x
Cistern capacity after	300000 m^3	50000 m^3	x