

INSPECTION REPORT
ARECIBO AERIAL TRAMWAY
ARECIBO, PUERTO RICO
AUGUST 6 TO 10, 2012

August 15, 2012

Mr. Felipe Soberal
Arecibo Observatory
HC-03 Box 53995
Arecibo, PR 00612

Dear Felipe

Enclosed please find the following:

1. Inspection Report for the inspection done August 6 to 10, 2012.
2. Rope inspection reports for the haul rope and track rope.

Thank you for the opportunity to be of service.

Sincerely yours

Paul Jordan
President

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enclosures

INSPECTION DATES: August 6 to 10, 2012

REPORT DATE: August 15, 2012

The Arecibo Aerial Tramway was inspected by Paul Jordan, P.E. of Ropeway Engineering, P.C. from August 6 to 10, 2012 in order to verify compliance with all applicable sections of ANSI Standard B77.1-1982 and to ascertain overall operating condition.

With respect to compliance to the ANSI Standard, all sections were complied with or not applicable with the exception of the following:

2.1.1.10 - Signs The carrier should have a sign indicating capacity in pounds and kilograms and number of passengers.

2.1.2.11.2 Automatic Stop Devices The tramway should have an automatic stop device that will be actuated in the event automatic controls fail to reduce tramway speeds to design values at critical points during terminal approach. Presently, if the MSA or MSB limit switch fails during the trip, the car will enter the terminal at full speed

2.1.4.3.2. Track Cable Brakes The track cable brake should be capable of stopping and holding a fully loaded carrier at the point of maximum gradient. The track cable brake was tested and found to be unable to hold the car at mid-span with 2 people in the car, no electric power to the drive motor and the service brake manually released.

2.2.1.5 Wiring All electrical wiring should be in accordance with the designer's specifications and applicable codes. One of the upper station travel limit switches is mounted in the wrong place and has an incorrect type of actuator arm (wire type) (See Photo 1.) This switch is a backup travel switch for the east travel switch but is not functional in its present condition. Also there is a circuit wired into the system and shown on the electrical schematic which energizes relays "Cable Car Path Up" and "Cable Car Path Down" but these relays have been removed.

The following work was done during the inspection on the dates indicated:

Monday, August 6 Mounted track rope cleaning device and tested on the part of the rope inside the lower terminal. Mounted torque bar on the rope cleaning device to keep the pull blocks from twisting during operation. Inspected MSA and MSB micro switches used for car terminal approach slowdown. Also inspected "Car in Feed Arm Path" micro switch which is actuated by the upper speed control cam and wired into the Azimuth Drive control. Observed Reeves drive operation and examined drive belt. Inspected cable car control cabinet wiring and circuit elements.

Tuesday, August 7 Tested track cable brake by applying it with one person in the car departing and then approaching the lower terminal at 50 fpm. The car did not stop or

slow down in either direction and there was no slippage of the haul rope in the drive sheave. Successfully tested automatic application of the track rope brake by slacking off the haul rope at the car with a lever hoist. (See Photo 3.) Disassembled and inspected brake pads and disks of Sterns service brake. (See Photo 7.)

Wednesday, August 8 Removed excess grease from the track rope with a groove cleaning apparatus (See Photo 4) so that the rope could be visually inspected. The groove cleaning apparatus was pulled from the top station to the bottom by the car which was moved by gravity and hand crank in order to limit the speed and force of the groove cleaner. Inspected track rope from the roof of the car and ½ of the haul rope from the lower terminal. (See Rope Inspection Reports.)

Thursday, August 9 Completed inspection of the haul rope at the upper terminal. Measured groove depth and inspected overall condition of haul rope sheaves in both terminals. The groove depth was found to be 0.79 inches, which is about 0.165 inch deeper than the depth as built. The carriage sheaves on the car were also measured and found to be 0.75 and 0.82 inch deep.

Inspected travel limit switches in lower terminal including wiring connections. Arecibo staff measured tension in the track rope at 5,700 lbs (See Photo 5) and haul rope at 535 lbs at a temperature of 90 degrees F. Tested track cable brake again by taking car to mid-span with 2 people on board and stopping the car. The track cable brake was then applied. The motor was disconnected from the electrical power source and the Sterns service brake was released manually. The car then rolled downhill due to the force of gravity. The track cable brake clamps on to the track rope but does not grip tightly enough to slowdown or hold the car. (See Photo 8.)

Friday, August 10 Inspected travel limit switches in upper terminal including wiring connections. Tested the over speed sensing switch by disconnecting the drive chain and turning the sprocket manually. The sensing switch opened its contact upon sensing the over speed. The switch was then reset (See Photo 6) and the drive chain was put back on the sprocket.

REPORT RECOMMENDATIONS:

1. Mount a sign in the car stating “4 passengers and 1000 lbs or 455 kg max. total weight”.
2. Install an automatic stop device that will be actuated in case the automatic speed control fails to reduce the tramway speed during terminal approach.
3. Repair the track cable brake so that it is capable of stopping and holding the fully loaded car at the point of maximum gradient.
4. Move the upper terminal travel switch with the wire actuator to the location opposite (west of) (See Photo 2) the east travel limit switch and replace the actuator arm with the same type (roller arm) that is mounted on the east travel limit switch.
5. Correct the electrical schematic to show that the “Cable Car Path Up” and “Cable Car Path Down” relays have been removed.
6. Order and install a new track rope since the existing track rope diameter is reduced to 94% which is the ANSI minimum.

Ropeway will submit proposals for any of the above recommendations if requested.

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Photo 1 – Incorrectly located travel switch at upper terminal.



Photo 2 – Location to mount incorrectly located travel switch.

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Photo 3 – Performing slack rope test of track cable brake.



Photo 4 – Removing excess grease from track rope with groove cleaner.

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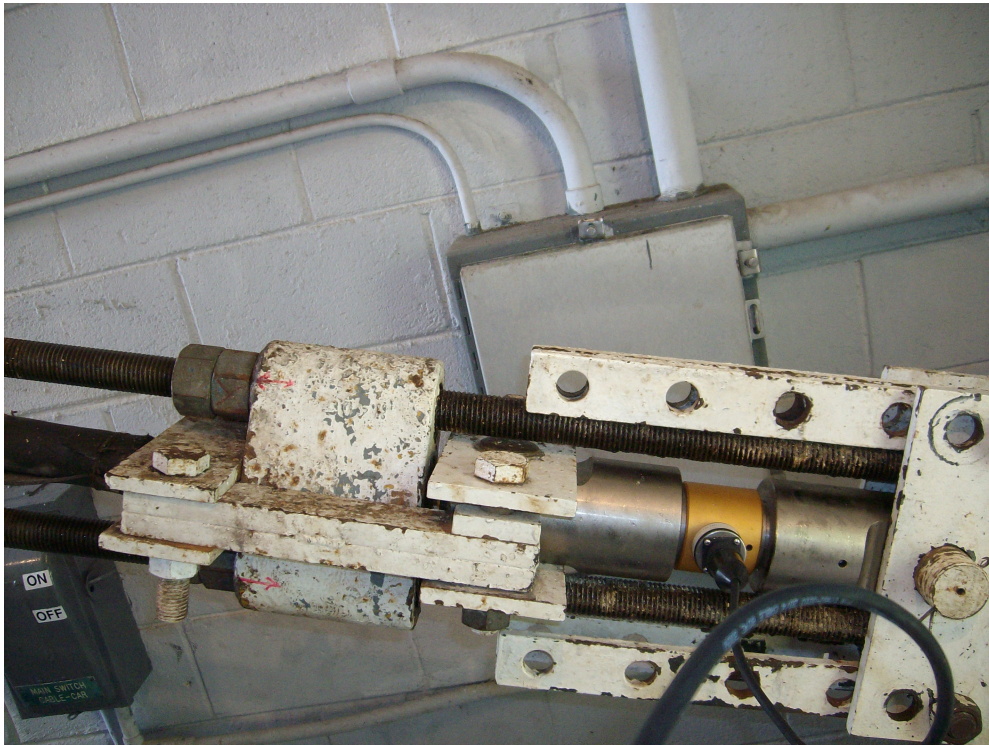


Photo 5 – Measuring track rope tension.

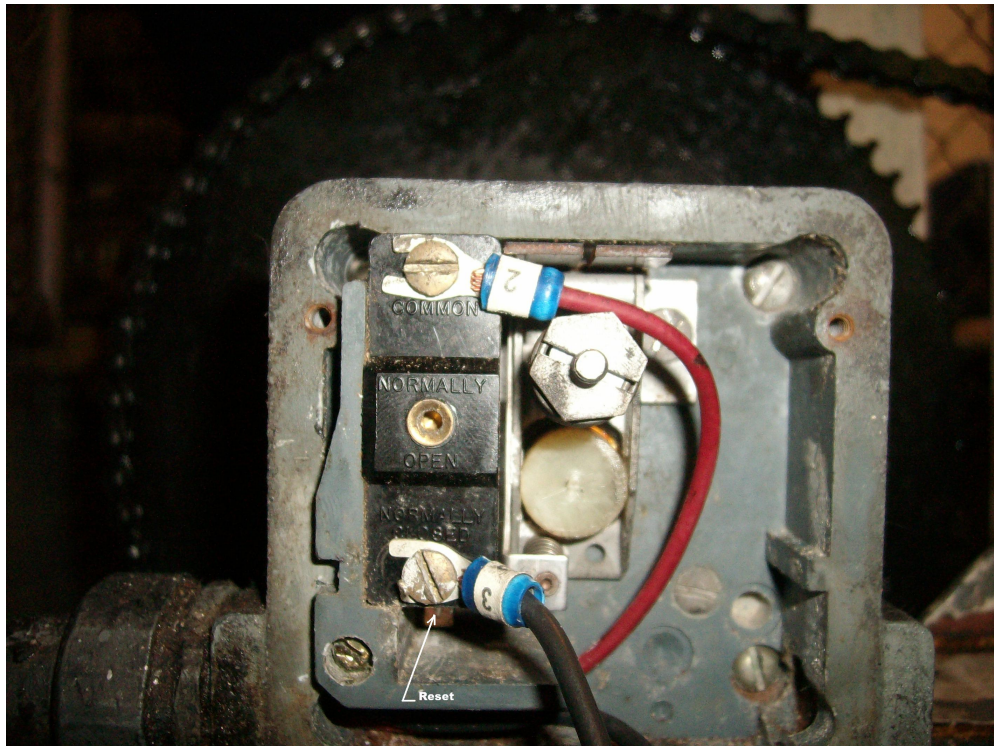


Photo 6 – Over speed sensing switch showing manual reset location (below microswitch).

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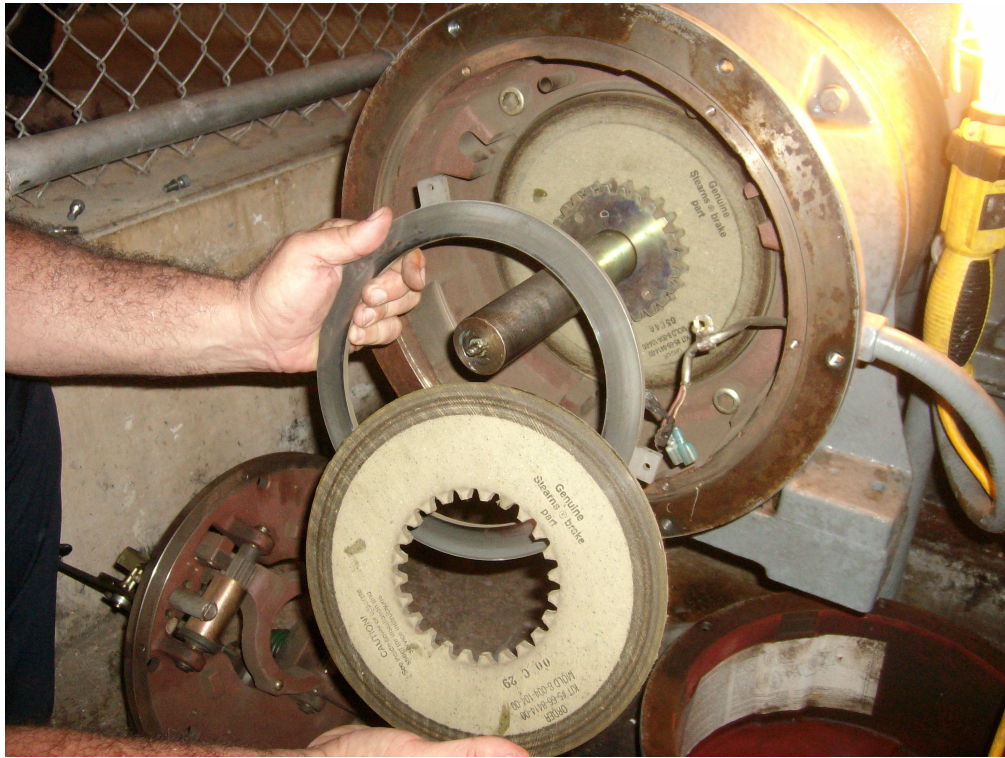


Photo 7 – Inspecting the Sterns service brake.



Photo 8 – Grip jaws of track rope brake clamp on to track rope but do not stop or hold

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car.