

## **What can you tell using QarVision?**

These are some of the things that we learned about a 20-year old traction elevator in an office building. The elevator is scheduled for modernization, but needs to keep running until the work begins. The elevator has 7 stops.

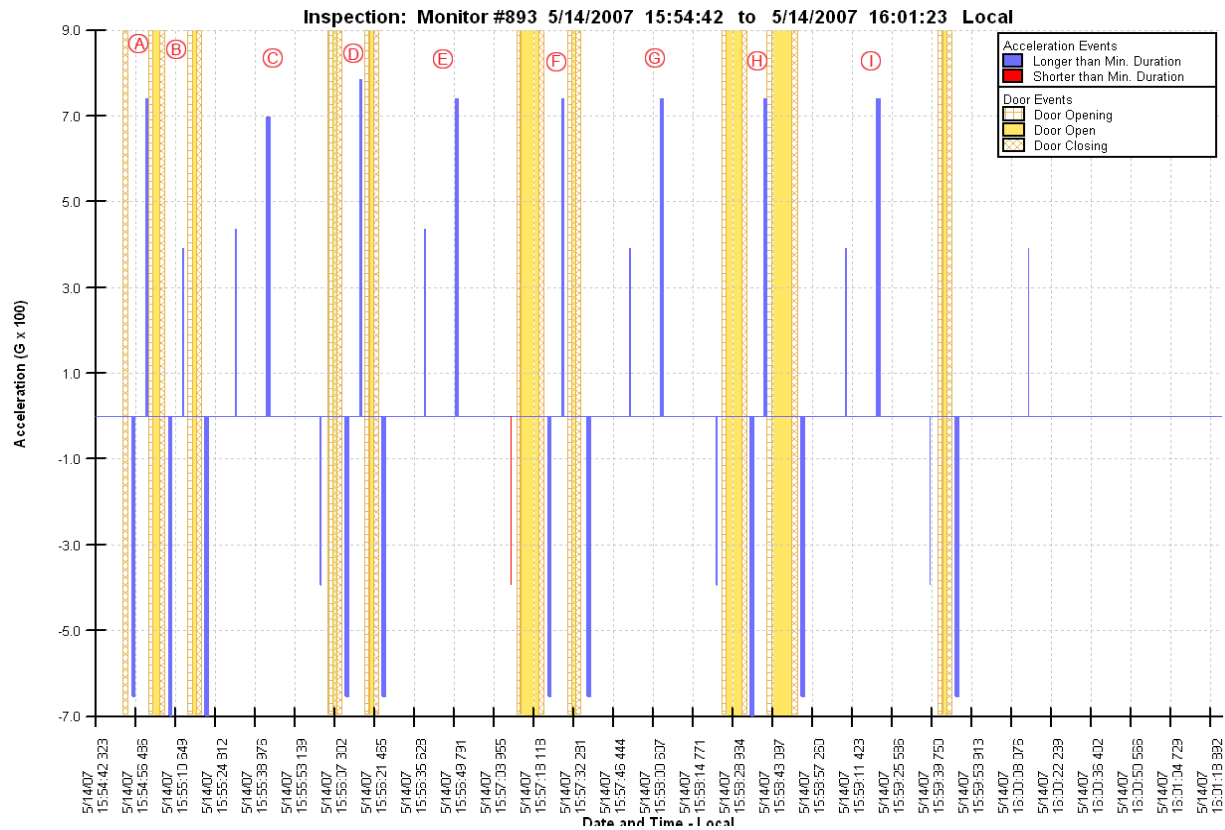
The QarVision unit is installed above the egg-crate grill in the car. The power supply and the antenna are located on top of the car, and the power supply is plugged into the 110 VAC trouble light outlet. The power cord and antenna cable are run through the access hatch in the top of the car. A Remote Sensor Interface is located in the machine room with the antenna lying on the floor above the hoistway. The motor temperature sensor is attached to the brush frame. The motor current sensor is clipped around one lead of the 3-phase power to the motor-generator. The brake temperature sensor is left unattached to measure the temperature of the machine room. The door sensor was attached to the door frame using removable tape.

The Remote Sensor Interface communicates wirelessly with the QarVision unit. The heavy reinforcing steel in the machine room floor attenuates the signal significantly, but the units can still communicate over 6 floors.

The elevator was known to cause problems before the QarVision system was installed. In particular, the elevator would often travel to a floor, but the door would not open. This behavior was reported by passengers, but was never seen by the elevator maintenance technician.

The following graph (Figure 1) was recorded from the QarVision system. It shows the door opening and closing (orange hatched areas), the door hold open time (solid orange), and the acceleration and deceleration.

In each trip, the car was on floor 6 and called to floor 5 or 4 (trips A, B, D, F, and H). The doors opened normally. When the passenger got into the car and registered a call to floor 6 (trips C, E, G, and I), the elevator went down several floors. It dwelled there for approximately 10 seconds but did not open the door. It then traveled to floor 6 and opened the door. The behavior is repeatable, but was never recorded, until now. It is now being investigated by the maintenance company.



**Figure 1**

<b>Trip</b>	<b>From floor</b>	<b>Car call to floor</b>	<b>Door</b>	<b>Travel to floor</b>	<b>Door</b>	<b>Travel to floor</b>	<b>Door</b>	<b>Elapsed Time</b>
A	6	5	closed	5	opened			7 Sec.
B	5	4	closed	4	opened			7.4 Sec.
C	4	6	closed	2		6	opened	45 Sec.
D	6	5	closed	5	opened			7.4 Sec.
E	5	6	closed	2		6	opened	48.8 Sec.
F	6	5	closed	5	opened			8.8 Sec.
G	5	6	closed	2		6	opened	50 Sec.
H	6	5	closed	5	opened			7 Sec.
I	5	6	closed	2		6	opened	50 Sec.

In another case, the elevator made 3 travels without the door opening (Figure 2). The calls were not recorded.

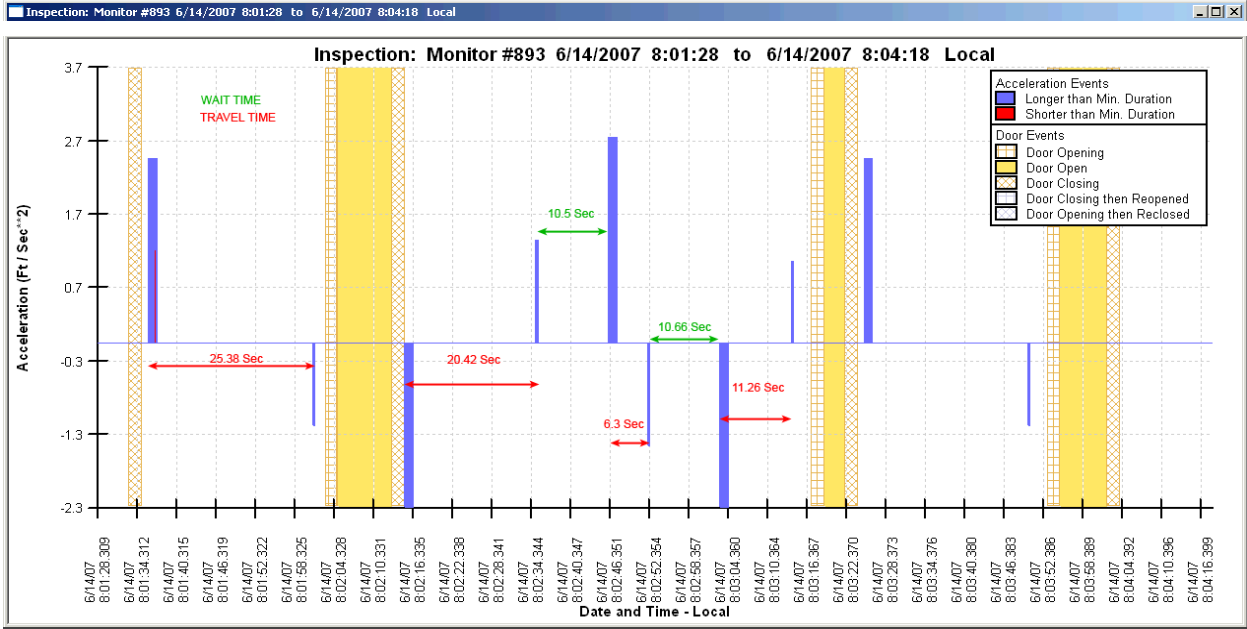


Figure 2

In the trip on the left, the elevator traveled up several floors in 25.38 seconds. The door opened normally and then closed. In the middle trip, a call down was issued, and the elevator traveled down for 20.42 seconds, delayed 10.5 seconds, traveled up for 6.3 seconds, delayed again for 10.66 seconds, and then traveled down for 11.26 seconds. During this time the door did not open. What should have been a trip of approx. 20 seconds, actually took 59.5 seconds. This behavior was recorded on several other occasions.

The QarVision system can produce performance reports over any period of time that the unit was installed. This can be over the entire time the elevator has run, or over a single trip.

The following report was created during one day of operation (Figure 3).

Elevator Monitor 893			
Database: \\Home\main\TEMP\QarVision sample data\ e0001 fresh on 5-29.mdb			
Local Time: 5/18/2007 7:41:29 To 5/19/2007 0:12:34			
Monitor Description:			
Number of trips: 615			
Number of door cycles: 597    Number of door reopens: 14			
Total Run Time: 02:08:02    Duty Cycle (Run Time / Elapsed Time): 12.9%			
	Minimum	Average	Maximum
Door opening time (sec)	1.898	2.110	2.617
Door closing time (sec)	2.050	2.251	16.847
Door hold open time (sec)	0.025	7.470	457.500
Car start delay (sec)	-0.382	1.194	27.815
Car stop to start open delay (sec)	0.058	2.229	3.691

Acceleration magnitude (Ft / Sec**2)	0.841	2.379	3.084
Deceleration magnitude (Ft / Sec**2)	0.981	1.344	3.084
Motor temperature (degrees F)	93.5	96.8	99.7
Brake / Machine Room temperature (degrees F)	73.5	78.1	84.1
Motor current (amps) recorded periodically	19.0	21.4	29.8
Hydraulic pressure recorded periodically	N/A	N/A	N/A
Motor current (amps) maximum while moving	20.0	24.8	31.7
Hydraulic pressure (PSI) maximum while moving	67.3	67.3	67.3

Trips per hour of the day: (This is the distribution of the trips the elevator made over the measured time)

Hour	# Trips
0:00	4  **
1:00	0
2:00	0
3:00	0
4:00	0
5:00	0
6:00	0
7:00	0
8:00	0
9:00	24  *****
10:00	73  *****
11:00	56  *****
12:00	58  *****
13:00	67  *****
14:00	87  *****
15:00	47  *****
16:00	63  *****
17:00	52  *****
18:00	25  *****
19:00	13  *****
20:00	13  *****
21:00	18  *****
22:00	13  *****
23:00	2  *

Length of trip up in seconds: (This is the distribution of the length of trips. Most trips are of short distance.)

Secs	# Trips
4.0	13  *****
5.0	69  *****
6.0	29  *****
9.0	17  *****
10.0	17  *****
11.0	62  *****
12.0	2  *
14.0	21  *****
15.0	17  *****
16.0	40  *****
17.0	1
19.0	1
20.0	21  *****
21.0	1
25.0	15  *****
26.0	6  *****

Length of trip down in seconds: (More trips are of longer distance and go to the first floor.)

Secs	# Trips
4.0	2
5.0	32
5.5	14
6.0	46
9.0	10
10.0	17
11.0	28
12.0	1
14.0	8
15.0	9
16.0	37
17.0	9
19.0	2
20.0	15
20.5	1
21.0	21
22.0	1
25.0	14
26.0	15
31.0	1

Duration of acceleration in seconds: (Accelerations are pretty consistent)

Secs	# Accelerations
0.1	19
0.2	1
0.3	4
0.4	1
1.1	2
1.2	52
1.3	340
1.4	221
1.5	17

Warnings:

- Local Time: 5/18/2007 12:22:18.0  
Door started opening while accelerating
- Local Time: 5/18/2007 13:34:57.0  
Door started opening while accelerating
- Local Time: 5/18/2007 14:16:4.0  
Door started opening while accelerating
- Local Time: 5/18/2007 14:29:24.0  
Door started opening while accelerating
- Local Time: 5/18/2007 14:51:8.0  
Door started opening while accelerating
- Local Time: 5/18/2007 15:9:24.0  
Door started opening while accelerating

# times closed door began to open, reclosed without opening fully: 4

Figure 3

The report shows the elevator door taking **16.847** seconds to close at one point, when the average closing time was 2.251 seconds. This is obviously a problem. The graph of the door closing times for this report (Figure 4), shows the door problem occurred at 15:45:53 on 5/18/2007.

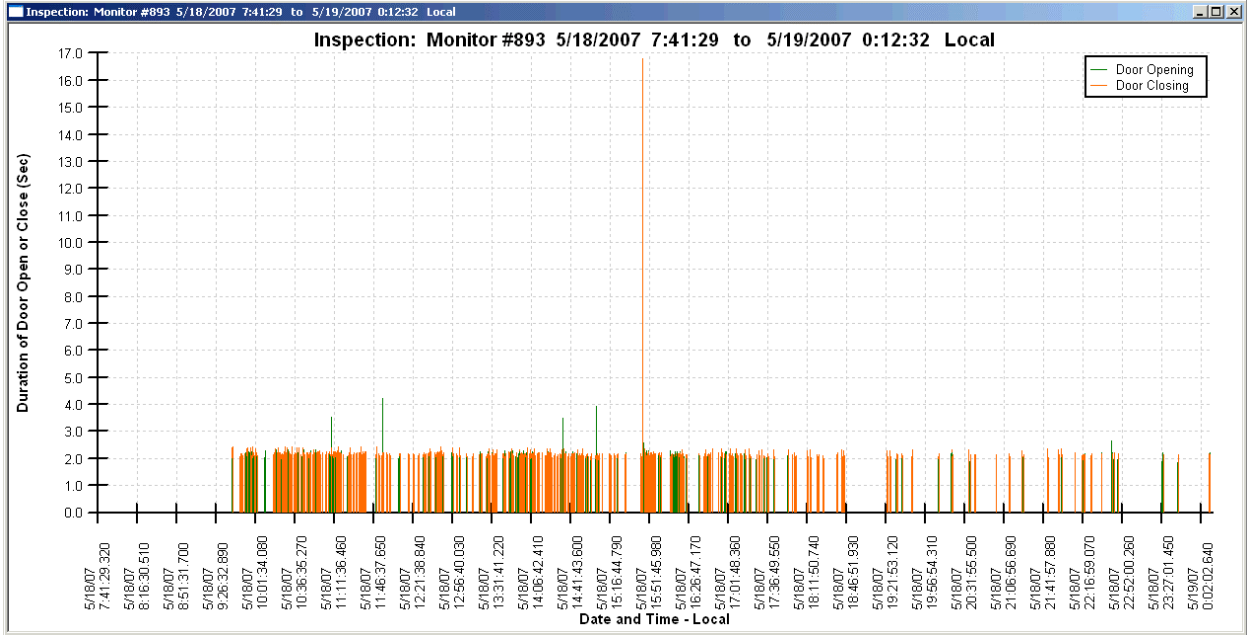


Figure 4

When the door activity is compared to the motion of the car (Figure 5), we see that the door was open for 13 seconds, took 16.84 seconds to close, and immediately opened again in 2.59 seconds.

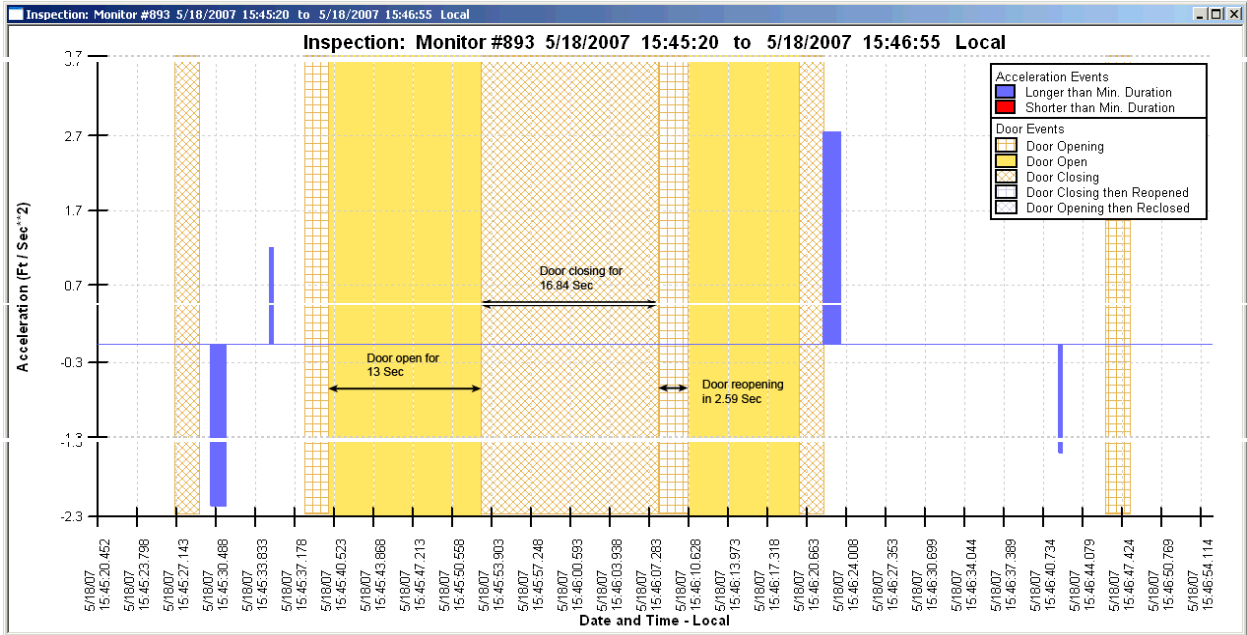


Figure 5

The cause of this behavior is unknown, but may be due to an obstruction in the door channel. The elevator controller had no way of knowing that this was happening.

These are some examples of the types of elevator behavior that were recorded by the QarVision system in one installation. If you would like to see more examples of what can be learned from the QarVision system, please contact us by phone or email.