Alternative Testing for CAT5 Inspections

LIBERTY

ELEVATOR EXPERTS

Overview of Technology

1. We Have to Accept technology:
    - How do we verify governors now (in some cases)?
    - New limitations on overspeed safeties

2. We can’t play the “what if” game:
    - Dishonest people will always find a way to be dishonest

Alternative Testing included in A17.1/B44 North America Elevator Standard

Since 2013

ALL CODES MUST BE ADOPTED BY YOUR LOCAL

AHJ

Alternative Method (Electronic Measurement) CAT5 Testing of Elevators

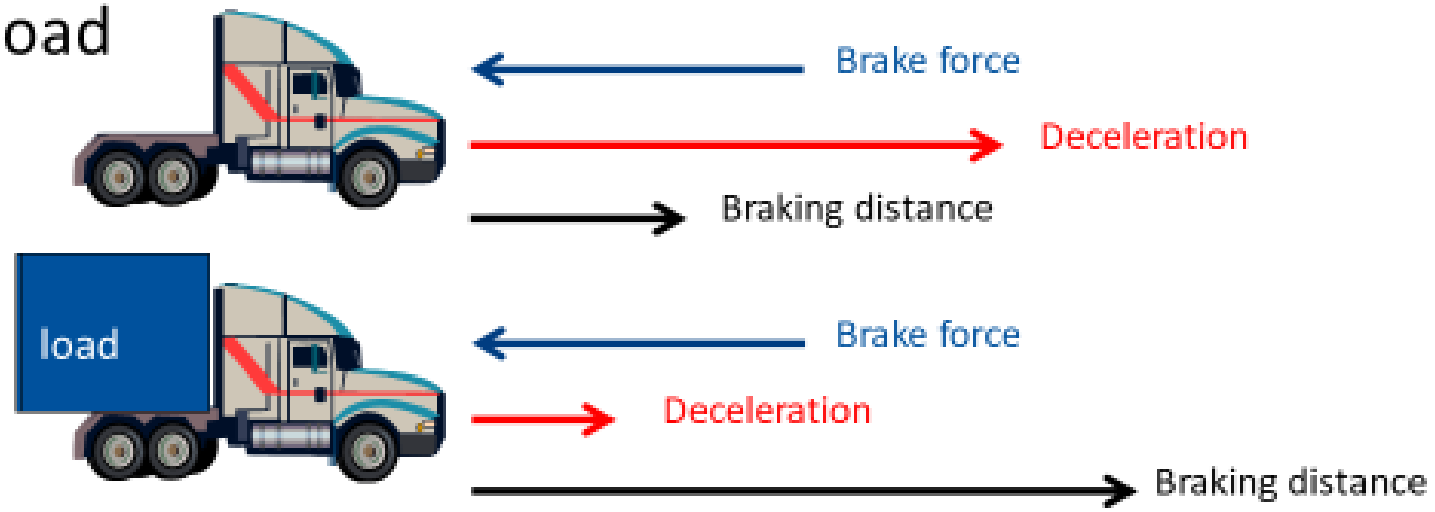
- Electronic Testing started and is ongoing in Europe (and Germany) over 20 years ago.
- ~2008 - 2009 – First demonstration of Henning designed system/method was done at the University of Michigan in Ann Arbor, MI USA. TSSA Engineering was involved.
- 2010 – September issue of Elevator World an article on this specific test published. Other articles on topic followed. More recent summary in
- 2012 – Wurtec distributes for Henning in North America.

Electronic Testing: Alternative Testing System

Basic / primary principle for electronic testing

F=MA … fundamental principle of physics.

- Example: truck emergency brake with and without load



Brake force is identical, unaffected by initial speed and load!

If you know the brake force, you can calculate the braking distance and the deceleration referred to any load whatever. Also for any ELEVATOR BRAKES and SAFETY GEARS!

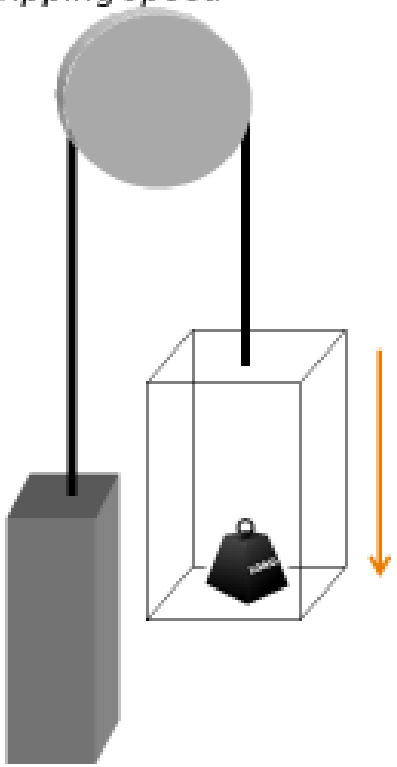
Testing with Weights --

Technical explanation in following slides…

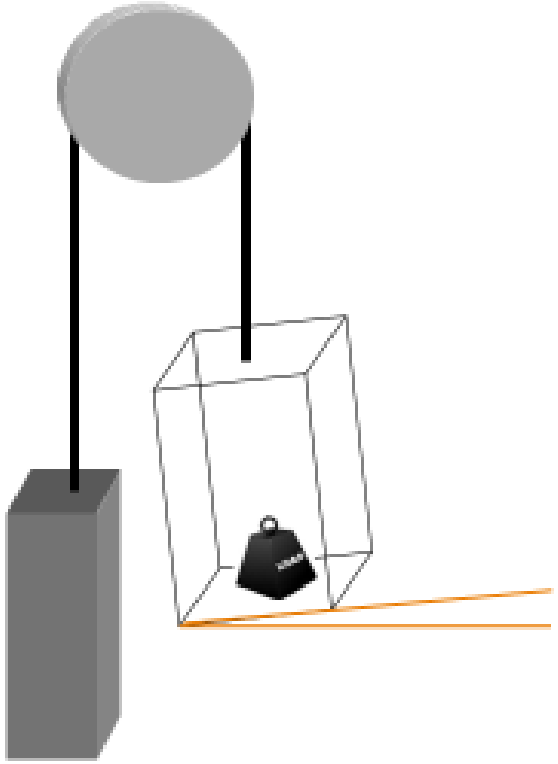
Category 5 test: Car Safeties **A17.1 2013 (8.6.4.20.1)**

By the Safeties!

Measuring stopping distance by decelerating a 100% loaded car by the safeties at governor tripping speed



The platform shall not be out of level more than 0.36 in./ft after stopping the car



Testing with an Electronic Testing System

Category 5 test: Car Safeties **A17.1 2013 (8.6.4.20.1)**

1. Physically measuring the amount of braking force of the safeties; and alignment of the car after the car came to stop.

Measured data…

2. Verifies that the measured misalignment is smaller than 0.36 in./ft

3. Verifies that the measured amount of safeties-force is able to decelerate the 100% loaded car at governor tripping speed (for type A+C safeties) within the stopping distance given in table 2.17.3 for type B safeties

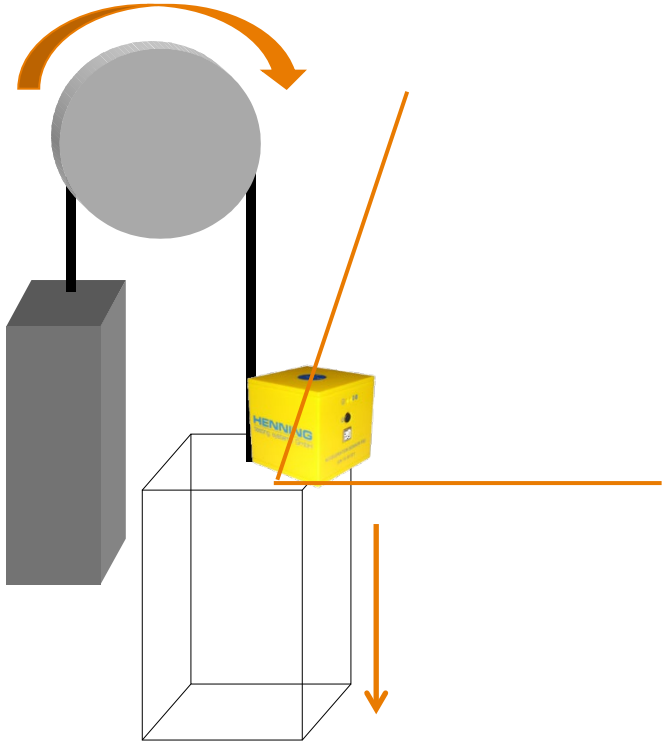
4. Verifies that the measured amount of force is also able to decelerate the 100% loaded car even in real emergency-case – complete loss of suspension means.

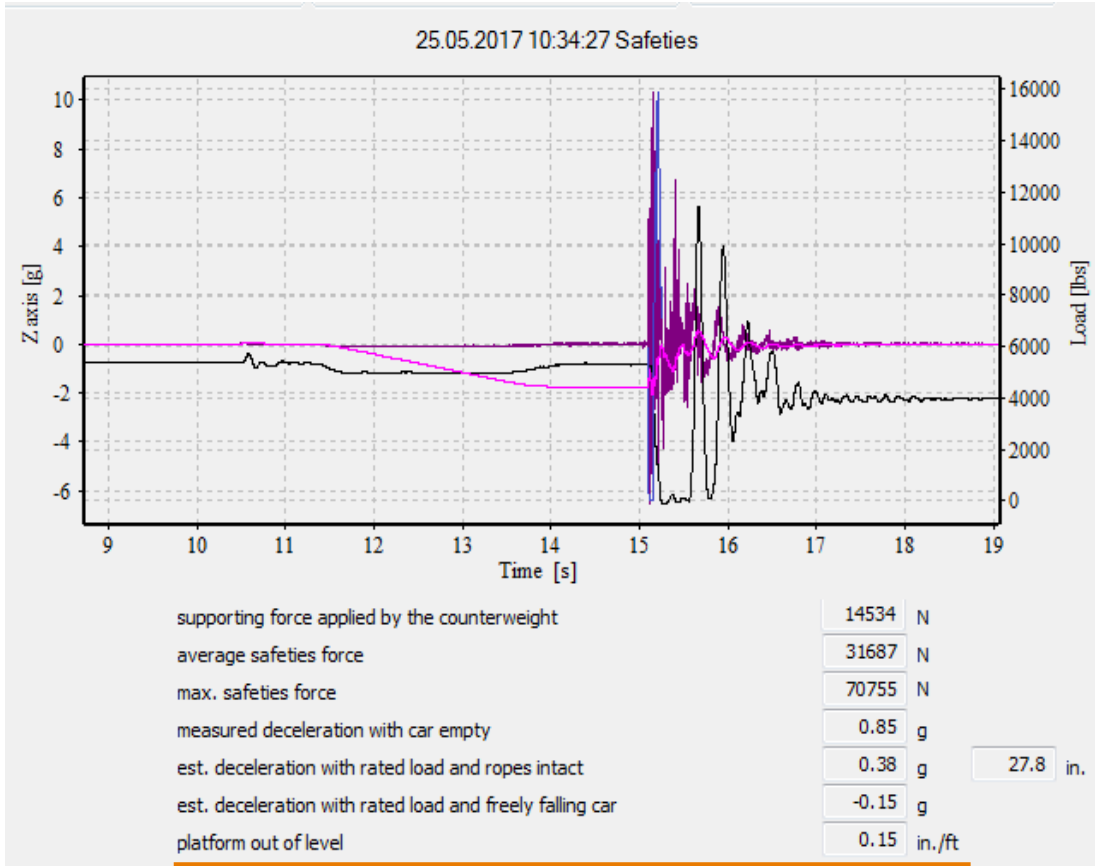
Testing with Electronic Testing System

Category 5 test: Car Safeties **A17.1 2013 (8.6.4.20.1)**

1. *Physically measuring the amount of braking force of the safeties and the alignment of the car after the car stops*

. *Measuring the alignment **before and after** the safeties stop and output the difference*

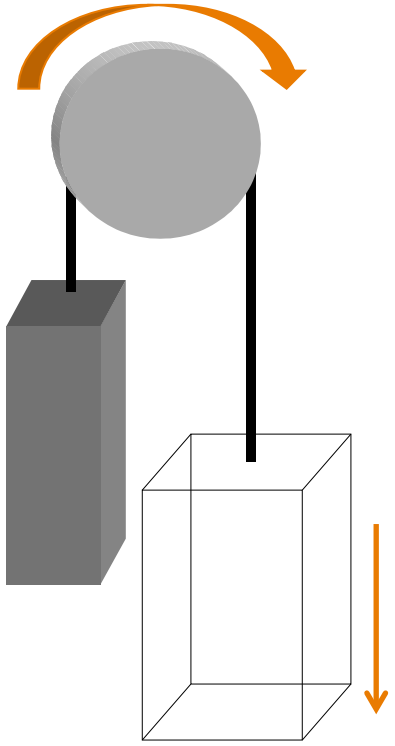




Testing with Electronic Testing System

Category 5 test: Car Safeties **A17.1 2013 (8.6.4.20.1)**

*1. Physically measure the amount of braking force of the safeties **and** the alignment of the car after the car came to a halt.* ***F=MA … fundamental of physics.***

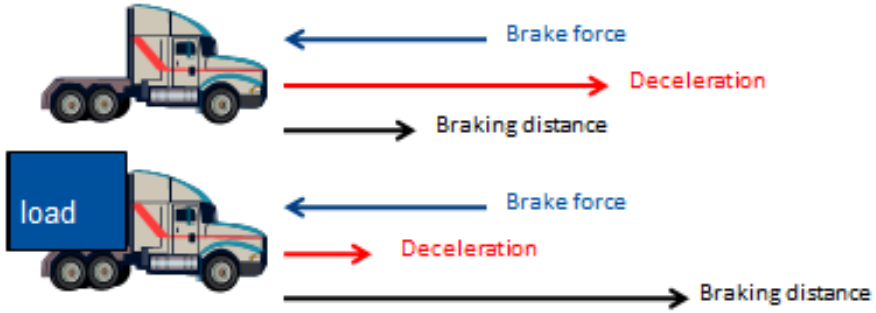


henning
MADE IN GERMANY

ELEVATOR
COMPONENTS

Basic principle for alternative testing systems

- Example: truck emergency brake with and without load



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Testing with Electronic Testing System

Category 5 test: Car Safeties **A17.1 2013 (8.6.4.20.1)**

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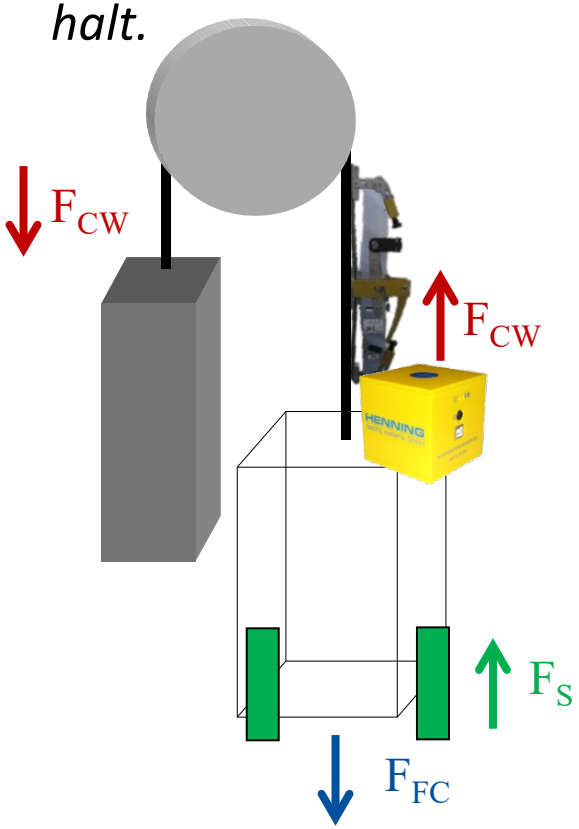
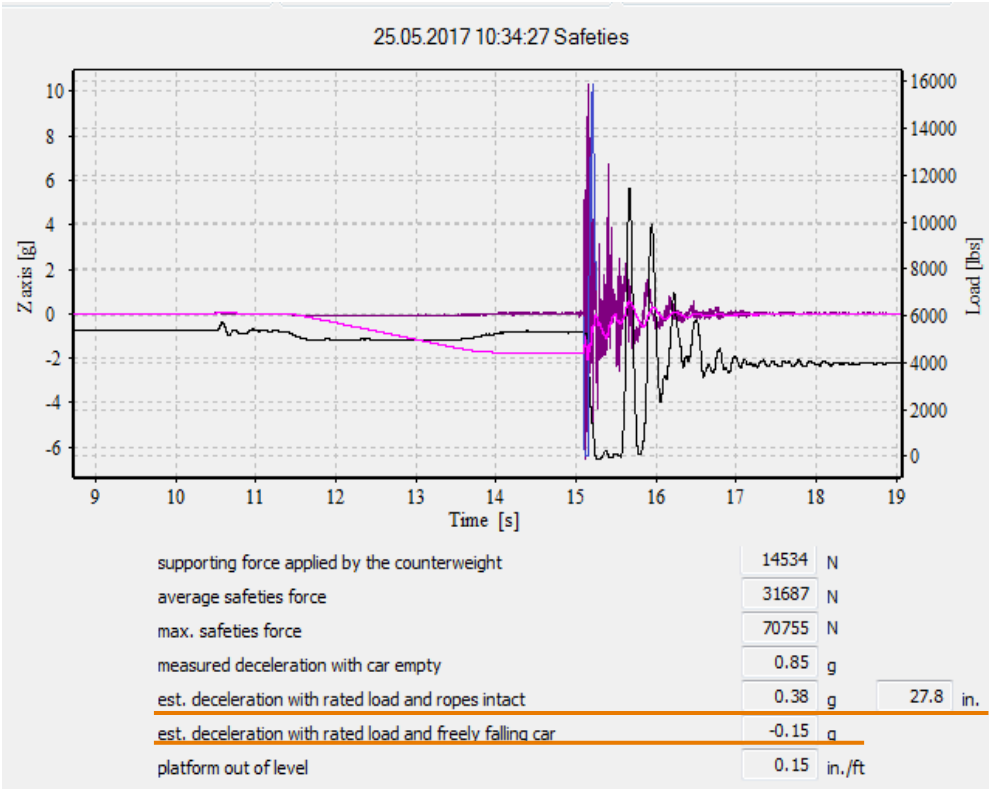




Testing with Electronic Testing System

Category 5 test: Braking system, Traction/Traction Limits **A17.1 2013 (8.6.4.20.10)**

1. *Physically measures the max. amount of traction*

   Measurably better than a go/no go test.

2. *Verifies that the measured braking system and amount of traction is large enough to decelerate the 125% overloaded car in down direction*

3. *Verifies that the measured amount of traction is small enough that the CWT cannot be raised with car blocked*

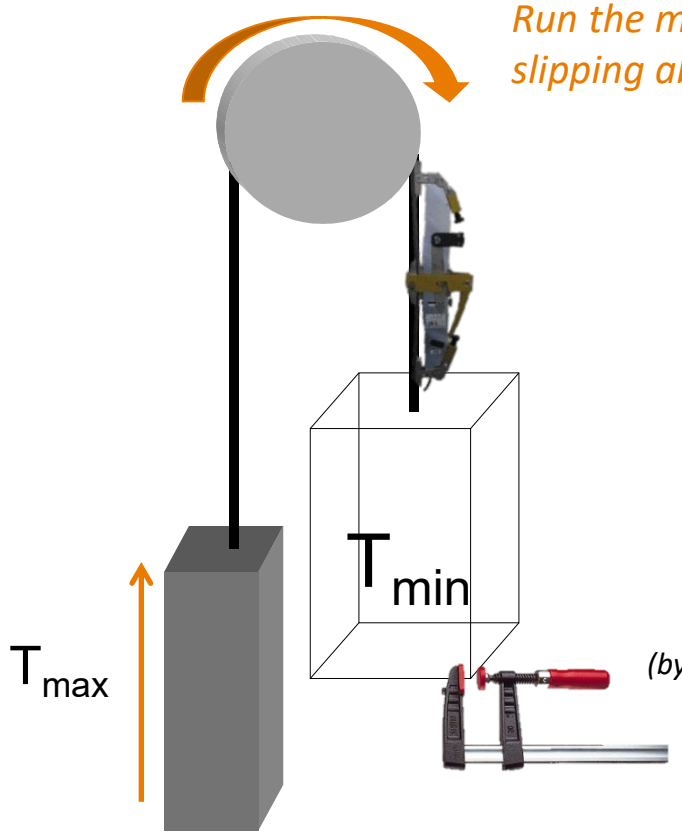
4. *Verifies that the measured amount of traction is small enough that the car cannot be raised with CWT blocked*

Testing with Electronic Testing System

Category 5 test: Braking system, Traction/Traction Limits **A17.1 2013 (8.6.4.20.10)**

1. Physically measuring the max. amount of traction

Run the machine/drive sheave in down direction until ropes are slipping above the traction sheave for ~ 2s . Or machine torques.



(by using the safeties)

Eytelwein equation

$$T_{max} / T_{min} \leq e^{\mu\alpha}$$

Along with Safeties Testing and Measurement of Traction, there are 3 other component tests in CAT5 Testing. They also use the same principles of physics and engineering and algorithms for measuring forces and data documentation.

- **Machine Brake Testing**
- **Emergency Brakes (including Rope Brakes)**
- **Buffer Function**

* Documentary reports show data collected; then able to compare results of stopping forces going forward.

Good reasons to move away from the old/existing method of CAT5 Safety Testing…full load testing is NOT necessary

- **The full load method of "testing" and assuring "safe" elevators began before we knew there is good technological alternative. Engineers and Code authorities did best they could with what they had--created the speed/mass chart for equating a full-load test to stopping/braking forces [ASME A17.1-2016/CSA B44-16, Table 2.17.3: Maximum and Minimum Stopping Distances for Type B Car Safeties with Rated Load &Type B Counterweight Safeties].**
- **Stopping distances are different (and thus estimates in the Table do not always work as intended) – there have been false positives and negatives.**
- **Where you initiate a Safety stop (higher or lower in the hoist-way) directly effects the safety slide distance -- the weight of the CWT/rope length on each side has less or more of spring effect – assisting stopping forces of brakes, the safeties and the buffer.**
- **Different constructions of ropes also effect the slide distance.**
- **And there's the full-load assumption that the CWT becomes airborne and does NOT affect the stopping forces. Now we KNOW that is true only about 25% of time. With weights you can't and don't know. Now we can get away from assumptions/estimates.**

- Reduced chances of physical injury to elevator employees (moving weights)
- Less weight cart use reduces potential damage to building-owners property, in addition to reducing logistics costs (moving weight carts)
- Elevator technician work aligns more toward technical and skilled work – in line with our important professional role and impact on **Safety**
- More discerning testing can create more work doing needed maintenance/repairs
- Time needed for training and learning new technology benefits elevator workers and our industry
- Finally, as allowed, this is optional (alternative) so it's phasing in by choice and readiness. Full load testing continues for acceptance. Consider this fact…

Many advantages to electronic testing

benefits of using newer/available technology

Reports with numerical measurements/data (big advantage for AHJ's); compared to checklists.

Authors of this Code were forward-thinking. Alternative Testing idea to include weighing cars/CWT's – giving us a direct and periodic view of elevator load balancing and masses. A practical and real Engineering improvement.

ELVI 2 Testing is verified to be on the safe side (5%+). Third Party Certification of this system that it meets all Code Requirements for Alternative Testing. This system's subcomponents have added value in other important traction elevator maintenance.

Testing design able to consider stopping/braking capability at all loads (not just full load)

Electronic testing is less damaging to the equipment during conduct of tests (+ there is more upside if Code changes in future)

Electronic Testing measures elevator system stopping ability if catastrophic complete loss of suspension means occurs