Full-Scale Benchmark Testing of HGV ABS

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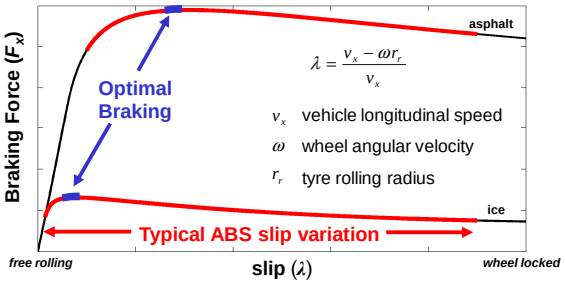
1. Why Investigate Braking?

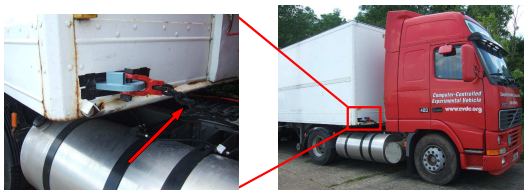
- Heavy Goods Vehicles (HGV's) require 47% more distance for braking than cars
- HGV's are involved in nearly twice as many fatal accidents per unit of travel as cars

- Current anti-lock braking systems (ABS) cycle inefficiently through low- and high-slip regions of the braking curve (see graph)
- The project goals:
  1. **Generate benchmark test data**
  2. Improve current HGV braking hardware
  3. Investigate more efficient ABS algorithms



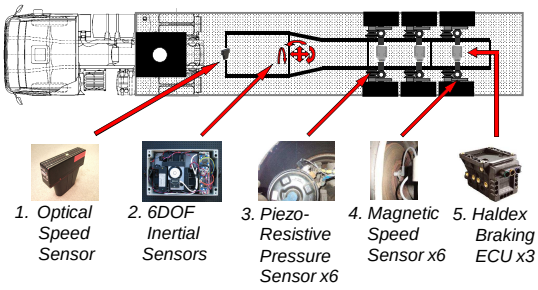
2. Initial Testing

- The CVDC trailer was used with conventional ABS and a Haldex tractor
- Chains between the tractor and trailer prevented "jackknifing" during tests



"Anti-Jackknife" Chains

- Over 40 parameters were measured, including (see picture):
  1. Vehicle speed
  2. Vehicle dynamics
  3. Brake chamber pressure at each trailer wheel
  4. Wheel speed at each trailer wheel
  5. ABS ECU pressure demands



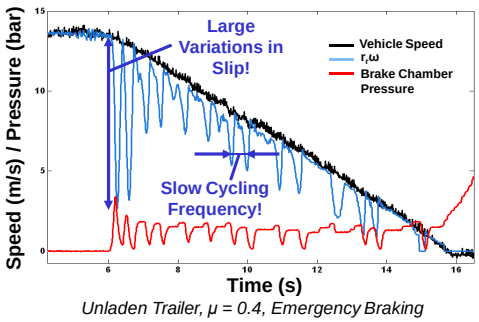
1. Optical Speed Sensor *2. 6DOF Inertial Sensors* *3. Piezo-Resistive Pressure Sensor x6* *4. Magnetic Speed Sensor x6* *5. Haldex Braking ECU x3*

3. Test Conditions and Results

- 50 km/h straight-line braking tests were performed at MIRA on 3 surfaces (μ = 0.2, 0.4, and 0.8)
- Brake pressure demands were 2 bar (light braking) and 6.5 bar (emergency braking)

MIRA's Straight-Line Wet-Grip Track

- The ABS cycled slowly at 2 – 3Hz, due to pneumatic delays (car ABS cycles at 15 – 30 Hz)
- Large wheel slips caused reductions in braking force, producing higher braking distances
- The results will be used to:
  - Update the CVDC braking simulation
  - Validate parameter estimation algorithms
  - Inform hardware and control system design



Unladen Trailer, μ = 0.4, Emergency Braking

Cambridge Vehicle Dynamics Consortium

University of Cambridge	Denby Transport	Haldex	Shell UK
ArvinMeritor	Firestone Industrial Products	Mektronika Systems	Tinsley Bridge
Camcon	Fluid Power Design	MIRA	Volvo Trucks
	FM Engineering	QinetiQ	

Braking Control