MEASUREMENT
of
FRICTION PROPERTIES

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MEASUREMENT APPROACH

- Scientific / Design /Engineering:
  - Available Force from Macro-texture Component
    - Measure macro-texture
  - Available Force from Micro-texture Component
    - **Measure micro-texture**

- Practical:
  - Combined Vehicle Control Force
  - Measure Macro-texture

CURRENT *MD* METHOD

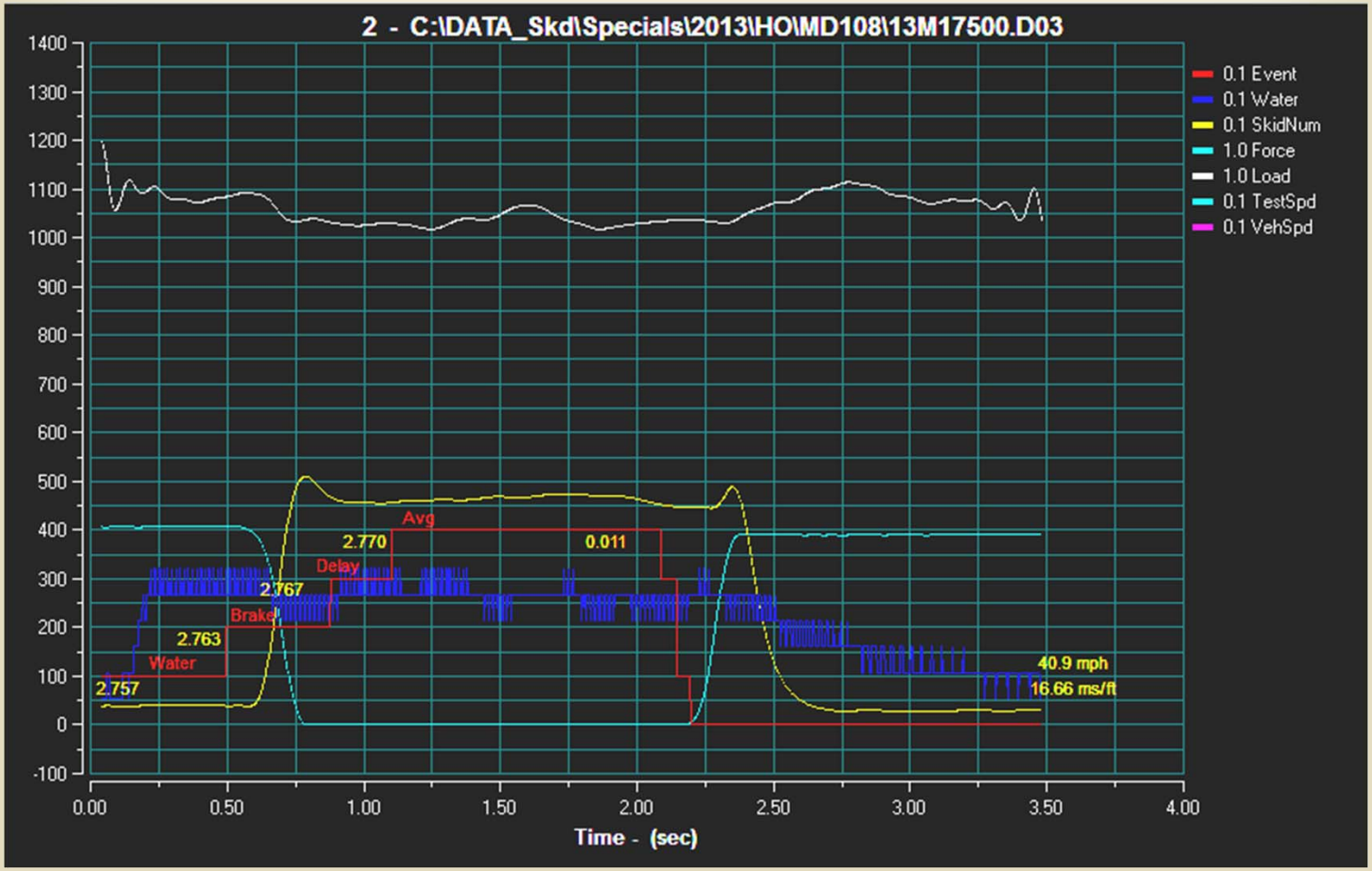
- E-274 Skid Truck
  - Measures Drag Force during Sliding Friction
  - Primary Sensor – Tire (grooved - smooth)
  - Collect Average value over 59 ft.*
  - Total Test Sequence ~ 225 ft.*
  - Water consumed - ~ 2 gal.

* = at 40 mph

TYPICAL EQUIPMENT

ATYPICAL EQUIPMENT

TYPICAL TEST



CURRENT APPLICATION

- Test network every 1056 ft. if > 1 mi
- Test every 528 ft. if < 1 mi.
- Deemed not testable if < ¼ mile
- Ribbed tire – focus on micro-texture
- Test driver's side wheel-path
- Test at Speed Limit with 40 mph Maximum
- Adjust Collected Value by - 0.6 SN per MPH

  (true adjustment is dependent on surface properties)

ISSUES

- Sampling 6% - 10% of pavement
- Large sample spacing:
  - Water consumption
  - Total test sequence time
  - Lost tests at intersections etc.
- Measuring “locked” friction
- Test spacing too far for ramps etc.

WHY

- Miss key pavement sections of concern:
  - Ramps, Sharp curves, Traffic control areas
  - Sections shorter that ¼ mile very difficult to test
- Apply the limited sample resources more effectively
- Increase the size of the sample (moderate)
- Functional test should more closely resemble the typical vehicle application

LIMITATIONS

- PRIMARY:
  - Water ……. 400-1000 gallons
  - Tire Tread …… 1/8 inch
- SECONDARY:
  - Braking Energy
  - Mechanical System Speeds

SCRATCH SYSTEM

- Tire Tread Width – 4” (narrower tire)
- Water consumption - ~ 0.2 gals/ test
- Down Force – 675 pounds (lighter trailer)
- One Second Total Test Cycle
- Digital Reliability Everywhere Possible
- Include:
  - Macro-texture Measurement
  - Sub-meter GPS

E-274 BASED PROPOSAL

- Data averaging time of 0.1 to 0.2 sec (6-12ft.)
- Start averaging at 60% - 80% “lock-up”
- Reduce total test time to 1 – 1.5 sec
- Reduce water consumption to ~ 0.5 gal
- Routine sample spacing - 0.05 mi (264ft)
- Short routes and projects - 0.02 mi. (105 ft)

IMMEDIATE ACTIONS

- Purchase a more flexible device – July 2013
  - Flexible control software:
    - Change test timing (percent slip, time)
    - Data sample rate ?
  - Improve water control:
    - Rapid electric flow control
    - Small accumulator for shock control ?
  - Improve data processing for the increased rate
    - Low noise, functional filtering
  - Include macro-texture laser and GPS

POTENTIAL FUTURE ACTIONS

- Servo driven water pump system on the trailer*
- More robust braking system with sturdier axles*
- Narrower test tire (full diameter) with a narrower nozzle to further reduce water requirements by ~30%

**May be included in current device as vendor option*

QUESTIONS?