

NON – LOCK FRICTION TESTING UPDATE

Fall 2016

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CURRENT METHOD

- **ASTM - E-274 Skid Truck**
 - Measure Drag Force during Sliding Friction
 - Primary Sensor – Tire (grooved/ribbed)
 - Collect Average force values over 59 ft.* (1 sec.)
 - Total Test Sequence ~ 225 ft.*
 - Water consumed - ~ 2 gal.

* = at standard test speed (40 mph)

EQUIPMENT



E – 274 ISSUES

- Only sampling 5% - 10% of pavement
- Large sample spacing (typically 1056 ft.):
 - CAUSES:
 - Water consumption per test
 - Total test sequence time
 - RESULTS:
 - Lost tests at intersections etc.
 - Sections shorter than $\frac{1}{4}$ mile very difficult to test
 - Miss key pavement sections of concern:
 - Ramps, Sharp curves, Traffic control areas
- Measuring “locked” sliding friction

PLAN

- **Apply the limited testing resources more effectively**
- **Collect a more representative sample**
- **Increase the size of the sample**
- **Functional test that more closely resembles the typical vehicle response (anti-lock brakes)**
- **Minimize the impact of tire structure properties**
- **Maintain focus on microtexture**

- *Measure macro-texture separately (laser)*

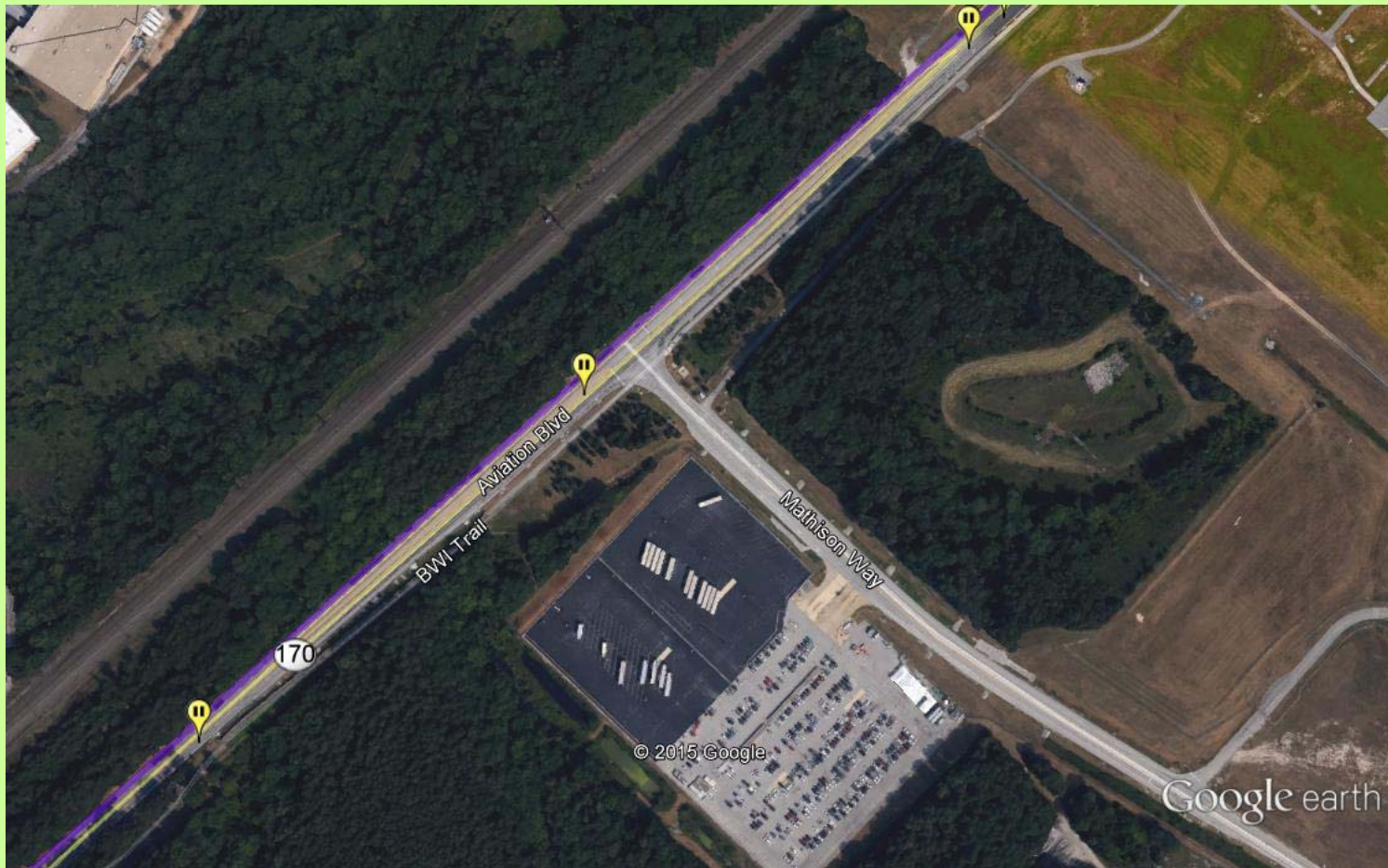
RESULT – NL TEST

- Data averaging time of 0.04 to 0.1 sec (3-5ft.)
- Averaging between 33% and 67% “lock-up”
- Reduce total test time to under 1 sec
- Reduce water consumption to ~ 0.5 gal
- Routine sample spacing - 0.04 mi (211ft)
- Short routes - 0.02 mi. (106 ft)
- Projects ~ 0.01 mi. (53ft)

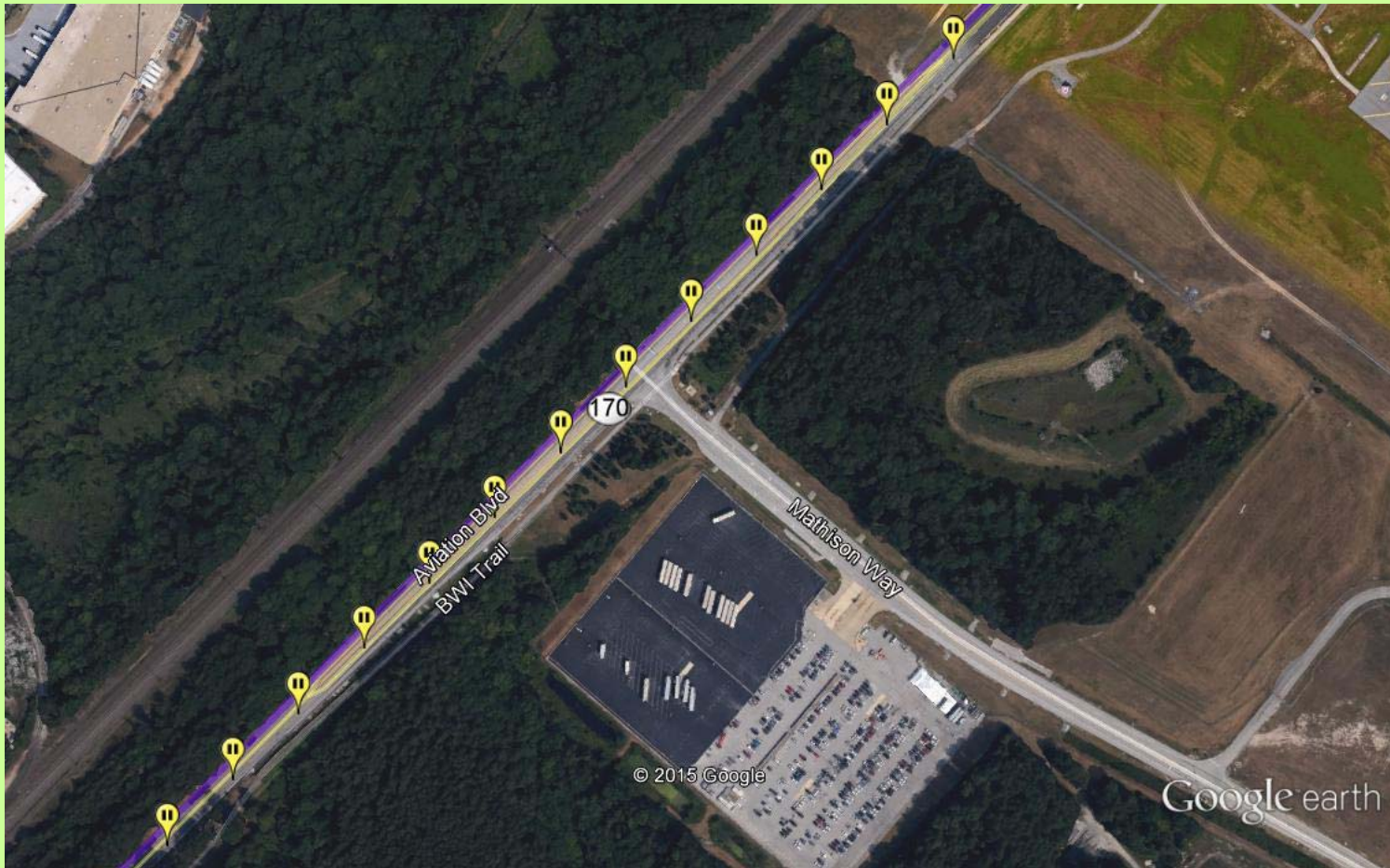
ADVANTAGES

- **More tests per mile (higher resolution data)**
- **Tests in critical areas (curves, intersections)**
- **Less water and tire wear per test**
- **Less impact from tire structure than other slip type tests**
- **Test is more representative of current vehicles with anti-lock brakes**

TESTING @ 0.2 Miles



TESTING @ 0.04 MILES



EQUIPMENT



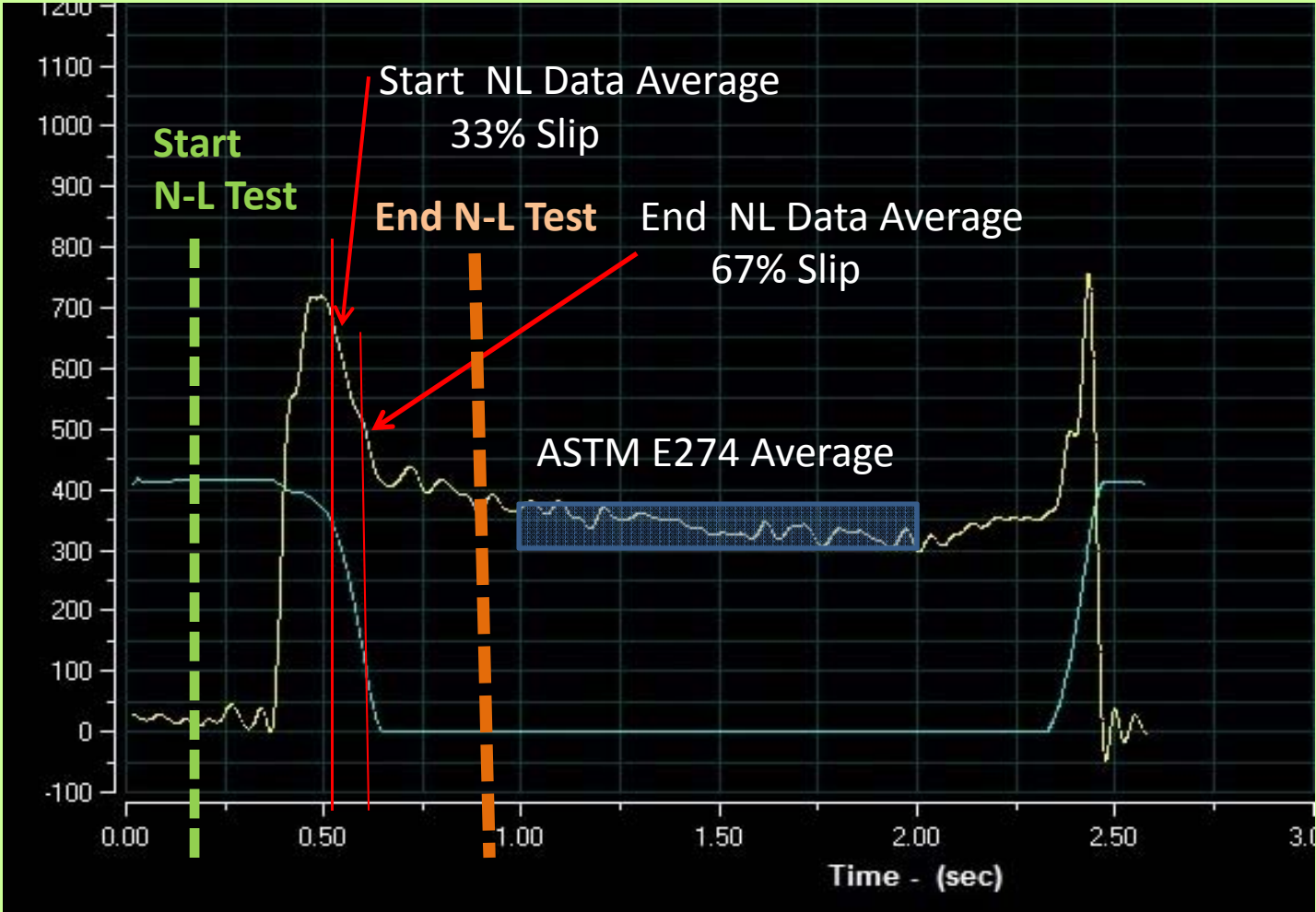
Large Equipment



KEY EQUIPMENT IMPROVEMENTS

- **Heavy duty brake calipers**
- **High output air compressor**
- **High output generator**
- **1kHz data sampling rate**
- **Automatic load leveling**
- **Texture laser & GPS**

TEST SEQUENCE



LAST YEAR

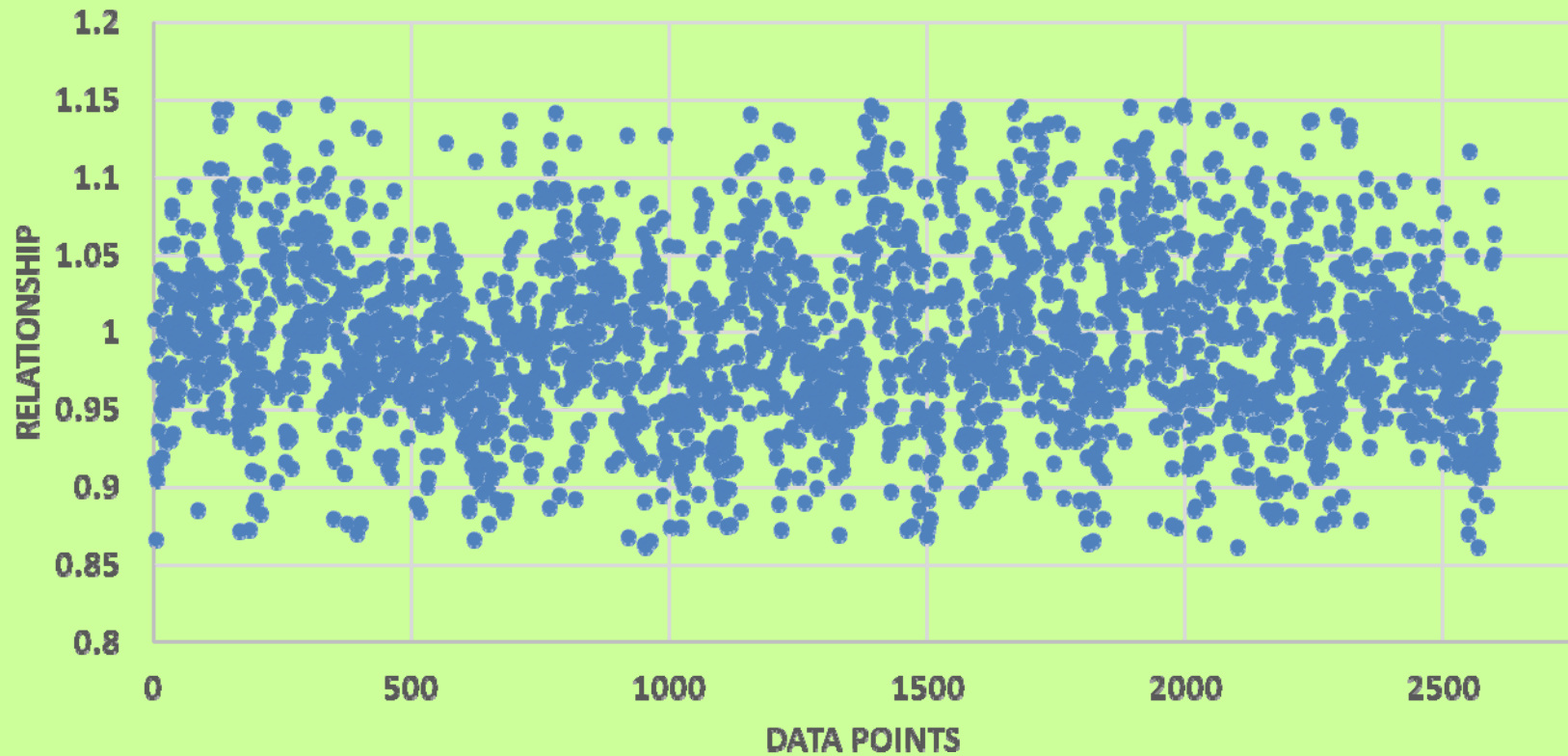
- **PG and Montgomery Counties**
- **4000 test points**
- **Derived SSN from full ASTM test**
- **Found a 0.77 relationship with .99 R²**

THIS YEAR

- **PG county same as last year**
 - 0.2 mile spacing
- **Montgomery County non-lock test only**
 - 0.04 mile spacing

Relationship Plot - PG County

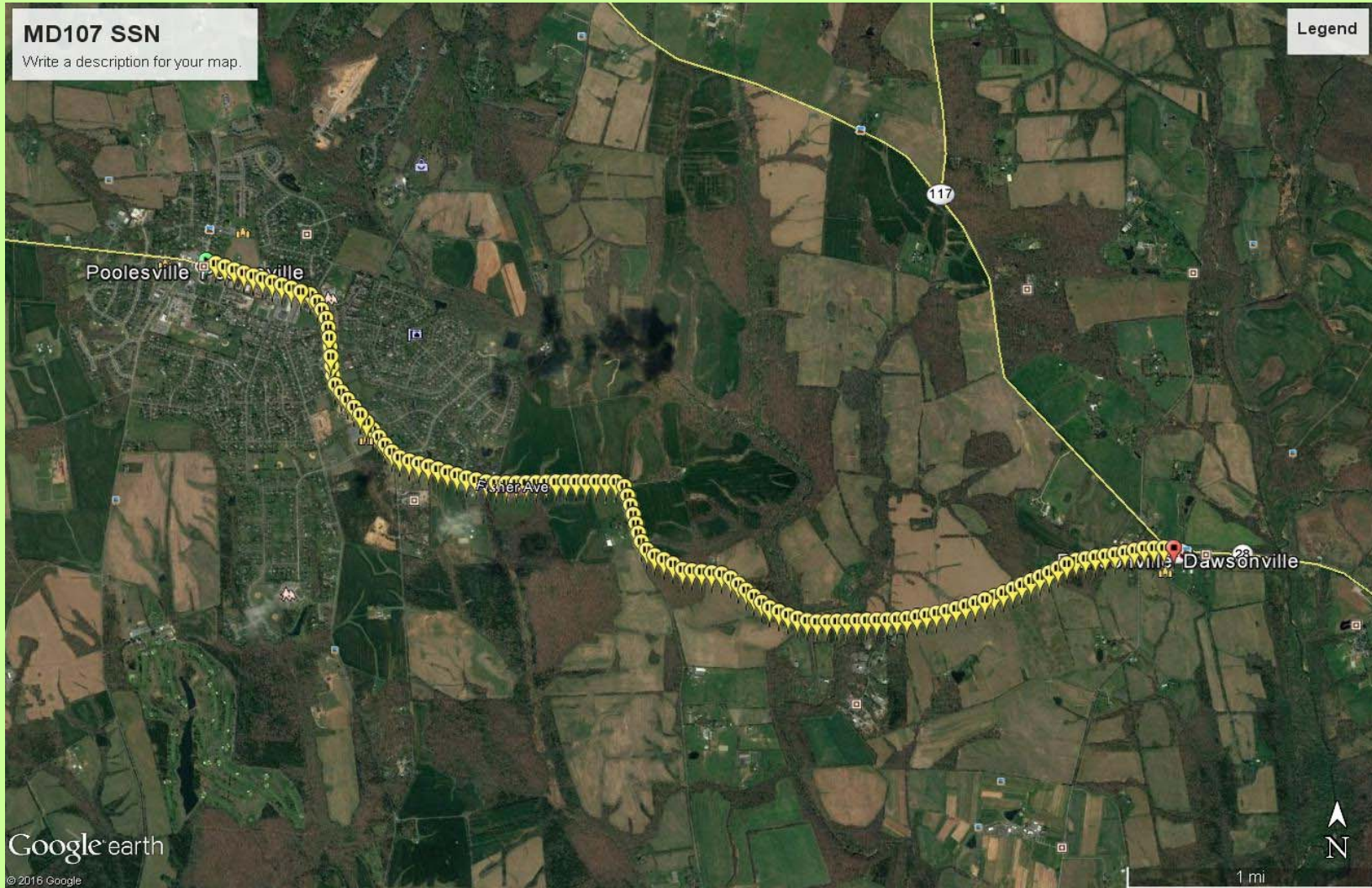
0.77 * SSN vs SN



SAMPLE DATA

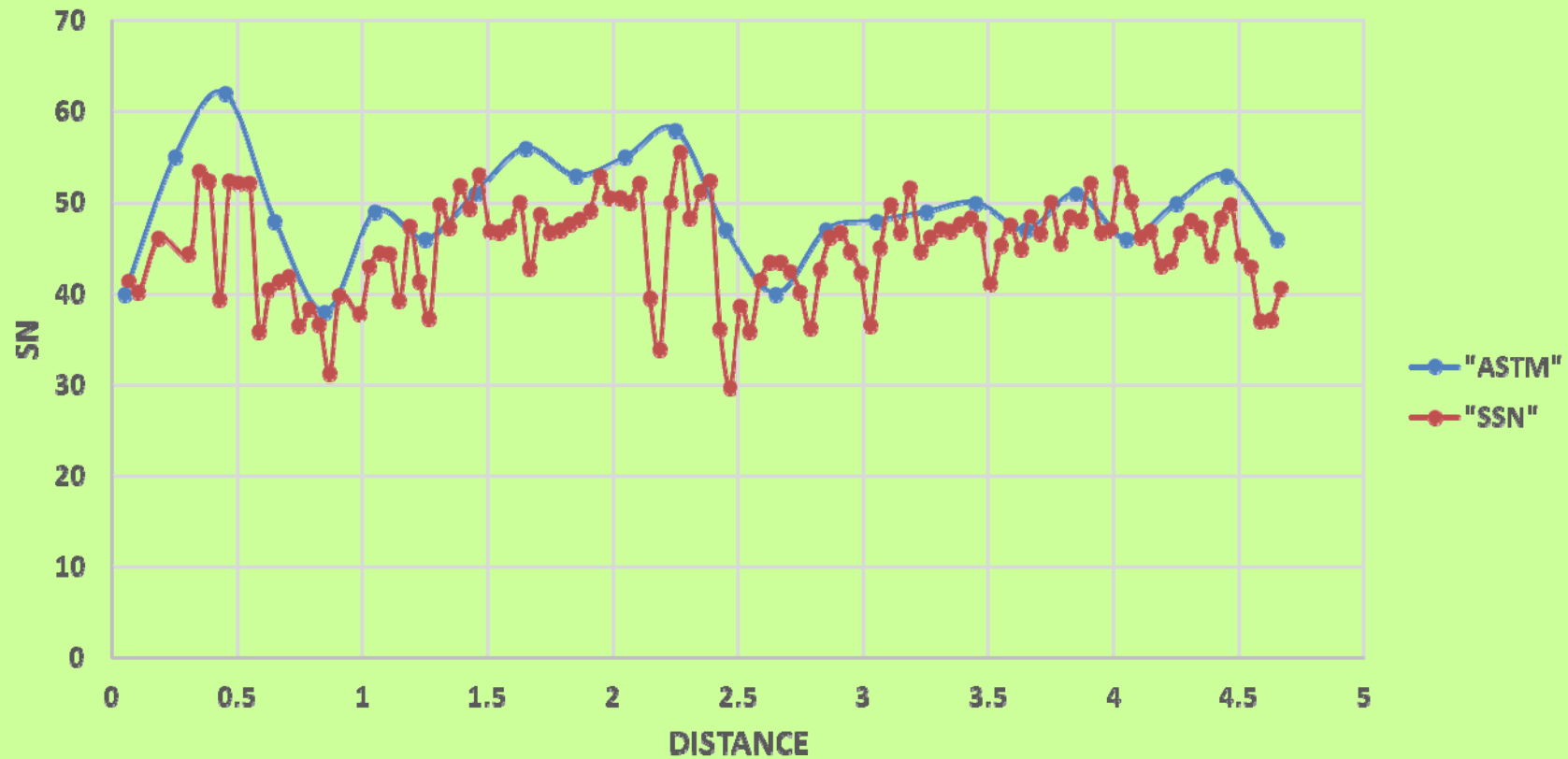
- **Montgomery County**
- **Maryland state maintained roads**
- **Typical SSN sample interval - 0.04 miles**
- **> 9000 test locations**
- **Vast majority asphalt pavement**

MD107 SSN



TYPICAL GRAPH

MD 107

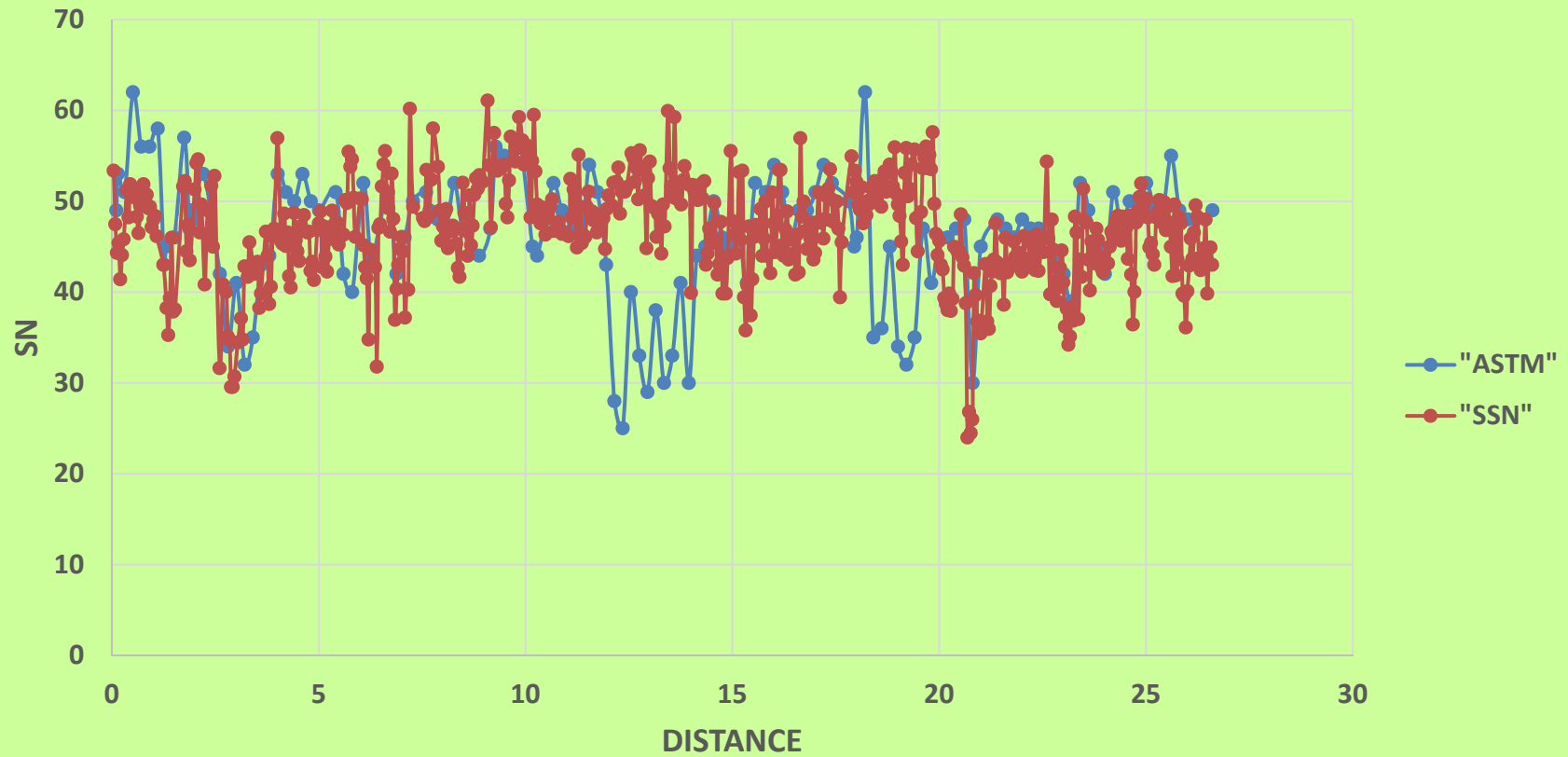


TYPICAL GRAPH



TYPICAL GRAPH

MD 355



DATA FILTERING

- **Removed :**
 - Speed less than 20 mph
 - Water (gal/min) less than 60% speed (mph)
 - Outliers outside 10 SSN of before/after averages

DATA FILTERING SUMMARY

- Total tests – 9510
- Bad tests – (s,w) 1204 (mostly speed)
- Acceptable tests - 8366
- Deemed outliers - 308
- Remaining tests - 8058

OVERALL ANALYSIS

- County Average SSN – 54.1
- County Average SSN (der) – 61.9 (last year *rev.*)
- County Average ASTM SN – 47.9 (2 years ago)
- County Average ASTM SN – 48.0 (last year *rev.*)
- Ratio Derived SSN ----- 0.78 (last year)
- Ratio Actual SSN ----- 0.83

CAUSE(S) of DIFFERENCE ?

- **Possibilities:**
 - Increased resolution
 - Detecting more low spots
 - Software calculation issues
 - Timing
 - Other
 - Combination of any

SUGGESTIONS

&

QUESTIONS