

A Pilot Naturalistic Driving Study on Fatigue in Winter Maintenance Operations



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Overview of Project

- Sponsored by Clear Roads
- Goal:
 - Feasibility of naturalistic driving approach in winter emergencies

Literature Review Summary

- Limited information
- Fatigue/drowsiness in trucks
 - Heavy vehicle
 - Inconsistent, varying schedules
 - Long shifts
- Fatigue in 15% to 30% of crashes

Naturalistic Driving Methods

- 4 VDOT operators
- 2 instrumented trucks
- Drove for 3 consecutive months
- 2 drove night shift, 2 drove day shift
 - 7p to 7a
 - 7a to 7p

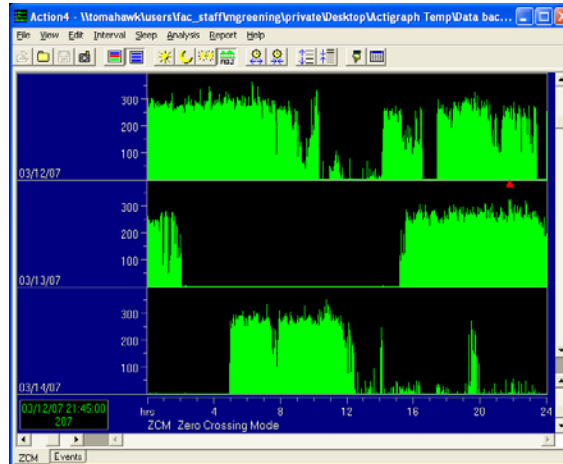
Test Vehicles



Instrumentation

- No experimenter present
- Highly capable DAS
 - 5 cameras and various sensors
- Data collected continuously
- Detailed pre-crash/crash

How do we Measure Sleep?

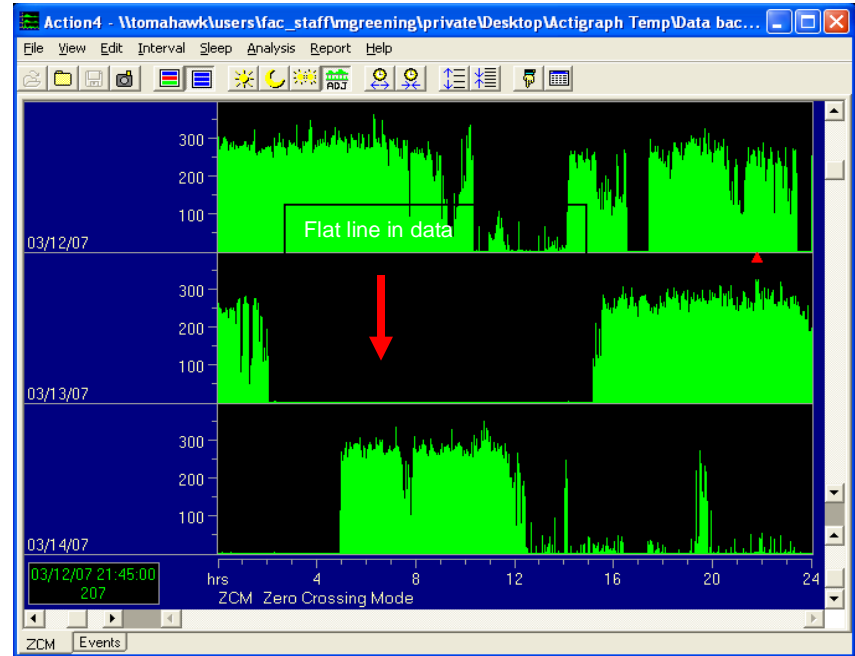


Operator Instructions

- Work/drive as you normally drive
- Wear watch for three months
- \$100/month

Actigraph Data Analysis

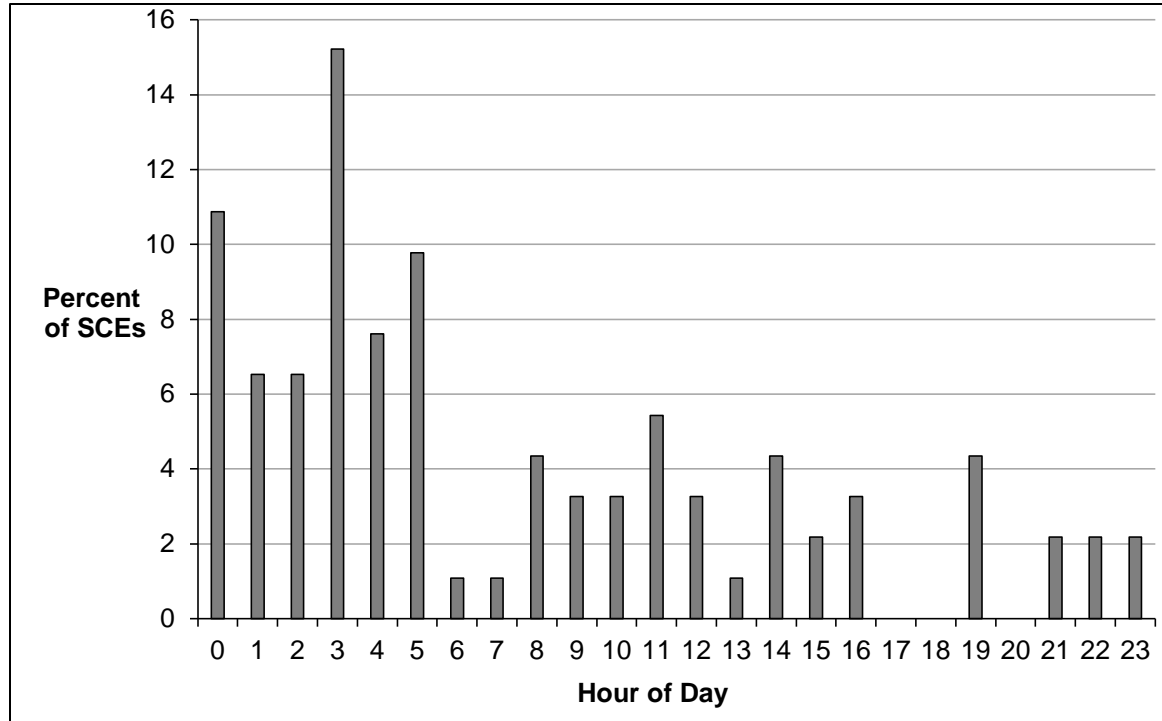
- Identify and mark any “bad data” episodes,
- Convert data into minute-by-minute files,
- Import all data into actigraphy database, and
- Implement algorithm to identify sleep periods



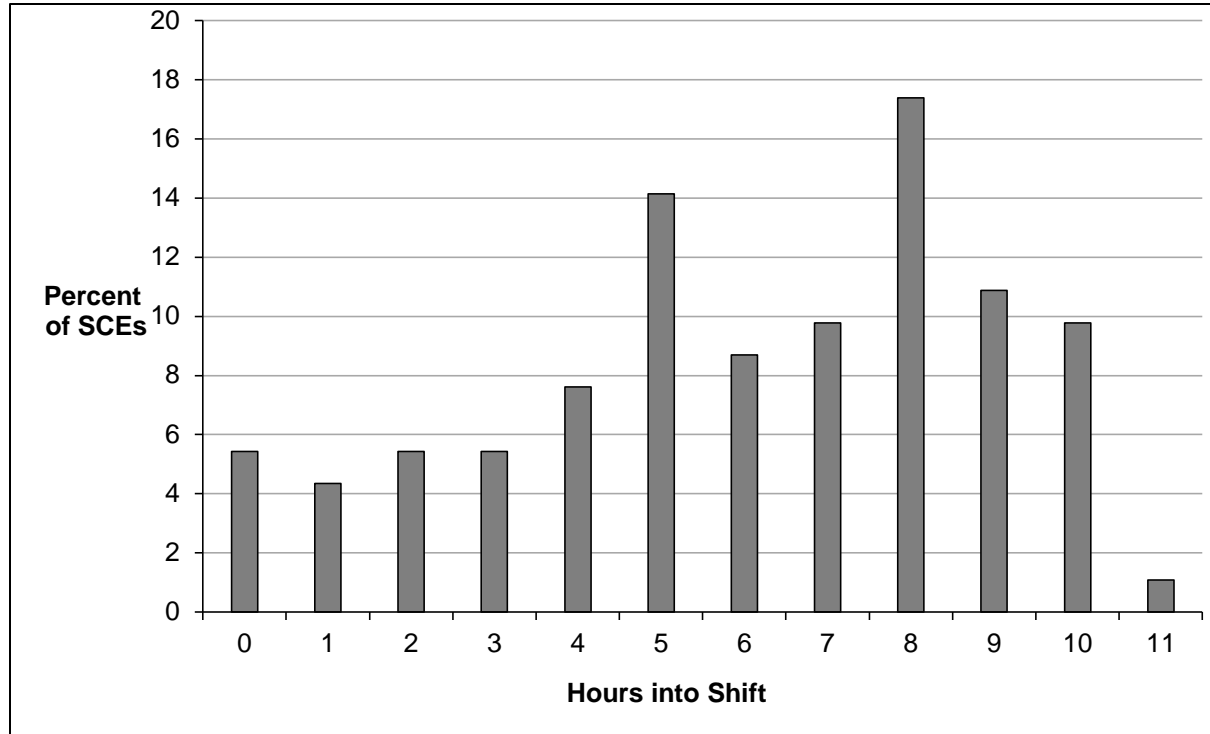
Naturalistic Driving Data Reduction

- Run triggers
- Validate triggers
- Classify event
- Apply data directory

Time of Day



Time on Task



Fatigue (ORD \geq 40)

Participant #	Total Number of SCEs	Total Number of SCEs with ORD \geq 40	Percent of SCEs Where Driver was Drowsy
1	52	33	63.5%
2	12	N/A	N/A
3	16	0	0%
4	12	0	0%
Total	92	33	35.9%

Actigraph Data

Participant #	Daily Sleep	Daily Sleep during Non-winter Emergency	Sleep 24 Hours Prior to a Winter Emergency	Sleep during Consecutive Winter Emergency Shifts	Sleep 24 Hours Prior to SCE
1	8.05	8.63	6.31	7.48	4.55
2	10.04	10.66	8.58	8.71	8.83
3	8.12	8.10	8.26	8.32	8.02
4	8.64	8.53	8.31	8.73	7.81
Average	8.71	8.98	7.87	8.31	7.30

Discussion

- Fatigue was evident in SCEs
 - Mostly during winter emergency
 - Between 12:00 a.m. and 6:00 a.m.
 - Contributing factor in 28.3%
- ...but only for 1 driver
- Less sleep during winter emergencies
- Less sleep prior to a SCE

Limitations

- Only 4 operators
- Driving data only during winter emergencies
- Specific to southwest VA
- Mostly rural area
- No daily logs

Future Research

- Naturalistic driving data showed some interesting trends
- Need more research
 - More instrumented trucks and operators
 - Log book to investigate naps
 - Drive during winter emergencies and regular hours
 - Technology/equipment that increases fatigue
- Design an FMP for winter maintenance operators