DaCoTA

Small Scale Naturalistic Driving Pilot Studies

Authors

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Aim

- To test and refine the practical and technical feasibility of methods of data gathering by naturalistic driving studies
- Activities:
  - Designing small scale pilot studies in Austria and Israel
  - Developing/modifying technological equipment required
  - Performing small scale studies
  - Analysing speed data and other indicators

The Austrian trial

- 10 devices/vehicles
- Duration March – July 2011

- Topics recommended for investigation:
  - Vehicle kms driven
  - Person kms driven
  - Number of trips
  - Time in traffic
  - Excessive speeds
  - Accelerations

Variables collected

- Driver variables:
  - Age, gender, purchasing date of license – through questionnaire
- Vehicle variables:
  - Make, model, age – through vehicle record
- Network variables:
  - Road type- urban rural, roadway geometry (curvature) – through GPS and map matching
- Additional variables:
  - Date and time of day, length of journey, time driven, speed, acceleration
- Exposure:
  - Aggregated per driver/device – vehicle kms, person kms, no. of trips, time in traffic

Technology

- Technology used-in- vehicle data acquisition system (DAS) recording:
  - GPS
  - Accelerometer
  - Cartographic data base for Map matching
  - Driver identification (through video recorder)

pDrive lite® front view

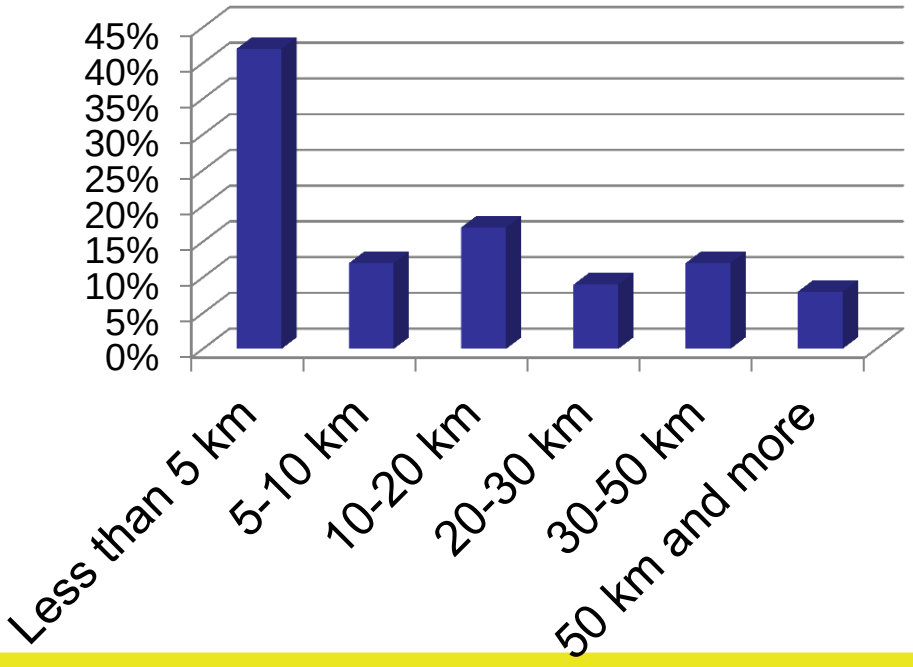
- Data collected : GPS position, Lateral acceleration, Longitudinal acceleration, Vertical acceleration, Speed, Date/Time
- Sampling rate :100 values per second, reduced to 10 values per second
- Video : Driver identification

Data collection

- A total of 4,551 trips were recorded of which 3,644 were participant trips
- Detailed information - per participant on: no. of trips, trip length, weekday distribution of trips, time of day, speeds, accelerations, road type distribution

Trip length	Number of Trips	Percent
Less than 5 km	1518	42%
5-10 km	435	12%
10-20 km	601	17%
20-30 km	341	9%
30-50 km	425	12%
50 km and more	297	8%
Total	3.617	100%

Trip distance



Speed distribution, accelerations (longitudinal and lateral):

		Female	Male	Total
Motorway	Mean	109,7	112,4	111,1
	SD	23,1	25,3	24,2
	Max.	166,3	180,9	180,9
Interurban	Mean	84,8	81,6	82,5
	SD	21,4	16,9	18,4
	Max.	148,6	161,5	161,5
Urban	Mean	51,2	62,4	58,3
	SD	20,4	22,3	22,3
	Max.	127,3	149,6	149,6

Detailed information on : speed distribution by road type, time of day, day of week, longitudinal and lateral accelerations, per driver and aggregated

Limitation:
As no detailed information on speed limits on each road segment is included in the map base, distribution of trips over the speed limit could not be obtained

The Israeli Trial

- 7 vehicles and drivers(not individually identified), over a six months period, resulting in 3,459 trips and 283,490 measurements
- **Equipment:**

Visual display of Mobileye

- A system that measures distances and headways to the vehicle in front and measures lane departures. This sytem was adapted to work in recording mode through the Tracktec

Tracktec recording device

- This system was originally designed for fleet management, and is used as a data logger, which records and transmits information. The system retrieves data from the car central computer using the Can-Bus and from MobilEye.
- **In addition**:
- A system that records fuel consumtion
- TransCAD - a GIS software to undertake map matching of the GPS records and to display and analyze the results

Data collection
types of event-based measurements

Cut-Off Warning	**The MobilEye Cut-Off Warning alerts the driver when a third vehicle enters between his vehicle and the vehicle in front**
Headway Warning	The MobilEye Headway Monitoring and Warning monitors the driving distance to the vehicle in front (headway) and alerts the driver when the headway is less than a pre-defined threshold
Night and Dusk Indicator	The MobilEye Night and Dusk Indicator operate when the MobilEye camera collects a light level less than a pre-defined threshold. It usually occurs towards sunset time
Lane Departure Warning	The MobilEye provides a Lane Departure Warning (LDW) to alert drivers when they are about to swerve unintentionally outside of the lane they are driving in. It does not record lane intended lane changes, where the driver uses his indicator.
Forward Collision Warning	The Forward Collision Warning alerts the driver to the danger of an impending collision with the vehicle in front. The MobilEye calculates the expected Time to Collision (TTC) with the vehicle in front and, when the TTC drops to a dangerous threshold, it immediately generates an FCW alert.

Results

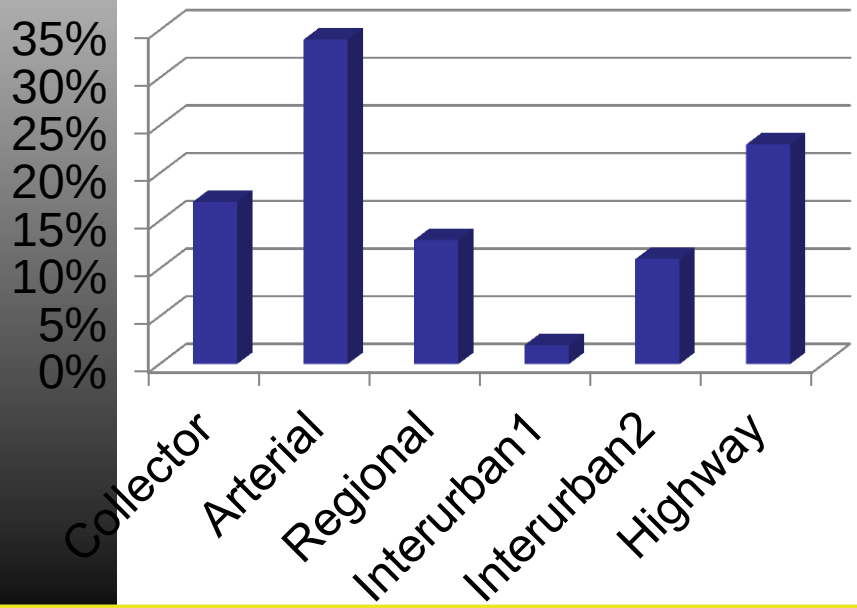
- Data on trip distribution by gender, time of day, day of week, trip length, and road type. All on an individual basis and aggregated.

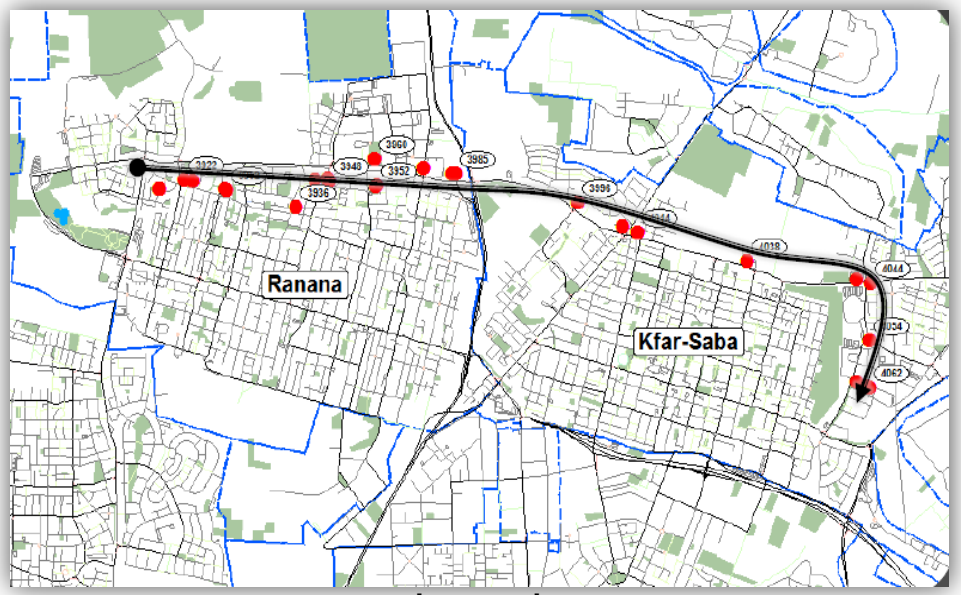
	Number of trips		Percent	
Trip length	Male	Female	Male	Female
Less than 5 km	1226	445	55%	36%
Between 5-10 km	233	284	11%	23%
Between 10-20 km	368	365	17%	29%
Between 20-30 km	180	47	8%	4%
Between 30-50 km	85	29	4%	2%
More than 50 km	118	79	5%	6%
Total	2.210	1.249	100%	100%

trips by distance and gender

Travel by road type

	Road type	Frequency of measurements by road type	
Urban	Collector	17%	51%
	Arterial	34%	
Interurban	Regional	13%	49%
	Interurban1	2%	
	Interurban2	11%	
	Highway	23%	





trip path

Headway distribution vs. Speed distribution

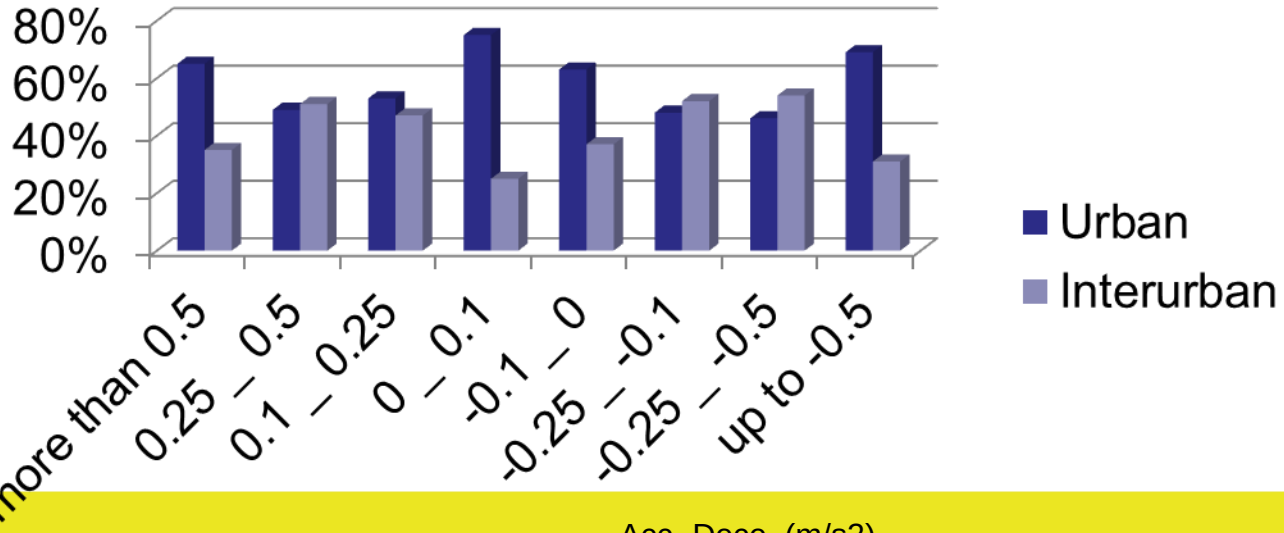
Speed distribution: by speed category and road type

Headway distribution : by headway (sec) and speed

Headway value (sec)	Speed			
	0-50	50-90	>90	Total
0.1-0.5	85%	10%	5%	100%
0.5-1	58%	22%	20%	100%
1-1.5	69%	20%	11%	100%
1.5-2	67%	21%	12%	100%
2-2.5	60%	25%	15%	100%
2.5 and up	61%	23%	16%	100%
Mean	64%	22%	14%	100%

Accelerations

Acc.-Dece. (m/s^2)	Urban	Interurban	Total
more than 0.5	65%	35%	100%
0.25 _ 0.5	49%	51%	100%
0.1 _ 0.25	53%	47%	100%
0 _ 0.1	75%	25%	100%
-0.1 _ 0	63%	37%	100%
-0.25 _ -0.1	48%	52%	100%
-0.25 _ -0.5	46%	54%	100%
up to -0.5	69%	31%	100%
Mean	51%	49%	100%



Cut-off warnings and headway warnings

Speed category	Count	Percent	Frequency of measurements by speed
up to 50	7213	44%	63%
50-90	5554	34%	22%
more than 90	3724	23%	15%
Total	16,491	100%	100%

headway warning distribution by speed

Lane departure warning

Road type	Count	Percent	Frequency of measurements by road type
Collector	3381	24%	17%
Arterial	5318	37%	34%
Regional	1760	12%	13%
Interurban1	394	3%	2%
Interurban2	1502	10%	11%
Highway	1959	14%	23%
Total	14.324	100%	100%

lane departure warning distribution by road type

Lane departure warning

Speed category	Count	Percent	Frequency of measurements by speed
up to 50	9672	68%	63%
50-90	3219	22%	22%
more than 90	1433	10%	15%
Total	14.324	100%	100%

lane departure warning distribution by speed

Lessons learned

- **Technology**: Current technology enabled the collection of the data required by the task. Technology is capable of much more (video). Equipment has to be adapted and professionally installed
- **Data handling** : Even a small scale pilot collects huge amounts of data (65 million data sets in the Austrian trial), issues s.a. data storage, data cleaning should be carefully considered
- **Results** : It is possible and feasible to collect very detailed information on driver behavior, exposure and trip characteristics (on an individual and aggregated basis) which are not possible to collect in other ways

Lessons learned (cont'd)

- The equipment is available, relatively cheap but needs to be adapted and expertly installed
- Much attention should be given to data handling, quality assurance, sampling rate and data reduction and data storage. Data compatibility is a major issue.
- A discussion should be held on what data should be included in a European-wide data base and what is feasible, for monitoring purposes