TeleFOT Field Operational Tests of Aftermarket and Nomadic Devices in Vehicles

Overview of TeleFOT work and results

TeleFOT Highlights

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Information Society and Media

SEVENTH FRAMEWORK PROGRAMME

Functions and Systems tested

- Traffic and travel Information systems
- Speed Alert/Limit information
- Personalised Navigation Devices (PNDs).
- Forward Collision Warning/Lane-Keeping Systems
- eCall
- Green Driving Advisory systems

Mostly available on an after-market product such as a smart-phone or other device

TeleFOT FOTs

- Field Operational Test (FOT) Methodology – "*Studies undertaken to evaluate a function or functions under normal operating conditions in environments typically encountered by the host vehicle(s) using quasi-experimental methods*"

- Test sites in Finland, Sweden, UK, France, Germany, Spain, Italy and Greece.
- June 2008 to November 2012

TeleFOT impact areas:

- Safety

- Mobility

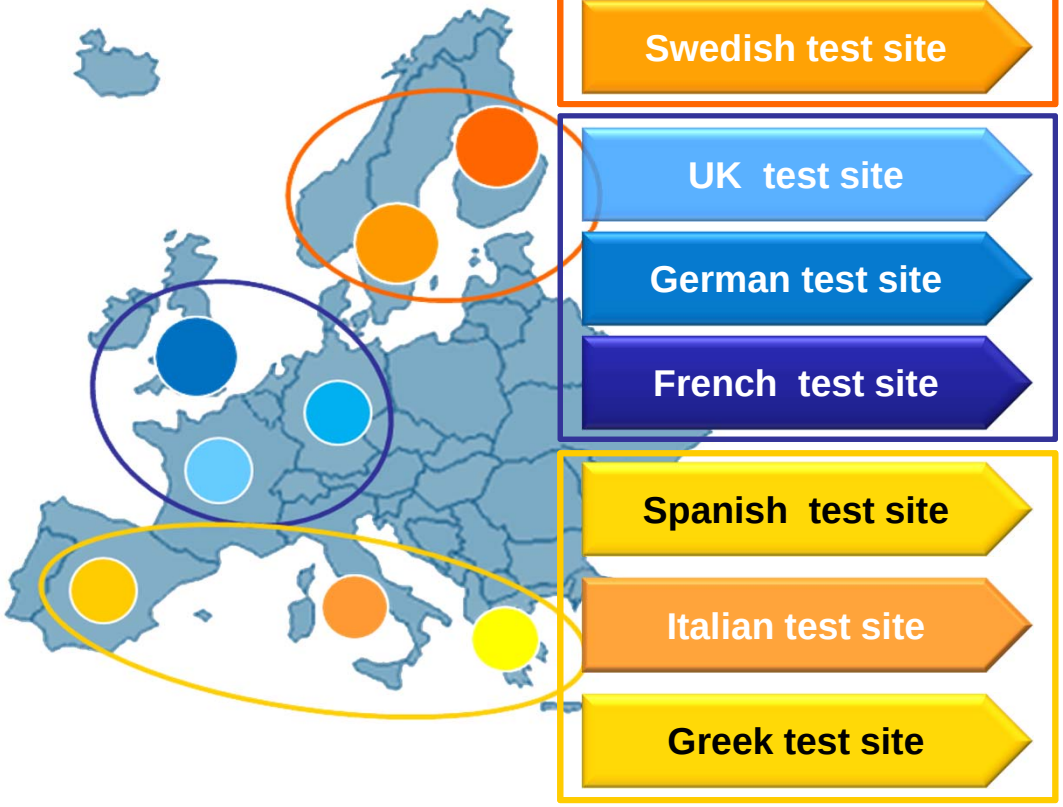
- Efficiency

- Environment
- User up-take (Acceptance and Adoption)

TeleFOT Summary

- Approximately 2,800 subjects tested in *Large-Scale* Field Operational Tests (n= 2,600) and *Detailed* Field Operational Tests (n=200)
- All participants used a range of nomadic devices providing driver assistance functions
- Over 10 million kilometres driven
- Several thousand hours of driving time

Assesses the impacts of aftermarket and nomadic devices in vehicles for driver support and raises wide awareness of their functions and potential

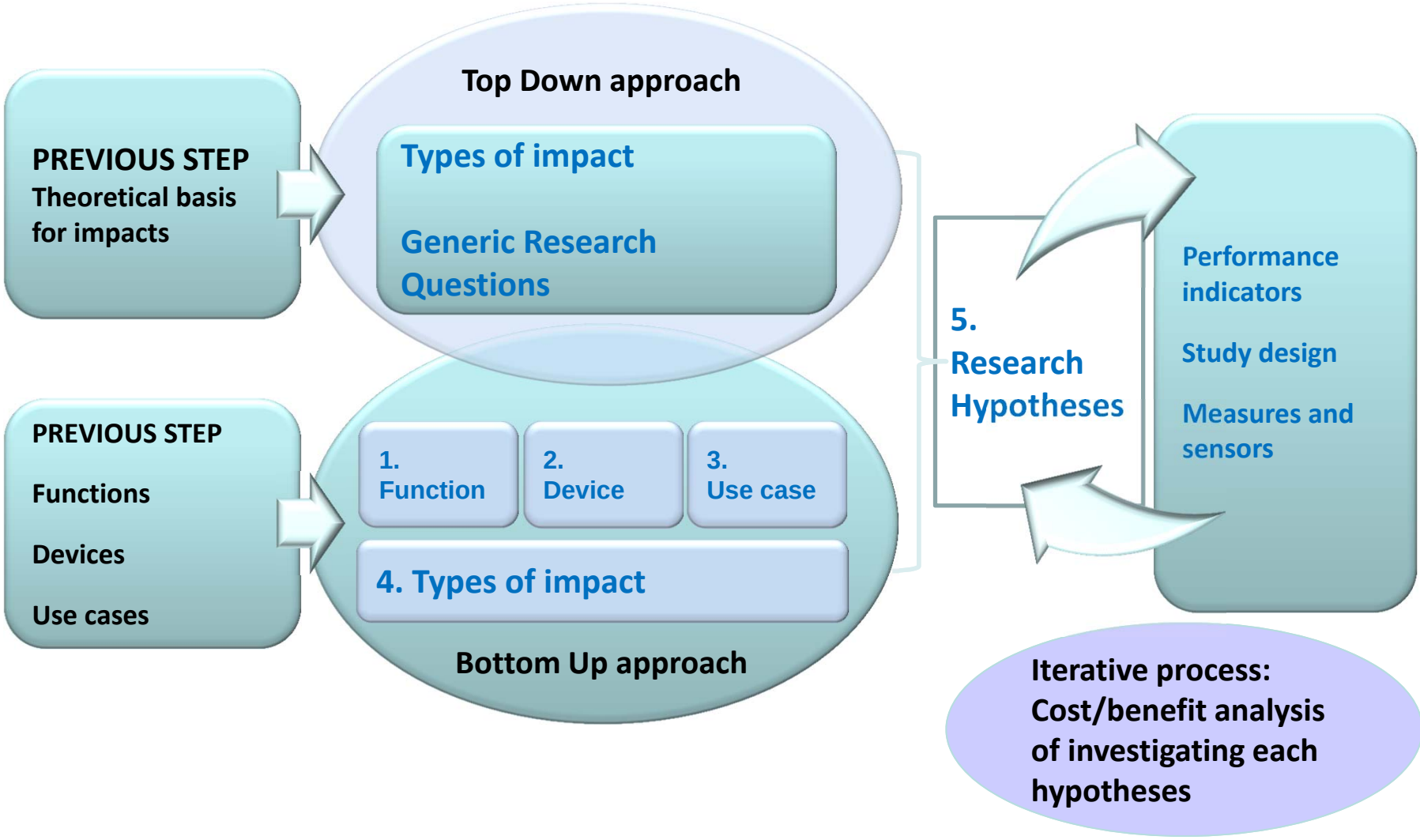


6400 questionnaires

1760 travel diaries

Hypotheses generation – process

Research Questions



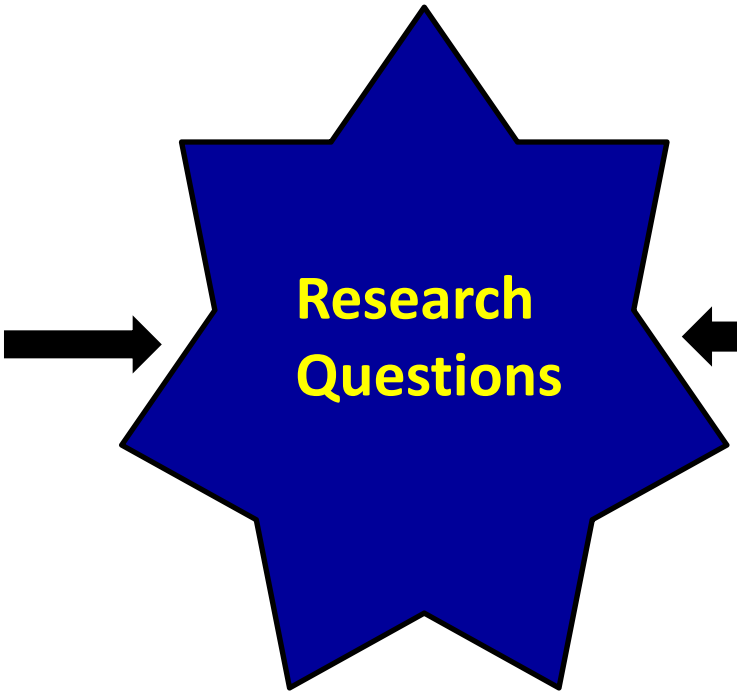
TeleFOT Development of Research Questions

Top Down

Bottom Up

Theoretical Basis for Impacts:

- Safety
- Mobility
- Efficiency
- Environment
- User Uptake



Specification of Functions:

- Navigation
- Traffic and Travel Information
- Speed alert
- Etc.

SAFETY

- To study positive and negative effects on visual behaviour and impact on driver distraction during ND usage.
- To study the positive and negative changes to other aspects of driver behaviour (e.g. speed, lateral/longitudinal control)
- 7 research questions, 15 hypotheses

MOBILITY

- To study effects of TeleFOT systems on trip decision, choice of mode, choice of route, etc.
- To calculate implications in terms of mobility including different dimensions of mobility (accessibility, travel demand, travel pattern, etc.
- 12 research questions, 12 hypotheses

EFFICIENCY

- Evaluation of impact of TeleFOT systems in terms of efficiency by analysing their effect on traffic-related indicators and parameters (including flow, travel time etc.)
- 6 research questions, 10 hypotheses

ENVIRONMENT

- To evaluate the impact of the TeleFOT systems on the environment by analysing their effect on fuel consumptions and emissions.
- 11 research questions, 13 hypotheses

USER UPTAKE

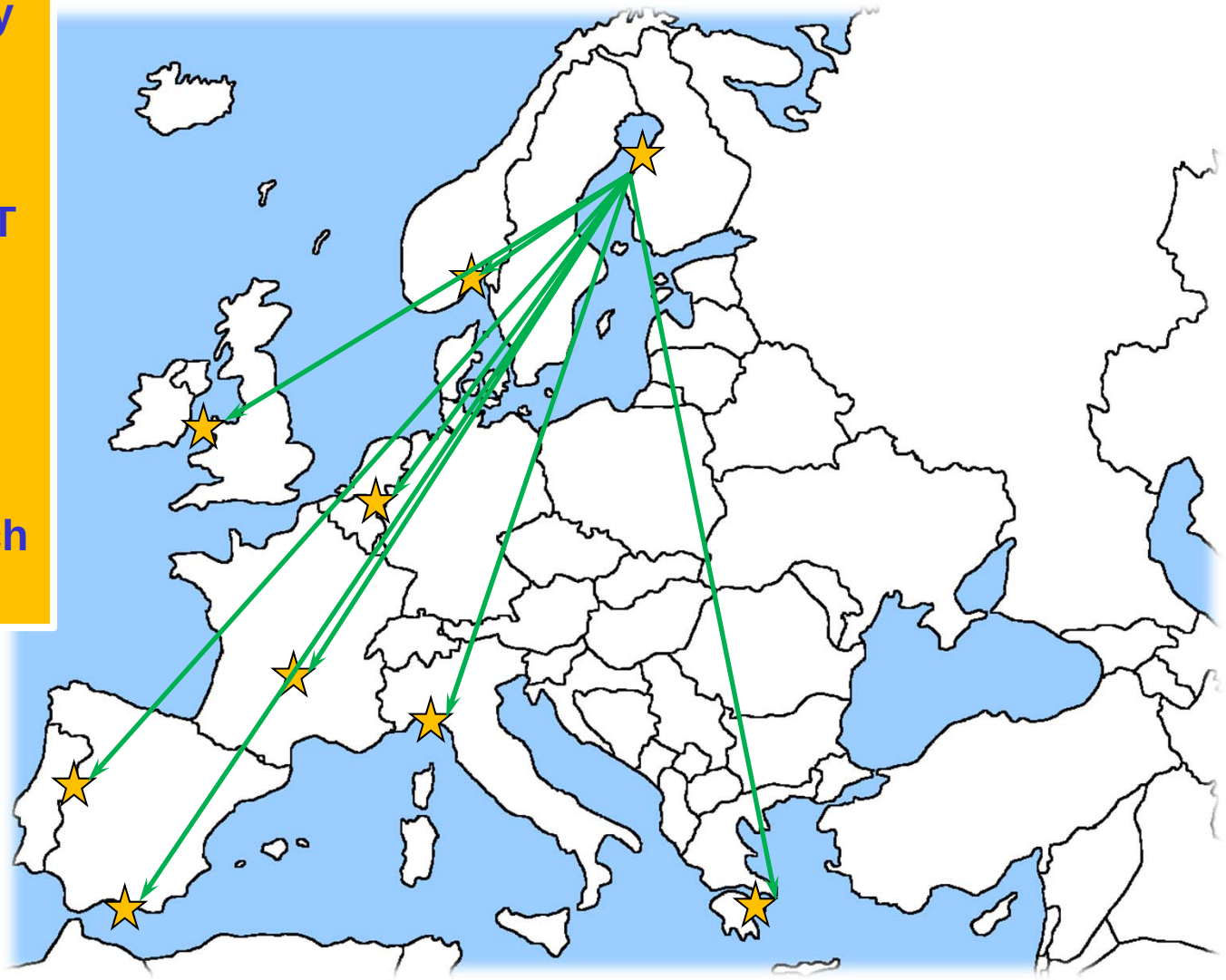
- To establish up-take process of functions tested in relation to usability, acceptance and adoption.
- To develop operational business models in respect of likely uptake in respect of functions tested
- 12 research questions, 22 hypotheses

Piloting of the Data Analysis

- Pilot analyses were undertaken in 3rd year of the project
- The piloting was intended to test the data-flow within the project and to ensure that the data could be used to satisfactorily address the Research Questions and Hypotheses
- The piloting worked well and help to iron out minor flaws in the data analysis

Data Sharing

- LFOT Data managed centrally in Finland
- All partners had access to all LFOT data and some DFOT data
- Partners took responsibility for individual research questions



Impact Assessment Domain	Number of Research Questions	Number of Hypotheses
Safety	7	15
Mobility	12	12
Efficiency	10	10
Environment	13	13
User Uptake	10	22
Totals	**52**	**72**

Field opErational teSt supporT Action (FESTA)

TeleFOT

Problems
Policy objectives
Impacts wanted

Problems solved?
Policy objectives met?
Impacts IRL?

Implementation Plan

Function identification & description

Use Cases

Research Questions &Hypotheses

Performance indicators

Study design

Measures & Sensors

The FOT Chain

Ethical and legal issues

Socio – Economic impact assessment

System & Function Analysis

Research Questions and Hypotheses analysis

Data Analysis

Database

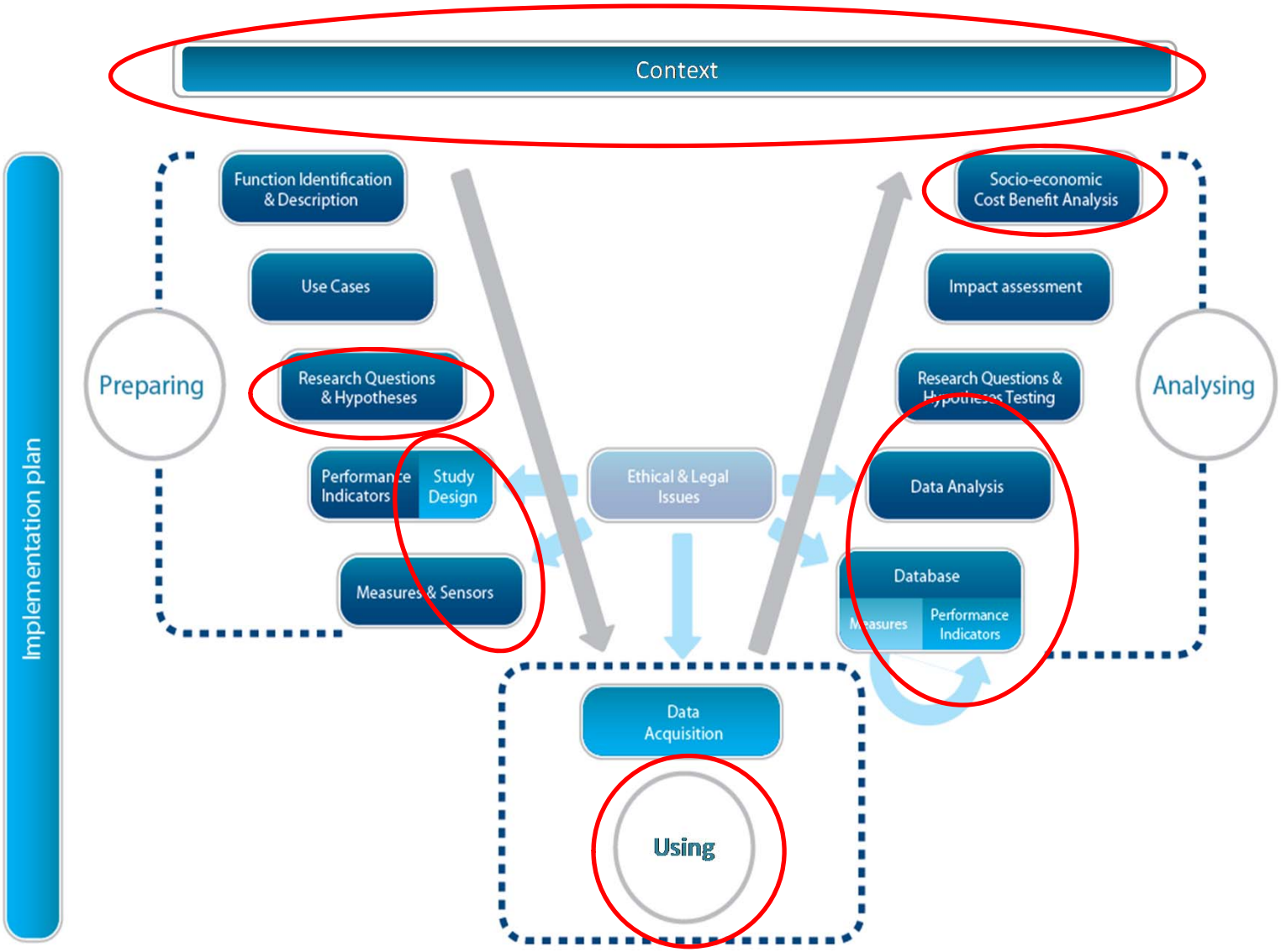
Measures

Performance indicators

Data acquisition

Data decoding

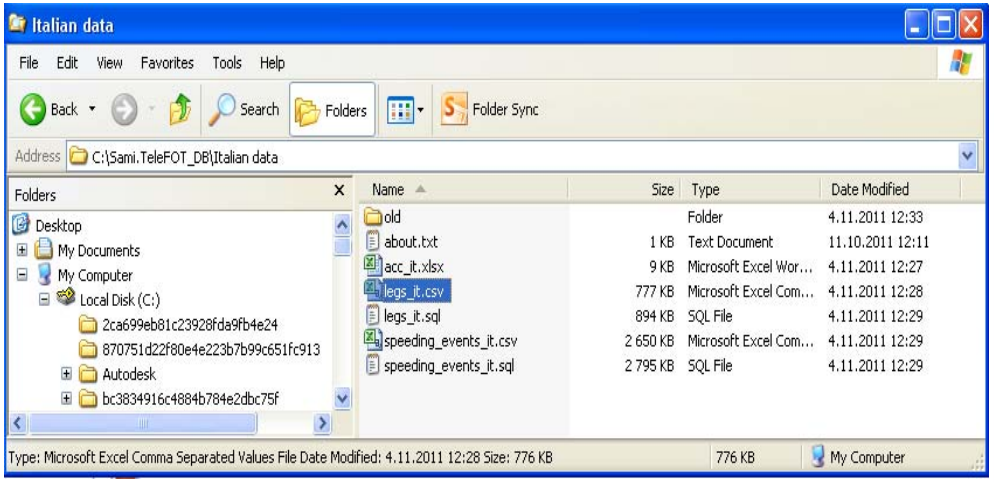
TeleFOT contributions to FOTology



Production of “Legs tables”

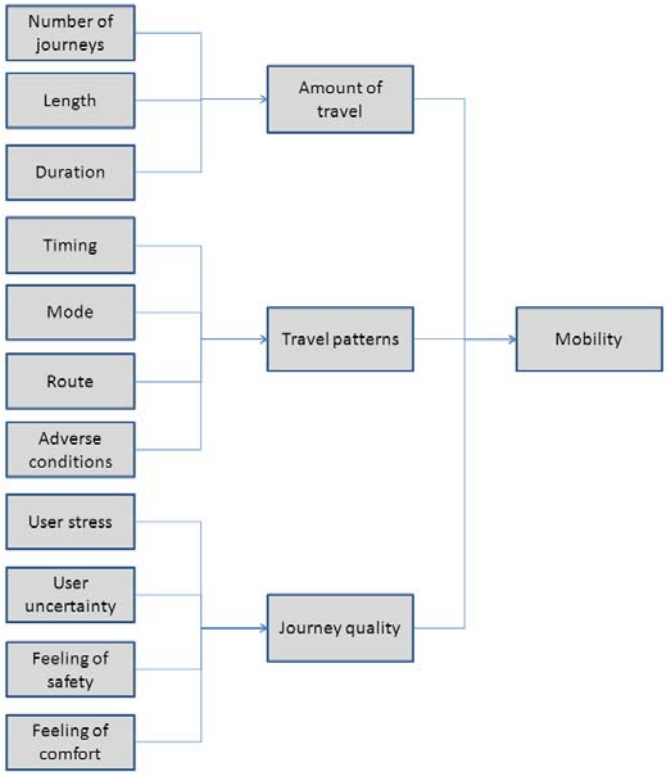
SQL example on acceleration histogram

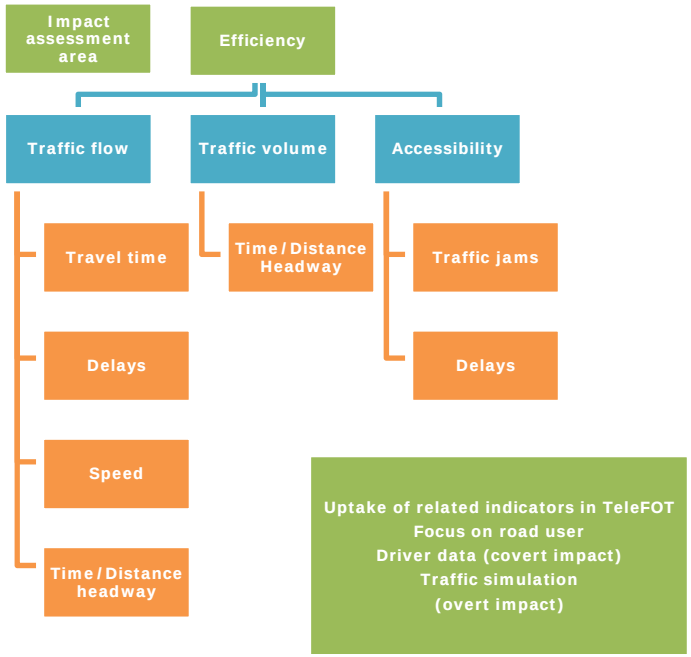
```
select sum(number_gps_deceleration_11_or_more),
sum(number_gps_deceleration_10_or_more),
sum(number_gps_deceleration_9_or_more),
sum(number_gps_deceleration_8_or_more),
sum(number_gps_deceleration_7_or_more),
sum(number_gps_deceleration_6_or_more),
sum(number_gps_deceleration_5_or_more),
sum(number_gps_deceleration_4_or_more),
sum(number_gps_deceleration_3_or_more),
sum(number_gps_deceleration_2_or_more),
sum(number_gps_acceleration_2_or_more),
sum(number_gps_acceleration_3_or_more),
sum(number_gps_acceleration_4_or_more),
sum(number_gps_acceleration_5_or_more)
from legs
```



Extremely useful tool for analysts as it effectively removed the need for analysis of all data logged at 1hz

- Creation of structured theoretical models behind the RQs in Mobility and Efficiency
- This made the implications of the analysis much easier





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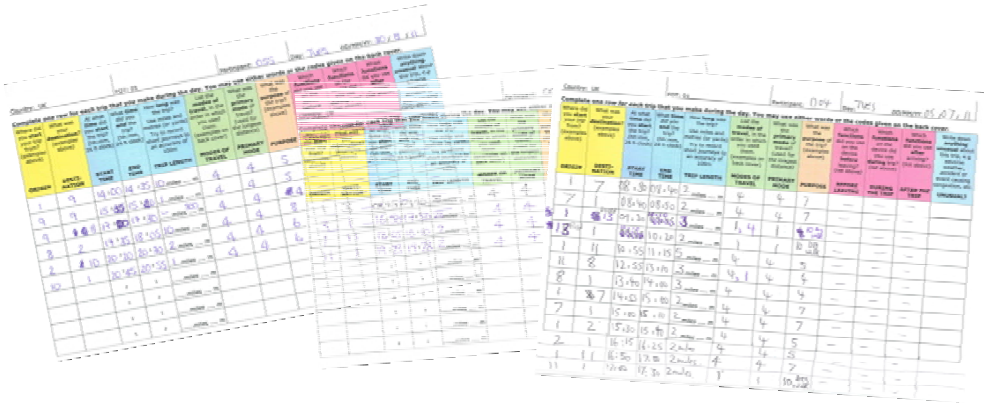
Subjective Data Collection

- Travel diaries (3-4 times one week) were well-used by the participants and led to the collection of valuable information on (e.g.) transport modes and journey purposes - which could not be determined from the logged data
- As changes in personal work life, family mobility needs, economic situation etc. affect mobility (more than availability of any of the functions), a supplement was created to travel diary to collect such information

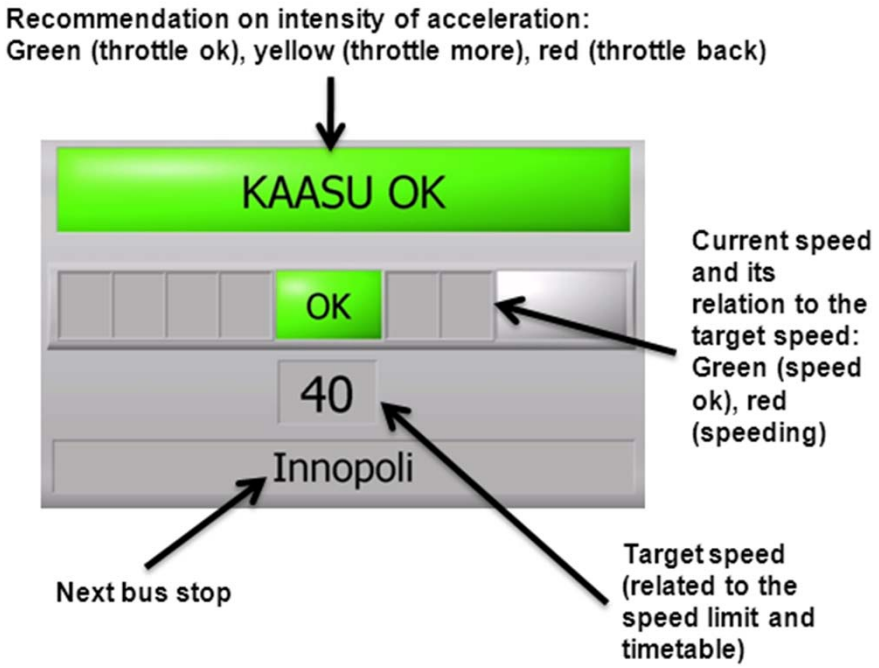


Detailed FOT Data Innovations

- Not all Detailed FOT data not stored centrally
- Test-site managers had complete control over DFOT data collection, storage, management and analysis
- Data-sharing was possible where relevant
- Therefore innovations on DFOT data analysis were handled at a local level.

Results from Finland – TeleBUS D-FOT

- TeleBUS - Green Driving FOT using bus fleet in Helsinki Metropolitan Area, Finland
- 15 buses with green driving application and data-logger
- One bus route, (i.e. frequently operated Jokeri route - 65 minutes total duration)
- 119 Drivers in total
- ~2 years of data
- Long-term effects



TeleBUS FOT – Key Results

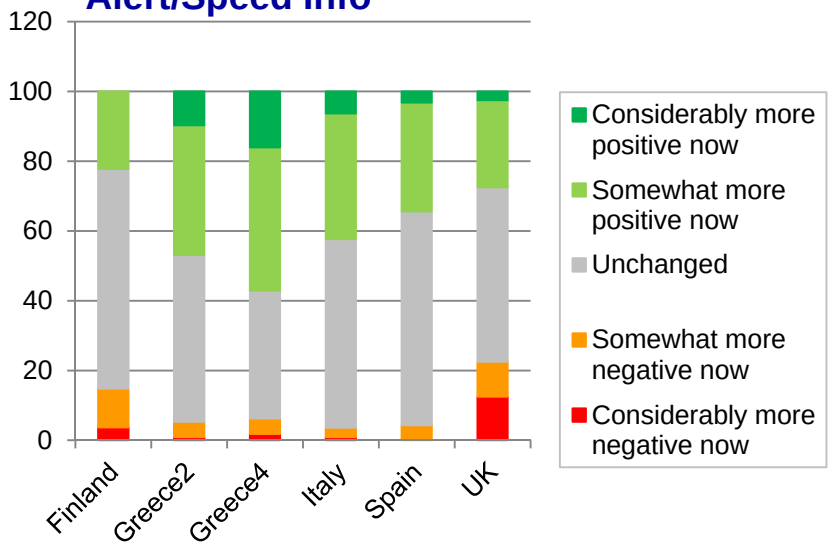
- GD application reduced speeding significantly among bus drivers
  - Application most beneficial in reducing speeding in **areas with low speed limits** and at **night time**
  - Drivers who used GD were speeding for 3.5% of journey when they then drove **with** the green driving application and for 12.2% of journey when they drove **without** the application; overall average fuel savings of 6%!

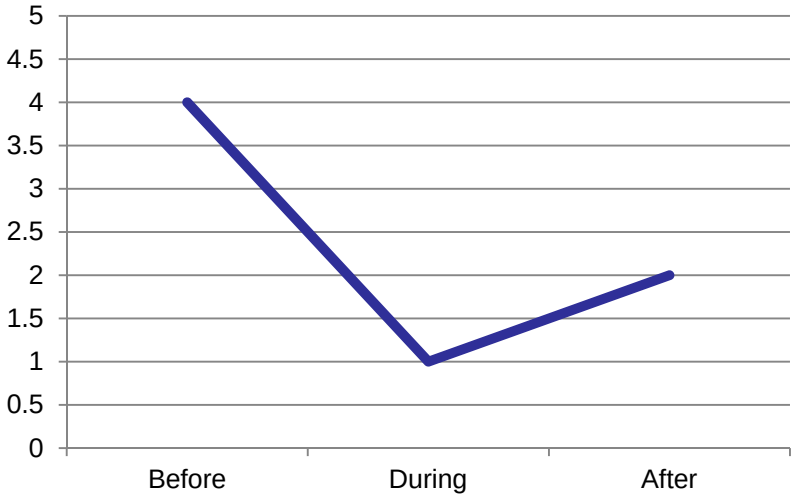
(source, Niina Sihvola, Satu Innamaa*, Merja Penttinen,VTT Technical Research Centre of Finland, ITS WC, 2011)

User Uptake Analysis

- Use
  - Large number of participants used the functions for less than 25% of trips made
  - Overall, functions were used more in relation to longer journeys than shorter trips
  - Green Driving and Speed Info/Alert were used more often than Navigation Support and Traffic Information
- Assessment
  - In general, participants were positive about the functions.
  - However, initial high expectations changed during first experience.
  - Once familiarised with the device/functions, assessments improved.

Example: Speed Alert/Speed Info





Measuring Visual Distraction

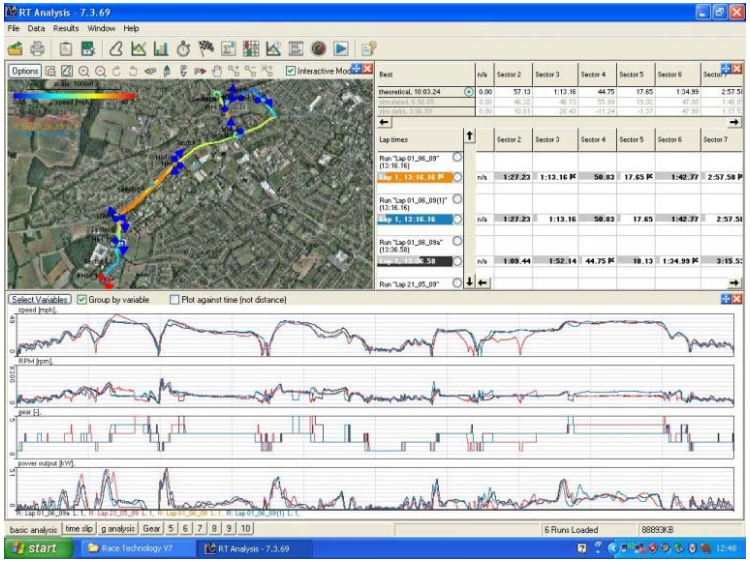
- Difficult overall but best approach is to assess glance behaviour (Victor et al., 2005)
  - Glance duration
  - Glance frequency
  - Where glance defined as "*the transition to a given area, such as a display and one or more consecutive fixations on the display until the eyes are moved to a new location*"

- NHTSA propose design guidelines for limiting glance behaviour:
  - "Glances totalling more than 2 seconds for any purpose increase near-crash/crash risk by at least two times that of normal, baseline driving''

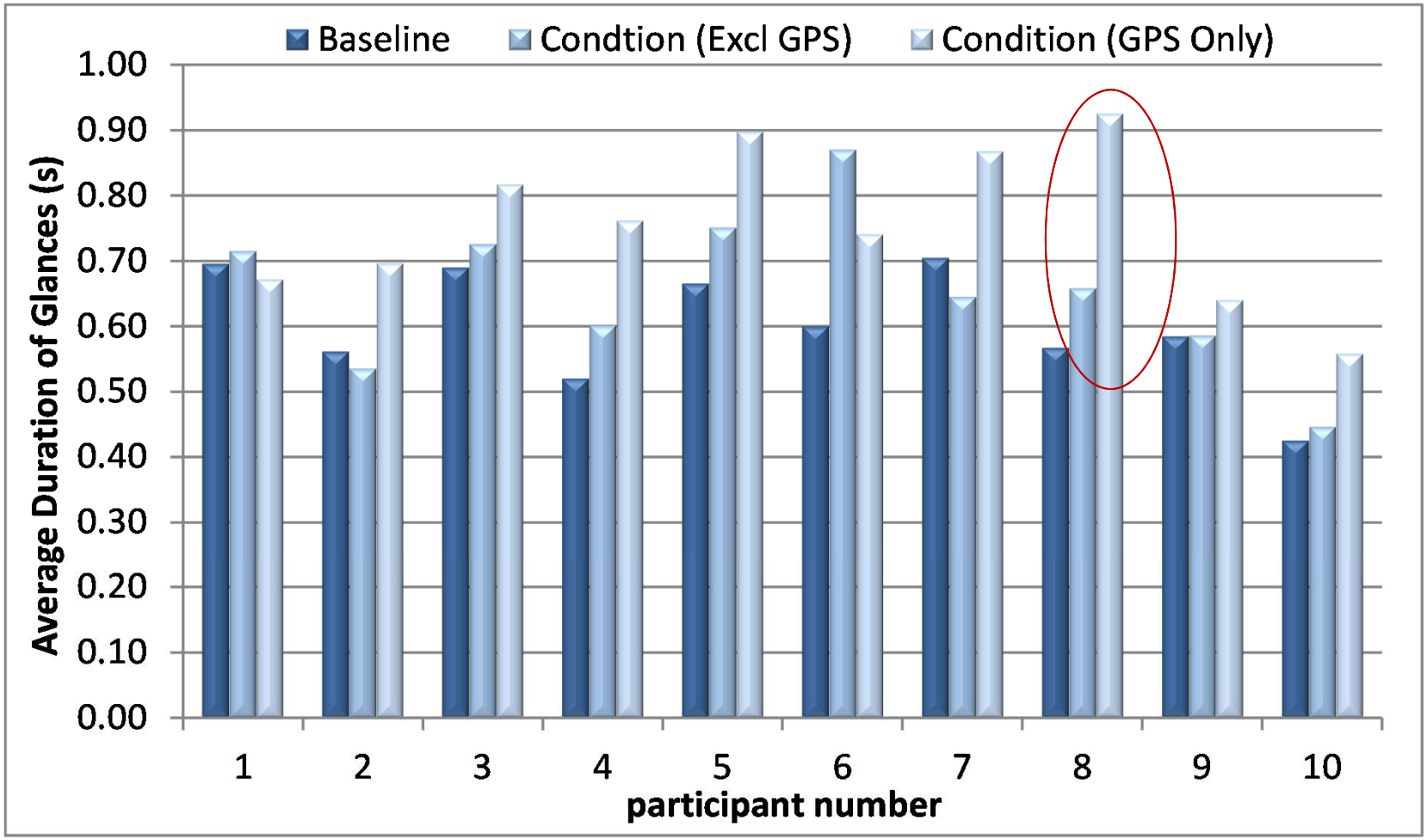
NHTSA, 2006. The Impact of Driver Inattention on Crash Risk: An Analysis using the 100-car Naturalistic Driving Study, National Highway Safety Administration, Report No. DOT HS 810 594

Use of in-depth video data collection procedures to support large-scale data collection

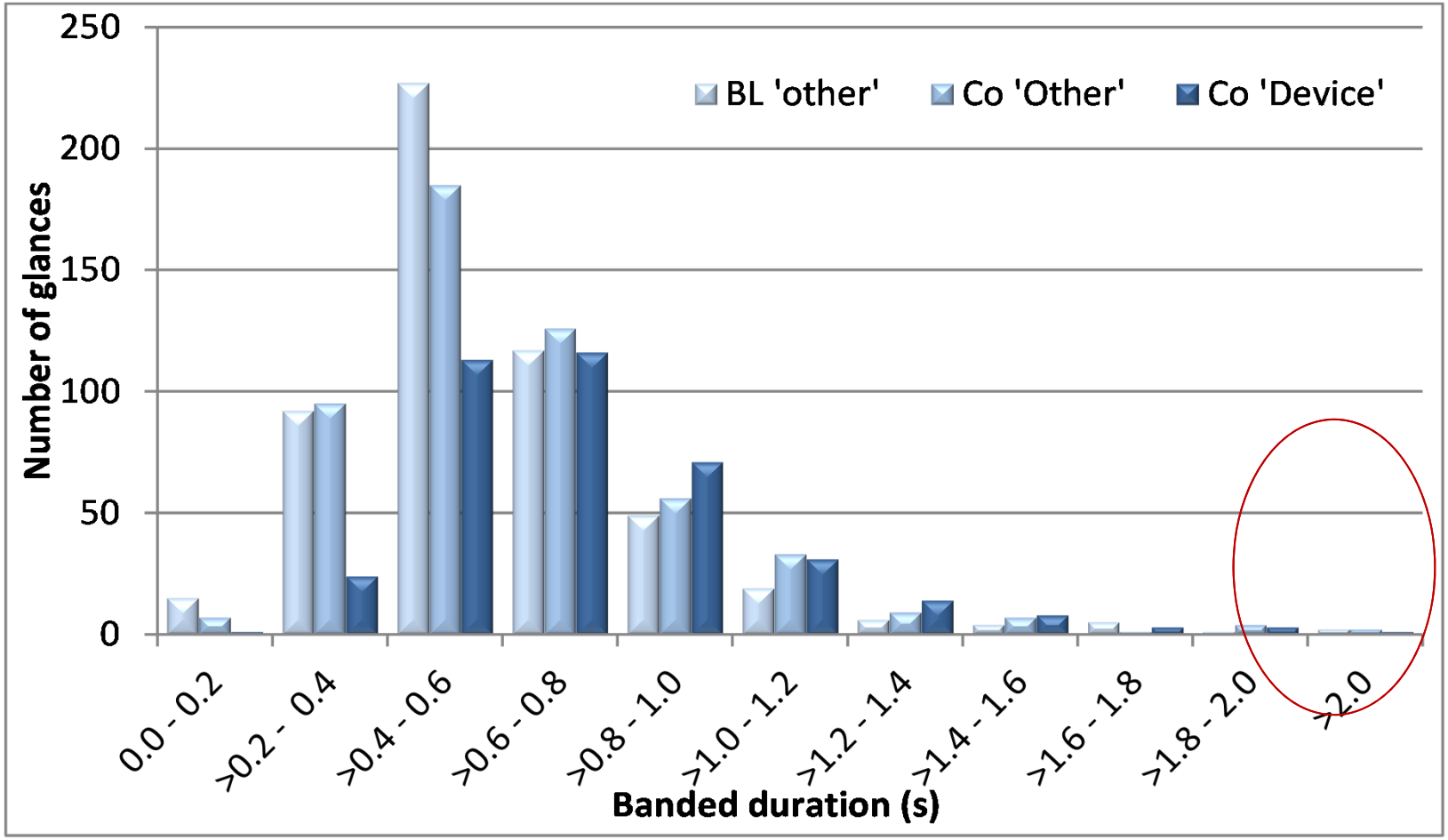
- In-depth data-logging and acquisition capability
- Multi-channel video footage
- Eye-tracking for visual and other aspects of driver behaviour



Average duration of glances across all junctions by glance location and trial type - Personal Navigation



Number of glances to test device and ‘other’ locations by glance duration – All trials, personal navigation device



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