Modelling risky driving behaviours of professional drivers under the operation of Advanced Driver Assistance Systems

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ATTIKES DIADROMES S.A.

Motivation and overview

- Professional drivers: considerable part of the driving population exhibiting distinct characteristics

- Work is driving:
  - Performance
  - Exposure, Experience and Ability
  - Stress and Fatigue
  - Owners/operators of the vehicle the fleet companies

- ITS a valuable tool. BUT…..

Background

- Aberrant driving, risky driving, violations ⟹ accident risk

- Professional drivers aberrant driving behavior via DBQ
    - Sociodemographic: age, gender, educational status, marital status, experience
    - Personality: sensation seeking, aggression, psychological symptoms
    - Work/Trip: daily driving hours, sleep time

- Driver monitoring ⟹ NATURALIST DRIVING STUDIES
    - Effectiveness of ADAS
    - Effectiveness of coaching

Objective

- Explore:
  - A. Contributory factors of aberrant driving behavior
  - B. Impact of ADAS (and contributory factors)
  - C. Impact of driver consultations (and contributory factors)

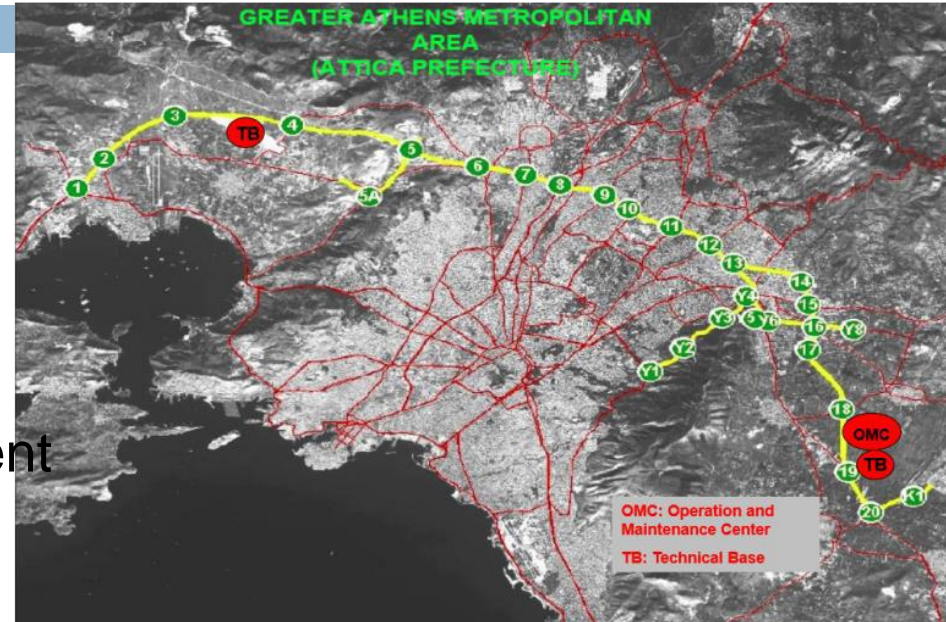- Design: Measures to improve driving behaviour
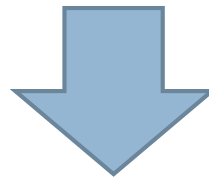
COLLECT DATA

Survey area

□ Attiki odos:

- □ 70 km closed tolled motorway

- □ 150 km roads (main motorway & ramps)

- □ 170 employees traffic management and maintenance

- □ TMC operating at a 24hour basis also coordinating patrol vehicles

GREATER ATHENS METROPOLITAN AREA (ATTICA PREFECTURE)

OMC: Operation and Maintenance Center

TB: Technical Base

Survey area

- □ Patrol drivers/vehicles:
  - □ Incident and maintenance issues detection
  - □ Response to incidents: securing the vehicle occupants, securing area, providing technical assistance and first-aid
  - □ Response to maintenance issues: inform TMC
  - □ 8 hour shifts (morning, afternoon, night, in-between)
  - □ 300km driven per shift
  - □ Vehicle equipped with monitoring device and ADAS (GPS, GIS, video detection and other sensors utilized)

Data collection

□ Initial data:

    □ 3months data of all system triggers (mid Oct21-mid Jan22)

    □ Trigger ID, driver ID, date, time, coordinates

# Driver performance

Aberrant driver behaviour triggers

| Violation type	Total	Violation type	Total	Violation type	Total
LDW/RDW	69636	Idling Long Idling Start	5485	Harsh Acceleration Y. Sev.	210
+5 Km/H	65732	Turn & Brake Y. Sev.	4532	Turn & Brake R. Sev.	106
+10 Km/H	56514	Harsh Acceleration G. Sev.	4004	NULL	84
+15 Km/H	40699	Turn & Accelerate G. Sev.	3428	Harsh Turn Y. Sev.	82
+20 Km/H	29291	Idling Short Idling Start	2766	Turn & Accelerate R. Sev.	81
Turn & Brake G. Sev.	24944	Speeding Speeding G. Sev.	2671	Harsh Acceleration R. Sev.	26
+25 Km/H	21600	DFD Comm. Established	2507	Speeding Yellow	12
+30 Km/H	15560	Speeding Green (EOM)	2299	Maneuver mem overflow	9
IP UP	12993	HMW	1685	Harsh Braking R. Sev.	7
Off Road Start	11838	DFD Comm. Lost	1254	Lane Crossing G. Sev.	6
Harsh Braking G. Sev.	11749	Harsh Braking Y. Sev.	690	Harsh Turn Red Sev.	1
Off Road End	10891	Turn & Accelerate Y. Sev.	424	Lane Crossing R. Sev.	1
Harsh Turn G. Sev.	9810	FCW/PCW	279	Crash Occured Maneuver	1
+35 Km/H	9495	UFCW	260	light	

Driver performance

- Prioritization considering attribute importance and observed frequency
- Some recorded "errors", are not actually errors

- What triggers these behaviours?
  - Driver
  - Environment
  - Work
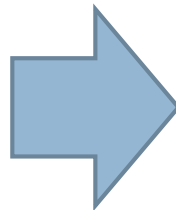
ADDITIONAL DATA REQUIRED !!!

WHO?

WHO?
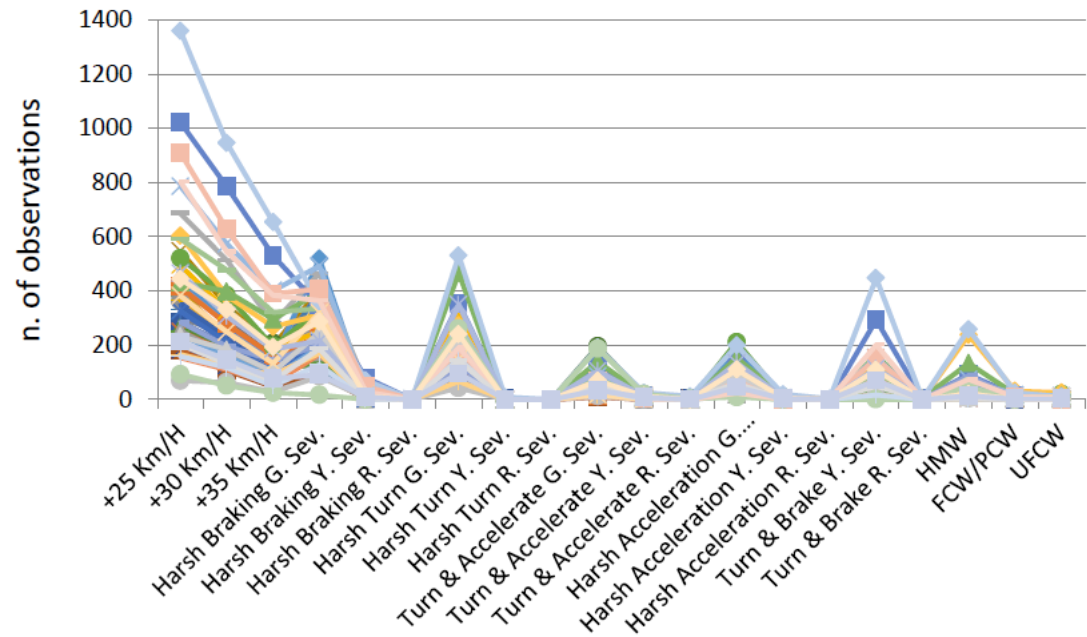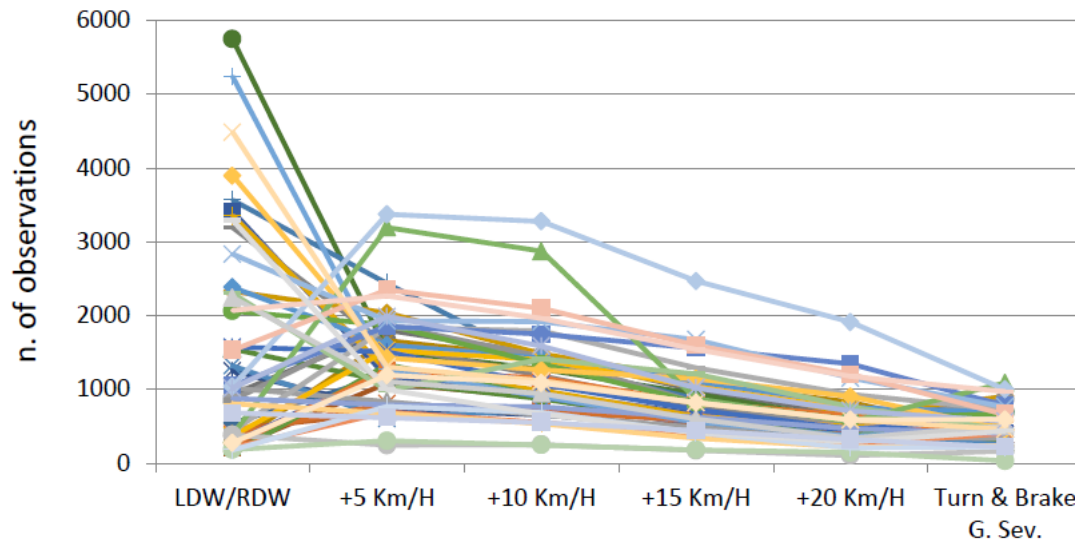
☐ Drivers:

  ☐ Sociodemographic characteristics and experience

 ☐ Personality characteristics and relevant attitudes

☐ Questionnaire design:

  ☐ Sociodemographic characteristics + work experience

  ☐ Personality (25q): anxiety, anger, sensation-seeking, altruism and normalness (Ulleberg and Rundom, 2003; Chen, 2009)

  ☐ Attitudes (17q): traffic rules, rule obedience and speeding (Ulleberg and Rundom, 2003; Chen, 2009)
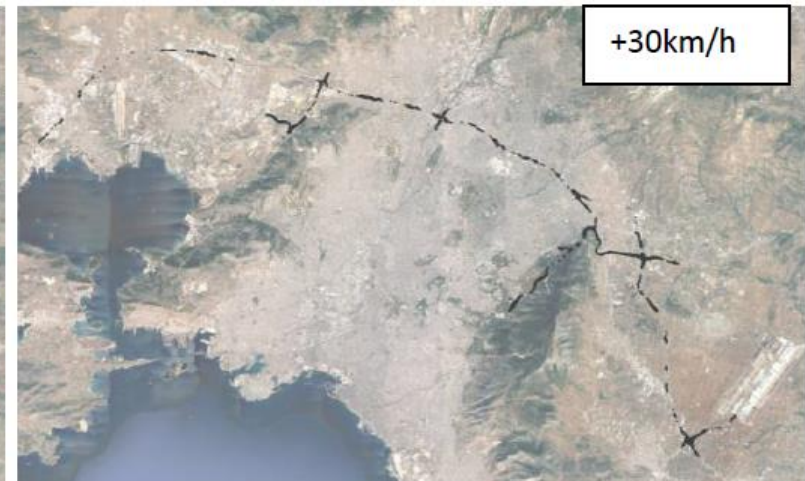
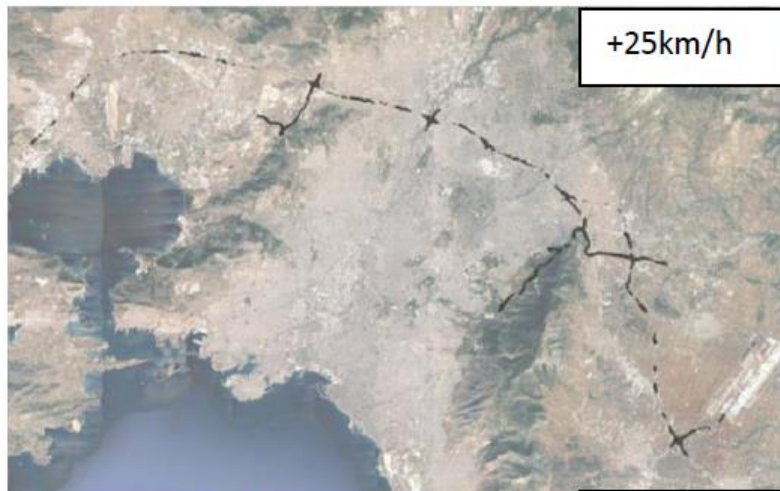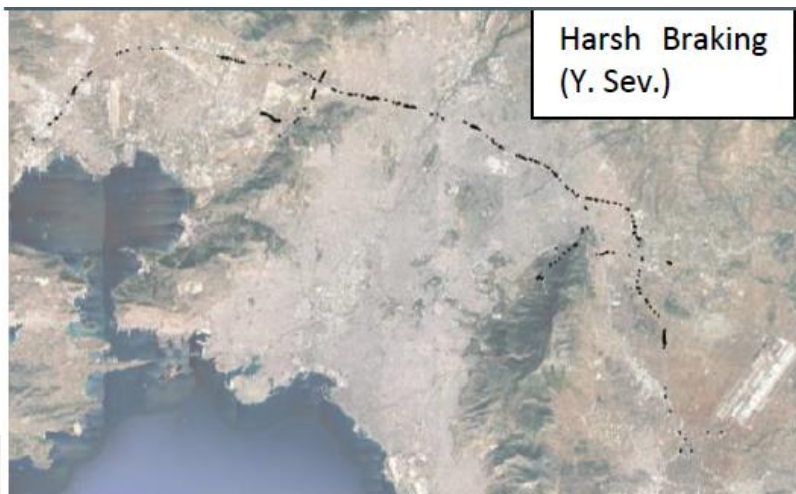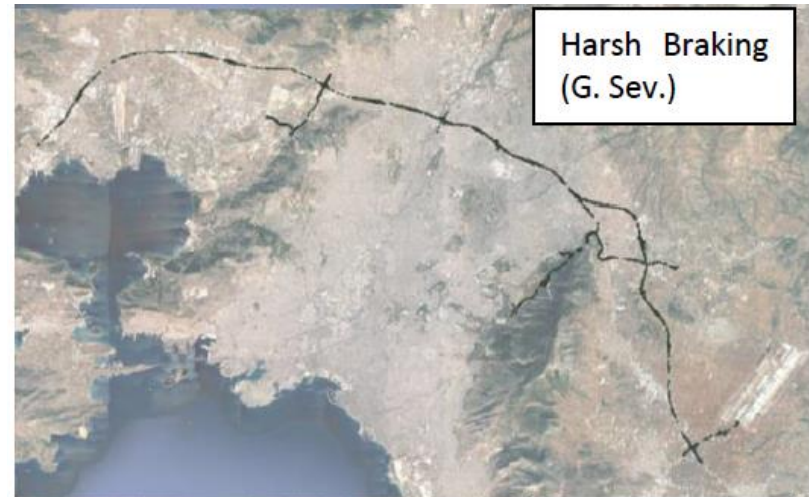☐ Distributed to all drivers. BUT….

WHERE?
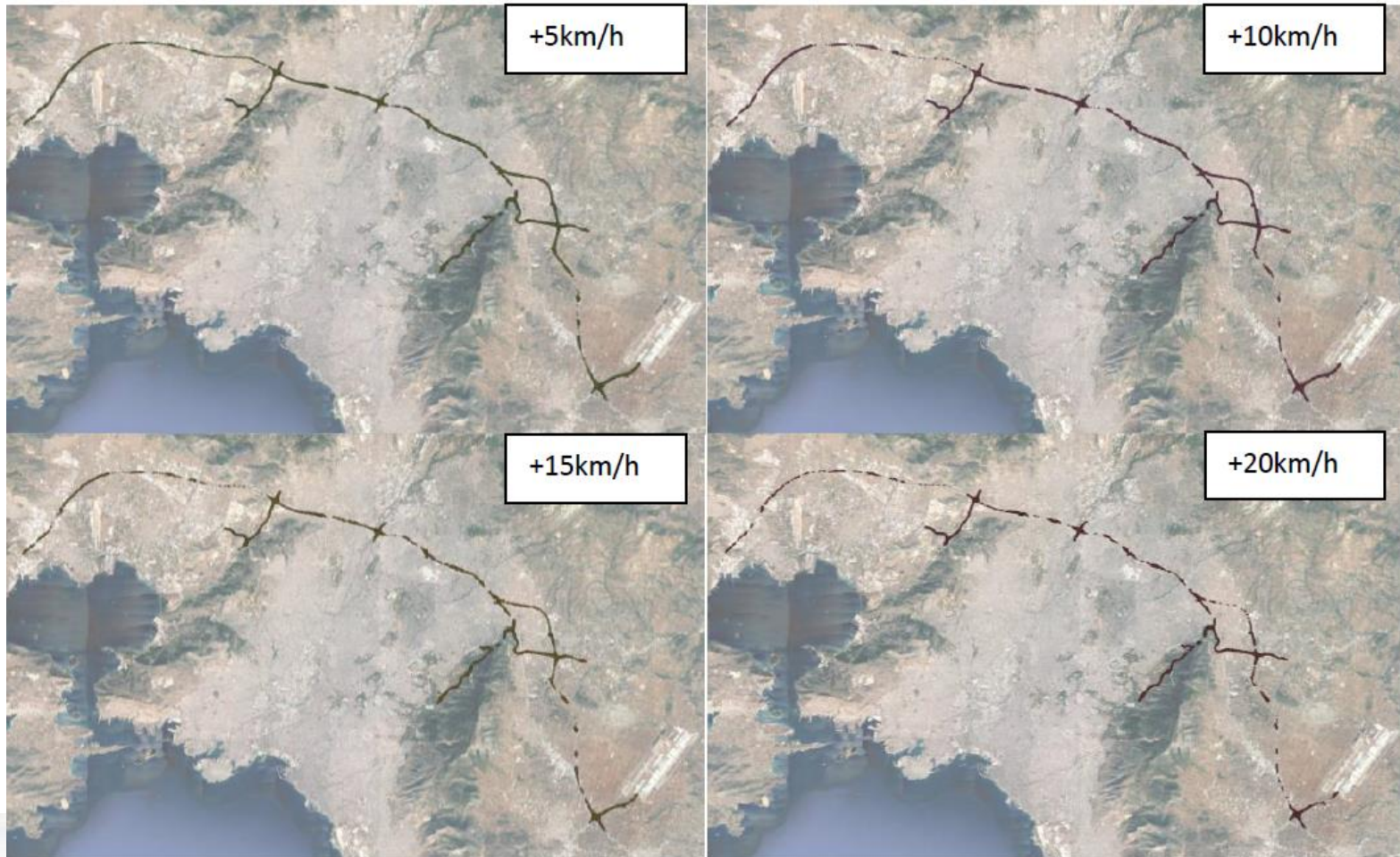
WHERE?

WHERE?

Spatial distribution also differs between different triggers

WHERE?

- Utilization of GIS
- Maps to include information:
    - Type of road segment1 (basic segment, on-ramp, off-ramp)
    - Type of road segment2 (inside/outside tunnels)
    - Road curvature (straight, curved, radius)
    - Speed limit
    - Other.... (number of lanes, lane width, gradient)

- Map-matching for all triggers
- Seek for associations between triggers and road environment
- Traffic conditions????

WHEN?
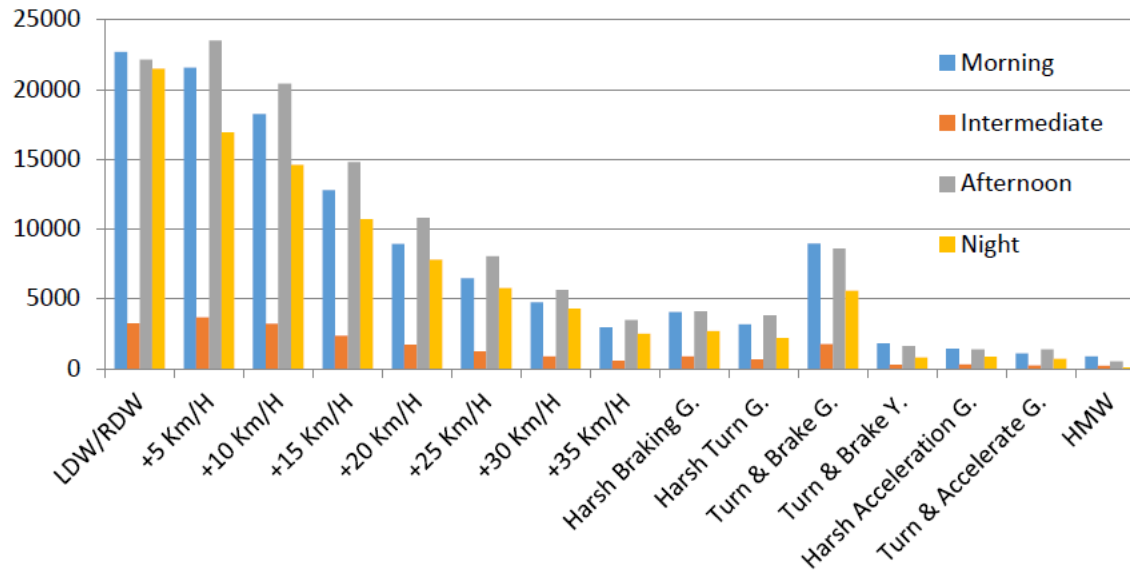
□ Can we obtain valid information from temporal distribution?

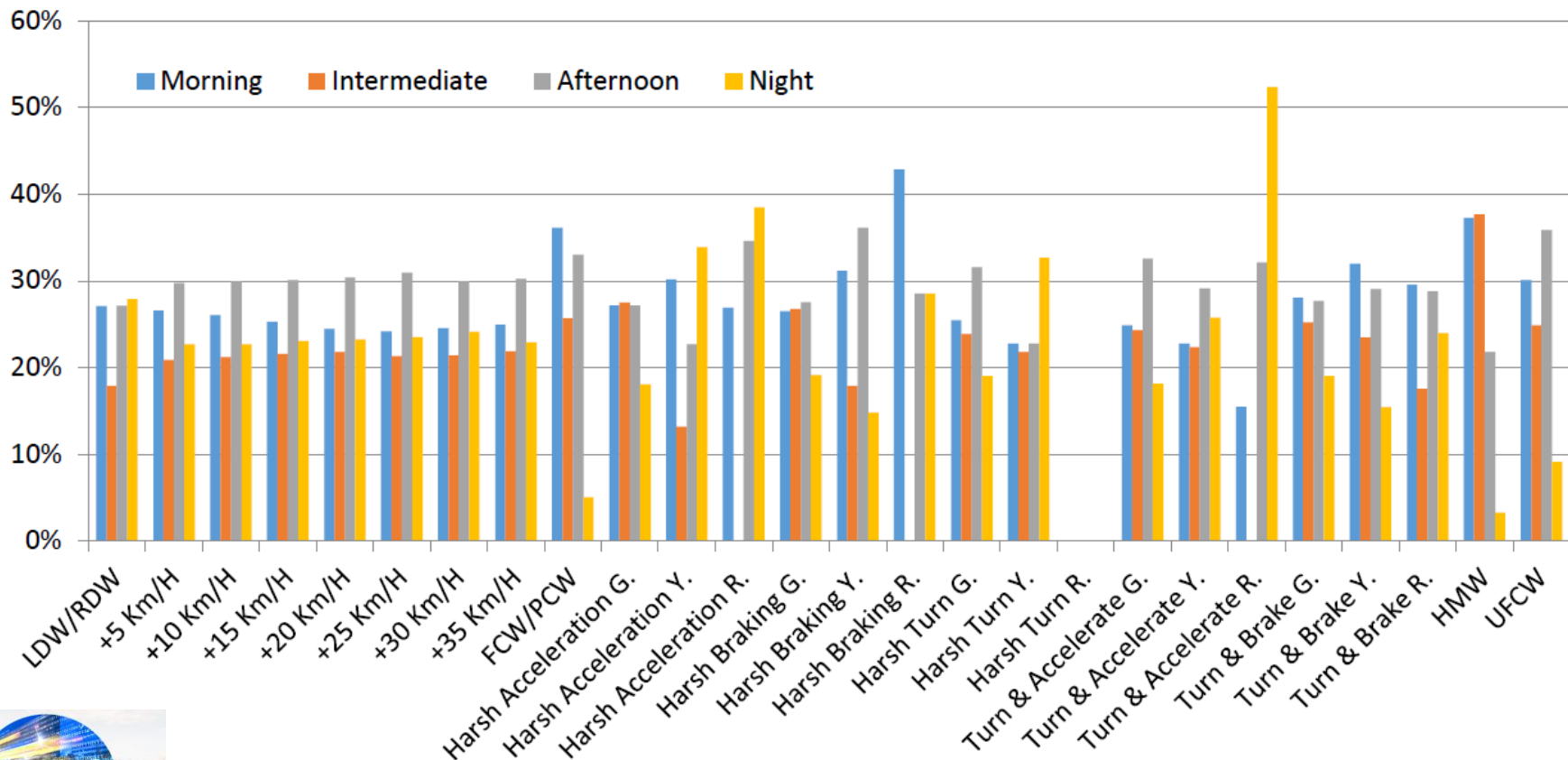□ BUT… the distribution of drives between the different shifts differs significantly
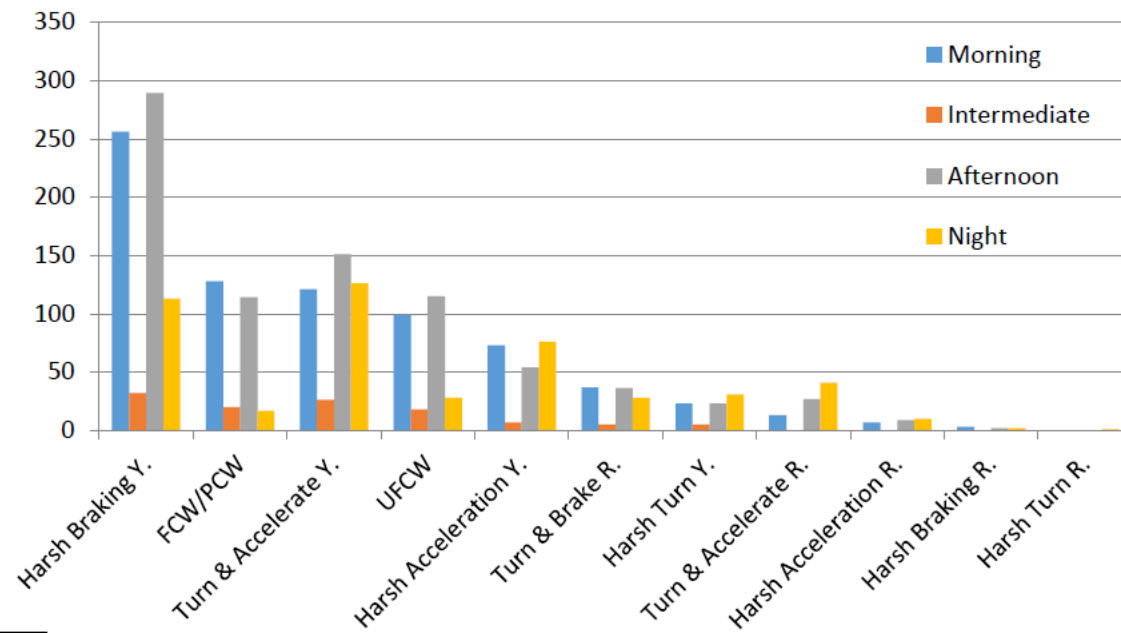
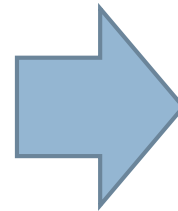# WHEN?

□ Temporal distribution following normalization

WHEN?

- Typical attributes
  - Time of day, day of week, month of year (also due to other factors, e.g. peak hours, weather conditions)
- Work related attributes
  - Type of shift
  - Hour in the shift
  - Consecutive working days
  - Incidence response

ADDITIONAL DATA REQUIRED !!!

ADAS & Consultations

- ☐ Effect of ADAS:

  - ☐ Utilize data prior to equipping the vehicles (vehicle trajectories, only for speeding violations)

- ☐ Effect of Employer Feedback:

  - ☐ Cluster data to: prior and following feedback/consultations
  - ☐ Explore behaviour modification between the two periods for individual drivers

Discussion

- ☐ Ongoing work…. Collection of all data
- ☐ Contributions:
  - ☐ Explore driver risky behaviours with real data and not self-recorded data, utilizing naturalistic driving data
  - ☐ Explore temporal and spatial distributions and determine associated factors affecting them
  - ☐ Include driver personality & attitudes

- ☐ Limitations:
  - ☐ Several potential contributory parameters not included (traffic & weather conditions)
  - ☐ Involves a particular type of professional drivers

Discussion

☐ Objective:

    ☐ Improve driving performance

Warning & informative ADAS functions

do not seem to affect professional driver behaviour !!

Alternative/additional measures are required !!

QUESTIONS ???

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