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Older driver behavior on freeways

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Older drivers' performance on the freeway: An issue of concern

- Substantial increase in the number and proportion of older drivers' licensing rates along with an increase in driving exposure are expected in the next decades
- Accidents involving older drivers will more often lead to serious injuries and fatalities
- The "design driver" of the early 21st century will be an individual over the age of 65

Age and driving skills

- ▶ Changes in functional abilities that affect safe driving

Normal changes: vision, memory, physical strength and flexibility

Health conditions: illnesses (dementia)

- ▶ Compensatory actions, driving experience (anticipation), positive attitudes

Older drivers drive less, avoid driving in difficult conditions and are largely more cautious drivers with conservative decision making

- ▶ **older people do show changes in functional abilities which - in some cases - cannot be compensated for**

Study Objectives

The investigation of:

- **actual older driver behavior on freeway**
- **the correlation between compensatory behaviors and safe driving**
- **the correlation between actual driving performance and performance self-assessment on freeways**

METHODOLOGY

Study Participants

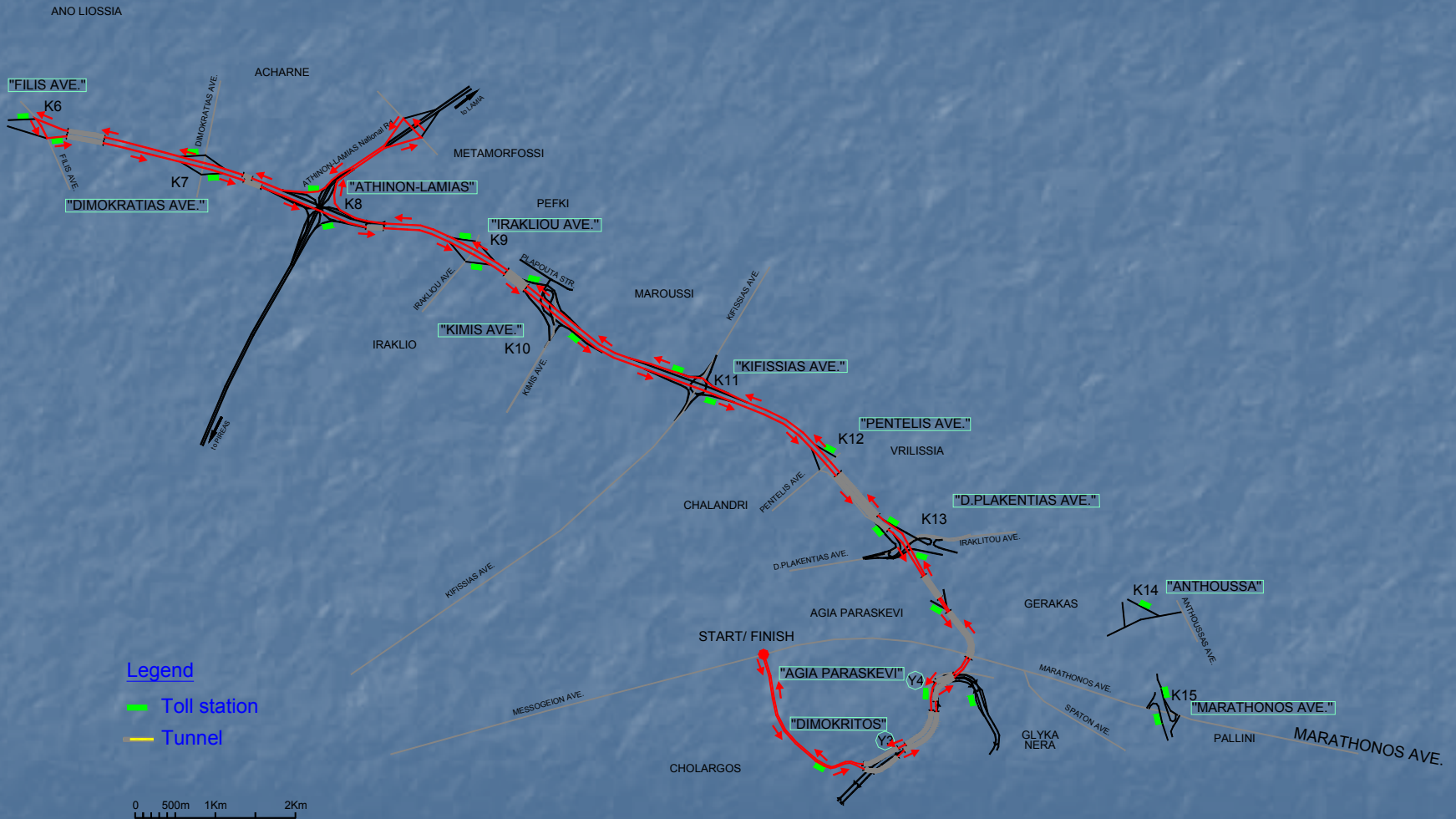
- **Forty healthy licensed active male drivers 65 to 74**
- **Not involved in recent accidents**
- **They used their own car**

On-road trial

- **34 km section of an urban freeway**
- **Freeway driving tasks included:**
 - driving on the freeway and exit finding,
 - lane changing,
 - freeway entering and exiting maneuvers at various interchanges,
 - at three freeway exits, two driving maneuvers in quick succession

Protocol developed: <http://users.ntua.gr/sophiav/>

The trial route



METHODOLOGY

Compensation related observations

- **task elements not inherently part of the task to be carried out**
- **behavioral adjustments indicating behavior to reduce the difficulty of the driving task considering that:**
 - **it might occur automatically as a reaction to cognitive overload**
 - **in driving tasks without safety risks**

Observed Types of Compensatory Behavior in the on-road trial (indicative)

Older drivers tend to...

- Perform limited lane changes
- Drive more slowly when listening to instructions
- Allow more space ahead by early slowing down when approaching complex conditions
- Slow down when entering tunnels
- Slow down on the freeway while searching for exits, directions or exit signs
- Change lane early to the right before exiting (paced task)

Sections where guidance was given-complex tasks

Traffic split



Sections where guidance was given-complex tasks

Lane drop



Sections where guidance was given-complex tasks

Sequence of direction choices-partly within tunnel



Self-assessment questionnaire

- **Feeling of danger due to their own driving performance**
- **Driver performance self-assessment**
- **Stated need for assistance through improvements in their own performance**
- **Stated need for assistance through improvements in roadway conditions**

METHODOLOGY

Performance Assessment

- Driving performance assessment was based on observations of driving behavior.
- Ranking of driving performance was based on task analysis
- Driving performance assessment – ranking:
Satisfactory, Adequate, Nearly adequate, Questionable

Compensation ratings

- Performance of behavioral adjustments to ease the driving task, irrespective of their favourable or unfavourable safety outcome: *Yes, No*

RESULTS

Correlation coefficients between compensation and other performance variables

	Speed driving style	Speed adaptation	Following distance	Visual behavior
Compensation	-0,525** 0,001	-0,446** 0,003	-0,350* 0,023	-0,354* 0,018

	Driving style during lane change	Driving style during entering	Speed adaptation during exiting	Kms driven on freeway last year
Compensation	-0,614** 0,000	-0,446** 0,003	-0,319* 0,039	0,400** 0,003

Non parametric correlation Kendall's tau (τ)

**** correlation statistically significant at 0.01 level**

*** correlation statistically significant at 0.05 level**

RESULTS

Shortcomings regarding compensatory adjustments

- Drivers adjusting their driving to overcome potential difficulties appear to perform less adequately in speed adaptation during freeway maneuvers.
- Compensatory adjustments were not supported by adequately safe performance revealing lack of knowledge of traffic regulations and less safe driving practices particularly important in freeway driving.
- Freeway environment appeared to be highly demanding for some drivers, particularly under dual tasking driving conditions

RESULTS

Examples of performance inadequacies related to compensation

- Early observations on the approach of complex situations with no repetition of checks before turning or crossing
- Low acceleration or late entrance to freeway in order to have time to check traffic conditions in front and behind him
- Slow entrance to the freeway with delayed checks
- Sudden slowing down or braking on the freeway while searching for the exits or directions
- Avoiding passing, slow driving behind heavy vehicles which obscured visibility

RESULTS

Self-assessment correlation matrix

- ▶ Decreased performance in several performance variables
Feeling of danger due to their own driving performance
Less favorable self assessment
- ▶ Less adequate perceived performance in entering and exiting maneuvers
Stated need for assistance through improvements in their own performance
- ▶ **Drivers' stated no need for assistance through improvements in their own performance during exiting**
Stated need for assistance through improvements in roadway conditions in exiting (specifically in exit signing)

CONCLUSIONS

- **Older drivers are aware of their own driving performance**
- **Driving problems potentially emerge under highly demanding freeway driving conditions**
- **Several shortcomings regarding compensatory adjustments appeared**

FUTURE WORK

- *Performance assessment*
- *Self-assessment instruments*
- *Educational material targeted to active older drivers*
- *Freeway design*