**Ernvall-Kelkka-Olkkonen:**

# ”Crash Violence” within the Traffic System in Finland

# Objectives:

1. **Crash violence and the scope**
2. **Research data and methods**
3. **Results:**
   - crash types
   - injury mechanisms and body areas
   - influence of speed
   - vehicle safety
4. **Conclusions and recommendations**

# The goal of traffic system according to Finnish ”mission zero”

Traffic system should be such that each **road user would survive alive in traffic**, if he or she:

- observes traffic regulations and safety recommendations
- even commits a human error.

# Crash violence

Those outcomes, injuries and fatalities, of crashes which have occurred, althought the drivers have

- obeyed traffic regulations,
- operated without any risky manouvres
- or commited only a human error,

can be interpreted as crash violence of traffic system

# Research data

**Original sample:**

**1163 fatalities** in two-vehicle crashes and single vehicle accidents occurred on the Finnish two-lane rural (outsides towns and villages) main road network of 11800 km and investigated detailed by Accident Investigation Teams in 1996-2003

# Final sample:

**524 fatalities (45 %)** of the total sample. Only fatalities from those crashes in which the parties were operated ”correctly”.

**Number of crashes: 442, vehicles: 849, occupants: 1417**

**Reasons for disqualification**:

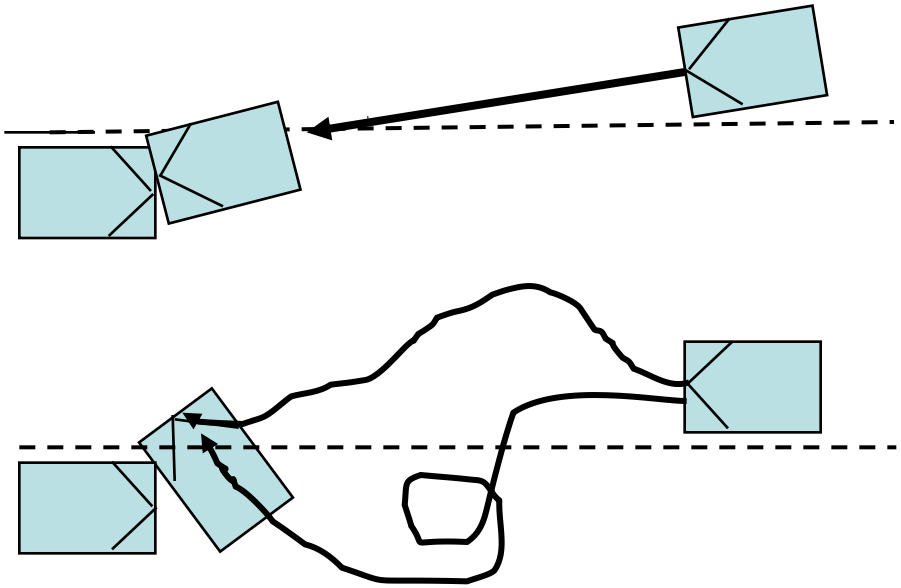
- alcohol (BAC > 0,5 per mille) and drugs
- exceeding of actual speed limit ( > 20 km/h)
- lack of safety belt use
- suiside or sudden fit of illness
- lack of valid driving licence

# Fatalities by crash types:

- **Meeting accidents** **302 ( 58%)**
- Crossing acc. 66 ( 13%)
- Overtaking acc. 59 ( 11%)

- Passenger car-passenger car ca. 56%
- Passenger car-heavy vehicle ca. 38%
- Single vehicle acc. ca. 7%

# Meeting accident

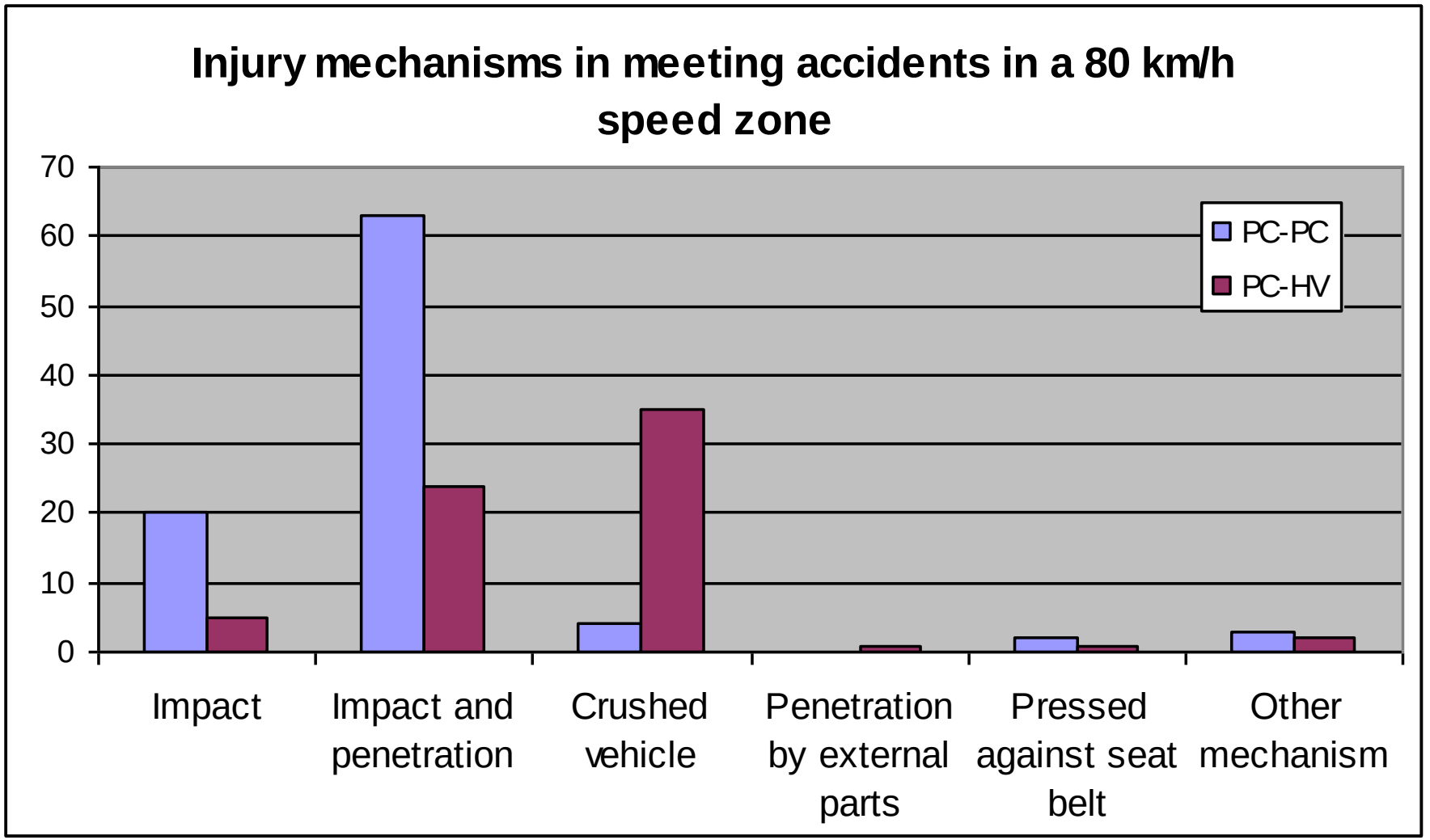


## carrying to opposite lane

**42 %,** dry or wet road
**head-on/side impact: 98%/2%**

## lost driving control

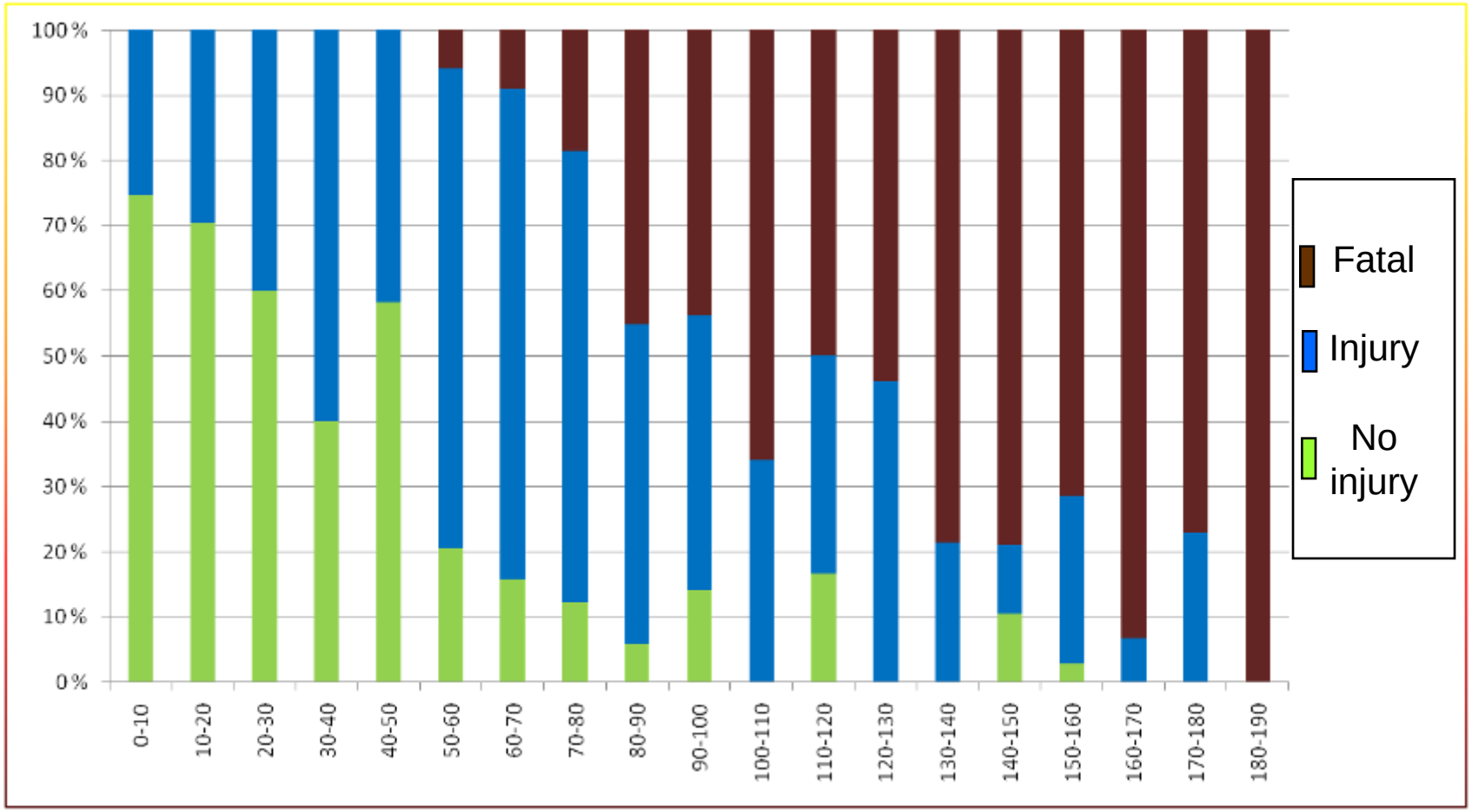
**46%,** slippery or icy road
**head-on/side impact: 45%/52%**


Injury mechanisms in meeting accidents in a 80 km/h speed zone
70
60
50
40
30
20
10
0
PC-PC
PC-HV
Impact
Impact and penetration
Crushed vehicle
Penetration by external parts
Pressed against seat belt
Other mechanism

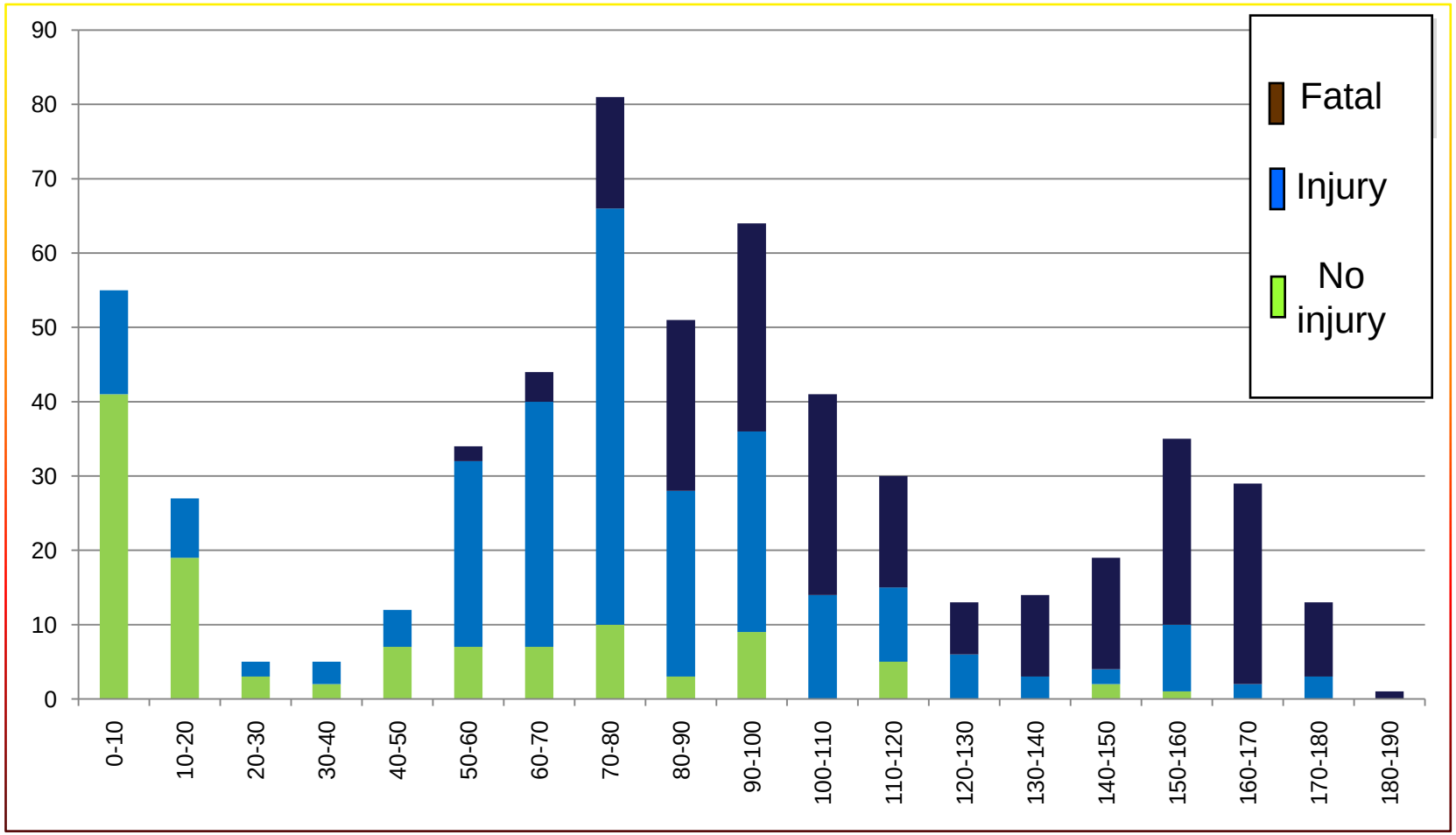
# Fatalities by body regions

| | *Impact* | | *Impact +penetration* | | *Crushed veh.* | | *Other* | |
|---|---|---|---|---|---|---|---|---|
| *Body area* | N | % | N | % | N | % | N | % |
| **Head** | **27** | **31.8** | **73** | **27.8** | **35** | **35.7** | **23** | **30.3** |
| Back | 13 | 15.3 | 30 | 11.4 | 5 | 5.1 | 5 | 6.6 |
| **Chest** | **17** | **20.0** | **66** | **25.1** | **10** | **10.2** | **11** | **14.5** |
| Abdomen and hips | 1 | 1.2 | 10 | 3.8 | 1 | 1.0 | 4 | 5.3 |
| Limbs | 1 | 1.2 | 3 | 1.1 | 3 | 3.1 | 1 | 1.3 |
| Multi | 1 | 1.2 | 7 | 2.7 | 15 | **15.3** | 2 | 2.6 |
| Other or unknown | 25 | 29.4 | 74 | 28.1 | 29 | 29.6 | 30 | 39.5 |
| ***Total*** | ***85*** | ***100.0*** | ***263*** | ***100.0*** | ***98*** | ***100.0*** | ***76*** | ***100.0*** |

# Delta-v (km/h) and severity of consequences for all occupants in fatal head-on collision accidents, n=573 occupants



## Distribution of delta-v and severity of consequences for occupants in fatal head-on collision accidents, n=573 occupants



# Vehicle Safety

- **Airbags saved 25 % of drivers and occupants**
- **Positive influence of ESP (ESC) would have been 15 %**
- **Positive influence of Driver alertness systems would have been 15 %**
- **Newer car models are continuously getting safer compared to their predictors**

# Conclusions and recommendations

## Traffic system does not support enough road users to survive alive in traffic

- **The risk to be involved in high-speed meeting, overtaking and crossing crashes must be reduced or prevented with median barriers and round-abouts**
- **Speed limit systems should be developed towards safer speeds and lower deviation of used speeds**
- **The use of automatic speed adaptation systems and speed limiters should increase and support**
- **The quality of road maintenance must improve especially in winter**
- **Vehicle primary and secondary safety research and development important**