Bumper Test Area – Benefit of extending test area (EC)

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Contents

Overview of benefit analysis task

Introduction

- Final Task of European Commission Bumper Test Area project…
- Estimate the likely range of EU-wide benefits for an improved regulatory test procedure
  - both in terms of casualty numbers
  - and as Euro values (€)
- Using
  - Analyses of the UK On-The-Spot (OTS) and German In-Depth Accident Study (GIDAS) databases
  - Crash test data and injury risks
  - Published information on European Union (EU) accident numbers

Estimating the target population

Pedestrian to front-of-car cases

Collision type	GIDAS	OTS
Pedestrians struck by front of car	758	116
All accidents	23,444	4,700
Proportion	**3.2%**	**2.5%**

Notes

- GIDAS figure excludes an unknown number where a pedestrian was struck by the front of a car, but the exact location of the contact was unknown
- The true GIDAS proportion could be higher than 3.2%
  - Round to 3.5% for later calculations
- OTS is biased towards higher severity cases, this could affect the proportion
  - Although consistent with GB national numbers

Estimating the target population

Serious injuries

OTS

- 53% of the pedestrians hurt in collisions with the fronts of cars were recorded as being seriously injured

GIDAS

- GIDAS severity based on MAIS
- 49 % of casualties had MAIS 2, 3 or 4
  - for cars manufactured after 2000
- Assumed that 50% of all reported pedestrian casualties from front-of-car impacts are seriously injured as a result

Estimating the target population

Under-reporting

HEATCO

- Some injury-causing accidents go unreported
- The HEATCO Project recommended that official seriously injured pedestrian casualty statistics should be multiplied by 1.35 to allow for under-reporting

UK

- After this, UK analysis suggested HEATCO values were too conservative
- Non-fatal pedestrian casualties = 1.6 to 3.7 x reported numbers
- This is for all severities
- For serious injuries, suggest range of 1.35 to 2.1

Estimating the target population

Affected area

- Earlier survey of car fronts suggests 10 to 20 % each side could be outside of the regulatory test area
- Use values of 20 and 40 % of vehicle width for lower and upper estimates of potential area affected by change

- Note that effectiveness is considered elsewhere, this is just to derive the target population.

Estimating the target population

Injuries caused by bumper

- Only the GIDAS database had sufficient detail in the injury descriptions
  - Reliable causation code given for each pedestrian injury
  - Able to identify those leg injuries attributed to the bumper contact
- Sample of 244 cases
  - Frontal impacts with post-2000 cars
- 32 (13%) had a bumper-caused AIS 2 or 3 injury (serious)
  - No other injury above AIS 1
  - Note that cerebral concussion classification has changed in later AIS
    - Without excluding concussion cases, 18 % would be in the target group

Estimating the target population

'Totals'

Casualties per annum

- Between 505 and 2,955

Value

- Converting one serious injury to one slight = € 212,042
  - No detailed European-wide values
  - Assuming UK values in the central region of European estimates
  - Euro rate of 1.2 to GBP
- Willingness to pay:
- Between € 107 million and € 627 million, per annum

Effectiveness of extended test zone

- Effectiveness estimates derived from test work
  - AIS 2+ injury risk data for Medial Collateral Ligament (MCL) elongation and tibia bending moment
  - Peak values obtained from car tests
  - Takahashi *et al*. (2012) (see GTR9-6-26) used to convert peaks to injury risk
  - Compare measured injury risk with proposed threshold limits

Effectiveness of extended test zone

Test data and limit values – calculated probabilities of serious injury

Test	Peak MCL elongation (mm)	MCL AIS2+ probability (a)	Peak tibia bending moment (Nm)	Tibia AIS2+ probability (b)	Overall AIS2+ probability (a+b-ab)
Limit values	22.0	0.64	340	0.29	0.74
Vehicle A	18.8	0.21	314	0.21	0.38
Vehicle B	23.7	0.84	395	0.51	0.92
Vehicle C	24.8	0.93	265	0.10	0.94

Effectiveness of extended test zone

Three vehicles

Vehicles B and C

- Reduction from 0.92 or 0.94 injury risk to 0.74
- This is 20 or 21% decrease in the risk of receiving a serious leg injury

All vehicles

- Vehicle A already meets the requirements and needs no changes even if the test area was expanded
- Only tested three cars
  - Not proposing to adjust for vehicle sales
- Mean reduction ~ 14 %
- Conservative – no manufacturer's margin
- But – Test with vehicle rotation would give smaller benefit
- Also – bumper beam changes around test point?

Effectiveness of extended test zone

GIDAS check

Time series casualty data

- During time of introducing pedestrian testing, injury risk dropped
  - Other characteristics changed also (e.g. collision speed)
  - Around 12-13 % reduction in overall serious injury risk
- If 75 % of vehicle front needed to be 'safe' then effectiveness of test zone could be ~ 16%

Effectiveness

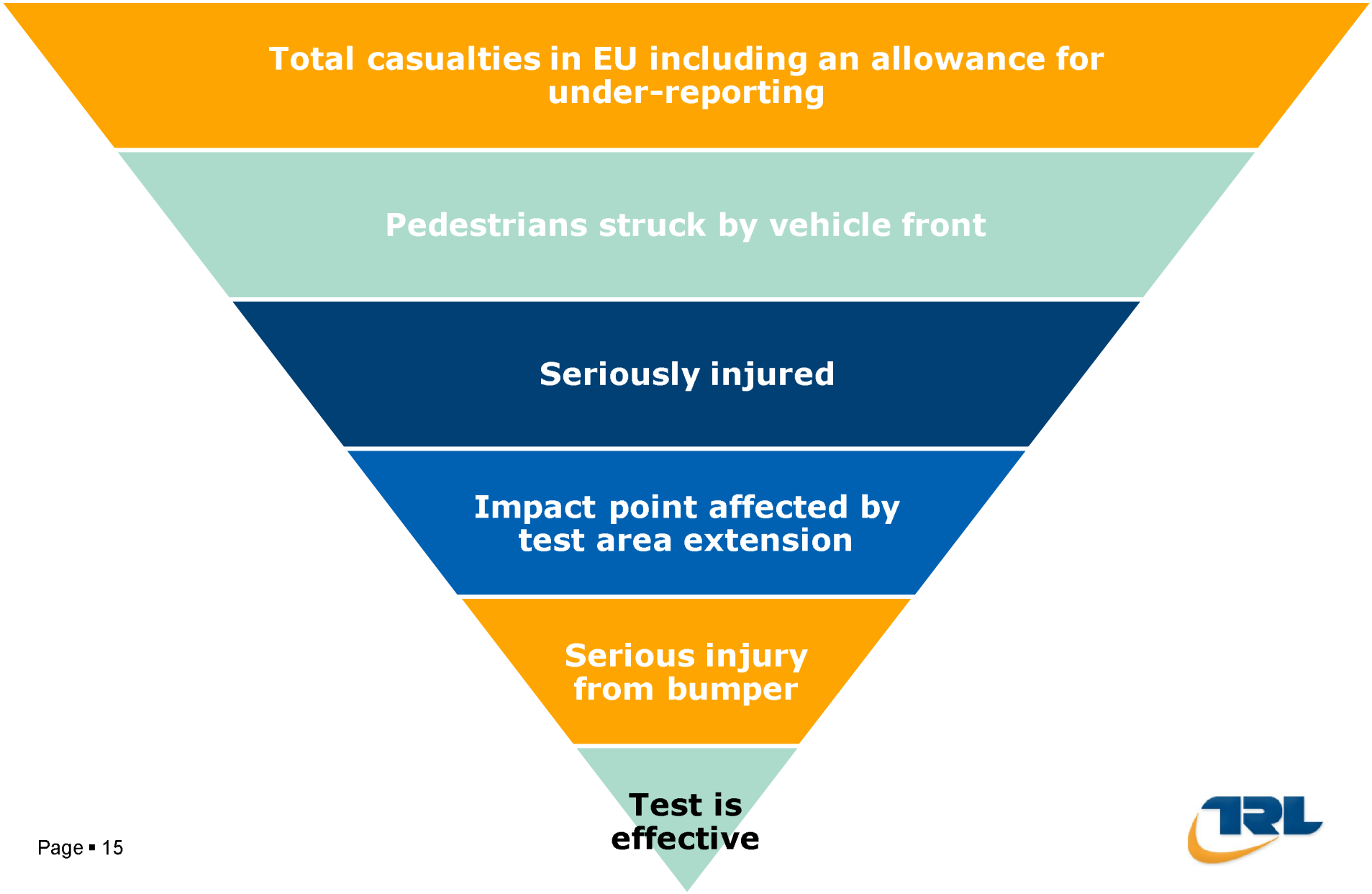
- Test work suggests ~ 14 %
- Historic trends support ~ 16 %
- Use these as upper and lower estimates
- Apply to the target population

Summary

Calculation steps

Step	Lower value	Upper value	Lower EU estimate	Upper EU estimate
Apply proportions of accidents in GIDAS and OTS involving pedestrians struck by car fronts to overall EU reported figures	2.5 %	3.5 %	28,512	39,917
Estimate proportion likely to be seriously injured, based on OTS and GIDAS	50 %	50 %	14,256	19,959
Make allowance for under-reporting	1.35	2.1	19,246	41,913
Select cases where point of impact may be affected by procedure change	20 %	40 %	3,850	16,769
Select cases where serious injuries are caused by contact with the bumper	13 %	18 %	505	2,955
Target population estimate			**505**	**2,955**

Summary


Total casualties in EU including an allowance for under-reporting
Pedestrians struck by vehicle front
Seriously injured
Impact point affected by test area extension
Serious injury from bumper
Test is effective

Summary

Overall estimates of casualty and financial benefits

Estimate	Casualties (lower)	Casualties (upper)	Valuation (lower) €million	Valuation (upper) €million
Target population	505	2,955	107	627
Overall benefit (14 – 16 %)	**71**	**473**	**15**	**100**

- Central values
  - Prevent 272 serious injuries in the EU per annum (± 201)
    - (or 206 +267/-135)
  - Save €58 million per annum (± €43m)
    - (or €43 million +57/-28m)

Caveats – Major assumptions

- The OTS and GIDAS databases are broadly representative of car-pedestrian accidents across the EU
  - The GIDAS study is set to represent accidents in Germany
  - OTS is known to have a bias towards severe crashes (in Great Britain)
  - Assumption is correct only if pedestrian accidents around Europe are the same as those occurring in Germany and GB
- An improved test procedure can only, at best, reduce serious injuries to slight injuries
  - It cannot prevent fatalities
  - It cannot convert slight injuries into non-injuries

Caveats – Major assumptions

- Injuries sustained from parts of the car other than the bumper would not be prevented by an improved test procedure
  - Only those pedestrians seriously injured by contact with the bumper, and not by any other contact, can be affected
- Only a certain proportion of the cars' bumper width can be improved by a new test procedure
  - The performance of the bumper in the central region is already controlled via the legislation
  - The performance of the vehicle corners is unlikely to need revision as pedestrian impacts there are likely to be glancing rather than perpendicular and very few hard components need to be placed there which would create injurious contacts

Do You Have Any Questions?

Thank you
Benefit of increased test area / Task Force – Bumper Test Area

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