

ACTIVE HOOD TRENDS

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ACTIVE HOOD TRENDS

Overview

- **Design Philosophy**
- **Advantages**
- **GTR No. 9**
- **Database Development**
- **Applications**
- **Market Trends**
- **Other Considerations**

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Design Philosophy

Pre-Crash Sensing

- Visual Identification

Contact Sensing

- Accelerometer
- Pressure Tube
- Resistive/Capacitive Sensor

Deployment

- Spring and Motor
- Pyrotechnic Damper
- Pedestrian Air Bag

Hood Design

- Steel versus Aluminum
- Lifting Hinges



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Advantages

Lifted hood increases space between pedestrian impact surface and underlying components, allowing:

- Euro NCAP rating and EU Type Approval
- Low hood profile
 - Minimal packaging space for large engine, RWD vehicles
- Avoid structural/styling change for existing vehicle new to a ped pro requirement market

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Design Philosophy



<http://www.youtube.com/watch?v=q4zfwUL3jol>

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GTR No. 9

What is it?

- Bumper and bonnet energy absorption testing for 40 kph vehicle-to-pedestrian collisions
 - Leg
 - Upper leg
 - Bonnet (hood)

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GTR No. 9

What does it say about active hoods?

- Section A (Statement of Technical Rationale and Justification)
- Section B (Text of Regulation)

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GTR No. 9

What does it say about active hoods?

- Section A (Statement of Technical Rationale and Justification)
§ A.8.b.122
 - Active devices must not create a higher risk of injuries for pedestrians.
 - INF GR/PS/141 Certification Standard for Type Approval Testing of Active Deployable Systems of the Bonnet Area
- Section B (Text of Regulation)

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GTR No. 9 – INF GR/PS/141

INF GR/PS/141

Calculate HIT

1. 6yo child
2. 5% female
3. 50% male

ST provided by manufacturer

$$TRT = ST + DT$$

HIT = Head Impact Time
TRT = Total Response Time
ST = Sensing Time
DT = Deployment Time

Physically measure TRT

1. $TRT < HIT$
2. System reaches and remains in intended position before impact
3. System can be supported in a representative way

Y
1, 2, 3
N

Static Headform Test

Dynamic Headform Test

Y
contact sensors
N

Determine TRT through other means, reevalutate

What does it say about active hoods?

- Section A (Statement of Technical Rationale and Justification)
- Section B (Text of Regulation)
 - § B.6.2.2
 - “All devices designed to protect vulnerable road users when impacted by the vehicle shall be correctly activated before and/or be active during the relevant test. It shall be the responsibility of the manufacturer to show that any devices will act as intended in a pedestrian impact.”

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Database Development

464 entries total

- 459 Euro NCAP test reports
- 4 additional Euro vehicles identified with active hoods
- 1 Australia only ANCAP vehicle

5 entries excluded from calculations for lack of overall ped scores

- 4 additional vehicles identified with active hoods
- 2008 Mercedes Viano Euro NCAP ped scores not reported

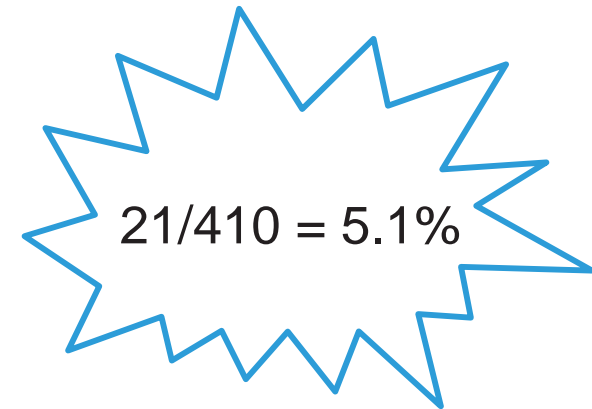
54 entries excluded from statistical calculations

- 22 Vehicles removed due to lack of historical [£ information](#) or not offered for sale in UK (includes 1 Australia vehicle)
 - GBP £1.00 = USD \$1.637 ([13 January 2014](#))
- 32 Repeat Euro NCAP test reports removed

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Applications

Year	Manufacturer	Model
2006	Citroen	C6
	Jaguar	XK
2007	Honda	Legend
2009	Nissan	GT-R
	Porsche	Panamera
2010	BMW	5-Series
2011	Fiat	Freemont ¹
	Jaguar	XF
	Lancia	Thema ²
	Lancia	Voyager ³
	Mercedes	C-Class Coupe
2012	Hyundai	Santa Fe
	Mercedes	A-Class
	Mercedes	E-Class
	Mercedes	M-Class
	Volvo	V-40
2013	Infiniti	Q50
	Lexus	IS 300h
	Mercedes	CLA
	Skoda	Octavia ⁴
2014	Jaguar	F-type



¹Sold in the US without active hood as Dodge Journey.

²Sold in the US without active hood as Chrysler 300.

³Sold in the US without active hood as Dodge Caravan.

⁴Originally marketed and tested with standard active hood, later deleted.

ACTIVE HOOD TRENDS

Euro NCAP Scoring

24 maximum headform points

6 maximum pelvis/upper legform points

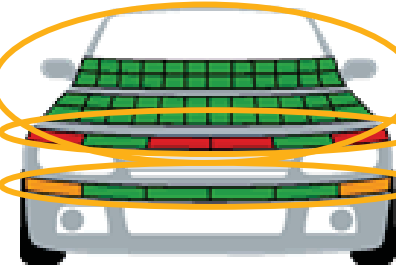
6 maximum lower legform points

36 possible total points



Pedestrian

Total 32 pts | 88%



HEAD 24.0 pts

PELVIS 2.0 pts

LEG 5.8 pts



*2012 Volvo V40 Euro NCAP Score

Test	Points
Headform	24
Pelvis/Upper Legform	6
Lower Legform	6
Total	36

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Euro NCAP Scoring

Year	2013	2014	2015
Box 1: Adult Occupant Protection	50%	40%	40%
Box 2: Child Occupant Protection	20%	20%	20%
Box 3: Pedestrian Protection	20%	20%	20%
Box 4: Safety Assist	10%	20%	20%

Overall Euro NCAP Rating Composition

Percent of total points for each Euro NCAP star level

Year	2013	2014	2015
For five stars, at least:	80%	75%	75%
For four stars, at least:	70%	65%	65%
For three stars, at least:	60%	50%	50%
For two stars, at least:	55%	40%	40%
For one star, at least:	45%	30%	30%

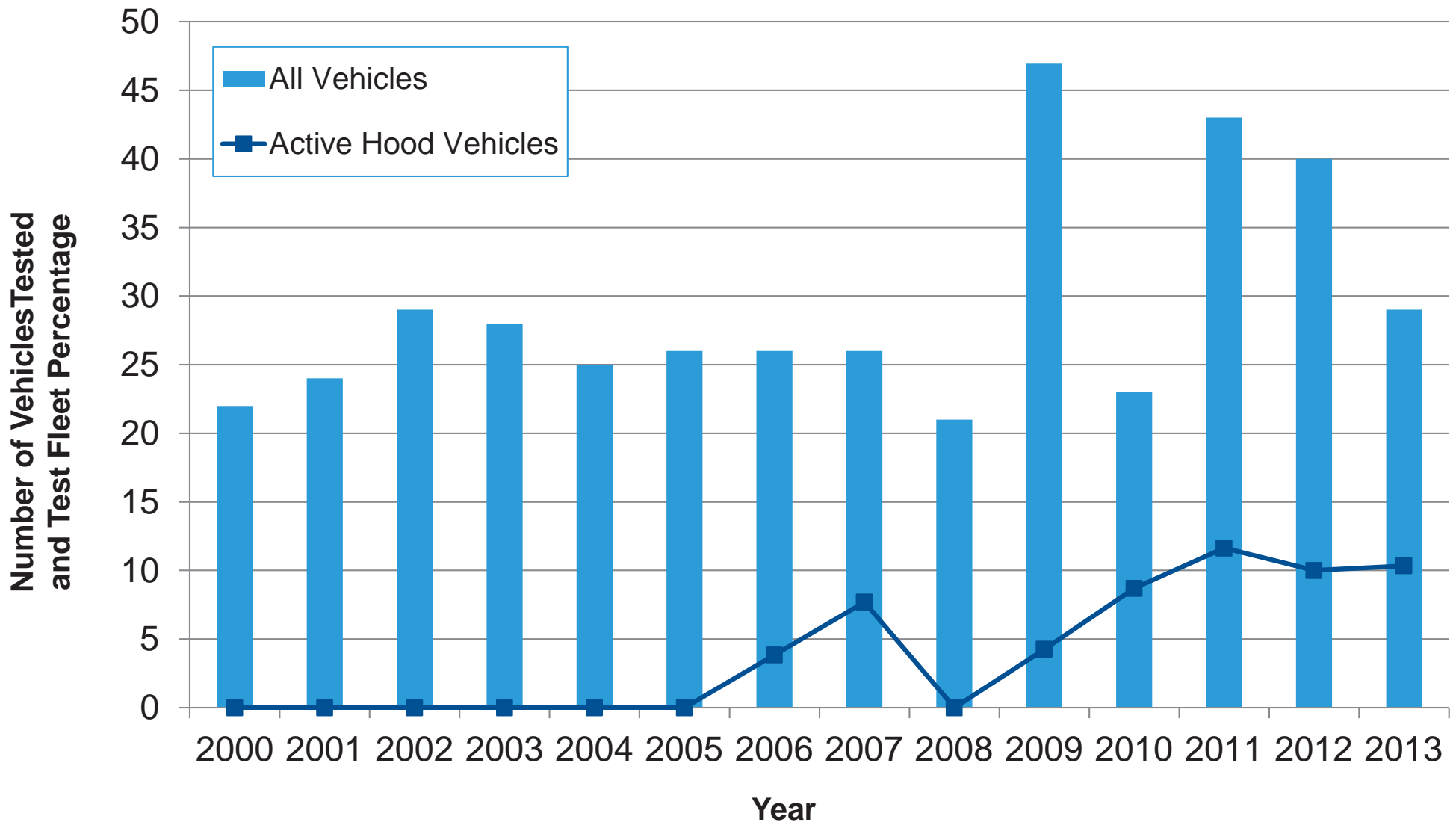
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Total	36

<http://www.euroncap.com/files/Euro-NCAP-Assessment-Protocol---Overall-Rating---v6.0---0-4e7fab4e-8606-4d35-be22-07e5b41529dc.pdf>

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Market Trends – Vehicles Tested

Euro NCAP/UK Vehicles (2000-2013)



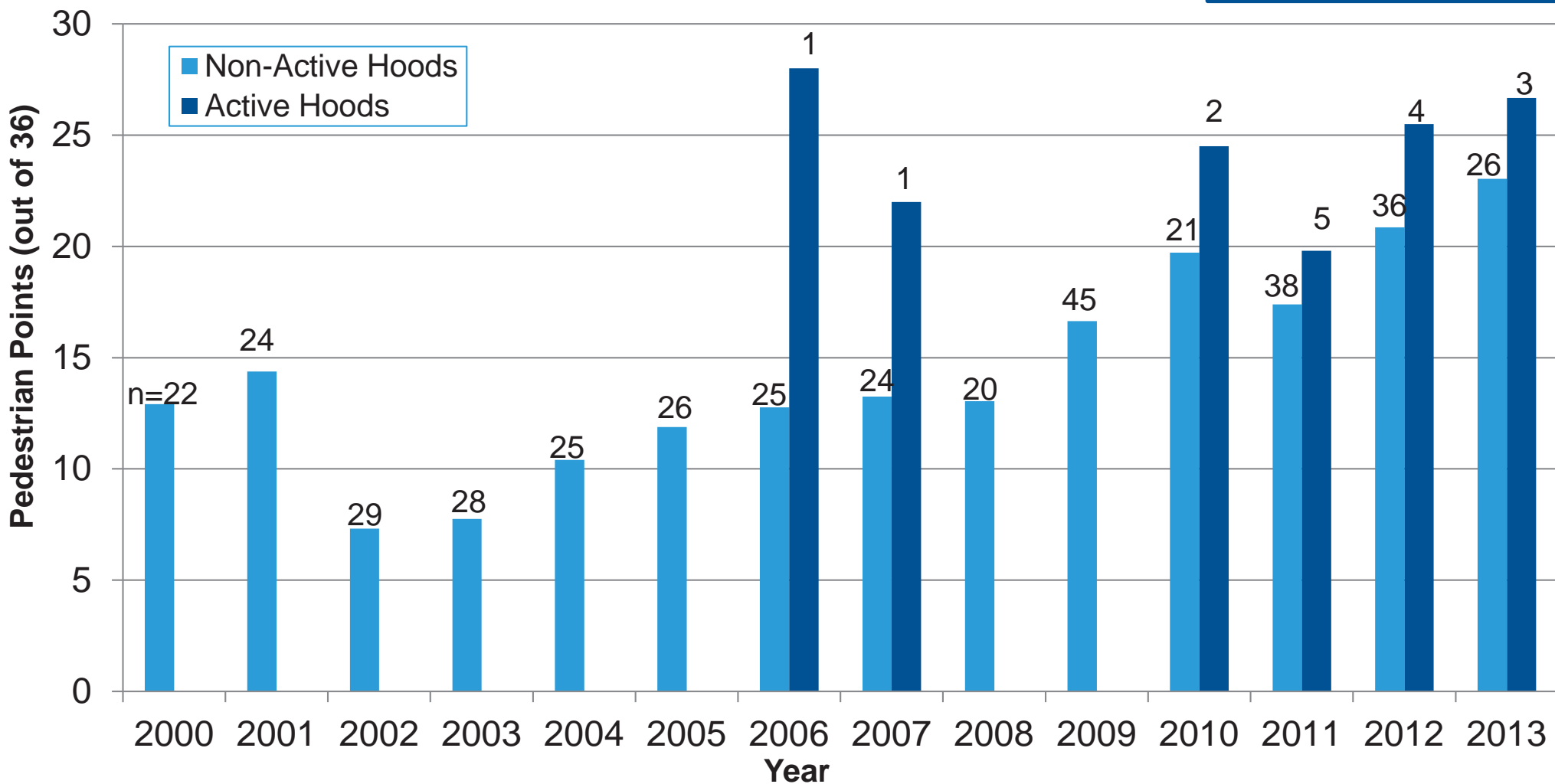
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Market Trends – Overall Pedestrian Scores over Time

Euro NCAP/UK Vehicles (2000-Present)

Overall Average Pedestrian Scores

Score distribution (max 36)
Non-Active Hoods: 0-28
Active Hoods: 17-32

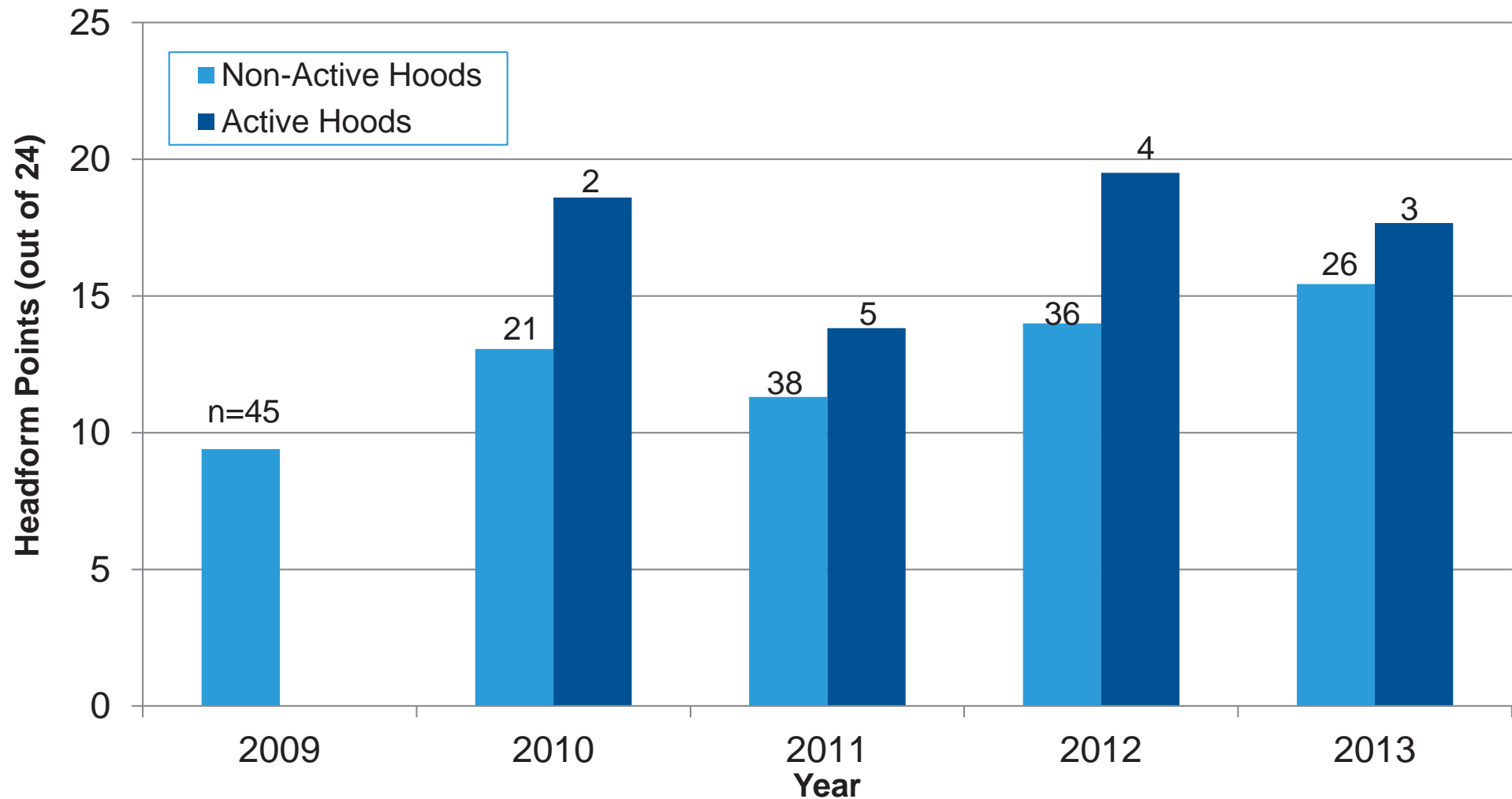


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Market Trends – Pedestrian Headform Scores over Time

Euro NCAP/UK Vehicles (2000-Present) Average Pedestrian Headform Scores

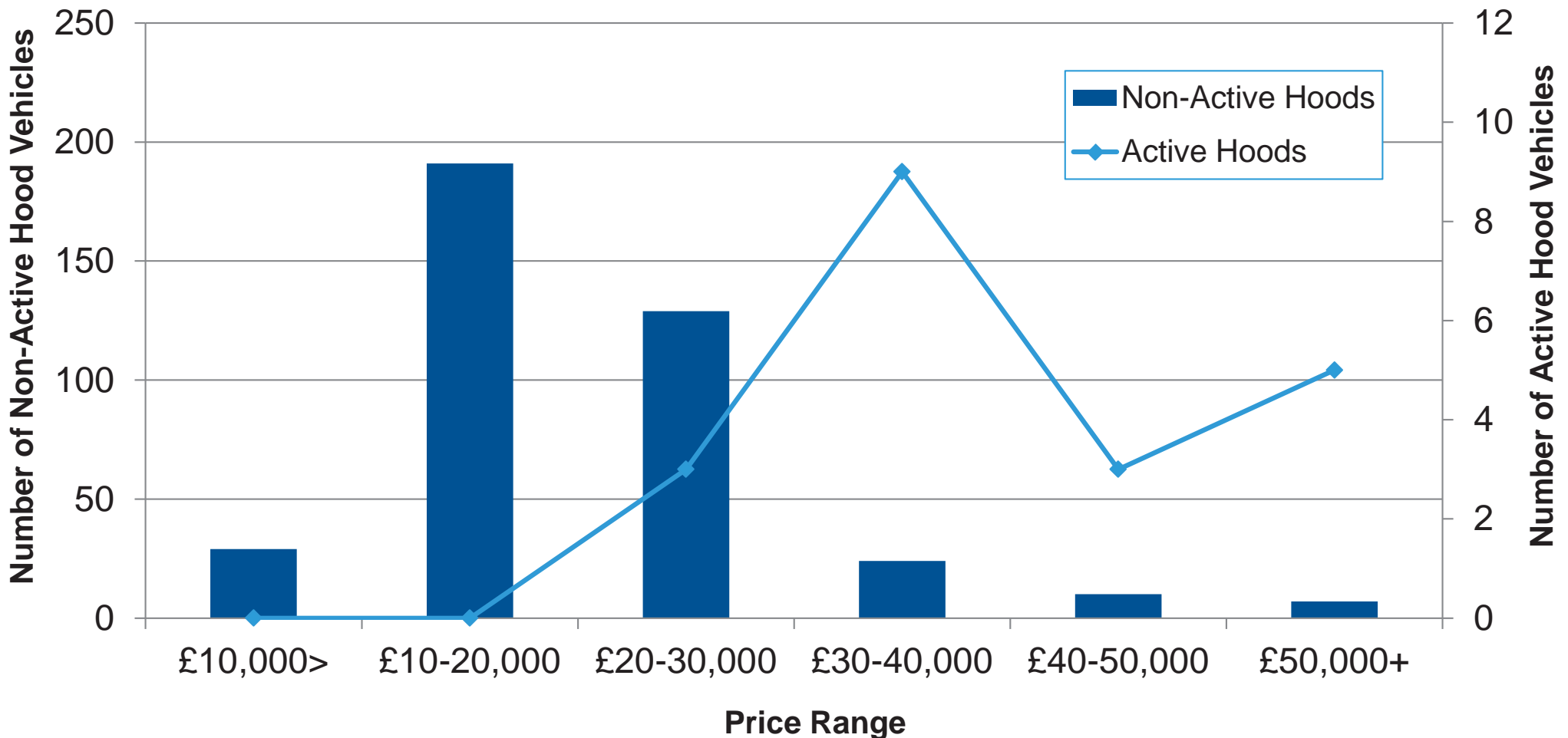
**Score distribution
(max 24)**
Non-Active Hoods: 3-20
Active Hoods: 11-24



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Market Trends – Vehicle Price

Euro NCAP/UK Vehicles (2000-Present)
Median Price Distribution



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Market Trends

Vehicles with active hoods tend to:

- Achieve higher overall pedestrian score
- Achieve higher headform scores

Average Euro NCAP pedestrian protection scores have steadily increased over time!

- Active hood not required for high headform scores
- Active hood vehicles tend to have higher headform scores than non-active hood vehicles

Active hood use may continue in the future,

- Minimizing front engine room packaging space for low profile vehicles
- Allowing lighter (sometimes aluminum) hoods

ACTIVE HOOD NOT REQUIRED FOR GOOD HEADFORM SCORE

2012 Subaru Forester

Non-Active Hood



£27,995 median price
20.3/24 headform points
26/36 pedestrian points

http://image.motortrend.com/f/photo_gallery/suvs/1206_2012_subaru_forester_photo_gallery/42154617/2012-Subaru-Forester-black.jpg

2011 Lancia Voyager

Active Hood



£32,265 median price
15.3/24 headform points
21/36 pedestrian points

<http://www.gmotors.co.uk/news/wp-content/uploads/2011/02/2012-Lancia-Grand-Voyager.jpg>

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Other Considerations

Manufacturer involvement provides key information

1. Demonstrate deployment
2. Sensor and headform launch timing
3. Euro NCAP scores depend on simulations

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Other Considerations

1. Additional vehicle cost
2. False deployments and post-deployment resetting/visibility criteria
3. Verification of deployment threshold
4. Safety at all impact speeds: vehicle pedestrian protection above and below deployment threshold

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Summary

GTR No. 9

- Specifically addresses active hoods
- Openings for further consideration

Active Hood Trends

- Vehicles with active hoods tend to achieve higher scores.
- Average Euro NCAP pedestrian protection scores have steadily increased over time.
- Active hood use may continue in the future.

Questions?