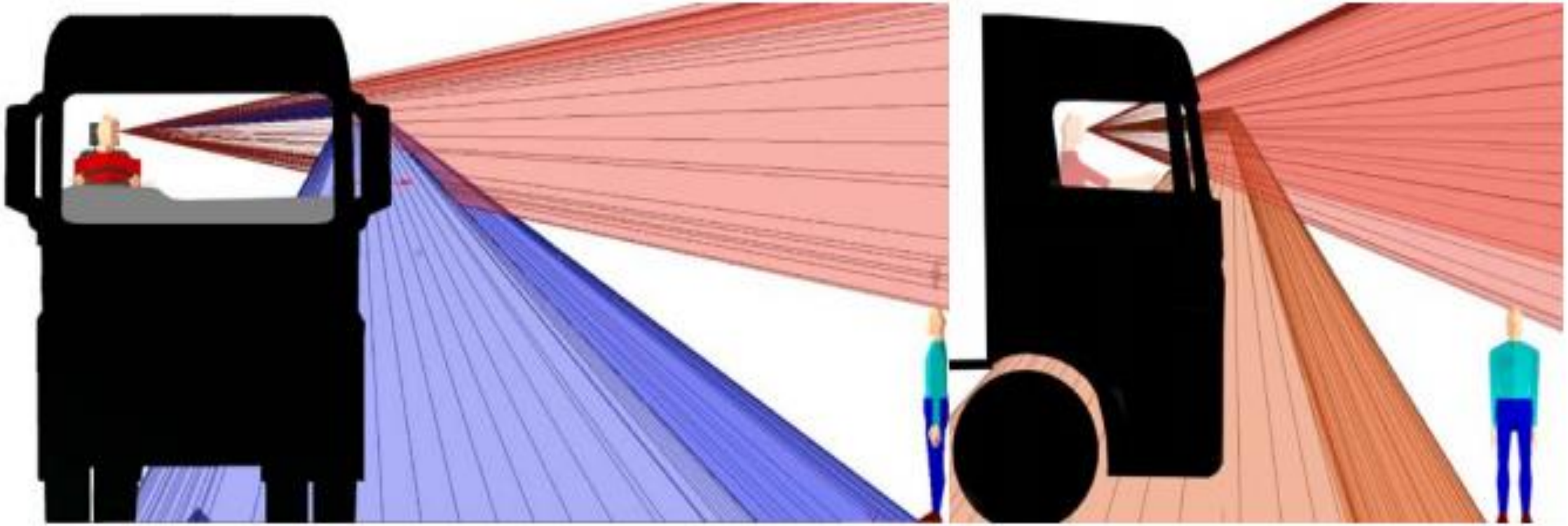

Assessing the potential for VECTO categories to be used as part of a differential direct vision standard

Introduction

- Several discussions have highlighted conflicting needs, preferences and ambitions for vehicles in urban and long haul or specialist environments
- After Osaka, Scania & T&E agreed to separately consider the potential for different standards of vision, based on the "VECTO" categories defined in EU legislation of CO_2 emissions
- Apollo were commissioned by T&E to independently assess a draft proposal from Scania & advise overall on the potential of VECTO to support differentiation and identify any additional options, pros & cons

The base proposal

Vecto group	Chassis	Axle config	Max mass (tonnes)	Sub-Group	Cab type	Engine Power (kW)	Proposed DVS Standard
0	Rigid	4*2	>3.5 - <7.5	NA			Urban
1	All	4*2	7.5 - 10	NA			Urban
2	All	4*2	>10 - 12	NA			Urban
3	All	4*2	>12 - 16	NA			Urban
4	Rigid	4*2	>16	4-UD (Urban Delivery)	Either	<170	Urban
		4*2		4-RD (Regional Delivery)	Day	≥170	Urban
		4*2			Sleeper	≥ 170 and <265	Urban
		4*2		4-LH (Long haul)	Sleeper	≥265	Highway
5	Tractor	4*2	>16	5-RD	Day	All	Highway
		4*2			Sleeper	<265	Highway
		4*2		5-LH	Sleeper	≥265	Highway
6	Rigid	4*4	7.5 - 16	NA			Highway
7	Rigid	4*4	>16	NA			Highway
8	Tractor	4*4	>16	NA			Highway

Vecto group	Chassis	Axle config	Max mass (tonnes)	Sub-Group	Cab type	Engine Power (kW)	Proposed DVS Standard
9	Rigid	6*2	All	9-RD	Day	All	Urban
				9-LH	Sleeper	All	Highway
10	Tractor	6*2	All	10-RD	Day		Highway
				10-LH	Sleeper		Highway
11	Rigid	6*4	All	11 - S (Standard)*	All	≤370	Urban
				11 - EMS (high capacity)*	Sleeper	>370	Highway
12	Tractor	6*4	All	NA			Highway
13	Rigid	6*6	All	NA			Highway
14	Tractor	6*6	All	NA			Highway
15	Rigid	8*2	All	11 - S (Standard)*	All	≤370	Urban
				11 - EMS (high capacity)*	Sleeper	>370	Highway
16	Rigid	8*4	All	11 - S (Standard)*	All	≤370	Urban
				11 - EMS (high capacity)*	Sleeper	>370	Highway
17	Rigid	8*6 or 8*8	All	NA			Highway

* means a new sub-category not yet confirmed in Vecto

Areas of potential debate

Vecto group	Chassis	Axle config	Max mass (tonnes)	Sub-Group	Cab type	Engine Power (kW)	Proposed DVS Standard
0	Rigid	4*2	>3.5 - <7.5	NA			Urban
1	All	4*2	7.5 - 10	NA			Urban
2	All	4*2	>10 - 12	NA			Urban
3	All	4*2	>12 - 16	NA			Urban
4	Rigid	4*2	>16	4-UD (Urban Delivery)	Either	<170	Urban
		4*2		4-RD (Regional Delivery)	Day	≥170	Urban
		4*2			Sleeper	≥ 170 and <265	Urban
		4*2		4-LH (Long haul)	Sleeper	≥265	Highway
5	Tractor	4*2	>16	5-RD	Day	All	Highway
		4*2			Sleeper	<265	Highway
		4*2		5-LH	Sleeper	≥265	Highway
6	Rigid	4*4	7.5 - 16	NA			Highway
7	Rigid	4*4	>16	NA			Highway
8	Tractor	4*4	>16	NA			Highway

Vecto group	Chassis	Axle config	Max mass (tonnes)	Sub-Group	Cab type	Engine Power (kW)	Proposed DVS Standard
9	Rigid	6*2	All	9-RD	Day	All	Urban
				9-LH	Sleeper	All	Highway
10	Tractor	6*2	All	10-RD	Day		Highway
				10-LH	Sleeper		Highway
11	Rigid	6*4	All	11 - S (Standard)*	All	≤370	Urban
				11 - EMS (high capacity)*	Sleeper	>370	Highway
12	Tractor	6*4	All	NA			Highway
13	Rigid	6*6	All	NA			Highway
14	Tractor	6*6	All	NA			Highway
15	Rigid	8*2	All	11 - S (Standard)*	All	≤370	Urban
				11 - EMS (high capacity)*	Sleeper	>370	Highway
16	Rigid	8*4	All	11 - S (Standard)*	All	≤370	Urban
				11 - EMS (high capacity)*	Sleeper	>370	Highway
17	Rigid	8*6 or 8*8	All	NA			Highway

* means a new sub-category not yet confirmed in Vecto

ALL WHEEL DRIVE

All Wheel Drive

- All wheel drive HGVs tend to be specialist, niche vehicles
- Typically serious off-road capability
- Total sales volume small
- Trips in urban areas likely to be very small
- Overall exposure to risk very low
- May not be length constrained or traditional in design
  - Risk per unit of exposure is possibly, but not definitely, high
- Overall risk - low

Areas of potential debate

Vecto group	Chassis	Axle config	Max mass (tonnes)	Sub-Group	Cab type	Engine Power (kW)	Proposed DVS Standard
0	Rigid	4*2	>3.5 - <7.5	NA			Urban
1	All	4*2	7.5 - 10	NA			Urban
2	All	4*2	>10 - 12	NA			Urban
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		4*2			Sleeper	≥ 170 and <265	Urban
		4*2		4-LH (Long haul)	Sleeper	≥265	Highway
5	Tractor	4*2	>16	5-RD	Day	All	Highway
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		4*2		5-LH	Sleeper	≥265	Highway
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				9-LH	Sleeper	All	Highway
10	Tractor	6*2	All	10-RD	Day		Highway
				10-LH	Sleeper		Highway
11	Rigid	6*4	All	11 - S (Standard)*	All	≤370	Urban
				11 - EMS (high capacity)*	Sleeper	>370	Highway
12	Tractor	6*4	All	NA			Highway
13	Rigid	6*6	All	NA			Highway
14	Tractor	6*6	All	NA			Highway
15	Rigid	8*2	All	11 - S (Standard)*	All	≤370	Urban
				11 - EMS (high capacity)*	Sleeper	>370	Highway
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				11 - EMS (high capacity)*	Sleeper	>370	Highway
17	Rigid	8*6 or 8*8	All	NA			Highway

All >16t tractors Highway

* means a new sub-category not yet confirmed in Vecto

Analysis of risks: articulated vehicles

Vecto sub-group	ACEA % Emissions	Scania proposed DVS standard	Vecto Group London approximation	London % trips by N3 vehicles	% London move off hit at front fatalities	% London left turn hit at nearside fatalities
5-LH	62.8%	Highway	5 or 8	9%	14%	5%
5-RD	0.8%	Highway				
10-RD	0.1%	Highway	10, 12 or 14	37%	21%	0%
10-LH	9.7%	Highway				

- Trip data from London ANPR camera network used for HGV Safety Permit Impact Assessment. Casualty data from S19 (2009-2018) with enhanced data (smaller sample)
- Articulated vehicles
  - C.73% Emissions
  - 44% of trips in London
  - 35% of moving off pedestrian and cyclist fatalities in London
  - 5% of left turn cyclist and pedestrian fatalities in London
- High exposure but low risk = low to medium proportion of fatalities

Example, based on measured vehicle

- Scania P450
  - 6*2 44 tonne GVW
  - Power450 hp (335kw)
  - Sleeper cab
  - Vecto 10-LH
- Advertised as urban and regional application
- Use: national transportation of plant in UK – mixed highway, rural & urban
- VECTO "Long-haul" = Highway standard BUT London DVS 3 star
  - Vecto definition imperfect
  - 'Urban' standard ought to be feasible at least for 5/10-RD?
- Market forces may be functioning – in absence of regulation, market is demanding and producing vehicles at least some vehicles with good vision
  - How widespread is existing good practice in this type of tractor? No data
  - Publication of rating would enhance market forces encourage best practice in both vehicle design and operator vehicle selection
- What type of tractor involved in artic-VRU close proximity collisions? Large exposure of P Series equivalent or small exposure of S series equivalent? No data

Areas of potential debate

Vecto group	Chassis	Axle config	Max mass (tonnes)	Sub-Group	Cab type	Engine Power (kW)	Proposed DVS Standard
0	Rigid	4*2	>3.5 - <7.5	NA			Urban
1	All	4*2	7.5 - 10	NA			Urban
2	All	4*2	>10 - 12	NA			Urban
3	All	4*2	>12 - 16	NA			Urban
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14	Tractor	6*6	All	NA			Highway
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17	Rigid	8*6 or 8*8	All	NA			Highway

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LH criteria for 2/3 axle rigids (exc AWD)

Analysis of risks

Vecto sub-group	ACEA % Emissions	Scania proposed DVS standard	Vecto Group London approximation	London % trips by N3 vehicles	% London move off hit at front fatalities	% London left turn hit at nearside fatalities
3	?	Urban	3 or 6	5%	4%	0%
4-LH	1.9%	Highway	4 or 7	18%	21%	21%
4-UD	0.4%	Urban				
4-RD	7.9%	Urban				
9-RD	7.2%	Urban	9, 11, or 13	13%	18%	16%
9-LH	9.2%	Highway				

- 2 or 3 axle rigids:
  - C.26% of emissions
  - 36% of trips in London
  - 39% of moving off collisions in London
  - 37% of left turn collisions in London
- Risk roughly in line with exposure and exposure is significant - Rigids very important to get right
- Potentially, a significant proportion of rigids could fall into "Highway" vision category. Is this fair?

Potential issues

- Differentiation by power >265 and sleeper cab
- Do we get vehicles that might cause problems in significant numbers, e.g.
  - Low power 6*2 rigids with sleeper cabs used in urban distribution?
  - 6*2 construction vehicles e.g. tippers with sleeper cabs?
- Appears possible based on spec sheets but searches of used trucks suggest rare:
  - More supporting evidence would be good to give confidence
  - Would introducing a power threshold in 9-LH help?

MODEL RANGE

FMX11 6x2 Platform - Tag - Rear Air Suspension FM 62 TR1HAX

TRUCK USE

□ RC-ROUGH	Operating class on/off road
□ RC-SMOOT	Operating class highway
□ GARB-PRE	Garbage preparation
□ SWAPBODY	Swap body vehicle preparation
□ TIPP-PRE	Tipper vehicle preparation
■ UNIFORM	Basic platform vehicle

CORE COMPONENTS

□ CHH-HIGH	Chassis height high - N3 "On Road" chassis - For a specific loading height always check the unique BEP chassis drawing
□ CHH-MED	Chassis height medium - For a specific loading height always check the unique BEP chassis drawing
□ TA-HYSBS	Electro-hydraulic steered tag axle, with steering lock out at 38kph 8x2 models with rear steer will use the engine PTO to drive the steering pump, so will need an adapter.
□ TAG-FIXD	Tag axle - Fixed with twin tyres on tag axle
■ TAG-FIXS	Tag axle - Fixed with single tyres on tag axle
■ RADT-GR	Rear air suspension, 2 axles - 1 driven/1 tag
■ FMX-DAY	Day cab - with steel safety cage design Designed and built to Swedish impact and ECE R29 regulations
□ FMX-HSLP	Globetrotter cab - with steel safety cage design Designed and built to Swedish impact and ECE R29 regulations
□ FMX-SLP	Sleeper cab - with steel safety cage design Designed and built to Swedish impact and ECE R29

PACKAGES

□ DRIVEFM	Cab Pa
□ DRIVEFM+	Cab Pa
□ BEDFM	One be
□ AUDHIG	High Pc playing phone a dashbo
□ MEDIA	AM/FM USB an Speake 7" touch
□ MEDIADF	AM/FM USB an Speake 7" touch Dynafle support
□ MEDIANAV	AM/FM USB an Speake 7" touch Truck b
□ MEDIANDF	AM/FM USB an Speake 7" touch Truck b Dynafle

Areas of potential debate

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		4*2			Sleeper	≥ 170 and <265	Urban
		4*2		4-LH (Long haul)	Sleeper	≥265	Highway
5	Tractor	4*2	>16	5-RD	Day	All	Highway
		4*2			Sleeper	<265	Highway
		4*2		5-LH	Sleeper	≥265	Highway
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15	Rigid	8*2	All	11 - S (Standard)*	All	≤370	Urban
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				11 - EMS (high capacity)*	Sleeper	>370	Highway
17	Rigid	8*6 or 8*8	All	NA			Highway

* means a new sub-category not yet confirmed in Vecto

Construction v forestry/EMS etc

Analysis of risks

Vecto sub-group	ACEA % Emissions	Scania proposed DVS standard	Vecto Group London approximation	London % trips by N3 vehicles	% London move off hit at front fatalities	% London left turn hit at nearside fatalities
Non-EMS	?	Urban	15,16 or 17	10%	21%	58%
EMS		Highway				

- Construction/forestry vehicles account for only 10% of trips in London, but 21% - 58% of relevant collisions
- Low exposure * very high risk = high proportion of fatalities
- Very important to get the definition right

Potential problem

- 4 axle tippers, cement vehicles and other construction vehicles identified as very high risk vehicle in London – assumed same for other cities
- In same Vecto definition as industry identified vehicles
- Is the proposed "EMS" definition good enough to separate?
  - Sleeper cab & power >370 kw

Example based on Inspected Vehicle

- Scania P450
  - 32 tonne GVW 8*4 axle config
  - Power450 hp (335kw)
  - Day cab
  - Vecto 16-S by proposed definition = urban standard
- Passes test but need confidence that it applies more widely
- Are there any perverse incentives?
  - Power criteria: Increase in power could potentially allow reduced vision. Disincentive may be fuel cost but overall it is possible
  - Sleeper cab: Additional capex but also additional length which = reduced manoeuvrability in urban areas. Seems less likely

Conclusions

- Industry proposal for Vecto differentiation has strong potential at a technical level
- AWD: specialist vehicles
- Tractor: Not the highest risk area, potentially some benefit to extending Urban requirement to regional distribution (RD) definitions
- 4*2 & 6*2 rigids: Higher risk for safety. Classification is logical but further evidence around usage of regional and long haul categories in urban areas would improve confidence. Addition of an engine power criteria to Vecto 9 (as already present in Vecto 4) may help
- 6*4, 8*2 and 8*4: Critical area to get right for safety. Low exposure but high risk construction vehicles are central to case for direct vision (at least based on London data). Acknowledged that, without significant redesign, 'urban' standard could cause challenges for certain niche/heavy operations. Forthcoming Vecto "EMS" subcategory appears to work but more data on usage/collisions would improve confidence