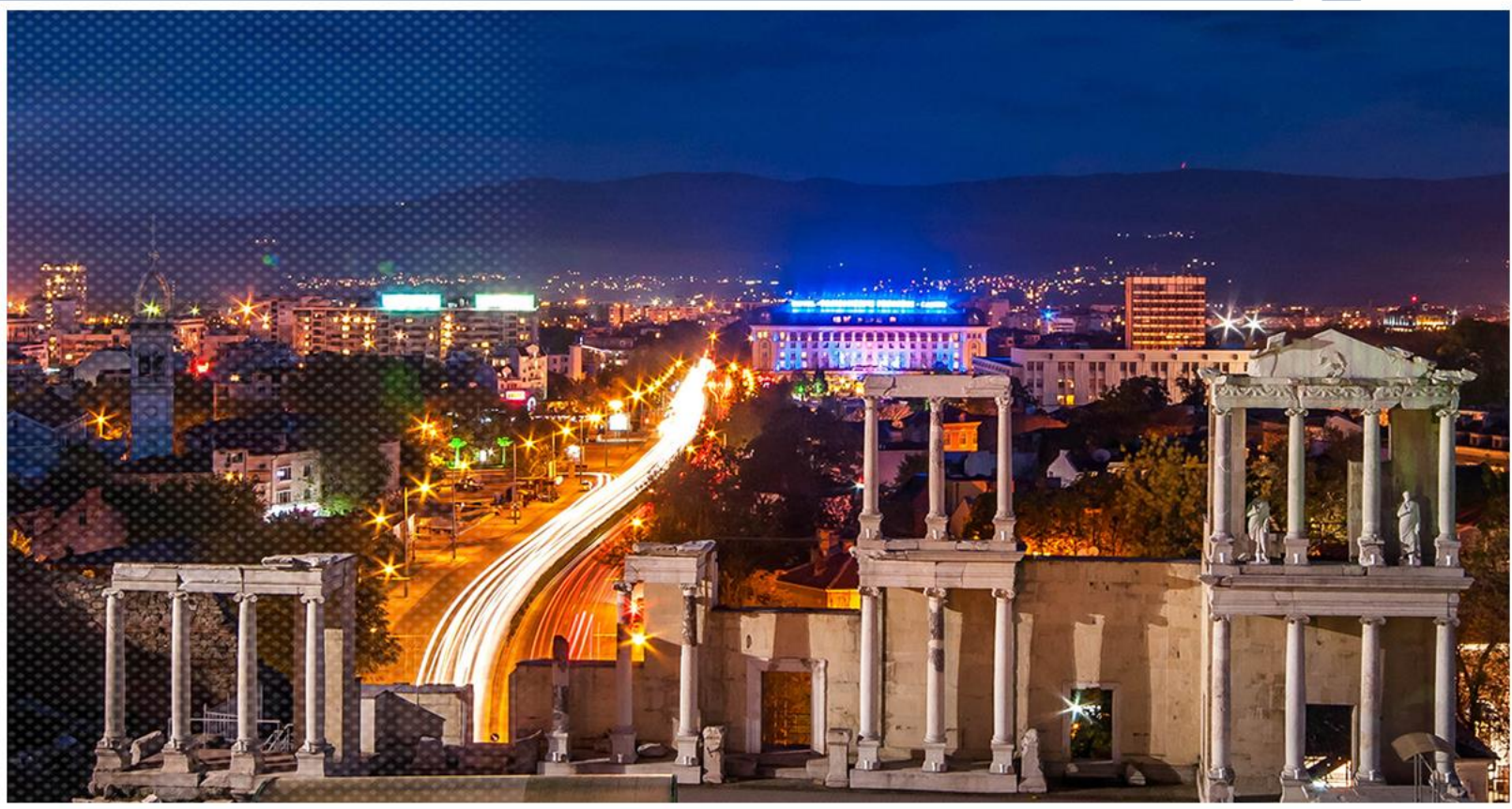


# Девета годишна конференция

19-20 септември 2023,  
Гранд хотел Пловдив, гр. Пловдив



БЪЛГАРСКА БРАНШОВА АСОЦИАЦИЯ  
**ПЪТНА БЕЗОПАСНОСТ**



**БЕЗОПАСНА ПЪТНА ИНФРАСТРУКТУРА**





БЪЛГАРСКА БРАНШОВА АСОЦИАЦИЯ  
ПЪТНА БЕЗОПАСНОСТ



# Buffers, Beginning & End Elements



Presented by

**Miles Boyd – Valtir LLC**

Director of Sales – UK and Central Europe



- Energy Absorbing End Terminals •



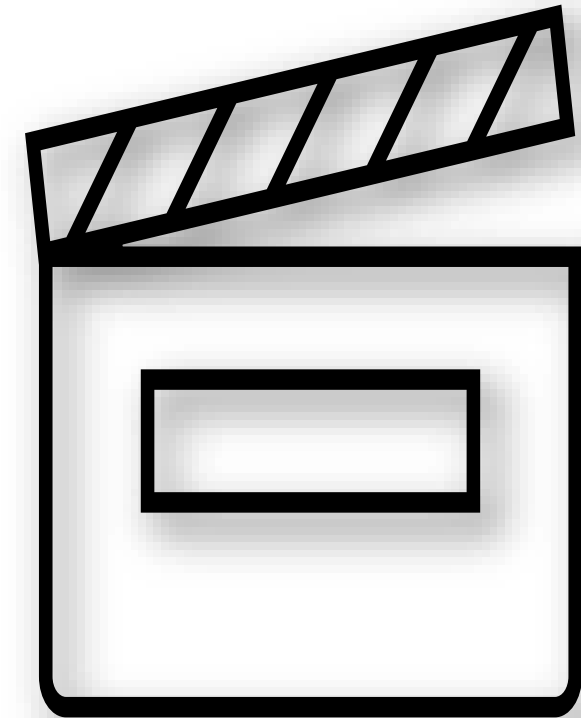
- Energy Absorbing Crash Cushions •



- Truck Mounted Attenuators •



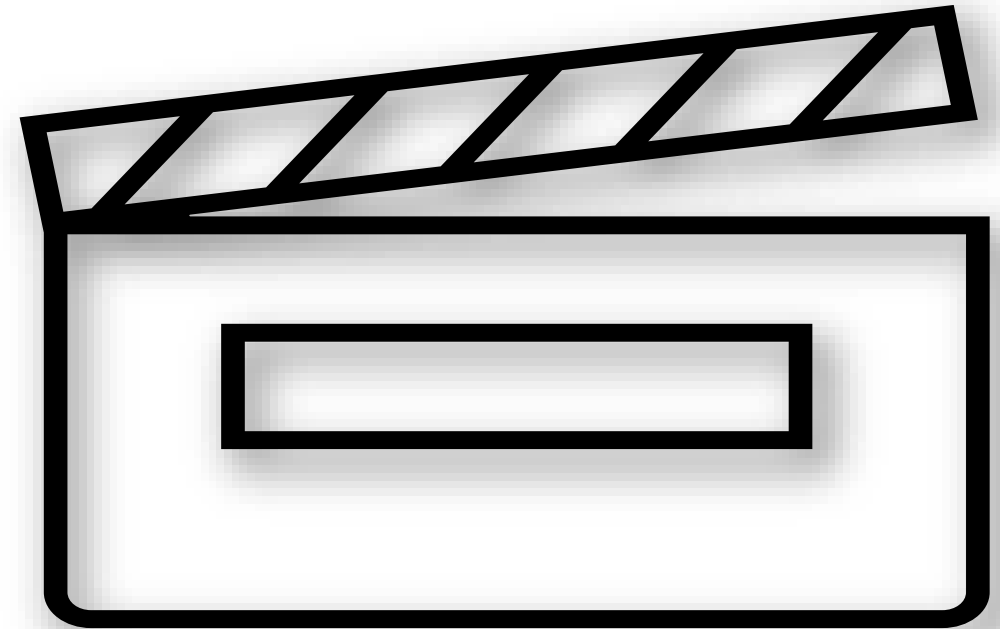
- Energy Absorbing End Terminals • **HISTORY - Fish Tail/Bullnose**
- Introduced in the early 60's.
- Developed to increase the impact area of the barrier
- & deflect errant vehicles.
- Quickly became considered a safety hazard.





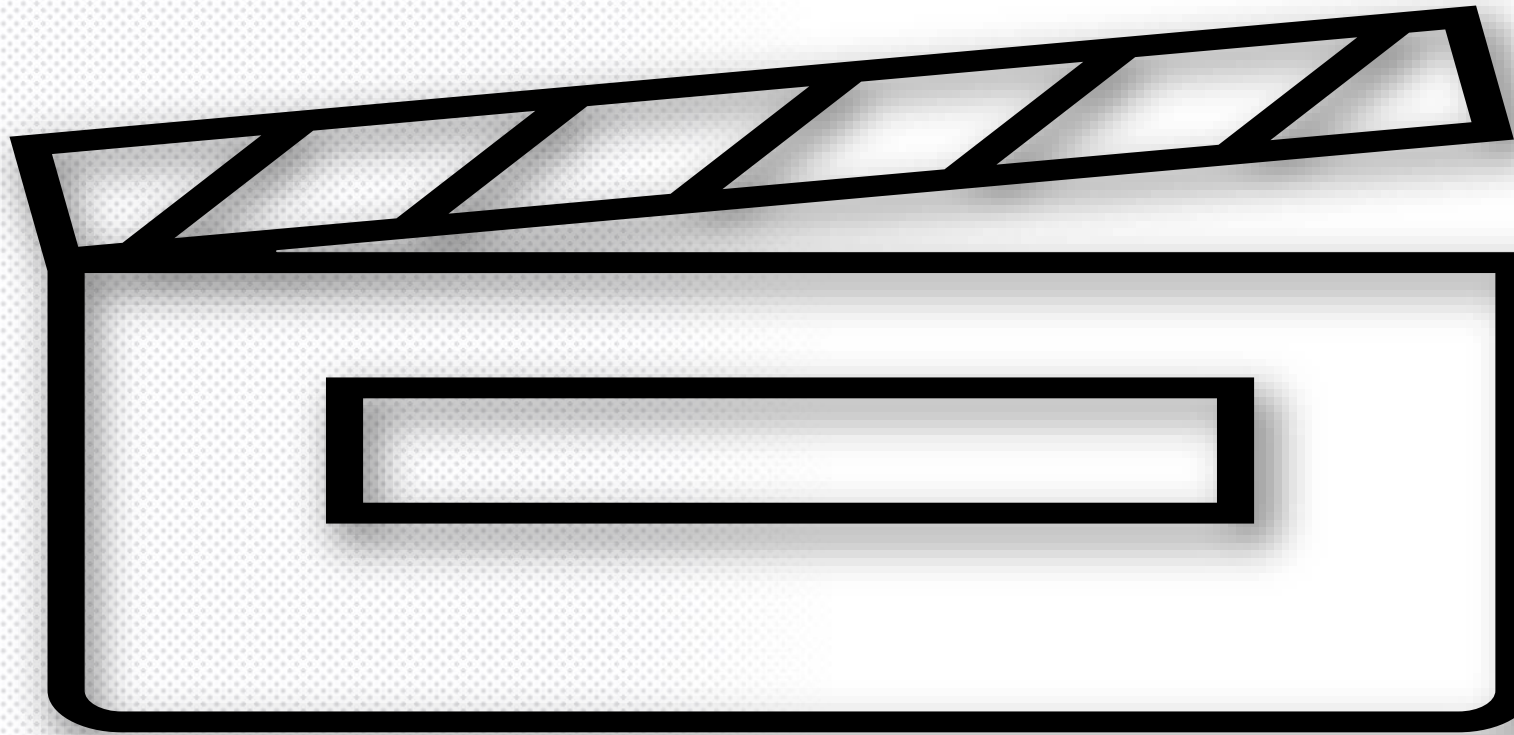
• Energy Absorbing End Terminals • **HISTORY - Ramp down**

- Introduced in the late 70's/early 80's.
- Developed to be an improvement on the fish tail end condition.
- Late 80's "ramping" studies began.





- Energy Absorbing End Terminals • **HISTORY - Ramp down**



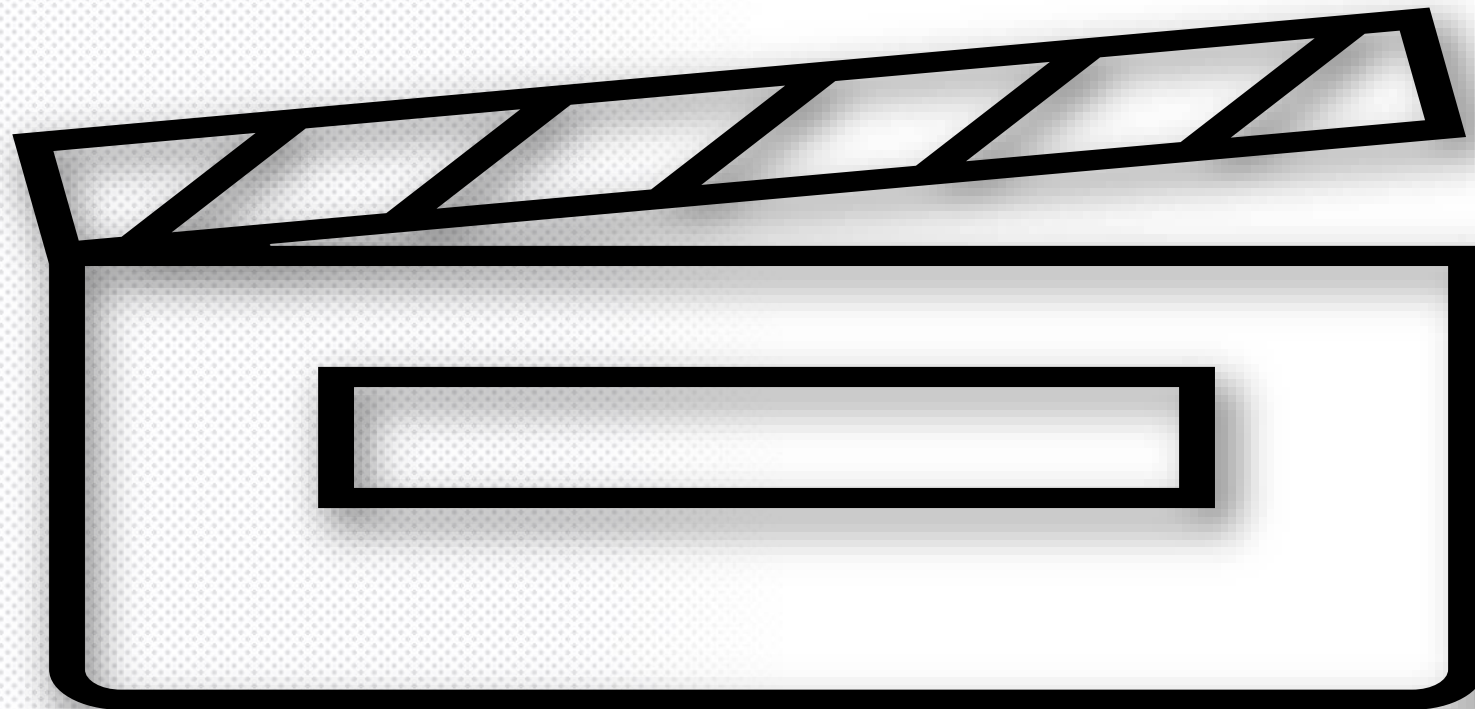


- Energy Absorbing End Terminals • **Current P4 & P2 Products**
- Designed to capture / re-direct errant vehicles.
- Designed to absorb impact energy.
- Designed to anchor the guardrail system.
- Designed to act as part of the guardrail system.
- Designed to be maintainable.
- Designed to be a visual hazard warning.





- Energy Absorbing End Terminals • Current P4 & P2 Products

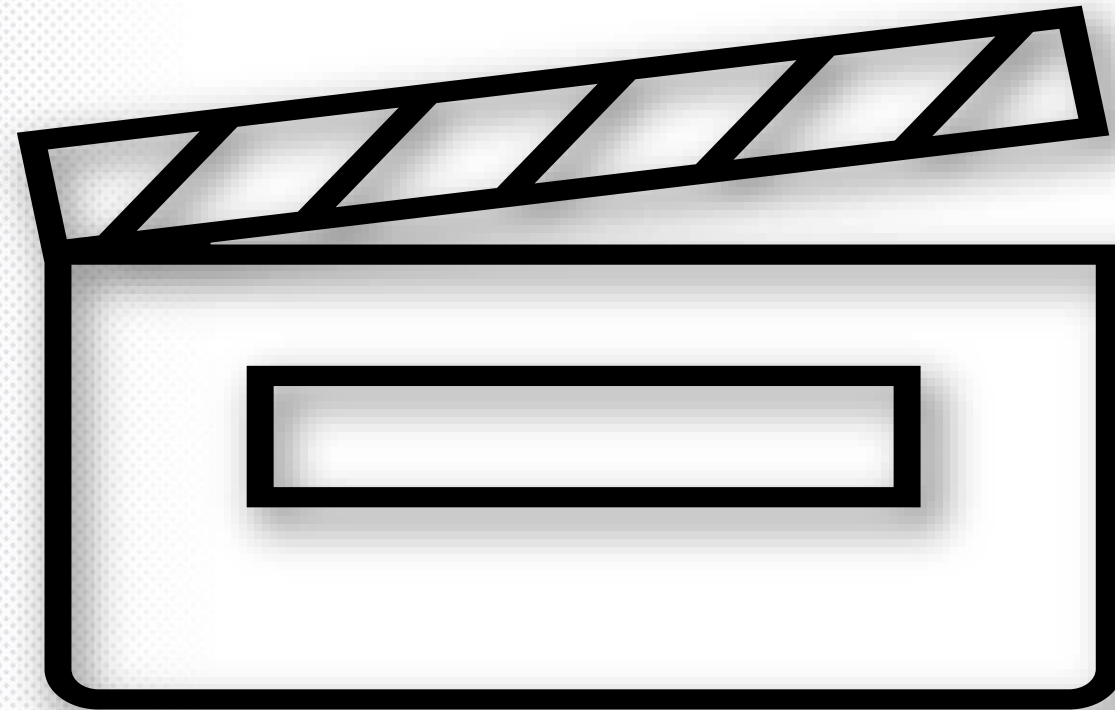






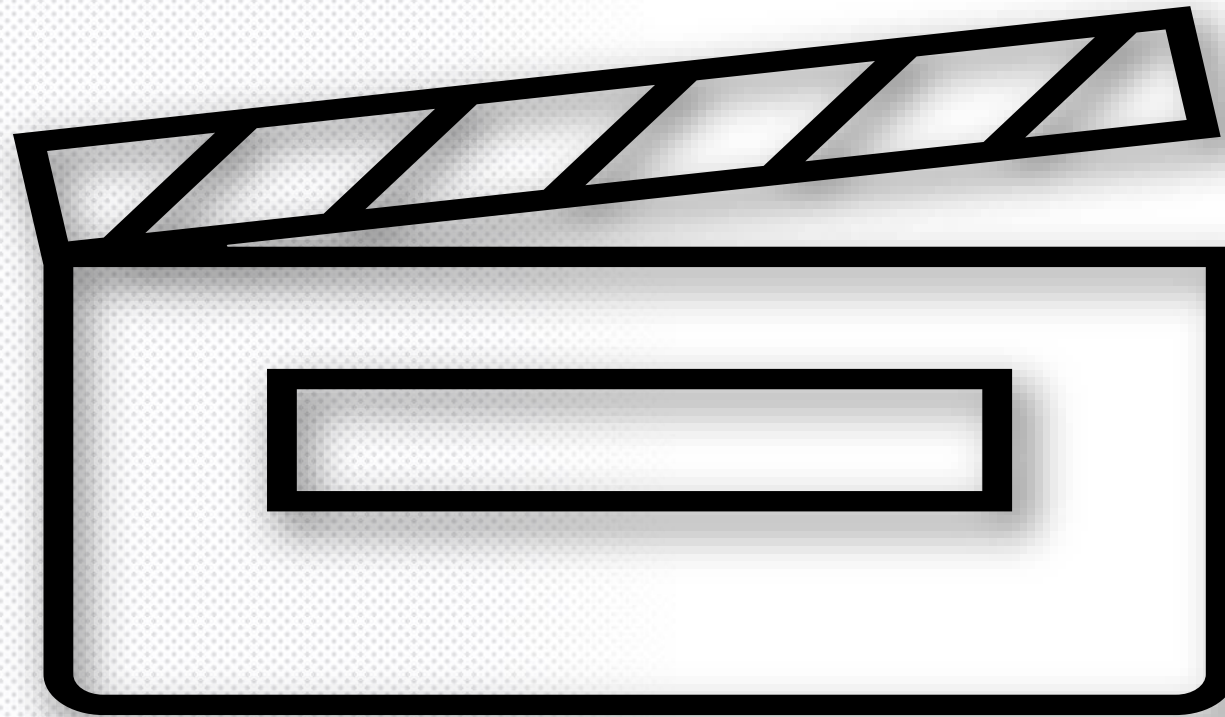
- Energy Absorbing End Terminals • **Current P4 & P2 Products**

- Capture / re-direct.
- Absorb energy
- Anchor the guardrail.
- Act as part of the guardrail system.



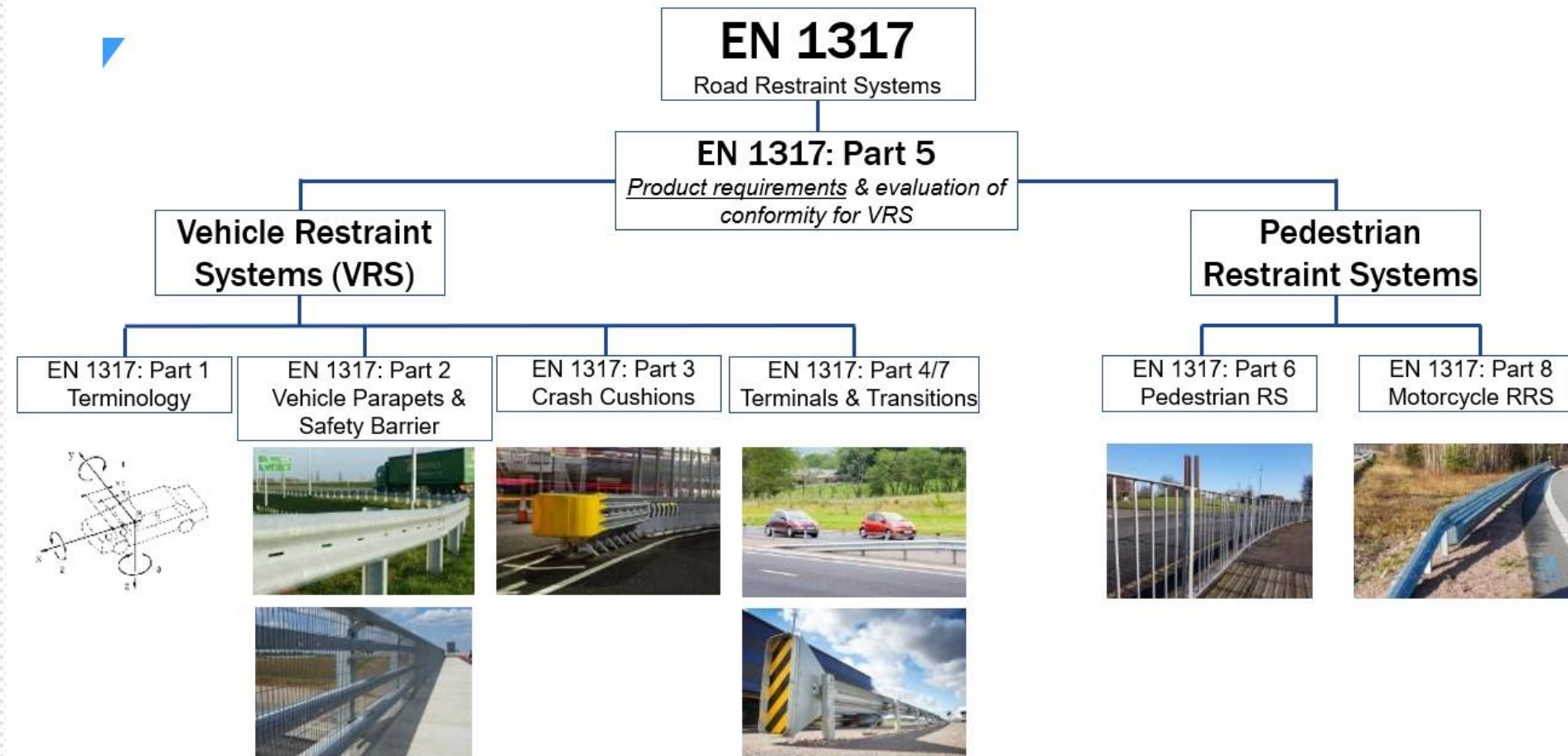


- Energy Absorbing End Terminals • **Current MASH & P4 Products**





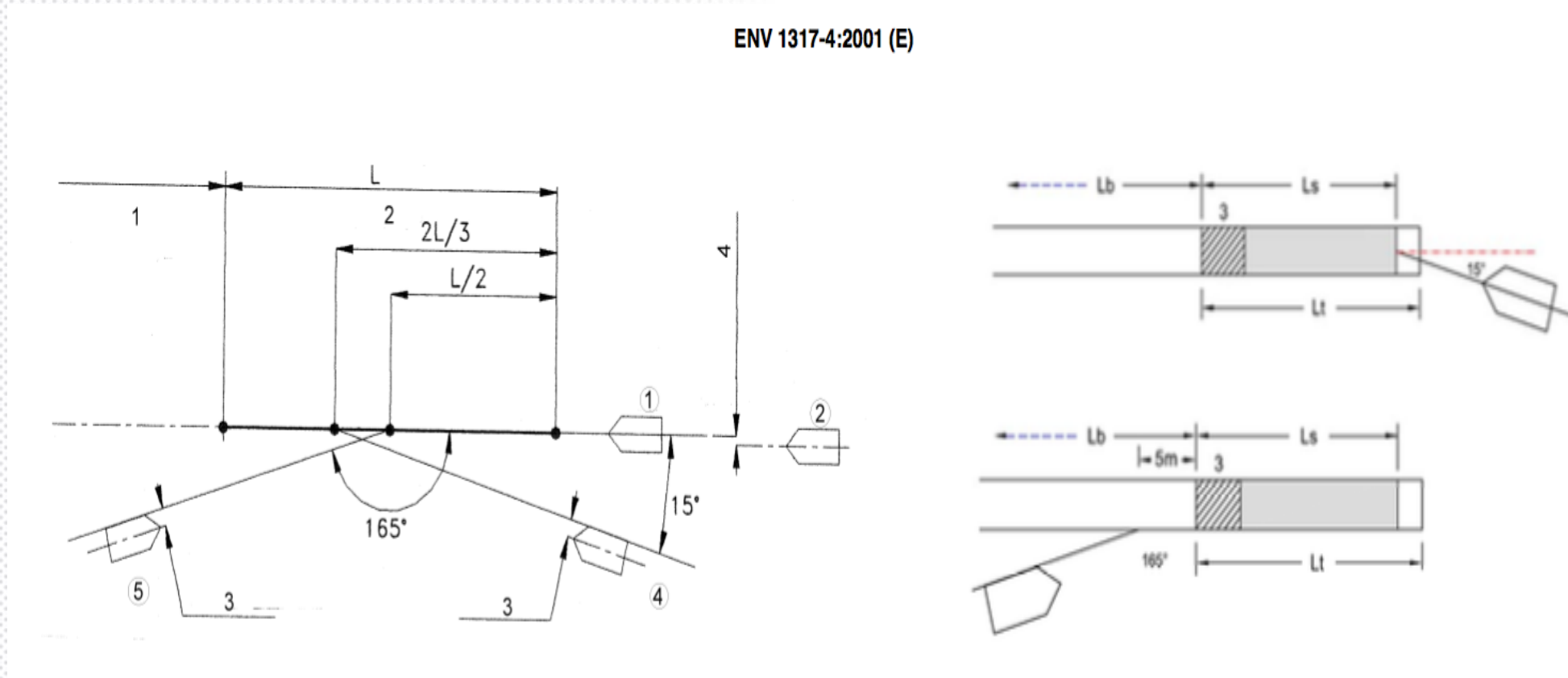
• Industry Progression & Governing Standards • EU, UK & EU Centric States





- Industry Progression & Governing Standards • **EU, UK & EU Centric States**
  - EN1317: Part 4 requires 4 tests.
  - EN1317: Part 7 (non-harmonized) requires an additional 2 tests.

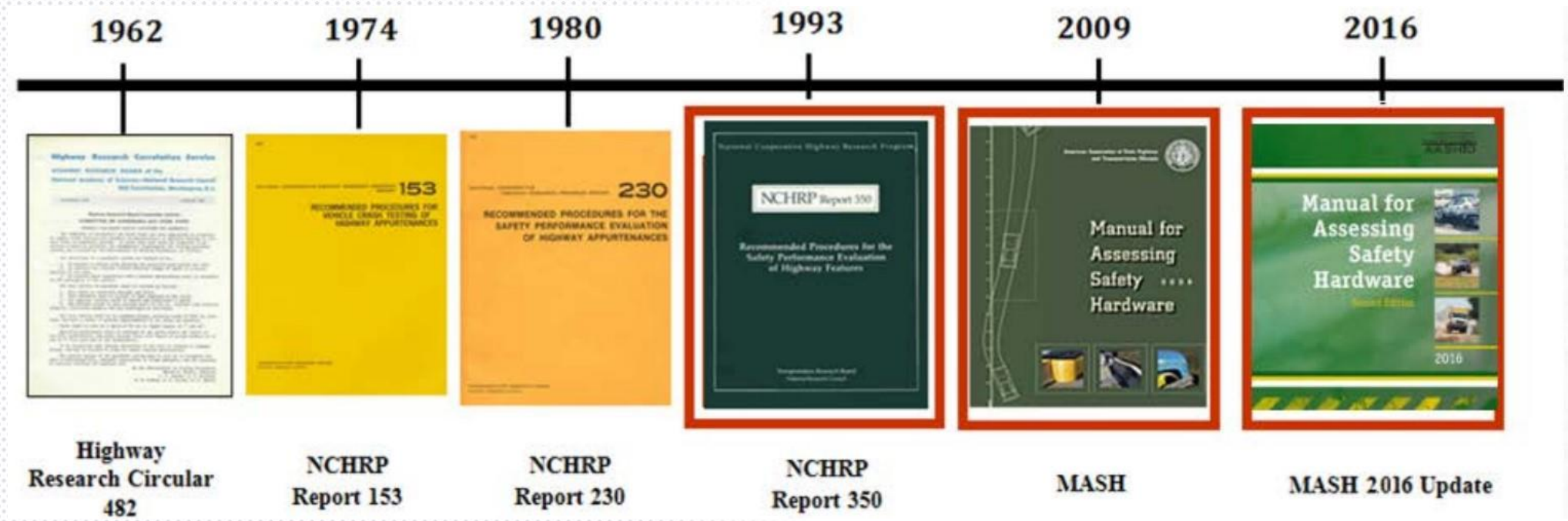
ENV 1317-4:2001 (E)





- Industry Progression & Governing Standards • US & US Centric States

### NCHRP 350 & M.A.S.H





- Energy Absorbing End Terminals • **Application & Consideration**

- Verge installation.
- Median (WAG / Road Crossing) installation.
- Bridge parapet / minor verge structures.
- Road speed.
- Site of increased accident activity.
- Guardrail connectivity & system compliance.
- Surrounding obstacles.
- Maintenance routine & financial parameters.





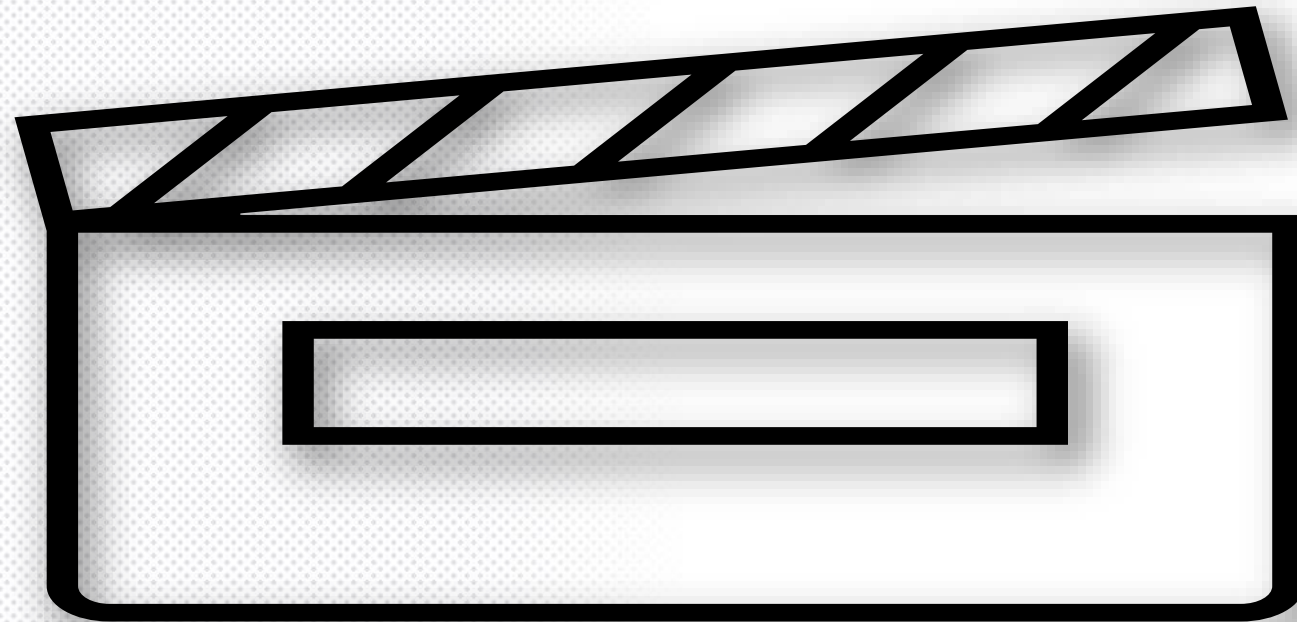
- Energy Absorbing Crash Cushions • **Current Products**

- Designed to capture / re-direct errant vehicles.
- Designed to absorb impact energy.
- Designed to be a **stand-alone** system.
- Designed to precede temp & perm structures.
- Designed to be maintainable.
- Designed to be a visual hazard warning.





- Energy Absorbing Crash Cushions • **Current Products**







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- Energy Absorbing Crash Cushions • **Current Products**



**CENTRA 110K Crash Cushion**  
**Test TC 5.3.110**  
**1500C 165° L/2 110 km/hr**





БЪЛГАРСКА БРАНШОВА АСОЦИАЦИЯ  
ПЪТНА БЕЗОПАСНОСТ



- Energy Absorbing Crash Cushions • **Current Products**



**CENTRA 110K Crash Cushion**  
**Test TC 1.3.110**  
**1500C 0° 110 km/hr Centered**







## • Energy Absorbing Crash Cushions • Application & Consideration

- Median / verge installation.
- Width of obstacle.
- Speed of road.
- Temporary or permanent.
- Length of system & space required.
- Obstacle connectivity & system compliance.
- Surrounding obstacles.
- Maintenance routine & financial parameters.

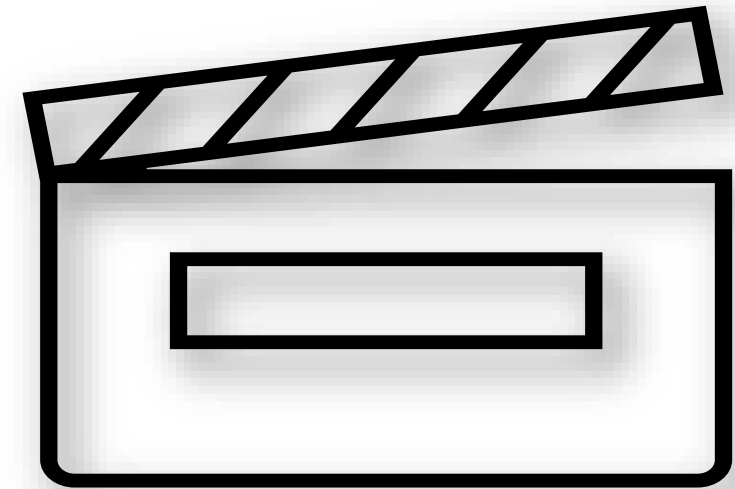
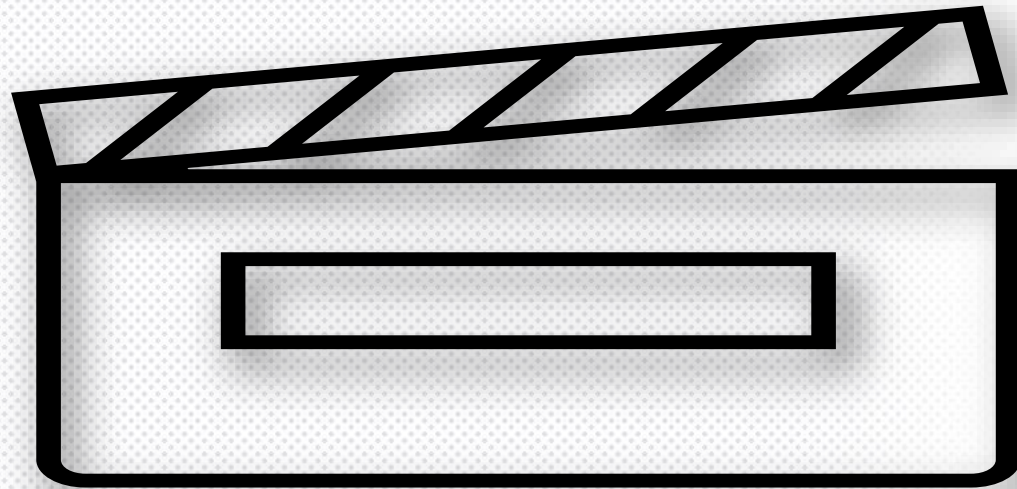


- Truck Mounted Attenuators • **Current Products**
- Introduced into Europe in the Early 90's.
- Designed to absorb impact energy.
- Designed to be permanently fixed to the vehicle.
- Designed to safeguard mobile workers.
- Designed to support TM works and lane closures.
- Designed to be repairable or sacrificial.
- Designed to be a visual hazard warning.



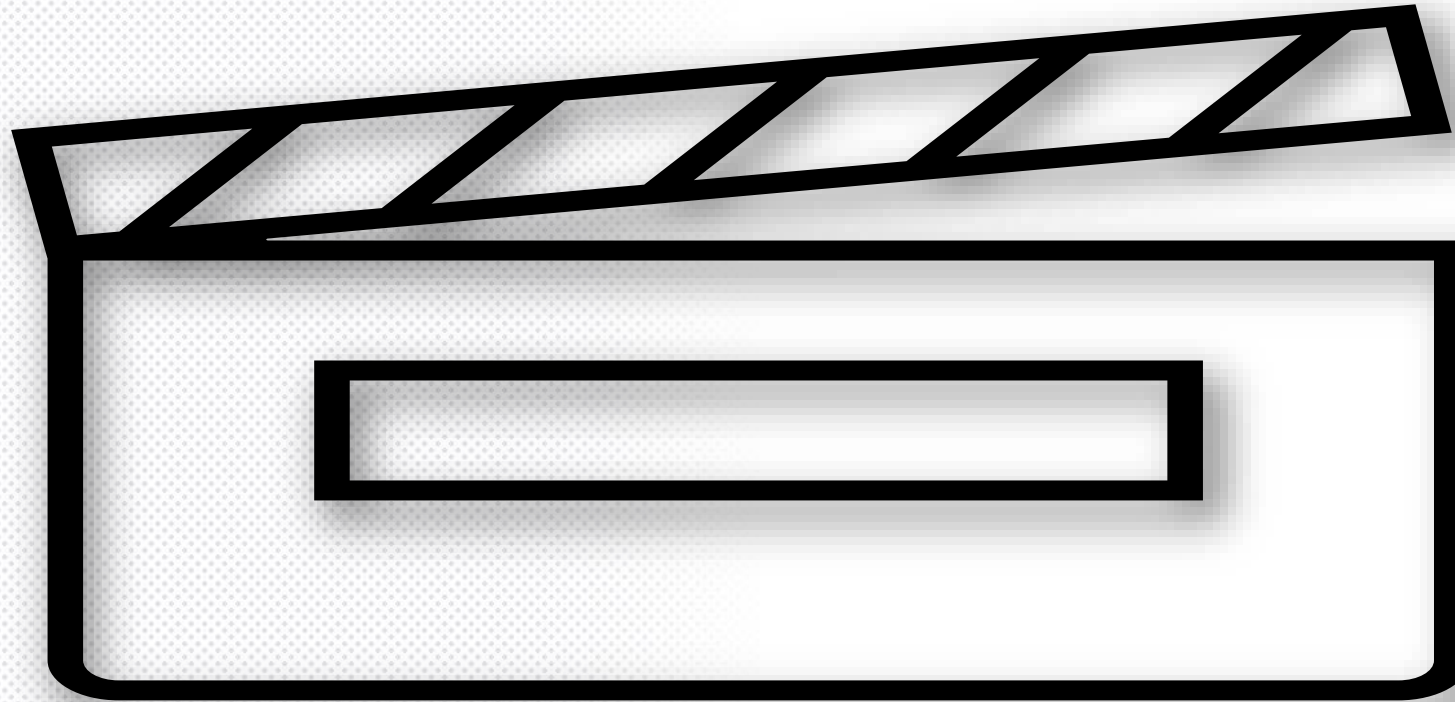


- Truck Mounted Attenuators • **Current Products**





- Truck Mounted Attenuators • **Current Products**



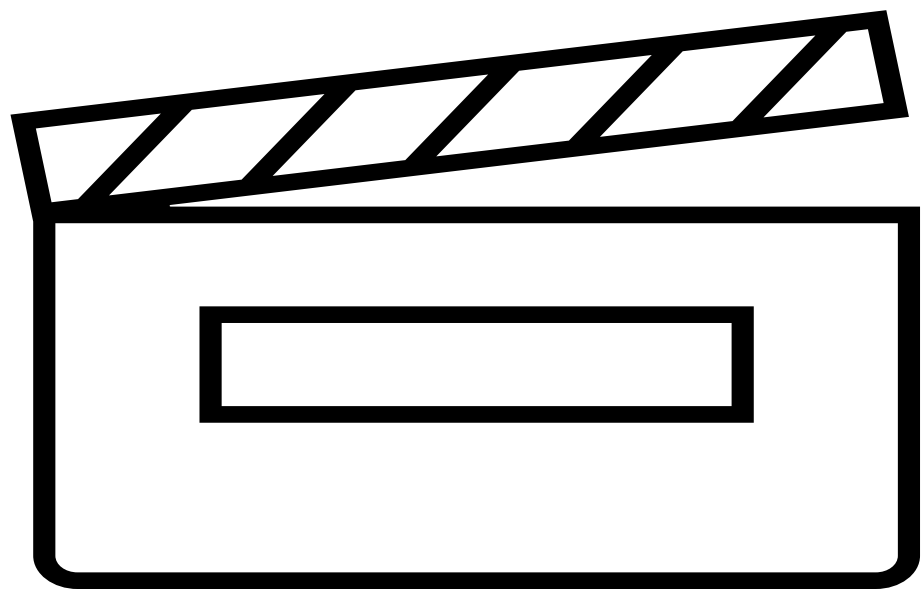
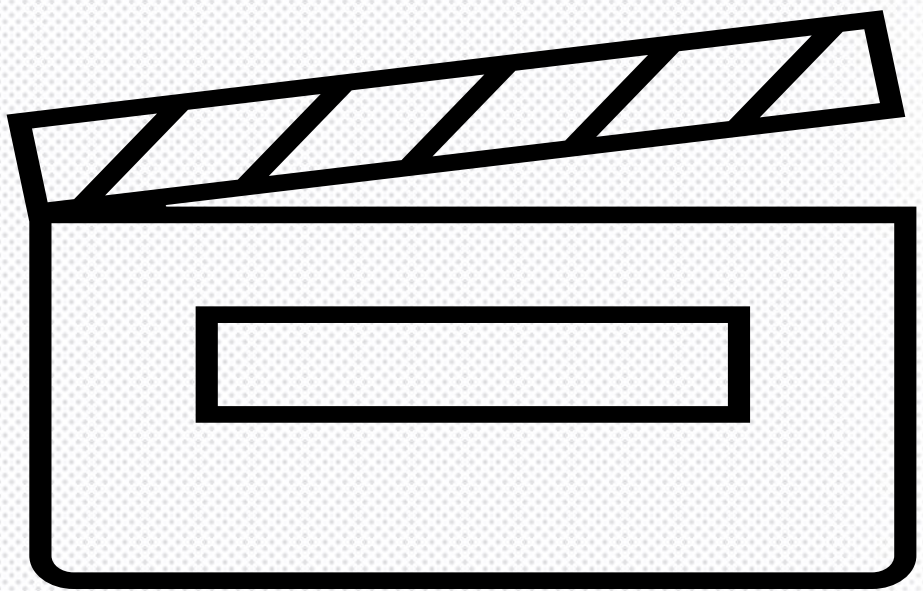
• Trailer Truck Mounted Attenuators (TTMA) • **Current Products**

- Introduced into Europe in the Early 2010's.
- Designed to absorb impact energy.
- Designed to be “hitched” to the vehicle.
- Designed to be low-cost.
- Designed to safeguard mobile workers.
- Designed to be maintenance free.





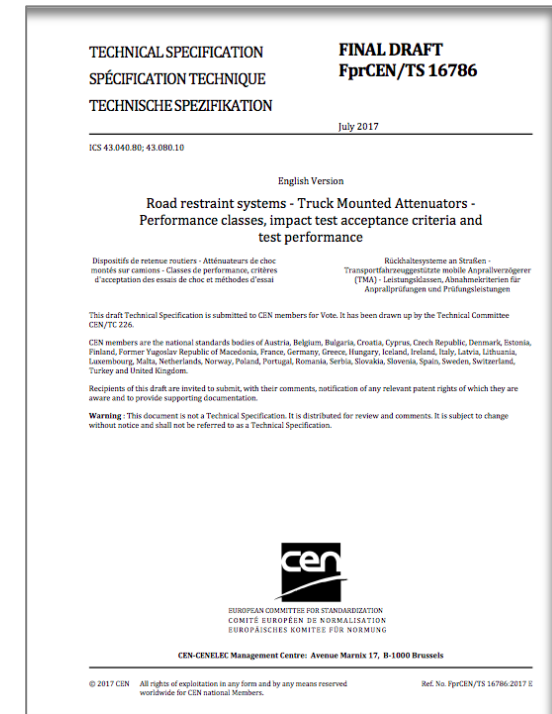
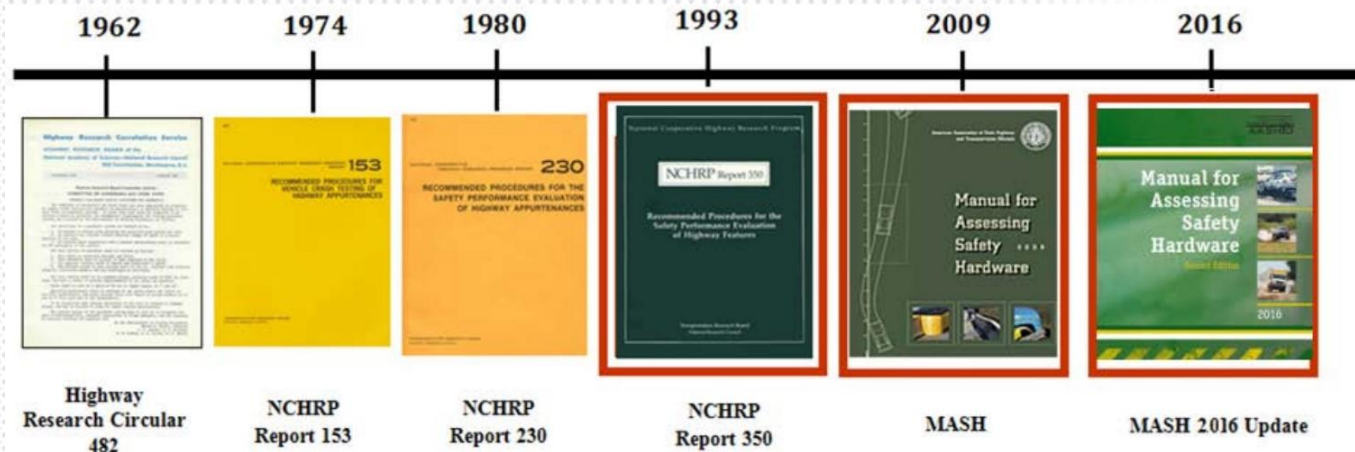
• Trailer Truck Mounted Attenuators (TTMA) • **Current Products**



- Industry Progression & Governing Standards • US & US Centric States

## European Technical Specification CEN/TS 16786

### NCHRP 350 & M.A.S.H





• Industry Progression & Governing Standards • US & US Centric States

- NCHRP 350 requires 4 tests (UK requires an additional test)

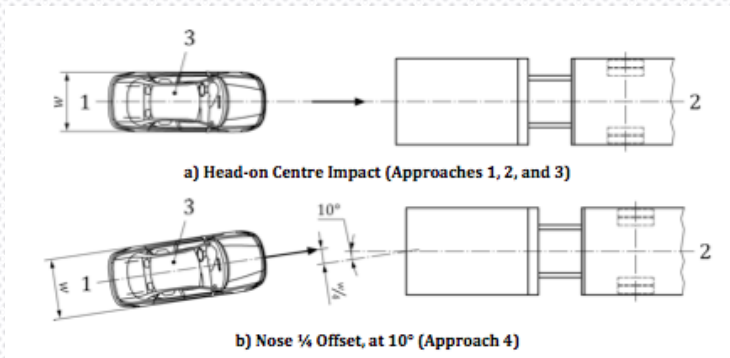


Table 5 — Speed Class 100 Test matrix

Speed Class	Test Designation	Impacting vehicle			Total mass of the whole system
		Total Test Mass kg	Impact Speed km/h	Approach angle and location of impact point, see Figure 1	
100	T-TMA100-1	900	100	head-on, centre	Maximum specified by the manufacturer
	T-TMA100-2	2 000	100	head-on, centre	10 000 kg or maximum specified by the manufacturer if less than 10 000 kg, or minimum specified by the manufacturer if greater than 10 000 kg
	T-TMA100-3 Additional Test	2 000	100	head-on, centre	Maximum specified by the manufacturer
	T-TMA100-4	2 000	100	nose 1/4 offset, at 10°	Minimum specified by the manufacturer



## • Truck Mounted Attenuators • Applications & Consideration

- User Speeds of roads and impact risk to operators.
- TMA or TTMA (trailer-mounted TMA).
- 10,000Kg benchmark for testing
- Lighter vehicles will roll on further.
- Heavier vehicles will increase deceleration forces
- Requirement for automatic Air-Brake.





## • Truck Mounted Attenuators • European Usage

- UK (Mandatory)
- Ireland (Mandatory)
- Austria (Best Practice)
- Belgium (Mandatory)
- Bulgaria
- Croatia
- Denmark
- Finland
- Hungary
- Italy (Best Practice)
- Nederland's (Best Practice)
- Poland (Best Practice)
- Slovenia
- Switzerland (Best Practice)





**Thank you for your time – any questions ?**