Advanced Emergency Braking System

Justification for EVSC as Obligation (illustrated on Kamm's Circle)



(MAN)

Forces at wheel





Index	Explanation	Index	Explanation
к	Kamm's circle	Fv	Vertical tire force
Fu	Tangential tire force	FRE	Resulting force on surface
Fs	Lateral tire force	F _{RR}	Resulting force in space

Source: BMW Group

MAN Truck 8	& Bus AG
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Influence of combined forces



Kamm's Circle.



Sum total of forces not exceeded:

Sum total of forces exceeded: Wheel slips on a dry surface The centrifugal forces generated in all steering maneouvres are taken up and absorbed by the lateral guidance force of the wheels. Kamm's Circle is a model to illustrate the distribution of forces on the wheel and the interaction between dynamic driving forces and friction.

The edge of the circle represents the friction limit of the tyre, acceleration and lateral guidance forces being shown as arrows. The force vector resulting from the addition of these two factors shows the overall level of forces acting on the tyres. Wherever this arrow extends beyond the circle, the force exerted is greater than the friction built up by the tyres, meaning that the car will lose its grip on the surface.

Maximum use of forces

- on a dry surface
- 2 on a wet surface
- On ice

→ Sum total of power-transmitting forces

Source: BMW Group

Influence of combined forces





 \rightarrow vehicle under instable conditions

Influences of EVSC



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Justifications supporting EVSC

- Where ABS simply brakes the wheels such to avoid wheel locking, the EVSC is able to brake the wheels separately to turn an unstable situation into a stable situation.
- Where an ABS simply decelerates the vehicle, the EVSC is able to reduce the yaw rate and hence increase the vehicle stability
- Where an ABS simply brakes the wheels "blindly" of a tractor/trailer combination, the EVSC is able to improve combination stability by "stretching" the combination
- Vehicles fitted with only AEBS + ABS could fulfil the AEBS requirements in the approval test conditions, but would decrease the vehicle stability when trying to achieve the same performances in emergency conditions in the real world. Vehicles fitted with AEBS + ABS + EVSC could mitigate the braking distances in emergency conditions in the real world but would improve the vehicle stability hence avoid additional danger to the other road users (jack-knife and roll-over are avoided).

