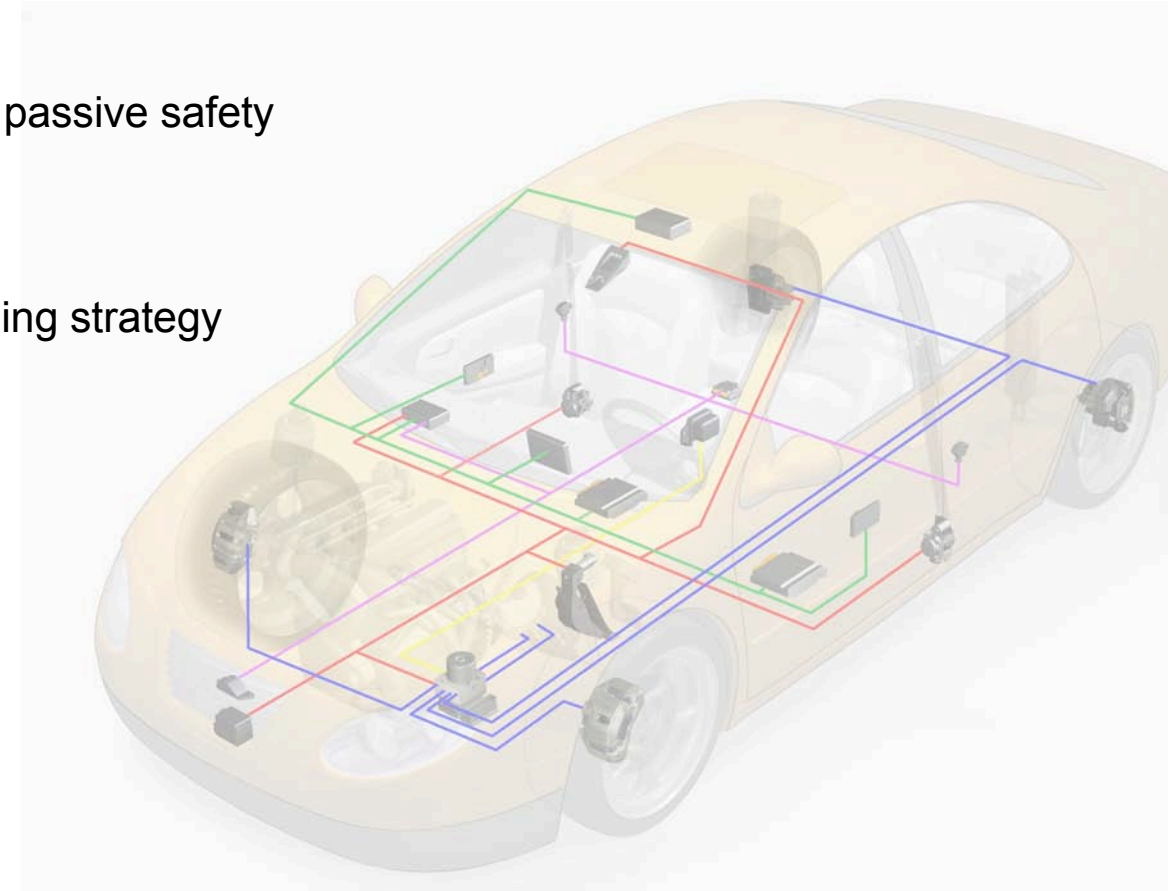
Intelligent Braking - The Seeing Car Improves Safety on the Road

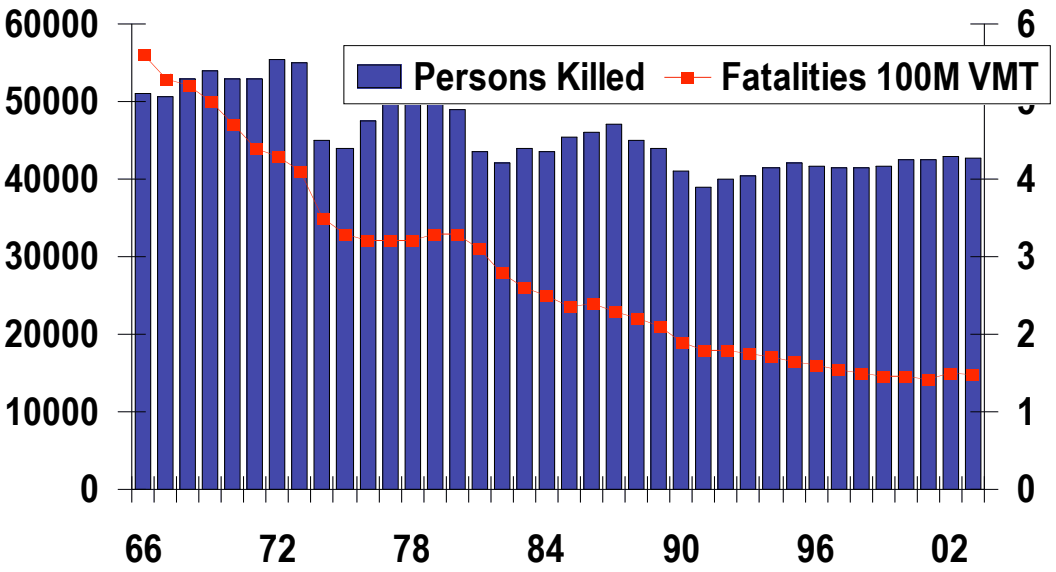
Agenda

APIA – Continental's Active Passive Integration Approach

- Motivation and Objectives
- Networking and integration of active and passive safety
- APIA Safety Strategy
- Reduction of stopping distance and warning strategy
- Reversible passive safety for precrash
- Test results
- Testride video
- Summary



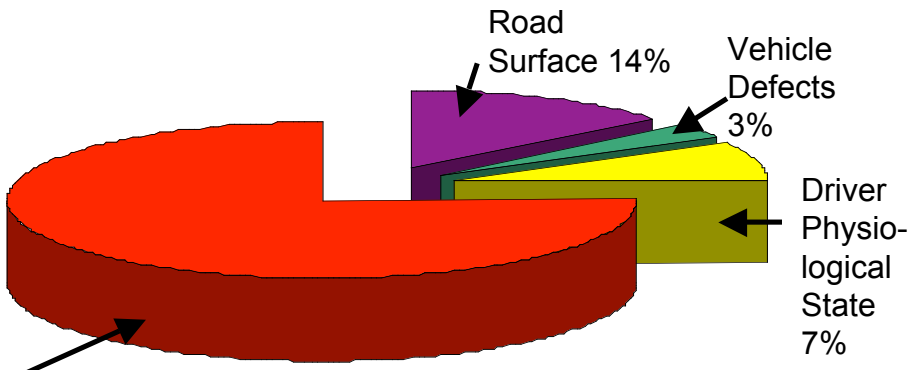
APIA – Motivation



The Safety Gains of Years Past Are Leveling Off

DOT Goal:

1.0 fatalities/100M Vehicle Miles Traveled (VMT)



Driving Task Error are most significant for injuries and fatalities 76%

Driver Behavior is Most Significant Opportunity to Reduce Injuries and Death

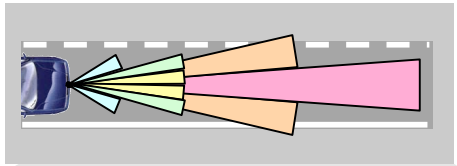
Source: 2002 FARS (Fatality Analysis Reporting System, NHTS

APIA

APIA

- assists driver to cope with driving task errors
- assists driver in hazardous driving situations
- assists driver already within reaction time
- assists driver to avoid crashes
- assists driver to reduce accident severity
- assists driver to mitigate injuries
- assists driver to avoid fatalities

APIA – Safety Control Module



Continental TEMIC

DAS
environmental sensors

safety
control module

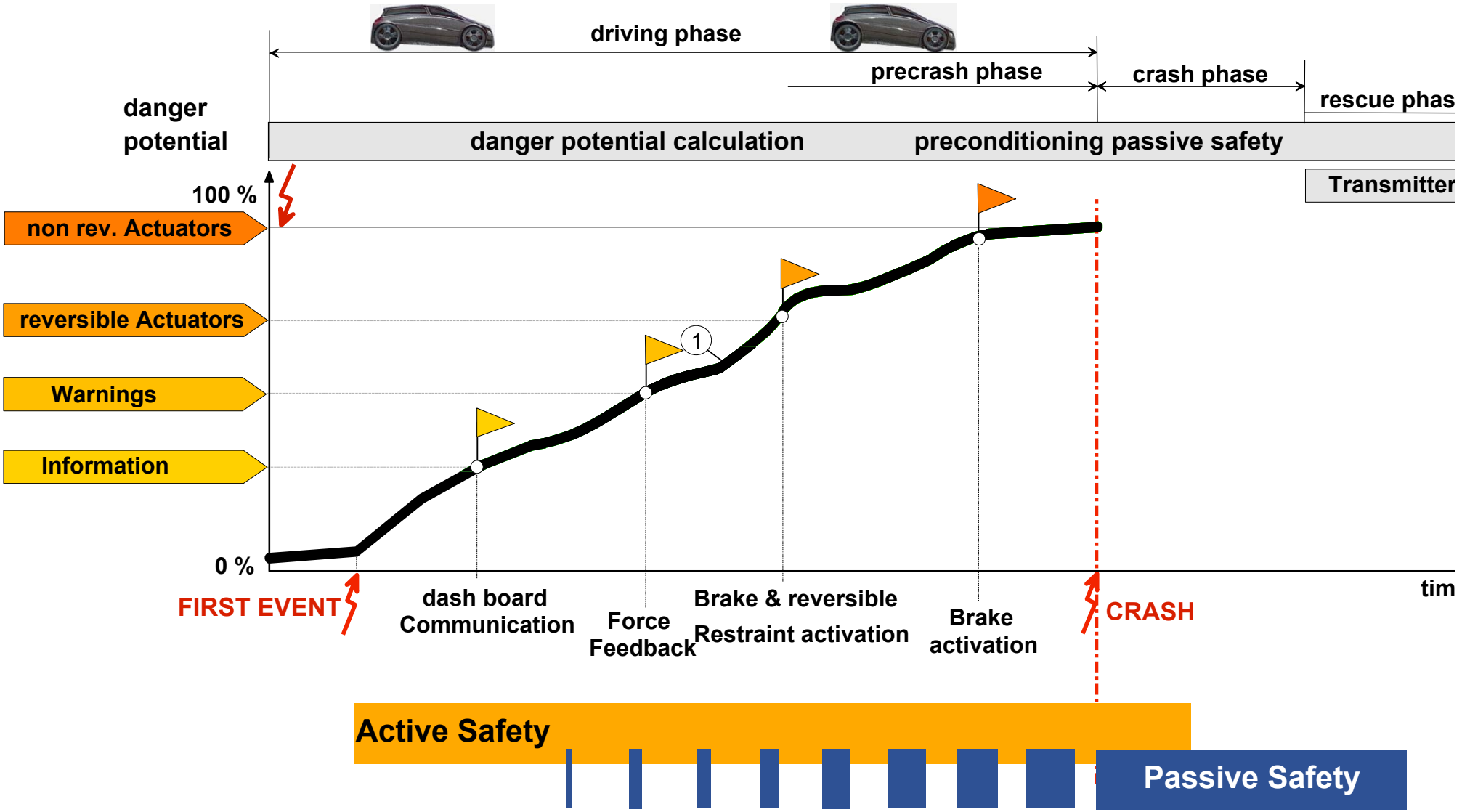
passive
safety

Continental TEMIC

active
safety

Continental TEVES

APIA – Danger Potential



APIA – Safety Strategy

Active Safety

- visual warning
- haptical warning
- prefill
- prebrake
- extended brake assist

Passive Safety

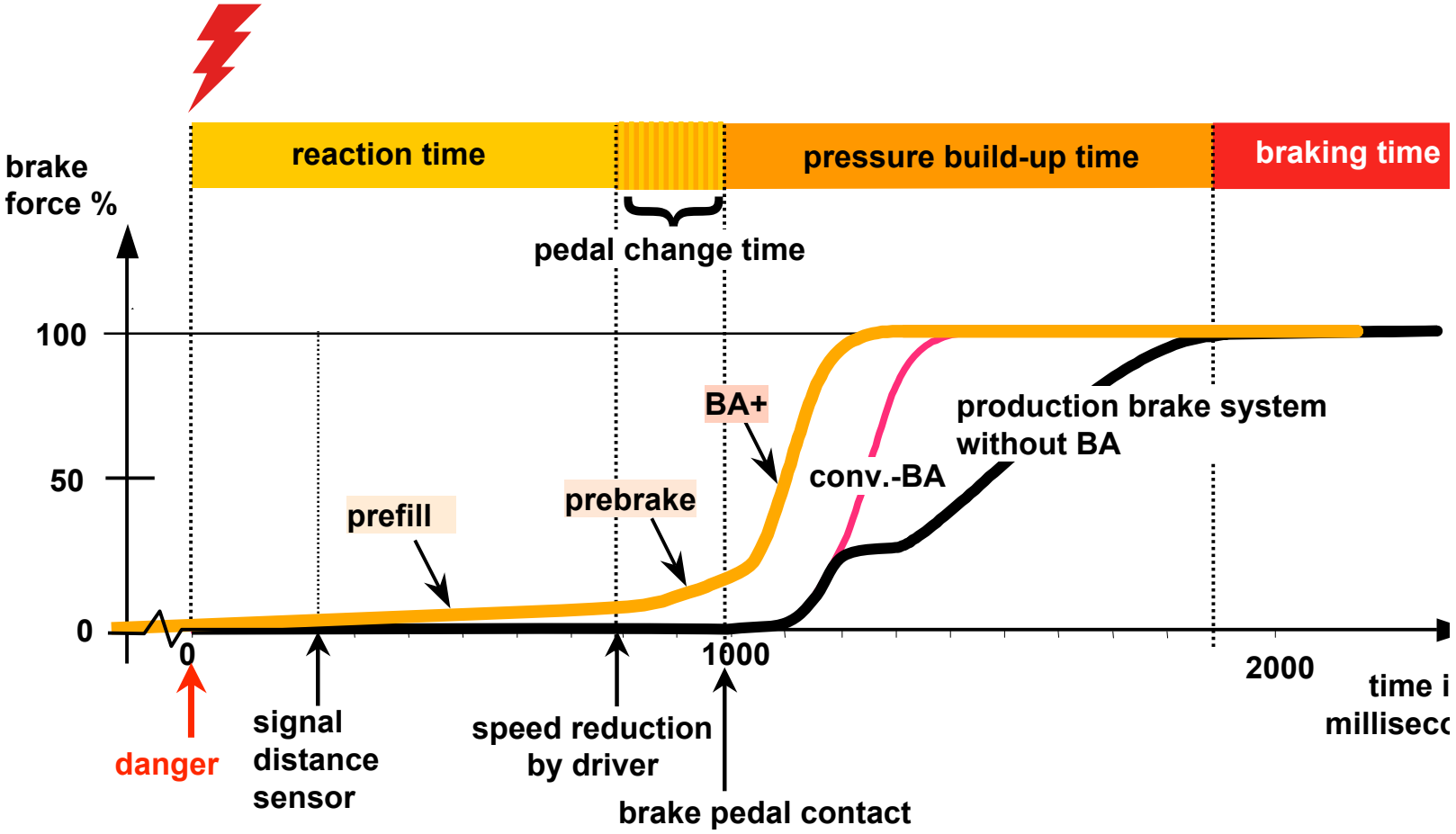
- belt slack reduction
- closing of sunroof & windows
- effective fastening of passengers
- anti-submarining
- positioning of passengers
- smart airbag

safety control module

APIA - Animation Video

APIA – Active Safety Strategy

- prefill
- prebrake
- extended brake assist BA+



APIA – Test Scenario

- Test assumptions
  - BMW E46, **MK60E5**
  - initial speed: **100kph**
  - **maximum danger**, so an emergency brake is necessary

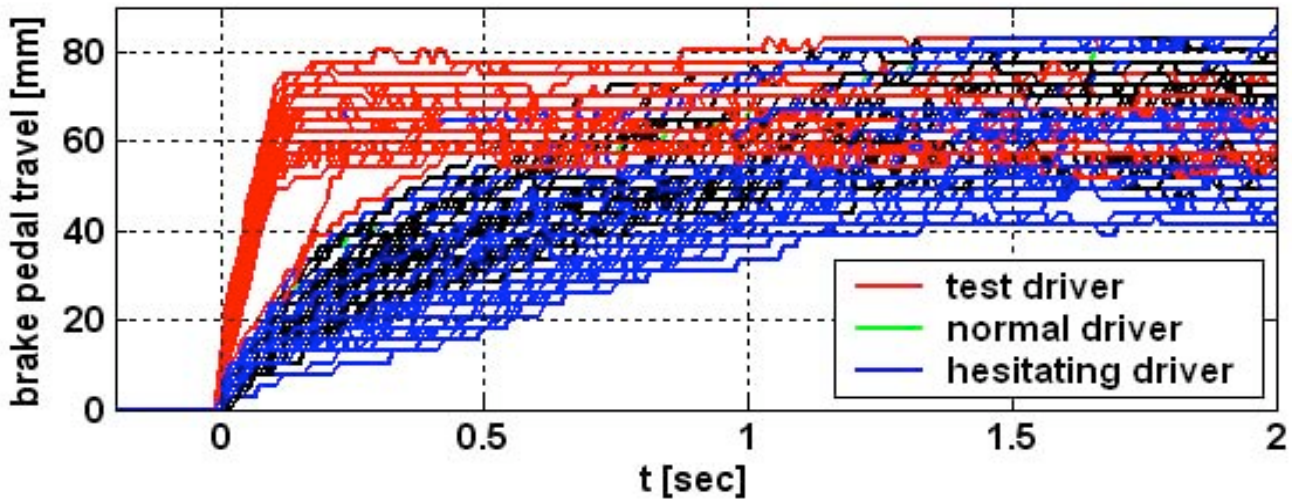
- Test types – system support

	des. brake pressure [bar]	**Prefill**	**Prebrake**	**BA+**
Type I	(0-0-0)	—	—	—
Type II	(4-4-4)	●	—	—
Type III	(4-4-120)	●	—	●
Type IV	(4-17-17)	●	●	—
Type V (APIA)	(4-17-120)	●	●	●

APIA – Test Driver Profiles

- Driver brake profiles

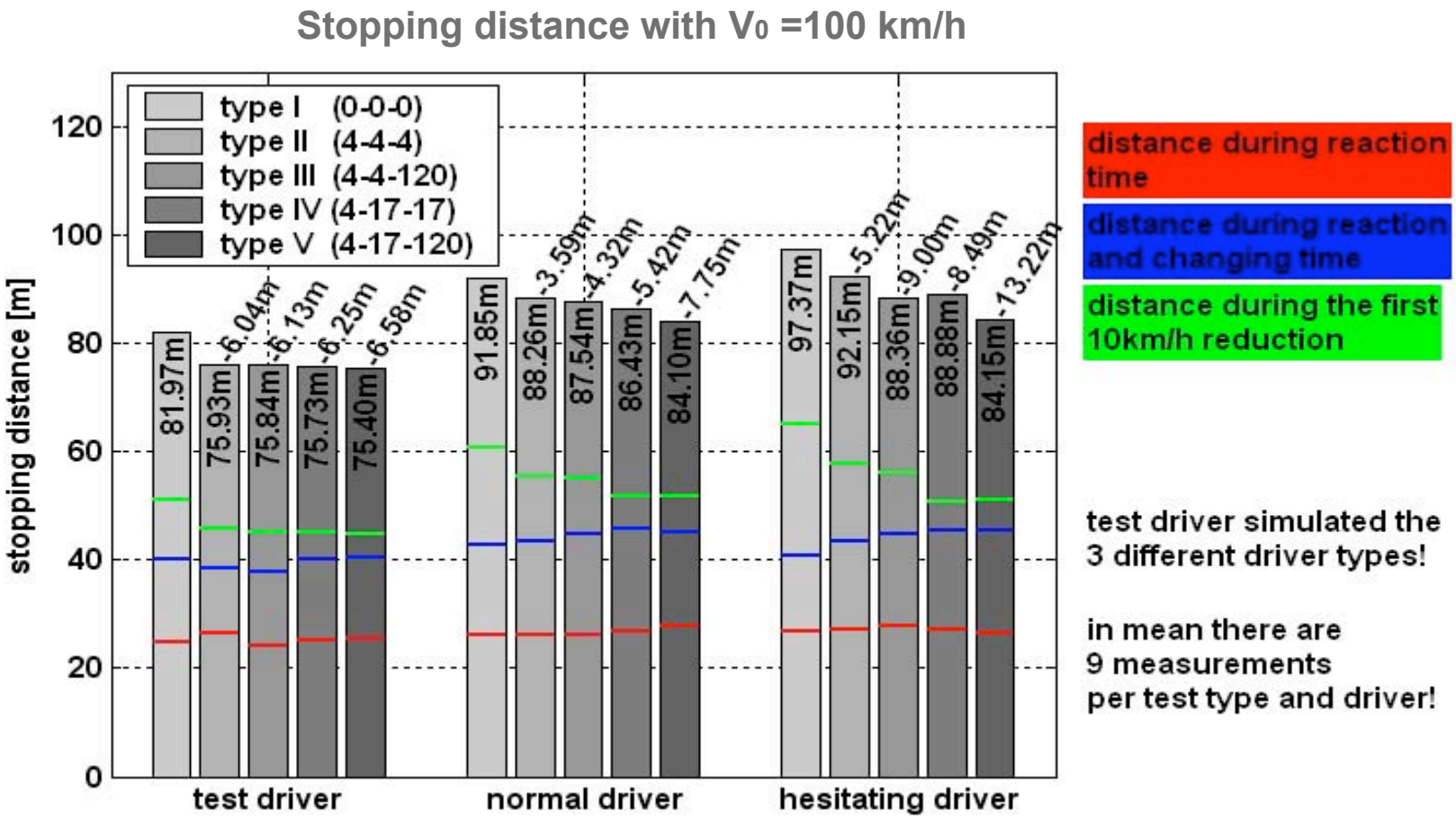
	reaction time	pedal changing time	pressure buildup
test driver	0.89sec	0.51sec	step
normal driver	0.93sec	0.64sec	linear
hesitating driver	0.96sec	0.62sec	plateau



Excel

APIA - Test Results
Reduction of Stopping Distance

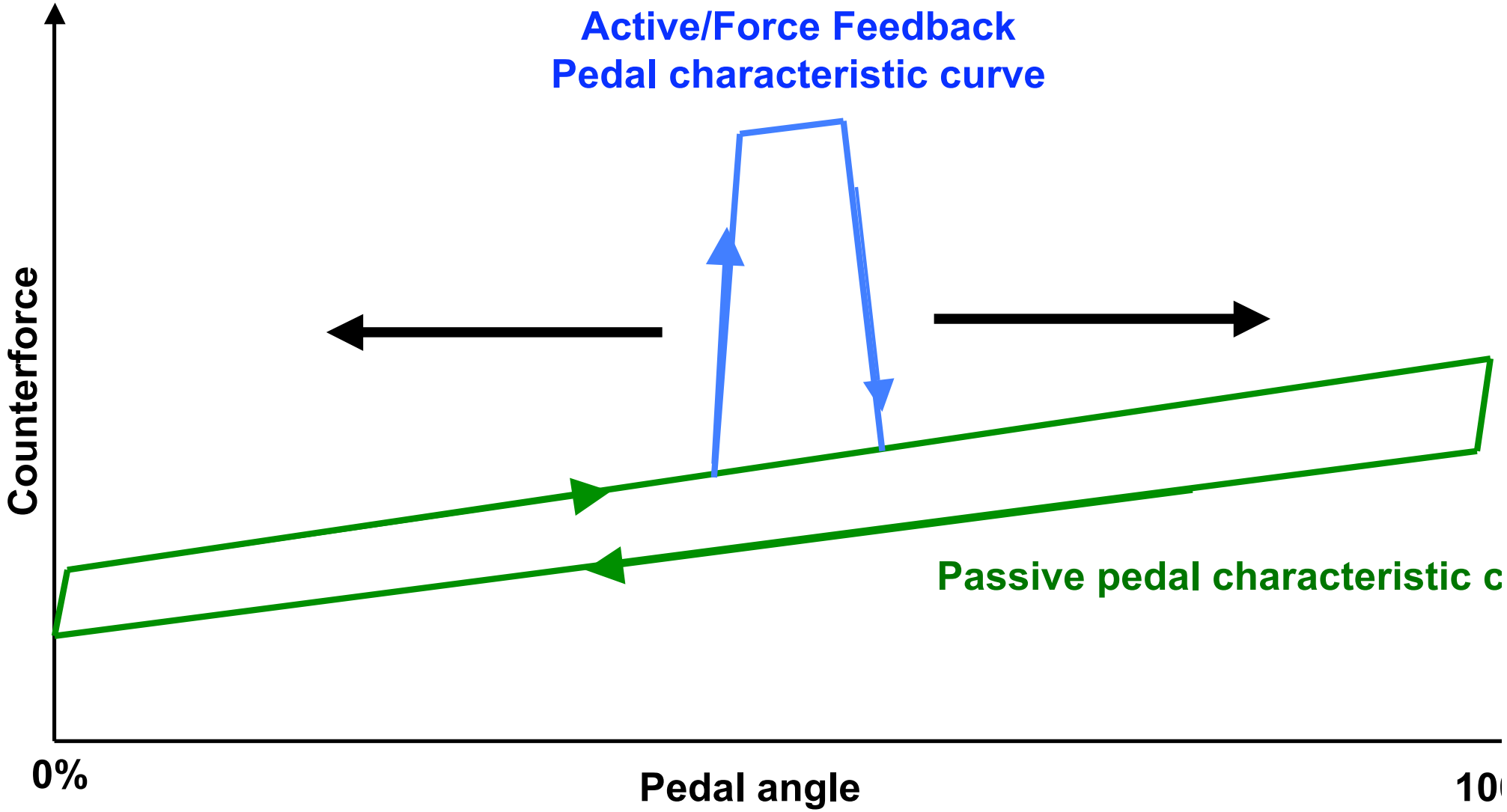
The results reflect the driver behaviour and the type of brake implementation.



Force Feedback Pedal Functions

- Base function (passive): function like a common accelerator pedal
- Advanced function (active): Implementation of an additional positive force (as counterforce to the drivers foot) generated by the FFP influencing the passive characteristic curve of pedal.
- FFP is a Human-Machine-Interface for
    - Longitudinal-Dynamic functions (Cruise Assistance (Limiter), Cruise Control)
    - Distance Warning
    - Display of warnings

Force Feedback Pedal Characteristic Curves



Reversible Belt Pretensioner

The versatile seatbelt pretensioner integrated in APIA

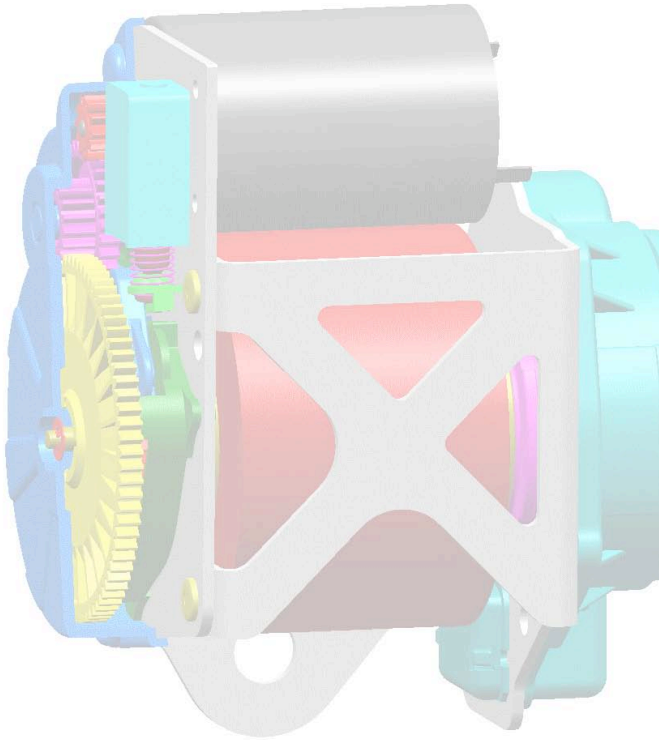
Activation degree

Comfort Mode: **25 - 100N**
Belt slack reduction after buckle up

Warning Mode: **100N**
Apply of 2 successive pre-tensioning cycles

Pre-Rewind Mode: **25 - 250N**
Adjustable and reversible pre-tensioning based on Danger Control Module of APIA

- smooth release of belt tension
- Mechanical locking to remain belt tension without further electrical power consumption



in cooperation with: TAKATA

APIA – Test Car

APIA – Video Testride

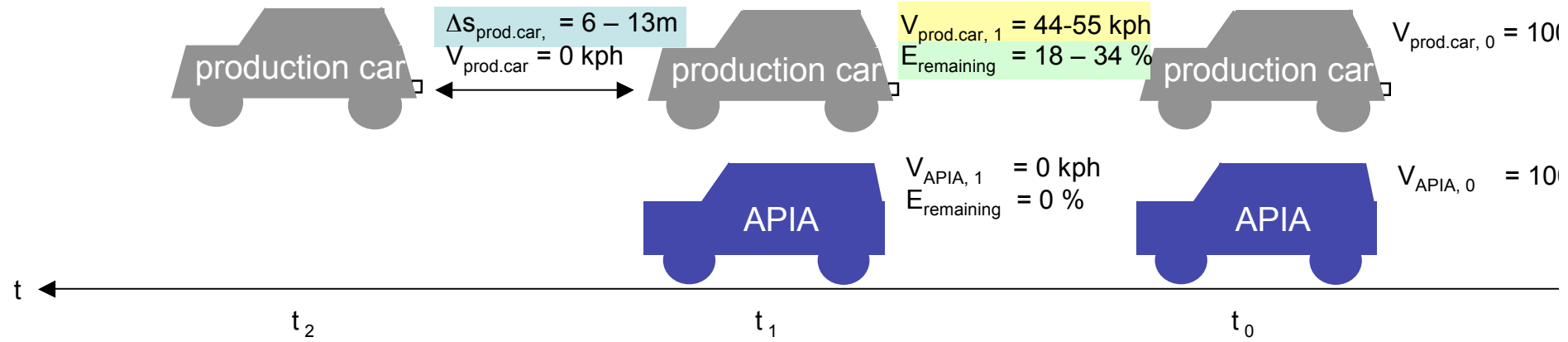
APIA – Summary

- prefill
- prebrake
- extended brake assist BA+

Implementing the APIA safety strategy leads to a reduction of

• stopping distance	up to	6 – 13m
• crash energy	up to	18 – 34%
• crash avoidance	up to crashspeed of	44 – 55 kph

(7 -



Thank you for your attention.