fka

CREATING IDEAS &
DRIVING INNOVATIONS

PERSPECTIVES FOR STEEL IN THE MOBILITY SECTOR

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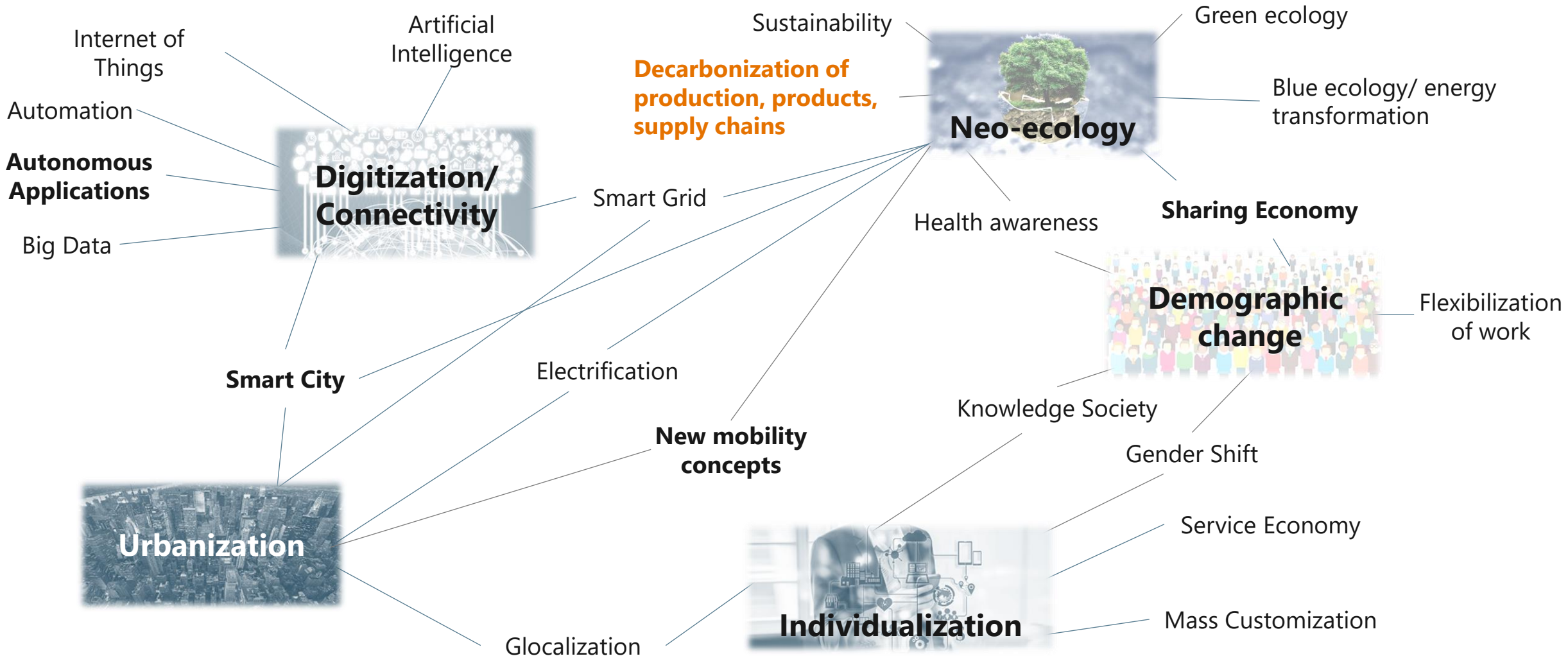
Future Mobility is technologically driven by decarbonization and (automated) Mobility as a Service (aMaaS)



Decarbonization in the mobility sector is substantiated by very concrete and enforceable use-phase targets

- Globally the strictest targets for newly registered vehicles
- Requiring 55 % CO_2 reduction compared to 2020 in Use Phase in 2030
- 100 % reduction until 2035 ➔ complete sales ban for petrol and diesel cars!

- Target enacted for 2025
- Requiring ca. 28 % CO_2 reduction compared to 2020

- Tightened targets under Biden administration until 2026
- Requiring ca. 30 % CO_2 reduction compared to 2021

- Target enacted for 2030
- Requiring ca. 32 % CO_2 reduction compared to 2016

- Commitment to decarbonization paths to mitigate climate change does not only include drivetrain electrification, but also a ***complete re-thinking of mobility*** including electrified, shared and automated vehicle fleets.

All global regions advance in AV legislation: EU enables homologation of aMaaS vehicles, whereas US liberalizes fleet testing. China does both.

EU

- **Germany** has become the first country in the world to **generally** allow autonomous vehicles onto public roads without requiring a human backup safety driver.
- Elsewhere **only decisions on case-by-case basis**

US

- However, **hotspot for testing** activities **in California**
- **48 permit holders for testing with a driver / 7 permit holders for driverless testing / 3 permit holders for deployment of AV services.**

China

- *Proposed Amendments of the Road Traffic Safety Law* clarify the **requirements for AV functions and liabilities: First AV specific proposals**
- **Regional legislations** and initiatives as forerunners, e.g. in **Shenzhen, Beijing as fast follower**

- **After lagging behind for some time, legislative obstacles for aMaaS are removed step-by-step**

Market roll-out progresses gradually, reaching breakthrough by offering public 24/7 commercial services without safety driver in 2023

» **Didi** offering public services incl. **safety driver** since June **2020** in outskirts of Shanghai

» **Waymo** offering driverless offering public services since March **2022** in San Francicso

» **Cruise** has started a **completely autonomous** service in San Francisco **in late 2022**

Conventional ridehailing

AV testing on public roads (on-board supervised)

AV in FMP fleets in selected areas (on-board supervised)

AV testing on public roads (remotely supervised)

AV in FMP fleets in selected areas (remotely supervised)

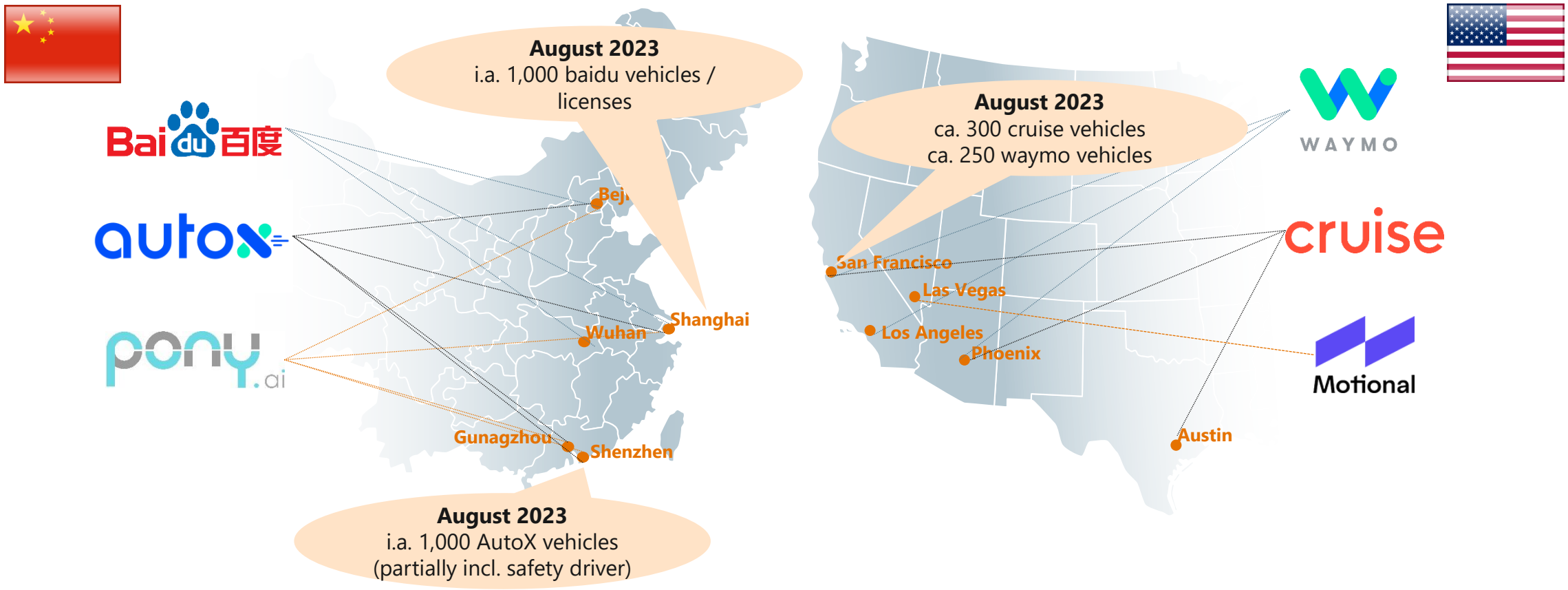
Unlimited commercial FMP fleets in selected areas

» **AutoX** offering **completely autonomous** public services on 1000m² area in Shenzhen, China without safety driver in **Jan. 2022**.

» In August 2023, Waymo received **unlimited allowance for AV service** deployment in San Francisco

Maturity / Progress

Hotspot metropolitan areas are the nucleus for realization of further industry plans

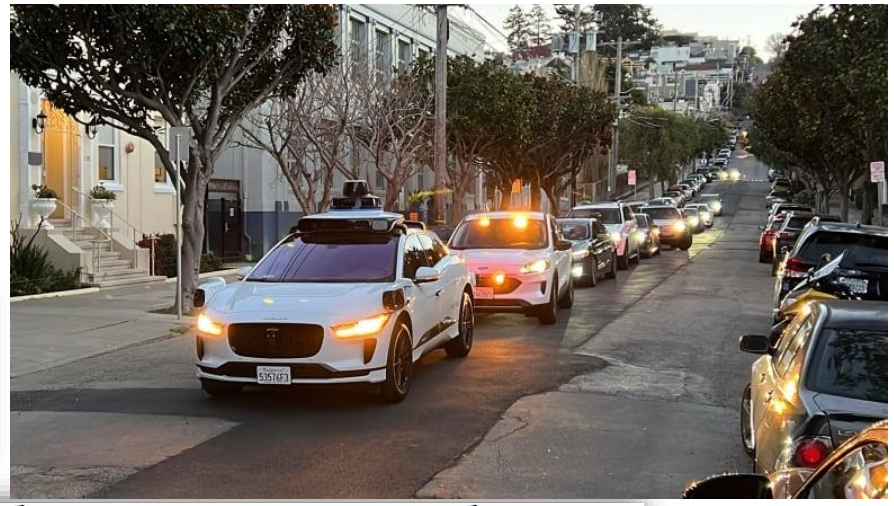


» Whereas **current AV fleet sizes include 200 – 1000 vehicles** per **city nowadays**, business plans of **future mobility providers** include an **exponential growth of relevant business figures** (passengers, mileage, revenue).

Accordingly, the industry gradually converges from conversion to purpose design to better meet requirements of large fleet operations

	WAYMO	cruise	Baidu 百度	ZOOX
Current: ▪ Based on series production vehicles ▪ Sensors, cameras and computers bolted on	 **Jaguar I-Pace**	 **Chevy Bolt**	 **Hongqi E-HS3**	 **Toyota RAV4**
Future: ▪ Custom designed vehicles for ride-hailing ▪ Without steering wheel and pedals ▪ Cameras and sensors integrated into the chassis ▪ Special features (more seating, four-wheel steering, communication with light and sound)	  **Waymo Zeekr**	  **Cruise Origin**	  **Baidu Apollo RT6**	  (not named)

However, AV services sometimes face the harsh and imperfect reality…



TRANSPO / AUTONOMOUS CARS / TECH

Cruise robotaxi collides with fire truck in San Francisco, leaving one injured

Robotaxi Traffic Jam Immediately Following 24/7 Robotaxi Approval — But What's The Big Picture?

Transportation

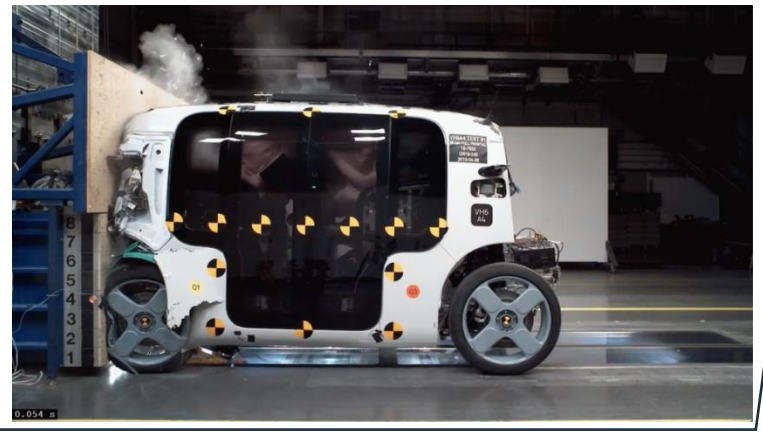
A Waymo self-driving car killed a dog in 'unavoidable' accident

Map shows every crash involving driverless cars in San Francisco

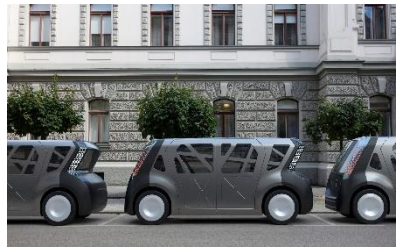
- Recent incidents including vehicle crashes demonstrate the necessity of further improvements
  - in **artificial intelligence and sensor technology**
  - in vehicle **passive safety characteristics**
- Further challenges for mass market applicability persist
  - in **cost reduction and scalability**
  - in **use case adaptability**

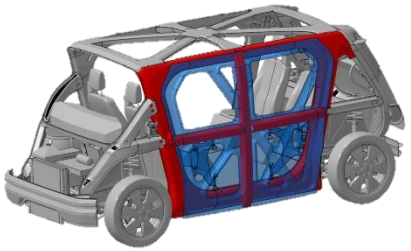
Passive safety is highly demanded, however not explicitly addressed by most FMP. Steel e-Motive can fill this gap.

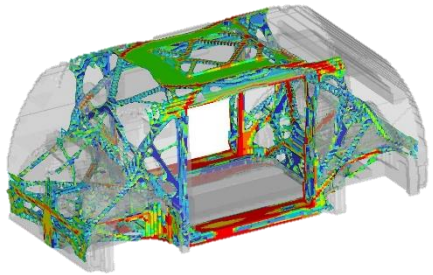
- **Recent incidents demonstrate** the relevance for passive safety
- Extremely relevant for new vehicle concepts due to **small front / rear overhangs**
- **Passive safety starts getting some attention** at Future Mobility Providers, as safety perception of passengers is crucial for business success
- **Zoox** actively **communicates passive safety** as a challenge, however **remains vague regarding test settings and parameters**



- **Transparent concepts in Steel e-Motive** how to **deal with**
  - **Short overhangs**
  - **New door concepts**
  - **Battery safety**





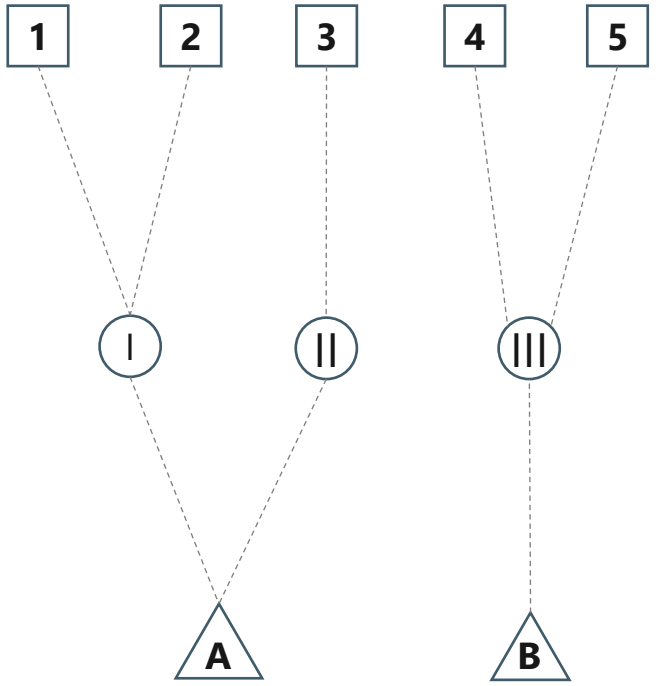


Scalable architectures to bring down costs and enable use case specific mobility solutions, as demonstrated in Steel E-Motive

Future mobility concepts

Vehicle architecture

Vehicle platforms



General platform characteristics

Scope
- Definition of platform coverage

Module definition
- Specification of modules and interfaces

Scalability
- Range of feasible characteristics
- E.g. battery capacity, HW performance

Upgradeability
- Replacement / extension during life cycle
- E.g. battery technology, AD sensors

Image Sources: Hyundai, Audi, Volkswagen

Use-case adaptability is key, as future automated mobility services will cover a variety of people and goods transportation services

Single-used MaaS | **Pooled MaaS**

Status-quo MaaS

Car sharing | **Ride hailing** | **Ride sharing** | **Shuttle service**

- » Usually 1-2 passengers
- » Urban & suburban area
- » Short-term usage

- » > 5 passengers
- » Urban or restricted area
- » Regular usage

STEEL E-MOTIVE

Future AMaaS

Potential use-cases


Basic comfort


Premium comfort


Productivity


Basic mobility


Premium mobility


Specific purposes

Based on the reality check of aMaaS and the challenges identified, some important implications for steel can be derived.

» **In principle, steel has very beneficial characteristics** for the **application in both conventional** vehicles **as well as in new (automated) vehicle concepts**: Costs, safety, sustainability etc.

– However, the messages have to be conveyed to the **right addressees**: **Future Mobility Providers** will be the **pacemakers of the future** in **automated** and **shared mobility services**

» Especially **innovative vehicle concepts** may create a **market-pull for high-performance steel grades**, to fully exploit **the design space**, e.g. regarding **short vehicle overhangs**

– Development should be **supported** with an **active ‚technology push'** by the steel industry

» This may **compensate for the slight decrease** of **total steel quantities** due to the **decreasing private car market**.

– **However,** until now, **future mobility concepts** are **still more associated with aluminum than with steel. Active communication of benefits required.**

THANK YOU FOR YOUR ATTENTION