

Side Conductive Electric Road System for Heavy-duty Trucks to EVs

Takamitsu Tajima
Honda R&D Co., Ltd.



Introduction

ERS (Electric Road System)

Test Results

Installation of ERS

Future Outlook

Conclusion



Background

Looking towards the realization of a zero-CO₂ society, it will be important to achieve zero emissions of CO₂ during vehicle operation.

Honda EV



The main issues facing EV are

- **Driving range**
- **Charging** (Nuisance, time, congestion at charging stations, provision of infrastructure)
- **Decline in dynamic performance due to increased battery weight**

Methods of Extending EV Driving Range

Electric Road Systems (Dynamic charging system)

Road Line



Honda



Alstom/Volvo

Volvo's electric roads concept points to a battery-free EV future



Elways

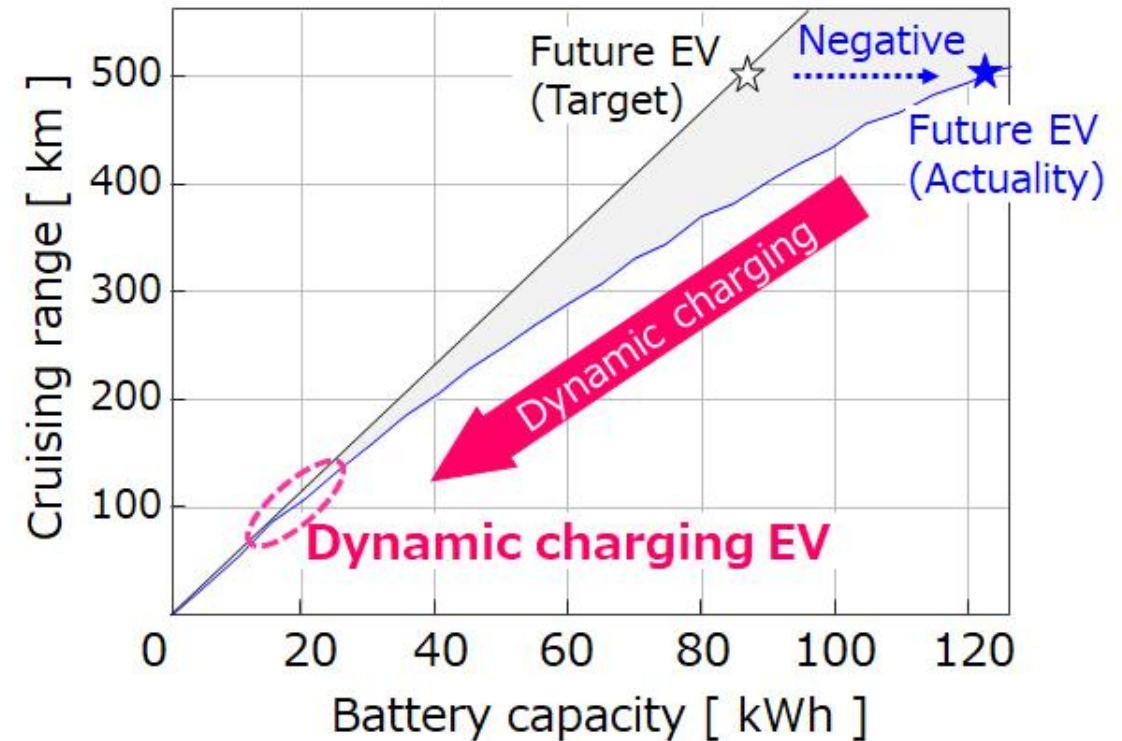


Elonroad

Overhead Line



Siemens/SCANIA

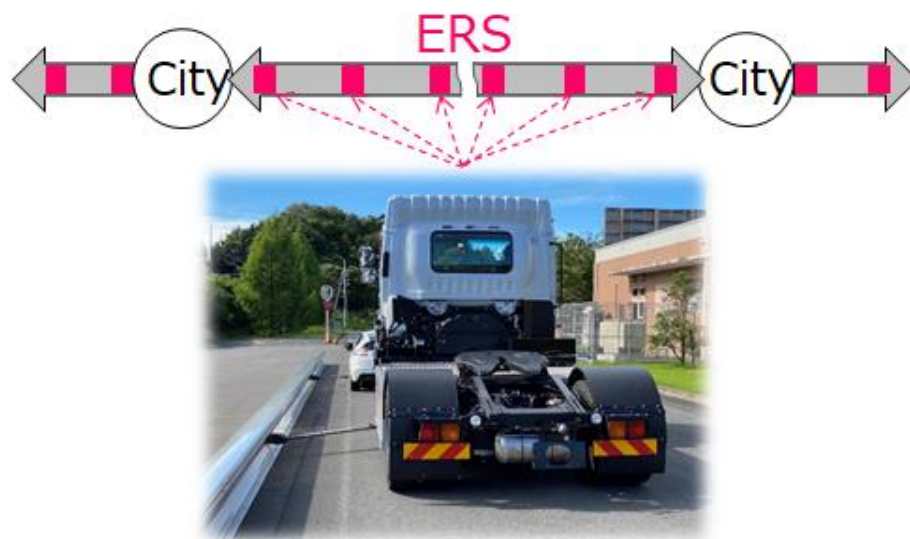


Goals of ERS Project

Goal

“ Vehicle Revolution ”

To extend the cruising range for EVs by enabling unlimited cruising range by simultaneously supplying energy and charging while driving.

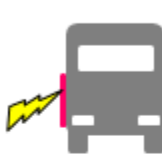


Effects

- Unlimited vehicle cruising range
- Zero stationary charging time
- Reduced battery load (1/10)
- More enjoyable driving thanks to a lifting of the power limitations on EVs

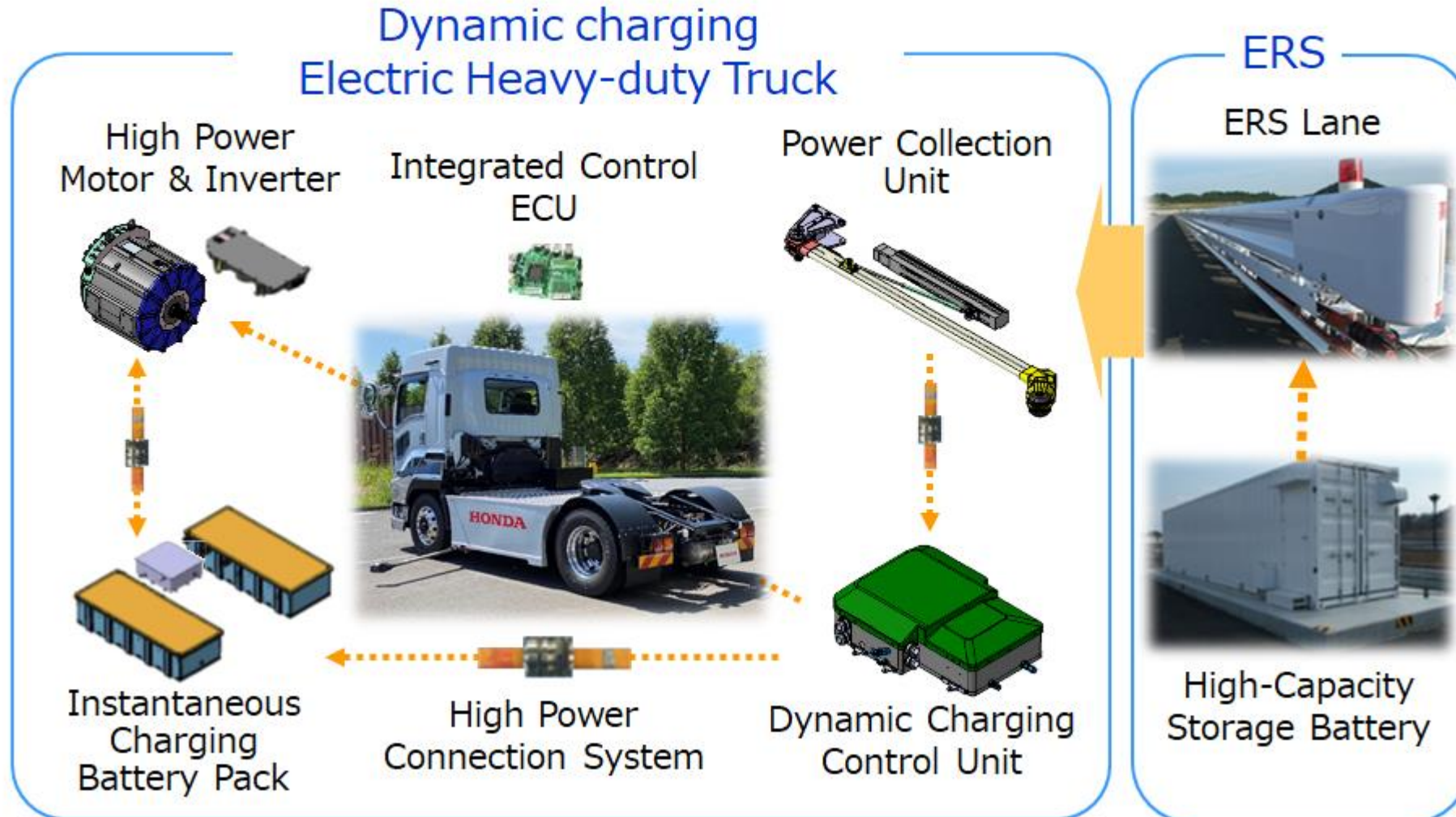
Comparison of superiority and inferiority of ERS

3 High score 2 Medium score 1 Low score

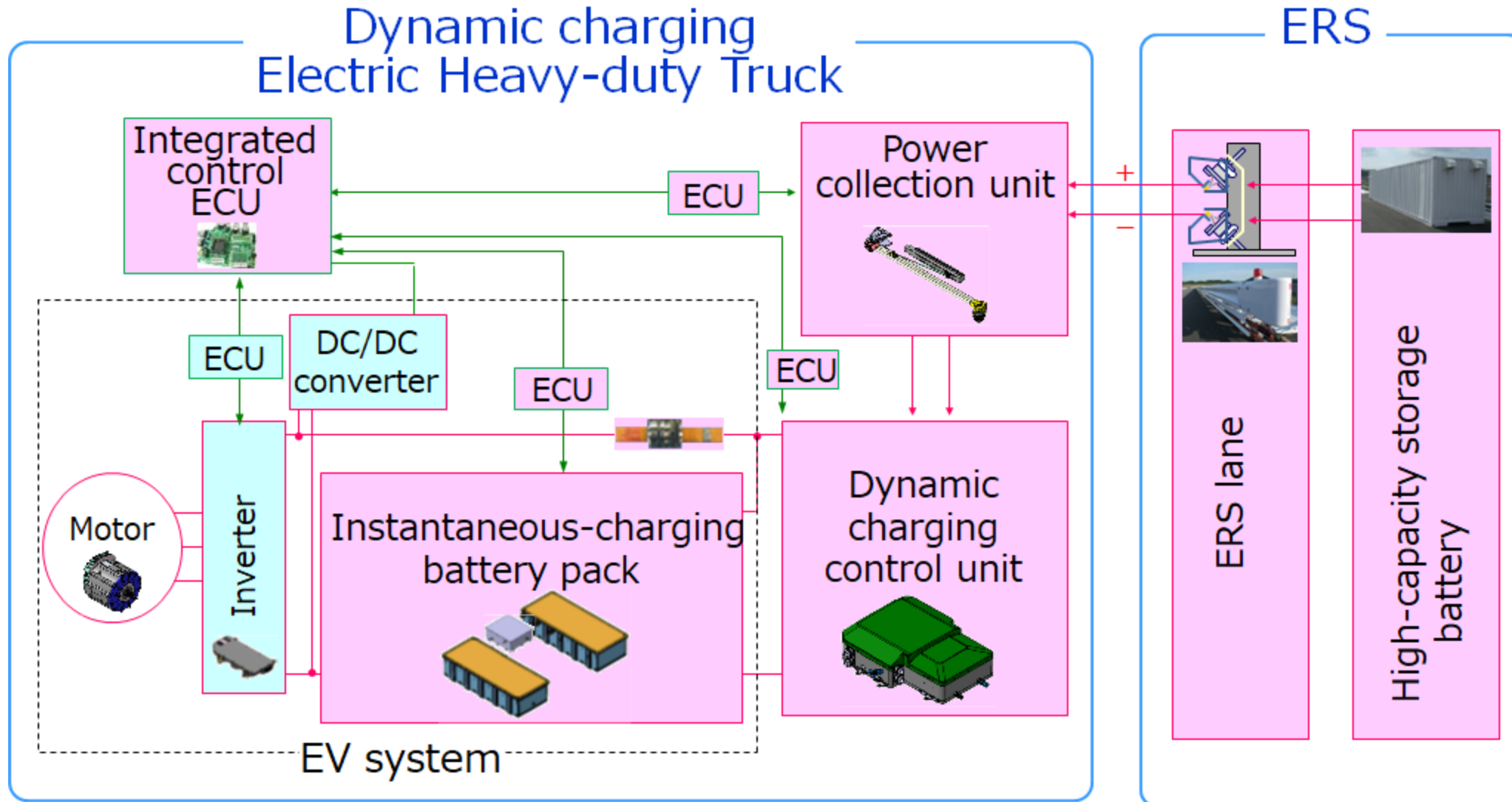
Type		Wireless			Conductive		
		Overhead	In-road	Side	Overhead	In-road	Side
							
Basic Specification	Supply power	1	1	1	3	3	3
	Vehicle speed	1	2	2	1	2	3
	Body type	1	3	2	1	3	3
Safety	Electro magnetic noise	1	1	1	3	3	3
	Foreign matter from road	3	1	2	3	1	2
	Motorcycle	1	1	1	3	1	3
Convenience	Positioning	1	1	1	2	1	3
	Emergency lane change	1	3	2	1	1	3
	Road maintenance	3	1	3	3	1	3
Cost		1	1	1	2	1	3

System Overview

Simultaneous development of infrastructure and vehicles

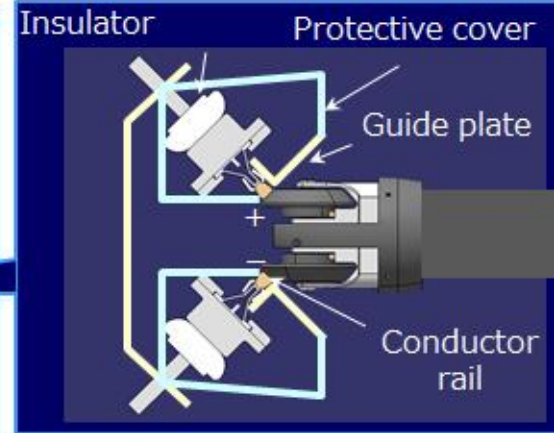
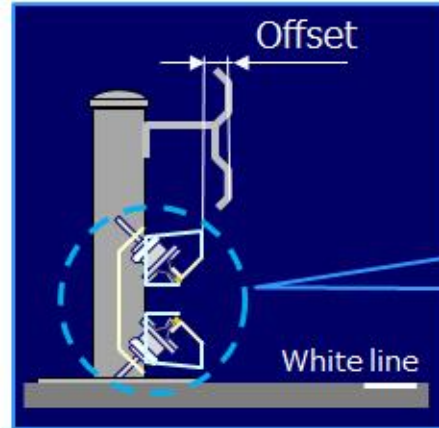


Dynamic Charging System Diagram



Infrastructure

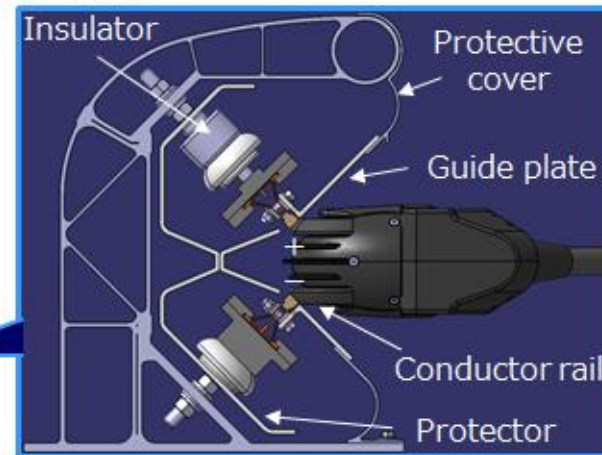
Guardrail type lane



Stationary charge

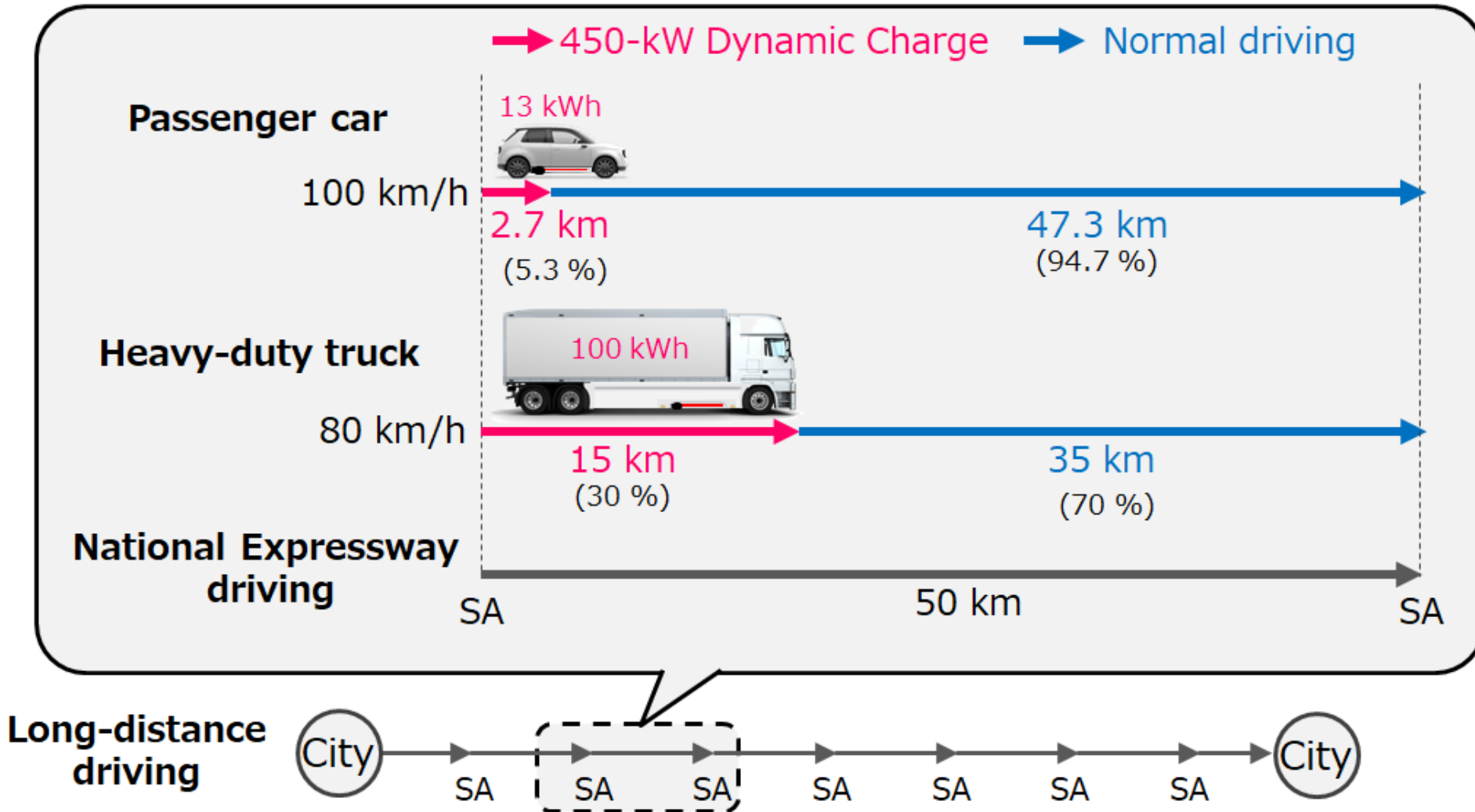


Aluminum extruded lane



450-kW Dynamic charge driving pattern

Infinite EV cruising range by intermittently charging while driving



Prototype Systems

Type	Type-0	Type-1	Type-2	Type-3	Type-4
Vehicle					
ERS power	100 kW	100 kW	180 kW	450 kW	450 kW
Power supply voltage	DC 375 V	DC 375 V	DC 600 V	DC 750 V	DC 750 V
Power supply current	300 A	300 A	300 A	600 A	600 A
Charging vehicle speed	20 km/h	70 km/h	155 km/h	150 km/h	90 km/h
Power transmission distance	0.1 - 1.2 m	0.1 - 1.2 m	0.1 - 1.3 m	0.1 - 1.3 m	0.1 - 1.5 m
ERS lane length	20 m	100 m	300 m	385 m	Over 400m (JARI)

Dynamic Charging Full-Electric Truck



Specification of Dynamic Charging Electric Heavy-duty Truck

Total vehicle weight		45.29t
Max. load weight		38.04t
Tractor weight		7.25t
Max. Speed (Legal Speed)		80 km/h (Speed Limiter)
Cruising Range		Infinite (km)
Motor	Max. Power	350 kW(476 PS)
	Max. Torque	3,500 N·m
Battery	Battery Capacity	100 kWh(50kWh×2)
	Max. Power Output	DC750 V、600 A
Dynamic Charge	Charging Power	450 kW (DC750 V,600A)
	Vehicle Speed	7(Creep speed)~80 km/h
	Vehicle to Road Distance	0.1 ~1.5 m
	Charging distance (80 km/h while driving)	Charges 15 km (in 50 km section)

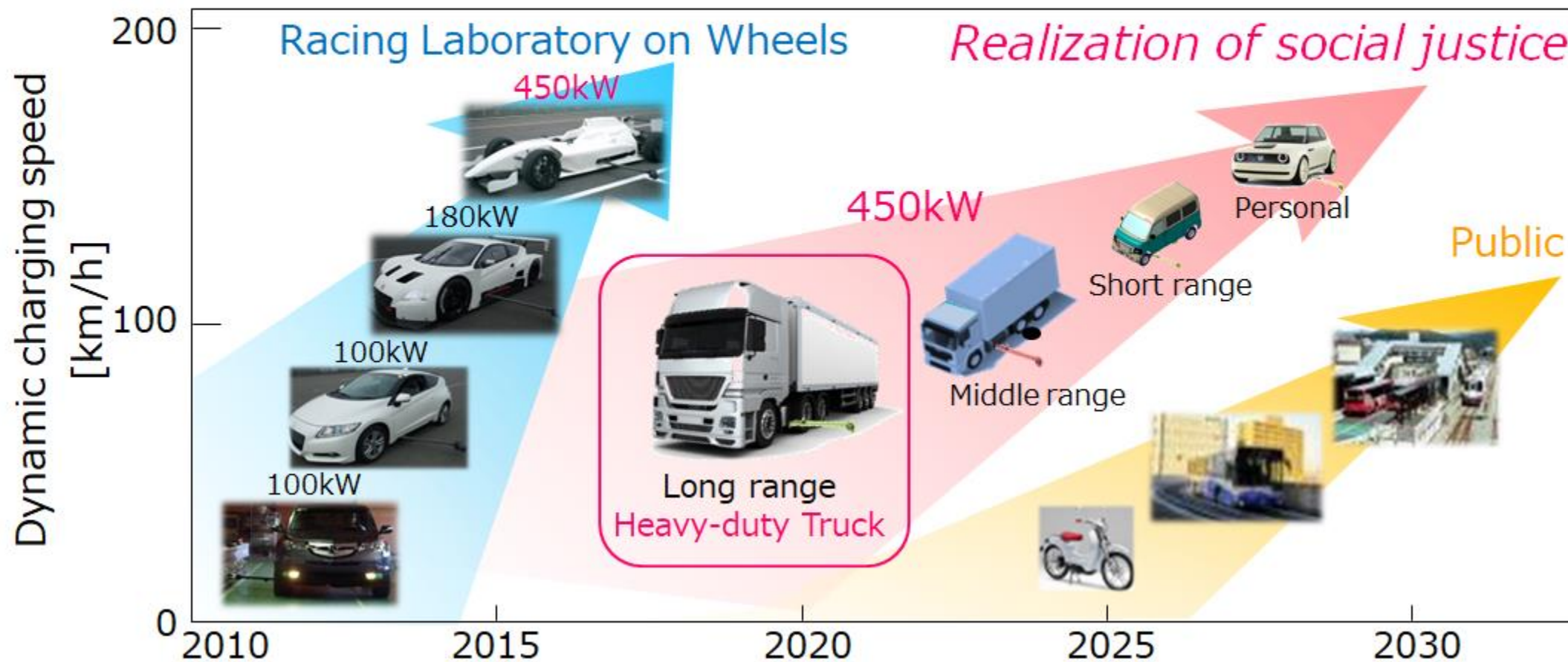
Results of 450 kW Charging Tests

450 kW (DC 750 V, 600 A) , 80 km/h



Goals of Research

Promotion of substitution of internal combustion engine vehicles and realization of carbon free society by ERS



Conclusion

Infrastructure and a vehicle system able to realize ultra-high power (450 kW, DC 750 V, 600 A) and high vehicle-speed (150 km/h) dynamic charging were developed.

The heavy-duty truck maximum motor power is 350 kW and its maximum dynamic charging speed is 80 km.

The results of dynamic charging tests conducted using a newly manufactured vehicle demonstrated that the system possessed the potential to realize the following effects:

- Remove restrictions on EV cruising range
- Reduce charge waiting time to zero
- Reduce battery weight in the vehicle (by less than 1/10)
- Increase driving pleasure by doing away with EV power restrictions

It was also shown that a 450 kW ERS would make it possible to considerably reduce battery capacity, helping to ensure the ability to supply batteries and secure resources for their manufacture.

In the future, Honda intend to continue efforts to boost the reliability and safety of the ERS, attempting to realize practical application of the system at an early stage.