CALCULATION OF THE MINIMAL LENGTH OF THE HIGH-SPEED LINE

Studentská vědecká konference

VRT – budoucnost české železnice
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MINISTERSTVO ŠKOLSTVÍ, MLÁDEŽE A TĚLOVÝCHOVY

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Content of the presentation

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- *Simulation model*
- *Outputs and evaluations of the simulation*
- *Project Positrans*
- *Conclusion and future of the research*

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Introduction into the problematics

- *Simulation as a tool for judgement of the track speed increasing.*
- *Pilot projects in CZ (Brno – Břeclav, Kolín – Poříčany, Ejpovice tunnel…)*
- *Input and output data for the model and finding evaluation criterions.*

Simulation model

Infrastructure
- network graph representing a transport network model
- kilometric position of key infrastructure elements
- line gradients and alignments

Paths
- interlocking table model (route tables and signal tables)
- creation of individual routes assigned to a specific signal point
- aggregation of individual routes in train journey itineraries

Vehicles
- entering of characteristics of individual vehicles
- creation of a vehicle database
- formation of trains

Timetable
- definition of the temporal position of individual connections
- assignment of vehicles to the connections
- creation of a comprehensive timetable

Simulation
- model calibration and validation
- description of simulation scenarios
- definition of required simulation outputs

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Simulation model

- *Simulation model in SW OpenTrack.*
- *50 block sections.*
- *Very simple infrastructure.*
- *One track for each trainset.*
- *Just origin and destination station.*
- *No slope, no curves.*

Example of a simulation model.

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Trainset data

- *Basic Middle-Europe trainsets.*
- *Different maximal speed, weight, tractive effort…*

Trainset	Maximal speed [km·h^{-1}]	Weight [t]	Maximal tractive effort [kN]	Maximal power [kW]	Maximal acceleration [m·s^{-2}]
Š 109E	200	445	274	6 400	0.560
Railjet	230	437	300	6 400	0.627
Pendolino	230	384	200	3 920	0.461
ICE 3	330	463	300	8 000	0.581

Trainset	Acceleration			Deceleration	
	Time [s]	Distance [km]	Energy [kWh]	Time [s]	Distance [km]
Š 109E	189	6.59	276	94	2.62
Railjet	415	20.80	605	107	3.40
Pendolino	402	18.25	393	107	3.40
ICE 3	540	36.37	1,135	154	7.07

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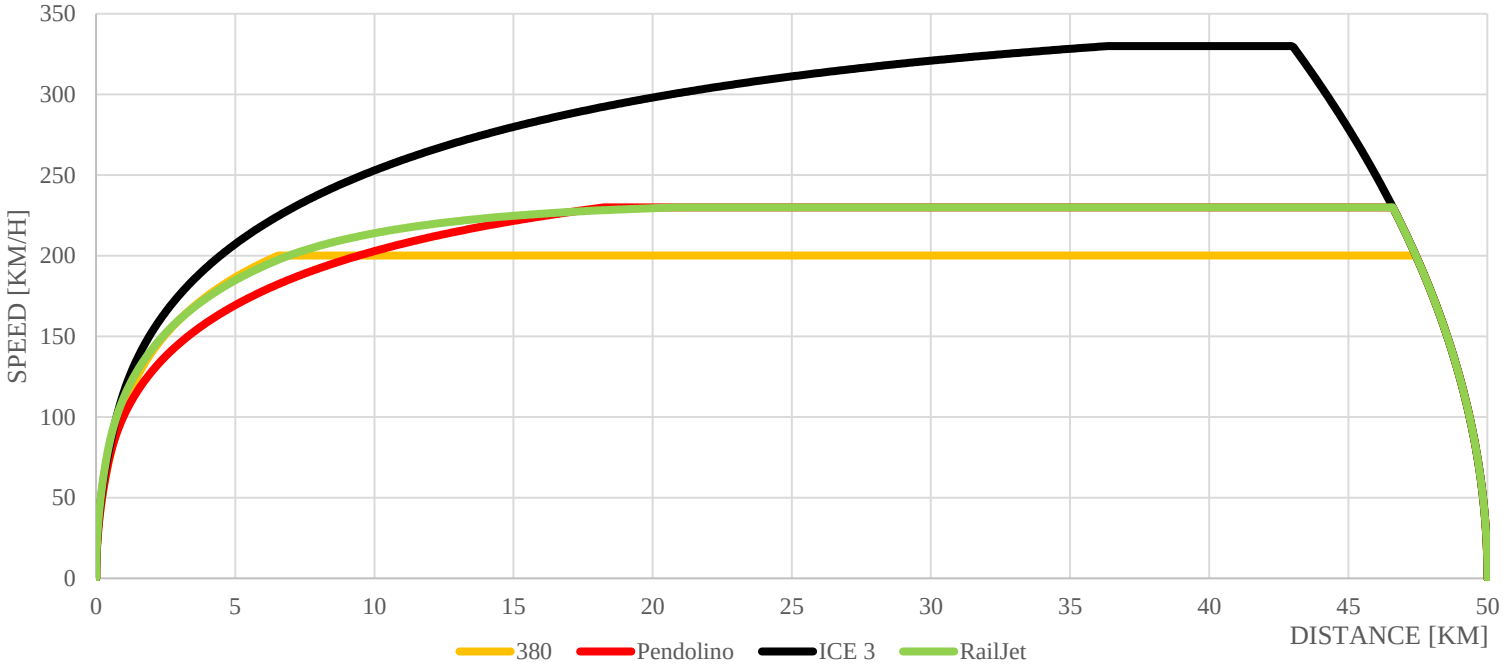
Outputs and evaluation of the simulation

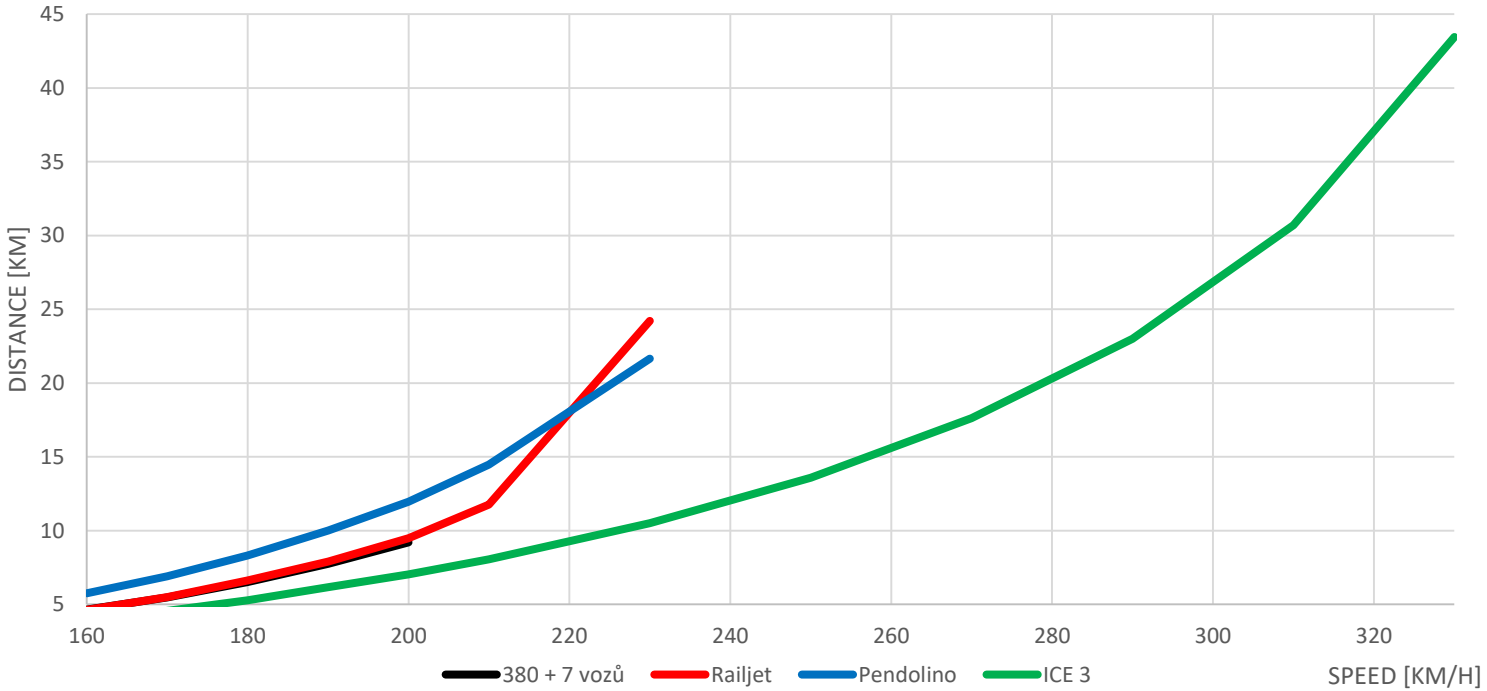
- *Realistic save of the journey time.*
- *Increase of the specific traction energy consumption.*
- *Searching for a sub-optimal variant of the minimal length of the track section.*

Track speed	Škoda 109 E + 7 coaches	Siemens Viaggio Comfort	Pendolino	ICE 3
160	4,66	4,63	5,76	3,97
180	6,51	6,62	8,32	5,29
200	9,21	9,481	11,97	7,04
230		24,21	21,65	10,51
250				13,58
330				43,44

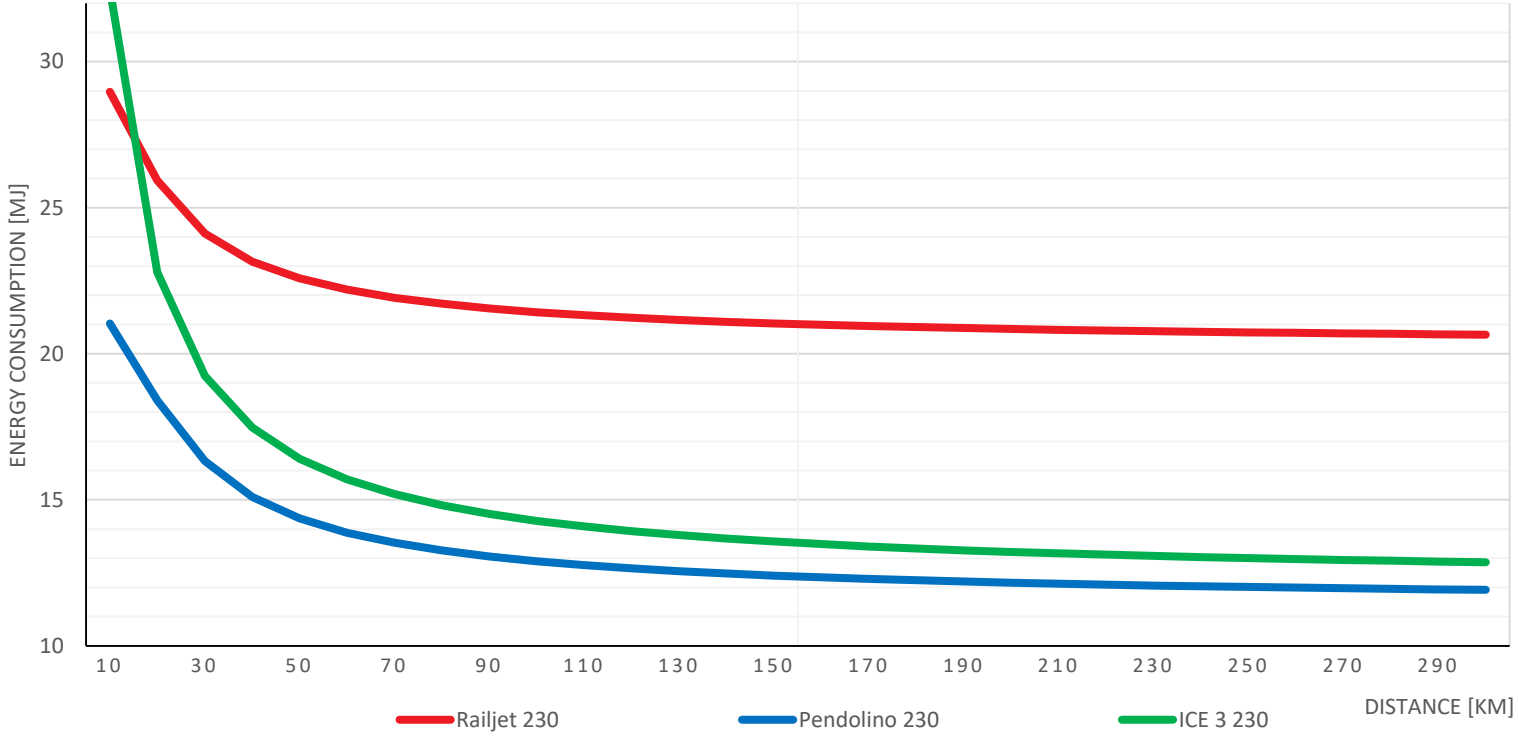
Outputs and evaluation of the simulation



Outputs and evaluation of the simulation



Outputs and evaluation of the simulation



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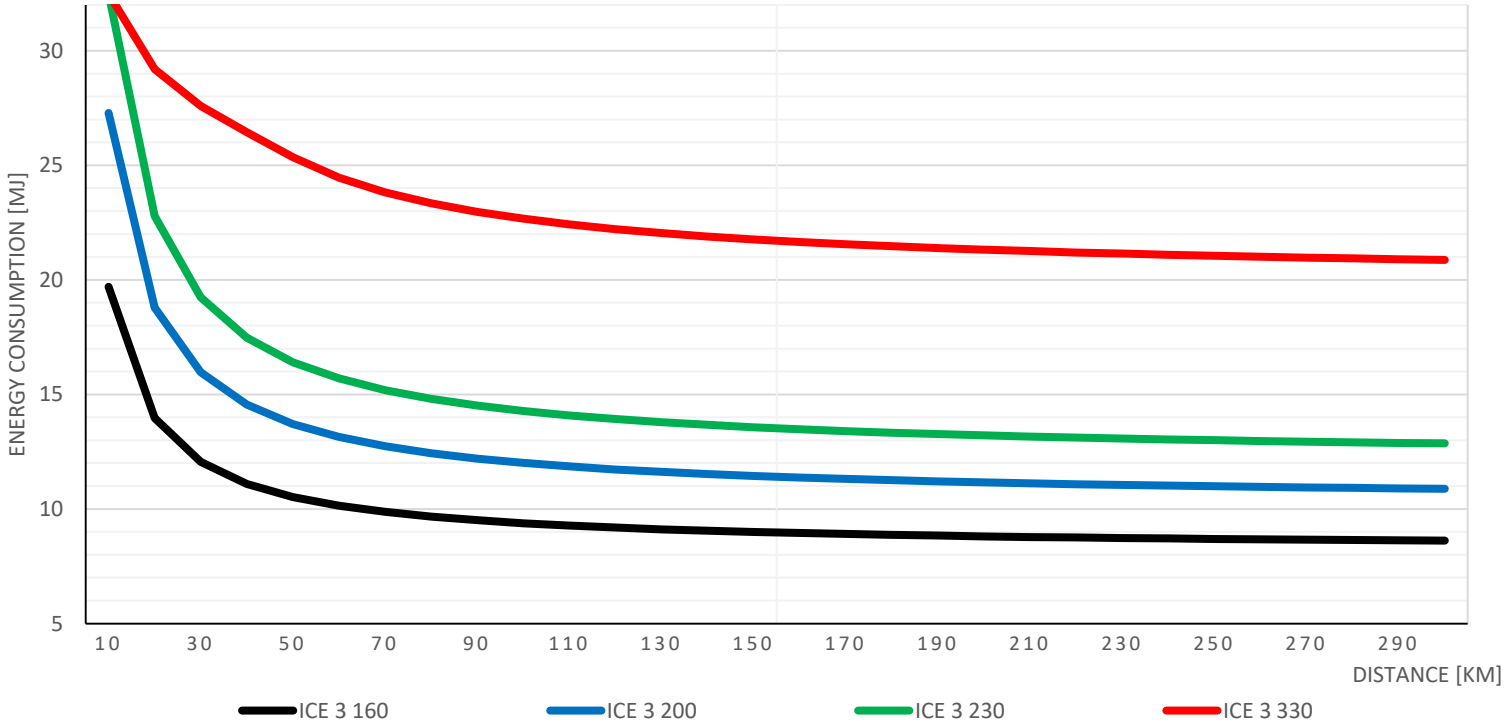
Outputs and evaluation of the simulation



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Factors of the efficiency

Technical - track	Technical – vehicle
• **Slope profile and track alignment (track resistance).** • **Speed profile.** • **Track and station interlocking system.** • **Electric traction system.**	• **Maximum speed** • **Traction efficiency.** • **Vehicle resistance.** • **Tractive characteristics.**
Technological • Conception of the timetable. • Conception of traffic control. • Stopping strategy. • Automated operation of the railway traffic. • Utilization of a track capacity.	Socioeconomics • Size of an agglomeration. • Distance and shape of agglomeration. • Traffic demand. • Economic power of the region or country.

Project PosiTrans

- Cooperation in Applied Research between the University of Pardubice and companies in the Field of Positioning, Detection and Simulation Technology for Transport Systems.
- Track transportation capacity and its determination using simulation.
- City Logistics and its modeling for securing sustainable development of the aglomeration.

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Thank you for your attention.

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