

Predictive Demand Modelling for Prospective Commercial High-Speed Rail Lines in the Czech Republic

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Introduction

Modelling transport demand = important tool for planning and managing transport.

Importance of user decisions:

- destination,
- mode of transport,
- price and route.

The modelling is focused on future high-speed transport.

Feasibility study of high-speed transport

(Fast connection No. 1)

Comprehensive document: viable solution for meeting future long-distance domestic, international and inter-regional demand:

- a new high-speed line from Prague to Brno, and further to Břeclav,
- verification of eliminating present and anticipated capacity problems on the conventional rail network and highways,
- an evaluation of economic benefits and improved transport serviceability.



Characteristics of Predicted Indicators for High-Speed Rail

- Year – time series
- Population – demography of the Czech Republic
- Passengers – number of transported passengers (in thousands)
- Distance – average distance per passenger (km)
- Revenue – of national carrier České dráhy (ČD) in rail transport (mil. CZK)
- Lines – all passenger train lines operated by ČD

The statistically described data were processed for the period 2000-2020.
The data prediction in the feasibility study refers to the year 2025.

Correlation of characteristics dataset

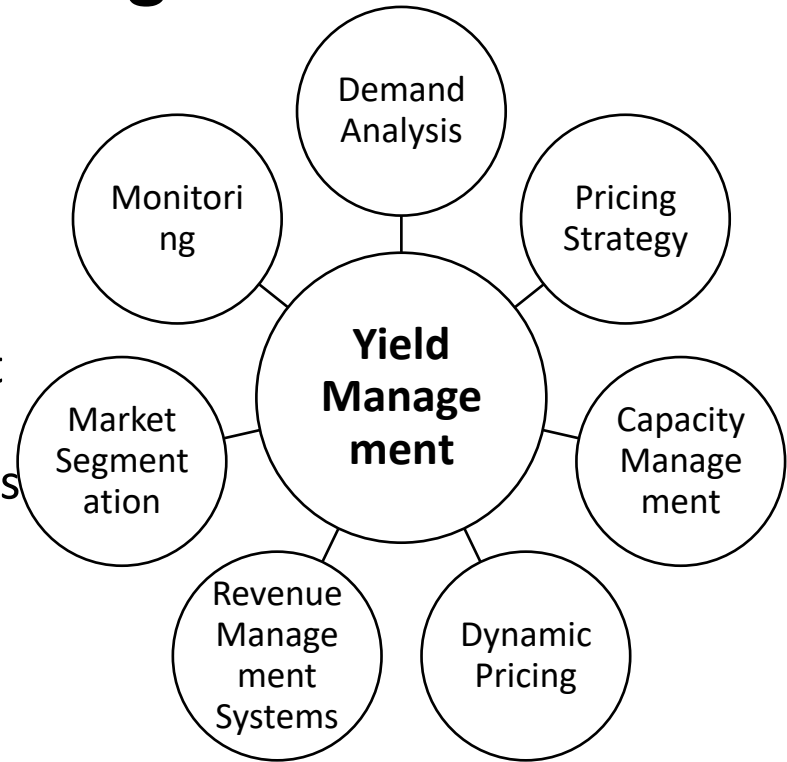
Variable	Observations	Observation with missing data	Observation without missing data	Minimum	Maximum	Mean	Standard deviation
Population	21	0	21	10,230	10,550	10,413	0,126
Passengers ('000)	21	0	21	6502,815	10930,618	7551,604	1299,257
Distance (km)	21	0	21	36,650	47,600	41,155	3,402
Revenue ('000 000)	21	0	21	4869,000	10398,000	6645,857	1401,480
Lines	21	0	21	142057,000	174256,000	165725,429	8059,311

Correlation matrix:

From \ To	population	passengers	distance	revenue	lines
Population	1	0,581	0,857	0,826	0,480
Passengers ('000)	0,581	1	0,757	0,866	0,030
Distance (km)	0,857	0,757	1	0,752	0,123
Revenue ('000 000)	0,826	0,866	0,752	1	0,415
Lines	0,480	0,030	0,123	0,415	1

Characteristics of Yield Management in Rail Transport

- **Demand Analysis:** Use of historical data to forecast demand.
- **Dynamic Pricing:** Real-time fare adjustments based on occupancy.
- **Capacity Management:** Optimal seat allocation for revenue maximization.
- **Market Segmentation:** Tailored offers for different passenger types.
- **Smart Tools:** Automated systems for pricing and forecasting.



Evaluation & Application

on the Sprinter Train Lines

Evaluation of the possibilities of implementing yield management methodologies on the planned high-speed rail, with a focus on Sprinter lines.

- Not only to increase revenues but also to improve the efficiency of capacity utilization.

Usage of descriptive statistics and graphical representations for predictive model of passenger demand (3 forecasting scenarios: optimistic, pessimistic, and realistic).

The results of the study are also applicable to other categories of railway service lines.