



Feasibility Study concerning High-Speed-Railway-Lines in Norway

Presentation

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High-Speed-Lines – Evaluation Method

Components included in the evaluation procedure are:

- **BT** **Reduction of transportation costs**
 - BT1 Decreased vehicle standby costs
 - BT2 Decreased vehicle operation costs
 - BT3 Chances in transport costs due to modal shifts
- **BI** **Transport infrastructure preservation**
 - BI1 Transport infrastructure renewal
 - BI2 Transport infrastructure maintenance
- **BS** **Increased transport safety**
- **BAD** **Improved accessibility of destinations**
 - BAD1 Reduction of travel time
 - BAD2 Improvement of accessibility
- **BSA** **Spatial advantages**
 - BSA1 Employment impacts from building transport infrastructure
 - BSA2 Employment impacts from operating transport infrastructure
 - BSA3 Contributions to promoting international relationships
- **BE** **Environmental relief**
 - BE1 Reduction of noise exposure
 - BE2 Reduction of exhaust emissions
 - BE3 Reduction of climatic relevant emissions
 - BE4 Reduction of community severance
- **BIT** **Impacts from induced traffic**
- **BL** **Improved links to and from seaports and airports**
- **BF** **Fulfilment of non-transport functions**
- **C** **Investment costs**

High-Speed-Lines – Evaluation Method

The **benefit-cost balance BCB** is defined as

$$\text{BCB} = (\text{BT} + \text{BI} + \text{BS} + \text{BAD} + \text{BSA} + \text{BE} + \text{BIT} + \text{BL} + \text{BF}) - \text{C}$$

and shows if benefits are greater than costs (in NOK).

The **benefit-cost ratio BCR** is defined as

$$\text{BCR} = (\text{BT} + \text{BI} + \text{BS} + \text{BAD} + \text{BSA} + \text{BE} + \text{BIT} + \text{BL} + \text{BF}) / \text{C}$$

and shows the benefits (in NOK) per NOK of investment.

High-Speed-Lines – Infrastructure Investments

Infrastructure	Oslo – Trondheim Investment MNOK	Oslo – Gøteborg Investment MNOK
Tunnel (without superstructure)	8'454	1'831
Open line	14'398	2'711
Constructions	2'281	796
Superstructure	9'325	1'790
Stations	147	101
Power Supply	428	50
Special Infrastructure	289	--
Facilities	40	20
Contractor Costs	35'352	7'299
Management/Engineering	10'622	2'190
Land acquisition	468	332
Project Costs	46'442	9'821
Maintenance facilities	1'800	--
Total investment	48'242	9'821
Uncertainty	9'622	2'086
Total Estimate	57'864	11'907



High-Speed-Line Oslo - Trondheim

External benefit		Evaluation procedure
		MNOK per year
BT3	Modal shift	1'288.3
BS	Increasing traffic safety	13.3
BAD1	Travel time	341.3
BAD2	Accessibility	34.1
BSA1	Employment impacts building	640.8
BSA2	Employment impacts operation	476.0
BSA3	International relationship	14.0
BE1	Noise reduction	1.5
BE2	Exhaust emissions	0.7
BE3	Climatic damage	126.6
Sum		2'936.6



High-Speed-Line Oslo - Trondheim

Operation Costs	- 108 MNOK per year
Costs of Vehicle investment	- 59 MNOK per year
External Benefits	2'937 MNOK per year
Overall Benefits (net)	2'770 MNOK per year
Annuity of Infrastructure investment	1'531 MNOK per year
Indicator BCB (Overall benefits – annuity)	1'239 MNOK per year
Indicator BCR (Overall benefits/annuity)	1.81



High-Speed-Line Oslo - Gøteborg

External benefit		Evaluation procedure
		MNOK per year
BT3	Modal shift	231.8
BS	Increasing traffic safety	13.1
BAD1	Travel time	86.4
BAD2	Accessibility	8.6
BSA1	Employment impacts building	127.2
BSA2	Employment impacts operation	208.0
BSA3	International relationship	5.1
BE1	Noise reduction	1.3
BE2	Exhaust emissions	0.1
BE3	Climatic damage	24.8
Sum		706.5



High-Speed-Line Oslo - Gøteborg

Operation Costs	- 96 MNOK per year
Costs of Vehicle investment	- 37 MNOK per year
External Benefits	707 MNOK per year
Overall Benefits (net)	574 MNOK per year
Annuity of Infrastructure investment	310 MNOK per year
Indicator BCB (Overall benefits – annuity)	264 MNOK per year
Indicator BCR (Overall benefits/annuity)	1.85



High-Speed-Lines – Indicator “Needed Benefits”

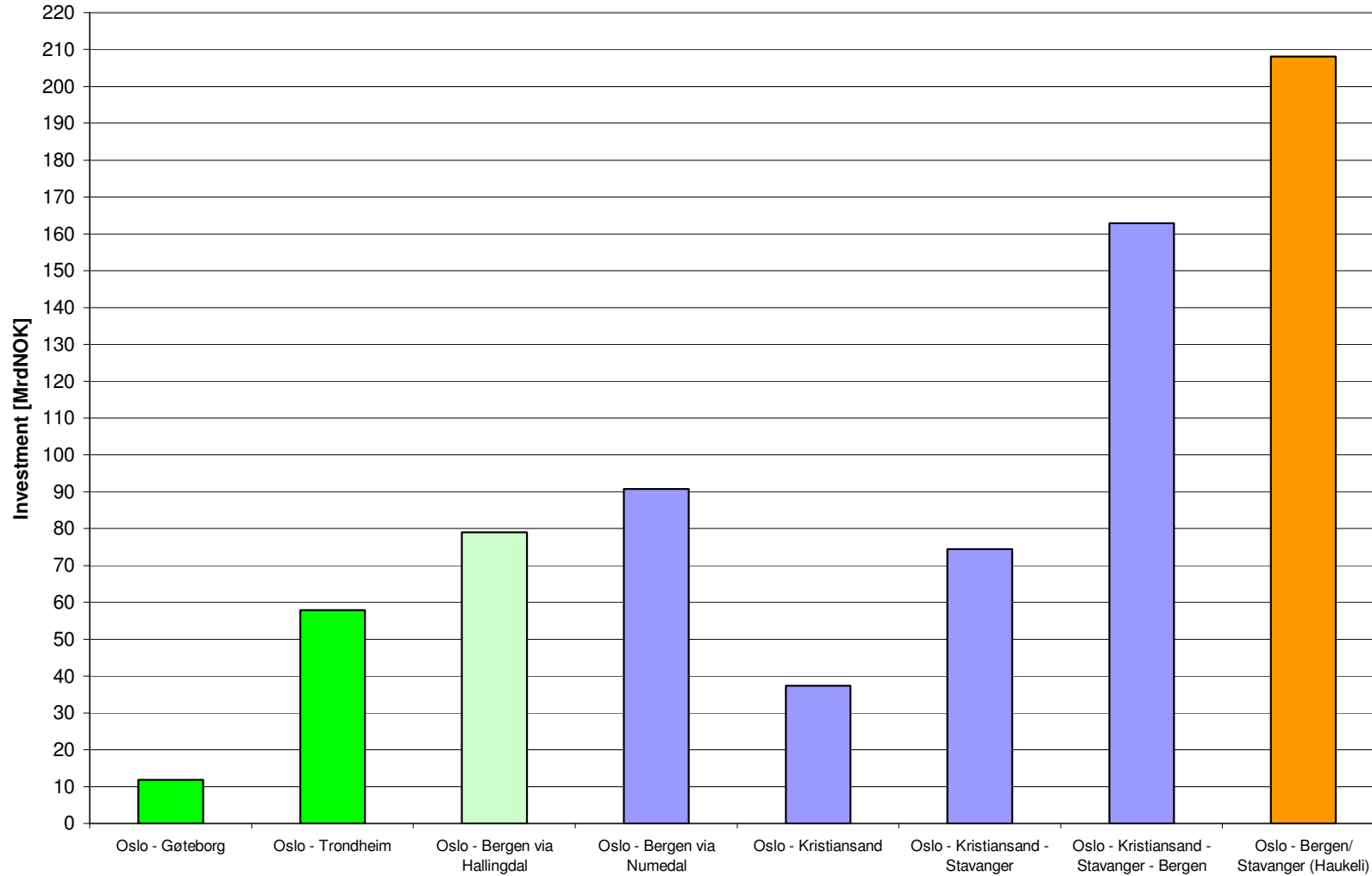
Cost-benefit-analysis gives a positive result, when the calculated Benefit-Cost-Ratio (BCR) is greater than 1.0.

$$\text{BCR} = \text{Sum of Benefits} / C \geq 1.0$$

That means: benefits induced by the investigated line must be at least the same as the costs of the project.

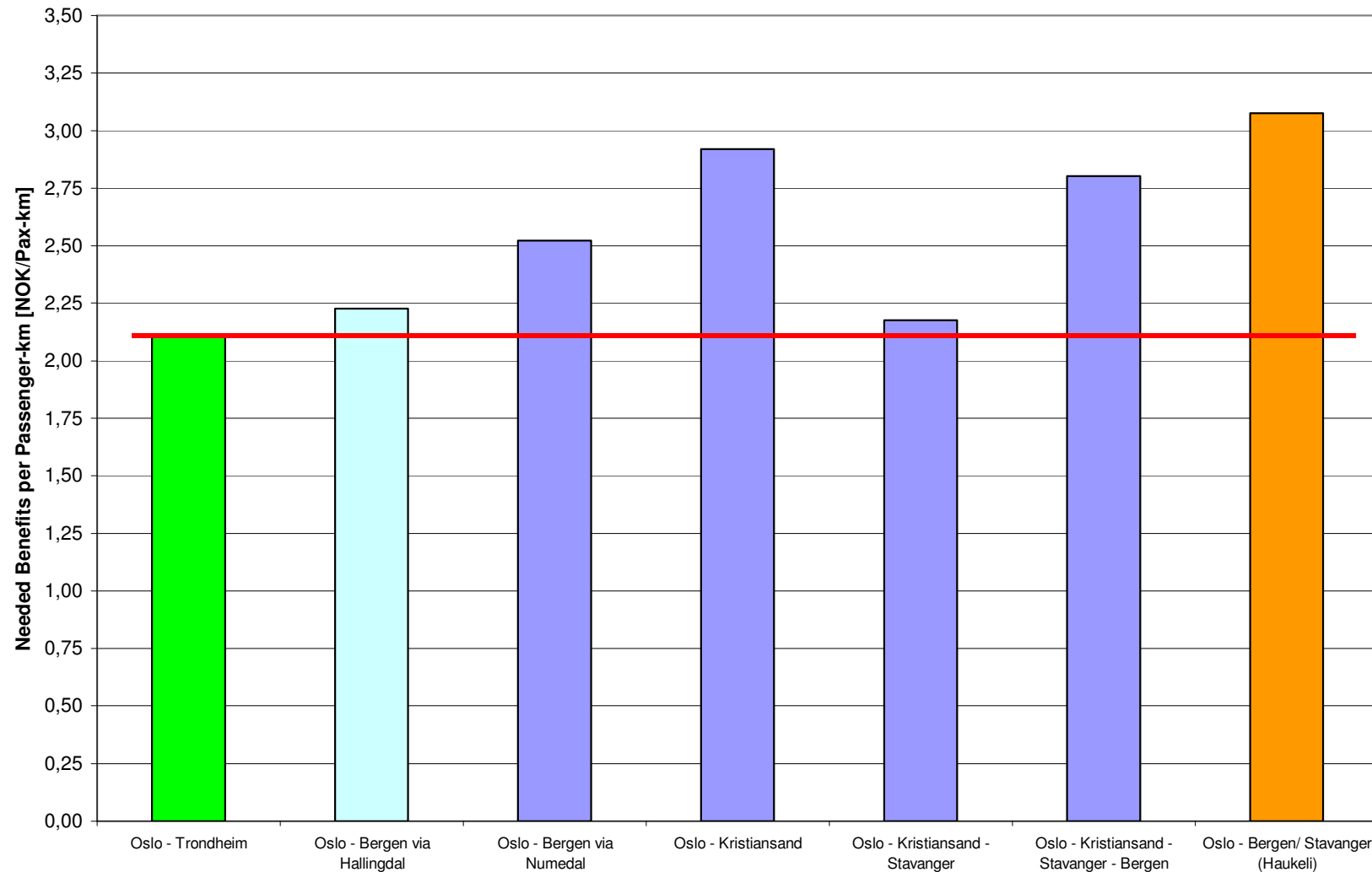
High-Speed-Railway Lines – Results

Infrastruktur Investment alternative Lines



High-Speed-Railway Lines – Results

Needed Benefits per Passenger-km High-Speed-Railway Lines



High-Speed-Railway Lines – Results

Presuppositions for the positive result of the Feasibility Study had been:

- concentrating on the main markets between the major points of demand and only few intermediate stops with adequate traffic demand
- offers strictly oriented on demand
- cost efficient planning of infrastructure with single track lines wherever sufficient
- additional regional services as feeder systems for the High-Speed-Services



High-Speed-Railway Lines – Results

- **High-Speed-Railway Lines reduce travel times, greenhouse gases and exhaust emissions as well as they increase traffic safety and give contributions to environmental benefits**
- **High-Speed-Traffic improves the accessibility between the major cities in Norway**
- **High-Speed-Traffic reduces domestic air traffic significantly**



High-Speed-Railway Lines – Conclusions

The Feasibility Study shows

- **A positive Benefit-Cost-Ratio for the two reference lines**
 - ⇒ from Oslo to Trondheim and
 - ⇒ from Oslo to Göteborg**in a detailed evaluation**

- **Comparable results for the lines**
 - ⇒ Oslo – Trondheim,
 - ⇒ Oslo – Bergen and
 - ⇒ Oslo – Kristiansand – Stavanger**in a simplified evaluation**

Further steps with a detailed planning should be done.