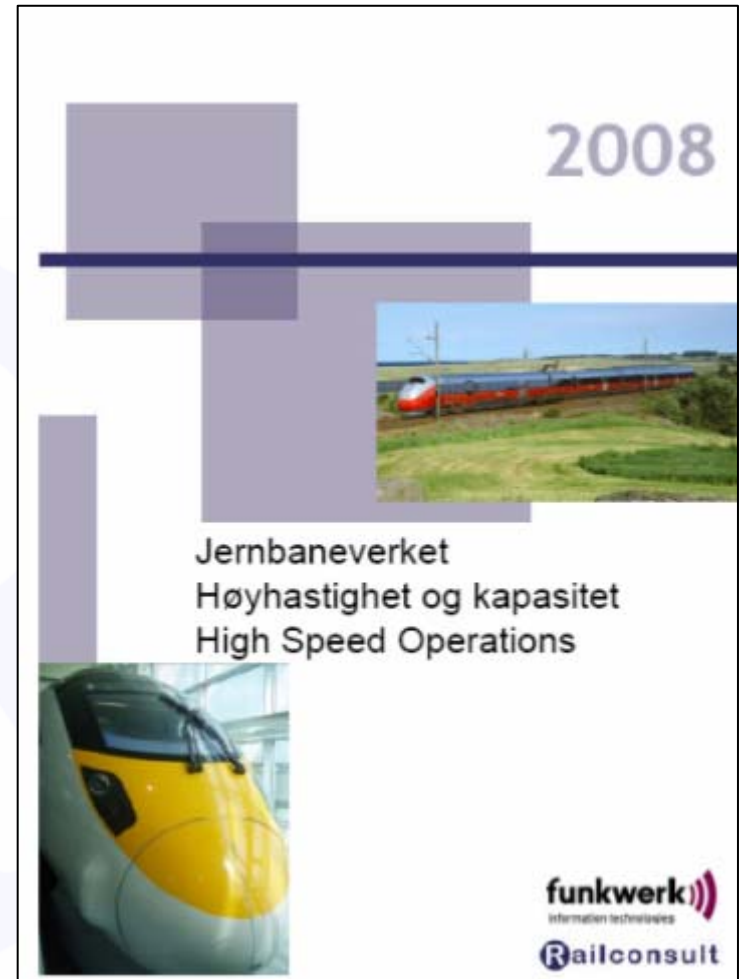


Høyhastighetstog i Norge Vurdering av kapasitetsmessige forhold.

27.november 2008

Ove Skovdahl
Railconsult AS



Background

- Ⓡ VWI 2007 High Speed Report

Purpose of the Project is to investigate:

- Ⓡ *Is it advisable to integrate High Speed Trains with other train traffic in IC-area?*
- Ⓡ *Is it advisable to run High Speed Trains in 1 or 2 hr service frequency on single track lines?*

Consultants

- Ⓡ Funkwerk-IT York
- Ⓡ Railconsult AS

Feasibility Study Concerning High-Speed Railway Lines in Norway

Report Phase 3
October 2007

Logos: VWI GmbH, ITT, A&I

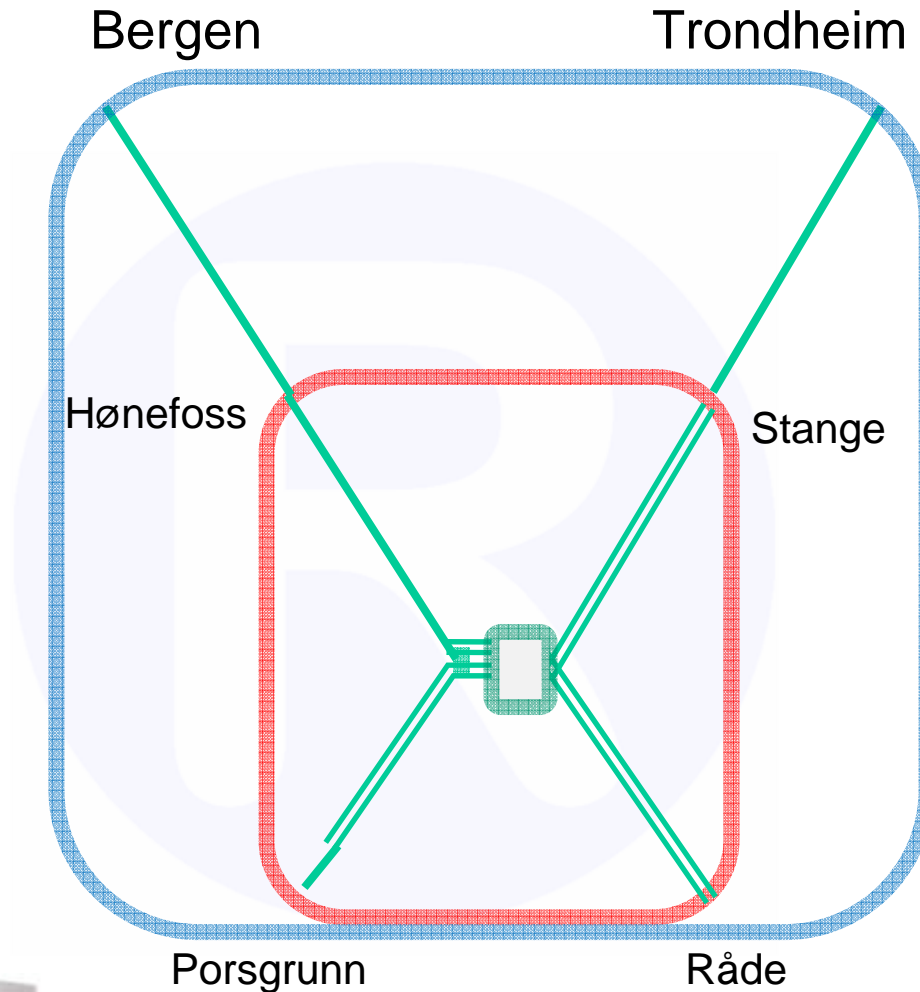


Working Method

- Ⓡ Workshops with stakeholders; agreement on assumptions.
- Ⓡ Working in phases; first IC Area and then HSL.
- Ⓡ Modelling, Calculations and Simulations by Funkwerk-IT
 - ▶ Modelling Infrastructure
 - ▶ Journey Time Calculations
 - ▶ Timetabling
 - ▶ Robustness Analysis
- Ⓡ Analysis in cooperation Funkwerk-IT and Railconsult AS.
- Ⓡ Project Periode June – October 2008

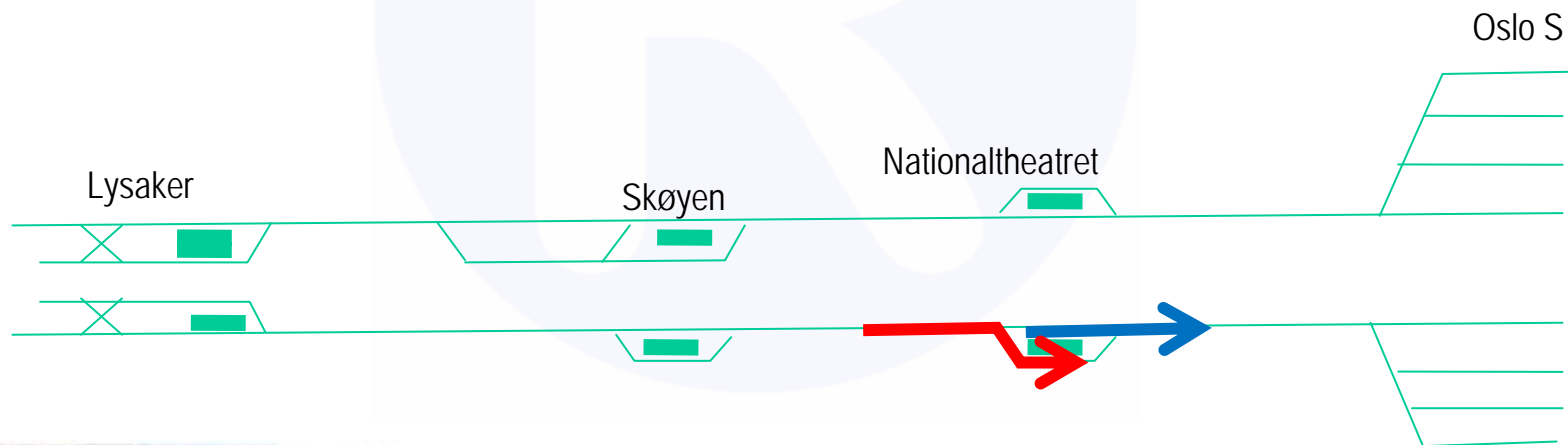


System Boundaries



Capacity Analysis

- Ⓡ Assumptions
- Ⓡ Analysis
- Ⓡ Conclusions



Train Service Concepts

Train Service Concept Definition for this project:

- Ⓡ Frequency
- Ⓡ Stopping Patterns
- Ⓡ Train type (max speed)

Workshop Conclusions:

- Ⓡ Using 2012 timetable proposal as basic concept.
- Ⓡ 6 Flytog per hour (3 Drammen, 3 Lysaker).
- Ⓡ Adjusting concept for reduced journey time when complete IC Area.
- Ⓡ Clockface timetable; same train paths every hour



Infrastructure

The railway infrastructure for this study consists of:

- Ⓡ The existing infrastructure.
- Ⓡ New infrastructure under construction, planned to be inaugurated in 2012. Future alignment is known.
- Ⓡ New infrastructure planned to be established before 2025, but future alignment not yet known
 - ▶ *4 Track Oslo – Ski (Oslo S section)*
 - ▶ *Double Track Tønsberg-Larvik*
- Ⓡ New High Speed lines. Future alignment drawn by VWI.

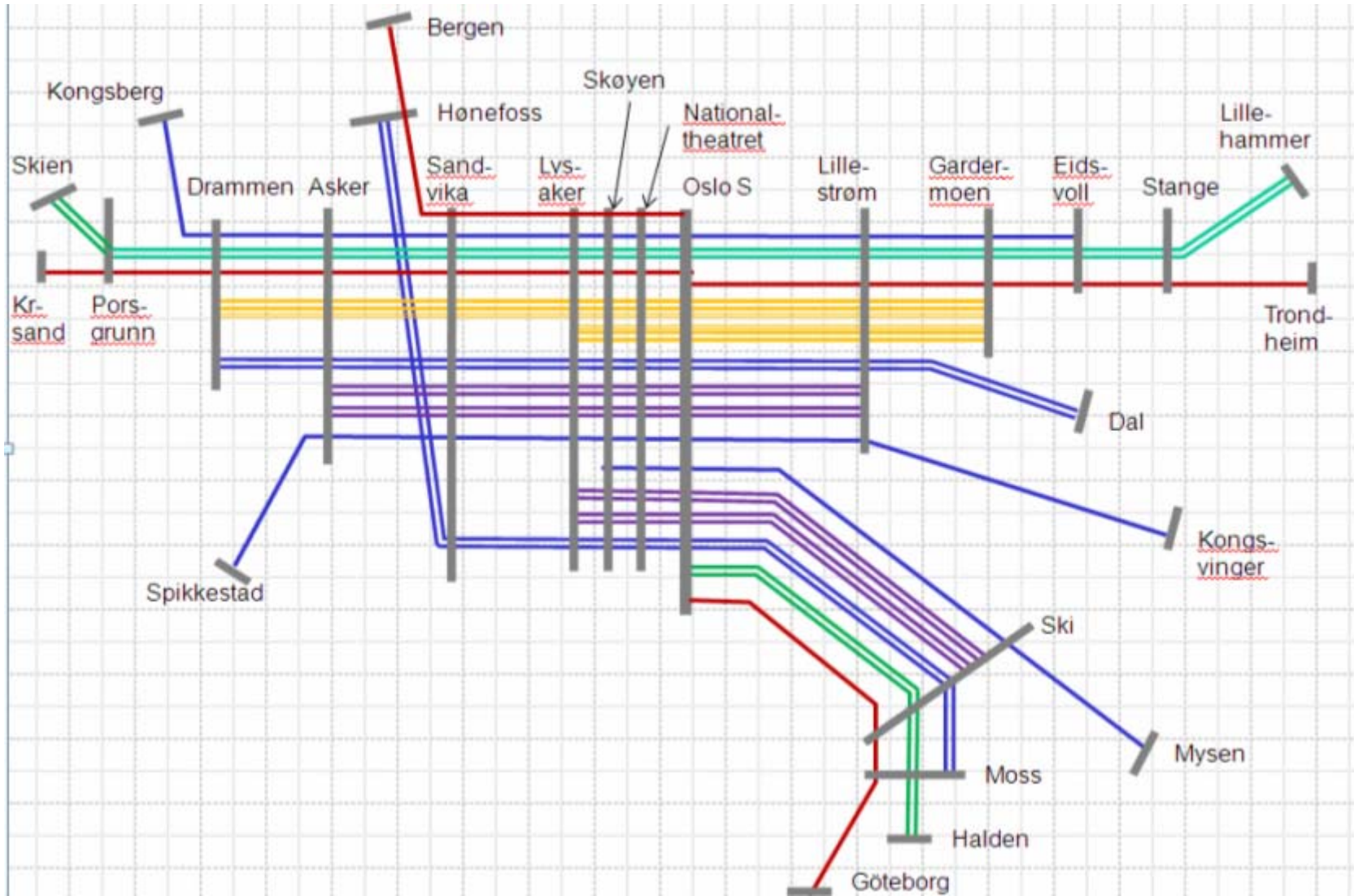


Timetable Assumptions

- Ⓡ IC Half-hourly to Lillehammer and Skien:
- Ⓡ High speed trains replace existing long distance trains (Bergen/ Kristiansand) Oslo - Drammen.
- Ⓡ Planning headway 2 min Lillestrøm-Oslo-Lysaker (*assuming sufficient improvements before traffic start*) and 3 min elsewhere
- Ⓡ Sufficient capacity for turning trains from Oslo west of Lysaker (substituting Skøyen/ Bestun).



Oslo – Lysaker. Distribution of Train Paths.



Timetabling Priorities

1. Oslo-Lysaker; follow NSB 2012 proposal, with cross city trains
2. IC Network.
3. High Speed Trains.
4. Local Trains Bergen/ Trondheim.

Buffer times added when trains entering into the Lysaker-Oslo section.



Methods

Journey Time Calculation

- ® Follobanen/ Østfoldbanen: JBV Calculations
- ® IC Area: RailPlan
- ® High Speed Lines: RailPlan

Timetabling:

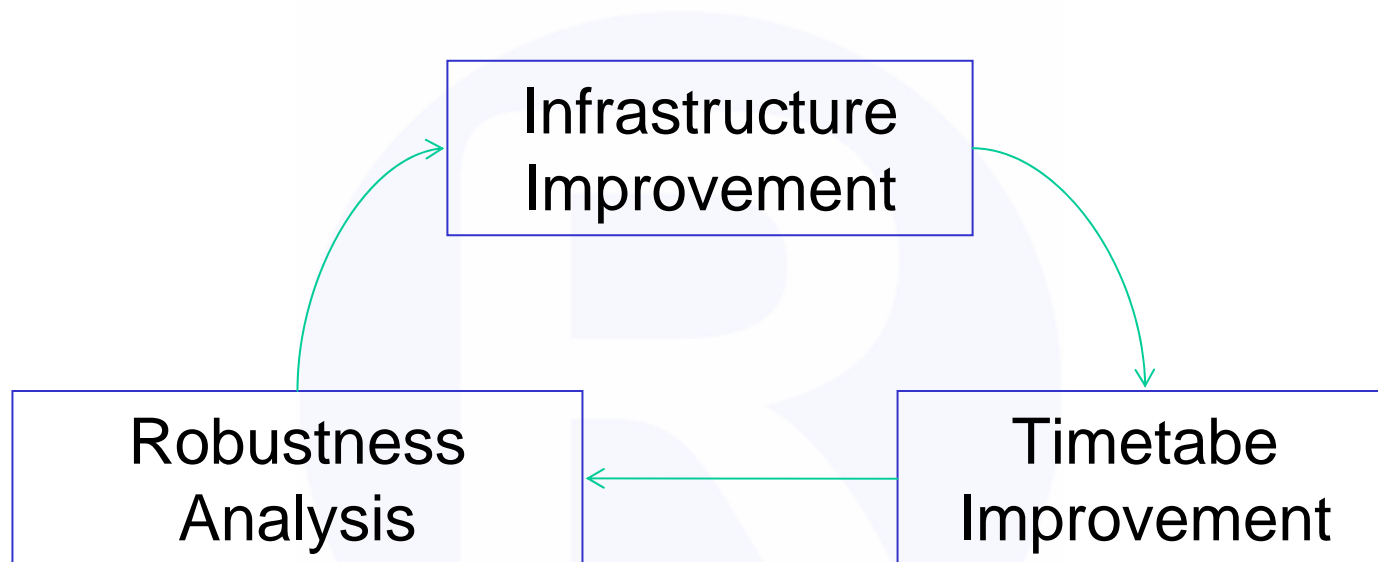
- ® TrainPlan

Robustness Analysis:

- ® Oslo – Lysaker: UIC Capacity Method
- ® IC Area: TrainPlan TTRA
- ® High Speed Lines: RailPlan



Planning Iteration/ Optimalisation Process

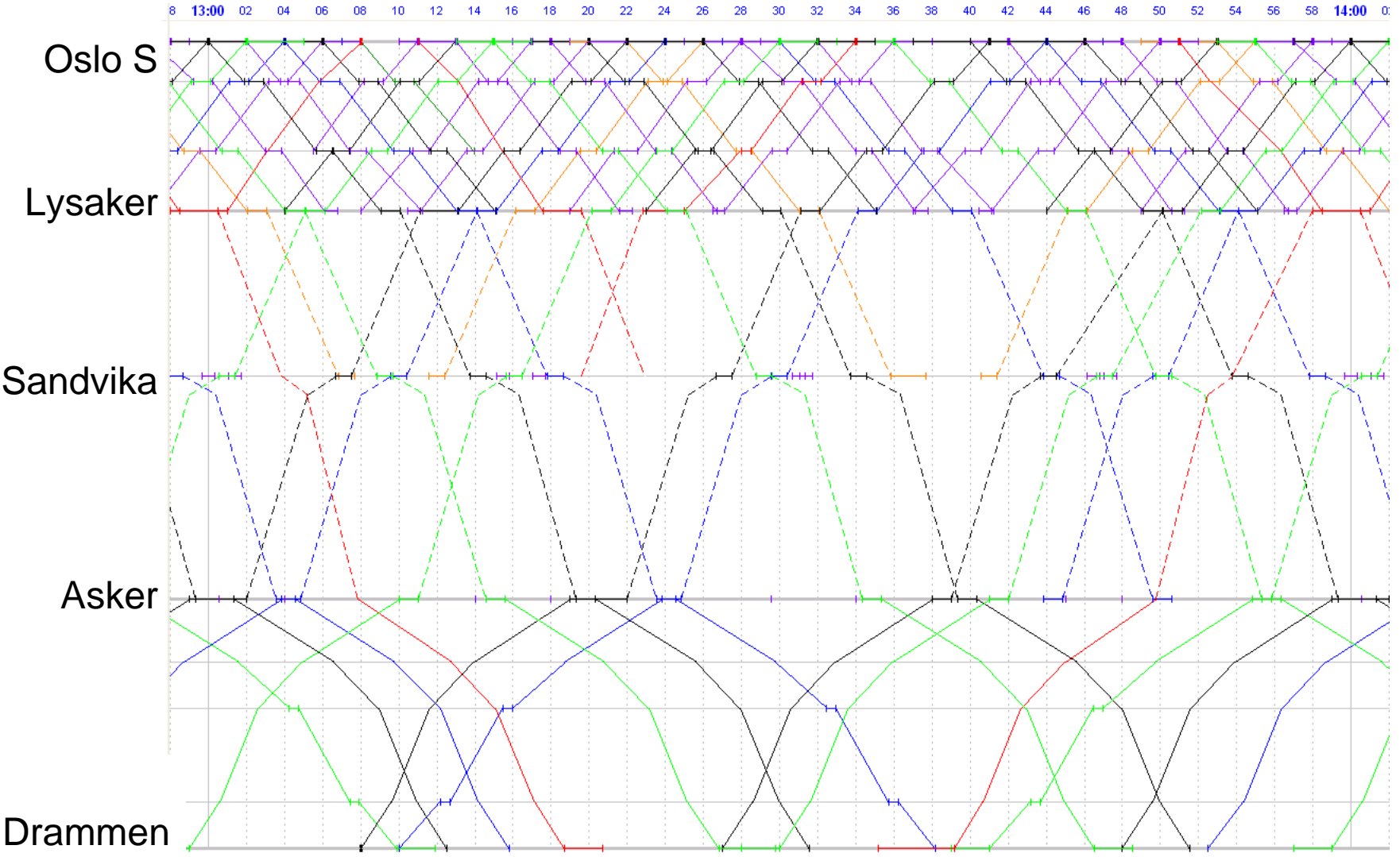


IC Area Timetable Example Oslo - Drammen

		2220	3732	2722	1672	3532	1222	611
		From LLS	From GAR	From SKI	From DAL	From GAR	From MYS	From OSL
		B693/130	REG/200	LKL/130	LKL/160	REG/200	LKL/130	HHT/300
Oslo S	dep	10:57	11:00	11:02	11:04	11:06	11:08	11:11
Nationaltheatret	arr	10:59	11:02	11:04	11:06	11:08	11:10	
	dep	11:00	11:03	11:05	11:07	11:09	11:11	11/13
Skøyen	arr	11:03	11:05	11:07	11:09	11:11	11:14	
	dep	11:04	11:06	11:08	11:10	11:12		11/15
Lysaker	arr	11:06	11:09	11:11	11:13	11:15		11:17
	dep	11:07	11:10		11:14			11:19
	line		HSL		HSL			HSL
Sandvika	arr	11:15	11:14		11:18			
	dep	11:16	11:14		11:18			11/23
Tanumåsen Bp,			11/16		11/20			
Asker	arr	11:29	11:19		11:23			
	dep		11:20		11:24			
Eriksrud			11/25		11/30			
Lier	arr				11:32			
Brakerøya	arr				11:35			
Drammen	arr		11:31		11:38			



IC Area Train Graph Oslo to Drammen



IC Area Conclusions

1. IC Area

- Ⓡ Simulation of full service in IC area suggests timetable not very robust. Whilst theoretically feasible to operate, we forecast it difficult to recover from significant delays.

2. Oslo - Lysaker

- Ⓡ Provided <90 second technical headway can be achieved Oslo - Lysaker, we forecast it possible to operate proposed timetable with 25 trains per hour.
- Ⓡ The change from the proposed 2012 timetable to this study is marginal.

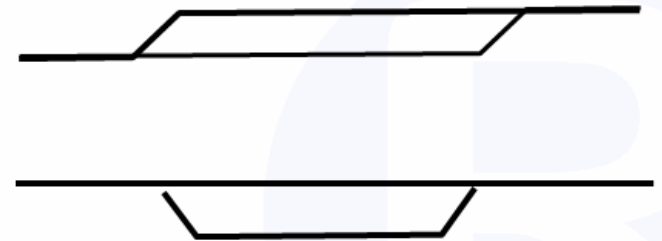
3. IC Area Single Track Lines

- Ⓡ We have been unable to identify a good service pattern on Ringeriksbanen which can operate reliably as planned with the proposed crossing points.



HSL Crossing Loops Assumptions

- Ⓡ In principle: Crossing Loops where necessary.
- Ⓡ Location of double track sections and crossing loops recommended in this report is slightly different from VVI proposal, reflecting timetable constraints approaching Oslo.
- Ⓡ Increase in number of crossing loops because of adjustment to Oslo area timetable.
- Ⓡ Some extra crossing loops proposed to increase robustness (perturbed running)



High Speed Line Robustness Conclusion

- Ⓡ VWI journey times have been confirmed.
- Ⓡ Two-hourly high speed service with some extra peak trains can operate robustly Oslo – Bergen and Oslo – Trondheim.
- Ⓡ One-hourly frequency can operate at a robustness level comparable with IC Area.
- Ⓡ As expected on a single line, significantly late trains cause further knock-on delays and rarely recover time themselves.
- Ⓡ Track configurations and timetables tested here are good at absorbing small delays, with most trains recovering fully from start delays of 5 minutes or less.
- Ⓡ As identified by VWI, siting of crossing loops is crucial and is tied very closely to the timetable selected.



Konklusjoner:

Under de gitte forutsetninger tyder dette studiet på at:

- Det vil kunne etableres driftsopplegg med høyhastighetstog i totimersfrekvens på enkeltspor.
- Høyhastighetstog i timesfrekvens kan implementeres på dobbeltsporede IC-strekninger.
- Forutsatt gjennomført kapasitetsforsterkende tiltak vil ruteplanen kunne gjennomføres Oslo - Lysaker med tilfredsstillende kvalitet.

Ruteplanen har samme antall tog Oslo-Lysaker som planlagt for 2012.

