



Dynamisches Eisenbahn System Modell  
Modèle dynamique d'un système ferroviaire  
Dynamic model of a railway system

# OpenTrack-Training in Riyadh Planning the future Operations on the SAR Network



Dave Dougill

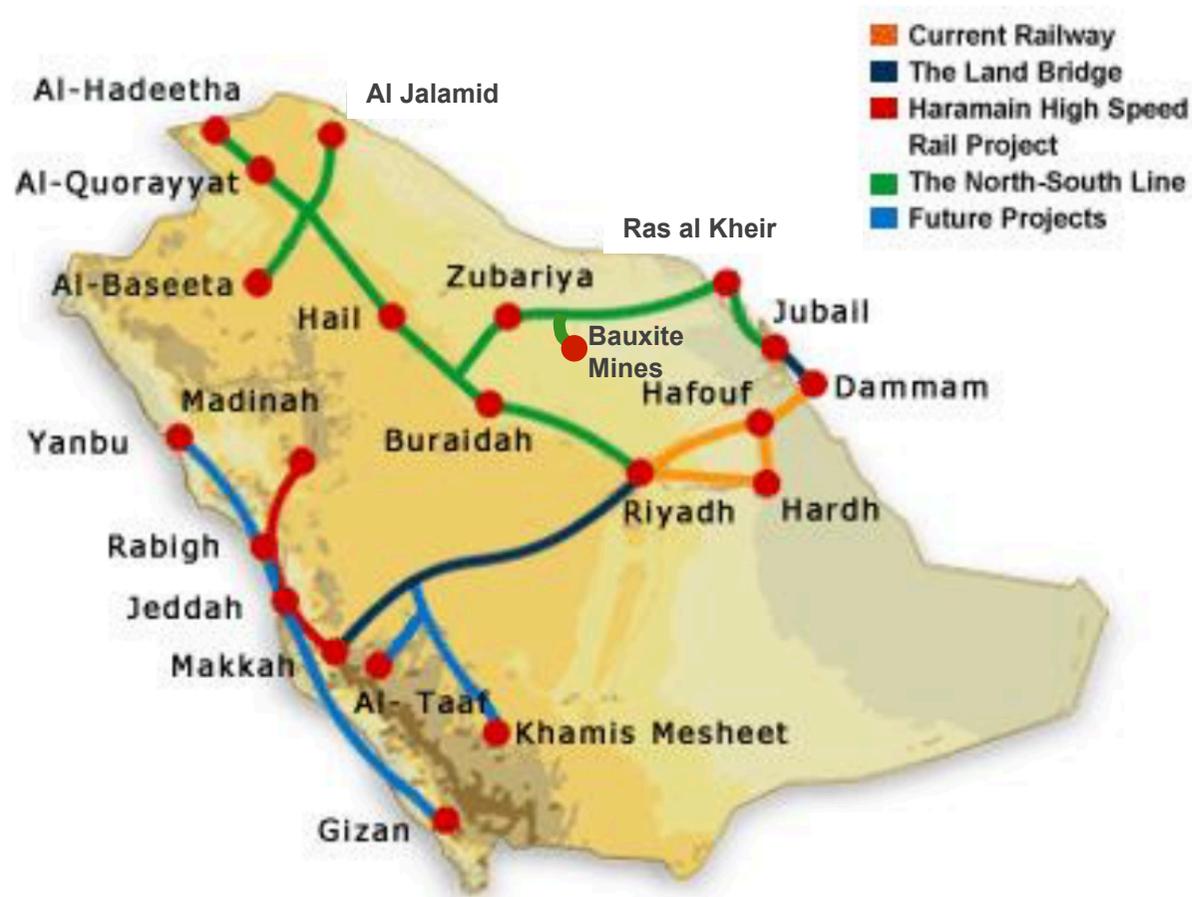
Presentation at nextRail17, 8<sup>th</sup> September 2017  
Jürg Suter

# Topic



- 1. Overview of SAR Network**
- 2. Application of OpenTrack at SAR**
- 3. Task and structure of the training**
- 4. Realization in Riyadh**
- 5. Conclusions: Exchange of experiences**

# 1. Overview of SAR Network



<http://pkonweb.com/saudi-arabia-seeks-private-partner-for-rail-operations/>, 10.08.2017

# 1. Overview of SAR Network



**Mineral  
Transport**

# 1. Overview of SAR Network



## SAR: Saudian Railway Company (Nord-South line)

### Mineral transport

#### - Traction:

- SD 70 locomotives  
22,6 m, 186 t

#### - Trains:

- Phosphate and Bauxite transport
- Train with 155 wagons  
4'650 t (empty), 20'150 t (loaded)



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# 1. Overview of SAR Network



**Passenger  
Service**

# 1. Overview of SAR Network



## **SAR: Saudian Railway Company** (Nord-South line)

### **Passenger service**

- Day Compositions:
  - CAF trains
  - 9 passenger cars
- Night Compositions:
  - CAF trains
  - 13 passenger cars



SAR

# 1. Overview of SAR Network



**Mixed service**

# 1. Overview of SAR Network



## Special conditions for operation management

- Infrastructure / Network:
  - Single track lines (1'361,3 km)
  - ETCS level 2



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# 1. Overview of SAR Network



## Special conditions for operation management

- Operation:
  - No fix time table (mineral trains)
  - Speed differences (80 km/h – 200 km/h)

AZ1	10/05/2016 05:46	10/05/2016 05:51	5:46	5:51	05/10/16	05/10/16	05:46	05:51	0:00
AZ1 South									0:00
Nariyah Yard	10/05/2016 05:11	10/05/2016 05:28	5:11	5:28	05/10/16	05/10/16	05:11	05:28	0:00
Nariyah Yard South									0:00
RAK IMY	10/05/2016 04:29	10/05/2016 04:34	4:29	4:34	05/10/16	05/10/16	04:29	04:34	0:00
RAK IMY South									0:11
RAK	10/04/2016 22:03	10/05/2016 04:00	22:03	4:00		05/10/16		04:00	0:00
			<b>Total Line Duration (hrs)</b>	<b>54:18</b>	<b>Delays in RAK (hrs)</b>	<b>0:00</b>	<b>Toal Line Delays (hrs)</b>		<b>46:28</b>
<b>Train ID</b>	<b>Next Train</b>			600208 (MBL-08)	400206 (MBE-06)				

# 1. Overview of SAR Network



## Special conditions for operation management

- Environment / Weather:
  - Sand storms



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# 1. Overview of SAR Network



## Operation management

- Operation Centre in Riyadh
  - Safety installations by Thales
- Intervention teams in the field



## 2. Application of OpenTrack at SAR



## 2. Application of OpenTrack at SAR



### Planification of Operation processes

- Create fix time tables for mineral trains
  - Better commitment of staff and rolling stock
  - Coordination with future passenger services
  - Investigations of incidents and delays
- Preparation of new requirements
  - Changements of transport volumes and rolling stock

# 3. Task and structure of the training



	Tu	We	Th	Fr	Sa	So	Mo	Tu	We	Th			
	27.10.	28.10.	29.10.	30.10.	31.10.	01.11.	02.11.	03.11.	04.11.	05.11.			
08:00	Prep.												
09:00													
10:00	Module 1	Module 2	Module 3			Module 3	Module 4.	Res.	Res.	Res.			
11:00													
12:00													
13:00													
14:00	Module 1	Module 3	Module 3			Module 4	Res.	Res.	Res.	Res.			
15:00													
16:00													
17:00		Prep.	Prep.			Prep.	Prep.	Prep.	Prep.				
18:00	Prep.												
19:00													
20:00													
21:00													

# 3. Task and structure of the training



## Structure of the training

Module 1: Basic knowledge

Module 2: Exercises

Module 3: Modelling of a SAR line

Module 4: Application and repetition

The participants...

- ... know the basic structure and the philosophy of operation of the tool OpenTrack,
- ...are able to model any railway line topology in an independent way,
- ...can build rolling stock, trains and time tables,
- ...can perform simulations independently and evaluate them,
- ...are able to prepare concrete experiments according to requirements and to evaluate them based on the simulation data.

### 3. Task and structure of the training

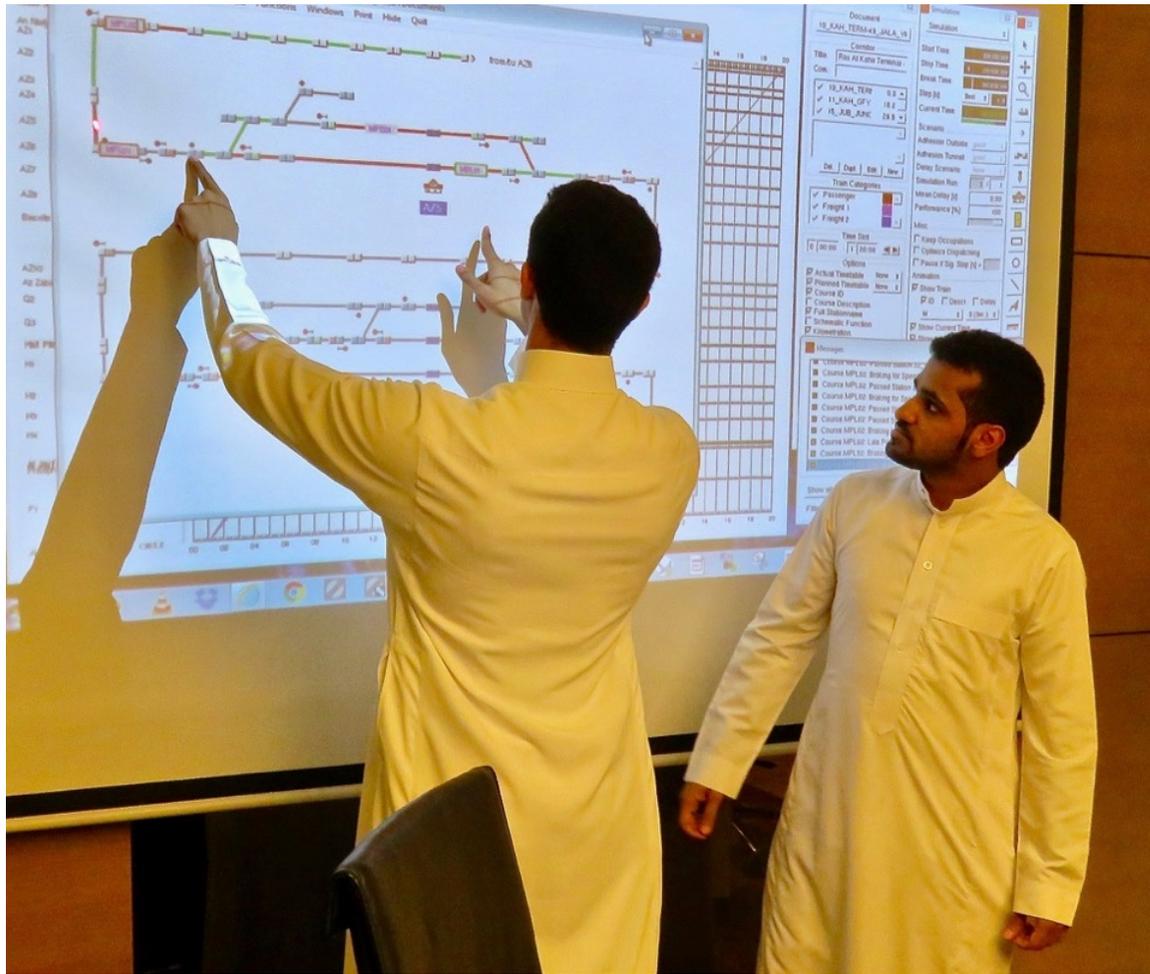


#### Theory and exercises

- Based on the OpenTrack Documentation and standard training
- Focussed on particular interests and requirements of SAR



# 4. Realization of the training in Riyadh



## 4. Realization of the training in Riyadh



### Contribution of OpenTrack

- Support the design of time tables under real conditions
  - Calculation of journey times of different train categories
  - Impact of incidents
- Planning of mixes service (mineral trains together with passenger trains on a single track line)

## 4. Realization of the training in Riyadh



### Solution in five steps

1. Analysis and understanding of the system
2. Elaboration of Infrastructure data
3. Modelling of infrastructure
4. Modelling of rolling stock
5. Design of timetable variations

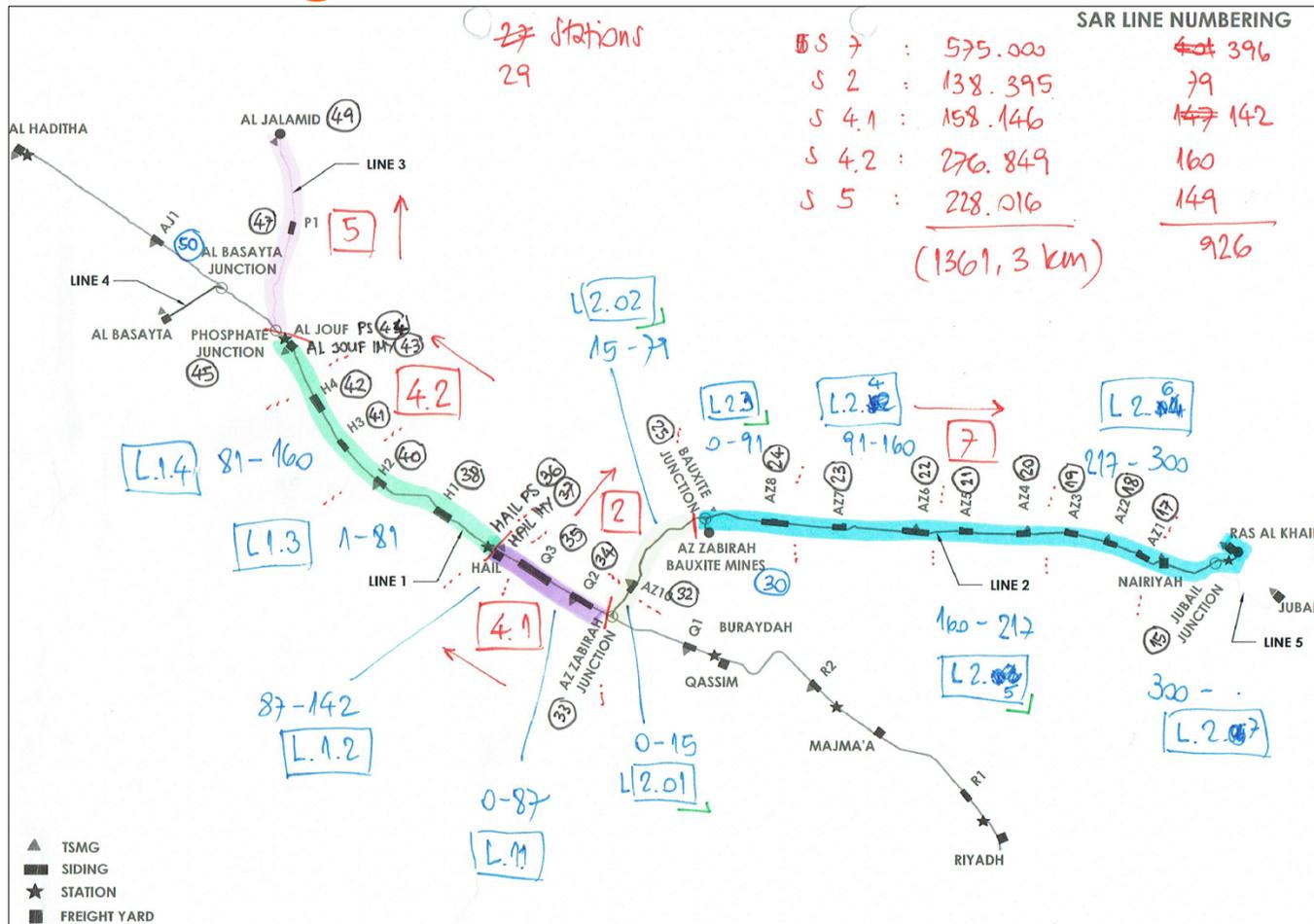


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# 4. Realization of the training in Riyadh



## Modelling of a SAR line



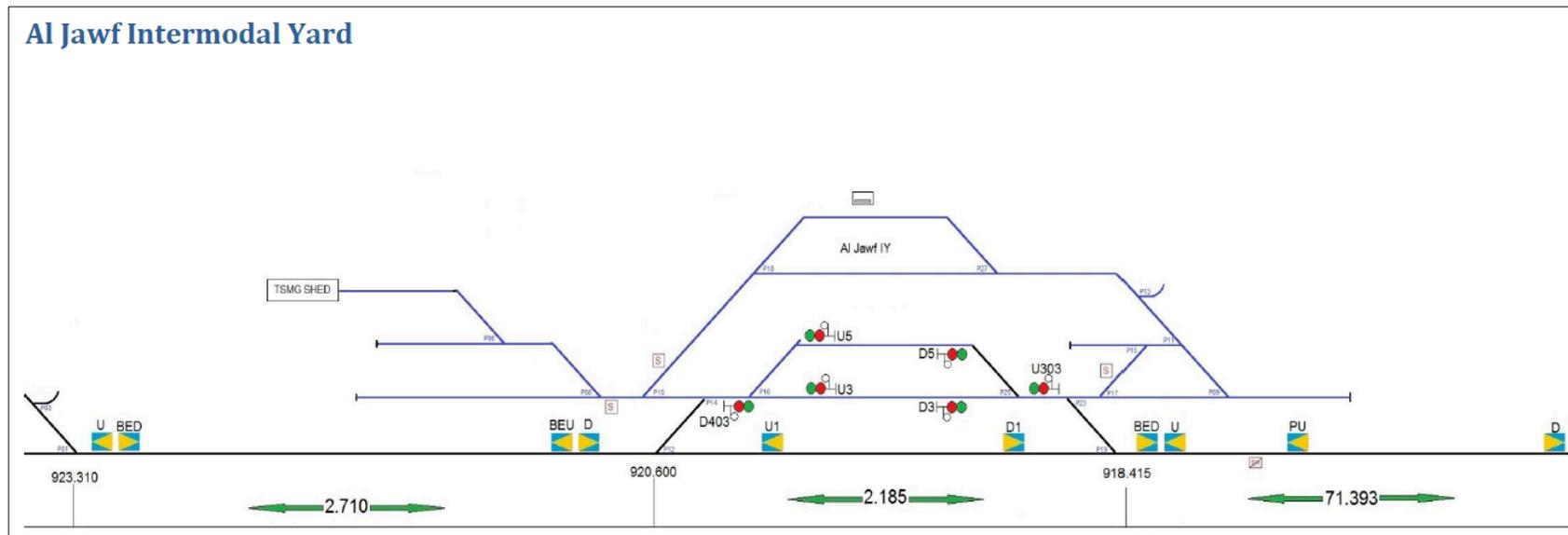
# 4. Realization of the training in Riyadh



## Modelling of a SAR line

First step:

To analyse and understand the system



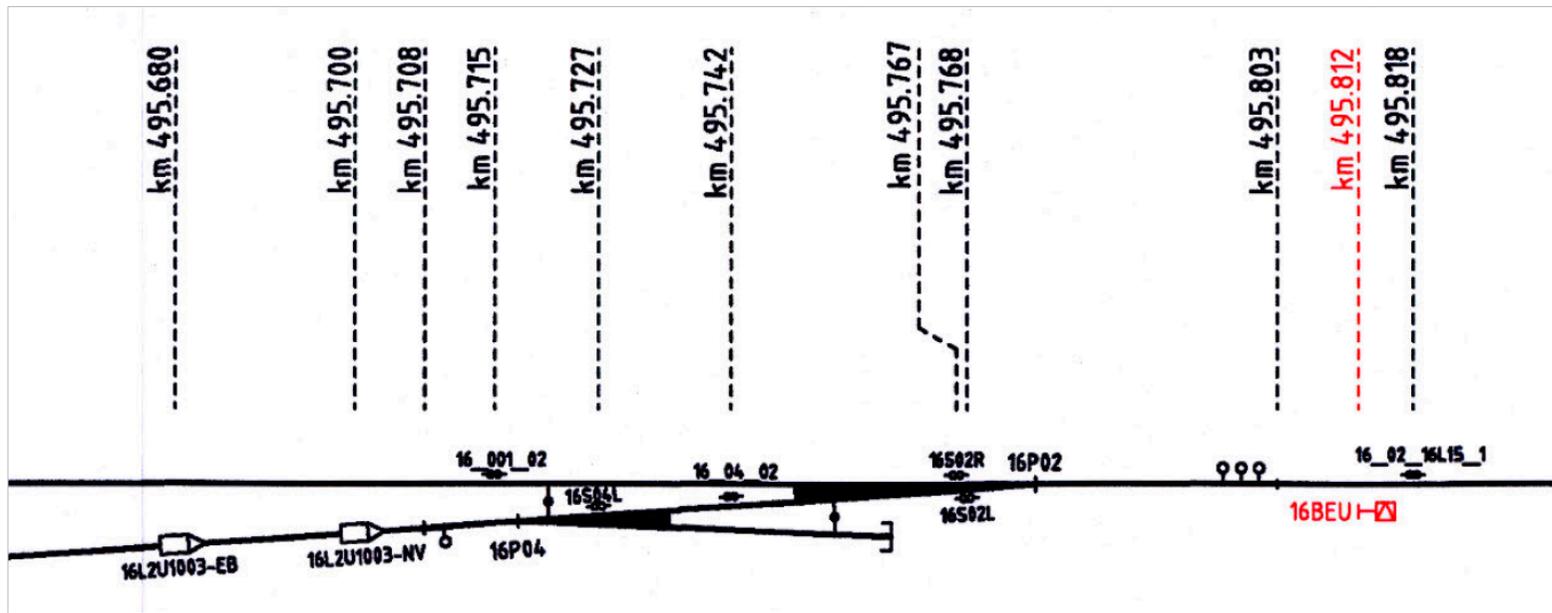
# 4. Realization of the training in Riyadh



## Modelling of a SAR line

First step:

To analyse and understand the system

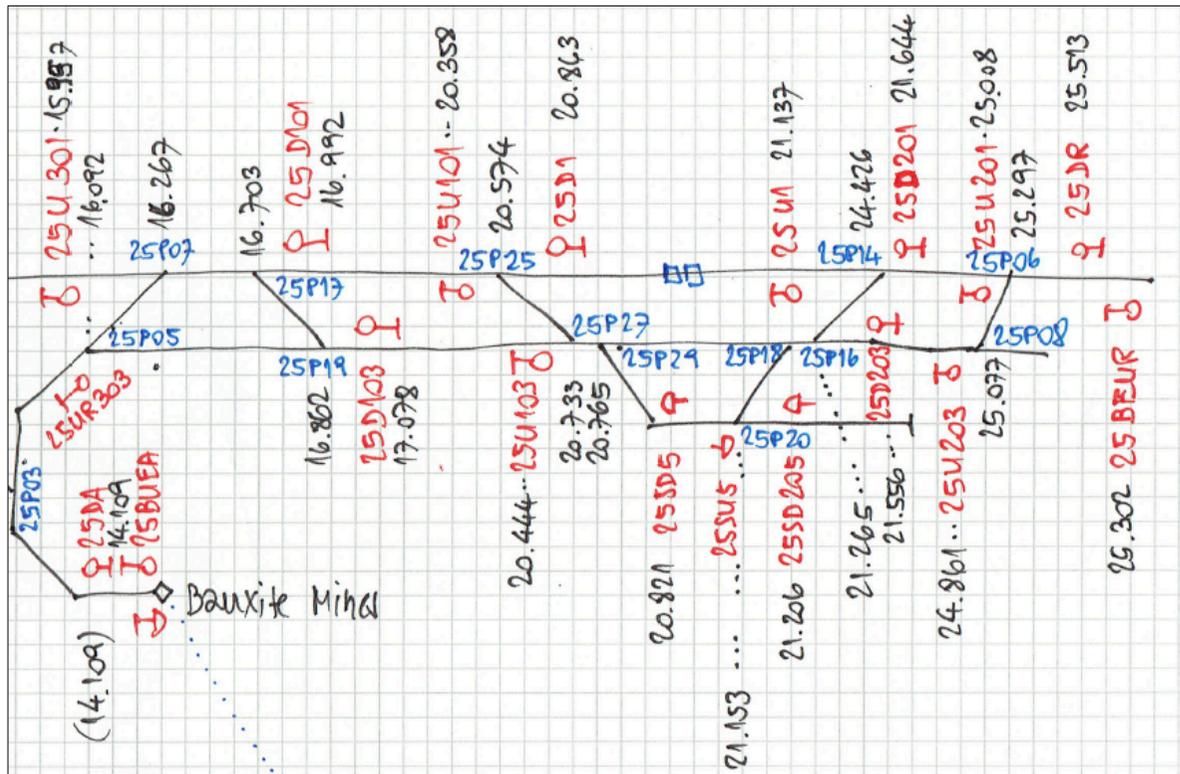


# 4. Realization of the training in Riyadh



## Modelling of a SAR line

First step: To analyse and understand the system



# 4. Realization of the training in Riyadh



## Modelling of a SAR line

Second step:

Establishment of infrastructure lists

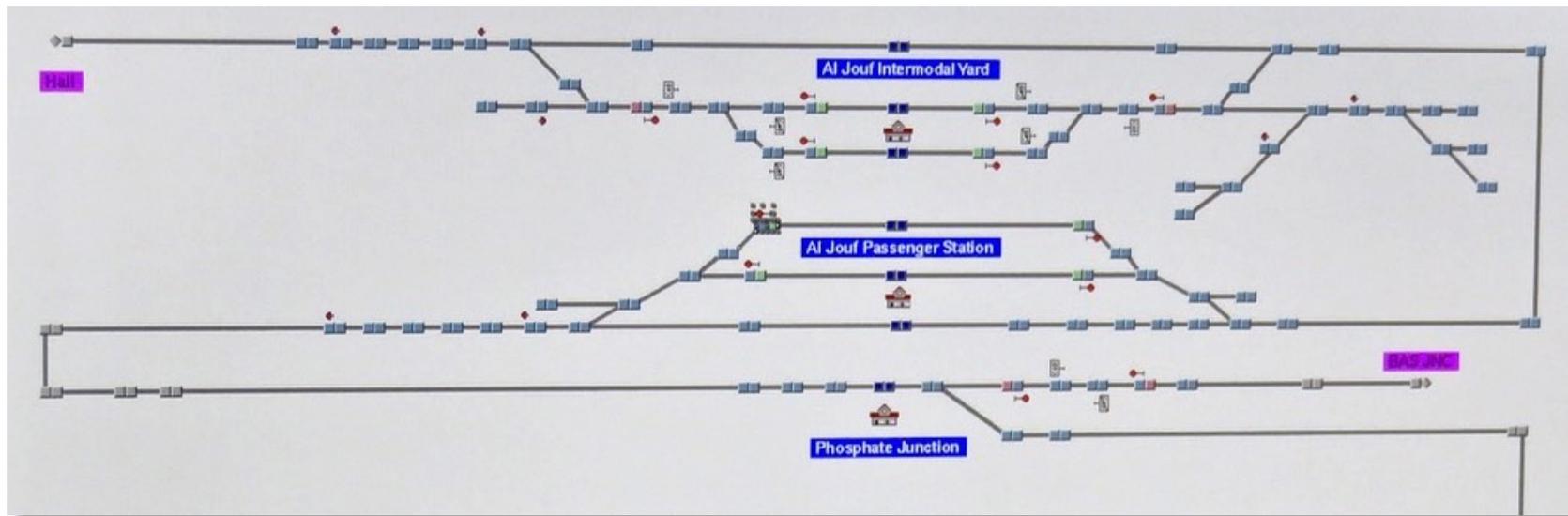
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1	//																			
2	//File: 151101_SAR_Master_L2_S7.xlsx																			
3	//																			
4	//																			
5	// Position	Name Up	Name Down	Km Up	Km Down	Speed Up								Gradient	Radius	Tunnel	Signal Up	Signal Down	Station	
352	544883	10U		544.883		250	120	80	60	250	120	80	60				Main Signal			347
353	546011			546.011		250	120	80	60	250	120	80	60	-3.25						348
354	546185	11BED		546.185		250	120	80	60	250	120	80	60					Main Signal		349
355	546186	11U		546.186		250	120	80	60	250	120	80	60				Main Signal			350
356	546187	11SHPD		546.187		250	120	80	60	250	120	80	60					Shunting Signal		351
357	546400	11P01		546.400		60	60	60	60	60	60	60	60							352
358	546693	11D1		546.693		60	60	60	60	60	60	60	60					Main Signal		353
359	547039			547.039		60	60	60	60	60	60	60	60	-0.53						354
360	547564	Ras Al Kahir GFY		547.564		60	60	60	60	60	60	60	60						11_KAH_GFY	355
361	548435	11U1		548.435		60	60	60	60	60	60	60	60				Main Signal			356
362	548728	11P02		548.728		60	60	60	60	60	60	60	60							357
363	548943	11D		548.943		250	120	80	60	250	120	80	60					Main Signal		358
364	548943	11BEU		548.943		250	120	80	60	250	120	80	60				Main Signal			359
365	548943	11SHPU		548.943		250	120	80	60	250	120	80	60					Shunting Signal		360
366	551743	11SHU		551.743		250	120	80	60	250	120	80	60					Shunting Signal		361
367	552474			552.474		250	120	80	60	250	120	80	60	0						362
368	554000			554.000		250	120	80	60	250	120	80	60	0						363
369	555000			555.000		250	120	80	60	250	120	80	60	0						364
370	554883	10U		554.883		250	120	80	60	250	120	80	60				Main Signal			365
371	555089	10BED		555.089		250	120	80	60	250	120	80	60					Main Signal		366
372	555169	10L2D		555.169		250	120	80	60	250	120	80	60				CAB Signal			367
373	555316	10P01		555.316		60	60	60	60	60	60	60	60							368
374	555404	10LOU901		555.404		60	60	60	60	60	60	60	60				CAB Signal			369
375	555404	10U901		555.404		60	60	60	60	60	60	60	60					Main Signal		370

# 4. Realization of the training in Riyadh in Riyadh



## Modelling of a SAR line

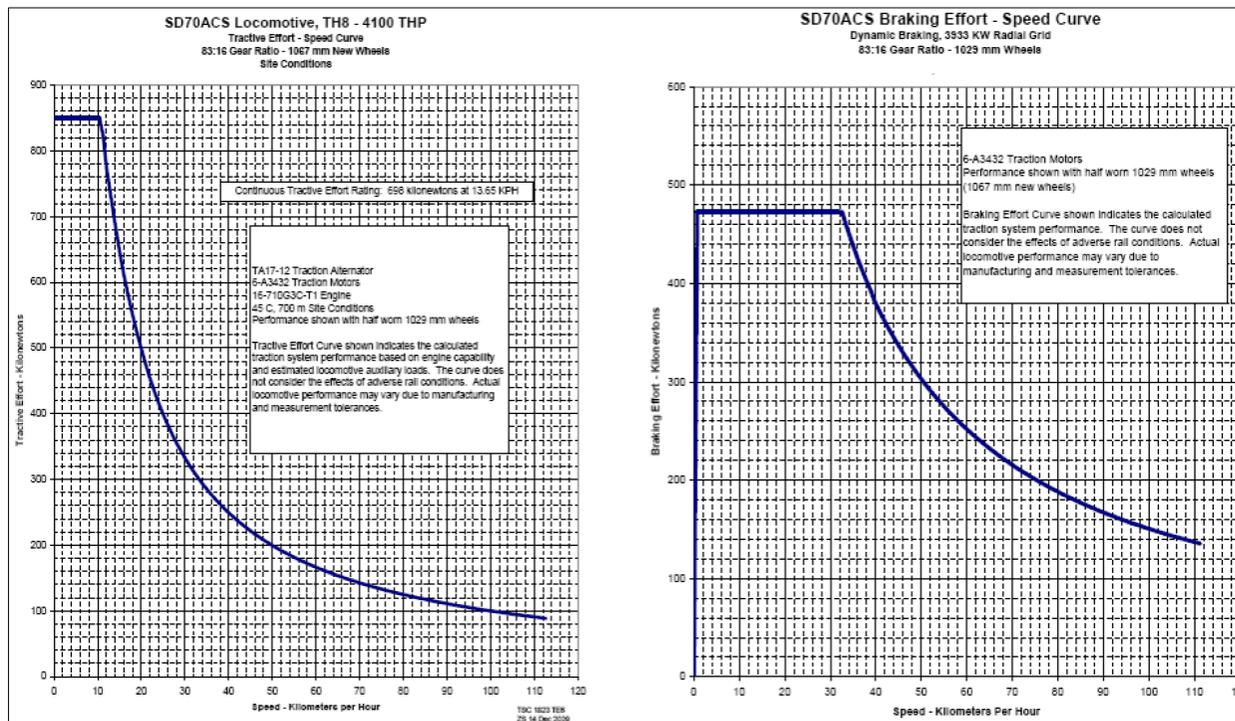
Third step: Modelling of infrastructure



# 4. Realization of the training in Riyadh

## Modelling of a SAR line

### Fourth step: Modelling of rolling stock



# 4. Realization of the training in Riyadh

## Modelling of a SAR line

Fifth step: Modelling of timetables

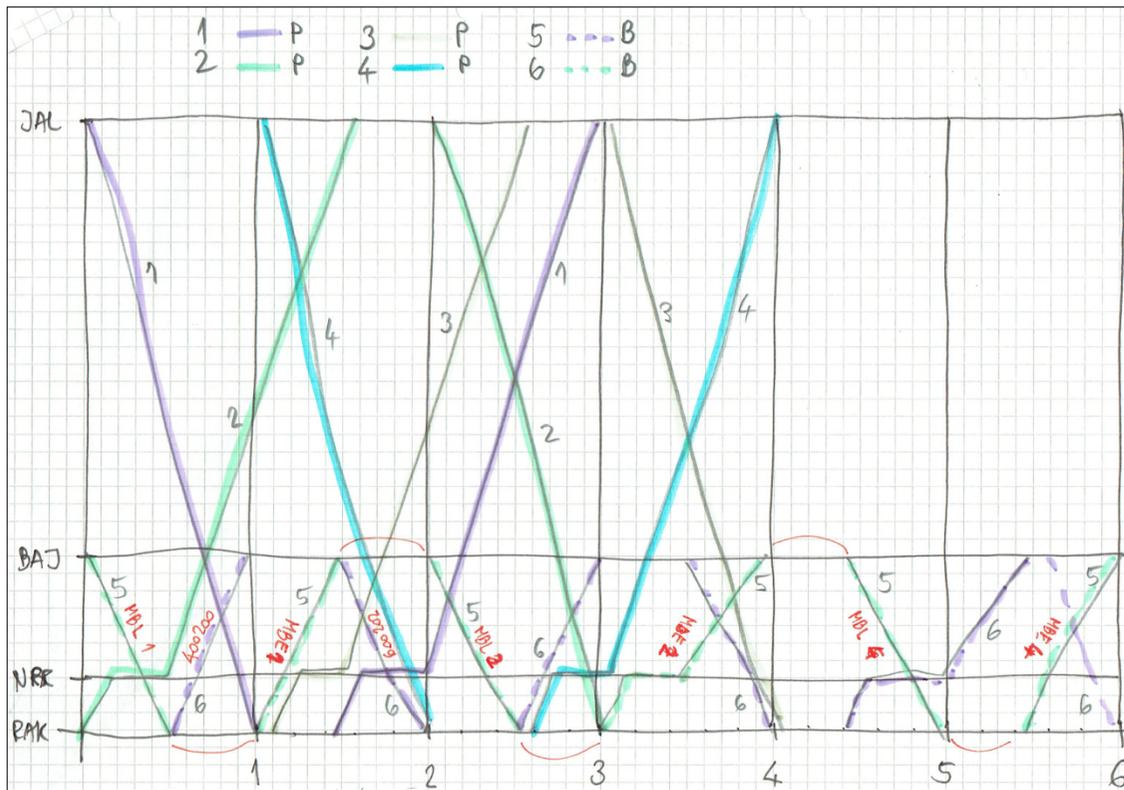


# 4. Realization of the training in Riyadh



## Modelling of a SAR line

### Fifth step: Modelling of timetables

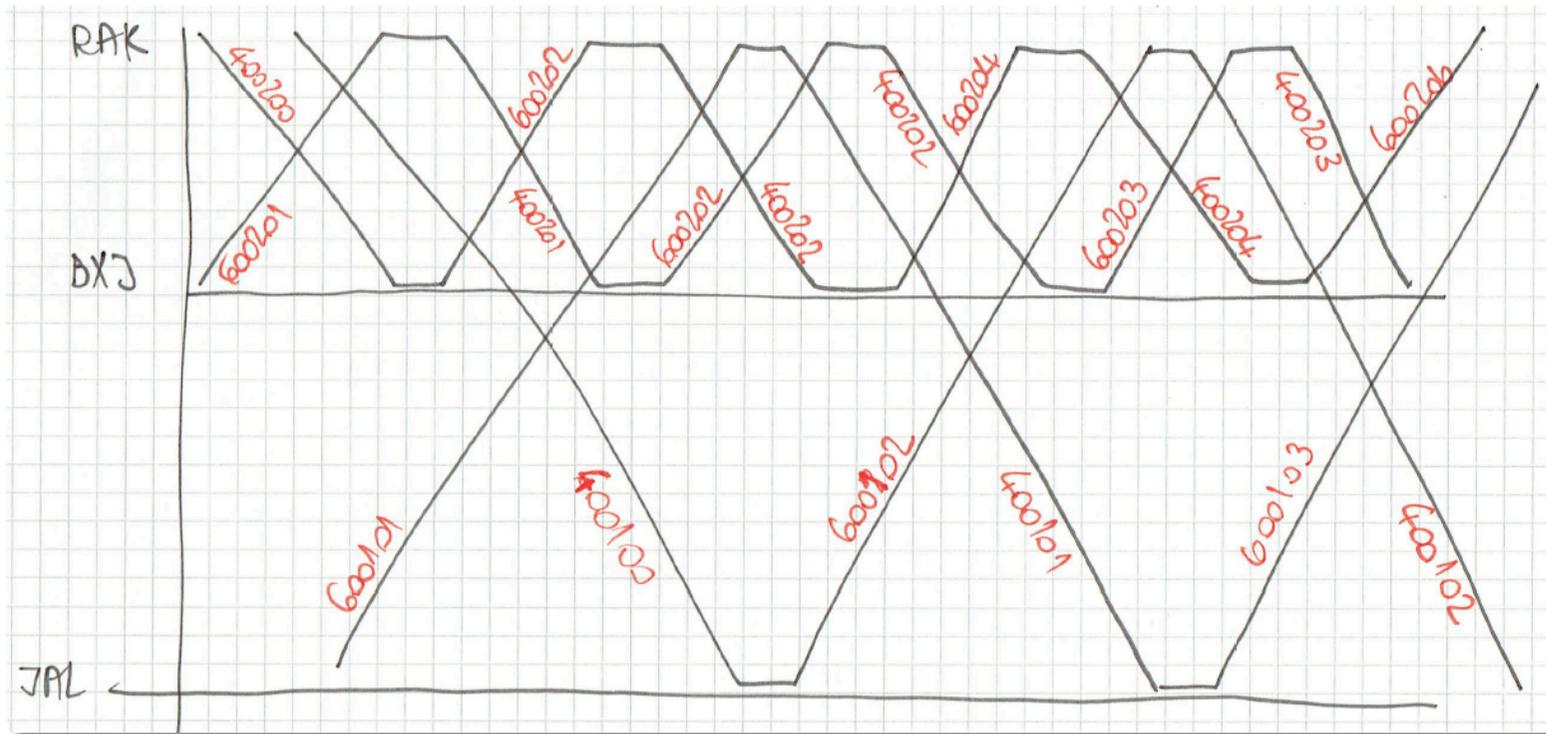


# 4. Realization of the training in Riyadh



## Modelling of a SAR line

Fifth step: Modelling of timetables



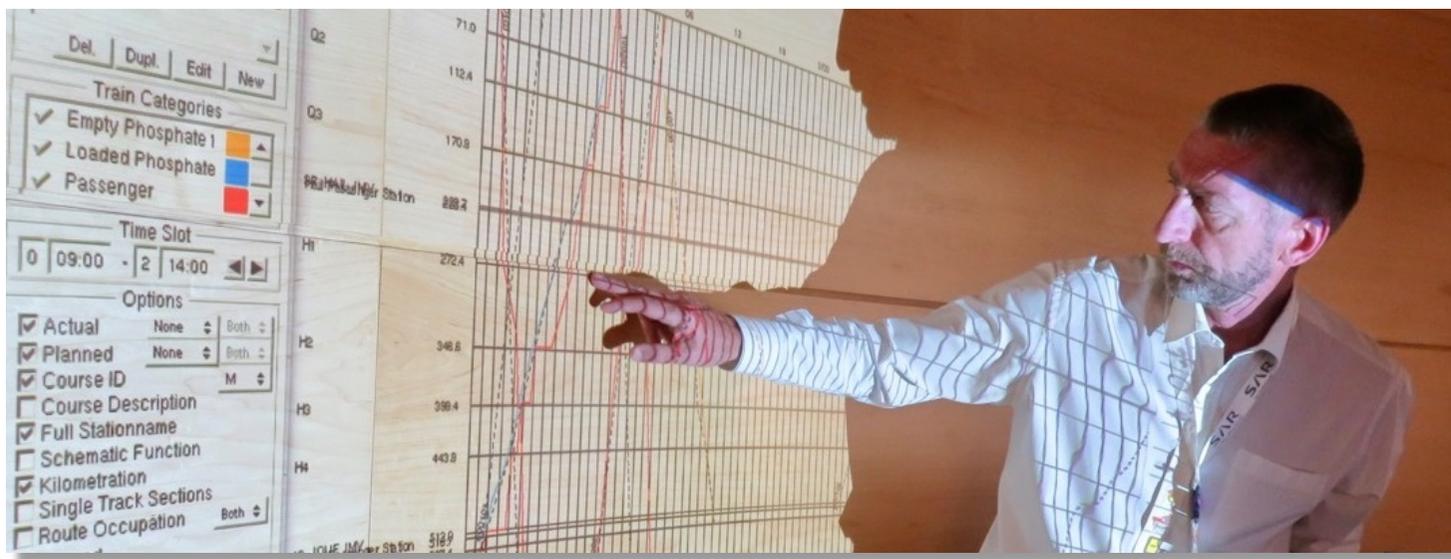
# 4. Realization of the training in Riyadh



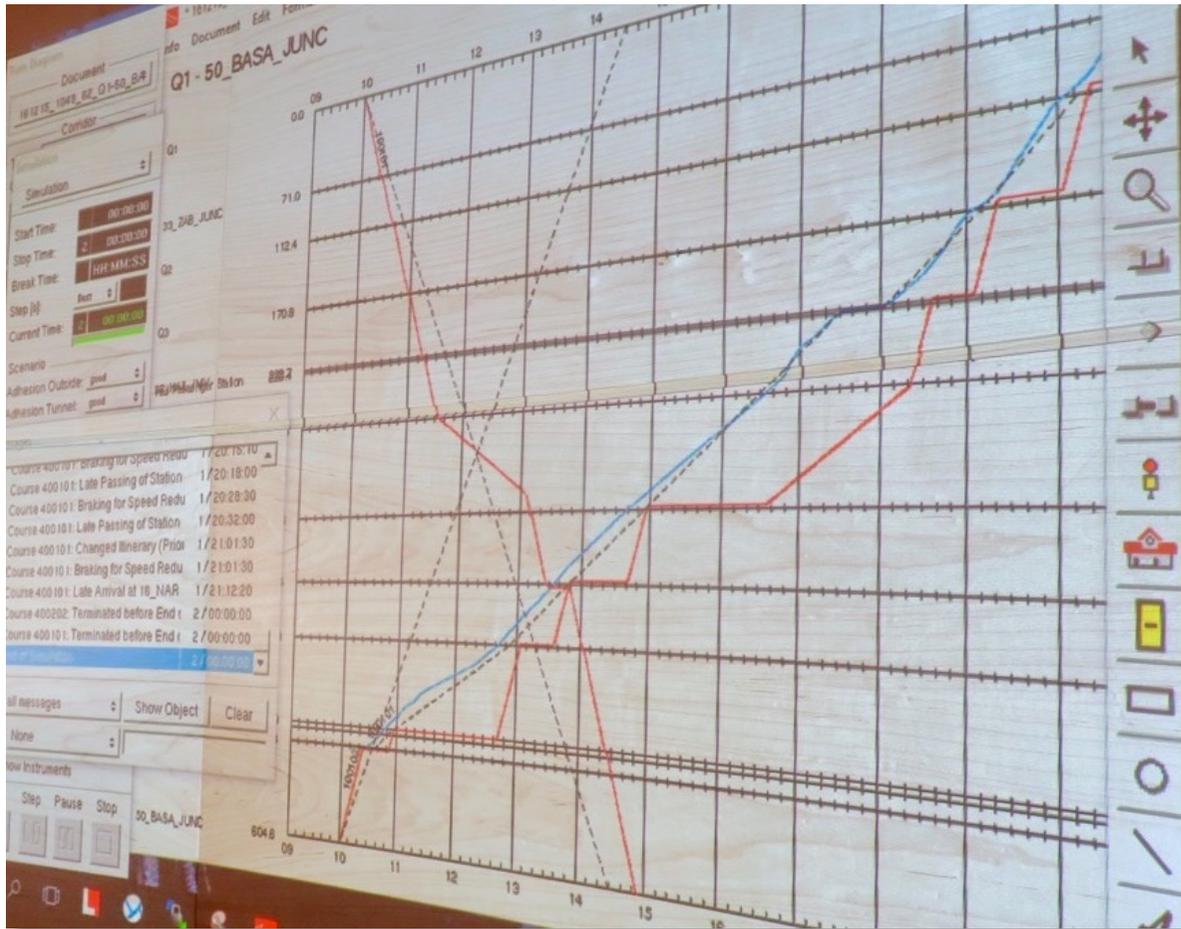
## Simulations

Creating scenarios for planning of operation

- Test timetable options
- Delays and Incidents



# 4. Realization of the training in Riyadh



## 5. Conclusions: Exchange of experiences



- Enough time to provide and find the data
- Theory and practice
- Expectations and use of the tool:  
OpenTrack doesn't take your responsibility

# Questions

