

HIGH-SPEED RAIL LINE—TANGIER-CASABLANCA

SNCF APO (ASSISTANT PROJECT OWNER) FOR MOROCCO'S HSR LINE



Trainset used for dynamic testing



Loukkès viaduct



Backfill 2128 – Excavations 2115



RGV M maintenance depot



Kenitra base camp and conventional rail connection

CONTENTS

1 - TANGIER–CASABLANCA BY HSR—A BRIEF HISTORY

1. Overview
2. SNCF's APO contract—a win-win partnership
3. Project timeline

2 - PROFESSIONAL EXPERTISE CONTRIBUTED

TANGIER-CASABLANCA BY HSR—A BRIEF HISTORY

TANGIER–CASABLANCA BY HSR—A BRIEF HISTORY

OVERVIEW

1. BACKGROUND: LINKING TANGIER–CASABLANCA BY HSR

Morocco: Fast facts

Population

- Nearly 35.3 million in 2017 (32 million in 2012) vs under 30 million in 2004
- Morocco is “a young country” that now shows signs of ageing
- Population is distributed **unequally**, with urban zones expanding
- 3 centres: Casa/Rabat, Fès Meknès and Tangier/Tetouan



Population by region/city

Population par région et par principales villes :

1. Oued Ed Dahab Lagouira	172 000
2. Laâyoune Boujdour Sakia El Hamra	317 000
3. Guelmim Es Smara	511 000
4. Souss Massa Draâ	3 491 000
5. Gharb Chrarda Bni Hassen dont Kénitra	1 784 000 1 231 000
6. Chaouia Ouardigha	1 731 000
7. Marrakech Tensift Al Haouz dont Marrakech	3 315 000 1 389 000
8. Oriental	2 002 000
9. Grand Casablanca dont Casablanca	3 910 000 3 524 000
10. Rabat Salé Zemmour Zaer	2 617 000
11. Doukkala Abda dont El Jadida	2 075 000 1 143 000
12. Tadla Azilal	1 508 000
13. Meknès Tafilalet	2 217 000
14. Fès Boulemane dont Fès	1 744 000 1 043 000
15. Taza Al Hoceima Taounate	1 865 000
16. Tanger Tétouan	2 985 000
TOTAL	32 245 000

Source : CFCIM, données du Haut-commissariat au Plan, 2012

Région	Entrants	Sortants	Solde
Oued Ed Dahab Lagouira	13	9	4
Laâyoune Boujdour Sakia El Hamra	32	24	8
Guelmim Es-semara	34	34	0
Souss Massa Draa	132	136	-4
Gharb Chrarda Beni Hssen	49	59	-10
Chaouia Ouardigha	64	80	-16
Marrakech Tensift Al Haouz	74	123	-49
Oriental	58	40	18
Grand Casablanca	177	98	79
Rabat Salé ZemmourZear	120	78	42
Doukkala Abda	35	83	-48
Tadla Azilal	39	50	-11
Meknes Tafilalet	65	88	-23
Fes Boulemane	66	55	11
Taza Al Hoceima Taounate	33	103	-70
Tanger Tetouan	98	29	69
Total	1089	1089	0

Source : CERED

86% of Morocco's total population lives on

20% of the country's total land area

1. TANGIER–CASABLANCA BY HSR—A BRIEF HISTORY

Key figures

	Maroc	France	Year
Population (millions)	35.30	67.20	2017
GDP, total (\$US bn)	110.70	2,574.81	2017
GDP per capita (\$US bn)	2,832	39,673	2016
Growth rate	3.9%	1.57%	2016
HDI (ranking/193 countries)	0.647 (131)	0.897 (23)	2015
Inflation	1.9%	1.4%	2017
Unemployment	10.8%	9.5%	2017
Participation rate	45.5%	71.4%	2017
Literacy rate	68.49%	99.2%	2015
% of young people passing BAC (high school diploma)	13.1%	76.7%	2012
GINI index (ranking/141 countries)	40.9 (66)	29.2 (112)	2012

Annotations: **x14** (between GDP total 2017), **x2,5** (between GDP per capita 2016), and red/orange circles around GDP per capita and Growth rate values.

1. TANGIER–CASABLANCA BY HSR—A BRIEF HISTORY

ONCF rail network — key figures *(in French)*

Track & stations

Rolling stock

Human resources



RÉSEAU FERRÉ NATIONAL

3600
Longueur des voies (km)

2110
Longueur des lignes (km)

75%
Lignes électrifiées

120
Gares

63
Densité du réseau (km/millions d'habitants/km²)

51%
Population desservie

MATÉRIEL ROULANT

214
Locomotives

37
Rames automotrices

567
Voitures à voyageurs

5275
Wagons à marchandises

CAPITAL HUMAIN

7535
Collaborateurs

16%
Taux d'encadrement

46
Age moyen (ans)

6%
Effectif féminin

By comparison, in 2016 SNCF had:

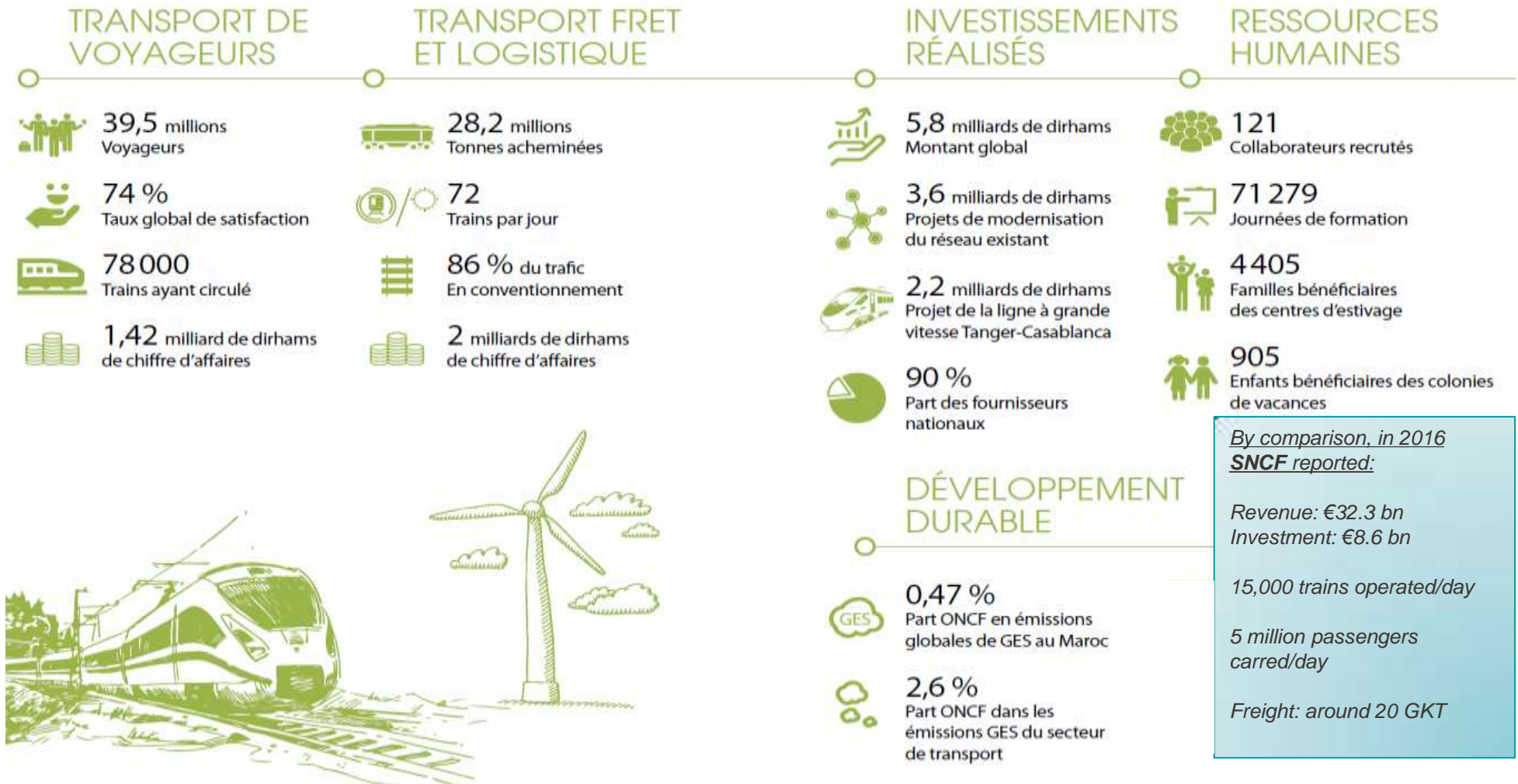
30,000 km of track
(incl 2,100 km of HSL)

3,000 stations

260,000 employees

1. TANGIER–CASABLANCA BY HSR—A BRIEF HISTORY

ONCF key figures for 2016 *(in French)* — Passengers, Freight, Investments, HR



TANGIER–CASABLANCA BY HSR—A BRIEF HISTORY

SNCF APO—A WIN-WIN PARTNERSHIP

2. SNCF APO IN MOROCCO—A WIN-WIN PARTNERSHIP

High-speed rail in Morocco

Africa's first high-speed rail line

- A **comprehensive, integrated project** with complex technical challenges
- **200 km of double-track line** designed for 350km/h and planned for commercial service at 320km/h:
 - ✓ All preliminary and on-site civil engineering (earthworks and bridges/viaducts)
 - ✓ All preliminary and on-site rail equipment (tracks, catenaries, signalling, electric traction, GSM-R)
 - ✓ All supplies/materials (ballast, rails, switches)
- Acquisition of **12 2N2 Alstom trainsets** adapted for Moroccan conditions (*RGV: Rames à Grande Vitesse Maroc*)
- A dedicated **maintenance depot** for these HSR/RGV trainsets
- **Adaptation of terminal installations** at arrival points in Tangier and Kenitra stations
- Construction of **4 new HSR stations**: Tangier, Kenitra, Rabat Agdal and Casa Voyageurs
- Preparation for **commercial start-up**

Total cost: €2.1bn

	Tangier - Rabat	Tangier - Casablanca
Today	3h45	4h45
Tomorrow	1h20	2h10



2. SNCF CONTRACT IN MOROCCO—A WIN-WIN PARTNERSHIP

National project, international financing

France funded 50% of the total: €1.070bn

Project financing

Source of funds		Amounts in MAD million		Additional financing
France	RPE	6 875	51%	700
	AFD	2 420		800
	Grants	825		
Arab funds	FADES	626	20%	500
	A.Dhabi fund	770		300
	Kuwaiti fund	1 100		
	Saudi fund	1 584		
Morocco	State budget	4 800	29%	700
	Hassan II Fund	1 000		
TOTAL		20,000		3,000

Financing of **trainsets** and **railway equipment**

Financing of **SNCF APO** contract and **MEP** (local experts in France)

Financing of **civil engineering works**

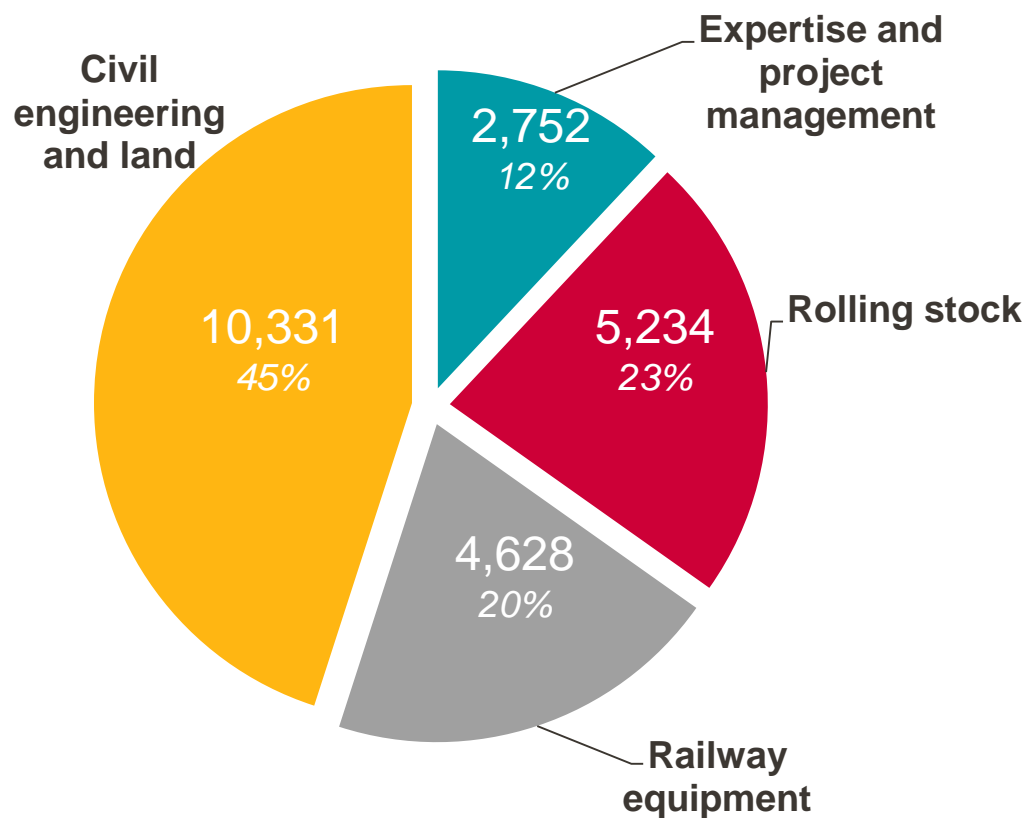
2. APO CONTRACT—A WIN-WIN PARTNERSHIP

Budget breakdown (excl stations and commercial start-up)

Field	Provisional budget (in MAD millions)
Intellectual services	2,752
Rolling stock and maintenance depot	5,234
NL railway equipment work bases	4,450
LN civil engineering	9,383
Terminal installations in Tangier and Kenitra (GC+EF)	178
Acquisition of land & rights of way	948
TOTAL	22,945

1€ ≈ 11 MAD

Figures in MAD millions



2. APO CONTRACT—A WIN-WIN PARTNERSHIP

SNCF role when the project began

MARCH 2008

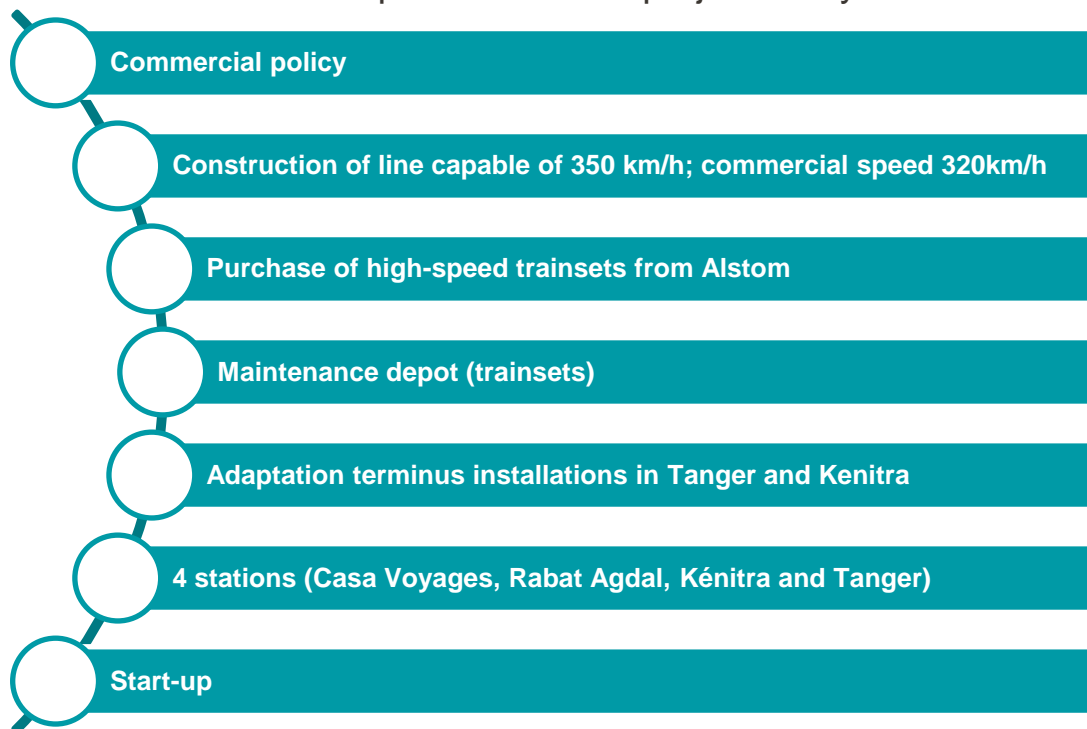
ONCF sets up DPLGV unit to act as Project Owner (*Maîtrise d'Ouvrage*)



APRIL 2009

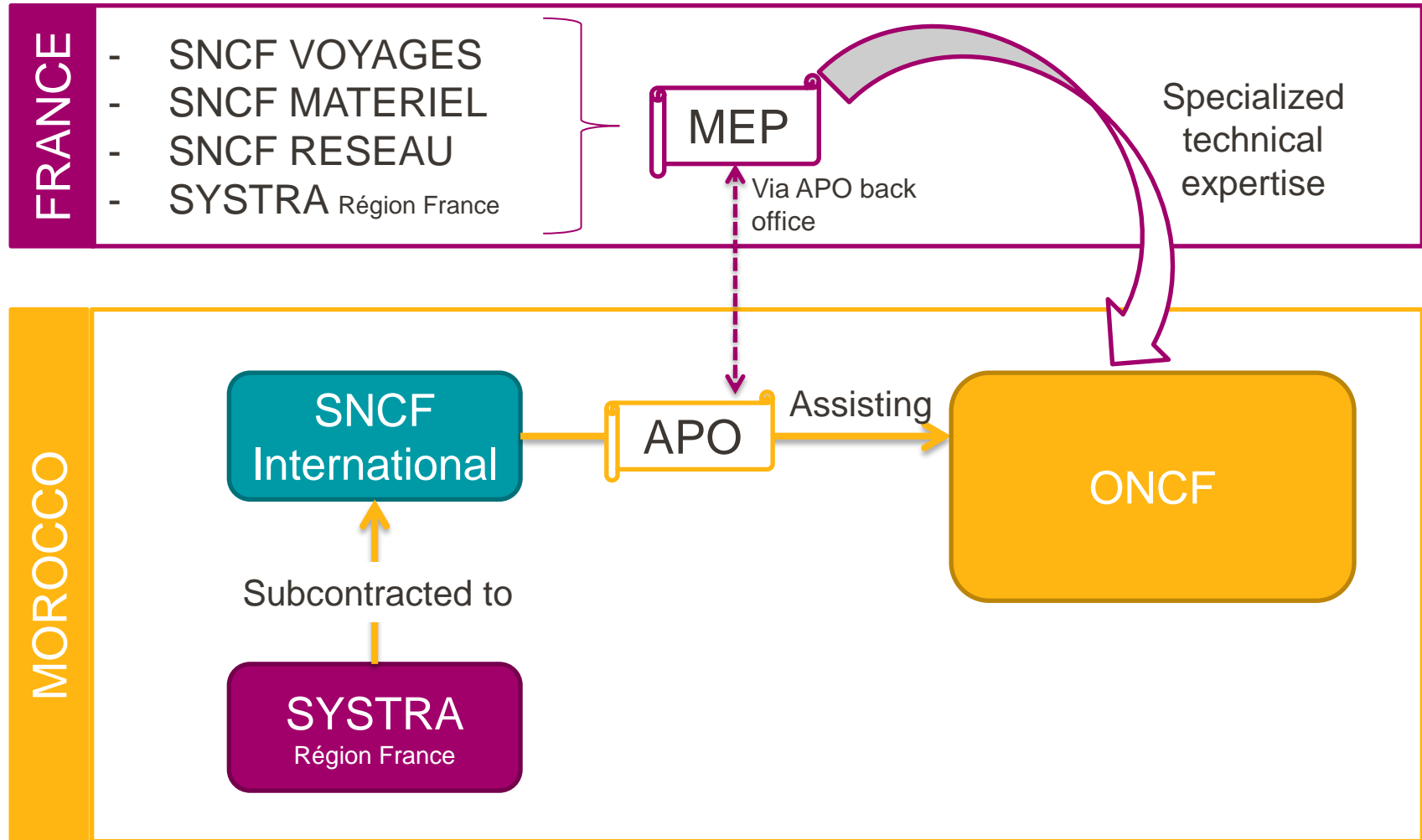
Contract signed with SNCF to act as Assistant Project Owner (APO), supported by a back-office contract covering input from specialized experts in France (MEP)

SNCF team sets up in Rabat for a projected 6-year mission.



2. APO CONTRACT—A WIN-WIN PARTNERSHIP

APO and MEP contracts



2. APO CONTRACT—A WIN-WIN PARTNERSHIP

APO at a glance

Total
contract
€64.8m

3
local employees

81
engineers
since 2009

2,508 man-
months

2016
revenue
€10m

TANGIER–CASABLANCA BY HSR—A BRIEF HISTORY

PROJECT TIMELINE & MILESTONES

3. PROJECT TIMELINE & MILESTONES



2007

2009

2010

2012

2013

2015

2016

2017

2018

22 October 2007:

Preliminary agreement signed between France and the Kingdom of Morocco, providing for:

- ✓ Financial cooperation
- ✓ Technical cooperation
- ✓ Technology cooperation



3. PROJECT TIMELINE & MILESTONES



2007

2009

2010

2012

2013

2015

2016

2017

2018

February 2009:

First five SNCF employees arrive in Morocco

9 April 2009:

SNCF Chairman Guillaume Pepy; Morocco's Minister for Transport Karim Ghellab; and ONCF CEO Mohamed Khlie sign contracts for **Assistance to Project Owner** (APO) to be provided by SNCF International and **Expert Missions/Missions d'expertise** (MEP) provided by other SNCF/SYSTRA experts based in France.

3. PROJECT TIMELINE & MILESTONES



2007

2009

2010

2012

2013

2015

2016

2017

2018

February 2009:

First five SNCF employees arrive in Morocco

9 April 2009:

SNCF Chairman Guillaume Pepy; Morocco's Minister for Transport Karim Ghellab; and ONCF CEO Mohamed Khlie sign contracts for **Project Owner Assistance** (AMO) to be provided by SNCF International and **Expert Missions** (MEP) to be provided by other SNCF/SYSTRA experts from France.

March 2010:

Preliminary draft project approved

April 2010:

Call for bids for civil engineering project management

2010 to 2011

Preparation of detailed design and final projects

3. PROJECT TIMELINE & MILESTONES



2007

2009

2010

2012

2013

2015

2016

2017

2018

2012 :

Call for bids for suppliers of civil engineering services



3. PROJECT TIMELINE & MILESTONES



2007

2009

2010

2012

2013

2015

2016

2017

2018

2012:

Call for bids for suppliers of civil engineering services



2013:

- Final IFF agreement signed by Guillaume Pepy, Chairman of SNCF Executive Board and Mohamed Khlie, CEO, ONCF.
- Railway equipment contracts signed by ONCF and French manufacturers



3. PROJECT TIMELINE & MILESTONES



July 2015:

High-speed trainsets delivered to Tangier; re-assembly begins



19 September 2015:

Tangier Moghogha depot opens in the presence of Morocco's King Mohammed VI and French President François Holland.

December 2015:

Work on HSR line begins.



3. PROJECT TIMELINE & MILESTONES



February 2016:

Creation of Morocco's high-speed rail maintenance company: **SMMRGV** (*Société Marocaine de Maintenance des Rames Grande Vitesse*)

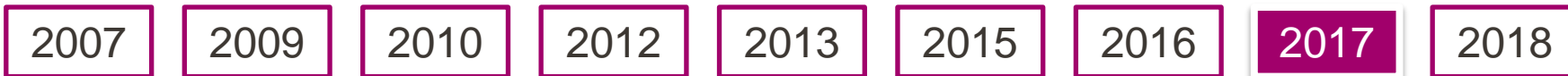


December 2016:

End of **railway equipment** works on first segment (40 km from Kenitra).



3. PROJECT TIMELINE & MILESTONES



6 February – 10 March 2017:

Dynamic tests, **Segment 1**

4 September – 22 December 2017:

Dynamic tests, **Segment 2**



9 October 2017:

French Minister for Foreign Affairs Jean-Yves Le Drian visits Rabat and views construction site from the air.

20 October 2017:

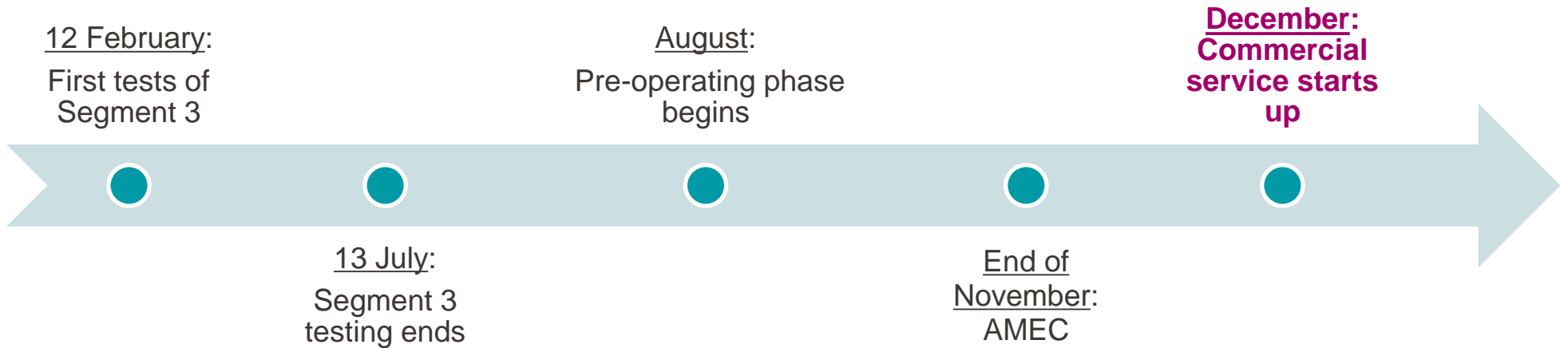
African rail speed record: 320 km/h



3. PROJECT TIMELINE & MILESTONES



Key dates—2018:



CONTENTS

1 - TANGIER–CASABLANCA BY HSR—A BRIEF HISTORY

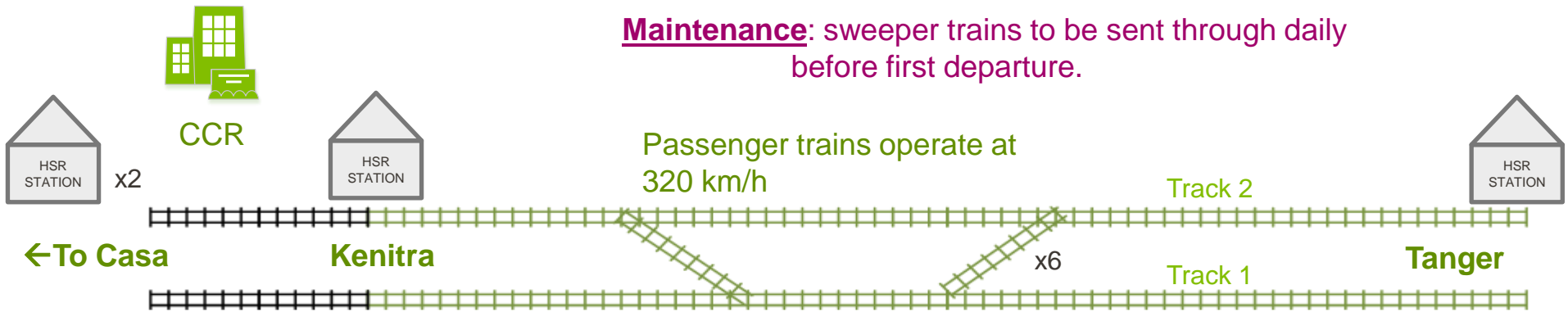
2 - APO PROFESSIONAL EXPERTISE—INPUT

1. OPERATING PRINCIPLES
2. PROJECT MANAGEMENT
3. CIVIL ENGINEERING
4. RAILWAY EQUIPMENT
5. TERMINAL INSTALLATIONS
6. STATIONS
7. MAINTENANCE DEPOT
8. ROLLING STOCK
9. ERTMS
10. TESTS
11. PREPARATION FOR COMMERCIAL START-UP
12. INFRASTRUCTURE MAINTENANCE
13. RAILWAY SAFETY
14. COMMERCIAL OFFER

APO PROFESSIONAL EXPERTISE

1. OPERATING PRINCIPLES—MOROCCO'S HSR

Infrastructure



Maintenance: sweeper trains to be sent through daily before first departure.

Passenger service:

- From 6 am to 9 pm
- One departure each hour
- Tangier/Casa: 2h10
- Additional trains can run each half-hour during peak periods

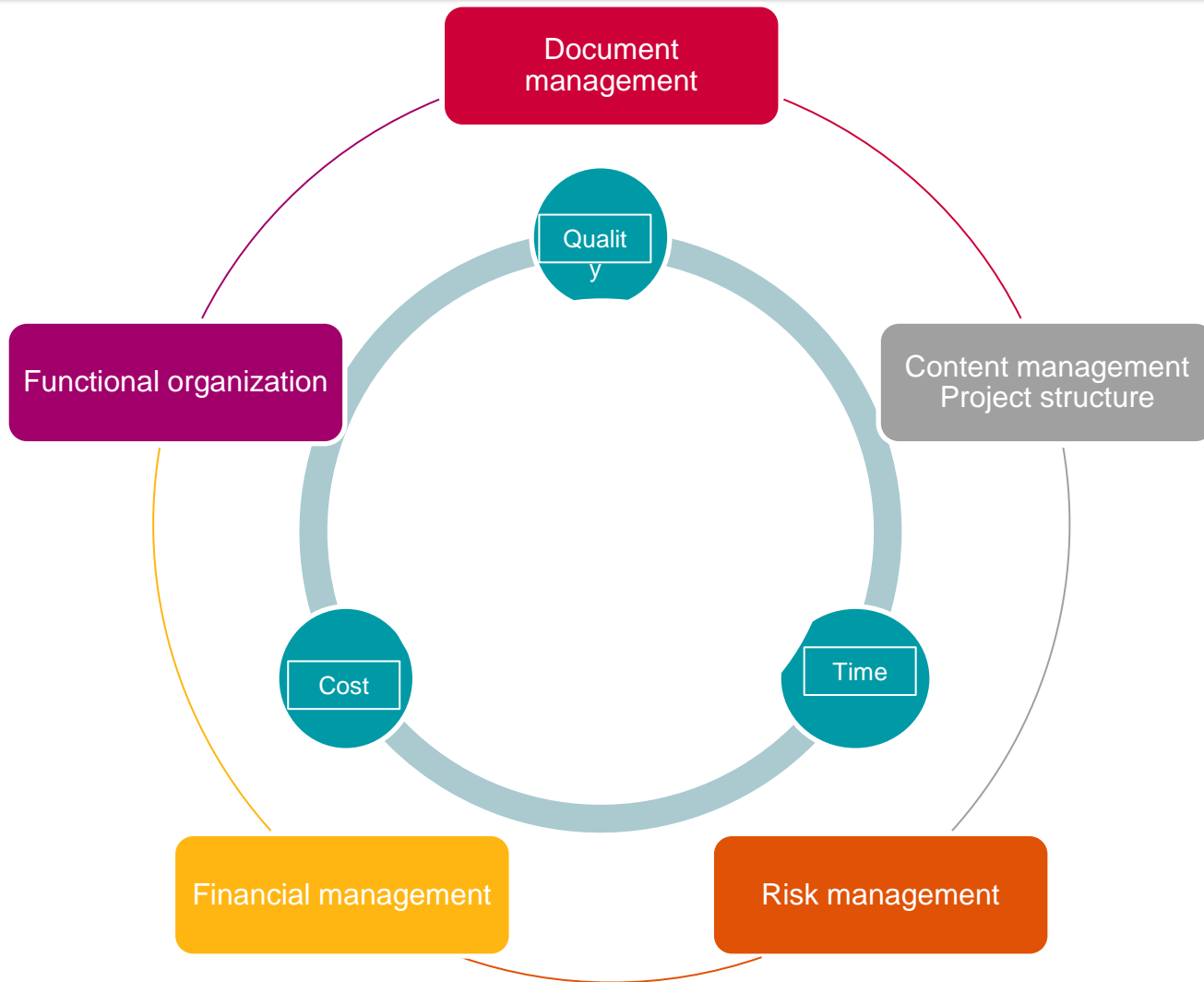
Simple units (SU) = 533 pers.



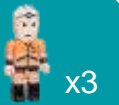
Multiple units (MU) = US x2 = 1066 pers.

≡ 12 SU

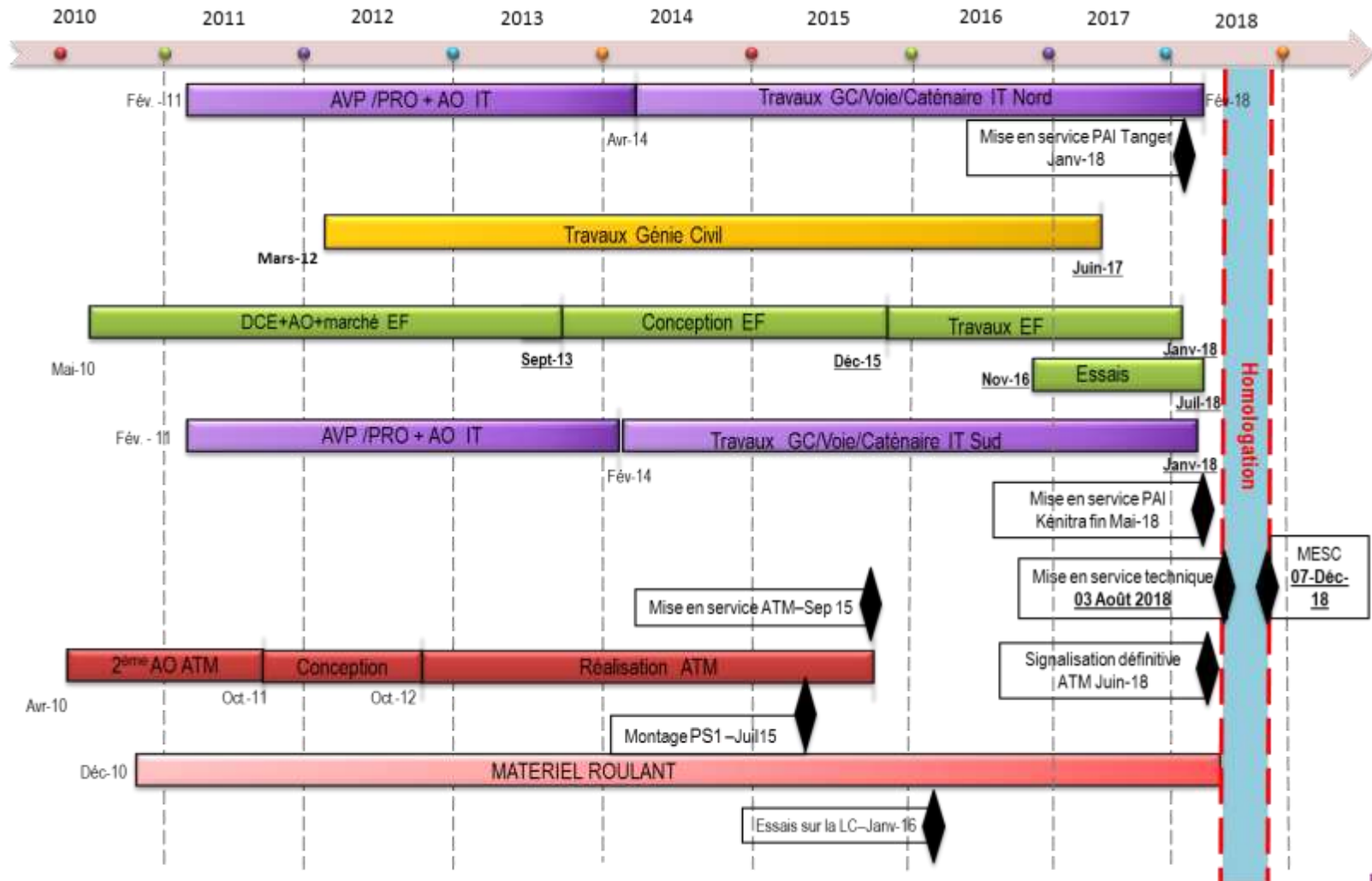
2. PROJECT MANAGEMENT



2. PROJECT MANAGEMENT



Timeline to end 2018



3. CIVIL ENGINEERING



Works



- ✓ 10 kms of viaducts
- ✓ 2.6 kms of elevated track
- ✓ 124 PRA
- ✓ 45 PRO



67 million cubic m of excavation/backfill = 27 Great Pyramids (volume)



3. CIVIL ENGINEERING



Works by segment

2 Project managers

Segment (TOARC)

working by



TOARC	TOARC length	Companies	Nationality
TOARC 0	4 km	SONASR	Morocco
TOARC 1	22 km	SINTRAM (*)	Morocco
TOARC 2	24 km	HOUAR / SEPROB	Morocco
TOARC 3	29 km	COVEC	China
TOARC 4	34 km	SGTM (*)	Morocco
TOARC 5	33 km	SGTM (*)	Morocco
TOARC 6	30 km	Sefiani / Arab Contractors	Morocco Egypt
TOARC 7	12 km	SINOHYDRO	China

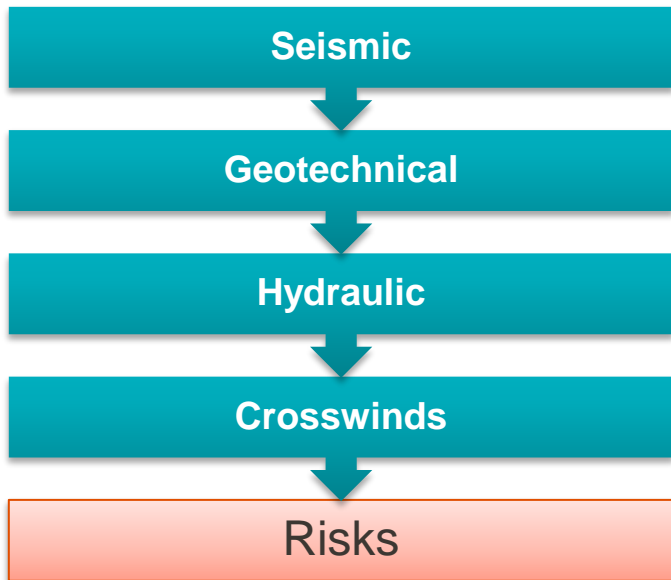
(*) Winning bids re-selected when initial call for bids was cancelled

3. CIVIL ENGINEERING



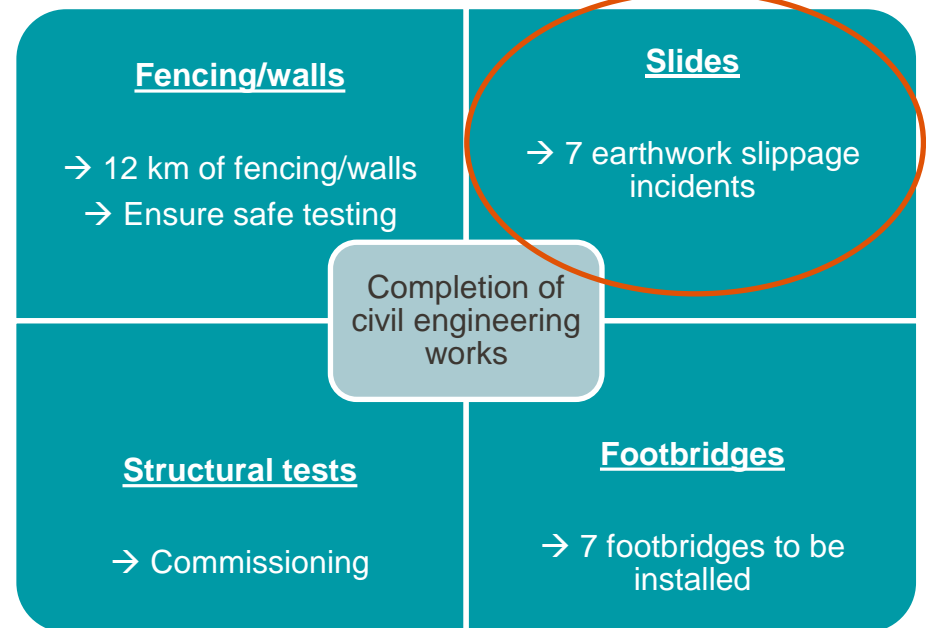
Works—risks and progress

All constraints/risks apply to this project



Success factors to date

Zoom



Slide of excavated material 2128 (pk 25)



Photo taken 17/01/2018

Incident:

- Slippage of slope

Risks:

- Damage to platform and track
- Test schedule disrupted

Corrective action:

- Stabilize slope
- Adjust angle of slope – earthworks
- Build protective wall
- Secure gas pipeline

4. RAILWAY EQUIPMENT



VCBT: catenary/track/work bases



Ballast



- First production of HSR-grade ballast in Morocco
- 1,600,000 tonnes (equal to 32 Arcs de Triomphe)

Track



- Double-track railbed, 14 m wide
- 48,000 tonnes of rails (equal to six Eiffel Towers)
- 700,000 sleepers
- 100 switches

4. RAILWAY EQUIPMENT



VCBT: catenary/track/work bases



Work bases

Kenitra



Tnine Sidi Lyameni



Sites used as work bases are scheduled to become **maintenance depots**

4. RAILWAY EQUIPMENT



Catenary power supply installations (IAC)

C/R Cat. :  C/R IAC : 

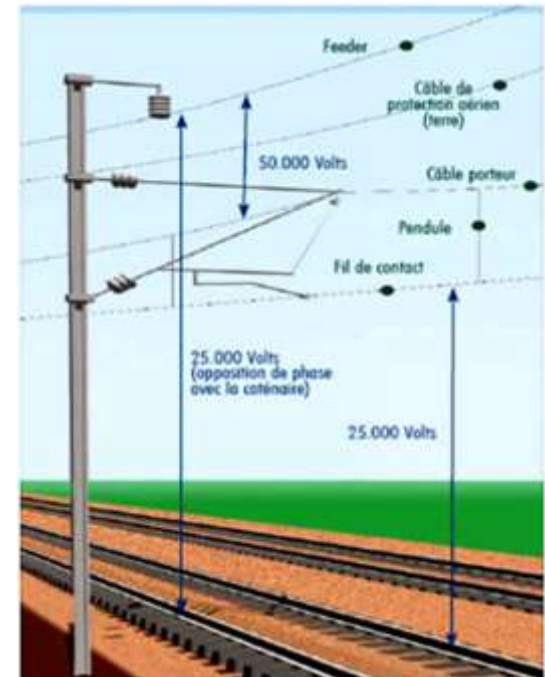
Catenaries (VCBT) and their power supply (IAC)

Traction power is supplied by:

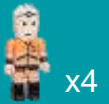
- ✓ sub-stations with transformers (50,000 V)
- ✓ Autotransformers that transform 50,000 V into 25,000 V for use by power units.

→ Installations to be remotely controlled from a substation control centre (CSS) in Rabat AGDAL

Catenaries



4. RAILWAY EQUIPMENT

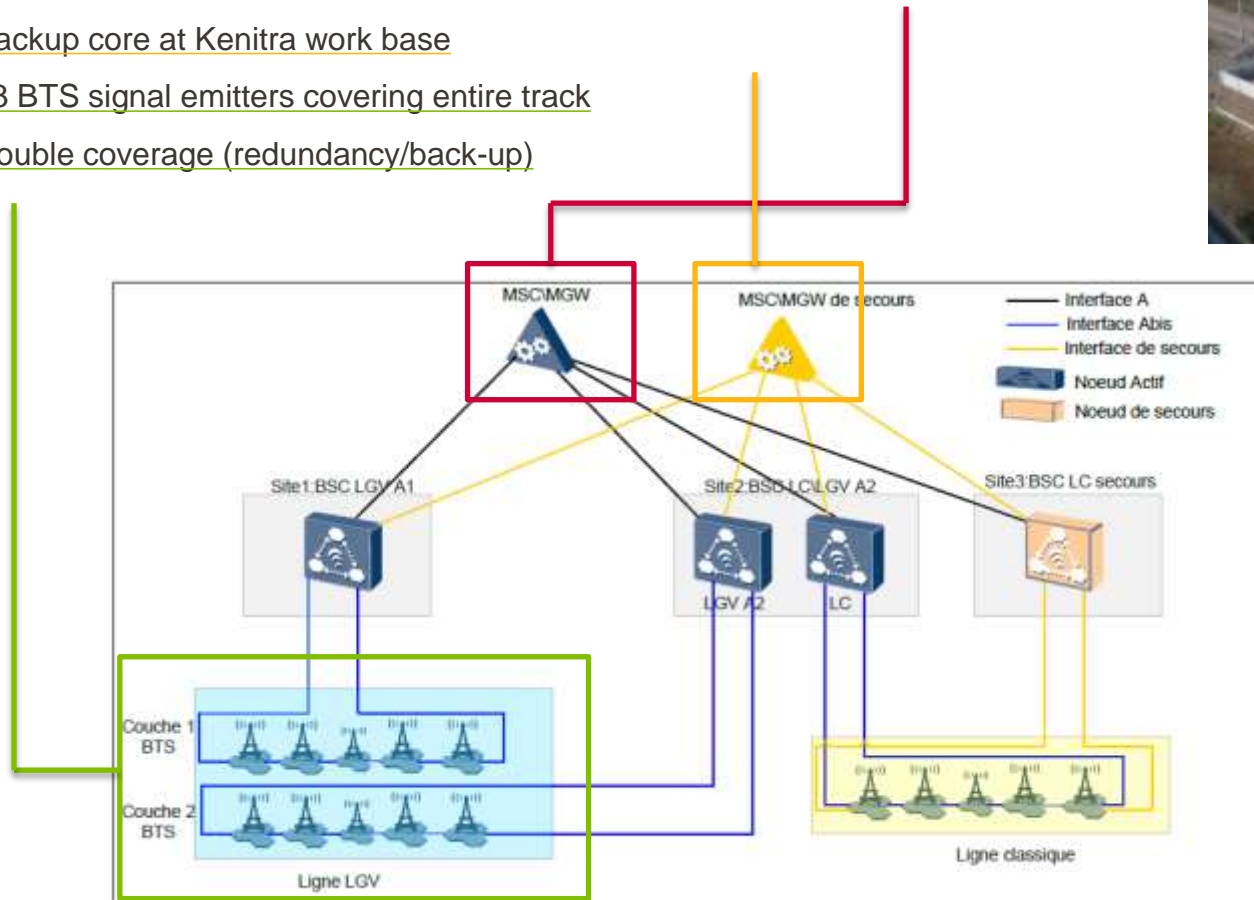


GSM-R: Global System for Mobile Communications – Railways

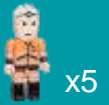


The **GSM/R system** (Voice and Data transmission) includes:

- ✓ Network core at Remote Control Station in Rabat
- ✓ Backup core at Kenitra work base
- ✓ 33 BTS signal emitters covering entire track
- ✓ Double coverage (redundancy/back-up)



4. RAILWAY EQUIPMENT



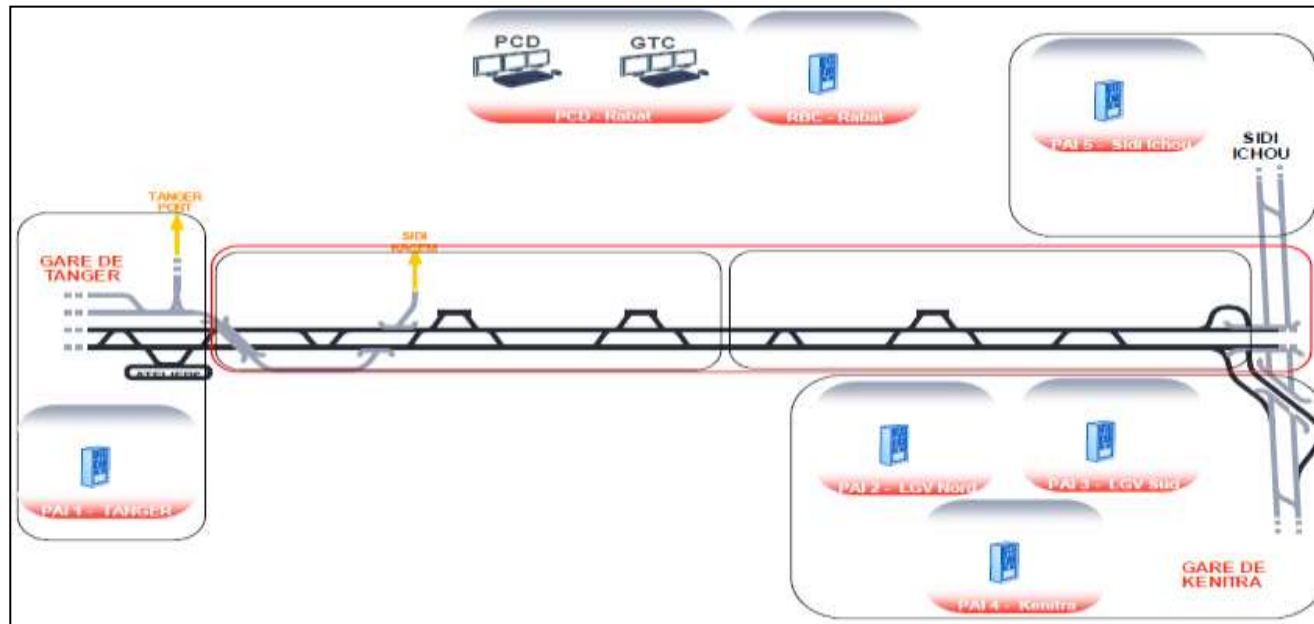
Signalling

C/R : **INEO**
GDF SUEZ



The HSR line's **signalling system** has several functional components:

- ✓ Remote command post (PCD), computerized signal boxes (PAI), and field centers
- ✓ European Rail Traffic Management System (ERTMS): ERTMS 2 on HSR line and ERTMS 1 for connections
- ✓ Related detection, warning and alarm equipment (high winds, earthquakes, etc.)



5. TERMINUS INSTALLATIONS



Terminus installations

C/R Kénitra :



C/R Tanger :



- Connect high-speed line to conventional lines
- 2 installations

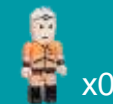
Tangier

- ✓ Develop 7 tracks with platforms handling departures and arrivals at speeds of 60 km/h and capable of **accommodating high-speed trains every half-hour**
- ✓ **Connect the maintenance depot** to platform-side tracks in Tangier (Northern side) and to HSR tracks (Southern side)

Kenitra

- ✓ Develop 7 tracks with platforms handling departures and arrivals at speeds of 60 km/h and capable of **accommodating high-speed trains every half-hour**
- ✓ **Connect HSR line to conventional line** including track use up to Kenitra station
- ✓ **Connect work base to conventional line**

6. STATIONS



Four HSR stations



Rabat Agdal

- Station bridge extends over tracks

Tangier

- Terminus (end station)

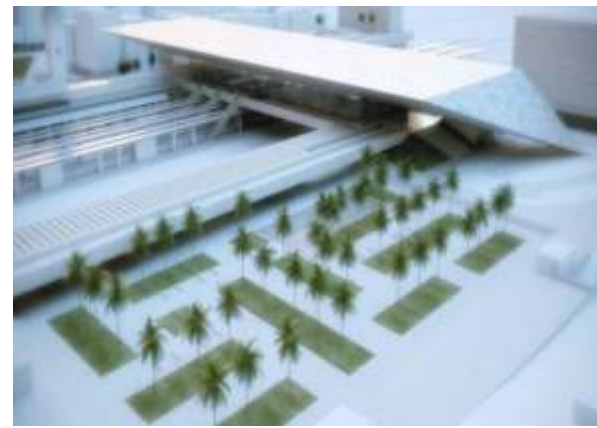


Kénitra

- Station bridge extends over tracks

Casa passenger station

- Station bridge extends over tracks



7. MAINTENANCE DEPOT



Tangier-Moghogha maintenance depot (ATM)

Depot is open and operating, but still not finished:

- Construction began in 2012 and continued until the unit opened in September 2015, but remains to be completed in 2018.
- Work in progress:
 - ✓ High-voltage segment
 - ✓ Servo systems
 - ✓ Signalling
- Tools

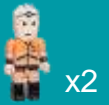


In use since February 2015

- To reassemble RGV M trainset components
- To maintain RGV M trainsets (testing)



8. ROLLING STOCK



Morocco's HSR trainsets (RGV M)

C/R : **ALSTOM**

Fast facts

- 12 trainsets supplied by Alstom
- Based on SNCF's TGV 2N2 technology
- Can run on ONCF's conventional lines (3kV continuous) as well as HSR (25kV alternating current).



Specific to RGV M

Safety features (ERTMS 2)

Air conditioning

Air filters

Engine cooling and ventilation

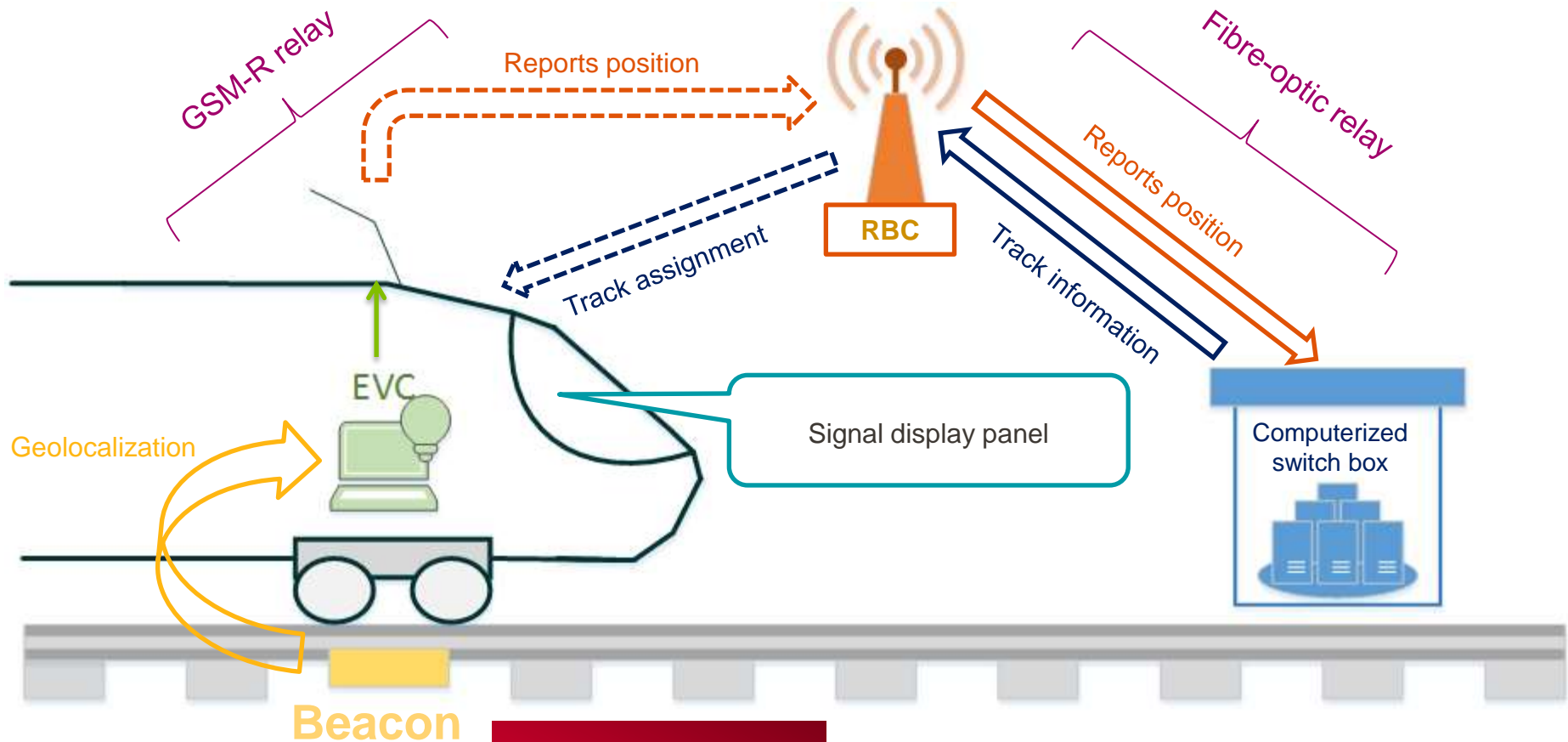
Operated at 3 kV

RGV M commissioning

- Two series: on conventional lines + on HSR line
- At 02/02/2018
 - ✓ 133 return journeys (61 as multi-unit and 72 as single units)
 - ✓ Total run: 86,720 km

9. ERTMS (EUROPEAN RAIL TRAFFIC MANAGEMENT SYSTEM)

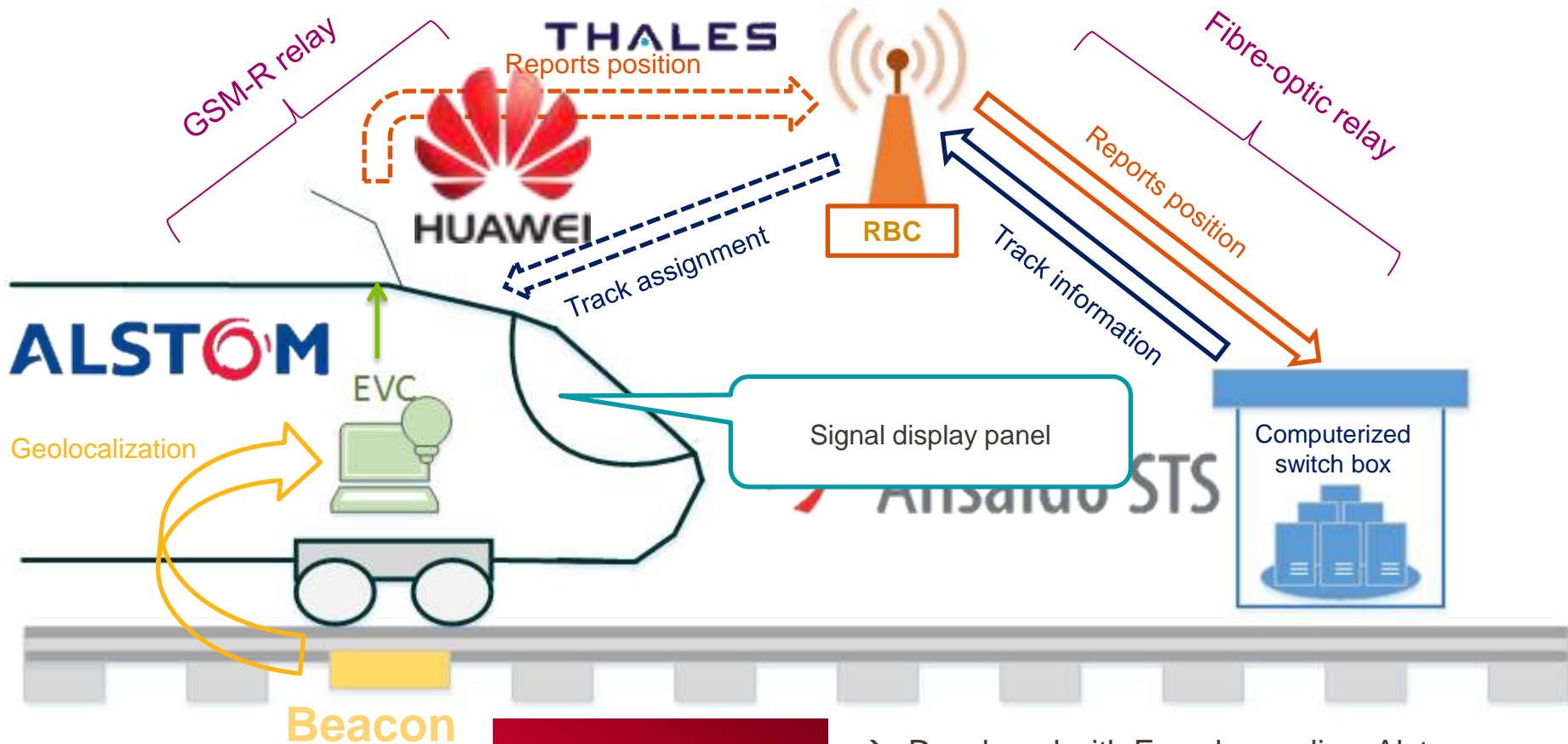
ERTMS on MOROCCO'S HSR LINE



Unique to
Morocco's HSR
line

9. ERTMS (EUROPEAN RAIL TRAFFIC MANAGEMENT SYSTEM)

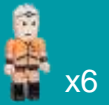
ERTMS on MOROCCO'S HSR LINE



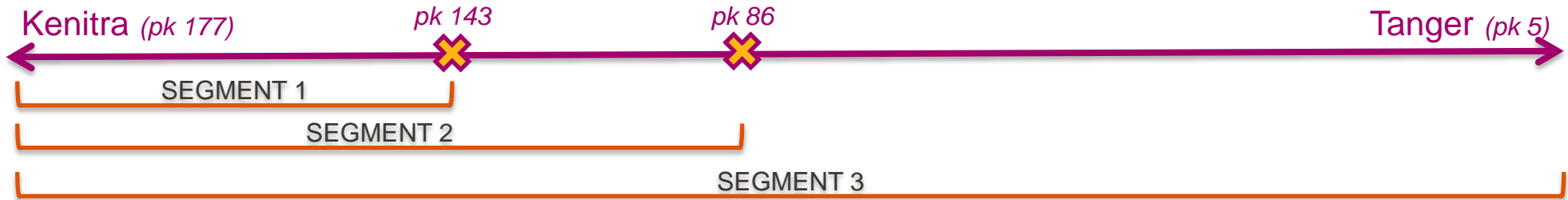
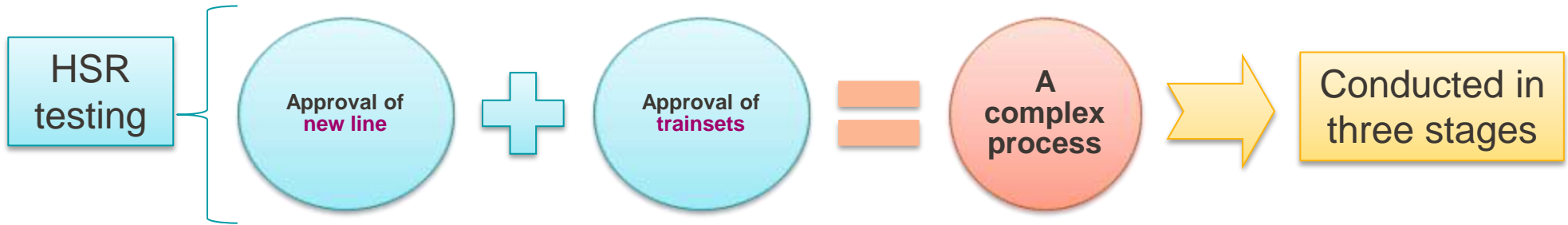
Unique to Morocco's HSR line

- Developed with French suppliers Alstom, Ansaldo and Thales/Huawei
- No back-up (vs France, where track-to-train transmission is also installed)

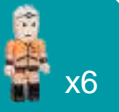
10. TESTS



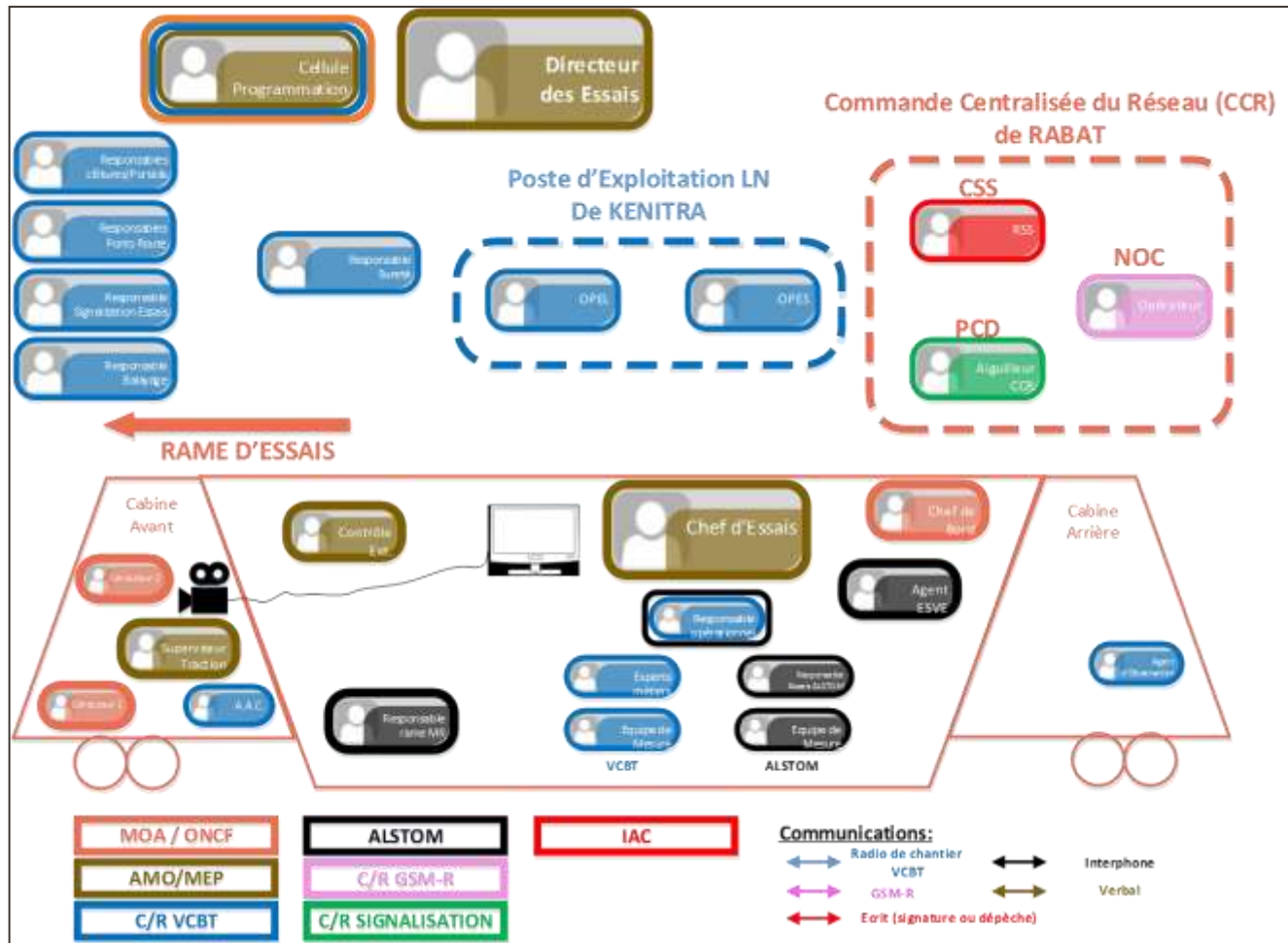
Testing Morocco's HSR line posed specific challenges



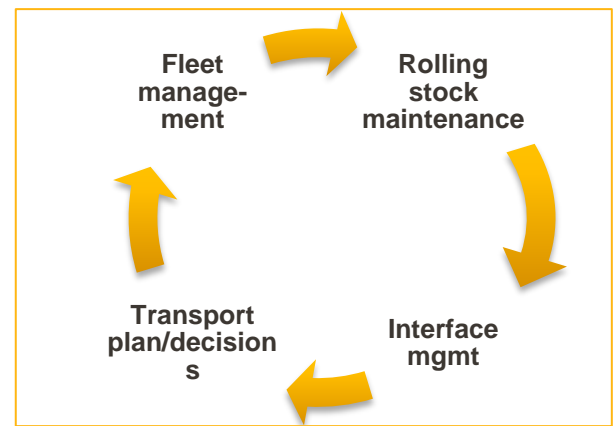
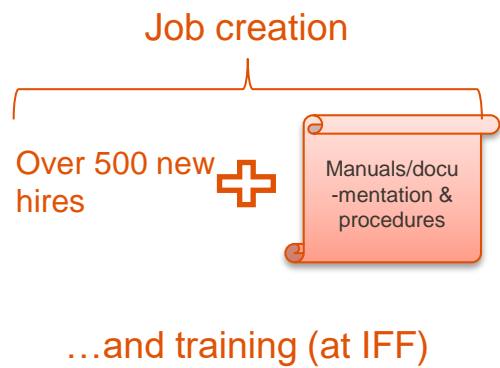
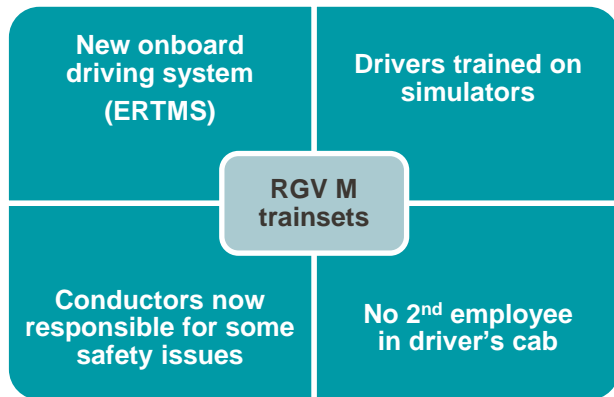
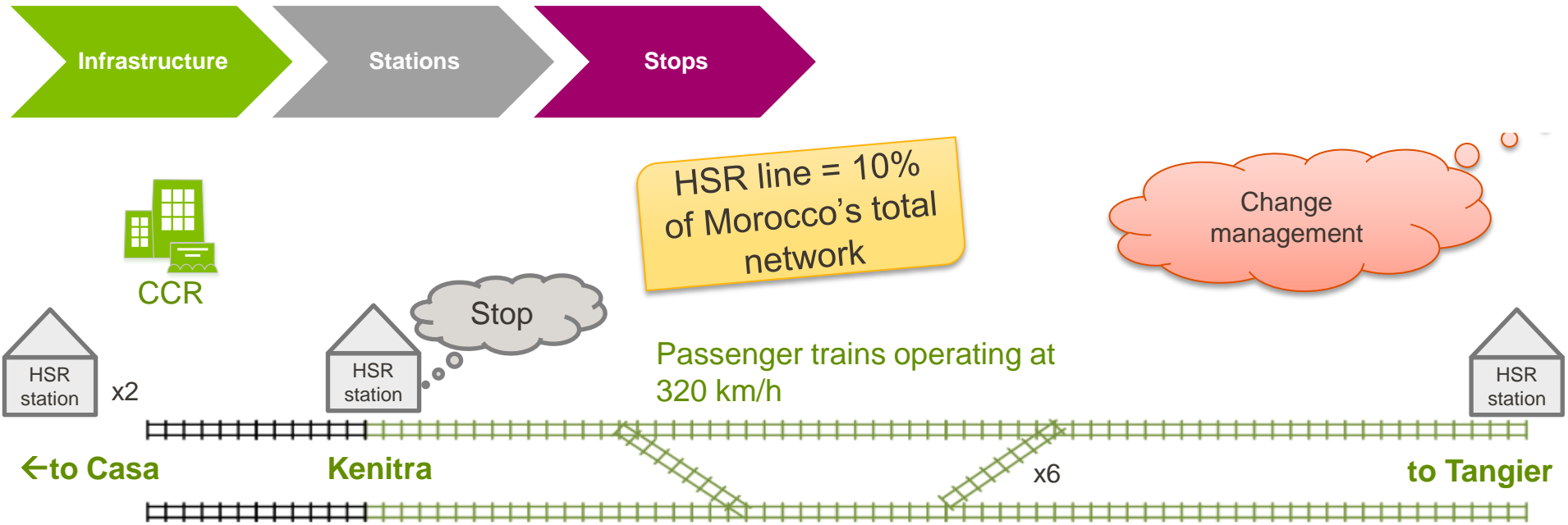
10. TESTS



A complex challenge



11. START-UP OF COMMERCIAL SERVICE

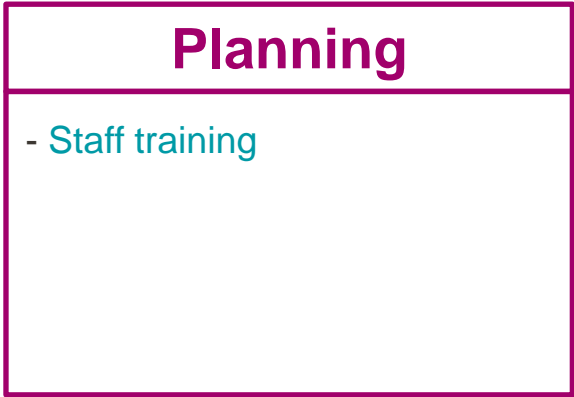
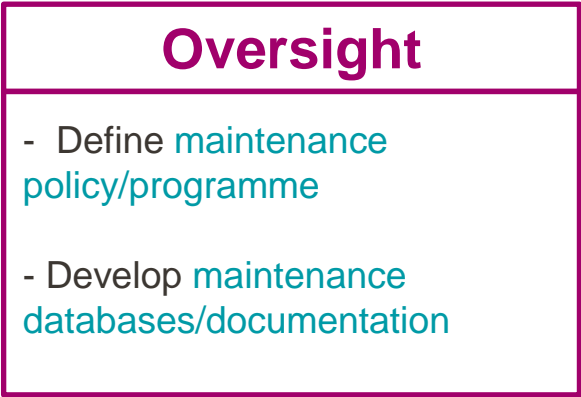


12. INFRASTRUCTURE MAINTENANCE

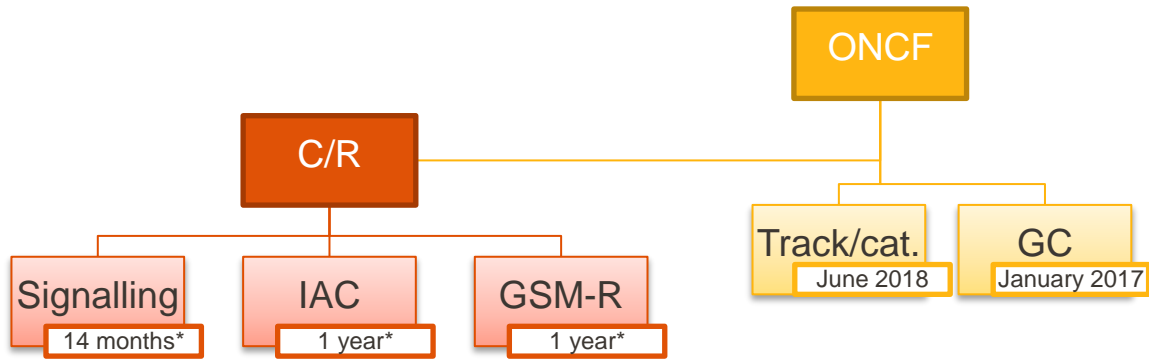


Organization

Services covered by SNCF's APO contract



Delivering maintenance



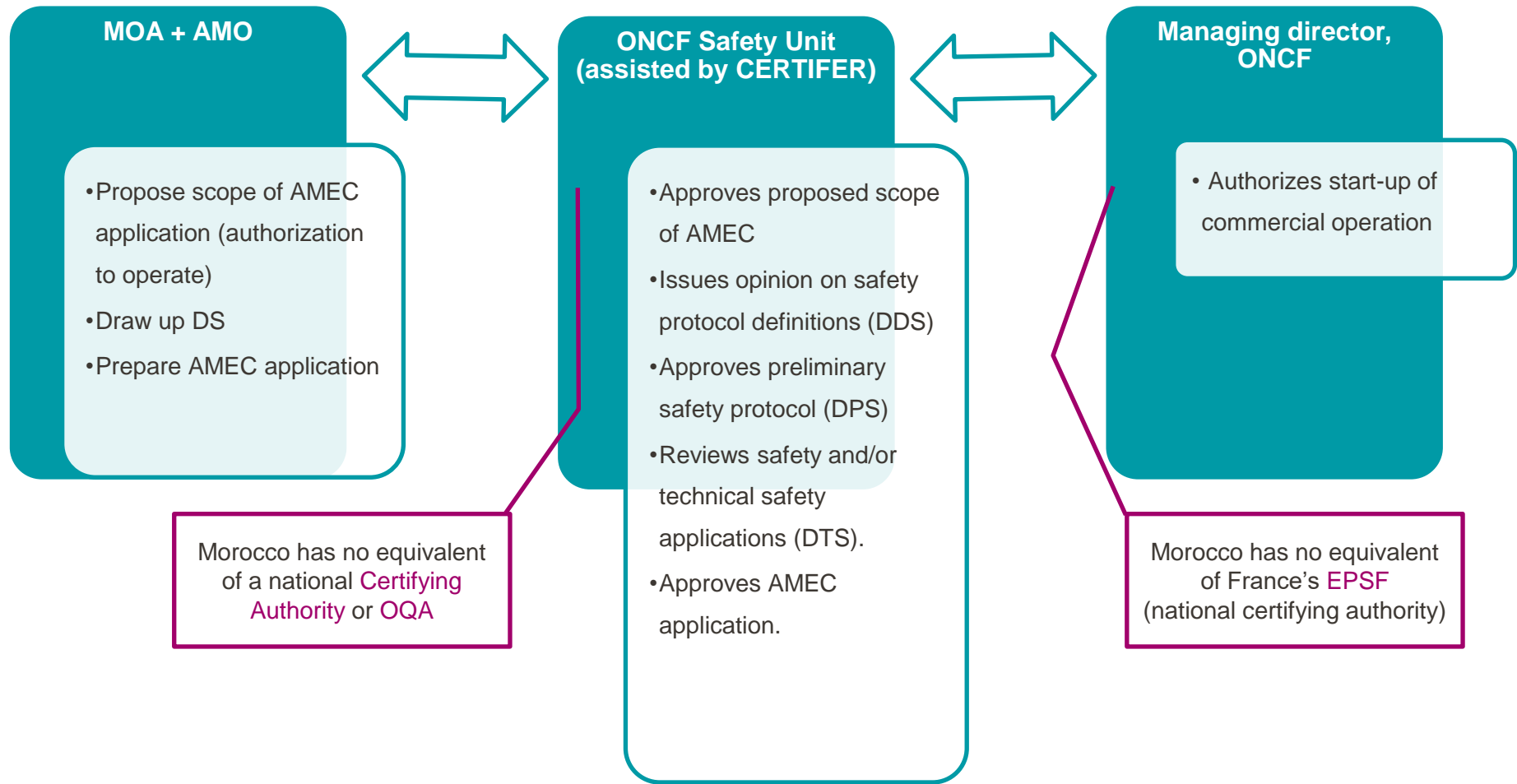
*Begins after start-up of technical service (August 2018)

Negotiations now under way for a maintenance assistance **contract with SNCF RESEAU**

13. SAFETY



ONCF's choice for HSR line



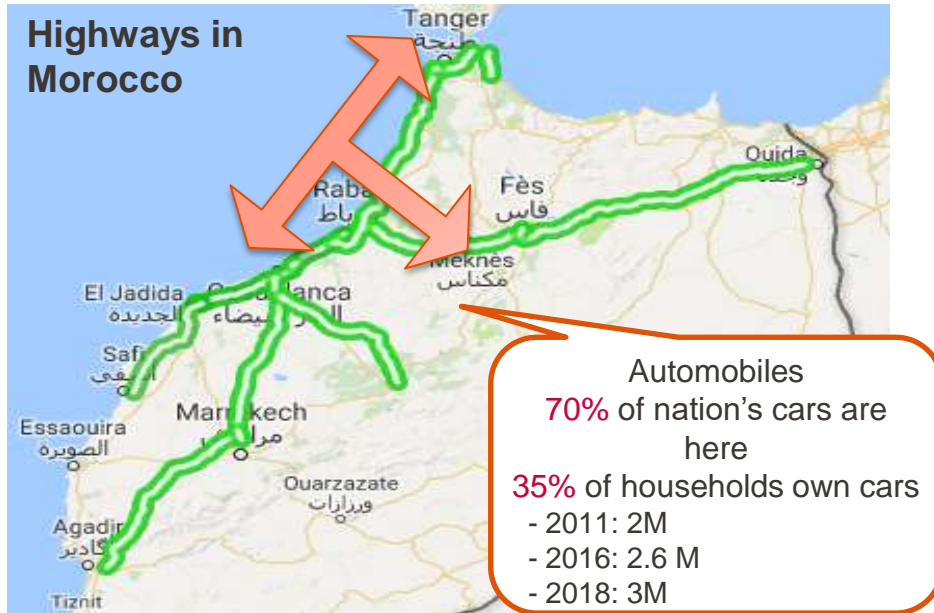
14. COMMERCIAL OFFERING



Market analysis

Rail competes directly with road...

...with road in the lead



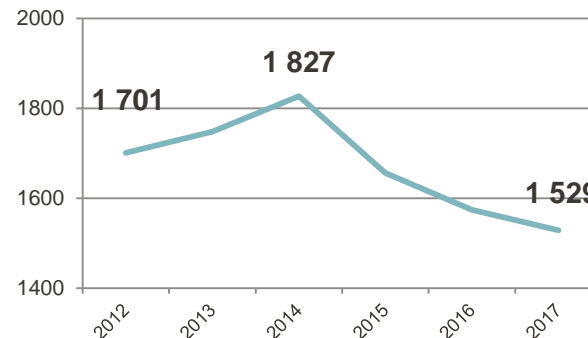
Total: 6.2 m journeys in 2015
(excl Moroccan expats and tourists)

Travel modes	Car		Train		Coach	
	3M 48%		1.6M 26%		1.4M 24%	
Segments	Business	Leisure	Business	Leisure	Business	Leisure
	1.2 M	1.8 M	0.6 M	1 M	0.4 M	1 M
	54%	45%	28%	26%	17%	28%

Daily/offer/dir. to/from Tangier	
	7 Casa 4 Fès
	55 Casa 15 Fès

Price in Dhs Tangier > Casa	
	300 6 CV diesel + toll
	1 st : 195 2 nd : 132
	Coach: 80 GTM: 145

Since 2015, ONCF has trailed private vehicles



Due to:
(1) Short-term disruption from engineering works
(2) Large existing stock of automobiles

14. COMMERCIAL OFFERING



Making “trains for all” a tool for winning market share

Mixed perceptions of ONCF...

Positive	Negative
Traditional operator Safety	Frequent delays Overcrowded trains Disorganized

Why people don't take trains

Business travellers	Delays Have company car Uncomfortable
Leisure	Frequent delays Price

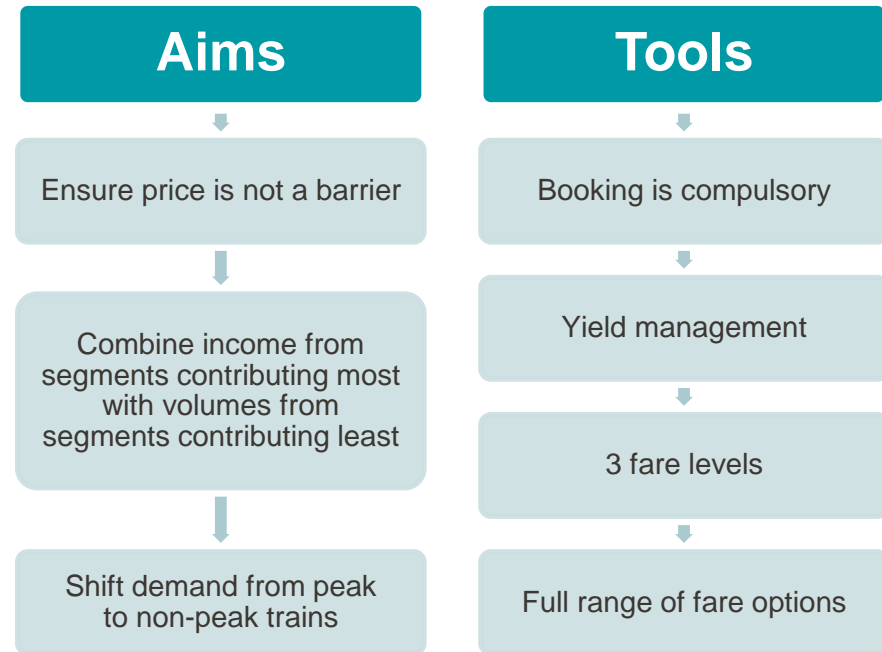
Surveys reveal great enthusiasm for HSR, but concern that fares may be too high

Plan to take train in future (survey)

- ✓ 80% definitely
- ✓ 15% probably

Scope for winning a further 65% market share

Making HSR a “train for all”



Revisit typical “customer path”

