

Santiago Bobo

Agencia de la Obra Publica
de la Junta de Andalucia



TRAMBAHÍA

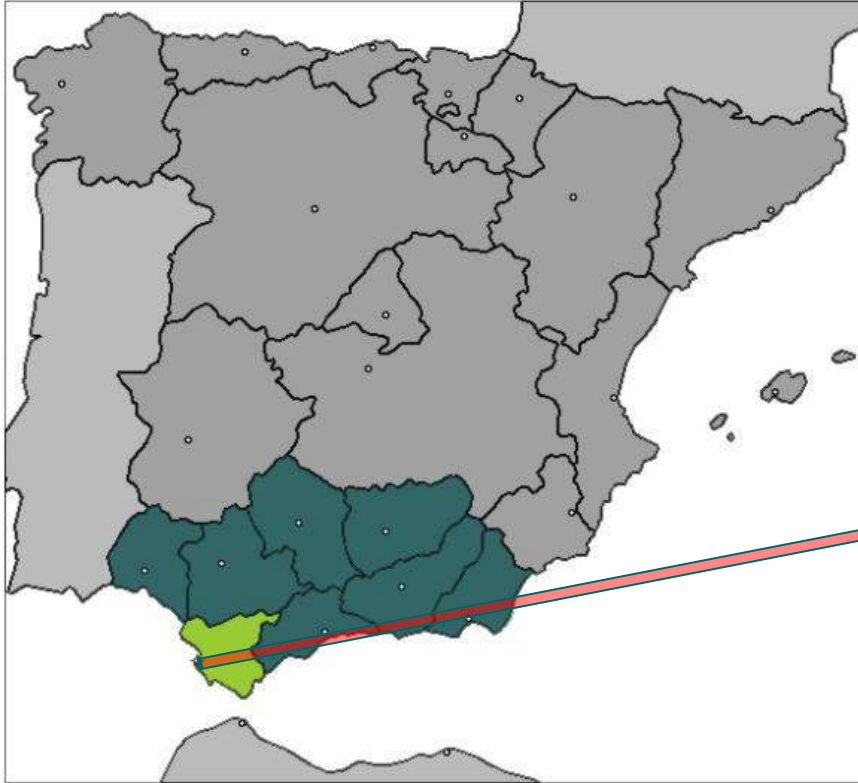
A TRAM TRAIN SYSTEM

CONTENTS:

1. HIGHLIGHTS OF CADIZ BAY
2. MOBILITY SOLUTION
3. TECHNICAL DESCRIPTION
4. FIRST YEAR EXPERIENCES.



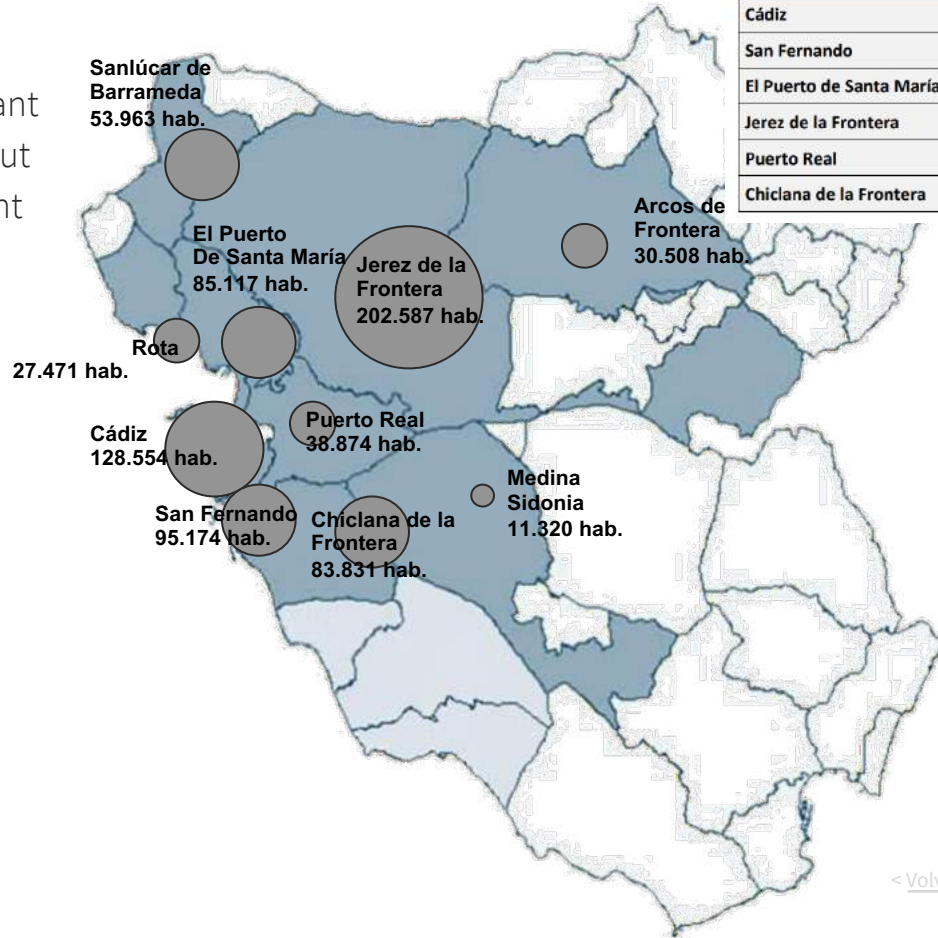
LOCATION



CÁDIZ BAY

Territory

Bahía de Cádiz (BC) it´s de most important metropolitan area of Cadiz Province about population and mobility. And a significant metropolitan area of Southern Spain.



Municipio	Increment. % Pobl. 2010-2020
Cádiz	-8,30
San Fernando	-1,70
El Puerto de Santa María	0,20
Jerez de la Frontera	2,00
Puerto Real	2,50
Chiclana de la Frontera	8,30

Mobility solution

The Metropolitan Transport Plan of Bahía de Cádiz, describes five Strategic lines:

SL-1	SL-2	SL-3	SL-4	SL-5
Promote mass public transportation	Promote sustainable transport	promote non-motorized transportation	enhance intermodality	use new technologies in transportation management

Mobility solution.



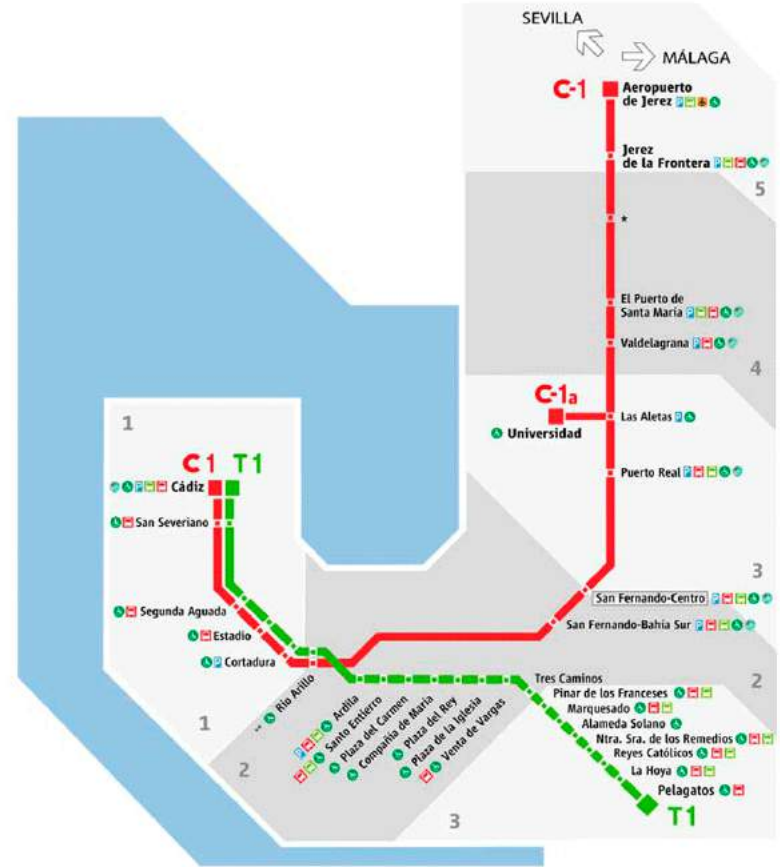
A **Train Tram system**, a hybrid transport solution that permits its use as tram in urban areas and as conventional commuter train in interurban segments. In addition, this system, allows us to use existing railways of the RFIG net.

Taking advantage of the existing infrastructure.

50% of Trambahía (T1) line uses existing railway infrastructure of RFIG network, operating both Trambahía and conventional lines (commuter, and long-distance trains) by the same layout.

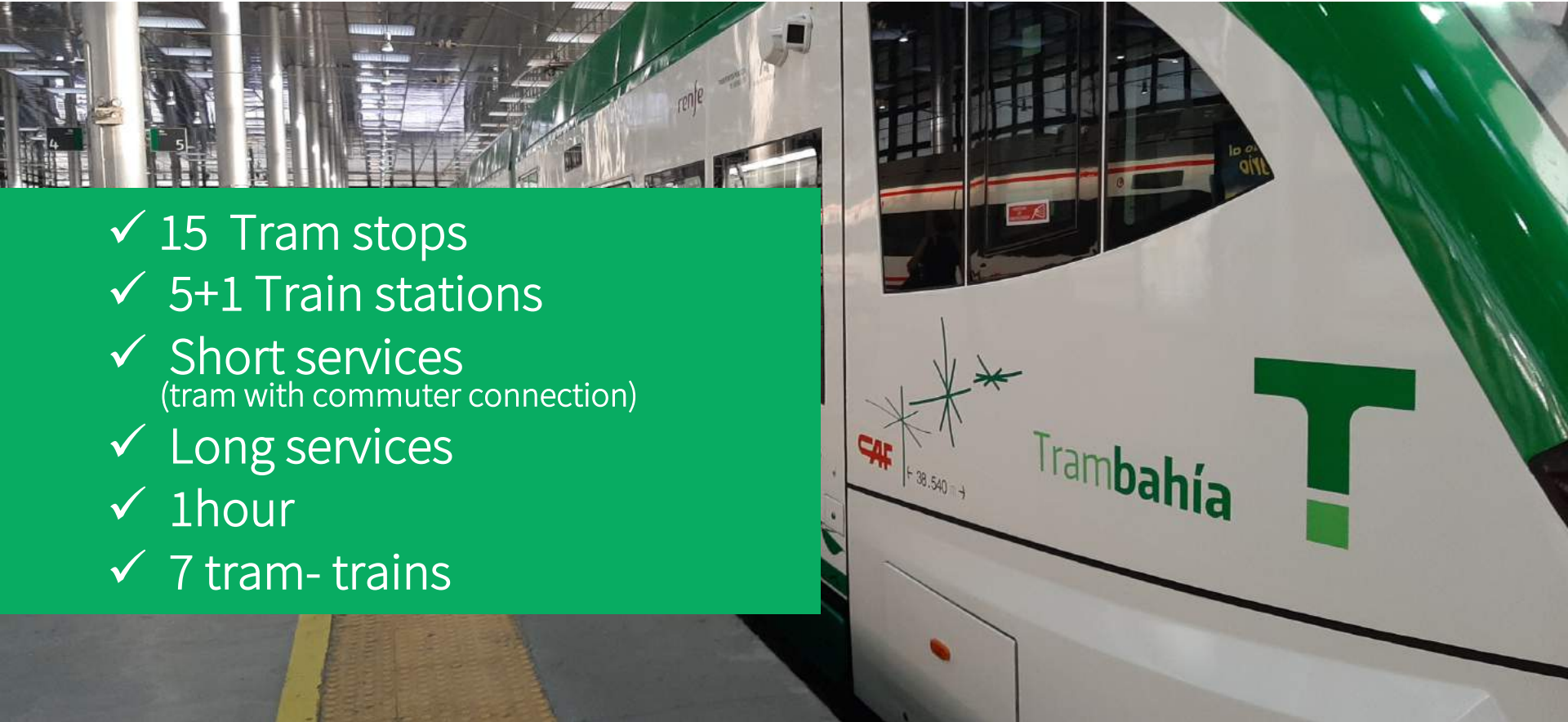


Mobility solution

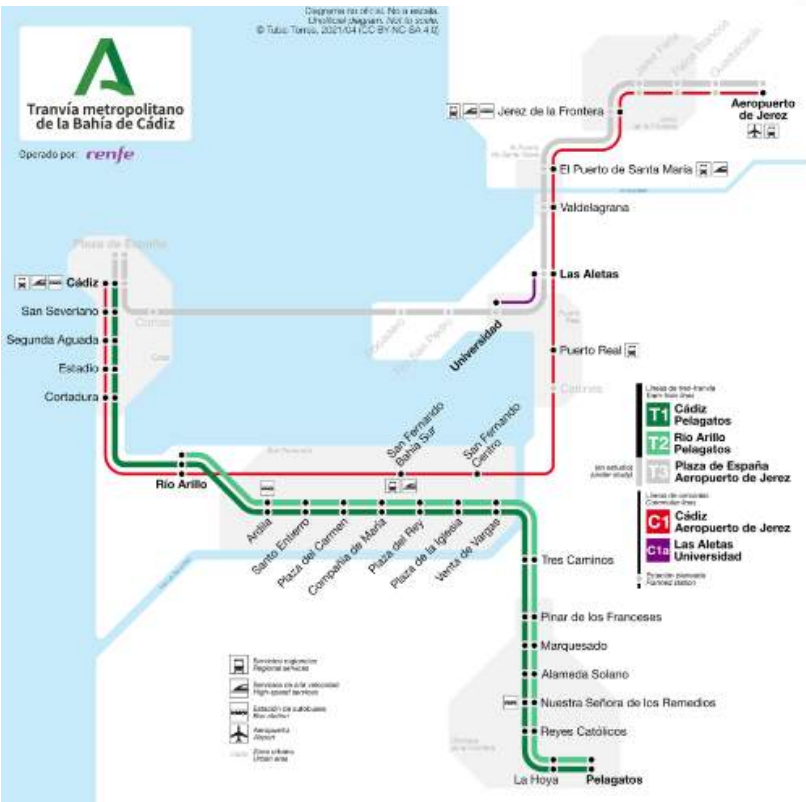


Mobility solution

- ✓ 15 Tram stops
- ✓ 5+1 Train stations
- ✓ Short services
(tram with commuter connection)
- ✓ Long services
- ✓ 1hour
- ✓ 7 tram- trains



Mobility solution



Departure point: Pelagatos

Destination: Cádiz

Day of travel:

14-03-2024

Request Return Times on the day



[Imprimir horarios](#)

Operado por

renfe

Línea	Salida Origen	Transbordo en RIO ARILLO		Línea	Llegada Destino	Time of travel
		Llegada	Salida			
T1	05:20	06:08	06:40	T1	06:55	1h 35min.
T1	05:54	Tren directo			06:55	1h 1min.
T1	06:24	07:10	07:20	C1	07:35	1h 11min.
T1	06:44	Tren directo			07:45	1h 1min.
T1	07:15	08:01	08:07	C1	08:22	1h 7min.
T1	07:44	Tren directo			08:45	1h 1min.
T1	08:12	08:58	09:03	C1	09:18	1h 6min.
T1	08:42	Tren directo			09:43	1h 1min.
T1	09:28	10:14	10:19	C1	10:34	1h 6min.
T1	09:39	Tren directo			10:40	1h 1min.
T1	10:07	10:53	10:57	C1	11:12	1h 5min.
T1	10:46	Tren directo			11:47	1h 1min.
T1	10:58	11:44	11:49	C1	12:04	1h 6min.
T1	11:40	Tren directo			12:41	1h 1min.
T1	12:06	12:52	12:57	C1	13:12	1h 6min.

TECHNICAL DESCRIPTION



3. TECHNICAL DESCRIPTION



TECHNICAL DESCRIPTION

Basics

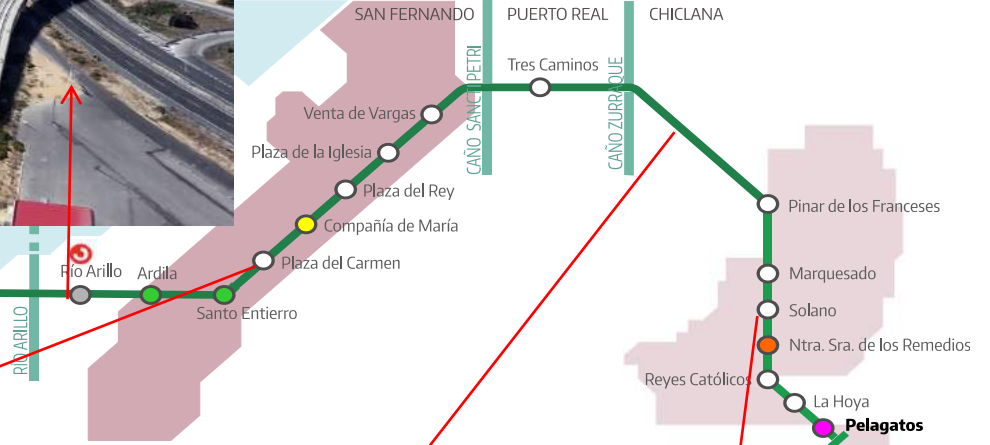
Trambahía is conformed by 11 km of existing iberian gauge doble balasted tracks part of the RFIG (Railway National network), and 13 km of new tracks as part of tram railway. 24 km in total.

In these tram sector, we can diferenciate 5 segmets along its layout:

- ✓ Rio Arillo station and its grade separation. (900m)
- ✓ San Fernando urban area. (4.401m)
- ✓ Interurban S Fdo – Chiclana segment. (6.481m)
- ✓ Chiclana urban area. (2.590m)
- ✓ Depots and Workshops.



3. TECHNICAL DESCRIPTION



Río Arillo Station (Grade separation link RFIG):



Railways platforms (200 m x 68cm).

Walkway , stairs and elevators.

Commuter, long services and high speed trains by inside tracks.

Meets RFIG Standards :

Interoperability (EU)

Turnouts

CCS

3000 V overhead

San Fernando (Urban section)



Twin tracks of iberian (1668 mm) gauge, needed to interoperability with RFIG. Anyway, infrastructure is prepared to change to UIC gauge (1435mm).

Layout runs along Real Street , principal street of San Fernando. Due to narrowness of several points of this historical avenue it was necessary to use dual rail. (2x Riph37N) to avoid turnouts in pedestrian areas (more than 2km).

In both, shared (pedestrians) and reserved transits , **Embebbed rail with corkelast © (Edilon-Sedra)** was used. In pedestrian grooved rail, finished in granite stone; and vignole UIC54 at reserved with grass



3. TECHNICAL DESCRIPTION



- ✓ Trolley Overhead on streetlight
- ✓ 750V dc
- ✓ Electrical substations in suburbs 20.000Vac doble ring, 2.200 V dc simple ring to stops needs.
- ✓ Electrical transformers 2200/400 V dc in stops

- ✓ Tram signalling (but SIL-4)
- ✓ Tram priority at street intersections
- ✓ Run on sight driving (no rear-end protection)
- ✓ GSM-R communications



3. TECHNICAL DESCRIPTION



3. TECHNICAL DESCRIPTION



TECHNICAL DESCRIPTION

Interurban

Ballasted Twin iberian gauge tracks.

UIC -54.

Polivalent sleepers (IBERIAN → UIC)

> 100 Km/h

Low (30cm) platforms at stops

As urban tram sections



Interurban

Standard railways overhead.

Railway Signalling (high lights) + ASFA (Signal Announcement and Automatic Braking)

750 V dc.

100 KM/h

GSM-R



Chiclana (Urban section)



3. TECHNICAL DESCRIPTION

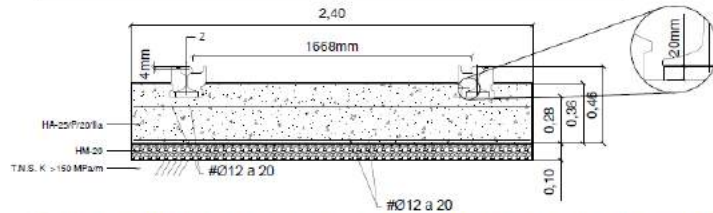
Unlike San Fernando, Chiclana layout runs along new city centre, through wide avenues. So reserved transit have been possible.

Vignole UIC-54 Embebbed rail with prefail © jacket was used. Except shared areas (pedestrian or traffic) with Riph37N

The surfaces are finished with colored prefabricated paving concrete blocks, simulating natural grass

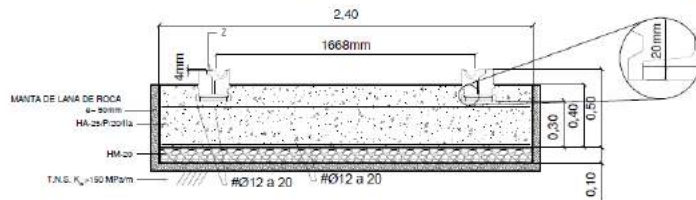


2 DETALLE DE LOSA CON CARRIL UIC54. ATENUACION 12dBv



Vibration mitigation solutions from jacket to Rockdelta rock wool anti-vibration mats were used.

4 DETALLE DE LOSA CON CARRIL DE GARGANTA PH37N. ATENUACION 24dBv CON LANA DE ROCA 50mm



3. TECHNICAL DESCRIPTION



- ✓ Trolley Overhead
- ✓ 750V dc
- ✓ Electrical substations in suburbs and Deposits
20.000Vac doble ring,
2.200 V dc simple ring to stops needs.
- ✓ Electrical transformers 2200/400 V dc in stops

- ✓ Tram signalling (SIL-4)
- ✓ Tram priority at street intersections
- ✓ Run on sight driving (no rear-end protection)
- ✓ GSM-R communications



Rolling Stock

7 Tram-train units (Mc – R- Mc) 38 m long.

Dual voltage motor : 750 and 3000 V dc , one pantograph, changing in motion (<30 km/h)

Vmax: 100 km/h

Doble height doors with ramps and mobile step.

55% Low floor with elevator to PRM

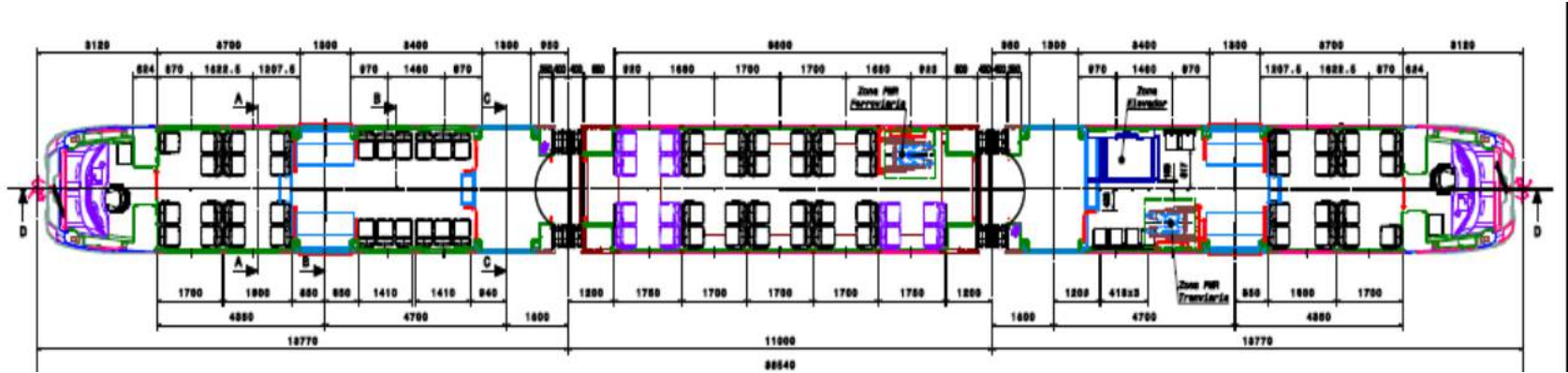
Dual communication system (GSM-R, Analogic Train to Track)



Tram – train by CAF



Tram – train by CAF



CAPACITY: 310 pax (6 p/m²)., 84 seats, 2 PRM

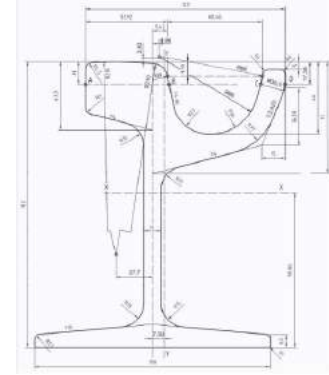
October 30th, 2020, AESF (Spanish Railway Safety Agency), homologated first iberian gauge tram-train, and its use in RFIG network was approved .

Hybrid operation requirements

Many parameters were designed to ensure hybrid operation.

In track system matters, it was needed to employ phenix embedded rail (Riph37N) instead of usual Ri60, because it was necessary wider groove where the flange of railway train fits

Iberian gauge (1668 mm) was a must, but eventual change to international UIC in the future, as well.



Hybrid operation requirements

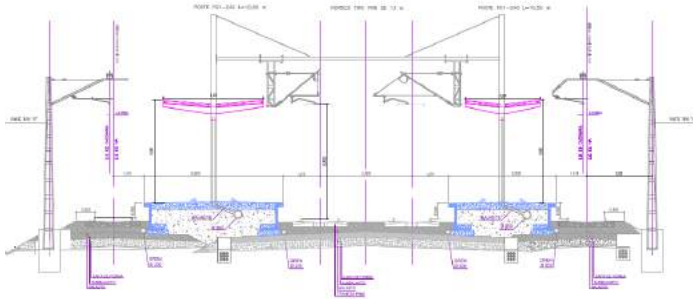


Regarding RFIG link, Infraestructure had to build **trap sidings** .

RFIG platforms are 68 cm **high**, tram ones, 30cm, and very **different gaps**. Rolling Stock resolved this issue



Hybrid operation requirements



Overhead have and neutral -dead voltage section to transits from 750Vdc to 3000 Vdc. (RFIG)

Rolling Stock have **dual voltage motors** , shifting in motion (<30km/h).



Tram resists **expansion wave** due to 300 km/h relative speed

RFIG BAHÍA SUR CCS had to be modified due to new interlockings. SIL-4.

Hybrid operation requirements



A signalling and communications border was established at Rio Arillo Station.

GSM-R → Tetra Analogic Train to track.

PCC Chiclana → CTC Santa Justa (Seville)

Tram driver → Train driver

Tram train continues its route, commanded by ADIF (RFIG) Control. Turnout at Rio Arillo on RFIG are under ADIF control too. Coming back is informed by ADIF to Chiclana PCC.



In Cádiz urban area, Tram train runs through State- owned existing tunnel, with five stations.

FIRST YEAR EXPERIENCES



First year experiences



October 26th, 2022, Trambahía was inaugurated.

First year experiences

MEDIA VIAJEROS 2024	
LABORABLES	5691,3
SÁB., DOM. Y FESTIVOS	3690,2

Daily passengers 2024 (feb)

26.10.22 --> TODAY

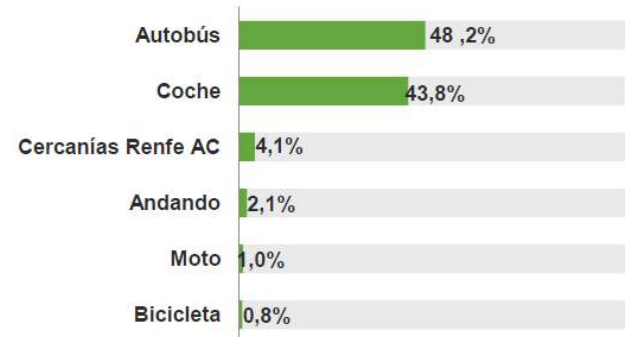


MEDIA DIARIA			
TODAS LAS PARADAS	5534	(MEDIA TOTAL ESTIMADA)	
TOTALES VIAJEROS			
PELAGATOS	38.862	TOTAL DE VALIDACIONES POR PARADAS	
LA HOYA	39.688		
REYES CATÓLICOS	91.847		
LOS REMEDIOS	227.540		
ALAMEDA SOLANO	94.570		
MARQUESADO	104.358		
PINAR DE LOS FRANCESES	61.681		
TRES CAMINOS	5.448		
VENTA VARGAS	205.534		
PLAZA DE LA IGLESIA	198.477		
PLAZA DEL REY	201.429		
COMPAÑIA DE MARÍA	131.700		
PLAZA DEL CARMEN	213.311		
SANTO ENTIERRO	288.052		
ARDILA	44.713		
TOTAL VALIDACIONES	1.947.210		(ZONA TRANVIARIA)
VALIDACIONES RFIG	594.245		(ESTIMADAS)
VALIDACIONES PERDIDAS	208.739		
TOTAL VIAJEROS	2.750.194	(TOTAL ESTIMADO)	

First year experiences



Passengers per location



Before T1, Passengers used to...

FIRST YEAR EXPERIENCES

Satisfaction survey 2023



Encuesta de satisfacción

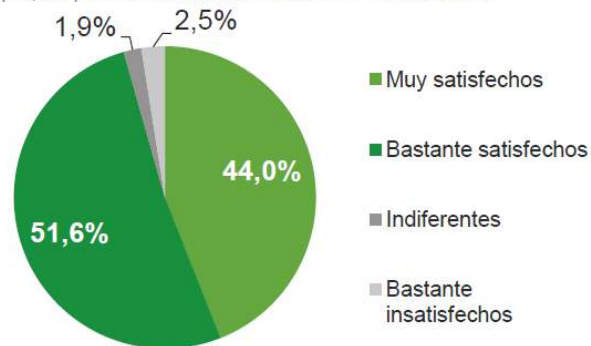
ÍNDICE DE CALIDAD PERCIBIDA 8,72 sobre 10, Notable alto

8,72

RECOMENDACIÓN TRAMBAHÍA

Un alto porcentaje de viajeros (80,3%) recomendaría el uso del Trambahía.

NIVEL DE SATISFACCIÓN



Thank you for your attention





Junta de Andalucía

Consejería de Fomento,
Articulación del Territorio y Vivienda

Agencia de Obra Pública de la Junta de Andalucía