

French Light Rail Overview

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65 routes with 700 kilometres of double-track in 30 cities, using 1,200 trams to provide 3 million daily rides



Reims with APS ground collection

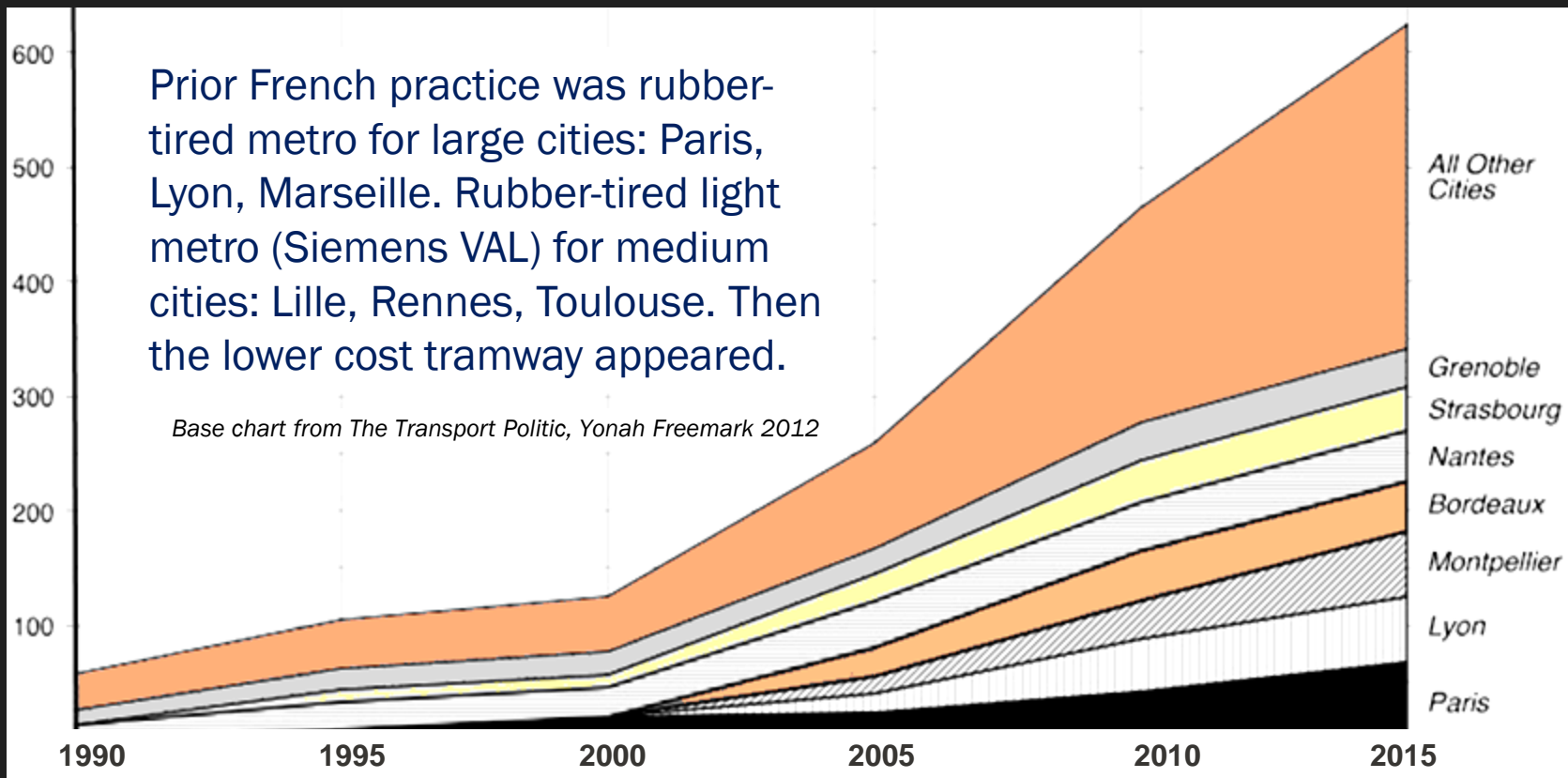


Lyon



Bordeaux with APS

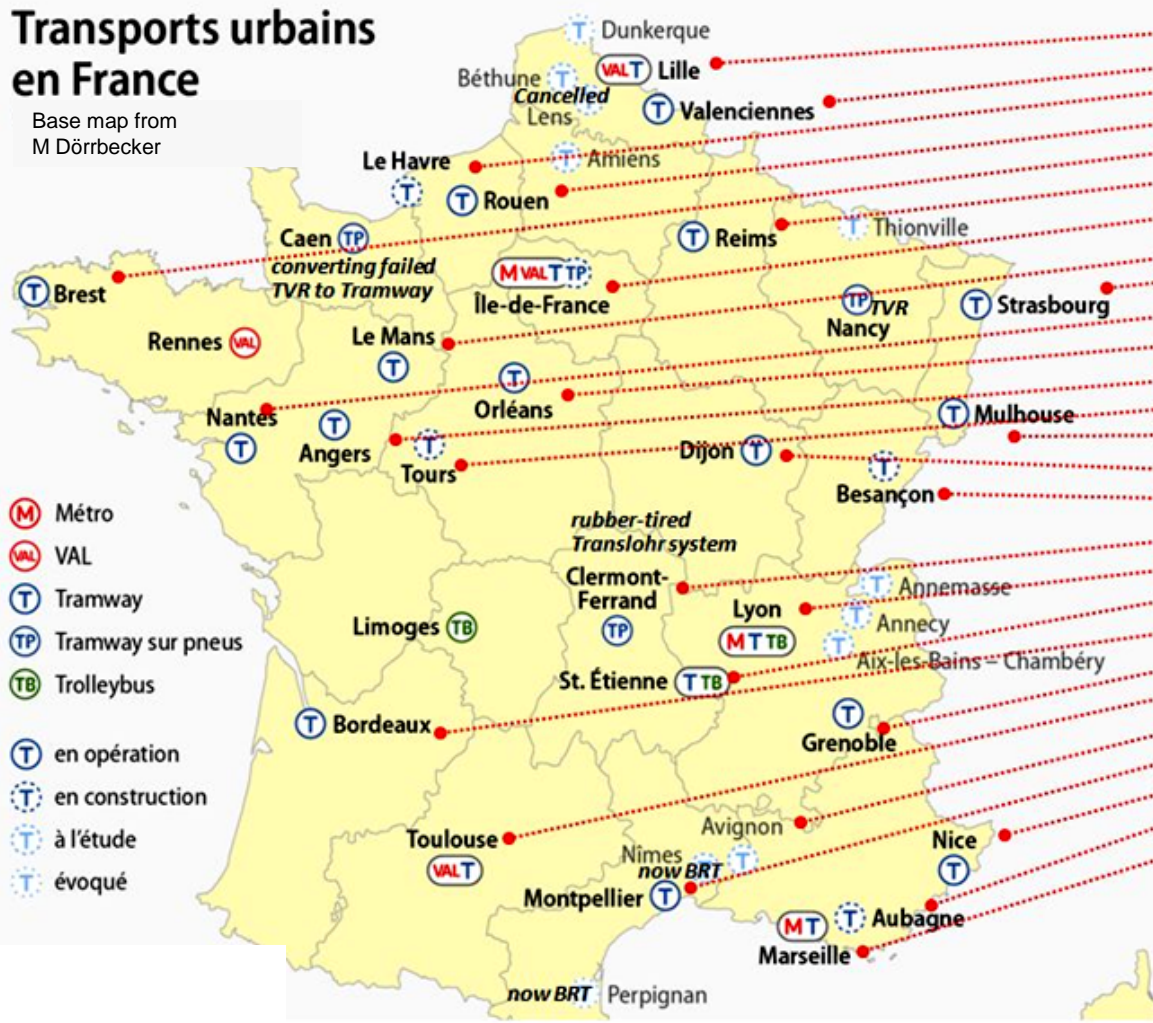
Growth of French Tramways—kilometres of route



Remarkable growth, particularly from 2000; there is no distinction between tramways (streetcars) and light rail in France, more a combination of features. *Tram-trains are not covered here but are gaining ground with dual-system vehicles capable of over 100km/h— 750 volts plus 1.5V DC or 25kV AC or diesel*

Transports urbains en France

Base map from M Dörrbecker



City	Population	Opened	Lines	km	pax/day
Lille	1,100,000	1994	2	22.4	32,000
Valenciennes	400,000	2006	1	18.3	33,000
Le Havre	610,000	2012	2	13	new
Rouen	530,000	1994	2	15.1	65,000
Brest	220,000	2012	1	14.3	new
Reims	290,000	2011	2	16.1	45,000
Paris (Île-de-France)	11,800,000	1992	4	41.4	315,000
Le Mans	150,000	2007	1	15.4	48,000
Strasbourg	640,000	1994	6	57.2	300,000
Nantes	800,000	1985	3	42.1	266,000
Orléans	120,000	2000	1	17.9	45,000
Angers	280,000	2011	1	12.3	35,000
Tours	300,000	2013	1	15.3	new
Mulhouse	250,000	2006	4	41.8	60,000
Dijon	250,000	2013	2	20	new
Besançon	140,000	2015	1	14.5	new
Clermont-Ferrand	260,000	2006	1	14.2	48,000
Lyon	1,760,000	2000	5	72.1	250,000
St-Etienne	320,000	1991	3	22.5	70,000
Bordeaux	1,010,000	2003	3	43.4	350,000
Grenoble	530,000	1987	4	36.4	210,000
Toulouse	1,100,000	2010	1	10.9	20,000
Avignon	90,000	2016	2	14.5	new
Montpellier	530,000	2000	5	54.4	282,000
Nice	350,000	2007	1	8.7	90,000
Aubagne	100,000	2014	1	9	new
Marseille	1,530,000	2007	1	11.5	87,000

Population is metro area (*agglomeration*). Paris (*Île-de-France*) data is incomplete; 11 lines are in construction or planning.

Tramways now run in most provincial cities —*la France profonde*. Twelve tramway cities have a population below 250,000, two below 100,000. Bordeaux, Lyon, Nantes, Grenoble, Montpellier and Strasbourg have networks with daily ridership over 250,000.

Factors in success

1. Funding from payroll tax *Versement Transport* of 1.5% – 2%
2. Strong mayors with six year terms combined with usually good corporate and public support
3. Peer pressure—one city builds a tramway, others want one
4. Speedy: 30-60 day independent national enquiry favours public utility over local (NIMBY) issues
5. Resultant *Déclaration d'Utilité Publique* gives powers including compulsory land purchase
6. Car ownership typical of Europe but lower than US, expensive fuel—double the USA, compact cities but some sprawl with location of hospitals, colleges in suburban areas
7. Utilities pay own relocation — and so minimised

Factors in success—2

8. Not reinventing the wheel—major consultants and contract operators ensure experience transfers from system to system, lowering risk, build time and cost
9. Attractive, standard, modular all-low-floor vehicle used in over 80% of systems, not quite the PCC car but getting there
10. Clean Air Act Loi sur l'air encourages public transport, allows restrictions and removal of capacity from roads and supports innovative traffic engineering
11. Close station spacing improves access at a small reduction in travel speed and provides high city centre visibility
12. Frequent service rather than longer trains at longer intervals
13. Light elegant overhead with options for off-wire operation
14. Environmental support—clean energy, grass tracks, new trees, rebuilt roads and intersections, creation of public spaces



Capital Costs

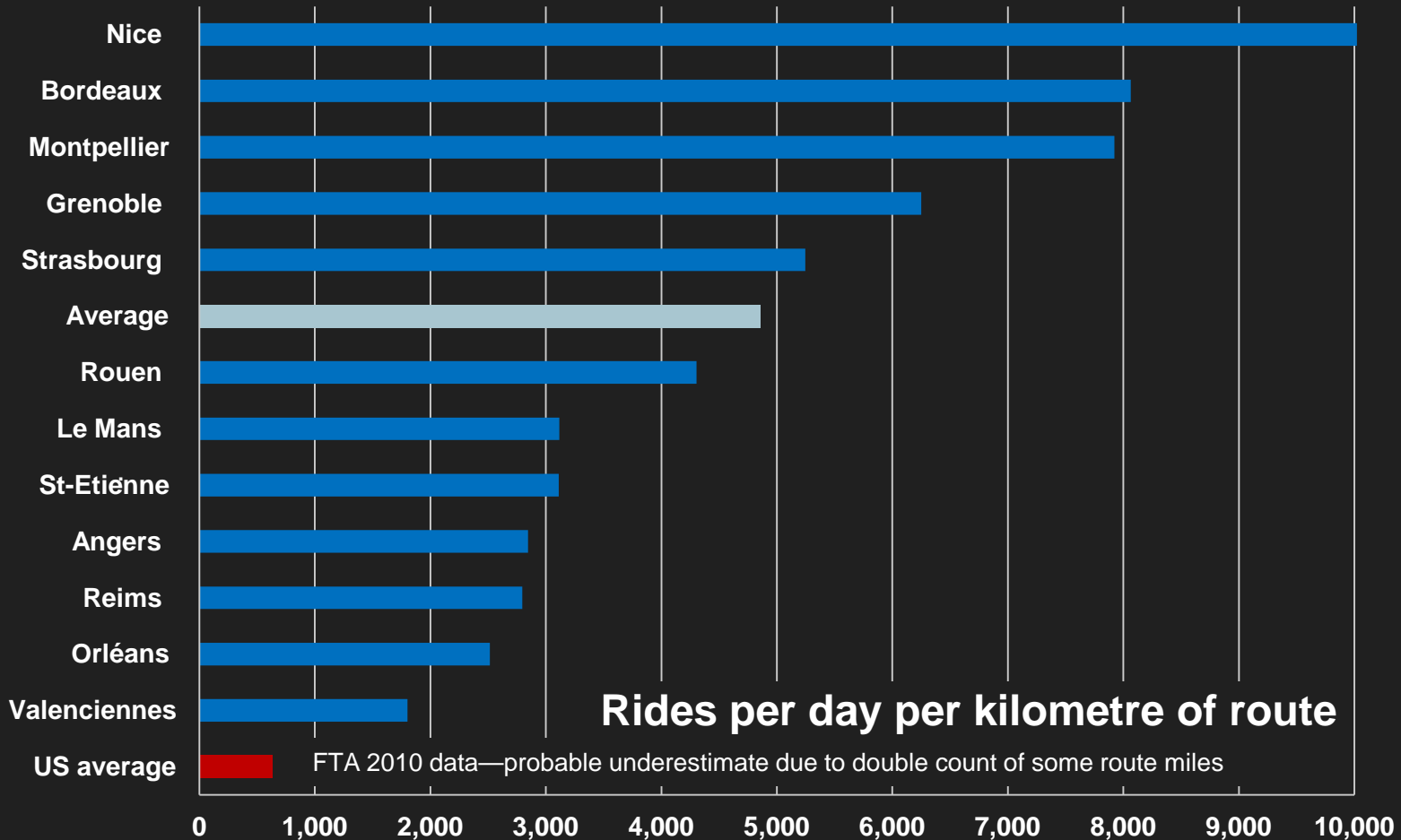
Despite the economies of scale from city to city: joint orders for vehicles, use of public land and easements, and minimising line poles (25% of spans in Brest are attached to buildings), French tramways are comparable or slightly more expensive than other European systems—although allowance should be made for the 15-25% of project costs that are spent on the urban environment—and any APS.

The average of eleven recent French systems is US\$ 29m/km, range \$20.4– \$51.2

The average of seven recent US systems is US\$ 35m/km, range \$28.6– \$43.5

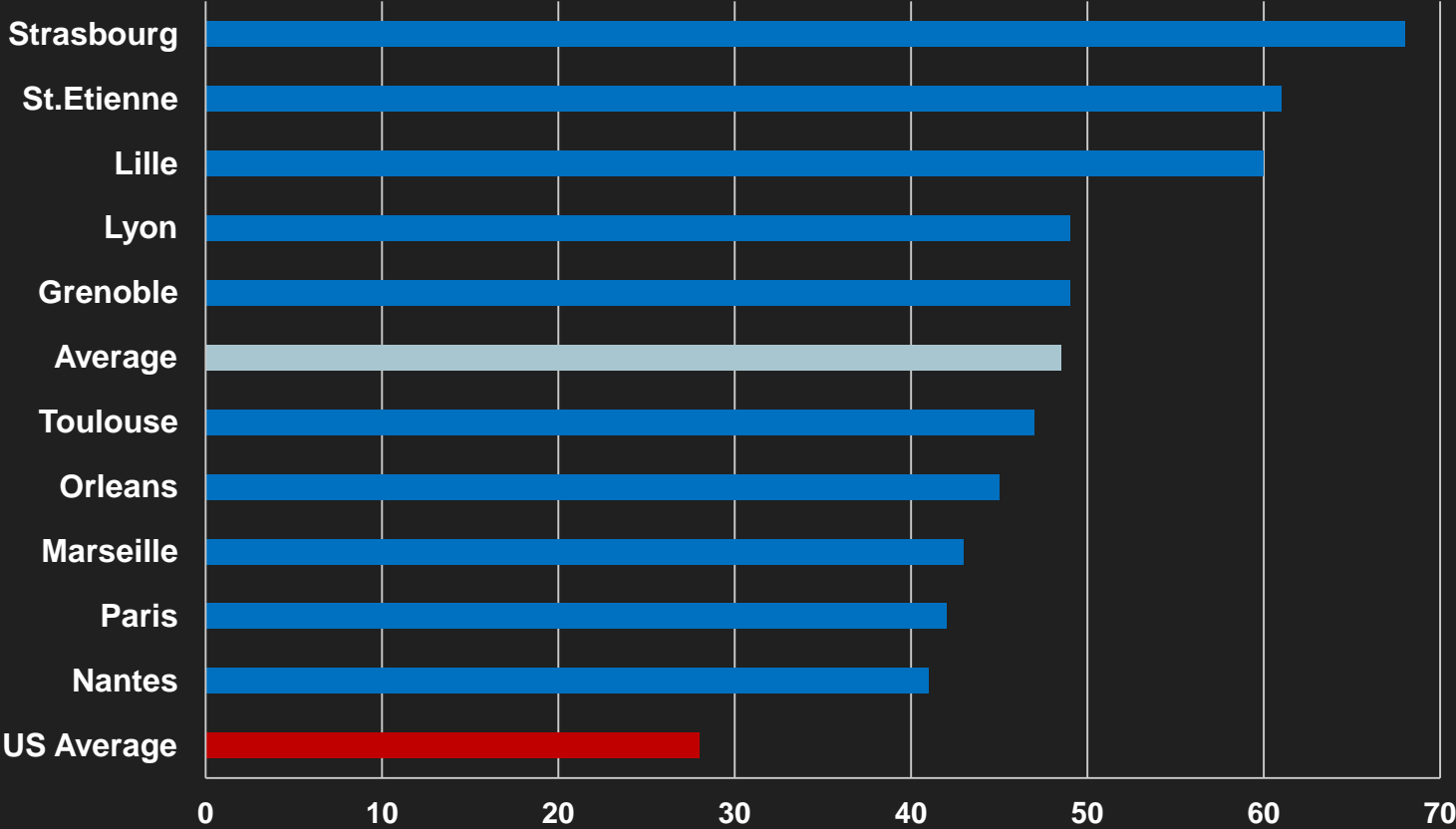
Excludes systems, such as Seattle, with tunnels or other high infrastructure costs; €=US\$1.3

Some results



Buses and trams are closely integrated with free transfers. Ridership increase is typically 30–60%. Montpellier went from 28.8m/year on the all bus system in 1999, to 62.2m in 2010 with 5 routes, an 150% increase.

LRT Farebox Recovery as percent of Direct Operating costs



Despite moderate fares and frequent service with union (*syndicat*) drivers, average farebox recovery at 48% is good, particularly given that on some systems heavily discounted students make up over half the riders. Alignments may often seem convoluted but ensure that universities, schools and other major generators—hospitals and railway stations—are well connected.

French Quirks



Translohr system in Clermont-Ferrand



Bombardier TVR in Nancy

The French have a thing for rubber, from autorails in the thirties with rubber-covered steel wheels to the Paris *métro sur pneus* of the fifties, initially quieter but now little different from modern steel-wheel metros—except for the third higher power consumption per passenger-km—with ensuing greater tunnel heating.

Two rubber-tired single-rail tramway systems were developed. The Bombardier (ex B&N) TVR has been a failure. Nancy is struggling to keep its line running while Caen has announced conversion to a conventional tramway.

The Translohr system in Clermont-Ferrand—home of Michelin—a 2nd line is being built in Paris—has been more successful but costs much the same to build and has higher power and maintenance costs. The claim of handling higher grades is only partly true—there are some equally steeply graded steel-wheel systems.

After financial difficulties Translohr was taken over by Alstom and the state in 2012.

Not quite right



Bordeaux with APS

There is no question that part of the French tramways' success is their positive environmental image—low-carbon nuclear electricity, low noise, grass, trees, traffic calming, urban regeneration. But grass does not grow everywhere and there are examples of quagmires, weeds, dead areas and even sections converted to plastic turf. There can be too much of a good thing—particularly given the continual higher maintenance.

Similarly the high cost overhead elimination with intermittent third-rail APS (*Alimentation par sol*), batteries, and pending inductive systems. Fine for in front of a cathedral or over a historic bridge but on mundane streets or in the suburbs this is a cost too far—and APS does not work in snow or ice. The Nice battery system has merit for moderate length sections where it delivers about half power—sufficient for city-centre operation.

Pick a front end—any front end



Alstom developed a standard high-floor French LRV for Nantes in the 80s (TFS 1). Low floor centre sections were later inserted here and for Paris and Grenoble. The all-low-floor Citadis design evolved and Alstom has successfully kept to a modular design with two widths and flexible lengths. Alstom will rarely customise except for the interior and fibre-glass moulded front. Despite EU regulations now requiring open bidding, Alstom maintains a high share of the French tram market. (82%)

These low cost variants allow distinct vehicles for each city—whether the symbolisation is a silk-worm—*Lyon*; a marine theme—*Bordeaux*; or a champagne flute—*Reims*; and so on.

My favourite has to be Tours (opening in 2013) with illuminated stripes forming a continuation of reflections from the rails—white at the front, red at the rear with integrated lights. Brilliant.

...and what about the interiors?



...well, different, unusual, colourful, innovative—but mainly breaking the rule that they should not be so contemporary as to be outdated well before the 30 year vehicle life. In a less litigious country they also manage with too few handholds or stanchions.

Thank you—merci

Waiting for the tram, Strasbourg 2011



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