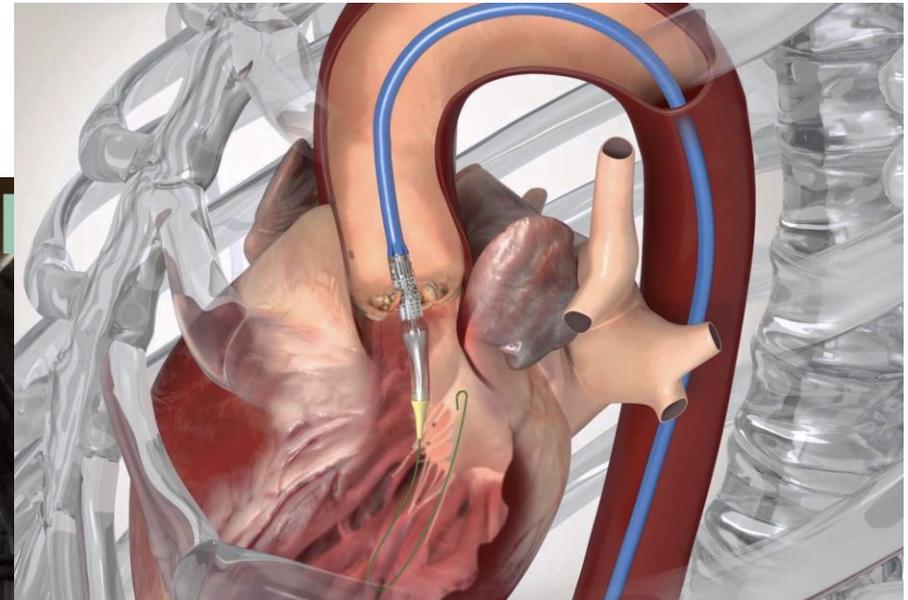


TAV and TAVI



Bernardino Chiaia

Centro SISCON, Politecnico di Torino

A social matter: ageing of infrastructures

Would you drive a 60y car?



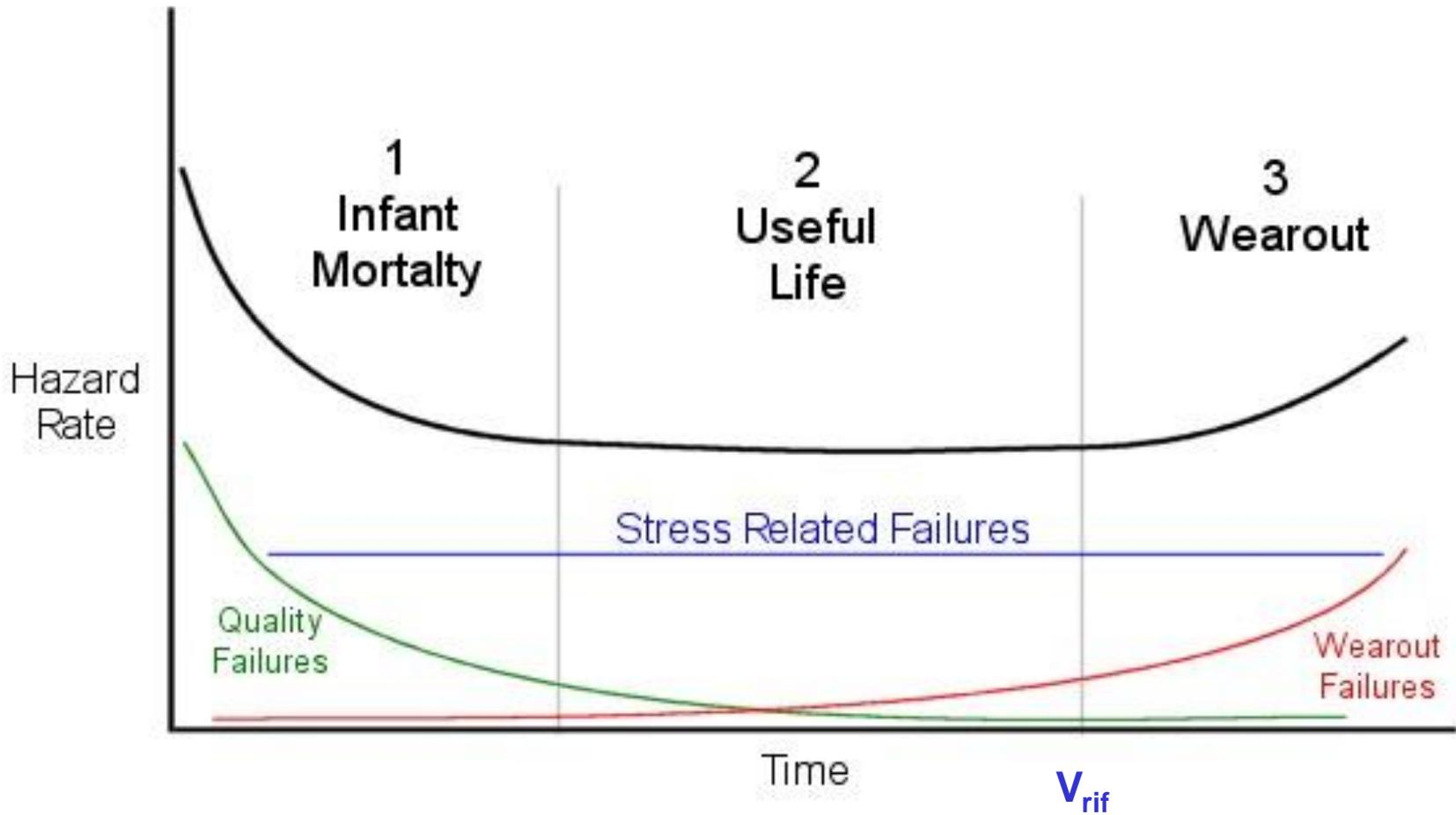
Would you work with a 50y computer?



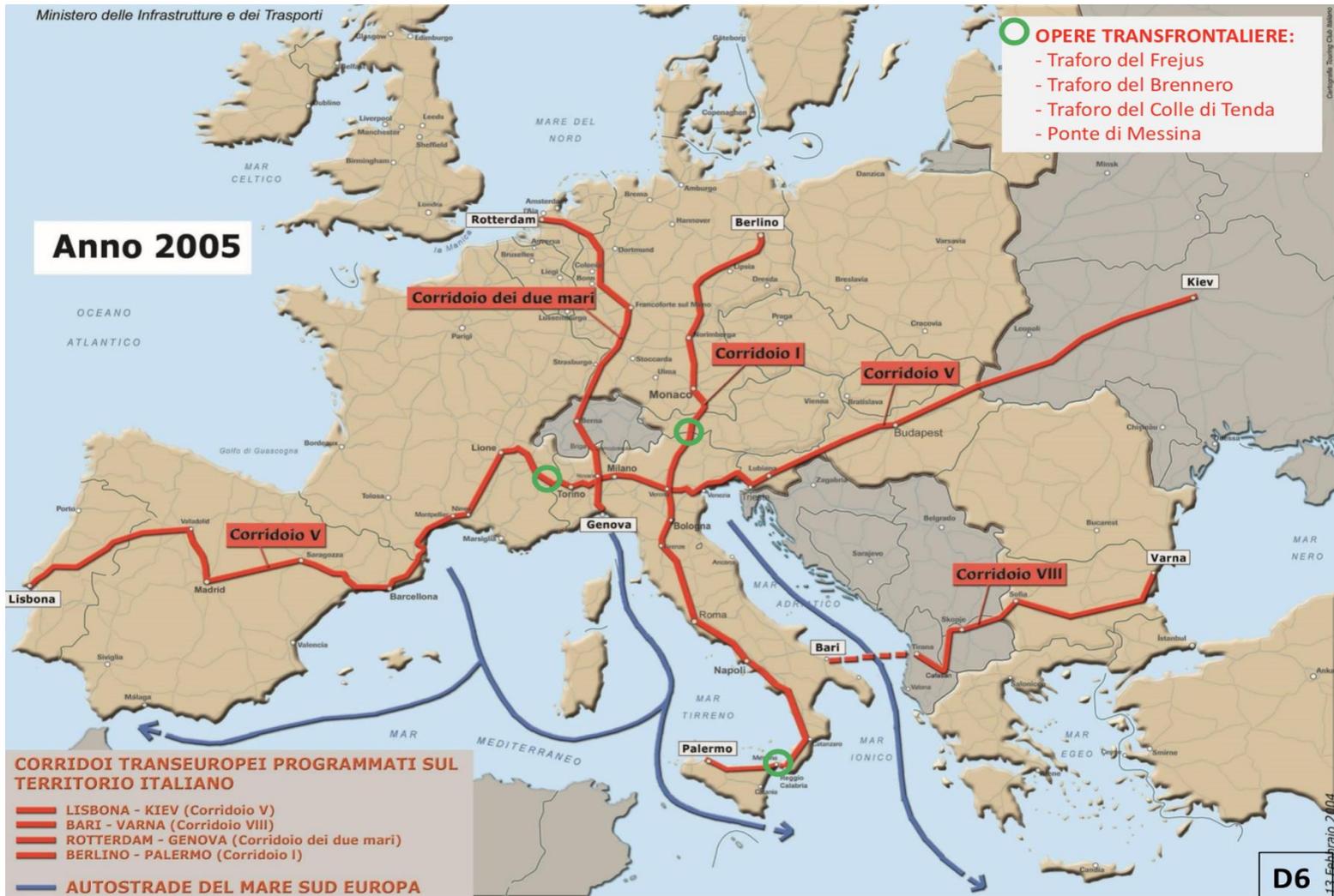
Would you **transplant** a
80y heart?

Would you fly on a 60y aircraft?

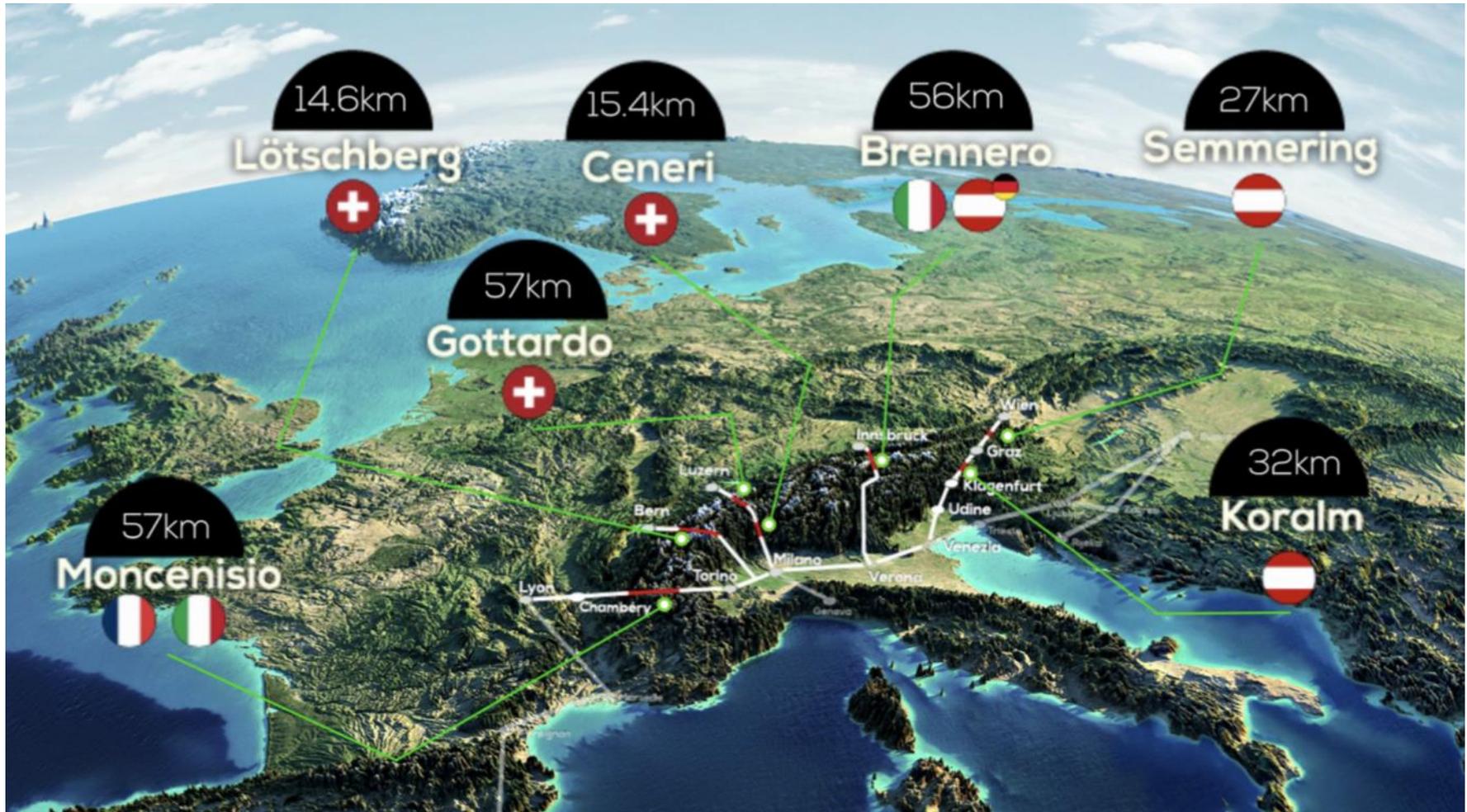
Evolution of the probability of failure with time



Trans-European Networks (TEN)



Seven base tunnels under the Alps



From the Frejus to the Mont Cenis tunnel

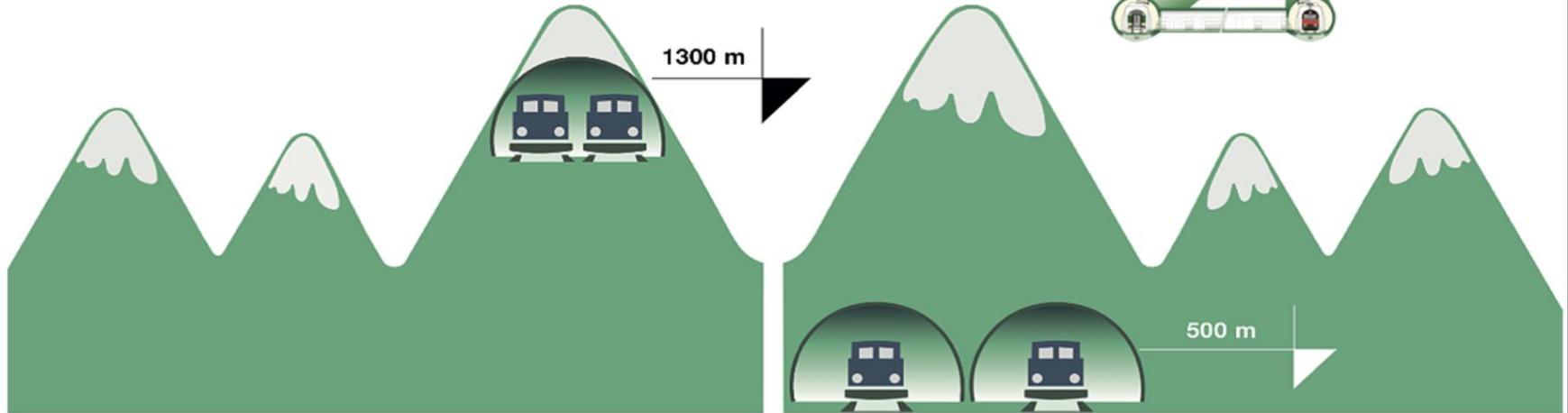
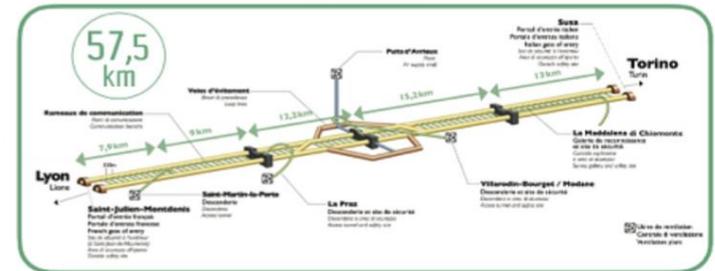
1871



TODAY



2029



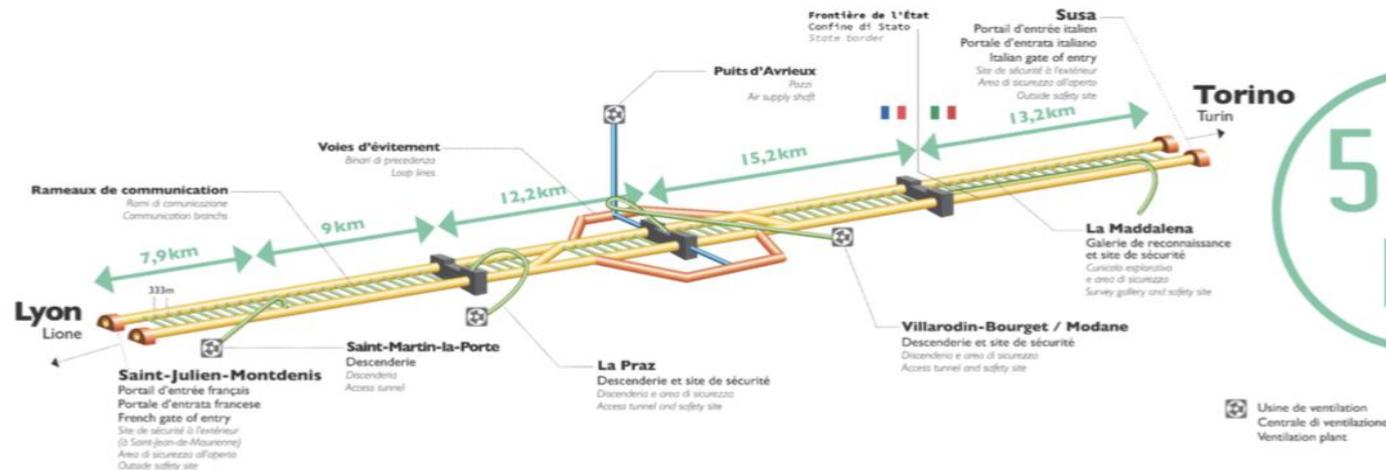
The Lyon - Turin railway line



The Mont Cenis base tunnel in numbers

12 operational sites between Italy and France
2 new international stations
>12 m/day: average digging speed of the tunnel boring machine
2029: date of completion of the work

8.6 billion Euros of investments
81 international calls for tenders
4,000 direct and 4,000 indirect jobs created between France and Italy
>20K commitments with contractors and sub-contractors



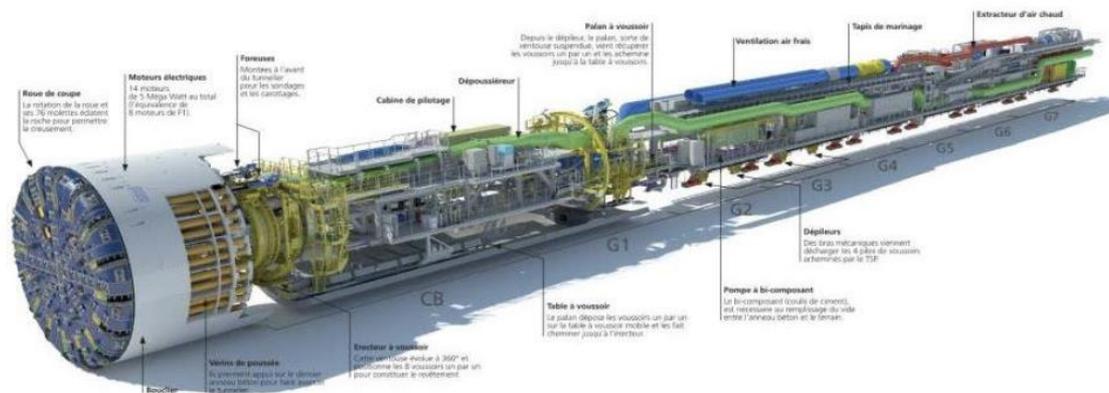
The current status of the base tunnel

18%
gallerie già
realizzate
pari a 28.5 KM

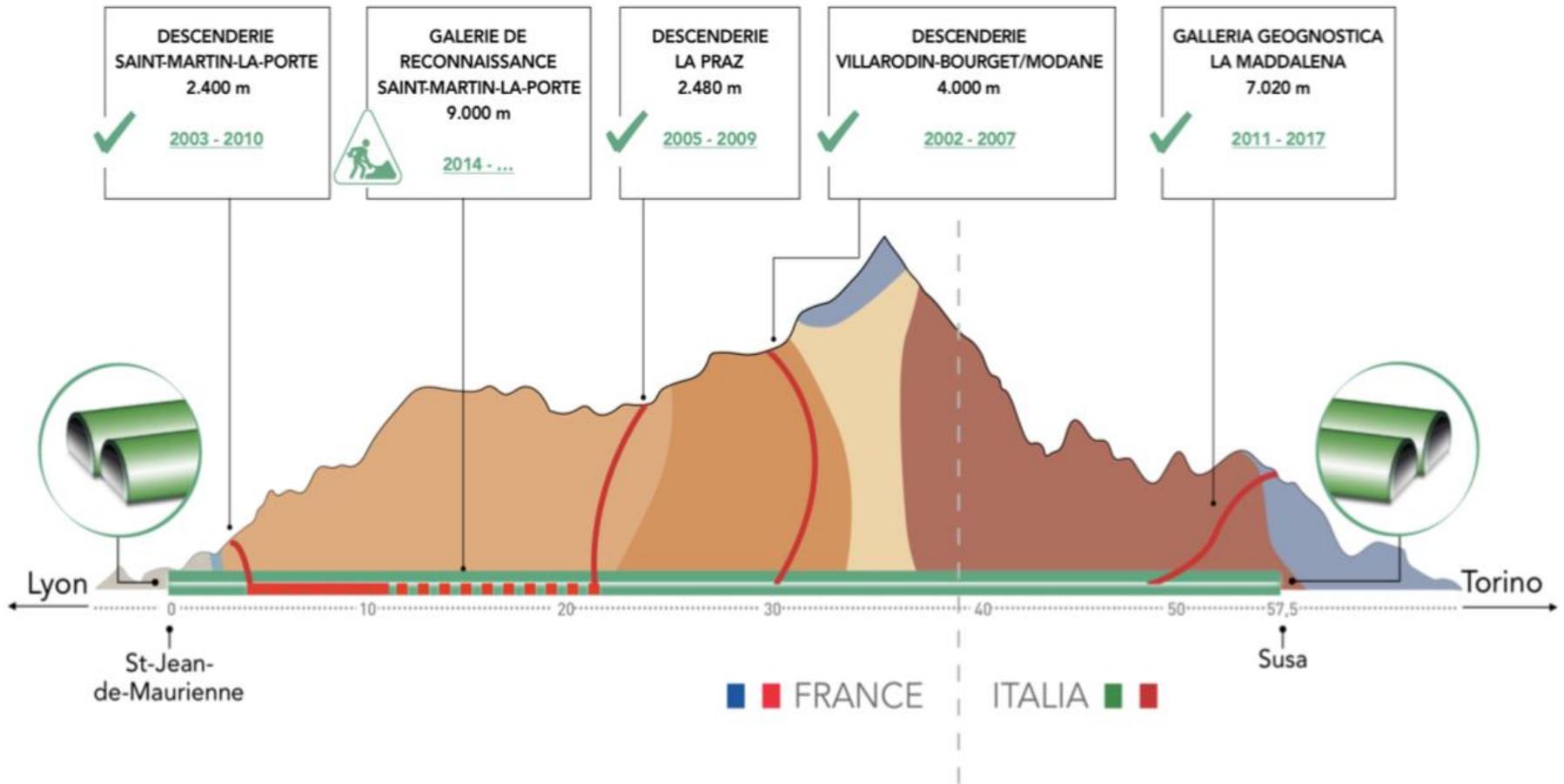
21%
opere
appaltate

100%
scavo
completato
a SMP4

68 KM
sondaggi
esplorativi
effettuati



Geognostic tunnels



The TBM at work in the tunnel



Health Impact Assessment

Application to the exploration tunnel «La Maddalena»



Inizio scavo 22/01/2013
Ragg. Pk 7+020 20/02/2017

Lunghezza totale	7020 m
Inizio lavori	Aprile 2012
Inizio scavo	Gennaio 2013
Fase 1 Scavo tradizionale (gen 2013 – lug 2013)	198 m
Fase Montaggio TBM (ago 2013 – ott 2013)	
Fase 2 Scavo TBM (nov 2013 – feb 2017)	6822 m
Fase 3 Smontaggio TBM e sistemazioni finali (in corso)	



Health Impact Assessment: monitoring 2012-2017

	2012	2013	2014	2015	2016	2017	Tot.
AMIANTO	675	198	450	491	476	464	2754
PM10- PM2.5	231	1113	1723	1784	1808	1806	8465
PM10 in continuo	/	6926	7580	8607	8683	9119	40915
RUMORE							
cantiere	52	64	89	97	98	98	498
traffico	49	35	42	42	43	42	253
VIBRAZIONI	16	19	19	25	18	24	121
Radioattività							
α	240	62	93	104	105	105	709
β	240	62	93	104	105	105	709
γ	32	18	23	24	24	55	121
Gas Radon	256	446	686			0	1388

Cost-benefit analysis

Cost/benefits **economic unbalance** according to the CBA of the Italian Minister of Infrastructures and Transport (2019):

- best scenario (highest benefits): **5,7 billions Euro**
- worst scenario (lowest benefits): **8,1 billions Euro**

Technical costs for the Base Tunnel = 9,6 billions Euro (3.0 billions on Italy)
plus 1,7 billions for network connection and accessories

The benefits have been calculated on the basis of the so called «***modal shift***» from road and air transportation to railway.

- best scenario: yearly traffic growth rate on railway = 2,8%
- worst scenario: yearly traffic growth rate on railway = 1,5%

The analysis considers **economic benefits equal to only 800 millions Euro**



Cost-benefit analysis

The optimistic forecast considers that the freight traffic from Torino to France increase **from 2,7 million tons/year (2017) to 51,8 million tons/year in 2059** (2.500% growth in 40 years)

The passengers traffic should also increase **from today 700.000 to 4,6 millions** with the simultaneous doubling of regional traffic (from 4,1 to 8 millions/year)

Of course this hypothesis implies that TAV will attract on the new line a big % of the traffic currently using the Swiss tunnels and the Ventimiglia gate (plus, obviously, most of the traffic now passing through Mont Blanc and Frejus tunnels)

BUT... the weak points of analysis should be highlighted



Cost-benefit analysis: comments

1) The analysis does not quantify correctly the environmental benefit:

The benefit related to lower environmental impact is only 90 Euro per CO₂ ton.

Paradox: the analysis considers the reduced tax income due to transfer of freight traffic from road to railway (simultaneous reduction of the highway fees and of taxes on gasoline...)

According to the optimistic scenario, the environmental benefit would only be a reduction of 800.000 CO₂ tons/year (only 500.000 CO₂ tons/year in the worse scenario).

This is equal to only 0,5% of gas emissions generated by transports in Italy (consider that in Rome more than 4 millions CO₂ tons/year are produced...).



Cost-benefit analysis: comments

2) The analysis does not consider the whole corridor:

The benefits are calculated on a less-than-100km segment of the entire Lisbon-Lyon-Kiev corridor which measures more than 2.000km.

Thus the CBA on a small segment is not significant because the scale of the benefits should be broadened at least to the rest of Northern Italy (including tirrenic and adriatic ports linked to the Belt&Road traffic)

Also the passenger traffic forecast should extend from the Turin-Lyon context to at least the Milan-Paris context (the 850 km from Milan to Paris will be made in almost 4 hours...).

This would widen the scenario by more than 4,5 millions passengers/year.



Cost-benefit analysis: comments

3) The analysis does not consider the correct duration of the infrastructure: the assumed service life duration is only 60 years.
On the contrary, RFI and TELT both assume a minimum value of the service life equal to 120 years.

The old Frejus Tunnel, constructed on 1861, is still in service...

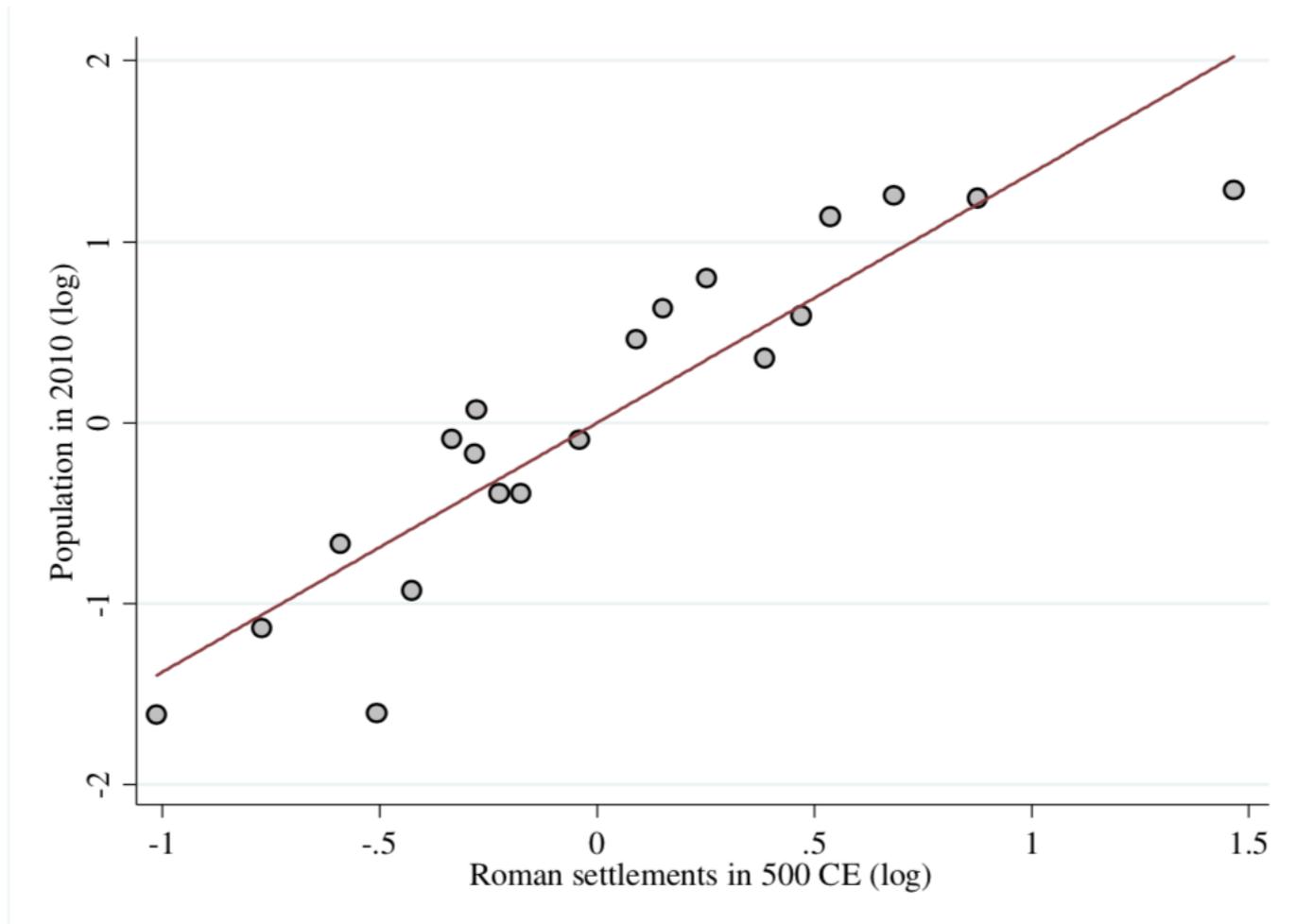
4) The analysis does not consider the 1000 full-time jobs expected at the peak of the works. No base camps for the workers who will be lodged in local structures. Up to 1 million overnight stays during the construction period.

About € 50-60 million of potential spill-over effects in the Susa valley.

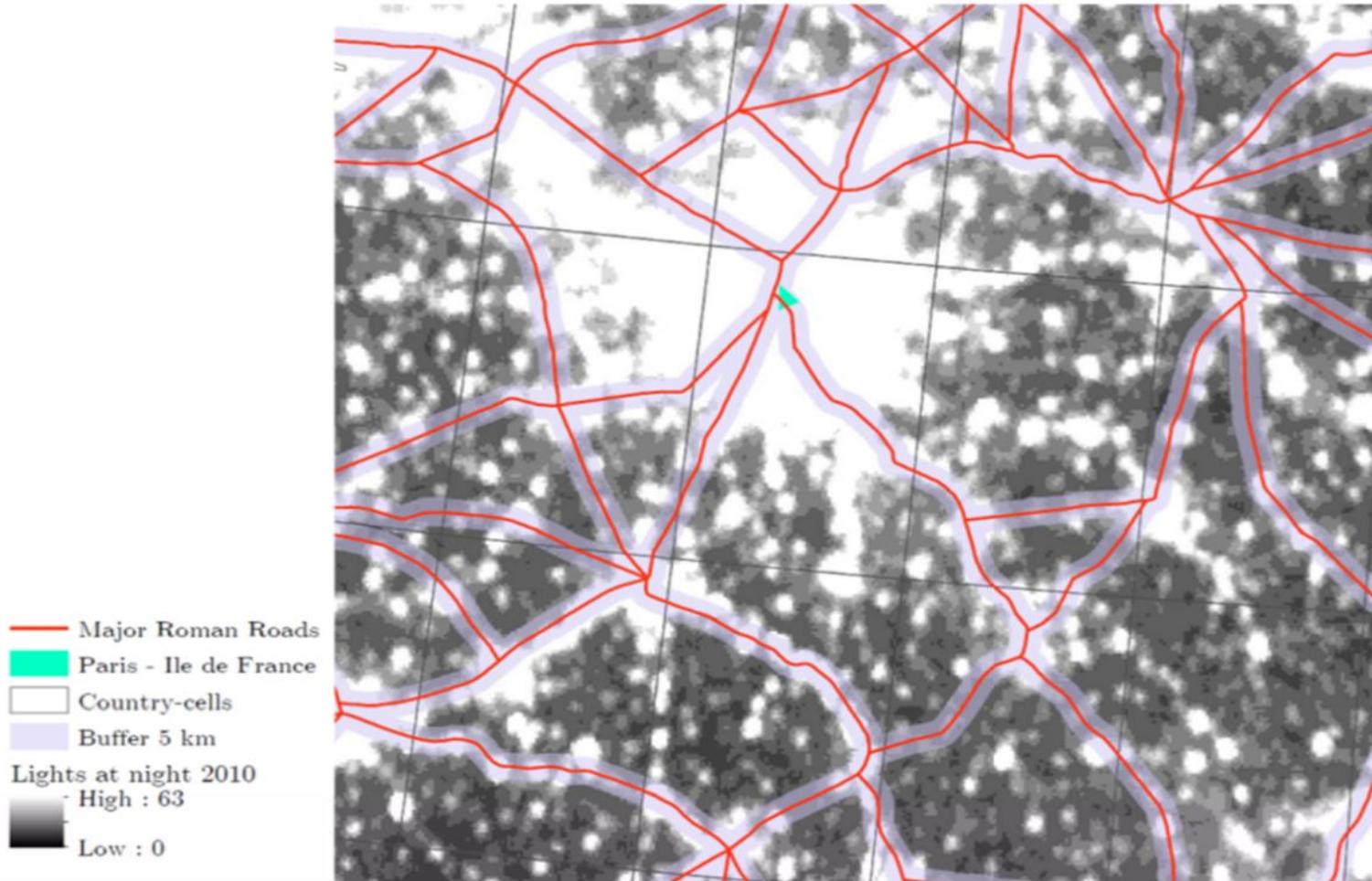
Via Appia (312-264 BCE)



Relation between 2010 population and extent of Roman Empire settlements in 500 CE



Roman roads and contemporary nightlight intensity around Lutetia (Paris)



Theory of complex systems

Due to complexity of the problem (economical, social and environmental benefits are intimately linked), even **small variations of the hypothesis** at the basis of the CBA and even **small and hidden errors** in the forecast algorithms may bring **to completely different conclusions**.

And this occurs in any case, i.e. also if we optimistically assume to agree a priori on the methods for calculating costs and benefits.

Thus, **the quantitative and absolute CBA of a certain infrastructure provide weak models, without statistical robustness and characterized by low reliability and replicability.**



Theory of complex systems

Many past experiences showed the scarce reliability of such analyses, e.g. in the case of infrastructures whose benefits have emerged many years after construction (Eurotunnel, A14 etc).

Only comparative CBA adopting the same hypotheses and the same forecasting algorithms to compare alternative solutions for a certain given problem (e.g. the connection between Turin and Lyon) **possess a higher degree of reliability.**

In the comparative CBA, systematic errors and model sensitivity play the same role in each analysis and thus elide when different solutions are compared.



A sad conclusion...

The trust on Institutions and experts is now very weak, according to a trend described in *“The death of expertise”*, Oxford University Press, 2017.

Experts are not considered reliable providers of qualified opinions and truths, but appear as owners of a elitarian wisdom far from people needs.

All opinions are equally sound and valid !

This is not correct because knowing some problems is different from understanding it.

The ***unconsciousness of incompetence*** is the key factor against expert opinions.

