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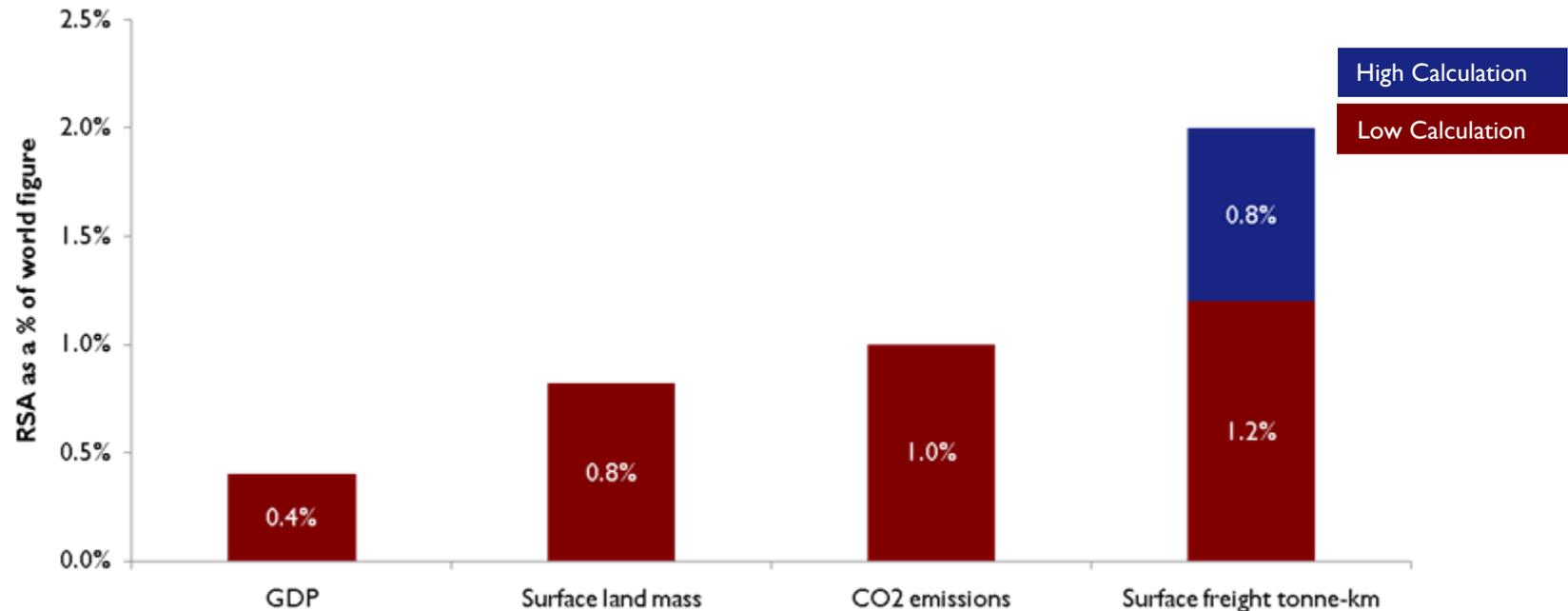
Sustainable Branch Line Revitalisation:

RESEARCH PRIORITIES FOR SOUTH AFRICA

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Cape Town, South Africa
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South Africa's CO2 emissions is sometimes a subject for debate (though not necessarily a domestic debate)

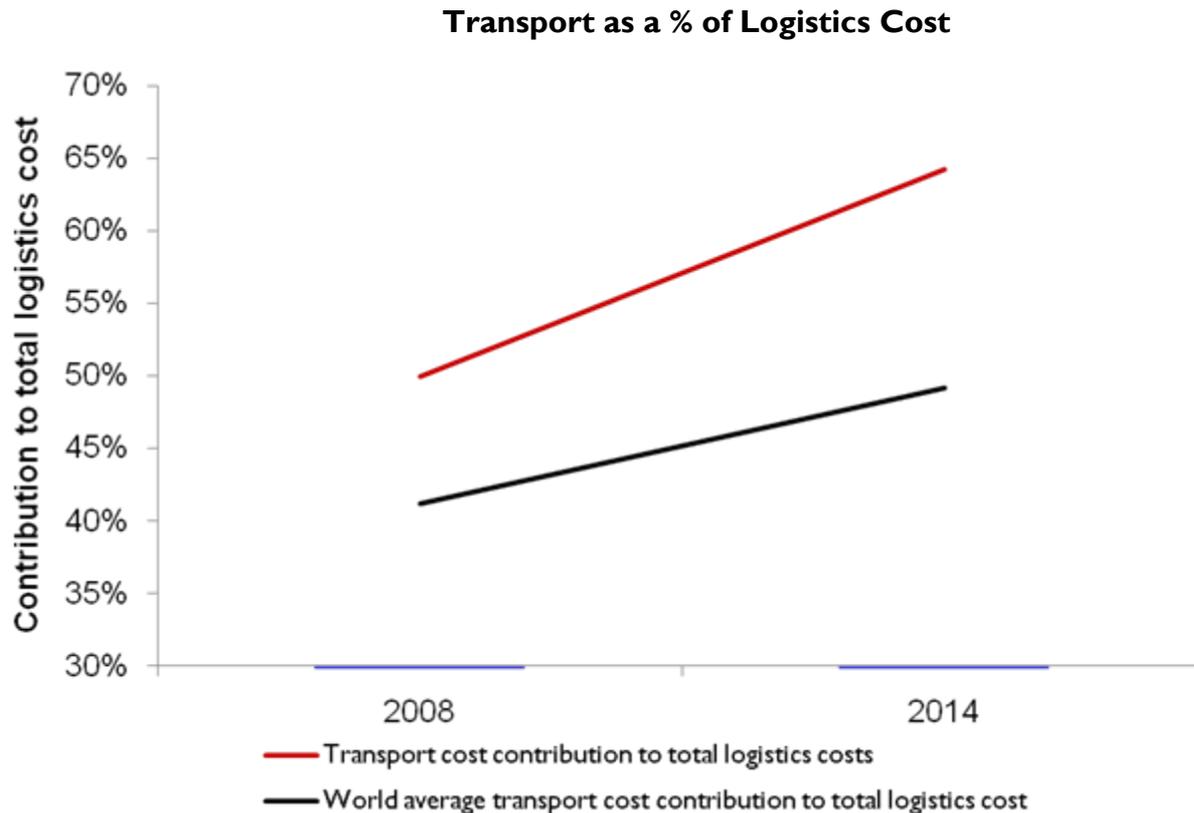


Source: In 2004 the world produced about 49 000 Mt CO₂ - equivalent of which South Africa emitted 440 Mt CO₂ - equivalent roughly 1% -Scenario Building Team (SBT) 2007 , Jones, T.Rodrigue, J.P., Gielen, D. - low calculation based on 2002 data / Comparison of Datamonitor 2009 (2008 data) and world GDP (2008) - high calculation

South Africa is a spatially challenged country

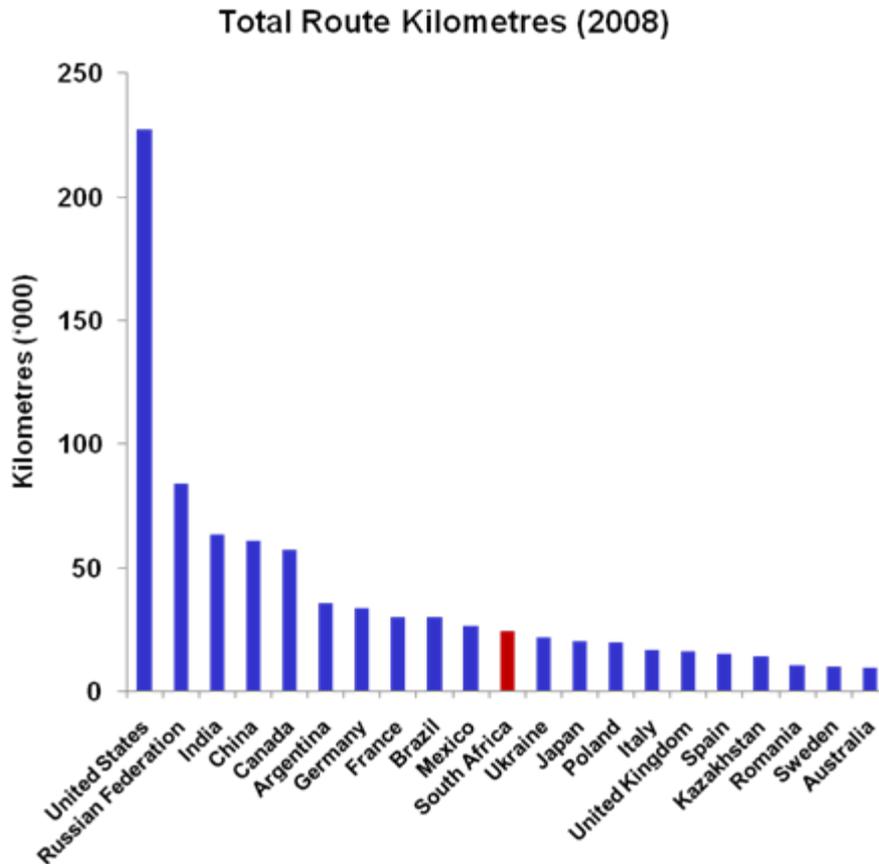


South Africa's freight logistics supply is at risk – an integrated sustainability dilemma (the triple fuel price scare)



The only sustainable solution is freight rail development – but where are we?

The installed network seems adequate



- 20 000 of the world's one million route kilometers is in South Africa
- That is 2% - exactly comparable to tonkilometer demand
- But the system has been plagued by failure, with under-maintained infrastructure and aging equipment

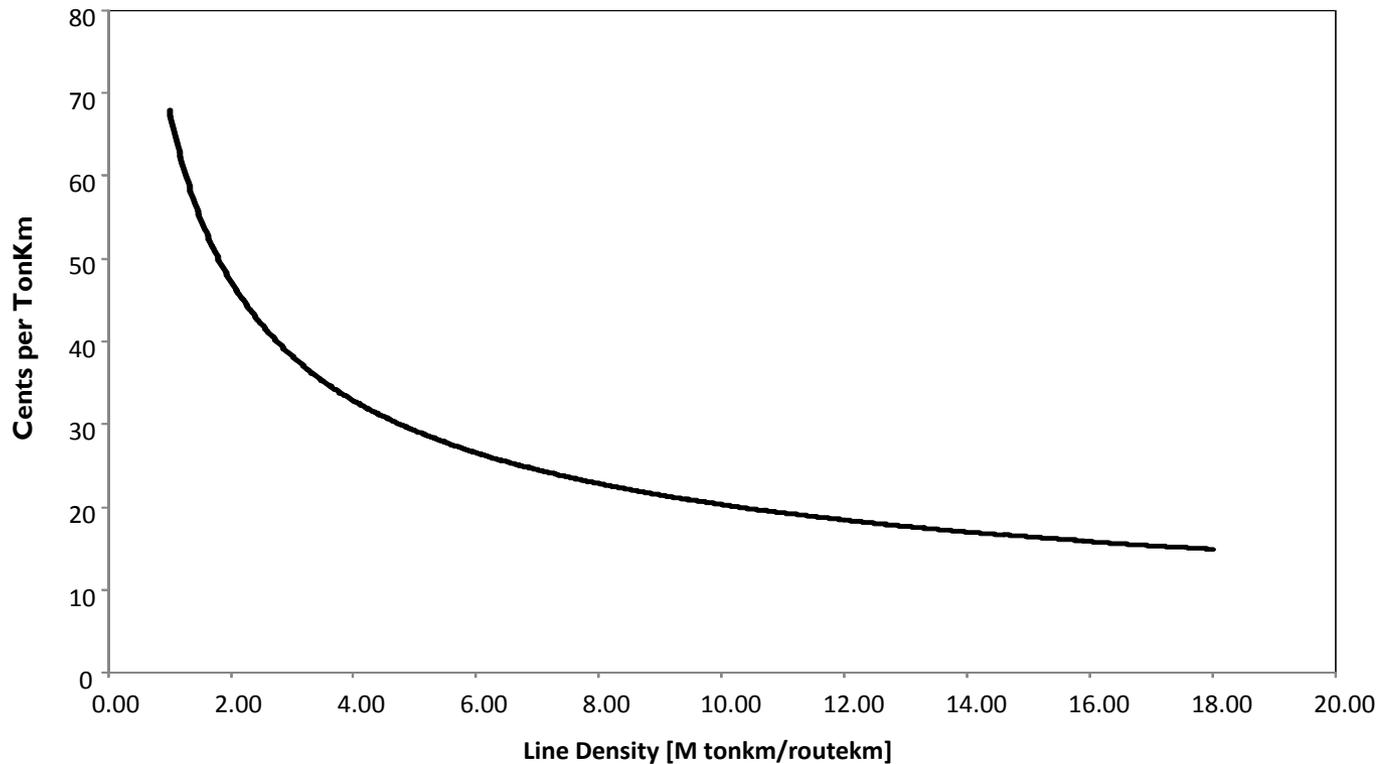


- However, at the edge of chaos, serious plans are being made to revive and revitalize

Source: World Bank

But on a macro level some of these plans could be flawed – and this is not a railway company problem, but a failure of perspective of the nation

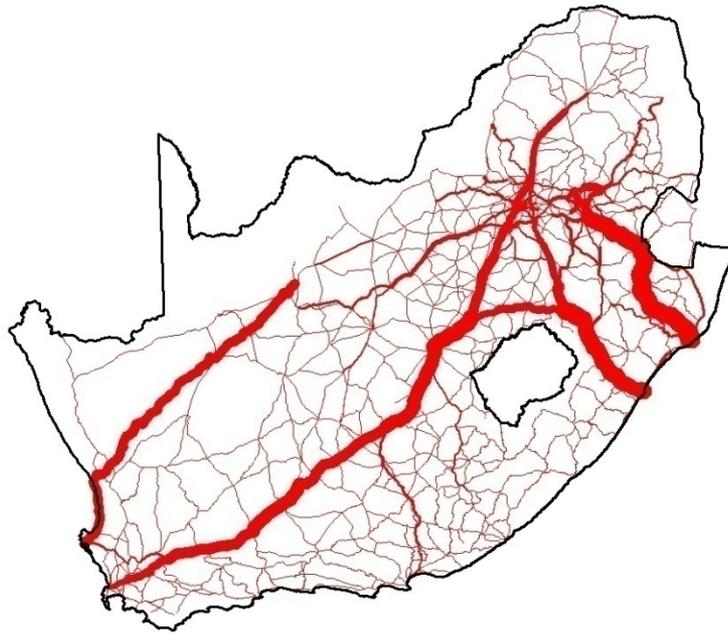
Densification is a major opportunity for making railways profitable



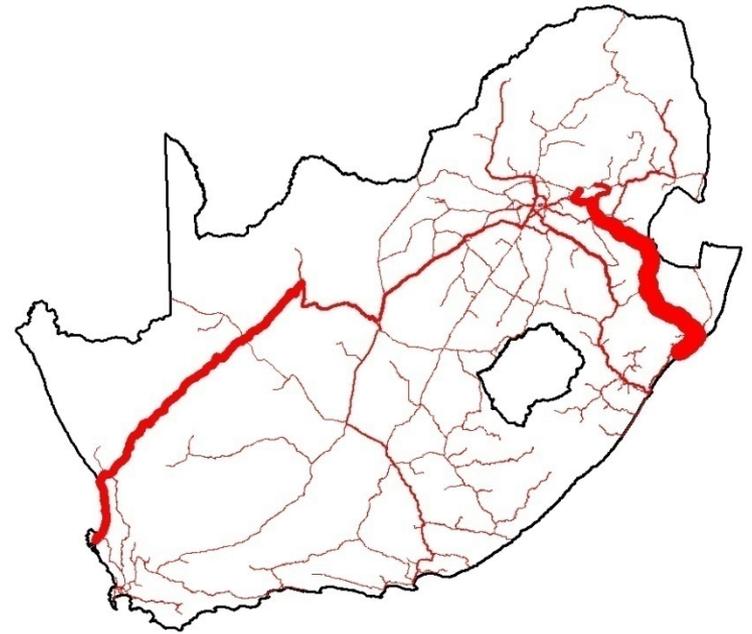
Source: Adapted from *The Economies of Freight Density in the Rail Freight Industry* (Harris, 1977)

It led to the “Beeching Axe” in the UK that started in the 1960’s and Harris’ research – that proves the well known curve of lowering cost

The South African system densified around two major export lines (coal and iron ore) – Intermodality that should have connected metro's were forgotten



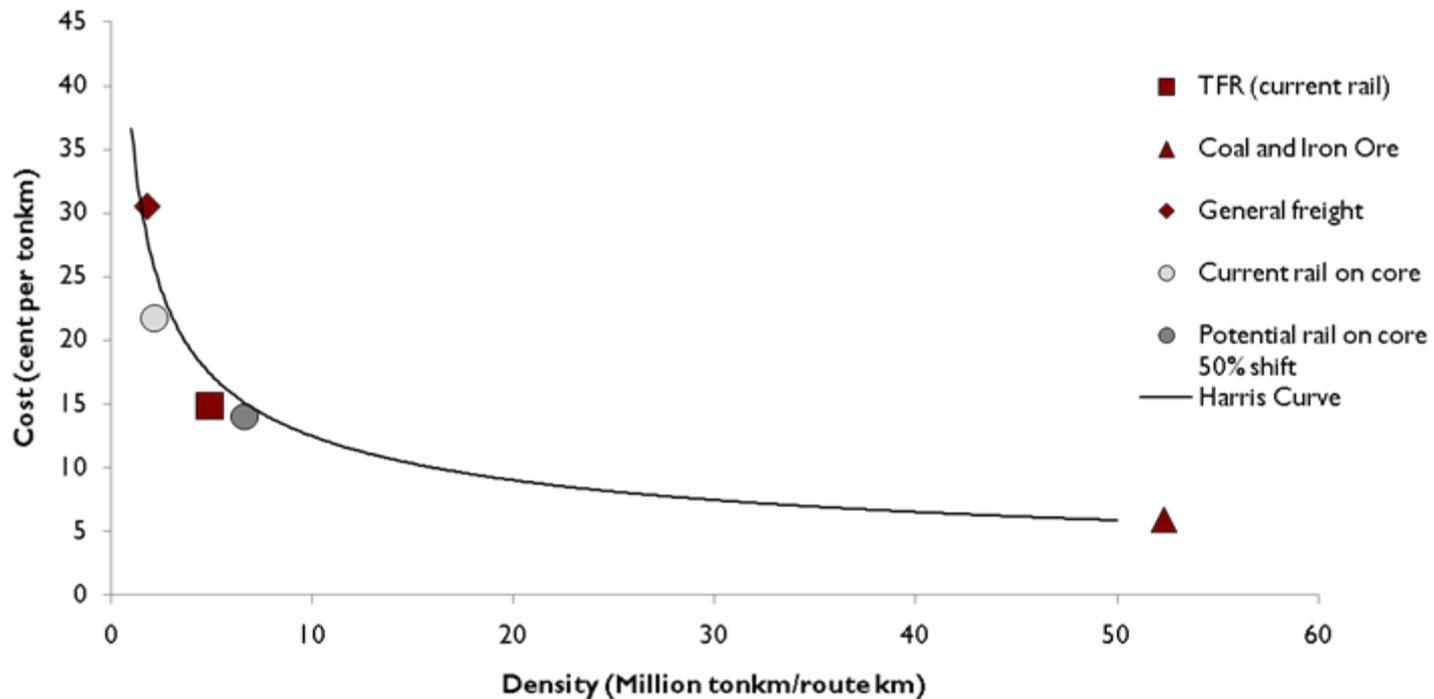
All flows



Rail flows

We are planning to fix it, but what about the rural areas?

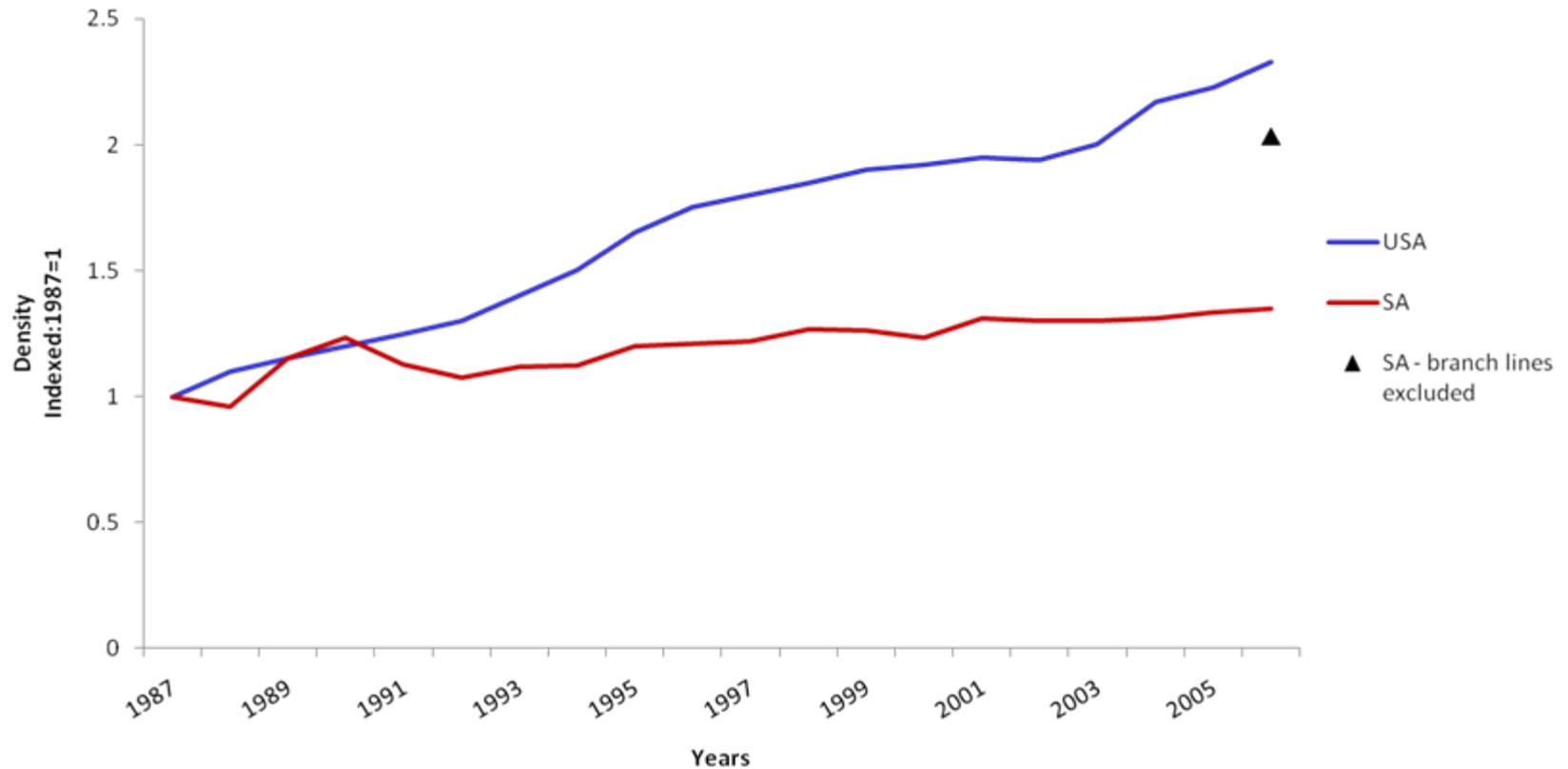
Harris' curve and densification economics suggest that 13 000 of the 20 000 kilometers is uneconomical



It will cause a substantial decrease of the nation's freight bill

But should we abandon low density lines? – It depends on how we measure

South Africa has not utilised densification opportunities



Now that we see it – the railway company wants it – but does the nation need it?

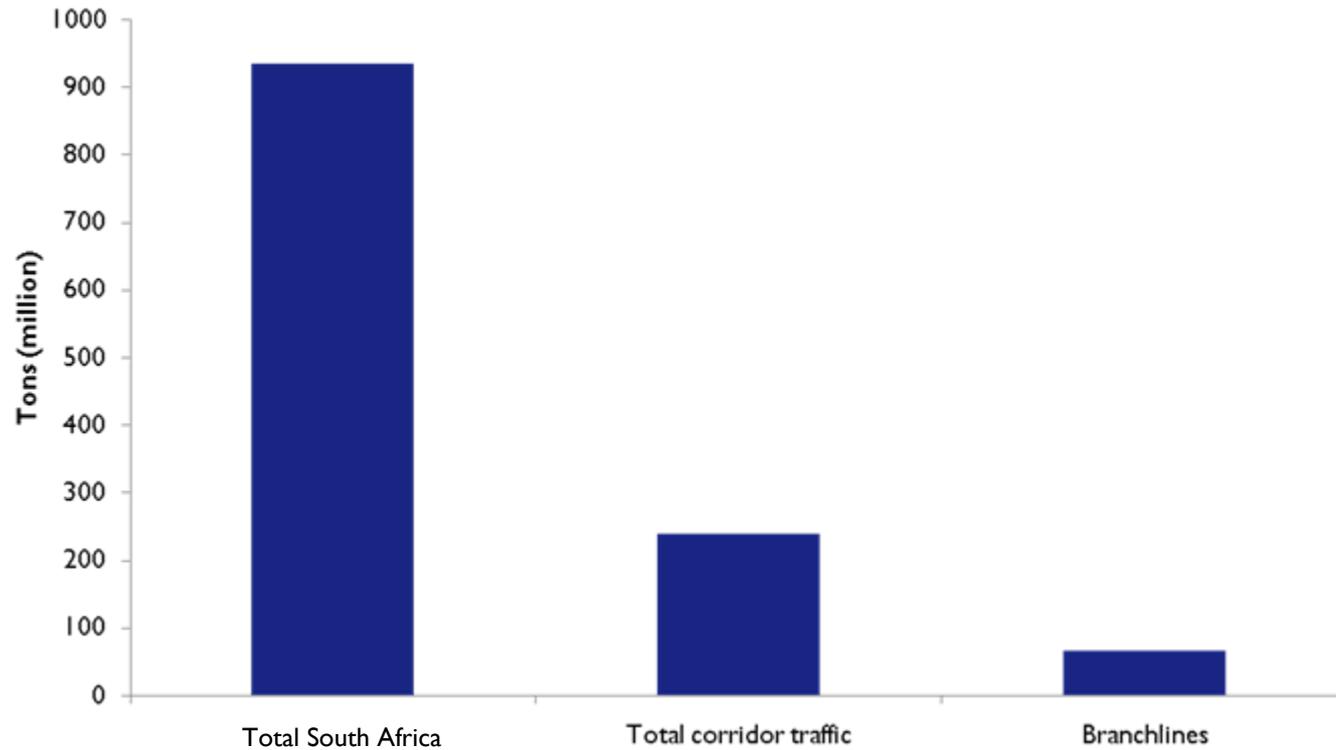


Research Approach

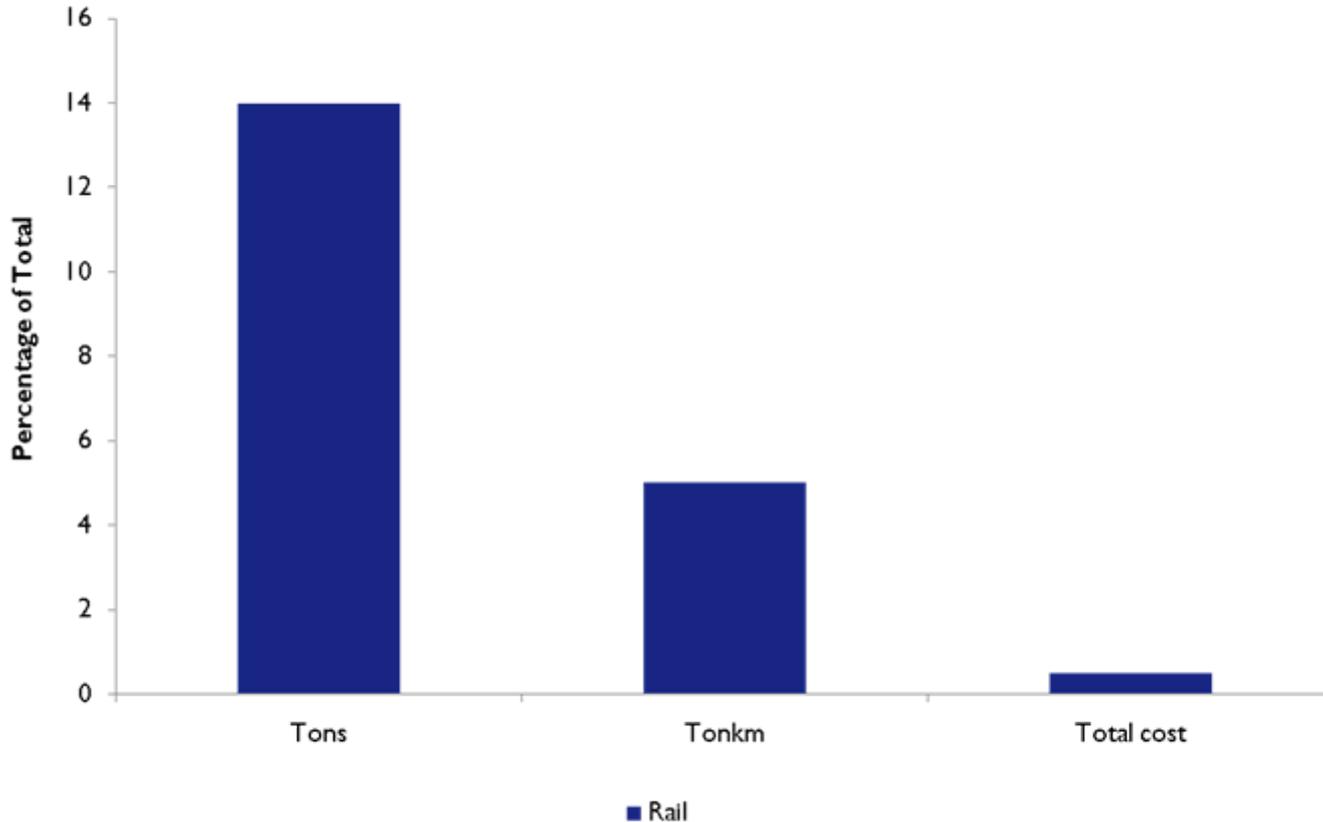


- Current, potential rail and road freight transport volumes and associated costs had to be determined
- Rail, water, pipeline, air and conveyor belt data is available, but not road data
- Therefore an extensive freight flow model was developed for South Africa
- Gravity modeling of total freight flows was used, based on supply and demand data for 62 commodity groups and within 356 magisterial districts
- The model also contains a 30-year forecast
- The model is also extended to calculate all freight costs on all modes

Potential branch line traffic seems low

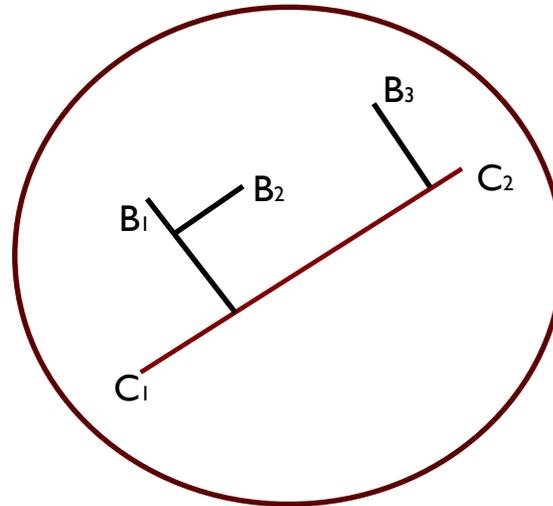


Rail currently has a negligible role in branch line related traffic



Which means that the densification opportunity does exist – it merely requires effort

Four flow types relating to branch lines were identified



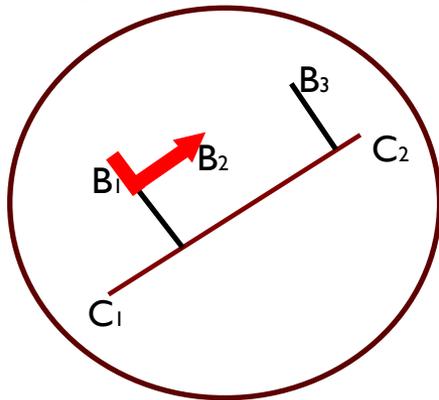
Code	Description for potential traffic
BB	utilise branch line only or two branch lines, but in the same branch line cluster. I.e. travel on the core line will not be required to gain this traffic
BC	originates on a branch line and terminates on the core line
CB	originates on a core line and terminates on the branch line
BCB	originates on a branch line, travels some distance on the core line and then utilises a second branch line
CC	originate and terminates on the core network

Branch line related flow volumes points to an interesting observation



BB

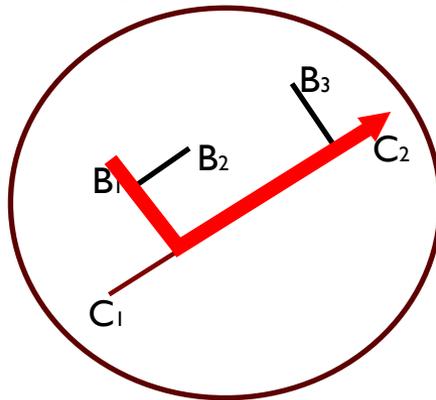
(Branch – branch)



7.3 million tons
(1.8 on rail)

BC

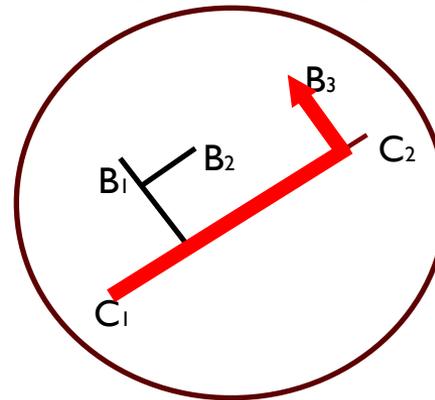
(Branch - core)



23.4 million tons
(4.1 on rail)

CB

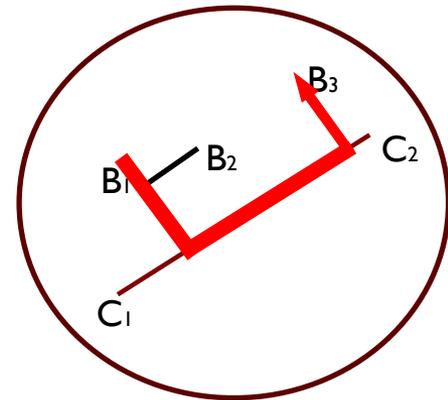
(Core – branch)



33.7 million tons
(3.2 on rail)

BCB

(Branch – core - branch)

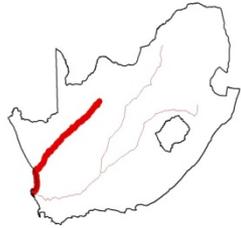


2.0 million tons
(0.1 on rail)

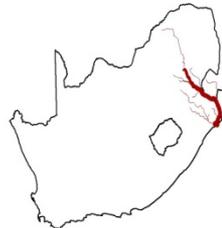
Branch lines are not separate systems – They could play an important role in “feeding” the core

Comparing All Flows

Export Mining Flows



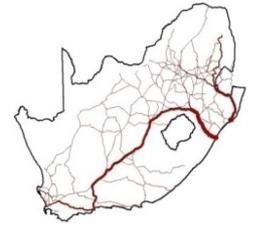
Pit to Port: Iron Ore



Pit to Port: Coal



Pit to Port: Manganese



Pit to Port: Other Mining Exports

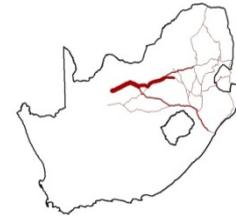
Domestic Mining



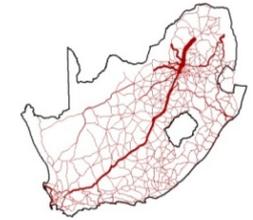
Pit to Plant: Iron Ore



Pit to Plant: Coal

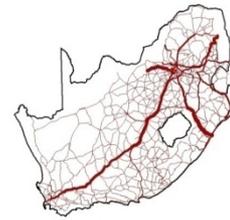


Pit to Plant: Manganese

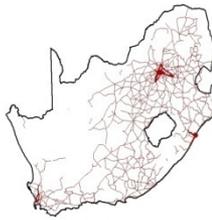


Pit to Plant: Domestic Mining

Intermediate Manufacturing

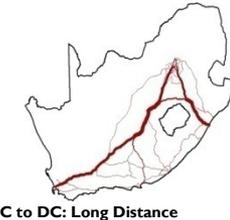


Plant to Plant/DC: Long Distance

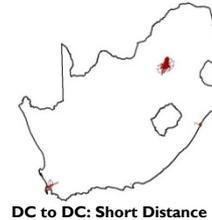


Plant to Plant/DC: Short Distance

Finished Palletized Goods

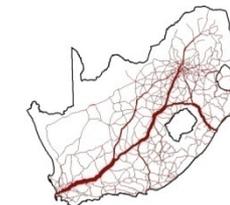


DC to DC: Long Distance

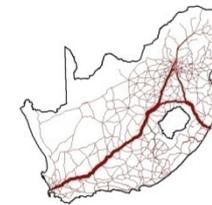


DC to DC: Short Distance

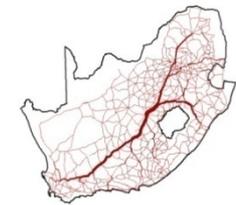
Rural Extraction and Delivery



Rural Agricultural: Extraction

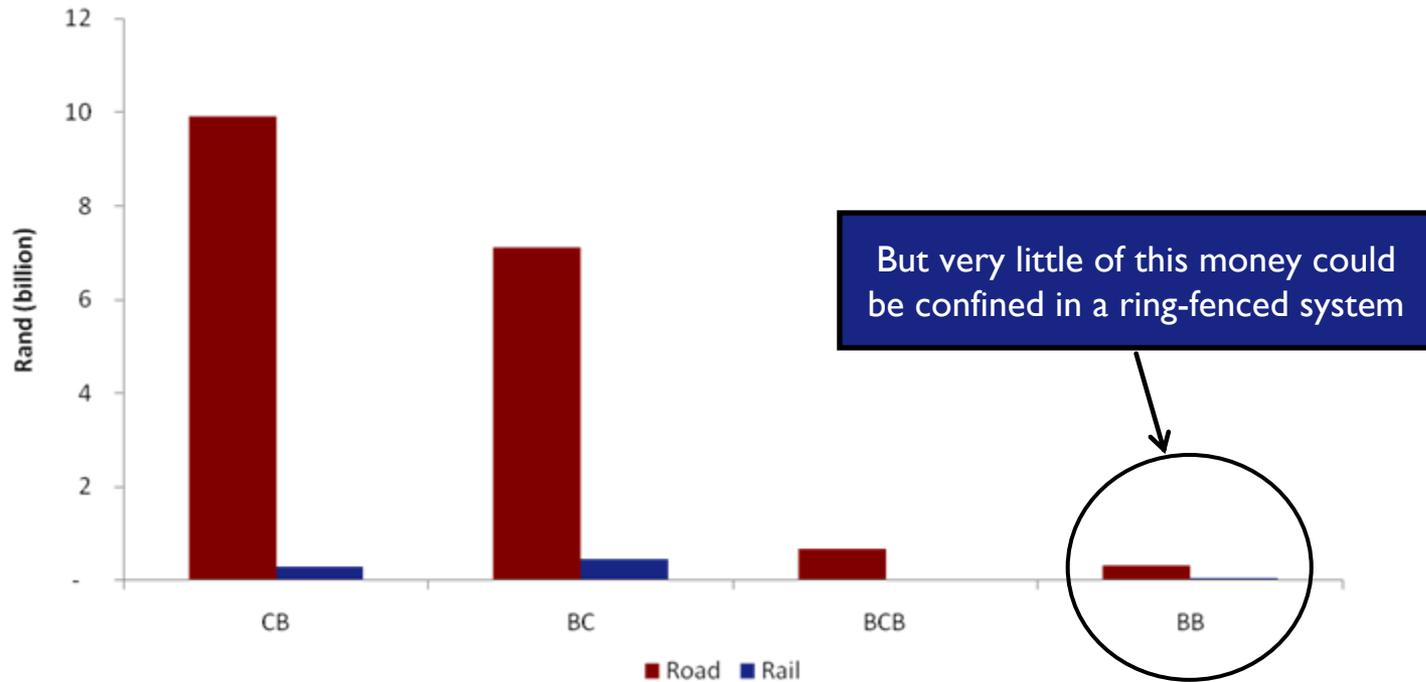


Rural Agricultural: Manufacturing Delivery



Rural Interchanges

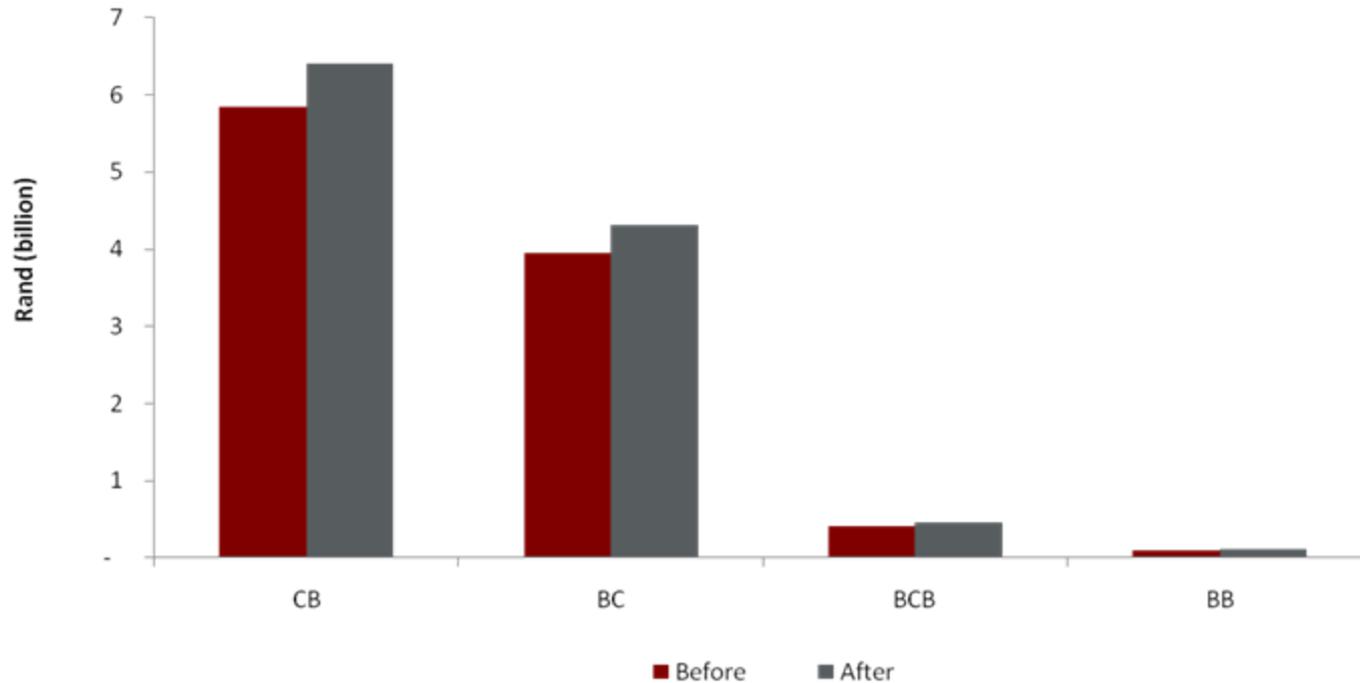
And the transport cost for these rural flows are substantial (R19 billion)



This cost is spent by freight owners on a rural road system, but not all user pay and externality costs are recuperated

A reduction in axle load limitation was recently suggested for rural roads to address this issue

Road costs will increase if the axle limit reduction is implemented

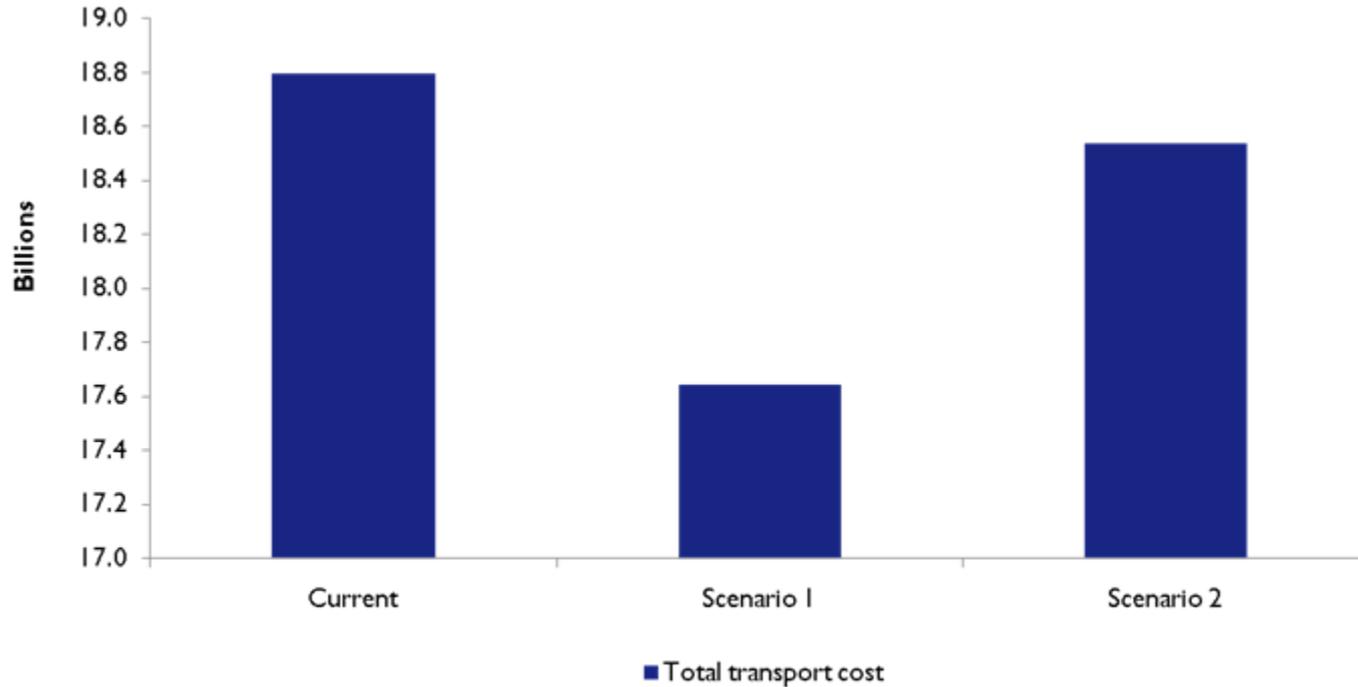


An increase of R1 billion of the freight bill

But the limitation will only make sense if traffic is induced to switch modes



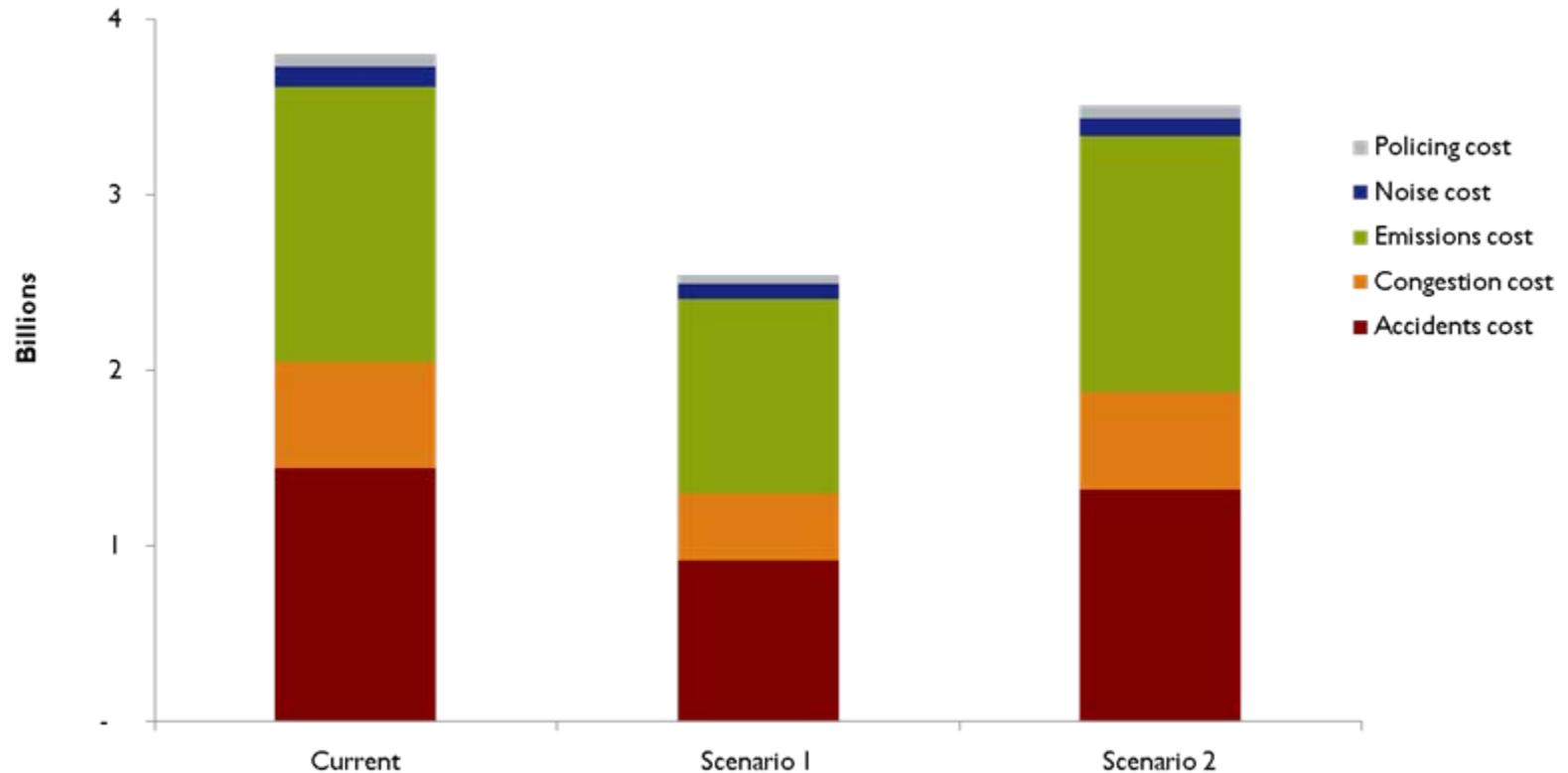
2 scenarios for switching of freight next to branch lines is proposed



Both scenarios indicate a decrease in the freight bill - R1.2 billion rand for scenario

1

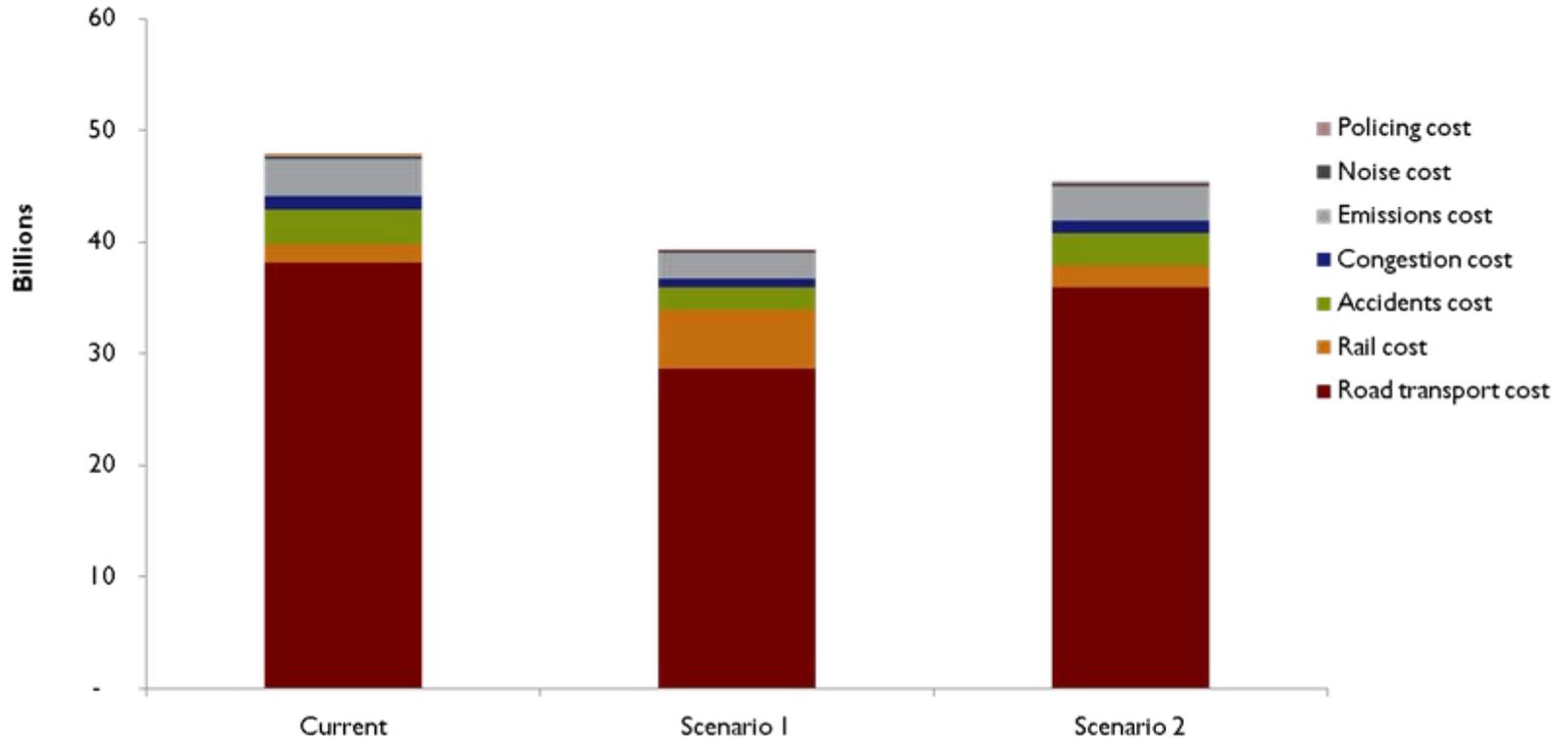
However externality costs should also be considered – This is R3.8 billion rand for the current system



A total saving of R2.4 billion rand can then be achieved by scenario 1



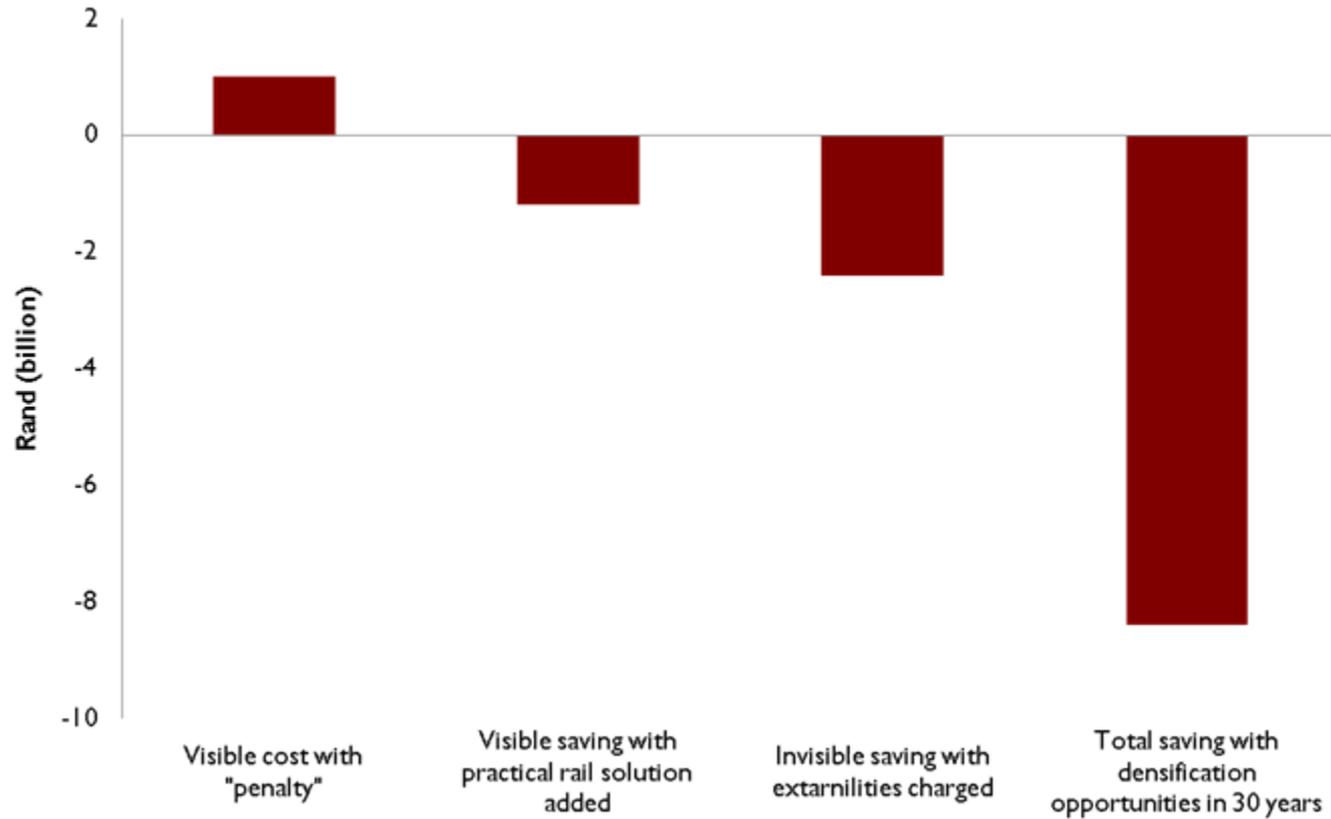
But a 30 year forecast indicate further savings



A saving of R8.4 billion rand can then be achieved by scenario 1



What does it all mean?



We really need to think of the future differently



Densification opportunities are important



- It can make a core railway competitive



- The approach should not be myopic
- Consider:
 - User pay principles for road – infrastructure issues
 - Including externalities – now and what it could be in the future
 - Complete understanding of freight flows
 - Understanding of future demand

Hardin's tragedy of the commons is well known



- “The population question has no technical solution; it requires a fundamental extension in morality”
- “One of the peculiarities of the warfare between reform and status quo is that it is thoughtlessly governed by a double standard. Whenever a re-form measure is proposed it is often defeated when its opponents triumphantly discover a flaw in it”
- The subconscious assumption is that the status quo is perfect and that there is a choice between reform and no action



- We can lament this condition and resign ourselves to a state of disbelief

Or as scientists persist on the road of the measured moral high ground, the continuous quest to make the argument flawless – “because I don't believe that nobody wants to know”



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**“The only real valuable thing is
intuition”**

Albert Einstein

