Rail Baltica being planned on basis of faulty study

The basis of the current activities related to Rail Baltica (hereinafter: RB) and the strongest argument in the related discussions is a study prepared by AECOM. The project manager of RB, has repeatedly accused the critics of failing to offer specific criticism related to factual or calculation errors or methodology. Below, a set of specific errors is presented. These errors have caused distortions due to which the study preferred the new route through Pärnu. After correcting the errors, it appears that it would cost less to construct the RB through Tartu and Valga, alongside the current route. The faulty feasibility study not only harms Southern Estonia and the Pärnu region, but also makes it unlikely to receive granting from Europe. In addition, the faulty feasibility calculations increase a real danger that the project will be a waste of taxpayers' money. The references in the text below are made to the Rail Baltica Final Report available on the website of the Estonian Technical Surveillance Authority http://tja.ee/rail-baltica-tasuvusanaluus.

1. The initial capital cost calculation of the Red route (Final Report Volume II, Table 122, p 165) contains a calculation error: the sum of the *Total Cost* rows should be larger by 4.65 million euros. The correct total of the rows is 4 112 200 000,00; the amount shown in the table is 4 107 550 000,00.

ntermodal facilites	Cost per unit, €	Passing loops	Cost per unit, €	Nodes, interchanges	Total cost, €
					54 400 000,00
					42 950 000,00
					24 850 000,00
					5 000 000,00
					34 800 000,00
1	50000000				80 000 000,00
					44 150 000,00
					17 800 000,00
					47 150 000,00
					116 750 000,00
					358 600 000,00
1	10000000				15 000 000,00
					17 150 000,00
					246 000 000,00
					269 000 000,00
					136 050 000,00
					24 000 000,00
					86 500 000,00
					144 250 000,00
1	50000000				80 000 000,00
					-
1	10000000				804 050 000,00
					328 000 000,00
1	10000000				15 000 000,00
					419 250 000,00
					125 700 000,00
1	50000000				150 000 000,00
					77 150 000,00
					264 750 000,00
					46 800 000,00
					32 450 000,00
					4 650 000,00
6		**0**		**0**	**4 107 550 000,00**
			Capital cost, €		**4 835 250 000,00**

The total of the rows is 4 112 200 000,00

2. The construction costs of corridors have been compared in tables 122 through 125 (Volume 2, pp 165–168), where unit prices have been used without any justification. The largest share of the construction cost is attributable to the construction of the railway. In the calculations, the following unit prices are used:

   4 million euros per kilometre – typical section;
   4.5 million euros per kilometre – suburban section;
   5 million euros per kilometre – urban section.

   According to the tables, the unit prices do not include electrification; this is added to the cost with the price of 1 million euros per kilometer.

   The track infrastructure cost estimate per kilometre (Final Report Volume I, Table 99, p 239) is considerably different. It <u>includes the cost of electrification</u> and the track costs are as follows:

   3 million euros per kilometre – typical section;
   3.5 million euros per kilometre – suburban section;
   4 million euros per kilometre – urban section.

   This is 2 million euros per kilometre less than in the route comparison tables.

   In calculating the construction costs, the feasibility study uses even lower unit prices for the route through Pärnu. The track cost calculation of the Red route (through Pärnu) in the corridor comparison tables is similar to the calculation using the lower cost per kilometre in tables 100 (Volume 1, p 240) and 105 (Volume 1, p 245).

   Due to the fact that wrong price is used in the largest component of the corridor comparison, the cost of each route has increased by 2 million euros per kilometre. This means that the **construction price has increased by about 1.5 billion euros per corridor**. This error does not affect the routes equally since the route lengths are not equal. The expenses increased the least for the Red route via Pärnu (by 1.46 billion euros) and the most for the Green route via Tartu (by 1.77 billion euros). **The difference between the increased prices for the Pärnu and Tartu route was 314 million euros in favour of the Pärnu route.** This amount is the better part of the 447 million euros' difference in construction costs that is shown in the track comparison. **If the comparison tables had used the track costs from the cost calculations, the price of the Green route via Tartu would be 133 million euros higher than the price of the preferred Red route.**

Table 122 – Initial Capital Cost (CAPEX) – Op

Track comparison:
4 million euros per kilometre – typical section
5 million euros per kilometre – urban section

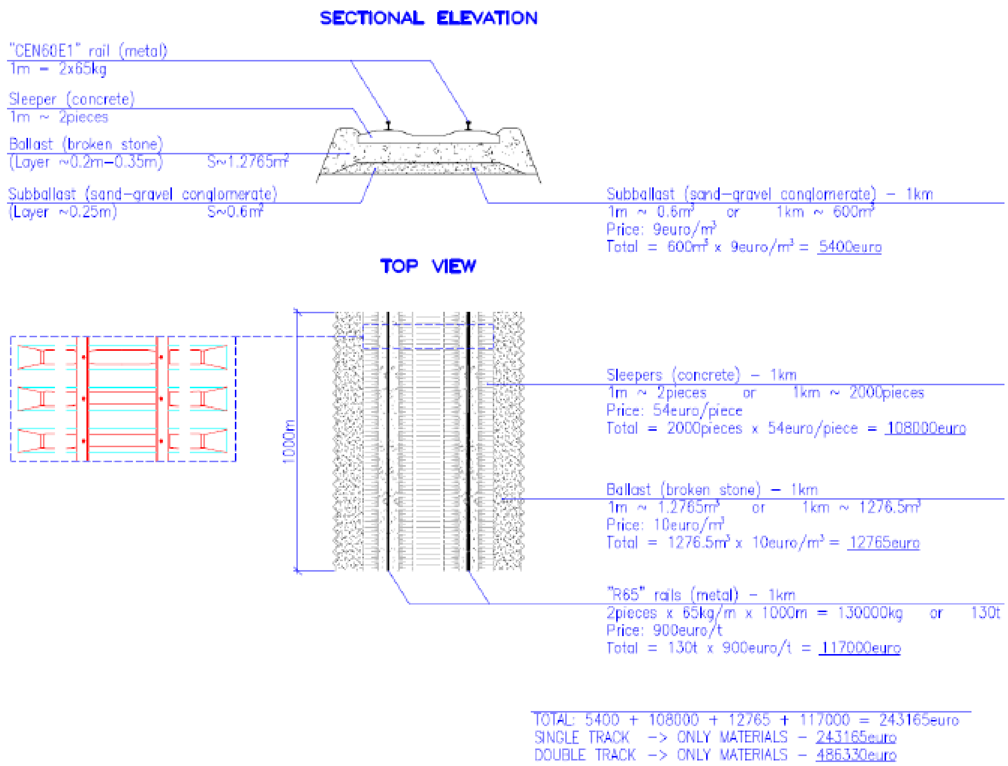
RAIL BALTICA section description. Option 1.

Section code	Cross-section type	Length, km	Cost per km, €	Cost, €	main roads (A, E class)	Cost per unit, €	1st class roads
A	1,2	10,6	4 500 000,0	47 700 000,0	1	400000	1
B	2	10,1	4 000 000,0	40 400 000,0	1	400000	1
C	2	5,8	4 000 000,0	23 200 000,0			
Tallinn							
E (1)	2,3	6,9	5 000 000,0	34 500 000,0			
TLL							
E (2)	2,3	8,7	5 000 000,0	43 500 000,0			
D	1	2,4	5 000 000,0	12 000 000,0	4	400000	1
F	1	10,9	4 000 000,0	43 600 000,0	1	400000	
G	1	27,5	4 000 000,0	110 000 000,0	0	400000	2
H	1	83,6	4 000 000,0	334 400 000,0			2
Parnu	2						
I	2	4,0	4 000 000,0	16 000 000,0	1	400000	
J	1	58,3	4 000 000,0	233 200 000,0	1	400000	3
K	1	61,1	4 000 000,0	244 400 000,0			3
L	1	30,8	4 000 000,0	123 200 000,0			2
M	1	5,2	4 000 000,0	20 800 000,0	1	400000	
N	1	15,4	5 000 000,0	77 000 000,0			2
O (in)	1,3	25,4	5 500 000,0	139 700 000,0	2	400000	2
Riga							
O (out)	1,3	25,4					
P	1	71,7	5 000 000,0	358 500 000,0	3		
Q (1)	1	62,5	5 000 000,0	312 500 000,0	2		
Panevezys	1						
Q (2)	1	80,7	5 000 000,0	403 500 000,0	3	400000	3
R	1	23,9	5 000 000,0	119 500 000,0	1	400000	
Kaunas	2						
S	2	15,4	4 500 000,0	69 300 000,0			2
T	1	61,8	4 000 000,0	247 200 000,0	1	400000	3
U	1	10,9	4 000 000,0	43 600 000,0			2
V	1	7,6	4 000 000,0	30 400 000,0			
W	2	1,1	4 000 000,0	4 400 000,0			
TOTAL:		727,7		3 132 500 000,0	22		37
Electification			1 000 000,0	727 700 000,0			

+ electrification 1 million euros per kilometre

Calculation of the track construction cost:

Figure 44 - Basis of Track Unit Costs



The track infrastructure estimate is based on materials (50%), equipment (20%), labour (22%) and other (8%) costs associated with double railway track, power network, electrification, SCB network, telecommunications, and GSM-R network. In addition, costs related to topographic surveys, geotechnical investigations, planning and design, author/technical supervision and a 5% contingency have been added to calculate the total expenditures related to track infrastructure.

Table 99 - Track Infrastructure Cost Estimate per Kilometer

Nr.	Item expenses	Cost
1	Double railway track	
	- materials (50%)	486 330 €
	- equipment (20%)	194 532 €
	- labour (22%)	213 985 €
	- other (8%)	77 813 €
	Sum:	**972 660 €**
2	Power network	
	- materials (50%)	125 000 €
	- equipment (20%)	50 000 €
	- labour (22%)	55 000 €
	- other (8%)	20 000 €
	Sum:	**250 000 €**
3	Electrification	
	- materials (50%)	500 000 €
	- equipment (20%)	200 000 €
	- labour (22%)	220 000 €
	- other (8%)	80 000 €
	Sum:	**1 000 000 €**
4	SCB network	
	- materials (50%)	142 857 €
	- equipment (20%)	57 143 €
	- labour (22%)	62 857 €
	- other (8%)	22 857 €
	Sum:	**285 714 €**
5	Telecommunication	
	- materials (50%)	64 286 €
	- equipment (20%)	25 715 €
	- labour (22%)	28 286 €
	- other (8%)	10 286 €
	Sum:	**128 573 €**
6	GSM-R netowrk	
	- materials (50%)	42 857 €
	- equipment (20%)	17 143 €
	- labour (22%)	18 857 €
	- other (8%)	8 657 €
	Sum:	**87 514 €**
7	Topography	
	- price: 200 €/ha	
	- zone length: approx 810km	
	- zone width: approx 100m	
	- area: approx 8100ha	
	Sum:	**2 000 €**
8	Geology	
	- price: 85 €/point	
	- point interval: approx 250m	
	- zone length: approx 810km	
	- point quantity: approx 3240	
	Sum:	**340 €**
9	Planning & design	
	- approx 4% of realization cost	
	Sum:	**109 072 €**
10	Author/technical supervision	
	- approx 0,1% of realization cost	
	Sum:	**2 836 €**
11	Contingency	
	- approx 5% of realization cost	
	Sum:	**141 935 €**
12	Total expenditures	
	- materials	1 361 330 €
	- equipment	544 532 €
	- labour	598 985 €
	- other	475 796 €
	Overall:	**2 980 644 €**

* VAT is not included

Cost Model Assumption:
3,000,000 EUR for typical section,
3,500,000 EUR suburban section,
4,000,000 EUR urban section,
4,500,000 EUR complicated urban section

Table 105 - Total CAPEX Costs

Feasibility study:

3 million euros per kilometre – typical section
4 million euros per kilometre – urban section

Section code	Length, km	Cost per km, €	Cost, €	main roads (A, E class)	Cost per unit, €	1st clas roads
A	10,6	3 500 000,0	37 100 000,0	1	400000	1
B	10,1	3 000 000,0	30 300 000,0	1	400000	1
C	5,8	3 000 000,0	17 400 000,0			
Tallinn						
E (1)	6,9	4 000 000,0	27 600 000,0			
TLL						
E (2)	8,7	4 000 000,0	34 800 000,0			
D	2,4	4 000 000,0	9 600 000,0	4	400000	1
F	10,9	3 000 000,0	32 700 000,0	1	400000	
G	27,5	3 000 000,0	82 500 000,0	1	400000	2
H	83,6	3 000 000,0	250 800 000,0			2
Parnu						
I	4,0	3 000 000,0	12 000 000,0	1	400000	
J	58,3	3 000 000,0	174 900 000,0	1	400000	3
K	61,1	3 000 000,0	183 300 000,0			3
L	30,8	3 000 000,0	92 400 000,0			2
M	5,2	3 000 000,0	15 600 000,0	1	400000	
N	15,4	4 000 000,0	61 600 000,0			2
O (in)	25,4	4 500 000,0	114 300 000,0	2	400000	2
Riga						
O (out)	25,4					
P	71,7	4 000 000,0	286 800 000,0	3	40	
Q (1)	62,5	4 000 000,0	250 000 000,0	2	40	
Panevezys						
Q (2)	80,7	4 000 000,0	322 800 000,0	3	400000	3
R	23,9	4 000 000,0	95 600 000,0	1	400000	
Kaunas						
S	15,4	3 500 000,0	53 900 000,0			2
T	61,8	3 000 000,0	185 400 000,0	1	400000	3
U	10,9	3 000 000,0	32 700 000,0			2
V	7,6	3 000 000,0	22 800 000,0			
W	1,1	3 000 000,0	3 300 000,0			
TOTAL:	**727,7**		**2 430 200 000,0**	**23**		**37**
Includes Electification						

No additional expenses on electrification

3. There is no further explanation in the study regarding the price of route electrification of 1 million euros per kilometre that constitutes about 800 million euros of the construction of each route. In his article (http://epl.delfi.ee/news/eesti/jalgpalli-mm-voib-tuua-tallinna-peterburi-vahele-kiire-elektrirongi.d?id=63758574, *Eesti Päevaleht* 11 January 2012; in Estonian), Andres Reimer claims on the basis of information received from Eesti Raudtee that railway electrification costs 250 000 euros per

kilometre. The largest railway electrification project in Estonia in the recent years is the project for reconstruction of the contact network of electrified railway tracks financed with the help of the Cohesion Fund. The purpose of the project is to fully design and construct a new contact network. According to the procurement data (reference number 120805), the electrification of 61.75 kilometres would cost 18.34 million euros. This means an average price of about 300,000 euros per kilometre. This price is approximately 700,000 euros per kilometre lower than the price used in the AECOM study. As a result, the price has increased for all routes, but the increase is the largest for the longest route via Tartu and the smallest for the direct route.

	Tallinn-Pärnu-…	Tallinn-Tartu-…
Length, kilometres	728	885
Cost of electrification with the price according to the AECOM study, million euros	728	885
Cost of electrification with the price according to the procurement, million euros	218	265
Effect on the route budget	509	619
Difference in the effect, million euros		110

This means that the use of the higher price of electrification has increased the construction price of the Tartu route by 110 million euros more than the price of the preferred direct route.

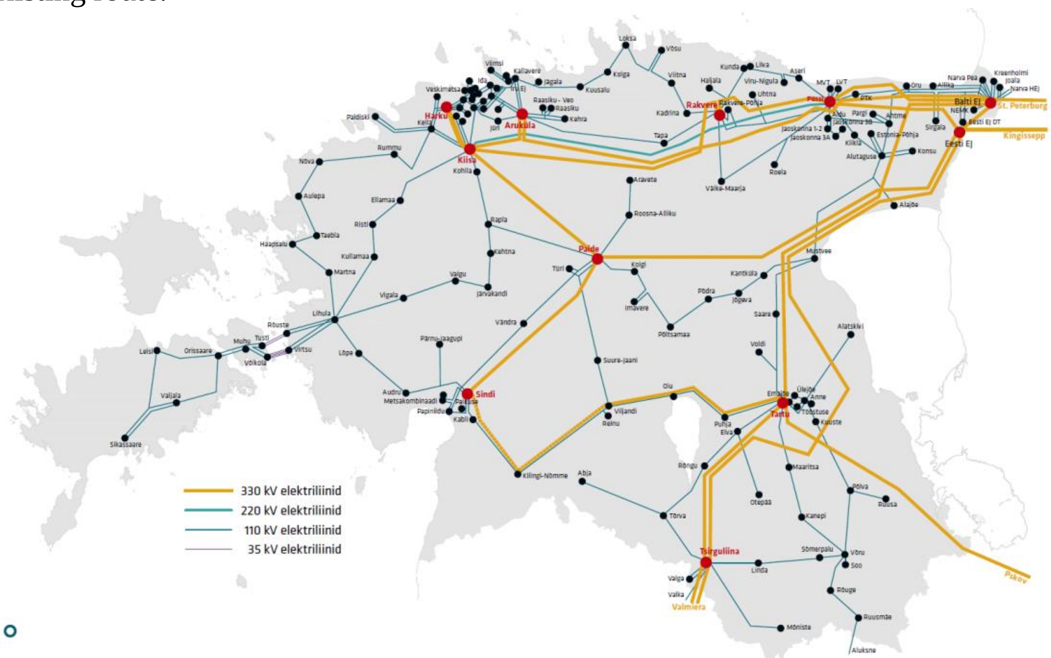
4. In comparing the construction costs, the fact that constructing along an already existing route is cheaper due to the existing infrastructure has been overlooked.

    a. According to Table 99, the construction of the power network constitutes about 10% of the total construction cost (item 2: 0.25 million euros per kilometer + items 9 through 11: 9.1%). There is no doubt that an electric railway needs a good high-voltage network. In the cities along the current railway route (i.e. Tartu, Valga, Valmiera), there is an existing electrical network of 330 kV; in Tapa, there is a direct connection with two 330 kV substations. In places that are tightly connected to the main network, the load increase due to the electric railway requires less additional investments. At the same time, there is even no 110 kV network between Pärnu and the border of Latvia. The first potential connection point is in Salacgriva in the end of a relatively long 110 kV line coming from Valmiera, which probably needs significant additional investments in order to strengthen the network.

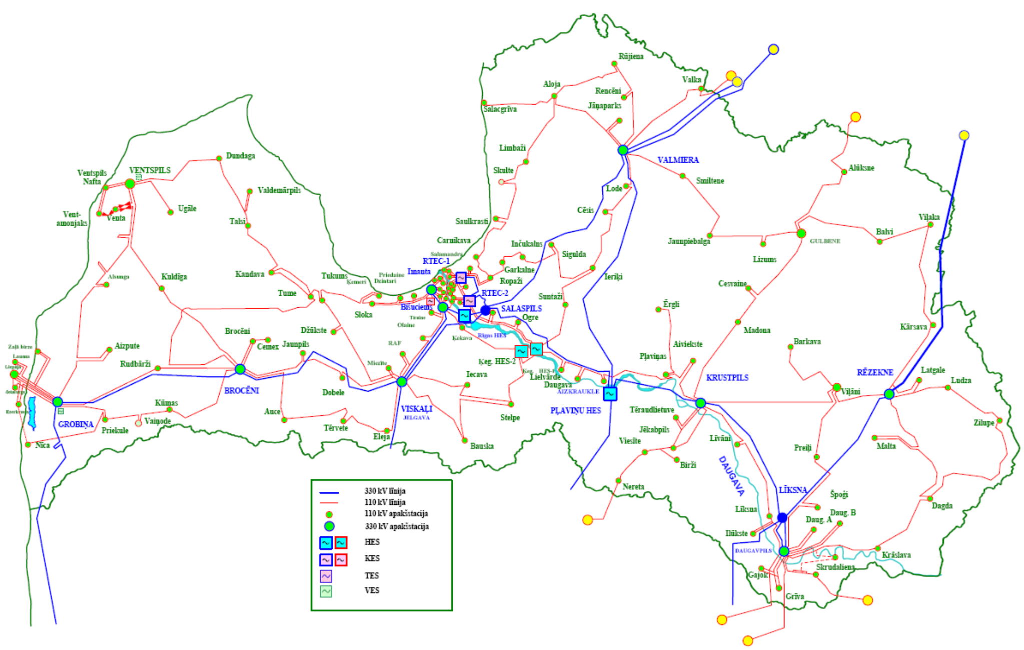
    b. It is clear that it would cost less to transport construction materials using the existing railway than using a railway under construction and with a gauge that is non-compatible with the rest of the railway network.

c. Unlike with constructing along the existing route, the construction of a new route also requires construction of maintenance roads and fences along the railway. Table 99 does not include such costs.

A more specific calculation would require an in-depth analysis that should be done in a study. The estimated difference in construction costs is 10% in favour of the existing route.



High voltage networks in Estonia



High voltage networks in Latvia

5. The comparison tables (Volume II, Tables 122 through 125, pp 165–168) calculate the area of land to be acquired using the ratio of 10 hectares per kilometre for every corridor, which means that the strip of land to be purchased would be 100 metres wide. Such a width is only necessary in the construction of a new track (type 1). In the comparison table of option 4 (via Tartu), the estimated cross-section types are 2 and 3. The new track running along an existing track (type 2) does not require as much additional land (according to the information on page 243, an existing alignment will require 50 m additional land). Type 3 is a solution with double tracks and needs virtually no additional land. Due to this error, the land acquisition cost of the Orange and Green routes has been at least doubled in the comparison tables.

RAIL BALTICA section description. Option 4.

Section code	Cross-section type	Length, km	Cost per km, €	Cost, €
A	1,2	10,6	4 500 000,0	47 700 000,0
B	2	10,1	4 500 000,0	45 450 000,0
C	2	5,8	4 500 000,0	26 100 000,0
Tallinn				
D (1)	2,3	6,9	5 000 000,0	34 500 000,0
TLL				
D (2)	2,3	8,7	5 000 000,0	43 500 000,0
E	2,3	15,4	5 000 000,0	77 000 000,0
F	2	159,6	4 000 000,0	638 400 000,0
Tartu	2,3			
G	2,3	88,4	5 000 000,0	442 000 000,0
H	2,3	46,3	5 000 000,0	231 500 000,0
Valmiera	2			
I	2	117,3	4 000 000,0	469 200 000,0
J	2,3	6,2	5 000 000,0	31 000 000,0
Riga				
K	2,3	42,4	5 000 000,0	212 000 000,0
Jelgava	2,3			
L	2	33,4	5 000 000,0	167 000 000,0
M	2	60,6	4 000 000,0	242 400 000,0
Siauliai	2			

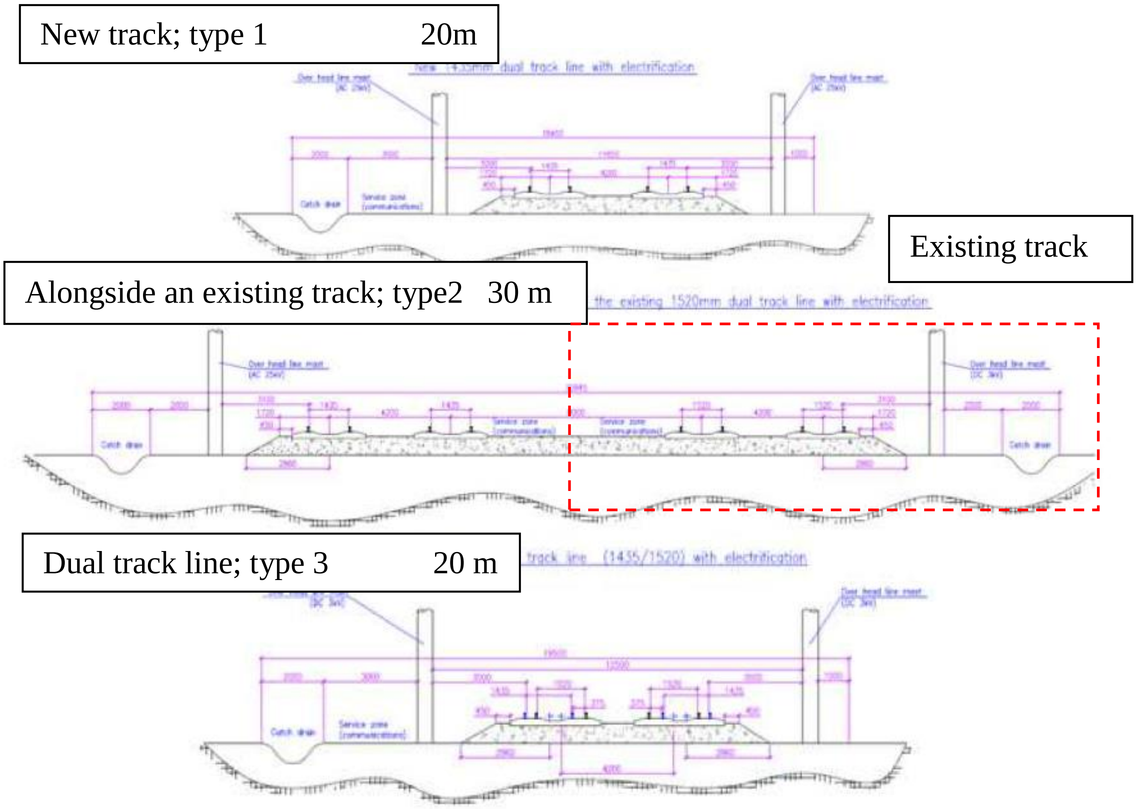
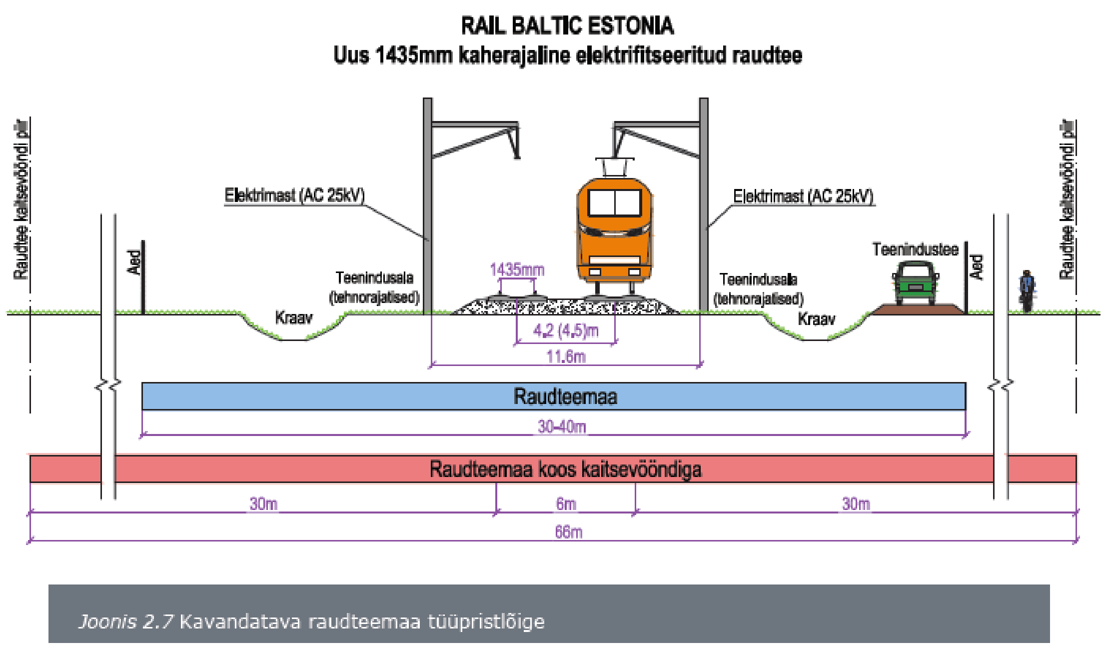


Figure taken from the AECOM study



The starting points of the county plans of Rail Baltica

6. The study fails to take into account that when cutting strips from the edges of the plots bordering an existing track, the land costs less than in average. According to modest estimations, the price of such land is at least one-third lower. In the case of a new route cutting through plots, the actual cost is probably several times higher than the average price of land per square metre.

7. In laying down the new route, it should be taken into account that the route will be extended in the planning phase. Based on the current plans in Estonia, the increase will be about 10 to 30 kilometres, i.e. 5–15 per cent. Currently, we do not know the exact length of the route and it could also not be taken into account in the AECOM study. However, it would be correct to take into account the probable prolongation of the new route by e.g. 8% when comparing the routes. There is no risk that the existing route would be prolonged.

8. The construction costs fail to take into account the construction costs of ecoducts or other compensatory measures required by environmental studies.

9. In calculating the track construction costs, the existing routes (Orange and Green) have been constructed according to all the requirements necessary for a speed of 240 km/h (grade-separated junctions). However, the estimated top speed is only 160 km/h, which does not require grade-separated junctions. The reduction of the estimated speed is explained with unsuitable radiuses of curvature. However, the number of such curves and the cost of reconstructing them to be suitable for passenger trains with the speed of 240 km/h have not been analysed. **A lower speed reduces the estimated number of passengers and the cost-efficiency of the line considerably.**

   The radius of curvature suitable for trains with the speed of 240 km/h has not been specified. There is only a table comparing the minimum radiuses of curvature for 200 km/h and 400 km/h.

Table 43 – Design parameter comparison (conventional vs.HSR)

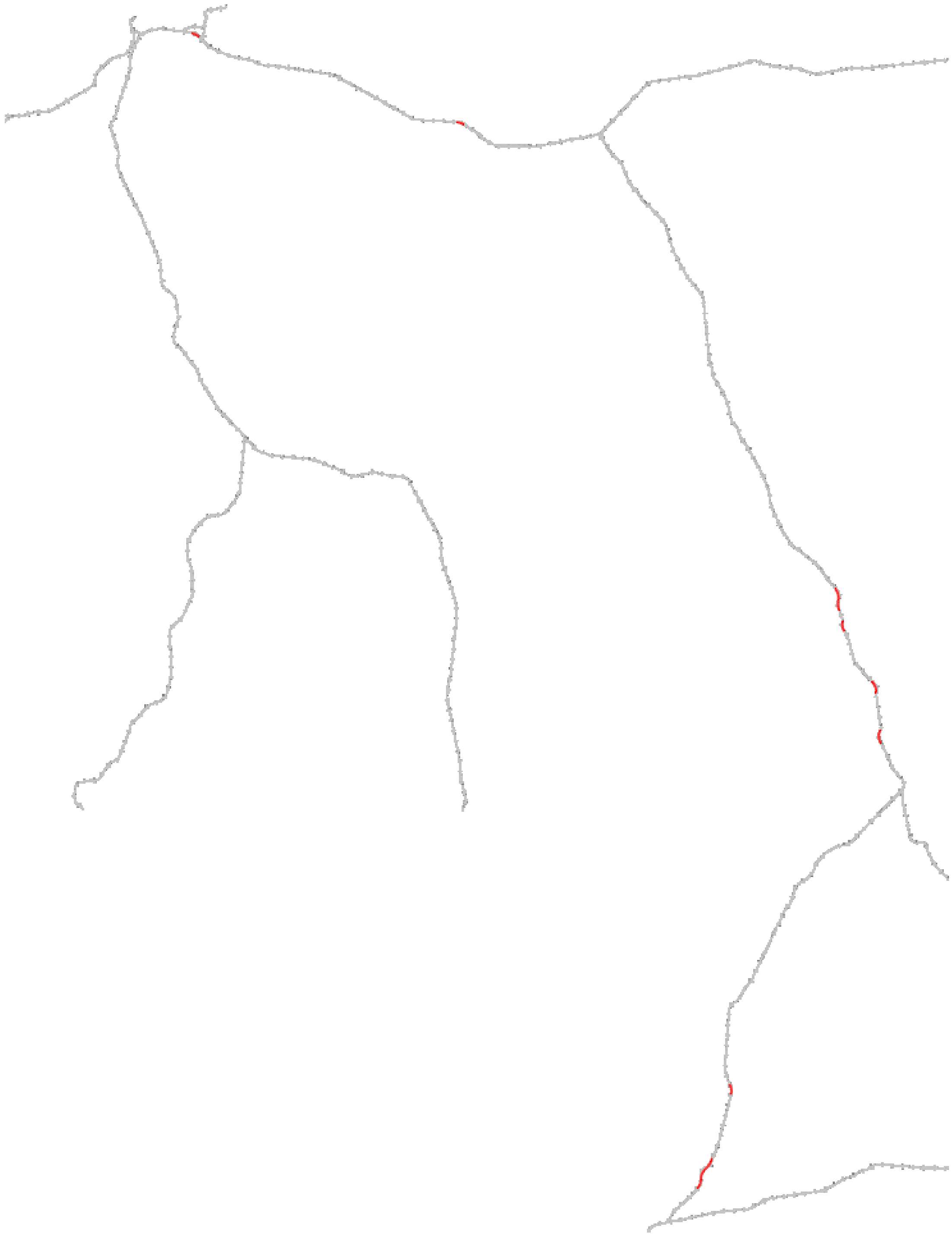
	Conventional Rail	HS Rail
Top speed (kph)	200	400
Installed power (MW)	4	20
Maximum gradient incline (%)	1	3
Minimum radius of curvature (m)	1800	7200
Average braking distance (m)	2000	5500

There are various considerations for calculating the minimum radiuses of curvature: working load, different speeds of freight trains, wear and tear, etc. According to Wikipedia, the radiuses of curvature are as follows:

Curve radius	**≤ 33 m/s = 120 km/h**	**≤ 56 m/s = 200 km/h**	**≤ 69 m/s = 250 km/h**	**≤ 83 m/s = 300 km/h**	**≤ 97 m/s = 350 km/h**	**≤ 111 m/s = 400 km/h**
Cant 160 mm, cant deficiency 100 mm, no tilting trains	630 m	1800 m	2800 m	4000 m	5400 m	7000 m
Cant 160 mm, cant deficiency 200 mm, with tilting trains	450 m	1300 m	2000 m	no tilting trains planned for these speeds		

The radiuses of curvature for the speeds provided in the AECOM study and Wikipedia are almost identical: 200 km/h – 1800 m and 400 km/h – 7000/7200 m. Therefore it may be estimated that for non-tilting trains going 240 km/h, the minimum radius is 2800 metres, and for tilting trains it is 2000 metres.

The following figure shows the curves on the existing corridor between Tallinn and Valga where the radius curvature is less than 2000 metres and straightening is necessary. The total length of the track that requires straightening is ca 20 kilometres; after straightening, Tapa, Tartu and Valga are the only places where slowdown is necessary.



Radius curvatures of less than 2 kilometres on the railway between Tallinn, Tapa, Tartu and Valga.

Although based on the above it seems that a 2 km radius curvature would allow passenger train speeds of 240 km/h, it is recommended that a minimum of 3 km radius curvature is used in passenger train traffic. In that case, the total length of the track that needs straightening is about 65 km.

The possibility of straightening any existing routes has not been discussed in the AECOM study.

10. The source data and methodology for calculating the passenger volumes in Table 48 (Volume I, p 139) has not been explained in detail. For example, according to the source data table the number of passengers per day between Tallinn and Tartu is 299 (Table 20, p 52), but according to the statistics of Elron, in January 2014 there were 1327 passengers per day on average on that route and the average number of passengers per day during the first five months of 2010 was 1200 (http://e24.postimees.ee/275932/edelaraudtee-reisijate-arv-kasvab). The number of car passengers is based on the statistics of motor vehicle traffic volumes (Table 15, p 49), but it has not been specified how the car flows are counted in the origin and destination points and how reliable the methodology is.

    The source data obtained using this unexplained methodology has been inserted in the Emme/3 software model by Inro Software (Volume I, p 74) that has not been described in detail either. This means that it is not possible to verify if the model and its configurations are suitable. In the output of the model, there is a varying difference between the numbers of current and estimated passengers to Tartu and Pärnu, e.g. for the direct routes Red and Yellow: Tallinn-Pärnu 3589 (current total number of passengers) -> 4029 (RB passengers); Tallinn-Tartu 4724 (current total number of passengers) -> 4261 (RB passengers). This means that on the Pärnu route, the number of RB passengers will exceed the current total number, and on the Tartu route, the number of RB passengers will be significantly lower than the current total number. Although this can be partially explained with the new passengers between Tallinn and Riga, the number of passengers between Tallinn and Riga should not be considerably different for these routes. Such an illogical model output needs further justification and analysis, not just retrieving a number from the software. Unfortunately, such justification and analysis cannot be found in this study.

Table 20 - Contains a summary of the estimated existing volumes for key internal movements in Estonia by mode.

		Rail	Road (Car)	Road (Coach)	Total
Tallinn – Tartu	Passengers per day	299	3,305	1,119	4,724
	% mode share	6%	70%	24%	100%
Tallinn – Parnu	Passengers per day	56	2,872	662	3,589
	% mode share	2%	80%	18%	100%

Table 48 - 2-way average daily passenger volumes (Fare rate of €0.05 per km)

Flow (2-way Daily)	Red			Orange			Yellow			Green		
	2020	2030	2040	2020	2030	2040	2020	2030	2040	2020	2030	2040
Tallinn to Parnu	4,029	4,734	5,545	2,834	3,339	3,923	-	-	-	-	-	-
Parnu to Riga	3,004	3,566	4,204	1,964	2,343	2,775	-	-	-	-	-	-
Tallinn to Tartu	-	-	-	-	-	-	4,261	5,017	5,916	2,677	3,191	3,808
Tartu to Valmiera	-	-	-	-	-	-	2,564	3,113	3,644	1,397	1,695	2,008
Valmiera to Riga	-	-	-	-	-	-	3,730	4,417	5,109	2,306	2,706	3,136
Riga to Jelgava	-	-	-	3,963	4,581	5,200	-	-	-	4,307	4,965	5,600
Jelgava to Kaunas	-	-	-	2,724	3,188	3,624	-	-	-	2,902	3,402	3,855
Riga to Panevezys	3,572	4,172	4,736	-	-	-	3,578	4,180	4,733	-	-	-
Panevezys to Kaunas	6,523	7,428	8,336	-	-	-	6,529	7,435	8,331	-	-	-
Kaunas to Poland	2,272	2,486	2,654	1,730	1,889	2,004	2,267	2,483	2,653	1,727	1,887	2,002

11. Therefore we can conclude that the numbers of passengers are not transparent and the source data is probably faulty, which means that the correctness of the result is doubtful. The next stage of the feasibility calculations is to find the price level with the best revenue, beginning with the minimum fare rate of 0.05 euros per kilometer. The revenue maximizing curves may be seen in Figure 23 (Volume I, p 140). However, the numbers in the tables and in the figures do not match. With the Red route, for example, when multiplying the number of passengers in Table 48 with the fare rate of 0.05 euros per kilometre and the route length, the revenue should be 21,260 (thousand euros), but the graph line is clearly below 20,000. With the Yellow route, the calculation result is 28,280, but the graph line is below 25,000. The sum of the maximum volumes on the graph should give the profitability of the main version used as the basis of further calculations provided in Table 54, but it is apparent that they do not match either. On the basis of the aforementioned, Table 52 has been prepared where the routes are compared according to their passenger volumes. Here, the passenger volumes for direct routes through Pärnu and Tartu (Red and Yellow, respectively) are almost equal.

Table 52 - Daily 2-way Passenger Demand

2-way Daily Flow	Red			Orange			Yellow			Green		
	2020	2030	2040	2020	2030	2040	2020	2030	2040	2020	2030	2040
Tallinn to Parnu	3,015	3,361	3,721	2,261	2,485	2,755	-	-	-	-	-	-
Parnu to Riga	2,168	2,432	2,695	1,510	1,672	1,867	-	-	-	-	-	-
Tallinn to Tartu	-	-	-	-	-	-	3,068	3,378	3,716	2,144	2,305	2,545
Tartu to Valmiera	-	-	-	-	-	-	1,819	2,088	2,276	1,043	1,150	1,272
Valmiera to Riga	-	-	-	-	-	-	2,735	3,062	3,314	1,805	1,926	2,083
Riga to Jelgava	-	-	-	3,067	3,324	3,625	-	-	-	3,325	3,581	3,867
Jelgava to Kaunas	-	-	-	2,034	2,211	2,402	-	-	-	2,157	2,343	2,530
Riga to Panevezys	2,566	2,837	2,945	-	-	-	2,603	2,883	2,989	-	-	-
Panevezys to Kaunas	4,611	4,972	5,120	-	-	-	4,649	5,018	5,165	-	-	-
Kaunas to Poland	1,114	1,038	856	857	768	710	1,104	1,021	836	844	751	694

12. A calculation error is also seen in Table 50. According to the table heading, the data should be derived by multiplying the fare rate from Table 49 with the distance. Most of the data is correct, but according to Figure 22, the distance between Panevezys and Kaunas is 105 kilometres and the fare rate for this section is 0.108 euros per kilometer. The product of multiplication of the two numbers is 11.34 euros. However, the price specified in Table 50 is 9.5 euros instead.

13. The passenger volume model has not taken into account the passengers between St Petersburg and Riga or between St Petersburg and Kaliningrad. Although the current train traffic via Rēzekne and the bus traffic via Tallinn and Tartu are significantly slower, the number of passengers using these lines is remarkably high. For those passengers, the Green route via Tartu would be more than 50 kilometres shorter.

14. The various route versions also take into account the effect on objects protected under heritage conservation. The assessment is based on the number of such objects in the cities on the route. Since there are 295 objects protected under heritage conservation in Tartu and only 78 in Pärnu, the route through Tartu is considered to have a high risk of conflicts in terms of heritage conservation. However, it should be quite clear that constructing a route along an existing line means a significantly smaller risk of conflicts compared with constructing a new route. According to a Deputy Mayor of Tartu, there are no problems related to Rail Baltica passing through the city and there is no need to demolish any buildings. (Lätlasi huvitab Riia-Tartu rongiliin *Tartu Postimees* 14 February 2014, in Estonian).

15. The freight model structure and process for forecasting demand has only been described generally in section 4.4.2 (p 80) and it is not possible to verify the correctness of applying the model on the basis of the materials published. However, some discrepancies stand out.

a. According to the text on page 87, the differences in the track gauge inhibit major freight transfer from the existing lines to the Rail Baltica line; however, according to the aggregate Table 39 (p 93), one bulk cargo train per day is estimated to travel between Latvia and St Petersburg although the existing routes via Pechory, Tartu or Rēzekne are shorter and do not include switching from one gauge to another. The same gauge problem occurs with freight traffic from and to Lithuania; according to Table 80 (p 173), non-bulk rail traffic between Lithuania and Northwest Russia will be 0% with Russian border waiting costs removed. Despite that fact, the estimated freight service volume according to Table 39 is 3 trains per day.

b. According to the model output, a 900 ton bulk freight train will travel daily between Pärnu and Tallinn, although for distances below 150 kilometres, use of rail is only expedient if there is no good road connection (p 82). It seems that although the preparers of the study have marked down that Via Baltica is being constructed between Tallinn and Pärnu (p 84), *de facto* they have failed to take into account.

If there are such discrepancies in the parts that may be easily verified, there may also be errors in the hidden parts.

16. Transport of paper from Finland to Germany and Poland constitutes an important share of transport (Table 29, p 57) and is expected to increase pursuant to the study Development of a Model of the World Pulp and Paper Industry, European Commission (Volume I, p 91). However, according to the referred study, consumption of paper does not increase in Western Europe, only in Eastern Europe. Moreover, the study only covers the period until 2030. The behaviour of the most important group of products requires a more detailed analysis. According to some studies, such as http://environmentalpaper.org/documents/state-of-the-paper-industry-2011-full.pdf, the use of paper is declining.

Table 29 - Main flows of over 300,000 tonnes per annum

O-D	Commodity	Tonnes
Finland - Germany	Paper	2,549,000
Latvia - Finland	Wood Products	1,257,000
Finland – Poland	Mineral Fuels & Oils	1,149,000
Finland – Germany	Wood Products	1,094,000
Lithuania - Latvia	Mineral Fuels & Oils	825,000
Lithuania - Estonia	Mineral Fuels & Oils	599,000
Lithuania - Finland	Wood Products	411,000
Finland - Poland	Paper	404,000
Germany - Finland	Iron & Steel	404,000
Finland - Germany	Mineral Fuels & Oils	347,000
Latvia - Germany	Wood Products	325,000
Poland - Lithuania	Food	305,000

17. On page 83, the benefits of electric freight trains are discussed, but according to Table 8.7.4.1 (Operating Cost), freight service is assumed to be diesel. Since this fuel type is more expensive, as are diesel engines, the longer distances (the Green corridor via Tartu) become less profitable in the freight service model.

18. The abovementioned errors have also been carried over into the aggregate table of comparison of different routes (pp 197–200), on the basis of which the direct route via Pärnu was chosen as the preferred corridor. The direct monetary value of some cost calculation errors (items 1–7) has been calculated and aggregated in the table below:

Error		Effect on difference in construction costs, million euros
1	Calculation error	4,65
2	Correction of unit price of construction cost	314
3	Effect of difference in the unit price for electrification	110
4	Saving of 0.3 million euros per kilometre from the construction cost of the Green route	270
5	50% of the land acquisition costs specified in the route comparison table	27
6	One-third of the land price adjusted on the basis of the previous item	9
7	Prolongation of the Red route by 8% at the price of 3 million euros per kilometre	175
Total		**910**

All errors are in favour of the Red route: the errors in the study have either increased the cost of the Green route via Tartu (items 2–6) or decreased the cost of the Red route via Pärnu (items 1, 7). In order to calculate the correct difference of the construction costs of the routes, the total amount of the monetary value of the errors must be subtracted from the difference of construction costs provided in the study.

Pursuant to the aggregate table on page 197 (detailed figures may be found in the table on page 164 of Volume II), the difference of construction costs of Option 1 and Option 4 as calculated by AECOM is 447 million euros.

447 million euros – 910 million euros = -462 million euros.

As it turns out, the construction of Route 4 via Tartu is actually 460 million euros cheaper than the construction of Route 1 via Pärnu that is preferred in the study.

		Comment		Red	Orange	Yellow	Green
Government	Capital Cost *	(incl estimate of land cost)		€4.88bn	€5.08bn	€5.51bn	€5.30bn
	Journey Time Savings	Annual Passenger Hours ('000)		1,939	872	1,996	983
		Passenger €'000		€ 14,153	€ 6,365	€ 14,573	€ 7,173
		Freight €'000		€ 37,000	€ 25,000	€ 25,000	€ 18,000
	Wider Economic Benefits Ranked as 1=best, 4 =worst	Labour mobility	Rail Baltica project will increase workplace accessibility and will expand labour market catchment areas.	2	4	3	1
		Efficiency gains and improved distribution	Rail Baltica project will deliver time, cost, frequency, quality and reliability savings to freight carriers and passengers.	3	4	2	1
		Business and economy	Rail Baltica can facilitate impact on business efficiency and the economy through productivity improvement, agglomeration benefits and the narrowing of the international production gap.	1	3	2	4
		Land development and investment	Rail Baltica project will offer major development opportunities that will present themselves either in the city centres particularly around Rail Baltica stations or in the outskirts of big cities.	4	2	3	1

19. In calculating the feasibility of the different routes, instead of optimising the profitability of RB as a separate phenomenon it is necessary to analyse the aggregate effect of the routes and the best profitability from the viewpoint of the entire transportation network of the three countries. Much of the amount to be spent in constructing the new route would improve traffic safety and reduce operating costs on the existing railway as well. Electrification, communications networks and grade-separated junctions with roads constitute more than half of the construction costs. In case of two separate routes, it is necessary to identify other sources for the same expenses on the other route; the cost calculation of RB does not include such sources.

20. The study fails to take into account that the maintenance costs for two separate routes (the existing Tallinn–Tartu–Riga route and the new Pärnu route) would be higher than the maintenance costs of two aligned routes. For example, a better part of the maintenance costs estimate (8.7.3.1, Volume I p 251) consists of communication and automatics; for example, stations that cost 1 million euros per station and are located 20 km apart need to be replaced every 20 years. For two separate routes (the existing Tallinn–Tartu–Riga route and the new Pärnu route), this expense is doubled.

8.7.3.1 Maintenance Costs

The following elements have been included in the maintenance costs estimate:

Track	Price	Frequency
Rail Grinding	1000 € per km.	Once every 3 years
Ballast Supplement	1000 € per km.	Once every 5 years
Track Tamped	4000 € per km.	Once every 5 years
Tensioning and Control	1000 € per km.	Once every 5 years
Insulated joint replacement	4000 € each, 1.3 per km.	Once every 8 years
Ballast cleaned	30,00 € per km.	Once every 20 years
Larger switch parts replaced	15,000 € per switch.1 switch per 5 km	Once every 20 years
Signalling and Telecommunication		
Safety installations (station)	1 million € per station (1 station per 20 km)	Once every 20 years
Safety installations (switches)	100,000 € per switch (1 station per 20 km, 4 switches per station)	Once every 20 years
Safety installations (blocks)	100,000 € per block, 1 block per 3 km	Once every 20 years
Overhead contact line / the catenary system		
Foundations and Poles		Assumed not to require replacement during appraisal period
All suspensions and catenary cables:	1,500 € per suspension, 20 suspensions per km	Once every 25 years
The overhead contact line	15,00 € per km.	Once every 25 years
Surrounding areas		
Weed control	5 m^2 per 1 metre of track 0.1€ per m^2	

In conclusion, it should be stated that the study contains an intolerable amount of simple calculation errors (items 1, 11, 12) that, while not considerably influencing the final outcome, indicate that the study has been prepared carelessly. The wrong unit prices that considerably affect the final outcome (items 2 and 3) have led the preparers of the study to false conclusions regarding the construction cost calculations of different routes and to picking out the probably unsuitable route. After correcting the errors that may be assigned monetary value, it turns out that constructing the RB route aligned alongside an existing route would be 460 million euros cheaper than the new route via Pärnu. Incorrect source data of the profitability calculations (item 10) and controversial methodology result in false estimates. In addition to correcting the errors, it is also necessary to assess the total impact of the different routes, taking into account the investments into and maintenance costs of the existing railway network from the viewpoint of all three countries (items 19, 20). The highlighted problems, monetary estimates in particular, require a more thorough analysis. The lacking or insufficient analysis of significant issues is the greatest shortcoming of the AECOM study.

Priit Humal
15.04.2014.