

How certain is an uncertainty interval?

An analysis of infrastructure investments cost development based on estimated uncertainties

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National plan for infrastructure, a 12-year plan revised every four years



The plan covers both investments in new infrastructure and maintenance of existing infrastructure in rail and road.










The investments that cost more than 100 million Swedish krona is stated by name in the government decision of the plan.

Major infrastructure investments in the national plan for infrastructure for the period 2018–2029

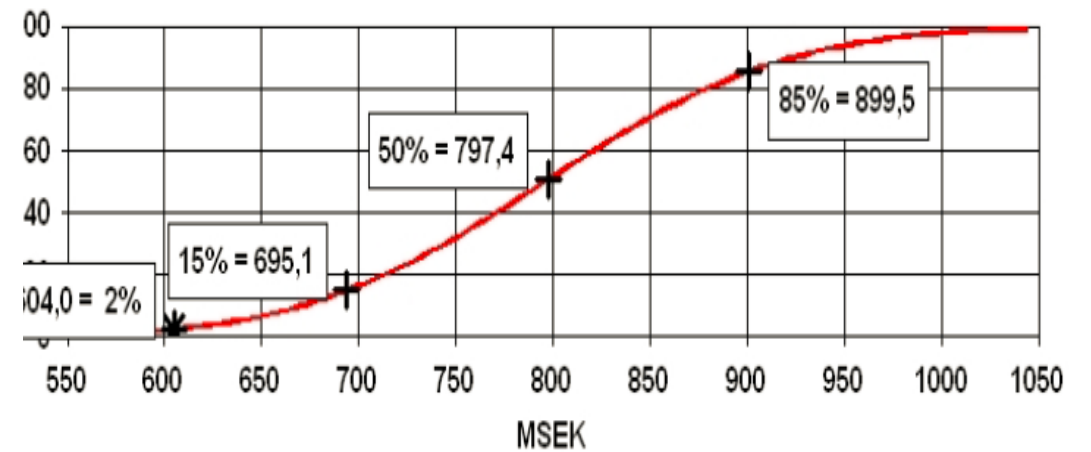
- In 2017 the Swedish Transport Administration provided a proposition to the government where we proposed which major investments in rail and road that should be included in the national plan.
- Each investment was presented with an cost estimation. For the first time we also presented an cost interval based on an uncertainty analysis.
- The government adopted the plan in 2018
 - 194 major infrastructure investments was included in the plan, for 137 of these we had presented an uncertainty interval.

Example of an uncertainty analysis

Uncertainties in the budget

Market 30%	
Ground work 27%	
Construction 14%	
Developer 7%	
Construction works 6%	
Environment 5%	
Resources 2%	
Signal 1%	
Others 5%	

Probability curve of total cost



Mean value: 797,4 MSEK Std.dev: 98,6 MSEK

Cost estimation intervals in the proposition

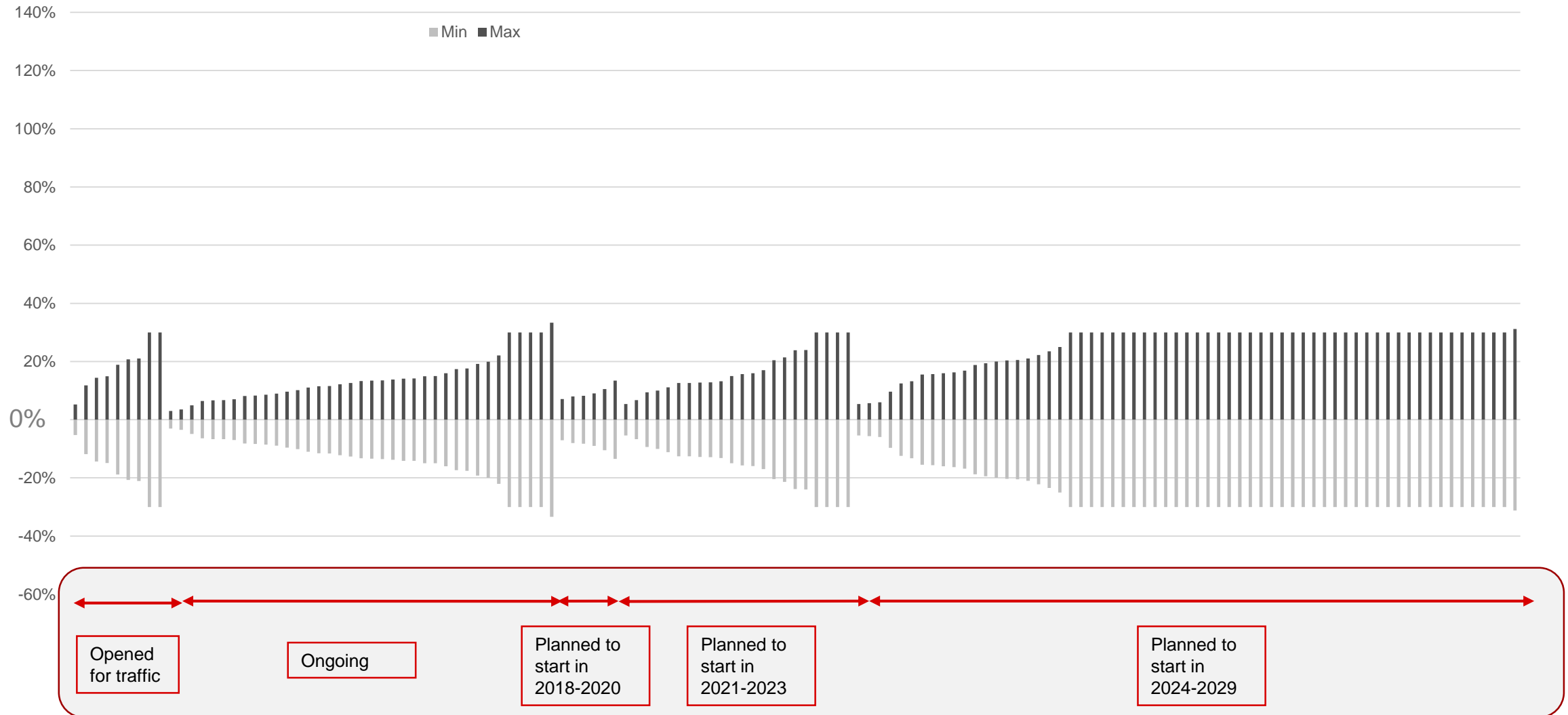
- The stated cost is based on the 50% probability level
 - Example: With 50% probability "Blekinge Kustbana" will cost a maximum of 103 million Swedish krona
- The intervals differs from 3% +/- to 30% +/- in the proposition

Planerad byggstart	Trafikslag	Län	Järnvägsstråk / Vägnummer / Farled	Objekt	Kostnad Nationell plan		Total objektkostnad		Osäkerhet STD AW (+/- %)	Min (15% sannolikhet)	Max (85% sannolikhet)
					2018-2029	Total	2018-2029	Total			
Större investeringar i nationell plan (>100 mnkr)					193 472	399 021	269 625	530 579			
2021-2023	Järnväg	Hela Landet	Hela landet	ERTMS, ScanMed etapp 1 inkl. Katrineholm-Åby (Korridor B)	5 869	6 188	5 869	6 188	13%	5 361	7 016
2024-2029	Järnväg	Hela Landet	Hela landet	ERTMS, ScanMed etapp 2 [Trelleborg - Malmö - Göteborg - Kornsjö]	3 184	3 184	3 184	3 184	25%	2 388	3 980
2021-2023	Järnväg	Hela Landet	Hela landet	Teletransmissionsanläggning	945	1 885	945	1 885	30%	1 319	2 450
Pågående	Väg	Hela Landet	Hela landet	Elvåg, pilotsträcka	300	300	600	600			
2024-2029	Järnväg	Blekinge	Blekingekustbanan	Blekinge kustbana. Mötesspår och hastighetshöjning (Etapp1)	52	52	103	103	30%	72	134

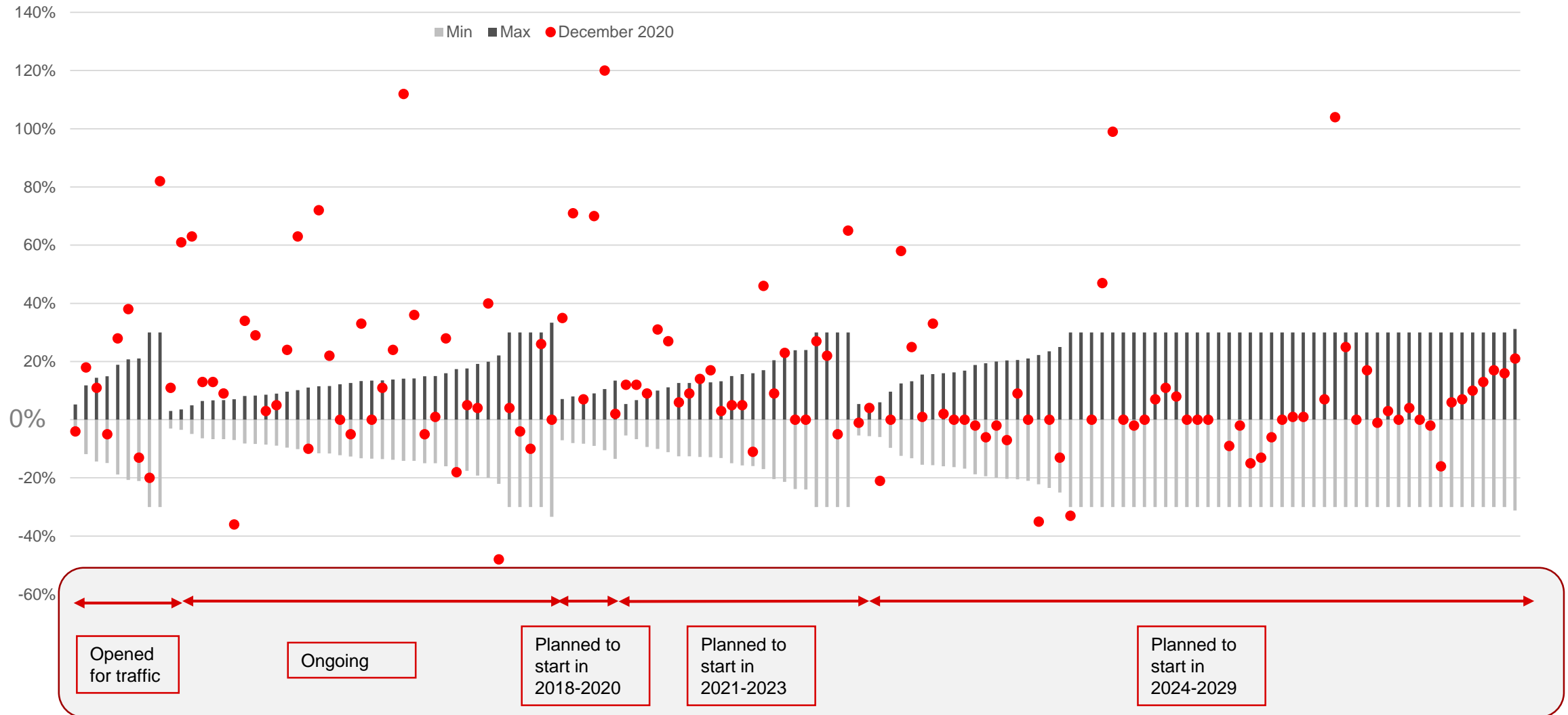
Increased costs but still within their interval?

- In late 2020, with new forecasts we knew that cost estimations had increased for some of the investments.
- We made a comparison between the given cost in the proposal for the national plan 2017 and the outcome or forecast in December 2020.
- We expected the outcome or new cost estimations to be within the uncertainty interval, i.e. the confidence interval, for a vast majority of the investments.

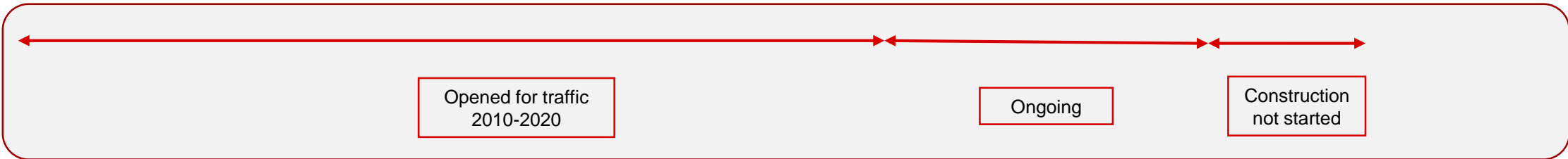
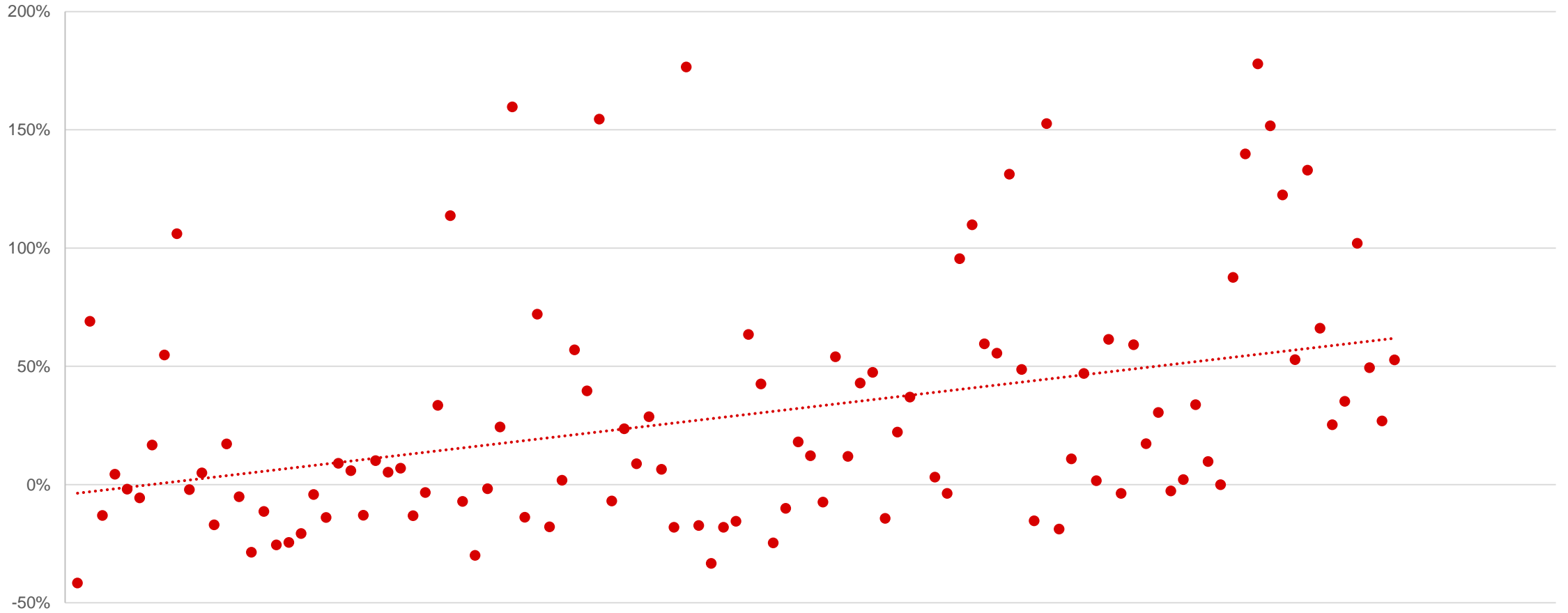
Cost variance for all investments with a given confidence interval, in the transport infrastructure plan for the period of 2018-2029 (December 2020)



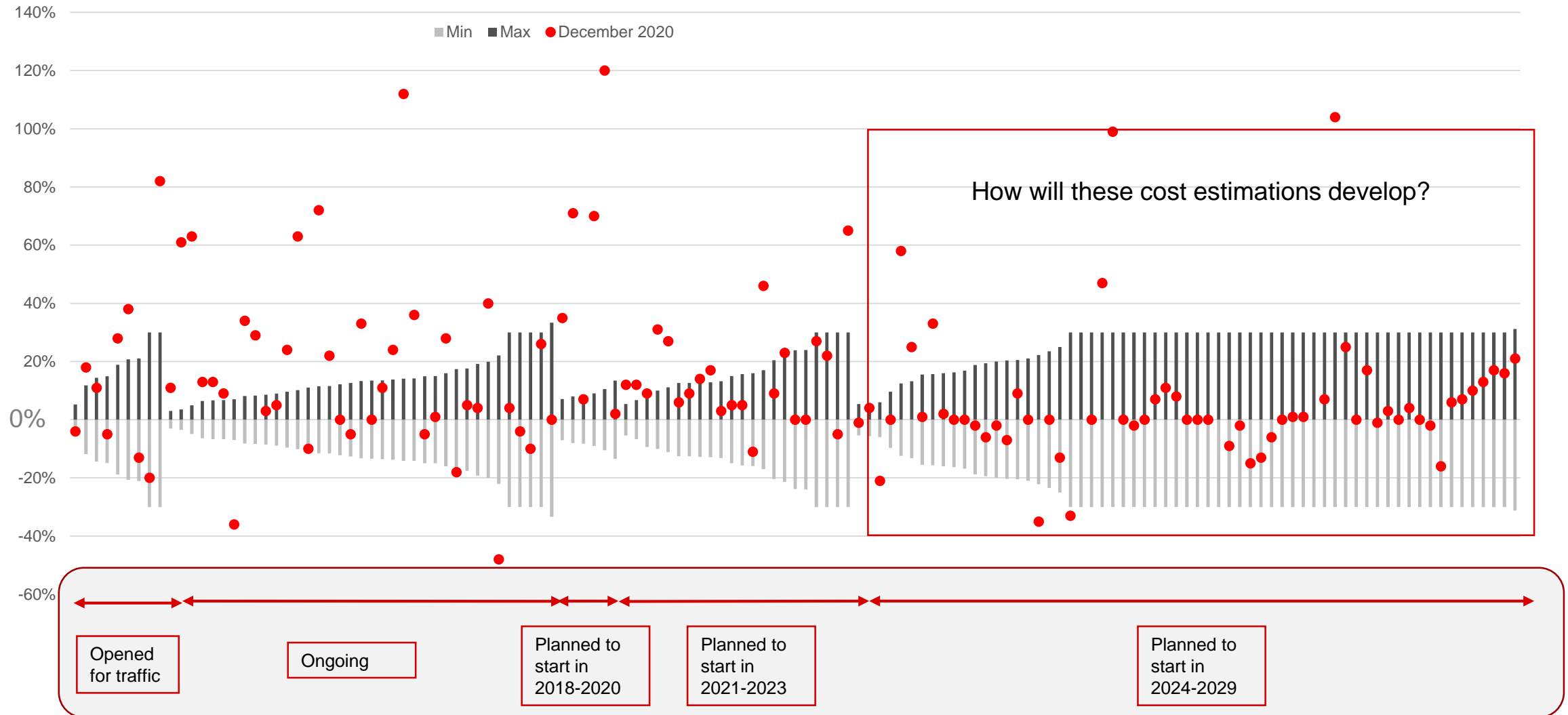
Cost variance for all investments with a given confidence interval, in the transport infrastructure plan for the period of 2018-2029 (December 2020)



Cost outcome/forecast per investment compared to the estimation in the national plan 2010-2021



Cost variance for all investments with a given confidence interval, in the transport infrastructure plan for the period of 2018-2029 (December 2020)



What did we learn?

What did we learn?

- History of following-up and analyze each investment/project -> do more system and comprehensive analyses
- Well-developed methods for uncertainty analysis, calculating as correctly as possible but not always on the “right” solution.
- Importance of early-stage governance and also consideration when the projects should be proposed to the government for decision.

What did it lead to?

Activities for improved cost governance and cost control

- Review of investments
- Improved early-stage governance
- Developed cost estimation capability
- Improved goal management
- Review of existing processes for decision making and information