What is a Benefit-to-Cost Ratio and how does it relate to projects?

The following is a simplified example showing how Benefit/Cost analysis is applied to your everyday life; you do it all the time without even thinking.

The Benefit/Cost Ratio (BCR) is based on a simple mathematical equation: Benefit divided by Cost; or B/C. A viable project must offer more benefit than the cost to construct said project.

1.0 is the baseline or threshold to the Benefit/Cost ratio analysis where:

BCR equal to or greater than (= to/or >) 1.0 is considered a good expenditure or a viable project.

BCR greater than 1.0 have greater benefits than costs; hence they have positive net benefits.

BCR less than (<) 1.0 when cost exceeds benefits is not a good expenditure and a project less than 1.0 is not viable.

Say you buy a bag of chips with a suggested retail price @$2.99 at your favorite store:

- Benefit $2.99 bag of chips/$2.99 Cost = BCR = 1.0 (acceptable expenditure)

Say you go to another store that has that same bag of chips, but on sale for $2.00:

- Benefit $2.99 bag of chips/$2.00 Cost = BCR=1.495 (a more positive expenditure)

Say you now go to the movies and the same bag of chips is marked-up to $3.50:

- Benefit $2.99 bag of chips/$3.50 Cost = BCR = 0.854 (not a good expenditure)

Commissioner Bernhardt and BCR of cancelled project in Wiscasset:

"Our responsibility going forward is to manage our existing obligations within our existing budget, and to limit adding new infrastructure to that which is shown to provide overwhelming benefits. We know federal transportation funding will continue to decrease, and the era of special earmarks for transportation projects is over."
August 2011 MaineDOT Press Release

Benefit-to-Cost Ratio of the Wiscasset Bypass Study cancelled in August 2011:

September 2009 Wiscasset Bypass Phase II Report page 27: (no longer available online)

4.4. Summary Comparison of Alternatives – Part 3 (Transportation and Cost Considerations)

Criteria	No Build	N8c	N2f	N2a
Traffic Safety & Mobility				
Change in Annual Crashes, 2030	0	-9	-15	-8
Change in VMT, 2030	0	9,700,000	8,500,000	9,300,000
Change in VHT, 2030	0	-1,130,000	-1,090,000	-1,030,000
Estimated Capital Cost, $M (2006) [8]	$1.1	$82.25	$78.95	$81.75 [8]
Life Cycle Cost, $M (100 Years)	N.A.	$136.01	$123.88	$122.02
Benefit-to-Cost Ratio (Life Cycle)	N.A.	2.46	2.43	2.27
Mitigation Costs (Included in Estimated Capital Cost, Life Cycle Cost & Benefit-to-Cost Above)				
Wetland, $M	N.A.	$1.35	$1.45	$2.05
Wildlife, $M	N.A.	$1.40	$1.80	$1.70
Historic, $M	$0.02	$0.10	$0.23	$0.06
Constructability				
Cofferdam Pier Construct Time (Weeks)	N.A.	32	20-30	6
Earthwork (Cubic Yards)				
Cut (Cubic Yards)	0	920,000	1,150,000	965,000
Fill (Cubic Yards)	0	275,000	420,000	400,000
Excess Earthwork (Cubic yards)	0	645,000	730,000	565,000
Operations	Mobility Decline	Improved Mobility	Improved Mobility	Improved Mobility

[8] Costs updated from DEIS to include new Clark's Point right-of-way and historic preservation costs.

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- Commissioner Bernhardt cancelled a Study in August 2011 with BCR's equal to 2.27, 2.43 and 2.46—BUT—moved forward to complete the I-395/Route 9 Connector Study promoting a preferred alternative (2B-2) with a BCR of only 1.1? (The B/C ratio in October 2017 INFRA Grant application became 1.3.)

- Many wonder why the DOT continues to spend one more cent on a project that teeters around not even being viable. Is underwhelming a word?

Now in December Of 2019:

There is every reason to believe that the newly experienced 46% to 60% rise in construction costs as reported in recent PPH and BDN articles will also affect the cost of the connector in a similar fashion and the connector's B/C ratio is probably already less than 1.0 which would make the project no longer viable. Mathematically, an increase in the cost above $23.775 million should drop the B/C ratio below the acceptable ratio of 1.0 and if you use the 46% increase that bloated the shortfall – that increase is $115.705 million or an increase of $36.455 million which would drastically drop the B/C ratio to 0.89.

BCR analysis: cost and BCR as of Oct 2017 is $79.25 million and 1.3.

Benefits as of October 2017 = Benefit/$79.25 million = 1.3

Solving for Benefits, Benefit = $79.25 million (X) 1.3 = $103.025M

Benefits as of October 2017 = $103.025 million

Question: When does the project become unviable?

Answer: When cost exceeds established benefit of $103.025 million.

Question: How much can the cost increase before that happens?

Answer: $23.775001 Or an increase of 30%

46% increase in cost = $115.705 million decreases B/C ratio to .89

60% increase in cost = $126.8 million decreases B/C ratio to .82

If the costs go up by the same 46% increase as bloated the shortfall since March estimates—OR—increases by 60% as with the cost of the Gorham Connector since 2017 estimates, the I-395/Route 9 Connector is no longer viable—that's simple mathematics.