VTI Economics Model

Case Studies of Quantifying Economic Impacts of WRI



HEAVY HAUL SEMINAR . MAY 2-3, 2018



ICRI-RCF VTI Economics Group



MONASH University

LBFoster















Goals of ICRI Economics Model

1. <u>Third Party</u> "Open Source" Model, but Built by Railroads

2. Data Available from <u>Different Departments/Specialties</u>

3. Decision Support Tool of Costs and <u>Benefits</u>



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Ex. of Current Economic Models









Ex. of Current Economic Models

Benefits of Rail Milling at Irish Rail

- Extended Rail Life
 - Rail replacement €150k
 per km vs. approx. €20 25k per km for milling
 - Milling can extend rail life up to 5-7 years

RAIL TRANSIT SEMINAR . APRIL 30, 2018

Reduced rail breakages











Why use ICRI Economics Model?

1. Find <u>New Savings</u> and Innovations

2. Compete and Protect Important Projects

3. <u>Improve Partnerships</u> of Railroad and Supplier



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1	Cost Category	Operating Expense (OPEX) Total	Free Cash Flow (FCF) Spent Total	% Savings from Life Extension	OPEX Savings	FCF Savings			
2	Depreciation	\$ 239,800,000	\$ -	14%	\$ 34,653,179.19	\$ -			
3	Capital	\$ -	\$ 333,500,000	14%	\$ -	\$ 48,193,641.62			
4	Maintenance	\$ 15,600,000	\$ 15,600,000	14%	\$ 2,254,335.26	\$ 2,254,335.26			
5	Grinding - Corrective	\$ 16,000,000	\$ 16,000,000	14%	\$ 2,312,138.73	\$ 2,312,138.73			
6	Grinding - Preventive	\$ 43,000,000	\$ 43,000,000	0%	\$ -	\$ -			
7	Lubrication	\$ 19,300,000	\$ 14,900,000	0%	\$ -	\$ -			
8	Inspections	\$ 22,800,000	\$ 22,800,000	0%	\$-	\$-			
9	TOTAL	\$ 356,500,000	\$ 445,800,000	11%	\$ 39,219,653	\$ 52,760,116			
10									
11	Current Rail Life	34.6		Cost to Implement	\$ 100,000,000	\$ 100,000,000			
12	Desired Rail Life	39.6		ROIC	39%	53%			
13									
14	Compliance	\$ 54,400,000							
15	Preventive	\$ 57,900,000							
16	Capital/Depreciation	\$ 286,650,000							



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3	Capital			14	% \$ -	\$ 48,193,641.62			
4	Maintenance			14	% \$ 2,254,335.26	\$ 2,254,335.26			
5	Grinding - Corrective	Differe	nt Categories of	Cost 14	% \$ 2,312,138.73	\$ 2,312,138.73			
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8	Inspections				% \$ -	\$ -			
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	HEAVY	HALL SEMINAR	• MAY 2-3, 20			~			

Case Studies: What Can We Learn

1. Cost of Defect Intervention

2. Cost of Defects by Different Root Causes

3. How to Value Life Extension?



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	Length of de	REMEDIAL fect (inch(es))	ACTION TABLE Percentage of exist sectional area we	ting rail head cross- eakened by defect	If the defective rail is not	
Defect	More than	But not more than	Less than	But not less than	replaced or repaired, take the remedial action prescribed in note	FRA - 49 CFR 213.113 - Defective Rails
Compound Fissure			70 100	5 70 100	B. A2. A.	https://www.law.cornell.edu/cfr/text/49/21
Transverse Fissure Detail Fracture Engine Burn Fracture Defective Weld			25 60 100	5 25 60 100	C. D. A2, or [E and H]. A, or [E and H].	
Horizontal Split Head Vertical Split Head Split Web Piped Rail Head Web Separation Defective Weld (Longitudinal)	 	2 4 (¹)			H and F. I and G. B. A.	
(Longitudinal)	<u>/</u> 2	1			H and F.	



HEAVY HAUL SEMINAR . MAY 2-3, 2018



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				Caladata the Cast of
TOTAL COST	Total Cost	\$	15,605,000	Calculate the Cost of
\$	Cost / Spot Replacement	\$	4,529	
\$	Cost / Joint Bar Application	\$	1,231	Different Maintenance
\$	Cost / Visual Inspection	\$	1,181	The first second s
\$	Cost / Internal Inspection	\$	1,381	Intervention
\$		Ψ	0,000,400	
85%	Labor	\$	13,230,000	Costs Drivon by Labor
15%	Material	\$	2 375 000	COSIS DIIVEII DY LADOI
STRATEGY				
#	Total Route Miles		23,650	
#	Total Rail Miles (2x Route Miles)		47,300	
#	Total Spot Replacements		2000	
#	Average Length of Spot Replacement (ft)		39	
#	Total Spot Replacement (ft)		78000	
#	Total Spot Replacement (miles)		14.77	
#	Total Joint Bars Applied		4100	
#	Visual Inspections Required		100	
#	Internal Inspections Required		1000	





	Grinding	Preventive + Corrective	Preventive Only	
Total OPEX	Total Cost	\$59,000,000	\$43,000,000	Calc
	Cost / Day	\$160,000	\$120,000	Cure
	Cost / Work Day / Crinder	\$110,000	\$80,000	the
	Cost/Pass Mile	\$2,200	\$2,200	
				Diff e
	74% Depreciation/Lease	\$43,510,000	\$31,770,000	
	13% Labor	\$7,830,000	\$5,720,000	l Grin
	13% Material + Inspection	\$7,620,000	\$5,560,000	
STRATEGY				Stra
#	Total Route Miles	23,650	23,650	
#	Tangent - Preventive	16000	16000	
#	Mild Curves - Preventive	3500	3500	
#	Medium Curves - Preventive	0	0	
#	Severe Curves - Preventive	0	0	
#	Corrective	1800	0	
#	Total Track Miles Ground	21300	19500	
#	Total Pass Miles	26700	19500	
#	Total Track Miles Ground - Preventative	19500	19500	
#	Total Track Miles Ground -	1800	0	



WRI 2018

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1	Capital/Depreciation	\$ 286,650,000							

Would More Prevention Reduce defect Costs?

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Case Study: Defect Root Cause

Failure Root Cause	Defect #	%	OPEX	%	Free Cash Flow	%
Rolling Contact Fatigue	6000	44%	\$ 15,500,000	62%	\$ 65,000,000	26%
Subsurface Fatigue	3500	26%	\$ 5,500,000	22%	\$ 80,000,000	32%
Weld	4000	30%	\$ 4,000,000	16%	\$ 45,000,000	18%
Wear	\$ -	0%	\$ -	0%	\$ 60,000,000	24%
TOTAL	13500	100%	\$ 25,000,000	100%	\$250,000,000	100%

Where Would You Focus Your Engineering Initiatives?



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1_						3%			
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BNSF-TR-17

BN	BNSF RAILWAY COMPANY DEPRECIATION RATES TRACK PROPERTY													
A/C #	Account Name	Density	Depreciation Rate											
ACCOUN	T 8, TIES													
8.10	8.10 TIES-WOOD 1 4.44													
8.20	TIES-WOOD	2	3.43											
8.90	TIES-WOOD	4 & 5	2.40											
8.11	TIES-CONCRETE	1	3.00											
8.21	TIES-CONCRETE	2	3.00											
ACCOUN	T 9, RAILS & OTM													
9.10	RAILS & OTM	1	2.78											
9.20	RAILS & OTM	2	2.40											
9.90	9.90 RAILS & OTM 4 & 5 1.78													
ACCOUN	T 11, BALLAST													



Surface Transportation Board

WRI 2018

https://www.stb.gov/stb/industry/econ_cadlas.html

Class 1 Track Life: = 35.97 Years (100% / 2.78%) Class 2 Track Life: = 41.66 Years (100% / 2.40%) Class 4/5 Track Life: = 56.17 Years (100% / 1.78%)





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	A	В			С	D	E	F	G	H	
1	Cost Category	Operating Expense (OPEX) Total	Free	Cash Flow	(FCF) Spent Total	% Savings from Life Extension	OPEX Savings	FCF Savings			
2	Depreciation	\$ 239,800,000	\$		-	14%	\$ 34,653,179.19	\$ -			
3	Capital	\$ -	\$		333,500,000	14%	\$-	\$ 48,193,641.62			
4	Maintenance	\$ 15,600,000	\$		15 600 000	14%	\$ 2 254 335 26	\$ 2 254 335.26			
5	Grinding - Corrective	\$ 16,000,000	\$					73			
6	Grinding - Preventive	\$ 43,000,000	\$					-			
7	Lubrication	\$ 19,300,000	\$					-			
8	Inspections	\$ 22,800,000	\$	\//ha	+ lc tha l	ngo) -					
9	TOTAL	\$ 356,500,000	\$	VVIId	LIS LIE L	nge: 16					
10											
1	Current Rail Life	34.6						00			
1	Desired Rail Life	39.6						<u>53%</u>			
15											
14	Compliance	\$ 54,400,000									
15	Preventive	\$ 57,900,000									
16	Capital/Depreciation	\$ 286,650,000									







8	5	୯	Ŧ				ICRI Pr	escriptive l	Maintenance a	nd Econor	nic N	/lodels - DI	RAFT U	PDATE Y	V2 201	18.04.13 - Excel	Wesley Th	iomas	困 —	σ×
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	A	В	C					G	H				
1	Cost Category	Operating Expense (OPEX) Total	Free Cash Flow (FCF) Spent Total	Savings from Life Extension	OPEX Savings	FCF Savings							
2	Depreciation	\$ 239,800,000	\$ -	14%	\$ 34,653,179.19	\$-							
3	Capital	\$ -	\$ 333,500,000	14%	\$-	\$ 48,193,641.62							
4	Maintenance	\$ 15,600,000	\$ 15,600,000	14%	\$ 2,254,335.26	\$ 2,254,335.26							
5	Grinding - Corrective	\$ 16,000,000	\$ 16,000,000	14%	\$ 2,312,138.73	\$ 2,312,138.73							
6	Grinding - Preventive	\$ 43,000,000	\$ 43,000,000	0%	\$ -	\$-							
7	Lubrication	\$ 19,300,000	\$ 14,900,000	0%	\$ -	\$-							
8	Inspections	\$ 22,800,000	\$ 22,800,000	0%	\$ -	\$-							
9	TOTAL	\$ 356,500,000	\$ 445,800,000	11%	\$ 39,219,653	\$ 52,760,116							
10													
11	Current Rail Life	34.6											
12	Desired Rail Life	39.6			~								
13			l Wha	it are the Savin	gs from	Lite							
14	Compliance	\$ 54,400,000											
15	Preventive	\$ 57,900,000		Extension2									
16	Capital/Depreciation	\$ 286,650,000		LALEIISIOI									

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				D	E	F	G	Н	
1				Savings from Life Extension	OPEX Savings	FCF Savings			
2				14%	\$ 34,653,179.19	\$-			
3	What is t	the Return on Inv	vested Capital?	14%	\$-	\$ 48,193,641.62			
4				14%	\$ 2,254,335.26	\$ 2,254,335.26			
Ę				14%	\$ 2,312,138.73	\$ 2,312,138.73			
6				0%	\$ -	\$ -			
7	-			U%	ə -	ð -			
8	Inspections	\$ 22,800,000	\$ 22,800,000	0%	\$-	\$-			
9	TOTAL	\$ 356,500,000	\$ 445,800,000	11%	\$ 39,219,653	\$ 52,760,116			
10									
11	Current Rail Life	34.6		Cost to Implement	\$ 100,000,000	\$ 100,000,000			
12	Desired Rail Life	39.6		ROIC	39%	53%			
13									
14	Compliance	\$ 54,400,000							
15	Preventive	\$ 57,900,000							
16	Capital/Depreciation	\$ 286,650,000							









Is Financial Life Lower than Actual Life?







Next Steps

1. Reach Out to Us

2. Use the Model

3. Test, Improve, and Add More Models



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HEAVY HAUL SEMINAR . MAY 2-3, 2018

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