RETURN ON CONVEYOR SAFETY

- How does the Maintenance or Operations Manager convince the Plant Manager to spend money from the annual budget for safety improvements?

- How does the Plant Manager influence Corporate to prioritize safety improvements?

- How does an Engineering firm persuade the owner to spend more on design and equipment up front to reduce risk?

Safety, Productivity & Business Performance

Business Performance Rank

Top 20%

Middle 50%

Bottom 30%

	Overall Equipment Effectiveness	Repeat Accident Rate	Injury Frequency Rate	Unscheduled Downtime
Top 20%	90%	0.2%	0.05	2%
Middle 50%	85%	2.4%	0.9	6%
Bottom 30%	76%	10%	3.0	14%

Quantifying the Connection between Safety and Productivity, Sustainable Plant Staff, 2011

3
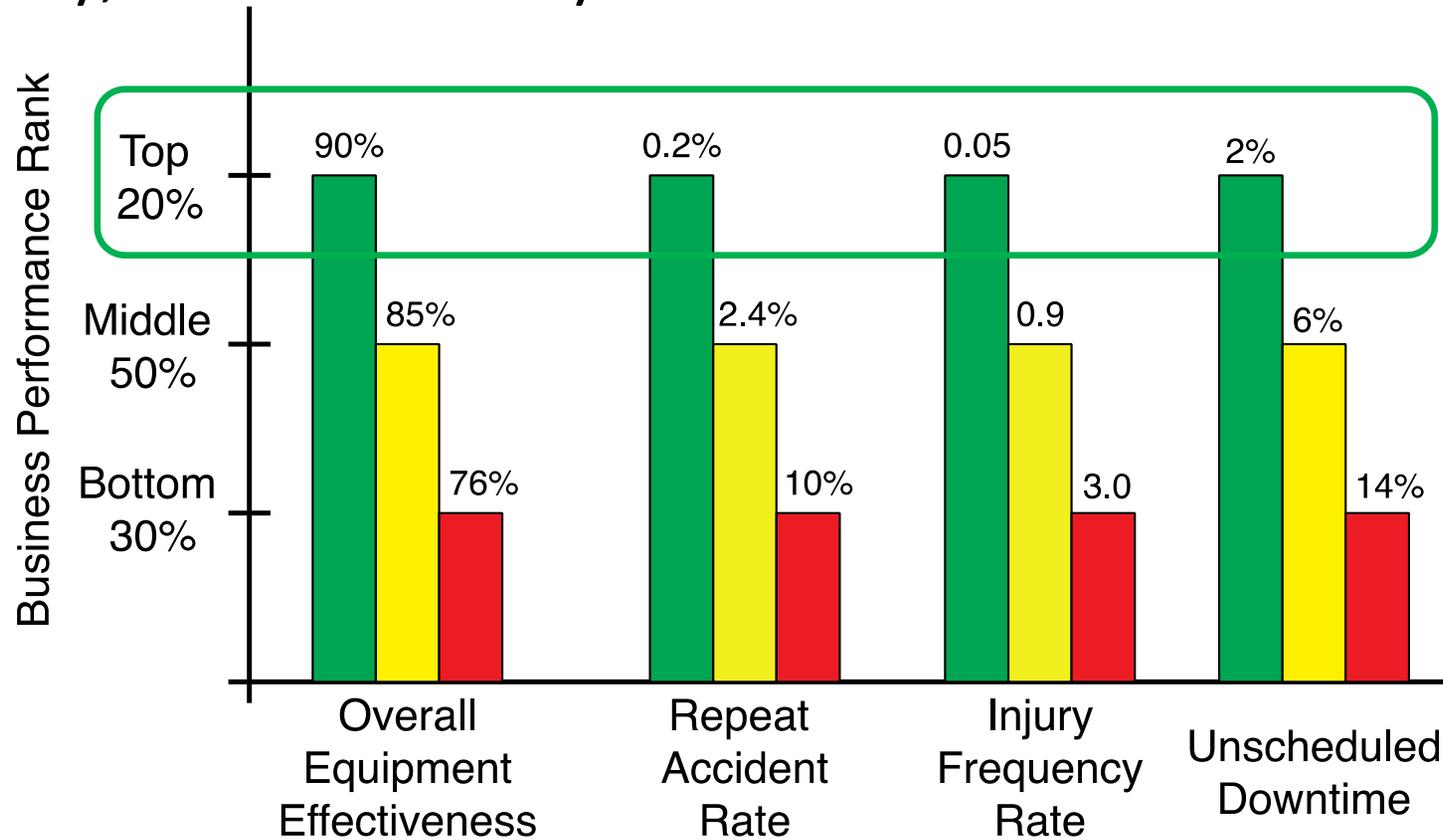
A Case History: Coeur Rochester

Improving Transfer Point Performance in Hard Rock Mines
Richard Shields
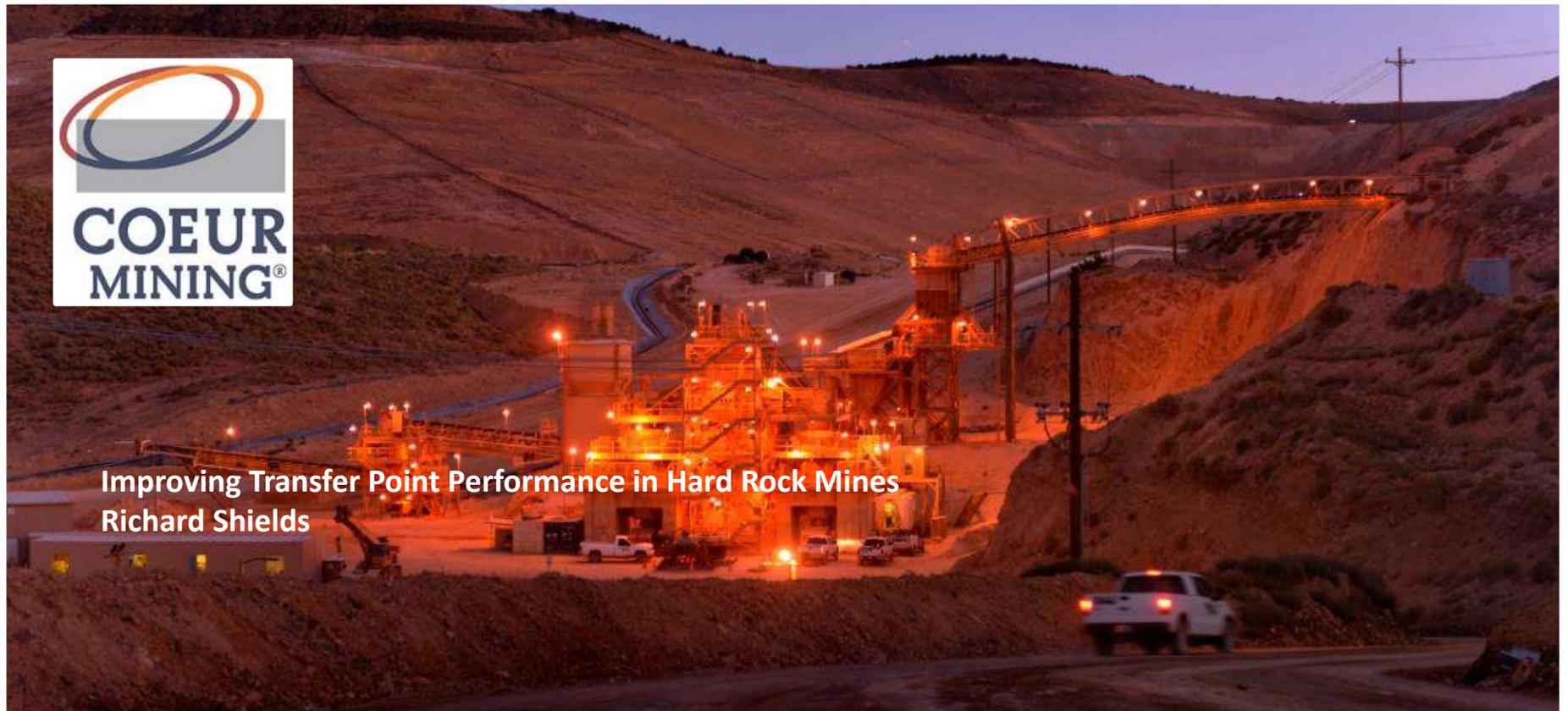
Conveyor B

- Carries Ore from the Secondary Crusher (Cone or Grizzly)to the Surge Pile Stacker.

- 1500 TPH of 4 inch (100 mm)-Minus Ore.

- "Most Improvement Potential"
  (= *'Had the Most Problems'*)

Conveyor	
Belt width	48 inches
Belt speed	386 fpm
Troughing angle	35 degrees
CEMA class/roll diameter	D / 6 inches
Length of chute wall	40 feet
Material	
Material type	Silver ore
Material size	4-inch minus

Conveyor B Specifications

The Problems of Conveyor B

- Severe Dust and Spillage
- Buried Idlers = *Shorter Life for 'Cans' and Bearings)*
- Excessive Cleanup Costs: *5-10 man-hours a day, 7 days a week*.
- Safety Risks *Cleanup Workers Close to Operating Conveyors.*
- Air Quality Concerns

The Completed Project

New

- External Wear Liner
- Belt Support Cradles
- Multiple-Layer Sealing Strip
- Tail Sealing Box

RETURN ON INVESTMENT (ROI)
BASED ON DIRECT EXPENSE REDUCTION

- Savings = 60 Man Hours/Week X 40 Weeks X $50

    = $120,000

- Rebuilt Transfer Point Cost = $120,000

- ROI = Savings/Cost = $120,000/$120,000 = 1 or 100%

- Years To Payback = 1.0

NPV = Net Present Value of a Series of Cash Flows

t = Time Period (y)

T = Number of Time Periods Analyzed (y)

Cash Flows = Savings - Costs for each Time Period ($)

i = Discount Rate [Cost of Money] (decimal or %)

Net Present Value: $NPV = - \text{Initial Investment} + \sum_{t=1}^{T} \dfrac{\text{Cash Flows}_t}{(1+i)^t}$

$$NPV() = - \text{Initial Investment} + \left[\dfrac{\text{Cash Flow Year 1}}{(1+\text{Cost of Money})^1} + \dfrac{\text{Cash Flow Year 2}}{(1+\text{Cost of Money})^2} + ... \right]$$

	Year 1	Year 2	Year 3	Year 4	Year 5
Annual Savings on Labor	$120,000	$120,000	$120,000	$120,000	$120,000
Annual Maintenance Cost	$10,000	$10,000	$10,000	$10,000	$10,000
Net Cash Flow	$110,000	$110,000	$110,000	$110,000	$110,000
Discount Rate	5%				
Net Present Value of Cash Flows =					$467,242
5 Year ROI = Net Present Value Minus Initial Investment =					**$356,242**

RETURN ON CONVEYOR SAFETY REDUCTION OF RISK

Risk = Probability ✕ Severity

- Probability = Chance of an Incident (i.e. Injury Frequency Rate)

- Severity = Cost of Incident (i.e. Cost of the Injury)

- Use NPV to Compare Cash Flow before and after Investments

RISK REDUCTION

EXPOSURE REDUCED FROM

70 HOURS PER WEEK TO 10

RISK REDUCTION = 60h/70h = 86%

COMPANY COST PER INCIDENT

	Fatal Accident Cost	Lost Time Accident Cost	First Aid Incident Cost	Fatal Disease Cost
Established Market Economies	$2,750,000	$150,000	$2,750	$160,150
Former Socialist Countries	$500,000	$28,000	$500	$29,120
India	$60,000	$3,000	$60	$3,140
China	$100,000	$6,000	$100	$5,820
Other Asian & Islands	$1,000,000	$56,000	$1,000	$58,200
Sub Saharan Africa	$210,000	$12,000	$200	$12,230
Latin America & Caribbean	$600,000	$33,000	$600	$31,400
Middle Eastern Crescent	$1,140,000	$64,000	$1,100	$59,740
World Average Rate	$795,000	$44,000	$789	$46,300

Accident Costs Based on sources for US, CAN, AUS and International Labour Organization estimated values.
Cost of Fatal Diseases based on *The Cost of Work-related Injury and Illness for Australian Employers, Workers and The Community: 2005-06,* Australian Safety and Compensation Council as the World average and factored by fatal accident cost.

GLOBAL FATALITY & INJURY RATES

Rates per 100,000 Industrial Workers per Year				
	Fatal Accidents	Lost Time Accidents	First Aid Incidents*	Fatal Diseases
Established Market Economies	3.8	2,900	8,700	67.0
Former Socialist Countries	9.5	7,250	21,750	80.9
India	9.0	6,900	20,700	59.0
China	12.2	9,300	27,900	52.2
Other Asian & Islands	18.5	14,100	42,300	43.0
Sub Saharan Africa	19.1	14,500	43,500	75.5
Latin America & Caribbean	18.0	13,700	41,100	49.4
Middle Eastern Crescent	13.3	10,150	30,450	89.3
World Average Rate	12.7	9,725	29,175	63.0

Introductory Report: Decent Work – Safe Work, Dr. J. Takala, International Labour Office, Geneva
XVIIth World Congress on Safety and Health at Work Orlando 2005   *First Aid Incidents estimated to be 3 x Lost Time Accidents.

Probable Annual Safety Risk Costs

Probability of Fatal Incident = 3.8/100,000 per Worker per Year

<u>Direct</u> Cost of Fatal Incidents = $2,750,000

Probable Fatal Accident Cost = 3.8/100,000 x $2,750,000 = $104.50
$104.50 x 86% = $898

Incident	Risk Reduction	Probability per 100,000 Workers	Cost per Incident per Worker	# of Workers Exposed	Annual Probable Cost
Fatal	86%	3.8	$2,750,000	10	$898
Lost Time	86%	2900	$150,000	10	$37,410
First Aid	86%	8700	$2,750	10	$2,058
Disease	86%	67	$160,150	10	$922
Total Annual Probable Cost of Accidents & Disease					$41,228

	Year 1	Year 2	Year 3	Year 4	Year 5
Annual Savings on Risk Reduction	$41,228	$41,228	$41,228	$41,228	$41,228
Cost of Maintenance	$10,000	$10,000	$10,000	$10,000	$10,000
Net Cash Flow	$31,228	$31,228	$31,228	$31,228	$31,228
Discount Rate	5%				
5 Year Net Present Value of Risk Reduction =					$135,461
5 Year Return on Conveyor Safety = NPV – Initial Cost					**$15,461**

ROI = Savings/Cost = 135,461/120,000 = 1.13

Additional Tangible Savings
25 to 30% Increase in Component Life
Increased Availability
Increased Production

Potential Less Tangible Savings
Better Labor Utilization
Fewer Citations
Higher Morale

FOUNDATIONS™ FOR CONVEYOR SAFETY
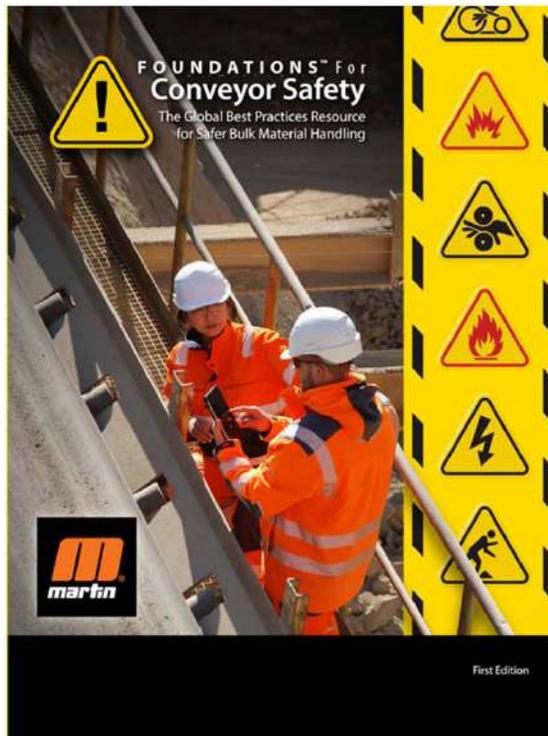
The Mission:
To Improve Conveyor Safety

6 Sections, 35 Chapters:
I.   Hazards Of Belt Conveyors
II. Hardware Solutions
III. Safe Work Practices
IV. Risk Analysis
V.   Building Better Conveyors
VI. The Payback

https://www.martin-eng.com/content/product/690/safety-book/

Direct Cost Savings are Important but,
Harder and Harder to Find.

Returns on Conveyor Safety are Real:
-Saves Lives
-Improves the Environment
-Increases Profits

Martin Engineering
www.martin-eng.com

Creating **VALUE**
in a cyclical environment

2017 SME ANNUAL CONFERENCE & EXPO
CMA 119th NATIONAL WESTERN MINING CONFERENCE

SME   CMA
       COLORADO MINING
       ASSOCIATION

DENVER, COLORADO | FEBRUARY 19-22, 2017