



Optimizing an Engineered Slope Conveyor System

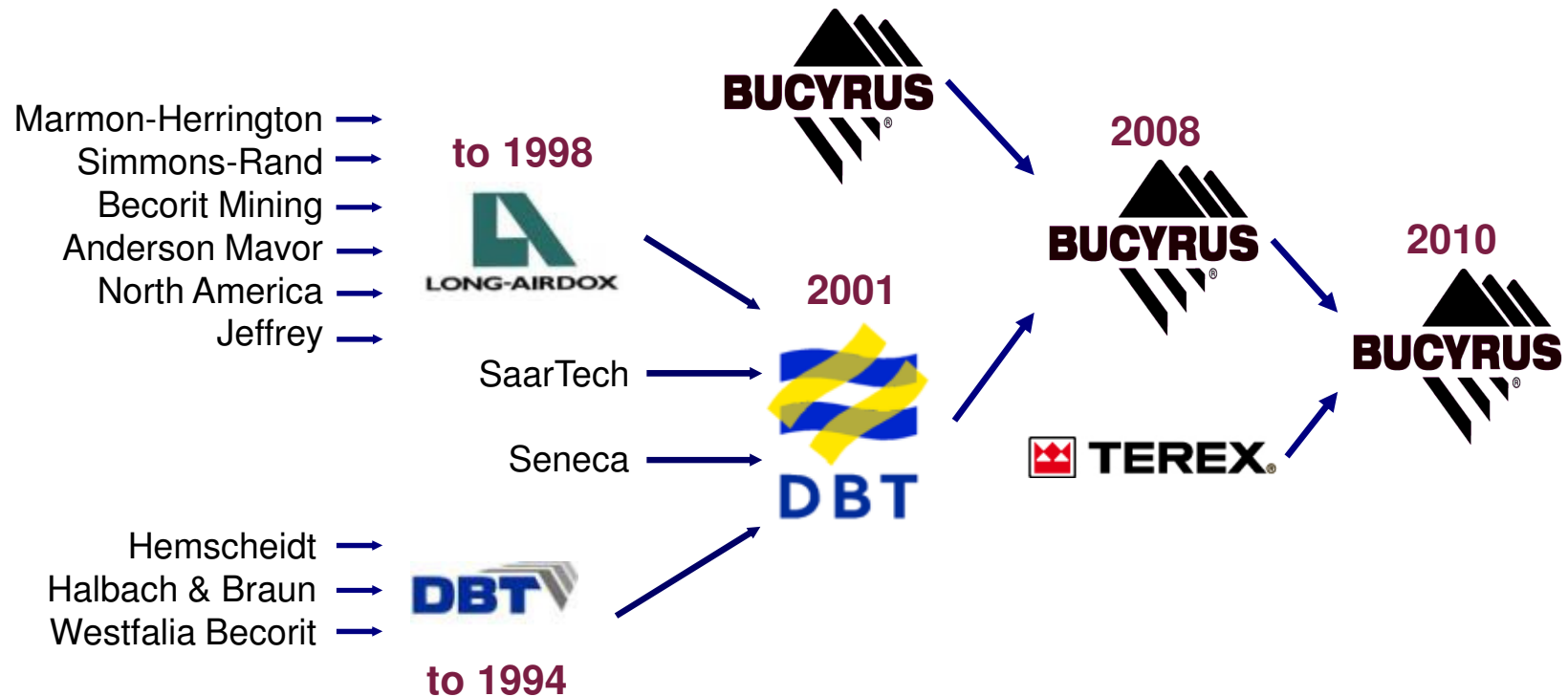
An OEM / Operator Collaboration

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February 21, 2012

WHEREVER THERE'S MINING



Who is Caterpillar Global Mining?



And in 2011...

Caterpillar Global Mining

Caterpillar Keeps Mining Emerging Markets With Bucyrus Buy

BUCY + CAT = mining equipment powerhouse

Caterpillar Gets 'Super-Sized' With Bucyrus Acquisition

As countries like China, India and Brazil continue to modernize at a fast clip, their demand for goods like precious metals and energy sources is rising just as quickly. Investors cheered the news as stocks in both companies rose. The planned merger would be the largest in the construction and mining industry in five years.

This week we're looking at Caterpillar Inc.'s (CAT) recently-announced acquisition of Bucyrus International (BUCY) for \$7.6 billion (\$8.6 billion including debt).

This deal is huge. It's big for Caterpillar, which hasn't made such an acquisition since 1980, according to Bloomberg. It's also one of the biggest in the mining and construction industry in the past five years. It's also a good time to do it: Financing costs are relatively low, and Caterpillar has some spare money in the bank.

In a move that took the mining equipment sector—as well as investment analysts—by surprise, Caterpillar Inc. announced on November 15 it had entered into an agreement to acquire fellow mining supplier Bucyrus International for an outlay of \$7.6 billion. The acquisition, said Caterpillar, will position the company to capitalize on what it sees as a robust long-term outlook for commodities-driven rapid growth in emerging markets.

CAT to Buy Bucyrus in Record Deal

Caterpillar Inc. (NYSE:CAT) is all set to buy Bucyrus International Inc. (NASDAQ:BUCY), a South Milwaukee-based manufacturer of surface and underground mining equipment, in a transaction worth \$8.6 billion.

The deal, if it gets through, would be the

biggest in the company's history. The billion-dollar deal capitalizes on the rising demand for coal and minerals triggered by growth in the emerging nations. The acquisition, subject to regulatory and Bucyrus shareholder approvals, is slated to close in mid-2011.

CATERPILLAR TO BUY BUCYRUS TO EXPAND MINING RANGE

CATERPILLAR BUYING BUCYRUS IN BIG BET ON MINING

DETROIT/PROVIDENCE, Rhode Island — Caterpillar Inc. staked a larger claim in the booming global mining industry with a \$7.6 billion deal to buy Bucyrus International Inc., the biggest acquisition in its 85-year history.

The deal would strengthen Caterpillar's position as the world's biggest maker of mining equipment, adding massive mining shovels and draglines to its lineup of trucks and excavators.

Shareholders of Bucyrus will receive \$92 cash per share, a 32 percent premium over the stock's closing price on Friday. Jim Dugan, a Caterpillar spokesman, said the deal, expected to close in mid-2011, was the biggest in the company's history by "a long shot." Including \$1 billion of Bucyrus debt being assumed by Caterpillar, the transaction is worth \$8.6 billion.

CATERPILLAR (CAT) DIGGING BUCYRUS (BUCY)

In M&A activity, Caterpillar (CAT, \$83.13, up \$2.09), the world's largest construction and mining equipment maker, decided now is the time to buy Bucyrus International (BUCY, \$89.79, up \$20.17) and moved aggressively to capitalize on the demand for commodities in emerging markets. Both stocks are trading higher on the \$7.6 billion buyout offer.

CAT ADDING BUCYRUS TO ITS PRODUCT PAYLOAD FOR \$8.6B

Despite obstacles, Caterpillar roars on, analysts say

Despite crisis in Japan, a lethargic U.S. construction industry and increased corporate taxes in its home state of Illinois, analysts agree the outlook is good for Caterpillar Inc., the world's largest heavy-equipment maker.

More than offsetting the difficulties, the analysts say, will be emerging-market demand for

construction equipment and miners' needs for equipment to increase production of metals. Although Caterpillar's agreement to acquire Bucyrus International Inc., an international mining equipment manufacturer, was approved by European Union anti-trust regulators last week, analysts aren't yet counting it in their forecasts.

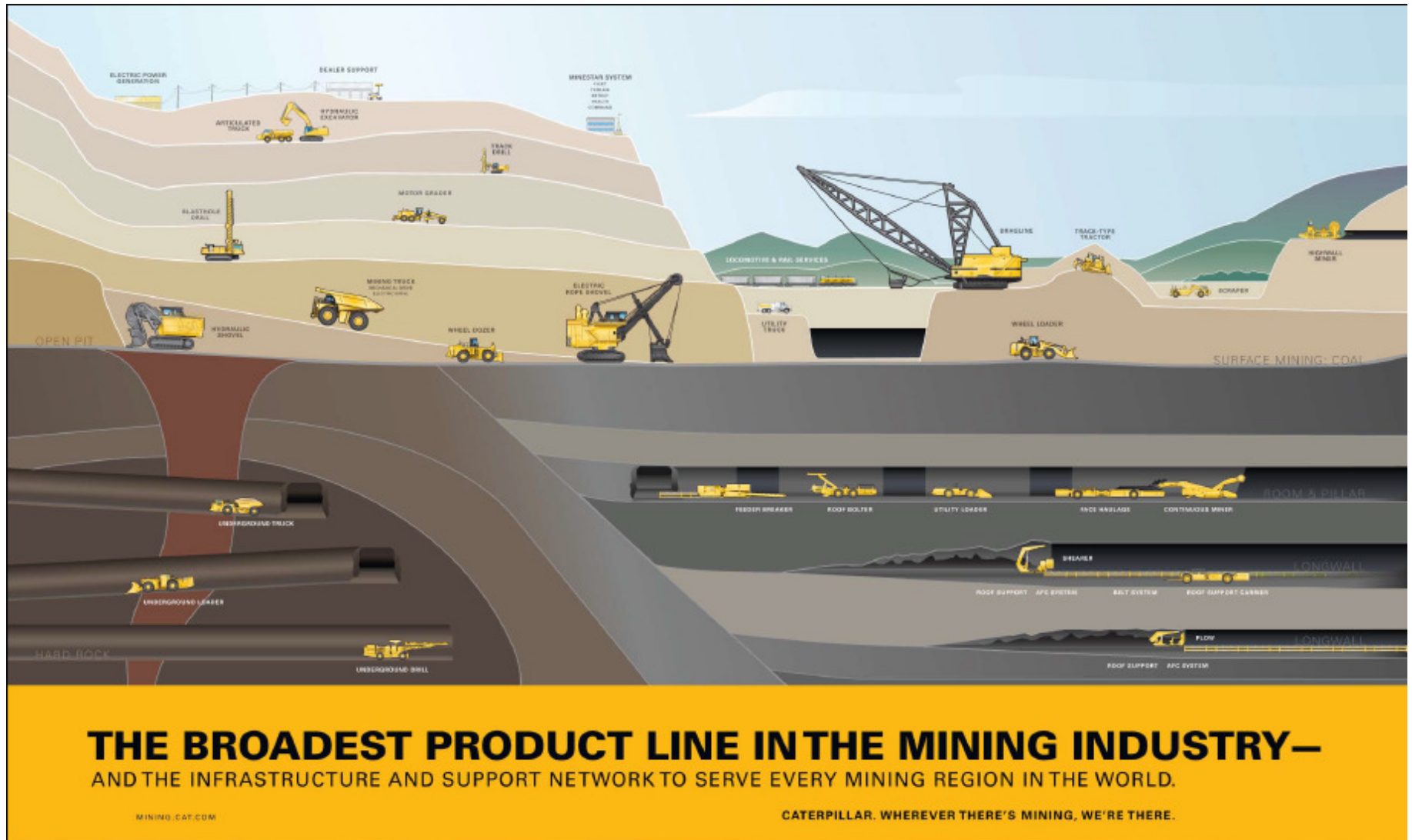
Caterpillar bets on continued commodities boom, acquires competitor

Shareholders have enough to ride the stock from the depths of the recession to the present have seen it nearly quadruple, from \$30.38 per share in July of 2009 to a 52-week high of \$116 on May 2.

Complete Mining Products Portfolio

Company	Surface Mining Equipment													Underground Mining Equipment									
	Dozers & Graders	Wheel Loaders	Mining Trucks	Hydraulic Shovels	Highwall Miners	Surface Drills	Rope Shovels	Draglines	Surface Belt Systems	Belt Systems	Roof Supports	Armored Face Conveyors	Shearers	Drills	Trucks & Loaders	Continuous Miners	Diesel Transport						
Caterpillar																							
Joy Global																							
Komatsu																							
Hitachi																							
Liebherr																							

Complete Mining Products Portfolio



Wherever There's Mining



The collage features 11 individual photos of Cat employees in various mining settings. Each employee is holding a yellow sign with text in a different language. The signs include: "WIR SIND VOR ORT", "WE'RE THERE", "JSME TAM", "精“采”有我!", "NÓS ESTAMOS LA.", and "WE'RE THERE". The backgrounds show large mining equipment, open-pit mines, and industrial interiors.

Wherever you go in the mining world, you'll find Cat® products hard at work. And our people are right there, too — building and supporting products, helping our customers mine more profitably, and striving to protect the health and safety of miners and the communities where they operate.

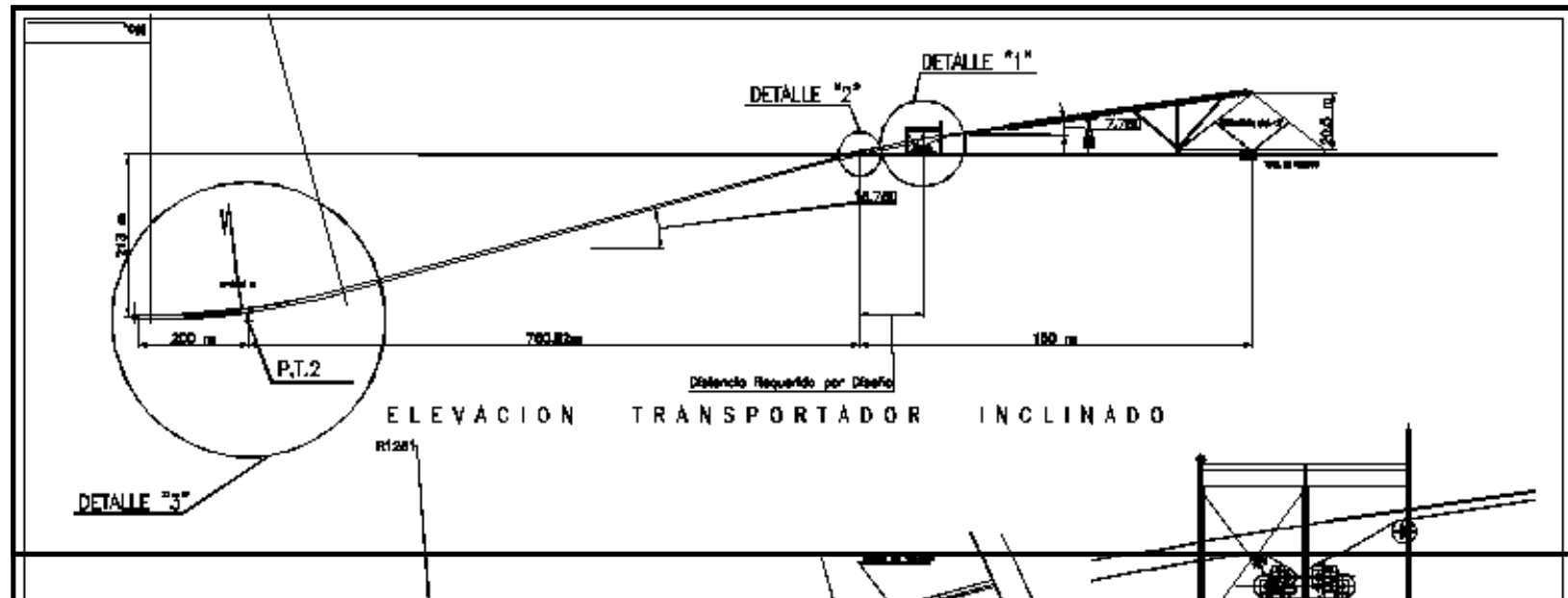
WHEREVER THERE'S MINING, WE'RE THERE.

MINING.CAT.COM

Preliminary Slope Layout Drawing

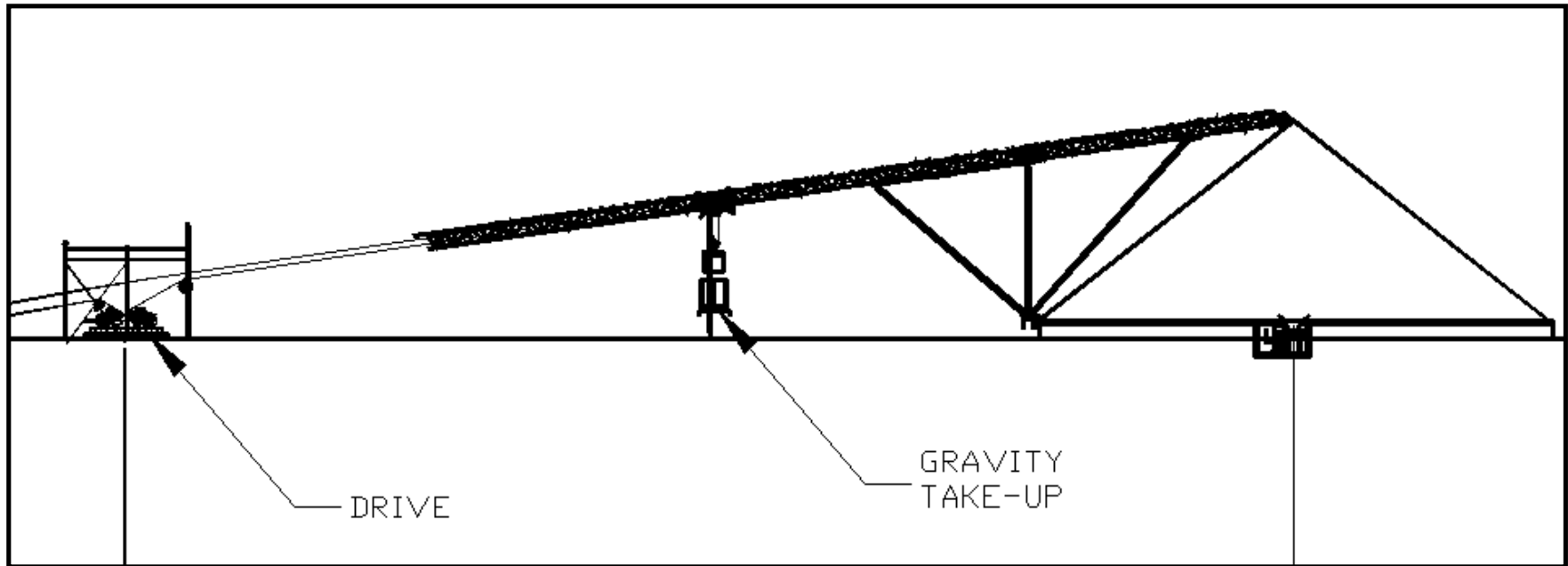
Design review

Preliminary Slope Design Layout Drawing



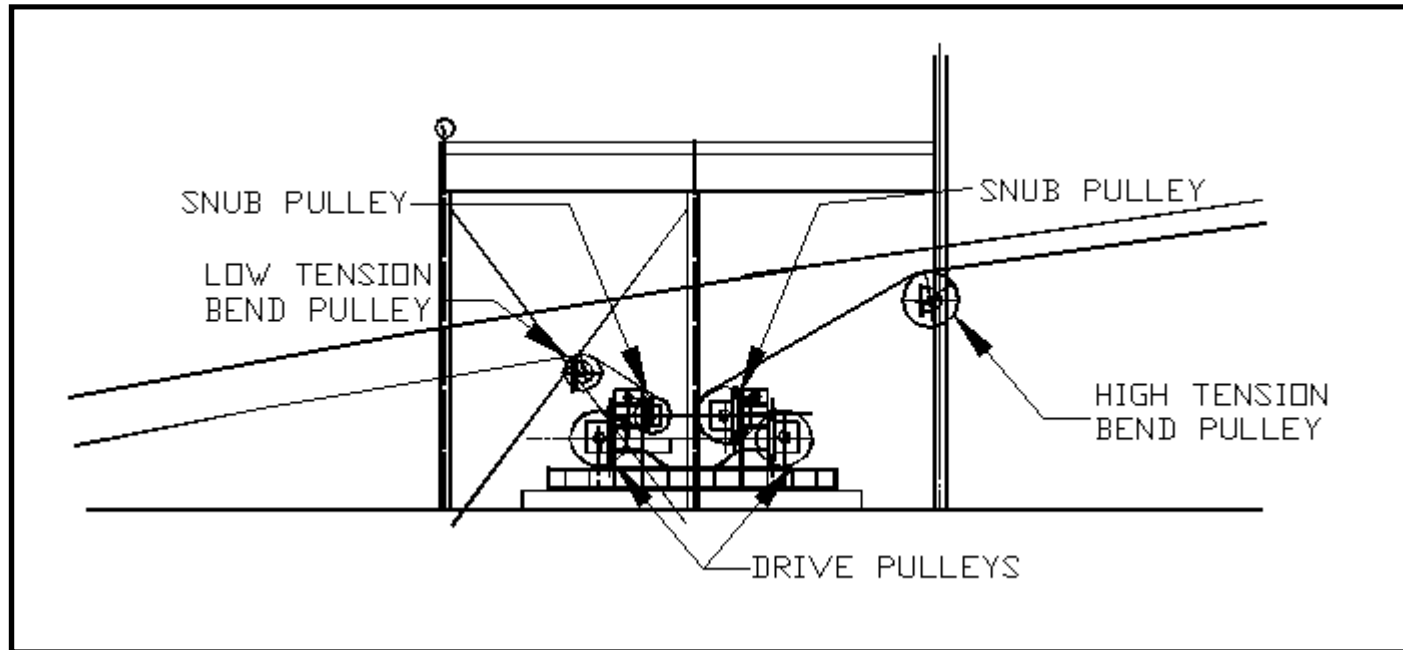
- Slope layout constraints provided by operator
 - Fixed points – opening of portal (PT 1) and bottom of slope (PT 2)
 - Distance between PT 1 and PT 2 is 760.82 m horizontal and 213.0 m vertical
 - From PT 1 to discharge pulley is 150 m horizontal and 20.5 m vertical
 - Distance from PT 2 to tail pulley depends on radius of curve; approximately 50 m + tangential point of radius at tail pulley (calculate the distance from tangential point of curve use $X = R * \tan(15.75/2)$)

Preliminary Design – Gravity Take Up Location



- Highest tension throughout the belt is seen at this location
- Would require a counterweight with 880,000 lbs of weight – over 440 tons!
- Obviously this is not practical

Preliminary Design – Drive Arrangement



- Four pulley drive arrangement
- Requires a low tension bend pulley inby the drive and a high tension bend pulley outby the drive
- Advantage – driving the clean side of the belt
- Disadvantage – higher cost solution

Preliminary Slope Conveyor Specifications

Design review

Preliminary Design Specification


	Option 1	Option 2	Option 3
Material Density	881 kg/m ³	881 kg/m ³	881 kg/m ³
Belt Width	60"	72"	72"
Length	1,086 m	1,111 m	1,357 m
Lift	233 m	233 m	233 m
Belt Speed	4.5 mps	4.5 mps	3.5 mps
Horizontal Curve Radius	2,956 m	1,251 m	2,865 m
Desired Tonnage	5,500 mtpH	5,500 mtpH	5,500 mtpH

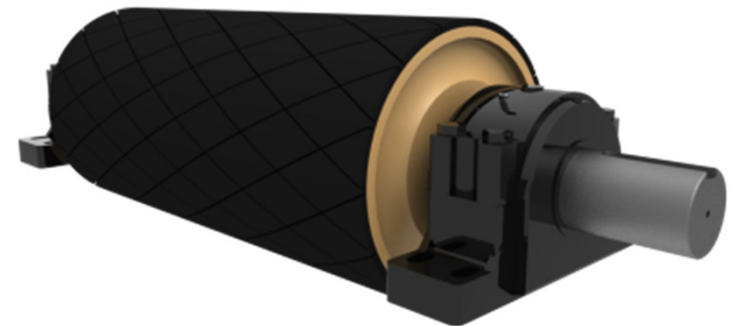
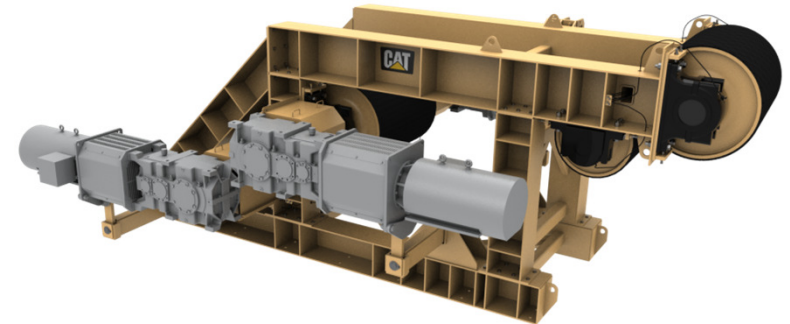
- Design constraints provided by operator
 - Voltage – 4160 v
 - Preferred drive technology – fluid coupling
 - Preferred take up type – gravity
 - Must be able to convey 5,500 mtpH

Caterpillar Slope Design Review Data

		60" Belt Width			72" Belt Width								
		650 TPKL	866 TPKL	780 TPXL	650 TPKL	866 TPKL	780 TPXL	650 TPKL	866 TPKL	780 TPXL			
	Belt Width		60"			72"							
	Length		1086 m			1357 m			1111 m				
	Lift		233 m										
	Belt Speed		4.5 mps			3.5 mps			4.5 mps				
	Desired Tonnage		5,500 mtph										
	Allowable Tonnage		3,750 mtph			4,250 mtph			5,500 mtph				
	Main Drive Config		4 x 1100 HP		2 x 2200 HP	4 x 1300 HP		2 x 2600 HP	4 x 1600 HP		2 x 3200 HP		
	HS Coupling		650 TPKL	866 TPKL	780 TPXL	650 TPKL	866 TPKL	780 TPXL	650 TPKL	866 TPKL	780 TPXL		
Drive	Backstop		BC-375MA			BC-540MA							
	Motor Speed		1800 RPM	1200 RPM		1800 RPM	1200 RPM		1800 RPM	1200 RPM			
	Total Horse Power		4400 HP			5200 HP			6400 HP				
	Voltage		4160 V										
	Drive Pulley Diameter		48"			54"							
	Take-up Type		Cylinder										
	Location		Tail										
Take-up	Cylinder	Take-up Tension Required		11,015#			20,716#			15,453#			
		Max Take-up Tension		21,536#			21,536#			21,536#			
		Max Line Pull		43,072#			43,072#			43,072#			
		Take-up Type		Gravity									
		Location		Drive									
	Gravity	Take-up Tension Required		46,187#			65,268#			59,174#			
		Take-up Weight		92,374#			130,536#			118,348#			
		Take-up Pulley Diameter		36"			42"						
	Belt	Cylinder	Cylinder TU Belt Suggested		ST3500			ST4500			ST4000		
			% Running Belt Rating		97%			93%			97%		
Gravity		Gravity TU Belt Suggested		ST4000			ST4500			ST4500			
		% Running Belt Rating		91%			99%			93%			
			Belt Cover Thicknesses		.25 x .125								
	Discharge Diameter		48"			54 "							
	Tail Pulley Diameter		36"			42 "							

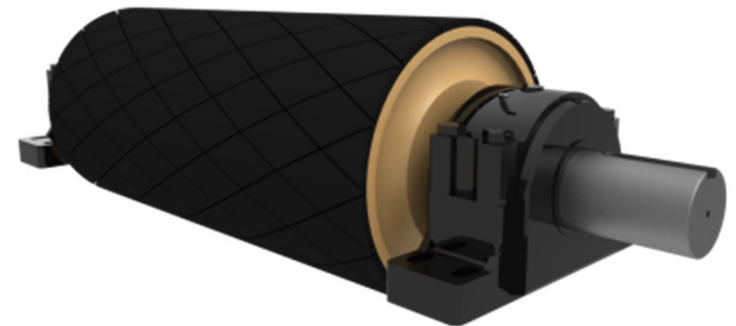
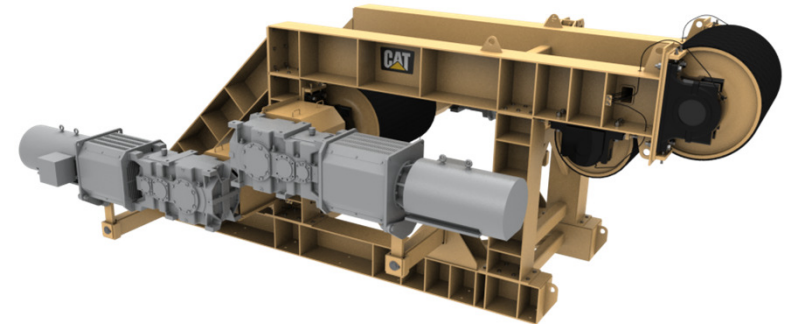
Option 1 – 60” Belt Width at 4.5 m/s

				60" Belt Width		
				650 TPKL	866 TPKL	780 TPXL
				Date: 09/28/2011		
		Belt Width		60"		
		Length		1086 m		
		Location:		Company: BUCYRUS		
		Lift		233 m		
		Description: Slope 60.11% 133.5 3750				
Belt Speed		4.5 mps				
Desired Tonnage		3,500 mtph				
Allowable Tonnage		3,750 mtph				
Drive	Main Drive Config		4 x 1100 HP			
	HS Coupling		650 TPKL	866 TPKL	780 TPXL	
	Backstop		BC-375MA			
	Motor Speed		1800 RPM	1200 RPM		
	Total Horse Power		4400 HP			
	Voltage		4160 V			
	Drive Pulley Diameter		48"			
	Take-up	Cylinder	Take-up Type		Cylinder	
Location			Tail			
Take-up Tension Required			11,015#			
Max Take-up Tension			21,536#			
Max Line Pull			43,072#			
Gravity		Take-up Type		Gravity		
		Location		Drive		
		Take-up Tension Required		46,187#		
		Take-up Weight		92,374#		
		Take-up Pulley Diameter		36"		
Belt	Cylinder	Cylinder TU Belt Suggested		ST3500		
		% Running Belt Rating		97%		
	Gravity	Gravity TU Belt Suggested		ST4000		
		% Running Belt Rating		91%		
	Belt Cover Thicknesses		.25 x .125			
	Discharge Diameter		48"			
Tail Pulley Diameter		36"				



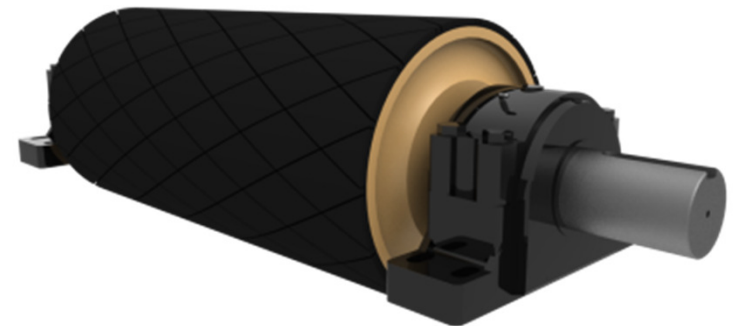
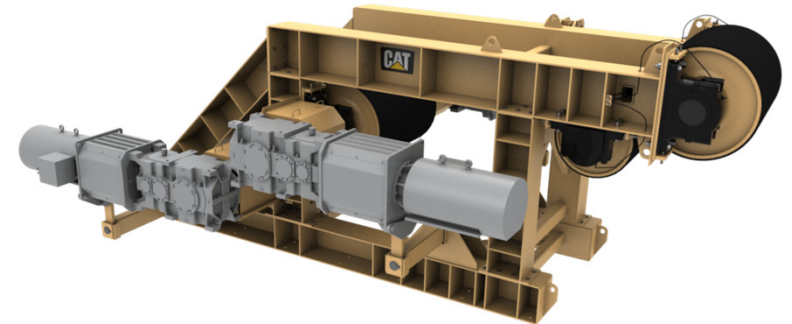
Option 2 – 72” Belt Width at 4.5 m/s

		72" Belt Width			
		650 TPKL	866 TPKL	780 TPXL	
		Date: 09/28/2011			
		72"			
		1111 m			
		Company: BUCYRUS			
		233 m			
		4.5 mps			
		5,500 mtpH			
		5,500 mtpH			
	Drive		4 x 1600 HP		2 x 3200 HP
			650 TPKL	866 TPKL	780 TPXL
		BQ-540MA			
		1800 RPM	1200 RPM		
		6400 HP			
		4160 V			
		54"			
		Cylinder			
		Tail			
		15,453#			
Take-up	Cylinder	21,536#			
		43,072#			
		Gravity			
		Drive			
		59,174#			
	Gravity	118,348#			
		42"			
		ST4000			
		97%			
		ST4500			
Belt	Cylinder	93%			
		.25 x .125			
	Gravity	54 "			
		42 "			



Option 3 – 72” Belt Width at 3.5 m/s

		72" Belt Width		
		650 TPKL	866 TPKL	780 TPXL
		Date: 09/28/2011 72"		
	Belt Width	1357 m		
	Length	233 m		
	Location: Lift	Company: BUCYRUS		
	Belt Speed	3.5 mps		
	Desired Tonnage	5,500 mtp		
	Allowable Tonnage	4,250 mtp		
	Main Drive Config	4 x 1300 HP Coal, Blumms 60M 2 x 2600 HP		
	HS Coupling	650 TPKL	866 TPKL	780 TPXL
	Backstop	BC-540MA		
Drive	Motor Speed	1800 RPM	1200 RPM	
	Total Horse Power	5200 HP		
	Voltage	4160 V		
	Drive Pulley Diameter	54"		
	Take-up Type	Cylinder		
	Location	Tail		
	Take-up Tension Required	20,716#		
	Max Take-up Tension	21,536#		
	Max Line Pull	43,072#		
	Take-up Type	Gravity		
Take-up	Cylinder	Location	Drive	
		Take-up Tension Required	65,268#	
		Take-up Weight	130,536#	
		Take-up Pulley Diameter	42"	
		Cylinder TU Belt Suggested	ST4500	
	Gravity	% Running Belt Rating	93%	
		Gravity TU Belt Suggested	ST4500	
		% Running Belt Rating	99%	
		Belt Cover Thicknesses	.25 x .125	
		Discharge Diameter	54 "	
	Tail Pulley Diameter	42 "		



Summary of Preliminary Design Review

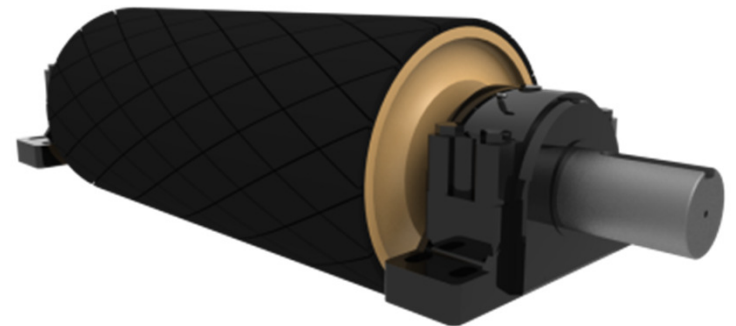
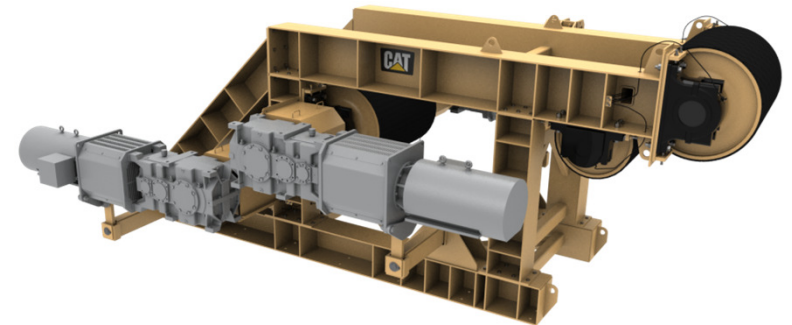
	Option 1	Option 2	Option 3
Belt Width	60"	72"	72"
Length	1086 m	1111 m	1357 m
Belt Speed	4.5 mps	4.5 mps	3.5 mps
Desired Tonnage	5,500 mtph	5,500 mtph	5,500 mtph
Allowable Tonnage	3,750 mtph	5,500 mtph	4,250 mtph
Main Drive Configuration Options	4 x 1100 HP 2 x 2200 HP	4 x 1600 HP 2 x 3200 HP	4 x 1300 HP 2 x 2600 HP
Total Horse Power	4400 HP	6400 HP	5200 HP
Backstop	BC-375MA	BC-540MA	BC-540MA

Technical Presentation at the Mine Site

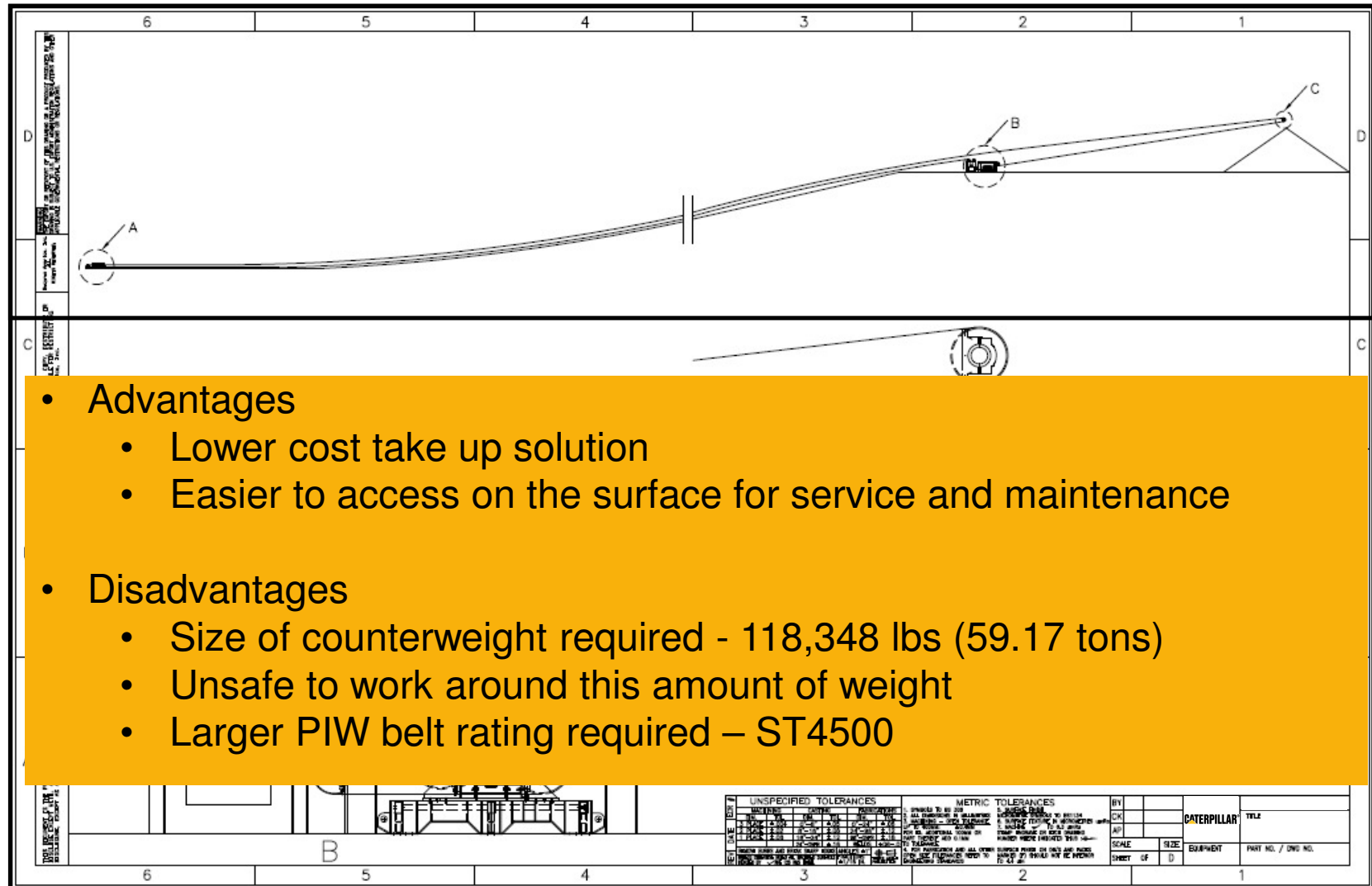
A collaborative process

Option 2 – 72” Belt Width at 4.5 m/s

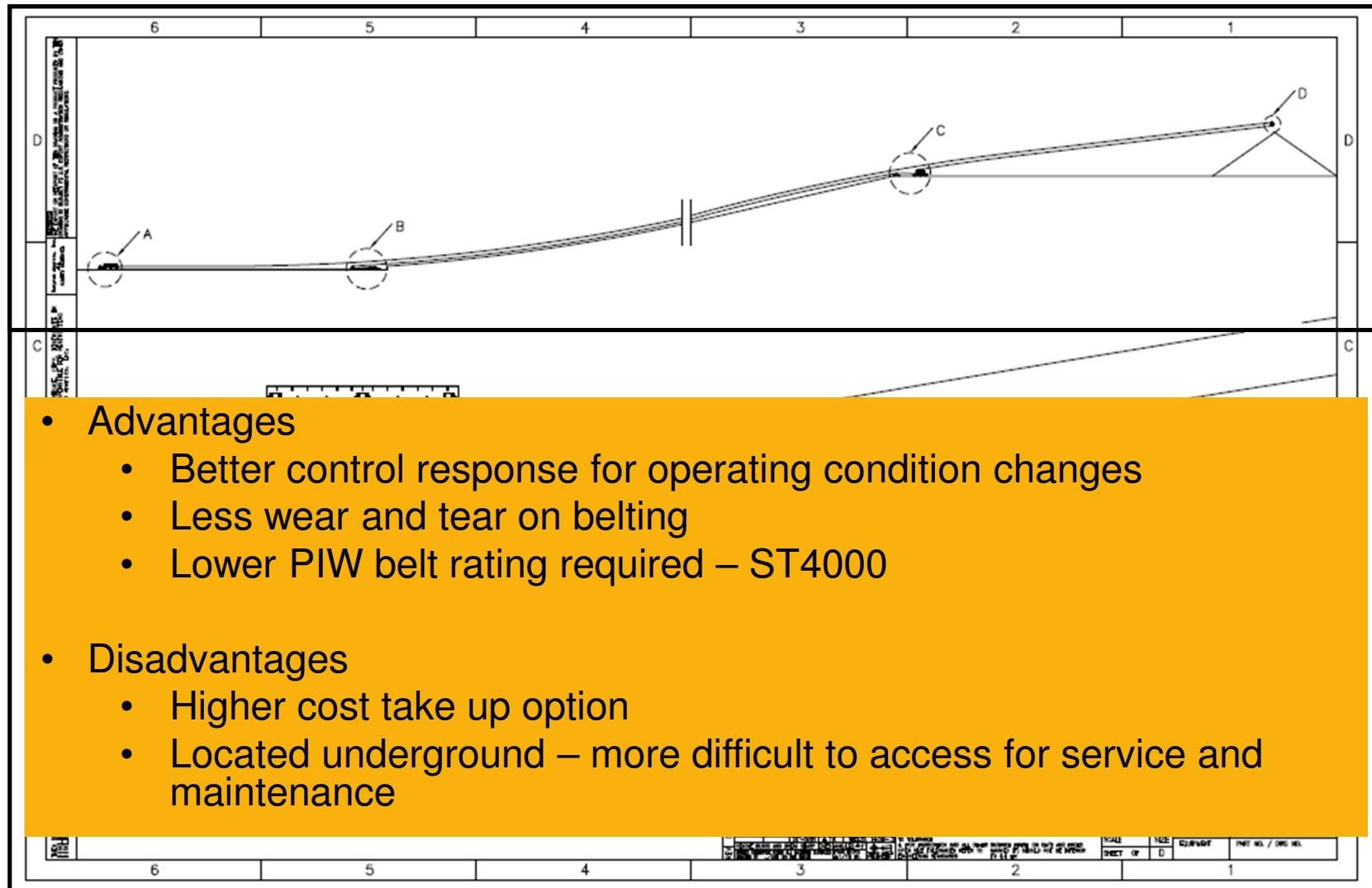
		72" Belt Width			
		650 TPKL	866 TPKL	780 TPXL	
		Belt Width	72"		
		Length	1111 m		
		Lift	233 m		
		Belt Speed	4.5 mps		
		Desired Tonnage	5,500 mtph		
		Allowable Tonnage	5,500 mtph		
Drive	Main Drive Config		4 x 1600 HP		2 x 3200 HP
	HS Coupling		650 TPKL	866 TPKL	780 TPXL
	Backstop		BC-540MA		
	Motor Speed		1800 RPM	1200 RPM	
	Total Horse Power		6400 HP		
	Voltage		4160 V		
	Drive Pulley Diameter		54"		
Take-up	Cylinder	Take-up Type		Cylinder	
		Location		Tail	
		Take-up Tension Required		15,453#	
		Max Take-up Tension		21,536#	
		Max Line Pull		43,072#	
	Gravity	Take-up Type		Gravity	
		Location		Drive	
		Take-up Tension Required		59,174#	
		Take-up Weight		118,348#	
		Take-up Pulley Diameter		42"	
Belt	Cylinder	Cylinder TU Belt Suggested		ST4000	
		% Running Belt Rating		97%	
	Gravity	Gravity TU Belt Suggested		ST4500	
		% Running Belt Rating		93%	
		Belt Cover Thicknesses		.25 x .125	
		Discharge Diameter		54 "	
		Tail Pulley Diameter		42 "	



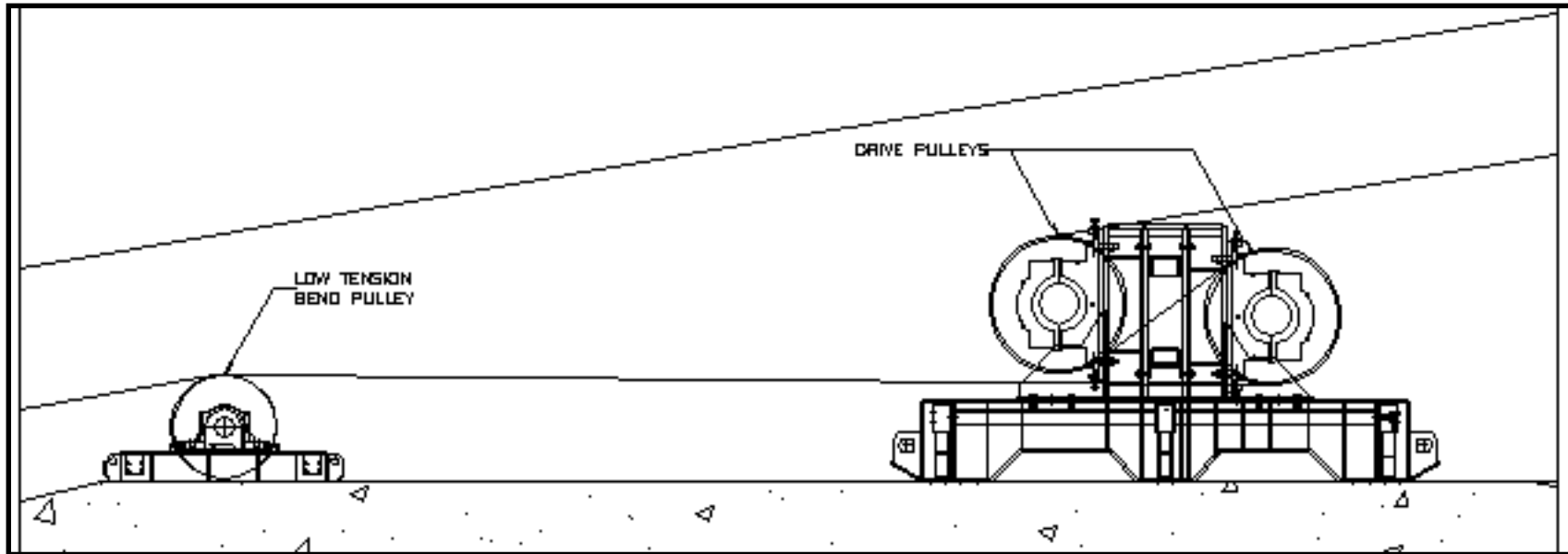
Slope Schematic – Gravity Take Up Option



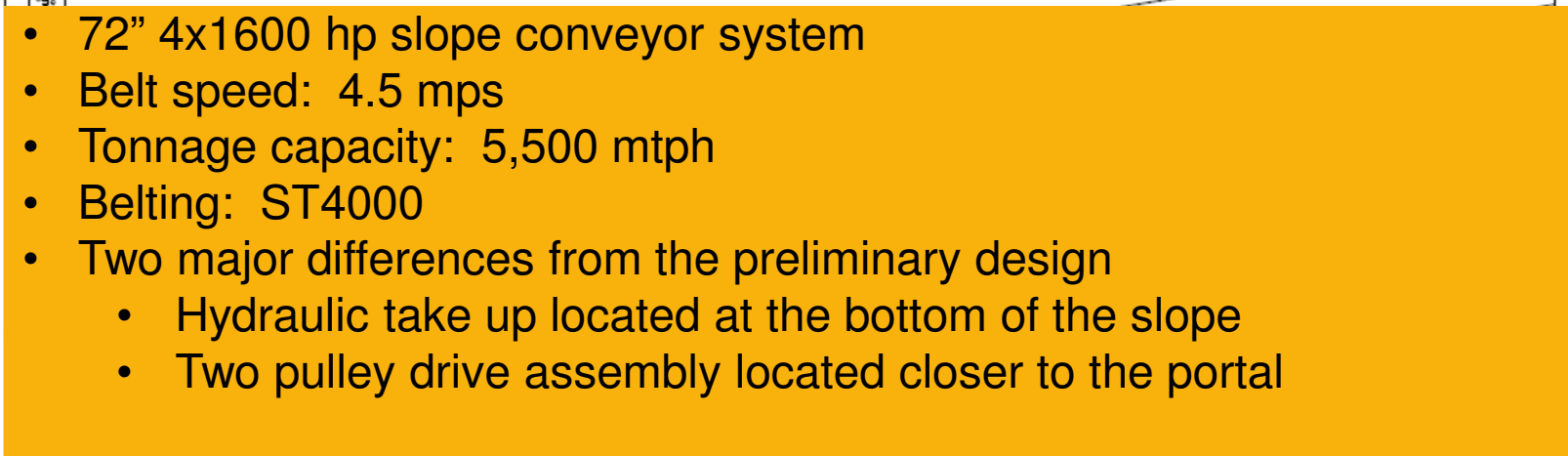
Slope Schematic – Hydraulic Take Up Option



Caterpillar Proposed Drive Layout

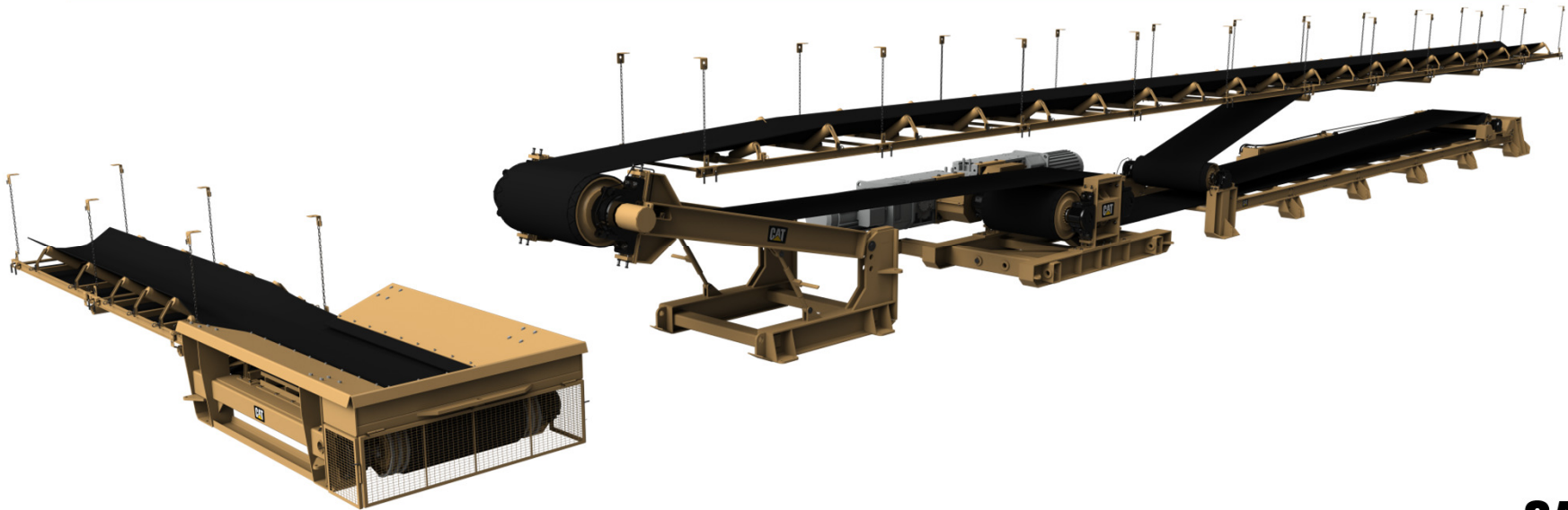


- Advantages
 - Lower cost drive solution
 - Eliminate the need for a high tension bend pulley
 - Eliminate the need for a drive truss frame
- Disadvantages
 - Primary drive pulley is driving the 'dirty' side of the belt
 - Requires good preventative maintenance procedures with belt cleaners



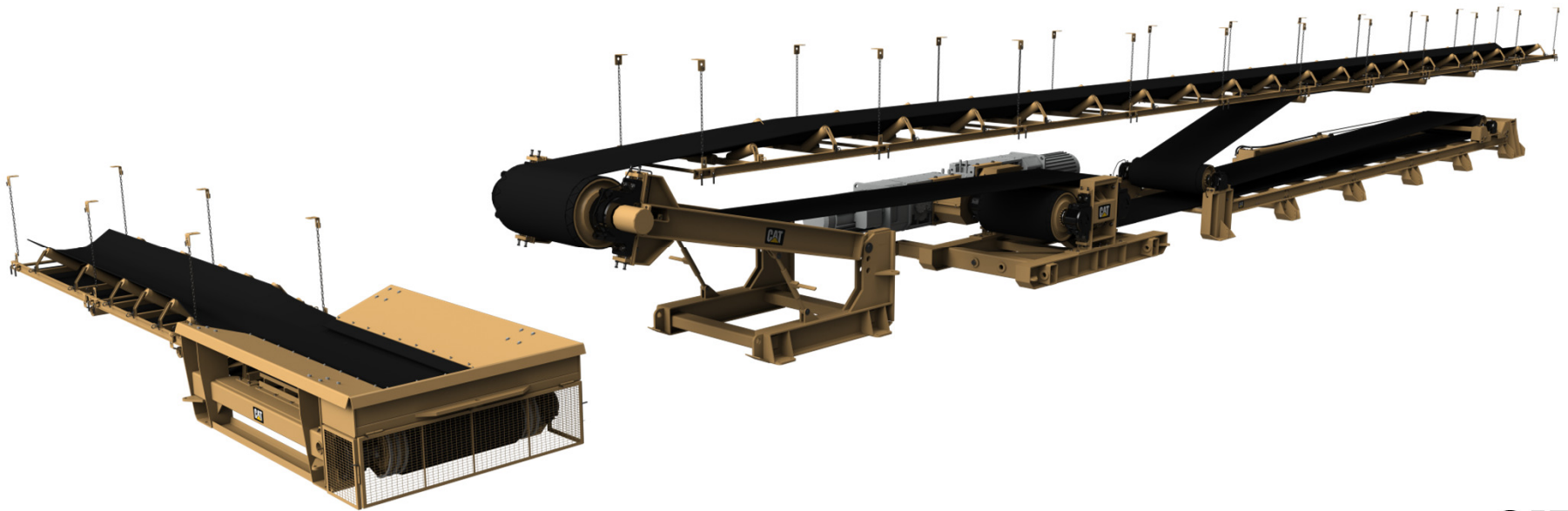
Collaborative Effort With Operator

- Jointly reviewed preliminary design options
- Discussed design concerns with preliminary slope layout drawing
- Discussed advantages and disadvantages of Caterpillar proposed slope design
- Discussed mine layout and mining plans
 - Two longwall panels mining two separate seams located on different levels in the mine (omitted from preliminary specifications)
 - Two separate main line conveyors transferring ROM coal onto the tail of the slope conveyor at different angles (omitted from preliminary specifications)



Summary

- Operator pleased with design review and proposed slope conveyor design
- Collaborative effort between Caterpillar and operator proved to be successful
- Agreed upon slope conveyor design that operator will use for the request for bid package
- Operator believes that because of this collaborative effort, the bid review process will be more efficient



Wherever there's mining, you'll find Caterpillar. Cat products are hard at work around the world — drilling and digging, loading and hauling, grading and dozing. And our people are there, too — supporting our products, training operators, helping customers mine safely and more profitably, and actively participating in the global mining industry.

WHEREVER THERE'S MINING, WE'RE THERE.