DSI OVERLAND CONVEYORS

BACKGROUND AND QUALIFICATIONS

Dos Santos International, LLC is well qualified to engineer and supply the most complicated high powered high-tech conveyors systems. We have extensive experience in analysis and design of high-tech conveyors of all types, utilizing our ***ExConTec*** proprietary analysis program. The writer's work has included engineering, supply, commissioning, and field testing and monitoring of new and existing complex slope belts, overland and downhill conveyor systems throughout North America, South America and in Europe. These have featured:

- Decisively regenerative drives with backup braking systems
- Flywheels with braking
- Booster drives, of the tripper type as well as the belt-on-belt type, with and without belt tension feedback and control
- Two-way conveying (carrying material on both the upper and return belt strands) with;
- Multiple horizontal and vertical curves

We are pleased to attach select tables and fliers that highlight the DSI capability:

1. Flier; DSI ***ExConTec*** Expanded Conveyor Technology (DSI in-house proprietary analysis program)
2. Table; DSI ***ExConTec*** Projects list (since 1998)
3. Table; J. A. Dos Santos Conveyor Projects (pre 1998)
4. Flier; DSI ***ExConTec*** at USM (Overland Conveyor System)
5. Flier; DSI ***ExConTec*** at Essroc (Two-Way Conveyor)
6. Flier; DSI ***ExConTec*** at TECO (Dock Conveyor with Tripper)
7. Flier; DSI ***ExConTec*** at Los Filos Overland Conveyor System

We look forward to the opportunity to discuss with you in detail the various installations listed and described and their relevance to your particular project.

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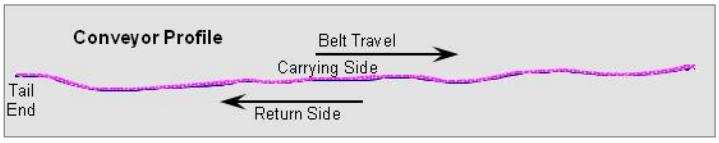
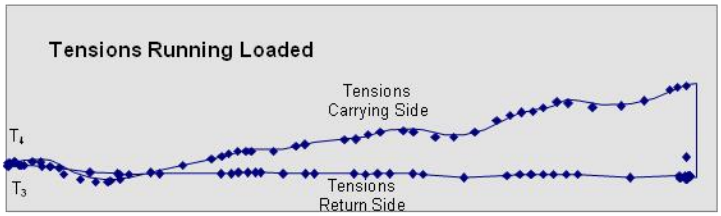
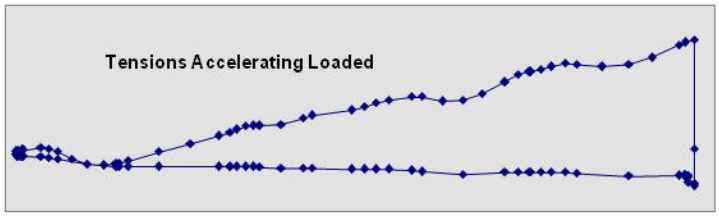
DSI EXPANDED CONVEYOR TECHNOLOGY

DSI ExConTec

More than an analysis tool, the **DSI Expanded Conveyor Technology** reflects a philosophy. Our comprehensive approach takes the conventional conveyor technology beyond the currently perceived limits. Utilizing derived load equivalents we are first to address and predict the extra flexural and shear resistances along vertical and horizontal curves. Our analysis models and software incorporate added features including the "Engineers Discretionary Factors", an allowance for incorporating the results of field testing or simply our client's philosophy.

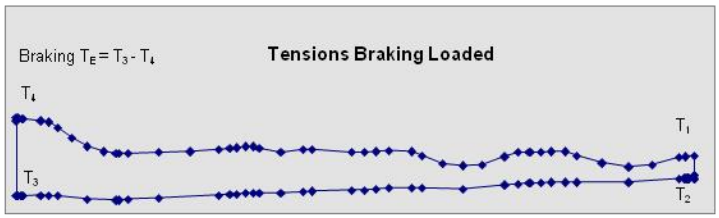


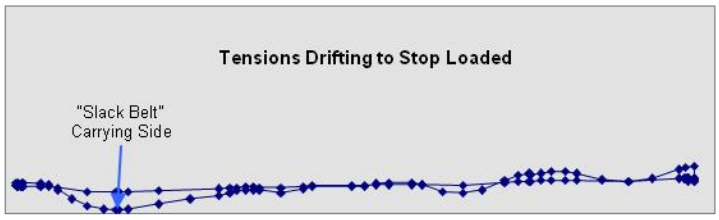




Material	coal		Belt Width	36	inches
- Density	55	pcf	Belt Speed	600	fpm
Conveying Rate	850	stph	Tension Rating	1000	PIW
CEMA Sct. 20° Sur.	0.980	Sq. ft.	Amb. Temperature	0	Deg. F
% CEMA Load	87.5	%	Temperature Factor	1.35	

	Tensions Summary				
	Running (lbs)	Empty (lbs)	Accel (lbs)	Brake (lbs)	Drift (lbs)
T1	31096.9	20014.1	41951.0	4369.4	11466.4
T2	8208.3	7877.4	6482.0	22362.9	8512.2
Tmax	31096.9	20014.1	41951.0	23009.4	11466.4
PIW	863.8	555.9	1165.3	639.2	318.5
Accel/Decel Time (secs)	N/A	N/A	19.5	6.9	10.6
Shaft HP	421.6	224.9	682.5	-327.3	0.0
7.0% Losses	29.5	15.7	47.8	22.9	0.0
Motor(+)/Brake(-) HP	451.1	240.7	730.3	-304.4	0.0
Selected Motor HP	525	525	525	525	525
NODE 1, T-U Tens. (lbs)	8500	8500	8500	8500	8500
Conveyor Stretch (ft)	30.3	27.5	39.4	23.2	14.9
Take-Up Stretch (ft)	15.1	13.8	19.7	11.6	7.4





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Special Features of the DSI ExConTec

1. Each run produces a complete tension and power analysis under steady state, starting and stopping conditions. Stopping is by braking and by drifting. Starting and stopping analyses utilize rigid body dynamics.

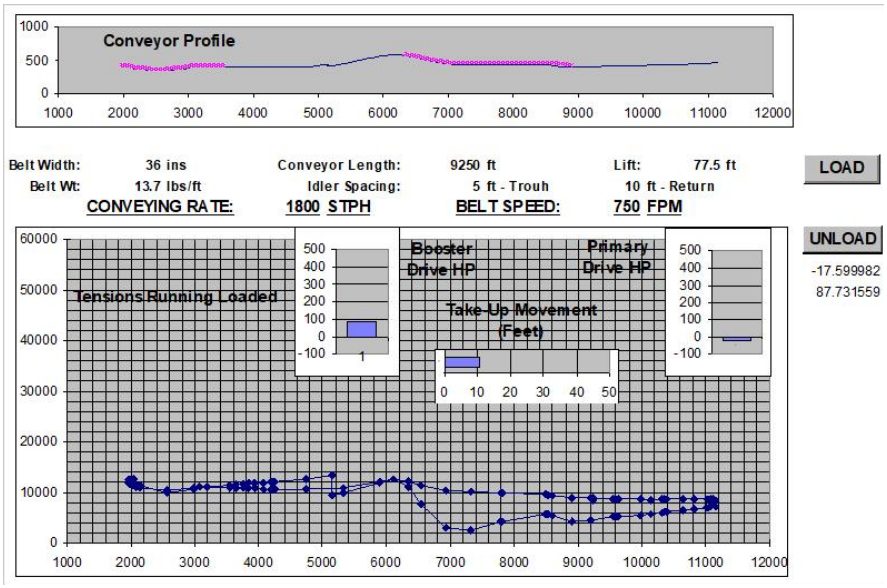
2. Sequential runs, using macros, allow real time analysis and graphical display of changing load conditions including load-on, trailing-off and any discontinuity of material flow. This feature allows us to spot, quickly, the aggravations of flow discontinuities.

3. Virtual material loads, or "load equivalents" are used to account for belt line resistances associated with the curving profile or plan of the conveyor line. These (previously unaccounted for) resistances become significant at horizontal curves where the effect is always increased resistance.

4. Ky, flex and shear resistance factors differ from CEMA reflecting DSI experience and philosophy.

5. In the analysis, belt tension becomes negative (compressive) when it drops below 0. This, though not realistic (as belt becomes slack), allows continued analysis indicating the tension increase required to correct the slack belt problem.

6. An in-put section entitled "Discretion by Responsible Engineer" offers the user an opportunity to affect the analysis by use of adjustment factors on the Ky and Kx values and on the terminal resistances. These factors can be used to alter the results according to known characteristics of the conveyors being analyzed, to reflect the user's design philosophy or to achieve matching of field monitored data.



Real time analysis quickly reveals the tension and power aggravations due to flow discontinuity at overland covneyor with “smart” booster drive.

Discretion by Responsible Engineer:					
	Ky Adjust:	0.83	Input	0.83	Default
	Kx Adjust:	1.5	Input	1.5	Default
RUN	Term. Adj.:		Input	1	Default
	T-U Tension	8400	lbs	AT NODE 1	

Discretionary input factors can reflect the customer’s experience and engineering philosophy.

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DSI ExConTec Projects

	Company / Location	System	Material/ Rate	Belt Width/ Speed	Length	Net Lift	Max Lift	Drives/ Brakes	Year
			(t/h)	(mm)/(m/s)	(m)	(m)	(m)	(kW)/ (kN)	
1	US Steel Mining /AL, USA	OL Conveyor 3-Flight System. Each Flight has Dual Pulley Drive, Head End, Remote							1999
		Flt 1	Coal / 1270	914 / 3.8	2812	23.5	73.1	298+224 / ---	
		Flt 2		914 / 3.8	2628	19.2	52.4	298+224/ ---	
		Flt 3		914 / 3.8	2751	23.5	37.8	298+224/ ---	
					8191			**1566 kW**	
2	Troy Belt / NY, USA	OL Conveyor, U-Profile, with Single Pulley Remote Drive, Tail Pulley Brake							1999
			Stone / 1134	1219 / 1.8	1180	- 3.1	- 35.4	149/ 35.6	
3	Acadia Equip / Ont, CN	OL Conveyor with 2-Horiz Curves, Dual Pulley Drive, Head End, Remote							2000
			Slag / 2722	1219 / 3.1	1363	4.0	4.0	2@224/ ---	
4	AIMCOR/ TX, USA	OL Pipe Conv, Dual Hd Dr, Tail Take-Up, Auto Hyd Winch, 3 Horiz Curves							2000
			Coke / 500	Ø305/ 4.3	914	6.7	6.7	280/ ---	
5	Acadia Equip / Ont, CN	Underground Slope Conveyor, Single Head Pulley Drive							2001
			Ore / 1451	1067 / 2.7	579	105.4	105.4	597/ ---	
6	Cherry Hill Construction / MD, USA	OL Conveyor 5-Flight System. Each has Single Pulley Drive, Head End, Remote							2002
		Flt 1	Soil / 1592	914 / 3.9	549	10.4	10.4	187/ ---	
		Flt 2		914 / 3.7	626	1.2	1.2	149/ ---	
		Flt 3		914 / 3.8	938	1.2	1.2	187/ ---	
		Flt 4		914 / 3.2	789	1.2	4.6	187/ ---	
		Flt 5		914 / 3.1	359	1.2	1.2	112/ ---	
					3261			**822 kW**	
7	BMH Systems / Ont, CN	Underground Load-out Conveyor, Dual Pulley Drive, Head End, Remote							2002
			Ore / 703	1067 / 2.5	709	127.3	127.3	2@224/ ---	
8	Continental Conveyor and Machine Works / Que, CN	Two-Way OL Conveyor, Horizontally Curving (9 horiz curves compounded by numerous vertical curves), with Smart and Natural Booster (Intermediate) Drives at Carrying and Return, Carrying Limestone from Quarry to Cement Plant #1, Returning Clinker to Cement Plants #2 & #3							2003
		Carry	Stone / 1320	1067 / 3.4	2752	46.8	57.8	298 Smart Booster 298+149 Dual Hd	
		Return	Clinker/ 420					149 Dumb Booster	
								894 kW	
9	BMH Systems / Ont, CN	Underground Load-out Conveyor, Single Pulley Head Drive							2003
			Ore / 200	1067 / 1.6	1216	180	180	187/ ---	

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DSI ExConTec Projects continued

	Company / Location	System	Material/ Rate	Belt Width/ Speed	Length	Net Lift	Max Lift	Drives/ Brakes	Year
			(t/h)	(mm)/(m/s)	(m)	(m)	(m)	(kW)/ (kN)	
10	TECO Terminal / LA, USA	Tripped Dock Conveyor to Shiploader, Dual Pulley Remote Drive							2003
			Coal / 6845	1829 / 4.5	430	8	8	522/ ---	
11	Bonem Corp / Ont, CN	Reclaim Conveyor with Single-Head Pulley Drive, Tail Take-Up, Horizontal Gravity							2004
			Ni-Cu /2550	1067 / 2.6	342	9.9	9.9	186 / ---	
12	Bonem Corp / Ont, CN	Tripper Conveyor, with Single-Head Pulley Drive, Gravity Take-Up, Remote							2004
			Ni-Cu / 400	762 / 1.4	414	23.4	23.4	75/---	
13	Energy Assoc/ NJ, USA	OL Pipe Conv, Dual Hd Dr.+Single Tail Drive, Tail Take-Up, Horiz. Gravity, 2 Horiz Curves							2004
			Alum / 800	Ø440 / 2.6	1800	-25	-25	3@ 150/ ---	
14	Pinnoak /AL, USA	Underground Slope Conveyor, Single Head Pulley Drive, Tail Take-Up, Horizontal Gravity							2005
			Coal / 2413	1524 / 3.4	1194	361	361	2@1865/ ---	
15	Bonem Corp / Ont, CN	Underground Slope Conveyor, Dual Pulley Drive at Head, Tail Take-Up, Horizontal Gravity							2005
			Sulfide /703	1067 / 2.5	710	127.3	127.3	2@224 / ---	
16	Goldcorp, Los Filos Gold Mine/ Mezcala, MX	8-Flight Overland Conveyor System, 6-Downhill-Regen, 3/w Horizontal Curves							2009
		Flt 1	Au Ore/1043	914 / 2.3	41.2	5.5	5.5	44.7 / ---	
		Flt 2		914 / 2.3	248	26.5	26.5	149 / ---	
		Flt 3		1219 / 1.2	213	-20.9	-20.9	Regen 44.7 / 17.9	
		Flt 4		914 / 2.3	243	-24.6	-24.6	Regen 74.6 / 34.5	
		Flt 5		914 / 2.3	476	-43.7	-43.7	Regen 149 / 63.7	
		Flt 6		914 / 2.3	201	-14.3	-14.3	Regen 44.7 / 21.4	
		Flt 7		914 / 2.3	84.5	-9.8	-9.8	Regen 44.7 / 13.3	
		Flt 8		914 / 2.3	148	-4.1	-4.1	Regen 44.7 / 8.3	
					1655			**596 kW**	
17	HSGP Project Abu Dhabi, UAE		9-Flight Conveyor System						2012
		5010CV0101/0201	Sulphur/840	1000 / 2.7	219.7	9.0	9.0	110 / ---	
		5010CV0102/0202	Sulphur/4000	2200 / 2.5	653.2	26.8	26.8	710 / ---	
		5015CV1001	Sulphur/4000	2200 / 2.5	238.7	20.3	20.3	400 / ---	
		5015CV0101/0201	Sulphur/2000	2200 / 0.9	13.4	0	0	110 / ---	
		7015CV1100/1200	Sulphur/2000	2200 / 0.9	17.7	0	0	110 / ---	
					2047			**2480 kW**	

DOS SANTOS INTERNATIONAL

DSI ExConTec Projects continued

	Company / Location		System	Material/ Rate	Belt Width/ Speed	Length	Net Lift	Max Lift	Drives/ Brakes	Year
			(t/h)		(mm)/(m/s)	(m)	(m)	(m)	(kW)/ (kN)	
18	SHAH Project Abu Dhabi, UAE		7-Flight Conveyor System							2013
		7010CV1100		Sulphur/720	1000 / 2.4	218.1	7.2	7.2	110 / ---	
		7010CV1200		Sulphur/720	1000 / 2.4	216.3	7.3	7.3	110 / ---	
		7010CV2100		Sulphur/4000	2200 / 2.5	706.4	26.8	26.8	710 / ---	
		7010CV2200		Sulphur/4000	2200 / 2.5	687.6	26.3	26.3	710 / ---	
		7015CV1100/1200		Sulphur/2000	2200 / 0.9	13.4	0	0	110 / ---	
		7015CV1300		Sulphur/4000	2200 / 2.5	238.7	20.4	20.4	500 / ---	
						2094			**2360 kW**	
19	Newcrest Mining, Dome Mine, WA, Australia		2-Flight Underground Collecting Conveyor System, Flight 2 with Trip Type Booster							2013
			Flt 1	Au Ore/2000	1200 / 2.5	785.5	37.0	37.0	355 / ---	
			Flt 2		1200 / 3.0	1974.8	371.9	371.9	2600 / ---	
						2760			**2955 kW**	
20	Ma'aden Gold, Kuwait		2-Flight Underground Collecting Conveyor System, Flight 2 with Trip Type Booster							2013
			CV002	Au Ore/451	900 / 1.0	2042	44.8	44.8	110 / ---	
			CV003		900 / 1.0	19.3	0	0	7.5 / ---	
						2061			**117.5 kW**	
21	Hansen Aggregates at Lindisfarne Quarry, Hobart, Tasmania		4-Flight Downhill-Regen Conveyor System							2013
			Flt 1	Dolomite/ 450	900 / 1.2	135	-30.2	-30.2	37 / ---	
			Flt 2		900 / 1.2	352	-62.8	-62.8	75 / ---	
			Flt 3		900 / 1.2	185	-30.9	-30.9	37 / ---	
			Flt 4		900 / 1.2	158	-0.2	-0.2	22 / ---	
						830			**171 kW**	

DOS SANTOS OVERLAND CONVEYORS

PRE 1998 PROJECTS:

	Company / Location	System	Material/ Rate (t/h)	Belt Wdth (mm)	Length (m)	Drives/ Brakes	Year
1	Zinc Mine / TN, USA	Underground Slope Conveyor					1993
		Single Flight	Zinc Ore / 227	914	1591	Single Pulley Head/Remote Drive	
2	Phosphate Mine / Venezuela	Overland Conveyor system, Decisively-Downhill Regenerative System					1993
		6 Flights	Phosph. Rock / 735	762	2279	Single Pulley Tail Drives / L S Disc, Caliper Brakes	
3	Coal Mine / AL, USA	Underground Slope Conveyor, Dual Pulley Drive, Head End, Remote, Tail Take-Up					1993
		Single Flight	Coal / 4990	1828	1356	4@1492 kW=5968 kW	
4	Coal Mine / Columbia	Overland Conveyor					1994
		2 Flights	Coal / 1451	1524	1652		
5	Dam Constr / CA, USA	Overland Conveyor, Alluvial Fill System, with Tripper-Booster drive at Flight 6					1995
		6 Flights	Alluvium / 1089	914	4663	448 kW Head Dr, 224 kW Tripper-Booster Dr.	
6	Dam Constr / CA, USA	Overland Conveyor, Rock Fill System, with Tripper-Booster drive at Flight 4					1995
		4 Flights	Rock / 2177	1219	3200	896 kW Head Dr., 448 kW Tripper-Booster Dr.	
7	Copper Mine / East Europe	Overland Conveyor, with Single Head Drive and three (3) Tripper Boosters					1997
		Single Flight	Overburden / 4700	1600	2786	1000 kW Head Dr., 3@1000 kW Tripper Booster Dr's= 4000 kW	

ExConTec at USM

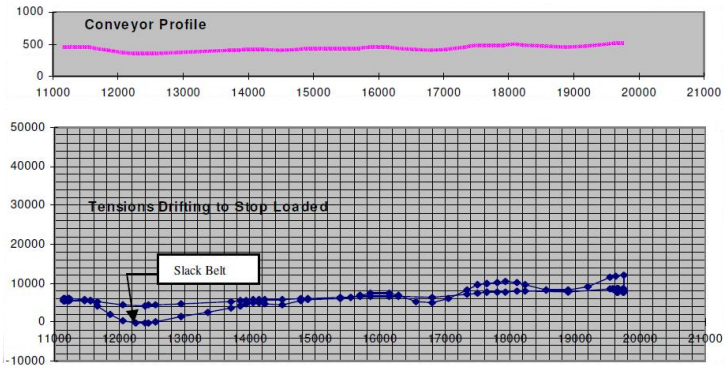
ORIGIN OF EXCONTEC COMPUTER PROGRAM

The **Expanded Conveyor Technology - *ExConTec*** Computer Simulation and Analysis Program was developed furing the 1998 Conveyor System Upgrade Study for U.S. Steel Mining at the Oak Grove (underground) Coal Mine, Adger, Alabama USA.

OVERLAND CONVEYOR SYSTEM

Project Description

The three-flight, 8.3 kilometer, coal conveying system, operating since 1974, delivers coal from the Oak Grove Mine - slope belt to the Concord preparation plant, near Oak Grove Alabama, USA. The system was designed for a continuous rate of 771 t/h. Actual conveying rates between 907 and 998 t/h and projected increase in mine production underscored the need to upgrade the system. The upgraded design was to deliver up to 1270 t/h continuously. Problems of the current system must be resolved as part of and prerequisite to the upgrade. Particularly, problems of slack belt when drifting, loaded, have persisted at OL-2. Poor troughability of the high tension multi-ply fabric belt, of only 914mm belt width, resulted in poor idler roll contact, when running empty, and poor belt alignment, at all three conveyor flights.



OL-2 belt went slack every time it stopped under load.

Dos Santos International was contracted to thoroughly analyze the current system summarize the operating limits; make recommendations for improving the current system, and make recommendations for upgrade to 1270 t/h.

FIELD MONITORING AND ExConTec CALIBRATION

A natural part of any upgrade, DSI studied the performance, operations and maintenance history of the system including past modifications. Additionally DSI conducted a comprehensive field monitoring program. Initial ***ExConTec*** modeling and analysis produced results considered acceptable, when compared to field monitoring, but with behavioral discrepancies. The DSI ***ExConTec*** Program was developed with special features to address such discrepancies including discretionary factors that permit calibration of the analysis model to reflect actual performance. Calibration of the Program, using only Kx and Ky multipliers, produced very close correlation with

field monitoring of all three conveyor flights. The calibrated program could now predict accurately performance of the upgraded conveyors.

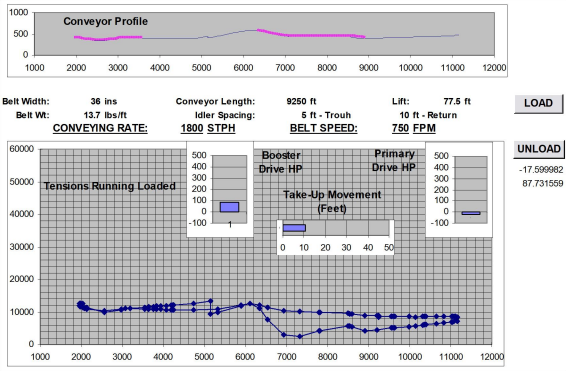
THE UPGRADED SYSTEM

With the calibrated ***–ExConTec*** Computer Simulation and Analysis Program DSI performed complete analysis and preliminary design of various upgrade configurations including; upgrade of the current head end driven system and; variations of tripper type booster driven systems, utilizing "Smart" booster as well as "Natural" booster scenarios. With a single booster drive strategically located at each conveyor flight maximum belt tensions could be mitigated, reducing the belt strength requirements, permitting a better troughing more trainable belt. Ironically, the "Smart" booster, with added controls, actually caused tension aggravations and regenerative driving at the head end of OL-1, under some transient loading conditions. This is shown graphically below. The Simpler "Natural" booster drive is a better solution in this case.

Ultimately, for lowest initial cost, the upgrade configuration chosen was the current head end driven system. Belt speed was increased along with the secondary drive power, of each conveyor flight. The Data Table (below) lists the parameters of the upgraded system. OL-2 slack belt problems were solved by appropriately increasing the take up tension.

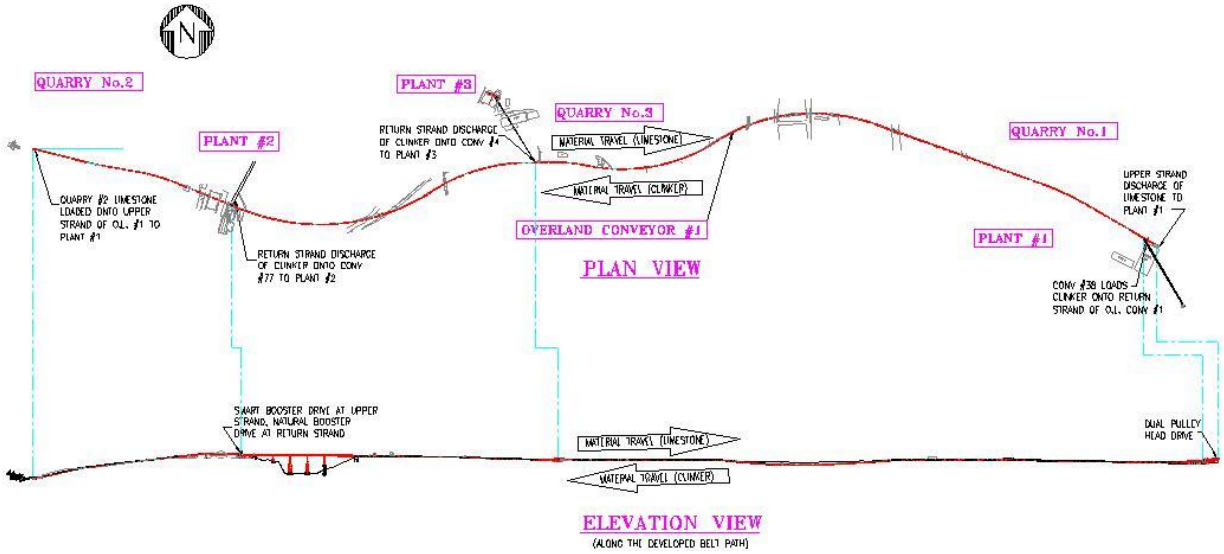
Additionally, Dos Santos International performed final and detailed design of modifications and reinforcements, required for the upgraded system.

Three (3) Flight Overland Conveyor System Upgrade at USM Oak Grove Mine			
	OL-1	OL-2	OL-3
Arrangement	--Wire rope type intermediate structure – --Belt turnovers--		
Material	Coal		
Design Rate	1270 t/h (1400 STPH)		
Conveying Angle	-12° to +15°	-13° to +8°	-11° to +12°
Length	2812 m (9226')	2628 m (8622')	2904 m (9526')
Lift - Net - Max	23.5 m (77') 73.1 m (240')	19.2 m (63') 52.4 m (172')	23.5 m (77') 37.8 m (124')
Belt Width	914 mm (36")		
Belt Speed	3.81 m/s (750 FPM)		
Drive - Primary - Secondary	298 kW (400 HP) 224 kW (300 HP)		
Inspection Drive	45 kW (60 HP) thru reducer		



Real time analysis reveals the tension and power aggravations to flow discontinuity at overland conveyor with "smart" booster drive.

ExConTec at Essroc



OVERLAND CONVEYOUR FOR CONTINENTAL CONVEYOR LTD, AT EASTERN USA CEMENT COMPANY

The 2.8 kilometer overland conveyor for an Easter USA Cement Company, depicted above, is the world's most advanced single flight conveyor system by virtue of the number of technologies featured, including:

- ✓ Two-way conveying, carrying crushed limestone, on the upper belt strand, and clinker on the return belt strand.
- ✓ Horizontally and vertically curving path featuring 9 horizontal curves, each with compound vertical curves.
- ✓ Belt turnovers, to utilized the thicker belt cover at the carrying side in either travel direction.
- ✓ Complete speed control with AC motors by variable frequency drives.
- ✓ Tripper type "Smart" booster (intermediate) drive at the upper belt strand.
- ✓ Tripper type "Natural" booster drive at the return strand.
- ✓ Multiple discharge points along the return strand.

The Data Table below lists the features and parameter of the Overland Conveyor.

PROJECT DESCRIPTION

The Customer needed to transport the limestone product of Quarry #2 to Cement Plant #1 and to distribute the Clinker from Plant #1 to Cement Plants #2 & #3. Significant savings could be realized by accomplishing these functions with a single, two-way conveyor but this required unprecedented combination of the latest technologies. Locations of Plants #2 & #3 along with topographical and right of way considerations dictated an irregular path including nine (9)

(relatively tight) horizontal curves which are compounded by continuously changing vertical curves.

CONTINENTAL CONVEYOR (ONTARIO) LTD, LEADER IN THE HORIZONTALLY CURVING CONVEYOR TECHNOLOGY

The challenge was entrusted to Continental Conveyor of Napanee Ontario and Thetford Mines Quebec, Canada. Continental Conveyor Ltd has demonstrated its leadership in the Horizontally Curving Conveyor Technology with many installations throughout North America. Their dedicated deep trough configuration and unique idler mounting system ensures reliable belt alignment, allowing fine adjustment of the super elevation angles including easy field adjustments during start-up and run-in.

This Conveyor presented additional special challenges in tension control, because of the tight horizontal curves and the numerous possible transient load conditions. Drive distribution along the beltline, by tripper type booster drives facilitates good tension control. The “Smart” booster at the carrying side will limit its out-put, only when required, to preclude a local low tension condition.

DSI ExConTec

Subsequent to final design Continental Conveyor Ltd chose Dos Santos International to perform a detailed comparative analysis using the **Expanded Conveyor Technology – *ExConTec*** Computer Simulation and Analysis Program. The ***ExConTec*** program is extremely versatile, with no intrinsic limitation on material carrying path or preference for location of drive, braking, or tensioning (take-up) stations. “Load” and “Unload” (Macro) buttons permit real time analysis of real loading conditions including loading on, trailing off of either or both carrying strands and any load discontinuities that will most aggravate the belt tension distribution. ***ExConTec*** also features expanded equations to account for the increased belt line resistance of induced curvature. The ***ExConTec*** discretionary factors permit calibration of the analysis model to reflect the experience and philosophy of the experts at Continental Conveyor Ltd.

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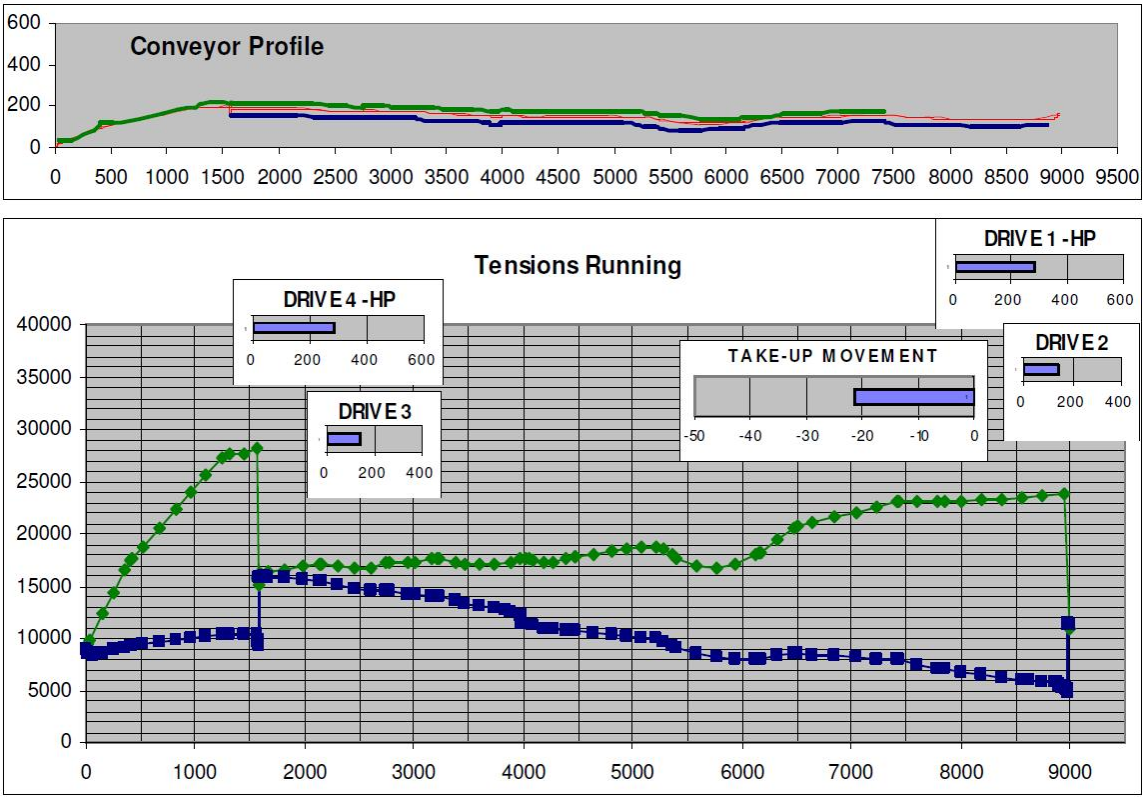
Two-Way Overland Conveyor		
	Upper Belt Strand	**Lower Belt Strand**
Material	Limestone	Clinker
Design Rate	1320 t/h (1455 STPH)	420 t/h (463 STPH)
Belt Width	1067 mm (42")	
Belt Speed	3.35 m/s (660 FPM)	
Lift Net	46.8 m (153.7')	14.7 m (48.1')
Length Overall	2752 m (9029')	
Load Path	2748 m (9014')	2225 m (7299')
Horizontal Curves Qty	9	9
Intermediate Discharges		2
Drive Power Distribution:	Smart Booster 298 kW (400 HP) Head Dual Pull 448 kW (600 HP) Total Upper 746 kW (1000 HP)	Natural Booster 149 kW (200 HP) Total Lower 149 kW (200 HP)



Real time analysis quickly reveals the tension and power distribution due to various material flow conditions at overland conveyor.

DSI EXPANDED CONVEYOR TECHNOLOGY

DSI ExConTec

C-6 Dock Conveyor At Transfer Terminal, Southern Louisiana, USA	
Material	Various Coals and Coke
Design Rate	6187 t/h (6820 STPH)
Peak Rate (Drives)	6845 t/h (7545 STPH)
Max Instant Rate	to 8000 t/h (8800 STPH)
Belt Width	1829 mm (72")
Belt Speed	4.55 m/s (895 FPM)
Lift	8.0 m (26.3')
Length	430 m (1409')
Drive Power	522 kW (700 HP)

DOCK CONVEYOR

The 1829 mm wide C-6 dock conveyor carries various types of coal and coke to the traveling shiploader. The coal feed comes from the storage yard, reclaimed by a bucket wheel type Stacker/Reclaimer (S/R) and from river barges which are unloaded by a bucket ladder type continuous barge unloader (CBU). The material is delivered to the shiploader by a belt tripper. The tripper location may be anywhere along the dock length as the shiploader travels to position its loading boom over each of the ship's holds. When the S/R and CBU are both working peak feed rates can exceed 8000 t/h.

Operating since 1983 the C-6 dock conveyor has experienced a slack belt condition when stopping loaded. Occasionally, under very heavy loading, the carrying belt has doubled over on itself when drifting to a stop.

The Data table (above) lists features and parameters of the C-6 dock conveyor.

PROJECT DESCRIPTION

Aware of the latest technologies in modeling, simulation and analysis of belt conveyors (which were not commonly used in the early 1980's) the customer decided to do a complete analysis of the C-6 conveyor and to determine the best solution for the slack belt problem.

DSI ExConTec

Dos Santos International was chosen to perform a detailed analysis of the C-6 dock conveyor and to recommend a solution to the slack belt problem.

Dos Santos work at this The Transfer Terminal, in Southern Louisiana, USA, dates back to the mid 1970's and has been steady throughout the late 1990's continuing to the present (2003). DSI familiarity with the terminal and all of its equipment complimented the Dos Santos reputation in the high-tech conveying field making DSI the logical choice.

Detailed conveyor analysis, using the Expanded Conveyor Technology ***ExConTec*** Computer Simulation and Analysis Program, is able to predict the slack belt condition. This is by rigid body dynamics, which determines the distribution of the inertial forces, superimposing these on the travel resistance forces as the conveyor drifts to a stop. The ***ExConTec*** program is extremely versatile, with no intrinsic limitation on material carrying path or preference for location of drive, braking, or tensioning (take-up) stations. "Load" and "Unload" (Macro) buttons permit real time analysis of real loading conditions including loading on, trailing off and any load discontinuities that will most aggravate the belt tension distribution. ***ExConTec*** also features expanded equations to account for the increased belt line resistance of induced curvature. The ***ExConTec*** discretionary factors permit calibration of the analysis model to reflect the experience and philosophy of The Terminal Operations including power monitoring of the C-6 dock conveyor.

DSI EXPANDED CONVEYOR TECHNOLOGY

DSI ExConTec

LOS FILOS PROJECT DESCRIPTION

Goldcorp's Los Filos Gold Mine, near Mezcala, Gerrero, Mexico, is a heap leach operation. The ore is trucked from the mountain top open pit mine to the crushing plant where it is reduced to 50mm (2") minus. From the crushing plant the ore is hauled down the hill, to the valley where it is stacked on engineered pads for leaching by a cyanide solution. The gold is then precipitated from the solution at the recovery plant.

A previous short-lived system conveyed the ore from the crushing plant to the leach pads via a glory hole ore pass and an underground conveyor, through the hill. Geological instability ultimately collapsed the ore pass, putting the transport system out of service only four months into its operation. Against this background, Dos Santos International was first contracted to supply a downhill sandwich belt high-angle conveyor to carry the ore over the same hill to the same destination. However, continued concerns with geological stability ultimately led Goldcorp to abandon the hill side as the haulage path.

Finally, a conventional overland conveyor system was developed to follow the already developed truck haulage ramps. The Dos Santos International proposal was chosen and DSI was awarded the Engineering and supply contract.

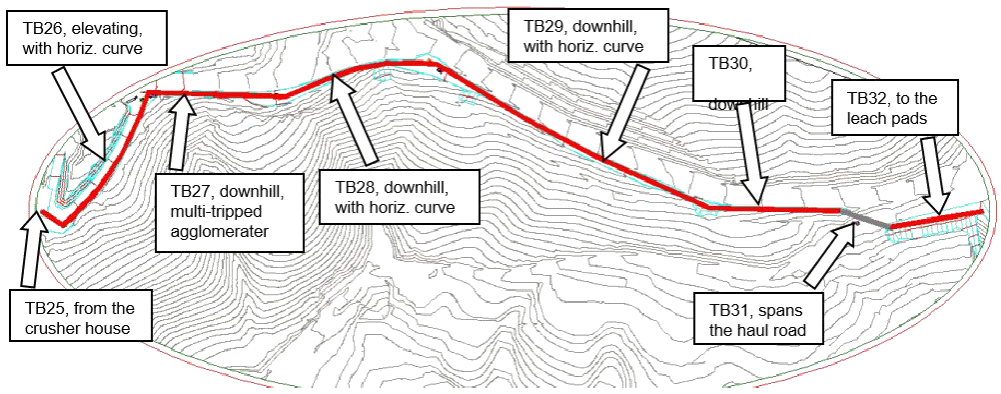
- The Dos Santos International proposal included two important commitments solely for the customer's benefit:
- DSI would maximize use of the conveying equipment and structure, already at the mine, from the collapsed and abandoned through-the-hill conveying system.

The awarded ten-flight system appeared to be a candidate for further rationalization and cost reduction, using horizontal curves to amalgamate successive conveyor flights. The DSI proposal included an amalgamation study as the first order of business.

Both commitments were fulfilled reaping cost savings to the customer.

LOS FILOS OVERLAND CONVEYOR SYSTEM

DSI completed start up of the overland conveyor system in January of 2010.



Conveying on the Edge: The multi-flight overland system follows the haul road on the edge of a steep drop-off

Office/WhatsApp/SMS: +1 770 423 9895 • info@DosSantosIntl.com
DosSantosIntl.com • 531 Roselane St - Suite 810 • Marietta, GA 30060

DOS SANTOS
INTERNATIONAL

Overland Conveyor System, Los Filos Gold Mine, Mezcala, Guerrero, Mexico								
Description	TB25	TB26 Elev. w/ Horiz. Curve	TB27 Down-hill Agglomerator w/ 5-int. trips	TB28 Down-hill w/ Horiz. Curve	TB29 Down-hill w/ Horiz. Curve	TB30 Down-hill	TB31 Down-hill	TB32 Down-hill
Material	Gold Ore							
Design Rate	1043 t/h (1150 STPH)							
Belt Width	914mm (36")		1219mm (48")	914mm (36")				
Belt Speed	2.3m/s (445FPM)		1.2m/s (244FPM)	2.3m/s (445FPM)				
Lift (-Drop)	5.5 m	26.5 m	(-20.9) m	(-24.6) m	(-43.7) m	(-14.30 m	(-9.8) m	(-4.1) m
Length	41.2 m	248 m	213 m	243 m	476 m	201 m	84.5 m	148 m
R-Horiz Curve		400 m		300 m	1000 m			
Qty Int. Trips			5					
Drive Power	44.7 kW	149 kW	44.7 kW Regen	74.6 kW Regen	149 kW Regen	44.7 kW Regen	44.7 kW Regen	44.7 kW Regen
Brake Tension			17.9 kN	34.5 kN	63.7 kN	21.4 kN	13.3 kN	8.3 kN

The DSI expertise, including the ***DSI ExConTec*** complete analysis software, proved particularly advantageous. It facilitated the use of horizontal curves to simplify the system, reducing both capital and operating and maintenance costs. Additionally, the third conveyor flight, TB27 is especially engineered to accomplish the agglomeration by mixing through five intermediate tripped transfers. The enroute agglomeration, conceived by Goldcorp, results in substantial savings by eliminating the need for the additional agglomerating drum.

Looking up TB26

Looking up the Overland Path: From TB25 to TB26

The overland conveying path is predominantly downhill. While this presents the normal controlled starting and stopping problems, it also presents great savings opportunities. The downhill flights are decisively regenerative. The drive motors, now generators, feed power back into the grid that powers the other mine equipment. These carefully engineered conveyors are equipped with variable frequency drives to ensure operation at maximum efficiency.

Looking down the Overland Path: From the tail of TB27, the agglomerating conveyor.

Looking up TB28

Office/WhatsApp/SMS: +1 770 423 9895 • info@DosSantosIntl.com
DosSantosIntl.com • 531 Roselane St - Suite 810 • Marietta, GA 30060