EXCONTEC AT USM

ORIGIN OF *EXCONTEC* COMPUTER PROGRAM

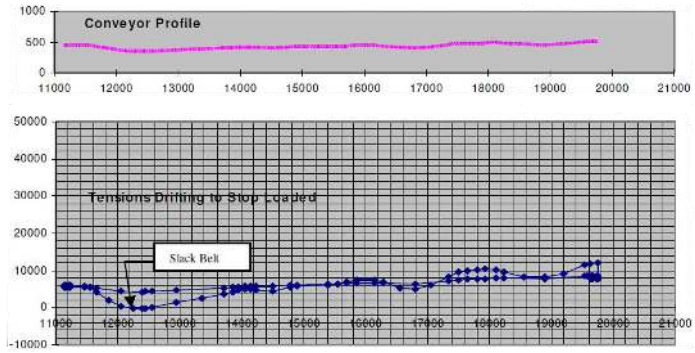
Origin of *ExConTec* Computer Program

The Expanded Conveyor Technology - *ExConTec* Computer Simulation and Analysis Program was developed during the 1998 conveyor system upgrade study for U.S. Steel Mining at the Oak Grove (underground) Coal Mine, Adger, AL 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, AL USA. They 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.



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

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 914 mm belt width, resulted in poor idler roll contact, when running empty and poor belt alignment, at all three conveyor flights.

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

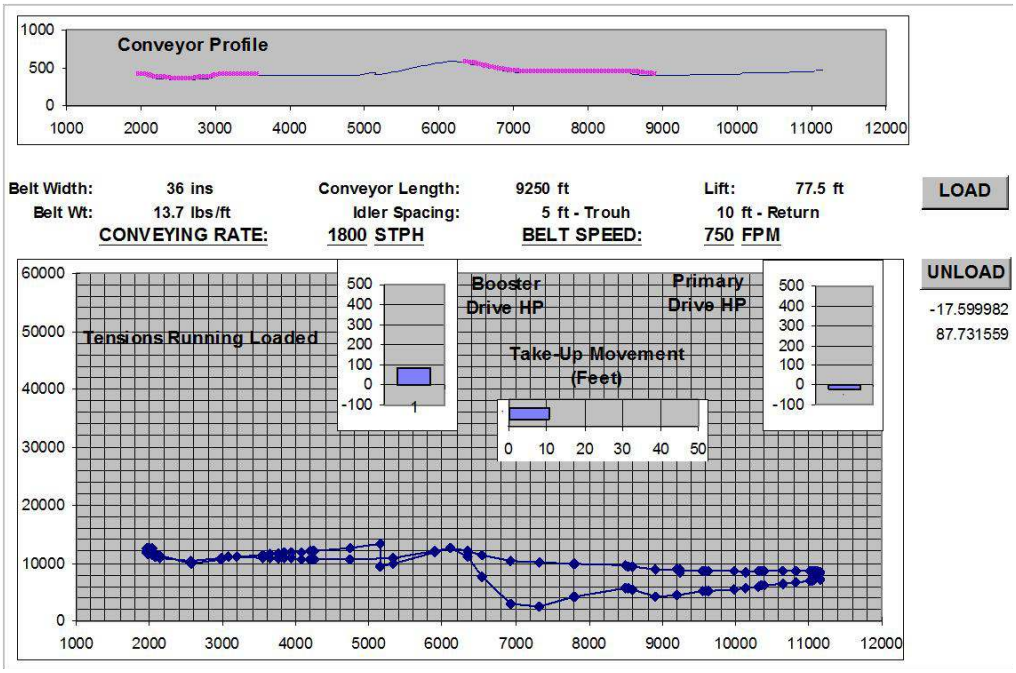
With the calibrated - *ExConTec* Computer Simulation and Analysis Program DSI performed complete analysis and preliminary design of various upgrade configurations including; upgrade of the current head end driven system and; variations of tripper type booster driven systems, utilizing “Smart” booster 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 tape up tension.

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

Three 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	23.5 m (77')	19.2 m (63')	23.5 m (77')
Lift - Max	73.1 m (240')	52.4 m (172')	37.8 m (124')
Belt Width	914 mm (36")		
Belt Speed	3.81 m/s (750 FPM)		
Drive - Primary	298 kW (400 HP)		
Drive Secondary	224 kW (300 HP)		
Inspection Drive	45 kW (60 HP) thru reducer		



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