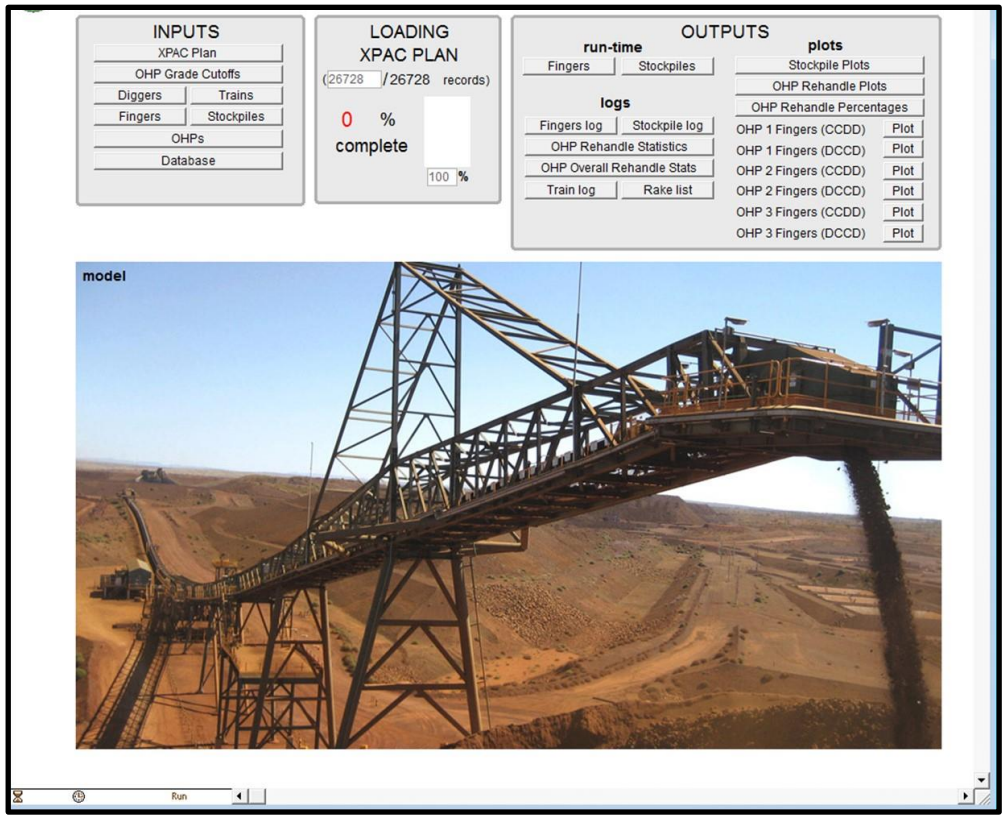
Moderate Complexity

Iron Ore: Grade Movement Model



Scope of Work

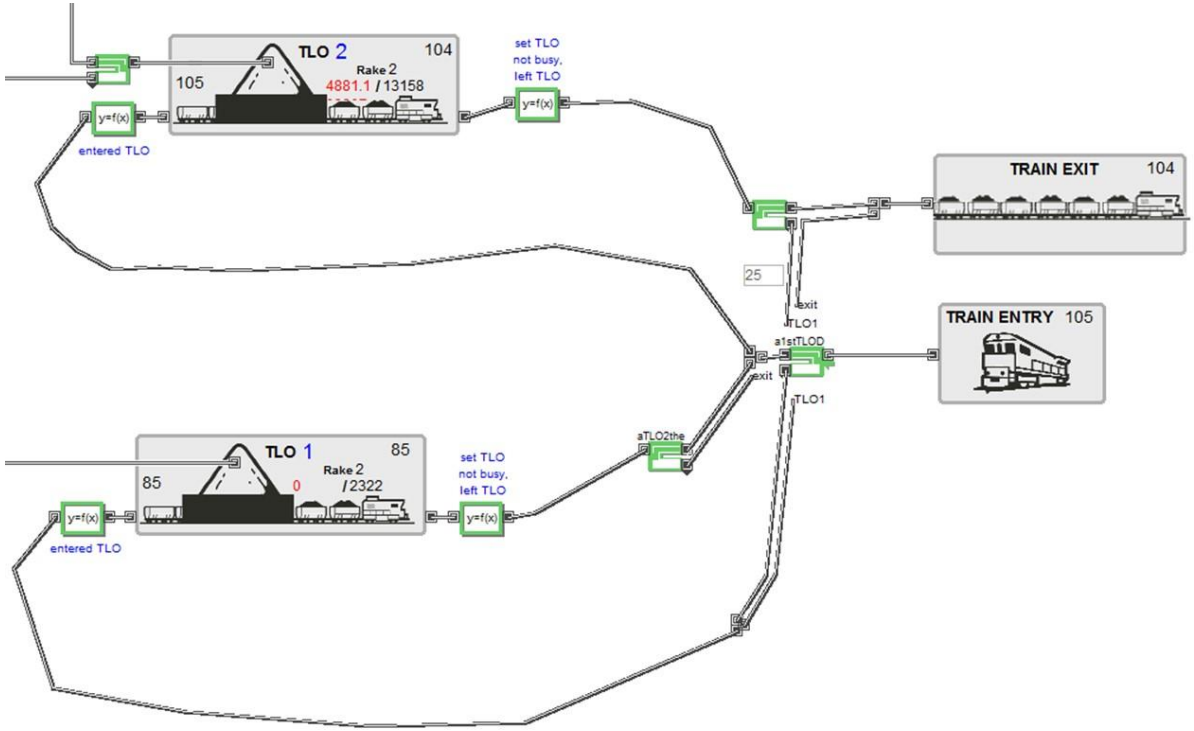
- Rob was contracted by mining company late in model development to finalise some key features of model development. Key features included:
  - Train generation
  - Information outputs

Deliverables

- Train generation
  - **Train Loadout.** Requirement was to check that percentages of trains assigned to types 1 and 2 matched the desired routing, plus change model to impact how trains appear at train load-out (TLO). A percentage of trains would bypass TLO1 and go direct to TLO2, while a greater percentage would be loaded at both TLO1 and TLO2.
  - **Rake Size.** Additional table field for Tonnes per car, Cars per rake and Rakes per train. Rake size calculated during simulation initialisation based on tonnes per car and cars per rake.
  - **Train Log.** A log of trains was coded into the model to verify both existing code as well as new programming.

Deliverables

- Train generation
  - **New pathways for trains.** Potential for alternate train routing testing was programmed into the model. Screenshot below shows pathway options for trains.



Deliverables

- Train generation
  - **Train Log.** Developed and coded into the model, screenshot below.

Example of train log (test data only):

Record #	train id	train type	identifier	num rakes	TLO2 then TLO1	entered TLO1	t entered TLO1	t waiting after TLO2 (hrs)	left TLO1	t left TLO1	time spent TLO1 (hrs)	entered TLO2	t entered TLO2	t waiting after TLO1 (hrs)	left TLO2	t left TLO2	time spent TLO2 (hrs)
1	1	2	BL 15% TLO1 85% TLO2	2	☐	☑	0.00		☑	5.47	5.47	☑	5.47	0.00	☑	39.03	33.56
2	2	2	BL 15% TLO1 85% TLO2	2	☐	☑	5.47		☑	10.47	5.01	☑	43.48	33.01	☑	47.27	3.79
3	3	1	TLO bypass	2	☐	☐			☐			☑	39.03		☑	43.48	4.46
4	4	1	TLO bypass	2	☐	☐			☐			☑	47.27		☑	51.73	4.46
5	5	1	TLO bypass	2	☐	☐			☐			☑	51.73		☑	56.19	4.46
6	6	2	BL 15% TLO1 85% TLO2	2	☐	☑	51.73		☑	53.74	2.01	☑	56.19	2.45	☑	59.98	3.79
7	7	1	TLO bypass	2	☐	☐			☐			☑	59.98		☑	75.42	15.43
8	8	2	BL 15% TLO1 85% TLO2	2	☐	☑	59.98		☑	61.99	2.01	☑	75.42	13.43	☑	79.21	3.79
9	9	1	TLO bypass	2	☐	☐			☐			☑	79.21		☑	83.66	4.46
10	10	2	BL 15% TLO1 85% TLO2	2	☐	☑	79.21		☑	81.21	2.01	☑	83.66	2.45	☑	87.45	3.79
11	11	2	BL 15% TLO1 85% TLO2	2	☐	☑	81.21		☑	83.66	2.45	☑	91.91	8.25	☑	95.70	3.79
12	12	2	BL 15% TLO1 85% TLO2	2	☐	☑	83.66		☑	91.91	8.25	☑	95.70	3.79	☑	99.49	3.79
13	13	1	TLO bypass	2	☐	☐			☐			☑	87.45		☑	91.91	4.46
14	14	2	BL 15% TLO1 85% TLO2	2	☐	☑	91.91		☑	95.70	3.79	☑	99.49	3.79	☑	113.00	13.51
15	15	2	BL 15% TLO1 85% TLO2	2	☐	☑	95.70		☑	99.49	3.79	☑	117.46	17.97	☑	121.25	3.79
16	16	2	BL 15% TLO1 85% TLO2	2	☐	☑	99.49		☑	117.46	17.97	☑	125.71	8.25	☑	129.50	3.79
17	17	1	TLO bypass	2	☐	☐			☐			☑	113.00		☑	117.46	4.46
18	18	2	BL 15% TLO1 85% TLO2	2	☐	☑	117.46		☑	125.71	8.25	☑	133.95	8.25	☑	148.54	14.59
19	19	1	TLO bypass	2	☐	☐			☐			☑	121.25		☑	125.71	4.46
20	20	1	TLO bypass	2	☐	☐			☐			☑	129.50		☑	133.95	4.46
21	21	1	TLO bypass	2	☐	☐			☐			☑	148.54		☑	153.00	4.46
22	22	2	BL 15% TLO1 85% TLO2	2	☐	☑	148.54		☑	150.55	2.01	☑	153.00	2.45	☑	156.79	3.79
23	23	2	BL 15% TLO1 85% TLO2	2	☐	☑	150.55		☑	153.00	2.45	☑	156.79	3.79	☑	160.58	3.79
24	24	2	BL 15% TLO1 85% TLO2	2	☐	☑	153.00		☑	156.79	3.79	☑	160.58	3.79	☑	164.37	3.79
25	25	2	BL 15% TLO1 85% TLO2	2	☐	☑	156.79		☑	160.58	3.79	☑	168.83	8.25	☑	172.62	3.79
26	26	2	BL 15% TLO1 85% TLO2	2	☐	☑	160.58		☑	168.83	8.25	☑	181.46	12.63	☑	185.25	3.79
27	27	1	TLO bypass	2	☐	☐			☐			☑	164.37		☑	168.83	4.46
28	28	1	TLO bypass	2	☐	☐			☐			☑	172.62		☑	181.46	8.84
29	29	2	BL 15% TLO1 85% TLO2	2	☐	☑	172.62		☑	181.46	8.84	☑	189.71	8.25	☑	193.50	3.79
30	30	2	BL 15% TLO1 85% TLO2	2	☐	☑	181.46		☑	189.71	8.25	☑	193.50	3.79	☑	197.29	3.79
31	31	1	TLO bypass	2	☐	☐			☐			☑	185.25		☑	189.71	4.46
32	32	2	BL 15% TLO1 85% TLO2	2	☐	☑	189.71		☑	193.50	3.79	☑	197.29	3.79	☑	201.08	3.79
33	33	2	BL 15% TLO1 85% TLO2	2	☐	☑	193.50		☑	197.29	3.79	☑	215.68	18.39	☑	219.47	3.79
34	34	2	BL 15% TLO1 85% TLO2	2	☐	☑	197.29		☑	215.68	18.39	☑	223.92	8.25	☑	227.71	3.79
35	35	1	TLO bypass	2	☐	☐			☐			☑	201.08		☑	215.68	14.60
36	36	1	TLO bypass	2	☐	☐			☐			☑	219.47		☑	223.92	4.46
37	37	2	BL 15% TLO1 85% TLO2	2	☐	☑	219.47		☑	223.92	4.46	☑	232.17	8.25	☑	235.96	3.79
38	38	1	TLO bypass	2	☐	☐			☐			☑	227.71		☑	232.17	4.46
39	39	2	BL 15% TLO1 85% TLO2	2	☐	☑	227.71		☑	232.17	4.46	☑	235.96	3.79	☑	239.75	3.79

Deliverables

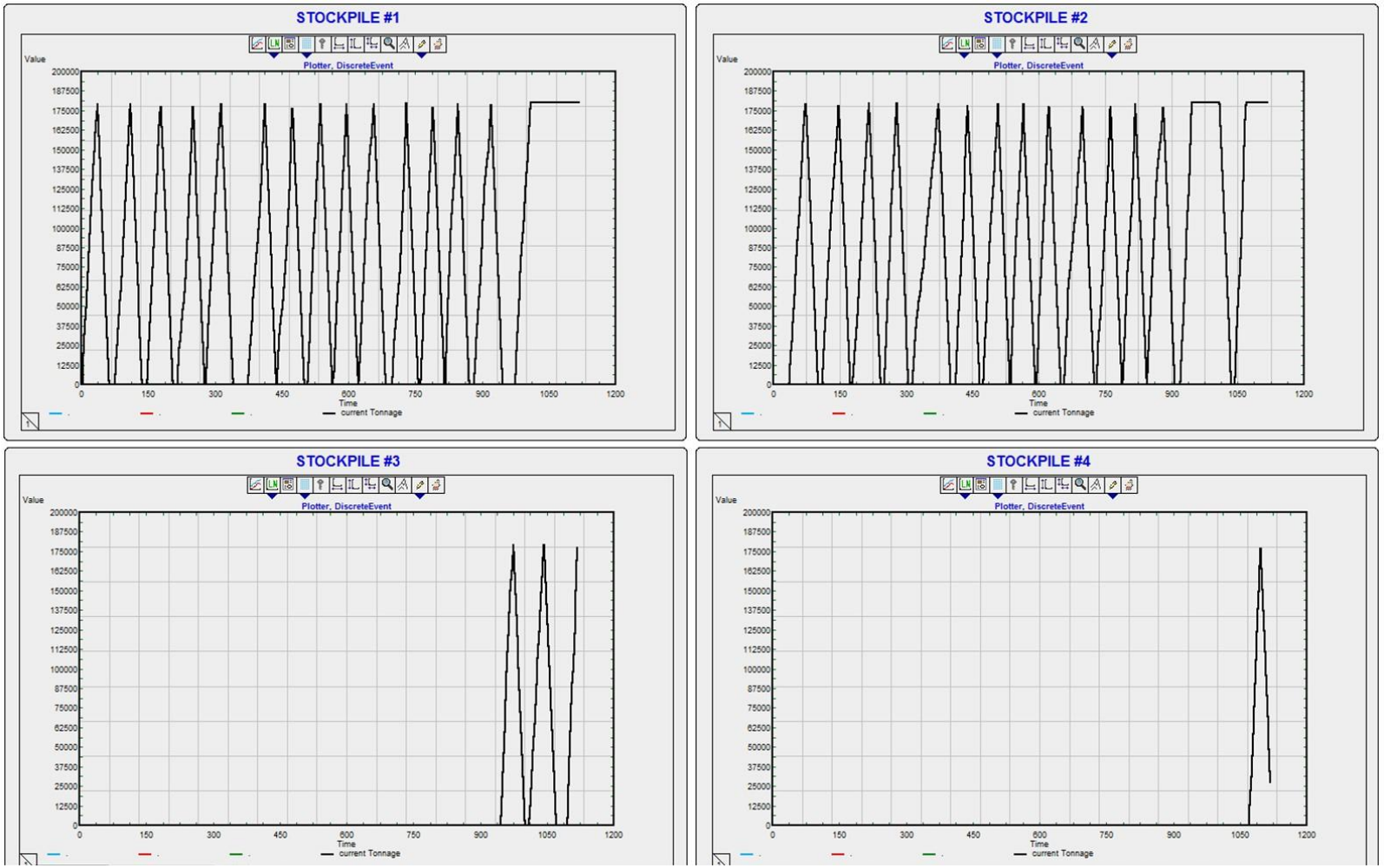
- Information outputs
  - **Rake list.** Include time railed, tonnes, Fe, P, SO2, Al2O3, LOI.
  - **Pre-crusher fingers.** Include lifecycle table, weighted average grade (WAG), plotters.
  - **Post-crusher stockpiles.** Include lifecycle table, WAG, plotters.
  - **Ore handling plant.** Include rehandle information, plotters.

Example of pre-crusher fingers log (test data only):

Record #	log id	finger #	OHP	Quadrant	build #	current size (T)	build (Y/N)	reclaim (Y/N)	Fe %	P %	SiO2 %	Al2O3 %	LOI %	Fe T	P T	SiO2 T	Al2O3 T	LOI T	build start	build end	build duration (hr)	wait time for loader (hr)	reclaim start	reclaim end	reclaim duration (hr)
1	1	25	OHP3	CCDD	1	0	☐	☐	57.53%	0.054%	4.79%	1.59%	10.85%	86873	82	7239	2407	16382	53.8	440.4	386.6	90.5	531.0	695.2	164.3
2	2	1	OHP1	CCDD	1	0	☐	☐	58.25%	0.043%	4.62%	1.53%	10.26%	87958	65	6969	2314	15489	120.8	662.7	541.9	0.0	662.7	827.0	164.3
3	3	7	OHP1	DCCD	1	0	☐	☐	57.65%	0.061%	4.76%	1.71%	10.68%	87047	92	7182	2580	16130	159.9	941.8	781.9	0.0	941.8	1106.0	164.3
4	4	31	OHP3	CCDD	1	0	☐	☐	57.49%	0.059%	4.36%	1.76%	11.04%	86808	89	6578	2663	16668	220.2	385.6	145.5	0.0	385.6	529.9	164.3
5	5	32	OHP3	DCCD	1	0	☐	☐	57.25%	0.053%	4.59%	1.79%	11.07%	86446	80	6935	2701	16717	386.0	461.3	95.2	235.0	696.3	860.5	164.3
6	6	13	OHP2	CCDD	1	99000	☑	☐	55.96%	0.041%	7.39%	3.24%	8.71%	55398	41	7312	3205	8625	432.1						
7	7	26	OHP3	CCDD	1	0	☐	☐	57.44%	0.049%	5.03%	1.78%	10.53%	86732	75	7599	2686	15895	440.9	543.6	102.7	318.1	861.6	1025.9	164.3
8	8	33	OHP3	DCCD	1	151000	☐	☐	56.20%	0.046%	5.88%	2.00%	11.18%	84858	70	8874	3013	16882	461.7	778.9	317.2				
9	9	27	OHP3	CCDD	1	32000	☐	☑	56.93%	0.041%	6.53%	1.83%	9.77%	85970	62	9866	2770	14751	544.0	671.4	127.4	355.6	1027.0		
10	10	19	OHP2	DCCD	1	5000	☐	☑	55.67%	0.033%	6.71%	3.18%	9.92%	84066	51	10137	4808	14978	660.4	998.5	338.1	0.0	998.5		
11	11	2	OHP1	CCDD	1	105000	☐	☑	57.60%	0.042%	6.21%	1.51%	9.47%	86974	64	9370	2279	14302	663.4	967.3	303.9	139.9	1107.1		
12	12	28	OHP3	CCDD	1	151000	☐	☐	56.85%	0.042%	6.36%	1.76%	10.03%	85836	63	9609	2659	15151	672.4	833.7	161.3				
13	13	31	OHP3	DCCD	2	151000	☐	☐	57.10%	0.048%	5.34%	1.73%	10.76%	86218	72	8067	2610	16248	779.4	971.8	192.4				
14	14	25	OHP3	CCDD	2	95000	☑	☐	56.33%	0.037%	6.97%	2.51%	9.29%	53511	35	6625	2384	8824	833.9						
15	15	8	OHP1	DCCD	1	56000	☑	☐	57.56%	0.039%	7.41%	1.28%	8.26%	32232	22	4152	716	4626	942.9						
16	16	1	OHP1	CCDD	2	110000	☑	☐	58.13%	0.042%	5.06%	1.45%	9.79%	63940	47	5566	1598	10770	968.3						
17	17	32	OHP3	DCCD	2	138000	☑	☐	56.24%	0.040%	9.06%	1.33%	8.85%	77613	56	12506	1837	12218	972.1						
18	18	20	OHP2	DCCD	1	125000	☑	☐	55.96%	0.031%	6.26%	3.25%	9.91%	69944	39	7819	4062	12389	998.9						

Deliverables

Example of post-crusher stockpile plots (test data only):



So what?

- Insight Acumen was able to “parachute-in” late in modelling project to support the decision maker, continue model development and incorporate required features.
- Post-development, model was used by company analysts for testing various possible futures and stockpiling grade options – outcomes and ROI unknown.

extendsim authorized consultant

InsightAcumen

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