

Heavy Haul Analysis



Various packets of analysis using Allison Transmission products are available:

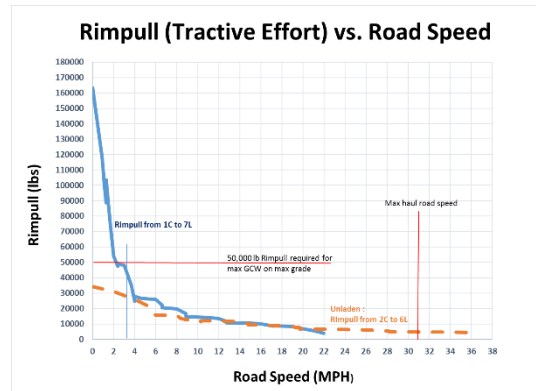
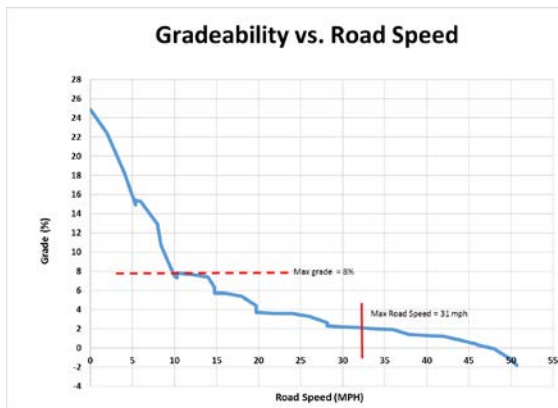
1. One iSCAAN run with specified input details. Standard report giving gradeability and speed on grade.

Typical values which can be shown:

Gradeability at 80%
Startability in 1C
Gradeability in 1L
Startability in 2C
Gradeability in 2L
Gradeability in 3L
Gradeability in 4L
Gradeability in 5L
Gradeability in 6L
Gradeability in 7L
Speed on 0% grade
Speed on 2% grade
Speed on 4% grade
Speed on 6% grade
Speed on 8% grade
Acceleration 0-30 mph

2. Multiple iSCAAN runs with axle ratio recommendation and matching load to grade-capability. Report with charts of gradeability vs road speed and rimpull.

	8.79 RAR / 2.03 aux trans	10.55 RAR / 2.23 aux trans	10.55 RAR / 2.03 aux trans
Startability in 1C	24.5%	34.2%	30.5%
Gradeability in 1L	16.2%	21.8%	19.7%
Startability in 2C	9.5%	13.6%	12.1%
Gradeability in 2L	7.1%	9.6%	8.7%
Gradeability in 3L	3.4%	4.8%	4.3%
Gradeability in 4L	2.4%	3.5%	2.3%
Gradeability in 5L	1.4%	1.3%	1.9%
Gradeability in 6L	0.7%	1.3%	1.1%
Gradeability in 7L	0.3%	9090.0%	0.8%
Speed on 0% grade	27 MPH @ 1934 rpm	21.2 MPH @ 2000 rpm	23.3 MPH @ 2000 rpm
Speed on 2% grade	11.7 MPH @ 1312 rpm	12.4 MPH @ 1800 rpm	12.5 MPH @ 1700 rpm
Speed on 4% grade	5.0 MPH @ 1860 rpm	6.6 MPH @ 1406 rpm	6.5 MPH @ 1625 rpm
Speed on 6% grade	4.9 MPH @ 1950 rpm	3.9 MPH @ 2000 rpm	4.2 MPH @ 2000 rpm
Speed on 8% grade	2.3 MPH @ 2000 rpm	3.5 MPH @ 1800 rpm	3.5 MPH @ 1600 rpm



OHANSSON ASSOCIATES

Client: XXXXXXX

Project: XXXXXXX

Request: Review analysis using a full excavator

1. Utilize a excavator with full drive. Take weight across
2. Use excavator axle with rear ratio of 10.68 and front ratio of 8.79
3. Unladen transfer case axles with ratios of 1.5 and 1.2:1
4. Double trailer 8-trail combination with a payload capacity of at least 100,000 lbs. capable of operating on the given haul road.

Result of analysis:

The 320 tonne crawler (320,000 lb) does not pose a problem as far as gradeability using the 10.55 ratio of the auxiliary transmission gear. The transmission is not required to shift into 7th gear (which follows the manufacturer's recommended procedure) during any of the open road operation.

The recommendation is that the entire loaded run be undertaken in 10th gear. This speed is limited to some 21 mph. An analysis indicates that during the loaded run the engine and torque will shift down to 10 gear as required and will not come from 10th gear when the entire length of the road can be undertaken in 10th gear and the maximum allowable mine property speed of 31.25 MPH (50 km/h).

Vehicle status
Vehicle: XXXXXXX

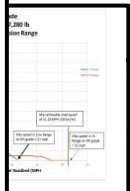
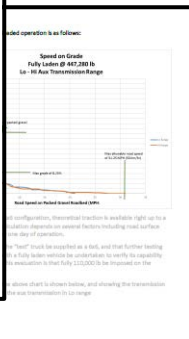
Notes:

Note that the 960/2000 engine cannot be used because it is above the rating of the Allison 4800CDS transmission.

Alt: Allison 4800CDS - 7 speed

Notes:

Rear axle ratio = 10.682
Front axle ratio = 10.545
Gearbox 10-A 14025
271 mph/100

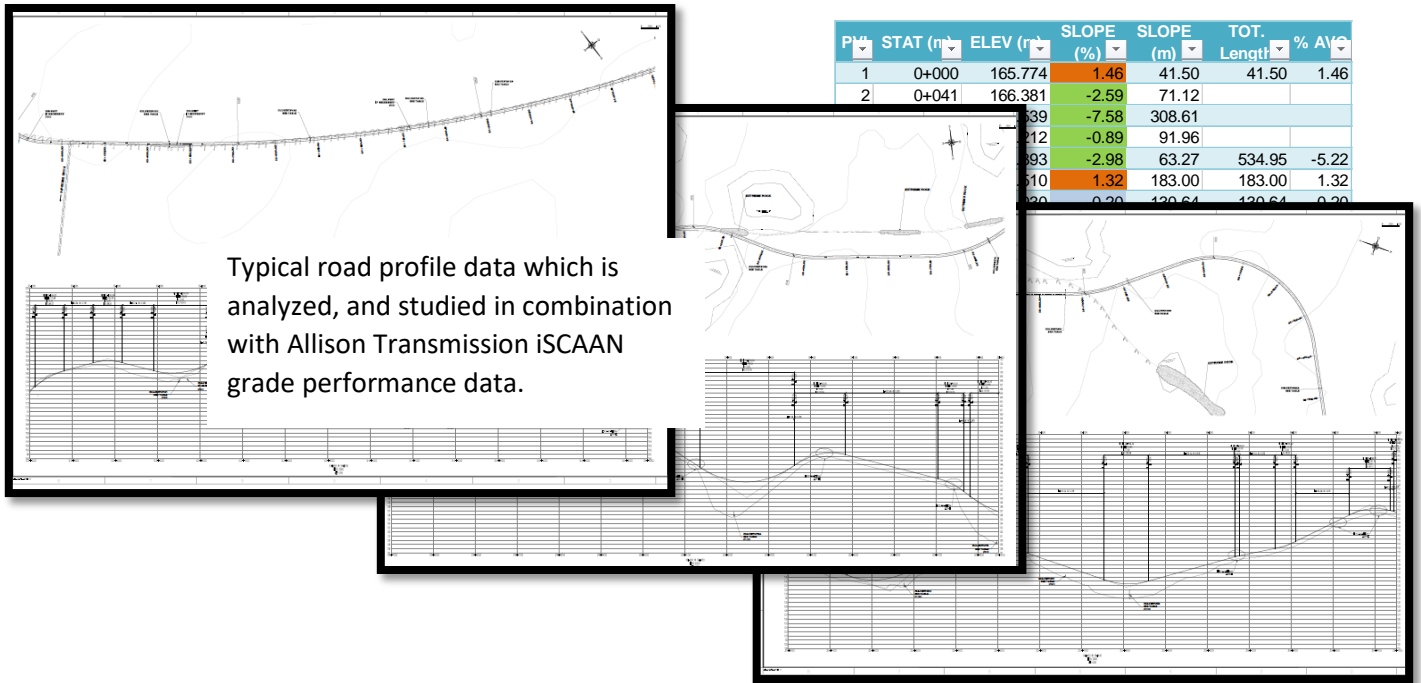


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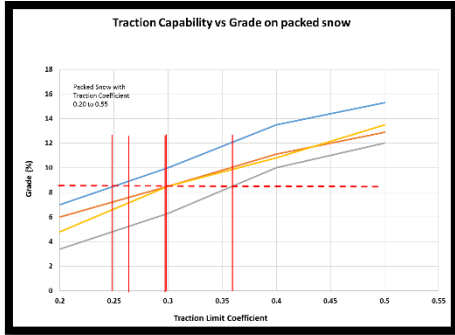
3. All data and reporting as per Package #2 plus full road study and recommendation as to vehicle setup and loading capability.



Portion of typical iSCAN Full Throttle Vehicle Performance report:

Automatic (2C-3C-3L-4L-5L-6L-7L)								
	Vehicle	Engine	Tractive	Drawbar	Wheel	Net %	Transm	
	Speed	Speed	Effort	Pull	Power	Grade	Heat Rej	
	(mph)	(rpm)	(lb)	(lb)	(hp)	(%)	(Btu/min)	
	2C	0	1653	62521	59121	0	21797	
	2C	1	1715	57124	53684	152.3	14341	
	2C	2	1809	48636	45156	259.4	8677	
	2C	2.3	1845	45658	42164	284.1	7256	70Percent
	2C	2.9	1910	40571	37053	315.4	5264	
	2L	2.9	1260	40345	36827	313.6	605	
	2L	3	1297	40264	36742	322.1	623	
	2L	4	1729	38491	34928	410.6	792	
	2L	4.6	2000	30272	26683	373.4	897	Governed
	3C	5	1889	23076	19472	307.7	5868	
	3C	5.7	1928	21110	17476	321.3	4650	
	3L	5.7	1340	21860	18225	332.7	600	
	3L	6	1409	21768	18121	348.3	630	
	3L	7	1643	21407	17717	399.6	723	
	3L	8	1878	18989	15257	405.1	794	

4. All data and reporting as per Package #3 plus traction studies, as well as comparative cycle time and productivity projections leading to vehicle configuration recommendation.



Traction study

Portion of a typical time on grade assessment, leading to cycle time projection. Not to be used for absolute cycle times, but for comparative studies with different vehicle configurations.

SLOPE (%)	Distance (ft)	not used	Speed (MPH)	Speed (ft/sec)	Time (sec)	Net Time	4800ORS 401k 8.79x2.23
-8.32	425	Y	4.41	6.47	65.64	10963.15	seconds
-8.25	509	Y	4.45	6.53	78.01	182.72	minutes
-7.80	945	Y	4.54	6.66	141.85	3.05	hours
-7.64	450	Y	4.53	6.65	67.67		
-7.58	1010	Y	4.53	6.64	152.06		
-7.44	640	Y	4.51	6.61	96.82		
-6.76	430	Y	4.42	6.48	66.40		
-6.45	810	Y	4.44	6.51	124.37		
-6.30	476	Y	4.47	6.56	72.53		
-6.15	359	Y	4.52	6.63	54.06		
-5.97	831	Y	4.60	6.75	122.98		
-5.92	452	Y	4.63	6.79	66.54		
-5.54	341	Y	4.90	7.19	47.47		

GCV (lb)	401,000	401,000	401,000	430,000	467,000	480,000	480,000	505,000	528,000
Payload (lb)	264,000	264,000	264,000	285,000	330,000	330,000	330,000	350,000	385,000
Vehicle type	10x10	8x6	10x10	10x10	10x10	10x10	10x10	10x10	10x10
Transmission	4800ORS	4800ORS	6620	4800ORS	4800ORS	4800ORS	6620	6620	6620
Engine	ISX 565/1850	ISX 565/1850	ISX 600/20250	ISX 565/1850	ISX 565/1850	ISX 565/1850	ISX 600/20250	ISX 600/20250	ISX 600/20250
Axle ratio	8.79	8.79	7.01	8.79	10.55	10.55	10.55	7.01	7.01
Transfer case ratio	2.23	na	2.23	2.23	0.91	0.91	0.91	1.41	1.41
Aux trans ratio	na	2.04	na	na	2.04	2.04	2.04	2.04	2.04
Total Driveline Ratio	19.6	17.9	15.6	19.6	19.5	19.5	19.5	30.3	30.3
Cycle time Laden (hr)	3.05	2.85	3.7	3.16	3.87	3.83	4.36	4.59	4.83
Cycle time unladen (hr)	1.7	1.7	1.7	1.7	1.7	1.7	1.77	1.77	1.77
Loading time (hr)	0.42	0.42	0.42	0.45	0.49	0.50	0.50	0.53	0.55
Offloading time (hr)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Total cycle time (hr)	5.37	5.17	6.02	5.51	6.26	6.23	6.83	7.09	7.35
Tonnes moved per 24 hrs	537	557	479	564	575	578	527	539	571
No of trucks required to move 10,000 tonne/day	19	18	21	18	18	18	19	19	18
Productivity index	93	96	83	98	100	100	91	93	99
Ranking	5	4	6	3	1	1	6	5	2
Trips/12 hr cycle	2	2	2	2	1	1	1	1	1
Tonnes / 2 shifts /24 hrs	240	240	240	259	150	150	150	159	175
No of trucks required to move 10,000 tonne/day	21	21	21	20	34	34	34	32	29
Ranking	2	2	2	1	5	5	5	4	3

- 5. Site visits can be arranged to view and recommend appropriate vehicle configurations suitable for the haul road and the operation.**

Analysis and performance calculations are based upon Allison Transmission Inc's iSCAAN program. Road surface, climatic conditions and powertrain performance variation may affect the results.

All recommendations are those of Johansson & Associates LLC, and do not imply approval by Allison Transmission Inc. from whom approval MUST be obtained before vehicle build may commence.

Allison Transmission, its Field Representatives and Distributors and Dealers are available for consultation.

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December, 2017