GRAIN BY RAIL IN EASTERN WASHINGTON

Spokane, Spangle & Palouse Rwy passing through Spangle, WA

Background

The initial question is whether rail transportation can substitute for barges if the Snake River dams are breached. However, that question leads to the broader question of whether rail transportation can more effectively supplant truck transportation of grain.

The high-level research conducted indicates that grain is trucked as much as 40 miles to the Snake River for barge movement. (Page 8)

There is also a substantial amount of trucking related to rail movement of grain. (Page 7)

The line haul railroads prefer, or more accurately, demand grain to be presented to them in 110 car trains. Special "shuttle" elevators have been established for that purpose, at McCoy, Ritzville, Four Lakes, and Endicott.

Virtually all grain received by the McCoy and Ritzville terminals is received by truck and loaded into unit trains. The terminals at Four Lakes and Endicott generally consolidate rail car shipments from small elevators. Like the Columbia River barges, grain for the "shuttle" elevators can be trucked for as much as 40 miles.

When rail transportation is available, truck traffic causes avoidable heavy wear and damage to roads. That is among the reasons that the State of Washington purchased the eastern Washington rail lines tht it owns.

Climate Emergency

The use of trucks where rail transportation is or should be available has an important connection to the climate emergency and an effective response. Toxic particulate resulting from tire wear accumulates in ground water.

Rail transportation uses 2/3 less energy than highway transportation and generates 2/3 fewer emissions. In the short term, the greatest possible mode shift from highway to rail must be effected as part of a strategy to reduce emissions by about 50 percent by 2030.

On conversion of both modes to electric power, the difference in energy consumption remains essential. Electrified highway transportation will generate a substantial new demand on the power supply. The conversion of heating and cooking from gas to electric power will create substantial additional new load. The conversion of highway fuel consumption in Washington State to electric power will require the equivalent of two new Grand Coulee dams, five new Columbia nuclear power generation stations, 6,900 wind turbines, or 181 square miles of solar panels.

Rail Capacity for Grain Movement

The line along the Snake River has different physical characteristics from the Washington State owned lines and operates differently as a result. There are only two grain elevators between Lewiston and Ayer. Both are currently oriented to barge loading, so will need to have rail loading facilities added. Grain movements consist of full trains loaded at Lewiston, running through to Ayer for delivery to Union Pacific and empty cars returning. There is a daily train of regular commercial freight, such as lumber. Capacity is determined in a similar manner to other main line railroads. The line may accommodate several trains in both directions. Since it is single track, trains in opposite directions can only meet at a place where there is more than one track, typically a siding or double track. The only track that can be used as a siding that can accommodate a full train is at Riparia, so capacity is figured accordingly.

There are five local elevators between Winona and Thornton, eight between Hooper and Pullman, and 12 between Marshall and Pullman, not including the McCoy "shuttle" elevator. Typical rail traffic on these lines consists of trains the distribute empty cars and collect loads, typically traveling along the line and returning in the same trip. For this type of traffic, the important consideration is the length of the trip, end to end, and the amount of time remaining within a crew's Federal hours of service limitaiton (12 hours) to perform all of the distributing and collecting of cars. Depending upon the rate at which cars are loaded, the grain hauling capacity may be doubled by employing a train on each of two shifts.

Rail capacity between Lewiston and Ayer

Grain by barge on the Lower Snake River passing Ice Harbor Dam in 2014 was 2,800,000 tons. That amount is the equivalent of 255 grain trains of 110 cars each, or five trains per week. The truck equivalent is 107,692 trucks per year, or 2,071 trucks per week.

The Great Northwest Railroad between Lewiston and Ayer is regularly used by one train a day, occasionally by more. The line has capacity of three trains per day in each direction with good reliability and can be stretched to six in either direction with some potential for less predictability of operation. With modest improvement, the capacity can be increased and/or the reliability of operation can be increased. For example, a train may leave Lewiston with 50 cars and stop at Almota and Central Ferry (after rail loading facilities are constructed) for additional cars. In either of the higher volume cases, careful traffic management would be required.

Rail Capacity for the Central Routes east of Hooper

A round trip between Hooper and Thornton or Pullman has a travel time of less than five hours. If necessary, two trains per day can operate on the line successively.

Rail Capacity between Marshall and Pullman

A one way trip between Marshall and Pullman with a train of empty grain cars takes two and a half hours. The return trip with a loaded grain train takes three hours. Trip time would be increased by the time needed to distribute empties and pick up loads from elevators along the way, making a two day trip for the crew likely. With the extension and rehabilitation of sidings along the line, a train each way every day could be accommodated, roughly 20,000 tons of grain per day.

Consolidating Loads for Further Movement on Class 1 Railroads

The short line operators can consolidate shipments into the size train that the Class 1 railroads demand. This may be accomplished over a period of several days, or in heavy loading season, more than on e 110 car train may be accumulated per day.

Energy Consumption

When electrified, the rail lines north and west of Pullman will have a small electric power footprint. The hilly nature of the Palouse is reflected in the rail lines. For example, a round trip between Marshall and Pullman, empty cars south, loaded cars north, returns to the grid 94 percent of the electricity used. Between Hooper and Thornton, the amount returned is 79 percent. Between Hooper and Pullman, the amount returned is 81 percent. Between Lewiston and Ayer, the return is only 44 percent because there is only a very slight grade.

Effective Service

The US railroad industry generally operates as a monopoly. The monopoly is also found in the short line railroads. When selling branch lines, the Class 1 railroads typically ensure that there is no connection to other than their own track, making all customers on the line captive to the original owning railroad. Short lines on those lines, are also a monopoly as a result.

Washington State is in the unusual position of owning a combination of former Class 1 lines that have a connection with two Class 1 railroads. The connection at Pullman is inconvenient, but nonetheless, there is a connection.

Washington state could dramatically improve the effectiveness of rail service by changing the contracting method. The state-owned rail lines could become effectively a toll road for trains. In such an arrangement, the state manages the operation and maintenance of the infrastructure and sells access by the train mile. An operator could arrange to move grain to either of the Class 1 railroads, BNSF and Union Pacific. More than one operator may compete for the service at each elevator along any of the lines.

The Toll Road for Trains arrangement ensures that the state's rail assets are properly maintained and well-utilized.

The arrangement would be greatly improved by connecting the former Union Pacific line that terminates at Thornton with the former Burlington Northern line at either Rosalia or Colfax,about eight miles. (Page 5) There was a railroad between these points, but it was abandoned and removed decades ago. There is visible evidence of the former rail line for most of the distance between Thornton and Rosalia.

Further reduction in truck miles could be effected by adding new rail loading facilities along the state-owned routes. Short line operators can serve such smaller loading facilities that Class 1 railroads won't. Part of the justification for purchasing the railroads in eastern Washington was reduction in truck traffic. The current situation is not as effective in that regard as it should be.

High Capacity Grain Cars

The railroad industry works its monopoly position against its subsidized competition. Class 1 railroads demand the use of cars with 286,000 pound capacity. This is much greater than many bridges on short line railroads were designed to accommodate. Although common carrier obligations require the nondiscriminatory acceptance of shipments tendered, they are able to not refuse, but rather provide a level of service and a price that makes trucking the favorable substitute for the same shipment. This puts the short lines at a serious disadvantage unless the track and bridges are improved to accommodate the high capacity cars.

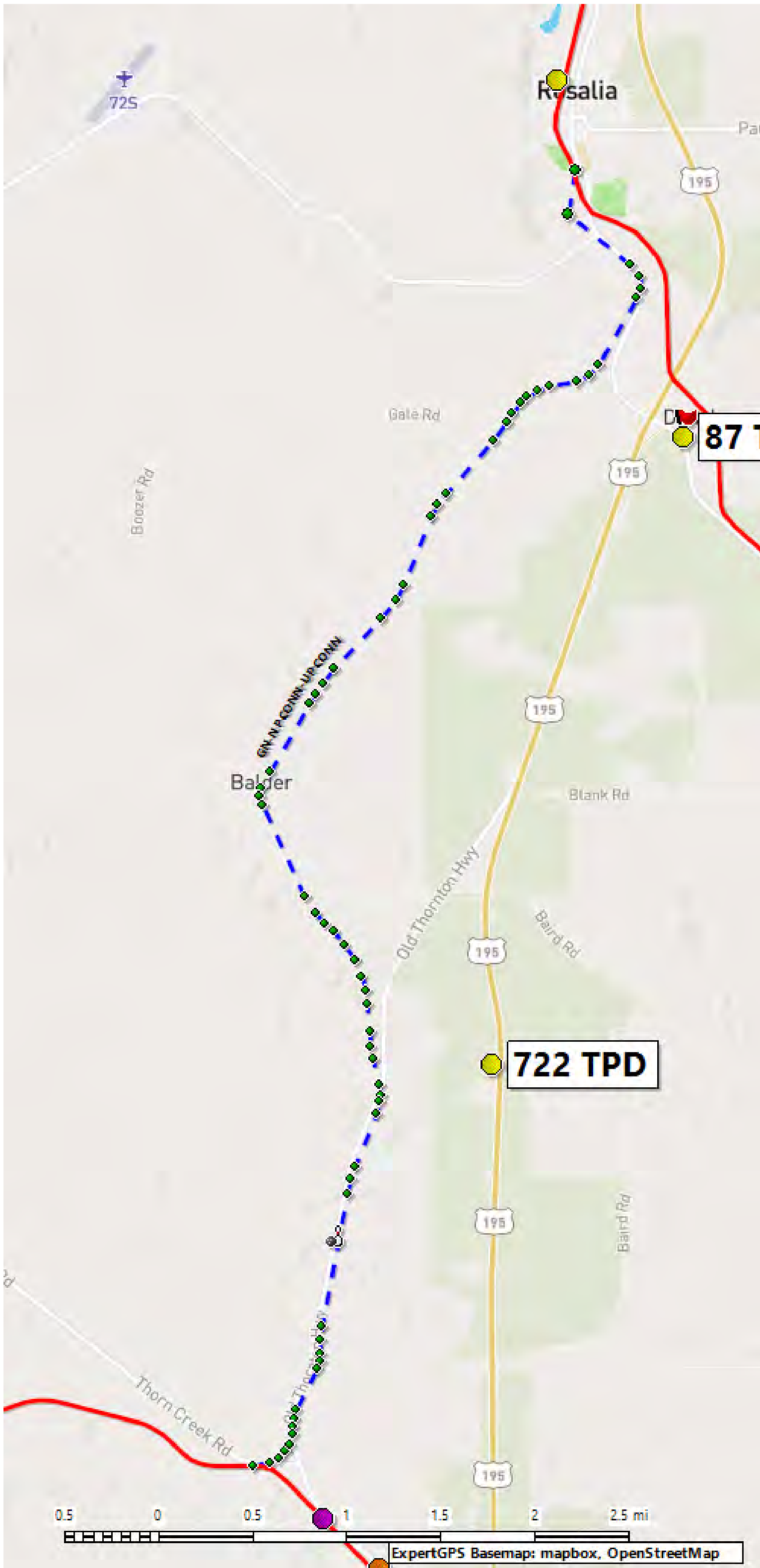
Were the short line operators to aggregate a 110 car train of cars with less than 286,000 pound capacity, the Class 1 railroads would be less likely to win a case brought against them for failure to meet Common Carrier obligations. Trucks would obviously not be a physically or economically practical alternative to movement by rail.

Subsidy

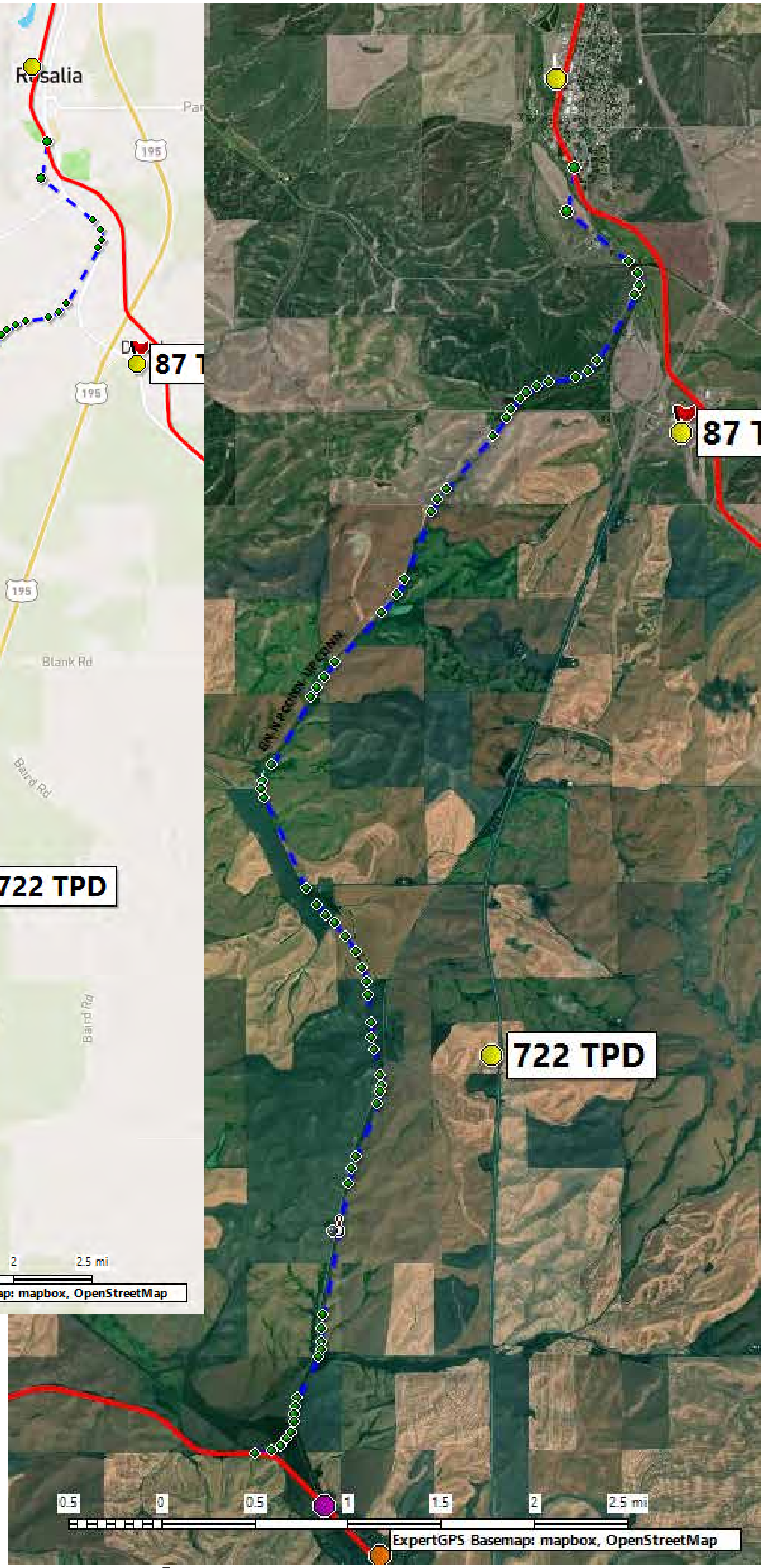
The remaining short line railroads in eastern Washington were once part of an extensive network, most of which has been abandoned long ago, and removed. The remaining lines barely survive. They were, and still are, the victims of government-subsidized competition.

Trucking is typically responsible for 99 percent of highway wear and damage and pays 35 percent of the cost through license fees and taxes. Trucking is also provided with special facilities not required by private users such as slow traffic lanes on steep grades, special parking spaces at rest areas, and intersections designed to accommodate the length of a truck turning a corner of the intersection.

Barges on the Snake River generally receive about $30 million in government subsidies annually.

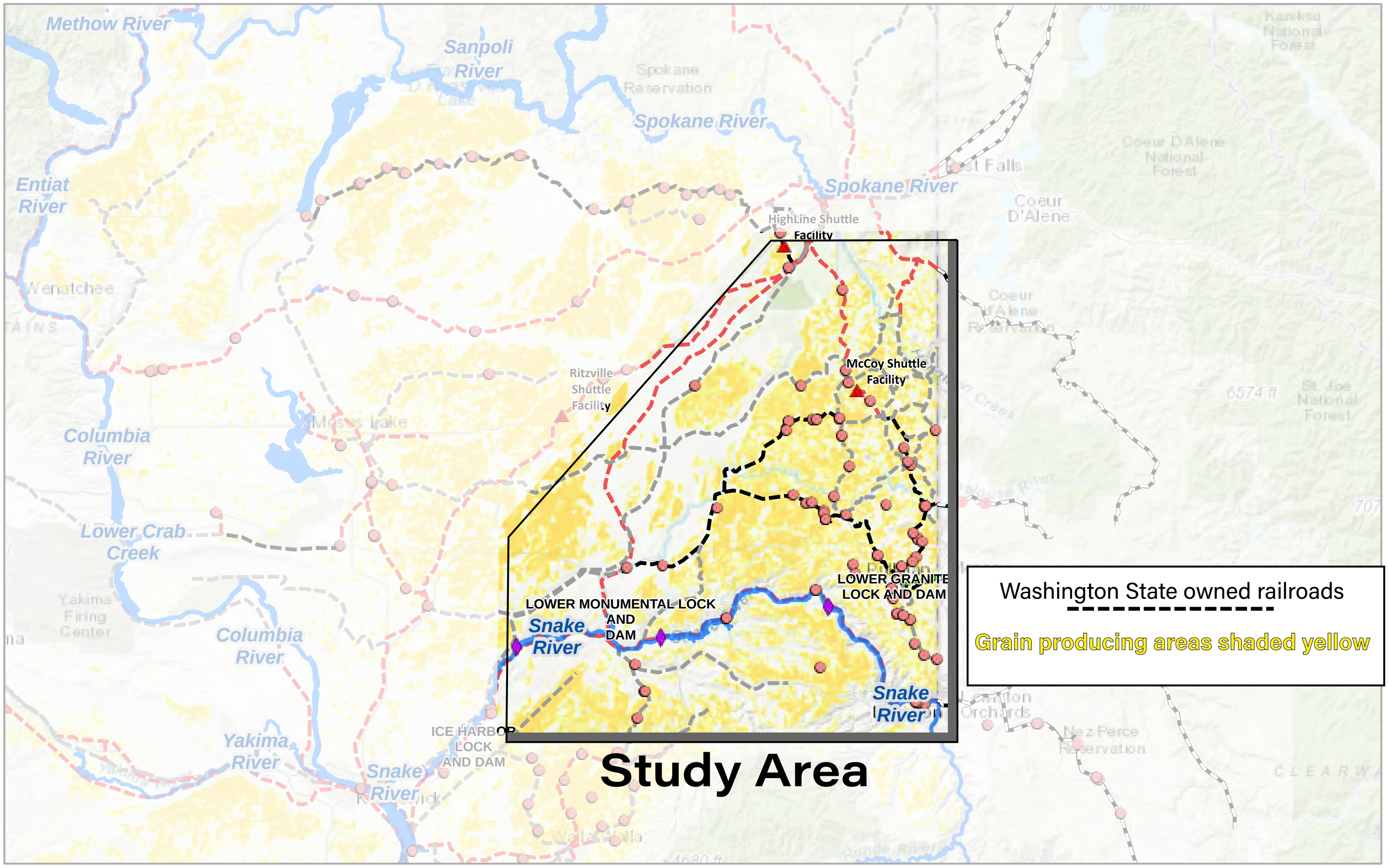


Rosalia
72S
Gale Rd
Boozer Rd
195
87 T
GN-N P CONN-UP CONN
Balder
Blank Rd
Old Thornton Hwy
Baird Rd
722 TPD
Thorn Creek Rd
0.5 0 0.5 1 1.5 2 2.5 mi
ExpertGPS Basemap: mapbox, OpenStreetMap



87 T
GN-N P CONN-UP CONN
722 TPD
0.5 0 0.5 1 1.5 2 2.5 mi
ExpertGPS Basemap: mapbox, OpenStreetMap

SE Washington Grain Transport Network



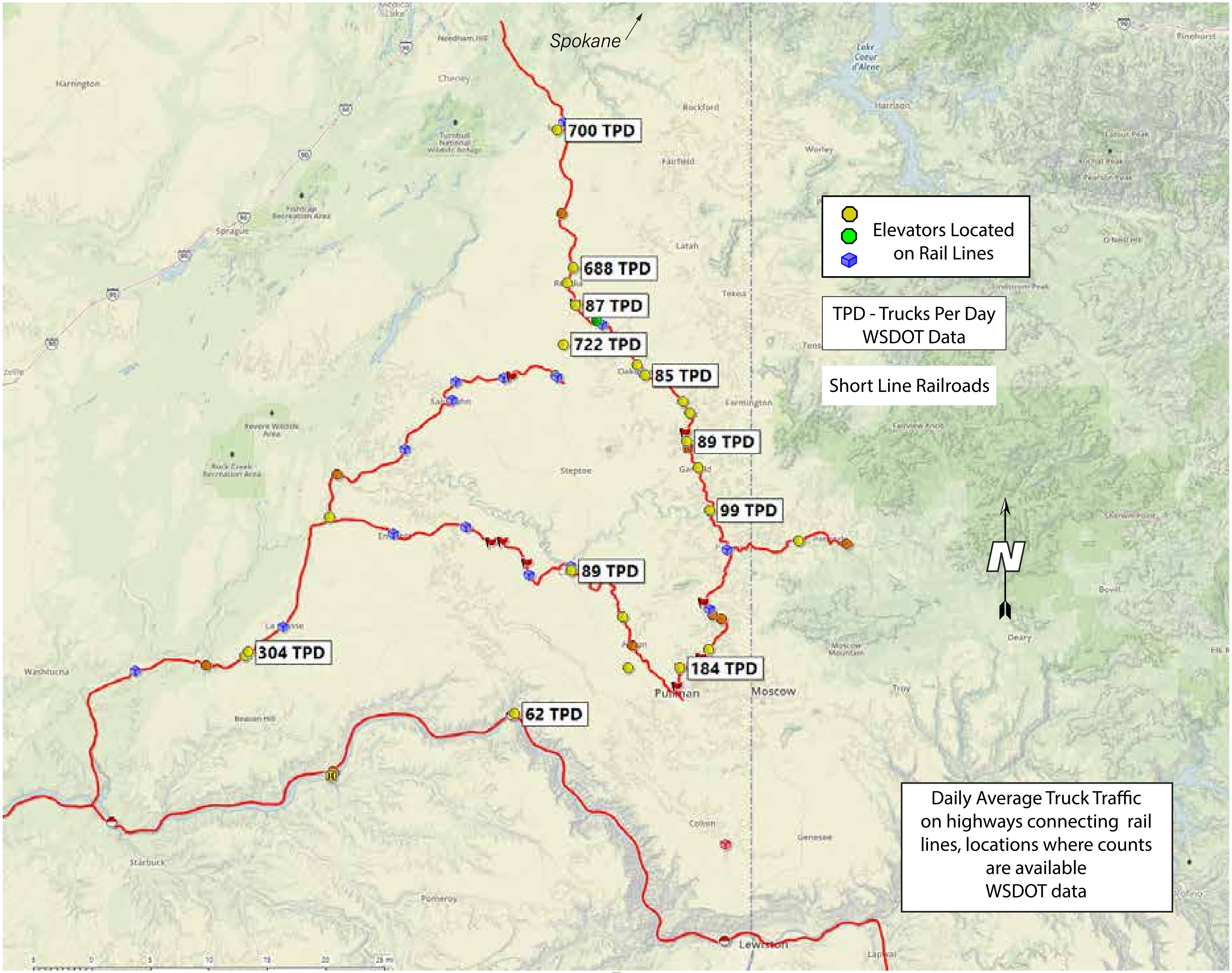
6/1/2022

1:2,157,089

0 12.5 25 50 mi

0 20 40 80 km

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri


Spokane
700 TPD
688 TPD
87 TPD
722 TPD
85 TPD
89 TPD
99 TPD
89 TPD
304 TPD
184 TPD
62 TPD
Pullman
Moscow
Lewiston
Elevators Located
on Rail Lines
TPD - Trucks Per Day
WSDOT Data
Short Line Railroads
N
Daily Average Truck Traffic
on highways connecting rail
lines, locations where counts
are available
WSDOT data


40 Miles from Snake River
Snake River
WASHINGTON
IDAHO
LEGEND

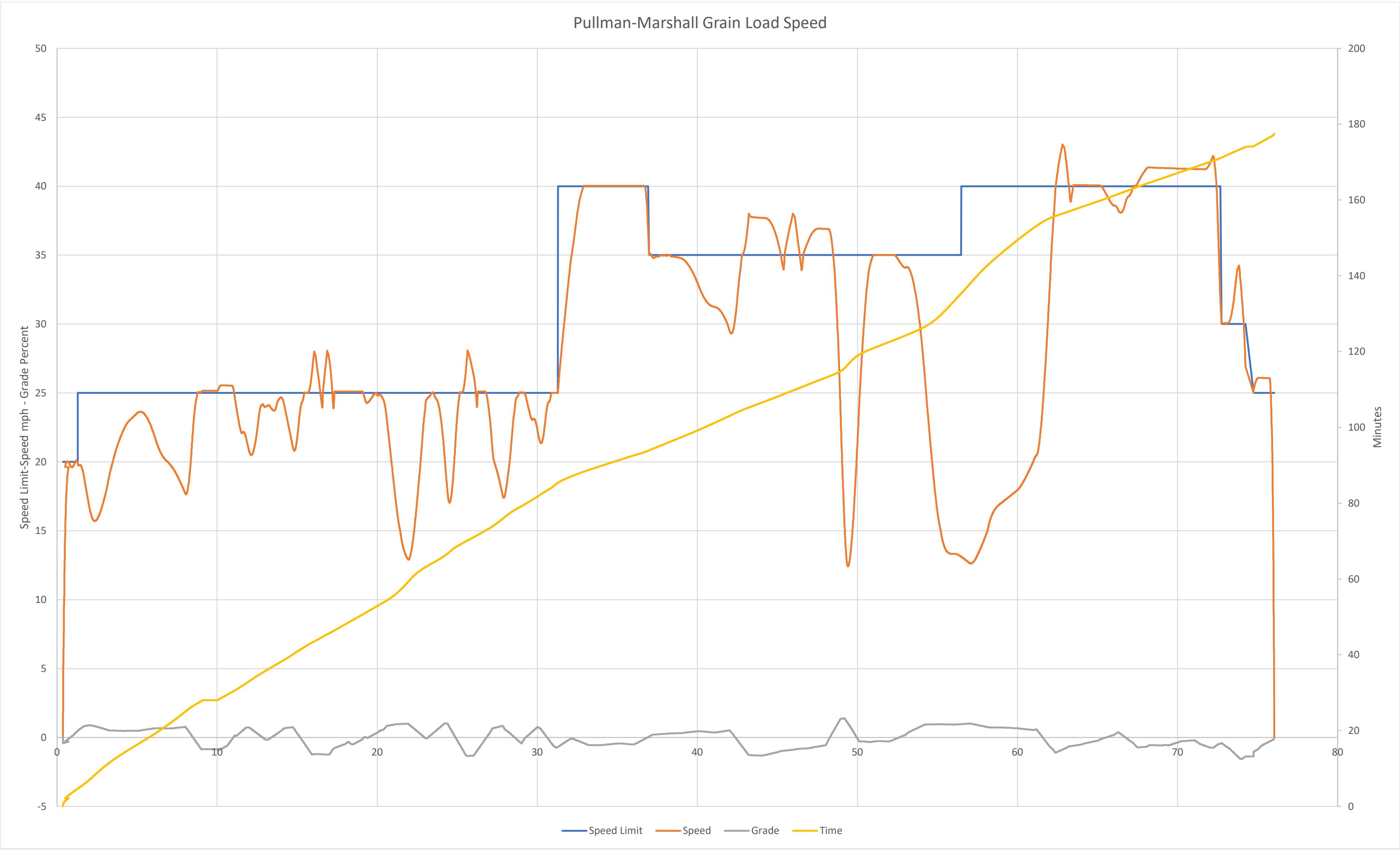
The following pages represent the data that supports the conclusions. It was developed using Train Performance Calculator (TPC) software. A TPC calculates movement and speed once per second, based on the forces affecting the train (e.g., power, braking, friction, air resistance, acceleration, grades) at that time.

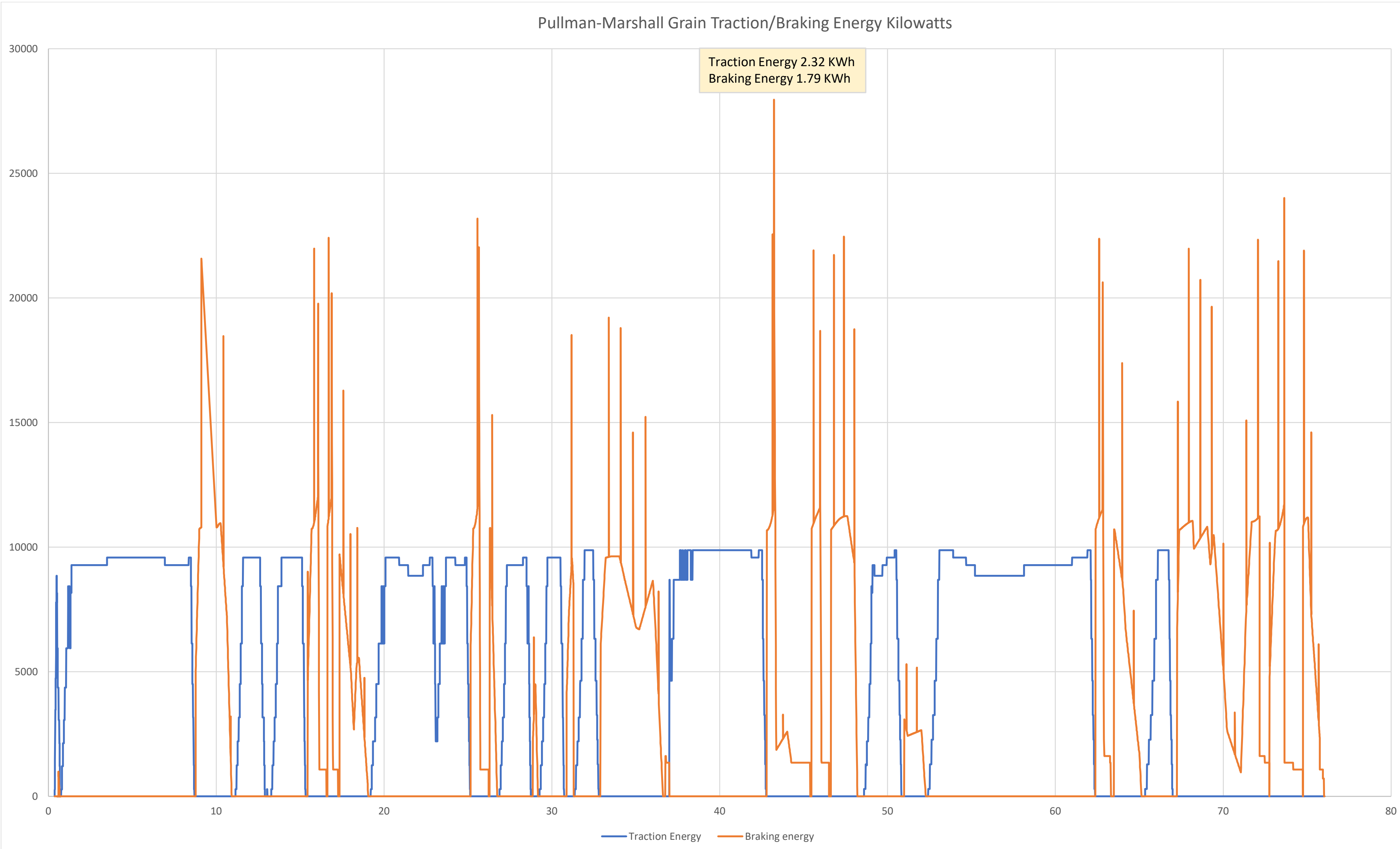
Even number pages 10-24 contain three-axis charts. They represent the speed limit and speed attained by the train, and the speed in percent. Speed limits represent the maximum that the track geometry (curves) allows. Federal Railroad Administration regulations divide railroad track into six classes, each with a specific maintenance requirement and maximum speed. Checking train performance against speed limit demonstrates whether the track is being maintained (or is proposed to be maintained) for a speed higher than a train can attain in normal operation.

The grades are shown in percent, meaning the amount of vertical change in 100 feet of run. A 1% grade rises one foot in 100 feet. On a railroad, a 1% grade is moderate, 2% steep, requiring some special considerations by locomotive engineers, and 3% is extreme.

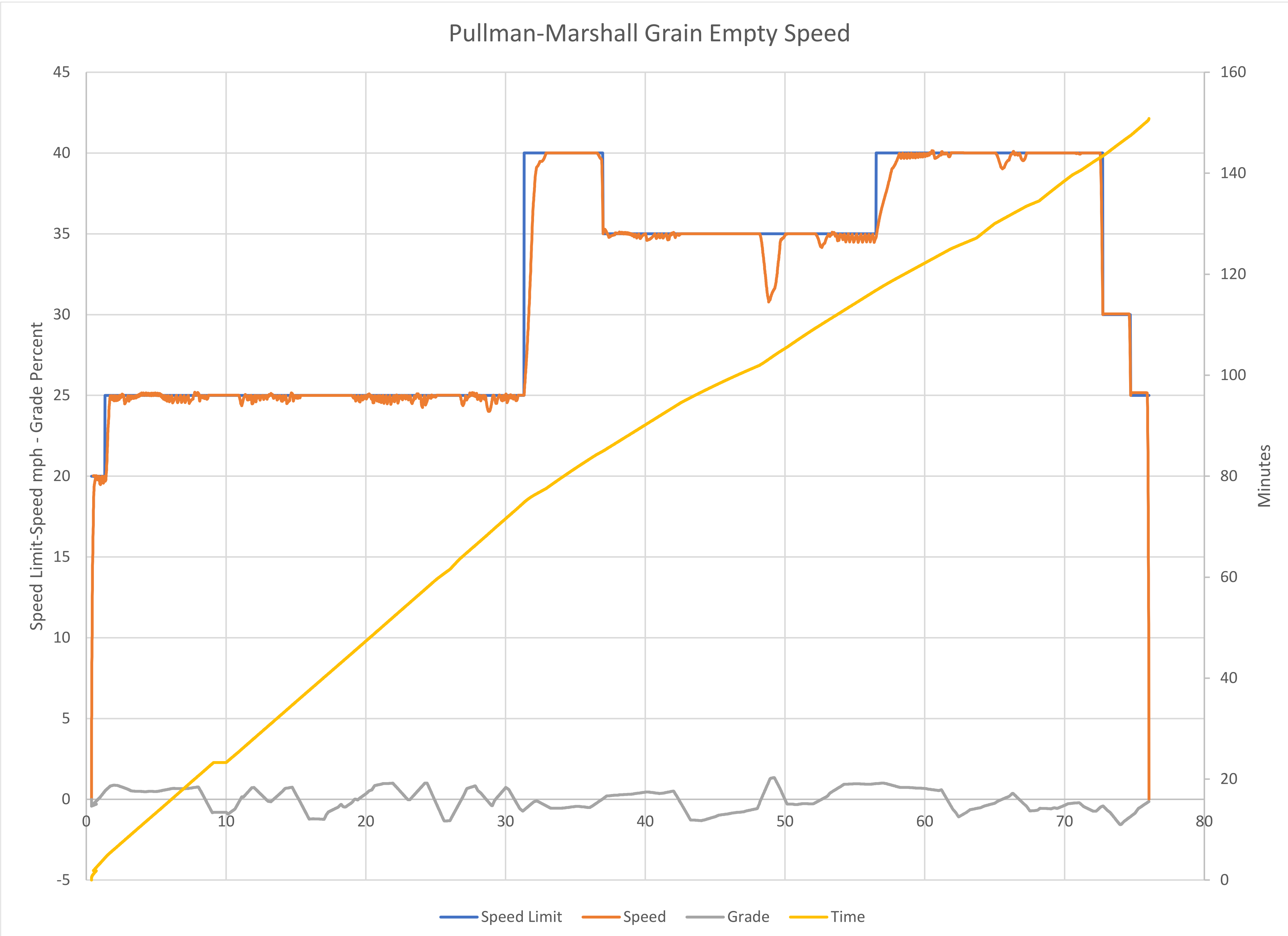
The line representing time is useful in analyzing the performance of the train in relation to the infrastructure. Time is the basis for scheduling trains and for determining capacity.

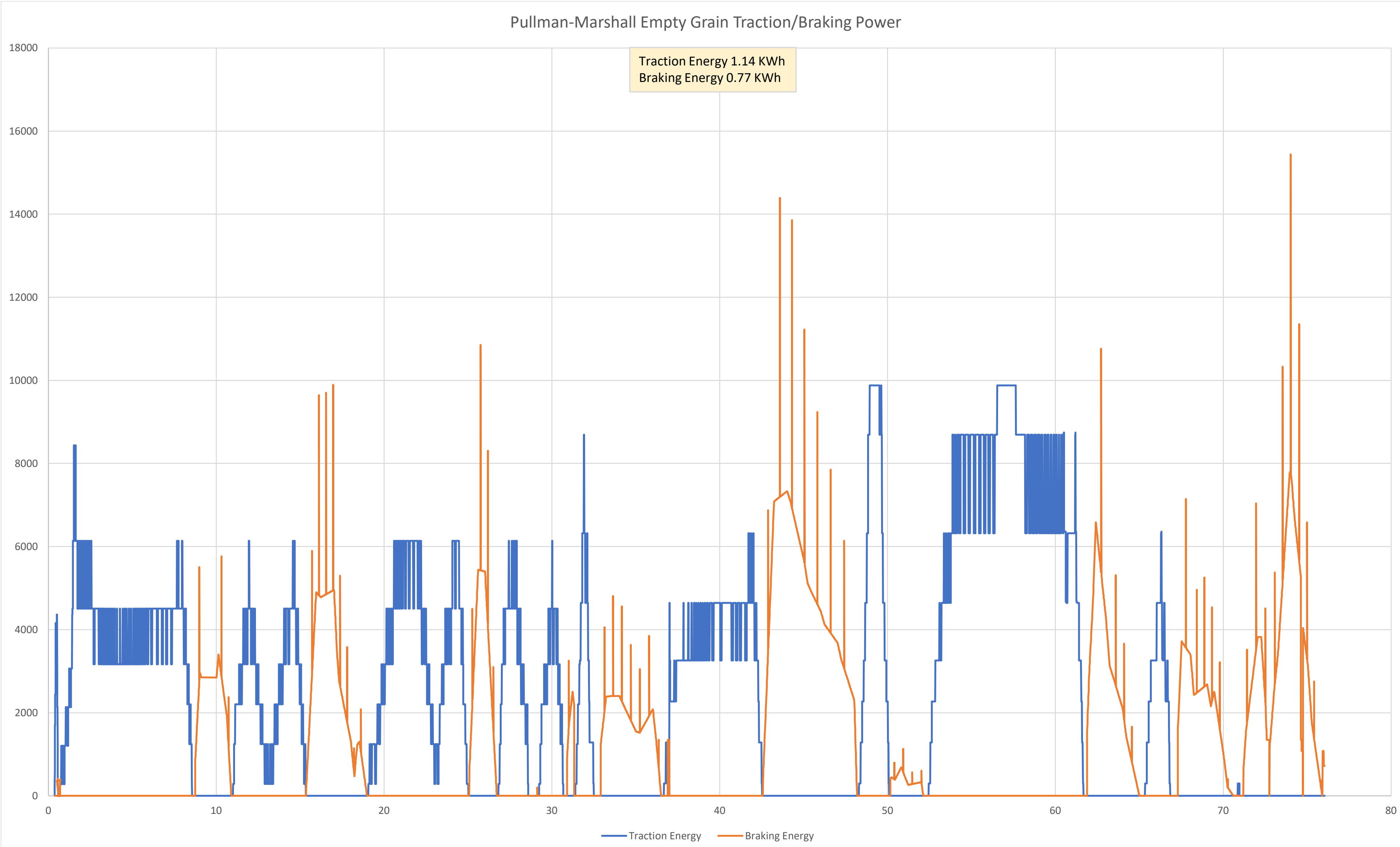
Odd number pages 11-25 contain two-axis charts. The horizontal axis represents distance. The vertical axis represents Kilowatts. There is a color for the power used when appplying power to the train, and a color for the energy that would be returned to the system by regenerative braking of an electric locomotive.


Pullman-Marshall Grain Load Speed
Speed Limit-Speed mph - Grade Percent
Minutes
Speed Limit
Speed
Grade
Time

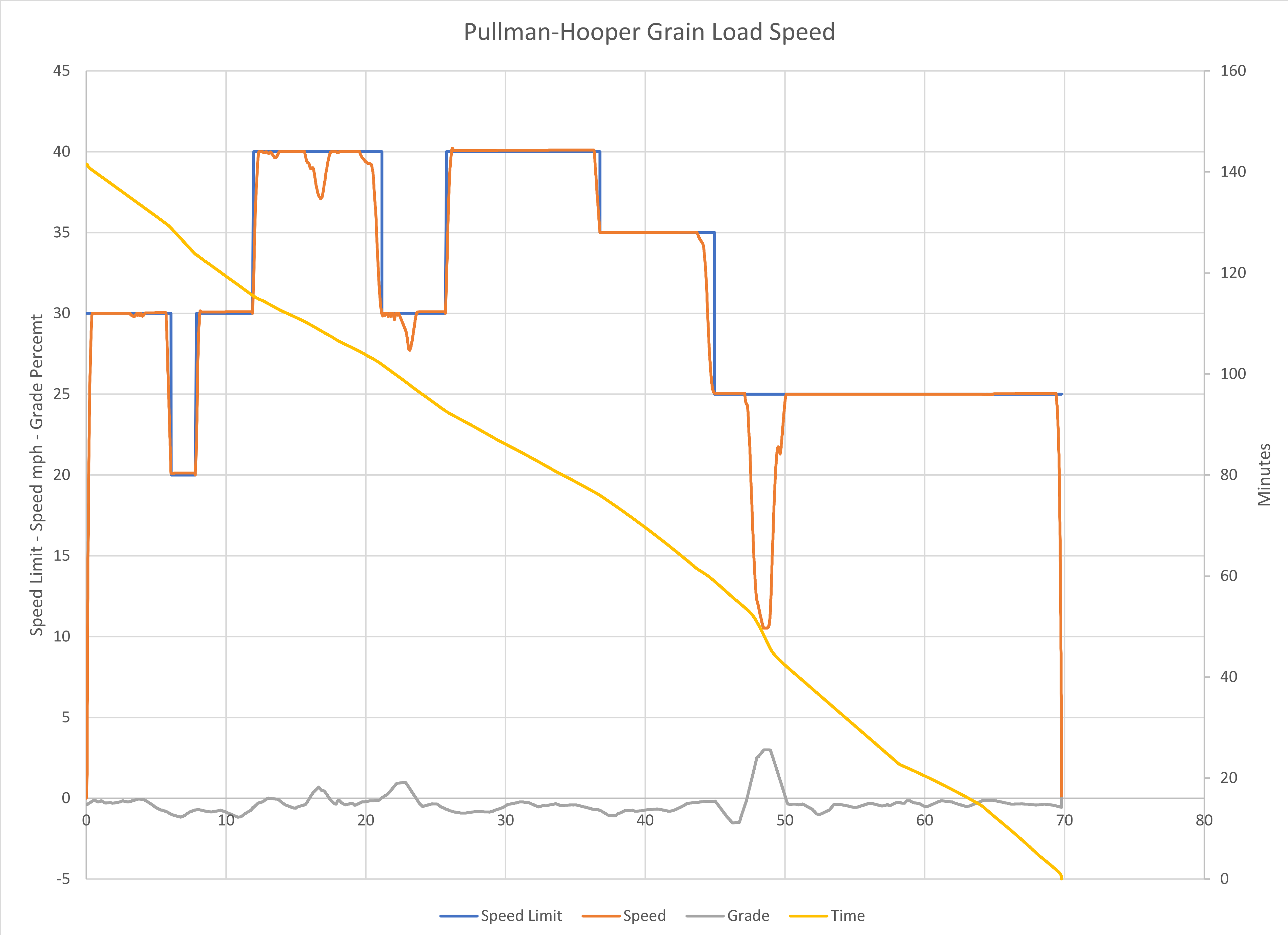


Pullman-Marshall Grain Traction/Braking Energy Kilowatts
Traction Energy 2.32 KWh
Braking Energy 1.79 KWh
30000
25000
20000
15000
10000
5000
0
0
10
20
30
40
50
60
70
80
Traction Energy
Braking energy

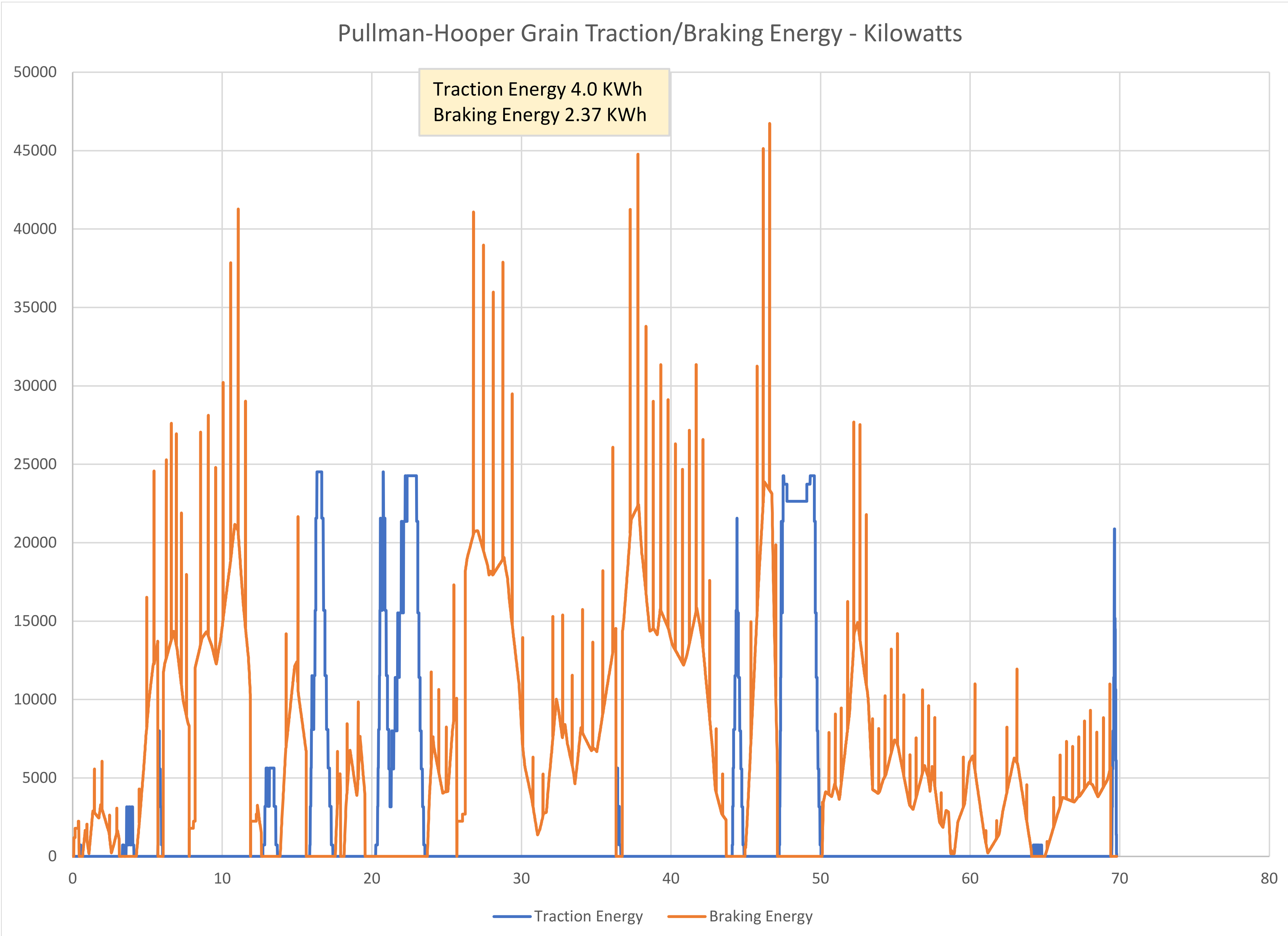

Pullman-Marshall Grain Empty Speed
Speed Limit-Speed mph - Grade Percent
Minutes
45
40
35
30
25
20
15
10
5
0
-5
160
140
120
100
80
60
40
20
0
0
10
20
30
40
50
60
70
80
Speed Limit
Speed
Grade
Time

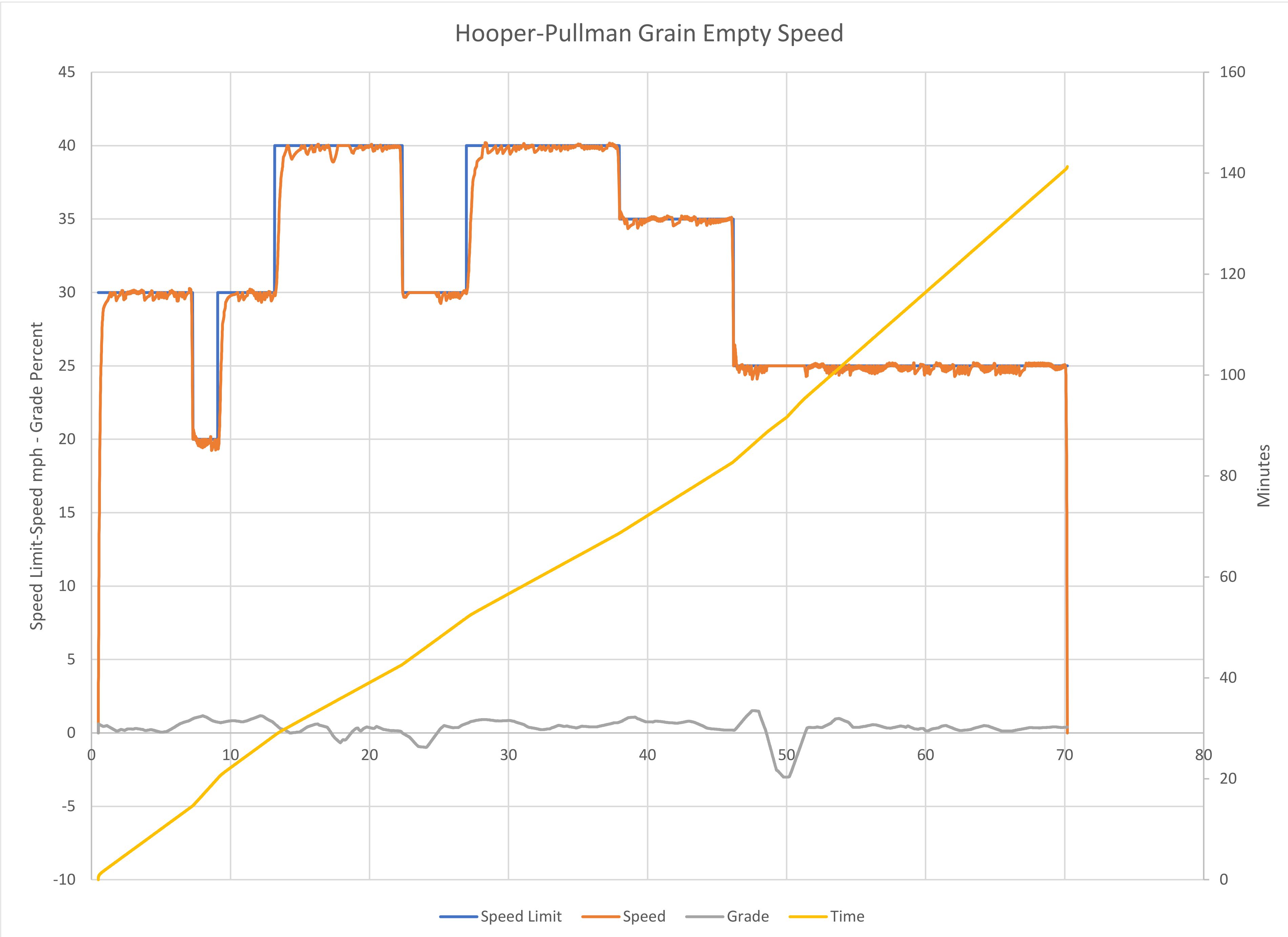


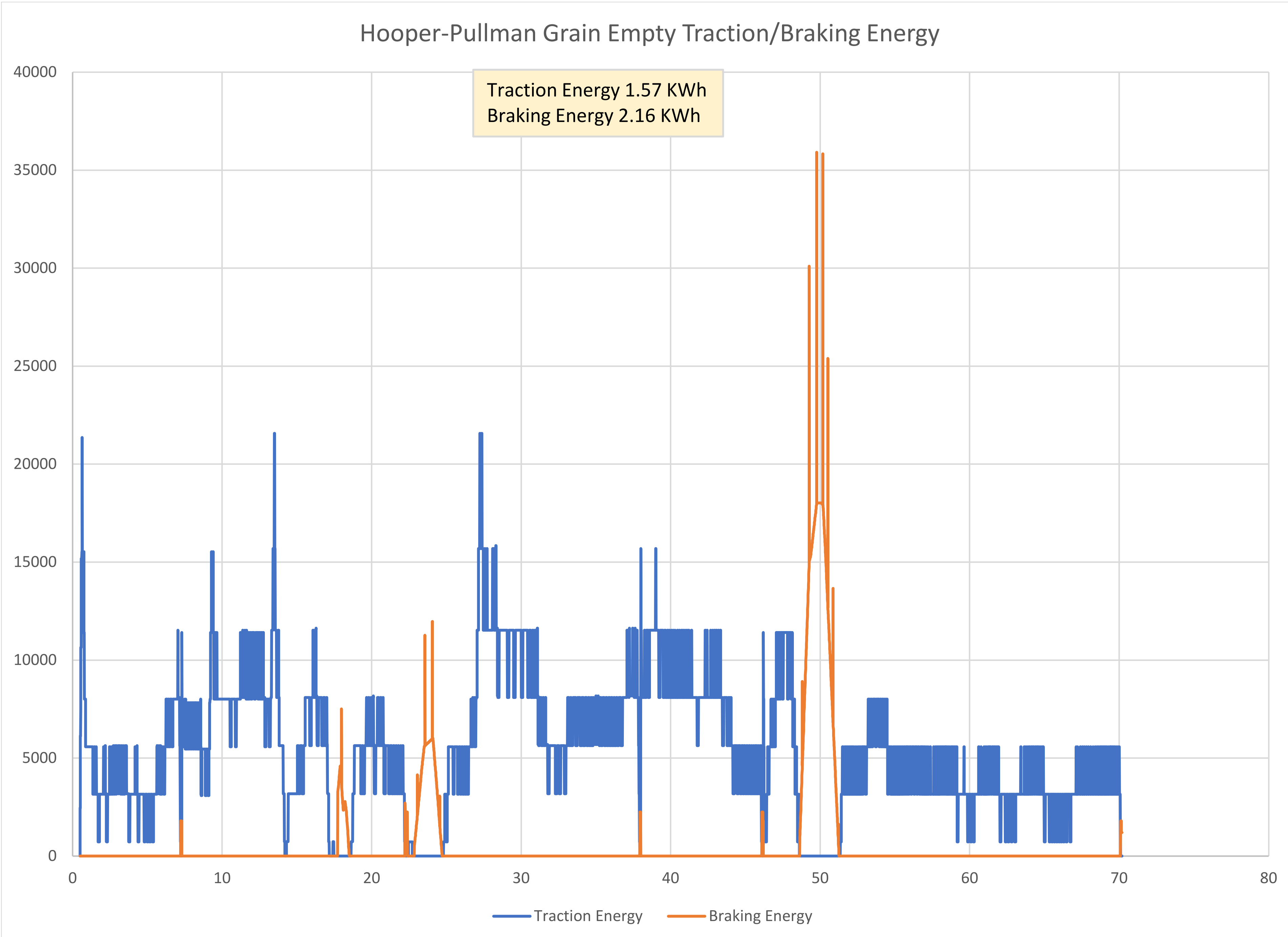
Pullman-Marshall Empty Grain Traction/Braking Power
Traction Energy 1.14 KWh
Braking Energy 0.77 KWh
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0
10
20
30
40
50
60
70
80
Traction Energy
Braking Energy

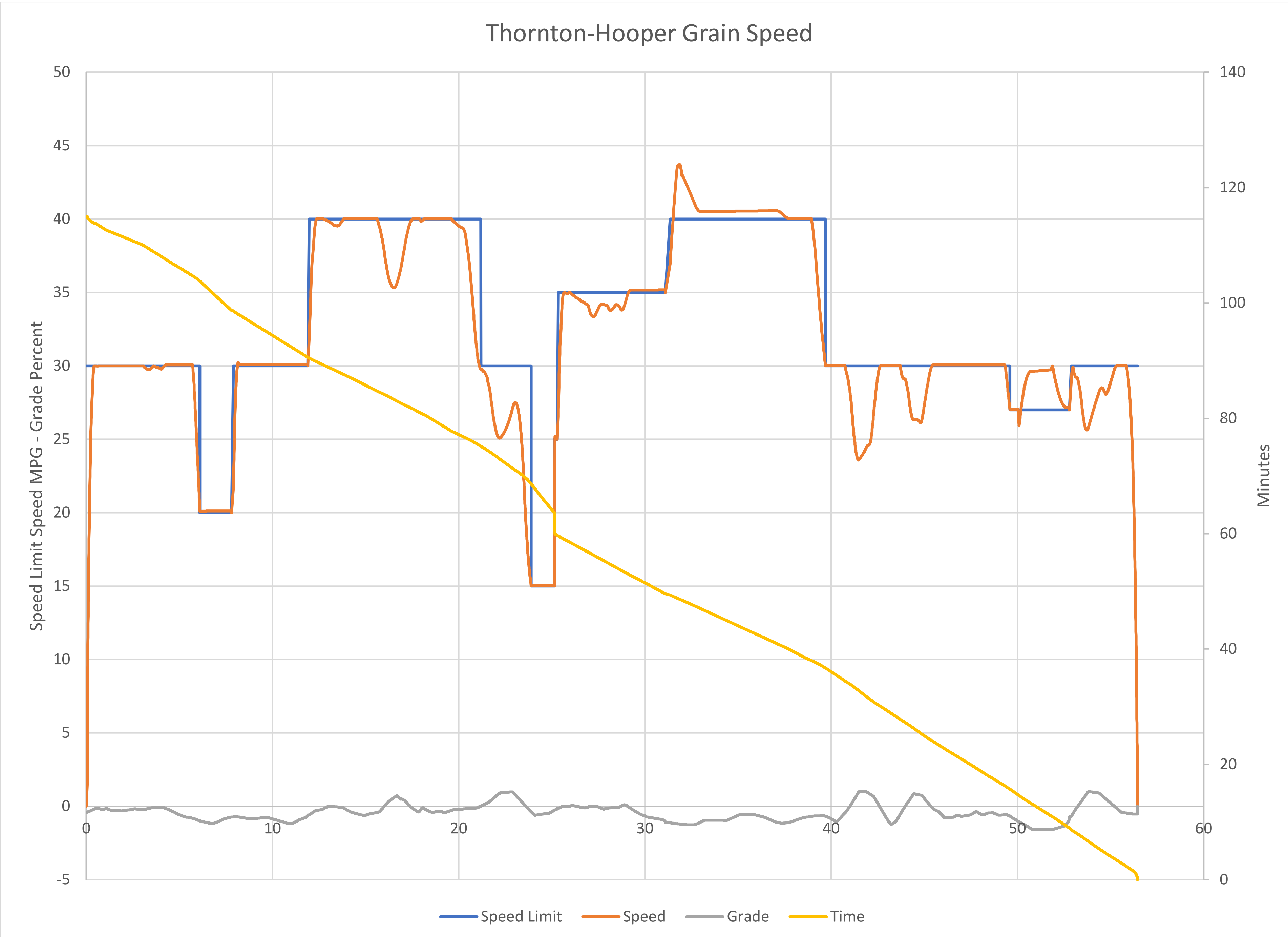


Pullman-Hooper Grain Load Speed
Speed Limit - Speed mph - Grade Percemt
Minutes
45
40
35
30
25
20
15
10
5
0
-5
160
140
120
100
80
60
40
20
0
0
10
20
30
40
50
60
70
80
Speed Limit
Speed
Grade
Time

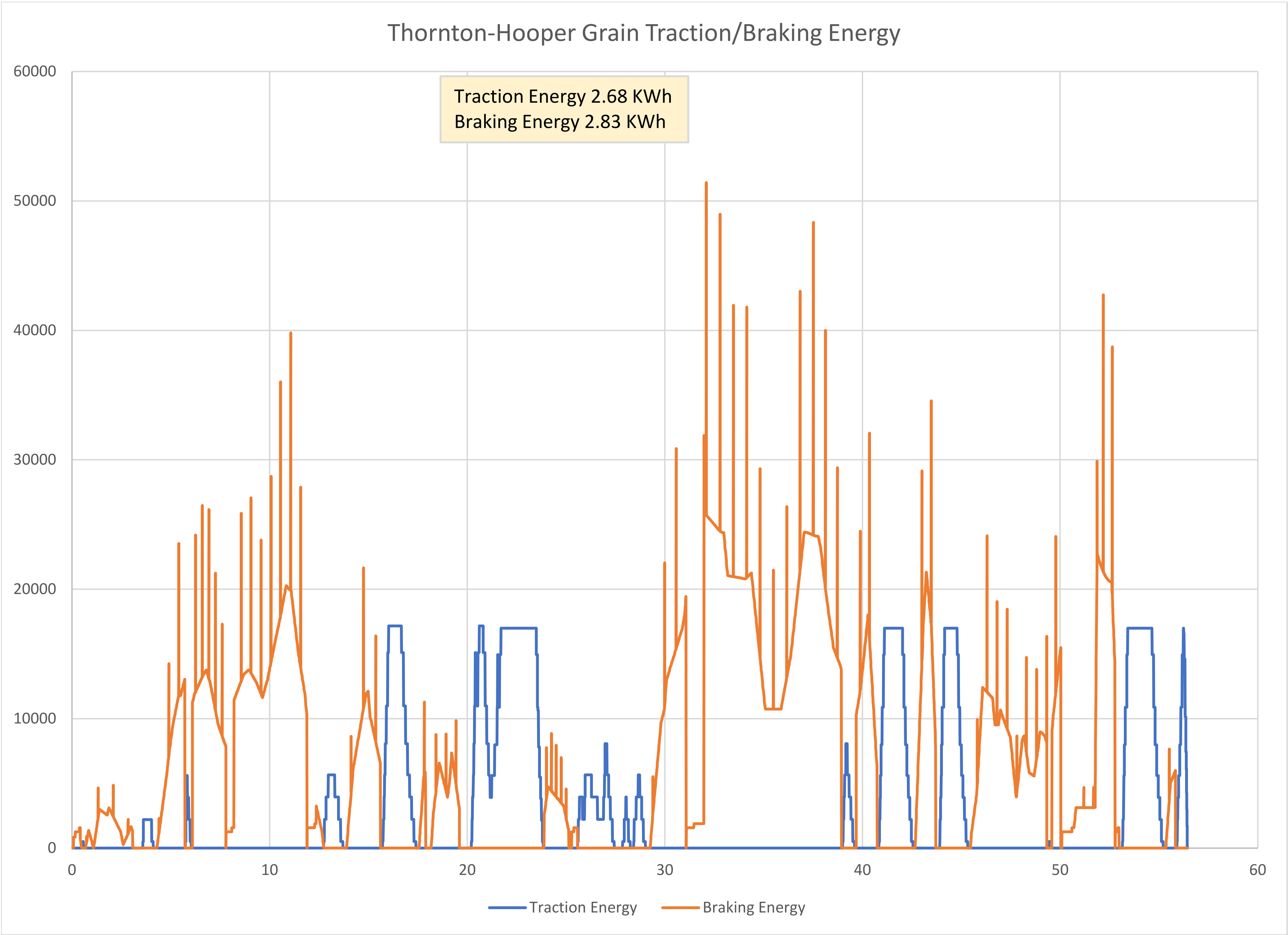

Pullman-Hooper Grain Traction/Braking Energy - Kilowatts
Traction Energy 4.0 KWh
Braking Energy 2.37 KWh
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
0
10
20
30
40
50
60
70
80
Traction Energy
Braking Energy

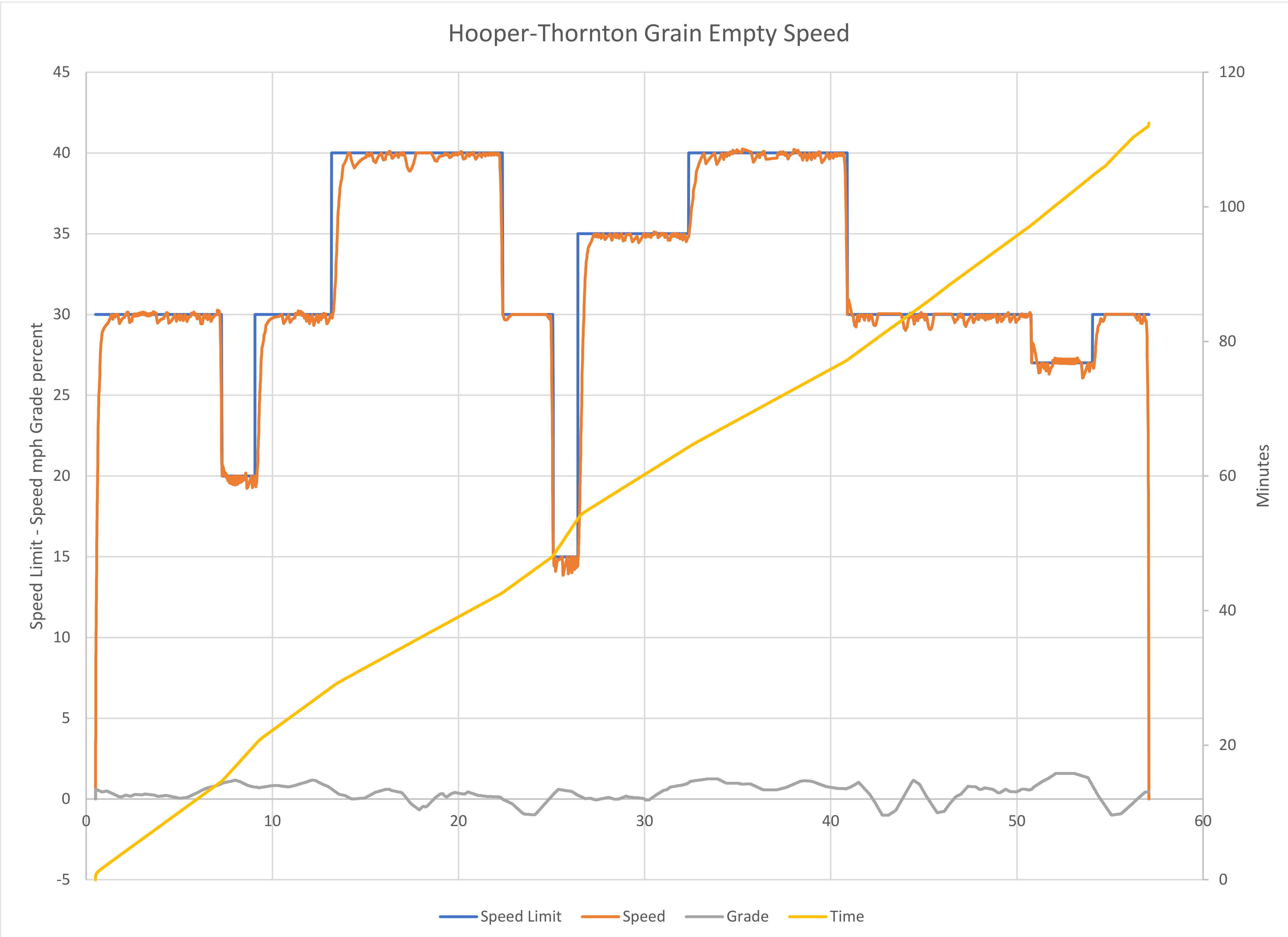

Hooper-Pullman Grain Empty Speed
Speed Limit-Speed mph - Grade Percent
Minutes
45
40
35
30
25
20
15
10
5
0
-5
-10
0
10
20
30
40
50
60
70
80
160
140
120
100
80
60
40
20
0
Speed Limit
Speed
Grade
Time


Hooper-Pullman Grain Empty Traction/Braking Energy
Traction Energy 1.57 KWh
Braking Energy 2.16 KWh
40000
35000
30000
25000
20000
15000
10000
5000
0
0
10
20
30
40
50
60
70
80
Traction Energy
Braking Energy

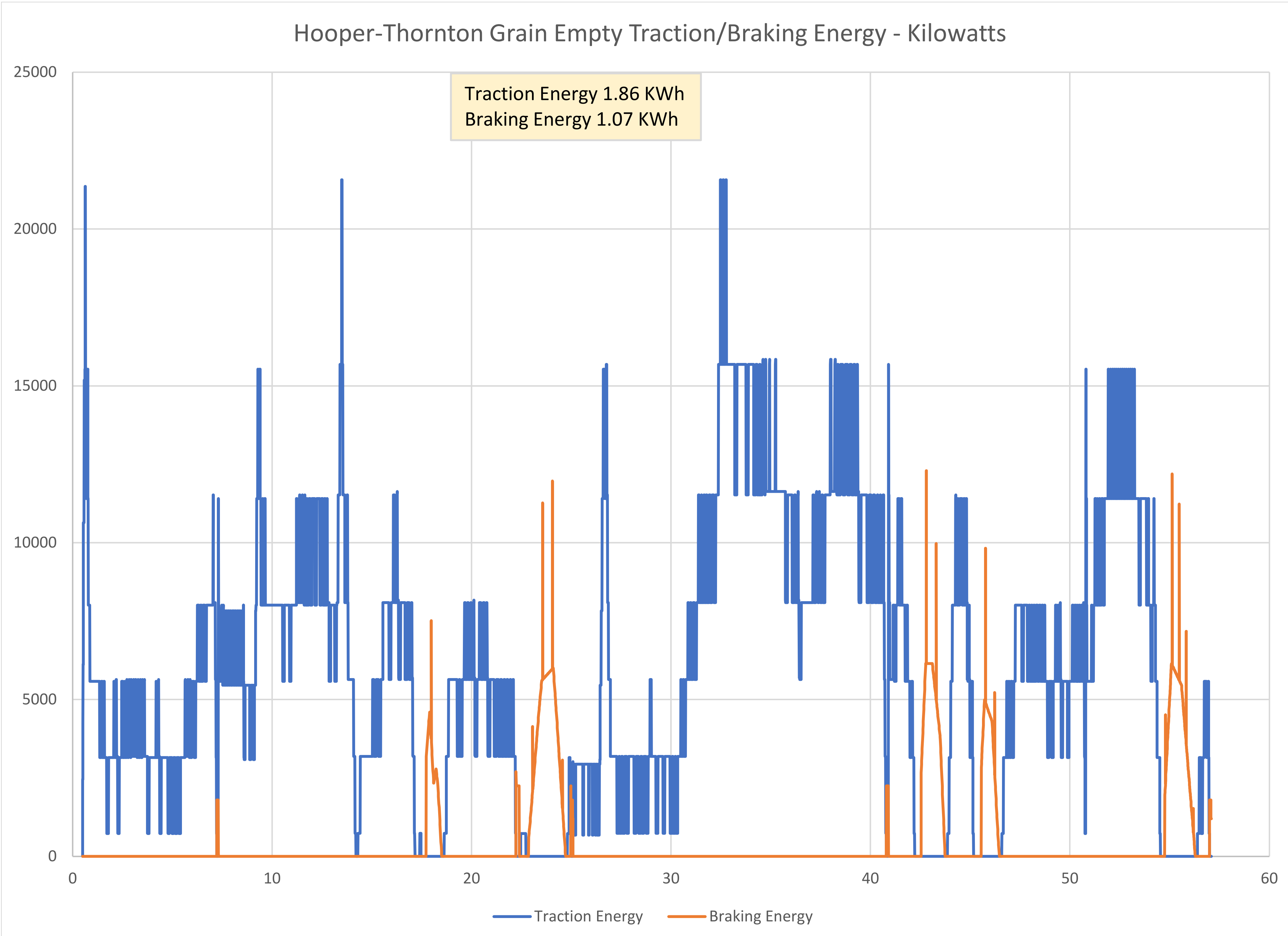


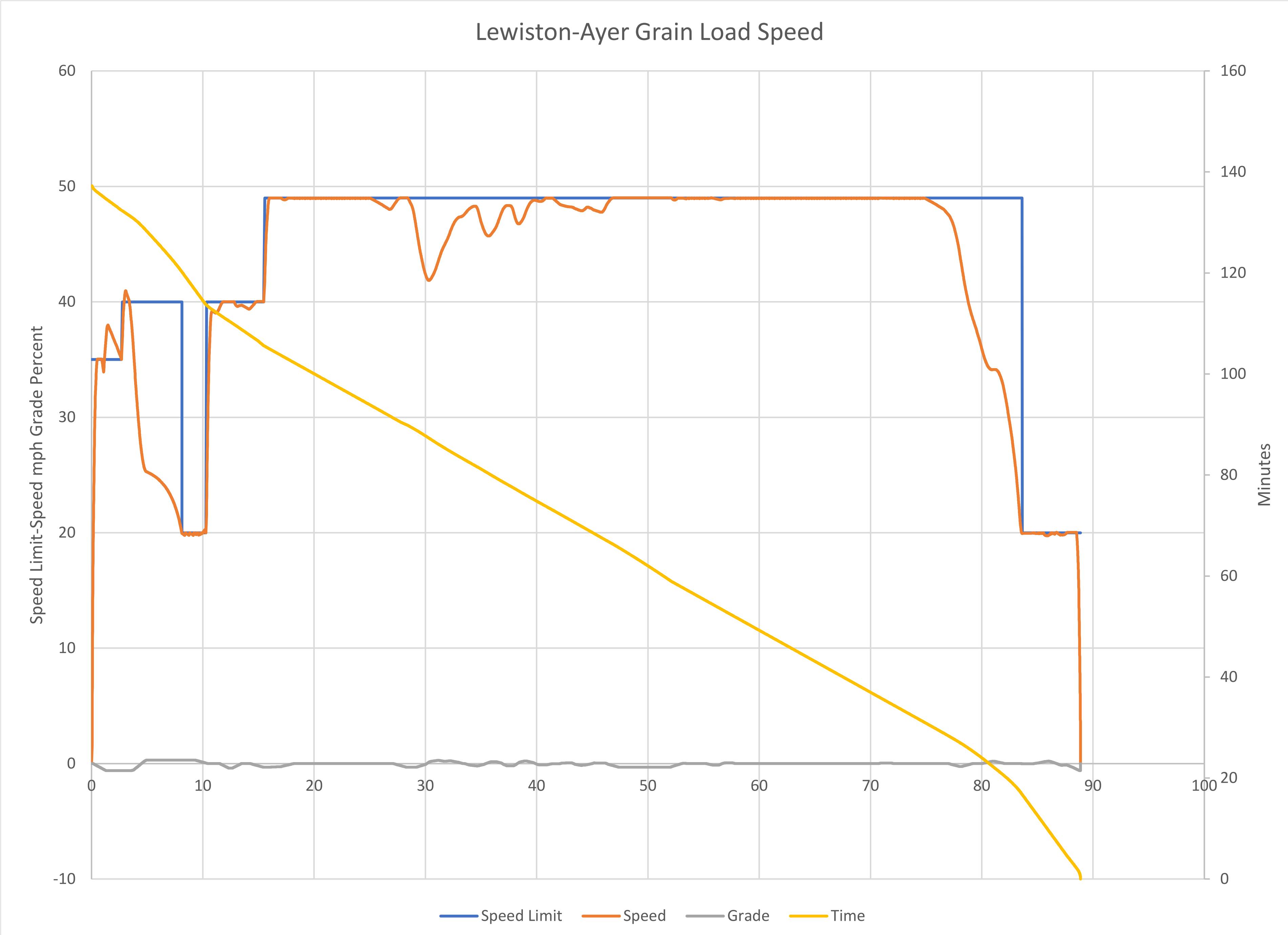
Thornton-Hooper Grain Speed
Speed Limit Speed MPG - Grade Percent
Minutes
50
45
40
35
30
25
20
15
10
5
0
-5
140
120
100
80
60
40
20
0
0
10
20
30
40
50
60
Speed Limit
Speed
Grade
Time

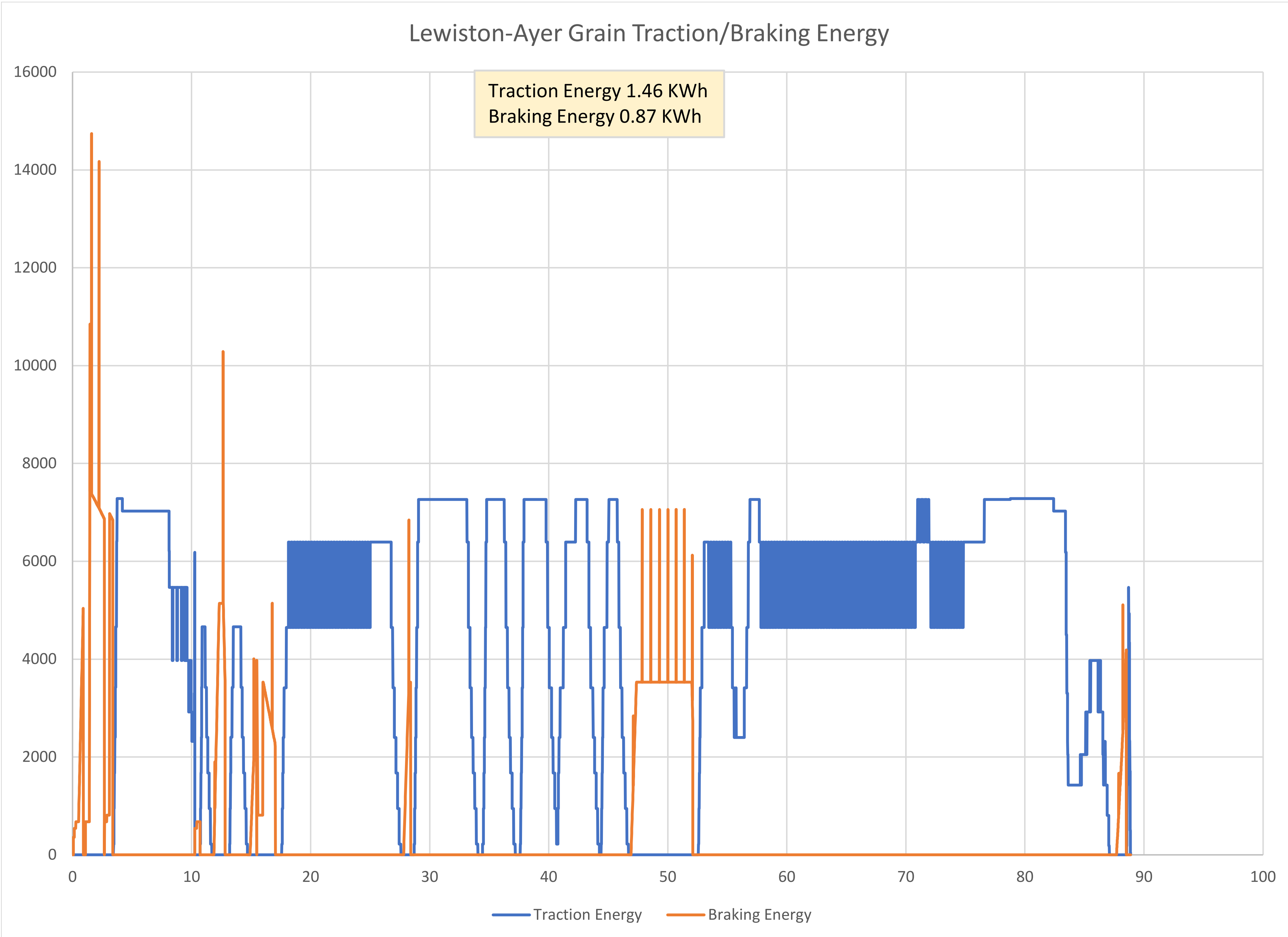

Thornton-Hooper Grain Traction/Braking Energy
Traction Energy 2.68 KWh
Braking Energy 2.83 KWh
60000
50000
40000
30000
20000
10000
0
0
10
20
30
40
50
60
Traction Energy
Braking Energy

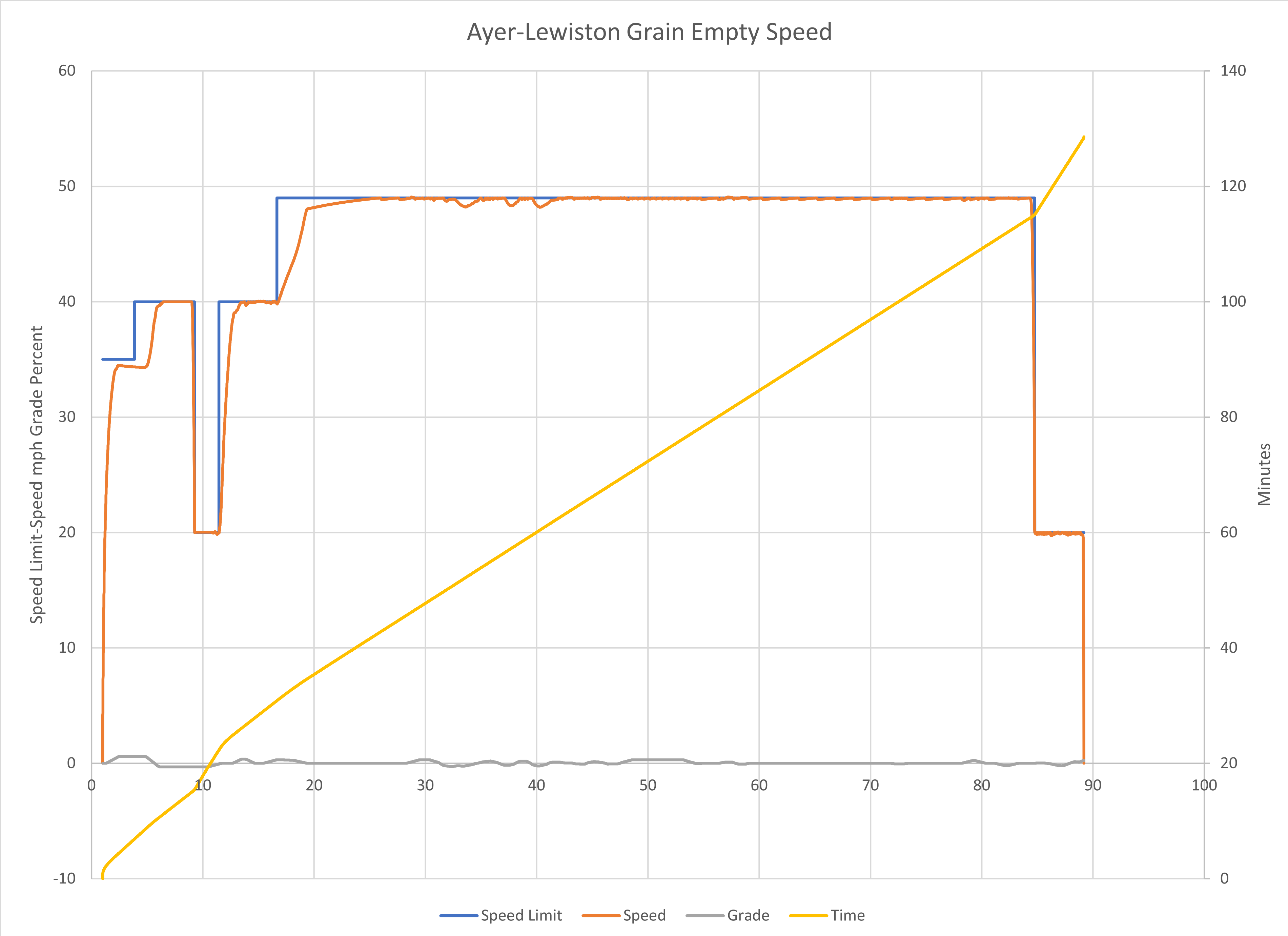


Hooper-Thornton Grain Empty Speed
Speed Limit - Speed mph Grade percent
Minutes
45
40
35
30
25
20
15
10
5
0
-5
120
100
80
60
40
20
0
0
10
20
30
40
50
60
Speed Limit
Speed
Grade
Time

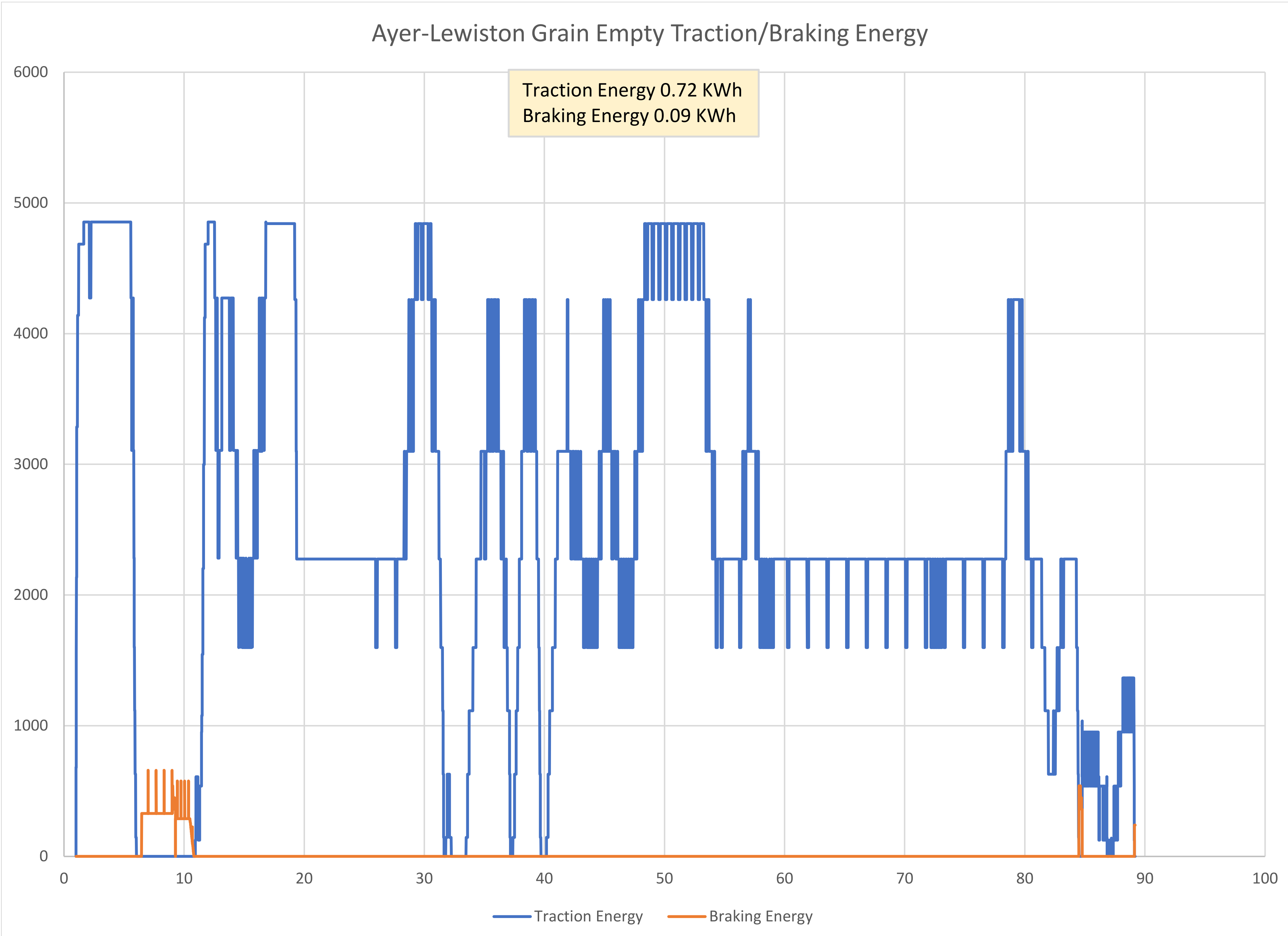

Hooper-Thornton Grain Empty Traction/Braking Energy - Kilowatts
Traction Energy 1.86 KWh
Braking Energy 1.07 KWh
25000
20000
15000
10000
5000
0
0
10
20
30
40
50
60
Traction Energy
Braking Energy


Lewiston-Ayer Grain Load Speed
Speed Limit-Speed mph Grade Percent
Minutes
60
50
40
30
20
10
0
-10
160
140
120
100
80
60
40
20
0
0
10
20
30
40
50
60
70
80
90
100
Speed Limit
Speed
Grade
Time


Lewiston-Ayer Grain Traction/Braking Energy
Traction Energy 1.46 KWh
Braking Energy 0.87 KWh
16000
14000
12000
10000
8000
6000
4000
2000
0
0
10
20
30
40
50
60
70
80
90
100
Traction Energy
Braking Energy



Ayer-Lewiston Grain Empty Speed
Speed Limit-Speed mph Grade Percent
Minutes
60
50
40
30
20
10
0
-10
140
120
100
80
60
40
20
0
0
10
20
30
40
50
60
70
80
90
100
Speed Limit
Speed
Grade
Time



Ayer-Lewiston Grain Empty Traction/Braking Energy
Traction Energy 0.72 KWh
Braking Energy 0.09 KWh
6000
5000
4000
3000
2000
1000
0
0
10
20
30
40
50
60
70
80
90
100
Traction Energy
Braking Energy

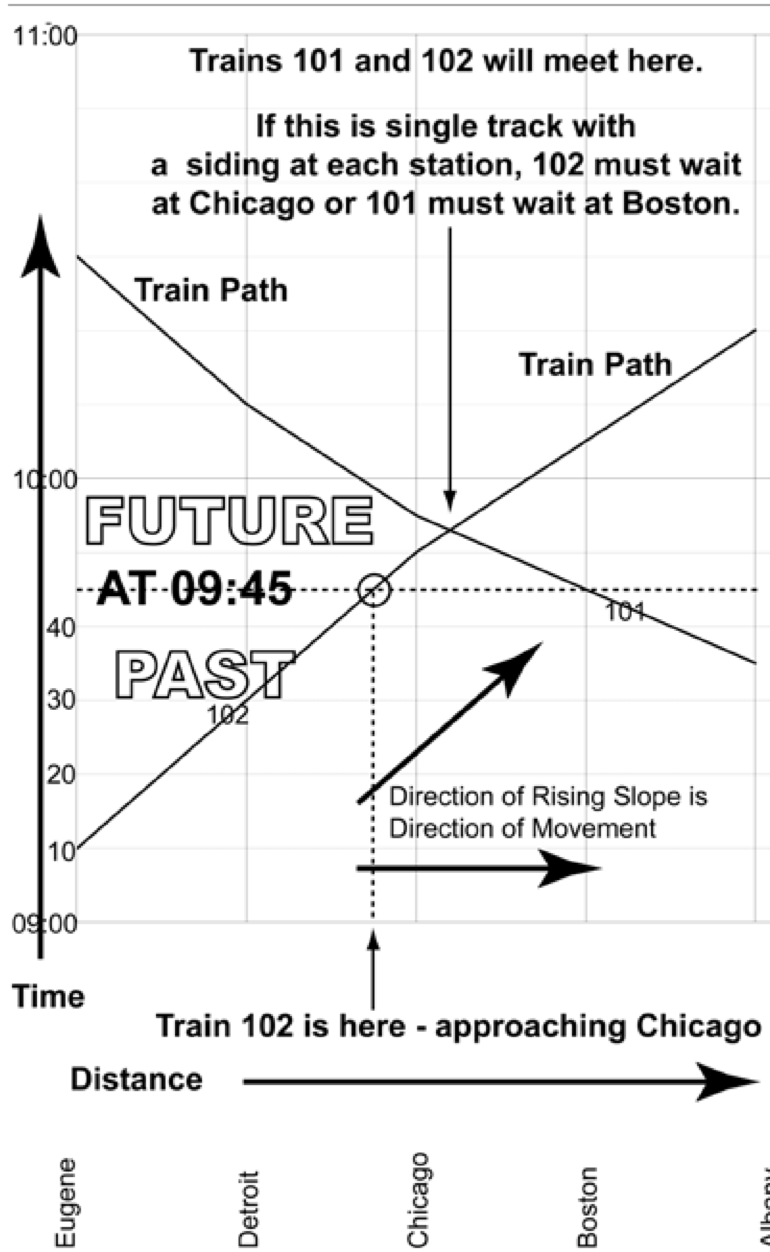
Idaho Wheat Commission

Wikimedia: David Gubler

Railroad operations is analyzed and planned using stringline diagrams (traffic diagrams).

The diagram is a time-distance graph. In the following examples, time is on the vertical axis and distance is on the horizontal axis.

The diagram at right is an example of how to interpret stringline disgrams. At any point on the line representing a train, the time atthat point is determined by looking at the vertical axis scale, and the location at that moment is found on the horizontal axis.

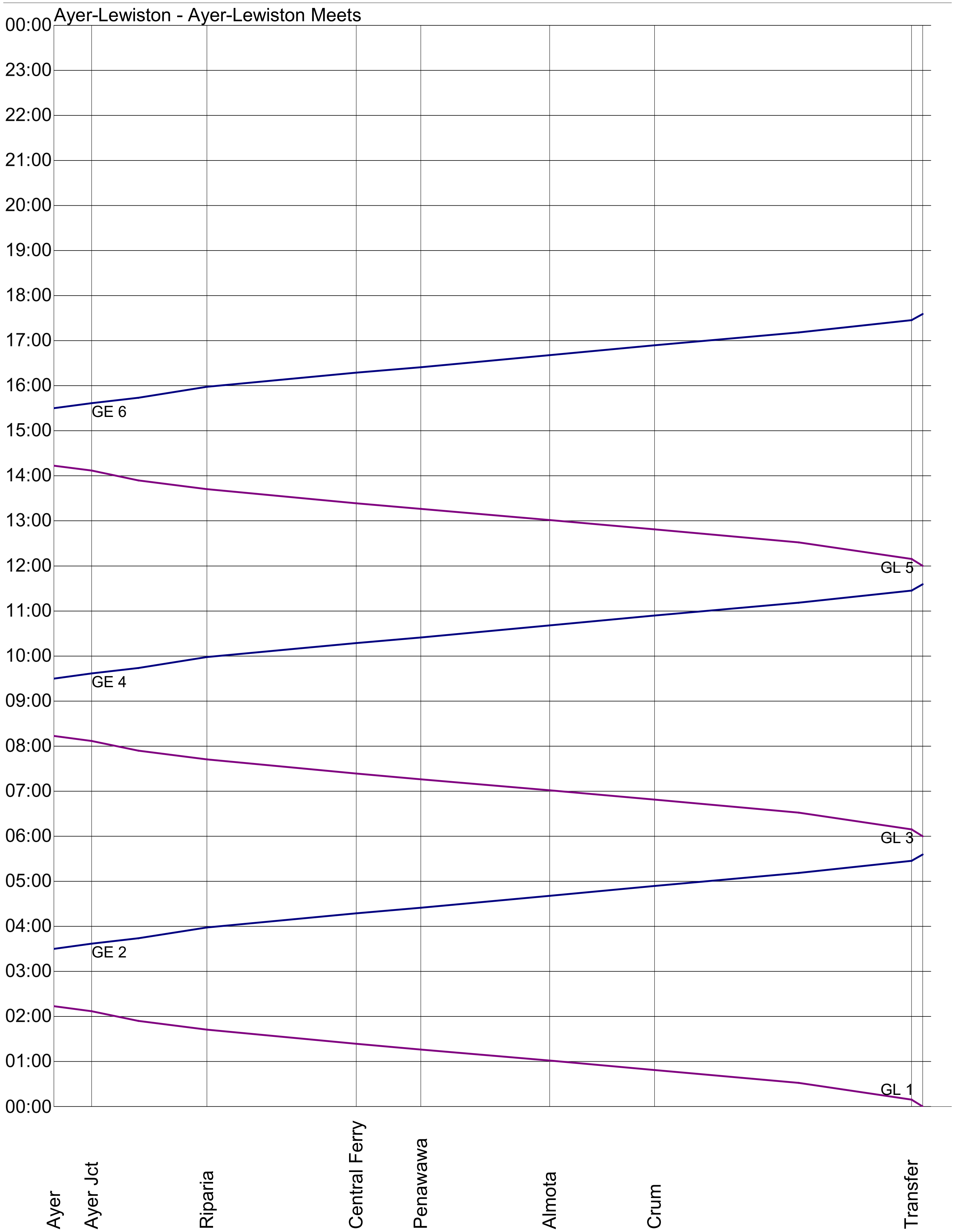


The diagrams on pages 25 and 26 represent the line between Lewiston and Ayer operating at full Practical Capacity. Theoretical capacity is the maximum number of trains if every movement opportunity is utilized. Practical capacity is generally considered to be 50-75 percent of Theoretical Capacity.

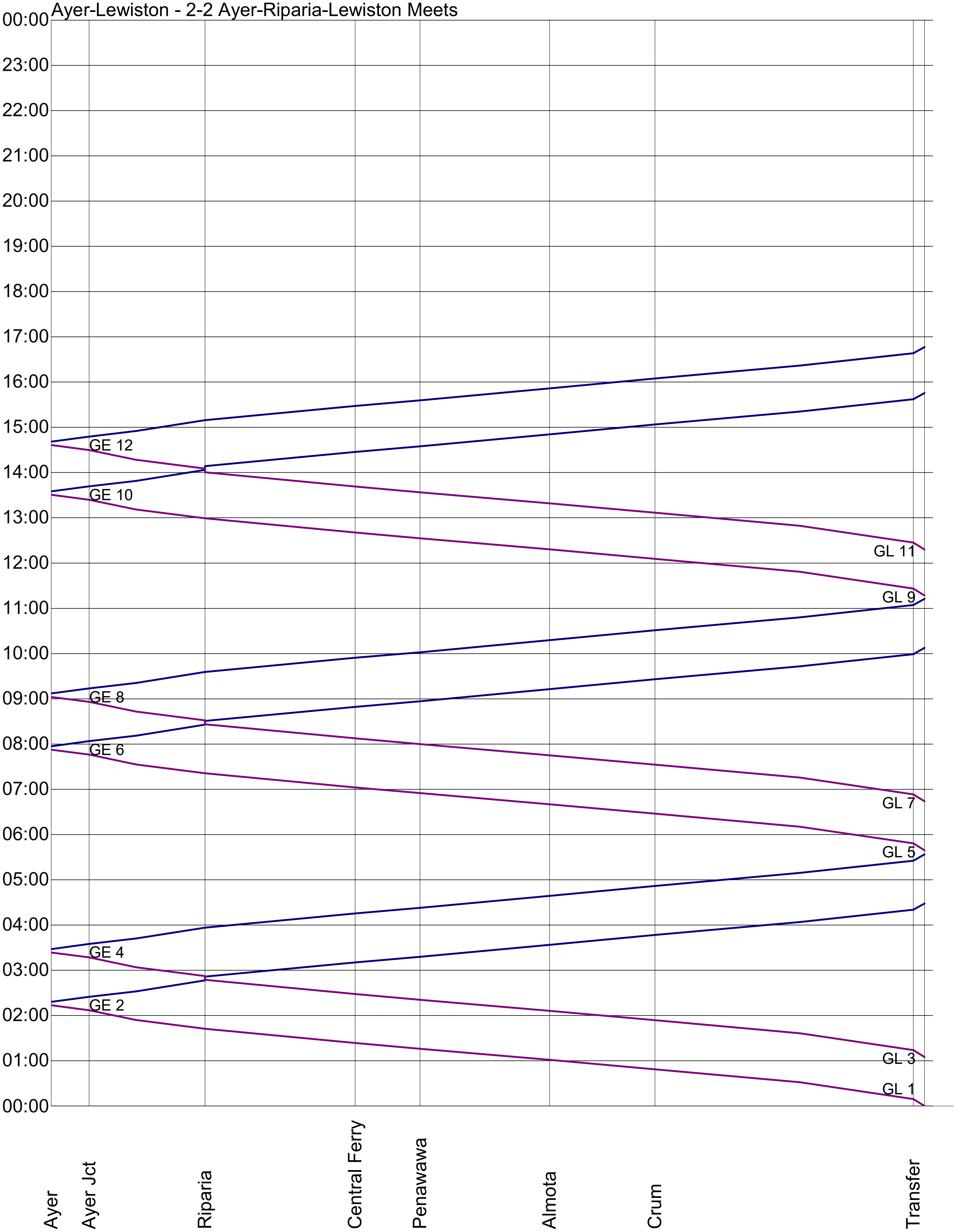
Theoretical Capacity represents the perfect situation. Every train is operating at exactly the right time, trains are not delayed for track conditions or maintenance, there is no effect of inclement weather, and nothing, track, signal, locomotive, or train is defective.

When developing schedules, trains are shown at the time that they will run. When all trains are drawn, conflicts (two trains needing a segment of track simultaneously) can be identified and proposed schedules adjusted. When merely determining capacity and there are no specific times, schedules are shown as closely together as they could operate. The part of the day remaining blank represents the reduction from Theoretical Capacity to Practical Capacity.

Page 28 shows the potential for round trips between Lewiston and Ayear, each train the only train when it occupies the line. Page 29 shows the potential if one of the tracks at Riparia (the only station with tracks long enough to accommodate a 110 car train) is used for opposite direction trains to meet. This arrangement could be employed during periods of unusually high traffic. A siding at Central Ferry (which appears to be the easiest place to construct a siding) would make the arrangement on page much more reliable and easier to manage under normal conditions. Later, sidings at Almota and Crum would increase capacity.



Ayer-Lewiston - Ayer-Lewiston Meets
00:00
23:00
22:00
21:00
20:00
19:00
18:00
17:00
16:00
15:00
14:00
13:00
12:00
11:00
10:00
09:00
08:00
07:00
06:00
05:00
04:00
03:00
02:00
01:00
00:00
GE 6
GL 5
GE 4
GL 3
GE 2
GL 1
Ayer
Ayer Jct
Riparia
Central Ferry
Penawawa
Almota
Crum
Transfer


Ayer-Lewiston - 2-2 Ayer-Riparia-Lewiston Meets
00:00
23:00
22:00
21:00
20:00
19:00
18:00
17:00
16:00
15:00
14:00
13:00
12:00
11:00
10:00
09:00
08:00
07:00
06:00
05:00
04:00
03:00
02:00
01:00
00:00
GE 12
GE 10
GE 8
GE 6
GE 4
GE 2
GL 11
GL 9
GL 7
GL 5
GL 3
GL 1
Ayer
Ayer Jct
Riparia
Central Ferry
Penawawa
Almota
Crum
Transfer