DESIGN MEMO

Date: May 6, 2011(Rev. 05)

To: I-69 Tier 2 PMC

From: Craig M. Gonsoski, PE
Gary K. Fisk, PE – Section 4 PM

Subject: **I-69 Section 4: Low Cost Design Criteria**
Low Cost Design Criteria Studies Summary

Tier 2 Low Cost Design Standards

The design standards developed for the Section 2 and Section 3 Draft Environmental Impact Statements (DEISs) utilize two sets of criteria, the "Initial" (desirable criteria) and "Low Cost" (minimum criteria). The Low Cost standards utilize "minimum" criteria for a freeway facility from the INDOT Design Manual. Most of these are consistent with current interstate construction in much of Indiana. The FHWA has already accepted several of these criteria for the Section 1 construction packages. Accordingly, these accepted criteria will be incorporated into the Initial design criteria for Section 4. Other cost savings measures identified within Sections 2 and 3 will also be incorporated into the Low Cost Design Criteria for Section 4. These criteria, as well as those accepted for Section 1, are summarized in the table below.

	Sections 2 & 3	Section 4	All Sections
	Initial Criteria	Initial Criteria	Low Cost Criteria
FHWA Accepted Criteria			
Median Width	84 ft	60 ft	60 ft
Inside Shoulder Width	6 ft Paved	4 ft Paved	4 ft Paved
Maximum Grade	3% (level)	4% (Rolling)	4% (Rolling)
Sections 2 & 3 - Low Cost Criteria			
Pavement Type	Concrete		Asphalt
Clear Zone	35 ft		30 ft
Minimum Grade	0.5%		0%
Bridge Slope Treatment	2:1 spill slopes		MSE Walls

Additional Section 4 Cost Savings Measures

Section 4 engineers worked closely with INDOT and the Tier 2 PMC to identify additional cost savings measures. Many of the measures focused on minimizing the effects of the topography within Section 4. This study area features steep hills and valleys with vertical relief of over 500 feet in some areas, as well as karst limestone geology with numerous caves, sinkholes and springs. The Tier 2 Team adopted a "Practical Design" approach to this section and evaluated each measure to determine whether one or more of them could provide substantial cost savings without compromising safety.

Some of the measures did not meet minimum values for either the Indiana Design Manual or the 2005 "AASHTO Design Standards for the Interstate System", and would require a Level 1 or Level 2 Design Exception. However, the FHWA's *Flexibility in Highway Design* notes, "An important concept in highway design is that every project is unique," and "Designers are faced with the task of balancing the need for the highway improvement with the need to safely integrate the design into the surrounding natural and human environments." With this in mind, the flexibility within the IDM was used to

investigate each measure in order to achieve a balanced road design while addressing design-related issues in a satisfactory manner.

After careful consideration of the potential cost savings and safety implications, several of the measures identified have been incorporated into the Section 4 Low Cost Design Criteria. These criteria are shown in the below table followed by further discussion of each.

Section 4 - Additional Low Cost Criteria	Initial Criteria	Low Cost Criteria
Critical Length of Grade – Max. Truck Speed Reduction on Upgrades	10 MPH (Min 60 MPH)	20 MPH (Min 50 MPH) *Lvl 2 DE Req'd*
Rock Cut Slope Treatment	2:1	Rock Cut Benching (20 ft)
High Embankment Treatment (Ht)	>24 ft	>24ft
Fill Slope Treatment	3:1	2:1 behind Guardrail
Interchanges	-Reduced Ramp Spacing -Low speed loop ramps	-Reduced Ramp Spacing -Low speed loop ramps
State Road Design Criteria	4R	4R: SR 45 (at SR 445) & SR 445 3R Desirable: SR 45(at I-69 Interchange) & SR 54
Local Road Design Criteria	3R Desirable	3R Desirable

❖ ***Critical Length of Grade***

Critical length of grade is defined as the maximum length of a specific upgrade on which a loaded truck can operate without an unreasonable reduction in speed. Critical length of grade is measured by quantifying the reduction in truck speeds below the average running speed of adjacent traffic. The American Association of State Highway and Transportation Officials (AASHTO) – Geometric Design of Highways and Streets (2004) ("Green Book") and the Indiana Design Manual (IDM) recommend a 10 mph speed reduction as a general guide to determine critical lengths of grade on major routes such as freeways. However, the AASHTO Green Book also notes that this standard is not a strict control, but is a guideline and in some instances, the terrain or other physical control may preclude meeting this guideline. It was found that using the 10 mph critical length of grade criterion, coupled with interstate freeway design criteria, restricted the design of the vertical profile such that it could not match the slopes of the existing terrain in Section 4. High fill areas and deep cuts along the roadway were needed to make up the remaining elevation differences, resulting in high earthwork costs (a major project issue).

In order to reduce earthwork costs, a Level 2 design exception request for critical length of grade was prepared, see attached memorandum dated May 6, 2011 from DLZ to the I-69 Tier 2 PMC. This design exception analyzed the cost and safety implications of using a maximum 20 mph truck speed reduction to design the Section 4 vertical roadway profile. Its findings and observations are summarized below.

- The data cited in the AASHTO Green Book, as the basis for recommending a 10 mph speed reduction, was found to have some shortcomings when applying it to a multi-lane interstate. The Green Book did not use data from any specific grade or unsafe location and most importantly, approximately 75% of the data were from two-lane highways that are not applicable to multi-lane, divided highways.
- A more recent study, "Revising the AASHTO Curve: Accident Involvement Rates for Trucks and Speed Differentials on Highway Grades" Brazil, 2007, found that truck crash involvement rates

on multi-lane divided highways is, in fact, much lower than indicated by the AASHTO data. The 2007 study from Brazil shows that on multi-lane roadways, there is no significant difference in accident rates, until a speed differential greater than 10 mph is reached. The 2007 study also shows that crash rates for speed differentials over 10 mph are significantly lower than predicted by the AASHTO data; i.e., the crash involvement rate for a 20 mph speed differential is approximately 1/5th (20%) of the AASHTO predicted rate.

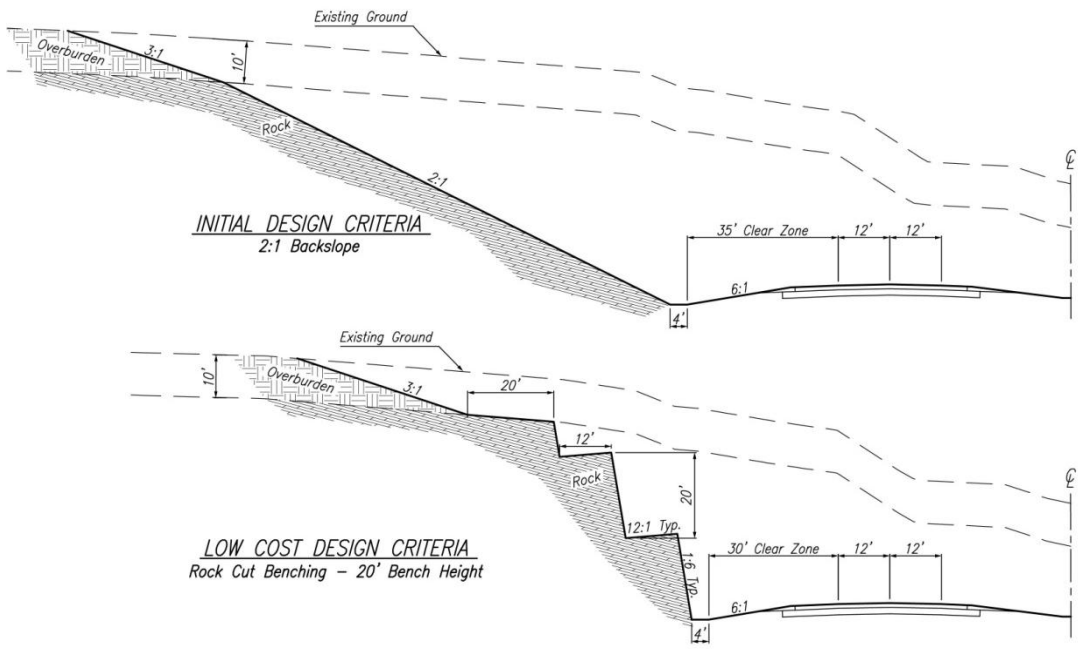
- The critical length of grade criteria is a level two design criteria as defined by the INDOT Design Manual, and is unique in that there is no absolute minimum value specified. In regards to application of this criteria, IDM 44-1.04 states "If the critical length of grade is exceeded, the grade should be flattened, **if practical** (emphasis added), or the need for a truck-climbing lane should be evaluated." Further, according to the IDM, a truck climbing lane is only warranted if the critical length of grade is exceeded. Therefore, using the proposed 20 mph truck speed reduction criteria to determine the maximum length of grade is within the flexibility of the standards as long as the need for truck climbing lanes is evaluated.
- Warrants for construction of truck climbing lanes were analyzed as a part of the Level 2 design exception request for critical length of grade (Exhibit B of the May 6, 2011 Memorandum) . The analysis indicated that truck climbing lanes were not warranted in Section 4 based on the level of service (LOS) criteria, which, using the 2030 projected traffic, is calculated to operate at LOS A or B in Section 4.
- The AASHTO Green Book notes that a multilane highway with a high LOS has sufficient capacity so that a slow moving vehicle does not impede the following vehicles that can readily move left to the adjacent lane without difficulty (AASHTO, 2004, p. 247).
- A benefit to cost ratio (B/C) analysis was performed and included with the Level 2 design exception request (attached). INDOT B/C analysis methodology calculates a user benefit based on savings from reduced accidents as one of the main factors. Therefore, this analysis considered the crash reduction savings of the 10 mph speed reduction as the user benefit because a 20 mph speed reduction is expected to have an increased crash rate. Consequently, the costs are the additional costs to construct the interstate to the 10 mph speed reduction criterion as the 20 mph criterion results in a cost savings. The analysis resulted in B/C ratios of 0.48 and 0.19 for two critical locations in Section 4. In other words, the benefit of using the 10 mph speed reduction, a reduced number of crashes, does not out-weigh the higher construction cost of the 10 mph truck speed reduction criterion when compared to using a 20 mph truck speed reduction to design the vertical profile.
- With a posted speed limit of 70 mph, the calculated minimum truck speed of 50 mph on upgrades, using the 20 mph speed reduction criterion, is still greater than the 45 mph minimum speed limit often posted on Indiana interstates.

The Level 2 design exception request documents consideration of impacts to safety, mobility and project costs and recommends that the Section 4 Low Cost Design Criteria include a maximum 20 mph speed reduction for the critical length of grade calculation. The operational flexibility in the IDM allows the designers of I-69 to design an interstate roadway that balances safety with costs and environmental impacts. The flexibility in the critical length of grade criteria is the greatest factor in the Section 4 low cost standards that reduces the environmental footprint of the highway by allowing the roadway to better follow the terrain, reducing earthwork volumes, as well as reducing bridge heights and lengths. Preliminary profiles were developed for the Low Cost alternative that varied only the critical length of grade analysis from the Initial Criteria. An approximate $100 million in construction costs ($113 million

in total costs) savings were realized using a maximum 20 mph speed reduction versus using a maximum 10 mph reduction for the critical length of grade analysis.

❖ *Rock Cut Slope Treatment*

The IDM allows for benching of the backslope when a cut is required in rock. However, at this point in the project development, the stability, depth, and location of the rock layer is unknown. A rock cut backslope of 2:1 was decided upon for the Initial design criteria. This assumes some rock layers could be less stable and unable to be benched, but also does not assume the increased cost of 3:1 slopes through the entire corridor. Based on a geological opinion of the type of rock anticipated in Section 4, the Low Cost design assumed a 20 foot benching height. Both designs assume a 10 foot deep overburden soil section sloped at 3:1. Preliminary designs showed an estimated cost difference of over $30 million between these two rock cut backslope criteria.



I-69 Section 4 – Rock Cut Slope Treatments

❖ *High Embankment Cost Reduction Measure*

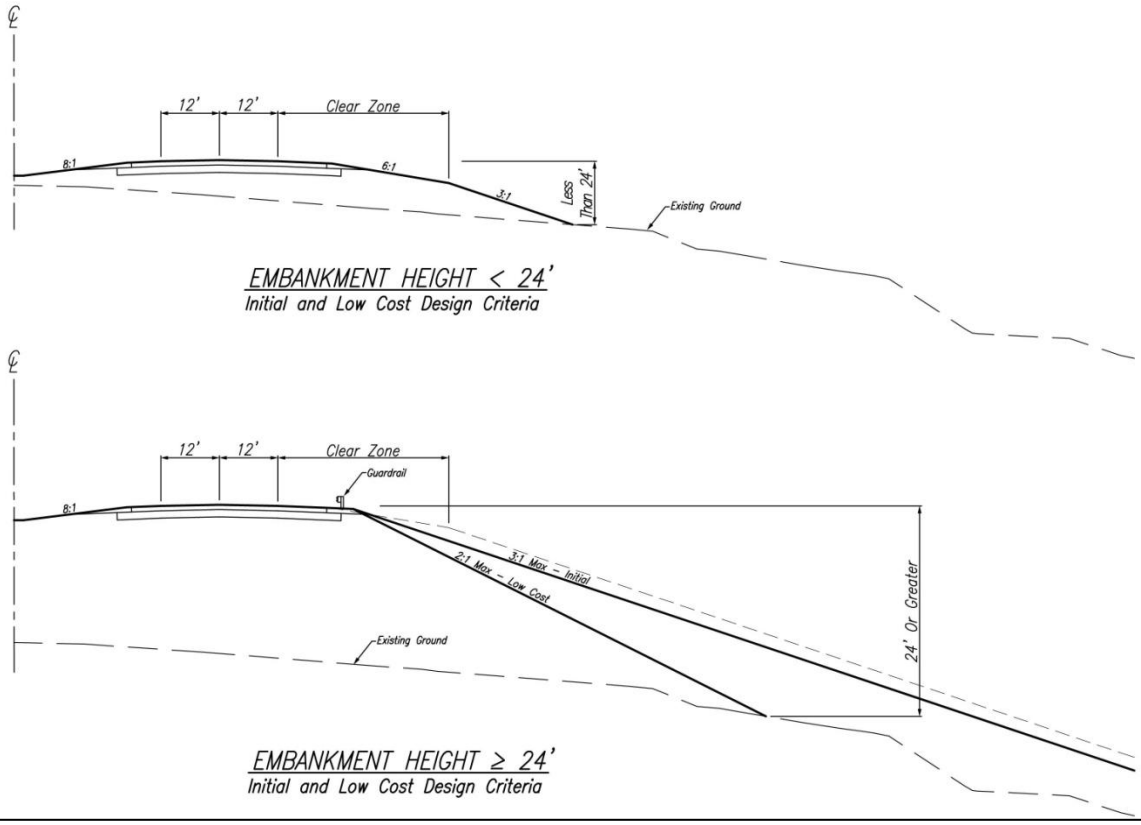
The preliminary designs for the I-69 interstate through the Section 4 terrain result in as much as 32% of the Section 4 alignment having embankment heights over 20 feet high. Due to the extent of these high fill areas, an alternative treatment of the roadside area and embankment slope was investigated. The results of this investigation, as summarized below, are included in a design memo dated May 6, 2011 from DLZ to the I-69 Tier 2 PMC (attached).

The typical section of I-69 Section 4 includes a 6:1 sloped clear zone, 30 feet – 35 feet from the edge of the travelway, for vehicle recovery before the foreslope or backslope. As a cost savings measure in high embankment areas, this recovery area is reduced with added guardrail protection, and the embankment foreslope breakpoint is located approximately 15 feet from the edge of the travelway; see the figure below, I-69 Section 4 – High Embankment Roadside and Slope Treatment. This high embankment cost

reduction measure resulted in reduced earthwork volumes and lowered overall construction costs and environmental impacts.

The preliminary designs for the I-69 Section 4 EIS assume that this reduction would require a roadside barrier (guardrail) to shield the embankment slope. Since the installation of guardrail offsets some of the earthwork cost savings, an economic analysis was used to determine the embankment height at which this measure becomes cost-effective. The cost analysis determined that an embankment height of approximately **24 feet** was the height at which the reduced earthwork and installation of guardrail becomes more economical than providing the 6:1 clear zone slope. Both the Initial and Low Cost designs include this high embankment cost reduction measure, including the installation of guardrail, where embankment heights reach 24 feet and greater.

It is also recommended that the low cost design criteria further enhance the high embankment cost reduction measure by increasing the embankment foreslopes behind guardrail from 3:1 to 2:1. By increasing the slopes, the amount of fill needed is further reduced, resulting in less excavation and borrow to balance the earthwork. It also results in a smaller right-of-way footprint which reduces right-of-way costs and environmental impacts.



I-69 Section 4 – High Embankment Roadside and Slope Treatment

A check of the roadside barrier warrants for embankments was also done as a part of this analysis. It was determined that guardrail is not warranted for embankment heights less than 24 feet, where the Section 4 typical cross section includes a full clear zone at the top of the embankment and maximum 3:1 slopes.

Where embankment heights exceed 24 feet and the cost savings measure is utilized, guardrail may be warranted to shield the high foreslope. The final determination on placement of roadside barriers will be made in the final design of the project where more detailed survey, design, and geotechnical investigation is available on the slope conditions and other hazards that may be present.

❖ ***Interchange Ramps***

The proposed interchanges within Section 4 were reviewed for measures to reduce interchange footprints and alternative configurations. A reduced ramp spacing of 800 feet was incorporated into both the Initial and Low Cost designs of the SR 45 interchange. The 2030 projected traffic volumes at this interchange indicate that stop controlled intersections will operate at Level of Service "A". The IDM recommends an intersection spacing of 1300 feet for efficient traffic signal operation. Based on traffic signals not being warranted at this interchange in the design year, reduced ramp spacing was used as a cost savings measure. The reduced ramp spacing also reduces the number of residential displacements and right-of-way costs.

Some interchange ramps at the proposed County Line and SR 37 Interchanges, with forecasted low traffic volumes, were designed using a minimum 30 mph design speed. There are three proposed low-speed ramps including:

1. County Line – NB I-69 to WB Connector Road
2. SR 37 – NB I-69 to SB SR 37
3. SR 37 – NB SR 37 to SB I-69

Utilization of the lower design speed to design the ramp geometrics (i.e. smaller radii) reduced the footprint at these two interchanges, which in turn reduced construction costs, residential displacements, and right-of-way costs.

❖ ***State & Local Road Design Criteria: 3R Desirable or 4R***

As explained in a design memo dated January 20, 2010 from DLZ to the I-69 Tier 2 PMC (attached), the state roads within the Section 4 corridor were evaluated to determine any benefits to using 3R desirable design standards verses 4R design standards. The existing conditions of SR 45 at proposed I-69 and SR 54 at proposed I-69 include narrow, or non-existent, shoulders and other sub-standard roadside conditions. A review of the crash histories and existing geometrics indicate that the overall safety of these roads will be improved over the existing conditions, using 3R desirable criteria. Also, the relatively low traffic volumes, expected decrease in traffic upon completion of I-69, and existing 3R classifications lend additional credence that desirable 3R criteria is appropriate. Therefore it is recommended that state and local roads be constructed using the less costly 3R desirable criteria as opposed to 4R criteria used for new roads.

One exception to the recommendation to use 3R desirable criteria for state and local roads is the new intersection and realignments of SR 45, SR 445 and the new County Line Interchange Connector Road. Construction cost savings could be realized by using 3R desirable criteria in this location, however, the IDM defines 4R reconstruction as major revisions to the existing horizontal and vertical alignment or reconstruction of a significant portion of the existing pavement structure. It also defines new construction as an intersection relocated to a new point of intersection. The proposed relocation of SR 445, including reconfiguration of the existing 3-way intersection into a 4-way intersection, would constitute major revisions and therefore it is recommended that SR 45, SR 445 and the County Line Interchange Connector Road be constructed to 4R design criteria.

Section 4 Cost Savings Measures - Not Carried Forward

As part of the engineering development for the I-69 Tier 2 Studies in Section 4, several measures were evaluated that did not warrant incorporation into the Low Cost Design Criteria at this stage of the project development. While these measures did not produce substantial cost savings when considered along the entire 27 miles of the Section 4 corridor, they may be warranted in some situations, as determined in final design. The following cost saving measures were studied but were not carried forward into the Section 4 Low Cost design criteria:

- Reduced design speed – *from 70 mph to 60 mph*
- Steeper maximum grade – *from 4.0% to 5.0%*
- Bifurcation of horizontal and/or vertical alignments
- Narrower median width with barrier

Reduced Design Speeds – A reduction of the design speed to 60 mph in Section 4 was evaluated to determine effects and potential cost savings. Lowering the design speed would have an adverse effect on the overall mobility benefit provided by I-69. Additionally, while the design speed evaluation showed a cost savings, it was found to be mainly due to the effect of design speed on the critical length of grade rather than any changes to the horizontal and vertical geometry. The critical length of grade increases as the initial truck speed decreases. Similar or greater cost savings were realized by utilizing a 20 mph truck speed reduction in the critical length of grade calculation without lowering the running speed of non-truck traffic. A lower design speed would also be inconsistent with Tier 1 performance evaluations. For example, such a reduction for 20 miles of Section 4 would increase the Evansville to Indianapolis travel time savings by 3 minutes, which is 11% of the 27 minute savings determined in the Tier 1 study. Evansville to Indianapolis travel time was the performance measure for one of three Tier 1 core goals. Therefore a 60 mph design speed was not incorporated into the Low Cost design criteria.

Steeper Maximum Grade – A change in the maximum grade criterion from 4% to 5% was considered in an effort to reduce earthwork balances through the Section 4 terrain. It was found, however, that the critical length of grade decreased as the roadway grades increased, severely limiting the length of steep grades. The most economical design grades for the road did not exceed 4% in any event; therefore, no meaningful benefit would be gained by increasing the maximum grade to 5%.

Bifurcated Alignments - The varying topography of the I-69 corridor in Section 4 creates situations where there are potential cost advantages to splitting the north and southbound lanes to follow independent alignments and profiles. There would be advantages if ridges of land were to run parallel to each other for a distance and coincide with the route of the highway. However, within the project corridor, the terrain undulates and changes so abruptly that the geometric criteria for the horizontal and vertical alignments limit any advantages of two separate lane groups. Furthermore, the many ridges and valleys in the corridor generally run perpendicular to the Section 4 alignments, or parallel for only a short distance, such that few opportunities for cost savings are available. Preliminary bifurcated alignments were developed; however, the initial results did not show any apparent cost advantages in separating the north and southbound lanes. The right-of-way footprint also increases, resulting in additional costs and environmental impacts. No substantial cost savings opportunity using bifurcated alignments was found, therefore, this measure was not incorporated into the Section 4 Low Cost design criteria.

Narrow Median with Barrier - Two different types of reduced medians were considered: a 48 foot median with a high-tension cable barrier system; and a 26.5 foot median (the narrowest median allowed

by the Indiana Design Manual for a rural freeway) with full depth paved shoulders and a concrete median barrier. While both options reduced the footprint and earthwork costs, these savings were offset by the additional costs associated with the median barrier. For example, the 26.5 foot median was estimated to save approximately $17 million in earthwork and right-of-way costs over the 27 mile length of Section 4; however, additional concrete median barrier, full depth pavement and bridge and drainage structure costs were calculated at approximately $38 million for a net increase in total cost of about $21 million. The options studied for narrow medians with a barrier resulted in increased costs; therefore, this measure was not incorporated into the Section 4 Low Cost design criteria

Conclusion

Several cost saving measures were investigated within Section 4 of I-69 to identify those which would provide a substantial cost savings for I-69. These are shown in the following summary table. After consideration of impacts to safety, mobility and project costs, several of these design elements were incorporated into the Section 4 Low Cost Design Criteria. Combined, the Section 4 Low Cost design criteria are estimated to save the project up to $250 million in construction and right-of-way costs compared to the Section 4 Initial design criteria. An even greater savings is realized when the Low Cost design criteria is compared to the Section 2 and 3 initial design criteria, which were determined at the onset of the Tier 2 studies.

Section 4 - Low Cost Savings Summary	Approximate Cost Savings vs. "Initial Criteria"
Critical Length of Grade – 20 mph Maximum Truck Speed Reduction	$113 M
Rock Cut Slope Treatment – 20 ft Benching	$30 M
Fill Slope Treatment – 2:1 Behind Guardrail	$19 M
State & Local Road Design Criteria – 3R Desirable	$250,000
Low Cost Criteria used in Sections 1, 2 and 3,and also applicable to Section 4	$88 M
Total Cost Savings	**$250 M**

Attachments:
1. I-69 Tier 2 - Design Memo: Section 4 State Road Design Criteria – 3R verses 4R, dated January 20, 2010.
2. I-69 Tier 2 - Design Memo: Level Two Design Exception for Critical Length of Grade, revised May 6, 2011.
3. I-69 Tier 2 – Design Memo: High Embankment Cost Reduction Measures, dated May 6, 2011.

DESIGN MEMO

Design Criteria Summary	Section 4	
	Initial Criteria	Low Cost Criteria
FHWA Accepted Criteria		
Median Width	60 ft	60 ft
Inside Shoulder Width	4 ft Paved	4 ft Paved
Maximum Grade	4% (Rolling Terrain)	4% (Rolling Terrain)
Section 2 & 3 - Low Cost Criteria		
Pavement Type	Concrete	Asphalt
Clear Zone	35 ft	30 ft
Minimum Grade	0.5%	0%
Bridge Slope Treatment	2:1 spill slopes	MSE Walls
Section 4 - Additional Low Cost Criteria		
Critical Length of Grade – Max. Truck Speed Reduction on Upgrades	10 MPH (Min 60 MPH)	20 MPH (Min 50 MPH) *Lvl 2 DE Req'd*
Rock Cut Slope Treatment	2:1	Rock Cut Benching (20 ft)
Guardrail Embankment Ht.	>24 ft	>24 ft
Fill Slope Treatment	3:1	2:1 behind Guardrail
Interchanges	-Reduced Ramp Spacing -Low speed loop ramps	-Reduced Ramp Spacing -Low speed loop ramps
State Road Design Criteria	4R	4R: SR 45 (at SR 445) & SR 445 3R Desirable: SR 45(at I-69 Interchange) & SR 54
Local Road Design Criteria	3R Desirable	3R Desirable
Section 4 - Low Cost Criteria – Not Carried Forward		
Design Speed	70 MPH	60 MPH
Maximum Grade	4%	5%
Narrower Median Width		26.5 ft with Concrete Median Barrier Or 48 ft with Cable Barrier
Lane Group Alignments	Parallel	Bifurcated

DESIGN MEMO

Date: January 20, 2010
To: I-69 Tier 2 PMC
From: Craig M. Gonsoski, PE
Gary K. Fisk, PE – Section 4 PM
Subject: Section 4 State Road Design Criteria – 3R verses 4R

As part of the engineering development for the I-69 Tier 2 Studies in Section 4, the PMC and INDOT have requested that the affected state roads within the study area be evaluated for the use of 3R design standards verses 4R design standards. The objective is to lower the overall construction costs while still improving the safety of the roadways.

Section 4 has four (4) state roads within its study area, which include SR 45, SR 54, and SR 445 in Greene County and SR 37 in Monroe County. SR 45 will be evaluated in two different locations:

1) The I-69 crossing (SR 45 over I-69) - A proposed interchange
2) The junction of SR 445 – A Connector Road from the Proposed County Line Interchange would form a 4-way intersection with SR 45 and SR 445.

SR 445 will be evaluated for the realignment and proposed new intersection with SR 45 and the Connector Road. SR 54 will be evaluated at the crossing of I-69 (I-69 over SR 54); no interchange is proposed for this location. SR 37 is on the 4R network and will connect to I-69 with a system interchange; **therefore, all construction on SR 37 will be to 4R standards**. Below is a table that summarizes the critical data for each of the state roads in Section 4.

Chapter 55 of the Indiana Design Manual (IDM) provides guidance for the applicability and evaluation of 3R projects. The IDM states historical accident data is the most critical element in this evaluation. Accident data for the above segments of the Section 4 state roads was obtained from INDOT for the 3-year period from January 1, 2006 to December 31, 2008 and evaluated for adverse accident experience. The findings for each segment are summarized and discussed below.

Summary of State Roads

Road	County	Functional Class	Posted Speed (MPH)	2030 No-Build (Ave Daily)*	2030 Build (Ave Daily)*	Proposed Treatment
SR 45	Greene	Rural Major Collector	55	3,529	2,757	Interchange / SR 45 Over
SR 54	Greene	Rural Major Collector	55	2,385	2,268	I-69 Over
SR 45-N of SR 445	Greene	Rural Major Collector	50	10,555	3,107	Relocated
SR 45-S of SR 445	Greene	Rural Major Collector	55	4,704	3,113	Relocated
SR 445	Greene	Rural Major Collector	55	4,704	5,982	Relocated
SR 37	**Monroe**	**Rural Arterial**	**60**	**27,415**	**28,079**	**System Interchange**
* Traffic Volumes from the I-69 Corridor Traffic Model, Bernardin,Lochmueller & Associates, Inc.						

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SR 45 Overpass (over I-69)

SR 45 is classified as a Rural Major Collector and is on the Indiana 3R network and national truck network. It is not on the National Highway System. The existing road is posted at 55 mph and provides two 12-ft. wide travel lanes with 2-ft. paved shoulders and 4-ft. usable shoulders. There is an interchange being considered at this location, but an overpass would be constructed in either case. According to the INDOT 2030 Long Range Plan, 2007 update, there are no projects planned for upgrading or reconstructing SR 45 beyond I-69.

The accident history for this segment of SR 45 shows a total of 10 crashes including one that involved personal injury and one that involved a fatality. Of the 10 crashes, the primary factor listed in 6 of these accidents was an Animal or Object in Road (5 deer strikes noted).

SR 45*: Crash Type and Severity 2006 to 2008

Crash Type	PDO	Injury	Fatality	Total
Head-On	4	0	0	4
Run Off	1	1	1	3
Right Angle	2	0	0	2
Other	1	0	0	1
Totals	**8**	**1**	**1**	**10**

*Includes a 1.3 mile segment from CR 300 S to CR 400 S.

Using desirable 3R criteria, from IDM Figure 55-3B, the paved shoulders would be increased from 2 feet to 4 feet and the usable shoulder increased from 4 feet to 8 feet. In addition, a 14' obstruction free zone (OFZ) with sideslope that does not exceed 6:1 (and is free from hazards or obstructions) will be provided. Other improvements include upgrades to meet current standards for superelevation and sight distance. The study level topographic data indicates an existing substandard sag vertical curve within the proposed improvements along SR 45. This curve would be lengthened to provide the proper sight distance. These upgrades to the shoulders, roadside and sight distances would help motorists react sooner to objects in the roadway such as deer as well as provide a larger area for avoidance.

Per the IDM, 4R criteria for a rural major collector would require 12' travel lanes with 10' usable and 8' paved shoulders. Clear Zone requirements are 20'-22' with a 6:1 foreslope then 3:1 sideslopes beyond the clear zone. A table of 4R verses 3R Design Criteria Differences is included at the end of this document. Utilizing the 3R desirable criteria for the construction of the SR 45 overpass (including all approach work) would reduce the construction costs for this project by approximately $130,000 when compared to the 4R criteria. This savings is due to the following reductions which would be implemented using desirable 3R instead of 4R:

- Earthwork –6'-8' reduction in the width of 6:1 foreslope on each side of the road,
- Paved Shoulders – 8' reduction (4' each side)
- Usable Shoulders – 4' reduction (2' each side), and
- Bridges – 4' reduction (2' each side) in bridge width.

Utilizing 3R desirable design criteria for the reconstruction of the SR 45 overpass would provide a section that is more consistent with the existing roadway to the north and south. The use of 4R design criteria for SR 45 in this vicinity would provide a relatively short section of roadway (approximately 1,900') designed and built to a much higher standard than the adjacent roadway. The use of 3R desirable criteria would still provide a section with wider shoulders and improved geometrics which would provide an improvement in the overall roadway safety.

SR 54 Underpass (under I-69)

SR 54 is classified as a Rural Major Collector and is on the Indiana 3R network and national truck network. It is not on the National Highway System. The existing road is posted at 55 mph and provides two 12-ft. wide travel lanes with 1-ft. paved shoulders and 3-ft. usable shoulders. I-69 will be constructed over SR 54. According to the INDOT 2030 Long Range Plan, 2007 update, there are no projects planned for upgrading or reconstructing SR 54 beyond I-69.

The accident history for this segment of SR 54 shows a total of 17 crashes including two that involved injuries, and one that involved a fatality. Of the 17 crashes, the primary factor listed in 11 of these accidents was an Animal or Object in Road (9 deer strikes noted).

SR 54*: Crash Type and Severity 2006 to 2008

Crash Type	PDO	Injury	Fatality	Total
Head-On	5	2	1	8
Run Off	5	0	0	5
Right Angle	1	0	0	1
Same Direction Sideswipe	1	0	0	1
Other	2	0	0	2
Totals	**14**	**2**	**1**	**17**
Includes a 1.5 mile segment from CR 1250 E to CR 325 S.				

If desirable 3R design standards were to be used, the usable shoulders would be increased from 3 feet to 8 feet and the paved shoulders increased from 1 foot to 4 feet. A 14' obstruction free zone would be implemented along a section of highway that rarely fulfills this criterion. The reconstructed portion of SR 54 would also be upgraded to meet current standards for superelevation and sight distance. By improving the sight distance, the reaction time and distance are increased for motorists if an object or deer were to appear in the roadway. By widening the shoulders and including an obstruction free zone, a larger maneuvering area is also created for avoidance.

Per the Indiana Design Manual (IDM), 4R criteria for a rural major collector requires 12' travel lanes with 10' usable and 8' paved shoulders. Clear Zone requirements are 20'-22' with a 6:1 foreslope then 3:1 sideslopes beyond the clear zone. A table of 4R verses 3R Design Criteria Differences is included at the end of this document. Utilizing the 3R desirable criteria for the construction of the SR 54 underpass (including all approach work) would reduce the construction costs for this project by approximately $120,000 when compared to the 4R criteria. This savings is due to the following reductions which would be implemented using desirable 3R instead of 4R:

- Earthwork –6'-8' reduction in the width of 6:1 foreslope on each side of the road,
- Paved Shoulders – 8' reduction (4' each side)
- Usable Shoulders – 4' reduction (2' each side), and
- Bridges – 6' reduction in length for both I-69 bridges over SR 54[1].

Utilizing 3R desirable design criteria for the reconstruction of the SR 54 underpass would provide a section that is more consistent with the existing roadway to the north and south. The use of 4R design criteria for SR 54 in this vicinity would provide a relatively short section of roadway (approximately 2,400') designed and built to a much higher standard than the adjacent roadway. The use of 3R desirable criteria would still provide an improved section, with wider shoulders and improved geometrics (if required), which would provide an enhancement in the overall roadway safety.

[1] The clear zone or obstruction free zone (OFZ) requirements set the minimum offset distance to the bridge spillslope and thus are the controlling criteria for bridge lengths over state or local roads. A reduction in the spillslope offset criteria along the local road correlates to approximately the same reduction in bridge length. Since the SR 54 bridges also cross a waterway to the west only the east side benefits from the reduced clear zone.

SR 45 & SR 445 Realignment and New Intersection

The preferred alignment of I-69 Section 4 includes constructing an interchange near the Greene and Monroe county line. This interchange would include a new connector road that ties into SR 45 near the junction of SR 445. A new four-leg intersection would be created by shifting SR 445 to the south and aligning it with the new Connector Road from the east. Realignment of SR 45 is also proposed in order to accommodate the new intersection (See Figure 1).

This portion of SR 45 is classified as a Rural Major Collector and is on the Indiana 3R[2] network as well as the national truck network. The existing road is posted at 55 mph south of the intersection with SR 445 and 50 mph north of the intersection. SR 45 in this location provides two 12-ft. wide travel lanes with 2-ft. paved shoulders. SR 445 is classified as a Rural Major Collector and is on the Indiana 3R network as well as the national truck network. The existing road is posted at 55 mph and provides two 11-ft. wide travel lanes with 2-ft. paved shoulders. According to the INDOT 2030 Long Range Plan, 2007 update, there are no projects planned for upgrading or reconstructing SR 45 or SR 445 beyond I-69.

The existing SR 45 and SR 445 intersection has an unorthodox configuration. The legs form a 'Y', as SR 445 approaches from the west and SR 45 from the northeast and southwest. There are no turn lanes. A signal has been installed since this intersection can be confusing to motorists as to who has the right-of-way and which movements constitute a turn and which are through. The rolling and curving alignments of the highways and lack of drive access control also have negative impacts on safety.

The accident history at and within 1,200' of this intersection shows a total of 31 crashes including 6 that involved injuries. There were no recorded fatalities. The majority of crashes were recorded as rear end incidents (16 of 31), with most due to driver distraction or following too close. The unique and almost confusing configuration of the intersection likely contributes to many of the rear end incidents.

SR 45 and SR 445 Intersection*:
Crash Type and Severity 2006 to 2008

Crash Type	PDO	Injury	Fatality	Total
Head-On	4	2	0	6
Run Off	4	0	0	4
Rear End	13	3	0	16
Right Angle	2	1	0	3
Same Direction Sideswipe	1	0	0	1
Other	1	0	0	1
Totals	**25**	**6**	**0**	**31**

*Within 1,200' of the intersection.

The construction of I-69, especially the incorporation of the County Line Interchange, is projected to reduce traffic and congestion on SR 45 (See Summary of State Roads table above) thereby improving safety along this state road corridor. Also, the new SR 45/SR 445 intersection will be realigned to create a more conventional four-legged intersection (see the Proposed SR 45, SR 445, and Connector Road Alignments figure at the end of this document).

A 55 mph design speed will be recommended for all legs of this new intersection. Per the Indiana Design Manual (IDM), 4R criteria for a rural major collector requires 12' travel lanes with 10' usable and 8' paved shoulders. For 55 mph, clear zone requirements are 20'-22' with a 6:1 foreslope then 3:1

[2] IDM Figure 55-2A, which shows the Indiana 3R & 4R system, appears to show a 4R Non-Interstate route following SR 445 from the junction of SR 54 and continuing along SR 45 northwest to SR 37. This same route is also shown proceeding southwest from the SR 445/SR 54 junction over a non-existent highway, which matches the proposed I-69 corridor. It was assumed that the 4R route shown was meant to represent the proposed I-69 and that SR 445 and SR 45 are not on the 4R system but instead are on the 3R system.

sideslopes. The desirable 3R criteria, from IDM Figure 55-3B, would provide the same 12' travel lane width and the shoulders could be reduced to 8' usable and 6' paved. The clear zone requirements would be reduced to 14' obstruction free zones (10' plus paved shoulder width). The new intersection and realigned portions of SR 45 and SR 445 would be upgraded to meet current design standards for sight distance, superelevation, and roadside safety.

A construction cost reduction of approximately $174,000 is estimated if SR 45 and SR 445 were reconstructed utilizing the 3R desirable criteria with the same design speed, functional classification and projected traffic volume. The construction costs for earthwork and shoulder pavement could be reduced utilizing the 3R desirable criteria as follows:

- Earthwork –6'-8' reduction in the width of 6:1 foreslope on each side,
- Paved Shoulders – 4' reduction (2' each side) on SR 45 only, and
- Usable Shoulders – 4' reduction (2' each side) on SR 45 only

The new County Line Interchange Connector Road will be designed as a Rural Major Collector with a 55 mph design speed. Since it is on new alignment, it is considered new construction and will be constructed to 4R design criteria. SR 445 will be relocated, with a shift of over 500' south of its existing location, and aligned with the proposed Connector Road.

The IDM defines 4R reconstruction as major revisions to the existing horizontal and vertical alignment or reconstruction of a significant portion of the existing pavement structure. It also defines new construction as an intersection relocated to a new point of intersection. The proposed relocation of SR 445, including reconfiguration of the existing 3-way intersection into a 4-way intersection, would constitute major revisions and therefore it is recommended that SR 45, SR 445 and the County Line Interchange Connector Road be constructed to 4R design criteria.

Recommendations

A review of the crash histories and existing geometrics indicate that the overall safety of SR 45 at I-69 and SR 54 at I-69 will be greatly benefited by using 3R desirable criteria. Although not to the extent of 4R criteria, the safety components of desirable 3R criteria are still above-and-beyond what is there now. Also, the relatively low traffic volumes, expected decrease in traffic once I-69 is constructed and classifications on the 3R Network lend additional credence that desirable 3R criteria is appropriate. Therefore it is recommended that these roads be constructed using 3R desirable criteria.

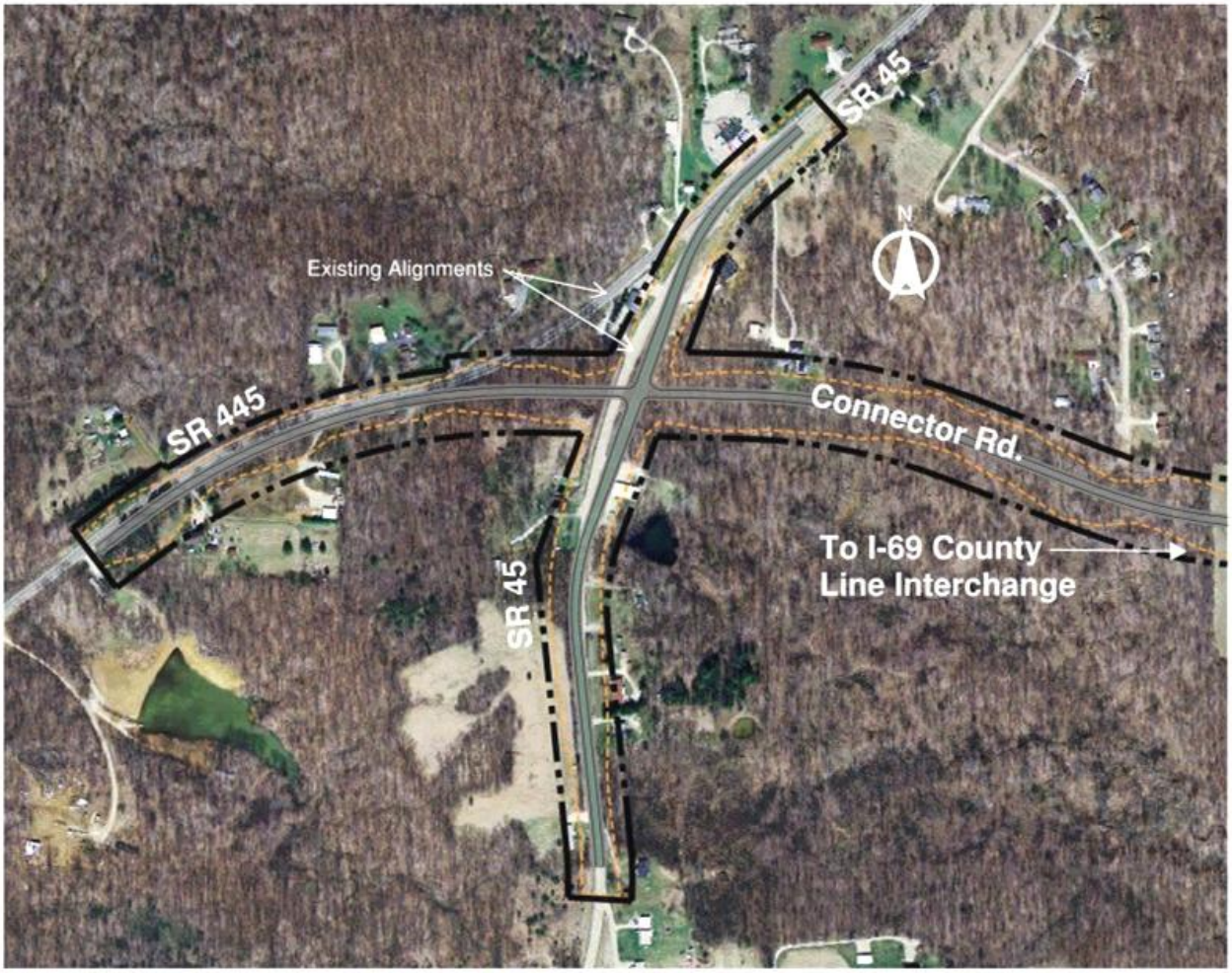
While some construction cost savings could be realized using 3R desirable criteria for the new intersection and realignments of SR 45, SR 445 at the new County Line Interchange Connector Road the extent of relocation necessary constitutes traditional 4R new construction. Therefore, 4R criteria is recommended for these roadways. These recommendations are summarized as follows.

Location	Recommended
SR 45 at I-69	**3R Desirable**
SR 54 at I-69	**3R Desirable**
SR 45 at SR 445/Connector Road	4R
SR 445 at SR 45/Connector Road	4R
Connector Road	4R
SR 37 at I-69	4R

4R verses 3R Design Criteria Differences

State Rural Major Collector	4R	3R Desirable		
		SR 45 & SR 54	SR 45 @ SR 445	SR 445
IDM Figure	(IDM Fig. 53-3)	(IDM Fig.55-3B)		
AADT	> 2000	1,000 ≤ AADT < 3,000	3,000 ≤ AADT < 5,000	≥ 5000
Travel Lane Width	12'	12'		
Shoulder Width, Usable	10'	8'		10'
Shoulder Width, Paved	8'	4'	6'	8'
Clear Zone: 55 mph	20'-22' 6:1 Fore	N/A		
Obstruction Free Zone	N/A	10' + Paved Shoulder (14')	10' + Paved Shoulder (16')	10' + Paved Shoulder (18')
Cut Foreslope	Des 6:1, Max 4:1	6:1 to OFZ, 3:1 Des. (2:1 Max*)		
Cut Ditch Width	4' ('V' in rock)	Traversable if in OFZ		
Cut Backslope	4:1 for 20'; 3:1 to Top	3:1 Des. (2:1 Max*)		
Fill Slope	Des 6:1 to CZ; Max 3:1 to Toe	6:1 to OFZ, 3:1 Des. (2:1 Max*)		
Maximum Grades: 55 mph	Rolling: 7%	Rolling: 8.5%		

* If certain restrictions exist



Proposed SR 45, SR 445, and Connector Road Alignments

DLZ
ENGINEERS - ARCHITECTS - SCIENTISTS
PLANNERS - SURVEYORS
SOUTH BEND, IN (574) 236-4400

SR 45 OVERPASS (OVER I-69)

Earthwork –6'-8' reduction in the width of 6:1 foreslope on each side of the road

	4R	3R Desirable	3R Savings	Unit Price	$ Savings
Common Excavation (CYS)	66,911	57,044	9,867	$ 4.32	$ 42,625.44
Rock Cut	2	-	2	$ 6.00	$ 12.00
Fill Volume (CYS)	69,818	62,951	6,867	no cost	
Borrow Req'd (CYS)	12,941	14,464	-1523	$ 5.32	$ (8,102.36)
				Total Savings =	**$ 42,637.44**

Shoulders – 8' reduction (4' each side), and

Assume:

Shoulder 330 lb/syd HMA Surface 9.5 mm @ $ 55.04 /ton
7 in Comp. Aggr No. 53 Base @ $ 14.79 /ton

Savings:

8	x	330	/	9	/	2000	x	$ 55.04	=	$ 8.07	/ LFT	x	1,930	LFT	=	**$**	**15,579.99**
8	x	0.389	Tons/sys	/	9	x	$ 14.79	=	$ 5.11	/ LFT	x	1,930	LFT	=	**$**	**9,870.12**
															Total Savings =	**$**	**25,450.11**

Bridges – 4' reduction (2' each side) in bridge width.

Assume: $ 87.80 /SFT for Low-Cost Alternative with MSE walls
4R - 48'-4" O-O Bridge width
3R - 44'-4" O-O Bridge width

Low-Cost Alt (with MSE walls) 177 FT x 4 FT x $ 87.80 = **$ 62,162.40**

TOTAL SAVINGS = $ 42,637.44 + $ 25,450.11 + $ 62,162.40 = $ 130,249.95

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SR 54 UNDERPASS (I-69 OVER)

Earthwork –6'-8' reduction in the width of 6:1 foreslope on each side of the road

	4R	3R Desirable	3R Savings	Unit Price	$ Savings
Common Excavation (CYS)	64,581	49,878	14,703	$ 4.32	$ 63,516.96
Rock Cut	37	-	37	$ 6.00	$ 222.00
Fill Volume (CYS)	60,847	50,949	9,898	no cost	
Borrow Req'd (CYS)	5,905	8,553	-2648	$ 5.32	$ (14,087.36)
				Total Savings =	**$ 49,651.60**

Shoulders – 8' reduction (4' each side), and

Assume:

Shoulder	330 lb/syd HMA Surface 9.5 mm	@	$ 55.04	/ton
	7 in Comp. Aggr No. 53 Base	@	$ 14.79	/ton

Savings:

8	x	330	/	9	/	2000	x	$ 55.04	=	$ 8.07	/ LFT	x	1,907	LFT	=	**$**	**15,394.32**
8	x	0.389	Tons/sys	/	9		x	$ 14.79	=	$ 5.11	/ LFT	x	1,907	LFT	=	**$**	**9,752.50**
															Total Savings =	**$**	**25,146.82**

Bridges – 6' reduction length for I-69 bridges over SR 54

Assume: $ 87.80 /SFT for Low-Cost Alternative with MSE walls

NB I-69 Bridge - 43'-4" O-O Bridge width	43.33	FT x	6	FT x	$ 87.80	=	**$**	**22,826.24**
SB I-69 Bridge - 43'-4" O-O Bridge width	43.33	FT x	6	FT x	$ 87.80	=	**$**	**22,826.24**
					Total Savings =		**$**	**45,652.49**

* SR 54 bridges are combined with a waterway bridge to the west so only the east side benefits from the reduced clear zone.

TOTAL SAVINGS = $ 49,651.60 + $ 25,146.82 + $ 45,652.49 = $ 120,450.91

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SR 45 @ SR 445 & South Connector Road

Earthwork –6'-8' reduction in the width of 6:1 foreslope on each side of the road

	4R	3R Desirable	3R Savings	Unit Price	$ Savings
Common Excavation (CYS)	104,693	70,026	34,667	$ 4.32	$ 149,761.44
Rock Cut	1,404	90	1,314	$ 6.00	$ 7,884.00
Fill Volume (CYS)	42,429	31,912	10,517	no cost	
Borrow Req'd (CYS)	-	-		$ 5.32	$ -
				Total Savings =	**$ 157,645.44**

Shoulders – 4' reduction (2' each side), and

Assume:

Shoulder	330 lb/syd HMA Surface 9.5 mm	@	$ 55.04	/ton
	7 in Comp. Aggr No. 53 Base	@	$ 14.79	/ton

Savings:

4	x	330	/	9	/	2000	x	$ 55.04	=	$ 4.04	/ LFT	x	2,500	LFT	=	**$**	**10,090.67**
4	x	0.389	Tons/sys		/	9	x	$ 14.79	=	$ 2.56	/ LFT	x	2,500	LFT	=	**$**	**6,392.57**
															Total Savings =	**$**	**16,483.23**

TOTAL SAVINGS = $ 157,645.44 + $ 16,483.23 = $ 174,128.67

OFFICE MEMORANDUM

Date: Revised May 6, 2011

To: I-69 Tier 2 PMC

From: Gary K. Fisk, PE – Section 4 PM
Craig M. Gonsoski, PE

Subject: **Level Two Design Exception for Critical Length of Grade**

After careful consideration of impacts to safety, mobility and projects costs, a Level Two design exception is desired for I-69 Section 4 for critical length of grade. Please see the following as documentation of the decision to request the Level Two Design Exception.

Following the issuance of the I-69 Tier 2 Section 4 Draft Environmental Impact Statement (DEIS) there was a formal comment period. Revisions have been made to this analysis based on comments received during this time. Changes include revisions to the Benefit/Cost (B/C) analysis methodology and calculations to better reflect crash involvement rates for trucks on interstates as opposed to all roads as well as expanding the analysis period to 30-years. Additional clarifications have also been added to this analysis.

The FHWA's *Flexibility in Highway Design* notes, "An important concept in highway design is that every project is unique," and "Designers are faced with the task of balancing the need for the highway improvement with the need to safely integrate the design into the surrounding natural and human environments." Due to the terrain encountered within Section 4 of the I-69 Tier 2 project, which features steep hills and valleys with vertical relief of over 500 feet in some areas, the flexibility within the IDM is being used to achieve a balanced road design while addressing design-related issues in a satisfactory manner. Within Section 4 of the I-69 Tier 2 project, it is proposed that a maximum 20 mph truck speed reduction criteria be used to determine the maximum length of grade for the project.

Critical Length of Grade Criteria

Critical length of grade is defined as the maximum length of a specific upgrade on which a loaded truck can operate without an unreasonable reduction in speed. A common basis for determining critical length of grade is based on a reduction in speed of trucks below the average running speed of traffic. The American Association of State Highway and Transportation Officials – Geometric Design of Highways (AASHTO) and Streets (2004) and the Indiana Design Manual (IDM) recommend a 10 mph speed reduction be used as a general guide for determining critical lengths of grade on major routes such as freeways, arterials, or on the extra-heavy-duty-highway system.

AASHTO states that the suggested design criteria for determining critical length of grade is not intended as a strict control but as a guideline, and recognizes that in some instances, the terrain or other physical control may preclude meeting these controls. The critical length of grade criteria is a level two design criteria and is unique in that there is no absolute minimum value specified. In regard to application of this criteria, IDM 44-1.04 states "If the critical length of grade is exceeded, the grade should be flattened, **if practical**, or the need for a truck-climbing lane should be evaluated." Further, according to the IDM, a truck climbing lane is only warranted if the critical length of grade is exceeded. Therefore, using the proposed 20 mph truck speed reduction criteria to determine the maximum length of grade is within the flexibility of the standards as long as the need for truck climbing lanes is evaluated.

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Warrants for construction of truck climbing lanes were analyzed and presented in a detailed report submitted to the Tier 2 PMC on August 13, 2009, see **Exhibit B**. That document indicated that truck climbing lanes were not warranted in Section 4 based on the level of service (LOS) criteria. Using the 2030 projected traffic, Section 4 is calculated to operate at LOS A or B. Justification for a climbing lane requires that a LOS E or F exist on the grade, or that there be a reduction of one or more LOS from the approach to the upgrade. The AASHTO *A Policy On Geometric Design of Highways and Streets* states that*:*

> *"Climbing lanes are not generally warranted on four-lane highways with directional volumes below 1,000 vehicles per hour regardless of the percentage of trucks. Although a truck driver will occasionally pass another truck under such conditions, the inconvenience with this low volume is not sufficient to justify the cost of a climbing lane in the absence of appropriate criteria"*

Furthermore, a multilane highway with a high LOS has sufficient capacity so that a slow moving vehicle does not impede the following vehicles that can readily move left to the adjacent lane without difficulty.

Safety Implications

Based on the design speed of 70 mph and an initial truck speed of 70 mph, the maximum truck speed reduction criteria desired for Section 4 is 20 mph, which exceeds the general 10 mph reduction criteria. The AASHTO guidance is based on studies from 1964 and 1970 that show the more a vehicle deviates from the average running speed of adjacent traffic, the greater its chances of becoming involved in a crash. AASHTO Exhibit 3-58 (extracted below) shows this analysis and that a 20 mph speed reduction may possibly result in more than four times greater truck crash involvement.

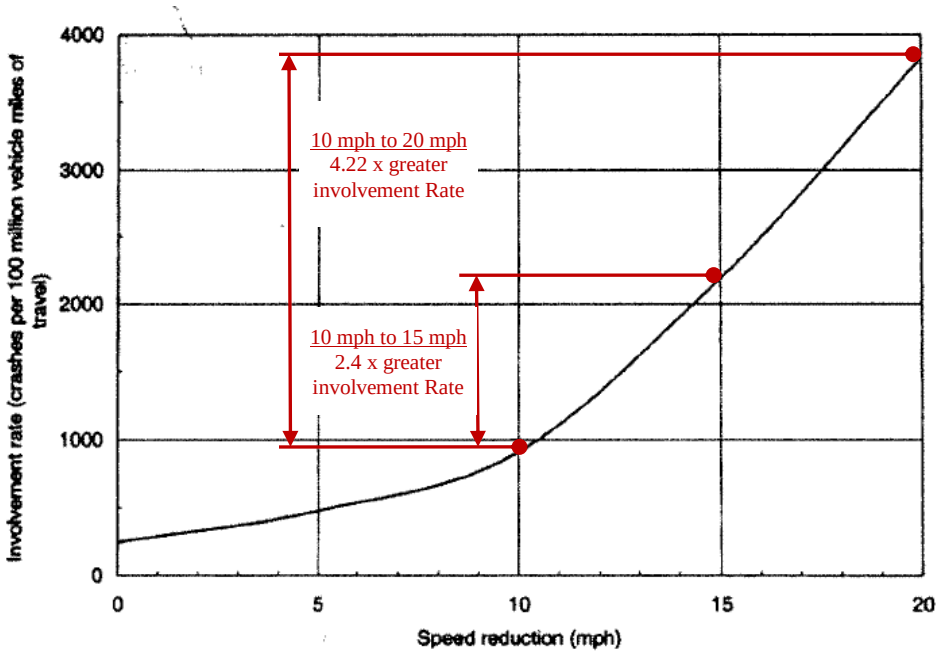

Exhibit 3-58. Crash Involvement Rate of Trucks for Which Running Speeds Are Reduced below Average Running Speed of All Traffic (41)

This study has some shortcomings when applying it to multi-lane interstates, as it did not use data from any specific grade or unsafe location. It used a speed distribution of vehicles on rural highways in one state and related it to crash involvement rates for trucks on level grades with an assumed average speed reduction for grades. Most important, about 75% of the data were from two-lane highways, and are not applicable to multi-lane, divided highways A more recent study, "Revising the AASHTO Curve: Accident Involvement Rates for Trucks and Speed Differentials on Highway Grades" Brazil, 2007, indicates the truck crash involvement rate on multi-lane divided highways is, in fact, much lower. This study's truck crash involvement rate curve is shown below (note this study uses metric units):

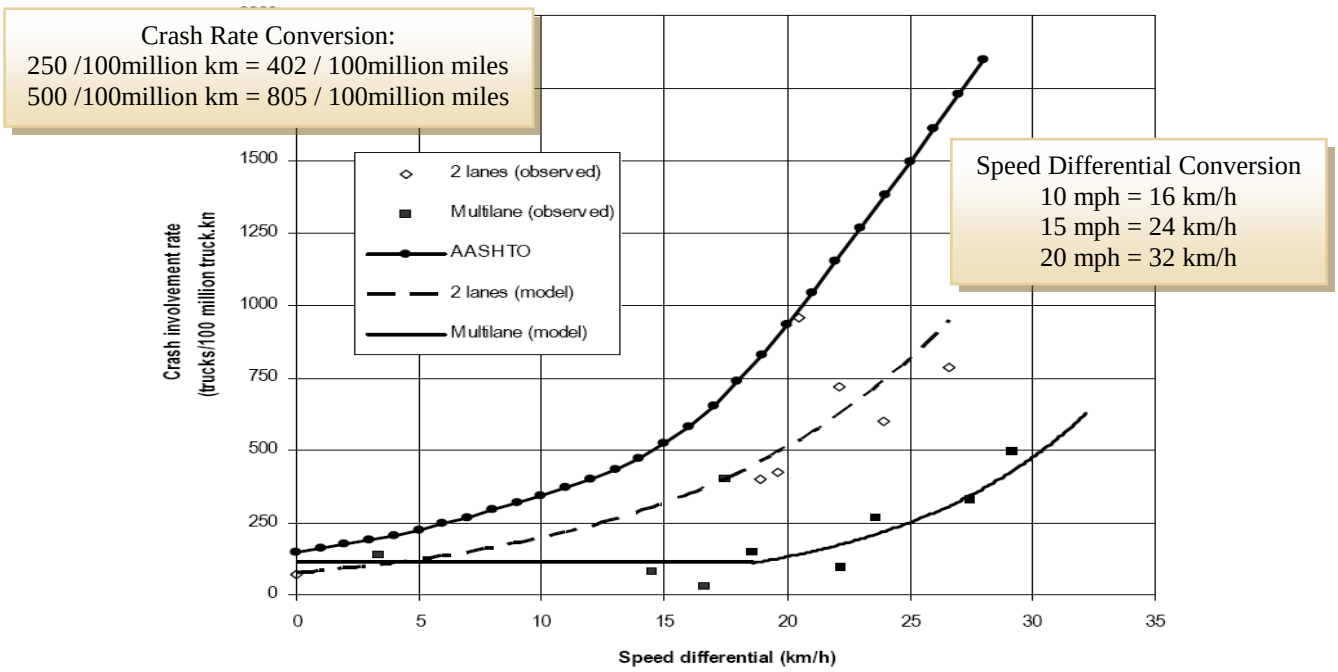

Figure 3 - Relationships between speed differential and crash involvement rates for trucks

Figure 3 from the 2007 study shows three lines. The top line represents the AASHTO relationship that is described above (AASHTO Exhibit 3-58, converted to metric units). The second dashed line represents what the study found for two-lane roads. The third solid line represents the speed differential versus crash involvement rate that the study found for multi-lane roads. The 2007 study from Brazil shows that on multi-lane roadways, there is no significant difference in accident rates, until you get over a 10 mph speed differential. The 2007 study also shows that crash rates for speed differentials over 10 mph are significantly lower than predicted by the AASHTO data; i.e., the crash involvement rate for a 20 mph speed differential is approximately 1/5th (20%) of the AASHTO predicted rate.

Benefit-to-Cost (B/C) Analysis

A Benefit-to-Cost (B/C) analysis was performed using guidance from the Indiana Design Manual (IDM), Chapter 50 and the Hazard Elimination Program – Manual on Improving Safety of Indiana Road Intersections and Sections, Joint Transportation Research Program in Cooperation with INDOT and FHWA (JTRP). A 30 year service life was chosen for the analysis since it is the maximum length noted for any major construction type noted in the IDM or JTRP Study and the crash costs were obtained from

IDM Figure 50-2a, These costs, specified in 2001 dollars, were inflated to 2010 values using 3% annual inflation.

Data from the *Large Truck and Bus Crash Facts 2008* (Federal Motor Carrier Safety Administration - Analysis Division, March 2010) was used to determine a fatal crash rate for large trucks on interstate highways. This was assumed to equate to a baseline fatal crash rate for a speed differential of 0 mph up to 10 mph, since a 10 mph speed reduction is an acceptable standard in the design of the proposed type of interstate in Indiana and throughout the United States. Corresponding baseline injury and PDO crash rates for interstates were calculated using data from the Indiana State Police Automated Reporting Information System (ARIES) for 2009. See the Benefit/Cost Analysis in **Exhibit A** for further information.

The data from the 2007 study done in Brazil was used in this comparative analysis of the speed reduction criteria because it reflects the safer nature of freeway facilities compared to two-lane rural highways. Given a possible decrease in truck crash involvement for a 10 mph versus a 20 mph truck speed reduction, a cost benefit analysis was performed to determine if construction of a profile to meet the 10 mph speed reduction is warranted given the additional costs of constructing to this standard. Crashes for the 15 mph and 20 mph truck speed reduction grades were calculated using the crash involvement rates from the 2007 Brazil data to inflate the calculated baseline crashes. For example, the baseline (0-10 mph) fatal, injury and PDO crashes were increased by a factor of 4.0 for a 20 mph speed differential because the involvement rate is 4 times greater at 800 crashes per 100 million vehicle miles of travel compared to 200 crashes per 100 million vehicle miles of travel for the 0-10 mph speed differential.

Two preliminary profiles were developed to evaluate the potential cost savings: one using the maximum 10 mph truck speed reduction, the other using a maximum 20 mph truck speed reduction. Two representative lengths of grade on the 20 mph reduction profile were chosen to be analyzed:

1. The length of grade with the highest overall truck speed reduction at nearly 20 mph, and
2. The longest length of grade with speed reduction greater than 10 mph (this profile section results in a 15 mph speed reduction).

A summary of the cost benefit analysis is found below. The methodology and calculations for the analysis are included in Exhibit A. The IDM states, "If the B/C ratio is less than but very close to 1, the secondary benefits, such as improved capacity or other economic benefits, resulting from the proposed improvement should be analyzed before abandoning the proposed improvement." Since neither analysis results in B/C ratios close to 1, secondary benefits were not considered.

Segment	Max. Speed Reduction	Add'l Cost to Construct to 10 mph SR	Est. Annual Crashes		CRF	B/C Ratio
			PDO	F/I		
Sta. 368+00 to 410+00 SB	20 mph	$ 3,376,298	4.088	0.612	0.75	0.48
Sta. 1127+00 to 1229+00 NB	15 mph	$8,145,319	5.952	0.894	0.50	0.19

As shown above, the benefit to cost ratio for the most critical sections were not greater than 1.0. In other words, the benefit, a reduced number of crashes, does not out-weigh the additional cost required to construct the roadway to the maximum 10 mph truck speed reduction criteria.

Additionally, the following general observations, based on research and engineering judgment, are noted in support of the proposed maximum 20 mph truck speed reduction criteria.

- **Cross-section and Vertical Alignment**
  The proposed cross-section with two travel lanes in each direction and a projected level of service of A or B (per I-69 Tier 2 Traffic Modeling) will allow vehicles to readily move to the adjacent lanes to pass the slower moving trucks without much difficulty. Additionally, the proposed vertical geometry of the segments will allow ample sight distance for drivers to see the slower moving trucks as they approach.

- **Experience with Differing Truck Speeds**
  Indiana and nine other states have truck speed limits set slower than other vehicle traffic on rural interstates. These states post truck speed limits from 5 to 15 mph slower than the maximum speed limit for other vehicles traveling the same routes. Therefore, drivers in Indiana are conditioned to expect trucks to be traveling at a slower speed.

- **Minimum Speed Limits**
  Minimum speed limits are set on various interstates throughout Indiana. Where posted on interstates, the minimum speed limit is set at 45 mph. In each segment exceeding the recommended 10 mph speed reduction, the greatest truck speed reduction calculated was 20 mph for a typical 200 lb/hp design vehicle. Therefore, the proposed minimum running speed of 50 mph is still greater than the 45 mph minimum speed limit often posted on Indiana interstates.

Recommendations

The IDM allows for the operational flexibility in the standards to allow the designer of I-69 to design an interstate roadway that balances safety with costs and environmental impacts. The flexibility in the critical length of grade criteria is the greatest factor in the Section 4 low cost standards that reduces the environmental footprint of the highway. This is because the roadway can better follow the terrain, reducing earthwork volumes, as well as bridge heights and lengths.

Based on the analysis provided herein and in the August 13, 2009 “Office Memorandum Truck Climbing Lane Warrant Analysis,” it is recommended to proceed with a proposed profile utilizing a maximum 20 mph truck speed reduction.

Although data does not suggest that the profile should change to reduce the speed differential, it is recommended that appropriate vertical grade warning signage be added to segments in which a greater than 10 mph truck speed reduction is expected. Special warning signs may also be considered in the final design indicating “Slow Moving Trucks Next __ Miles.”

Exhibit A

Benefit/Cost Analysis

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B/C ANALYSIS

Determine Predicted Crash Rates for Trucks/Buses

From "Large Truck and Bus Crash Facts 2008"

Analysis Division Federal Motor Carrier Safety Administration, March 2010

Table 19. Large Truck and Passenger Vehicle Fatal Crashes (per 100 million veh-miles traveled) by Roadway Function Class, 1981-2008

Interstate - Large Trucks

2006 =	1.2			
2007 =	1.2	-->	**Use Average =**	**1.20**
2008 =	1.2			

Large Truck Injury Crash Involvement (per 100 million veh-miles traveled)

Table 3: Collisions involving large trucks, by roadway class and collision severity, 2009

	Severity of collision									
	Fatal		Incapacitating		Non-incapacitating		Property damage only		Total	
Roadway classification	Count	% Severity total	Count	% Severity total	Count	% Severity total	Count	% Severity total	Count	% Severity total
Local/city road	9	11.0%	32	19.6%	260	23.0%	2,650	28.9%	2,951	28.0%
Interstate	23	28.0%	42	25.8%	322	28.5%	2,503	27.3%	2,890	27.4%
State road	22	26.8%	33	20.2%	224	19.8%	1,155	12.6%	1,434	13.6%
US route	27	32.9%	42	25.8%	233	20.6%	1,015	11.1%	1,317	12.5%
Unknown	0	0.0%	2	1.2%	21	1.9%	1,246	13.6%	1,269	12.0%
County road	1	1.2%	12	7.4%	71	6.3%	597	6.5%	681	6.5%
Total	**82**	**100.0%**	**163**	**100.0%**	**1,131**	**100.0%**	**9,166**	**100.0%**	**10,542**	**100.0%**

Source: Indiana State Police Automated Reporting Information Exchange System (ARIES), as of March 1, 2010.

Notes:
Non-incapacitating collisions include collisions with *non-incapacitating* and *possible* injuries.
Unknown road class includes collisions reported as *Unknown* and those with no road class code reported.

Injury Rate to Fatal Rate Ratio on Interstates in Indiana (see above)

42	Incapacitating Injuries
322	Non-incapacitating Injuries
364	Total Injuries
23	Fatal Injuries
15.8	Ratio Injury to Fatal
1.2	Fatal Crash Involvement Rate Above
19	**Large Truck Injury Crash Involvement**

PDO Rate to Fatal Rate Ratio on Interstates in Indiana (see above)

2503	PDO Crashes
23	Fatal Injuries
109	Ratio PDO to Fatal
1.2	Fatal Crash Involvement Rate Above
131	**Large Truck PDO Crash Involvement**

B/C ANALYSIS

Determine Predicted Crash Rates for Trucks/Buses

From "Large Truck and Bus Crash Facts 2008"

Us Analysis Division Federal Motor Carrier Safety Administration, March 2010

Speed Reduction	Involvement Rate*	0-10 mph	10-15 mph	10-20 mph
0	200			
10	200	1		
15	400		2	
20	800			4

* Crashes per 100 million vehicle miles of travel

Crash Reduction Factors

CRF (15 mph to 10 mph) = $\frac{400 - 200}{400} = 1 - \frac{1}{2} =$ **0.5**

CRF (20 mph to 10 mph) = $\frac{800 - 200}{800} = 1 - \frac{1}{4} =$ **0.75**

B/C ANALYSIS

Sta 368+00 to 410+00 Southbound Max Speed Reduction of 20 mph

From "Large Truck and Bus Crash Facts 2008"

Tru Analysis Division = 2,671 trucks/day

Segment Length = 0.80 miles

Directional Truck ADT from I-69 Tier 2 Corridor Traffic Model
* Directional Volume used since the speed reduction only occurs on the upgrade lane group therefore the number of expected crashes only changes on the upgrade.

Truck veh-mile per year = 2,671 x 365 days x 0.80 miles
= 779,932 truck miles/year

Determine normally expected F, I, & PDO at 10 mph speed reduction then at 20 mph max reduction

F_{10} = 1.20 / 100,000,000 x 779,932 = 0.009 F/yr

F_{20} = 0.009 x 4.00 = 0.036 F/yr

I_{10} = 19.00 / 100,000,000 x 779,932 = 0.148 I/yr

I_{20} = 0.148 x 4.00 = 0.592 I/yr

F/I = 0.036 + 0.592

F/I = 0.628 /yr

PDO_{10} = 131.00 / 100,000,000 x 779,932 = 1.022 I/yr

PDO_{20} = 1.022 x 4.00 = **4.088 I/yr**

Costs

		Construction Costs	/mile	Total Project Costs	/mile
Initial Criteria Cost Estimate	=	$623,947,000	$23,238,250	$722,289,000	$26,900,894
20 mph Reduction	=	$ 522,515,000	$19,460,521	$608,972,000	$22,680,521
Cost Increase	=	$101,432,000	$3,777,728	$113,317,000	$4,220,372

Total Mileage = 26.85

Total Construction Cost Increase	0.80	miles x	$3,777,728.12	=	$3,022,182.50
Total Project Cost Increase	**0.80**	**miles x**	**$4,220,372.44**	**=**	**$3,376,297.95**

B/C ANALYSIS

Sta 1127+00 to 1229+00 Northbound Max Speed Reduction of 15 mph

From "Large Truck and Bus Crash Facts 2008"

Tru Analysis Division = 3,225 trucks/day

Segment Length = 1.93 miles

Directional Truck ADT from I-69 Tier 2 Corridor Traffic Model
* Directional Volume used since the speed reduction only occurs on the upgrade lane group therefore the number of expected crashes only changes on the upgrade.

Truck veh-mile per year = 3,225 x 365 days x 1.93 miles
= 2,271,851 truck miles/year

Determine normally expected F, I, & PDO at 10 mph speed reduction then at 15 mph max reduction

F_{10} = 1.20 / 100,000,000 x 2,271,851 = 0.027 F/yr

F_{15} = 0.027 x 2.00 = 0.054 F/yr

I_{10} = 19.00 / 100,000,000 x 2,271,851 = 0.432 I/yr

I_{15} = 0.432 x 2.00 = 0.864 I/yr

F/I = 0.054 + 0.864

F/I = 0.918 /yr

PDO_{10} = 131.00 / 100,000,000 x 2,271,851 = 2.976 I/yr

PDO_{15} = 2.976 x 2.00 = **5.952 I/yr**

Costs

		Construction Costs	/mile	Total Project Costs	/mile
Initial Criteria Cost Estimate	=	$623,947,000	$23,238,250	$722,289,000	$26,900,894
20 mph Reduction	=	$ 522,515,000	$19,460,521	$608,972,000	$22,680,521
Cost Increase	=	$101,432,000	$3,777,728	$113,317,000	$4,220,372

Total Mileage = 26.85

Total Construction Cost Increase	1.93	miles x	$3,777,728.12	=	$7,291,015.27
Total Project Cost Increase	**1.93**	**miles x**	**$4,220,372.44**	**=**	**$8,145,318.81**

Benefit / Cost Analysis
I 69 Tier 2 - Section 4 - Construction of Profile at Max 10 mph Speed Reduction
Sta. 368+00 to 410+00 SB

Rev. 3/17/2011

							Accident Reduction			Adjusted Benefits						Benefit / Cost Calculations									
Service Year	Avg Ann PDO Acc	Avg Ann F/I Acc	ARF (PDO)	ARF (F/I)	PDO Acc * ARF	F/I Acc * ARF	APF	PDO	F/I	PDO * $8481	F/I * $97860	Total Benefits	PWF	Adj. Benefit	Cum. Yr. Benefit	Cap. Recovery	EUAB	Initial Cost	AMC	PWF-EQ	Salvage	PWF -SP	EUAC	B/C	NAB
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1	4.09	0.63	0.75	0.75	3.07	0.47	1.02	3.13	0.48	$26,522.80	$47,013.90	$73,536.70	0.9615	$70,705.54	$70,705.54	1.0400	$73,533.76	$3,376,298.00	$0.00	0.9615	$0.00	0.9615	$3,511,349.92	0.02	-$3,437,816.16
2	4.09	0.63	0.75	0.75	3.07	0.47	1.04	3.19	0.49	$27,053.26	$47,954.18	$75,007.44	0.9246	$69,351.88	$140,057.41	0.5302	$74,258.44	$3,376,298.00	$0.00	1.8861	$0.00	0.9246	$1,790,113.20	0.04	-$1,715,854.76
3	4.09	0.63	0.75	0.75	3.07	0.47	1.06	3.25	0.50	$27,594.32	$48,913.26	$76,507.58	0.8890	$68,015.24	$208,072.66	0.3603	$74,968.58	$3,376,298.00	$0.00	2.7751	$0.00	0.8890	$1,216,480.17	0.06	-$1,141,511.59
4	4.09	0.63	0.75	0.75	3.07	0.47	1.08	3.32	0.51	$28,146.21	$49,891.53	$78,037.74	0.8548	$66,706.66	$274,779.31	0.2755	$75,701.70	$3,376,298.00	$0.00	3.6299	$0.00	0.8548	$930,170.10	0.08	-$854,468.40
5	4.09	0.63	0.75	0.75	3.07	0.47	1.10	3.39	0.52	$28,709.13	$50,889.36	$79,598.49	0.8219	$65,422.00	$340,201.31	0.2246	$76,409.22	$3,376,298.00	$0.00	4.4518	$0.00	0.8219	$758,316.53	0.10	-$681,907.32
6	4.09	0.63	0.75	0.75	3.07	0.47	1.13	3.45	0.53	$29,283.32	$51,907.15	$81,190.46	0.7903	$64,164.82	$404,366.14	0.1908	$77,153.06	$3,376,298.00	$0.00	5.2421	$0.00	0.7903	$644,197.66	0.12	-$567,044.60
7	4.09	0.63	0.75	0.75	3.07	0.47	1.15	3.52	0.54	$29,868.98	$52,945.29	$82,814.27	0.7599	$62,930.56	$467,296.70	0.1666	$77,851.63	$3,376,298.00	$0.00	6.0021	$0.00	0.7599	$562,491.25	0.14	-$484,639.62
8	4.09	0.63	0.75	0.75	3.07	0.47	1.17	3.59	0.55	$30,466.36	$54,004.19	$84,470.56	0.7307	$61,722.64	$529,019.34	0.1485	$78,559.37	$3,376,298.00	$0.00	6.7327	$0.00	0.7307	$501,380.25	0.16	-$422,820.88
9	4.09	0.63	0.75	0.75	3.07	0.47	1.20	3.66	0.56	$31,075.69	$55,084.28	$86,159.97	0.7026	$60,535.99	$589,555.33	0.1345	$79,295.19	$3,376,298.00	$0.00	7.4353	$0.00	0.7026	$454,112.08	0.17	-$374,816.89
10	4.09	0.63	0.75	0.75	3.07	0.47	1.22	3.74	0.57	$31,697.20	$56,185.96	$87,883.17	0.6756	$59,373.87	$648,929.20	0.1233	$80,012.97	$3,376,298.00	$0.00	8.1109	$0.00	0.6756	$416,297.54	0.19	-$336,284.57
11	4.09	0.63	0.75	0.75	3.07	0.47	1.24	3.81	0.59	$32,331.15	$57,309.68	$89,640.83	0.6496	$58,230.68	$707,159.88	0.1141	$80,686.94	$3,376,298.00	$0.00	8.7605	$0.00	0.6496	$385,235.60	0.21	-$304,548.66
12	4.09	0.63	0.75	0.75	3.07	0.47	1.27	3.89	0.60	$32,977.77	$58,455.88	$91,433.65	0.6246	$57,109.46	$764,269.33	0.1066	$81,471.11	$3,376,298.00	$0.00	9.3851	$0.00	0.6246	$359,913.37	0.23	-$278,442.26
13	4.09	0.63	0.75	0.75	3.07	0.47	1.29	3.97	0.61	$33,637.32	$59,624.99	$93,262.32	0.6006	$56,013.35	$820,282.68	0.1001	$82,110.30	$3,376,298.00	$0.00	9.9856	$0.00	0.6006	$337,967.43	0.24	-$255,857.13
14	4.09	0.63	0.75	0.75	3.07	0.47	1.32	4.05	0.62	$34,310.07	$60,817.49	$95,127.57	0.5775	$54,936.17	$875,218.85	0.0947	$82,883.23	$3,376,298.00	$0.00	10.5631	$0.00	0.5775	$319,735.42	0.26	-$236,852.20
15	4.09	0.63	0.75	0.75	3.07	0.47	1.35	4.13	0.63	$34,996.27	$62,033.84	$97,030.12	0.5553	$53,880.82	$929,099.68	0.0899	$83,526.06	$3,376,298.00	$0.00	11.1184	$0.00	0.5553	$303,529.19	0.28	-$220,003.13
16	4.09	0.63	0.75	0.75	3.07	0.47	1.37	4.21	0.65	$35,696.20	$63,274.52	$98,970.72	0.5339	$52,840.47	$981,940.14	0.0858	$84,250.46	$3,376,298.00	$0.00	11.6523	$0.00	0.5339	$289,686.37	0.29	-$205,435.90
17	4.09	0.63	0.75	0.75	3.07	0.47	1.40	4.29	0.66	$36,410.12	$64,540.01	$100,950.13	0.5134	$51,827.80	$1,033,767.94	0.0822	$84,975.72	$3,376,298.00	$0.00	12.1657	$0.00	0.5134	$277,531.70	0.31	-$192,555.97
18	4.09	0.63	0.75	0.75	3.07	0.47	1.43	4.38	0.67	$37,138.32	$65,830.81	$102,969.14	0.4936	$50,825.57	$1,084,593.51	0.0790	$85,682.89	$3,376,298.00	$0.00	12.6593	$0.00	0.4936	$266,727.54	0.32	-$181,044.66
19	4.09	0.63	0.75	0.75	3.07	0.47	1.46	4.47	0.69	$37,881.09	$67,147.43	$105,028.52	0.4746	$49,846.54	$1,134,440.04	0.0761	$86,330.89	$3,376,298.00	$0.00	13.1339	$0.00	0.4746	$256,936.28	0.34	-$170,605.39
20	4.09	0.63	0.75	0.75	3.07	0.47	1.49	4.56	0.70	$38,638.71	$68,490.38	$107,129.09	0.4564	$48,893.72	$1,183,333.76	0.0736	$87,093.36	$3,376,298.00	$0.00	13.5903	$0.00	0.4564	$248,495.53	0.35	-$161,402.17
21	4.09	0.63	0.75	0.75	3.07	0.47	1.52	4.65	0.71	$39,411.49	$69,860.18	$109,271.67	0.4388	$47,948.41	$1,231,282.17	0.0713	$87,790.42	$3,376,298.00	$0.00	14.0292	$0.00	0.4388	$240,730.05	0.36	-$152,939.63
22	4.09	0.63	0.75	0.75	3.07	0.47	1.55	4.74	0.73	$40,199.72	$71,257.39	$111,457.10	0.4220	$47,034.90	$1,278,317.06	0.0692	$88,459.54	$3,376,298.00	$0.00	14.4511	$0.00	0.4220	$233,639.82	0.38	-$145,180.28
23	4.09	0.63	0.75	0.75	3.07	0.47	1.58	4.83	0.74	$41,003.71	$72,682.54	$113,686.25	0.4057	$46,122.51	$1,324,439.58	0.0673	$89,134.78	$3,376,298.00	$0.00	14.8568	$0.00	0.4057	$227,224.86	0.39	-$138,090.07
24	4.09	0.63	0.75	0.75	3.07	0.47	1.61	4.93	0.76	$41,823.79	$74,136.19	$115,959.97	0.3901	$45,235.98	$1,369,675.56	0.0656	$89,850.72	$3,376,298.00	$0.00	15.2470	$0.00	0.3901	$221,485.15	0.41	-$131,634.43
25	4.09	0.63	0.75	0.75	3.07	0.47	1.64	5.03	0.77	$42,660.26	$75,618.91	$118,279.17	0.3751	$44,366.52	$1,414,042.08	0.0640	$90,498.69	$3,376,298.00	$0.00	15.6221	$0.00	0.3751	$216,083.07	0.42	-$125,584.38
26	4.09	0.63	0.75	0.75	3.07	0.47	1.67	5.13	0.79	$43,513.47	$77,131.29	$120,644.75	0.3607	$43,516.56	$1,457,558.64	0.0626	$91,243.17	$3,376,298.00	$0.00	15.9828	$0.00	0.3607	$211,356.25	0.43	-$120,113.08
27	4.09	0.63	0.75	0.75	3.07	0.47	1.71	5.23	0.80	$44,383.74	$78,673.91	$123,057.65	0.3468	$42,676.39	$1,500,235.03	0.0612	$91,814.38	$3,376,298.00	$0.00	16.3296	$0.00	0.3468	$206,629.44	0.44	-$114,815.05
28	4.09	0.63	0.75	0.75	3.07	0.47	1.74	5.34	0.82	$45,271.41	$80,247.39	$125,518.80	0.3335	$41,860.52	$1,542,095.55	0.0600	$92,525.73	$3,376,298.00	$0.00	16.6631	$0.00	0.3335	$202,577.88	0.46	-$110,052.15
29	4.09	0.63	0.75	0.75	3.07	0.47	1.78	5.44	0.84	$46,176.84	$81,852.34	$128,029.18	0.3207	$41,058.96	$1,583,154.51	0.0589	$93,247.80	$3,376,298.00	$0.00	16.9837	$0.00	0.3207	$198,863.95	0.47	-$105,616.15
30	4.09	0.63	0.75	0.75	3.07	0.47	1.81	5.55	0.85	$47,100.38	$83,489.39	$130,589.76	0.3083	$40,260.82	$1,623,415.33	0.0578	$93,833.41	$3,376,298.00	$0.00	17.2920	$0.00	0.3083	$195,150.02	**0.48**	-$101,316.62

Column	Column Description
1	Service Year - time frame improvement can reasonably impact accident experience
2	Average Annual Property Damage Only (PDO) Accidents
3	Average Annual Fatality or Injury (F/I) Accidents
4	Accident Reduction Factor (ARF) for PDO Accidents - calculated herein
5	Accident Reduction Factor (ARF) for F/I Accidents - calculated herein
6	PDO Accidents multiplied by ARF for PDO Accidents - Col. 2 * Col. 4
7	F/I Accidents multiplied by ARF for F/I accidents - Col. 3 * Col.5
8	Accident Projection Factor (APF) - 2% increase in accidents per year
9	Accident Reduction for PDO accidents - Col. 6 * Col. 8
10	Accident Reduction for F/I accidents - Col. 7 * Col. 8
11	PDO Accidents multiplied by $6500 plus 3% inflation for 9 yrs- from Indiana Design Manual Fig 50-2A
12	F/I Accidents multiplied by $75000 plus 3% inflation for 9 yrs- from Indiana Design Manual Fig 50-2A
13	Total Unadjusted Benefits - Sum of Col. 11 and Col. 12
14	Present Worth Factor (PWF) - Factor to determine present value of economic benefit during service life
15	Adjusted Benefits - Total unadjusted benefits mult. By PWF - Col. 13 * Col. 14
16	Adjusted cumulative year benefit
17	Capital Recovery Factor (CRF) - Design Manual Figure 50-2C
18	Equivalent Uniform Annual Benefit (EUAB) - CRF mult. By adjusted cumulative year benefit - Col. 16 * Col. 17
19	Initial Cost of the recommended improvement
20	Annual Maintenance Cost (AMC)
21	Present Worth Factor for an Equal Payment Series (PWF-EQ) - from Design Manual 50-2C
22	Salvage value of the improvement at the end of the service life
23	Present Worth Factor for a Single Payment (PWF-SP) - from Design Manual 50-2C
24	Equivalent Uniform Annual Costs (EUAC) - CRF * [initial cost + (AMC*PWF-EQ) - (Salvage Value * PWF-SP)]
25	Benefit to Cost Ratio (B/C) - EUAB divided by EUAC
26	Net Annual Benefit (NAB) - difference between EUAB and EUAC

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Benefit / Cost Analysis
I 69 Tier 2 - Section 4 - Construction of Profile at Max 10 mph Speed Reduction
Sta. 1127+00 to 1229+00 NB

Rev. 3/17/2011

							Accident Reduction			Adjusted Benefits						Benefit / Cost Calculations									
Service Year	Avg Ann PDO Acc	Avg Ann F/I Acc	ARF (PDO)	ARF (F/I)	PDO Acc * ARF	F/I Acc * ARF	APF	PDO	F/I	PDO * $8481	F/I * $97860	Total Benefits	PWF	Adj. Benefit	Cum. Yr. Benefit	Cap. Recovery	EUAB	Initial Cost	AMC	PWF-EQ	Salvage	PWF -SP	EUAC	B/C	NAB
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**
1	5.95	0.92	0.50	0.50	2.98	0.46	1.02	3.04	0.47	$25,744.25	$45,816.09	$71,560.34	0.9615	$68,805.27	$68,805.27	1.0400	$71,557.48	$8,145,318.00	$0.00	0.9615	$0.00	0.9615	$8,471,130.72	0.01	-$8,399,573.24
2	5.95	0.92	0.50	0.50	2.98	0.46	1.04	3.10	0.48	$26,259.13	$46,732.42	$72,991.55	0.9246	$67,487.98	$136,293.25	0.5302	$72,262.68	$8,145,318.00	$0.00	1.8861	$0.00	0.9246	$4,318,647.60	0.02	-$4,246,384.92
3	5.95	0.92	0.50	0.50	2.98	0.46	1.06	3.16	0.49	$26,784.31	$47,667.07	$74,451.38	0.8890	$66,187.27	$202,480.53	0.3603	$72,953.73	$8,145,318.00	$0.00	2.7751	$0.00	0.8890	$2,934,758.08	0.02	-$2,861,804.34
4	5.95	0.92	0.50	0.50	2.98	0.46	1.08	3.22	0.50	$27,320.00	$48,620.41	$75,940.41	0.8548	$64,913.86	$267,394.38	0.2755	$73,667.15	$8,145,318.00	$0.00	3.6299	$0.00	0.8548	$2,244,035.11	0.03	-$2,170,367.96
5	5.95	0.92	0.50	0.50	2.98	0.46	1.10	3.29	0.51	$27,866.40	$49,592.81	$77,459.21	0.8219	$63,663.73	$331,058.11	0.2246	$74,355.65	$8,145,318.00	$0.00	4.4518	$0.00	0.8219	$1,829,438.42	0.04	-$1,755,082.77
6	5.95	0.92	0.50	0.50	2.98	0.46	1.13	3.35	0.52	$28,423.73	$50,584.67	$79,008.40	0.7903	$62,440.34	$393,498.45	0.1908	$75,079.50	$8,145,318.00	$0.00	5.2421	$0.00	0.7903	$1,554,126.67	0.05	-$1,479,047.17
7	5.95	0.92	0.50	0.50	2.98	0.46	1.15	3.42	0.53	$28,992.20	$51,596.36	$80,588.57	0.7599	$61,239.25	$454,737.70	0.1666	$75,759.30	$8,145,318.00	$0.00	6.0021	$0.00	0.7599	$1,357,009.98	0.06	-$1,281,250.68
8	5.95	0.92	0.50	0.50	2.98	0.46	1.17	3.49	0.54	$29,572.05	$52,628.29	$82,200.34	0.7307	$60,063.79	$514,801.49	0.1485	$76,448.02	$8,145,318.00	$0.00	6.7327	$0.00	0.7307	$1,209,579.72	0.06	-$1,133,131.70
9	5.95	0.92	0.50	0.50	2.98	0.46	1.20	3.56	0.55	$30,163.49	$53,680.86	$83,844.34	0.7026	$58,909.04	$573,710.52	0.1345	$77,164.07	$8,145,318.00	$0.00	7.4353	$0.00	0.7026	$1,095,545.27	0.07	-$1,018,381.21
10	5.95	0.92	0.50	0.50	2.98	0.46	1.22	3.63	0.56	$30,766.76	$54,754.47	$85,521.23	0.6756	$57,778.14	$631,488.66	0.1233	$77,862.55	$8,145,318.00	$0.00	8.1109	$0.00	0.6756	$1,004,317.71	0.08	-$926,455.16
11	5.95	0.92	0.50	0.50	2.98	0.46	1.24	3.70	0.57	$31,382.09	$55,849.56	$87,231.66	0.6496	$56,665.68	$688,154.35	0.1141	$78,518.41	$8,145,318.00	$0.00	8.7605	$0.00	0.6496	$929,380.78	0.08	-$850,862.37
12	5.95	0.92	0.50	0.50	2.98	0.46	1.27	3.77	0.58	$32,009.73	$56,966.56	$88,976.29	0.6246	$55,574.59	$743,728.94	0.1066	$79,281.50	$8,145,318.00	$0.00	9.3851	$0.00	0.6246	$868,290.90	0.09	-$789,009.39
13	5.95	0.92	0.50	0.50	2.98	0.46	1.29	3.85	0.59	$32,649.93	$58,105.89	$90,755.81	0.6006	$54,507.94	$798,236.88	0.1001	$79,903.51	$8,145,318.00	$0.00	9.9856	$0.00	0.6006	$815,346.33	0.10	-$735,442.82
14	5.95	0.92	0.50	0.50	2.98	0.46	1.32	3.93	0.61	$33,302.93	$59,268.00	$92,570.93	0.5775	$53,459.71	$851,696.59	0.0947	$80,655.67	$8,145,318.00	$0.00	10.5631	$0.00	0.5775	$771,361.61	0.10	-$690,705.95
15	5.95	0.92	0.50	0.50	2.98	0.46	1.35	4.01	0.62	$33,968.98	$60,453.36	$94,422.35	0.5553	$52,432.73	$904,129.32	0.0899	$81,281.23	$8,145,318.00	$0.00	11.1184	$0.00	0.5553	$732,264.09	0.11	-$650,982.86
16	5.95	0.92	0.50	0.50	2.98	0.46	1.37	4.09	0.63	$34,648.36	$61,662.43	$96,310.80	0.5339	$51,420.33	$955,549.66	0.0858	$81,986.16	$8,145,318.00	$0.00	11.6523	$0.00	0.5339	$698,868.28	0.12	-$616,882.12
17	5.95	0.92	0.50	0.50	2.98	0.46	1.40	4.17	0.64	$35,341.33	$62,895.68	$98,237.01	0.5134	$50,434.88	$1,005,984.54	0.0822	$82,691.93	$8,145,318.00	$0.00	12.1657	$0.00	0.5134	$669,545.14	0.12	-$586,853.21
18	5.95	0.92	0.50	0.50	2.98	0.46	1.43	4.25	0.66	$36,048.16	$64,153.59	$100,201.75	0.4936	$49,459.58	$1,055,444.12	0.0790	$83,380.09	$8,145,318.00	$0.00	12.6593	$0.00	0.4936	$643,480.12	0.13	-$560,100.04
19	5.95	0.92	0.50	0.50	2.98	0.46	1.46	4.34	0.67	$36,769.12	$65,436.67	$102,205.79	0.4746	$48,506.87	$1,103,950.99	0.0761	$84,010.67	$8,145,318.00	$0.00	13.1339	$0.00	0.4746	$619,858.70	0.14	-$535,848.03
20	5.95	0.92	0.50	0.50	2.98	0.46	1.49	4.42	0.68	$37,504.50	$66,745.40	$104,249.90	0.4564	$47,579.66	$1,151,530.64	0.0736	$84,752.66	$8,145,318.00	$0.00	13.5903	$0.00	0.4564	$599,495.40	0.14	-$514,742.75
21	5.95	0.92	0.50	0.50	2.98	0.46	1.52	4.51	0.70	$38,254.59	$68,080.31	$106,334.90	0.4388	$46,659.75	$1,198,190.40	0.0713	$85,430.98	$8,145,318.00	$0.00	14.0292	$0.00	0.4564	$580,761.17	0.15	-$495,330.20
22	5.95	0.92	0.50	0.50	2.98	0.46	1.55	4.60	0.71	$39,019.69	$69,441.91	$108,461.60	0.4220	$45,770.79	$1,243,961.19	0.0692	$86,082.11	$8,145,318.00	$0.00	14.4511	$0.00	0.4564	$563,656.01	0.15	-$477,573.89
23	5.95	0.92	0.50	0.50	2.98	0.46	1.58	4.69	0.72	$39,800.08	$70,830.75	$110,630.83	0.4057	$44,882.93	$1,288,844.12	0.0673	$86,739.21	$8,145,318.00	$0.00	14.8568	$0.00	0.4564	$548,179.90	0.16	-$461,440.69
24	5.95	0.92	0.50	0.50	2.98	0.46	1.61	4.79	0.74	$40,596.08	$72,247.37	$112,843.45	0.3901	$44,020.23	$1,332,864.35	0.0656	$87,435.90	$8,145,318.00	$0.00	15.2470	$0.00	0.4564	$534,332.86	0.16	-$446,896.96
25	5.95	0.92	0.50	0.50	2.98	0.46	1.64	4.88	0.75	$41,408.00	$73,692.31	$115,100.32	0.3751	$43,174.13	$1,376,038.48	0.0640	$88,066.46	$8,145,318.00	$0.00	15.6221	$0.00	0.4564	$521,300.35	0.17	-$433,233.89
26	5.95	0.92	0.50	0.50	2.98	0.46	1.67	4.98	0.77	$42,236.16	$75,166.16	$117,402.32	0.3607	$42,347.02	$1,418,385.50	0.0626	$88,790.93	$8,145,318.00	$0.00	15.9828	$0.00	0.4564	$509,896.91	0.17	-$421,105.97
27	5.95	0.92	0.50	0.50	2.98	0.46	1.71	5.08	0.78	$43,080.89	$76,669.48	$119,750.37	0.3468	$41,529.43	$1,459,914.92	0.0612	$89,346.79	$8,145,318.00	$0.00	16.3296	$0.00	0.4564	$498,493.46	0.18	-$409,146.67
28	5.95	0.92	0.50	0.50	2.98	0.46	1.74	5.18	0.80	$43,942.50	$78,202.87	$122,145.38	0.3335	$40,735.48	$1,500,650.41	0.0600	$90,039.02	$8,145,318.00	$0.00	16.6631	$0.00	0.4564	$488,719.08	0.18	-$398,680.06
29	5.95	0.92	0.50	0.50	2.98	0.46	1.78	5.28	0.82	$44,821.35	$79,766.93	$124,588.28	0.3207	$39,955.46	$1,540,605.87	0.0589	$90,741.69	$8,145,318.00	$0.00	16.9837	$0.00	0.4564	$479,759.23	0.19	-$389,017.54
30	5.95	0.92	0.50	0.50	2.98	0.46	1.81	5.39	0.83	$45,717.78	$81,362.27	$127,080.05	0.3083	$39,178.78	$1,579,784.65	0.0578	$91,311.55	$8,145,318.00	$0.00	17.2920	$0.00	0.4564	$470,799.38	**0.19**	-$379,487.83

Column	Column Description
1	Service Year - time frame improvement can reasonably impact accident experience
2	Average Annual Property Damage Only (PDO) Accidents
3	Average Annual Fatality or Injury (F/I) Accidents
4	Accident Reduction Factor (ARF) for PDO Accidents - calculated herein
5	Accident Reduction Factor (ARF) for F/I Accidents - calculated herein
6	PDO Accidents multiplied by ARF for PDO Accidents - Col. 2 * Col. 4
7	F/I Accidents multiplied by ARF for F/I accidents - Col. 3 * Col.5
8	Accident Projection Factor (APF) - 2% increase in accidents per year
9	Accident Reduction for PDO accidents - Col. 6 * Col. 8
10	Accident Reduction for F/I accidents - Col. 7 * Col. 8
11	PDO Accidents multiplied by $6500 plus 3% inflation for 9 yrs- from Indiana Design Manual Fig 50-2A
12	F/I Accidents multiplied by $75000 plus 3% inflation for 9 yrs- from Indiana Design Manual Fig 50-2A
13	Total Unadjusted Benefits - Sum of Col. 11 and Col. 12

Column	Column Description
14	Present Worth Factor (PWF) - Factor to determine present value of economic benefit during service life
15	Adjusted Benefits - Total unadjusted benefits mult. By PWF - Col. 13 * Col. 14
16	Adjusted cumulative year benefit
17	Capital Recovery Factor (CRF) - Design Manual Figure 50-2C
18	Equivalent Uniform Annual Benefit (EUAB) - CRF mult. By adjusted cumulative year benefit - Col. 16 * Col. 17
19	Initial Cost of the recommended improvement
20	Annual Maintenance Cost (AMC)
21	Present Worth Factor for an Equal Payment Series (PWF-EQ) - from Design Manual 50-2C
22	Salvage value of the improvement at the end of the service life
23	Present Worth Factor for a Single Payment (PWF-SP) - from Design Manual 50-2C
24	Equivalent Uniform Annual Costs (EUAC) - CRF * [initial cost + (AMC*PWF-EQ) - (Salvage Value * PWF-SP)]
25	Benefit to Cost Ratio (B/C) - EUAB divided by EUAC
26	Net Annual Benefit (NAB) - difference between EUAB and EUAC

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Exhibit B

Truck Climbing Lane Warrant Analysis

Section 4 Project Office
3802 Industrial Boulevard – Suite 2
Bloomington, IN 47403
Phone: 812-334-8869 Fax: 812-334-2370

OFFICE MEMORANDUM

Date: August 13, 2009
To: Tier 2 PMC
From: Gary Fisk – Section 4 PM
Subject: Truck Climbing Lane Warrant Analysis

At the request of the PMC and INDOT, a truck climbing lane warrant analysis was performed on I-69 Section 4. This analysis will be used by the PMC for documentation for a subsequent Low cost alternative studies, using a 20 mph reduction in truck speeds. The initial truck speed will equal the design speed of the roadway, 70 mph. A profile (named TSP-056) was developed utilizing a maximum 20 mph truck speed reduction criteria (attached output of profile from highway design software).

The truck speed profile was computed using NCHRP Report 505 *"Review of Truck Characteristics as Factors in Roadway Design"*, 2003 (attached are the truck speed profiles in tabular format for each Northbound and Southbound direction, as well as a graphic summary).

In accordance with the guidance from the PMC, Truck Climbing Lane Warrants from Indiana Department of Transportation Design Manual Chapter 44-2.01(02):

"A climbing lane may be warranted if all of the following conditions are satisfied:"

1) "The critical length of grade is less than the length of grade being evaluated; and"

This condition is satisfied. Listed below are the locations in which the length of grade is greater than the critical length of grade resulting in greater than a 10 mph truck speed reduction from the design speed.

Northbound

- Sta. 137+45.14 to Sta. 139+99.14
- Sta. 173+00.00 to Sta. 202+00.00
- Sta. 237+50.00 to v264+50.00
- Sta. 443+00.00 to Sta. 472+00.00
- Sta. 554+50.00 to Sta. 588+00.00
- Sta. 609+00.00 to Sta. 630+00.00
- Sta. 690+00.00 to Sta. 718+00.00
- Sta. 929+00.00 to Sta. 1021+00.00
- Sta. 1127+00.00 to Sta. 1229+00.00
- Sta. 1468+00.00 to Sta. 1493+00.00
- Sta. 1516+00.00 to Sta. 1529+24.22

Southbound

- Sta. 327+00.00 to Sta. 310+00.00
- Sta. 368+00.00 to Sta. 410+00.00
- Sta. 765+00.00 to Sta. 718+00.00
- Sta. 1080+00.00 to Sta. 1021+00.00
- Sta. 1313+50.00 to Sta. 1281+50.00
- Sta. 1420+00.00 to Sta. 1379+00.00

Section 4 Project Office
3802 Industrial Boulevard – Suite 2
Bloomington, IN 47403
Phone: 812-334-8869 Fax: 812-334-2370

2) "…and One of the following conditions exists:
a) the LOS on the upgrade is E or F, or
b) there is a reduction of one or more LOS when moving from the approach segment to the upgrade; "

LOS calculations were performed for critical locations along the alignment using the HCS software (see attached output). Representative/worst case locations were selected for analysis. The critical locations were determined by the following criteria:

i. The area that has the highest overall speed reduction (SB Sta. 368+00 to Sta. 410+00);
ii. The area that has a speed reduction greater than 10 mph for the longest length of profile (NB Sta. 1127+00 to Sta. 1229+00); and
iii. A combination of the above two (which corresponds to SB Sta. 368+00 to Sta. 410+00).
iv. The highest directional peak hour lane volume (SB Sta. 1281+00 to Sta. 1313+50).
v. The highest directional peak hour truck % volumes (NB Sta. 554+50 to Sta. 588+00).

The LOS calculation was performed with HCS software for peak hour directional volumes for the critical areas identified above. Below is the LOS criteria:

Level Of Service	Density Range (pc/mi/ln)	Service Flow Rate (pc/h/ln)
A	0 to 11	0 to 770
B	>11 to 18	771 to 1260
C	>18 to 26	1261 to 1770
D	>26 to 35	1771 to 2150
E	>35 to 45	2151 to 2400
F	>45	>2400

The results of the analysis are attached and summarized in a table below. All of the conditions resulted in LOS calculations with a LOS of "A", with the exception of the Section from Southbound Station 1281+00 to Station 1313+50, where the traffic volume is the highest. This segment had a density of 11.1 pc/mi/ln, just into a "B" LOS, where an "A" is 11.0.

The condition for the warrant reads "***there is a reduction of one or more LOS when moving from the approach segment to the upgrade*** ". In evaluating the 11.1 density along the upgrade, we performed an HCS analysis for the approach segment, which consists of a grade of 0.04% for 0.5 mile, as a comparison and sensitivity check on the grade. The density through the approach segment resulted in 10.4 pc/mi/ln. Thus, the density from the approach segment to the upgrade increased the density by only 0.7 pc/mi/ln. The LOS is more dependent on the volumes in this section, not the grade. As this density is on the cusp of the LOS "A", and the difference was only 0.7 pc/mi/ln, we do not consider this LOS reduction to be a "reduction of one or more LOS". Therefore, neither of the above criteria (2a, 2b) is met for a truck climbing lane.

3) "…and… The construction costs and the construction impacts (e.g., environmental, right of way) are considered reasonable."

Since the LOS criteria was not met for a truck climbing lane, the construction costs and impacts were not calculated.

Summary of the LOS analysis input / output:

	Representitive Sections						
	Critical Grade				Appr Segment	Highest Volume	Highest % Trucks
Segment	SB Sta. 368+00 to Sta. 410+00		NB Sta. 1127+00 to Sta. 1229+03		SB Sta. 1313+50 to Sta. 1340+00	SB Sta. 1281+00 to Sta. 1313+50	NB Sta. 554+50 to Sta. 588+00
Terrain	2.8% for 4200'		4.0% for 2000', 0.6% for 2500', 1.14% for 5500'		-0.04% for 2650'	3.37% for 3200'	3.29% for 3500'
Inputs							
AM/PM	AM	PM	AM	PM	PM	PM	AM
Peak-hour Volume (veh/h)	691	934	994	1089	1207	1207	636
% Trucks	21	16	16	15	13	13	23
number of lanes	2	2	2	2	2	2	2
Lane Width (ft)	12	12	12	12	12	12	12
Right Shoulder Width (ft)	10	10	10	10	10	10	10
interchange density (Int/mi)	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Free-flow speed (mi/h)	70	70	70	70	70	70	70
Rural/Urban	Rural	Rural	Rural	Rural	Rural	Rural	Rural
Factors							
Peak-Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Right-Shoulder Lateral Clearance Factor (mi/h)	0	0	0	0	0	0	0
Interchange Density Factor (mi/h)	0	0	0	0	0	0	0
Lane Width Factor (mi/h)	0	0	0	0	0	0	0
Number of Lanes Factor	0	0	0	0	0	0	0
Heavy Vehicle Factor	0.905	0.926	0.926	0.930	0.885	0.885	0.813
Passenger-Car Equivilent for Trucks	1.5	1.5	1.5	1.5	1.5	2.0	2.0
Driver Population Factor	1	1	1	1	1	1	1
Output							
Flow Rate (pc/h/ln)	434	573	610	665	730	775	444
Average pc speed (mi/h)	70	70	70	70	70	70	70
Density (pc/mi/ln)	6.2	8.2	8.7	9.5	10.4	11.1	6.3
Level of Service	A	A	A	A	A	B	A

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R O A D C A L C -p-profile-RA03

VERT.	STATION	Elevation	GRADE (%SLOPE)	DISTANCE
BOP	7409.1446	578.0600	-0.97	1600.0000
1	9009.1446	562.5800	0.48	1500.0000
2	10509.1446	569.8000	2.37	3490.0000
3	13999.1446	652.5000	-2.54	3300.8554
4	17300.0000	568.7204	3.00	2900.0000
5	20200.0000	655.7204	0.08	3550.0000
6	23750.0000	658.4900	2.20	2700.0000
7	26450.0000	717.8900	0.52	4550.0000
8	31000.0000	741.5495	-3.80	1700.0000
9	32700.0000	676.9495	3.80	1500.0000
10	34200.0000	733.9495	-0.66	2600.0000
11	36800.0000	716.7469	-2.80	4200.0000
12	41000.0000	599.1469	-0.50	3300.0000
13	44300.0000	582.6469	3.26	2900.0000
14	47200.0000	677.1439	-0.70	4700.0000
15	51900.0000	644.2297	1.49	1700.0000
16	53600.0000	669.5228	-3.30	1850.0000
17	55450.0000	608.4516	3.29	3350.0000
18	58800.0000	718.6941	-1.15	2100.0000
19	60900.0000	694.6111	2.78	2100.0000
20	63000.0000	752.9630	0.52	3000.0000
21	66000.0000	768.5939	-0.19	3000.0000
22	69000.0000	762.9819	2.07	2800.0000
23	71800.0000	820.8873	-1.73	2500.0000
24	74300.0000	777.6635	-4.00	2200.0000
25	76500.0000	689.6635	-0.39	2300.0000
26	78800.0000	680.7423	3.25	1550.0000
27	80350.0000	731.1918	-0.62	2250.0000
28	82600.0000	717.1727	0.62	5200.0000
29	87800.0000	749.2000	-1.65	5100.0000
30	92900.0000	665.2100	4.00	2100.0000
31	95000.0000	749.2100	0.60	3400.0000
32	98400.0000	769.6100	1.90	3700.0000
33	102100.0000	839.9040	-2.92	3300.0000
34	105400.0000	743.6100	-0.92	2600.0000
35	108000.0000	719.7500	2.30	2000.0000
36	110000.0000	765.7000	-1.55	2700.0000
37	112700.0000	723.8100	4.00	2200.0000
38	114900.0000	811.8100	0.60	2500.0000
39	117400.0000	826.8100	1.14	5500.0000
40	122900.0000	889.5475	-0.97	5250.0000
41	128150.0000	838.6384	-3.37	3200.0000
42	131350.0000	730.8778	0.04	2650.0000
43	134000.0000	731.9264	-1.34	1150.0000
44	135150.0000	716.5726	1.10	2750.0000
45	137900.0000	746.8226	-2.42	4100.0000

VERT.	STATION	Elevation	GRADE (%SLOPE)	DISTANCE
46	142000.0000	647.4600	2.90	2400.0000
47	144400.0000	717.0041	-3.52	2400.0000
48	146800.0000	632.5695	2.80	2500.0000
49	149300.0000	702.5695	0.60	2300.0000
50	151600.0000	716.3695	3.60	1324.2244
51	152924.2244	764.0416	0.20	2800.7756
52	155725.0000	769.6000	1.40	989.4791
EOP	156714.4791	783.4467		

STATION EQUATIONS

STATION BACK	STATION AHEAD
N/A	

R O A D C A L C -p-profile-RA03

R O A D C A L C - V E R T I C A L C U R V E D A T A

CURVE NUMBER 1 SAG

V E R T I C A L C U R V E D A T A

L = 1000.0000
K = 690.2105
E = 1.8110

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	8509.1446	567.4175	
VPI	9009.1446	564.3910	562.5800
VPT	9509.1446	564.9867	
LOW POINT	9176.9233		564.1871
PASS-THROUGH POINT	9176.9233		564.1871

SIGHT DISTANCE

HEADLIGHT = 2517.4740

CURVE NUMBER 2 SAG

R O A D C A L C -p-profile-RA03

R O A D C A L C - V E R T I C A L C U R V E D A T A

V E R T I C A L C U R V E D A T A

L = 1000.0000
K = 529.5785
E = 2.3604

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	10009.1446	567.3933	
VPI	10509.1446	572.1604	569.8000
VPT	11009.1446	581.6481	
LOW POINT	10009.1446		567.3933
PASS-THROUGH POINT	10264.0484		569.2337

SIGHT DISTANCE

HEADLIGHT = 7990.8678

CURVE NUMBER 3 CREST

V E R T I C A L C U R V E D A T A

L = 3000.0000
K = 611.2788
E = -18.4040

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	12499.1446	616.9556	
VPI	13999.1446	634.0960	652.5000
VPT	15499.1446	614.4283	
HIGH POINT	13947.6478		634.1177
PASS-THROUGH POINT	13947.6478		634.1177

SIGHT DISTANCE

STOPPING = 1148.6181
PASSING = 1148.6181

User Name: cvergon Date: 08-10-09
Project: I-69 Tier2 - Alignment Development Time: 09:34:12
SubProject: Copy of Copy of RA03-Preferred-4-10-07 - CWV 056 Page: 4

R O A D C A L C -p-profile-RA03

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R O A D C A L C - V E R T I C A L C U R V E D A T A

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CURVE NUMBER 4 SAG

V E R T I C A L C U R V E D A T A

L = 1250.0000
K = 225.7085

E = 8.6533

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	16675.0000	584.5837	
VPI	17300.0000	577.3738	568.7204
VPT	17925.0000	587.4704	
LOW POINT	17247.8745		577.3136
PASS-THROUGH POINT	17247.8745		577.3136

SIGHT DISTANCE

HEADLIGHT = 888.0186

CURVE NUMBER 5 CREST

V E R T I C A L C U R V E D A T A

L = 1000.0000
K = 342.2332
E = -3.6525

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	19700.0000	640.7204	
VPI	20200.0000	652.0680	655.7204
VPT	20700.0000	656.1105	
HIGH POINT	20700.0000		656.1105
PASS-THROUGH POINT	20673.3005		656.0793

SIGHT DISTANCE

STOPPING = 859.4429
PASSING = 859.4429

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R O A D C A L C - V E R T I C A L C U R V E D A T A

CURVE NUMBER 6 SAG

V E R T I C A L C U R V E D A T A

L = 1000.0000
K = 471.2570
E = 2.6525

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	23250.0000	658.0999	
VPI	23750.0000	661.1425	658.4900
VPT	24250.0000	669.4900	
LOW POINT	23250.0000		658.0999
PASS-THROUGH POINT	23286.7654		658.1429

SIGHT DISTANCE

HEADLIGHT = 3341.0789

CURVE NUMBER 7 CREST

V E R T I C A L C U R V E D A T A

L = 1500.0000
K = 892.8514
E = -3.1500

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	25700.0000	701.3900	
VPI	26450.0000	714.7400	717.8900
VPT	27200.0000	721.7899	
HIGH POINT	27200.0000		721.7899
PASS-THROUGH POINT	26735.7269		718.1687

SIGHT DISTANCE

R O A D C A L C - V E R T I C A L C U R V E D A T A

STOPPING = 1388.1793
PASSING = 1388.1793

CURVE NUMBER 8 CREST

V E R T I C A L C U R V E D A T A

L = 1800.0000
K = 416.6677
E = -9.7200

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	30100.0000	736.8696	

VPI	31000.0000	731.8295	741.5495
VPT	31900.0000	707.3495	
HIGH POINT	30316.6627		737.4329
PASS-THROUGH POINT	30316.6627		737.4329

SIGHT DISTANCE

STOPPING = 948.3112
PASSING = 948.3112

CURVE NUMBER 9 SAG

V E R T I C A L C U R V E D A T A

L = 1500.0000
K = 197.3684
E = 14.2500

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	31950.0000	705.4495	
VPI	32700.0000	691.1995	676.9495
VPT	33450.0000	705.4495	
LOW POINT	32700.0000		691.1995

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R O A D C A L C - V E R T I C A L C U R V E D A T A

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PASS-THROUGH POINT	32700.0000	691.1995

SIGHT DISTANCE

HEADLIGHT = 787.6667

CURVE NUMBER 10 CREST

V E R T I C A L C U R V E D A T A

L = 1500.0000
K = 336.1993
E = -8.3656

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	33450.0000	705.4495	
VPI	34200.0000	725.5839	733.9495
VPT	34950.0000	728.9872	

HIGH POINT	34727.5573	729.7231
PASS-THROUGH POINT	34727.5573	729.7231

SIGHT DISTANCE

STOPPING = 851.8328
PASSING = 851.8328

CURVE NUMBER 11 CREST

V E R T I C A L C U R V E D A T A

L = 1000.0000
K = 467.6480
E = -2.6730

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	36300.0000	720.0551	
VPI	36800.0000	714.0739	716.7469
VPT	37300.0000	702.7469	

R O A D C A L C - V E R T I C A L C U R V E D A T A

HIGH POINT	36300.0000	720.0551
PASS-THROUGH POINT	36609.4143	716.9843

SIGHT DISTANCE

STOPPING = 1004.6624
PASSING = 1004.6624

CURVE NUMBER 12 SAG

V E R T I C A L C U R V E D A T A

L = 2000.0000
K = 869.5652
E = 5.7500

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	40000.0000	627.1469	
VPI	41000.0000	604.8969	599.1469
VPT	42000.0000	594.1469	
LOW POINT	42000.0000		594.1469

```
PASS-THROUGH POINT  41565.2174                                597.4078

SIGHT DISTANCE

HEADLIGHT =          4502.9389

CURVE NUMBER 13   SAG
--------------------------------------------------------------------------------

V E R T I C A L  C U R V E   D A T A

L =    2000.0000
K =     532.1246
E =       9.3963

STATIONS AND ELEVATIONS

                    STATION           ELEVATION ON CURVE    ELEVATION ON TANGENT
VPC                 43300.0000          587.6469



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             R O A D C A L C    - V E R T I C A L  C U R V E  D A T A
================================================================================
VPI                 44300.0000          592.0432              582.6469
VPT                 45300.0000          615.2321

LOW POINT           43566.0623                                586.9817
PASS-THROUGH POINT  43566.0623                                586.9817

SIGHT DISTANCE

HEADLIGHT =          1964.3061

CURVE NUMBER 14   CREST
--------------------------------------------------------------------------------

V E R T I C A L  C U R V E   D A T A

L =    2000.0000
K =     505.2010
E =      -9.8971

STATIONS AND ELEVATIONS

                    STATION           ELEVATION ON CURVE    ELEVATION ON TANGENT
VPC                 46200.0000          644.5587
VPI                 47200.0000          667.2469              677.1439
VPT                 48200.0000          670.1409

HIGH POINT          47846.2068                                671.3797
PASS-THROUGH POINT  47846.2068                                671.3797

SIGHT DISTANCE

STOPPING  =          1044.2105
```

PASSING = 1044.2105

CURVE NUMBER 15 SAG

V E R T I C A L C U R V E D A T A

L = 800.0000
K = 365.6087
E = 2.1881

STATIONS AND ELEVATIONS

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R O A D C A L C - V E R T I C A L C U R V E D A T A

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	51500.0000	647.0309	
VPI	51900.0000	646.4179	644.2297
VPT	52300.0000	650.1811	
LOW POINT	51756.0364		646.1344
PASS-THROUGH POINT	51756.0364		646.1344

SIGHT DISTANCE

HEADLIGHT = 2422.1456

CURVE NUMBER 16 CREST

V E R T I C A L C U R V E D A T A

L = 1500.0000
K = 313.2192
E = -8.9793

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	52850.0000	658.3641	
VPI	53600.0000	660.5435	669.5228
VPT	54350.0000	644.7642	
HIGH POINT	53316.0170		661.8309
PASS-THROUGH POINT	53316.0170		661.8309

SIGHT DISTANCE

STOPPING = 822.2051
PASSING = 822.2051

CURVE NUMBER 17 SAG

V E R T I C A L C U R V E D A T A

L = 1400.0000
K = 212.3797
E = 11.5359

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R O A D C A L C - V E R T I C A L C U R V E D A T A

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	54750.0000	631.5596	
VPI	55450.0000	619.9875	608.4516
VPT	56150.0000	631.4873	
LOW POINT	55451.0968		619.9875
PASS-THROUGH POINT	55451.0968		619.9875

SIGHT DISTANCE

HEADLIGHT = 840.8591

CURVE NUMBER 18 CREST

V E R T I C A L C U R V E D A T A

L = 1500.0000
K = 338.0184
E = -8.3206

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	58050.0000	694.0129	
VPI	58800.0000	710.3735	718.6941
VPT	59550.0000	710.0930	
HIGH POINT	59162.3576		712.3157
PASS-THROUGH POINT	59162.3576		712.3157

SIGHT DISTANCE

STOPPING = 854.1343
PASSING = 854.1343

CURVE NUMBER 19 SAG

V E R T I C A L C U R V E D A T A

L = 1000.0000
K = 254.7466

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E = 4.9068

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	60400.0000	700.3451	
VPI	60900.0000	699.5179	694.6111
VPT	61400.0000	708.5044	
LOW POINT	60692.1455		698.6699
PASS-THROUGH POINT	60692.1455		698.6699

SIGHT DISTANCE

HEADLIGHT = 990.5721

CURVE NUMBER 20 CREST

V E R T I C A L C U R V E D A T A

L = 1000.0000
K = 442.9421
E = -2.8220

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	62500.0000	739.0697	
VPI	63000.0000	750.1409	752.9630
VPT	63500.0000	755.5681	
HIGH POINT	63500.0000		755.5681
PASS-THROUGH POINT	63269.2140		753.7644

SIGHT DISTANCE

STOPPING = 977.7536
PASSING = 977.7536

CURVE NUMBER 21 CREST

V E R T I C A L C U R V E D A T A

R O A D C A L C -p-profile-RA03

R O A D C A L C - V E R T I C A L C U R V E D A T A

L = 2000.0000
K = 2824.4798
E = -1.7702

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	65000.0000	763.3836	
VPI	66000.0000	766.8236	768.5939
VPT	67000.0000	766.7232	
HIGH POINT	66471.6382		767.2174
PASS-THROUGH POINT	66471.6382		767.2174

SIGHT DISTANCE

STOPPING = 2524.0191
PASSING = 2524.0191

CURVE NUMBER 22 SAG

V E R T I C A L C U R V E D A T A

L = 1000.0000
K = 443.4363
E = 2.8189

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	68500.0000	763.9172	
VPI	69000.0000	765.8008	762.9819
VPT	69500.0000	773.3222	
LOW POINT	68582.9515		763.8396
PASS-THROUGH POINT	68582.9515		763.8396

SIGHT DISTANCE

HEADLIGHT = 2598.8721

CURVE NUMBER 23 CREST

R O A D C A L C -p-profile-RA03

R O A D C A L C - V E R T I C A L C U R V E D A T A

V E R T I C A L C U R V E D A T A

L = 1500.0000
K = 395.0487
E = -7.1194

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	71050.0000	805.3769	
VPI	71800.0000	813.7679	820.8873
VPT	72550.0000	807.9202	
HIGH POINT	71866.9804		813.8247
PASS-THROUGH POINT	71866.9804		813.8247

SIGHT DISTANCE

STOPPING = 923.3817
PASSING = 923.3817

CURVE NUMBER 24 CREST

V E R T I C A L C U R V E D A T A

L = 1500.0000
K = 660.4876
E = -4.2582

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	73550.0000	790.6307	
VPI	74300.0000	773.4053	777.6635
VPT	75050.0000	747.6635	
HIGH POINT	73550.0000		790.6307
PASS-THROUGH POINT	74300.0000		773.4053

SIGHT DISTANCE

STOPPING = 1193.9559
PASSING = 1193.9559

R O A D C A L C -p-profile-RA03

R O A D C A L C - V E R T I C A L C U R V E D A T A

CURVE NUMBER 25 SAG

V E R T I C A L C U R V E D A T A

L = 1000.0000
K = 276.8459
E = 4.5151

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	76000.0000	709.6635	
VPI	76500.0000	694.1787	689.6635
VPT	77000.0000	687.7241	
LOW POINT	77000.0000		687.7241
PASS-THROUGH POINT	76892.6166		688.3489

SIGHT DISTANCE

HEADLIGHT = 1073.0188

CURVE NUMBER 26 SAG

V E R T I C A L C U R V E D A T A

L = 1000.0000
K = 274.5224
E = 4.5534

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	78300.0000	682.6817	
VPI	78800.0000	685.2956	680.7423
VPT	79300.0000	697.0163	
LOW POINT	78406.4822		682.4752
PASS-THROUGH POINT	78406.4822		682.4752

SIGHT DISTANCE

HEADLIGHT = 1063.7851

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R O A D C A L C - V E R T I C A L C U R V E D A T A

CURVE NUMBER 27 CREST

V E R T I C A L C U R V E D A T A

L = 1500.0000
K = 386.8095
E = -7.2710

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	79600.0000	706.7807	
VPI	80350.0000	723.9208	731.1918
VPT	81100.0000	726.5188	
HIGH POINT	80858.9908		727.2696
PASS-THROUGH POINT	80858.9908		727.2696

SIGHT DISTANCE

STOPPING = 913.7019
PASSING = 913.7019

CURVE NUMBER 28 SAG

V E R T I C A L C U R V E D A T A

L = 1500.0000
K = 1210.6746
E = 2.3231

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	81850.0000	721.8457	
VPI	82600.0000	719.4958	717.1727
VPT	83350.0000	721.7920	
LOW POINT	82600.0000		719.4958
PASS-THROUGH POINT	82600.0000		719.4958

SIGHT DISTANCE

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R O A D C A L C - V E R T I C A L C U R V E D A T A

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HEADLIGHT = 4336.3975

CURVE NUMBER 29 CREST

V E R T I C A L C U R V E D A T A

L = 2000.0000

K = 883.8717
E = -5.6569

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	86800.0000	743.0409	
VPI	87800.0000	743.5431	749.2000
VPT	88800.0000	732.7314	
HIGH POINT	87344.3846		744.7174
PASS-THROUGH POINT	87344.3846		744.7174

SIGHT DISTANCE

STOPPING = 1381.1809
PASSING = 1381.1809

CURVE NUMBER 30 SAG

V E R T I C A L C U R V E D A T A

L = 2000.0000
K = 354.1790
E = 14.1172

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	91900.0000	681.6786	
VPI	92900.0000	679.3272	665.2100
VPT	93900.0000	705.2100	
LOW POINT	92483.2841		676.8757
PASS-THROUGH POINT	92483.2841		676.8757

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R O A D C A L C - V E R T I C A L C U R V E D A T A

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SIGHT DISTANCE

HEADLIGHT = 1340.4672

CURVE NUMBER 31 CREST

V E R T I C A L C U R V E D A T A

L = 1500.0000
K = 441.1765
E = -6.3750

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	94250.0000	719.2100	
VPI	95000.0000	742.8350	749.2100
VPT	95750.0000	753.7100	
HIGH POINT	95750.0000		753.7100
PASS-THROUGH POINT	95485.2941		751.3276

SIGHT DISTANCE

STOPPING = 975.8030
PASSING = 975.8030

CURVE NUMBER 32 SAG

V E R T I C A L C U R V E D A T A

L = 1000.0000
K = 769.3263
E = 1.6248

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	97900.0000	766.6100	
VPI	98400.0000	771.2348	769.6100
VPT	98900.0000	779.1092	

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R O A D C A L C - V E R T I C A L C U R V E D A T A

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LOW POINT	97900.0000	766.6100
PASS-THROUGH POINT	98361.5958	770.7644

SIGHT DISTANCE

HEADLIGHT = 2794.1285

CURVE NUMBER 33 CREST

V E R T I C A L C U R V E D A T A

L = 1600.0000
K = 332.0991
E = -9.6357

STATIONS AND ELEVATIONS

STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT

VPC	101300.0000	824.7053	
VPI	102100.0000	830.2683	839.9040
VPT	102900.0000	816.5600	
HIGH POINT	101930.9346		830.6987
PASS-THROUGH POINT	101930.9346		830.6987

SIGHT DISTANCE

STOPPING = 846.6225
PASSING = 846.6225

CURVE NUMBER 34 SAG

V E R T I C A L C U R V E D A T A

L = 1500.0000
K = 749.8843
E = 3.7506

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	104650.0000	765.4950	
VPI	105400.0000	747.3606	743.6100

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R O A D C A L C - V E R T I C A L C U R V E D A T A

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VPT	106150.0000	736.7273	
LOW POINT	106150.0000		736.7273
PASS-THROUGH POINT	105461.8369		746.2001

SIGHT DISTANCE

HEADLIGHT = 6660.3943

CURVE NUMBER 35 SAG

V E R T I C A L C U R V E D A T A

L = 1500.0000
K = 466.5351
E = 6.0285

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	107250.0000	726.6327	
VPI	108000.0000	725.7785	719.7500
VPT	108750.0000	736.9813	

```
LOW POINT           107678.1357                                  724.6682
PASS-THROUGH POINT  107678.1357                                  724.6682

SIGHT DISTANCE

HEADLIGHT =          1774.6954

CURVE NUMBER 36   CREST
--------------------------------------------------------------------------------

V E R T I C A L  C U R V E   D A T A

L =    1500.0000
K =     389.7134
E =      -7.2168

STATIONS AND ELEVATIONS

                    STATION           ELEVATION ON CURVE    ELEVATION ON TANGENT
VPC                 109250.0000         748.4688
VPI                 110000.0000         758.4832              765.7000


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             R O A D C A L C    - V E R T I C A L  C U R V E  D A T A
==============================================================================
VPT                 110750.0000         754.0639

HIGH POINT          110145.3666                                  758.7543
PASS-THROUGH POINT  110145.3666                                  758.7543

SIGHT DISTANCE

STOPPING  =           917.1252
PASSING   =           917.1252


CURVE NUMBER 37   SAG
--------------------------------------------------------------------------------

V E R T I C A L  C U R V E   D A T A

L =    1500.0000
K =     270.1981
E =      10.4090

STATIONS AND ELEVATIONS

                    STATION           ELEVATION ON CURVE    ELEVATION ON TANGENT
VPC                 111950.0000         735.4461
VPI                 112700.0000         734.2190              723.8100
VPT                 113450.0000         753.8100

LOW POINT           112369.2075                                  732.1941
PASS-THROUGH POINT  112369.2075                                  732.1941
```

SIGHT DISTANCE

HEADLIGHT = 1045.0559

CURVE NUMBER 38 CREST

V E R T I C A L C U R V E D A T A

L = 1100.0000
K = 323.5293
E = -4.6750

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT

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R O A D C A L C - V E R T I C A L C U R V E D A T A

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VPC	114350.0000	789.8100	
VPI	114900.0000	807.1350	811.8100
VPT	115450.0000	815.1100	
HIGH POINT	115450.0000		815.1100
PASS-THROUGH POINT	115255.8824		813.3629

SIGHT DISTANCE

STOPPING = 835.6276
PASSING = 835.6276

CURVE NUMBER 39 SAG

V E R T I C A L C U R V E D A T A

L = 500.0000
K = 924.7583
E = 0.3379

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	117150.0000	825.3100	
VPI	117400.0000	827.1479	826.8100
VPT	117650.0000	829.6617	
LOW POINT	117150.0000		825.3100
PASS-THROUGH POINT	117400.0000		827.1479

SIGHT DISTANCE

HEADLIGHT = 3337.4325

CURVE NUMBER 40 CREST

V E R T I C A L C U R V E D A T A

L = 2000.0000
K = 947.6969
E = -5.2759

STATIONS AND ELEVATIONS

R O A D C A L C - V E R T I C A L C U R V E D A T A

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	121900.0000	878.1407	
VPI	122900.0000	884.2716	889.5475
VPT	123900.0000	879.8505	
HIGH POINT	122981.0206		884.3062
PASS-THROUGH POINT	122981.0206		884.3062

SIGHT DISTANCE

STOPPING = 1430.1800
PASSING = 1430.1800

CURVE NUMBER 41 CREST

V E R T I C A L C U R V E D A T A

L = 1000.0000
K = 417.0452
E = -2.9973

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	127650.0000	843.4869	
VPI	128150.0000	835.6411	838.6384
VPT	128650.0000	821.8008	
HIGH POINT	127650.0000		843.4869
PASS-THROUGH POINT	128054.4077		837.6046

SIGHT DISTANCE

STOPPING = 948.7407
PASSING = 948.7407

CURVE NUMBER 42 SAG

V E R T I C A L C U R V E D A T A

L = 2000.0000

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R O A D C A L C -p-profile-RA03

R O A D C A L C - V E R T I C A L C U R V E D A T A

K = 587.0111
E = 8.5177

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	130350.0000	764.5530	
VPI	131350.0000	739.3955	730.8778
VPT	132350.0000	731.2735	
LOW POINT	132326.7712		731.2689
PASS-THROUGH POINT	132326.7712		731.2689

SIGHT DISTANCE

HEADLIGHT = 2168.9790

CURVE NUMBER 43 CREST

V E R T I C A L C U R V E D A T A

L = 600.0000
K = 436.4640
E = -1.0310

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	133700.0000	731.8077	
VPI	134000.0000	730.8954	731.9264
VPT	134300.0000	727.9211	
HIGH POINT	133717.2715		731.8111
PASS-THROUGH POINT	133717.2715		731.8111

SIGHT DISTANCE

STOPPING = 1085.0171
PASSING = 1085.0171

CURVE NUMBER 44 SAG

V E R T I C A L C U R V E D A T A

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R O A D C A L C -p-profile-RA03

R O A D C A L C - V E R T I C A L C U R V E D A T A

L = 600.0000
K = 246.3952
E = 1.8263

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	134850.0000	720.5779	
VPI	135150.0000	718.3989	716.5726
VPT	135450.0000	719.8726	
LOW POINT	135178.9653		718.3819
PASS-THROUGH POINT	135178.9653		718.3819

SIGHT DISTANCE

HEADLIGHT = 1344.8029

CURVE NUMBER 45 CREST

V E R T I C A L C U R V E D A T A

L = 1400.0000
K = 397.3345
E = -6.1661

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	137200.0000	739.1226	
VPI	137900.0000	740.6565	746.8226
VPT	138600.0000	729.8583	
HIGH POINT	137637.0680		741.5265
PASS-THROUGH POINT	137637.0680		741.5265

SIGHT DISTANCE

STOPPING = 926.0493
PASSING = 926.0493

CURVE NUMBER 46 SAG

R O A D C A L C -p-profile-RA03

R O A D C A L C - V E R T I C A L C U R V E D A T A

V E R T I C A L C U R V E D A T A

L = 1100.0000
K = 206.7222
E = 7.3166

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	141450.0000	660.7891	
VPI	142000.0000	654.7765	647.4600
VPT	142550.0000	663.3972	
LOW POINT	141950.9869		654.7184
PASS-THROUGH POINT	141950.9869		654.7184

SIGHT DISTANCE

HEADLIGHT = 820.8224

CURVE NUMBER 47 CREST

V E R T I C A L C U R V E D A T A

L = 2100.0000
K = 327.3180
E = -16.8414

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	143350.0000	686.5785	
VPI	144400.0000	700.1627	717.0041
VPT	145450.0000	680.0640	
HIGH POINT	144298.4602		700.3202
PASS-THROUGH POINT	144298.4602		700.3202

SIGHT DISTANCE

STOPPING = 840.5062
PASSING = 840.5062

R O A D C A L C - V E R T I C A L C U R V E D A T A

CURVE NUMBER 48 SAG

V E R T I C A L C U R V E D A T A

L = 1500.0000
K = 237.4129
E = 11.8465

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	146050.0000	658.9553	
VPI	146800.0000	644.4160	632.5695
VPT	147550.0000	653.5695	
LOW POINT	146885.2440		644.2629
PASS-THROUGH POINT	146885.2440		644.2629

SIGHT DISTANCE

HEADLIGHT = 929.3831

CURVE NUMBER 49 CREST

V E R T I C A L C U R V E D A T A

L = 1500.0000
K = 681.8182
E = -4.1250

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	148550.0000	681.5695	
VPI	149300.0000	698.4445	702.5695
VPT	150050.0000	707.0695	
HIGH POINT	150050.0000		707.0695
PASS-THROUGH POINT	149640.9091		703.3877

SIGHT DISTANCE

STOPPING = 1213.0822
PASSING = 1213.0822

R O A D C A L C - V E R T I C A L C U R V E D A T A

CURVE NUMBER 50 SAG

V E R T I C A L C U R V E D A T A

L = 800.0000
K = 266.6667
E = 3.0000

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	151200.0000	713.9695	
VPI	151600.0000	719.3695	716.3695
VPT	152000.0000	730.7695	
LOW POINT	151200.0000		713.9695
PASS-THROUGH POINT	151360.0000		715.4095

SIGHT DISTANCE

HEADLIGHT = 1113.4776

CURVE NUMBER 51 CREST

V E R T I C A L C U R V E D A T A

L = 1100.0000
K = 323.3829
E = -4.6771

STATIONS AND ELEVATIONS

	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	152374.2244	744.2416	
VPI	152924.2244	759.3645	764.0416
VPT	153474.2244	765.1331	
HIGH POINT	153474.2244		765.1331
PASS-THROUGH POINT	153410.0459		764.9421

SIGHT DISTANCE

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R O A D C A L C -p-profile-RA03

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R O A D C A L C - V E R T I C A L C U R V E D A T A

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STOPPING = 835.4385
PASSING = 835.4385

CURVE NUMBER 52 SAG

V E R T I C A L C U R V E D A T A

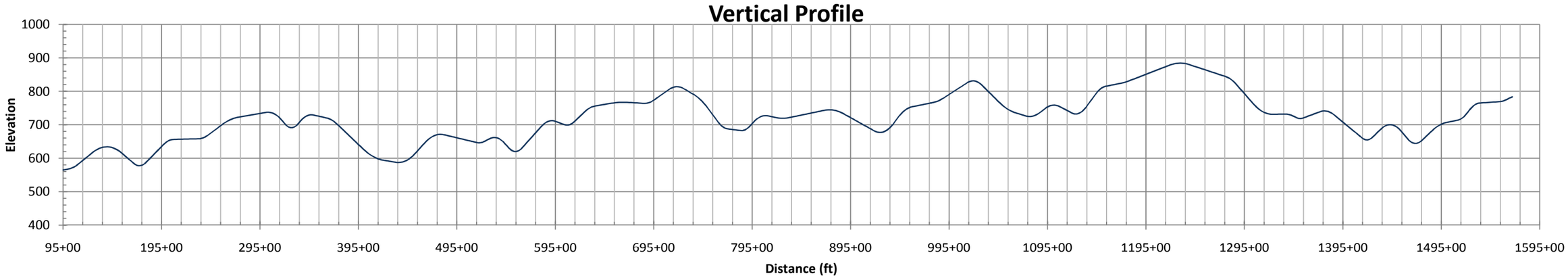
L = 400.0000
K = 333.0732
E = 0.6005

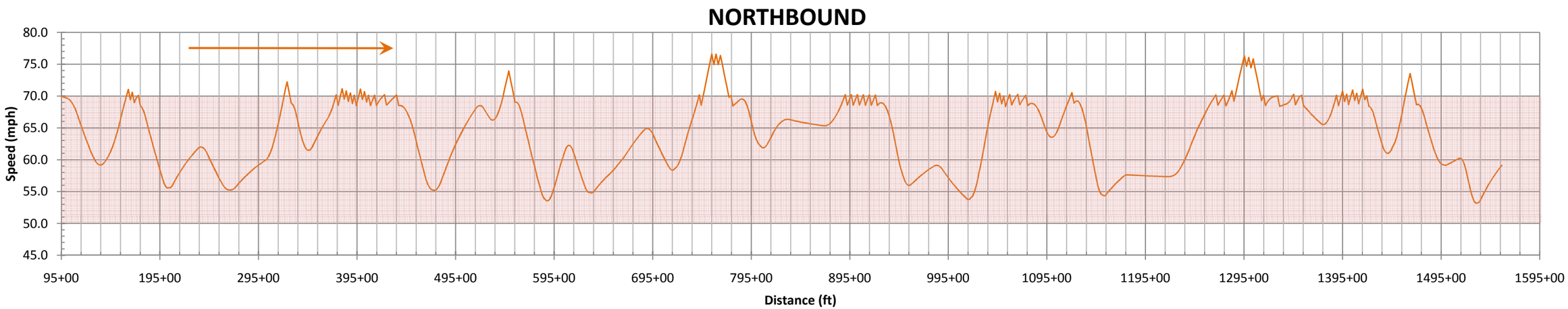
STATIONS AND ELEVATIONS

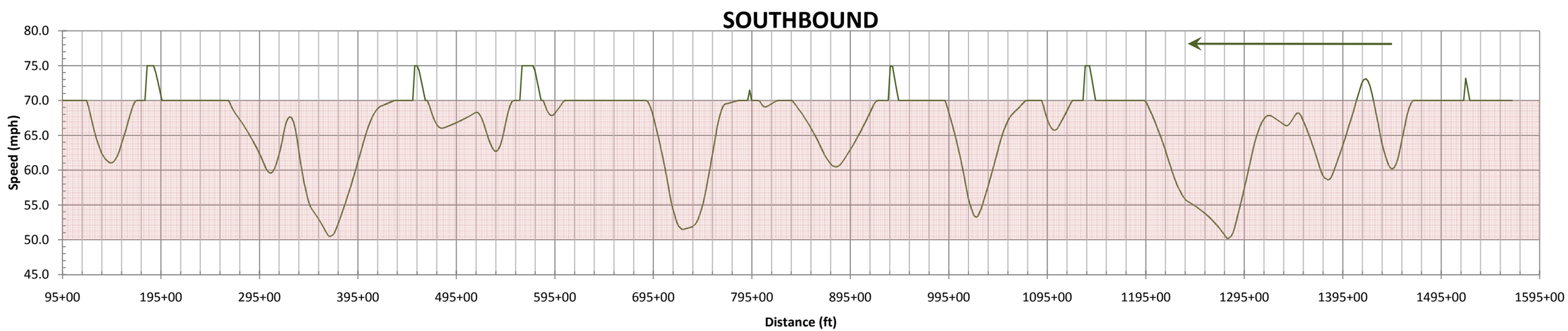
	STATION	ELEVATION ON CURVE	ELEVATION ON TANGENT
VPC	155525.0000	769.2031	
VPI	155725.0000	770.2005	769.6000
VPT	155925.0000	772.3988	
LOW POINT	155525.0000		769.2031
PASS-THROUGH POINT	155591.1016		769.3999

SIGHT DISTANCE

HEADLIGHT = 1266.3161


Vertical Profile
Elevation
1000
900
800
700
600
500
400
95+00
195+00
295+00
395+00
495+00
595+00
695+00
795+00
895+00
995+00
1095+00
1195+00
1295+00
1395+00
1495+00
1595+00
Distance (ft)


NORTHBOUND
Speed (mph)
80.0
75.0
70.0
65.0
60.0
55.0
50.0
45.0
95+00
195+00
295+00
395+00
495+00
595+00
695+00
795+00
895+00
995+00
1095+00
1195+00
1295+00
1395+00
1495+00
1595+00
Distance (ft)


SOUTHBOUND
Speed (mph)
80.0
75.0
70.0
65.0
60.0
55.0
50.0
45.0
95+00
195+00
295+00
395+00
495+00
595+00
695+00
795+00
895+00
995+00
1095+00
1195+00
1295+00
1395+00
1495+00
1595+00
Distance (ft)

Desired Speed (mph) =	70.0	Maximum speed (mph) =	75.0
Initial Speed (mph) =	70.0	Minimum speed (mph) =	53.2
Weight/power ratio (lb/hp) =	200.0	Speed difference (mph) =	21.8
Weight/frontal area ratio (lb/ft2) =	564.0		
Elevation (ft) =	500.0		
Horsepower correction factor for elevation =	1.0000	(= 1 for diesel engines)	
Aerodynamic drag correction factor for elevation =	0.9854		
Time Interval (sec) =	2		

NORTHBOUND

	BEGIN	END
RESULTS	+00	1470+60
INPUT (CONVERT)	+00	1472+14
INPUT(ORIG)	95+00	1567+14

1		2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Elapsed Time		Desired Speed		Actual Station	Start of Interval			Local Grade	Limiting acceleration			New speed based on vehicle performance		Limiting acceleration and speed based on driver preferences			Actual acceleration	End of Interval		
					Speed		Position		Coasting	Power	Effective			Speed		Acceleration		New Speed		New Position
(sec)	(Min)	(mph)	(ft/sec)	FYI	(mph)	(ft/sec)	(ft)	(%)	(ft/sec2)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(mph)	(ft/sec)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(ft)
0.0	0.00	70.0	102.7	95+00	70.0	102.7	+00	0.48	-0.84	-0.09	-0.09	69.9	102.5	70.0	102.7	0.00	-0.09	69.9	102.5	205.2
2.0	0.03	70.0	102.7	97+05	69.9	102.5	2+05	0.48	-0.84	-0.09	-0.09	69.8	102.3	71.5	104.9	2.44	-0.09	69.8	102.3	409.9
4.0	0.07	70.0	102.7	99+10	69.8	102.3	4+10	0.48	-0.84	-0.08	-0.09	69.6	102.1	71.4	104.8	2.48	-0.09	69.6	102.1	614.4
6.0	0.10	70.0	102.7	101+14	69.6	102.1	6+14	0.65	-0.89	-0.14	-0.14	69.4	101.9	71.4	104.6	2.52	-0.14	69.4	101.9	818.4
8.0	0.13	70.0	102.7	103+18	69.4	101.9	8+18	1.03	-1.01	-0.25	-0.26	69.1	101.3	71.2	104.4	2.58	-0.26	69.1	101.3	1021.6
10.0	0.17	70.0	102.7	105+22	69.1	101.3	10+22	1.41	-1.13	-0.37	-0.38	68.6	100.6	70.9	104.0	2.69	-0.38	68.6	100.6	1223.5
12.0	0.20	70.0	102.7	107+23	68.6	100.6	12+23	1.79	-1.24	-0.47	-0.49	67.9	99.6	70.5	103.4	2.85	-0.49	67.9	99.6	1423.7
14.0	0.23	70.0	102.7	109+24	67.9	99.6	14+24	2.16	-1.36	-0.58	-0.60	67.1	98.4	70.0	102.7	3.06	-0.60	67.1	98.4	1621.7
16.0	0.27	70.0	102.7	111+22	67.1	98.4	16+22	2.37	-1.41	-0.63	-0.65	66.2	97.1	69.4	101.7	3.32	-0.65	66.2	97.1	1817.2
18.0	0.30	70.0	102.7	113+17	66.2	97.1	18+17	2.37	-1.40	-0.61	-0.63	65.4	95.9	68.7	100.7	3.60	-0.63	65.4	95.9	2010.2
20.0	0.33	70.0	102.7	115+10	65.4	95.9	20+10	2.37	-1.39	-0.59	-0.61	64.5	94.6	68.0	99.7	3.87	-0.61	64.5	94.6	2200.7
22.0	0.37	70.0	102.7	117+01	64.5	94.6	22+01	2.37	-1.39	-0.57	-0.59	63.7	93.5	67.3	98.8	4.13	-0.59	63.7	93.5	2388.8
24.0	0.40	70.0	102.7	118+89	63.7	93.5	23+89	2.37	-1.38	-0.55	-0.57	63.0	92.3	66.7	97.9	4.39	-0.57	63.0	92.3	2574.6
26.0	0.43	70.0	102.7	120+75	63.0	92.3	25+75	2.37	-1.37	-0.53	-0.55	62.2	91.2	66.1	97.0	4.63	-0.55	62.2	91.2	2758.1
28.0	0.47	70.0	102.7	122+58	62.2	91.2	27+58	2.37	-1.36	-0.51	-0.53	61.5	90.2	65.5	96.1	4.87	-0.53	61.5	90.2	2939.5
30.0	0.50	70.0	102.7	124+40	61.5	90.2	29+40	2.33	-1.34	-0.48	-0.50	60.8	89.2	64.9	95.3	5.10	-0.50	60.8	89.2	3118.8
32.0	0.53	70.0	102.7	126+19	60.8	89.2	31+19	2.04	-1.24	-0.38	-0.39	60.3	88.4	64.4	94.5	5.32	-0.39	60.3	88.4	3296.4
34.0	0.57	70.0	102.7	127+96	60.3	88.4	32+96	2.04	-1.24	-0.36	-0.38	59.7	87.6	64.0	93.9	5.49	-0.38	59.7	87.6	3472.3
36.0	0.60	70.0	102.7	129+72	59.7	87.6	34+72	1.71	-1.13	-0.25	-0.26	59.4	87.1	63.6	93.3	5.65	-0.26	59.4	87.1	3647.1
38.0	0.63	70.0	102.7	131+47	59.4	87.1	36+47	1.39	-1.02	-0.13	-0.14	59.2	86.8	63.3	92.9	5.76	-0.14	59.2	86.8	3821.0
40.0	0.67	70.0	102.7	133+21	59.2	86.8	38+21	1.06	-0.91	-0.02	-0.03	59.2	86.8	63.2	92.6	5.82	-0.03	59.2	86.8	3994.6
42.0	0.70	70.0	102.7	134+95	59.2	86.8	39+95	0.73	-0.80	0.08	0.08	59.3	86.9	63.1	92.6	5.83	0.08	59.3	86.9	4168.3
44.0	0.73	70.0	102.7	136+68	59.3	86.9	41+68	0.41	-0.70	0.18	0.18	59.5	87.3	63.2	92.7	5.80	0.18	59.5	87.3	4342.5
46.0	0.77	70.0	102.7	138+43	59.5	87.3	43+43	0.08	-0.60	0.28	0.27	59.9	87.8	63.4	93.0	5.72	0.27	59.9	87.8	4517.6
48.0	0.80	70.0	102.7	140+18	59.9	87.8	45+18	-0.25	-0.50	0.38	0.36	60.4	88.6	63.7	93.4	5.61	0.36	60.4	88.6	4694.0
50.0	0.83	70.0	102.7	141+94	60.4	88.6	46+94	-0.25	-0.50	0.36	0.35	60.9	89.3	64.1	94.0	5.45	0.35	60.9	89.3	4871.8
52.0	0.87	70.0	102.7	143+72	60.9	89.3	48+72	-0.58	-0.40	0.46	0.44	61.5	90.1	64.5	94.6	5.30	0.44	61.5	90.1	5051.2
54.0	0.90	70.0	102.7	145+51	61.5	90.1	50+51	-0.90	-0.30	0.55	0.53	62.2	91.2	64.9	95.2	5.11	0.53	62.2	91.2	5232.5
56.0	0.93	70.0	102.7	147+33	62.2	91.2	52+33	-1.23	-0.20	0.64	0.61	63.0	92.4	65.5	96.1	4.88	0.61	63.0	92.4	5416.2
58.0	0.97	70.0	102.7	149+16	63.0	92.4	54+16	-1.56	-0.11	0.72	0.70	64.0	93.8	66.2	97.0	4.61	0.70	64.0	93.8	5602.4
60.0	1.00	70.0	102.7	151+02	64.0	93.8	56+02	-1.87	-0.02	0.80	0.77	65.0	95.4	66.9	98.1	4.31	0.77	65.0	95.4	5791.6
62.0	1.03	70.0	102.7	152+92	65.0	95.4	57+92	-2.21	0.08	0.88	0.86	66.2	97.1	67.7	99.3	3.98	0.86	66.2	97.1	5984.0
64.0	1.07	70.0	102.7	154+84	66.2	97.1	59+84	-2.50	0.16	0.95	0.92	67.4	98.9	68.6	100.7	3.61	0.92	67.4	98.9	6180.0
66.0	1.10	70.0	102.7	156+80	67.4	98.9	61+80	-2.54	0.16	0.93	0.91	68.7	100.7	69.6	102.1	3.21	0.91	68.7	100.7	6379.6
68.0	1.13	70.0	102.7	158+80	68.7	100.7	63+80	-2.54	0.15	0.91	0.88	69.9	102.5	70.6	103.5	2.82	0.88	69.9	102.5	6582.8
70.0	1.17	70.0	102.7	160+83	69.9	102.5	65+83	-2.54	0.14	0.88	0.86	71.0	104.2	71.5	104.9	2.44	0.86	71.0	104.2	6789.5
72.0	1.20	70.0	102.7	162+90	70.0	102.7	67+90	-2.54	0.13	0.88	0.85	71.2	104.4	70.0	102.7	0.00	0.00	70.0	102.7	6994.9
74.0	1.23	70.0	102.7	164+95	70.0	102.7	69+95	-2.54	0.13	0.88	0.85	71.2	104.4	70.0	102.7	0.00	0.00	70.0	102.7	7200.2
76.0	1.27	70.0	102.7	167+00	70.0	102.7	72+00	-2.37	0.08	0.82	0.80	71.1	104.3	70.0	102.7	0.00	0.00	70.0	102.7	7405.5
78.0	1.30	70.0	102.7	169+06	70.0	102.7	74+06	-1.54	-0.19	0.56	0.54	70.7	103.8	70.0	102.7	0.00	0.00	70.0	102.7	7610.9
80.0	1.33	70.0	102.7	171+11	70.0	102.7	76+11	-0.66	-0.47	0.27	0.27	70.4	103.2	70.0	102.7	0.00	0.00	70.0	102.7	7816.2
82.0	1.37	70.0	102.7	173+16	70.0	102.7	78+16	0.23	-0.76	-0.01	-0.01	70.0	102.6	70.0	102.7	0.00	-0.01	70.0	102.6	8021.5
84.0	1.40	70.0	102.7	175+22	70.0	102.6	80+22	1.12	-1.04	-0.29	-0.30	69.6	102.0	71.6	105.1	2.40	-0.30	69.6	102.0	8226.2
86.0	1.43	70.0	102.7	177+26	69.6	102.0	82+26	2.00	-1.32	-0.57	-0.58	68.8	100.9	71.3	104.6	2.53	-0.58	68.8	100.9	8429.1
88.0	1.47	70.0	102.7	179+29	68.8	100.9	84+29	2.83	-1.58	-0.81	-0.84	67.6	99.2	70.7	103.7	2.79	-0.84	67.6	99.2	8629.2
90.0	1.50	70.0	102.7	181+29	67.6	99.2	86+29	3.00	-1.62	-0.84	-0.87	66.5	97.5	69.8	102.4	3.15	-0.87	66.5	97.5	8825.9
92.0	1.53	70.0	102.7	183+26	66.5	97.5	88+26	3.00	-1.61	-0.82	-0.84	65.3	95.8	68.9	101.0	3.52	-0.84	65.3	95.8	9019.2
94.0	1.57	70.0	102.7	185+19	65.3	95.8	90+19	3.00	-1.60	-0.79	-0.81	64.2	94.2	68.0	99.7	3.88	-0.81	64.2	94.2	9209.1
96.0	1.60	70.0	102.7	187+09	64.2	94.2	92+09	3.00	-1.59	-0.76	-0.79	63.1	92.6	67.1	98.4	4.24	-0.79	63.1	92.6	9395.9

1		2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Elapsed Time		Desired Speed		Actual Station	Start of Interval			Local Grade	Limiting acceleration			New speed based on vehicle performance		Limiting acceleration and speed based on driver preferences			Actual acceleration	End of Interval		
					Speed		Position		Coasting	Power	Effective			Speed		Acceleration		New Speed		New Position
(sec)	(Min)	(mph)	(ft/sec)	FYI	(mph)	(ft/sec)	(ft)	(%)	(ft/sec2)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(mph)	(ft/sec)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(ft)
98.0	1.63	70.0	102.7	188+96	63.1	92.6	93+96	3.00	-1.57	-0.74	-0.76	62.1	91.1	66.2	97.2	4.58	-0.76	62.1	91.1	9579.5
100.0	1.67	70.0	102.7	190+80	62.1	91.1	95+80	3.00	-1.56	-0.71	-0.74	61.1	89.6	65.4	96.0	4.91	-0.74	61.1	89.6	9760.2
102.0	1.70	70.0	102.7	192+60	61.1	89.6	97+60	3.00	-1.55	-0.69	-0.72	60.1	88.1	64.6	94.8	5.23	-0.72	60.1	88.1	9937.9
104.0	1.73	70.0	102.7	194+38	60.1	88.1	99+38	3.00	-1.54	-0.67	-0.69	59.2	86.8	63.9	93.7	5.54	-0.69	59.2	86.8	10112.8
106.0	1.77	70.0	102.7	196+13	59.2	86.8	101+13	2.93	-1.51	-0.62	-0.64	58.3	85.5	63.1	92.6	5.83	-0.64	58.3	85.5	10285.0
108.0	1.80	70.0	102.7	197+85	58.3	85.5	102+85	2.93	-1.50	-0.60	-0.62	57.4	84.2	62.4	91.6	6.11	-0.62	57.4	84.2	10454.8
110.0	1.83	70.0	102.7	199+55	57.4	84.2	104+55	2.42	-1.33	-0.41	-0.43	56.8	83.4	61.8	90.6	6.38	-0.43	56.8	83.4	10622.4
112.0	1.87	70.0	102.7	201+22	56.8	83.4	106+22	1.83	-1.14	-0.21	-0.22	56.5	82.9	61.3	89.9	6.57	-0.22	56.5	82.9	10788.7
114.0	1.90	70.0	102.7	202+89	56.5	82.9	107+89	1.25	-0.94	-0.02	-0.02	56.5	82.9	61.1	89.6	6.66	-0.02	56.5	82.9	10954.5
116.0	1.93	70.0	102.7	204+54	56.5	82.9	109+54	0.66	-0.76	0.17	0.16	56.7	83.2	61.1	89.6	6.67	0.16	56.7	83.2	11120.6
118.0	1.97	70.0	102.7	206+21	56.7	83.2	111+21	0.15	-0.59	0.33	0.31	57.2	83.8	61.2	89.8	6.60	0.31	57.2	83.8	11287.6
120.0	2.00	70.0	102.7	207+88	57.2	83.8	112+88	0.15	-0.60	0.32	0.30	57.6	84.4	61.6	90.3	6.47	0.30	57.6	84.4	11455.9
122.0	2.03	70.0	102.7	209+56	57.6	84.4	114+56	0.08	-0.58	0.33	0.32	58.0	85.1	61.9	90.8	6.34	0.32	58.0	85.1	11625.5
124.0	2.07	70.0	102.7	211+25	58.0	85.1	116+25	0.08	-0.58	0.32	0.31	58.4	85.7	62.2	91.3	6.20	0.31	58.4	85.7	11796.2
126.0	2.10	70.0	102.7	212+96	58.4	85.7	117+96	0.08	-0.59	0.31	0.30	58.8	86.3	62.6	91.8	6.07	0.30	58.8	86.3	11968.2
128.0	2.13	70.0	102.7	214+68	58.8	86.3	119+68	0.08	-0.59	0.30	0.29	59.2	86.9	62.9	92.2	5.94	0.29	59.2	86.9	12141.3
130.0	2.17	70.0	102.7	216+41	59.2	86.9	121+41	0.08	-0.59	0.29	0.28	59.6	87.4	63.2	92.7	5.82	0.28	59.6	87.4	12315.6
132.0	2.20	70.0	102.7	218+16	59.6	87.4	123+16	0.08	-0.60	0.28	0.27	60.0	87.9	63.5	93.1	5.70	0.27	60.0	87.9	12490.9
134.0	2.23	70.0	102.7	219+91	60.0	87.9	124+91	0.08	-0.60	0.27	0.26	60.3	88.5	63.8	93.5	5.58	0.26	60.3	88.5	12667.4
136.0	2.27	70.0	102.7	221+67	60.3	88.5	126+67	0.08	-0.60	0.26	0.25	60.7	89.0	64.0	93.9	5.47	0.25	60.7	89.0	12844.8
138.0	2.30	70.0	102.7	223+45	60.7	89.0	128+45	0.08	-0.61	0.25	0.24	61.0	89.5	64.3	94.3	5.36	0.24	61.0	89.5	13023.2
140.0	2.33	70.0	102.7	225+23	61.0	89.5	130+23	0.08	-0.61	0.25	0.24	61.3	89.9	64.6	94.7	5.25	0.24	61.3	89.9	13202.6
142.0	2.37	70.0	102.7	227+03	61.3	89.9	132+03	0.08	-0.61	0.24	0.23	61.6	90.4	64.8	95.1	5.15	0.23	61.6	90.4	13383.0
144.0	2.40	70.0	102.7	228+83	61.6	90.4	133+83	0.08	-0.62	0.23	0.22	61.9	90.8	65.1	95.4	5.05	0.22	61.9	90.8	13564.2
146.0	2.43	70.0	102.7	230+64	61.9	90.8	135+64	0.08	-0.62	0.22	0.22	62.2	91.3	65.3	95.8	4.96	0.22	62.2	91.3	13746.3
148.0	2.47	70.0	102.7	232+46	62.2	91.3	137+46	0.20	-0.66	0.18	0.17	62.5	91.6	65.5	96.1	4.86	0.17	62.5	91.6	13929.2
150.0	2.50	70.0	102.7	234+29	62.5	91.6	139+29	0.61	-0.80	0.04	0.04	62.5	91.7	65.7	96.4	4.79	0.04	62.5	91.7	14112.5
152.0	2.53	70.0	102.7	236+12	62.5	91.7	141+12	0.88	-0.89	-0.05	-0.05	62.5	91.6	65.8	96.5	4.77	-0.05	62.5	91.6	14295.8
154.0	2.57	70.0	102.7	237+96	62.5	91.6	142+96	1.18	-0.98	-0.14	-0.15	62.3	91.3	65.7	96.4	4.79	-0.15	62.3	91.3	14478.7
156.0	2.60	70.0	102.7	239+79	62.3	91.3	144+79	1.65	-1.13	-0.28	-0.30	61.8	90.7	65.6	96.2	4.86	-0.30	61.8	90.7	14660.7
158.0	2.63	70.0	102.7	241+61	61.8	90.7	146+61	2.04	-1.25	-0.40	-0.42	61.3	89.9	65.2	95.7	4.98	-0.42	61.3	89.9	14841.3
160.0	2.67	70.0	102.7	243+41	61.3	89.9	148+41	2.19	-1.29	-0.43	-0.45	60.7	89.0	64.8	95.0	5.16	-0.45	60.7	89.0	15020.1
162.0	2.70	70.0	102.7	245+20	60.7	89.0	150+20	2.20	-1.29	-0.42	-0.44	60.1	88.1	64.3	94.3	5.36	-0.44	60.1	88.1	15197.2
164.0	2.73	70.0	102.7	246+97	60.1	88.1	151+97	2.20	-1.29	-0.41	-0.43	59.5	87.2	63.8	93.6	5.55	-0.43	59.5	87.2	15372.5
166.0	2.77	70.0	102.7	248+73	59.5	87.2	153+73	2.20	-1.28	-0.40	-0.41	58.9	86.4	63.4	93.0	5.73	-0.41	58.9	86.4	15546.2
168.0	2.80	70.0	102.7	250+46	58.9	86.4	155+46	2.20	-1.27	-0.38	-0.40	58.4	85.6	63.0	92.3	5.91	-0.40	58.4	85.6	15718.2
170.0	2.83	70.0	102.7	252+18	58.4	85.6	157+18	2.20	-1.27	-0.37	-0.38	57.9	84.9	62.5	91.7	6.08	-0.38	57.9	84.9	15888.7
172.0	2.87	70.0	102.7	253+89	57.9	84.9	158+89	2.20	-1.26	-0.36	-0.37	57.4	84.1	62.1	91.1	6.25	-0.37	57.4	84.1	16057.7
174.0	2.90	70.0	102.7	255+58	57.4	84.1	160+58	2.20	-1.26	-0.34	-0.36	56.9	83.4	61.7	90.5	6.41	-0.36	56.9	83.4	16225.2
176.0	2.93	70.0	102.7	257+25	56.9	83.4	162+25	2.17	-1.25	-0.32	-0.34	56.4	82.7	61.3	90.0	6.56	-0.34	56.4	82.7	16391.4
178.0	2.97	70.0	102.7	258+91	56.4	82.7	163+91	1.98	-1.18	-0.25	-0.26	56.1	82.2	61.0	89.4	6.71	-0.26	56.1	82.2	16556.3
180.0	3.00	70.0	102.7	260+56	56.1	82.2	165+56	1.75	-1.10	-0.17	-0.17	55.8	81.9	60.7	89.0	6.82	-0.17	55.8	81.9	16720.4
182.0	3.03	70.0	102.7	262+20	55.8	81.9	167+20	1.53	-1.03	-0.09	-0.09	55.7	81.7	60.5	88.8	6.89	-0.09	55.7	81.7	16884.0
184.0	3.07	70.0	102.7	263+84	55.7	81.7	168+84	1.53	-1.03	-0.09	-0.09	55.6	81.5	60.4	88.6	6.93	-0.09	55.6	81.5	17047.2
186.0	3.10	70.0	102.7	265+47	55.6	81.5	170+47	1.30	-0.95	-0.01	-0.01	55.6	81.5	60.3	88.5	6.97	-0.01	55.6	81.5	17210.2
188.0	3.13	70.0	102.7	267+10	55.6	81.5	172+10	1.08	-0.88	0.06	0.06	55.6	81.6	60.3	88.5	6.98	0.06	55.6	81.6	17373.2
190.0	3.17	70.0	102.7	268+73	55.6	81.6	173+73	0.86	-0.81	0.13	0.12	55.8	81.8	60.4	88.5	6.95	0.12	55.8	81.8	17536.7
192.0	3.20	70.0	102.7	270+37	55.8	81.8	175+37	0.63	-0.74	0.20	0.19	56.1	82.2	60.5	88.7	6.90	0.19	56.1	82.2	17700.7
194.0	3.23	70.0	102.7	272+01	56.1	82.2	177+01	0.52	-0.71	0.23	0.22	56.4	82.7	60.7	89.0	6.82	0.22	56.4	82.7	17865.6
196.0	3.27	70.0	102.7	273+66	56.4	82.7	178+66	0.52	-0.71	0.22	0.21	56.6	83.1	60.9	89.4	6.72	0.21	56.6	83.1	18031.3
198.0	3.30	70.0	102.7	275+31	56.6	83.1	180+31	0.52	-0.71	0.21	0.20	56.9	83.5	61.2	89.7	6.63	0.20	56.9	83.5	18197.9
200.0	3.33	70.0	102.7	276+98	56.9	83.5	181+98	0.52	-0.71	0.20	0.20	57.2	83.9	61.4	90.0	6.54	0.20	57.2	83.9	18365.2
202.0	3.37	70.0	102.7	278+65	57.2	83.9	183+65	0.52	-0.72	0.20	0.19	57.4	84.3	61.6	90.3	6.46	0.19	57.4	84.3	18533.4
204.0	3.40	70.0	102.7	280+33	57.4	84.3	185+33	0.52	-0.72	0.19	0.18	57.7	84.6	61.8	90.6	6.38	0.18	57.7	84.6	18702.2
206.0	3.43	70.0	102.7	282+02	57.7	84.6	187+02	0.52	-0.72	0.18	0.18	57.9	85.0	62.0	90.9	6.30	0.18	57.9	85.0	18871.8
208.0	3.47	70.0	102.7	283+72	57.9	85.0	188+72	0.52	-0.72	0.18	0.17	58.2	85.3	62.2	91.2	6.22	0.17	58.2	85.3	19042.1
210.0	3.50	70.0	102.7	285+42	58.2	85.3	190+42	0.52	-0.73	0.17	0.17	58.4	85.6	62.4	91.5	6.15	0.17	58.4	85.6	19213.1

1		2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Elapsed Time		Desired Speed		Actual Station	Start of Interval			Local Grade	Limiting acceleration			New speed based on vehicle performance		Limiting acceleration and speed based on driver preferences			Actual acceleration	End of Interval		
					Speed		Position		Coasting	Power	Effective			Speed		Acceleration		New Speed		New Position
(sec)	(Min)	(mph)	(ft/sec)	FYI	(mph)	(ft/sec)	(ft)	(%)	(ft/sec2)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(mph)	(ft/sec)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(ft)
212.0	3.53	70.0	102.7	287+13	58.4	85.6	192+13	0.52	-0.73	0.17	0.16	58.6	86.0	62.5	91.7	6.08	0.16	58.6	86.0	19384.7
214.0	3.57	70.0	102.7	288+85	58.6	86.0	193+85	0.52	-0.73	0.16	0.16	58.8	86.3	62.7	92.0	6.01	0.16	58.8	86.3	19556.9
216.0	3.60	70.0	102.7	290+57	58.8	86.3	195+57	0.52	-0.73	0.16	0.15	59.0	86.6	62.9	92.2	5.94	0.15	59.0	86.6	19729.8
218.0	3.63	70.0	102.7	292+30	59.0	86.6	197+30	0.52	-0.73	0.15	0.15	59.2	86.9	63.0	92.5	5.87	0.15	59.2	86.9	19903.3
220.0	3.67	70.0	102.7	294+03	59.2	86.9	199+03	0.52	-0.74	0.15	0.14	59.4	87.2	63.2	92.7	5.81	0.14	59.4	87.2	20077.3
222.0	3.70	70.0	102.7	295+77	59.4	87.2	200+77	0.52	-0.74	0.14	0.14	59.6	87.4	63.3	92.9	5.75	0.14	59.6	87.4	20251.9
224.0	3.73	70.0	102.7	297+52	59.6	87.4	202+52	0.52	-0.74	0.14	0.13	59.8	87.7	63.5	93.1	5.69	0.13	59.8	87.7	20427.0
226.0	3.77	70.0	102.7	299+27	59.8	87.7	204+27	0.52	-0.74	0.13	0.13	60.0	88.0	63.6	93.3	5.63	0.13	60.0	88.0	20602.7
228.0	3.80	70.0	102.7	301+03	60.0	88.0	206+03	0.46	-0.72	0.15	0.14	60.2	88.2	63.8	93.5	5.58	0.14	60.2	88.2	20778.9
230.0	3.83	70.0	102.7	302+79	60.2	88.2	207+79	0.04	-0.59	0.28	0.27	60.5	88.8	63.9	93.8	5.52	0.27	60.5	88.8	20955.9
232.0	3.87	70.0	102.7	304+56	60.5	88.8	209+56	-0.44	-0.44	0.42	0.41	61.1	89.6	64.2	94.2	5.40	0.41	61.1	89.6	21134.2
234.0	3.90	70.0	102.7	306+34	61.1	89.6	211+34	-0.92	-0.29	0.56	0.54	61.8	90.7	64.6	94.8	5.23	0.54	61.8	90.7	21314.5
236.0	3.93	70.0	102.7	308+14	61.8	90.7	213+14	-1.40	-0.14	0.70	0.67	62.7	92.0	65.2	95.7	4.99	0.67	62.7	92.0	21497.2
238.0	3.97	70.0	102.7	309+97	62.7	92.0	214+97	-1.40	-0.15	0.68	0.65	63.6	93.3	65.9	96.7	4.70	0.65	63.6	93.3	21682.5
240.0	4.00	70.0	102.7	311+83	63.6	93.3	216+83	-1.88	-0.01	0.81	0.78	64.7	94.9	66.6	97.7	4.42	0.78	64.7	94.9	21870.7
242.0	4.03	70.0	102.7	313+71	64.7	94.9	218+71	-2.36	0.14	0.94	0.91	65.9	96.7	67.5	99.0	4.08	0.91	65.9	96.7	22062.4
244.0	4.07	70.0	102.7	315+62	65.9	96.7	220+62	-2.84	0.28	1.06	1.03	67.3	98.8	68.5	100.4	3.69	1.03	67.3	98.8	22257.8
246.0	4.10	75.0	110.0	317+58	67.3	98.8	222+58	-3.32	0.42	1.19	1.15	68.9	101.1	70.6	103.6	4.82	1.15	68.9	101.1	22457.7
248.0	4.13	75.0	110.0	319+58	68.9	101.1	224+58	-3.71	0.52	1.27	1.24	70.6	103.6	71.9	105.4	4.33	1.24	70.6	103.6	22662.3
250.0	4.17	75.0	110.0	321+62	70.6	103.6	226+62	-3.04	0.29	1.02	1.00	72.0	105.6	73.2	107.4	3.79	1.00	72.0	105.6	22871.4
252.0	4.20	70.0	102.7	323+71	70.0	102.7	228+71	-2.03	-0.03	0.71	0.69	70.9	104.1	70.0	102.7	0.00	0.00	70.0	102.7	23076.8
254.0	4.23	70.0	102.7	325+77	70.0	102.7	230+77	-1.01	-0.36	0.39	0.38	70.5	103.4	70.0	102.7	0.00	0.00	70.0	102.7	23282.1
256.0	4.27	70.0	102.7	327+82	70.0	102.7	232+82	0.00	-0.68	0.06	0.06	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	23487.4
258.0	4.30	70.0	102.7	329+87	70.0	102.7	234+87	1.01	-1.01	-0.26	-0.27	69.6	102.1	70.0	102.7	0.00	-0.27	69.6	102.1	23692.2
260.0	4.33	70.0	102.7	331+92	69.6	102.1	236+92	2.03	-1.33	-0.58	-0.59	68.8	100.9	71.4	104.6	2.52	-0.59	68.8	100.9	23895.3
262.0	4.37	70.0	102.7	333+95	68.8	100.9	238+95	3.04	-1.65	-0.88	-0.91	67.6	99.1	70.7	103.7	2.77	-0.91	67.6	99.1	24095.4
264.0	4.40	70.0	102.7	335+95	67.6	99.1	240+95	3.60	-1.82	-1.03	-1.06	66.1	97.0	69.7	102.3	3.16	-1.06	66.1	97.0	24291.6
266.0	4.43	70.0	102.7	337+92	66.1	97.0	242+92	3.06	-1.62	-0.83	-0.85	65.0	95.3	68.6	100.6	3.62	-0.85	65.0	95.3	24483.9
268.0	4.47	70.0	102.7	339+84	65.0	95.3	244+84	2.46	-1.42	-0.61	-0.63	64.1	94.0	67.7	99.3	3.99	-0.63	64.1	94.0	24673.2
270.0	4.50	70.0	102.7	341+73	64.1	94.0	246+73	1.87	-1.22	-0.40	-0.41	63.6	93.2	67.0	98.3	4.26	-0.41	63.6	93.2	24860.5
272.0	4.53	70.0	102.7	343+60	63.6	93.2	248+60	1.27	-1.02	-0.20	-0.20	63.3	92.8	66.6	97.7	4.44	-0.20	63.3	92.8	25046.5
274.0	4.57	70.0	102.7	345+46	63.3	92.8	250+46	0.68	-0.83	0.00	0.00	63.3	92.8	66.4	97.3	4.53	0.00	63.3	92.8	25232.1
276.0	4.60	70.0	102.7	347+32	63.3	92.8	252+32	0.08	-0.64	0.19	0.18	63.5	93.2	66.4	97.3	4.53	0.18	63.5	93.2	25418.1
278.0	4.63	70.0	102.7	349+18	63.5	93.2	254+18	-0.49	-0.45	0.37	0.36	64.0	93.9	66.6	97.6	4.45	0.36	64.0	93.9	25605.2
280.0	4.67	70.0	102.7	351+05	64.0	93.9	256+05	-0.66	-0.40	0.41	0.40	64.6	94.7	66.9	98.2	4.29	0.40	64.6	94.7	25793.8
282.0	4.70	70.0	102.7	352+94	64.6	94.7	257+94	-0.66	-0.41	0.40	0.39	65.1	95.5	67.4	98.8	4.12	0.39	65.1	95.5	25983.9
284.0	4.73	70.0	102.7	354+84	65.1	95.5	259+84	-0.66	-0.42	0.39	0.37	65.6	96.2	67.8	99.4	3.96	0.37	65.6	96.2	26175.6
286.0	4.77	70.0	102.7	356+76	65.6	96.2	261+76	-0.66	-0.42	0.37	0.36	66.1	96.9	68.2	100.0	3.79	0.36	66.1	96.9	26368.7
288.0	4.80	70.0	102.7	358+69	66.1	96.9	263+69	-0.66	-0.43	0.36	0.35	66.6	97.6	68.6	100.6	3.64	0.35	66.6	97.6	26563.3
290.0	4.83	70.0	102.7	360+63	66.6	97.6	265+63	-0.66	-0.43	0.35	0.34	67.0	98.3	69.0	101.1	3.49	0.34	67.0	98.3	26759.3
292.0	4.87	70.0	102.7	362+59	67.0	98.3	267+59	-0.72	-0.42	0.36	0.35	67.5	99.0	69.3	101.7	3.34	0.35	67.5	99.0	26956.7
294.0	4.90	70.0	102.7	364+57	67.5	99.0	269+57	-1.09	-0.30	0.47	0.45	68.1	99.9	69.7	102.2	3.19	0.45	68.1	99.9	27155.6
296.0	4.93	70.0	102.7	366+56	68.1	99.9	271+56	-1.52	-0.17	0.59	0.57	68.9	101.1	70.2	102.9	2.99	0.57	68.9	101.1	27356.6
298.0	4.97	70.0	102.7	368+57	68.9	101.1	273+57	-1.94	-0.04	0.71	0.69	69.9	102.5	70.8	103.8	2.74	0.69	69.9	102.5	27560.2
300.0	5.00	70.0	102.7	370+60	69.9	102.5	275+60	-2.37	0.08	0.83	0.80	71.0	104.1	71.5	104.9	2.44	0.80	71.0	104.1	27766.7
302.0	5.03	70.0	102.7	372+67	70.0	102.7	277+67	-2.75	0.20	0.94	0.92	71.3	104.5	70.0	102.7	0.00	0.00	70.0	102.7	27972.1
304.0	5.07	70.0	102.7	374+72	70.0	102.7	279+72	-2.80	0.22	0.96	0.94	71.3	104.5	70.0	102.7	0.00	0.00	70.0	102.7	28177.4
306.0	5.10	70.0	102.7	376+77	70.0	102.7	281+77	-2.80	0.22	0.96	0.94	71.3	104.5	70.0	102.7	0.00	0.00	70.0	102.7	28382.7
308.0	5.13	70.0	102.7	378+83	70.0	102.7	283+83	-2.80	0.22	0.96	0.94	71.3	104.5	70.0	102.7	0.00	0.00	70.0	102.7	28588.1
310.0	5.17	70.0	102.7	380+88	70.0	102.7	285+88	-2.80	0.22	0.96	0.94	71.3	104.5	70.0	102.7	0.00	0.00	70.0	102.7	28793.4
312.0	5.20	70.0	102.7	382+93	70.0	102.7	287+93	-2.80	0.22	0.96	0.94	71.3	104.5	70.0	102.7	0.00	0.00	70.0	102.7	28998.7
314.0	5.23	70.0	102.7	384+99	70.0	102.7	289+99	-2.80	0.22	0.96	0.94	71.3	104.5	70.0	102.7	0.00	0.00	70.0	102.7	29204.1
316.0	5.27	70.0	102.7	387+04	70.0	102.7	292+04	-2.80	0.22	0.96	0.94	71.3	104.5	70.0	102.7	0.00	0.00	70.0	102.7	29409.4
318.0	5.30	70.0	102.7	389+09	70.0	102.7	294+09	-2.80	0.22	0.96	0.94	71.3	104.5	70.0	102.7	0.00	0.00	70.0	102.7	29614.7
320.0	5.33	70.0	102.7	391+15	70.0	102.7	296+15	-2.80	0.22	0.96	0.94	71.3	104.5	70.0	102.7	0.00	0.00	70.0	102.7	29820.1
322.0	5.37	70.0	102.7	393+20	70.0	102.7	298+20	-2.80	0.22	0.96	0.94	71.3	104.5	70.0	102.7	0.00	0.00	70.0	102.7	30025.4
324.0	5.40	70.0	102.7	395+25	70.0	102.7	300+25	-2.80	0.22	0.96	0.94	71.3	104.5	70.0	102.7	0.00	0.00	70.0	102.7	30230.7

1		2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Elapsed Time		Desired Speed		Actual Station	Start of Interval			Local Grade	Limiting acceleration			New speed based on vehicle performance		Limiting acceleration and speed based on driver preferences			Actual acceleration	End of Interval		
					Speed		Position		Coasting	Power	Effective			Speed		Acceleration		New Speed		New Position
(sec)	(Min)	(mph)	(ft/sec)	FYI	(mph)	(ft/sec)	(ft)	(%)	(ft/sec2)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(mph)	(ft/sec)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(ft)
326.0	5.43	70.0	102.7	397+31	70.0	102.7	302+31	-2.80	0.22	0.96	0.94	71.3	104.5	70.0	102.7	0.00	0.00	70.0	102.7	30436.1
328.0	5.47	70.0	102.7	399+36	70.0	102.7	304+36	-2.80	0.22	0.96	0.94	71.3	104.5	70.0	102.7	0.00	0.00	70.0	102.7	30641.4
330.0	5.50	70.0	102.7	401+41	70.0	102.7	306+41	-2.69	0.18	0.92	0.90	71.2	104.5	70.0	102.7	0.00	0.00	70.0	102.7	30846.7
332.0	5.53	70.0	102.7	403+47	70.0	102.7	308+47	-2.45	0.11	0.85	0.83	71.1	104.3	70.0	102.7	0.00	0.00	70.0	102.7	31052.1
334.0	5.57	70.0	102.7	405+52	70.0	102.7	310+52	-2.22	0.03	0.78	0.76	71.0	104.2	70.0	102.7	0.00	0.00	70.0	102.7	31257.4
336.0	5.60	70.0	102.7	407+57	70.0	102.7	312+57	-2.00	-0.04	0.70	0.68	70.9	104.0	70.0	102.7	0.00	0.00	70.0	102.7	31462.7
338.0	5.63	70.0	102.7	409+63	70.0	102.7	314+63	-1.77	-0.11	0.63	0.61	70.8	103.9	70.0	102.7	0.00	0.00	70.0	102.7	31668.1
340.0	5.67	70.0	102.7	411+68	70.0	102.7	316+68	-1.53	-0.19	0.56	0.54	70.7	103.7	70.0	102.7	0.00	0.00	70.0	102.7	31873.4
342.0	5.70	70.0	102.7	413+73	70.0	102.7	318+73	-1.24	-0.28	0.46	0.45	70.6	103.6	70.0	102.7	0.00	0.00	70.0	102.7	32078.7
344.0	5.73	70.0	102.7	415+79	70.0	102.7	320+79	-1.00	-0.36	0.38	0.37	70.5	103.4	70.0	102.7	0.00	0.00	70.0	102.7	32284.1
346.0	5.77	70.0	102.7	417+84	70.0	102.7	322+84	-0.76	-0.44	0.31	0.30	70.4	103.3	70.0	102.7	0.00	0.00	70.0	102.7	32489.4
348.0	5.80	70.0	102.7	419+89	70.0	102.7	324+89	-0.52	-0.52	0.23	0.22	70.3	103.1	70.0	102.7	0.00	0.00	70.0	102.7	32694.7
350.0	5.83	70.0	102.7	421+95	70.0	102.7	326+95	-0.50	-0.52	0.22	0.22	70.3	103.1	70.0	102.7	0.00	0.00	70.0	102.7	32900.1
352.0	5.87	70.0	102.7	424+00	70.0	102.7	329+00	-0.50	-0.52	0.22	0.22	70.3	103.1	70.0	102.7	0.00	0.00	70.0	102.7	33105.4
354.0	5.90	70.0	102.7	426+05	70.0	102.7	331+05	-0.50	-0.52	0.22	0.22	70.3	103.1	70.0	102.7	0.00	0.00	70.0	102.7	33310.7
356.0	5.93	70.0	102.7	428+11	70.0	102.7	333+11	-0.50	-0.52	0.22	0.22	70.3	103.1	70.0	102.7	0.00	0.00	70.0	102.7	33516.1
358.0	5.97	70.0	102.7	430+16	70.0	102.7	335+16	-0.50	-0.52	0.22	0.22	70.3	103.1	70.0	102.7	0.00	0.00	70.0	102.7	33721.4
360.0	6.00	70.0	102.7	432+21	70.0	102.7	337+21	-0.45	-0.54	0.21	0.20	70.3	103.1	70.0	102.7	0.00	0.00	70.0	102.7	33926.7
362.0	6.03	70.0	102.7	434+27	70.0	102.7	339+27	-0.12	-0.64	0.10	0.10	70.1	102.9	70.0	102.7	0.00	0.00	70.0	102.7	34132.1
364.0	6.07	70.0	102.7	436+32	70.0	102.7	341+32	0.25	-0.76	-0.02	-0.02	70.0	102.6	70.0	102.7	0.00	-0.02	70.0	102.6	34337.4
366.0	6.10	70.0	102.7	438+37	70.0	102.6	343+37	0.63	-0.88	-0.14	-0.14	69.8	102.4	71.6	105.0	2.41	-0.14	69.8	102.4	34542.4
368.0	6.13	70.0	102.7	440+42	69.8	102.4	345+42	1.00	-1.00	-0.25	-0.26	69.4	101.8	71.5	104.8	2.47	-0.26	69.4	101.8	34746.5
370.0	6.17	70.0	102.7	442+47	69.4	101.8	347+47	1.38	-1.12	-0.36	-0.37	68.9	101.1	71.2	104.4	2.58	-0.37	68.9	101.1	34949.5
372.0	6.20	70.0	102.7	444+49	68.9	101.1	349+49	1.76	-1.24	-0.47	-0.49	68.3	100.1	70.8	103.8	2.74	-0.49	68.3	100.1	35150.7
374.0	6.23	70.0	102.7	446+51	68.3	100.1	351+51	2.13	-1.35	-0.58	-0.60	67.5	98.9	70.3	103.1	2.95	-0.60	67.5	98.9	35349.7
376.0	6.27	70.0	102.7	448+50	67.5	98.9	353+50	2.51	-1.46	-0.68	-0.70	66.5	97.5	69.6	102.1	3.21	-0.70	66.5	97.5	35546.2
378.0	6.30	70.0	102.7	450+46	66.5	97.5	355+46	2.88	-1.57	-0.78	-0.80	65.4	95.9	68.9	101.0	3.51	-0.80	65.4	95.9	35739.6
380.0	6.33	70.0	102.7	452+40	65.4	95.9	357+40	3.21	-1.67	-0.86	-0.89	64.2	94.1	68.0	99.8	3.86	-0.89	64.2	94.1	35929.7
382.0	6.37	70.0	102.7	454+30	64.2	94.1	359+30	3.26	-1.67	-0.85	-0.87	63.0	92.4	67.1	98.4	4.24	-0.87	63.0	92.4	36116.2
384.0	6.40	70.0	102.7	456+16	63.0	92.4	361+16	3.26	-1.66	-0.82	-0.85	61.8	90.7	66.1	97.0	4.62	-0.85	61.8	90.7	36299.3
386.0	6.43	70.0	102.7	457+99	61.8	90.7	362+99	3.26	-1.64	-0.79	-0.82	60.7	89.1	65.2	95.7	4.98	-0.82	60.7	89.1	36479.1
388.0	6.47	70.0	102.7	459+79	60.7	89.1	364+79	3.26	-1.63	-0.76	-0.79	59.6	87.5	64.4	94.4	5.34	-0.79	59.6	87.5	36655.7
390.0	6.50	70.0	102.7	461+56	59.6	87.5	366+56	3.26	-1.62	-0.74	-0.77	58.6	85.9	63.5	93.2	5.68	-0.77	58.6	85.9	36829.1
392.0	6.53	70.0	102.7	463+29	58.6	85.9	368+29	3.06	-1.55	-0.65	-0.67	57.7	84.6	62.7	92.0	6.01	-0.67	57.7	84.6	36999.6
394.0	6.57	70.0	102.7	465+00	57.7	84.6	370+00	2.66	-1.41	-0.50	-0.52	57.0	83.6	62.0	90.9	6.30	-0.52	57.0	83.6	37167.8
396.0	6.60	70.0	102.7	466+68	57.0	83.6	371+68	2.27	-1.28	-0.35	-0.37	56.5	82.8	61.4	90.1	6.53	-0.37	56.5	82.8	37334.2
398.0	6.63	70.0	102.7	468+34	56.5	82.8	373+34	1.87	-1.15	-0.22	-0.23	56.2	82.4	61.0	89.5	6.69	-0.23	56.2	82.4	37499.4
400.0	6.67	70.0	102.7	469+99	56.2	82.4	374+99	1.87	-1.14	-0.21	-0.22	55.9	81.9	60.8	89.2	6.78	-0.22	55.9	81.9	37663.7
402.0	6.70	70.0	102.7	471+64	55.9	81.9	376+64	1.48	-1.01	-0.07	-0.08	55.8	81.8	60.6	88.8	6.88	-0.08	55.8	81.8	37827.4
404.0	6.73	70.0	102.7	473+27	55.8	81.8	378+27	1.08	-0.88	0.05	0.05	55.8	81.9	60.5	88.7	6.91	0.05	55.8	81.9	37991.1
406.0	6.77	70.0	102.7	474+91	55.8	81.9	379+91	0.69	-0.76	0.18	0.17	56.1	82.2	60.5	88.8	6.89	0.17	56.1	82.2	38155.2
408.0	6.80	70.0	102.7	476+55	56.1	82.2	381+55	0.29	-0.63	0.30	0.29	56.5	82.8	60.7	89.0	6.81	0.29	56.5	82.8	38320.2
410.0	6.83	70.0	102.7	478+20	56.5	82.8	383+20	-0.11	-0.51	0.42	0.40	57.0	83.6	61.0	89.5	6.69	0.40	57.0	83.6	38486.6
412.0	6.87	70.0	102.7	479+87	57.0	83.6	384+87	-0.11	-0.51	0.40	0.39	57.5	84.4	61.4	90.1	6.52	0.39	57.5	84.4	38654.6
414.0	6.90	70.0	102.7	481+55	57.5	84.4	386+55	-0.50	-0.39	0.51	0.49	58.2	85.4	61.9	90.7	6.35	0.49	58.2	85.4	38824.3
416.0	6.93	70.0	102.7	483+24	58.2	85.4	388+24	-0.70	-0.33	0.56	0.54	58.9	86.4	62.4	91.5	6.14	0.54	58.9	86.4	38996.1
418.0	6.97	70.0	102.7	484+96	58.9	86.4	389+96	-0.70	-0.34	0.54	0.52	59.7	87.5	63.0	92.3	5.90	0.52	59.7	87.5	39170.0
420.0	7.00	70.0	102.7	486+70	59.7	87.5	391+70	-0.70	-0.35	0.53	0.51	60.3	88.5	63.5	93.2	5.68	0.51	60.3	88.5	39346.0
422.0	7.03	70.0	102.7	488+46	60.3	88.5	393+46	-0.70	-0.35	0.51	0.49	61.0	89.5	64.1	94.0	5.46	0.49	61.0	89.5	39524.0
424.0	7.07	70.0	102.7	490+24	61.0	89.5	395+24	-0.70	-0.36	0.49	0.48	61.7	90.4	64.6	94.7	5.25	0.48	61.7	90.4	39703.9
426.0	7.10	70.0	102.7	492+04	61.7	90.4	397+04	-0.70	-0.37	0.48	0.46	62.3	91.4	65.1	95.5	5.04	0.46	62.3	91.4	39885.7
428.0	7.13	70.0	102.7	493+86	62.3	91.4	398+86	-0.70	-0.37	0.46	0.45	62.9	92.3	65.6	96.2	4.84	0.45	62.9	92.3	40069.3
430.0	7.17	70.0	102.7	495+69	62.9	92.3	400+69	-0.70	-0.38	0.45	0.43	63.5	93.1	66.1	96.9	4.65	0.43	63.5	93.1	40254.7
432.0	7.20	70.0	102.7	497+55	63.5	93.1	402+55	-0.70	-0.39	0.44	0.42	64.1	94.0	66.5	97.6	4.46	0.42	64.1	94.0	40441.8
434.0	7.23	70.0	102.7	499+42	64.1	94.0	404+42	-0.70	-0.39	0.42	0.41	64.6	94.8	67.0	98.2	4.28	0.41	64.6	94.8	40630.6
436.0	7.27	70.0	102.7	501+31	64.6	94.8	406+31	-0.70	-0.40	0.41	0.40	65.2	95.6	67.4	98.9	4.10	0.40	65.2	95.6	40820.9
438.0	7.30	70.0	102.7	503+21	65.2	95.6	408+21	-0.70	-0.40	0.40	0.38	65.7	96.3	67.8	99.5	3.93	0.38	65.7	96.3	41012.8

1		2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Elapsed Time		Desired Speed		Actual Station	Start of Interval			Local Grade	Limiting acceleration			New speed based on vehicle performance		Limiting acceleration and speed based on driver preferences			Actual acceleration	End of Interval		
					Speed		Position		Coasting	Power	Effective			Speed		Acceleration		New Speed		New Position
(sec)	(Min)	(mph)	(ft/sec)	FYI	(mph)	(ft/sec)	(ft)	(%)	(ft/sec2)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(mph)	(ft/sec)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(ft)
440.0	7.33	70.0	102.7	505+13	65.7	96.3	410+13	-0.70	-0.41	0.38	0.37	66.2	97.1	68.3	100.1	3.77	0.37	66.2	97.1	41206.3
442.0	7.37	70.0	102.7	507+06	66.2	97.1	412+06	-0.70	-0.42	0.37	0.36	66.7	97.8	68.7	100.7	3.60	0.36	66.7	97.8	41401.2
444.0	7.40	70.0	102.7	509+01	66.7	97.8	414+01	-0.70	-0.42	0.36	0.35	67.2	98.5	69.0	101.3	3.45	0.35	67.2	98.5	41597.5
446.0	7.43	70.0	102.7	510+98	67.2	98.5	415+98	-0.70	-0.43	0.35	0.34	67.6	99.2	69.4	101.8	3.30	0.34	67.6	99.2	41795.2
448.0	7.47	70.0	102.7	512+95	67.6	99.2	417+95	-0.70	-0.43	0.34	0.33	68.1	99.9	69.8	102.4	3.15	0.33	68.1	99.9	41994.3
450.0	7.50	70.0	102.7	514+94	68.1	99.9	419+94	-0.65	-0.45	0.31	0.31	68.5	100.5	70.1	102.9	3.00	0.31	68.5	100.5	42194.7
452.0	7.53	70.0	102.7	516+95	68.5	100.5	421+95	-0.12	-0.63	0.14	0.13	68.7	100.7	70.5	103.4	2.87	0.13	68.7	100.7	42395.9
454.0	7.57	70.0	102.7	518+96	68.7	100.7	423+96	0.35	-0.78	-0.02	-0.02	68.7	100.7	70.6	103.6	2.82	-0.02	68.7	100.7	42597.3
456.0	7.60	70.0	102.7	520+97	68.7	100.7	425+97	0.98	-0.99	-0.22	-0.23	68.4	100.3	70.6	103.5	2.82	-0.23	68.4	100.3	42798.3
458.0	7.63	70.0	102.7	522+98	68.4	100.3	427+98	1.42	-1.12	-0.35	-0.36	67.9	99.5	70.3	103.2	2.92	-0.36	67.9	99.5	42998.1
460.0	7.67	70.0	102.7	524+98	67.9	99.5	429+98	1.49	-1.14	-0.36	-0.37	67.3	98.8	70.0	102.6	3.08	-0.37	67.3	98.8	43196.4
462.0	7.70	70.0	102.7	526+96	67.3	98.8	431+96	1.49	-1.13	-0.35	-0.36	66.9	98.1	69.6	102.0	3.24	-0.36	66.9	98.1	43393.2
464.0	7.73	70.0	102.7	528+93	66.9	98.1	433+93	1.31	-1.07	-0.28	-0.29	66.5	97.5	69.2	101.4	3.40	-0.29	66.5	97.5	43588.7
466.0	7.77	70.0	102.7	530+89	66.5	97.5	435+89	0.69	-0.87	-0.08	-0.08	66.3	97.3	68.9	101.0	3.52	-0.08	66.3	97.3	43783.5
468.0	7.80	70.0	102.7	532+83	66.3	97.3	437+83	0.05	-0.66	0.13	0.13	66.5	97.6	68.8	100.9	3.56	0.13	66.5	97.6	43978.4
470.0	7.83	70.0	102.7	534+78	66.5	97.6	439+78	-0.59	-0.46	0.33	0.32	67.0	98.2	68.9	101.1	3.50	0.32	67.0	98.2	44174.1
472.0	7.87	70.0	102.7	536+74	67.0	98.2	441+74	-1.23	-0.25	0.52	0.51	67.7	99.2	69.2	101.6	3.36	0.51	67.7	99.2	44371.5
474.0	7.90	70.0	102.7	538+72	67.7	99.2	443+72	-1.86	-0.06	0.71	0.69	68.6	100.6	69.8	102.4	3.14	0.69	68.6	100.6	44571.4
476.0	7.93	70.0	102.7	540+71	68.6	100.6	445+71	-2.50	0.14	0.90	0.87	69.8	102.3	70.5	103.5	2.85	0.87	69.8	102.3	44774.3
478.0	7.97	75.0	110.0	542+74	69.8	102.3	447+74	-3.12	0.32	1.07	1.04	71.2	104.4	72.5	106.4	4.05	1.04	71.2	104.4	44981.1
480.0	8.00	75.0	110.0	544+81	71.2	104.4	449+81	-3.30	0.37	1.09	1.07	72.7	106.6	73.7	108.0	3.60	1.07	72.7	106.6	45192.1
482.0	8.03	75.0	110.0	546+92	72.7	106.6	451+92	-3.27	0.34	1.05	1.03	74.1	108.6	74.8	109.7	3.14	1.03	74.1	108.6	45407.3
484.0	8.07	70.0	102.7	549+07	70.0	102.7	454+07	-2.59	0.15	0.89	0.87	71.2	104.4	70.0	102.7	0.00	0.00	70.0	102.7	45612.6
486.0	8.10	70.0	102.7	551+13	70.0	102.7	456+13	-1.64	-0.16	0.59	0.57	70.8	103.8	70.0	102.7	0.00	0.00	70.0	102.7	45817.9
488.0	8.13	70.0	102.7	553+18	70.0	102.7	458+18	-0.66	-0.47	0.28	0.27	70.4	103.2	70.0	102.7	0.00	0.00	70.0	102.7	46023.3
490.0	8.17	70.0	102.7	555+23	70.0	102.7	460+23	0.27	-0.77	-0.02	-0.02	70.0	102.6	70.0	102.7	0.00	-0.02	70.0	102.6	46228.6
492.0	8.20	70.0	102.7	557+29	70.0	102.6	462+29	1.23	-1.08	-0.33	-0.34	69.5	101.9	71.6	105.0	2.41	-0.34	69.5	101.9	46433.1
494.0	8.23	70.0	102.7	559+33	69.5	101.9	464+33	2.30	-1.42	-0.66	-0.68	68.6	100.6	71.3	104.5	2.56	-0.68	68.6	100.6	46635.7
496.0	8.27	70.0	102.7	561+36	68.6	100.6	466+36	3.03	-1.64	-0.87	-0.90	67.4	98.8	70.5	103.4	2.85	-0.90	67.4	98.8	46835.0
498.0	8.30	70.0	102.7	563+35	67.4	98.8	468+35	3.29	-1.71	-0.93	-0.96	66.1	96.9	69.6	102.0	3.24	-0.96	66.1	96.9	47030.7
500.0	8.33	70.0	102.7	565+31	66.1	96.9	470+31	3.29	-1.70	-0.90	-0.93	64.8	95.0	68.5	100.5	3.65	-0.93	64.8	95.0	47222.6
502.0	8.37	70.0	102.7	567+23	64.8	95.0	472+23	3.29	-1.69	-0.87	-0.90	63.6	93.2	67.6	99.1	4.05	-0.90	63.6	93.2	47410.9
504.0	8.40	70.0	102.7	569+11	63.6	93.2	474+11	3.29	-1.67	-0.84	-0.87	62.4	91.5	66.6	97.7	4.44	-0.87	62.4	91.5	47595.6
506.0	8.43	70.0	102.7	570+96	62.4	91.5	475+96	3.29	-1.66	-0.81	-0.84	61.2	89.8	65.7	96.3	4.81	-0.84	61.2	89.8	47776.9
508.0	8.47	70.0	102.7	572+77	61.2	89.8	477+77	3.29	-1.65	-0.79	-0.82	60.1	88.2	64.8	95.0	5.18	-0.82	60.1	88.2	47954.9
510.0	8.50	70.0	102.7	574+55	60.1	88.2	479+55	3.29	-1.64	-0.76	-0.79	59.0	86.6	63.9	93.7	5.53	-0.79	59.0	86.6	48129.6
512.0	8.53	70.0	102.7	576+30	59.0	86.6	481+30	3.29	-1.63	-0.73	-0.76	58.0	85.1	63.0	92.5	5.87	-0.76	58.0	85.1	48301.3
514.0	8.57	70.0	102.7	578+01	58.0	85.1	483+01	3.29	-1.62	-0.71	-0.74	57.0	83.6	62.2	91.3	6.20	-0.74	57.0	83.6	48470.0
516.0	8.60	70.0	102.7	579+70	57.0	83.6	484+70	3.29	-1.61	-0.68	-0.71	56.0	82.2	61.4	90.1	6.52	-0.71	56.0	82.2	48635.7
518.0	8.63	70.0	102.7	581+36	56.0	82.2	486+36	3.12	-1.54	-0.60	-0.63	55.2	80.9	60.7	89.0	6.83	-0.63	55.2	80.9	48798.8
520.0	8.67	70.0	102.7	582+99	55.2	80.9	487+99	2.55	-1.35	-0.40	-0.42	54.6	80.1	60.0	88.0	7.10	-0.42	54.6	80.1	48959.8
522.0	8.70	70.0	102.7	584+60	54.6	80.1	489+60	1.96	-1.16	-0.20	-0.20	54.3	79.7	59.6	87.4	7.28	-0.20	54.3	79.7	49119.6
524.0	8.73	70.0	102.7	586+20	54.3	79.7	491+20	1.37	-0.96	0.00	0.00	54.3	79.7	59.3	87.0	7.37	0.00	54.3	79.7	49278.9
526.0	8.77	70.0	102.7	587+79	54.3	79.7	492+79	1.37	-0.96	0.00	0.00	54.3	79.7	59.3	87.0	7.37	0.00	54.3	79.7	49438.3
528.0	8.80	70.0	102.7	589+38	54.3	79.7	494+38	0.78	-0.77	0.19	0.18	54.6	80.0	59.3	87.0	7.37	0.18	54.6	80.0	49598.0
530.0	8.83	70.0	102.7	590+98	54.6	80.0	495+98	0.18	-0.58	0.37	0.36	55.1	80.7	59.5	87.3	7.29	0.36	55.1	80.7	49758.8
532.0	8.87	70.0	102.7	592+59	55.1	80.7	497+59	-0.41	-0.40	0.55	0.52	55.8	81.8	59.9	87.9	7.13	0.52	55.8	81.8	49921.3
534.0	8.90	70.0	102.7	594+21	55.8	81.8	499+21	-0.98	-0.22	0.71	0.68	56.7	83.2	60.5	88.7	6.91	0.68	56.7	83.2	50086.3
536.0	8.93	70.0	102.7	595+86	56.7	83.2	500+86	-0.98	-0.23	0.69	0.66	57.6	84.5	61.2	89.8	6.61	0.66	57.6	84.5	50253.9
538.0	8.97	70.0	102.7	597+54	57.6	84.5	502+54	-1.15	-0.18	0.72	0.69	58.5	85.9	61.9	90.8	6.33	0.69	58.5	85.9	50424.3
540.0	9.00	70.0	102.7	599+24	58.5	85.9	504+24	-1.15	-0.19	0.70	0.67	59.5	87.2	62.7	91.9	6.03	0.67	59.5	87.2	50597.3
542.0	9.03	70.0	102.7	600+97	59.5	87.2	505+97	-1.15	-0.20	0.67	0.65	60.3	88.5	63.4	92.9	5.74	0.65	60.3	88.5	50773.0
544.0	9.07	70.0	102.7	602+73	60.3	88.5	507+73	-1.15	-0.21	0.65	0.63	61.2	89.8	64.1	94.0	5.46	0.63	61.2	89.8	50951.3
546.0	9.10	70.0	102.7	604+51	61.2	89.8	509+51	-0.75	-0.35	0.51	0.49	61.9	90.7	64.7	94.9	5.19	0.49	61.9	90.7	51131.8
548.0	9.13	70.0	102.7	606+32	61.9	90.7	511+32	0.03	-0.61	0.24	0.23	62.2	91.2	65.3	95.7	4.98	0.23	62.2	91.2	51313.7
550.0	9.17	70.0	102.7	608+14	62.2	91.2	513+14	0.82	-0.86	-0.02	-0.02	62.2	91.2	65.5	96.1	4.88	-0.02	62.2	91.2	51496.0
552.0	9.20	70.0	102.7	609+96	62.2	91.2	514+96	0.82	-0.86	-0.02	-0.02	62.1	91.1	65.5	96.0	4.89	-0.02	62.1	91.1	51678.3

1		2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Elapsed Time		Desired Speed		Actual Station	Start of Interval			Local Grade	Limiting acceleration			New speed based on vehicle performance		Limiting acceleration and speed based on driver preferences			Actual acceleration	End of Interval		
					Speed		Position		Coasting	Power	Effective			Speed		Acceleration		New Speed		New Position
(sec)	(Min)	(mph)	(ft/sec)	FYI	(mph)	(ft/sec)	(ft)	(%)	(ft/sec2)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(mph)	(ft/sec)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(ft)
554.0	9.23	70.0	102.7	611+78	62.1	91.1	516+78	1.60	-1.11	-0.27	-0.28	61.8	90.6	65.5	96.0	4.89	-0.28	61.8	90.6	51860.0
556.0	9.27	70.0	102.7	613+60	61.8	90.6	518+60	2.39	-1.36	-0.51	-0.53	61.0	89.5	65.2	95.6	5.01	-0.53	61.0	89.5	52040.1
558.0	9.30	70.0	102.7	615+40	61.0	89.5	520+40	2.78	-1.48	-0.62	-0.64	60.2	88.2	64.6	94.8	5.24	-0.64	60.2	88.2	52217.8
560.0	9.33	70.0	102.7	617+18	60.2	88.2	522+18	2.78	-1.47	-0.60	-0.62	59.3	87.0	63.9	93.7	5.52	-0.62	59.3	87.0	52393.1
562.0	9.37	70.0	102.7	618+93	59.3	87.0	523+93	2.78	-1.46	-0.58	-0.60	58.5	85.8	63.3	92.8	5.79	-0.60	58.5	85.8	52565.8
564.0	9.40	70.0	102.7	620+66	58.5	85.8	525+66	2.78	-1.46	-0.56	-0.58	57.7	84.6	62.6	91.8	6.04	-0.58	57.7	84.6	52736.3
566.0	9.43	70.0	102.7	622+36	57.7	84.6	527+36	2.78	-1.45	-0.54	-0.56	56.9	83.5	62.0	90.9	6.29	-0.56	56.9	83.5	52904.4
568.0	9.47	70.0	102.7	624+04	56.9	83.5	529+04	2.72	-1.42	-0.50	-0.52	56.2	82.5	61.4	90.1	6.54	-0.52	56.2	82.5	53070.4
570.0	9.50	70.0	102.7	625+70	56.2	82.5	530+70	2.72	-1.42	-0.48	-0.50	55.6	81.5	60.8	89.2	6.76	-0.50	55.6	81.5	53234.4
572.0	9.53	70.0	102.7	627+34	55.6	81.5	532+34	2.33	-1.28	-0.34	-0.35	55.1	80.8	60.3	88.5	6.98	-0.35	55.1	80.8	53396.6
574.0	9.57	70.0	102.7	628+97	55.1	80.8	533+97	1.88	-1.13	-0.18	-0.19	54.8	80.4	59.9	87.9	7.13	-0.19	54.8	80.4	53557.8
576.0	9.60	70.0	102.7	630+58	54.8	80.4	535+58	1.42	-0.99	-0.03	-0.03	54.8	80.3	59.7	87.6	7.21	-0.03	54.8	80.3	53718.5
578.0	9.63	70.0	102.7	632+19	54.8	80.3	537+19	0.97	-0.84	0.11	0.11	54.9	80.5	59.7	87.6	7.22	0.11	54.9	80.5	53879.4
580.0	9.67	70.0	102.7	633+79	54.9	80.5	538+79	0.97	-0.84	0.11	0.11	55.1	80.8	59.8	87.7	7.18	0.11	55.1	80.8	54040.7
582.0	9.70	70.0	102.7	635+41	55.1	80.8	540+41	0.58	-0.72	0.23	0.22	55.4	81.2	59.9	87.9	7.13	0.22	55.4	81.2	54202.7
584.0	9.73	70.0	102.7	637+03	55.4	81.2	542+03	0.52	-0.70	0.24	0.23	55.7	81.7	60.2	88.2	7.03	0.23	55.7	81.7	54365.6
586.0	9.77	70.0	102.7	638+66	55.7	81.7	543+66	0.52	-0.70	0.23	0.23	56.0	82.1	60.4	88.6	6.93	0.23	56.0	82.1	54529.4
588.0	9.80	70.0	102.7	640+29	56.0	82.1	545+29	0.52	-0.71	0.23	0.22	56.3	82.6	60.7	89.0	6.84	0.22	56.3	82.6	54694.0
590.0	9.83	70.0	102.7	641+94	56.3	82.6	546+94	0.52	-0.71	0.22	0.21	56.6	83.0	60.9	89.3	6.74	0.21	56.6	83.0	54859.6
592.0	9.87	70.0	102.7	643+60	56.6	83.0	548+60	0.52	-0.71	0.21	0.20	56.9	83.4	61.1	89.6	6.65	0.20	56.9	83.4	55026.0
594.0	9.90	70.0	102.7	645+26	56.9	83.4	550+26	0.52	-0.71	0.21	0.20	57.1	83.8	61.3	90.0	6.56	0.20	57.1	83.8	55193.1
596.0	9.93	70.0	102.7	646+93	57.1	83.8	551+93	0.52	-0.72	0.20	0.19	57.4	84.2	61.5	90.3	6.48	0.19	57.4	84.2	55361.1
598.0	9.97	70.0	102.7	648+61	57.4	84.2	553+61	0.52	-0.72	0.19	0.18	57.6	84.5	61.7	90.6	6.40	0.18	57.6	84.5	55529.8
600.0	10.00	70.0	102.7	650+30	57.6	84.5	555+30	0.49	-0.71	0.20	0.19	57.9	84.9	61.9	90.9	6.32	0.19	57.9	84.9	55699.2
602.0	10.03	70.0	102.7	651+99	57.9	84.9	556+99	0.49	-0.71	0.19	0.18	58.1	85.3	62.1	91.1	6.23	0.18	58.1	85.3	55869.4
604.0	10.07	70.0	102.7	653+69	58.1	85.3	558+69	0.41	-0.69	0.21	0.20	58.4	85.7	62.3	91.4	6.16	0.20	58.4	85.7	56040.4
606.0	10.10	70.0	102.7	655+40	58.4	85.7	560+40	0.34	-0.67	0.22	0.21	58.7	86.1	62.6	91.7	6.07	0.21	58.7	86.1	56212.2
608.0	10.13	70.0	102.7	657+12	58.7	86.1	562+12	0.27	-0.65	0.24	0.23	59.0	86.6	62.8	92.1	5.98	0.23	59.0	86.6	56384.8
610.0	10.17	70.0	102.7	658+85	59.0	86.6	563+85	0.20	-0.63	0.25	0.24	59.4	87.1	63.0	92.4	5.88	0.24	59.4	87.1	56558.4
612.0	10.20	70.0	102.7	660+58	59.4	87.1	565+58	0.13	-0.61	0.27	0.26	59.7	87.6	63.3	92.8	5.77	0.26	59.7	87.6	56733.1
614.0	10.23	70.0	102.7	662+33	59.7	87.6	567+33	0.06	-0.59	0.28	0.27	60.1	88.1	63.6	93.2	5.66	0.27	60.1	88.1	56908.7
616.0	10.27	70.0	102.7	664+09	60.1	88.1	569+09	-0.01	-0.57	0.30	0.28	60.5	88.7	63.9	93.7	5.54	0.28	60.5	88.7	57085.5
618.0	10.30	70.0	102.7	665+86	60.5	88.7	570+86	-0.01	-0.58	0.29	0.28	60.8	89.2	64.2	94.1	5.42	0.28	60.8	89.2	57263.5
620.0	10.33	70.0	102.7	667+63	60.8	89.2	572+63	-0.08	-0.56	0.30	0.29	61.2	89.8	64.5	94.5	5.30	0.29	61.2	89.8	57442.5
622.0	10.37	70.0	102.7	669+43	61.2	89.8	574+43	-0.15	-0.54	0.31	0.30	61.6	90.4	64.8	95.0	5.18	0.30	61.6	90.4	57622.7
624.0	10.40	70.0	102.7	671+23	61.6	90.4	576+23	-0.19	-0.53	0.31	0.30	62.1	91.0	65.1	95.5	5.05	0.30	62.1	91.0	57804.2
626.0	10.43	70.0	102.7	673+04	62.1	91.0	578+04	-0.19	-0.54	0.30	0.29	62.5	91.6	65.4	95.9	4.91	0.29	62.5	91.6	57986.8
628.0	10.47	70.0	102.7	674+87	62.5	91.6	579+87	-0.19	-0.54	0.30	0.29	62.9	92.2	65.7	96.4	4.79	0.29	62.9	92.2	58170.6
630.0	10.50	70.0	102.7	676+71	62.9	92.2	581+71	-0.19	-0.55	0.29	0.28	63.2	92.7	66.0	96.8	4.66	0.28	63.2	92.7	58355.5
632.0	10.53	70.0	102.7	678+56	63.2	92.7	583+56	-0.19	-0.55	0.28	0.27	63.6	93.3	66.3	97.3	4.54	0.27	63.6	93.3	58541.5
634.0	10.57	70.0	102.7	680+42	63.6	93.3	585+42	-0.19	-0.55	0.27	0.26	64.0	93.8	66.6	97.7	4.43	0.26	64.0	93.8	58728.6
636.0	10.60	70.0	102.7	682+29	64.0	93.8	587+29	-0.19	-0.56	0.26	0.25	64.3	94.3	66.9	98.1	4.32	0.25	64.3	94.3	58916.7
638.0	10.63	70.0	102.7	684+17	64.3	94.3	589+17	-0.13	-0.58	0.23	0.23	64.6	94.8	67.2	98.5	4.21	0.23	64.6	94.8	59105.8
640.0	10.67	70.0	102.7	686+06	64.6	94.8	591+06	0.26	-0.71	0.10	0.10	64.7	95.0	67.4	98.9	4.11	0.10	64.7	95.0	59295.5
642.0	10.70	70.0	102.7	687+95	64.7	95.0	592+95	0.26	-0.71	0.10	0.10	64.9	95.1	67.5	99.0	4.07	0.10	64.9	95.1	59485.6
644.0	10.73	70.0	102.7	689+86	64.9	95.1	594+86	0.71	-0.86	-0.05	-0.05	64.8	95.0	67.6	99.2	4.03	-0.05	64.8	95.0	59675.7
646.0	10.77	70.0	102.7	691+76	64.8	95.0	596+76	1.17	-1.00	-0.19	-0.20	64.5	94.6	67.6	99.1	4.05	-0.20	64.5	94.6	59865.4
648.0	10.80	70.0	102.7	693+65	64.5	94.6	598+65	1.62	-1.14	-0.33	-0.34	64.1	94.0	67.3	98.8	4.13	-0.34	64.1	94.0	60054.0
650.0	10.83	70.0	102.7	695+54	64.1	94.0	600+54	2.05	-1.28	-0.46	-0.47	63.4	93.0	67.0	98.2	4.28	-0.47	63.4	93.0	60241.0
652.0	10.87	70.0	102.7	697+41	63.4	93.0	602+41	2.07	-1.28	-0.45	-0.46	62.8	92.1	66.5	97.5	4.48	-0.46	62.8	92.1	60426.1
654.0	10.90	70.0	102.7	699+26	62.8	92.1	604+26	2.07	-1.27	-0.43	-0.45	62.2	91.2	66.0	96.8	4.68	-0.45	62.2	91.2	60609.4
656.0	10.93	70.0	102.7	701+09	62.2	91.2	606+09	2.07	-1.26	-0.42	-0.43	61.6	90.3	65.5	96.1	4.88	-0.43	61.6	90.3	60791.0
658.0	10.97	70.0	102.7	702+91	61.6	90.3	607+91	2.07	-1.26	-0.40	-0.42	61.0	89.5	65.0	95.4	5.06	-0.42	61.0	89.5	60970.8
660.0	11.00	70.0	102.7	704+71	61.0	89.5	609+71	2.07	-1.25	-0.39	-0.41	60.5	88.7	64.6	94.7	5.24	-0.41	60.5	88.7	61149.0
662.0	11.03	70.0	102.7	706+49	60.5	88.7	611+49	2.07	-1.25	-0.38	-0.39	59.9	87.9	64.2	94.1	5.42	-0.39	59.9	87.9	61325.6
664.0	11.07	70.0	102.7	708+26	59.9	87.9	613+26	2.07	-1.24	-0.36	-0.38	59.4	87.1	63.7	93.5	5.59	-0.38	59.4	87.1	61500.6
666.0	11.10	70.0	102.7	710+01	59.4	87.1	615+01	1.93	-1.19	-0.31	-0.32	59.0	86.5	63.3	92.9	5.75	-0.32	59.0	86.5	61674.3

1		2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Elapsed Time		Desired Speed		Actual Station	Start of Interval			Local Grade	Limiting acceleration			New speed based on vehicle performance		Limiting acceleration and speed based on driver preferences			Actual acceleration	End of Interval		
					Speed		Position		Coasting	Power	Effective			Speed		Acceleration		New Speed		New Position
(sec)	(Min)	(mph)	(ft/sec)	FYI	(mph)	(ft/sec)	(ft)	(%)	(ft/sec2)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(mph)	(ft/sec)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(ft)
668.0	11.13	70.0	102.7	711+74	59.0	86.5	616+74	1.93	-1.19	-0.30	-0.31	58.6	85.9	63.0	92.4	5.89	-0.31	58.6	85.9	61846.7
670.0	11.17	70.0	102.7	713+47	58.6	85.9	618+47	1.44	-1.02	-0.13	-0.13	58.4	85.6	62.7	91.9	6.02	-0.13	58.4	85.6	62018.2
672.0	11.20	70.0	102.7	715+18	58.4	85.6	620+18	0.93	-0.86	0.04	0.04	58.4	85.7	62.5	91.7	6.08	0.04	58.4	85.7	62189.5
674.0	11.23	70.0	102.7	716+90	58.4	85.7	621+90	0.42	-0.70	0.20	0.19	58.7	86.1	62.6	91.8	6.07	0.19	58.7	86.1	62361.3
676.0	11.27	70.0	102.7	718+61	58.7	86.1	623+61	-0.08	-0.54	0.35	0.34	59.2	86.8	62.8	92.1	5.98	0.34	59.2	86.8	62534.1
678.0	11.30	70.0	102.7	720+34	59.2	86.8	625+34	-0.59	-0.38	0.50	0.48	59.8	87.7	63.1	92.6	5.84	0.48	59.8	87.7	62708.6
680.0	11.33	70.0	102.7	722+09	59.8	87.7	627+09	-1.10	-0.22	0.65	0.63	60.7	89.0	63.6	93.4	5.63	0.63	60.7	89.0	62885.3
682.0	11.37	70.0	102.7	723+85	60.7	89.0	628+85	-1.10	-0.23	0.63	0.61	61.5	90.2	64.3	94.3	5.36	0.61	61.5	90.2	63064.5
684.0	11.40	70.0	102.7	725+64	61.5	90.2	630+64	-1.59	-0.08	0.76	0.74	62.5	91.7	65.0	95.3	5.10	0.74	62.5	91.7	63246.3
686.0	11.43	70.0	102.7	727+46	62.5	91.7	632+46	-1.73	-0.04	0.79	0.76	63.5	93.2	65.8	96.4	4.78	0.76	63.5	93.2	63431.2
688.0	11.47	70.0	102.7	729+31	63.5	93.2	634+31	-1.73	-0.06	0.76	0.74	64.5	94.7	66.6	97.6	4.45	0.74	64.5	94.7	63619.0
690.0	11.50	70.0	102.7	731+19	64.5	94.7	636+19	-1.73	-0.07	0.74	0.72	65.5	96.1	67.4	98.8	4.13	0.72	65.5	96.1	63809.8
692.0	11.53	70.0	102.7	733+10	65.5	96.1	638+10	-1.73	-0.08	0.72	0.70	66.5	97.5	68.1	99.9	3.82	0.70	66.5	97.5	64003.4
694.0	11.57	70.0	102.7	735+03	66.5	97.5	640+03	-1.74	-0.08	0.70	0.68	67.4	98.8	68.9	101.0	3.52	0.68	67.4	98.8	64199.7
696.0	11.60	70.0	102.7	737+00	67.4	98.8	642+00	-1.96	-0.02	0.75	0.73	68.4	100.3	69.6	102.1	3.23	0.73	68.4	100.3	64398.8
698.0	11.63	70.0	102.7	738+99	68.4	100.3	643+99	-2.26	0.06	0.82	0.80	69.5	101.9	70.4	103.2	2.91	0.80	69.5	101.9	64601.0
700.0	11.67	70.0	102.7	741+01	69.5	101.9	646+01	-2.56	0.15	0.90	0.87	70.7	103.6	71.2	104.5	2.57	0.87	70.7	103.6	64806.6
702.0	11.70	70.0	102.7	743+07	70.0	102.7	648+07	-2.86	0.24	0.98	0.96	71.3	104.6	70.0	102.7	0.00	0.00	70.0	102.7	65011.9
704.0	11.73	75.0	110.0	745+12	70.0	102.7	650+12	-3.17	0.34	1.08	1.05	71.4	104.8	72.7	106.7	3.98	1.05	71.4	104.8	65219.3
706.0	11.77	75.0	110.0	747+19	71.4	104.8	652+19	-3.47	0.42	1.14	1.11	73.0	107.0	73.8	108.3	3.53	1.11	73.0	107.0	65431.1
708.0	11.80	75.0	110.0	749+31	73.0	107.0	654+31	-3.77	0.50	1.21	1.18	74.6	109.4	75.0	110.0	3.05	1.18	74.6	109.4	65647.5
710.0	11.83	75.0	110.0	751+47	74.6	109.4	656+47	-3.99	0.55	1.24	1.21	76.2	111.8	76.3	111.9	2.54	1.21	76.2	111.8	65868.6
712.0	11.87	75.0	110.0	753+69	75.0	110.0	658+69	-4.00	0.55	1.24	1.21	76.6	112.4	75.0	110.0	0.00	0.00	75.0	110.0	66088.6
714.0	11.90	75.0	110.0	755+89	75.0	110.0	660+89	-4.00	0.55	1.24	1.21	76.6	112.4	75.0	110.0	0.00	0.00	75.0	110.0	66308.6
716.0	11.93	75.0	110.0	758+09	75.0	110.0	663+09	-4.00	0.55	1.24	1.21	76.6	112.4	75.0	110.0	0.00	0.00	75.0	110.0	66528.6
718.0	11.97	75.0	110.0	760+29	75.0	110.0	665+29	-3.85	0.50	1.19	1.16	76.6	112.3	75.0	110.0	0.00	0.00	75.0	110.0	66748.6
720.0	12.00	75.0	110.0	762+49	75.0	110.0	667+49	-3.02	0.23	0.92	0.90	76.2	111.8	75.0	110.0	0.00	0.00	75.0	110.0	66968.6
722.0	12.03	70.0	102.7	764+69	70.0	102.7	669+69	-2.31	0.06	0.80	0.78	71.1	104.2	70.0	102.7	0.00	0.00	70.0	102.7	67173.9
724.0	12.07	70.0	102.7	766+74	70.0	102.7	671+74	-1.54	-0.19	0.56	0.54	70.7	103.8	70.0	102.7	0.00	0.00	70.0	102.7	67379.3
726.0	12.10	70.0	102.7	768+79	70.0	102.7	673+79	-0.75	-0.44	0.30	0.30	70.4	103.3	70.0	102.7	0.00	0.00	70.0	102.7	67584.6
728.0	12.13	70.0	102.7	770+85	70.0	102.7	675+85	-0.39	-0.56	0.19	0.18	70.3	103.0	70.0	102.7	0.00	0.00	70.0	102.7	67789.9
730.0	12.17	70.0	102.7	772+90	70.0	102.7	677+90	-0.39	-0.56	0.19	0.18	70.3	103.0	70.0	102.7	0.00	0.00	70.0	102.7	67995.3
732.0	12.20	70.0	102.7	774+95	70.0	102.7	679+95	-0.39	-0.56	0.19	0.18	70.3	103.0	70.0	102.7	0.00	0.00	70.0	102.7	68200.6
734.0	12.23	70.0	102.7	777+01	70.0	102.7	682+01	-0.39	-0.56	0.19	0.18	70.3	103.0	70.0	102.7	0.00	0.00	70.0	102.7	68405.9
736.0	12.27	70.0	102.7	779+06	70.0	102.7	684+06	-0.39	-0.56	0.19	0.18	70.3	103.0	70.0	102.7	0.00	0.00	70.0	102.7	68611.3
738.0	12.30	70.0	102.7	781+11	70.0	102.7	686+11	-0.39	-0.56	0.19	0.18	70.3	103.0	70.0	102.7	0.00	0.00	70.0	102.7	68816.6
740.0	12.33	70.0	102.7	783+17	70.0	102.7	688+17	-0.30	-0.59	0.16	0.16	70.2	103.0	70.0	102.7	0.00	0.00	70.0	102.7	69021.9
742.0	12.37	70.0	102.7	785+22	70.0	102.7	690+22	0.44	-0.83	-0.08	-0.08	69.9	102.5	70.0	102.7	0.00	-0.08	69.9	102.5	69227.1
744.0	12.40	70.0	102.7	787+27	69.9	102.5	692+27	1.12	-1.04	-0.29	-0.30	69.5	101.9	71.6	104.9	2.43	-0.30	69.5	101.9	69431.5
746.0	12.43	70.0	102.7	789+32	69.5	101.9	694+32	1.84	-1.27	-0.51	-0.53	68.8	100.9	71.2	104.5	2.56	-0.53	68.8	100.9	69634.3
748.0	12.47	70.0	102.7	791+34	68.8	100.9	696+34	2.53	-1.48	-0.72	-0.74	67.8	99.4	70.7	103.6	2.79	-0.74	67.8	99.4	69834.5
750.0	12.50	70.0	102.7	793+35	67.8	99.4	698+35	3.16	-1.68	-0.90	-0.92	66.5	97.5	69.9	102.5	3.11	-0.92	66.5	97.5	70031.4
752.0	12.53	70.0	102.7	795+31	66.5	97.5	700+31	3.25	-1.69	-0.90	-0.93	65.2	95.7	68.9	101.0	3.51	-0.93	65.2	95.7	70224.6
754.0	12.57	70.0	102.7	797+25	65.2	95.7	702+25	3.00	-1.60	-0.79	-0.81	64.1	94.1	67.9	99.6	3.91	-0.81	64.1	94.1	70414.4
756.0	12.60	70.0	102.7	799+14	64.1	94.1	704+14	2.48	-1.42	-0.60	-0.62	63.3	92.8	67.0	98.3	4.26	-0.62	63.3	92.8	70601.3
758.0	12.63	70.0	102.7	801+01	63.3	92.8	706+01	1.96	-1.24	-0.41	-0.42	62.7	92.0	66.4	97.4	4.53	-0.42	62.7	92.0	70786.1
760.0	12.67	70.0	102.7	802+86	62.7	92.0	707+86	1.45	-1.07	-0.23	-0.24	62.4	91.5	65.9	96.7	4.71	-0.24	62.4	91.5	70969.5
762.0	12.70	70.0	102.7	804+70	62.4	91.5	709+70	0.93	-0.90	-0.06	-0.06	62.3	91.4	65.7	96.3	4.81	-0.06	62.3	91.4	71152.4
764.0	12.73	70.0	102.7	806+52	62.3	91.4	711+52	0.41	-0.73	0.11	0.10	62.4	91.6	65.6	96.2	4.84	0.10	62.4	91.6	71335.4
766.0	12.77	70.0	102.7	808+35	62.4	91.6	713+35	-0.11	-0.57	0.27	0.26	62.8	92.1	65.7	96.4	4.79	0.26	62.8	92.1	71519.1
768.0	12.80	70.0	102.7	810+19	62.8	92.1	715+19	-0.56	-0.42	0.41	0.39	63.3	92.9	66.0	96.8	4.68	0.39	63.3	92.9	71704.1
770.0	12.83	70.0	102.7	812+04	63.3	92.9	717+04	-0.62	-0.41	0.41	0.40	63.9	93.7	66.4	97.4	4.51	0.40	63.9	93.7	71890.6
772.0	12.87	70.0	102.7	813+91	63.9	93.7	718+91	-0.62	-0.42	0.40	0.39	64.4	94.5	66.8	98.0	4.34	0.39	64.4	94.5	72078.8
774.0	12.90	70.0	102.7	815+79	64.4	94.5	720+79	-0.62	-0.42	0.39	0.38	64.9	95.2	67.3	98.6	4.17	0.38	64.9	95.2	72268.5
776.0	12.93	70.0	102.7	817+69	64.9	95.2	722+69	-0.62	-0.43	0.38	0.37	65.4	96.0	67.7	99.2	4.01	0.37	65.4	96.0	72459.7
778.0	12.97	70.0	102.7	819+60	65.4	96.0	724+60	-0.58	-0.45	0.35	0.34	65.9	96.6	68.1	99.8	3.85	0.34	65.9	96.6	72652.3
780.0	13.00	70.0	102.7	821+52	65.9	96.6	726+52	-0.42	-0.50	0.29	0.28	66.3	97.2	68.4	100.3	3.70	0.28	66.3	97.2	72846.1

1		2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Elapsed Time		Desired Speed		Actual Station	Start of Interval			Local Grade	Limiting acceleration			New speed based on vehicle performance		Limiting acceleration and speed based on driver preferences			Actual acceleration	End of Interval		
					Speed		Position		Coasting	Power	Effective			Speed		Acceleration		New Speed		New Position
(sec)	(Min)	(mph)	(ft/sec)	FYI	(mph)	(ft/sec)	(ft)	(%)	(ft/sec2)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(mph)	(ft/sec)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(ft)
782.0	13.03	70.0	102.7	823+46	66.3	97.2	728+46	-0.25	-0.56	0.23	0.22	66.6	97.6	68.7	100.8	3.58	0.22	66.6	97.6	73041.0
784.0	13.07	70.0	102.7	825+41	66.6	97.6	730+41	-0.09	-0.62	0.17	0.16	66.8	98.0	69.0	101.1	3.48	0.16	66.8	98.0	73236.6
786.0	13.10	70.0	102.7	827+37	66.8	98.0	732+37	0.10	-0.68	0.11	0.10	66.9	98.2	69.1	101.4	3.41	0.10	66.9	98.2	73432.7
788.0	13.13	70.0	102.7	829+33	66.9	98.2	734+33	0.24	-0.73	0.05	0.05	67.0	98.3	69.2	101.5	3.37	0.05	67.0	98.3	73629.2
790.0	13.17	70.0	102.7	831+29	67.0	98.3	736+29	0.41	-0.78	0.00	0.00	67.0	98.3	69.3	101.6	3.35	0.00	67.0	98.3	73825.8
792.0	13.20	70.0	102.7	833+26	67.0	98.3	738+26	0.57	-0.83	-0.05	-0.05	66.9	98.2	69.3	101.6	3.35	-0.05	66.9	98.2	74022.2
794.0	13.23	70.0	102.7	835+22	66.9	98.2	740+22	0.62	-0.85	-0.06	-0.07	66.9	98.0	69.2	101.5	3.37	-0.07	66.9	98.0	74218.5
796.0	13.27	70.0	102.7	837+18	66.9	98.0	742+18	0.62	-0.85	-0.06	-0.06	66.8	97.9	69.2	101.4	3.40	-0.06	66.8	97.9	74414.4
798.0	13.30	70.0	102.7	839+14	66.8	97.9	744+14	0.62	-0.85	-0.06	-0.06	66.7	97.8	69.1	101.3	3.43	-0.06	66.7	97.8	74610.1
800.0	13.33	70.0	102.7	841+10	66.7	97.8	746+10	0.62	-0.84	-0.06	-0.06	66.6	97.7	69.0	101.2	3.45	-0.06	66.6	97.7	74805.6
802.0	13.37	70.0	102.7	843+06	66.6	97.7	748+06	0.62	-0.84	-0.06	-0.06	66.5	97.6	69.0	101.2	3.48	-0.06	66.5	97.6	75000.8
804.0	13.40	70.0	102.7	845+01	66.5	97.6	750+01	0.62	-0.84	-0.05	-0.06	66.4	97.4	68.9	101.1	3.50	-0.06	66.4	97.4	75195.9
806.0	13.43	70.0	102.7	846+96	66.4	97.4	751+96	0.62	-0.84	-0.05	-0.05	66.4	97.3	68.8	101.0	3.53	-0.05	66.4	97.3	75390.6
808.0	13.47	70.0	102.7	848+91	66.4	97.3	753+91	0.62	-0.84	-0.05	-0.05	66.3	97.2	68.8	100.9	3.55	-0.05	66.3	97.2	75585.2
810.0	13.50	70.0	102.7	850+85	66.3	97.2	755+85	0.62	-0.84	-0.05	-0.05	66.2	97.1	68.7	100.8	3.57	-0.05	66.2	97.1	75779.6
812.0	13.53	70.0	102.7	852+80	66.2	97.1	757+80	0.62	-0.84	-0.05	-0.05	66.2	97.0	68.7	100.7	3.60	-0.05	66.2	97.0	75973.7
814.0	13.57	70.0	102.7	854+74	66.2	97.0	759+74	0.62	-0.84	-0.05	-0.05	66.1	96.9	68.6	100.7	3.62	-0.05	66.1	96.9	76167.7
816.0	13.60	70.0	102.7	856+68	66.1	96.9	761+68	0.62	-0.84	-0.04	-0.05	66.0	96.8	68.6	100.6	3.64	-0.05	66.0	96.8	76361.5
818.0	13.63	70.0	102.7	858+61	66.0	96.8	763+61	0.62	-0.84	-0.04	-0.04	66.0	96.8	68.5	100.5	3.66	-0.04	66.0	96.8	76555.1
820.0	13.67	70.0	102.7	860+55	66.0	96.8	765+55	0.62	-0.84	-0.04	-0.04	65.9	96.7	68.5	100.4	3.68	-0.04	65.9	96.7	76748.5
822.0	13.70	70.0	102.7	862+49	65.9	96.7	767+49	0.62	-0.84	-0.04	-0.04	65.9	96.6	68.4	100.4	3.70	-0.04	65.9	96.6	76941.8
824.0	13.73	70.0	102.7	864+42	65.9	96.6	769+42	0.62	-0.84	-0.04	-0.04	65.8	96.5	68.4	100.3	3.71	-0.04	65.8	96.5	77134.9
826.0	13.77	70.0	102.7	866+35	65.8	96.5	771+35	0.62	-0.83	-0.04	-0.04	65.7	96.4	68.3	100.2	3.73	-0.04	65.7	96.4	77327.8
828.0	13.80	70.0	102.7	868+28	65.7	96.4	773+28	0.50	-0.80	0.00	0.00	65.7	96.4	68.3	100.2	3.75	0.00	65.7	96.4	77520.6
830.0	13.83	70.0	102.7	870+21	65.7	96.4	775+21	0.28	-0.72	0.07	0.07	65.8	96.6	68.3	100.2	3.75	0.07	65.8	96.6	77713.6
832.0	13.87	70.0	102.7	872+14	65.8	96.6	777+14	0.05	-0.65	0.14	0.14	66.0	96.8	68.4	100.3	3.72	0.14	66.0	96.8	77907.0
834.0	13.90	70.0	102.7	874+07	66.0	96.8	779+07	-0.18	-0.58	0.21	0.20	66.3	97.2	68.5	100.5	3.66	0.20	66.3	97.2	78101.1
836.0	13.93	70.0	102.7	876+01	66.3	97.2	781+01	-0.40	-0.51	0.28	0.27	66.7	97.8	68.7	100.8	3.57	0.27	66.7	97.8	78296.1
838.0	13.97	70.0	102.7	877+96	66.7	97.8	782+96	-0.40	-0.52	0.27	0.26	67.0	98.3	69.0	101.2	3.46	0.26	67.0	98.3	78492.2
840.0	14.00	70.0	102.7	879+92	67.0	98.3	784+92	-0.63	-0.45	0.33	0.32	67.5	98.9	69.3	101.6	3.34	0.32	67.5	98.9	78689.4
842.0	14.03	70.0	102.7	881+89	67.5	98.9	786+89	-0.85	-0.38	0.39	0.38	68.0	99.7	69.6	102.1	3.20	0.38	68.0	99.7	78888.1
844.0	14.07	70.0	102.7	883+88	68.0	99.7	788+88	-1.08	-0.31	0.46	0.44	68.6	100.6	70.1	102.7	3.04	0.44	68.6	100.6	79088.4
846.0	14.10	70.0	102.7	885+88	68.6	100.6	790+88	-1.31	-0.25	0.51	0.50	69.3	101.6	70.5	103.4	2.85	0.50	69.3	101.6	79290.6
848.0	14.13	70.0	102.7	887+91	69.3	101.6	792+91	-1.53	-0.18	0.57	0.56	70.0	102.7	71.1	104.2	2.63	0.56	70.0	102.7	79494.9
850.0	14.17	70.0	102.7	889+95	70.0	102.7	794+95	-1.65	-0.15	0.59	0.58	70.8	103.8	70.0	102.7	0.00	0.00	70.0	102.7	79700.2
852.0	14.20	70.0	102.7	892+00	70.0	102.7	797+00	-1.65	-0.15	0.59	0.58	70.8	103.8	70.0	102.7	0.00	0.00	70.0	102.7	79905.6
854.0	14.23	70.0	102.7	894+06	70.0	102.7	799+06	-1.65	-0.15	0.59	0.58	70.8	103.8	70.0	102.7	0.00	0.00	70.0	102.7	80110.9
856.0	14.27	70.0	102.7	896+11	70.0	102.7	801+11	-1.65	-0.15	0.59	0.58	70.8	103.8	70.0	102.7	0.00	0.00	70.0	102.7	80316.2
858.0	14.30	70.0	102.7	898+16	70.0	102.7	803+16	-1.65	-0.15	0.59	0.58	70.8	103.8	70.0	102.7	0.00	0.00	70.0	102.7	80521.6
860.0	14.33	70.0	102.7	900+22	70.0	102.7	805+22	-1.65	-0.15	0.59	0.58	70.8	103.8	70.0	102.7	0.00	0.00	70.0	102.7	80726.9
862.0	14.37	70.0	102.7	902+27	70.0	102.7	807+27	-1.65	-0.15	0.59	0.58	70.8	103.8	70.0	102.7	0.00	0.00	70.0	102.7	80932.2
864.0	14.40	70.0	102.7	904+32	70.0	102.7	809+32	-1.65	-0.15	0.59	0.58	70.8	103.8	70.0	102.7	0.00	0.00	70.0	102.7	81137.6
866.0	14.43	70.0	102.7	906+38	70.0	102.7	811+38	-1.65	-0.15	0.59	0.58	70.8	103.8	70.0	102.7	0.00	0.00	70.0	102.7	81342.9
868.0	14.47	70.0	102.7	908+43	70.0	102.7	813+43	-1.65	-0.15	0.59	0.58	70.8	103.8	70.0	102.7	0.00	0.00	70.0	102.7	81548.2
870.0	14.50	70.0	102.7	910+48	70.0	102.7	815+48	-1.65	-0.15	0.59	0.58	70.8	103.8	70.0	102.7	0.00	0.00	70.0	102.7	81753.6
872.0	14.53	70.0	102.7	912+54	70.0	102.7	817+54	-1.65	-0.15	0.59	0.58	70.8	103.8	70.0	102.7	0.00	0.00	70.0	102.7	81958.9
874.0	14.57	70.0	102.7	914+59	70.0	102.7	819+59	-1.65	-0.15	0.59	0.58	70.8	103.8	70.0	102.7	0.00	0.00	70.0	102.7	82164.2
876.0	14.60	70.0	102.7	916+64	70.0	102.7	821+64	-1.65	-0.15	0.59	0.58	70.8	103.8	70.0	102.7	0.00	0.00	70.0	102.7	82369.6
878.0	14.63	70.0	102.7	918+70	70.0	102.7	823+70	-1.58	-0.18	0.57	0.55	70.8	103.8	70.0	102.7	0.00	0.00	70.0	102.7	82574.9
880.0	14.67	70.0	102.7	920+75	70.0	102.7	825+75	-1.08	-0.33	0.41	0.40	70.5	103.5	70.0	102.7	0.00	0.00	70.0	102.7	82780.2
882.0	14.70	70.0	102.7	922+80	70.0	102.7	827+80	-0.52	-0.52	0.23	0.22	70.3	103.1	70.0	102.7	0.00	0.00	70.0	102.7	82985.6
884.0	14.73	70.0	102.7	924+86	70.0	102.7	829+86	0.05	-0.70	0.05	0.05	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	83190.9
886.0	14.77	70.0	102.7	926+91	70.0	102.7	831+91	0.61	-0.88	-0.13	-0.13	69.8	102.4	70.0	102.7	0.00	-0.13	69.8	102.4	83396.0
888.0	14.80	70.0	102.7	928+96	69.8	102.4	833+96	1.18	-1.06	-0.31	-0.32	69.4	101.8	71.5	104.9	2.46	-0.32	69.4	101.8	83600.1
890.0	14.83	70.0	102.7	931+00	69.4	101.8	836+00	1.84	-1.27	-0.51	-0.53	68.7	100.7	71.2	104.4	2.59	-0.53	68.7	100.7	83802.6
892.0	14.87	70.0	102.7	933+03	68.7	100.7	838+03	2.32	-1.42	-0.65	-0.67	67.8	99.4	70.6	103.5	2.82	-0.67	67.8	99.4	84002.7
894.0	14.90	70.0	102.7	935+03	67.8	99.4	840+03	2.89	-1.59	-0.81	-0.84	66.6	97.7	69.9	102.5	3.11	-0.84	66.6	97.7	84199.8

1		2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Elapsed Time		Desired Speed		Actual Station	Start of Interval			Local Grade	Limiting acceleration			New speed based on vehicle performance		Limiting acceleration and speed based on driver preferences			Actual acceleration	End of Interval		
					Speed		Position		Coasting	Power	Effective			Speed		Acceleration		New Speed		New Position
(sec)	(Min)	(mph)	(ft/sec)	FYI	(mph)	(ft/sec)	(ft)	(%)	(ft/sec2)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(mph)	(ft/sec)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(ft)
896.0	14.93	70.0	102.7	937+00	66.6	97.7	842+00	3.32	-1.71	-0.92	-0.95	65.3	95.8	69.0	101.2	3.47	-0.95	65.3	95.8	84393.3
898.0	14.97	70.0	102.7	938+93	65.3	95.8	843+93	3.93	-1.90	-1.09	-1.12	63.8	93.6	68.0	99.7	3.88	-1.12	63.8	93.6	84582.7
900.0	15.00	70.0	102.7	940+83	63.8	93.6	845+83	4.00	-1.90	-1.07	-1.11	62.3	91.3	66.8	97.9	4.37	-1.11	62.3	91.3	84767.6
902.0	15.03	70.0	102.7	942+68	62.3	91.3	847+68	3.87	-1.85	-1.00	-1.03	60.9	89.3	65.6	96.2	4.85	-1.03	60.9	89.3	84948.2
904.0	15.07	70.0	102.7	944+48	60.9	89.3	849+48	3.43	-1.69	-0.82	-0.85	59.7	87.6	64.5	94.6	5.29	-0.85	59.7	87.6	85125.1
906.0	15.10	70.0	102.7	946+25	59.7	87.6	851+25	2.98	-1.53	-0.65	-0.68	58.8	86.2	63.6	93.2	5.66	-0.68	58.8	86.2	85298.9
908.0	15.13	70.0	102.7	947+99	58.8	86.2	852+99	2.98	-1.52	-0.63	-0.65	57.9	84.9	62.8	92.2	5.95	-0.65	57.9	84.9	85470.0
910.0	15.17	70.0	102.7	949+70	57.9	84.9	854+70	2.53	-1.37	-0.46	-0.48	57.2	84.0	62.1	91.2	6.23	-0.48	57.2	84.0	85638.9
912.0	15.20	70.0	102.7	951+39	57.2	84.0	856+39	2.07	-1.22	-0.30	-0.31	56.8	83.3	61.6	90.4	6.44	-0.31	56.8	83.3	85806.2
914.0	15.23	70.0	102.7	953+06	56.8	83.3	858+06	1.62	-1.07	-0.14	-0.15	56.6	83.0	61.3	89.9	6.58	-0.15	56.6	83.0	85972.5
916.0	15.27	70.0	102.7	954+73	56.6	83.0	859+73	1.17	-0.92	0.01	0.01	56.6	83.0	61.1	89.7	6.64	0.01	56.6	83.0	86138.6
918.0	15.30	70.0	102.7	956+39	56.6	83.0	861+39	0.73	-0.78	0.15	0.14	56.8	83.3	61.1	89.7	6.64	0.14	56.8	83.3	86305.0
920.0	15.33	70.0	102.7	958+05	56.8	83.3	863+05	0.60	-0.74	0.18	0.17	57.0	83.7	61.3	89.9	6.58	0.17	57.0	83.7	86472.0
922.0	15.37	70.0	102.7	959+72	57.0	83.7	864+72	0.60	-0.74	0.18	0.17	57.3	84.0	61.5	90.2	6.50	0.17	57.3	84.0	86639.6
924.0	15.40	70.0	102.7	961+40	57.3	84.0	866+40	0.60	-0.74	0.17	0.16	57.5	84.3	61.7	90.4	6.43	0.16	57.5	84.3	86808.0
926.0	15.43	70.0	102.7	963+08	57.5	84.3	868+08	0.60	-0.75	0.16	0.16	57.7	84.6	61.8	90.7	6.36	0.16	57.7	84.6	86977.0
928.0	15.47	70.0	102.7	964+77	57.7	84.6	869+77	0.60	-0.75	0.16	0.15	57.9	85.0	62.0	90.9	6.29	0.15	57.9	85.0	87146.6
930.0	15.50	70.0	102.7	966+47	57.9	85.0	871+47	0.60	-0.75	0.15	0.15	58.1	85.2	62.2	91.2	6.23	0.15	58.1	85.2	87316.8
932.0	15.53	70.0	102.7	968+17	58.1	85.2	873+17	0.60	-0.75	0.15	0.14	58.3	85.5	62.3	91.4	6.16	0.14	58.3	85.5	87487.6
934.0	15.57	70.0	102.7	969+88	58.3	85.5	874+88	0.60	-0.75	0.14	0.14	58.5	85.8	62.5	91.6	6.10	0.14	58.5	85.8	87658.9
936.0	15.60	70.0	102.7	971+59	58.5	85.8	876+59	0.60	-0.76	0.14	0.13	58.7	86.1	62.6	91.9	6.04	0.13	58.7	86.1	87830.8
938.0	15.63	70.0	102.7	973+31	58.7	86.1	878+31	0.60	-0.76	0.13	0.13	58.9	86.3	62.8	92.1	5.98	0.13	58.9	86.3	88003.2
940.0	15.67	70.0	102.7	975+03	58.9	86.3	880+03	0.60	-0.76	0.13	0.13	59.0	86.6	62.9	92.3	5.93	0.13	59.0	86.6	88176.1
942.0	15.70	70.0	102.7	976+76	59.0	86.6	881+76	0.60	-0.76	0.13	0.12	59.2	86.8	63.0	92.5	5.87	0.12	59.2	86.8	88349.5
944.0	15.73	70.0	102.7	978+50	59.2	86.8	883+50	0.63	-0.77	0.11	0.11	59.3	87.0	63.2	92.7	5.82	0.11	59.3	87.0	88523.4
946.0	15.77	70.0	102.7	980+23	59.3	87.0	885+23	0.86	-0.85	0.04	0.03	59.4	87.1	63.3	92.8	5.77	0.03	59.4	87.1	88697.6
948.0	15.80	70.0	102.7	981+98	59.4	87.1	886+98	0.86	-0.85	0.03	0.03	59.4	87.2	63.3	92.9	5.76	0.03	59.4	87.2	88871.9
950.0	15.83	70.0	102.7	983+72	59.4	87.2	888+72	1.12	-0.93	-0.05	-0.05	59.4	87.1	63.4	92.9	5.75	-0.05	59.4	87.1	89046.1
952.0	15.87	70.0	102.7	985+46	59.4	87.1	890+46	1.38	-1.01	-0.13	-0.14	59.2	86.8	63.3	92.8	5.77	-0.14	59.2	86.8	89220.0
954.0	15.90	70.0	102.7	987+20	59.2	86.8	892+20	1.64	-1.10	-0.21	-0.22	58.9	86.4	63.2	92.6	5.83	-0.22	58.9	86.4	89393.2
956.0	15.93	70.0	102.7	988+93	58.9	86.4	893+93	1.87	-1.17	-0.27	-0.29	58.5	85.8	62.9	92.3	5.92	-0.29	58.5	85.8	89565.3
958.0	15.97	70.0	102.7	990+65	58.5	85.8	895+65	1.90	-1.17	-0.28	-0.29	58.1	85.2	62.6	91.8	6.04	-0.29	58.1	85.2	89736.3
960.0	16.00	70.0	102.7	992+36	58.1	85.2	897+36	1.90	-1.17	-0.27	-0.28	57.7	84.7	62.3	91.4	6.17	-0.28	57.7	84.7	89906.2
962.0	16.03	70.0	102.7	994+06	57.7	84.7	899+06	1.90	-1.17	-0.26	-0.27	57.4	84.1	62.0	91.0	6.29	-0.27	57.4	84.1	90075.0
964.0	16.07	70.0	102.7	995+75	57.4	84.1	900+75	1.90	-1.16	-0.25	-0.26	57.0	83.6	61.7	90.5	6.40	-0.26	57.0	83.6	90242.8
966.0	16.10	70.0	102.7	997+43	57.0	83.6	902+43	1.90	-1.16	-0.24	-0.25	56.7	83.1	61.5	90.1	6.51	-0.25	56.7	83.1	90409.5
968.0	16.13	70.0	102.7	999+10	56.7	83.1	904+10	1.90	-1.16	-0.23	-0.24	56.3	82.6	61.2	89.7	6.62	-0.24	56.3	82.6	90575.3
970.0	16.17	70.0	102.7	1000+75	56.3	82.6	905+75	1.90	-1.15	-0.22	-0.23	56.0	82.2	60.9	89.4	6.72	-0.23	56.0	82.2	90740.1
972.0	16.20	70.0	102.7	1002+40	56.0	82.2	907+40	1.90	-1.15	-0.21	-0.22	55.7	81.7	60.7	89.0	6.82	-0.22	55.7	81.7	90904.1
974.0	16.23	70.0	102.7	1004+04	55.7	81.7	909+04	1.90	-1.15	-0.21	-0.21	55.4	81.3	60.4	88.7	6.92	-0.21	55.4	81.3	91067.1
976.0	16.27	70.0	102.7	1005+67	55.4	81.3	910+67	1.90	-1.15	-0.20	-0.21	55.2	80.9	60.2	88.3	7.01	-0.21	55.2	80.9	91229.3
978.0	16.30	70.0	102.7	1007+29	55.2	80.9	912+29	1.90	-1.14	-0.19	-0.20	54.9	80.5	60.0	88.0	7.10	-0.20	54.9	80.5	91390.7
980.0	16.33	70.0	102.7	1008+91	54.9	80.5	913+91	1.90	-1.14	-0.18	-0.19	54.6	80.1	59.8	87.7	7.19	-0.19	54.6	80.1	91551.3
982.0	16.37	70.0	102.7	1010+51	54.6	80.1	915+51	1.90	-1.14	-0.18	-0.18	54.4	79.7	59.6	87.4	7.27	-0.18	54.4	79.7	91711.1
984.0	16.40	70.0	102.7	1012+11	54.4	79.7	917+11	1.88	-1.13	-0.16	-0.17	54.1	79.4	59.4	87.1	7.35	-0.17	54.1	79.4	91870.3
986.0	16.43	70.0	102.7	1013+70	54.1	79.4	918+70	1.88	-1.13	-0.16	-0.16	53.9	79.1	59.2	86.8	7.43	-0.16	53.9	79.1	92028.8
988.0	16.47	70.0	102.7	1015+29	53.9	79.1	920+29	1.42	-0.98	0.00	0.00	53.9	79.1	59.0	86.6	7.50	0.00	53.9	79.1	92186.9
990.0	16.50	70.0	102.7	1016+87	53.9	79.1	921+87	0.78	-0.77	0.20	0.19	54.2	79.4	59.0	86.6	7.50	0.19	54.2	79.4	92345.4
992.0	16.53	70.0	102.7	1018+45	54.2	79.4	923+45	0.13	-0.56	0.40	0.38	54.7	80.2	59.2	86.9	7.42	0.38	54.7	80.2	92505.0
994.0	16.57	70.0	102.7	1020+05	54.7	80.2	925+05	-0.51	-0.36	0.59	0.56	55.5	81.3	59.6	87.5	7.25	0.56	55.5	81.3	92666.6
996.0	16.60	70.0	102.7	1021+67	55.5	81.3	926+67	-0.51	-0.37	0.57	0.55	56.2	82.4	60.2	88.3	7.01	0.55	56.2	82.4	92830.3
998.0	16.63	70.0	102.7	1023+30	56.2	82.4	928+30	-1.15	-0.17	0.75	0.72	57.2	83.9	60.8	89.2	6.77	0.72	57.2	83.9	92996.6
1000.0	16.67	70.0	102.7	1024+97	57.2	83.9	929+97	-1.79	0.03	0.93	0.90	58.4	85.7	61.6	90.3	6.46	0.90	58.4	85.7	93166.2
1002.0	16.70	70.0	102.7	1026+66	58.4	85.7	931+66	-2.44	0.22	1.11	1.07	59.9	87.8	62.6	91.7	6.07	1.07	59.9	87.8	93339.6
1004.0	16.73	70.0	102.7	1028+40	59.9	87.8	933+40	-2.90	0.36	1.22	1.18	61.5	90.2	63.7	93.4	5.61	1.18	61.5	90.2	93517.6
1006.0	16.77	70.0	102.7	1030+18	61.5	90.2	935+18	-2.92	0.35	1.19	1.15	63.0	92.5	65.0	95.3	5.10	1.15	63.0	92.5	93700.2
1008.0	16.80	70.0	102.7	1032+00	63.0	92.5	937+00	-2.92	0.33	1.15	1.12	64.6	94.7	66.2	97.1	4.60	1.12	64.6	94.7	93887.4

1		2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Elapsed Time		Desired Speed		Actual Station	Start of Interval			Local Grade	Limiting acceleration			New speed based on vehicle performance		Limiting acceleration and speed based on driver preferences			Actual acceleration	End of Interval		
					Speed		Position		Coasting	Power	Effective			Speed		Acceleration		New Speed		New Position
(sec)	(Min)	(mph)	(ft/sec)	FYI	(mph)	(ft/sec)	(ft)	(%)	(ft/sec2)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(mph)	(ft/sec)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(ft)
1010.0	16.83	70.0	102.7	1033+87	64.6	94.7	938+87	-2.92	0.32	1.12	1.08	66.0	96.9	67.4	98.8	4.12	1.08	66.0	96.9	94078.9
1012.0	16.87	70.0	102.7	1035+79	66.0	96.9	940+79	-2.92	0.30	1.09	1.05	67.5	99.0	68.5	100.5	3.65	1.05	67.5	99.0	94274.8
1014.0	16.90	70.0	102.7	1037+75	67.5	99.0	942+75	-2.92	0.28	1.05	1.02	68.9	101.0	69.7	102.2	3.20	1.02	68.9	101.0	94474.8
1016.0	16.93	70.0	102.7	1039+75	68.9	101.0	944+75	-2.92	0.27	1.02	0.99	70.2	103.0	70.8	103.8	2.76	0.99	70.2	103.0	94678.8
1018.0	16.97	70.0	102.7	1041+79	70.0	102.7	946+79	-2.92	0.26	1.00	0.97	71.3	104.6	70.0	102.7	0.00	0.00	70.0	102.7	94884.1
1020.0	17.00	70.0	102.7	1043+84	70.0	102.7	948+84	-2.92	0.26	1.00	0.97	71.3	104.6	70.0	102.7	0.00	0.00	70.0	102.7	95089.5
1022.0	17.03	70.0	102.7	1045+89	70.0	102.7	950+89	-2.92	0.26	1.00	0.97	71.3	104.6	70.0	102.7	0.00	0.00	70.0	102.7	95294.8
1024.0	17.07	70.0	102.7	1047+95	70.0	102.7	952+95	-2.84	0.23	0.97	0.95	71.3	104.6	70.0	102.7	0.00	0.00	70.0	102.7	95500.1
1026.0	17.10	70.0	102.7	1050+00	70.0	102.7	955+00	-2.32	0.06	0.81	0.78	71.1	104.2	70.0	102.7	0.00	0.00	70.0	102.7	95705.5
1028.0	17.13	70.0	102.7	1052+05	70.0	102.7	957+05	-2.05	-0.02	0.72	0.70	71.0	104.1	70.0	102.7	0.00	0.00	70.0	102.7	95910.8
1030.0	17.17	70.0	102.7	1054+11	70.0	102.7	959+11	-1.78	-0.11	0.64	0.62	70.8	103.9	70.0	102.7	0.00	0.00	70.0	102.7	96116.1
1032.0	17.20	70.0	102.7	1056+16	70.0	102.7	961+16	-1.52	-0.19	0.55	0.54	70.7	103.7	70.0	102.7	0.00	0.00	70.0	102.7	96321.5
1034.0	17.23	70.0	102.7	1058+21	70.0	102.7	963+21	-1.25	-0.28	0.47	0.45	70.6	103.6	70.0	102.7	0.00	0.00	70.0	102.7	96526.8
1036.0	17.27	70.0	102.7	1060+27	70.0	102.7	965+27	-0.99	-0.36	0.38	0.37	70.5	103.4	70.0	102.7	0.00	0.00	70.0	102.7	96732.1
1038.0	17.30	70.0	102.7	1062+32	70.0	102.7	967+32	-0.92	-0.39	0.36	0.35	70.5	103.4	70.0	102.7	0.00	0.00	70.0	102.7	96937.5
1040.0	17.33	70.0	102.7	1064+37	70.0	102.7	969+37	-0.92	-0.39	0.36	0.35	70.5	103.4	70.0	102.7	0.00	0.00	70.0	102.7	97142.8
1042.0	17.37	70.0	102.7	1066+43	70.0	102.7	971+43	-0.92	-0.39	0.36	0.35	70.5	103.4	70.0	102.7	0.00	0.00	70.0	102.7	97348.1
1044.0	17.40	70.0	102.7	1068+48	70.0	102.7	973+48	-0.92	-0.39	0.36	0.35	70.5	103.4	70.0	102.7	0.00	0.00	70.0	102.7	97553.5
1046.0	17.43	70.0	102.7	1070+53	70.0	102.7	975+53	-0.92	-0.39	0.36	0.35	70.5	103.4	70.0	102.7	0.00	0.00	70.0	102.7	97758.8
1048.0	17.47	70.0	102.7	1072+59	70.0	102.7	977+59	-0.85	-0.41	0.34	0.33	70.4	103.3	70.0	102.7	0.00	0.00	70.0	102.7	97964.1
1050.0	17.50	70.0	102.7	1074+64	70.0	102.7	979+64	-0.48	-0.53	0.22	0.21	70.3	103.1	70.0	102.7	0.00	0.00	70.0	102.7	98169.5
1052.0	17.53	70.0	102.7	1076+69	70.0	102.7	981+69	0.05	-0.70	0.05	0.05	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	98374.8
1054.0	17.57	70.0	102.7	1078+75	70.0	102.7	983+75	0.48	-0.84	-0.09	-0.09	69.9	102.5	70.0	102.7	0.00	-0.09	69.9	102.5	98580.0
1056.0	17.60	70.0	102.7	1080+80	69.9	102.5	985+80	0.90	-0.97	-0.22	-0.23	69.6	102.0	71.5	104.9	2.44	-0.23	69.6	102.0	98784.5
1058.0	17.63	70.0	102.7	1082+84	69.6	102.0	987+84	1.33	-1.11	-0.35	-0.36	69.1	101.3	71.3	104.6	2.54	-0.36	69.1	101.3	98987.8
1060.0	17.67	70.0	102.7	1084+88	69.1	101.3	989+88	1.76	-1.24	-0.48	-0.49	68.4	100.3	70.9	104.0	2.69	-0.49	68.4	100.3	99189.4
1062.0	17.70	70.0	102.7	1086+89	68.4	100.3	991+89	2.18	-1.37	-0.60	-0.61	67.6	99.1	70.4	103.2	2.91	-0.61	67.6	99.1	99388.9
1064.0	17.73	70.0	102.7	1088+89	67.6	99.1	993+89	2.30	-1.40	-0.62	-0.63	66.7	97.8	69.7	102.3	3.17	-0.63	66.7	97.8	99585.8
1066.0	17.77	70.0	102.7	1090+86	66.7	97.8	995+86	2.30	-1.39	-0.60	-0.61	65.9	96.6	69.0	101.3	3.45	-0.61	65.9	96.6	99780.2
1068.0	17.80	70.0	102.7	1092+80	65.9	96.6	997+80	2.15	-1.33	-0.53	-0.55	65.1	95.5	68.4	100.3	3.71	-0.55	65.1	95.5	99972.3
1070.0	17.83	70.0	102.7	1094+72	65.1	95.5	999+72	1.66	-1.16	-0.35	-0.37	64.6	94.8	67.8	99.4	3.95	-0.37	64.6	94.8	100162.6
1072.0	17.87	70.0	102.7	1096+63	64.6	94.8	1001+63	1.14	-0.99	-0.18	-0.19	64.4	94.4	67.4	98.9	4.11	-0.19	64.4	94.4	100351.8
1074.0	17.90	70.0	102.7	1098+52	64.4	94.4	1003+52	0.63	-0.82	-0.01	-0.01	64.3	94.4	67.2	98.6	4.19	-0.01	64.3	94.4	100540.5
1076.0	17.93	70.0	102.7	1100+41	64.3	94.4	1005+41	0.12	-0.66	0.15	0.15	64.6	94.7	67.2	98.6	4.19	0.15	64.6	94.7	100729.6
1078.0	17.97	70.0	102.7	1102+30	64.6	94.7	1007+30	-0.40	-0.50	0.31	0.30	65.0	95.3	67.4	98.8	4.13	0.30	65.0	95.3	100919.6
1080.0	18.00	70.0	102.7	1104+20	65.0	95.3	1009+20	-0.91	-0.33	0.47	0.45	65.6	96.2	67.7	99.3	3.99	0.45	65.6	96.2	101111.0
1082.0	18.03	70.0	102.7	1106+11	65.6	96.2	1011+11	-1.41	-0.18	0.61	0.59	66.4	97.4	68.2	100.0	3.80	0.59	66.4	97.4	101304.6
1084.0	18.07	70.0	102.7	1108+05	66.4	97.4	1013+05	-1.55	-0.14	0.64	0.62	67.2	98.6	68.8	100.9	3.54	0.62	67.2	98.6	101500.6
1086.0	18.10	70.0	102.7	1110+01	67.2	98.6	1015+01	-1.55	-0.15	0.62	0.60	68.1	99.8	69.5	101.9	3.27	0.60	68.1	99.8	101699.1
1088.0	18.13	70.0	102.7	1111+99	68.1	99.8	1016+99	-1.55	-0.16	0.60	0.59	68.9	101.0	70.1	102.8	3.01	0.59	68.9	101.0	101899.9
1090.0	18.17	70.0	102.7	1114+00	68.9	101.0	1019+00	-1.55	-0.17	0.59	0.57	69.6	102.2	70.8	103.8	2.76	0.57	69.6	102.2	102103.1
1092.0	18.20	70.0	102.7	1116+03	69.6	102.2	1021+03	-1.55	-0.18	0.57	0.55	70.4	103.3	71.4	104.7	2.51	0.55	70.4	103.3	102308.5
1094.0	18.23	70.0	102.7	1118+09	70.0	102.7	1023+09	-1.55	-0.18	0.56	0.55	70.7	103.8	70.0	102.7	0.00	0.00	70.0	102.7	102513.8
1096.0	18.27	70.0	102.7	1120+14	70.0	102.7	1025+14	-1.28	-0.27	0.48	0.46	70.6	103.6	70.0	102.7	0.00	0.00	70.0	102.7	102719.2
1098.0	18.30	70.0	102.7	1122+19	70.0	102.7	1027+19	-0.53	-0.51	0.24	0.23	70.3	103.1	70.0	102.7	0.00	0.00	70.0	102.7	102924.5
1100.0	18.33	70.0	102.7	1124+25	70.0	102.7	1029+25	0.22	-0.75	-0.01	-0.01	70.0	102.7	70.0	102.7	0.00	-0.01	70.0	102.7	103129.8
1102.0	18.37	70.0	102.7	1126+30	70.0	102.7	1031+30	1.16	-1.06	-0.31	-0.32	69.6	102.0	71.6	105.1	2.40	-0.32	69.6	102.0	103334.5
1104.0	18.40	70.0	102.7	1128+35	69.6	102.0	1033+35	1.97	-1.31	-0.56	-0.57	68.8	100.9	71.3	104.6	2.54	-0.57	68.8	100.9	103537.4
1106.0	18.43	70.0	102.7	1130+37	68.8	100.9	1035+37	2.70	-1.54	-0.77	-0.80	67.7	99.3	70.7	103.7	2.79	-0.80	67.7	99.3	103737.6
1108.0	18.47	70.0	102.7	1132+38	67.7	99.3	1037+38	3.44	-1.77	-0.99	-1.02	66.3	97.3	69.8	102.4	3.13	-1.02	66.3	97.3	103934.1
1110.0	18.50	70.0	102.7	1134+34	66.3	97.3	1039+34	3.98	-1.92	-1.12	-1.16	64.7	94.9	68.7	100.8	3.57	-1.16	64.7	94.9	104126.3
1112.0	18.53	70.0	102.7	1136+26	64.7	94.9	1041+26	4.00	-1.91	-1.10	-1.13	63.2	92.7	67.5	99.0	4.07	-1.13	63.2	92.7	104313.9
1114.0	18.57	70.0	102.7	1138+14	63.2	92.7	1043+14	4.00	-1.90	-1.06	-1.10	61.7	90.5	66.3	97.2	4.56	-1.10	61.7	90.5	104497.1
1116.0	18.60	70.0	102.7	1139+97	61.7	90.5	1044+97	4.00	-1.88	-1.02	-1.06	60.2	88.4	65.1	95.5	5.03	-1.06	60.2	88.4	104676.0
1118.0	18.63	70.0	102.7	1141+76	60.2	88.4	1046+76	4.00	-1.87	-0.99	-1.03	58.8	86.3	64.0	93.9	5.49	-1.03	58.8	86.3	104850.6
1120.0	18.67	70.0	102.7	1143+51	58.8	86.3	1048+51	4.00	-1.85	-0.95	-0.99	57.5	84.3	62.9	92.2	5.93	-0.99	57.5	84.3	105021.3
1122.0	18.70	70.0	102.7	1145+21	57.5	84.3	1050+21	3.66	-1.73	-0.81	-0.85	56.3	82.6	61.8	90.7	6.36	-0.85	56.3	82.6	105188.2

1		2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Elapsed Time		Desired Speed		Actual Station	Start of Interval			Local Grade	Limiting acceleration			New speed based on vehicle performance		Limiting acceleration and speed based on driver preferences			Actual acceleration	End of Interval		
					Speed		Position		Coasting	Power	Effective			Speed		Acceleration		New Speed		New Position
(sec)	(Min)	(mph)	(ft/sec)	FYI	(mph)	(ft/sec)	(ft)	(%)	(ft/sec2)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(mph)	(ft/sec)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(ft)
1124.0	18.73	70.0	102.7	1146+88	56.3	82.6	1051+88	2.98	-1.50	-0.57	-0.59	55.5	81.5	60.9	89.4	6.73	-0.59	55.5	81.5	105352.3
1126.0	18.77	70.0	102.7	1148+52	55.5	81.5	1053+52	2.30	-1.27	-0.33	-0.34	55.1	80.8	60.3	88.4	6.98	-0.34	55.1	80.8	105514.5
1128.0	18.80	70.0	102.7	1150+15	55.1	80.8	1055+15	1.62	-1.05	-0.10	-0.10	54.9	80.6	59.9	87.9	7.13	-0.10	54.9	80.6	105675.8
1130.0	18.83	70.0	102.7	1151+76	54.9	80.6	1056+76	1.62	-1.05	-0.10	-0.10	54.8	80.4	59.8	87.7	7.18	-0.10	54.8	80.4	105836.7
1132.0	18.87	70.0	102.7	1153+37	54.8	80.4	1058+37	0.94	-0.83	0.12	0.12	55.0	80.6	59.7	87.6	7.22	0.12	55.0	80.6	105997.7
1134.0	18.90	70.0	102.7	1154+98	55.0	80.6	1059+98	0.60	-0.72	0.23	0.22	55.3	81.0	59.8	87.8	7.17	0.22	55.3	81.0	106159.3
1136.0	18.93	70.0	102.7	1156+59	55.3	81.0	1061+59	0.60	-0.72	0.22	0.21	55.5	81.5	60.1	88.1	7.07	0.21	55.5	81.5	106321.8
1138.0	18.97	70.0	102.7	1158+22	55.5	81.5	1063+22	0.60	-0.73	0.21	0.20	55.8	81.9	60.3	88.4	6.98	0.20	55.8	81.9	106485.2
1140.0	19.00	70.0	102.7	1159+85	55.8	81.9	1064+85	0.60	-0.73	0.21	0.20	56.1	82.3	60.5	88.8	6.89	0.20	56.1	82.3	106649.3
1142.0	19.03	70.0	102.7	1161+49	56.1	82.3	1066+49	0.60	-0.73	0.20	0.19	56.3	82.6	60.7	89.1	6.81	0.19	56.3	82.6	106814.2
1144.0	19.07	70.0	102.7	1163+14	56.3	82.6	1068+14	0.60	-0.73	0.19	0.19	56.6	83.0	60.9	89.4	6.72	0.19	56.6	83.0	106979.9
1146.0	19.10	70.0	102.7	1164+80	56.6	83.0	1069+80	0.60	-0.74	0.19	0.18	56.8	83.4	61.1	89.7	6.64	0.18	56.8	83.4	107146.2
1148.0	19.13	70.0	102.7	1166+46	56.8	83.4	1071+46	0.60	-0.74	0.18	0.17	57.1	83.7	61.3	89.9	6.57	0.17	57.1	83.7	107313.3
1150.0	19.17	70.0	102.7	1168+13	57.1	83.7	1073+13	0.60	-0.74	0.17	0.17	57.3	84.1	61.5	90.2	6.49	0.17	57.3	84.1	107481.1
1152.0	19.20	70.0	102.7	1169+81	57.3	84.1	1074+81	0.60	-0.74	0.17	0.16	57.5	84.4	61.7	90.5	6.42	0.16	57.5	84.4	107649.6
1154.0	19.23	70.0	102.7	1171+50	57.5	84.4	1076+50	0.61	-0.75	0.16	0.15	57.7	84.7	61.9	90.7	6.35	0.15	57.7	84.7	107818.6
1156.0	19.27	70.0	102.7	1173+19	57.7	84.7	1078+19	0.76	-0.80	0.11	0.10	57.9	84.9	62.0	91.0	6.28	0.10	57.9	84.9	107988.2
1158.0	19.30	70.0	102.7	1174+88	57.9	84.9	1079+88	0.98	-0.87	0.03	0.03	57.9	85.0	62.1	91.1	6.24	0.03	57.9	85.0	108158.1
1160.0	19.33	70.0	102.7	1176+58	57.9	85.0	1081+58	1.13	-0.92	-0.02	-0.02	57.9	84.9	62.2	91.2	6.22	-0.02	57.9	84.9	108328.0
1162.0	19.37	70.0	102.7	1178+28	57.9	84.9	1083+28	1.14	-0.92	-0.02	-0.02	57.9	84.9	62.2	91.2	6.23	-0.02	57.9	84.9	108497.8
1164.0	19.40	70.0	102.7	1179+98	57.9	84.9	1084+98	1.14	-0.92	-0.02	-0.02	57.9	84.8	62.1	91.1	6.24	-0.02	57.9	84.8	108667.5
1166.0	19.43	70.0	102.7	1181+67	57.9	84.8	1086+67	1.14	-0.92	-0.02	-0.02	57.8	84.8	62.1	91.1	6.25	-0.02	57.8	84.8	108837.2
1168.0	19.47	70.0	102.7	1183+37	57.8	84.8	1088+37	1.14	-0.92	-0.02	-0.02	57.8	84.8	62.1	91.1	6.26	-0.02	57.8	84.8	109006.7
1170.0	19.50	70.0	102.7	1185+07	57.8	84.8	1090+07	1.14	-0.92	-0.02	-0.02	57.8	84.7	62.1	91.0	6.26	-0.02	57.8	84.7	109176.3
1172.0	19.53	70.0	102.7	1186+76	57.8	84.7	1091+76	1.14	-0.92	-0.02	-0.02	57.8	84.7	62.1	91.0	6.27	-0.02	57.8	84.7	109345.7
1174.0	19.57	70.0	102.7	1188+46	57.8	84.7	1093+46	1.14	-0.92	-0.01	-0.02	57.7	84.7	62.0	91.0	6.28	-0.02	57.7	84.7	109515.1
1176.0	19.60	70.0	102.7	1190+15	57.7	84.7	1095+15	1.14	-0.92	-0.01	-0.01	57.7	84.7	62.0	91.0	6.28	-0.01	57.7	84.7	109684.4
1178.0	19.63	70.0	102.7	1191+84	57.7	84.7	1096+84	1.14	-0.92	-0.01	-0.01	57.7	84.6	62.0	90.9	6.29	-0.01	57.7	84.6	109853.7
1180.0	19.67	70.0	102.7	1193+54	57.7	84.6	1098+54	1.14	-0.92	-0.01	-0.01	57.7	84.6	62.0	90.9	6.30	-0.01	57.7	84.6	110022.9
1182.0	19.70	70.0	102.7	1195+23	57.7	84.6	1100+23	1.14	-0.92	-0.01	-0.01	57.7	84.6	62.0	90.9	6.30	-0.01	57.7	84.6	110192.1
1184.0	19.73	70.0	102.7	1196+92	57.7	84.6	1101+92	1.14	-0.92	-0.01	-0.01	57.6	84.5	62.0	90.9	6.31	-0.01	57.6	84.5	110361.2
1186.0	19.77	70.0	102.7	1198+61	57.6	84.5	1103+61	1.14	-0.92	-0.01	-0.01	57.6	84.5	61.9	90.9	6.32	-0.01	57.6	84.5	110530.3
1188.0	19.80	70.0	102.7	1200+30	57.6	84.5	1105+30	1.14	-0.92	-0.01	-0.01	57.6	84.5	61.9	90.8	6.32	-0.01	57.6	84.5	110699.3
1190.0	19.83	70.0	102.7	1201+99	57.6	84.5	1106+99	1.14	-0.92	-0.01	-0.01	57.6	84.5	61.9	90.8	6.33	-0.01	57.6	84.5	110868.2
1192.0	19.87	70.0	102.7	1203+68	57.6	84.5	1108+68	1.14	-0.92	-0.01	-0.01	57.6	84.4	61.9	90.8	6.33	-0.01	57.6	84.4	111037.1
1194.0	19.90	70.0	102.7	1205+37	57.6	84.4	1110+37	1.14	-0.92	-0.01	-0.01	57.6	84.4	61.9	90.8	6.34	-0.01	57.6	84.4	111206.0
1196.0	19.93	70.0	102.7	1207+06	57.6	84.4	1112+06	1.14	-0.92	-0.01	-0.01	57.5	84.4	61.9	90.8	6.34	-0.01	57.5	84.4	111374.8
1198.0	19.97	70.0	102.7	1208+75	57.5	84.4	1113+75	1.14	-0.92	-0.01	-0.01	57.5	84.4	61.9	90.7	6.34	-0.01	57.5	84.4	111543.6
1200.0	20.00	70.0	102.7	1210+44	57.5	84.4	1115+44	1.14	-0.92	-0.01	-0.01	57.5	84.4	61.9	90.7	6.35	-0.01	57.5	84.4	111712.4
1202.0	20.03	70.0	102.7	1212+12	57.5	84.4	1117+12	1.14	-0.92	-0.01	-0.01	57.5	84.3	61.9	90.7	6.35	-0.01	57.5	84.3	111881.1
1204.0	20.07	70.0	102.7	1213+81	57.5	84.3	1118+81	1.14	-0.92	-0.01	-0.01	57.5	84.3	61.8	90.7	6.36	-0.01	57.5	84.3	112049.8
1206.0	20.10	70.0	102.7	1215+50	57.5	84.3	1120+50	1.14	-0.92	-0.01	-0.01	57.5	84.3	61.8	90.7	6.36	-0.01	57.5	84.3	112218.4
1208.0	20.13	70.0	102.7	1217+18	57.5	84.3	1122+18	1.14	-0.92	-0.01	-0.01	57.5	84.3	61.8	90.7	6.37	-0.01	57.5	84.3	112387.0
1210.0	20.17	70.0	102.7	1218+87	57.5	84.3	1123+87	1.11	-0.91	0.00	0.00	57.5	84.3	61.8	90.7	6.37	0.00	57.5	84.3	112555.6
1212.0	20.20	70.0	102.7	1220+56	57.5	84.3	1125+56	0.93	-0.85	0.06	0.06	57.6	84.4	61.8	90.7	6.37	0.06	57.6	84.4	112724.3
1214.0	20.23	70.0	102.7	1222+24	57.6	84.4	1127+24	0.72	-0.78	0.12	0.12	57.7	84.6	61.9	90.8	6.34	0.12	57.7	84.6	112893.4
1216.0	20.27	70.0	102.7	1223+93	57.7	84.6	1128+93	0.72	-0.79	0.12	0.12	57.9	84.9	62.0	90.9	6.29	0.12	57.9	84.9	113062.9
1218.0	20.30	70.0	102.7	1225+63	57.9	84.9	1130+63	0.51	-0.72	0.18	0.18	58.1	85.2	62.1	91.1	6.24	0.18	58.1	85.2	113233.0
1220.0	20.33	70.0	102.7	1227+33	58.1	85.2	1132+33	0.30	-0.65	0.25	0.24	58.4	85.7	62.3	91.4	6.17	0.24	58.4	85.7	113403.9
1222.0	20.37	70.0	102.7	1229+04	58.4	85.7	1134+04	0.09	-0.59	0.30	0.29	58.8	86.3	62.6	91.8	6.06	0.29	58.8	86.3	113575.9
1224.0	20.40	70.0	102.7	1230+76	58.8	86.3	1135+76	-0.13	-0.52	0.36	0.35	59.3	87.0	62.9	92.2	5.94	0.35	59.3	87.0	113749.2
1226.0	20.43	70.0	102.7	1232+49	59.3	87.0	1137+49	-0.34	-0.46	0.42	0.40	59.9	87.8	63.3	92.8	5.79	0.40	59.9	87.8	113924.0
1228.0	20.47	70.0	102.7	1234+24	59.9	87.8	1139+24	-0.55	-0.40	0.47	0.46	60.5	88.7	63.7	93.4	5.61	0.46	60.5	88.7	114100.5
1230.0	20.50	70.0	102.7	1236+01	60.5	88.7	1141+01	-0.76	-0.34	0.52	0.51	61.2	89.7	64.2	94.1	5.42	0.51	61.2	89.7	114278.9
1232.0	20.53	70.0	102.7	1237+79	61.2	89.7	1142+79	-0.76	-0.34	0.51	0.49	61.8	90.7	64.7	94.9	5.20	0.49	61.8	90.7	114459.4
1234.0	20.57	70.0	102.7	1239+59	61.8	90.7	1144+59	-0.94	-0.29	0.55	0.53	62.6	91.8	65.2	95.7	4.98	0.53	62.6	91.8	114641.8
1236.0	20.60	70.0	102.7	1241+42	62.6	91.8	1146+42	-0.97	-0.29	0.54	0.52	63.3	92.8	65.8	96.5	4.75	0.52	63.3	92.8	114826.4

1		2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Elapsed Time		Desired Speed		Actual Station	Start of Interval			Local Grade	Limiting acceleration			New speed based on vehicle performance		Limiting acceleration and speed based on driver preferences			Actual acceleration	End of Interval		
					Speed		Position		Coasting	Power	Effective			Speed		Acceleration		New Speed		New Position
(sec)	(Min)	(mph)	(ft/sec)	FYI	(mph)	(ft/sec)	(ft)	(%)	(ft/sec2)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(mph)	(ft/sec)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(ft)
1238.0	20.63	70.0	102.7	1243+26	63.3	92.8	1148+26	-0.97	-0.30	0.53	0.51	64.0	93.8	66.4	97.3	4.53	0.51	64.0	93.8	115013.1
1240.0	20.67	70.0	102.7	1245+13	64.0	93.8	1150+13	-0.97	-0.30	0.51	0.49	64.7	94.8	66.9	98.1	4.31	0.49	64.7	94.8	115201.7
1242.0	20.70	70.0	102.7	1247+02	64.7	94.8	1152+02	-0.97	-0.31	0.49	0.48	65.3	95.8	67.4	98.9	4.09	0.48	65.3	95.8	115392.3
1244.0	20.73	70.0	102.7	1248+92	65.3	95.8	1153+92	-0.97	-0.32	0.48	0.47	65.9	96.7	68.0	99.7	3.89	0.47	65.9	96.7	115584.8
1246.0	20.77	70.0	102.7	1250+85	65.9	96.7	1155+85	-0.97	-0.33	0.47	0.45	66.6	97.6	68.5	100.4	3.69	0.45	66.6	97.6	115779.2
1248.0	20.80	70.0	102.7	1252+79	66.6	97.6	1157+79	-0.97	-0.33	0.45	0.44	67.2	98.5	68.9	101.1	3.49	0.44	67.2	98.5	115975.3
1250.0	20.83	70.0	102.7	1254+75	67.2	98.5	1159+75	-0.97	-0.34	0.44	0.43	67.7	99.3	69.4	101.8	3.30	0.43	67.7	99.3	116173.1
1252.0	20.87	70.0	102.7	1256+73	67.7	99.3	1161+73	-0.97	-0.35	0.43	0.41	68.3	100.2	69.9	102.5	3.12	0.41	68.3	100.2	116372.6
1254.0	20.90	70.0	102.7	1258+73	68.3	100.2	1163+73	-0.97	-0.35	0.41	0.40	68.8	101.0	70.3	103.1	2.94	0.40	68.8	101.0	116573.7
1256.0	20.93	70.0	102.7	1260+74	68.8	101.0	1165+74	-0.97	-0.36	0.40	0.39	69.4	101.8	70.7	103.7	2.77	0.39	69.4	101.8	116776.5
1258.0	20.97	70.0	102.7	1262+76	69.4	101.8	1167+76	-0.97	-0.36	0.39	0.38	69.9	102.5	71.1	104.3	2.60	0.38	69.9	102.5	116980.7
1260.0	21.00	70.0	102.7	1264+81	69.9	102.5	1169+81	-0.97	-0.37	0.38	0.37	70.4	103.2	71.6	104.9	2.43	0.37	70.4	103.2	117186.5
1262.0	21.03	70.0	102.7	1266+86	70.0	102.7	1171+86	-0.97	-0.37	0.38	0.37	70.5	103.4	70.0	102.7	0.00	0.00	70.0	102.7	117391.8
1264.0	21.07	70.0	102.7	1268+92	70.0	102.7	1173+92	-0.97	-0.37	0.38	0.37	70.5	103.4	70.0	102.7	0.00	0.00	70.0	102.7	117597.1
1266.0	21.10	70.0	102.7	1270+97	70.0	102.7	1175+97	-0.97	-0.37	0.38	0.37	70.5	103.4	70.0	102.7	0.00	0.00	70.0	102.7	117802.5
1268.0	21.13	70.0	102.7	1273+02	70.0	102.7	1178+02	-0.97	-0.37	0.38	0.37	70.5	103.4	70.0	102.7	0.00	0.00	70.0	102.7	118007.8
1270.0	21.17	70.0	102.7	1275+08	70.0	102.7	1180+08	-0.97	-0.37	0.38	0.37	70.5	103.4	70.0	102.7	0.00	0.00	70.0	102.7	118213.1
1272.0	21.20	70.0	102.7	1277+13	70.0	102.7	1182+13	-1.10	-0.33	0.42	0.41	70.6	103.5	70.0	102.7	0.00	0.00	70.0	102.7	118418.5
1274.0	21.23	70.0	102.7	1279+18	70.0	102.7	1184+18	-1.57	-0.18	0.57	0.55	70.8	103.8	70.0	102.7	0.00	0.00	70.0	102.7	118623.8
1276.0	21.27	70.0	102.7	1281+24	70.0	102.7	1186+24	-2.05	-0.02	0.72	0.70	71.0	104.1	70.0	102.7	0.00	0.00	70.0	102.7	118829.1
1278.0	21.30	70.0	102.7	1283+29	70.0	102.7	1188+29	-2.53	0.13	0.87	0.85	71.2	104.4	70.0	102.7	0.00	0.00	70.0	102.7	119034.5
1280.0	21.33	75.0	110.0	1285+34	70.0	102.7	1190+34	-3.01	0.29	1.03	1.00	71.4	104.7	72.7	106.7	3.98	1.00	71.4	104.7	119241.8
1282.0	21.37	75.0	110.0	1287+42	71.4	104.7	1192+42	-3.35	0.38	1.11	1.08	72.8	106.8	73.8	108.2	3.55	1.08	72.8	106.8	119453.3
1284.0	21.40	75.0	110.0	1289+53	72.8	106.8	1194+53	-3.37	0.37	1.08	1.05	74.3	108.9	74.9	109.9	3.09	1.05	74.3	108.9	119669.1
1286.0	21.43	75.0	110.0	1291+69	74.3	108.9	1196+69	-3.37	0.35	1.05	1.03	75.7	111.0	76.1	111.6	2.63	1.03	75.7	111.0	119889.0
1288.0	21.47	75.0	110.0	1293+89	75.0	110.0	1198+89	-3.37	0.34	1.03	1.01	76.4	112.0	75.0	110.0	0.00	0.00	75.0	110.0	120109.0
1290.0	21.50	75.0	110.0	1296+09	75.0	110.0	1201+09	-3.37	0.34	1.03	1.01	76.4	112.0	75.0	110.0	0.00	0.00	75.0	110.0	120329.0
1292.0	21.53	75.0	110.0	1298+29	75.0	110.0	1203+29	-3.37	0.34	1.03	1.01	76.4	112.0	75.0	110.0	0.00	0.00	75.0	110.0	120549.0
1294.0	21.57	75.0	110.0	1300+49	75.0	110.0	1205+49	-3.37	0.34	1.03	1.01	76.4	112.0	75.0	110.0	0.00	0.00	75.0	110.0	120769.0
1296.0	21.60	75.0	110.0	1302+69	75.0	110.0	1207+69	-3.36	0.34	1.03	1.01	76.4	112.0	75.0	110.0	0.00	0.00	75.0	110.0	120989.0
1298.0	21.63	75.0	110.0	1304+89	75.0	110.0	1209+89	-3.11	0.26	0.95	0.93	76.3	111.9	75.0	110.0	0.00	0.00	75.0	110.0	121209.0
1300.0	21.67	70.0	102.7	1307+09	70.0	102.7	1212+09	-2.77	0.21	0.95	0.93	71.3	104.5	70.0	102.7	0.00	0.00	70.0	102.7	121414.3
1302.0	21.70	70.0	102.7	1309+14	70.0	102.7	1214+14	-2.43	0.10	0.84	0.82	71.1	104.3	70.0	102.7	0.00	0.00	70.0	102.7	121619.6
1304.0	21.73	70.0	102.7	1311+20	70.0	102.7	1216+20	-2.09	-0.01	0.73	0.71	71.0	104.1	70.0	102.7	0.00	0.00	70.0	102.7	121825.0
1306.0	21.77	70.0	102.7	1313+25	70.0	102.7	1218+25	-1.75	-0.12	0.62	0.61	70.8	103.9	70.0	102.7	0.00	0.00	70.0	102.7	122030.3
1308.0	21.80	70.0	102.7	1315+30	70.0	102.7	1220+30	-1.41	-0.23	0.52	0.50	70.7	103.7	70.0	102.7	0.00	0.00	70.0	102.7	122235.6
1310.0	21.83	70.0	102.7	1317+36	70.0	102.7	1222+36	-1.07	-0.34	0.41	0.40	70.5	103.5	70.0	102.7	0.00	0.00	70.0	102.7	122441.0
1312.0	21.87	70.0	102.7	1319+41	70.0	102.7	1224+41	-0.73	-0.45	0.30	0.29	70.4	103.2	70.0	102.7	0.00	0.00	70.0	102.7	122646.3
1314.0	21.90	70.0	102.7	1321+46	70.0	102.7	1226+46	-0.39	-0.56	0.19	0.18	70.3	103.0	70.0	102.7	0.00	0.00	70.0	102.7	122851.6
1316.0	21.93	70.0	102.7	1323+52	70.0	102.7	1228+52	-0.06	-0.67	0.08	0.08	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	123057.0
1318.0	21.97	70.0	102.7	1325+57	70.0	102.7	1230+57	0.04	-0.70	0.05	0.05	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	123262.3
1320.0	22.00	70.0	102.7	1327+62	70.0	102.7	1232+62	0.04	-0.70	0.05	0.05	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	123467.6
1322.0	22.03	70.0	102.7	1329+68	70.0	102.7	1234+68	0.04	-0.70	0.05	0.05	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	123673.0
1324.0	22.07	70.0	102.7	1331+73	70.0	102.7	1236+73	0.04	-0.70	0.05	0.05	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	123878.3
1326.0	22.10	70.0	102.7	1333+78	70.0	102.7	1238+78	0.04	-0.70	0.05	0.05	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	124083.6
1328.0	22.13	70.0	102.7	1335+84	70.0	102.7	1240+84	0.04	-0.70	0.05	0.05	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	124289.0
1330.0	22.17	70.0	102.7	1337+89	70.0	102.7	1242+89	-0.02	-0.68	0.07	0.07	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	124494.3
1332.0	22.20	70.0	102.7	1339+94	70.0	102.7	1244+94	-0.42	-0.55	0.20	0.19	70.3	103.1	70.0	102.7	0.00	0.00	70.0	102.7	124699.6
1334.0	22.23	70.0	102.7	1342+00	70.0	102.7	1247+00	-0.88	-0.40	0.35	0.34	70.5	103.3	70.0	102.7	0.00	0.00	70.0	102.7	124905.0
1336.0	22.27	70.0	102.7	1344+05	70.0	102.7	1249+05	-1.34	-0.25	0.49	0.48	70.7	103.6	70.0	102.7	0.00	0.00	70.0	102.7	125110.3
1338.0	22.30	70.0	102.7	1346+10	70.0	102.7	1251+10	-1.34	-0.25	0.49	0.48	70.7	103.6	70.0	102.7	0.00	0.00	70.0	102.7	125315.6
1340.0	22.33	70.0	102.7	1348+16	70.0	102.7	1253+16	-1.11	-0.33	0.42	0.41	70.6	103.5	70.0	102.7	0.00	0.00	70.0	102.7	125521.0
1342.0	22.37	70.0	102.7	1350+21	70.0	102.7	1255+21	-0.32	-0.58	0.17	0.16	70.2	103.0	70.0	102.7	0.00	0.00	70.0	102.7	125726.3
1344.0	22.40	70.0	102.7	1352+26	70.0	102.7	1257+26	0.49	-0.84	-0.09	-0.09	69.9	102.5	70.0	102.7	0.00	-0.09	69.9	102.5	125931.4
1346.0	22.43	70.0	102.7	1354+31	69.9	102.5	1259+31	1.07	-1.03	-0.28	-0.28	69.5	101.9	71.5	104.9	2.44	-0.28	69.5	101.9	126135.8
1348.0	22.47	70.0	102.7	1356+36	69.5	101.9	1261+36	1.10	-1.03	-0.28	-0.28	69.1	101.3	71.2	104.5	2.56	-0.28	69.1	101.3	126339.1
1350.0	22.50	70.0	102.7	1358+39	69.1	101.3	1263+39	1.10	-1.03	-0.27	-0.27	68.7	100.8	70.9	104.0	2.69	-0.27	68.7	100.8	126541.2

1		2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Elapsed Time		Desired Speed		Actual Station	Start of Interval			Local Grade	Limiting acceleration			New speed based on vehicle performance		Limiting acceleration and speed based on driver preferences			Actual acceleration	End of Interval		
					Speed		Position		Coasting	Power	Effective			Speed		Acceleration		New Speed		New Position
(sec)	(Min)	(mph)	(ft/sec)	FYI	(mph)	(ft/sec)	(ft)	(%)	(ft/sec2)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(mph)	(ft/sec)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(ft)
1352.0	22.53	70.0	102.7	1360+41	68.7	100.8	1265+41	1.10	-1.02	-0.26	-0.27	68.4	100.3	70.6	103.6	2.80	-0.27	68.4	100.3	126742.3
1354.0	22.57	70.0	102.7	1362+42	68.4	100.3	1267+42	1.10	-1.02	-0.25	-0.26	68.0	99.7	70.4	103.2	2.92	-0.26	68.0	99.7	126942.3
1356.0	22.60	70.0	102.7	1364+42	68.0	99.7	1269+42	1.10	-1.01	-0.24	-0.25	67.7	99.2	70.1	102.8	3.03	-0.25	67.7	99.2	127141.3
1358.0	22.63	70.0	102.7	1366+41	67.7	99.2	1271+41	1.10	-1.01	-0.24	-0.24	67.3	98.8	69.8	102.4	3.14	-0.24	67.3	98.8	127339.3
1360.0	22.67	70.0	102.7	1368+39	67.3	98.8	1273+39	1.10	-1.01	-0.23	-0.23	67.0	98.3	69.5	102.0	3.24	-0.23	67.0	98.3	127536.3
1362.0	22.70	70.0	102.7	1370+36	67.0	98.3	1275+36	1.10	-1.00	-0.22	-0.23	66.7	97.8	69.3	101.6	3.35	-0.23	66.7	97.8	127732.5
1364.0	22.73	70.0	102.7	1372+32	66.7	97.8	1277+32	0.85	-0.92	-0.13	-0.14	66.5	97.6	69.1	101.3	3.44	-0.14	66.5	97.6	127927.9
1366.0	22.77	70.0	102.7	1374+28	66.5	97.6	1279+28	0.34	-0.76	0.03	0.03	66.6	97.6	68.9	101.1	3.50	0.03	66.6	97.6	128123.0
1368.0	22.80	70.0	102.7	1376+23	66.6	97.6	1281+23	-0.16	-0.59	0.19	0.19	66.8	98.0	68.9	101.1	3.49	0.19	66.8	98.0	128318.7
1370.0	22.83	70.0	102.7	1378+19	66.8	98.0	1283+19	-0.66	-0.43	0.35	0.34	67.3	98.7	69.1	101.4	3.41	0.34	67.3	98.7	128515.3
1372.0	22.87	70.0	102.7	1380+15	67.3	98.7	1285+15	-1.17	-0.28	0.50	0.48	67.9	99.6	69.5	101.9	3.26	0.48	67.9	99.6	128713.6
1374.0	22.90	70.0	102.7	1382+14	67.9	99.6	1287+14	-1.67	-0.12	0.64	0.63	68.8	100.9	70.0	102.7	3.05	0.63	68.8	100.9	128914.2
1376.0	22.93	70.0	102.7	1384+14	68.8	100.9	1289+14	-2.17	0.03	0.79	0.76	69.8	102.4	70.7	103.7	2.78	0.76	69.8	102.4	129117.5
1378.0	22.97	70.0	102.7	1386+17	69.8	102.4	1291+17	-2.42	0.10	0.84	0.82	71.0	104.1	71.5	104.9	2.45	0.82	71.0	104.1	129324.0
1380.0	23.00	70.0	102.7	1388+24	70.0	102.7	1293+24	-2.42	0.10	0.84	0.82	71.1	104.3	70.0	102.7	0.00	0.00	70.0	102.7	129529.3
1382.0	23.03	70.0	102.7	1390+29	70.0	102.7	1295+29	-2.42	0.10	0.84	0.82	71.1	104.3	70.0	102.7	0.00	0.00	70.0	102.7	129734.6
1384.0	23.07	70.0	102.7	1392+35	70.0	102.7	1297+35	-2.42	0.10	0.84	0.82	71.1	104.3	70.0	102.7	0.00	0.00	70.0	102.7	129940.0
1386.0	23.10	70.0	102.7	1394+40	70.0	102.7	1299+40	-2.42	0.10	0.84	0.82	71.1	104.3	70.0	102.7	0.00	0.00	70.0	102.7	130145.3
1388.0	23.13	70.0	102.7	1396+45	70.0	102.7	1301+45	-2.42	0.10	0.84	0.82	71.1	104.3	70.0	102.7	0.00	0.00	70.0	102.7	130350.6
1390.0	23.17	70.0	102.7	1398+51	70.0	102.7	1303+51	-2.42	0.10	0.84	0.82	71.1	104.3	70.0	102.7	0.00	0.00	70.0	102.7	130556.0
1392.0	23.20	70.0	102.7	1400+56	70.0	102.7	1305+56	-2.42	0.10	0.84	0.82	71.1	104.3	70.0	102.7	0.00	0.00	70.0	102.7	130761.3
1394.0	23.23	70.0	102.7	1402+61	70.0	102.7	1307+61	-2.42	0.10	0.84	0.82	71.1	104.3	70.0	102.7	0.00	0.00	70.0	102.7	130966.6
1396.0	23.27	70.0	102.7	1404+67	70.0	102.7	1309+67	-2.42	0.10	0.84	0.82	71.1	104.3	70.0	102.7	0.00	0.00	70.0	102.7	131172.0
1398.0	23.30	70.0	102.7	1406+72	70.0	102.7	1311+72	-2.42	0.10	0.84	0.82	71.1	104.3	70.0	102.7	0.00	0.00	70.0	102.7	131377.3
1400.0	23.33	70.0	102.7	1408+77	70.0	102.7	1313+77	-2.42	0.10	0.84	0.82	71.1	104.3	70.0	102.7	0.00	0.00	70.0	102.7	131582.6
1402.0	23.37	70.0	102.7	1410+83	70.0	102.7	1315+83	-2.42	0.10	0.84	0.82	71.1	104.3	70.0	102.7	0.00	0.00	70.0	102.7	131788.0
1404.0	23.40	70.0	102.7	1412+88	70.0	102.7	1317+88	-2.42	0.10	0.84	0.82	71.1	104.3	70.0	102.7	0.00	0.00	70.0	102.7	131993.3
1406.0	23.43	70.0	102.7	1414+93	70.0	102.7	1319+93	-2.15	0.01	0.75	0.73	71.0	104.1	70.0	102.7	0.00	0.00	70.0	102.7	132198.6
1408.0	23.47	70.0	102.7	1416+99	70.0	102.7	1321+99	-1.21	-0.29	0.45	0.44	70.6	103.5	70.0	102.7	0.00	0.00	70.0	102.7	132404.0
1410.0	23.50	70.0	102.7	1419+04	70.0	102.7	1324+04	-0.25	-0.60	0.14	0.14	70.2	102.9	70.0	102.7	0.00	0.00	70.0	102.7	132609.3
1412.0	23.53	70.0	102.7	1421+09	70.0	102.7	1326+09	0.72	-0.92	-0.17	-0.17	69.8	102.3	70.0	102.7	0.00	-0.17	69.8	102.3	132814.3
1414.0	23.57	70.0	102.7	1423+14	69.8	102.3	1328+14	1.69	-1.22	-0.47	-0.48	69.1	101.4	71.5	104.8	2.47	-0.48	69.1	101.4	133018.0
1416.0	23.60	70.0	102.7	1425+18	69.1	101.4	1330+18	2.63	-1.52	-0.76	-0.78	68.0	99.8	70.9	104.0	2.68	-0.78	68.0	99.8	133219.1
1418.0	23.63	70.0	102.7	1427+19	68.0	99.8	1332+19	2.90	-1.59	-0.82	-0.84	66.9	98.1	70.1	102.8	3.02	-0.84	66.9	98.1	133417.1
1420.0	23.67	70.0	102.7	1429+17	66.9	98.1	1334+17	2.90	-1.58	-0.79	-0.82	65.8	96.5	69.2	101.5	3.38	-0.82	65.8	96.5	133611.7
1422.0	23.70	70.0	102.7	1431+12	65.8	96.5	1336+12	2.90	-1.57	-0.77	-0.79	64.7	94.9	68.3	100.2	3.74	-0.79	64.7	94.9	133803.1
1424.0	23.73	70.0	102.7	1433+03	64.7	94.9	1338+03	2.88	-1.55	-0.74	-0.76	63.7	93.4	67.5	99.0	4.08	-0.76	63.7	93.4	133991.3
1426.0	23.77	70.0	102.7	1434+91	63.7	93.4	1339+91	2.44	-1.40	-0.57	-0.59	62.9	92.2	66.7	97.8	4.41	-0.59	62.9	92.2	134176.9
1428.0	23.80	70.0	102.7	1436+77	62.9	92.2	1341+77	1.83	-1.19	-0.36	-0.37	62.4	91.5	66.0	96.9	4.66	-0.37	62.4	91.5	134360.6
1430.0	23.83	70.0	102.7	1438+61	62.4	91.5	1343+61	1.22	-0.99	-0.15	-0.16	62.1	91.1	65.6	96.3	4.82	-0.16	62.1	91.1	134543.2
1432.0	23.87	70.0	102.7	1440+43	62.1	91.1	1345+43	0.61	-0.79	0.05	0.05	62.2	91.2	65.5	96.0	4.89	0.05	62.2	91.2	134725.5
1434.0	23.90	70.0	102.7	1442+26	62.2	91.2	1347+26	0.00	-0.60	0.24	0.23	62.5	91.7	65.5	96.1	4.87	0.23	62.5	91.7	134908.5
1436.0	23.93	70.0	102.7	1444+08	62.5	91.7	1349+08	-0.62	-0.40	0.43	0.42	63.1	92.5	65.8	96.5	4.77	0.42	63.1	92.5	135092.8
1438.0	23.97	70.0	102.7	1445+93	63.1	92.5	1350+93	-0.62	-0.41	0.42	0.40	63.6	93.4	66.2	97.1	4.59	0.40	63.6	93.4	135278.6
1440.0	24.00	70.0	102.7	1447+79	63.6	93.4	1352+79	-1.23	-0.22	0.60	0.58	64.4	94.5	66.7	97.8	4.41	0.58	64.4	94.5	135466.5
1442.0	24.03	70.0	102.7	1449+67	64.4	94.5	1354+67	-1.84	-0.03	0.78	0.75	65.5	96.0	67.3	98.7	4.16	0.75	65.5	96.0	135657.0
1444.0	24.07	70.0	102.7	1451+57	65.5	96.0	1356+57	-2.45	0.16	0.95	0.92	66.7	97.9	68.1	99.9	3.84	0.92	66.7	97.9	135850.9
1446.0	24.10	75.0	110.0	1453+51	66.7	97.9	1358+51	-3.06	0.34	1.12	1.08	68.2	100.0	70.1	102.9	5.02	1.08	68.2	100.0	136048.8
1448.0	24.13	75.0	110.0	1455+49	68.2	100.0	1360+49	-3.50	0.46	1.22	1.19	69.8	102.4	71.3	104.6	4.55	1.19	69.8	102.4	136251.2
1450.0	24.17	75.0	110.0	1457+51	69.8	102.4	1362+51	-3.52	0.45	1.19	1.16	71.4	104.7	72.6	106.4	4.04	1.16	71.4	104.7	136458.4
1452.0	24.20	75.0	110.0	1459+58	71.4	104.7	1364+58	-3.52	0.43	1.16	1.13	72.9	107.0	73.8	108.3	3.54	1.13	72.9	107.0	136670.1
1454.0	24.23	75.0	110.0	1461+70	72.9	107.0	1366+70	-3.28	0.34	1.05	1.03	74.3	109.0	75.0	110.0	3.05	1.03	74.3	109.0	136886.1
1456.0	24.27	70.0	102.7	1463+86	70.0	102.7	1368+86	-2.11	0.00	0.74	0.72	71.0	104.1	70.0	102.7	0.00	0.00	70.0	102.7	137091.4
1458.0	24.30	70.0	102.7	1465+91	70.0	102.7	1370+91	-1.26	-0.28	0.47	0.46	70.6	103.6	70.0	102.7	0.00	0.00	70.0	102.7	137296.8
1460.0	24.33	70.0	102.7	1467+97	70.0	102.7	1372+97	-0.42	-0.55	0.20	0.20	70.3	103.1	70.0	102.7	0.00	0.00	70.0	102.7	137502.1
1462.0	24.37	70.0	102.7	1470+02	70.0	102.7	1375+02	0.90	-0.97	-0.22	-0.23	69.7	102.2	70.0	102.7	0.00	-0.23	69.7	102.2	137707.0
1464.0	24.40	70.0	102.7	1472+07	69.7	102.2	1377+07	1.75	-1.24	-0.49	-0.50	69.0	101.2	71.4	104.7	2.50	-0.50	69.0	101.2	137910.4

1		2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Elapsed Time		Desired Speed		Actual Station	Start of Interval			Local Grade	Limiting acceleration			New speed based on vehicle performance		Limiting acceleration and speed based on driver preferences			Actual acceleration	End of Interval		
					Speed		Position		Coasting	Power	Effective			Speed		Acceleration		New Speed		New Position
(sec)	(Min)	(mph)	(ft/sec)	FYI	(mph)	(ft/sec)	(ft)	(%)	(ft/sec2)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(mph)	(ft/sec)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(ft)
1466.0	24.43	70.0	102.7	1474+10	69.0	101.2	1379+10	2.56	-1.50	-0.73	-0.75	68.0	99.7	70.9	103.9	2.72	-0.75	68.0	99.7	138111.3
1468.0	24.47	70.0	102.7	1476+11	68.0	99.7	1381+11	2.80	-1.56	-0.79	-0.81	66.9	98.1	70.0	102.7	3.04	-0.81	66.9	98.1	138309.1
1470.0	24.50	70.0	102.7	1478+09	66.9	98.1	1383+09	2.80	-1.55	-0.76	-0.78	65.8	96.5	69.2	101.5	3.39	-0.78	65.8	96.5	138503.6
1472.0	24.53	70.0	102.7	1480+04	65.8	96.5	1385+04	2.80	-1.54	-0.74	-0.76	64.8	95.0	68.3	100.2	3.73	-0.76	64.8	95.0	138695.1
1474.0	24.57	70.0	102.7	1481+95	64.8	95.0	1386+95	2.80	-1.53	-0.71	-0.74	63.8	93.5	67.5	99.0	4.06	-0.74	63.8	93.5	138883.6
1476.0	24.60	70.0	102.7	1483+84	63.8	93.5	1388+84	2.80	-1.52	-0.69	-0.71	62.8	92.1	66.7	97.9	4.38	-0.71	62.8	92.1	139069.3
1478.0	24.63	70.0	102.7	1485+69	62.8	92.1	1390+69	2.79	-1.50	-0.66	-0.69	61.9	90.7	66.0	96.8	4.68	-0.69	61.9	90.7	139252.1
1480.0	24.67	70.0	102.7	1487+52	61.9	90.7	1392+52	2.58	-1.43	-0.57	-0.59	61.0	89.5	65.2	95.7	4.98	-0.59	61.0	89.5	139432.3
1482.0	24.70	70.0	102.7	1489+32	61.0	89.5	1394+32	2.29	-1.32	-0.46	-0.48	60.4	88.6	64.6	94.8	5.24	-0.48	60.4	88.6	139610.4
1484.0	24.73	70.0	102.7	1491+10	60.4	88.6	1396+10	1.99	-1.22	-0.35	-0.36	59.9	87.8	64.1	94.0	5.44	-0.36	59.9	87.8	139786.8
1486.0	24.77	70.0	102.7	1492+87	59.9	87.8	1397+87	1.71	-1.13	-0.25	-0.26	59.5	87.3	63.7	93.4	5.60	-0.26	59.5	87.3	139962.0
1488.0	24.80	70.0	102.7	1494+62	59.5	87.3	1399+62	1.41	-1.02	-0.14	-0.15	59.3	87.0	63.4	93.0	5.71	-0.15	59.3	87.0	140136.3
1490.0	24.83	70.0	102.7	1496+36	59.3	87.0	1401+36	1.11	-0.93	-0.05	-0.05	59.3	86.9	63.3	92.8	5.78	-0.05	59.3	86.9	140310.3
1492.0	24.87	70.0	102.7	1498+10	59.3	86.9	1403+10	0.82	-0.83	0.05	0.05	59.3	87.0	63.2	92.7	5.80	0.05	59.3	87.0	140484.2
1494.0	24.90	70.0	102.7	1499+84	59.3	87.0	1404+84	0.82	-0.83	0.05	0.05	59.4	87.1	63.3	92.8	5.78	0.05	59.4	87.1	140658.4
1496.0	24.93	70.0	102.7	1501+58	59.4	87.1	1406+58	0.61	-0.77	0.11	0.11	59.6	87.3	63.3	92.9	5.76	0.11	59.6	87.3	140832.8
1498.0	24.97	70.0	102.7	1503+33	59.6	87.3	1408+33	0.60	-0.77	0.11	0.11	59.7	87.6	63.4	93.1	5.71	0.11	59.7	87.6	141007.7
1500.0	25.00	70.0	102.7	1505+08	59.7	87.6	1410+08	0.60	-0.77	0.11	0.11	59.8	87.8	63.6	93.2	5.66	0.11	59.8	87.8	141183.1
1502.0	25.03	70.0	102.7	1506+83	59.8	87.8	1411+83	0.60	-0.77	0.11	0.10	60.0	88.0	63.7	93.4	5.62	0.10	60.0	88.0	141358.8
1504.0	25.07	70.0	102.7	1508+59	60.0	88.0	1413+59	0.60	-0.77	0.10	0.10	60.1	88.2	63.8	93.5	5.57	0.10	60.1	88.2	141535.0
1506.0	25.10	70.0	102.7	1510+35	60.1	88.2	1415+35	0.60	-0.77	0.10	0.10	60.2	88.4	63.9	93.7	5.53	0.10	60.2	88.4	141711.5
1508.0	25.13	70.0	102.7	1512+12	60.2	88.4	1417+12	0.97	-0.89	-0.02	-0.02	60.2	88.3	64.0	93.9	5.49	-0.02	60.2	88.3	141888.2
1510.0	25.17	70.0	102.7	1513+88	60.2	88.3	1418+88	0.97	-0.89	-0.02	-0.02	60.2	88.3	64.0	93.8	5.50	-0.02	60.2	88.3	142064.8
1512.0	25.20	70.0	102.7	1515+65	60.2	88.3	1420+65	1.73	-1.13	-0.26	-0.27	59.8	87.7	63.9	93.8	5.51	-0.27	59.8	87.7	142240.8
1514.0	25.23	70.0	102.7	1517+41	59.8	87.7	1422+41	2.47	-1.37	-0.49	-0.51	59.1	86.7	63.7	93.4	5.63	-0.51	59.1	86.7	142415.2
1516.0	25.27	70.0	102.7	1519+15	59.1	86.7	1424+15	3.23	-1.61	-0.71	-0.74	58.1	85.2	63.1	92.6	5.85	-0.74	58.1	85.2	142587.2
1518.0	25.30	70.0	102.7	1520+87	58.1	85.2	1425+87	3.60	-1.72	-0.81	-0.84	57.0	83.5	62.3	91.4	6.17	-0.84	57.0	83.5	142755.9
1520.0	25.33	70.0	102.7	1522+56	57.0	83.5	1427+56	3.60	-1.71	-0.78	-0.81	55.9	81.9	61.4	90.1	6.53	-0.81	55.9	81.9	142921.4
1522.0	25.37	70.0	102.7	1524+21	55.9	81.9	1429+21	3.60	-1.70	-0.75	-0.78	54.8	80.3	60.5	88.8	6.88	-0.78	54.8	80.3	143083.7
1524.0	25.40	70.0	102.7	1525+84	54.8	80.3	1430+84	3.12	-1.53	-0.57	-0.60	54.0	79.2	59.7	87.6	7.22	-0.60	54.0	79.2	143243.2
1526.0	25.43	70.0	102.7	1527+43	54.0	79.2	1432+43	2.66	-1.38	-0.40	-0.42	53.4	78.3	59.1	86.6	7.48	-0.42	53.4	78.3	143400.6
1528.0	25.47	70.0	102.7	1529+01	53.4	78.3	1434+01	1.98	-1.15	-0.17	-0.18	53.2	78.0	58.6	86.0	7.66	-0.18	53.2	78.0	143556.9
1530.0	25.50	70.0	102.7	1530+57	53.2	78.0	1435+57	1.30	-0.93	0.05	0.05	53.2	78.1	58.4	85.7	7.74	0.05	53.2	78.1	143712.9
1532.0	25.53	70.0	102.7	1532+13	53.2	78.1	1437+13	0.82	-0.78	0.21	0.20	53.5	78.4	58.5	85.8	7.72	0.20	53.5	78.4	143869.4
1534.0	25.57	70.0	102.7	1533+69	53.5	78.4	1438+69	0.38	-0.64	0.34	0.32	53.9	79.1	58.7	86.1	7.63	0.32	53.9	79.1	144026.9
1536.0	25.60	70.0	102.7	1535+27	53.9	79.1	1440+27	0.20	-0.58	0.38	0.37	54.4	79.8	59.0	86.6	7.49	0.37	54.4	79.8	144185.9
1538.0	25.63	70.0	102.7	1536+86	54.4	79.8	1441+86	0.20	-0.59	0.37	0.35	54.9	80.5	59.4	87.2	7.33	0.35	54.9	80.5	144346.2
1540.0	25.67	70.0	102.7	1538+46	54.9	80.5	1443+46	0.20	-0.59	0.36	0.34	55.4	81.2	59.8	87.7	7.18	0.34	55.4	81.2	144508.0
1542.0	25.70	70.0	102.7	1540+08	55.4	81.2	1445+08	0.20	-0.60	0.35	0.33	55.8	81.9	60.2	88.3	7.03	0.33	55.8	81.9	144671.1
1544.0	25.73	70.0	102.7	1541+71	55.8	81.9	1446+71	0.20	-0.60	0.33	0.32	56.3	82.5	60.5	88.8	6.89	0.32	56.3	82.5	144835.5
1546.0	25.77	70.0	102.7	1543+36	56.3	82.5	1448+36	0.20	-0.60	0.32	0.31	56.7	83.1	60.9	89.3	6.75	0.31	56.7	83.1	145001.2
1548.0	25.80	70.0	102.7	1545+01	56.7	83.1	1450+01	0.20	-0.61	0.31	0.30	57.1	83.7	61.2	89.8	6.62	0.30	57.1	83.7	145168.1
1550.0	25.83	70.0	102.7	1546+68	57.1	83.7	1451+68	0.20	-0.61	0.30	0.29	57.5	84.3	61.5	90.2	6.49	0.29	57.5	84.3	145336.1
1552.0	25.87	70.0	102.7	1548+36	57.5	84.3	1453+36	0.20	-0.62	0.29	0.28	57.9	84.9	61.8	90.7	6.36	0.28	57.9	84.9	145505.4
1554.0	25.90	70.0	102.7	1550+05	57.9	84.9	1455+05	0.20	-0.62	0.28	0.27	58.2	85.4	62.1	91.1	6.24	0.27	58.2	85.4	145675.7
1556.0	25.93	70.0	102.7	1551+76	58.2	85.4	1456+76	0.20	-0.62	0.27	0.26	58.6	86.0	62.4	91.6	6.12	0.26	58.6	86.0	145847.1
1558.0	25.97	70.0	102.7	1553+47	58.6	86.0	1458+47	0.20	-0.63	0.26	0.25	59.0	86.5	62.7	92.0	6.01	0.25	59.0	86.5	146019.5
1560.0	26.00	70.0	102.7	1555+19	59.0	86.5	1460+19	0.24	-0.64	0.24	0.23	59.3	86.9	63.0	92.4	5.90	0.23	59.3	86.9	146192.9
1562.0	26.03	70.0	102.7	1556+93	59.3	86.9	1461+93	0.72	-0.80	0.08	0.08	59.4	87.1	63.2	92.7	5.80	0.08	59.4	87.1	146366.9
1564.0	26.07	70.0	102.7	1558+67	59.4	87.1	1463+67	1.28	-0.98	-0.10	-0.10	59.2	86.9	63.3	92.9	5.76	-0.10	59.2	86.9	146540.9
1566.0	26.10	70.0	102.7	1560+41	59.2	86.9	1465+41	1.40	-1.02	-0.13	-0.14	59.0	86.6	63.2	92.7	5.81	-0.14	59.0	86.6	146714.4
1568.0	26.13	70.0	102.7	1562+14	59.0	86.6	1467+14	1.40	-1.02	-0.13	-0.13	58.9	86.3	63.0	92.5	5.87	-0.13	58.9	86.3	146887.3
1570.0	26.17	70.0	102.7	1563+87	58.9	86.3	1468+87	1.40	-1.02	-0.12	-0.13	58.7	86.1	62.9	92.3	5.93	-0.13	58.7	86.1	147059.7
1572.0	26.20	70.0	102.7	1565+60	58.7	86.1	1470+60	1.40	-1.01	-0.12	-0.13	58.5	85.8	62.8	92.1	5.98	-0.13	58.5	85.8	147231.6

Desired Speed (mph) =	70.0	Maximum speed (mph) =	75.0
Initial Speed (mph) =	70.0	Minimum speed (mph) =	50.2
Weight/power ratio (lb/hp) =	200.0	Speed difference (mph) =	24.8
Weight/frontal area ratio (lb/ft2) =	564.0		
Elevation (ft) =	500.0		
Horsepower correction factor for elevation =	1.0000	(= 1 for diesel engines)	
Aerodynamic drag correction factor for elevation =	0.9854		
Time Interval (sec) =	2		

SOUTHBOUND

	BEGIN	END
RESULTS	1472+14	-6+38
INPUT (CONVERT)	1472+14	+00
INPUT(ORIG)	1567+14	95+00

1		2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Elapsed Time		Desired Speed		Actual Station	Start of Interval			Local Grade	Limiting acceleration			New speed based on vehicle performance		Limiting acceleration and speed based on driver preferences			Actual acceleration	End of Interval		
					Speed		Position		Coasting	Power	Effective			Speed		Acceleration		New Speed		New Position
(sec)	(Min)	(mph)	(ft/sec)	FYI	(mph)	(ft/sec)	(ft)	(%)	(ft/sec2)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(mph)	(ft/sec)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(ft)
0.0	0.00	70.0	102.7	1567+14	70.0	102.7	1472+14	0.00	-0.68	0.06	0.06	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	147009.1
2.0	0.03	70.0	102.7	1565+09	70.0	102.7	1470+09	-1.40	-0.23	0.51	0.50	70.7	103.7	70.0	102.7	0.00	0.00	70.0	102.7	146803.8
4.0	0.07	70.0	102.7	1563+04	70.0	102.7	1468+04	-1.40	-0.23	0.51	0.50	70.7	103.7	70.0	102.7	0.00	0.00	70.0	102.7	146598.5
6.0	0.10	70.0	102.7	1560+98	70.0	102.7	1465+98	-1.40	-0.23	0.51	0.50	70.7	103.7	70.0	102.7	0.00	0.00	70.0	102.7	146393.1
8.0	0.13	70.0	102.7	1558+93	70.0	102.7	1463+93	-1.28	-0.27	0.47	0.46	70.6	103.6	70.0	102.7	0.00	0.00	70.0	102.7	146187.8
10.0	0.17	70.0	102.7	1556+88	70.0	102.7	1461+88	-0.72	-0.45	0.30	0.29	70.4	103.2	70.0	102.7	0.00	0.00	70.0	102.7	145982.5
12.0	0.20	70.0	102.7	1554+82	70.0	102.7	1459+82	-0.24	-0.61	0.14	0.14	70.2	102.9	70.0	102.7	0.00	0.00	70.0	102.7	145777.1
14.0	0.23	70.0	102.7	1552+77	70.0	102.7	1457+77	-0.20	-0.62	0.13	0.12	70.2	102.9	70.0	102.7	0.00	0.00	70.0	102.7	145571.8
16.0	0.27	70.0	102.7	1550+72	70.0	102.7	1455+72	-0.20	-0.62	0.13	0.12	70.2	102.9	70.0	102.7	0.00	0.00	70.0	102.7	145366.5
18.0	0.30	70.0	102.7	1548+66	70.0	102.7	1453+66	-0.20	-0.62	0.13	0.12	70.2	102.9	70.0	102.7	0.00	0.00	70.0	102.7	145161.1
20.0	0.33	70.0	102.7	1546+61	70.0	102.7	1451+61	-0.20	-0.62	0.13	0.12	70.2	102.9	70.0	102.7	0.00	0.00	70.0	102.7	144955.8
22.0	0.37	70.0	102.7	1544+56	70.0	102.7	1449+56	-0.20	-0.62	0.13	0.12	70.2	102.9	70.0	102.7	0.00	0.00	70.0	102.7	144750.5
24.0	0.40	70.0	102.7	1542+50	70.0	102.7	1447+50	-0.20	-0.62	0.13	0.12	70.2	102.9	70.0	102.7	0.00	0.00	70.0	102.7	144545.1
26.0	0.43	70.0	102.7	1540+45	70.0	102.7	1445+45	-0.20	-0.62	0.13	0.12	70.2	102.9	70.0	102.7	0.00	0.00	70.0	102.7	144339.8
28.0	0.47	70.0	102.7	1538+40	70.0	102.7	1443+40	-0.20	-0.62	0.13	0.12	70.2	102.9	70.0	102.7	0.00	0.00	70.0	102.7	144134.5
30.0	0.50	70.0	102.7	1536+34	70.0	102.7	1441+34	-0.20	-0.62	0.13	0.12	70.2	102.9	70.0	102.7	0.00	0.00	70.0	102.7	143929.1
32.0	0.53	70.0	102.7	1534+29	70.0	102.7	1439+29	-0.21	-0.61	0.13	0.13	70.2	102.9	70.0	102.7	0.00	0.00	70.0	102.7	143723.8
34.0	0.57	70.0	102.7	1532+24	70.0	102.7	1437+24	-0.82	-0.42	0.33	0.32	70.4	103.3	70.0	102.7	0.00	0.00	70.0	102.7	143518.5
36.0	0.60	70.0	102.7	1530+18	70.0	102.7	1435+18	-1.30	-0.26	0.48	0.47	70.6	103.6	70.0	102.7	0.00	0.00	70.0	102.7	143313.1
38.0	0.63	70.0	102.7	1528+13	70.0	102.7	1433+13	-1.98	-0.05	0.70	0.68	70.9	104.0	70.0	102.7	0.00	0.00	70.0	102.7	143107.8
40.0	0.67	70.0	102.7	1526+08	70.0	102.7	1431+08	-2.66	0.17	0.92	0.89	71.2	104.5	70.0	102.7	0.00	0.00	70.0	102.7	142902.5
42.0	0.70	75.0	110.0	1524+02	70.0	102.7	1429+02	-3.60	0.48	1.22	1.18	71.6	105.0	72.7	106.7	3.98	1.18	71.6	105.0	142699.5
44.0	0.73	75.0	110.0	1522+00	71.6	105.0	1427+00	-3.60	0.46	1.18	1.15	73.2	107.3	74.0	108.5	3.47	1.15	73.2	107.3	142491.7
46.0	0.77	75.0	110.0	1519+92	73.2	107.3	1424+92	-3.23	0.32	1.03	1.00	74.6	109.3	75.2	110.3	2.97	1.00	74.6	109.3	142279.1
48.0	0.80	70.0	102.7	1517+79	70.0	102.7	1422+79	-2.47	0.11	0.86	0.83	71.1	104.3	70.0	102.7	0.00	0.00	70.0	102.7	142073.7
50.0	0.83	70.0	102.7	1515+74	70.0	102.7	1420+74	-1.73	-0.13	0.62	0.60	70.8	103.9	70.0	102.7	0.00	0.00	70.0	102.7	141868.4
52.0	0.87	70.0	102.7	1513+68	70.0	102.7	1418+68	-0.97	-0.37	0.38	0.37	70.5	103.4	70.0	102.7	0.00	0.00	70.0	102.7	141663.1
54.0	0.90	70.0	102.7	1511+63	70.0	102.7	1416+63	-0.60	-0.49	0.26	0.25	70.3	103.2	70.0	102.7	0.00	0.00	70.0	102.7	141457.7
56.0	0.93	70.0	102.7	1509+58	70.0	102.7	1414+58	-0.60	-0.49	0.26	0.25	70.3	103.2	70.0	102.7	0.00	0.00	70.0	102.7	141252.4
58.0	0.97	70.0	102.7	1507+52	70.0	102.7	1412+52	-0.60	-0.49	0.26	0.25	70.3	103.2	70.0	102.7	0.00	0.00	70.0	102.7	141047.1
60.0	1.00	70.0	102.7	1505+47	70.0	102.7	1410+47	-0.60	-0.49	0.26	0.25	70.3	103.2	70.0	102.7	0.00	0.00	70.0	102.7	140841.7
62.0	1.03	70.0	102.7	1503+42	70.0	102.7	1408+42	-0.60	-0.49	0.26	0.25	70.3	103.2	70.0	102.7	0.00	0.00	70.0	102.7	140636.4
64.0	1.07	70.0	102.7	1501+36	70.0	102.7	1406+36	-0.61	-0.49	0.26	0.25	70.3	103.2	70.0	102.7	0.00	0.00	70.0	102.7	140431.1
66.0	1.10	70.0	102.7	1499+31	70.0	102.7	1404+31	-0.82	-0.42	0.33	0.32	70.4	103.3	70.0	102.7	0.00	0.00	70.0	102.7	140225.7
68.0	1.13	70.0	102.7	1497+26	70.0	102.7	1402+26	-1.11	-0.32	0.42	0.41	70.6	103.5	70.0	102.7	0.00	0.00	70.0	102.7	140020.4
70.0	1.17	70.0	102.7	1495+20	70.0	102.7	1400+20	-1.41	-0.23	0.51	0.50	70.7	103.7	70.0	102.7	0.00	0.00	70.0	102.7	139815.1
72.0	1.20	70.0	102.7	1493+15	70.0	102.7	1398+15	-1.67	-0.15	0.60	0.58	70.8	103.8	70.0	102.7	0.00	0.00	70.0	102.7	139609.7
74.0	1.23	70.0	102.7	1491+10	70.0	102.7	1396+10	-1.99	-0.04	0.70	0.68	70.9	104.0	70.0	102.7	0.00	0.00	70.0	102.7	139404.4
76.0	1.27	70.0	102.7	1489+04	70.0	102.7	1394+04	-2.29	0.05	0.80	0.78	71.1	104.2	70.0	102.7	0.00	0.00	70.0	102.7	139199.1
78.0	1.30	70.0	102.7	1486+99	70.0	102.7	1391+99	-2.58	0.15	0.89	0.87	71.2	104.4	70.0	102.7	0.00	0.00	70.0	102.7	138993.7
80.0	1.33	70.0	102.7	1484+94	70.0	102.7	1389+94	-2.79	0.22	0.96	0.93	71.3	104.5	70.0	102.7	0.00	0.00	70.0	102.7	138788.4
82.0	1.37	70.0	102.7	1482+88	70.0	102.7	1387+88	-2.80	0.22	0.96	0.94	71.3	104.5	70.0	102.7	0.00	0.00	70.0	102.7	138583.1
84.0	1.40	70.0	102.7	1480+83	70.0	102.7	1385+83	-2.80	0.22	0.96	0.94	71.3	104.5	70.0	102.7	0.00	0.00	70.0	102.7	138377.7
86.0	1.43	70.0	102.7	1478+78	70.0	102.7	1383+78	-2.80	0.22	0.96	0.94	71.3	104.5	70.0	102.7	0.00	0.00	70.0	102.7	138172.4
88.0	1.47	70.0	102.7	1476+72	70.0	102.7	1381+72	-2.80	0.22	0.96	0.94	71.3	104.5	70.0	102.7	0.00	0.00	70.0	102.7	137967.1

1		2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Elapsed Time		Desired Speed		Actual Station	Start of Interval			Local Grade	Limiting acceleration			New speed based on vehicle performance		Limiting acceleration and speed based on driver preferences			Actual acceleration	End of Interval		
					Speed		Position		Coasting	Power	Effective			Speed		Acceleration		New Speed		New Position
(sec)	(Min)	(mph)	(ft/sec)	FYI	(mph)	(ft/sec)	(ft)	(%)	(ft/sec2)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(mph)	(ft/sec)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(ft)
90.0	1.50	70.0	102.7	1474+67	70.0	102.7	1379+67	-2.56	0.14	0.88	0.86	71.2	104.4	70.0	102.7	0.00	0.00	70.0	102.7	137761.7
92.0	1.53	70.0	102.7	1472+62	70.0	102.7	1377+62	-1.75	-0.12	0.62	0.61	70.8	103.9	70.0	102.7	0.00	0.00	70.0	102.7	137556.4
94.0	1.57	70.0	102.7	1470+56	70.0	102.7	1375+56	-0.90	-0.39	0.35	0.34	70.5	103.4	70.0	102.7	0.00	0.00	70.0	102.7	137351.1
96.0	1.60	70.0	102.7	1468+51	70.0	102.7	1373+51	-0.06	-0.66	0.08	0.08	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	137145.7
98.0	1.63	70.0	102.7	1466+46	70.0	102.7	1371+46	1.08	-1.03	-0.28	-0.29	69.6	102.1	70.0	102.7	0.00	-0.29	69.6	102.1	136939.8
100.0	1.67	70.0	102.7	1464+40	69.6	102.1	1369+40	1.84	-1.27	-0.52	-0.53	68.9	101.0	71.3	104.6	2.53	-0.53	68.9	101.0	136734.6
102.0	1.70	70.0	102.7	1462+35	68.9	101.0	1367+35	2.53	-1.49	-0.72	-0.74	67.9	99.5	70.8	103.8	2.75	-0.74	67.9	99.5	136531.1
104.0	1.73	70.0	102.7	1460+31	67.9	99.5	1365+31	3.28	-1.72	-0.94	-0.97	66.6	97.6	70.0	102.6	3.07	-0.97	66.6	97.6	136330.0
106.0	1.77	70.0	102.7	1458+30	66.6	97.6	1363+30	3.52	-1.78	-0.98	-1.01	65.2	95.6	68.9	101.1	3.49	-1.01	65.2	95.6	136132.8
108.0	1.80	70.0	102.7	1456+33	65.2	95.6	1361+33	3.52	-1.76	-0.95	-0.98	63.8	93.6	67.9	99.5	3.93	-0.98	63.8	93.6	135939.7
110.0	1.83	70.0	102.7	1454+40	63.8	93.6	1359+40	3.50	-1.74	-0.91	-0.95	62.5	91.7	66.8	98.0	4.35	-0.95	62.5	91.7	135750.5
112.0	1.87	70.0	102.7	1452+51	62.5	91.7	1357+51	3.06	-1.59	-0.74	-0.77	61.5	90.2	65.8	96.5	4.76	-0.77	61.5	90.2	135565.5
114.0	1.90	70.0	102.7	1450+66	61.5	90.2	1355+66	2.45	-1.38	-0.52	-0.54	60.8	89.1	65.0	95.3	5.10	-0.54	60.8	89.1	135384.1
116.0	1.93	70.0	102.7	1448+84	60.8	89.1	1353+84	1.84	-1.18	-0.31	-0.32	60.3	88.5	64.4	94.4	5.33	-0.32	60.3	88.5	135205.2
118.0	1.97	70.0	102.7	1447+05	60.3	88.5	1352+05	1.23	-0.97	-0.10	-0.11	60.2	88.2	64.0	93.9	5.47	-0.11	60.2	88.2	135028.1
120.0	2.00	70.0	102.7	1445+28	60.2	88.2	1350+28	0.62	-0.78	0.09	0.09	60.3	88.4	63.9	93.8	5.52	0.09	60.3	88.4	134851.8
122.0	2.03	70.0	102.7	1443+52	60.3	88.4	1348+52	0.00	-0.58	0.29	0.28	60.7	89.0	64.0	93.9	5.48	0.28	60.7	89.0	134675.5
124.0	2.07	70.0	102.7	1441+76	60.7	89.0	1346+76	-0.61	-0.39	0.47	0.46	61.3	89.9	64.3	94.3	5.36	0.46	61.3	89.9	134498.5
126.0	2.10	70.0	102.7	1439+98	61.3	89.9	1344+98	-1.22	-0.20	0.65	0.63	62.1	91.1	64.8	95.0	5.16	0.63	62.1	91.1	134320.0
128.0	2.13	70.0	102.7	1438+20	62.1	91.1	1343+20	-1.22	-0.21	0.63	0.61	63.0	92.4	65.5	96.0	4.89	0.61	63.0	92.4	134138.9
130.0	2.17	70.0	102.7	1436+39	63.0	92.4	1341+39	-1.83	-0.02	0.81	0.78	64.0	93.9	66.1	97.0	4.63	0.78	64.0	93.9	133955.7
132.0	2.20	70.0	102.7	1434+56	64.0	93.9	1339+56	-2.44	0.17	0.98	0.95	65.3	95.8	67.0	98.2	4.29	0.95	65.3	95.8	133769.8
134.0	2.23	70.0	102.7	1432+70	65.3	95.8	1337+70	-2.88	0.30	1.09	1.06	66.8	97.9	68.0	99.7	3.88	1.06	66.8	97.9	133580.3
136.0	2.27	70.0	102.7	1430+80	66.8	97.9	1335+80	-2.90	0.29	1.06	1.03	68.2	100.0	69.1	101.4	3.42	1.03	68.2	100.0	133386.5
138.0	2.30	70.0	102.7	1428+86	68.2	100.0	1333+86	-2.90	0.27	1.03	1.00	69.5	102.0	70.2	103.0	2.98	1.00	69.5	102.0	133188.5
140.0	2.33	70.0	102.7	1426+88	69.5	102.0	1331+88	-2.90	0.26	1.00	0.97	70.9	104.0	71.3	104.5	2.54	0.97	70.9	104.0	132986.4
142.0	2.37	75.0	110.0	1424+86	70.9	104.0	1329+86	-2.63	0.15	0.89	0.86	72.1	105.7	73.4	107.7	3.71	0.86	72.1	105.7	132780.2
144.0	2.40	75.0	110.0	1422+80	72.1	105.7	1327+80	-1.69	-0.16	0.56	0.55	72.8	106.8	74.3	109.0	3.33	0.55	72.8	106.8	132570.0
146.0	2.43	75.0	110.0	1420+70	72.8	106.8	1325+70	-0.72	-0.48	0.23	0.23	73.1	107.2	74.9	109.9	3.10	0.23	73.1	107.2	132356.9
148.0	2.47	75.0	110.0	1418+57	73.1	107.2	1323+57	0.25	-0.80	-0.08	-0.08	73.0	107.1	75.2	110.2	3.00	-0.08	73.0	107.1	132142.3
150.0	2.50	75.0	110.0	1416+42	73.0	107.1	1321+42	1.21	-1.11	-0.39	-0.40	72.5	106.3	75.1	110.1	3.04	-0.40	72.5	106.3	131927.3
152.0	2.53	75.0	110.0	1414+27	72.5	106.3	1319+27	2.15	-1.40	-0.68	-0.70	71.5	104.9	74.6	109.5	3.21	-0.70	71.5	104.9	131713.4
154.0	2.57	75.0	110.0	1412+13	71.5	104.9	1317+13	2.42	-1.48	-0.74	-0.76	70.5	103.3	73.9	108.4	3.51	-0.76	70.5	103.3	131502.2
156.0	2.60	75.0	110.0	1410+02	70.5	103.3	1315+02	2.42	-1.47	-0.72	-0.74	69.5	101.9	73.1	107.2	3.84	-0.74	69.5	101.9	131294.0
158.0	2.63	70.0	102.7	1407+94	69.5	101.9	1312+94	2.42	-1.46	-0.70	-0.72	68.5	100.4	71.2	104.4	2.57	-0.72	68.5	100.4	131088.8
160.0	2.67	70.0	102.7	1405+89	68.5	100.4	1310+89	2.42	-1.45	-0.68	-0.70	67.5	99.0	70.4	103.3	2.88	-0.70	67.5	99.0	130886.6
162.0	2.70	70.0	102.7	1403+87	67.5	99.0	1308+87	2.42	-1.44	-0.65	-0.67	66.6	97.7	69.7	102.2	3.18	-0.67	66.6	97.7	130687.2
164.0	2.73	70.0	102.7	1401+87	66.6	97.7	1306+87	2.42	-1.43	-0.63	-0.65	65.7	96.4	69.0	101.2	3.48	-0.65	65.7	96.4	130490.5
166.0	2.77	70.0	102.7	1399+90	65.7	96.4	1304+90	2.42	-1.42	-0.61	-0.63	64.8	95.1	68.3	100.1	3.76	-0.63	64.8	95.1	130296.5
168.0	2.80	70.0	102.7	1397+96	64.8	95.1	1302+96	2.42	-1.41	-0.59	-0.61	64.0	93.9	67.6	99.1	4.03	-0.61	64.0	93.9	130105.0
170.0	2.83	70.0	102.7	1396+05	64.0	93.9	1301+05	2.42	-1.40	-0.57	-0.59	63.2	92.7	66.9	98.2	4.30	-0.59	63.2	92.7	129916.1
172.0	2.87	70.0	102.7	1394+16	63.2	92.7	1299+16	2.42	-1.39	-0.56	-0.58	62.4	91.5	66.3	97.2	4.55	-0.58	62.4	91.5	129729.5
174.0	2.90	70.0	102.7	1392+30	62.4	91.5	1297+30	2.42	-1.38	-0.54	-0.56	61.7	90.4	65.7	96.3	4.80	-0.56	61.7	90.4	129545.3
176.0	2.93	70.0	102.7	1390+45	61.7	90.4	1295+45	2.42	-1.37	-0.52	-0.54	60.9	89.4	65.1	95.5	5.04	-0.54	60.9	89.4	129363.4
178.0	2.97	70.0	102.7	1388+63	60.9	89.4	1293+63	2.42	-1.37	-0.50	-0.52	60.2	88.3	64.5	94.6	5.28	-0.52	60.2	88.3	129183.6
180.0	3.00	70.0	102.7	1386+84	60.2	88.3	1291+84	2.42	-1.36	-0.48	-0.50	59.5	87.3	64.0	93.8	5.50	-0.50	59.5	87.3	129006.0
182.0	3.03	70.0	102.7	1385+06	59.5	87.3	1290+06	2.17	-1.27	-0.39	-0.40	59.0	86.5	63.4	93.0	5.72	-0.40	59.0	86.5	128830.6
184.0	3.07	70.0	102.7	1383+31	59.0	86.5	1288+31	1.67	-1.10	-0.21	-0.22	58.7	86.1	63.0	92.4	5.89	-0.22	58.7	86.1	128657.1
186.0	3.10	70.0	102.7	1381+57	58.7	86.1	1286+57	1.17	-0.94	-0.05	-0.05	58.6	86.0	62.8	92.0	5.99	-0.05	58.6	86.0	128484.9
188.0	3.13	70.0	102.7	1379+85	58.6	86.0	1284+85	0.66	-0.78	0.12	0.11	58.8	86.2	62.7	92.0	6.01	0.11	58.8	86.2	128313.2
190.0	3.17	70.0	102.7	1378+13	58.8	86.2	1283+13	0.66	-0.78	0.11	0.11	58.9	86.4	62.8	92.1	5.96	0.11	58.9	86.4	128141.1
192.0	3.20	70.0	102.7	1376+41	58.9	86.4	1281+41	0.16	-0.62	0.27	0.26	59.3	86.9	62.9	92.3	5.91	0.26	59.3	86.9	127968.8
194.0	3.23	70.0	102.7	1374+69	59.3	86.9	1279+69	-0.34	-0.46	0.42	0.41	59.8	87.7	63.2	92.7	5.80	0.41	59.8	87.7	127795.8

1		2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Elapsed Time		Desired Speed		Actual Station	Start of Interval			Local Grade	Limiting acceleration			New speed based on vehicle performance		Limiting acceleration and speed based on driver preferences			Actual acceleration	End of Interval		
					Speed		Position		Coasting	Power	Effective			Speed		Acceleration		New Speed		New Position
(sec)	(Min)	(mph)	(ft/sec)	FYI	(mph)	(ft/sec)	(ft)	(%)	(ft/sec2)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(mph)	(ft/sec)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(ft)
196.0	3.27	70.0	102.7	1372+96	59.8	87.7	1277+96	-0.85	-0.30	0.57	0.55	60.6	88.8	63.7	93.4	5.62	0.55	60.6	88.8	127621.4
198.0	3.30	70.0	102.7	1371+21	60.6	88.8	1276+21	-1.10	-0.23	0.63	0.61	61.4	90.1	64.2	94.2	5.39	0.61	61.4	90.1	127444.9
200.0	3.33	70.0	102.7	1369+45	61.4	90.1	1274+45	-1.10	-0.24	0.61	0.59	62.2	91.2	64.9	95.2	5.12	0.59	62.2	91.2	127266.0
202.0	3.37	70.0	102.7	1367+66	62.2	91.2	1272+66	-1.10	-0.24	0.59	0.57	63.0	92.4	65.5	96.1	4.87	0.57	63.0	92.4	127084.7
204.0	3.40	70.0	102.7	1365+85	63.0	92.4	1270+85	-1.10	-0.25	0.57	0.56	63.7	93.5	66.1	97.0	4.62	0.56	63.7	93.5	126901.0
206.0	3.43	70.0	102.7	1364+01	63.7	93.5	1269+01	-1.10	-0.26	0.56	0.54	64.5	94.6	66.7	97.9	4.38	0.54	64.5	94.6	126715.1
208.0	3.47	70.0	102.7	1362+15	64.5	94.6	1267+15	-1.10	-0.27	0.54	0.52	65.2	95.6	67.3	98.7	4.15	0.52	65.2	95.6	126527.0
210.0	3.50	70.0	102.7	1360+27	65.2	95.6	1265+27	-1.10	-0.28	0.52	0.51	65.9	96.6	67.9	99.5	3.92	0.51	65.9	96.6	126336.8
212.0	3.53	70.0	102.7	1358+37	65.9	96.6	1263+37	-1.10	-0.28	0.51	0.49	66.6	97.6	68.4	100.3	3.70	0.49	66.6	97.6	126144.5
214.0	3.57	70.0	102.7	1356+45	66.6	97.6	1261+45	-1.10	-0.29	0.49	0.48	67.2	98.6	68.9	101.1	3.49	0.48	67.2	98.6	125950.2
216.0	3.60	70.0	102.7	1354+50	67.2	98.6	1259+50	-1.07	-0.31	0.47	0.46	67.8	99.5	69.5	101.9	3.28	0.46	67.8	99.5	125754.0
218.0	3.63	70.0	102.7	1352+54	67.8	99.5	1257+54	-0.49	-0.50	0.27	0.26	68.2	100.0	69.9	102.6	3.09	0.26	68.2	100.0	125555.5
220.0	3.67	70.0	102.7	1350+56	68.2	100.0	1255+56	0.32	-0.77	0.00	0.00	68.2	100.0	70.2	103.0	2.97	0.00	68.2	100.0	125355.5
222.0	3.70	70.0	102.7	1348+56	68.2	100.0	1253+56	1.11	-1.02	-0.25	-0.26	67.8	99.5	70.2	103.0	2.97	-0.26	67.8	99.5	125155.0
224.0	3.73	70.0	102.7	1346+55	67.8	99.5	1251+55	1.34	-1.09	-0.31	-0.32	67.4	98.9	69.9	102.6	3.08	-0.32	67.4	98.9	124955.3
226.0	3.77	70.0	102.7	1344+55	67.4	98.9	1249+55	1.34	-1.08	-0.30	-0.31	67.0	98.2	69.6	102.1	3.22	-0.31	67.0	98.2	124756.9
228.0	3.80	70.0	102.7	1342+57	67.0	98.2	1247+57	1.28	-1.06	-0.28	-0.28	66.6	97.7	69.3	101.6	3.36	-0.28	66.6	97.7	124559.9
230.0	3.83	70.0	102.7	1340+60	66.6	97.7	1245+60	0.88	-0.93	-0.14	-0.14	66.4	97.4	69.0	101.1	3.48	-0.14	66.4	97.4	124364.3
232.0	3.87	70.0	102.7	1338+64	66.4	97.4	1243+64	0.42	-0.78	0.01	0.01	66.4	97.4	68.8	100.9	3.54	0.01	66.4	97.4	124169.6
234.0	3.90	70.0	102.7	1336+70	66.4	97.4	1241+70	0.02	-0.65	0.14	0.14	66.6	97.7	68.8	100.9	3.54	0.14	66.6	97.7	123975.0
236.0	3.93	70.0	102.7	1334+75	66.6	97.7	1239+75	-0.04	-0.63	0.15	0.15	66.8	98.0	69.0	101.1	3.48	0.15	66.8	98.0	123780.0
238.0	3.97	70.0	102.7	1332+80	66.8	98.0	1237+80	-0.04	-0.63	0.15	0.14	67.0	98.3	69.1	101.4	3.42	0.14	67.0	98.3	123584.4
240.0	4.00	70.0	102.7	1330+84	67.0	98.3	1235+84	-0.04	-0.64	0.14	0.14	67.2	98.5	69.3	101.6	3.35	0.14	67.2	98.5	123388.1
242.0	4.03	70.0	102.7	1328+88	67.2	98.5	1233+88	-0.04	-0.64	0.14	0.14	67.4	98.8	69.4	101.8	3.29	0.14	67.4	98.8	123191.3
244.0	4.07	70.0	102.7	1326+91	67.4	98.8	1231+91	-0.04	-0.64	0.14	0.13	67.5	99.1	69.6	102.0	3.23	0.13	67.5	99.1	122994.0
246.0	4.10	70.0	102.7	1324+94	67.5	99.1	1229+94	-0.04	-0.64	0.13	0.13	67.7	99.3	69.7	102.2	3.18	0.13	67.7	99.3	122796.1
248.0	4.13	70.0	102.7	1322+96	67.7	99.3	1227+96	0.06	-0.68	0.10	0.09	67.9	99.5	69.9	102.4	3.12	0.09	67.9	99.5	122597.6
250.0	4.17	70.0	102.7	1320+98	67.9	99.5	1225+98	0.39	-0.78	-0.01	-0.01	67.8	99.5	70.0	102.6	3.08	-0.01	67.8	99.5	122398.6
252.0	4.20	70.0	102.7	1318+99	67.8	99.5	1223+99	0.73	-0.89	-0.12	-0.12	67.7	99.2	69.9	102.6	3.09	-0.12	67.7	99.2	122199.3
254.0	4.23	70.0	102.7	1316+99	67.7	99.2	1221+99	1.07	-1.00	-0.22	-0.23	67.4	98.8	69.8	102.4	3.14	-0.23	67.4	98.8	122000.4
256.0	4.27	70.0	102.7	1315+00	67.4	98.8	1220+00	1.41	-1.11	-0.33	-0.34	66.9	98.1	69.6	102.0	3.24	-0.34	66.9	98.1	121802.1
258.0	4.30	70.0	102.7	1313+02	66.9	98.1	1218+02	1.75	-1.21	-0.43	-0.44	66.3	97.2	69.2	101.5	3.38	-0.44	66.3	97.2	121605.0
260.0	4.33	70.0	102.7	1311+05	66.3	97.2	1216+05	2.09	-1.31	-0.52	-0.54	65.6	96.2	68.7	100.8	3.57	-0.54	65.6	96.2	121409.5
262.0	4.37	70.0	102.7	1309+09	65.6	96.2	1214+09	2.43	-1.42	-0.61	-0.63	64.7	94.9	68.2	100.0	3.81	-0.63	64.7	94.9	121215.9
264.0	4.40	70.0	102.7	1307+16	64.7	94.9	1212+16	2.77	-1.52	-0.70	-0.73	63.7	93.4	67.5	99.0	4.08	-0.73	63.7	93.4	121024.7
266.0	4.43	70.0	102.7	1305+25	63.7	93.4	1210+25	3.11	-1.62	-0.79	-0.81	62.6	91.8	66.7	97.8	4.39	-0.81	62.6	91.8	120836.1
268.0	4.47	70.0	102.7	1303+36	62.6	91.8	1208+36	3.36	-1.68	-0.84	-0.87	61.4	90.1	65.8	96.6	4.74	-0.87	61.4	90.1	120650.8
270.0	4.50	70.0	102.7	1301+51	61.4	90.1	1206+51	3.37	-1.67	-0.81	-0.85	60.3	88.4	64.9	95.2	5.12	-0.85	60.3	88.4	120468.9
272.0	4.53	70.0	102.7	1299+69	60.3	88.4	1204+69	3.37	-1.66	-0.79	-0.82	59.1	86.8	64.0	93.9	5.48	-0.82	59.1	86.8	120290.5
274.0	4.57	70.0	102.7	1297+91	59.1	86.8	1202+91	3.37	-1.65	-0.76	-0.79	58.1	85.2	63.1	92.6	5.84	-0.79	58.1	85.2	120115.4
276.0	4.60	70.0	102.7	1296+15	58.1	85.2	1201+15	3.37	-1.64	-0.73	-0.76	57.0	83.6	62.3	91.4	6.18	-0.76	57.0	83.6	119943.6
278.0	4.63	70.0	102.7	1294+44	57.0	83.6	1199+44	3.37	-1.63	-0.71	-0.74	56.0	82.2	61.5	90.2	6.51	-0.74	56.0	82.2	119774.8
280.0	4.67	70.0	102.7	1292+75	56.0	82.2	1197+75	3.37	-1.62	-0.68	-0.71	55.1	80.7	60.7	89.0	6.83	-0.71	55.1	80.7	119609.0
282.0	4.70	70.0	102.7	1291+09	55.1	80.7	1196+09	3.37	-1.61	-0.66	-0.69	54.1	79.4	59.9	87.9	7.13	-0.69	54.1	79.4	119446.2
284.0	4.73	70.0	102.7	1289+46	54.1	79.4	1194+46	3.37	-1.61	-0.63	-0.66	53.2	78.1	59.2	86.8	7.43	-0.66	53.2	78.1	119286.1
286.0	4.77	70.0	102.7	1287+86	53.2	78.1	1192+86	3.35	-1.59	-0.60	-0.63	52.4	76.8	58.5	85.8	7.72	-0.63	52.4	76.8	119128.7
288.0	4.80	70.0	102.7	1286+29	52.4	76.8	1191+29	3.35	-1.59	-0.58	-0.61	51.5	75.6	57.8	84.8	7.99	-0.61	51.5	75.6	118973.9
290.0	4.83	70.0	102.7	1284+74	51.5	75.6	1189+74	3.01	-1.47	-0.45	-0.47	50.9	74.6	57.2	83.8	8.25	-0.47	50.9	74.6	118821.9
292.0	4.87	70.0	102.7	1283+22	50.9	74.6	1188+22	2.53	-1.31	-0.27	-0.29	50.5	74.1	56.7	83.1	8.45	-0.29	50.5	74.1	118672.0
294.0	4.90	70.0	102.7	1281+72	50.5	74.1	1186+72	2.05	-1.15	-0.11	-0.12	50.3	73.8	56.3	82.6	8.58	-0.12	50.3	73.8	118523.7
296.0	4.93	70.0	102.7	1280+24	50.3	73.8	1185+24	2.05	-1.15	-0.11	-0.11	50.2	73.6	56.2	82.5	8.63	-0.11	50.2	73.6	118375.8
298.0	4.97	70.0	102.7	1278+76	50.2	73.6	1183+76	1.57	-0.99	0.05	0.05	50.2	73.7	56.1	82.3	8.68	0.05	50.2	73.7	118228.7
300.0	5.00	70.0	102.7	1277+29	50.2	73.7	1182+29	1.10	-0.84	0.20	0.19	50.5	74.1	56.1	82.4	8.66	0.19	50.5	74.1	118081.7

1		2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Elapsed Time		Desired Speed		Actual Station	Start of Interval			Local Grade	Limiting acceleration			New speed based on vehicle performance		Limiting acceleration and speed based on driver preferences			Actual acceleration	End of Interval		
					Speed		Position		Coasting	Power	Effective			Speed		Acceleration		New Speed		New Position
(sec)	(Min)	(mph)	(ft/sec)	FYI	(mph)	(ft/sec)	(ft)	(%)	(ft/sec2)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(mph)	(ft/sec)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(ft)
302.0	5.03	70.0	102.7	1275+82	50.5	74.1	1180+82	0.97	-0.80	0.23	0.22	50.8	74.5	56.3	82.6	8.58	0.22	50.8	74.5	117934.0
304.0	5.07	70.0	102.7	1274+34	50.8	74.5	1179+34	0.97	-0.81	0.22	0.21	51.1	74.9	56.6	83.0	8.48	0.21	51.1	74.9	117785.4
306.0	5.10	70.0	102.7	1272+85	51.1	74.9	1177+85	0.97	-0.81	0.22	0.20	51.4	75.3	56.8	83.3	8.39	0.20	51.4	75.3	117636.0
308.0	5.13	70.0	102.7	1271+36	51.4	75.3	1176+36	0.97	-0.81	0.21	0.20	51.6	75.7	57.0	83.6	8.30	0.20	51.6	75.7	117485.7
310.0	5.17	70.0	102.7	1269+86	51.6	75.7	1174+86	0.97	-0.81	0.20	0.19	51.9	76.1	57.2	84.0	8.22	0.19	51.9	76.1	117334.6
312.0	5.20	70.0	102.7	1268+35	51.9	76.1	1173+35	0.97	-0.81	0.19	0.18	52.1	76.5	57.4	84.3	8.14	0.18	52.1	76.5	117182.7
314.0	5.23	70.0	102.7	1266+83	52.1	76.5	1171+83	0.97	-0.82	0.19	0.18	52.4	76.8	57.6	84.5	8.06	0.18	52.4	76.8	117030.1
316.0	5.27	70.0	102.7	1265+30	52.4	76.8	1170+30	0.97	-0.82	0.18	0.17	52.6	77.2	57.8	84.8	7.98	0.17	52.6	77.2	116876.8
318.0	5.30	70.0	102.7	1263+77	52.6	77.2	1168+77	0.97	-0.82	0.17	0.17	52.8	77.5	58.0	85.1	7.91	0.17	52.8	77.5	116722.7
320.0	5.33	70.0	102.7	1262+23	52.8	77.5	1167+23	0.97	-0.82	0.17	0.16	53.1	77.8	58.2	85.3	7.83	0.16	53.1	77.8	116568.0
322.0	5.37	70.0	102.7	1260+68	53.1	77.8	1165+68	0.97	-0.82	0.16	0.15	53.3	78.1	58.4	85.6	7.77	0.15	53.3	78.1	116412.7
324.0	5.40	70.0	102.7	1259+13	53.3	78.1	1164+13	0.97	-0.83	0.16	0.15	53.5	78.4	58.5	85.8	7.70	0.15	53.5	78.4	116256.7
326.0	5.43	70.0	102.7	1257+57	53.5	78.4	1162+57	0.97	-0.83	0.15	0.14	53.7	78.7	58.7	86.1	7.63	0.14	53.7	78.7	116100.1
328.0	5.47	70.0	102.7	1256+00	53.7	78.7	1161+00	0.97	-0.83	0.14	0.14	53.9	79.0	58.8	86.3	7.57	0.14	53.9	79.0	115943.0
330.0	5.50	70.0	102.7	1254+43	53.9	79.0	1159+43	0.97	-0.83	0.14	0.13	54.0	79.3	59.0	86.5	7.51	0.13	54.0	79.3	115785.3
332.0	5.53	70.0	102.7	1252+85	54.0	79.3	1157+85	0.97	-0.83	0.13	0.13	54.2	79.5	59.1	86.7	7.46	0.13	54.2	79.5	115627.0
334.0	5.57	70.0	102.7	1251+27	54.2	79.5	1156+27	0.97	-0.83	0.13	0.12	54.4	79.8	59.3	86.9	7.40	0.12	54.4	79.8	115468.2
336.0	5.60	70.0	102.7	1249+68	54.4	79.8	1154+68	0.97	-0.84	0.13	0.12	54.6	80.0	59.4	87.1	7.35	0.12	54.6	80.0	115308.9
338.0	5.63	70.0	102.7	1248+09	54.6	80.0	1153+09	0.97	-0.84	0.12	0.12	54.7	80.2	59.5	87.3	7.29	0.12	54.7	80.2	115149.1
340.0	5.67	70.0	102.7	1246+49	54.7	80.2	1151+49	0.97	-0.84	0.12	0.11	54.9	80.5	59.6	87.5	7.24	0.11	54.9	80.5	114988.9
342.0	5.70	70.0	102.7	1244+89	54.9	80.5	1149+89	0.97	-0.84	0.11	0.11	55.0	80.7	59.8	87.7	7.20	0.11	55.0	80.7	114828.1
344.0	5.73	70.0	102.7	1243+28	55.0	80.7	1148+28	0.97	-0.84	0.11	0.10	55.2	80.9	59.9	87.8	7.15	0.10	55.2	80.9	114667.0
346.0	5.77	70.0	102.7	1241+67	55.2	80.9	1146+67	0.97	-0.84	0.11	0.10	55.3	81.1	60.0	88.0	7.10	0.10	55.3	81.1	114505.4
348.0	5.80	70.0	102.7	1240+05	55.3	81.1	1145+05	0.97	-0.84	0.10	0.10	55.4	81.3	60.1	88.2	7.06	0.10	55.4	81.3	114343.4
350.0	5.83	70.0	102.7	1238+43	55.4	81.3	1143+43	0.94	-0.84	0.11	0.10	55.6	81.5	60.2	88.3	7.02	0.10	55.6	81.5	114181.0
352.0	5.87	70.0	102.7	1236+81	55.6	81.5	1141+81	0.76	-0.78	0.16	0.16	55.8	81.8	60.3	88.5	6.97	0.16	55.8	81.8	114018.3
354.0	5.90	70.0	102.7	1235+18	55.8	81.8	1140+18	0.55	-0.71	0.22	0.21	56.1	82.2	60.5	88.7	6.91	0.21	56.1	82.2	113855.1
356.0	5.93	70.0	102.7	1233+55	56.1	82.2	1138+55	0.34	-0.65	0.28	0.27	56.4	82.8	60.7	89.1	6.81	0.27	56.4	82.8	113691.2
358.0	5.97	70.0	102.7	1231+91	56.4	82.8	1136+91	0.13	-0.58	0.34	0.33	56.9	83.4	61.0	89.5	6.69	0.33	56.9	83.4	113526.3
360.0	6.00	70.0	102.7	1230+26	56.9	83.4	1135+26	0.13	-0.59	0.33	0.32	57.3	84.1	61.4	90.0	6.55	0.32	57.3	84.1	113360.0
362.0	6.03	70.0	102.7	1228+60	57.3	84.1	1133+60	-0.09	-0.52	0.39	0.37	57.8	84.8	61.7	90.5	6.42	0.37	57.8	84.8	113192.6
364.0	6.07	70.0	102.7	1226+93	57.8	84.8	1131+93	-0.30	-0.46	0.44	0.42	58.4	85.7	62.1	91.1	6.26	0.42	58.4	85.7	113023.9
366.0	6.10	70.0	102.7	1225+24	58.4	85.7	1130+24	-0.51	-0.40	0.49	0.48	59.1	86.6	62.5	91.7	6.07	0.48	59.1	86.6	112853.5
368.0	6.13	70.0	102.7	1223+53	59.1	86.6	1128+53	-0.72	-0.34	0.55	0.53	59.8	87.7	63.1	92.5	5.87	0.53	59.8	87.7	112681.3
370.0	6.17	70.0	102.7	1221+81	59.8	87.7	1126+81	-0.93	-0.27	0.60	0.57	60.6	88.8	63.6	93.3	5.64	0.57	60.6	88.8	112507.1
372.0	6.20	70.0	102.7	1220+07	60.6	88.8	1125+07	-0.93	-0.28	0.58	0.56	61.3	89.9	64.2	94.2	5.39	0.56	61.3	89.9	112330.6
374.0	6.23	70.0	102.7	1218+31	61.3	89.9	1123+31	-1.11	-0.23	0.62	0.60	62.1	91.1	64.8	95.1	5.15	0.60	62.1	91.1	112151.9
376.0	6.27	70.0	102.7	1216+52	62.1	91.1	1121+52	-1.14	-0.23	0.61	0.59	62.9	92.3	65.5	96.0	4.89	0.59	62.9	92.3	111970.8
378.0	6.30	70.0	102.7	1214+71	62.9	92.3	1119+71	-1.14	-0.24	0.59	0.57	63.7	93.4	66.1	96.9	4.64	0.57	63.7	93.4	111787.3
380.0	6.33	70.0	102.7	1212+87	63.7	93.4	1117+87	-1.14	-0.25	0.57	0.55	64.5	94.5	66.7	97.8	4.39	0.55	64.5	94.5	111601.6
382.0	6.37	70.0	102.7	1211+02	64.5	94.5	1116+02	-1.14	-0.25	0.55	0.54	65.2	95.6	67.3	98.7	4.15	0.54	65.2	95.6	111413.5
384.0	6.40	70.0	102.7	1209+14	65.2	95.6	1114+14	-1.14	-0.26	0.54	0.52	65.9	96.7	67.9	99.5	3.92	0.52	65.9	96.7	111223.3
386.0	6.43	70.0	102.7	1207+23	65.9	96.7	1112+23	-1.14	-0.27	0.52	0.51	66.6	97.7	68.4	100.4	3.70	0.51	66.6	97.7	111031.0
388.0	6.47	70.0	102.7	1205+31	66.6	97.7	1110+31	-1.14	-0.28	0.51	0.49	67.3	98.7	69.0	101.2	3.48	0.49	67.3	98.7	110836.7
390.0	6.50	70.0	102.7	1203+37	67.3	98.7	1108+37	-1.14	-0.29	0.49	0.48	67.9	99.6	69.5	101.9	3.27	0.48	67.9	99.6	110640.3
392.0	6.53	70.0	102.7	1201+40	67.9	99.6	1106+40	-1.14	-0.29	0.48	0.46	68.5	100.5	70.0	102.7	3.06	0.46	68.5	100.5	110442.0
394.0	6.57	70.0	102.7	1199+42	68.5	100.5	1104+42	-1.14	-0.30	0.46	0.45	69.2	101.4	70.5	103.4	2.86	0.45	69.2	101.4	110241.8
396.0	6.60	70.0	102.7	1197+42	69.2	101.4	1102+42	-1.14	-0.31	0.45	0.44	69.8	102.3	71.0	104.1	2.67	0.44	69.8	102.3	110039.9
398.0	6.63	70.0	102.7	1195+40	69.8	102.3	1100+40	-1.14	-0.31	0.44	0.42	70.3	103.1	71.4	104.8	2.48	0.42	70.3	103.1	109836.1
400.0	6.67	70.0	102.7	1193+36	70.0	102.7	1098+36	-1.14	-0.32	0.43	0.42	70.6	103.5	70.0	102.7	0.00	0.00	70.0	102.7	109630.8
402.0	6.70	70.0	102.7	1191+31	70.0	102.7	1096+31	-1.14	-0.32	0.43	0.42	70.6	103.5	70.0	102.7	0.00	0.00	70.0	102.7	109425.4
404.0	6.73	70.0	102.7	1189+25	70.0	102.7	1094+25	-1.14	-0.32	0.43	0.42	70.6	103.5	70.0	102.7	0.00	0.00	70.0	102.7	109220.1
406.0	6.77	70.0	102.7	1187+20	70.0	102.7	1092+20	-1.14	-0.32	0.43	0.42	70.6	103.5	70.0	102.7	0.00	0.00	70.0	102.7	109014.8

1		2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Elapsed Time		Desired Speed		Actual Station	Start of Interval			Local Grade	Limiting acceleration			New speed based on vehicle performance		Limiting acceleration and speed based on driver preferences			Actual acceleration	End of Interval		
					Speed		Position		Coasting	Power	Effective			Speed		Acceleration		New Speed		New Position
(sec)	(Min)	(mph)	(ft/sec)	FYI	(mph)	(ft/sec)	(ft)	(%)	(ft/sec2)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(mph)	(ft/sec)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(ft)
408.0	6.80	70.0	102.7	1185+15	70.0	102.7	1090+15	-1.14	-0.32	0.43	0.42	70.6	103.5	70.0	102.7	0.00	0.00	70.0	102.7	108809.4
410.0	6.83	70.0	102.7	1183+09	70.0	102.7	1088+09	-1.14	-0.32	0.43	0.42	70.6	103.5	70.0	102.7	0.00	0.00	70.0	102.7	108604.1
412.0	6.87	70.0	102.7	1181+04	70.0	102.7	1086+04	-1.14	-0.32	0.43	0.42	70.6	103.5	70.0	102.7	0.00	0.00	70.0	102.7	108398.8
414.0	6.90	70.0	102.7	1178+99	70.0	102.7	1083+99	-1.14	-0.32	0.43	0.42	70.6	103.5	70.0	102.7	0.00	0.00	70.0	102.7	108193.4
416.0	6.93	70.0	102.7	1176+93	70.0	102.7	1081+93	-1.13	-0.32	0.43	0.42	70.6	103.5	70.0	102.7	0.00	0.00	70.0	102.7	107988.1
418.0	6.97	70.0	102.7	1174+88	70.0	102.7	1079+88	-0.98	-0.37	0.38	0.37	70.5	103.4	70.0	102.7	0.00	0.00	70.0	102.7	107782.8
420.0	7.00	70.0	102.7	1172+83	70.0	102.7	1077+83	-0.76	-0.44	0.31	0.30	70.4	103.3	70.0	102.7	0.00	0.00	70.0	102.7	107577.4
422.0	7.03	70.0	102.7	1170+77	70.0	102.7	1075+77	-0.61	-0.49	0.26	0.25	70.3	103.2	70.0	102.7	0.00	0.00	70.0	102.7	107372.1
424.0	7.07	70.0	102.7	1168+72	70.0	102.7	1073+72	-0.60	-0.49	0.26	0.25	70.3	103.2	70.0	102.7	0.00	0.00	70.0	102.7	107166.8
426.0	7.10	70.0	102.7	1166+67	70.0	102.7	1071+67	-0.60	-0.49	0.26	0.25	70.3	103.2	70.0	102.7	0.00	0.00	70.0	102.7	106961.4
428.0	7.13	70.0	102.7	1164+61	70.0	102.7	1069+61	-0.60	-0.49	0.26	0.25	70.3	103.2	70.0	102.7	0.00	0.00	70.0	102.7	106756.1
430.0	7.17	70.0	102.7	1162+56	70.0	102.7	1067+56	-0.60	-0.49	0.26	0.25	70.3	103.2	70.0	102.7	0.00	0.00	70.0	102.7	106550.8
432.0	7.20	70.0	102.7	1160+51	70.0	102.7	1065+51	-0.60	-0.49	0.26	0.25	70.3	103.2	70.0	102.7	0.00	0.00	70.0	102.7	106345.4
434.0	7.23	70.0	102.7	1158+45	70.0	102.7	1063+45	-0.60	-0.49	0.26	0.25	70.3	103.2	70.0	102.7	0.00	0.00	70.0	102.7	106140.1
436.0	7.27	70.0	102.7	1156+40	70.0	102.7	1061+40	-0.60	-0.49	0.26	0.25	70.3	103.2	70.0	102.7	0.00	0.00	70.0	102.7	105934.8
438.0	7.30	70.0	102.7	1154+35	70.0	102.7	1059+35	-0.60	-0.49	0.26	0.25	70.3	103.2	70.0	102.7	0.00	0.00	70.0	102.7	105729.4
440.0	7.33	70.0	102.7	1152+29	70.0	102.7	1057+29	-0.94	-0.38	0.37	0.36	70.5	103.4	70.0	102.7	0.00	0.00	70.0	102.7	105524.1
442.0	7.37	70.0	102.7	1150+24	70.0	102.7	1055+24	-1.62	-0.16	0.58	0.57	70.8	103.8	70.0	102.7	0.00	0.00	70.0	102.7	105318.8
444.0	7.40	70.0	102.7	1148+19	70.0	102.7	1053+19	-2.30	0.06	0.80	0.78	71.1	104.2	70.0	102.7	0.00	0.00	70.0	102.7	105113.4
446.0	7.43	70.0	102.7	1146+13	70.0	102.7	1051+13	-2.98	0.28	1.02	0.99	71.4	104.6	70.0	102.7	0.00	0.00	70.0	102.7	104908.1
448.0	7.47	75.0	110.0	1144+08	70.0	102.7	1049+08	-3.66	0.50	1.24	1.20	71.6	105.1	72.7	106.7	3.98	1.20	71.6	105.1	104705.2
450.0	7.50	75.0	110.0	1142+05	71.6	105.1	1047+05	-4.00	0.59	1.31	1.28	73.4	107.6	74.0	108.5	3.46	1.28	73.4	107.6	104497.6
452.0	7.53	75.0	110.0	1139+98	73.4	107.6	1044+98	-4.00	0.57	1.27	1.24	75.1	110.1	75.4	110.5	2.91	1.24	75.1	110.1	104284.8
454.0	7.57	75.0	110.0	1137+85	75.0	110.0	1042+85	-4.00	0.55	1.24	1.21	76.6	112.4	75.0	110.0	0.00	0.00	75.0	110.0	104064.8
456.0	7.60	75.0	110.0	1135+65	75.0	110.0	1040+65	-3.98	0.54	1.23	1.20	76.6	112.4	75.0	110.0	0.00	0.00	75.0	110.0	103844.8
458.0	7.63	75.0	110.0	1133+45	75.0	110.0	1038+45	-3.44	0.37	1.06	1.03	76.4	112.1	75.0	110.0	0.00	0.00	75.0	110.0	103624.8
460.0	7.67	70.0	102.7	1131+25	70.0	102.7	1036+25	-2.70	0.19	0.93	0.91	71.2	104.5	70.0	102.7	0.00	0.00	70.0	102.7	103419.5
462.0	7.70	70.0	102.7	1129+19	70.0	102.7	1034+19	-1.97	-0.05	0.69	0.68	70.9	104.0	70.0	102.7	0.00	0.00	70.0	102.7	103214.1
464.0	7.73	70.0	102.7	1127+14	70.0	102.7	1032+14	-1.16	-0.31	0.44	0.43	70.6	103.5	70.0	102.7	0.00	0.00	70.0	102.7	103008.8
466.0	7.77	70.0	102.7	1125+09	70.0	102.7	1030+09	-0.63	-0.48	0.27	0.26	70.4	103.2	70.0	102.7	0.00	0.00	70.0	102.7	102803.5
468.0	7.80	70.0	102.7	1123+03	70.0	102.7	1028+03	0.21	-0.75	0.00	0.00	70.0	102.7	70.0	102.7	0.00	0.00	70.0	102.7	102598.1
470.0	7.83	70.0	102.7	1120+98	70.0	102.7	1025+98	0.98	-1.00	-0.25	-0.25	69.6	102.1	71.6	105.1	2.40	-0.25	69.6	102.1	102392.3
472.0	7.87	70.0	102.7	1118+92	69.6	102.1	1023+92	1.55	-1.18	-0.42	-0.44	69.1	101.3	71.4	104.7	2.51	-0.44	69.1	101.3	102187.1
474.0	7.90	70.0	102.7	1116+87	69.1	101.3	1021+87	1.55	-1.17	-0.41	-0.42	68.5	100.4	70.9	104.0	2.70	-0.42	68.5	100.4	101983.7
476.0	7.93	70.0	102.7	1114+84	68.5	100.4	1019+84	1.55	-1.17	-0.40	-0.41	67.9	99.6	70.4	103.3	2.88	-0.41	67.9	99.6	101782.1
478.0	7.97	70.0	102.7	1112+82	67.9	99.6	1017+82	1.55	-1.16	-0.39	-0.40	67.4	98.8	70.0	102.7	3.06	-0.40	67.4	98.8	101582.0
480.0	8.00	70.0	102.7	1110+82	67.4	98.8	1015+82	1.55	-1.15	-0.37	-0.38	66.9	98.1	69.6	102.1	3.23	-0.38	66.9	98.1	101383.6
482.0	8.03	70.0	102.7	1108+84	66.9	98.1	1013+84	1.55	-1.15	-0.36	-0.37	66.3	97.3	69.2	101.4	3.40	-0.37	66.3	97.3	101186.8
484.0	8.07	70.0	102.7	1106+87	66.3	97.3	1011+87	1.41	-1.10	-0.30	-0.31	65.9	96.7	68.8	100.9	3.56	-0.31	65.9	96.7	100991.5
486.0	8.10	70.0	102.7	1104+92	65.9	96.7	1009+92	0.91	-0.93	-0.13	-0.14	65.7	96.4	68.4	100.4	3.69	-0.14	65.7	96.4	100797.9
488.0	8.13	70.0	102.7	1102+98	65.7	96.4	1007+98	0.40	-0.76	0.03	0.03	65.8	96.5	68.3	100.2	3.75	0.03	65.8	96.5	100605.1
490.0	8.17	70.0	102.7	1101+05	65.8	96.5	1006+05	-0.12	-0.60	0.20	0.19	66.0	96.8	68.3	100.2	3.74	0.19	66.0	96.8	100412.6
492.0	8.20	70.0	102.7	1099+13	66.0	96.8	1004+13	-0.63	-0.44	0.35	0.34	66.5	97.5	68.5	100.5	3.66	0.34	66.5	97.5	100219.6
494.0	8.23	70.0	102.7	1097+20	66.5	97.5	1002+20	-1.14	-0.28	0.51	0.49	67.2	98.5	68.9	101.0	3.51	0.49	67.2	98.5	100025.5
496.0	8.27	70.0	102.7	1095+25	67.2	98.5	1000+25	-1.66	-0.12	0.66	0.64	68.0	99.8	69.4	101.8	3.29	0.64	68.0	99.8	99829.7
498.0	8.30	70.0	102.7	1093+30	68.0	99.8	998+30	-2.15	0.03	0.80	0.77	69.1	101.3	70.1	102.8	3.02	0.77	69.1	101.3	99631.7
500.0	8.33	70.0	102.7	1091+32	69.1	101.3	996+32	-2.30	0.07	0.82	0.80	70.2	102.9	70.9	104.0	2.68	0.80	70.2	102.9	99430.6
502.0	8.37	70.0	102.7	1089+31	70.0	102.7	994+31	-2.30	0.06	0.80	0.78	71.1	104.2	70.0	102.7	0.00	0.00	70.0	102.7	99225.2
504.0	8.40	70.0	102.7	1087+25	70.0	102.7	992+25	-2.18	0.02	0.76	0.74	71.0	104.1	70.0	102.7	0.00	0.00	70.0	102.7	99019.9
506.0	8.43	70.0	102.7	1085+20	70.0	102.7	990+20	-1.76	-0.12	0.63	0.61	70.8	103.9	70.0	102.7	0.00	0.00	70.0	102.7	98814.6
508.0	8.47	70.0	102.7	1083+15	70.0	102.7	988+15	-1.33	-0.25	0.49	0.48	70.7	103.6	70.0	102.7	0.00	0.00	70.0	102.7	98609.2
510.0	8.50	70.0	102.7	1081+09	70.0	102.7	986+09	-0.90	-0.39	0.35	0.34	70.5	103.4	70.0	102.7	0.00	0.00	70.0	102.7	98403.9
512.0	8.53	70.0	102.7	1079+04	70.0	102.7	984+04	-0.48	-0.53	0.22	0.21	70.3	103.1	70.0	102.7	0.00	0.00	70.0	102.7	98198.6

1		2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Elapsed Time		Desired Speed		Actual Station	Start of Interval			Local Grade	Limiting acceleration			New speed based on vehicle performance		Limiting acceleration and speed based on driver preferences			Actual acceleration	End of Interval		
					Speed		Position		Coasting	Power	Effective			Speed		Acceleration		New Speed		New Position
(sec)	(Min)	(mph)	(ft/sec)	FYI	(mph)	(ft/sec)	(ft)	(%)	(ft/sec2)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(mph)	(ft/sec)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(ft)
514.0	8.57	70.0	102.7	1076+99	70.0	102.7	981+99	-0.05	-0.67	0.08	0.08	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	97993.2
516.0	8.60	70.0	102.7	1074+93	70.0	102.7	979+93	0.31	-0.78	-0.03	-0.03	70.0	102.6	70.0	102.7	0.00	-0.03	70.0	102.6	97787.8
518.0	8.63	70.0	102.7	1072+88	70.0	102.6	977+88	0.85	-0.96	-0.21	-0.21	69.7	102.2	71.6	105.0	2.42	-0.21	69.7	102.2	97582.2
520.0	8.67	70.0	102.7	1070+82	69.7	102.2	975+82	0.92	-0.97	-0.22	-0.23	69.4	101.7	71.4	104.7	2.51	-0.23	69.4	101.7	97377.4
522.0	8.70	70.0	102.7	1068+77	69.4	101.7	973+77	0.92	-0.97	-0.21	-0.22	69.1	101.3	71.1	104.3	2.60	-0.22	69.1	101.3	97173.5
524.0	8.73	70.0	102.7	1066+74	69.1	101.3	971+74	0.92	-0.97	-0.21	-0.21	68.8	100.9	70.9	104.0	2.70	-0.21	68.8	100.9	96970.5
526.0	8.77	70.0	102.7	1064+71	68.8	100.9	969+71	0.92	-0.96	-0.20	-0.21	68.5	100.4	70.7	103.6	2.79	-0.21	68.5	100.4	96768.4
528.0	8.80	70.0	102.7	1062+68	68.5	100.4	967+68	0.92	-0.96	-0.19	-0.20	68.2	100.0	70.4	103.3	2.88	-0.20	68.2	100.0	96567.1
530.0	8.83	70.0	102.7	1060+67	68.2	100.0	965+67	0.99	-0.98	-0.21	-0.22	67.9	99.6	70.2	103.0	2.97	-0.22	67.9	99.6	96366.6
532.0	8.87	70.0	102.7	1058+67	67.9	99.6	963+67	1.25	-1.06	-0.29	-0.30	67.5	99.0	70.0	102.7	3.06	-0.30	67.5	99.0	96166.9
534.0	8.90	70.0	102.7	1056+67	67.5	99.0	961+67	1.52	-1.14	-0.36	-0.38	67.0	98.2	69.7	102.2	3.19	-0.38	67.0	98.2	95968.1
536.0	8.93	70.0	102.7	1054+68	67.0	98.2	959+68	1.78	-1.22	-0.44	-0.45	66.4	97.3	69.3	101.6	3.35	-0.45	66.4	97.3	95770.7
538.0	8.97	70.0	102.7	1052+71	66.4	97.3	957+71	2.05	-1.30	-0.51	-0.53	65.7	96.3	68.8	100.9	3.55	-0.53	65.7	96.3	95575.0
540.0	9.00	70.0	102.7	1050+75	65.7	96.3	955+75	2.32	-1.38	-0.58	-0.60	64.8	95.1	68.2	100.1	3.78	-0.60	64.8	95.1	95381.2
542.0	9.03	70.0	102.7	1048+81	64.8	95.1	953+81	2.58	-1.46	-0.65	-0.67	63.9	93.8	67.6	99.1	4.03	-0.67	63.9	93.8	95189.6
544.0	9.07	70.0	102.7	1046+90	63.9	93.8	951+90	2.84	-1.53	-0.71	-0.73	62.9	92.3	66.9	98.1	4.32	-0.73	62.9	92.3	95000.6
546.0	9.10	70.0	102.7	1045+01	62.9	92.3	950+01	2.92	-1.55	-0.71	-0.73	61.9	90.8	66.1	96.9	4.64	-0.73	61.9	90.8	94814.6
548.0	9.13	70.0	102.7	1043+15	61.9	90.8	948+15	2.92	-1.54	-0.68	-0.71	61.0	89.4	65.3	95.8	4.95	-0.71	61.0	89.4	94631.5
550.0	9.17	70.0	102.7	1041+31	61.0	89.4	946+31	2.92	-1.53	-0.66	-0.69	60.0	88.1	64.6	94.7	5.26	-0.69	60.0	88.1	94451.3
552.0	9.20	70.0	102.7	1039+51	60.0	88.1	944+51	2.92	-1.52	-0.64	-0.66	59.1	86.7	63.8	93.6	5.56	-0.66	59.1	86.7	94273.8
554.0	9.23	70.0	102.7	1037+74	59.1	86.7	942+74	2.92	-1.51	-0.62	-0.64	58.3	85.4	63.1	92.6	5.84	-0.64	58.3	85.4	94099.1
556.0	9.27	70.0	102.7	1035+99	58.3	85.4	940+99	2.92	-1.50	-0.59	-0.62	57.4	84.2	62.4	91.6	6.12	-0.62	57.4	84.2	93927.0
558.0	9.30	70.0	102.7	1034+27	57.4	84.2	939+27	2.92	-1.49	-0.57	-0.60	56.6	83.0	61.8	90.6	6.39	-0.60	56.6	83.0	93757.4
560.0	9.33	70.0	102.7	1032+57	56.6	83.0	937+57	2.92	-1.48	-0.55	-0.58	55.8	81.9	61.1	89.7	6.65	-0.58	55.8	81.9	93590.2
562.0	9.37	70.0	102.7	1030+90	55.8	81.9	935+90	2.92	-1.48	-0.53	-0.56	55.1	80.7	60.5	88.8	6.89	-0.56	55.1	80.7	93425.4
564.0	9.40	70.0	102.7	1029+25	55.1	80.7	934+25	2.90	-1.46	-0.51	-0.53	54.3	79.7	59.9	87.9	7.13	-0.53	54.3	79.7	93262.8
566.0	9.43	70.0	102.7	1027+63	54.3	79.7	932+63	2.44	-1.31	-0.34	-0.36	53.8	79.0	59.4	87.1	7.36	-0.36	53.8	79.0	93102.7
568.0	9.47	70.0	102.7	1026+03	53.8	79.0	931+03	2.44	-1.30	-0.33	-0.34	53.4	78.3	59.0	86.5	7.52	-0.34	53.4	78.3	92944.1
570.0	9.50	70.0	102.7	1024+44	53.4	78.3	929+44	1.79	-1.09	-0.11	-0.12	53.2	78.1	58.6	86.0	7.67	-0.12	53.2	78.1	92787.3
572.0	9.53	70.0	102.7	1022+87	53.2	78.1	927+87	1.15	-0.88	0.10	0.09	53.4	78.2	58.5	85.8	7.72	0.09	53.4	78.2	92631.3
574.0	9.57	70.0	102.7	1021+31	53.4	78.2	926+31	0.51	-0.68	0.30	0.29	53.7	78.8	58.6	85.9	7.67	0.29	53.7	78.8	92475.4
576.0	9.60	70.0	102.7	1019+75	53.7	78.8	924+75	-0.13	-0.48	0.49	0.47	54.4	79.8	58.9	86.4	7.55	0.47	54.4	79.8	92318.7
578.0	9.63	70.0	102.7	1018+19	54.4	79.8	923+19	-0.13	-0.48	0.48	0.46	55.0	80.7	59.4	87.1	7.35	0.46	55.0	80.7	92160.1
580.0	9.67	70.0	102.7	1016+60	55.0	80.7	921+60	-0.78	-0.28	0.67	0.64	55.9	82.0	59.9	87.8	7.15	0.64	55.9	82.0	92000.0
582.0	9.70	70.0	102.7	1015+00	55.9	82.0	920+00	-1.42	-0.08	0.85	0.81	57.0	83.6	60.6	88.8	6.87	0.81	57.0	83.6	91837.7
584.0	9.73	70.0	102.7	1013+38	57.0	83.6	918+38	-1.88	0.06	0.97	0.93	58.3	85.4	61.4	90.1	6.52	0.93	58.3	85.4	91672.4
586.0	9.77	70.0	102.7	1011+72	58.3	85.4	916+72	-1.90	0.05	0.94	0.91	59.5	87.3	62.4	91.6	6.12	0.91	59.5	87.3	91503.4
588.0	9.80	70.0	102.7	1010+03	59.5	87.3	915+03	-1.90	0.04	0.91	0.88	60.7	89.0	63.4	93.0	5.73	0.88	60.7	89.0	91330.6
590.0	9.83	70.0	102.7	1008+31	60.7	89.0	913+31	-1.90	0.03	0.88	0.85	61.9	90.7	64.3	94.4	5.35	0.85	61.9	90.7	91154.3
592.0	9.87	70.0	102.7	1006+54	61.9	90.7	911+54	-1.90	0.02	0.86	0.83	63.0	92.4	65.3	95.7	4.98	0.83	63.0	92.4	90974.5
594.0	9.90	70.0	102.7	1004+75	63.0	92.4	909+75	-1.90	0.01	0.83	0.80	64.1	94.0	66.1	97.0	4.62	0.80	64.1	94.0	90791.4
596.0	9.93	70.0	102.7	1002+91	64.1	94.0	907+91	-1.90	-0.01	0.80	0.78	65.1	95.5	67.0	98.3	4.28	0.78	65.1	95.5	90605.0
598.0	9.97	70.0	102.7	1001+05	65.1	95.5	906+05	-1.90	-0.02	0.78	0.76	66.2	97.1	67.8	99.5	3.94	0.76	66.2	97.1	90415.4
600.0	10.00	70.0	102.7	999+15	66.2	97.1	904+15	-1.90	-0.03	0.76	0.74	67.2	98.5	68.6	100.7	3.61	0.74	67.2	98.5	90222.8
602.0	10.03	70.0	102.7	997+23	67.2	98.5	902+23	-1.90	-0.04	0.73	0.71	68.1	100.0	69.4	101.8	3.29	0.71	68.1	100.0	90027.1
604.0	10.07	70.0	102.7	995+27	68.1	100.0	900+27	-1.90	-0.05	0.71	0.69	69.1	101.3	70.2	102.9	2.99	0.69	69.1	101.3	89828.6
606.0	10.10	70.0	102.7	993+29	69.1	101.3	898+29	-1.90	-0.06	0.69	0.67	70.0	102.7	70.9	104.0	2.69	0.67	70.0	102.7	89627.3
608.0	10.13	70.0	102.7	991+27	70.0	102.7	896+27	-1.90	-0.07	0.67	0.65	70.9	104.0	70.0	102.7	0.00	0.00	70.0	102.7	89422.0
610.0	10.17	70.0	102.7	989+22	70.0	102.7	894+22	-1.87	-0.08	0.66	0.64	70.9	104.0	70.0	102.7	0.00	0.00	70.0	102.7	89216.6
612.0	10.20	70.0	102.7	987+17	70.0	102.7	892+17	-1.64	-0.16	0.59	0.57	70.8	103.8	70.0	102.7	0.00	0.00	70.0	102.7	89011.3
614.0	10.23	70.0	102.7	985+11	70.0	102.7	890+11	-1.38	-0.24	0.51	0.49	70.7	103.7	70.0	102.7	0.00	0.00	70.0	102.7	88806.0
616.0	10.27	70.0	102.7	983+06	70.0	102.7	888+06	-1.12	-0.32	0.42	0.41	70.6	103.5	70.0	102.7	0.00	0.00	70.0	102.7	88600.6
618.0	10.30	70.0	102.7	981+01	70.0	102.7	886+01	-0.86	-0.41	0.34	0.33	70.5	103.3	70.0	102.7	0.00	0.00	70.0	102.7	88395.3

1		2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Elapsed Time		Desired Speed		Actual Station	Start of Interval			Local Grade	Limiting acceleration			New speed based on vehicle performance		Limiting acceleration and speed based on driver preferences			Actual acceleration	End of Interval		
					Speed		Position		Coasting	Power	Effective			Speed		Acceleration		New Speed		New Position
(sec)	(Min)	(mph)	(ft/sec)	FYI	(mph)	(ft/sec)	(ft)	(%)	(ft/sec2)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(mph)	(ft/sec)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(ft)
620.0	10.33	70.0	102.7	978+95	70.0	102.7	883+95	-0.63	-0.48	0.27	0.26	70.4	103.2	70.0	102.7	0.00	0.00	70.0	102.7	88190.0
622.0	10.37	70.0	102.7	976+90	70.0	102.7	881+90	-0.60	-0.49	0.26	0.25	70.3	103.2	70.0	102.7	0.00	0.00	70.0	102.7	87984.6
624.0	10.40	70.0	102.7	974+85	70.0	102.7	879+85	-0.60	-0.49	0.26	0.25	70.3	103.2	70.0	102.7	0.00	0.00	70.0	102.7	87779.3
626.0	10.43	70.0	102.7	972+79	70.0	102.7	877+79	-0.60	-0.49	0.26	0.25	70.3	103.2	70.0	102.7	0.00	0.00	70.0	102.7	87574.0
628.0	10.47	70.0	102.7	970+74	70.0	102.7	875+74	-0.60	-0.49	0.26	0.25	70.3	103.2	70.0	102.7	0.00	0.00	70.0	102.7	87368.6
630.0	10.50	70.0	102.7	968+69	70.0	102.7	873+69	-0.60	-0.49	0.26	0.25	70.3	103.2	70.0	102.7	0.00	0.00	70.0	102.7	87163.3
632.0	10.53	70.0	102.7	966+63	70.0	102.7	871+63	-0.60	-0.49	0.26	0.25	70.3	103.2	70.0	102.7	0.00	0.00	70.0	102.7	86958.0
634.0	10.57	70.0	102.7	964+58	70.0	102.7	869+58	-0.60	-0.49	0.26	0.25	70.3	103.2	70.0	102.7	0.00	0.00	70.0	102.7	86752.6
636.0	10.60	70.0	102.7	962+53	70.0	102.7	867+53	-0.60	-0.49	0.26	0.25	70.3	103.2	70.0	102.7	0.00	0.00	70.0	102.7	86547.3
638.0	10.63	70.0	102.7	960+47	70.0	102.7	865+47	-0.60	-0.49	0.26	0.25	70.3	103.2	70.0	102.7	0.00	0.00	70.0	102.7	86342.0
640.0	10.67	70.0	102.7	958+42	70.0	102.7	863+42	-0.60	-0.49	0.26	0.25	70.3	103.2	70.0	102.7	0.00	0.00	70.0	102.7	86136.6
642.0	10.70	70.0	102.7	956+37	70.0	102.7	861+37	-0.73	-0.45	0.30	0.29	70.4	103.2	70.0	102.7	0.00	0.00	70.0	102.7	85931.3
644.0	10.73	70.0	102.7	954+31	70.0	102.7	859+31	-1.17	-0.31	0.44	0.43	70.6	103.5	70.0	102.7	0.00	0.00	70.0	102.7	85726.0
646.0	10.77	70.0	102.7	952+26	70.0	102.7	857+26	-1.62	-0.16	0.58	0.57	70.8	103.8	70.0	102.7	0.00	0.00	70.0	102.7	85520.6
648.0	10.80	70.0	102.7	950+21	70.0	102.7	855+21	-2.07	-0.02	0.73	0.71	71.0	104.1	70.0	102.7	0.00	0.00	70.0	102.7	85315.3
650.0	10.83	70.0	102.7	948+15	70.0	102.7	853+15	-2.53	0.13	0.87	0.85	71.2	104.4	70.0	102.7	0.00	0.00	70.0	102.7	85110.0
652.0	10.87	70.0	102.7	946+10	70.0	102.7	851+10	-2.98	0.28	1.02	0.99	71.4	104.6	70.0	102.7	0.00	0.00	70.0	102.7	84904.6
654.0	10.90	75.0	110.0	944+05	70.0	102.7	849+05	-3.43	0.42	1.16	1.13	71.5	104.9	72.7	106.7	3.98	1.13	71.5	104.9	84701.6
656.0	10.93	75.0	110.0	942+02	71.5	104.9	847+02	-3.87	0.55	1.27	1.24	73.2	107.4	73.9	108.4	3.49	1.24	73.2	107.4	84494.2
658.0	10.97	75.0	110.0	939+94	73.2	107.4	844+94	-3.93	0.54	1.25	1.22	74.9	109.9	75.3	110.4	2.96	1.22	74.9	109.9	84281.8
660.0	11.00	75.0	110.0	937+82	74.9	109.9	842+82	-3.63	0.43	1.12	1.09	76.4	112.0	76.6	112.3	2.43	1.09	76.4	112.0	84064.3
662.0	11.03	75.0	110.0	935+64	75.0	110.0	840+64	-3.06	0.24	0.94	0.92	76.2	111.8	75.0	110.0	0.00	0.00	75.0	110.0	83844.3
664.0	11.07	70.0	102.7	933+44	70.0	102.7	838+44	-2.40	0.09	0.83	0.81	71.1	104.3	70.0	102.7	0.00	0.00	70.0	102.7	83638.9
666.0	11.10	70.0	102.7	931+39	70.0	102.7	836+39	-1.84	-0.09	0.65	0.64	70.9	103.9	70.0	102.7	0.00	0.00	70.0	102.7	83433.6
668.0	11.13	70.0	102.7	929+34	70.0	102.7	834+34	-1.18	-0.30	0.44	0.43	70.6	103.5	70.0	102.7	0.00	0.00	70.0	102.7	83228.3
670.0	11.17	70.0	102.7	927+28	70.0	102.7	832+28	-0.61	-0.49	0.26	0.25	70.3	103.2	70.0	102.7	0.00	0.00	70.0	102.7	83022.9
672.0	11.20	70.0	102.7	925+23	70.0	102.7	830+23	-0.05	-0.67	0.08	0.08	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	82817.6
674.0	11.23	70.0	102.7	923+18	70.0	102.7	828+18	0.52	-0.85	-0.10	-0.10	69.9	102.5	70.0	102.7	0.00	-0.10	69.9	102.5	82612.1
676.0	11.27	70.0	102.7	921+12	69.9	102.5	826+12	1.08	-1.03	-0.28	-0.29	69.5	101.9	71.5	104.9	2.44	-0.29	69.5	101.9	82406.6
678.0	11.30	70.0	102.7	919+07	69.5	101.9	824+07	1.58	-1.18	-0.43	-0.44	68.9	101.0	71.2	104.5	2.57	-0.44	68.9	101.0	82201.9
680.0	11.33	70.0	102.7	917+02	68.9	101.0	822+02	1.65	-1.20	-0.44	-0.45	68.3	100.1	70.7	103.8	2.76	-0.45	68.3	100.1	81999.0
682.0	11.37	70.0	102.7	914+99	68.3	100.1	819+99	1.65	-1.19	-0.42	-0.44	67.7	99.2	70.3	103.1	2.95	-0.44	67.7	99.2	81797.9
684.0	11.40	70.0	102.7	912+98	67.7	99.2	817+98	1.65	-1.19	-0.41	-0.42	67.1	98.4	69.8	102.4	3.14	-0.42	67.1	98.4	81598.6
686.0	11.43	70.0	102.7	910+99	67.1	98.4	815+99	1.65	-1.18	-0.40	-0.41	66.5	97.6	69.4	101.7	3.32	-0.41	66.5	97.6	81401.0
688.0	11.47	70.0	102.7	909+01	66.5	97.6	814+01	1.65	-1.17	-0.38	-0.40	66.0	96.8	68.9	101.1	3.50	-0.40	66.0	96.8	81205.1
690.0	11.50	70.0	102.7	907+05	66.0	96.8	812+05	1.65	-1.17	-0.37	-0.38	65.5	96.0	68.5	100.5	3.67	-0.38	65.5	96.0	81010.7
692.0	11.53	70.0	102.7	905+11	65.5	96.0	810+11	1.65	-1.16	-0.36	-0.37	65.0	95.3	68.1	99.9	3.84	-0.37	65.0	95.3	80818.0
694.0	11.57	70.0	102.7	903+18	65.0	95.3	808+18	1.65	-1.16	-0.35	-0.36	64.5	94.6	67.7	99.3	4.00	-0.36	64.5	94.6	80626.7
696.0	11.60	70.0	102.7	901+27	64.5	94.6	806+27	1.65	-1.15	-0.34	-0.35	64.0	93.9	67.3	98.7	4.15	-0.35	64.0	93.9	80436.9
698.0	11.63	70.0	102.7	899+37	64.0	93.9	804+37	1.65	-1.15	-0.33	-0.34	63.5	93.2	66.9	98.2	4.30	-0.34	63.5	93.2	80248.5
700.0	11.67	70.0	102.7	897+49	63.5	93.2	802+49	1.65	-1.14	-0.32	-0.33	63.1	92.5	66.6	97.6	4.45	-0.33	63.1	92.5	80061.5
702.0	11.70	70.0	102.7	895+61	63.1	92.5	800+61	1.65	-1.14	-0.31	-0.32	62.7	91.9	66.2	97.1	4.59	-0.32	62.7	91.9	79875.8
704.0	11.73	70.0	102.7	893+76	62.7	91.9	798+76	1.65	-1.13	-0.29	-0.31	62.2	91.3	65.9	96.6	4.73	-0.31	62.2	91.3	79691.4
706.0	11.77	70.0	102.7	891+91	62.2	91.3	796+91	1.65	-1.13	-0.29	-0.30	61.8	90.7	65.6	96.1	4.86	-0.30	61.8	90.7	79508.2
708.0	11.80	70.0	102.7	890+08	61.8	90.7	795+08	1.65	-1.13	-0.28	-0.29	61.4	90.1	65.2	95.7	4.99	-0.29	61.4	90.1	79326.3
710.0	11.83	70.0	102.7	888+26	61.4	90.1	793+26	1.65	-1.12	-0.27	-0.28	61.1	89.6	64.9	95.2	5.11	-0.28	61.1	89.6	79145.5
712.0	11.87	70.0	102.7	886+45	61.1	89.6	791+45	1.53	-1.08	-0.22	-0.23	60.8	89.1	64.6	94.8	5.23	-0.23	60.8	89.1	78965.9
714.0	11.90	70.0	102.7	884+66	60.8	89.1	789+66	1.31	-1.01	-0.14	-0.15	60.6	88.8	64.4	94.4	5.33	-0.15	60.6	88.8	78787.4
716.0	11.93	70.0	102.7	882+87	60.6	88.8	787+87	1.08	-0.93	-0.06	-0.07	60.5	88.7	64.2	94.2	5.39	-0.07	60.5	88.7	78609.6
718.0	11.97	70.0	102.7	881+10	60.5	88.7	786+10	0.85	-0.86	0.01	0.01	60.5	88.7	64.2	94.1	5.42	0.01	60.5	88.7	78432.2
720.0	12.00	70.0	102.7	879+32	60.5	88.7	784+32	0.63	-0.78	0.08	0.08	60.6	88.9	64.2	94.1	5.42	0.08	60.6	88.9	78255.0
722.0	12.03	70.0	102.7	877+55	60.6	88.9	782+55	0.40	-0.71	0.15	0.15	60.8	89.2	64.3	94.2	5.38	0.15	60.8	89.2	78077.5
724.0	12.07	70.0	102.7	875+78	60.8	89.2	780+78	0.18	-0.64	0.22	0.21	61.1	89.6	64.4	94.5	5.32	0.21	61.1	89.6	77899.7

1		2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Elapsed Time		Desired Speed		Actual Station	Start of Interval			Local Grade	Limiting acceleration			New speed based on vehicle performance		Limiting acceleration and speed based on driver preferences			Actual acceleration	End of Interval		
					Speed		Position		Coasting	Power	Effective			Speed		Acceleration		New Speed		New Position
(sec)	(Min)	(mph)	(ft/sec)	FYI	(mph)	(ft/sec)	(ft)	(%)	(ft/sec2)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(mph)	(ft/sec)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(ft)
726.0	12.10	70.0	102.7	874+00	61.1	89.6	779+00	-0.05	-0.57	0.28	0.27	61.5	90.1	64.6	94.8	5.23	0.27	61.5	90.1	77721.0
728.0	12.13	70.0	102.7	872+21	61.5	90.1	777+21	-0.05	-0.57	0.28	0.27	61.8	90.7	64.9	95.2	5.11	0.27	61.8	90.7	77541.3
730.0	12.17	70.0	102.7	870+41	61.8	90.7	775+41	-0.28	-0.51	0.34	0.33	62.3	91.3	65.2	95.7	4.99	0.33	62.3	91.3	77360.7
732.0	12.20	70.0	102.7	868+61	62.3	91.3	773+61	-0.50	-0.44	0.40	0.39	62.8	92.1	65.6	96.2	4.85	0.39	62.8	92.1	77178.8
734.0	12.23	70.0	102.7	866+79	62.8	92.1	771+79	-0.62	-0.41	0.42	0.41	63.3	92.9	66.0	96.8	4.68	0.41	63.3	92.9	76995.5
736.0	12.27	70.0	102.7	864+95	63.3	92.9	769+95	-0.62	-0.41	0.41	0.40	63.9	93.7	66.4	97.4	4.51	0.40	63.9	93.7	76810.4
738.0	12.30	70.0	102.7	863+10	63.9	93.7	768+10	-0.62	-0.42	0.40	0.39	64.4	94.5	66.8	98.0	4.34	0.39	64.4	94.5	76623.8
740.0	12.33	70.0	102.7	861+24	64.4	94.5	766+24	-0.62	-0.42	0.39	0.37	64.9	95.2	67.3	98.6	4.17	0.37	64.9	95.2	76435.6
742.0	12.37	70.0	102.7	859+36	64.9	95.2	764+36	-0.62	-0.43	0.38	0.36	65.4	96.0	67.7	99.2	4.01	0.36	65.4	96.0	76245.8
744.0	12.40	70.0	102.7	857+46	65.4	96.0	762+46	-0.62	-0.43	0.36	0.35	65.9	96.7	68.1	99.8	3.85	0.35	65.9	96.7	76054.6
746.0	12.43	70.0	102.7	855+55	65.9	96.7	760+55	-0.62	-0.44	0.35	0.34	66.4	97.3	68.4	100.4	3.70	0.34	66.4	97.3	75862.0
748.0	12.47	70.0	102.7	853+62	66.4	97.3	758+62	-0.62	-0.44	0.34	0.33	66.8	98.0	68.8	100.9	3.55	0.33	66.8	98.0	75668.0
750.0	12.50	70.0	102.7	851+68	66.8	98.0	756+68	-0.62	-0.45	0.33	0.32	67.3	98.7	69.1	101.4	3.41	0.32	67.3	98.7	75472.6
752.0	12.53	70.0	102.7	849+73	67.3	98.7	754+73	-0.62	-0.45	0.32	0.31	67.7	99.3	69.5	101.9	3.27	0.31	67.7	99.3	75275.9
754.0	12.57	70.0	102.7	847+76	67.7	99.3	752+76	-0.62	-0.46	0.31	0.30	68.1	99.9	69.8	102.4	3.13	0.30	68.1	99.9	75077.9
756.0	12.60	70.0	102.7	845+78	68.1	99.9	750+78	-0.62	-0.46	0.30	0.30	68.5	100.5	70.2	102.9	3.00	0.30	68.5	100.5	74878.7
758.0	12.63	70.0	102.7	843+79	68.5	100.5	748+79	-0.62	-0.47	0.29	0.29	68.9	101.1	70.5	103.4	2.87	0.29	68.9	101.1	74678.3
760.0	12.67	70.0	102.7	841+78	68.9	101.1	746+78	-0.62	-0.47	0.29	0.28	69.3	101.6	70.8	103.8	2.75	0.28	69.3	101.6	74476.8
762.0	12.70	70.0	102.7	839+77	69.3	101.6	744+77	-0.62	-0.48	0.28	0.27	69.7	102.2	71.1	104.2	2.63	0.27	69.7	102.2	74274.1
764.0	12.73	70.0	102.7	837+74	69.7	102.2	742+74	-0.62	-0.48	0.27	0.26	70.0	102.7	71.4	104.7	2.51	0.26	70.0	102.7	74070.3
766.0	12.77	70.0	102.7	835+70	70.0	102.7	740+70	-0.62	-0.48	0.26	0.25	70.3	103.2	70.0	102.7	0.00	0.00	70.0	102.7	73865.0
768.0	12.80	70.0	102.7	833+65	70.0	102.7	738+65	-0.57	-0.50	0.25	0.24	70.3	103.1	70.0	102.7	0.00	0.00	70.0	102.7	73659.6
770.0	12.83	70.0	102.7	831+60	70.0	102.7	736+60	-0.41	-0.55	0.20	0.19	70.3	103.0	70.0	102.7	0.00	0.00	70.0	102.7	73454.3
772.0	12.87	70.0	102.7	829+54	70.0	102.7	734+54	-0.24	-0.60	0.14	0.14	70.2	102.9	70.0	102.7	0.00	0.00	70.0	102.7	73249.0
774.0	12.90	70.0	102.7	827+49	70.0	102.7	732+49	-0.10	-0.65	0.10	0.09	70.1	102.9	70.0	102.7	0.00	0.00	70.0	102.7	73043.6
776.0	12.93	70.0	102.7	825+44	70.0	102.7	730+44	0.09	-0.71	0.04	0.04	70.0	102.7	70.0	102.7	0.00	0.00	70.0	102.7	72838.3
778.0	12.97	70.0	102.7	823+38	70.0	102.7	728+38	0.25	-0.76	-0.02	-0.02	70.0	102.6	70.0	102.7	0.00	-0.02	70.0	102.6	72632.9
780.0	13.00	70.0	102.7	821+33	70.0	102.6	726+33	0.42	-0.82	-0.07	-0.07	69.9	102.5	71.6	105.0	2.41	-0.07	69.9	102.5	72427.5
782.0	13.03	70.0	102.7	819+28	69.9	102.5	724+28	0.58	-0.87	-0.12	-0.12	69.7	102.3	71.5	104.9	2.44	-0.12	69.7	102.3	72222.3
784.0	13.07	70.0	102.7	817+22	69.7	102.3	722+22	0.62	-0.88	-0.13	-0.13	69.5	102.0	71.4	104.7	2.49	-0.13	69.5	102.0	72017.5
786.0	13.10	70.0	102.7	815+18	69.5	102.0	720+18	0.62	-0.88	-0.12	-0.13	69.4	101.7	71.3	104.5	2.55	-0.13	69.4	101.7	71813.3
788.0	13.13	70.0	102.7	813+13	69.4	101.7	718+13	0.62	-0.88	-0.12	-0.12	69.2	101.5	71.1	104.3	2.60	-0.12	69.2	101.5	71609.6
790.0	13.17	70.0	102.7	811+10	69.2	101.5	716+10	0.56	-0.85	-0.10	-0.10	69.1	101.3	71.0	104.1	2.65	-0.10	69.1	101.3	71406.4
792.0	13.20	70.0	102.7	809+06	69.1	101.3	714+06	0.11	-0.71	0.05	0.05	69.1	101.4	70.9	104.0	2.70	0.05	69.1	101.4	71203.9
794.0	13.23	70.0	102.7	807+04	69.1	101.4	712+04	-0.41	-0.54	0.22	0.21	69.4	101.8	71.0	104.1	2.68	0.21	69.4	101.8	71001.6
796.0	13.27	70.0	102.7	805+02	69.4	101.8	710+02	-0.93	-0.38	0.37	0.36	69.9	102.5	71.2	104.4	2.59	0.36	69.9	102.5	70798.7
798.0	13.30	70.0	102.7	802+99	69.9	102.5	707+99	-1.45	-0.22	0.53	0.51	70.6	103.6	71.6	105.0	2.43	0.51	70.6	103.6	70594.6
800.0	13.33	70.0	102.7	800+95	70.0	102.7	705+95	-1.96	-0.05	0.69	0.67	70.9	104.0	70.0	102.7	0.00	0.00	70.0	102.7	70389.3
802.0	13.37	70.0	102.7	798+89	70.0	102.7	703+89	-2.48	0.12	0.86	0.84	71.1	104.3	70.0	102.7	0.00	0.00	70.0	102.7	70184.0
804.0	13.40	70.0	102.7	796+84	70.0	102.7	701+84	-3.00	0.28	1.02	1.00	71.4	104.7	70.0	102.7	0.00	0.00	70.0	102.7	69978.6
806.0	13.43	75.0	110.0	794+79	70.0	102.7	699+79	-3.25	0.36	1.11	1.08	71.5	104.8	72.7	106.7	3.98	1.08	71.5	104.8	69775.4
808.0	13.47	75.0	110.0	792+75	71.5	104.8	697+75	-3.16	0.32	1.04	1.02	72.9	106.9	73.9	108.3	3.52	1.02	72.9	106.9	69567.8
810.0	13.50	70.0	102.7	790+68	70.0	102.7	695+68	-2.53	0.13	0.87	0.85	71.2	104.4	70.0	102.7	0.00	0.00	70.0	102.7	69362.5
812.0	13.53	70.0	102.7	788+63	70.0	102.7	693+63	-1.64	-0.16	0.59	0.57	70.8	103.8	70.0	102.7	0.00	0.00	70.0	102.7	69157.2
814.0	13.57	70.0	102.7	786+57	70.0	102.7	691+57	-0.95	-0.38	0.37	0.36	70.5	103.4	70.0	102.7	0.00	0.00	70.0	102.7	68951.8
816.0	13.60	70.0	102.7	784+52	70.0	102.7	689+52	-0.24	-0.61	0.14	0.14	70.2	102.9	70.0	102.7	0.00	0.00	70.0	102.7	68746.5
818.0	13.63	70.0	102.7	782+47	70.0	102.7	687+47	0.30	-0.78	-0.03	-0.03	70.0	102.6	70.0	102.7	0.00	-0.03	70.0	102.6	68541.1
820.0	13.67	70.0	102.7	780+41	70.0	102.6	685+41	0.39	-0.81	-0.06	-0.06	69.9	102.5	71.6	105.0	2.41	-0.06	69.9	102.5	68335.8
822.0	13.70	70.0	102.7	778+36	69.9	102.5	683+36	0.39	-0.81	-0.06	-0.06	69.8	102.4	71.5	104.9	2.44	-0.06	69.8	102.4	68130.7
824.0	13.73	70.0	102.7	776+31	69.8	102.4	681+31	0.39	-0.81	-0.05	-0.06	69.7	102.3	71.5	104.8	2.46	-0.06	69.7	102.3	67925.8
826.0	13.77	70.0	102.7	774+26	69.7	102.3	679+26	0.39	-0.80	-0.05	-0.05	69.6	102.1	71.4	104.7	2.49	-0.05	69.6	102.1	67721.2
828.0	13.80	70.0	102.7	772+21	69.6	102.1	677+21	0.39	-0.80	-0.05	-0.05	69.6	102.0	71.4	104.7	2.51	-0.05	69.6	102.0	67516.8
830.0	13.83	70.0	102.7	770+17	69.6	102.0	675+17	0.39	-0.80	-0.05	-0.05	69.5	101.9	71.3	104.6	2.54	-0.05	69.5	101.9	67312.6

1		2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Elapsed Time		Desired Speed		Actual Station	Start of Interval			Local Grade	Limiting acceleration			New speed based on vehicle performance		Limiting acceleration and speed based on driver preferences			Actual acceleration	End of Interval		
					Speed		Position		Coasting	Power	Effective			Speed		Acceleration		New Speed		New Position
(sec)	(Min)	(mph)	(ft/sec)	FYI	(mph)	(ft/sec)	(ft)	(%)	(ft/sec2)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(mph)	(ft/sec)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(ft)
832.0	13.87	70.0	102.7	768+13	69.5	101.9	673+13	0.75	-0.92	-0.16	-0.17	69.3	101.6	71.2	104.5	2.56	-0.17	69.3	101.6	67108.4
834.0	13.90	70.0	102.7	766+08	69.3	101.6	671+08	1.80	-1.25	-0.49	-0.51	68.6	100.6	71.1	104.2	2.63	-0.51	68.6	100.6	66904.2
836.0	13.93	70.0	102.7	764+04	68.6	100.6	669+04	2.53	-1.48	-0.71	-0.73	67.6	99.1	70.5	103.4	2.85	-0.73	67.6	99.1	66701.6
838.0	13.97	70.0	102.7	762+02	67.6	99.1	667+02	3.20	-1.69	-0.90	-0.93	66.3	97.3	69.7	102.3	3.17	-0.93	66.3	97.3	66501.5
840.0	14.00	70.0	102.7	760+01	66.3	97.3	665+01	3.98	-1.92	-1.12	-1.16	64.7	94.9	68.7	100.8	3.57	-1.16	64.7	94.9	66304.6
842.0	14.03	70.0	102.7	758+05	64.7	94.9	663+05	4.00	-1.91	-1.09	-1.13	63.2	92.7	67.5	99.0	4.07	-1.13	63.2	92.7	66112.5
844.0	14.07	70.0	102.7	756+13	63.2	92.7	661+13	4.00	-1.90	-1.06	-1.10	61.7	90.5	66.3	97.2	4.56	-1.10	61.7	90.5	65925.0
846.0	14.10	70.0	102.7	754+25	61.7	90.5	659+25	4.00	-1.88	-1.02	-1.06	60.2	88.4	65.1	95.5	5.03	-1.06	60.2	88.4	65741.9
848.0	14.13	70.0	102.7	752+42	60.2	88.4	657+42	4.00	-1.87	-0.99	-1.03	58.8	86.3	64.0	93.8	5.49	-1.03	58.8	86.3	65563.1
850.0	14.17	70.0	102.7	750+63	58.8	86.3	655+63	3.99	-1.85	-0.95	-0.99	57.5	84.3	62.9	92.2	5.93	-0.99	57.5	84.3	65388.5
852.0	14.20	70.0	102.7	748+89	57.5	84.3	653+89	3.77	-1.77	-0.85	-0.88	56.3	82.6	61.8	90.7	6.36	-0.88	56.3	82.6	65218.1
854.0	14.23	70.0	102.7	747+18	56.3	82.6	652+18	3.47	-1.66	-0.72	-0.75	55.3	81.1	60.9	89.3	6.74	-0.75	55.3	81.1	65051.5
856.0	14.27	70.0	102.7	745+51	55.3	81.1	650+51	3.17	-1.55	-0.60	-0.62	54.4	79.8	60.1	88.1	7.07	-0.62	54.4	79.8	64888.1
858.0	14.30	70.0	102.7	743+88	54.4	79.8	648+88	2.86	-1.45	-0.48	-0.50	53.7	78.8	59.4	87.1	7.34	-0.50	53.7	78.8	64727.5
860.0	14.33	70.0	102.7	742+28	53.7	78.8	647+28	2.86	-1.44	-0.46	-0.48	53.1	77.8	58.9	86.4	7.55	-0.48	53.1	77.8	64568.9
862.0	14.37	70.0	102.7	740+69	53.1	77.8	645+69	2.56	-1.34	-0.35	-0.36	52.6	77.1	58.4	85.6	7.76	-0.36	52.6	77.1	64412.5
864.0	14.40	70.0	102.7	739+13	52.6	77.1	644+13	2.26	-1.24	-0.24	-0.25	52.2	76.6	58.0	85.0	7.92	-0.25	52.2	76.6	64257.8
866.0	14.43	70.0	102.7	737+58	52.2	76.6	642+58	1.96	-1.13	-0.13	-0.14	52.1	76.3	57.7	84.6	8.03	-0.14	52.1	76.3	64104.3
868.0	14.47	70.0	102.7	736+04	52.1	76.3	641+04	1.96	-1.13	-0.13	-0.13	51.9	76.1	57.6	84.4	8.09	-0.13	51.9	76.1	63951.4
870.0	14.50	70.0	102.7	734+51	51.9	76.1	639+51	1.74	-1.06	-0.05	-0.05	51.8	76.0	57.4	84.2	8.14	-0.05	51.8	76.0	63799.1
872.0	14.53	70.0	102.7	732+99	51.8	76.0	637+99	1.73	-1.06	-0.05	-0.05	51.7	75.9	57.4	84.1	8.17	-0.05	51.7	75.9	63647.1
874.0	14.57	70.0	102.7	731+47	51.7	75.9	636+47	1.73	-1.06	-0.04	-0.05	51.7	75.8	57.3	84.1	8.19	-0.05	51.7	75.8	63495.2
876.0	14.60	70.0	102.7	729+95	51.7	75.8	634+95	1.73	-1.06	-0.04	-0.04	51.6	75.7	57.3	84.0	8.21	-0.04	51.6	75.7	63343.6
878.0	14.63	70.0	102.7	728+44	51.6	75.7	633+44	1.73	-1.06	-0.04	-0.04	51.5	75.6	57.2	83.9	8.23	-0.04	51.5	75.6	63192.1
880.0	14.67	70.0	102.7	726+92	51.5	75.6	631+92	1.73	-1.06	-0.04	-0.04	51.5	75.5	57.2	83.9	8.25	-0.04	51.5	75.5	63040.8
882.0	14.70	70.0	102.7	725+41	51.5	75.5	630+41	1.59	-1.01	0.01	0.01	51.5	75.5	57.1	83.8	8.26	0.01	51.5	75.5	62889.8
884.0	14.73	70.0	102.7	723+90	51.5	75.5	628+90	1.10	-0.85	0.16	0.16	51.7	75.8	57.1	83.8	8.26	0.16	51.7	75.8	62739.0
886.0	14.77	70.0	102.7	722+39	51.7	75.8	627+39	1.10	-0.85	0.16	0.15	51.9	76.1	57.3	84.0	8.19	0.15	51.9	76.1	62587.6
888.0	14.80	70.0	102.7	720+88	51.9	76.1	625+88	0.59	-0.69	0.31	0.30	52.3	76.7	57.5	84.3	8.13	0.30	52.3	76.7	62435.9
890.0	14.83	70.0	102.7	719+36	52.3	76.7	624+36	0.08	-0.53	0.46	0.44	52.9	77.6	57.8	84.7	8.00	0.44	52.9	77.6	62283.3
892.0	14.87	70.0	102.7	717+83	52.9	77.6	622+83	-0.42	-0.37	0.61	0.58	53.7	78.8	58.3	85.4	7.81	0.58	53.7	78.8	62129.2
894.0	14.90	70.0	102.7	716+29	53.7	78.8	621+29	-0.42	-0.38	0.59	0.56	54.5	79.9	58.9	86.3	7.56	0.56	54.5	79.9	61972.8
896.0	14.93	70.0	102.7	714+73	54.5	79.9	619+73	-0.93	-0.23	0.73	0.70	55.4	81.3	59.5	87.2	7.32	0.70	55.4	81.3	61814.3
898.0	14.97	70.0	102.7	713+14	55.4	81.3	618+14	-1.44	-0.07	0.86	0.83	56.6	83.0	60.2	88.3	7.01	0.83	56.6	83.0	61653.4
900.0	15.00	70.0	102.7	711+53	56.6	83.0	616+53	-1.93	0.08	0.99	0.95	57.9	84.9	61.1	89.6	6.66	0.95	57.9	84.9	61489.4
902.0	15.03	70.0	102.7	709+89	57.9	84.9	614+89	-2.07	0.11	1.01	0.97	59.2	86.8	62.1	91.1	6.24	0.97	59.2	86.8	61321.6
904.0	15.07	70.0	102.7	708+22	59.2	86.8	613+22	-2.07	0.10	0.97	0.94	60.5	88.7	63.2	92.6	5.83	0.94	60.5	88.7	61149.8
906.0	15.10	70.0	102.7	706+50	60.5	88.7	611+50	-2.07	0.08	0.94	0.91	61.7	90.5	64.2	94.1	5.42	0.91	61.7	90.5	60974.3
908.0	15.13	70.0	102.7	704+74	61.7	90.5	609+74	-2.07	0.07	0.91	0.88	62.9	92.3	65.1	95.5	5.03	0.88	62.9	92.3	60795.1
910.0	15.17	70.0	102.7	702+95	62.9	92.3	607+95	-2.07	0.06	0.89	0.86	64.1	94.0	66.1	96.9	4.65	0.86	64.1	94.0	60612.3
912.0	15.20	70.0	102.7	701+12	64.1	94.0	606+12	-2.07	0.05	0.86	0.83	65.2	95.6	67.0	98.3	4.28	0.83	65.2	95.6	60426.0
914.0	15.23	70.0	102.7	699+26	65.2	95.6	604+26	-2.07	0.04	0.83	0.81	66.3	97.3	67.9	99.6	3.92	0.81	66.3	97.3	60236.3
916.0	15.27	70.0	102.7	697+36	66.3	97.3	602+36	-2.07	0.02	0.81	0.78	67.4	98.8	68.7	100.8	3.57	0.78	67.4	98.8	60043.3
918.0	15.30	70.0	102.7	695+43	67.4	98.8	600+43	-2.05	0.01	0.78	0.76	68.4	100.3	69.6	102.1	3.23	0.76	68.4	100.3	59847.2
920.0	15.33	70.0	102.7	693+47	68.4	100.3	598+47	-1.62	-0.14	0.62	0.60	69.2	101.5	70.4	103.2	2.90	0.60	69.2	101.5	59647.7
922.0	15.37	70.0	102.7	691+48	69.2	101.5	596+48	-1.17	-0.30	0.45	0.44	69.8	102.4	71.0	104.2	2.64	0.44	69.8	102.4	59445.5
924.0	15.40	70.0	102.7	689+46	69.8	102.4	594+46	-0.71	-0.45	0.30	0.29	70.2	103.0	71.5	104.9	2.45	0.29	70.2	103.0	59241.3
926.0	15.43	70.0	102.7	687+41	70.0	102.7	592+41	-0.26	-0.60	0.15	0.15	70.2	103.0	70.0	102.7	0.00	0.00	70.0	102.7	59035.9
928.0	15.47	70.0	102.7	685+36	70.0	102.7	590+36	0.13	-0.73	0.02	0.02	70.0	102.7	70.0	102.7	0.00	0.00	70.0	102.7	58830.6
930.0	15.50	70.0	102.7	683+31	70.0	102.7	588+31	0.19	-0.74	0.01	0.00	70.0	102.7	70.0	102.7	0.00	0.00	70.0	102.7	58625.3
932.0	15.53	70.0	102.7	681+25	70.0	102.7	586+25	0.19	-0.74	0.01	0.00	70.0	102.7	70.0	102.7	0.00	0.00	70.0	102.7	58419.9
934.0	15.57	70.0	102.7	679+20	70.0	102.7	584+20	0.19	-0.74	0.01	0.00	70.0	102.7	70.0	102.7	0.00	0.00	70.0	102.7	58214.6
936.0	15.60	70.0	102.7	677+15	70.0	102.7	582+15	0.19	-0.74	0.01	0.00	70.0	102.7	70.0	102.7	0.00	0.00	70.0	102.7	58009.3

1		2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Elapsed Time		Desired Speed		Actual Station	Start of Interval			Local Grade	Limiting acceleration			New speed based on vehicle performance		Limiting acceleration and speed based on driver preferences			Actual acceleration	End of Interval		
					Speed		Position		Coasting	Power	Effective			Speed		Acceleration		New Speed		New Position
(sec)	(Min)	(mph)	(ft/sec)	FYI	(mph)	(ft/sec)	(ft)	(%)	(ft/sec2)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(mph)	(ft/sec)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(ft)
938.0	15.63	70.0	102.7	675+09	70.0	102.7	580+09	0.19	-0.74	0.01	0.00	70.0	102.7	70.0	102.7	0.00	0.00	70.0	102.7	57803.9
940.0	15.67	70.0	102.7	673+04	70.0	102.7	578+04	0.19	-0.74	0.01	0.00	70.0	102.7	70.0	102.7	0.00	0.00	70.0	102.7	57598.6
942.0	15.70	70.0	102.7	670+99	70.0	102.7	575+99	0.19	-0.74	0.01	0.00	70.0	102.7	70.0	102.7	0.00	0.00	70.0	102.7	57393.3
944.0	15.73	70.0	102.7	668+93	70.0	102.7	573+93	0.15	-0.73	0.02	0.02	70.0	102.7	70.0	102.7	0.00	0.00	70.0	102.7	57187.9
946.0	15.77	70.0	102.7	666+88	70.0	102.7	571+88	0.08	-0.71	0.04	0.04	70.1	102.7	70.0	102.7	0.00	0.00	70.0	102.7	56982.6
948.0	15.80	70.0	102.7	664+83	70.0	102.7	569+83	0.01	-0.69	0.06	0.06	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	56777.3
950.0	15.83	70.0	102.7	662+77	70.0	102.7	567+77	-0.06	-0.66	0.08	0.08	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	56571.9
952.0	15.87	70.0	102.7	660+72	70.0	102.7	565+72	-0.13	-0.64	0.11	0.10	70.1	102.9	70.0	102.7	0.00	0.00	70.0	102.7	56366.6
954.0	15.90	70.0	102.7	658+67	70.0	102.7	563+67	-0.20	-0.62	0.13	0.13	70.2	102.9	70.0	102.7	0.00	0.00	70.0	102.7	56161.3
956.0	15.93	70.0	102.7	656+61	70.0	102.7	561+61	-0.27	-0.60	0.15	0.15	70.2	103.0	70.0	102.7	0.00	0.00	70.0	102.7	55955.9
958.0	15.97	70.0	102.7	654+56	70.0	102.7	559+56	-0.34	-0.57	0.17	0.17	70.2	103.0	70.0	102.7	0.00	0.00	70.0	102.7	55750.6
960.0	16.00	70.0	102.7	652+51	70.0	102.7	557+51	-0.41	-0.55	0.20	0.19	70.3	103.1	70.0	102.7	0.00	0.00	70.0	102.7	55545.3
962.0	16.03	70.0	102.7	650+45	70.0	102.7	555+45	-0.49	-0.53	0.22	0.21	70.3	103.1	70.0	102.7	0.00	0.00	70.0	102.7	55339.9
964.0	16.07	70.0	102.7	648+40	70.0	102.7	553+40	-0.52	-0.52	0.23	0.23	70.3	103.1	70.0	102.7	0.00	0.00	70.0	102.7	55134.6
966.0	16.10	70.0	102.7	646+35	70.0	102.7	551+35	-0.52	-0.52	0.23	0.23	70.3	103.1	70.0	102.7	0.00	0.00	70.0	102.7	54929.3
968.0	16.13	70.0	102.7	644+29	70.0	102.7	549+29	-0.52	-0.52	0.23	0.23	70.3	103.1	70.0	102.7	0.00	0.00	70.0	102.7	54723.9
970.0	16.17	70.0	102.7	642+24	70.0	102.7	547+24	-0.52	-0.52	0.23	0.23	70.3	103.1	70.0	102.7	0.00	0.00	70.0	102.7	54518.6
972.0	16.20	70.0	102.7	640+19	70.0	102.7	545+19	-0.52	-0.52	0.23	0.23	70.3	103.1	70.0	102.7	0.00	0.00	70.0	102.7	54313.3
974.0	16.23	70.0	102.7	638+13	70.0	102.7	543+13	-0.52	-0.52	0.23	0.23	70.3	103.1	70.0	102.7	0.00	0.00	70.0	102.7	54107.9
976.0	16.27	70.0	102.7	636+08	70.0	102.7	541+08	-0.52	-0.52	0.23	0.23	70.3	103.1	70.0	102.7	0.00	0.00	70.0	102.7	53902.6
978.0	16.30	70.0	102.7	634+03	70.0	102.7	539+03	-0.58	-0.50	0.25	0.24	70.3	103.2	70.0	102.7	0.00	0.00	70.0	102.7	53697.3
980.0	16.33	70.0	102.7	631+97	70.0	102.7	536+97	-1.42	-0.22	0.52	0.51	70.7	103.7	70.0	102.7	0.00	0.00	70.0	102.7	53491.9
982.0	16.37	70.0	102.7	629+92	70.0	102.7	534+92	-1.88	-0.08	0.66	0.65	70.9	104.0	70.0	102.7	0.00	0.00	70.0	102.7	53286.6
984.0	16.40	70.0	102.7	627+87	70.0	102.7	532+87	-2.33	0.07	0.81	0.79	71.1	104.2	70.0	102.7	0.00	0.00	70.0	102.7	53081.3
986.0	16.43	70.0	102.7	625+81	70.0	102.7	530+81	-2.72	0.19	0.94	0.91	71.2	104.5	70.0	102.7	0.00	0.00	70.0	102.7	52875.9
988.0	16.47	70.0	102.7	623+76	70.0	102.7	528+76	-2.78	0.21	0.95	0.93	71.3	104.5	70.0	102.7	0.00	0.00	70.0	102.7	52670.6
990.0	16.50	70.0	102.7	621+71	70.0	102.7	526+71	-2.78	0.21	0.95	0.93	71.3	104.5	70.0	102.7	0.00	0.00	70.0	102.7	52465.3
992.0	16.53	70.0	102.7	619+65	70.0	102.7	524+65	-2.78	0.21	0.95	0.93	71.3	104.5	70.0	102.7	0.00	0.00	70.0	102.7	52259.9
994.0	16.57	70.0	102.7	617+60	70.0	102.7	522+60	-2.78	0.21	0.95	0.93	71.3	104.5	70.0	102.7	0.00	0.00	70.0	102.7	52054.6
996.0	16.60	70.0	102.7	615+55	70.0	102.7	520+55	-2.78	0.21	0.95	0.93	71.3	104.5	70.0	102.7	0.00	0.00	70.0	102.7	51849.3
998.0	16.63	70.0	102.7	613+49	70.0	102.7	518+49	-2.39	0.09	0.83	0.81	71.1	104.3	70.0	102.7	0.00	0.00	70.0	102.7	51643.9
1000.0	16.67	70.0	102.7	611+44	70.0	102.7	516+44	-1.60	-0.17	0.58	0.56	70.8	103.8	70.0	102.7	0.00	0.00	70.0	102.7	51438.6
1002.0	16.70	70.0	102.7	609+39	70.0	102.7	514+39	-0.82	-0.42	0.33	0.32	70.4	103.3	70.0	102.7	0.00	0.00	70.0	102.7	51233.3
1004.0	16.73	70.0	102.7	607+33	70.0	102.7	512+33	-0.03	-0.67	0.07	0.07	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	51027.9
1006.0	16.77	70.0	102.7	605+28	70.0	102.7	510+28	0.75	-0.93	-0.18	-0.18	69.8	102.3	70.0	102.7	0.00	-0.18	69.8	102.3	50822.2
1008.0	16.80	70.0	102.7	603+22	69.8	102.3	508+22	1.15	-1.05	-0.30	-0.30	69.3	101.7	71.4	104.8	2.48	-0.30	69.3	101.7	50617.0
1010.0	16.83	70.0	102.7	601+17	69.3	101.7	506+17	1.15	-1.04	-0.29	-0.30	68.9	101.1	71.1	104.3	2.61	-0.30	68.9	101.1	50413.0
1012.0	16.87	70.0	102.7	599+13	68.9	101.1	504+13	1.15	-1.04	-0.28	-0.29	68.5	100.5	70.8	103.8	2.74	-0.29	68.5	100.5	50210.3
1014.0	16.90	70.0	102.7	597+10	68.5	100.5	502+10	1.15	-1.04	-0.27	-0.28	68.2	100.0	70.5	103.4	2.86	-0.28	68.2	100.0	50008.6
1016.0	16.93	70.0	102.7	595+09	68.2	100.0	500+09	0.98	-0.98	-0.21	-0.21	67.9	99.5	70.2	103.0	2.98	-0.21	67.9	99.5	49808.3
1018.0	16.97	70.0	102.7	593+08	67.9	99.5	498+08	0.41	-0.79	-0.02	-0.02	67.8	99.5	70.0	102.6	3.07	-0.02	67.8	99.5	49609.1
1020.0	17.00	70.0	102.7	591+09	67.8	99.5	496+09	-0.18	-0.60	0.17	0.17	68.1	99.8	69.9	102.6	3.08	0.17	68.1	99.8	49410.5
1022.0	17.03	70.0	102.7	589+10	68.1	99.8	494+10	-0.78	-0.41	0.36	0.35	68.5	100.5	70.1	102.9	3.01	0.35	68.5	100.5	49211.5
1024.0	17.07	70.0	102.7	587+11	68.5	100.5	492+11	-1.37	-0.23	0.53	0.52	69.3	101.6	70.5	103.4	2.86	0.52	69.3	101.6	49011.4
1026.0	17.10	70.0	102.7	585+11	69.3	101.6	490+11	-1.96	-0.04	0.71	0.69	70.2	103.0	71.1	104.2	2.64	0.69	70.2	103.0	48809.7
1028.0	17.13	70.0	102.7	583+10	70.0	102.7	488+10	-2.55	0.14	0.88	0.86	71.2	104.4	70.0	102.7	0.00	0.00	70.0	102.7	48604.3
1030.0	17.17	75.0	110.0	581+04	70.0	102.7	486+04	-3.12	0.32	1.06	1.04	71.4	104.7	72.7	106.7	3.98	1.04	71.4	104.7	48401.1
1032.0	17.20	75.0	110.0	579+01	71.4	104.7	484+01	-3.29	0.36	1.09	1.06	72.9	106.9	73.8	108.3	3.54	1.06	72.9	106.9	48193.7
1034.0	17.23	75.0	110.0	576+94	72.9	106.9	481+94	-3.29	0.34	1.06	1.03	74.3	108.9	75.0	109.9	3.08	1.03	74.3	108.9	47982.1
1036.0	17.27	75.0	110.0	574+82	74.3	108.9	479+82	-3.29	0.33	1.03	1.00	75.6	110.9	76.1	111.6	2.63	1.00	75.6	110.9	47766.2
1038.0	17.30	75.0	110.0	572+66	75.0	110.0	477+66	-3.29	0.32	1.01	0.99	76.3	112.0	75.0	110.0	0.00	0.00	75.0	110.0	47546.2
1040.0	17.33	75.0	110.0	570+46	75.0	110.0	475+46	-3.29	0.32	1.01	0.99	76.3	112.0	75.0	110.0	0.00	0.00	75.0	110.0	47326.2
1042.0	17.37	75.0	110.0	568+26	75.0	110.0	473+26	-3.29	0.32	1.01	0.99	76.3	112.0	75.0	110.0	0.00	0.00	75.0	110.0	47106.2

1		2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Elapsed Time		Desired Speed		Actual Station	Start of Interval			Local Grade	Limiting acceleration			New speed based on vehicle performance		Limiting acceleration and speed based on driver preferences			Actual acceleration	End of Interval		
					Speed		Position		Coasting	Power	Effective			Speed		Acceleration		New Speed		New Position
(sec)	(Min)	(mph)	(ft/sec)	FYI	(mph)	(ft/sec)	(ft)	(%)	(ft/sec2)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(mph)	(ft/sec)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(ft)
1044.0	17.40	75.0	110.0	566+06	75.0	110.0	471+06	-3.29	0.32	1.01	0.99	76.3	112.0	75.0	110.0	0.00	0.00	75.0	110.0	46886.2
1046.0	17.43	75.0	110.0	563+86	75.0	110.0	468+86	-3.29	0.32	1.01	0.99	76.3	112.0	75.0	110.0	0.00	0.00	75.0	110.0	46666.2
1048.0	17.47	75.0	110.0	561+66	75.0	110.0	466+66	-3.03	0.23	0.92	0.90	76.2	111.8	75.0	110.0	0.00	0.00	75.0	110.0	46446.2
1050.0	17.50	70.0	102.7	559+46	70.0	102.7	464+46	-2.30	0.06	0.80	0.78	71.1	104.2	70.0	102.7	0.00	0.00	70.0	102.7	46240.9
1052.0	17.53	70.0	102.7	557+41	70.0	102.7	462+41	-1.23	-0.29	0.46	0.45	70.6	103.6	70.0	102.7	0.00	0.00	70.0	102.7	46035.6
1054.0	17.57	70.0	102.7	555+36	70.0	102.7	460+36	-0.27	-0.60	0.15	0.15	70.2	103.0	70.0	102.7	0.00	0.00	70.0	102.7	45830.2
1056.0	17.60	70.0	102.7	553+30	70.0	102.7	458+30	0.66	-0.90	-0.15	-0.15	69.8	102.4	70.0	102.7	0.00	-0.15	69.8	102.4	45624.6
1058.0	17.63	70.0	102.7	551+25	69.8	102.4	456+25	1.64	-1.21	-0.45	-0.47	69.2	101.4	71.5	104.8	2.46	-0.47	69.2	101.4	45418.9
1060.0	17.67	70.0	102.7	549+19	69.2	101.4	454+19	2.59	-1.51	-0.75	-0.77	68.1	99.9	71.0	104.1	2.67	-0.77	68.1	99.9	45214.5
1062.0	17.70	70.0	102.7	547+15	68.1	99.9	452+15	3.27	-1.72	-0.94	-0.97	66.8	98.0	70.2	102.9	3.00	-0.97	66.8	98.0	45012.8
1064.0	17.73	70.0	102.7	545+13	66.8	98.0	450+13	3.30	-1.71	-0.92	-0.95	65.5	96.1	69.1	101.4	3.42	-0.95	65.5	96.1	44815.0
1066.0	17.77	70.0	102.7	543+15	65.5	96.1	448+15	3.12	-1.64	-0.83	-0.86	64.3	94.3	68.1	99.9	3.83	-0.86	64.3	94.3	44621.1
1068.0	17.80	70.0	102.7	541+21	64.3	94.3	446+21	2.50	-1.43	-0.61	-0.63	63.5	93.1	67.2	98.5	4.20	-0.63	63.5	93.1	44431.2
1070.0	17.83	70.0	102.7	539+31	63.5	93.1	444+31	1.86	-1.21	-0.38	-0.40	62.9	92.3	66.5	97.6	4.47	-0.40	62.9	92.3	44244.2
1072.0	17.87	70.0	102.7	537+44	62.9	92.3	442+44	1.23	-1.00	-0.17	-0.17	62.7	92.0	66.1	96.9	4.64	-0.17	62.7	92.0	44059.3
1074.0	17.90	70.0	102.7	535+59	62.7	92.0	440+59	0.59	-0.79	0.04	0.04	62.8	92.0	65.9	96.7	4.71	0.04	62.8	92.0	43875.4
1076.0	17.93	70.0	102.7	533+75	62.8	92.0	438+75	-0.05	-0.59	0.25	0.24	63.1	92.5	66.0	96.7	4.70	0.24	63.1	92.5	43691.8
1078.0	17.97	70.0	102.7	531+92	63.1	92.5	436+92	-0.69	-0.39	0.44	0.43	63.7	93.4	66.2	97.1	4.59	0.43	63.7	93.4	43507.7
1080.0	18.00	70.0	102.7	530+08	63.7	93.4	435+08	-0.69	-0.39	0.43	0.41	64.2	94.2	66.7	97.8	4.41	0.41	64.2	94.2	43321.8
1082.0	18.03	70.0	102.7	528+22	64.2	94.2	433+22	-1.31	-0.20	0.61	0.59	65.0	95.4	67.1	98.4	4.23	0.59	65.0	95.4	43134.6
1084.0	18.07	70.0	102.7	526+35	65.0	95.4	431+35	-1.49	-0.15	0.65	0.63	65.9	96.6	67.7	99.4	3.97	0.63	65.9	96.6	42945.1
1086.0	18.10	70.0	102.7	524+45	65.9	96.6	429+45	-1.49	-0.16	0.63	0.61	66.7	97.9	68.4	100.3	3.70	0.61	66.7	97.9	42753.0
1088.0	18.13	70.0	102.7	522+53	66.7	97.9	427+53	-1.42	-0.19	0.59	0.57	67.5	99.0	69.1	101.3	3.44	0.57	67.5	99.0	42558.5
1090.0	18.17	70.0	102.7	520+58	67.5	99.0	425+58	-0.79	-0.40	0.37	0.36	68.0	99.7	69.7	102.2	3.19	0.36	68.0	99.7	42361.1
1092.0	18.20	70.0	102.7	518+61	68.0	99.7	423+61	-0.28	-0.57	0.20	0.19	68.3	100.1	70.1	102.8	3.03	0.19	68.3	100.1	42162.0
1094.0	18.23	70.0	102.7	516+62	68.3	100.1	421+62	0.30	-0.76	0.01	0.01	68.3	100.1	70.3	103.1	2.95	0.01	68.3	100.1	41961.8
1096.0	18.27	70.0	102.7	514+62	68.3	100.1	419+62	0.70	-0.89	-0.12	-0.12	68.1	99.9	70.3	103.1	2.94	-0.12	68.1	99.9	41761.3
1098.0	18.30	70.0	102.7	512+61	68.1	99.9	417+61	0.70	-0.89	-0.12	-0.12	67.9	99.7	70.2	102.9	3.00	-0.12	67.9	99.7	41561.2
1100.0	18.33	70.0	102.7	510+61	67.9	99.7	415+61	0.70	-0.89	-0.11	-0.12	67.8	99.4	70.0	102.7	3.05	-0.12	67.8	99.4	41361.7
1102.0	18.37	70.0	102.7	508+62	67.8	99.4	413+62	0.70	-0.88	-0.11	-0.11	67.6	99.2	69.9	102.5	3.10	-0.11	67.6	99.2	41162.6
1104.0	18.40	70.0	102.7	506+63	67.6	99.2	411+63	0.70	-0.88	-0.11	-0.11	67.5	99.0	69.8	102.3	3.15	-0.11	67.5	99.0	40964.0
1106.0	18.43	70.0	102.7	504+64	67.5	99.0	409+64	0.70	-0.88	-0.10	-0.11	67.3	98.8	69.7	102.2	3.20	-0.11	67.3	98.8	40765.9
1108.0	18.47	70.0	102.7	502+66	67.3	98.8	407+66	0.70	-0.88	-0.10	-0.10	67.2	98.6	69.5	102.0	3.24	-0.10	67.2	98.6	40568.1
1110.0	18.50	70.0	102.7	500+68	67.2	98.6	405+68	0.70	-0.88	-0.10	-0.10	67.1	98.4	69.4	101.8	3.29	-0.10	67.1	98.4	40370.8
1112.0	18.53	70.0	102.7	498+71	67.1	98.4	403+71	0.70	-0.88	-0.09	-0.10	66.9	98.2	69.3	101.7	3.33	-0.10	66.9	98.2	40173.9
1114.0	18.57	70.0	102.7	496+74	66.9	98.2	401+74	0.70	-0.87	-0.09	-0.09	66.8	98.0	69.2	101.5	3.37	-0.09	66.8	98.0	39977.4
1116.0	18.60	70.0	102.7	494+77	66.8	98.0	399+77	0.70	-0.87	-0.09	-0.09	66.7	97.8	69.1	101.4	3.41	-0.09	66.7	97.8	39781.3
1118.0	18.63	70.0	102.7	492+81	66.7	97.8	397+81	0.70	-0.87	-0.09	-0.09	66.6	97.6	69.0	101.2	3.45	-0.09	66.6	97.6	39585.5
1120.0	18.67	70.0	102.7	490+85	66.6	97.6	395+85	0.70	-0.87	-0.08	-0.08	66.4	97.4	68.9	101.1	3.49	-0.08	66.4	97.4	39390.1
1122.0	18.70	70.0	102.7	488+90	66.4	97.4	393+90	0.70	-0.87	-0.08	-0.08	66.3	97.3	68.8	101.0	3.53	-0.08	66.3	97.3	39195.0
1124.0	18.73	70.0	102.7	486+95	66.3	97.3	391+95	0.70	-0.87	-0.08	-0.08	66.2	97.1	68.8	100.8	3.56	-0.08	66.2	97.1	39000.3
1126.0	18.77	70.0	102.7	485+00	66.2	97.1	390+00	0.70	-0.87	-0.07	-0.08	66.1	97.0	68.7	100.7	3.60	-0.08	66.1	97.0	38805.9
1128.0	18.80	70.0	102.7	483+06	66.1	97.0	388+06	0.70	-0.87	-0.07	-0.07	66.0	96.8	68.6	100.6	3.63	-0.07	66.0	96.8	38611.8
1130.0	18.83	70.0	102.7	481+12	66.0	96.8	386+12	0.50	-0.80	-0.01	-0.01	66.0	96.8	68.5	100.5	3.66	-0.01	66.0	96.8	38418.1
1132.0	18.87	70.0	102.7	479+18	66.0	96.8	384+18	0.11	-0.67	0.12	0.12	66.2	97.0	68.5	100.5	3.67	0.12	66.2	97.0	38224.8
1134.0	18.90	70.0	102.7	477+25	66.2	97.0	382+25	-0.29	-0.55	0.24	0.24	66.5	97.5	68.6	100.7	3.62	0.24	66.5	97.5	38031.1
1136.0	18.93	70.0	102.7	475+31	66.5	97.5	380+31	-0.69	-0.42	0.36	0.35	67.0	98.2	68.9	101.0	3.51	0.35	67.0	98.2	37836.8
1138.0	18.97	70.0	102.7	473+37	67.0	98.2	378+37	-1.08	-0.30	0.48	0.46	67.6	99.1	69.3	101.6	3.36	0.46	67.6	99.1	37641.3
1140.0	19.00	70.0	102.7	471+41	67.6	99.1	376+41	-1.48	-0.18	0.59	0.57	68.4	100.3	69.8	102.3	3.16	0.57	68.4	100.3	37444.2
1142.0	19.03	70.0	102.7	469+44	68.4	100.3	374+44	-1.87	-0.06	0.70	0.68	69.3	101.7	70.4	103.2	2.91	0.68	69.3	101.7	37245.0
1144.0	19.07	70.0	102.7	467+45	69.3	101.7	372+45	-2.27	0.06	0.81	0.78	70.4	103.2	71.1	104.3	2.62	0.78	70.4	103.2	37043.2
1146.0	19.10	70.0	102.7	465+43	70.0	102.7	370+43	-2.66	0.17	0.92	0.89	71.2	104.5	70.0	102.7	0.00	0.00	70.0	102.7	36837.9
1148.0	19.13	75.0	110.0	463+38	70.0	102.7	368+38	-3.06	0.30	1.04	1.02	71.4	104.7	72.7	106.7	3.98	1.02	71.4	104.7	36634.6

1		2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Elapsed Time		Desired Speed		Actual Station	Start of Interval			Local Grade	Limiting acceleration			New speed based on vehicle performance		Limiting acceleration and speed based on driver preferences			Actual acceleration	End of Interval		
					Speed		Position		Coasting	Power	Effective			Speed		Acceleration		New Speed		New Position
(sec)	(Min)	(mph)	(ft/sec)	FYI	(mph)	(ft/sec)	(ft)	(%)	(ft/sec2)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(mph)	(ft/sec)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(ft)
1150.0	19.17	75.0	110.0	461+35	71.4	104.7	366+35	-3.26	0.35	1.08	1.05	72.8	106.8	73.8	108.2	3.54	1.05	72.8	106.8	36427.3
1152.0	19.20	75.0	110.0	459+27	72.8	106.8	364+27	-3.26	0.33	1.05	1.02	74.2	108.8	74.9	109.9	3.09	1.02	74.2	108.8	36215.7
1154.0	19.23	75.0	110.0	457+16	74.2	108.8	362+16	-3.26	0.32	1.02	0.99	75.6	110.8	76.0	111.5	2.65	0.99	75.6	110.8	36000.0
1156.0	19.27	75.0	110.0	455+00	75.0	110.0	360+00	-3.26	0.31	1.00	0.98	76.3	112.0	75.0	110.0	0.00	0.00	75.0	110.0	35780.0
1158.0	19.30	75.0	110.0	452+80	75.0	110.0	357+80	-3.21	0.29	0.98	0.96	76.3	111.9	75.0	110.0	0.00	0.00	75.0	110.0	35560.0
1160.0	19.33	70.0	102.7	450+60	70.0	102.7	355+60	-2.88	0.25	0.99	0.96	71.3	104.6	70.0	102.7	0.00	0.00	70.0	102.7	35354.7
1162.0	19.37	70.0	102.7	448+55	70.0	102.7	353+55	-2.51	0.12	0.87	0.84	71.2	104.4	70.0	102.7	0.00	0.00	70.0	102.7	35149.4
1164.0	19.40	70.0	102.7	446+49	70.0	102.7	351+49	-2.13	0.00	0.75	0.73	71.0	104.1	70.0	102.7	0.00	0.00	70.0	102.7	34944.0
1166.0	19.43	70.0	102.7	444+44	70.0	102.7	349+44	-1.76	-0.12	0.63	0.61	70.8	103.9	70.0	102.7	0.00	0.00	70.0	102.7	34738.7
1168.0	19.47	70.0	102.7	442+39	70.0	102.7	347+39	-1.38	-0.24	0.51	0.49	70.7	103.7	70.0	102.7	0.00	0.00	70.0	102.7	34533.4
1170.0	19.50	70.0	102.7	440+33	70.0	102.7	345+33	-1.00	-0.36	0.39	0.38	70.5	103.4	70.0	102.7	0.00	0.00	70.0	102.7	34328.0
1172.0	19.53	70.0	102.7	438+28	70.0	102.7	343+28	-0.63	-0.48	0.27	0.26	70.4	103.2	70.0	102.7	0.00	0.00	70.0	102.7	34122.7
1174.0	19.57	70.0	102.7	436+23	70.0	102.7	341+23	-0.25	-0.60	0.15	0.14	70.2	102.9	70.0	102.7	0.00	0.00	70.0	102.7	33917.4
1176.0	19.60	70.0	102.7	434+17	70.0	102.7	339+17	0.12	-0.72	0.03	0.02	70.0	102.7	70.0	102.7	0.00	0.00	70.0	102.7	33712.0
1178.0	19.63	70.0	102.7	432+12	70.0	102.7	337+12	0.45	-0.83	-0.08	-0.08	69.9	102.5	70.0	102.7	0.00	-0.08	69.9	102.5	33506.5
1180.0	19.67	70.0	102.7	430+07	69.9	102.5	335+07	0.50	-0.84	-0.09	-0.10	69.8	102.3	71.5	104.9	2.44	-0.10	69.8	102.3	33301.3
1182.0	19.70	70.0	102.7	428+01	69.8	102.3	333+01	0.50	-0.84	-0.09	-0.09	69.6	102.1	71.4	104.8	2.48	-0.09	69.6	102.1	33096.5
1184.0	19.73	70.0	102.7	425+97	69.6	102.1	330+97	0.50	-0.84	-0.09	-0.09	69.5	101.9	71.3	104.6	2.52	-0.09	69.5	101.9	32892.1
1186.0	19.77	70.0	102.7	423+92	69.5	101.9	328+92	0.50	-0.84	-0.08	-0.09	69.4	101.8	71.3	104.5	2.56	-0.09	69.4	101.8	32688.0
1188.0	19.80	70.0	102.7	421+88	69.4	101.8	326+88	0.50	-0.84	-0.08	-0.08	69.3	101.6	71.2	104.4	2.59	-0.08	69.3	101.6	32484.3
1190.0	19.83	70.0	102.7	419+84	69.3	101.6	324+84	0.52	-0.84	-0.08	-0.09	69.2	101.4	71.1	104.2	2.63	-0.09	69.2	101.4	32280.9
1192.0	19.87	70.0	102.7	417+81	69.2	101.4	322+81	0.76	-0.92	-0.16	-0.16	68.9	101.1	71.0	104.1	2.67	-0.16	68.9	101.1	32077.7
1194.0	19.90	70.0	102.7	415+78	68.9	101.1	320+78	1.00	-0.99	-0.23	-0.24	68.6	100.6	70.8	103.8	2.74	-0.24	68.6	100.6	31875.0
1196.0	19.93	70.0	102.7	413+75	68.6	100.6	318+75	1.24	-1.07	-0.30	-0.31	68.2	100.0	70.5	103.5	2.84	-0.31	68.2	100.0	31673.2
1198.0	19.97	70.0	102.7	411+73	68.2	100.0	316+73	1.53	-1.16	-0.39	-0.40	67.6	99.2	70.2	103.0	2.97	-0.40	67.6	99.2	31472.4
1200.0	20.00	70.0	102.7	409+72	67.6	99.2	314+72	1.77	-1.22	-0.45	-0.46	67.0	98.3	69.8	102.4	3.15	-0.46	67.0	98.3	31273.0
1202.0	20.03	70.0	102.7	407+73	67.0	98.3	312+73	2.00	-1.29	-0.51	-0.52	66.3	97.2	69.3	101.6	3.34	-0.52	66.3	97.2	31075.4
1204.0	20.07	70.0	102.7	405+75	66.3	97.2	310+75	2.22	-1.36	-0.56	-0.58	65.5	96.1	68.7	100.8	3.57	-0.58	65.5	96.1	30879.7
1206.0	20.10	70.0	102.7	403+80	65.5	96.1	308+80	2.45	-1.42	-0.62	-0.64	64.6	94.8	68.1	99.9	3.82	-0.64	64.6	94.8	30686.3
1208.0	20.13	70.0	102.7	401+86	64.6	94.8	306+86	2.69	-1.49	-0.67	-0.70	63.7	93.4	67.4	98.9	4.10	-0.70	63.7	93.4	30495.3
1210.0	20.17	70.0	102.7	399+95	63.7	93.4	304+95	2.80	-1.52	-0.69	-0.71	62.7	92.0	66.7	97.8	4.40	-0.71	62.7	92.0	30307.0
1212.0	20.20	70.0	102.7	398+07	62.7	92.0	303+07	2.80	-1.51	-0.66	-0.69	61.8	90.6	65.9	96.7	4.71	-0.69	61.8	90.6	30121.6
1214.0	20.23	70.0	102.7	396+22	61.8	90.6	301+22	2.80	-1.50	-0.64	-0.67	60.9	89.3	65.2	95.6	5.00	-0.67	60.9	89.3	29939.1
1216.0	20.27	70.0	102.7	394+39	60.9	89.3	299+39	2.80	-1.49	-0.62	-0.64	60.0	88.0	64.5	94.6	5.29	-0.64	60.0	88.0	29759.2
1218.0	20.30	70.0	102.7	392+59	60.0	88.0	297+59	2.80	-1.48	-0.60	-0.62	59.1	86.8	63.8	93.6	5.57	-0.62	59.1	86.8	29582.0
1220.0	20.33	70.0	102.7	390+82	59.1	86.8	295+82	2.80	-1.47	-0.58	-0.60	58.3	85.5	63.1	92.6	5.84	-0.60	58.3	85.5	29407.3
1222.0	20.37	70.0	102.7	389+07	58.3	85.5	294+07	2.80	-1.46	-0.56	-0.58	57.5	84.4	62.5	91.6	6.10	-0.58	57.5	84.4	29235.0
1224.0	20.40	70.0	102.7	387+35	57.5	84.4	292+35	2.80	-1.45	-0.54	-0.56	56.8	83.3	61.9	90.7	6.35	-0.56	56.8	83.3	29065.1
1226.0	20.43	70.0	102.7	385+65	56.8	83.3	290+65	2.80	-1.45	-0.52	-0.54	56.0	82.2	61.3	89.9	6.59	-0.54	56.0	82.2	28897.5
1228.0	20.47	70.0	102.7	383+98	56.0	82.2	288+98	2.80	-1.44	-0.50	-0.52	55.3	81.1	60.7	89.0	6.83	-0.52	55.3	81.1	28732.1
1230.0	20.50	70.0	102.7	382+32	55.3	81.1	287+32	2.80	-1.43	-0.48	-0.50	54.6	80.1	60.1	88.2	7.05	-0.50	54.6	80.1	28568.8
1232.0	20.53	70.0	102.7	380+69	54.6	80.1	285+69	2.80	-1.43	-0.46	-0.49	54.0	79.2	59.6	87.4	7.27	-0.49	54.0	79.2	28407.6
1234.0	20.57	70.0	102.7	379+08	54.0	79.2	284+08	2.80	-1.42	-0.45	-0.47	53.3	78.2	59.1	86.6	7.48	-0.47	53.3	78.2	28248.3
1236.0	20.60	70.0	102.7	377+48	53.3	78.2	282+48	2.80	-1.42	-0.43	-0.45	52.7	77.3	58.6	85.9	7.68	-0.45	52.7	77.3	28091.0
1238.0	20.63	70.0	102.7	375+91	52.7	77.3	280+91	2.80	-1.41	-0.41	-0.43	52.1	76.5	58.1	85.2	7.87	-0.43	52.1	76.5	27935.5
1240.0	20.67	70.0	102.7	374+35	52.1	76.5	279+35	2.80	-1.41	-0.40	-0.42	51.6	75.6	57.6	84.5	8.06	-0.42	51.6	75.6	27781.8
1242.0	20.70	70.0	102.7	372+82	51.6	75.6	277+82	2.75	-1.38	-0.36	-0.38	51.0	74.9	57.2	83.9	8.24	-0.38	51.0	74.9	27629.7
1244.0	20.73	70.0	102.7	371+30	51.0	74.9	276+30	2.37	-1.26	-0.23	-0.24	50.7	74.4	56.8	83.3	8.41	-0.24	50.7	74.4	27479.6
1246.0	20.77	70.0	102.7	369+80	50.7	74.4	274+80	1.94	-1.12	-0.08	-0.09	50.6	74.2	56.5	82.9	8.51	-0.09	50.6	74.2	27330.6
1248.0	20.80	70.0	102.7	368+31	50.6	74.2	273+31	1.94	-1.12	-0.08	-0.09	50.5	74.0	56.4	82.7	8.55	-0.09	50.5	74.0	27182.1
1250.0	20.83	70.0	102.7	366+82	50.5	74.0	271+82	1.52	-0.98	0.06	0.06	50.5	74.1	56.3	82.6	8.59	0.06	50.5	74.1	27034.1
1252.0	20.87	70.0	102.7	365+34	50.5	74.1	270+34	1.09	-0.84	0.19	0.18	50.8	74.5	56.4	82.7	8.56	0.18	50.8	74.5	26886.2
1254.0	20.90	70.0	102.7	363+86	50.8	74.5	268+86	0.72	-0.72	0.30	0.29	51.2	75.1	56.6	83.0	8.48	0.29	51.2	75.1	26737.8

1		2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Elapsed Time		Desired Speed		Actual Station	Start of Interval			Local Grade	Limiting acceleration			New speed based on vehicle performance		Limiting acceleration and speed based on driver preferences			Actual acceleration	End of Interval		
					Speed		Position		Coasting	Power	Effective			Speed		Acceleration		New Speed		New Position
(sec)	(Min)	(mph)	(ft/sec)	FYI	(mph)	(ft/sec)	(ft)	(%)	(ft/sec2)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(mph)	(ft/sec)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(ft)
1256.0	20.93	70.0	102.7	362+38	51.2	75.1	267+38	0.72	-0.73	0.29	0.28	51.6	75.6	56.9	83.4	8.36	0.28	51.6	75.6	26588.2
1258.0	20.97	70.0	102.7	360+88	51.6	75.6	265+88	0.66	-0.71	0.30	0.29	52.0	76.2	57.2	83.9	8.24	0.29	52.0	76.2	26437.5
1260.0	21.00	70.0	102.7	359+37	52.0	76.2	264+37	0.66	-0.72	0.29	0.28	52.3	76.8	57.5	84.3	8.11	0.28	52.3	76.8	26285.6
1262.0	21.03	70.0	102.7	357+86	52.3	76.8	262+86	0.66	-0.72	0.28	0.27	52.7	77.3	57.8	84.8	8.00	0.27	52.7	77.3	26132.6
1264.0	21.07	70.0	102.7	356+33	52.7	77.3	261+33	0.66	-0.72	0.27	0.26	53.0	77.8	58.1	85.2	7.88	0.26	53.0	77.8	25978.6
1266.0	21.10	70.0	102.7	354+79	53.0	77.8	259+79	0.66	-0.73	0.26	0.25	53.4	78.3	58.3	85.6	7.77	0.25	53.4	78.3	25823.4
1268.0	21.13	70.0	102.7	353+23	53.4	78.3	258+23	0.66	-0.73	0.25	0.24	53.7	78.8	58.6	86.0	7.66	0.24	53.7	78.8	25667.3
1270.0	21.17	70.0	102.7	351+67	53.7	78.8	256+67	0.66	-0.73	0.24	0.23	54.0	79.2	58.9	86.3	7.56	0.23	54.0	79.2	25510.2
1272.0	21.20	70.0	102.7	350+10	54.0	79.2	255+10	0.66	-0.73	0.23	0.22	54.3	79.7	59.1	86.7	7.46	0.22	54.3	79.7	25352.2
1274.0	21.23	70.0	102.7	348+52	54.3	79.7	253+52	0.49	-0.68	0.28	0.27	54.7	80.2	59.4	87.1	7.36	0.27	54.7	80.2	25193.3
1276.0	21.27	70.0	102.7	346+93	54.7	80.2	251+93	-0.08	-0.50	0.45	0.43	55.3	81.1	59.6	87.5	7.25	0.43	55.3	81.1	25033.8
1278.0	21.30	70.0	102.7	345+34	55.3	81.1	250+34	-0.68	-0.31	0.63	0.60	56.1	82.3	60.1	88.1	7.06	0.60	56.1	82.3	24872.8
1280.0	21.33	70.0	102.7	343+73	56.1	82.3	248+73	-1.27	-0.13	0.80	0.76	57.1	83.8	60.7	89.1	6.80	0.76	57.1	83.8	24709.7
1282.0	21.37	70.0	102.7	342+10	57.1	83.8	247+10	-1.27	-0.14	0.77	0.74	58.2	85.3	61.6	90.3	6.47	0.74	58.2	85.3	24543.6
1284.0	21.40	70.0	102.7	340+44	58.2	85.3	245+44	-1.87	0.04	0.93	0.90	59.4	87.1	62.4	91.4	6.15	0.90	59.4	87.1	24374.8
1286.0	21.43	70.0	102.7	338+75	59.4	87.1	243+75	-2.46	0.22	1.09	1.05	60.8	89.2	63.3	92.9	5.76	1.05	60.8	89.2	24202.7
1288.0	21.47	75.0	110.0	337+03	60.8	89.2	242+03	-3.06	0.40	1.25	1.21	62.5	91.6	65.5	96.1	6.89	1.21	62.5	91.6	24026.7
1290.0	21.50	75.0	110.0	335+27	62.5	91.6	240+27	-3.60	0.56	1.39	1.34	64.3	94.3	66.8	98.0	6.37	1.34	64.3	94.3	23846.2
1292.0	21.53	75.0	110.0	333+46	64.3	94.3	238+46	-3.04	0.36	1.16	1.13	65.8	96.6	68.2	100.1	5.79	1.13	65.8	96.6	23659.8
1294.0	21.57	70.0	102.7	331+60	65.8	96.6	236+60	-2.03	0.02	0.81	0.78	66.9	98.1	68.4	100.3	3.72	0.78	66.9	98.1	23468.3
1296.0	21.60	70.0	102.7	329+68	66.9	98.1	234+68	-1.01	-0.32	0.46	0.44	67.5	99.0	69.2	101.5	3.38	0.44	67.5	99.0	23273.0
1298.0	21.63	70.0	102.7	327+73	67.5	99.0	232+73	0.00	-0.65	0.12	0.12	67.7	99.2	69.7	102.2	3.19	0.12	67.7	99.2	23075.2
1300.0	21.67	70.0	102.7	325+75	67.7	99.2	230+75	1.01	-0.98	-0.21	-0.21	67.4	98.8	69.8	102.4	3.14	-0.21	67.4	98.8	22876.3
1302.0	21.70	70.0	102.7	323+76	67.4	98.8	228+76	2.03	-1.31	-0.52	-0.54	66.6	97.7	69.6	102.0	3.23	-0.54	66.6	97.7	22677.6
1304.0	21.73	70.0	102.7	321+78	66.6	97.7	226+78	3.04	-1.62	-0.83	-0.86	65.5	96.0	69.0	101.2	3.47	-0.86	65.5	96.0	22480.4
1306.0	21.77	70.0	102.7	319+80	65.5	96.0	224+80	3.71	-1.83	-1.02	-1.05	64.0	93.9	68.1	99.9	3.84	-1.05	64.0	93.9	22286.3
1308.0	21.80	70.0	102.7	317+86	64.0	93.9	222+86	3.32	-1.69	-0.86	-0.89	62.8	92.1	67.0	98.2	4.29	-0.89	62.8	92.1	22096.7
1310.0	21.83	70.0	102.7	315+97	62.8	92.1	220+97	2.84	-1.52	-0.68	-0.70	61.9	90.7	66.0	96.8	4.68	-0.70	61.9	90.7	21911.0
1312.0	21.87	70.0	102.7	314+11	61.9	90.7	219+11	2.84	-1.51	-0.66	-0.68	60.9	89.4	65.3	95.7	4.98	-0.68	60.9	89.4	21728.2
1314.0	21.90	70.0	102.7	312+28	60.9	89.4	217+28	2.36	-1.35	-0.48	-0.50	60.2	88.4	64.5	94.6	5.27	-0.50	60.2	88.4	21548.5
1316.0	21.93	70.0	102.7	310+48	60.2	88.4	215+48	1.88	-1.18	-0.31	-0.32	59.8	87.7	64.0	93.9	5.49	-0.32	59.8	87.7	21371.1
1318.0	21.97	70.0	102.7	308+71	59.8	87.7	213+71	1.40	-1.03	-0.15	-0.15	59.6	87.4	63.6	93.3	5.63	-0.15	59.6	87.4	21195.4
1320.0	22.00	70.0	102.7	306+95	59.6	87.4	211+95	0.92	-0.87	0.01	0.01	59.6	87.4	63.5	93.1	5.70	0.01	59.6	87.4	21020.6
1322.0	22.03	70.0	102.7	305+21	59.6	87.4	210+21	0.44	-0.71	0.16	0.16	59.8	87.7	63.5	93.1	5.69	0.16	59.8	87.7	20846.1
1324.0	22.07	70.0	102.7	303+46	59.8	87.7	208+46	-0.04	-0.56	0.31	0.30	60.2	88.3	63.7	93.4	5.62	0.30	60.2	88.3	20671.2
1326.0	22.10	70.0	102.7	301+71	60.2	88.3	206+71	-0.46	-0.43	0.44	0.42	60.8	89.2	64.0	93.8	5.49	0.42	60.8	89.2	20495.3
1328.0	22.13	70.0	102.7	299+95	60.8	89.2	204+95	-0.52	-0.42	0.44	0.43	61.4	90.0	64.4	94.5	5.31	0.43	61.4	90.0	20317.8
1330.0	22.17	70.0	102.7	298+18	61.4	90.0	203+18	-0.52	-0.42	0.43	0.41	61.9	90.9	64.9	95.2	5.13	0.41	61.9	90.9	20138.6
1332.0	22.20	70.0	102.7	296+39	61.9	90.9	201+39	-0.52	-0.43	0.41	0.40	62.5	91.7	65.3	95.8	4.95	0.40	62.5	91.7	19957.7
1334.0	22.23	70.0	102.7	294+58	62.5	91.7	199+58	-0.52	-0.43	0.40	0.39	63.0	92.4	65.7	96.4	4.78	0.39	63.0	92.4	19775.2
1336.0	22.27	70.0	102.7	292+75	63.0	92.4	197+75	-0.52	-0.44	0.39	0.38	63.5	93.2	66.2	97.0	4.61	0.38	63.5	93.2	19591.0
1338.0	22.30	70.0	102.7	290+91	63.5	93.2	195+91	-0.52	-0.44	0.38	0.36	64.0	93.9	66.6	97.6	4.45	0.36	64.0	93.9	19405.4
1340.0	22.33	70.0	102.7	289+05	64.0	93.9	194+05	-0.52	-0.45	0.37	0.35	64.5	94.6	67.0	98.2	4.29	0.35	64.5	94.6	19218.3
1342.0	22.37	70.0	102.7	287+18	64.5	94.6	192+18	-0.52	-0.46	0.35	0.34	65.0	95.3	67.3	98.8	4.14	0.34	65.0	95.3	19029.8
1344.0	22.40	70.0	102.7	285+30	65.0	95.3	190+30	-0.52	-0.46	0.34	0.33	65.4	96.0	67.7	99.3	3.99	0.33	65.4	96.0	18839.8
1346.0	22.43	70.0	102.7	283+40	65.4	96.0	188+40	-0.52	-0.46	0.33	0.32	65.9	96.6	68.1	99.8	3.85	0.32	65.9	96.6	18648.5
1348.0	22.47	70.0	102.7	281+49	65.9	96.6	186+49	-0.52	-0.47	0.32	0.31	66.3	97.2	68.4	100.3	3.71	0.31	66.3	97.2	18455.9
1350.0	22.50	70.0	102.7	279+56	66.3	97.2	184+56	-0.52	-0.47	0.31	0.30	66.7	97.9	68.7	100.8	3.57	0.30	66.7	97.9	18262.0
1352.0	22.53	70.0	102.7	277+62	66.7	97.9	182+62	-0.52	-0.48	0.30	0.30	67.1	98.4	69.1	101.3	3.44	0.30	67.1	98.4	18066.9
1354.0	22.57	70.0	102.7	275+67	67.1	98.4	180+67	-0.52	-0.48	0.30	0.29	67.5	99.0	69.4	101.8	3.31	0.29	67.5	99.0	17870.6
1356.0	22.60	70.0	102.7	273+71	67.5	99.0	178+71	-0.52	-0.49	0.29	0.28	67.9	99.6	69.7	102.2	3.19	0.28	67.9	99.6	17673.1
1358.0	22.63	70.0	102.7	271+73	67.9	99.6	176+73	-0.63	-0.46	0.31	0.30	68.3	100.2	70.0	102.6	3.07	0.30	68.3	100.2	17474.6
1360.0	22.67	70.0	102.7	269+75	68.3	100.2	174+75	-0.86	-0.39	0.38	0.37	68.8	100.9	70.3	103.1	2.94	0.37	68.8	100.9	17275.0

1		2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Elapsed Time		Desired Speed		Actual Station	Start of Interval			Local Grade	Limiting acceleration			New speed based on vehicle performance		Limiting acceleration and speed based on driver preferences			Actual acceleration	End of Interval		
					Speed		Position		Coasting	Power	Effective			Speed		Acceleration		New Speed		New Position
(sec)	(Min)	(mph)	(ft/sec)	FYI	(mph)	(ft/sec)	(ft)	(%)	(ft/sec2)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(mph)	(ft/sec)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(ft)
1362.0	22.70	70.0	102.7	267+75	68.8	100.9	172+75	-1.08	-0.32	0.44	0.42	69.4	101.8	70.7	103.7	2.78	0.42	69.4	101.8	17074.0
1364.0	22.73	70.0	102.7	265+74	69.4	101.8	170+74	-1.30	-0.26	0.50	0.48	70.0	102.7	71.2	104.4	2.60	0.48	70.0	102.7	16871.4
1366.0	22.77	70.0	102.7	263+71	70.0	102.7	168+71	-1.53	-0.19	0.55	0.54	70.7	103.7	70.0	102.7	0.00	0.00	70.0	102.7	16666.1
1368.0	22.80	70.0	102.7	261+66	70.0	102.7	166+66	-1.75	-0.12	0.63	0.61	70.8	103.9	70.0	102.7	0.00	0.00	70.0	102.7	16460.8
1370.0	22.83	70.0	102.7	259+61	70.0	102.7	164+61	-1.98	-0.05	0.70	0.68	70.9	104.0	70.0	102.7	0.00	0.00	70.0	102.7	16255.4
1372.0	22.87	70.0	102.7	257+55	70.0	102.7	162+55	-2.17	0.02	0.76	0.74	71.0	104.1	70.0	102.7	0.00	0.00	70.0	102.7	16050.1
1374.0	22.90	70.0	102.7	255+50	70.0	102.7	160+50	-2.20	0.03	0.77	0.75	71.0	104.2	70.0	102.7	0.00	0.00	70.0	102.7	15844.8
1376.0	22.93	70.0	102.7	253+45	70.0	102.7	158+45	-2.20	0.03	0.77	0.75	71.0	104.2	70.0	102.7	0.00	0.00	70.0	102.7	15639.4
1378.0	22.97	70.0	102.7	251+39	70.0	102.7	156+39	-2.20	0.03	0.77	0.75	71.0	104.2	70.0	102.7	0.00	0.00	70.0	102.7	15434.1
1380.0	23.00	70.0	102.7	249+34	70.0	102.7	154+34	-2.20	0.03	0.77	0.75	71.0	104.2	70.0	102.7	0.00	0.00	70.0	102.7	15228.8
1382.0	23.03	70.0	102.7	247+29	70.0	102.7	152+29	-2.20	0.03	0.77	0.75	71.0	104.2	70.0	102.7	0.00	0.00	70.0	102.7	15023.4
1384.0	23.07	70.0	102.7	245+23	70.0	102.7	150+23	-2.20	0.03	0.77	0.75	71.0	104.2	70.0	102.7	0.00	0.00	70.0	102.7	14818.1
1386.0	23.10	70.0	102.7	243+18	70.0	102.7	148+18	-2.19	0.02	0.76	0.74	71.0	104.2	70.0	102.7	0.00	0.00	70.0	102.7	14612.8
1388.0	23.13	70.0	102.7	241+13	70.0	102.7	146+13	-1.90	-0.07	0.67	0.66	70.9	104.0	70.0	102.7	0.00	0.00	70.0	102.7	14407.4
1390.0	23.17	70.0	102.7	239+07	70.0	102.7	144+07	-1.50	-0.20	0.54	0.53	70.7	103.7	70.0	102.7	0.00	0.00	70.0	102.7	14202.1
1392.0	23.20	70.0	102.7	237+02	70.0	102.7	142+02	-1.03	-0.35	0.39	0.38	70.5	103.4	70.0	102.7	0.00	0.00	70.0	102.7	13996.8
1394.0	23.23	70.0	102.7	234+97	70.0	102.7	139+97	-0.61	-0.49	0.26	0.25	70.3	103.2	70.0	102.7	0.00	0.00	70.0	102.7	13791.4
1396.0	23.27	70.0	102.7	232+91	70.0	102.7	137+91	-0.20	-0.62	0.13	0.12	70.2	102.9	70.0	102.7	0.00	0.00	70.0	102.7	13586.1
1398.0	23.30	70.0	102.7	230+86	70.0	102.7	135+86	-0.08	-0.66	0.09	0.09	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	13380.8
1400.0	23.33	70.0	102.7	228+81	70.0	102.7	133+81	-0.08	-0.66	0.09	0.09	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	13175.4
1402.0	23.37	70.0	102.7	226+75	70.0	102.7	131+75	-0.08	-0.66	0.09	0.09	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	12970.1
1404.0	23.40	70.0	102.7	224+70	70.0	102.7	129+70	-0.08	-0.66	0.09	0.09	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	12764.8
1406.0	23.43	70.0	102.7	222+65	70.0	102.7	127+65	-0.08	-0.66	0.09	0.09	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	12559.4
1408.0	23.47	70.0	102.7	220+59	70.0	102.7	125+59	-0.08	-0.66	0.09	0.09	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	12354.1
1410.0	23.50	70.0	102.7	218+54	70.0	102.7	123+54	-0.08	-0.66	0.09	0.09	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	12148.8
1412.0	23.53	70.0	102.7	216+49	70.0	102.7	121+49	-0.08	-0.66	0.09	0.09	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	11943.4
1414.0	23.57	70.0	102.7	214+43	70.0	102.7	119+43	-0.08	-0.66	0.09	0.09	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	11738.1
1416.0	23.60	70.0	102.7	212+38	70.0	102.7	117+38	-0.08	-0.66	0.09	0.09	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	11532.8
1418.0	23.63	70.0	102.7	210+33	70.0	102.7	115+33	-0.08	-0.66	0.09	0.09	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	11327.4
1420.0	23.67	70.0	102.7	208+27	70.0	102.7	113+27	-0.08	-0.66	0.09	0.09	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	11122.1
1422.0	23.70	70.0	102.7	206+22	70.0	102.7	111+22	-0.15	-0.63	0.11	0.11	70.2	102.9	70.0	102.7	0.00	0.00	70.0	102.7	10916.8
1424.0	23.73	70.0	102.7	204+17	70.0	102.7	109+17	-0.66	-0.47	0.28	0.27	70.4	103.2	70.0	102.7	0.00	0.00	70.0	102.7	10711.4
1426.0	23.77	70.0	102.7	202+11	70.0	102.7	107+11	-1.25	-0.28	0.46	0.45	70.6	103.6	70.0	102.7	0.00	0.00	70.0	102.7	10506.1
1428.0	23.80	70.0	102.7	200+06	70.0	102.7	105+06	-1.83	-0.09	0.65	0.63	70.9	103.9	70.0	102.7	0.00	0.00	70.0	102.7	10300.8
1430.0	23.83	70.0	102.7	198+01	70.0	102.7	103+01	-2.42	0.09	0.84	0.82	71.1	104.3	70.0	102.7	0.00	0.00	70.0	102.7	10095.4
1432.0	23.87	75.0	110.0	195+95	70.0	102.7	100+95	-3.00	0.28	1.02	1.00	71.4	104.7	72.7	106.7	3.98	1.00	71.4	104.7	9892.1
1434.0	23.90	75.0	110.0	193+92	71.4	104.7	98+92	-3.00	0.27	0.99	0.97	72.7	106.6	73.8	108.2	3.55	0.97	72.7	106.6	9684.7
1436.0	23.93	75.0	110.0	191+85	72.7	106.6	96+85	-3.00	0.25	0.97	0.94	74.0	108.5	74.8	109.7	3.13	0.94	74.0	108.5	9473.4
1438.0	23.97	75.0	110.0	189+73	74.0	108.5	94+73	-3.00	0.24	0.94	0.92	75.2	110.3	75.8	111.2	2.73	0.92	75.2	110.3	9258.3
1440.0	24.00	75.0	110.0	187+58	75.0	110.0	92+58	-3.00	0.22	0.92	0.90	76.2	111.8	75.0	110.0	0.00	0.00	75.0	110.0	9038.3
1442.0	24.03	75.0	110.0	185+38	75.0	110.0	90+38	-3.00	0.22	0.92	0.90	76.2	111.8	75.0	110.0	0.00	0.00	75.0	110.0	8818.3
1444.0	24.07	75.0	110.0	183+18	75.0	110.0	88+18	-3.00	0.22	0.92	0.90	76.2	111.8	75.0	110.0	0.00	0.00	75.0	110.0	8598.3
1446.0	24.10	75.0	110.0	180+98	75.0	110.0	85+98	-3.00	0.22	0.92	0.90	76.2	111.8	75.0	110.0	0.00	0.00	75.0	110.0	8378.3
1448.0	24.13	70.0	102.7	178+78	70.0	102.7	83+78	-2.83	0.23	0.97	0.94	71.3	104.6	70.0	102.7	0.00	0.00	70.0	102.7	8172.9
1450.0	24.17	70.0	102.7	176+73	70.0	102.7	81+73	-2.00	-0.04	0.71	0.69	70.9	104.0	70.0	102.7	0.00	0.00	70.0	102.7	7967.6
1452.0	24.20	70.0	102.7	174+68	70.0	102.7	79+68	-1.12	-0.32	0.42	0.41	70.6	103.5	70.0	102.7	0.00	0.00	70.0	102.7	7762.3
1454.0	24.23	70.0	102.7	172+62	70.0	102.7	77+62	-0.23	-0.61	0.14	0.14	70.2	102.9	70.0	102.7	0.00	0.00	70.0	102.7	7556.9
1456.0	24.27	70.0	102.7	170+57	70.0	102.7	75+57	0.66	-0.89	-0.14	-0.15	69.8	102.4	70.0	102.7	0.00	-0.15	69.8	102.4	7351.3
1458.0	24.30	70.0	102.7	168+51	69.8	102.4	73+51	1.54	-1.18	-0.42	-0.44	69.2	101.5	71.5	104.8	2.46	-0.44	69.2	101.5	7145.7
1460.0	24.33	70.0	102.7	166+46	69.2	101.5	71+46	2.37	-1.44	-0.67	-0.69	68.3	100.1	71.0	104.2	2.65	-0.69	68.3	100.1	6941.3
1462.0	24.37	70.0	102.7	164+41	68.3	100.1	69+41	2.54	-1.48	-0.71	-0.73	67.3	98.7	70.3	103.1	2.95	-0.73	67.3	98.7	6739.6
1464.0	24.40	70.0	102.7	162+40	67.3	98.7	67+40	2.54	-1.47	-0.69	-0.71	66.3	97.2	69.5	101.9	3.27	-0.71	66.3	97.2	6540.9
1466.0	24.43	70.0	102.7	160+41	66.3	97.2	65+41	2.54	-1.46	-0.66	-0.68	65.4	95.9	68.7	100.8	3.57	-0.68	65.4	95.9	6345.1

1		2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Elapsed Time		Desired Speed		Actual Station	Start of Interval			Local Grade	Limiting acceleration			New speed based on vehicle performance		Limiting acceleration and speed based on driver preferences			Actual acceleration	End of Interval		
					Speed		Position		Coasting	Power	Effective			Speed		Acceleration		New Speed		New Position
(sec)	(Min)	(mph)	(ft/sec)	FYI	(mph)	(ft/sec)	(ft)	(%)	(ft/sec2)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(mph)	(ft/sec)	(ft/sec2)	(ft/sec2)	(mph)	(ft/sec)	(ft)
1468.0	24.47	70.0	102.7	158+45	65.4	95.9	63+45	2.54	-1.45	-0.64	-0.66	64.5	94.5	68.0	99.7	3.87	-0.66	64.5	94.5	6152.0
1470.0	24.50	70.0	102.7	156+52	64.5	94.5	61+52	2.54	-1.44	-0.62	-0.64	63.6	93.3	67.3	98.7	4.15	-0.64	63.6	93.3	5961.6
1472.0	24.53	70.0	102.7	154+62	63.6	93.3	59+62	2.50	-1.42	-0.59	-0.61	62.8	92.0	66.6	97.7	4.43	-0.61	62.8	92.0	5773.9
1474.0	24.57	70.0	102.7	152+74	62.8	92.0	57+74	2.21	-1.32	-0.48	-0.49	62.1	91.1	66.0	96.7	4.70	-0.49	62.1	91.1	5588.8
1476.0	24.60	70.0	102.7	150+89	62.1	91.1	55+89	1.87	-1.20	-0.35	-0.36	61.6	90.3	65.4	96.0	4.91	-0.36	61.6	90.3	5406.0
1478.0	24.63	70.0	102.7	149+06	61.6	90.3	54+06	1.56	-1.09	-0.24	-0.25	61.2	89.8	65.0	95.4	5.07	-0.25	61.2	89.8	5224.9
1480.0	24.67	70.0	102.7	147+25	61.2	89.8	52+25	1.23	-0.99	-0.13	-0.13	61.1	89.6	64.8	95.0	5.17	-0.13	61.1	89.6	5044.9
1482.0	24.70	70.0	102.7	145+45	61.1	89.6	50+45	0.90	-0.88	-0.02	-0.02	61.0	89.5	64.6	94.8	5.23	-0.02	61.0	89.5	4865.8
1484.0	24.73	70.0	102.7	143+66	61.0	89.5	48+66	0.58	-0.77	0.09	0.08	61.1	89.7	64.6	94.8	5.24	0.08	61.1	89.7	4686.9
1486.0	24.77	70.0	102.7	141+87	61.1	89.7	46+87	0.25	-0.67	0.19	0.18	61.4	90.0	64.7	94.9	5.21	0.18	61.4	90.0	4507.9
1488.0	24.80	70.0	102.7	140+08	61.4	90.0	45+08	0.25	-0.67	0.18	0.18	61.6	90.4	64.9	95.2	5.13	0.18	61.6	90.4	4328.2
1490.0	24.83	70.0	102.7	138+28	61.6	90.4	43+28	-0.08	-0.57	0.28	0.27	62.0	90.9	65.1	95.4	5.05	0.27	62.0	90.9	4147.9
1492.0	24.87	70.0	102.7	136+48	62.0	90.9	41+48	-0.41	-0.47	0.38	0.36	62.5	91.7	65.4	95.9	4.93	0.36	62.5	91.7	3966.8
1494.0	24.90	70.0	102.7	134+67	62.5	91.7	39+67	-0.73	-0.37	0.47	0.45	63.1	92.6	65.8	96.4	4.78	0.45	63.1	92.6	3784.4
1496.0	24.93	70.0	102.7	132+84	63.1	92.6	37+84	-1.06	-0.27	0.56	0.54	63.8	93.6	66.2	97.1	4.58	0.54	63.8	93.6	3600.4
1498.0	24.97	70.0	102.7	131+00	63.8	93.6	36+00	-1.39	-0.17	0.65	0.63	64.7	94.9	66.8	98.0	4.35	0.63	64.7	94.9	3414.3
1500.0	25.00	70.0	102.7	129+14	64.7	94.9	34+14	-1.71	-0.07	0.73	0.71	65.7	96.3	67.5	99.0	4.08	0.71	65.7	96.3	3225.9
1502.0	25.03	70.0	102.7	127+26	65.7	96.3	32+26	-2.04	0.02	0.81	0.79	66.7	97.9	68.2	100.1	3.77	0.79	66.7	97.9	3034.9
1504.0	25.07	70.0	102.7	125+35	66.7	97.9	30+35	-2.33	0.10	0.88	0.86	67.9	99.6	69.1	101.3	3.43	0.86	67.9	99.6	2840.8
1506.0	25.10	70.0	102.7	123+41	67.9	99.6	28+41	-2.37	0.10	0.87	0.84	69.1	101.3	70.0	102.7	3.06	0.84	69.1	101.3	2643.3
1508.0	25.13	70.0	102.7	121+43	69.1	101.3	26+43	-2.37	0.09	0.84	0.82	70.2	102.9	70.9	104.0	2.70	0.82	70.2	102.9	2442.3
1510.0	25.17	70.0	102.7	119+42	70.0	102.7	24+42	-2.37	0.08	0.82	0.80	71.1	104.3	70.0	102.7	0.00	0.00	70.0	102.7	2237.0
1512.0	25.20	70.0	102.7	117+37	70.0	102.7	22+37	-2.37	0.08	0.82	0.80	71.1	104.3	70.0	102.7	0.00	0.00	70.0	102.7	2031.7
1514.0	25.23	70.0	102.7	115+32	70.0	102.7	20+32	-2.37	0.08	0.82	0.80	71.1	104.3	70.0	102.7	0.00	0.00	70.0	102.7	1826.3
1516.0	25.27	70.0	102.7	113+26	70.0	102.7	18+26	-2.37	0.08	0.82	0.80	71.1	104.3	70.0	102.7	0.00	0.00	70.0	102.7	1621.0
1518.0	25.30	70.0	102.7	111+21	70.0	102.7	16+21	-2.37	0.08	0.82	0.80	71.1	104.3	70.0	102.7	0.00	0.00	70.0	102.7	1415.7
1520.0	25.33	70.0	102.7	109+16	70.0	102.7	14+16	-2.16	0.01	0.76	0.74	71.0	104.1	70.0	102.7	0.00	0.00	70.0	102.7	1210.3
1522.0	25.37	70.0	102.7	107+10	70.0	102.7	12+10	-1.79	-0.11	0.64	0.62	70.8	103.9	70.0	102.7	0.00	0.00	70.0	102.7	1005.0
1524.0	25.40	70.0	102.7	105+05	70.0	102.7	10+05	-1.41	-0.23	0.52	0.50	70.7	103.7	70.0	102.7	0.00	0.00	70.0	102.7	799.7
1526.0	25.43	70.0	102.7	103+00	70.0	102.7	8+00	-1.03	-0.35	0.39	0.38	70.5	103.4	70.0	102.7	0.00	0.00	70.0	102.7	594.3
1528.0	25.47	70.0	102.7	100+94	70.0	102.7	5+94	-0.65	-0.47	0.27	0.27	70.4	103.2	70.0	102.7	0.00	0.00	70.0	102.7	389.0
1530.0	25.50	70.0	102.7	98+89	70.0	102.7	3+89	-0.48	-0.53	0.22	0.21	70.3	103.1	70.0	102.7	0.00	0.00	70.0	102.7	183.7
1532.0	25.53	70.0	102.7	96+84	70.0	102.7	1+84	-0.48	-0.53	0.22	0.21	70.3	103.1	70.0	102.7	0.00	0.00	70.0	102.7	-21.7
1534.0	25.57	70.0	102.7	94+78	70.0	102.7	-+22	0.00	-0.68	0.06	0.06	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	-227.0
1536.0	25.60	70.0	102.7	92+73	70.0	102.7	-2+27	0.00	-0.68	0.06	0.06	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	-432.3
1538.0	25.63	70.0	102.7	90+68	70.0	102.7	-4+32	0.00	-0.68	0.06	0.06	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	-637.7
1540.0	25.67	70.0	102.7	88+62	70.0	102.7	-6+38	0.00	-0.68	0.06	0.06	70.1	102.8	70.0	102.7	0.00	0.00	70.0	102.7	-843.0

Grade-SB 368+00 to 410+00 AM

HCS2000: Basic Freeway Segments Release 4.1f

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Chris Vergon
Agency or Company:	DLZ Indiana, LLC
Date Performed:	8/5/2009
Analysis Time Period:	
Freeway/Direction:	I-69 SB
From/To:	Sta. 368+00 to Sta. 443+00
Jurisdiction:	INDOT
Analysis Year:	
Description:	Truck Climbing Lane Warrent

Flow Inputs and Adjustments

Volume, V	691	veh/h
Peak-hour factor, PHF	0.88	
Peak 15-min volume, v15	196	v
Trucks and buses	21	%
Recreational vehicles	0	%
Terrain type:	Grade	
Grade	2.80	%
Segment length	0.80	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	3.0	
Heavy vehicle adjustment, fHV	0.905	
Driver population factor, fp	1.00	
Flow rate, vp	434	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.09	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Base	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	70.0	mi/h
	Rural Freeway	

LOS and Performance Measures

Flow rate, vp	434	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	70.0	mi/h
Number of lanes, N	2	
Density, D	6.2	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Grade-SB 368+00 to 410+00 PM

HCS2000: Basic Freeway Segments Release 4.1f

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Chris Vergon
Agency or Company:	DLZ Indiana, LLC
Date Performed:	8/5/2009
Analysis Time Period:	
Freeway/Direction:	I-69 SB
From/To:	Sta. 368+00 to Sta. 443+00
Jurisdiction:	INDOT
Analysis Year:	
Description:	Truck Climbing Lane Warrent

Flow Inputs and Adjustments

Volume, V	934	veh/h
Peak-hour factor, PHF	0.88	
Peak 15-min volume, v15	265	v
Trucks and buses	16	%
Recreational vehicles	0	%
Terrain type:	Grade	
Grade	2.80	%
Segment length	0.80	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	3.0	
Heavy vehicle adjustment, fHV	0.926	
Driver population factor, fp	1.00	
Flow rate, vp	573	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.09	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Base	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	70.0	mi/h
	Rural Freeway	

LOS and Performance Measures

Flow rate, vp	573	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	70.0	mi/h
Number of lanes, N	2	
Density, D	8.2	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Composite-NB 1127+00 to 1229+00 AM

HCS2000: Basic Freeway Segments Release 4.1f

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Chris Vergon
Agency or Company:	DLZ Indiana, LLC
Date Performed:	8/5/2009
Analysis Time Period:	
Freeway/Direction:	I-69 NB
From/To:	Sta. 1127+00 to Sta. 1229+00
Jurisdiction:	INDOT
Analysis Year:	
Description:	Truck Climbing Lane Warrent

Flow Inputs and Adjustments

Volume, V	994	veh/h
Peak-hour factor, PHF	0.88	
Peak 15-min volume, v15	282	v
Trucks and buses	16	%
Recreational vehicles	0	%
Terrain type:	Composite	
Grade	1.00	%
Segment length	1.93	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.926	
Driver population factor, fp	1.00	
Flow rate, vp	610	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.09	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Base	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	70.0	mi/h
	Rural Freeway	

LOS and Performance Measures

Flow rate, vp	610	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	70.0	mi/h
Number of lanes, N	2	
Density, D	8.7	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Composite-NB 1127+00 to 1229+00 PM

HCS2000: Basic Freeway Segments Release 4.1f

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Chris Vergon
Agency or Company:	DLZ Indiana, LLC
Date Performed:	8/5/2009
Analysis Time Period:	
Freeway/Direction:	I-69 NB
From/To:	Sta. 1127+00 to Sta. 1229+00
Jurisdiction:	INDOT
Analysis Year:	
Description:	Truck Climbing Lane Warrent

Flow Inputs and Adjustments

Volume, V	1089	veh/h
Peak-hour factor, PHF	0.88	
Peak 15-min volume, v15	309	v
Trucks and buses	15	%
Recreational vehicles	0	%
Terrain type:	Composite	
Grade	1.00	%
Segment length	1.93	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	665	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.09	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Base	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	70.0	mi/h
	Rural Freeway	

LOS and Performance Measures

Flow rate, vp	665	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	70.0	mi/h
Number of lanes, N	2	
Density, D	9.5	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Chris Vergon
Agency or Company:	DLZ Indiana, LLC
Date Performed:	8/13/2009
Analysis Time Period:	
Freeway/Direction:	I-69 SB
From/To:	Approach Seg 1340+00 - 1313+50
Jurisdiction:	INDOT
Analysis Year:	
Description:	Truck Climbing Lane Warrant

Flow Inputs and Adjustments

Volume, V	1207	veh/h
Peak-hour factor, PHF	0.88	
Peak 15-min volume, v15	343	v
Trucks and buses	13	%
Recreational vehicles	0	%
Terrain type:	Grade	
Grade	-0.04	%
Segment length	0.50	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.939	
Driver population factor, fp	1.00	
Flow rate, vp	730	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.40	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Base	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	70.0	mi/h
	Rural Freeway	

LOS and Performance Measures

Flow rate, vp	730	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	70.0	mi/h
Number of lanes, N	2	
Density, D	10.4	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Chris Vergon
Agency or Company:	DLZ Indiana, LLC
Date Performed:	8/13/2009
Analysis Time Period:	
Freeway/Direction:	I-69 SB
From/To:	Sta. 1281+00 to Sta. 1313+50
Jurisdiction:	INDOT
Analysis Year:	
Description:	Truck Climbing Lane Warrent

Flow Inputs and Adjustments

Volume, V	1207	veh/h
Peak-hour factor, PHF	0.88	
Peak 15-min volume, v15	343	v
Trucks and buses	13	%
Recreational vehicles	0	%
Terrain type:	Grade	
Grade	3.37	%
Segment length	0.61	mi
Trucks and buses PCE, ET	2.0	
Recreational vehicle PCE, ER	3.0	
Heavy vehicle adjustment, fHV	0.885	
Driver population factor, fp	1.00	
Flow rate, vp	775	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.40	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Base	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	70.0	mi/h
	Rural Freeway	

LOS and Performance Measures

Flow rate, vp	775	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	70.0	mi/h
Number of lanes, N	2	
Density, D	11.1	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Chris Vergon
Agency or Company:	DLZ Indiana, LLC
Date Performed:	8/13/2009
Analysis Time Period:	
Freeway/Direction:	I-69 NB
From/To:	Sta. 554+50 to Sta. 588+00
Jurisdiction:	INDOT
Analysis Year:	
Description:	Truck Climbing Lane Warrent

Flow Inputs and Adjustments

Volume, V	636	veh/h
Peak-hour factor, PHF	0.88	
Peak 15-min volume, v15	181	v
Trucks and buses	23	%
Recreational vehicles	0	%
Terrain type:	Grade	
Grade	3.29	%
Segment length	0.63	mi
Trucks and buses PCE, ET	2.0	
Recreational vehicle PCE, ER	3.0	
Heavy vehicle adjustment, fHV	0.813	
Driver population factor, fp	1.00	
Flow rate, vp	444	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.40	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Base	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	70.0	mi/h
	Rural Freeway	

LOS and Performance Measures

Flow rate, vp	444	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	70.0	mi/h
Number of lanes, N	2	
Density, D	6.3	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

OFFICE MEMORANDUM

Date: May 6, 2011

To: I-69 Tier 2 PMC

From: Gary K. Fisk, PE – Section 4 PM
Craig M. Gonsoski, PE

Subject: **I-69 Section 4: Low Cost Design Criteria**
High Embankment Cost Reduction Measures

The design standards developed for the I-69 Section 4 Environmental Impact Statement (EIS) utilize two sets of design criteria, the "initial" (desirable criteria) and "low cost" (minimum criteria). As part of the development of the low cost criteria, measures to reduce the earthwork costs on high fill embankments were analyzed. This analysis also included a review of the associated warrants for roadside barrier protection.

Embankment Cost Reduction Measure

The Section 4 study area features steep hills and valleys with vertical relief of over 500 feet in some areas. The preliminary designs for the I-69 interstate through this terrain result in as much as 32% of the Section 4 alignment having embankment heights over 20 feet high. Due to the extent of these high fill areas, an alternative treatment of the roadside area and embankment slope was investigated in an effort to reduce earthwork volumes, minimize the environmental footprint of the highway, and reduce costs.

The *AASHTO Roadside Design Guide* defines a clear zone as the total roadside border area, starting at the edge of the traveled way, available for safe use by errant vehicles. This area may consist of a shoulder, a recoverable slope, a non-recoverable slope, and/or a clear run-out area[1]. The typical roadway cross section for I-69 Section 4 includes a clear zone, which varies in width from 35 feet (initial criteria) to 30 feet (low cost criteria), comprised of the shoulder and a 6:1 recoverable slope. A reduction in the width of the 6:1 sloped area was investigated as a measure to reduce the overall width of the roadway embankment in the high fill areas. To accomplish this, the 6:1 recoverable slope at the top of the embankment was reduced and the 3:1 non-recoverable embankment slope was introduced into the clear zone. This resulted in about a 13-foot (low cost criteria) to 18-foot (initial criteria) reduction in the width of the embankment on both sides of the road, for a total reduction of about 26-feet (low) to 36-feet (initial), depending on the existing slope at the toe of the embankment. It was assumed that a roadside barrier (guardrail) would be required to shield the non-recoverable embankment slope in the clear zone. At low embankment heights, the cost associated with adding a barrier is greater than the

[1] A recoverable slope is a slope on which a motorist may, to a greater or lesser extent, retain or regain control of a vehicle by slowing or stopping. Slopes flatter than 1V:4H are generally recoverable. A non-recoverable slope is a traversable slope on which an errant vehicle will continue to the bottom. Embankment slopes between 1V:3H and 1V:4H may be considered traversable but non-recoverable if they are smooth and free of fixed objects. A clear run-out area is the area at the bottom of a non-recoverable slope available for safe use by errant vehicles. AASHTO Roadside Design Guide, 2002, Section 3.3.2.

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earthwork cost saving. Therefore, a cost analysis was performed to determine the embankment height at which the cost savings of the reduced embankment is greater than the added barrier costs.

The cost analysis compared the typical cross section cost differences for providing a 6:1 slope to the edge of the clear zone, versus implementing guardrail at the edge of the shoulder, with the 3:1 slope breakpoint behind the barrier (within the clear zone). See **Figure 1**: I-69 Section 4 - High Embankment Roadside and Slope Treatment. The analysis utilized the low cost design criteria with asphalt pavement and a 30 foot clear zone, since the lower cost items would yield a higher cost equivalence point and therefore a more conservative embankment height at which to begin utilizing this measure. The guardrail section included a 2 foot barrier offset from the edge of shoulder, the addition of paved shoulders to the face of guardrail, and placed the 3:1 slope breakpoint 2 feet behind the guardrail post. The cost analysis, which calculated costs on a per foot basis, is shown in **Exhibit A,** *Clear Zone Embankment vs. Guardrail with Reduced Embankment Calculations*. The cost analysis determined that an embankment height of approximately **24 feet** was the height at which the reduced earthwork and installation of guardrail becomes more economical than providing 6:1 slopes out to the edge of the clear zone.

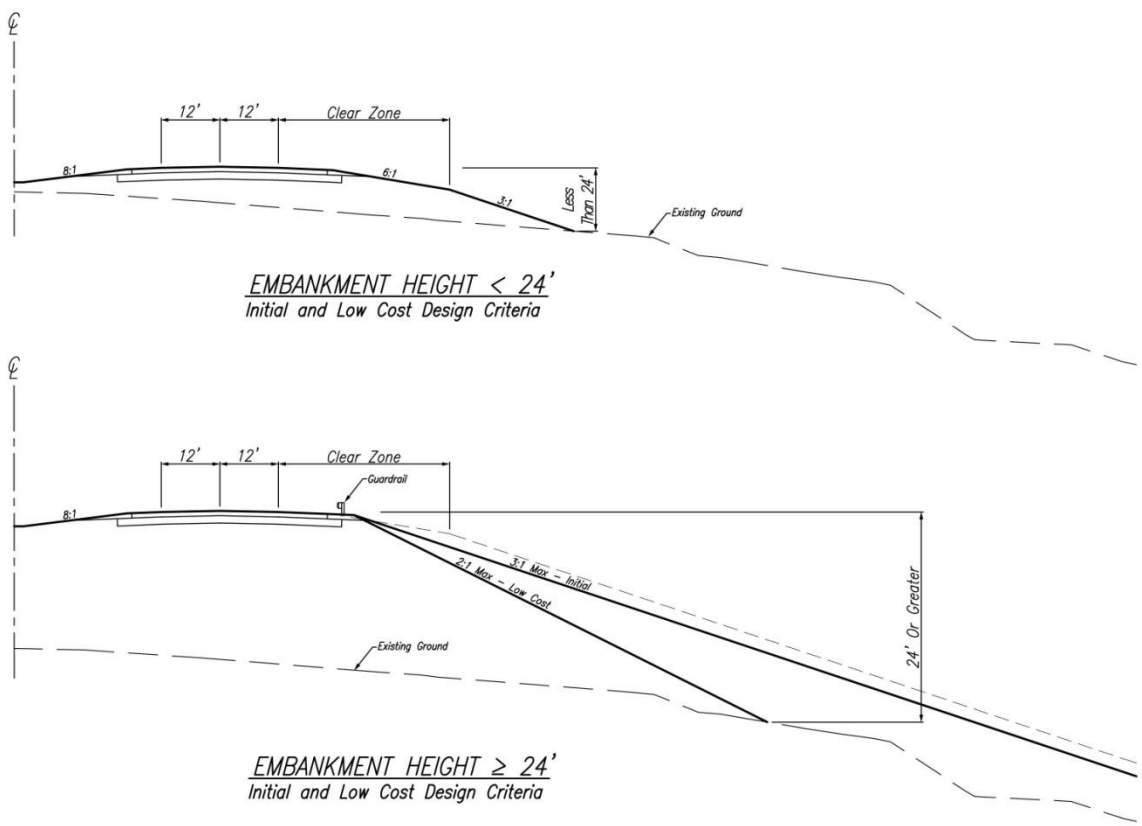


Figure 1: I-69 Section 4 - High Embankment Roadside and Slope Treatment

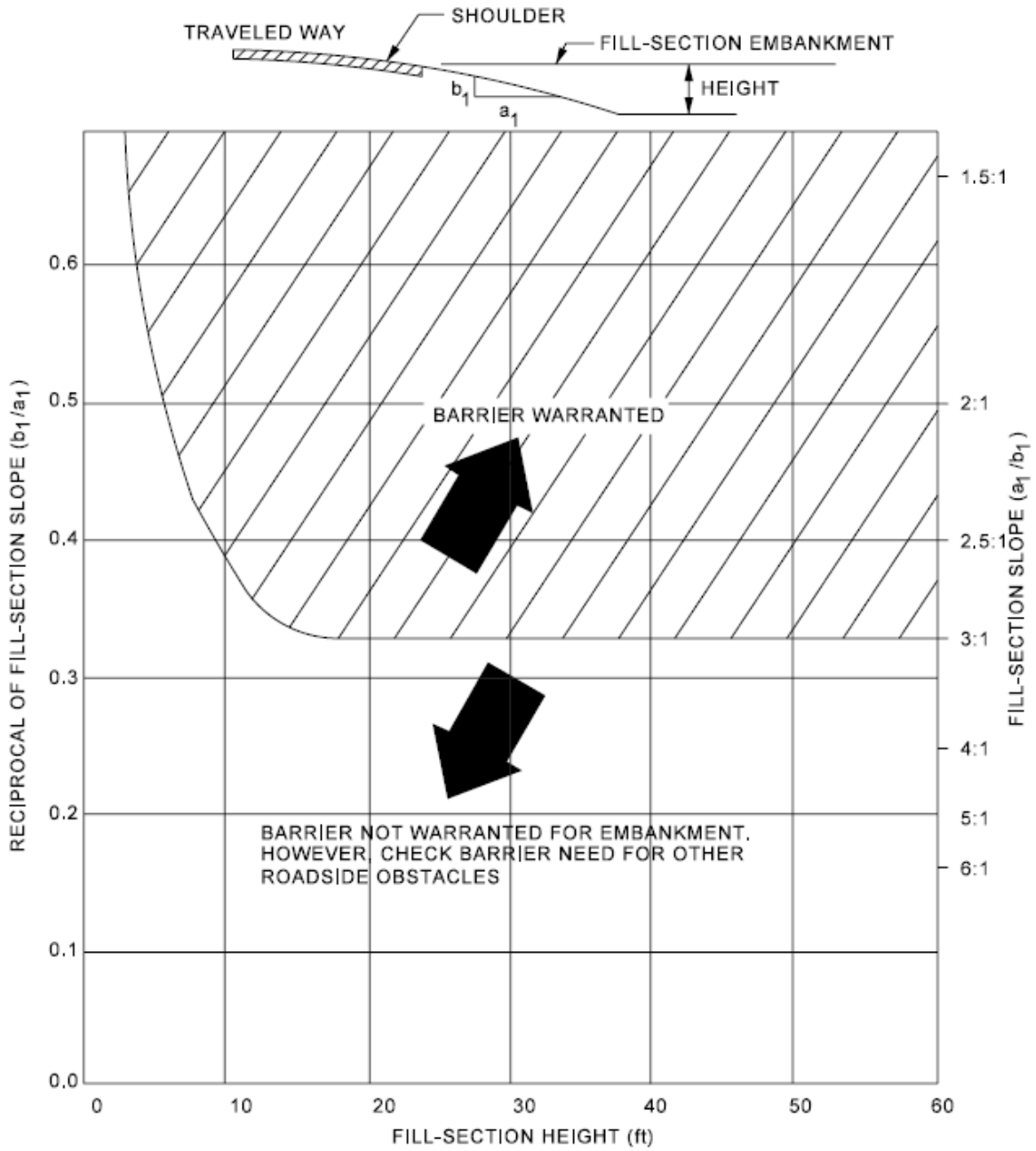
Based on this analysis, a high embankment cost reduction measure was applied to both the initial and low cost design criteria for the I-69 Section 4 EIS. This measure was applied where the preliminary design embankment heights were 24 feet or greater, and resulted in reduced earthwork volumes and lower overall construction costs and environmental impacts. The low cost design criteria further expanded on this cost reduction measure by increasing the high embankment foreslopes from 3:1 to 2:1, see **Figure 1**. By increasing the slope behind the roadside barrier, the amount of fill needed is further decreased, resulting in less required excavation or borrow to balance the earthwork. It also results in a smaller right-of-way footprint which further reduces environmental impacts, as well as construction and right-of-way costs.

Warrants for a Roadside Barrier at an Embankment

The warrants for a roadside barrier were also reviewed as a part of the high embankment cost reduction measure analysis. According to the Indiana Design Manual (IDM), Chapter 49-3.02, the basic factors in determining the need for a roadside barrier at an embankment are the lateral clearance from the barrier to the hazard and the distance from the barrier to the top of the embankment slope. The IDM Figure 49-3C, see **Figure 2**: Indiana Design Manual Barrier Warrant for Embankment, describes the barrier warrant at an embankment for a divided or undivided roadway of 4 or more lanes. Slope-height combinations which appear on or below the curve do not warrant shielding. This figure is also included in the AASHTO *Roadside Design Guide, 2002* (RDG), Figure 5.1 comparative risk warrants for embankments. The RDG states that these criteria are based on studies of the relative severity of encroachments on embankments versus impacts with roadside barriers.

The I-69 Section 4 typical cross sections, for both the initial and low cost design criteria, include a clear zone and maximum 3:1 embankment slope for embankment heights less than 24 feet (see **Figure 1**). Using IDM Figure 49-3C, all 3:1 fill slope-height combinations fall on or below the curve, and therefore a barrier is not warranted for embankment heights less than 24 feet.

For embankment heights of 24 feet or more, the I-69 Section 4 typical cross sections (for both the initial and low cost design criteria) utilize the high embankment cost reduction measure. This measure introduces the 3:1 embankment slope into the clear zone. A 3:1 fill slope is considered non-recoverable in both the IDM and RDG, therefore, a clear runout area beyond the bottom of the slope is required to meet the clear zone requirements. However, if providing a clear runout area is not feasible, or if the foreslope is not smooth and free of fixed objects, then the foreslope is considered a hazard and warrants shielding. The I-69 Section 4 EIS assumed that guardrail would be warranted due to the potential for rocky embankment surfaces and/or providing a clear runout area is not feasible.



BARRIER WARRANT FOR EMBANKMENT: ROADWAY OF 4 OR MORE LANES; DIVIDED OR UNDIVIDED

Figure 49-3C

Figure 2: Indiana Design Manual Barrier Warrant for Embankment

Cost Effectiveness Analysis

According to the IDM, the method for treating a hazard should also be based on an analysis of factors such as initial cost, maintenance cost, and the greatest safety return[2]. It encourages that the cost-effectiveness of the countermeasures for hazardous roadside conditions be considered. Therefore, the designer is encouraged to use the ROADSIDE computer software as a tool in selecting an alternative safety treatment which offers the greatest anticipated return of safety benefits for the funds expended[3]. The AASHTO *Roadside Design Guide, 2002* includes an updated and significantly revised version of ROADSIDE, titled the Roadside Safety Analysis Program (RSAP).

The RSAP was used to complete a Benefit/Cost (B/C) analysis of the high embankment cost reduction measure conditions. Reports generated by RSAP detailing this analysis, including the Benefit/Cost Ratio, costs, and input data, are included in attached Exhibit B, RSAP Benefit/Cost Analysis. The alternatives analyzed included the following, which are numbered according to the alternative assigned in RSAP:

1. **Reduced Embankment (Base Condition):** 26 feet high[4] with 3:1 slopes starting at a 15 feet offset from the edge of pavement (10 foot shoulder plus 5 feet). No guardrail protection. Least costly embankment construction, and matches the proposed guardrail embankment cross section. No cost.

2. **Embankment with Clear Zone (CZ)**: 26 feet high with 3:1 slopes starting at a clear zone distance of 30 feet from the edge of pavement. No guardrail protection. Costs include added embankment construction costs.

3. **Guardrail Protection for Reduced Embankment**: Guardrail protection with terminal end sections, 2 foot guardrail offset from edge of shoulder (12 foot offset from edge of pavement). Same embankment as alternative 1, costs include widened asphalt shoulders and guardrail installation.

In the analysis, the "base condition" is required to be the least costly (and highest crash costs) option; typically this is the existing, do nothing option. For this analysis, the base condition is the unprotected condition of Alternative 3 (the high embankment cost reduction typical cross section). This condition could be implemented if the foreslopes are smooth and a clear runout area is provided at the bottom of the embankment slope.

Crash severity estimation is perhaps the most important step of a cost-effectiveness analysis. The crash costs are principally a function of the crash severity (i.e., the probability of injury

[2] Indiana Design Manual, Chapter 49-3.01(02) Example Hazards.
[3] Indiana Design Manual, Chapter 49-1.05 Cost-Effectiveness of Safety Improvements
[4] An embankment slope height of 26 feet was the closest increment to the 24 foot embankment height determined above available for selection from the pre-defined list of feature types in RSAP.

and/or fatality) given that the associated accident costs are highly non-linear. However, crash severity is also the most difficult parameter to estimate[5]. The severity index (SI) used by RSAP is a scale associated with fixed levels or percentages of fatality, injury, and property-damage-only (PDO) crash costs.

Given the difficulty in estimating crash severity, the analysis was completed with two different conditions representing varying crash severities. First, the typical (ideal) embankment slope conditions, assuming smooth 3:1 slopes with the proper clear zone at the top of the embankment or a clear runout area at the bottom, was analyzed. The second analysis represents more severe slope conditions such as a rocky surfaces or fixed objects in the embankment. This second analysis also represents conditions where a ditch may be needed at the toe of the embankment or the clear runout area cannot be provided due to existing ground slopes or environmental restriction. **Table 1:** RSAP B/C Analysis shows the results of the analysis.

Table 1: RSAP B/C Analysis

Initial Condition	Compared To	B/C Ratio
1-Red. Embankment (Base)	2-Embankment with CZ	2.71 – 3.57
1-Red. Embankment (Base)	3-Guardrail Protection	0.20 – 6.74

The analysis showed that the addition of both a clear zone and guardrail protection provide a benefit in reduced crash costs over an unprotected embankment slope near the roadway, with B/C ratios greater than 1.0. In instances where the foreslope is smooth, and a clear runout area is provided, the B/C ratio is only 0.20, indicating that guardrail may not be required. However, as the clear zone is being reduced below usual practice for the design of new interstates, the addition of guardrail is generally recommended, even in cases where the Benefit/Cost Ratio is less than 1.0. Further information on the slope conditions, and other hazards such as ditch locations, are required to make a final determination on the placement of barrier protection. The preliminary designs for the I-69 Section 4 EIS assumed guardrail in all conditions for embankment slopes 24 feet high or greater.

Summary & Recommendation

The development of the low cost design criteria for I-69 Section 4 included an analysis of a high embankment cost reduction measure and a review of the associated warrants for roadside barrier protection at embankments. The high embankment cost reduction measure reduced earthwork volumes and lowered overall construction costs and environmental impacts by reducing the clear recovery area provided at the top of the embankment. The preliminary designs for the I-69 Section 4 EIS assumed that this reduction would require a roadside barrier (guardrail) to shield the embankment slope. The installation of guardrail offsets some of the earthwork cost savings,

[5] National Cooperative Highway Research Program (NCHRP) Report 492, Roadside Safety Analysis Program (RSAP) – Engineer's Manual, Chapter 7, p. 51.

therefore, an economic analysis was completed to determine the embankment height at which this measure is cost effective. Based on the analysis, it is recommended that this measure be implemented where embankments heights of 24 feet or greater are encountered.

It is also recommended that the low cost design criteria further expand upon the high embankment cost reduction measure by increasing the high embankment foreslopes from 3:1 to 2:1. 2:1 slopes are considered non-recoverable, therefore, roadside barrier would be required for implementation of this measure in the low cost design criteria. Increasing the slopes behind the guardrail further reduces the amount of fill, resulting in less required excavation or borrow to balance the earthwork. The increased foreslopes also result in a smaller right-of-way footprint, which reduces right-of-way costs and environmental impacts.

A review of the roadside barrier warrants for embankments was completed to ensure that a roadside barrier is not warranted at a lower height than recommended for this measure. It was determined that guardrail is not warranted for embankment heights less than 24 ft where the I-69 Section 4 typical cross section includes a full clear zone at the top of the embankment, and maximum 3:1 slopes. Where embankment heights exceed 24 feet, and the cost savings measure is utilized, guardrail may be warranted to shield the high foreslope. A Benefit/Cost analysis indicated that the guardrail warrants will depend on slope conditions and other factors that affect crash severities. However, as the clear zone is being reduced below usual practice for the design of new interstates, the addition of guardrail is generally recommended. The final determination on placement of roadside barriers will be made in the final design of the project, where more detailed survey, design, and geotechnical investigation is available on the slope conditions and other hazards that may be present.

Exhibit A

Clear Zone Embankment vs. Guardrail with Reduced Embankment Calculations

DLZ
ENGINEERS - ARCHITECTS - SCIENTISTS
PLANNERS - SURVEYORS
2211 East Jefferson Blvd South Bend, IN 46615
Phone: (574) 236-4400

PROJECT NO	0461-1511	SHEET	1 of 2
PROJECT	I-69 Tier 2 Section 4		
SUBJECT	Guardrail Embankment Height Analysis		
CALCULATED BY	CMG	DATE	5/21/09
CHECKED BY		DATE	

Clear Zone Embankment vs. Guardrail with Reduced Embankment

Variables		
Fill Height (Rounded)	**24**	**FT**
Clear Zone	30	FT
Clear Zone Slope	6	:1
Required Shoulder	10	FT
Embankment Slope	3	:1
Shoulder Slope	4	%
Guardrail Offset	2	FT
Offset behind guardrail	2	FT
Add'l Paved Shoulder	2	FT

Cost Variables		
Borrow Cost	$ 6.08	/CYD
W-beam Guardrail	$ 17.00	/LFT
HMA Surface	$ 64.78	/Ton
HMA Base	$ 50.67	/Ton
Aggregate, No. 53 Base	$ 22.16	/Ton

HMA Shoulder Section				
Surface	1.5	in	165	#/SY
Base	4.5	in	495	#/SY
Aggr No. 53 Base	12	in	0.667	Ton/SY

Fill Height (X)	**23.6714**	**FT**	above --> use GR
			below --> use CZ

Typical 6:1 Slope to Clear Zone, then 3:1 Embankment Slope

CZ slope length (Y)	20.00	FT
CZ slope height (Z)	3.33	FT
Embankment height (X-Z)	20.34	FT
Embankment length (L)	61.01	FT
Embankment Fill	39.28	CY/LFT
Embankment Cost	$ 238.82	/LFT

Cost (CZ) = $ 238.82 /LFT

Guardrail: No Clear Zone, 3:1 slope behind guardrail

Guardrail Shld Length (Y)	5.42	FT
Guardrail slope height (Z)	0.22	FT
Embankment height (X-Z)	23.45	FT
Embankment length (L)	70.36	FT
Embankment Fill	35.29	CY/LFT
Embankment Cost	$ 214.56	/LFT

HMA Shoulder Section				
Surface	0.02	Ton/LFT	$	1.19
Base	0.06	Ton/LFT	$	2.79
No. 53 Base	0.15	Ton/LFT	$	3.28
		TOTAL =	$	7.26

COST (GR) = $ 214.56 + $ 17.00 + $ 7.26 = $ 238.82

COST (CZ) - COST (GR) = $ 0.00

Used an iterative process to calculate the point where the Embankment cost for providing a Clear Zone, COST(CZ) equals the cost of reducing the embankment but adding guardrail with paved shoulders, COST(GR).

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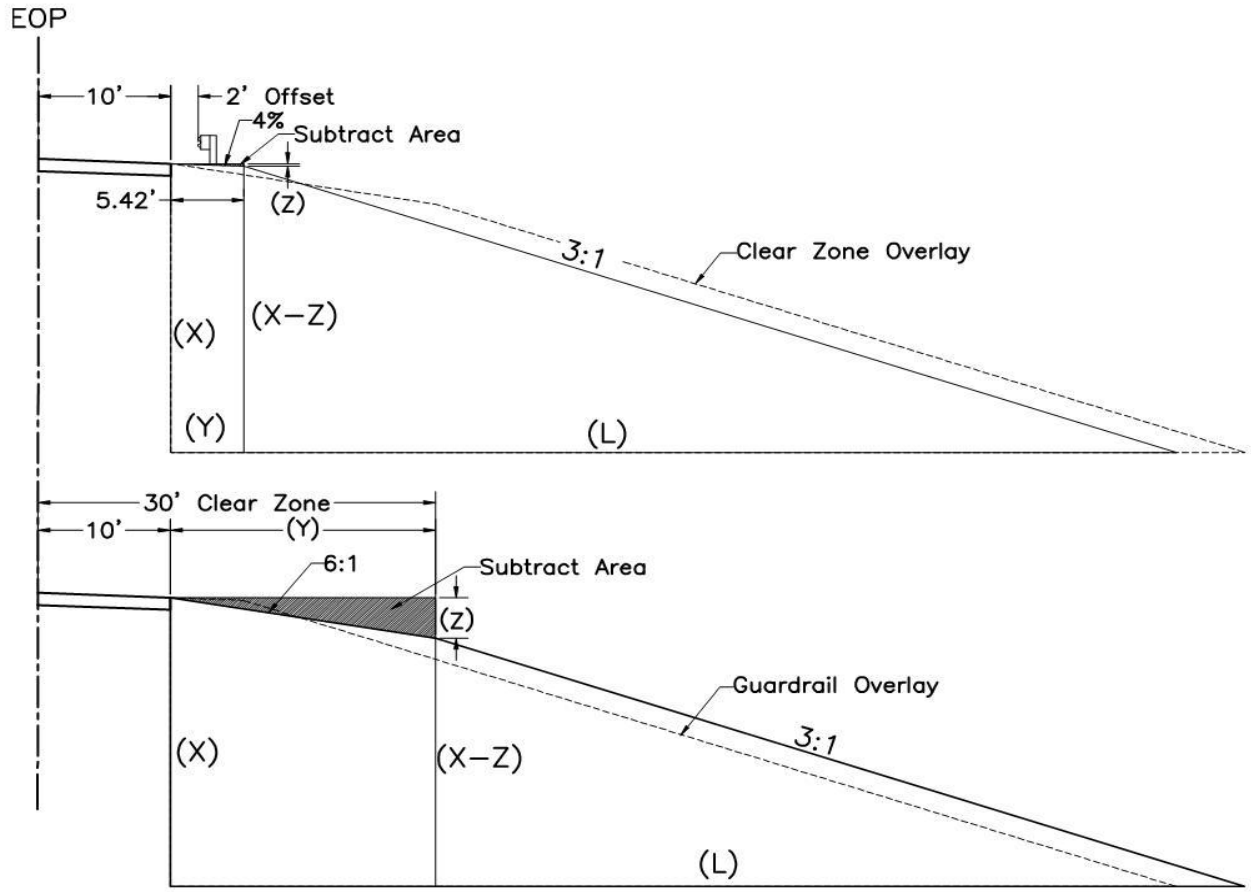
PROJECT NO	0461-1511	SHEET	2 of 2
PROJECT	I-69 Tier 2 Section 4		
SUBJECT	Guardrail Embankment Height Analysis		
CALCULATED BY	CMG	DATE	5/21/09
CHECKED BY		DATE	



AREA = (X*Y) − (0.5*Y*Z) + [0.5*(X−Z)*L]

Z = Y*0.04 (FOR 4% SHOULDER SLOPE)
Z = Y*0.1667 (FOR 6:1 CLEAR ZONE SLOPE)
L = (X−Z)*3 (FOR 3:1 FORESLOPE)

Exhibit B

RSAP Benefit/Cost Analysis

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Roadside Safety Analysis Program (RSAP) Benefit/Cost Analysis

Assumptions

Cost:

Life: Embankment - 20 years Guardrail - 10 years Discount Rate: 4%

These assumptions are consistent with the values used by INDOT in the ROADSIDE computer program to develop the 2-lane, 2-way roadway embankment warrant figures as outlined in IDM Chapter 49-11.0.

Highway:

Rural, Freeway, Two-Way, Divided, 70 MPH
4 lanes, 12 ft wide, 11 ft usable right (outside) shoulder, 5 ft usable left (inside) shoulder.
2030 ADT = 23618, no growth factor used since this is the forcasted volume.
24% trucks with RSAP vehicle mix
Encroachment Rate Adj Factor = 1 (no adjustment)

Segment:

1000 ft long segments
Straight (no curve), and level (0% grade)
60 ft median of divided highway.

Features:

Guardrail: 1,000 LFT consisting of:
975 LFT of w-beam guardrail
12.5 LFT End Section at beginning of segment
12.5 LFT End Section at end of Segment.
2 ft feature width.
2 ft Guardrail offset from effective usable (paved) shoulder,

Embankments: 1000 Ft. Long
Feature width based on height of embankment, see page 3

Crash Costs:

Crash Severity	Roadside Design Guide
Fatal Crash	$1,000,000.00
Severe Injury Crash	$200,000.00
Moderate Injury Crash	$12,500.00
Slight Injury Crash	$3,750.00
PDO Crash Level 2	$3,125.00
PDO Crash Level 1	$625.00

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Roadside Safety Analysis Program (RSAP) Benefit/Cost Analysis

Installation Cost Assumptions and Calculations

Alternative 1: Unprotected Guardrail Embankment $0.00

Uses reduced guardrail embankment with offset 15 ft from eop. Fill Height = 26.00 3 :1 Slope

Guardrail Embankment Cost $256.13 /LFT

Alternative 3: Clear Zone Embankment $28,000.00

Uses clear zone embankment with offset 30 ft from eop. Fill Height = 26.00 3 :1 Slope

Typical Clear Zone Embankment Cost $283.13 /LFT

Added Cost (above baseline) = $283.13 - $256.13 = $27.00

1000 LFT x $27.00 /CYD = $27,003.22

Alternative 4: Guardrail with Reduced Embankment $25,000.00

Uses reduced guardrail embankment with offset 15 ft from eop. Fill Height = 26.00 3 :1 Slope

Guardrail Embankment Cost $256.13 /LFT

Added Cost (above baseline) = $256.13 - $256.13 = $0.00

1000 LFT x $0.00 /CYD = $0.00

Added Costs for Shoulder Widening (1) = $7.26 /LFT

1000 LFT x $7.26 /CYD = $7,260.00

Added Costs for guardrail installation (1) = $17.00 /LFT (includes end sections)

1000 LFT x $17.00 /CYD = $17,000.00

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Roadside Safety Analysis Program (RSAP) Benefit/Cost Analysis

Installation Cost Assumptions and Calculations

Variables			Cost Variables			
Fill Height (Rounded)	**26**	**FT**	Borrow Cost		$6.08	/CYD
Clear Zone	30	FT	W-beam Guardrail		$17.00	/LFT
Clear Zone Slope	6	:1				
Required Shoulder	10	FT				
Embankment Slope	3	:1	HMA Surface		$64.78	/Ton
			HMA Base		$50.67	/Ton
Shoulder Slope	4	%	Aggregate, No. 53 Base		$22.16	/Ton
Guardrail Offset	2	FT				
Offset behind guardrail	2	FT	HMA Shoulder Section			
Add'l Paved Shoulder	2	FT	Surface	1.5 in	165	#/SY
			Base	4.5 in	495	#/SY
			Aggr No. 53 Base	12 in	0.667	Ton/SY

Fill Height (X)	**26.00**	**FT**	above --> use GR
			below --> use CZ

Typical 6:1 Slope to Clear Zone, then 3:1 Embankment Slope

CZ slope length (Y)	20.00	FT			
CZ slope height (Z)	3.33	FT			
Embankment height (X-Z)	22.67	FT			
Embankment length (L)	68.00	FT			
Embankment Fill	46.57	CY/LFT			
Embankment Cost	$283.13	/LFT	Cost (CZ) =	$283.13	/LFT

Guardrail: No Clear Zone, 3:1 slope behind guardrail

			HMA Shoulder Section			
Guardrail Shld Length (Y)	5.42	FT				
Guardrail slope height (Z)	0.22	FT	Surface	0.02	Ton/LFT	$1.19
Embankment height (X-Z)	25.78	FT	Base	0.06	Ton/LFT	$2.79
Embankment length (L)	77.35	FT	No. 53 Base	0.15	Ton/LFT	$3.28
Embankment Fill	42.13	CY/LFT			TOTAL =	$7.26
Embankment Cost	$256.13	/LFT				

COST (GR) =	$256.13	+	$17.00	+	$7.26	=	$280.39

COST (CZ) - COST (GR) = $2.75

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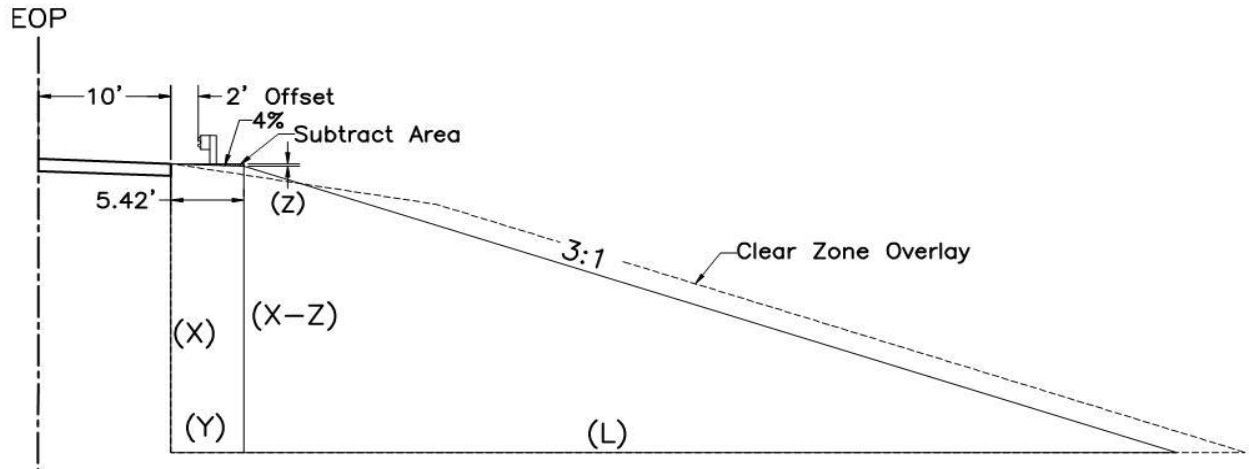
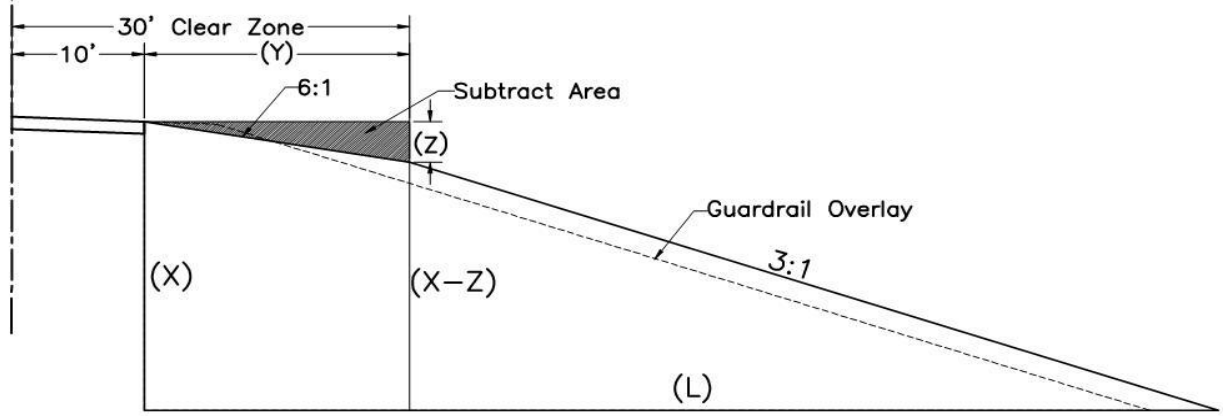
PROJECT NO	0461-1511	SHEET	4 of 6
PROJECT	I-69 Tier 2 Section 4		
SUBJECT	RSAP B/C Analysis		
CALCULATED BY	CMG	DATE	4/28/11
CHECKED BY		DATE	





AREA = (X*Y) − (0.5*Y*Z) + [0.5*(X−Z)*L]

Z = Y*0.04 (FOR 4% SHOULDER SLOPE)
Z = Y*0.1667 (FOR 6:1 CLEAR ZONE SLOPE)
L = (X−Z)*3 (FOR 3:1 FORESLOPE)

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Roadside Safety Analysis Program (RSAP) Benefit/Cost Analysis

Installation Cost Assumptions and Calculations

Variables			Cost Variables			
Fill Height (Rounded)	**26**	**FT**	Borrow Cost		$6.08	/CYD
Clear Zone	30	FT	W-beam Guardrail		$17.00	/LFT
Clear Zone Slope	6	:1				
Required Shoulder	10	FT				
Embankment Slope	2	:1	HMA Surface		$64.78	/Ton
			HMA Base		$50.67	/Ton
Shoulder Slope	4	%	Aggregate, No. 53 Base		$22.16	/Ton
Guardrail Offset	2	FT				
Offset behind guardrail	2	FT	HMA Shoulder Section			
Add'l Paved Shoulder	2	FT	Surface	1.5 in	165	#/SY
			Base	4.5 in	495	#/SY
			Aggr No. 53 Base	12 in	0.667	Ton/SY

Fill Height (X)	**26.00**	**FT**	above --> use GR
			below --> use CZ

Typical 6:1 Slope to Clear Zone, then 3:1 Embankment Slope

CZ slope length (Y)	20.00	FT			
CZ slope height (Z)	3.33	FT			
Embankment height (X-Z)	22.67	FT			
Embankment length (L)	45.33	FT			
Embankment Fill	37.05	CY/LFT			
Embankment Cost	$225.29	/LFT	Cost (CZ) =	$225.29	/LFT

Guardrail: No Clear Zone, 3:1 slope behind guardrail

Guardrail Shld Length (Y)	5.42	FT	HMA Shoulder Section			
Guardrail slope height (Z)	0.22	FT	Surface	0.02	Ton/LFT	$1.19
Embankment height (X-Z)	25.78	FT	Base	0.06	Ton/LFT	$2.79
Embankment length (L)	51.57	FT	No. 53 Base	0.15	Ton/LFT	$3.28
Embankment Fill	29.82	CY/LFT			TOTAL =	$7.26
Embankment Cost	$181.28	/LFT				

COST (GR) =	$181.28	+	$17.00	+	$7.26	=	$205.54

COST (CZ) - COST (GR) = $19.75

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Roadside Safety Analysis Program (RSAP) Benefit/Cost Analysis

Installation Cost Assumptions and Calculations

Alternative 1: Unprotected Guardrail Embankment $0.00

Uses reduced guardrail embankment with offset 15 ft from eop. Fill Height = 26.00 2 :1 Slope

Guardrail Embankment Cost $181.28 /LFT

Alternative 3: Clear Zone Embankment $45,000.00

Uses clear zone embankment with offset 30 ft from eop. Fill Height = 26.00 2 :1 Slope

Typical Clear Zone Embankment Cost $225.29 /LFT

Added Cost (above baseline) = $225.29 - $181.28 = $44.00

1000 LFT x $44.00 /CYD = $44,004.98

Alternative 4: Guardrail with Reduced Embankment $25,000.00

Uses reduced guardrail embankment with offset 15 ft from eop. Fill Height = 26.00 2 :1 Slope

Guardrail Embankment Cost $181.28 /LFT

Added Cost (above baseline) = $181.28 - $181.28 = $0.00

1000 LFT x $0.00 /CYD = $0.00

Added Costs for Shoulder Widening (1) = $7.26 /LFT

1000 LFT x $7.26 /CYD = $7,260.00

Added Costs for guardrail installation (1) = $17.00 /LFT (includes end sections)

1000 LFT x $17.00 /CYD = $17,000.00

Date: April 28, 2011 **Time:** 18:08:02PM

Benefit/Cost Ratio Report

Page: 1

File Name: RSAP_4-27-11_Combined Scenarios.rpd
Project Description: Guardrail-Embankment Height

Alternative	Description
1	Embankment: 3:1 slope H=26 ft Breakpoint 15 ft offset, Unprotected (within Clear Zone)
2	Clear Zone Embankment: 3:1 slope H=26 ft Outside of Clear Zone (Unprotected)
3	Guardrail with Terminal End Sections, 12 ft offset

	Alternative		
Alternative	1	2	3
1	0.00	2.71	0.20
2	0.00	0.00	-4.57
3	0.00	0.00	0.00

Date: April 28, 2011 **Time:** 18:08:02PM

Alternative Cost Report

File Name: RSAP_4-27-11_Combined Scenarios.rpd
Project Description: Guardrail-Embankment Height

Alternative	Description
1	Embankment: 3:1 slope H=26 ft Breakpoint 15 ft offset, Unprotected (within Clear Zone)
2	Clear Zone Embankment: 3:1 slope H=26 ft Outside of Clear Zone (Unprotected)
3	Guardrail with Terminal End Sections, 12 ft offset

Alternative	Expected Crash Frequency (Acc/Yr)	Annual Crash Cost ($)	Annual Installation Cost ($)	Annual Maintenance Cost ($)	Annual Repair Cost ($)
1	0.193318	19771.19	0.00	0.00	0.00
2	0.119498	14196.95	2060.29	0.00	0.00
3	0.183999	19152.65	3082.27	0.00	62.30

Date: April 28, 2011

Feature Cost Report

Time: 18:08:02PM

File Name: RSAP_4-27-11_Combined Scenarios.rpd
Project Description: Guardrail-Embankment Height

Alternative: **1**
Description: **Embankment: 3:1 slope H=26 ft Breakpoint 15 ft offset, Unprotected (within Clear Zone)**

Feature	Distance From Beginning Of First Segment	Expected Crash Freq (Acc/Year)	Average Severity	Annual Crash Cost ($)	Category	Type
1.1	0.0	0.189519	4.46	19768.87	Foreslopes	3:1, H = 8.0 m (26 ft)
2.1	0.0	0.003799	0.57	2.32	Foreslopes	Flat Ground

Date: April 28, 2011

Feature Cost Report

Time: 18:08:02PM

File Name: RSAP_4-27-11_Combined Scenarios.rpd
Project Description: Guardrail-Embankment Height

Alternative: **2**
Description: **Clear Zone Embankment: 3:1 slope H=26 ft Outside of Clear Zone (Unprotected)**

Feature	Distance From Beginning Of First Segment	Expected Crash Freq (Acc/Year)	Average Severity	Annual Crash Cost ($)	Category	Type
1.1	0.0	0.097135	4.59	13978.19	Foreslopes	3:1, H = 8.0 m (26 ft)
2.1	0.0	0.022363	2.09	218.75	Foreslopes	6:1, H >= 0.3 m (1 ft)

Date: April 28, 2011

Feature Cost Report

Time: 18:08:02PM

File Name: RSAP_4-27-11_Combined Scenarios.rpd
Project Description: Guardrail-Embankment Height

Alternative: **3**
Description: **Guardrail with Terminal End Sections, 12 ft offset**

Feature	Distance From Beginning Of First Segment	Expected Crash Freq (Acc/Year)	Average Severity	Annual Crash Cost ($)	Category	Type
1.1	12.5	0.180476	3.44	16740.11	Longitudinal Barriers	TL-1 Guardrail
2.1	987.5	0.001127	3.75	300.01	Terminals and Crash Cushions	TL-3 Guardrail Terminal
3.1	0.0	0.002396	5.99	2112.53	Terminals and Crash Cushions	Blunt End

Date: April 28, 2011 **Time:** 18:08:02PM

Input Data Report

File Name: RSAP_4-27-11_Combined Scenarios.rpd
Project Description: Guardrail-Embankment Height

Alternavtive 1[Baseline(Existing)Condition]

Description	Embankment: 3:1 slope H=26 ft Breakpoint 15 ft offset, Unprotected (withi
Life(years)	20
Total Installation Cost ($)	0.00
Annual Maintenance Cost ($)	0.00
Discount Rate	4.00
Area Type	Rural
Functional Class	Freeway
Highway Type	Two-Way, Divided
Number of Lanes	4
Lane Width(ft)	12.0
Right Shoulder Width(ft)	11.0
Left Shoulder Width(ft)	5.0
Speed Limit(mph)	70.0
Nominal Percent Truck(%)	24.0
ADT	23618
Traffic Growth Factor(%)	0.0
Encroachment Rate Adjustment Factor	1
Random Seed Number	66690000 (Auto Generated)

Segment	Length(ft)	Median Width(ft)	Percent Grade(%)	Curvature Direction	Curvature Radius(ft)
1	1000.0	60.0	0.0	None	

Date: April 28, 2011

Input Data Report

Time: 18:08:03PM

File Name: RSAP_4-27-11_Combined Scenarios.rpd
Project Description: Guardrail-Embankment Height

Alternative **1 [Baseline(Existing) Conditions]**

Feature	Category	Type
1	Foreslopes	3:1, H = 8.0 m (26 ft)
2	Foreslopes	Flat Ground

Date: April 28, 2011

Input Data Report

Time: 18:08:03PM

File Name: RSAP_4-27-11_Combined Scenarios.rpd
Project Description: Guardrail-Embankment Height

Alternative **1 [Baseline(Existing) Conditions]**

Feature	Length(ft)	Width(ft)	Flare Rate	Location	Offset(ft)	Distance(ft)	Repetitions	Spacing(ft)
1	1000.0	77.0	0.000	Right	15.0	0.0		
2	1000.0	3.0	0.000	Right	12.0	0.0		

Date: April 28, 2011 **Time:** 18:08:03PM

Input Data Report

File Name: RSAP_4-27-11_Combined Scenarios.rpd
Project Description: Guardrail-Embankment Height

Alternavtive 2

Description	Clear Zone Embankment: 3:1 slope H=26 ft Outside of Clear Zone (Unprote
Life(years)	20
Total Installation Cost ($)	28000.00
Annual Maintenance Cost ($)	0.00
Discount Rate	4.00
Area Type	Rural
Functional Class	Freeway
Highway Type	Two-Way, Divided
Number of Lanes	4
Lane Width(ft)	12.0
Right Shoulder Width(ft)	11.0
Left Shoulder Width(ft)	5.0
Speed Limit(mph)	70.0
Nominal Percent Truck(%)	24.0
ADT	23618
Traffic Growth Factor(%)	0.0
Encroachment Rate Adjustment Factor	1
Random Seed Number	66690000 (Auto Generated)

Segment	Length(ft)	Median Width(ft)	Percent Grade(%)	Curvature Direction	Curvature Radius(ft)
1	1000.0	60.0	0.0	None	

Date: April 28, 2011

Input Data Report

Time: 18:08:03PM

Page: 10

File Name: RSAP_4-27-11_Combined Scenarios.rpd
Project Description: Guardrail-Embankment Height

Alternative **2**

Feature	Category	Type
1	Foreslopes	3:1, H = 8.0 m (26 ft)
2	Foreslopes	6:1, H >= 0.3 m (1 ft)

Date: April 28, 2011

Input Data Report

Time: 18:08:03PM

Page: 11

File Name: RSAP_4-27-11_Combined Scenarios.rpd
Project Description: Guardrail-Embankment Height

Alternative **2**

Feature	Length(ft)	Width(ft)	Flare Rate	Location	Offset(ft)	Distance(ft)	Repetitions	Spacing(ft)
1	1000.0	68.0	0.000	Right	30.0	0.0		
2	1000.0	18.0	0.000	Right	12.0	0.0		

Date: April 28, 2011 **Time:** 18:08:03PM

Input Data Report

File Name: RSAP_4-27-11_Combined Scenarios.rpd
Project Description: Guardrail-Embankment Height

Alternavtive 3

Description	Guardrail with Terminal End Sections, 12 ft offset
Life(years)	10
Total Installation Cost ($)	25000.00
Annual Maintenance Cost ($)	0.00
Discount Rate	4.00
Area Type	Rural
Functional Class	Freeway
Highway Type	Two-Way, Divided
Number of Lanes	4
Lane Width(ft)	12.0
Right Shoulder Width(ft)	11.0
Left Shoulder Width(ft)	5.0
Speed Limit(mph)	70.0
Nominal Percent Truck(%)	24.0
ADT	23618
Traffic Growth Factor(%)	0.0
Encroachment Rate Adjustment Factor	1
Random Seed Number	66690000 (Auto Generated)

Segment	Length(ft)	Median Width(ft)	Percent Grade(%)	Curvature Direction	Curvature Radius(ft)
1	1000.0	60.0	0.0	None	

File Name: RSAP_4-27-11_Combined Scenarios.rpd
Project Description: Guardrail-Embankment Height

Alternative **3**

Feature	Category	Type
1	Longitudinal Barriers	TL-1 Guardrail
2	Terminals and Crash Cushions	TL-3 Guardrail Terminal
3	Terminals and Crash Cushions	Blunt End

File Name: RSAP_4-27-11_Combined Scenarios.rpd
Project Description: Guardrail-Embankment Height

Alternative **3**

Feature	Length(ft)	Width(ft)	Flare Rate	Location	Offset(ft)	Distance(ft)	Repetitions	Spacing(ft)
1	975.0	2.0	0.000	Right	12.0	12.5		
2	12.5	2.0	0.000	Right	12.0	987.5		
3	12.5	2.0	0.000	Right	12.0	0.0		

Date: April 28, 2011 **Time:** 18:13:24PM

Benefit/Cost Ratio Report

File Name: RSAP_4-27-11_Combined Scenarios_More Severe.rpd
Project Description: Guardrail-Embankment Height

Alternative	Description
1	Embankment: Critical 2:1 slope H=26 ft Breakpoint 15 ft offset, Unprotected (within Clear Zone)
2	Clear Zone Embankment: Critical 2:1 slope H=26 ft Outside of Clear Zone (Unprotected)
3	Guardrail with Terminal End Sections, 12 ft offset

	Alternative		
Alternative	**1**	**3**	**2**
1	0.00	6.74	3.57
3	0.00	0.00	-55.85
2	0.00	0.00	0.00

Date: April 28, 2011 **Time:** 18:13:24PM

Alternative Cost Report

File Name: RSAP_4-27-11_Combined Scenarios_More Severe.rpd
Project Description: Guardrail-Embankment Height

Alternative	Description
1	Embankment: Critical 2:1 slope H=26 ft Breakpoint 15 ft offset, Unprotected (within Clear Zone)
2	Clear Zone Embankment: Critical 2:1 slope H=26 ft Outside of Clear Zone (Unprotected)
3	Guardrail with Terminal End Sections, 12 ft offset

Alternative	Expected Crash Frequency (Acc/Yr)	Annual Crash Cost ($)	Annual Installation Cost ($)	Annual Maintenance Cost ($)	Annual Repair Cost ($)
1	0.190118	40391.59	0.00	0.00	0.00
2	0.119550	28558.35	3311.18	0.00	0.00
3	0.184081	19213.94	3082.27	0.00	61.60

Date: April 28, 2011

Feature Cost Report

Time: 18:13:24PM

File Name: RSAP_4-27-11_Combined Scenarios_More Severe.rpd
Project Description: Guardrail-Embankment Height

Alternative: **1**
Description: **Embankment: Critical 2:1 slope H=26 ft Breakpoint 15 ft offset, Unprotected (within Clear Zone)**

Feature	Distance From Beginning Of First Segment	Expected Crash Freq (Acc/Year)	Average Severity	Annual Crash Cost ($)	Category	Type
1.1	0.0	0.186305	6.06	40389.36	Foreslopes	2:1, H = 8.0 m (26 ft)
2.1	0.0	0.003813	0.57	2.23	Foreslopes	Flat Ground

Date: April 28, 2011

Feature Cost Report

Time: 18:13:24PM

File Name: RSAP_4-27-11_Combined Scenarios_More Severe.rpd
Project Description: Guardrail-Embankment Height

Alternative: **2**
Description: **Clear Zone Embankment: Critical 2:1 slope H=26 ft Outside of Clear Zone (Unprotected)**

Feature	Distance From Beginning Of First Segment	Expected Crash Freq (Acc/Year)	Average Severity	Annual Crash Cost ($)	Category	Type
1.1	0.0	0.097172	6.23	28332.64	Foreslopes	2:1, H = 8.0 m (26 ft)
2.1	0.0	0.022378	2.10	225.71	Foreslopes	6:1, H >= 0.3 m (1 ft)

Date: April 28, 2011

Feature Cost Report

Time: 18:13:24PM

File Name: RSAP_4-27-11_Combined Scenarios_More Severe.rpd
Project Description: Guardrail-Embankment Height

Alternative: **3**
Description: **Guardrail with Terminal End Sections, 12 ft offset**

Feature	Distance From Beginning Of First Segment	Expected Crash Freq (Acc/Year)	Average Severity	Annual Crash Cost ($)	Category	Type
1.1	12.5	0.180564	3.46	16841.33	Longitudinal Barriers	TL-1 Guardrail
2.1	987.5	0.001130	3.83	297.67	Terminals and Crash Cushions	TL-3 Guardrail Terminal
3.1	0.0	0.002387	5.98	2074.93	Terminals and Crash Cushions	Blunt End

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Input Data Report

File Name: RSAP_4-27-11_Combined Scenarios_More Severe.rpd
Project Description: Guardrail-Embankment Height

Alternavtive 1[Baseline(Existing)Condition]

Description	Embankment: Critical 2:1 slope H=26 ft Breakpoint 15 ft offset, Unprotecte
Life(years)	20
Total Installation Cost ($)	0.00
Annual Maintenance Cost ($)	0.00
Discount Rate	4.00
Area Type	Rural
Functional Class	Freeway
Highway Type	Two-Way, Divided
Number of Lanes	4
Lane Width(ft)	12.0
Right Shoulder Width(ft)	11.0
Left Shoulder Width(ft)	5.0
Speed Limit(mph)	70.0
Nominal Percent Truck(%)	24.0
ADT	23618
Traffic Growth Factor(%)	0.0
Encroachment Rate Adjustment Factor	1
Random Seed Number	26806000 (Auto Generated)

Segment	Length(ft)	Median Width(ft)	Percent Grade(%)	Curvature Direction	Curvature Radius(ft)
1	1000.0	60.0	0.0	None	

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File Name: RSAP_4-27-11_Combined Scenarios_More Severe.rpd
Project Description: Guardrail-Embankment Height

Alternative **1 [Baseline(Existing) Conditions]**

Feature	Category	Type
1	Foreslopes	2:1, H = 8.0 m (26 ft)
2	Foreslopes	Flat Ground

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File Name: RSAP_4-27-11_Combined Scenarios_More Severe.rpd
Project Description: Guardrail-Embankment Height

Alternative **1 [Baseline(Existing) Conditions]**

Feature	Length(ft)	Width(ft)	Flare Rate	Location	Offset(ft)	Distance(ft)	Repetitions	Spacing(ft)
1	1000.0	60.0	0.000	Right	15.0	0.0		
2	1000.0	3.0	0.000	Right	12.0	0.0		

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File Name: RSAP_4-27-11_Combined Scenarios_More Severe.rpd
Project Description: Guardrail-Embankment Height

Alternavtive 2

Description	Clear Zone Embankment: Critical 2:1 slope H=26 ft Outside of Clear Zone (
Life(years)	20
Total Installation Cost ($)	45000.00
Annual Maintenance Cost ($)	0.00
Discount Rate	4.00
Area Type	Rural
Functional Class	Freeway
Highway Type	Two-Way, Divided
Number of Lanes	4
Lane Width(ft)	12.0
Right Shoulder Width(ft)	11.0
Left Shoulder Width(ft)	5.0
Speed Limit(mph)	70.0
Nominal Percent Truck(%)	24.0
ADT	23618
Traffic Growth Factor(%)	0.0
Encroachment Rate Adjustment Factor	1
Random Seed Number	26806000 (Auto Generated)

Segment	Length(ft)	Median Width(ft)	Percent Grade(%)	Curvature Direction	Curvature Radius(ft)
1	1000.0	60.0	0.0	None	

Input Data Report

File Name: RSAP_4-27-11_Combined Scenarios_More Severe.rpd
Project Description: Guardrail-Embankment Height

Alternative **2**

Feature	Category	Type
1	Foreslopes	2:1, H = 8.0 m (26 ft)
2	Foreslopes	6:1, H >= 0.3 m (1 ft)

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File Name: RSAP_4-27-11_Combined Scenarios_More Severe.rpd
Project Description: Guardrail-Embankment Height

Alternative **2**

Feature	Length(ft)	Width(ft)	Flare Rate	Location	Offset(ft)	Distance(ft)	Repetitions	Spacing(ft)
1	1000.0	60.0	0.000	Right	30.0	0.0		
2	1000.0	18.0	0.000	Right	12.0	0.0		

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File Name: RSAP_4-27-11_Combined Scenarios_More Severe.rpd
Project Description: Guardrail-Embankment Height

Alternavtive 3

Description	Guardrail with Terminal End Sections, 12 ft offset
Life(years)	10
Total Installation Cost ($)	25000.00
Annual Maintenance Cost ($)	0.00
Discount Rate	4.00
Area Type	Rural
Functional Class	Freeway
Highway Type	Two-Way, Divided
Number of Lanes	4
Lane Width(ft)	12.0
Right Shoulder Width(ft)	11.0
Left Shoulder Width(ft)	5.0
Speed Limit(mph)	70.0
Nominal Percent Truck(%)	24.0
ADT	23618
Traffic Growth Factor(%)	0.0
Encroachment Rate Adjustment Factor	1
Random Seed Number	26806000 (Auto Generated)

Segment	Length(ft)	Median Width(ft)	Percent Grade(%)	Curvature Direction	Curvature Radius(ft)
1	1000.0	60.0	0.0	None	

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File Name: RSAP_4-27-11_Combined Scenarios_More Severe.rpd
Project Description: Guardrail-Embankment Height

Alternative **3**

Feature	Category	Type
1	Longitudinal Barriers	TL-1 Guardrail
2	Terminals and Crash Cushions	TL-3 Guardrail Terminal
3	Terminals and Crash Cushions	Blunt End

File Name: RSAP_4-27-11_Combined Scenarios_More Severe.rpd
Project Description: Guardrail-Embankment Height

Alternative **3**

Feature	Length(ft)	Width(ft)	Flare Rate	Location	Offset(ft)	Distance(ft)	Repetitions	Spacing(ft)
1	975.0	2.0	0.000	Right	12.0	12.5		
2	12.5	2.0	0.000	Right	12.0	987.5		
3	12.5	2.0	0.000	Right	12.0	0.0		