HIGHWAY SAFETY MANUAL (1st EDITION)
PART B OREGON DATA ASSESSMENT

Draft Report

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EXECUTIVE SUMMARY

This report describes an effort to evaluate the SafetyAnalyst, a set of highway safety software tools generally based on procedures introduced in the Highway Safety Manual (HSM) Part B. The purpose of this research is to determine if the SafetyAnalyst is compatible with Oregon Department of Transportation (ODOT) databases. The research also presents an effort to identify current data deficiencies and, where feasible, recommend ways to prioritize and populate essential crash and road variables. This report consists of eight sections that collectively summarize the research efforts and findings resulting from the Oregon data and SafetyAnalyst assessment.

The research team found that the Oregon crash data can be converted to the required SafetyAnalyst format, though many variables cannot be completely populated as the SafetyAnalyst definitions are more extensive than those used in the Oregon database. Nevertheless, the Oregon crash data is reasonably compatible and, with some formatting adjustments, can be used in SafetyAnalyst. Only two of the crash variables that cannot be directly populated from the Oregon data are critical (sensitive) to the SafetyAnalyst outcome. Both of these variables can be developed with minimal effort. Other crash variables would simply need to be reformatted.

The SafetyAnalyst input tables include categories of required, conditionally required, and desired variables. For successful use of the SafetyAnalyst tool, the required and conditionally required variables are essential to the analysis. The desired variables will enhance the analysis but are not critical. As a result, the project team evaluated all variables with an emphasis on those that were required or conditionally required. This report also includes sample input tables as well as the output report from SafetyAnalyst for a case study that included seven sites.

The research team also used the case study input information as a control group for a sensitivity analysis for the individual variables. The sensitivity analysis of the road variables determined that additional data collection or modification is needed for eighteen of the road variables that are sensitive to the analysis and identified as required variables. Ten of these sensitive road variables, though, are associated with intersection approach legs. The SafetyAnalyst program can execute without the detailed approach leg information (the variables would be populated using some general assumptions), but results from the tool would then need to be disregarded for the detailed intersection leg analysis. As a result, eight additional road-related variables could be collected to fully populate the SafetyAnalyst critical variables until such time as individual intersection approach volumes can be added to the Oregon data.

Of special note is the dependence of the SafetyAnalyst analysis on traffic volume information. In particular, the minor road traffic volume is an extremely sensitive variable for intersection evaluation. This variable is also limited for facilities that are not

on the state highway system. As a result, the single variable that requires the greatest attention would be the minor road traffic volume. The major road traffic volume is also a critical variable, but for state highways this value is already available in Oregon.

1 INTRODUCTION

In 2010, the American Association of State and Highway Officials (AASHTO) published the *Highway Safety Manual* (HSM). This document combines historic safety assessment methods with new science-based safety analysis techniques to provide several safety evaluation options for transportation agencies. Included in Volume 1, Part B of the HSM are safety management methods, while Volume 2, Part C of the HSM provides corridor-specific predictive procedures. A companion software tool, SafetyAnalyst, generally represents the techniques presented in Part B of the HSM.

Currently the Oregon Department of Transportation (ODOT) uses computationally descriptive analysis tools such as the Safety Priority Index System (SPIS) to help identify and prioritize improvements at high crash locations. With the publication of the HSM and release of the SafetyAnalyst, the ODOT safety analysis methods could feasibly be expanded to incorporate these new procedures; however, implementation of these new resources requires adaptation of databases and supplemental data collection. The research effort included in this report, therefore, evaluates compatibility issues between current and required data for the SafetyAnalyst. To help define data collection priorities, this research effort also includes a sensitivity assessment for data requirements for the SafetyAnalyst required variables.

Part B of the HSM (*AASHTO, 2010*) includes the following six main components:

- Network screening,
- Diagnosis,
- Countermeasure selection,
- Economic appraisal,
- Prioritizing projects, and
- Safety effectiveness evaluation.

The SafetyAnalyst includes portions of these components, but this analysis focuses on network screening, the primary procedure included in SafetyAnalyst and the procedure most similar to that used in SPIS. Network screening is a process to review the overall transportation network, identify candidate sites that could benefit the most from safety enhancement projects, and then rank the sites based on their potential for crash reduction. The diagnosis process incorporates crash data, site conditions, and other information to help support the evaluation of crash patterns. Countermeasure selection then permits an analyst to assess the crash patterns and site characteristics to help identify candidate countermeasure improvements that will enhance safety at the site. The countermeasure assessment should consider roadway, vehicle, operations, and human factors. The economic appraisal component enables a user to assess the benefit and cost of each countermeasure and contrast perceived benefits to those of alternative plans configurations in an effort to identify the most cost-effective treatments. These options can then be prioritized in terms of the cost, mobility, and the environmental influence. The HSM safety effectiveness evaluation component provides a variety of techniques to

analytically assess the potential for the various countermeasures to reduce crashes (AASHTO, 2010). Since the SafetyAnalyst is a set of software tools based on the HSM Part B steps, this analysis software can be implemented to evaluate, on a large scale, the safety improvement measures for state and local highway agencies. The computational method used by SafetyAnalyst is based on the predictive methods for determining expected crashes as included in the safety effectiveness evaluation section.

The goal of the project reviewed in this report, therefore, is to evaluate the steps necessary to incorporate SafetyAnalyst into the ODOT safety assessment procedures and assess the level of effort required to successful integrate this software tool. One significant issue with adapting the SafetyAnalyst for Oregon highways is the quantity and format of required data elements necessary for successful implementation of the SafetyAnalyst. The SafetyAnalyst requires extensive data and before an agency can use this tool, they must first compile (in a specific format) a minimum set of data elements for the following categories:

- Roadway Segment Characteristics Data,
- Intersection Characteristics Data,
- Ramp Characteristics Data, and
- Crash Data.

As a result, this research project incorporated six tasks necessary to complete this assessment. The first task was the identification and summarization of specific data needs and deficiencies. The research team reviewed the coding manuals for the SafetyAnalyst and the existing ODOT data system, searched for data deficiencies, and assessed the data format for current ODOT elements. The second research task was to evaluate the functionality of the SafetyAnalyst. This task included a comparison between the functions of the SafetyAnalyst with the Oregon SPIS tool. For the third task, the project teams developed a plan to format and evaluate data for sample corridors and their ultimate analysis with the SafetyAnalyst. This data evaluation plan addressed expected data deficiencies and formatting issues that would compromise importing and using data with SafetyAnalyst. The fourth task executed the task three data collection plan. Upon import of the data into the SafetyAnalyst, the research team then performed a sensitivity analysis to help determine critical data elements needed to successfully and effectively use this software tool. Though originally the research team intended to incorporate a direct comparison between results obtained by SafetyAnalyst and SPIS, the project team determined that this comparison did not provide useful results since many of the test site variables for SafetyAnalyst were unknown and so estimated by the project team. The project concluded with developing recommendations for data collection priorities required for successful implementation of the SafetyAnalyst in Oregon (task five) and compiling these findings in this report (task six).

The results of this research effort are included in this report beginning with this introduction (Section 1.0) followed by a brief literature review (Section 2.0). Section 3.0 reviews data needs for the successful implementation of SafetyAnalyst. Section 4.0 reviews the case study evaluation for seven sites. Since some data variables may be

desirable, but not essential to use SafetyAnalyst, Section 5.0 includes the method and results of a sensitivity analysis that evaluates all of the required variables. This report then includes conclusions and recommendations (Section 6.0), references (Section 7.0), and an appendix with supporting tables (Section 8.0).

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2 LITERATURE REVIEW

SafetyAnalyst is a set of software tools developed to assist transportation agencies with site and network safety assessment, prioritization, and cost effectiveness. This software tool was developed by the Federal Highway Administration (FHWA), assessed by a variety to state transportation agencies, and is currently distributed by AASHTO. The ultimate goal of the research effort reviewed in this report was to evaluate how the SafetyAnalyst could be incorporated into the Oregon system, and to determine if this tool compares favorably to the current SPIS system in use by ODOT. One component of this assessment by the research team is brief literature review to identify the requirements of SafetyAnalyst so that the current ODOT database and procedures can be compared to this tool. Since the focus of this literature review is very specific, there are two key documents required for this evaluation. To identify the data needs of the SafetyAnalyst, the *SafetyAnalyst Data Import Reference* (ITT Corporation, 2009) is critical. The Oregon crash data content and format is identified in the *Statewide Crash Data System Motor Vehicle Traffic Crash Analysis and Code Manual* (ODOT, 2007).

2.1 REQUIRED SAFETYANALYST DATABASE

The SafetyAnalyst is a software suite developed to manage the highway safety assessment process. The required data include roadway segment, intersection, ramp, and crash data. The format for this input information includes a specific data quality and format requirement that is formatted into ten data tables (ITT Corporation, 2009). The 12 SafetyAnalyst data tables are summarized as follows and described in detail in the appendix (see Table 8.4):

- *AltRoadwaySegment,*
- *AltSegmentTraffic,*
- *AltRamp,*
- *AltRampTraffic,*
- *AltIntersection,*
- *AltMajorRoadTraffic,*
- *AltMinorRoadTraffic,*
- *AltLeg,*
- *AltLegTraffic,*
- *AltAccident,*
- *AltConstructionProject,* and
- *AltImplementedCountermeasure.*

To contrast the SafetyAnalyst data variables to Oregon site and crash data, the research team classified the 12 SafetyAnalyst input tables into four primary categories:

- Crash Data (*AltAccident*),
- Roadway Data (*AltRoadwaySegment, AltSegmentTraffic, AltRamp, AltRampTraffic, AltIntersection, AltMajorRoadTraffic, AltMinorRoadTraffic, AltLeg, and AltLegTraffic*),
- Construction Project (*AltConstructionProject*), and
- Implement Countermeasure (*AltImplementedCountermeasure*).

The SafetyAnalyst uses data from the last two tables (construction and countermeasure) for special evaluations. The research team did not comprehensively assess their data input requirements since they are not aligned with the network analysis focus of this report.

Table 8.2, included in the appendix of this report, is a comprehensive table that defines the SafetyAnalyst input elements for the crash data. Table 2.1 is a sample table of the SafetyAnalyst crash data variable descriptions. The table includes the following five columns: Variable Name, Variable Description, Data Type, Possible Values, and Required or Desired. The variable name is the specific SafetyAnalyst identifier used for each input variable. The variable description provides a definition of the variable, while the data type column provides information about the format of the data (e.g., alphanumeric string, unconstrained string, etc.). The possible values column then summaries potential values used by each variable and, where appropriate, defines these values. The column required or desired addresses how critical the variable is to successful SafetyAnalyst performance.

Table 2.1: SafetyAnalyst Sample Crash Data Variable Description

Variable Name	Variable Description	Data Type	Possible values	Required or Desired
agencyID	Accident ID	Alphanumeric string	N/A	Required
locSystem	Location System	Enumerated string	A - Route/Milepost, B - Route/County/ Milepost C - Route/section/distance D - Section/distance	Required

Table 8.4 in the appendix contrasts the roadway data variables for both SafetyAnalyst and the Oregon available data. The nine roadway data tables identified above are included in this table. The *AltRoadwaySegment* table includes variable information that describes the roadway segments. *AltSegmentTraffic* variables describe the volume or traffic flow for the roadway segments. *AltRamp* provides ramp-specific variable information, while the *AltRampTraffic* includes traffic-specific data elements associated with the ramps. The *AltIntersection* table identifies attributes associated with intersections supported by traffic volume information for major and minor roads (shown in tables *AltMajorRoadTraffic* and *AltMinorRoadTraffic*). The *AltLeg* table identifies variables that represent the intersection approaches, and the companion traffic volume data is included in the *AltLegTraffic* table.

2.2 OREGON DEPARTMENT OF TRANSPORTATION CRASH DATABASE

Currently, ODOT uses a quantitative descriptive safety analysis tool, SPIS, for system-wide safety assessment. This tool, developed by ODOT initially in 1986, fulfills the requirement of the Highway Safety Improvement Program (HSIP). The primary function of SPIS is for network screening (ODOT, 2010). Transportation safety evaluation and enhancements projects are costly, so only a subset of sites can be evaluated each study period. It is therefore essential to screen and prioritize all sites based on their potential for safety improvement (crash reduction). ODOT uses SPIS as an initial step to help identify high crash segments and intersections on state highways so that they can be further evaluated for safety enhancement efforts.

The analysis of SPIS is based on three years of crash data. A site will be a candidate SPIS site if there are three or more crashes or one or more fatal crashes in the three year period. SPIS sites are divided into 0.1 mile sections of the highway network and then assessed using sliding window techniques. The priority index is determined by three major factors: *Crash frequency indicator* (IV_{Freq}), *crash rate indicator* (IV_{Rate}), and *crash severity indicator* ($IV_{Severity}$). The *crash severity indicator* value is assigned a 50 percent weight in the SPIS score, while the *crash frequency indicator* value and the *crash rate indicator* values are each assigned 25 percent weights in the overall SPIS score (ODOT 2009).

In SPIS, the *crash frequency indicator* is assigned a value between zero and 25 (based on the three-year study period). The relationship between the *crash frequency indicator* and total crashes is logarithmic. When total crashes reach 150 per 0.1mile in three years, the maximum value 25 can be obtained. This relationship is depicted by equation 2-1.

$$IV_{Freq} = \left[\frac{LOG(TotalCrashes + 1)}{LOG(150 + 1)} \right] \times 25 \qquad \text{Equation 2–1}$$

Where:

TotalCrashes = total number of crashes, and
IV_{Freq} = *crash frequency indicator* (ODOT 2009).

The value of *crash rate indicator* is also between zero and 25 and is determined based on a logarithmic distribution of crashes per million entering vehicles. This crash per million entering vehicle value is calculated using the total crashes and the average daily traffic (ADT). When this crash rate value reaches seven crashes per million entering vehicles, the maximum *crash rate indicator* value of 25 is assigned. The crash rate indicator is represented by equation 2-2.

$$IV_{Rate} = \left[\frac{LOG\left(\left(\frac{(TotalCrashes)(1{,}000{,}000)}{(3yr)(365days)(ADT)} \right) + 1 \right)}{LOG(7+1)} \right] \times 25 \qquad \text{Equation 2–2}$$

Where:

TotalCrashes = Total Number of Crashes,
ADT = Average Daily Traffic, and
IV_{Rate} = Crash rate indicator (ODOT, 2009).

SPIS assigns the *crash severity indicator* a value from zero to 50. The value of this indicator is determined based on a linear distribution of the severity score and rates the most severe injury in each crash. For example, if a crash involves both a fatality and property damage, the crash would be included as a fatality in the crash severity analysis. Crashes that are designated as fatalities or incapacitating injuries are assigned a level "A" with a severity score of 100 severity score. Serious or possible injury crashes are assigned levels "B" and "C" respectively and given a score of ten. Property damage only crashes receive a severity score of one. The *crash severity indicator* is then determined based on equation 2-3.

$$IV_{Severity} = \left[\frac{100(FATAL + INJ_A) + (10)(INJ_B + INJ_C) + (PDO)}{300} \right] \times 50 \qquad \text{Equation 2–3}$$

Where:

$IV_{Severity}$ = *crash severity indicator*,
FATAL = number of fatal crashes,
INJ_A = number of severe injury crashes (Class A),
INJ_B = number of moderate injury crashes (Class B),
INJ_C = number of minor injury crashes (Class C), and
PDO = number of property damage only crashes (ODOT, 2009).

SPIS compiles the associated score, based on the weighted sum of the *crash frequency indicator*, the *crash rate indicator*, and the *crash severity indicator* for each 0.01 mile section. This value is then used to evaluate and rank sites to help Oregon transportation agencies identify candidate locations that would benefit the greatest from safety enhancement efforts.

2.3 LITERATURE REVIEW SUMMARY

SafetyAnalyst provides an additional safety effectiveness analysis option; however, currently ODOT uses the SPIS safety management program SPIS and it is clear that the assessment techniques differ. Where SPIS is based on crash severity weighting for short segments the SafetyAnalyst uses a comprehensive data set to evaluate additional site characteristics that may be relevant in the safety effectiveness ranking process. The data

structure for SafetyAnalyst is very different from that required for SPIS. This research effort assessed the compatibility of the currently available Oregon database to those required by SafetyAnalyst. Following this data comparison, the ranking of SPIS sites relative to SafetyAnalyst should be considered. Where the SPIS ranking uses crash history and crash severity information, the *crash rate indicator* value uses the crash rate method that is only one of many available in the HSM (and consequently the SafetyAnalyst). This brief literature review identified the databases and their associated tables that are required for both programs. This report, from this point forward, will address how Oregon data directly compares to required SafetyAnalyst variables. Table 8.3, located in the appendix of this report, pairs the SafetyAnalyst variable with a companion Oregon variable, when available. This table includes the following six columns: SafetyAnalyst Variable Name, ODOT Variable Name, Variable Description, Data Type, Possible values, and Note.

The column SafetyAnalyst Variable Name depicts each variable name as required by SafetyAnalyst. The column ODOT Variable Name represents those Oregon variables that most closely match the SafetyAnalyst variable in the first column. If a companion Oregon variable is not available, this column will indicate that this variable should be generated. The third column, Variable Description, provides a brief definition of the ODOT variable. The column Data Type then depicts the format of the Oregon data variable, while the Possible Values column demonstrates the individual values for each variable. The column includes comments about how to convert the Oregon variables to the required SafetyAnalyst format. Since the data translation is not seamless, Section 3.0 introduces the data collection summary and recommendations for modifying, where possible, the data conversion or generation for use in SafetyAnalyst.

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3 DATA VARIABLE ASSESSMENT

The introduction of the HSM and SafetyAnalyst as potential tools for the evaluation of system-wide highway safety in Oregon can be constrained by intense data requirements that may not be directly comparable to the currently available Oregon data. As a first step towards assessing this potential constraint, the research team evaluated the crash and roadway data requirements for the SafetyAnalyst and contrasted those to the Oregon data. The goal of this summary, therefore, is to review the individual data elements and how they compare to those required for use with the SafetyAnalyst. Where data limitations are noted, this section identifies potential modifications to current data elements or additional data collection needs.

3.1 DATA COMPATIBILITY FOR OREGON CRASH DATA

The following sections compare and assess specific crash data elements required for use with the SafetyAnalyst software. Since SafetyAnalyst includes variables that are identified as "required" or "conditionally required" as well as a collection of variables that are designated as "desired" variables, prioritization of adapting Oregon crash data should initially focus on the required variables; however, this review addresses all of the variables to further assist with future expansion of data elements to the SafetyAnalyst input format. In cases where Oregon crash data does not include a comparable data element, this limitation is noted and additional data collection would be required before Oregon could effectively consider incorporating the variable. In SafetyAnalyst, the crash input data is maintained in a table named *AltAccident*, so the crash variables reviewed in the following section are located in this input table.

The Oregon crash data is divided into crash level, vehicle level, participant level, and system-generated variables. For a systematic analysis as performed by SafetyAnalyst, most of the required input variables are aligned with the various data elements included in the crash level and vehicle level summary (ODOT, 2007). The appendix of this report includes specific information about the crash data variables in SafetyAnalyst (see Table 8.2) and the companion ODOT variables (see Table 8.3) where available.

Table 3.1provides an overview of the SafetyAnalyst crash variables. These variables are summarized based on required, conditionally required, and desired variables. The top portion of the table or the “required” variables merit the highest priority when connecting Oregon crash data to the appropriate SafetyAnalyst input format.

Table 3.1 includes data suitability columns that indicate if the variables in the Oregon crash database are comparable to those required by SafetyAnalyst. In most cases, the “required” SafetyAnalyst variables are available or can be reasonably generated. The only two “required” variables that are not currently available in the Oregon crash database are the initial travel direction variables for the various vehicles. These SafetyAnalyst variables have a different definition than similar variables in the Oregon data.

Table 3.1: SafetyAnalyst (*AltAccident* Table) Crash Data Variable Needs

Required or Desired	Comparable to ODOT Data	Can be Approximated using Current ODOT Data	Requires Additional Data but Portions are Available	Requires New Data Collection
Required	• accidentDate • accident Severity1 • agencyID • numberOf Fatalities • numberOf Injuries • numVehicles • routeName	• collisionType • locOffset	• junction Relationship • locSystem • routeType • v1vehicle Maneuver • v2vehicle Maneuver	• v1InitialTravel Direction • v2InitialTravel Direction
Conditionally Required	• county	• sideOfDivided Highway	• locSection	
Desired	• accidentTime • workZone	• accidentIntersec-tionID • accidentRampID • accidentSegmentID • bikeIndicator • drugInvolved • gisID* • pedestrianIndicator • v1firstEvent • v2firstEvent	• driveway Indicator • environment Condition • lightCondition • roadCondition • runoffIndicator • schoolBus • surfaceCondition • v1vehicle Configuration • v2vehicle Configuration • weather Condition	• comment • gisID* • towIndicator • v1driverDOB • v2driverDOB

*Available for recent years, so years where GIS data is not available would require new data collection

Each SafetyAnalyst crash variable and how that variable relates to items contained in the Oregon crash data is individually reviewed in this section.

3.1.1 *accidentDate* - Accident Date

SafetyAnalyst uses a "required" variable named *accidentDate* to represent the year, month, and day when a crash occurred. This variable can be populated using the information from the Oregon crash data variable Crash Date (CRASH_DT).

3.1.2 *accidentIntersectionID* - Agency Intersection Identifier

If the reporting agency has determined the owner of the facility where the crash occurred (prior to importing into SafetyAnalyst), then the associated "desired" variable name is *accidentIntersectionID* and this variable is an agency intersection identifier. If this information is unknown, SafetyAnalyst will attempt to associate the crash with an intersection based on the location information. This variable can be approximated using current Oregon data. One possible source of information is the ODOT crash database variable for the Intersecting Street Number (ISECT_AGY_ST_NO).

3.1.3 *accidentRampID* - Agency Ramp Identifier

If the reporting agency has determined the “owner” of the ramp where the crash occurred (prior to importing into SafetyAnalyst), then the "desired" variable name is *accidentRampID*. If this information is not available at the time of input, SafetyAnalyst will attempt to determine the associated ramp identifier. The ODOT crash database does not directly include a ramp identifier variable, but the Oregon Connection Number (RD_CON_NO) that is used to identify an on-ramp, off-ramp, over-crossing, or undercrossing roadway may provide some useful information to help populate this field.

3.1.4 *accidentSegmentID* - Agency Segment Identifier

If the reporting agency has determined the owner and location of the roadway segment where the crash occurred (prior to importing into SafetyAnalyst), then the "desired" variable name is *accidentSegmentID*. The ODOT crash database does not directly include a segment identifier variable, but the Agency Street Number (AGY_ST_NO) included in the Oregon crash database may provide some information that will help populate this field.

3.1.5 *accidentSeverity1* - Accident Severity Level 1

The level of crash severity is included in the SafetyAnalyst "required" variable named *accidentSeverity1*. The candidate input values for this variable in SafetyAnalyst include the following:

K - Fatal injury;
A - Severe Injury;
B - Non-Incapacitating Injury;
C - Possible Injury;
P - Property-Damage-Only; and
X - Unknown.

This variable corresponds to the Crash Injury Severity (KABCO_crash) variable in the ODOT crash database. The conversion values shown in Table 3.2 demonstrate how to translate the Oregon values so that they directly match the *accidentSeverity1* variable requirements in SafetyAnalyst. Following the recommended recoding of Oregon data, this variable is comparable to the SafetyAnalyst values.

Table 3.2: Recoding for the *accidentSeverity1* Variable

SafetyAnalyst Variable	Generated Oregon Variable*
K - Fatal Injury - Fatal Injury	If CRASH INJURY SEVERITY(KABCO_crash) = K
A - Severe Injury - Severe Injury	If CRASH INJURY SEVERITY (KABCO_crash) = A
B - Non-Incapacitating Injury - Non-Incapacitating Injury	If CRASH INJURY SEVERITY (KABCO_crash) = B
C - Possible Injury - Possible Injury	If CRASH INJURY SEVERITY (KABCO_crash) = C
P - Property-Damage-Only - Property-Damage-Only	If CRASH INJURY SEVERITY (KABCO_crash) = O
X - Unknown - Unknown	Other cases
*All descriptions shown with capital letters are consistent with the Oregon database	

3.1.6 *accidentTime* - Accident Time of Day

The hour and minute when the crash occurred is identified by the SafetyAnalyst "desired" variable named *accidentTime*. This variable is equivalent to the ODOT Crash Hour (CRASH_HR_NO) variable.

3.1.7 *agencyID* - Accident ID

Each state uses a distinct code number to define crashes and help link the crash, vehicle, and driver characteristics. The SafetyAnalyst "required" variable for this crash identifier is *agencyID*. The ODOT crash database uses the CRASH_ID variable. The Oregon values range from 00001 to 79999 and these values indicate the actual number assigned by Department of Motor Vehicles (DMV). A CRASH_ID value of 8xxxx indicates a crash number that was assigned to an incorrect county, and a 9xxxx value indicates that the ID number is a duplicate.

3.1.8 *bikeIndicator* - Bicycle Indicator

If the crash involved a bicycle, the SafetyAnalyst uses the "desired" variable named *bikeIndicator*. The candidate input values for this variable include:

Y - Yes, one or more bicycles involved;
N - No bicycles involved; and
X - unknown whether bicycles involved.

The Oregon data uses the Crash Level Event variable (CRASH_EVNT_1_CD or similar) to determine if a bicycle was involved in the crash. Table 3.3 demonstrates how this SafetyAnalyst variable can be extracted using data currently available in the ODOT crash database.

Table 3.3: Recoding for the *bikeIndicator* Variable

SafetyAnalyst Variable	Generated Oregon Variable*
Y - Yes - One or more bicycles involved	If Not TOTAL PEDALCYCLISTS INVOLVED IN THE CRASH (TOT_PEDCYCL_CNT) = 0
N - No - No bicycles involved	If TOTAL PEDALCYCLISTS INVOLVED IN THE CRASH (TOT_PEDCYCL_CNT) = 0
X - Unknown - Unknown whether bicycles involved	Other
*All descriptions shown with capital letters are consistent with the Oregon database	

3.1.9 *collisionType* - Crash Type and Manner of Collision

The crash type and manner of collision are incorporated in the SafetyAnalyst "required" variable *collisionType*. The candidate input values for this variable include:

1 - Collision with parked motor vehicle;
2 - Collision with railroad train;
3 - Collision with bicyclist;
4 - Collision with pedestrian;
5 - Collision with animal;
6 - Collision with fixed object;
7 - Collision with other object;
8 - Other single-vehicle collision;
9 - Overturn;
10 - Fire or explosion;
11 - Other single-vehicle non-collision;
21 - Rear-end;
22 - Head-on;
23 - Rear-to-rear;
24 - Angle;
25 - Sideswipe, same direction;
26 - Sideswipe, opposite direction;
27 - Other multiple-vehicle collision; and
99 - Unknown.

The Oregon crash data uses the crash type and collision type variables to provide data comparable to SafetyAnalyst's *collisionType* variable. The Oregon data provides information that can be directly used with SafetyAnalyst with the exception of item 8 - Other single-vehicle collision, 11 - Other single-vehicle non-collision, and 23 - Rear-to-rear input values. In the Oregon data, these values would be identified by the crash type input of 0 - Other non-collision. As a result the *collisionType* variable can be suitably approximated or generated from current Oregon data as demonstrated in Table 3.4.

Table 3.4: Recoding for the *collisionType* Variable

SafetyAnalyst Variable	Generated Oregon Variable*
1 - Collision with parked motor vehicle	If CRASH TYPE value (CRASH_TYP_CD) = 2
2 - Collision with railroad train	If CRASH TYPE value (CRASH_TYP_CD) = 4
3 - Collision with bicyclist	If CRASH TYPE value (CRASH_TYP_CD) = 6
4 - Collision with pedestrian	If CRASH TYPE value (CRASH_TYP_CD) = 3
5 - Collision with animal	If CRASH TYPE value (CRASH_TYP_CD) = 7
6 - Collision with fixed object	If CRASH TYPE value (CRASH_TYP_CD) = 8
7 - Collision with other object	If CRASH TYPE value (CRASH_TYP_CD) = 9
8 - Other single-vehicle collision	Data element not available
9 - Overturn	If CRASH TYPE value (CRASH_TYP_CD) = &
10 - Fire or explosion	CRASH LEVEL EVENTS (CRASH_EVNT_1_CD, CRASH_EVNT_2_CD, CRASH_EVNT_3_CD) = 087
11 - Other single-vehicle non-collision	If COLLISION TYPE value (COLLIS_TYP_CD) = 8
21 - Rear-end	If COLLISION TYPE value (COLLIS_TYP_CD) = 3
22 - Head-on	If COLLISION TYPE value (COLLIS_TYP_CD) = 2
23 - Rear-to-rear	Data element not available
24 - Angle	If COLLISION TYPE value (COLLIS_TYP_CD) = 1
25 - Sideswipe, same direction	If COLLISION TYPE value (COLLIS_TYP_CD) = 5
26 - Sideswipe, opposite direction	If COLLISION TYPE value (COLLIS_TYP_CD) = 4
27 - Other multiple-vehicle collision	If COLLISION TYPE value (COLLIS_TYP_CD) = Other except 1, 2, 3, 4, 5, 8
99 - Unknown	
*All descriptions shown with capital letters are consistent with the Oregon database	

3.1.10 *comment* - Comment

Any optional comments associated with a specific crash can be included in the SafetyAnalyst "desired" variable *comment*. Currently the Oregon crash data does not include a similar variable, so this variable would need to be created or left blank.

3.1.11 *county* - County

The county where the crash occurred can be indicated by the SafetyAnalyst variable named *county*. This variable is "conditionally required" as it applies only to location system information that includes a Route/County/Milepost format. The Oregon crash database variable for COUNTY (CNTY_ID) can be directly used to populate this variable in SafetyAnalyst.

3.1.12 *drivewayIndicator* - Driveway Indicator

To determine if a crash occurred in close proximity to a driveway, SafetyAnalyst uses the "desired" variable known as *drivewayIndicator*. The candidate SafetyAnalyst input values for this variable include:

1 - No;
2 - Yes, at driveway;
3 - Yes, near driveway and related; and
99 - Unknown.

The Oregon driveway-related crash variable includes a simple yes or no option as to whether the crash occurred at a driveway, so this value cannot be directly translated to the SafetyAnalyst variable. Until additional information could be developed, however, the values currently available in Oregon (SafetyAnalyst input values one and two) can be applied to this variable in a truncated format.

3.1.13 *drugInvolved* - Alcohol/Drug Involvement

The suspected or demonstrated use of drugs or alcohol by any the vehicle drivers or non-motorists involved in the crash, as assessed by the investigating police officer, is included as the SafetyAnalyst "desired" variable *drugInvolved*. The input options for the SafetyAnalyst variable include:

1 - Neither alcohol or other drugs;
2 - Yes, alcohol involved;
3 - Yes, drugs other than alcohol involved;
4 - Yes, alcohol and drugs involved; and
99 - Unknown.

The Oregon crash data includes a drug-involved value (DRUG_INVLV_FLG) as well as an alcohol-involved value (ALCHL_INVLV_FLG) that can be used to generate a comparable variable for SafetyAnalyst. Table 3.5 shows the specific conversions needed to generate the SafetyAnalyst variable using Oregon data.

Table 3.5: Recoding for the *drugInvolved* Variable

SafetyAnalyst Variable	Generated Oregon Variable*
1 - Neither alcohol nor other drugs	If DRUG-INVOLVED value (DRUG_INVLV_FLG) = 0 or ALCOHOL-INVOLVED value (ALCHL_INVLV_FLG) = 0
2 - Yes (alcohol)	Only ALCOHOL-INVOLVED value (ALCHL_INVLV_FLG) = 1
3 - Yes (drugs other than alcohol)	Only DRUG-INVOLVED value (DRUG_INVLV_FLG) = 1
4 - Yes (alcohol and drugs)	If both DRUG-INVOLVED value (DRUG_INVLV_FLG) = 1 and ALCOHOL-INVOLVED value (ALCHL_INVLV_FLG) = 1
99 - Unknown	DRUG USE REPORTED (DRUG_USE_RPT_IND) = 9 and ALCOHOL USE REPORTED (ALCHL_USE_RPT_IND) = 9
*All descriptions shown with capital letters are consistent with the Oregon database	

3.1.14 *environmentCondition* - Contributing Circumstances and Environment Variable

Oregon data includes a variety of variables that can be included as contributing circumstances and environmental values. The corresponding SafetyAnalyst "desired" variable is *environmentCondition*. This variable identifies potential environmental factors that may have contributed to the crash. The *environmentCondition* input values as defined by SafetyAnalyst are:

1 - None;
2 - Weather conditions;
3 - Physical obstruction(s);
4 - Glare;
5 - Animal(s) in roadway;

6 - Other; and
99 - Unknown.

The ODOT crash data does not include an exact match for this variable. The Oregon data could be modified to extract this information. For example, Item 5 (animal in road) could be developed using the Oregon data element for Crash Type-Other for the identification of animal-involved crashes. This information could also be acquired from miscellaneous collisions as well as vehicle level events.

For the weather conditions and physical obstructions input, the ODOT crash database provides similar information in the weather condition, crash level, and vehicle level events. Though glare is not directly addressed in the Oregon data, the participant level includes such information as "blinded by the sun" that could be used to populate this field. Consequently, the *environmentCondition* variable can be suitably approximated or generated from current data. To convert Oregon crash information to SafetyAnalyst format, the Oregon crash events and participant events can be used to generate the companion variable as indicated in Table 3.6.

Table 3.6: Recoding for the *environmentCondition* Variable

SafetyAnalyst Variable	Generated Oregon Variable*
1 - None	None
2 - Weather conditions	If CRASH LEVEL EVENTS (CRASH_EVNT_1_CD, CRASH_EVNT_2_CD, CRASH_EVNT_3_CD) = 076, 077, 085, or 124 (Need new data collection)
3 - Physical obstruction(s)	If CRASH LEVEL EVENTS (CRASH_EVNT_1_CD, CRASH_EVNT_2_CD, CRASH_EVNT_3_CD) = 023, 062, 063, 064, 068, 080, 097, 100, 101 (Need new data collection)
4 - Glare	If PARTICIPANT LEVEL ACTION value (ACTN_CD) = 026
5 - Animal(s) in roadway	If CRASH LEVEL EVENTS (CRASH_EVNT_1_CD, CRASH_EVNT_2_CD, CRASH_EVNT_3_CD) = 030, 031, 032, 033, 034, or 035
6 - Other	Other
99 - Unknown	If CRASH LEVEL EVENTS (CRASH_EVNT_1_CD, CRASH_EVNT_2_CD, CRASH_EVNT_3_CD) = Blank
*All descriptions shown with capital letters are consistent with the Oregon database	

3.1.15 *gisID* - GIS Identifier

SafetyAnalyst includes a "desired" variable known as *gisID* to help define the geographic location of the crash. This variable is not used directly by SafetyAnalyst, but simply included to enable a geographic information system (GIS) interface with the data. In recent years, ODOT has added the latitude and longitude values to the Oregon crash data, so for some of the available data this variable could be generated. For previous years, crash information in Oregon can only be located using a linear referencing system. The *gisID* variable, therefore, can be approximated using current Oregon data for recent years, but would require additional data collection for earlier years. For this reason, the *gisID* variable shown in Table 3.1 is included in the “Can be Approximated” column as well as the “Requires New Data” column.

3.1.16 *junctionRelationship* - Relationship to Junction

The orientation of a crash as it relates to an intersection is represented in SafetyAnalyst as the "required" variable known as *junctionRelationship*. The SafetyAnalyst values for this variable are summarized as follows:

1 - Non-junction;
2 - At intersection;
3 - Intersection-related;
4 - At driveway or driveway-related;
5 - Entrance/exit ramp;
6 - Other part of interchange;
7 - Railroad/highway grade crossing;
8 - Crossover related;
9 - Other; and
99 - Unknown.

The Oregon crash data includes information as components of the character of road (RD_CHAR_CD) and the intersection-related (ISECT_REL_FLG) input variables; however, it does not provide comparable data for the entrance/exit ramp, other part of interchange, or crossover related values. As a result, additional data is required before this variable can be comprehensively incorporated; however, portions of the variable are currently available. Table 3.7 depicts the available conversion options for the Oregon data.

Table 3.7: Recoding for the *junctionRelationship* Variable

SafetyAnalyst Variable	Generated Oregon Variable*
1 - Non-junction	If INTERSECTION TYPE value (ISECT_TYP_CD)=Blank, requires additional data collection
2 - At intersection	If CHARACTER OF ROAD value (RD_CHAR_CD)=1
3 - Intersection-related	If INTERSECTION-RELATED value (ISECT_REL_FLG)= 1
4 - At driveway or driveway-related	If DRIVEWAY-RELATED value (DRVWY_REL_FLG)= 1
5 - Entrance/exit ramp	If CHARACTER OF ROAD value (RD_CHAR_CD)= 6, or if CONNECTION NUMBER value (RD_CON_NO)= not Blank , requires additional data collection
6 - Other part of interchange	Other
7 - Railroad/highway grade crossing	CRASH LEVEL EVENTS value(CRASH_EVNT_1_CD, CRASH_EVNT_2_CD, CRASH_EVNT_3_CD)= 015,016, or 019
8 - Crossover related	If CHARACTER OF ROAD value(RD_CHAR_CD)=8, requires additional data collection
9 - Other	Other
99 - Unknown	If CHARACTER OF ROAD value(RD_CHAR_CD)=0
*All descriptions shown with capital letters are consistent with the Oregon database	

3.1.17 *lightCondition* - Light Condition

The lighting conditions at the time and location of the crash are represented by the SafetyAnalyst "desired" variable *lightCondition*. The various input options include:

1 - Daylight;
2 - Dawn;
3 - Dusk;
4 - Dark-lighted;
5 - Dark-not lighted;
6 - Dark-unknown lighting;
7 - Other; and
99 - Unknown.

The Oregon light condition variable (LGT_COND_CD) generally matches that required for SafetyAnalyst. Data items that do not directly match are the 6 - Dark-unknown lighting, and the 7 - Other options values as neither of these are available in the Oregon data. Though these two input items could enhance the compatibility of the data input for SafetyAnalyst, the current Oregon data can be used to approximate the SafetyAnalyst variable in a truncated fashion. Table 3.8 demonstrates the available Oregon crash data variable fields and how they can be converted to the SafetyAnalyst format.

Table 3.8: Recoding for the *lightCondition* Variable

SafetyAnalyst Variable	Generated Oregon Variable*
1 - Daylight	If LIGHT CONDITION value(LGT_COND_CD) = 1
2 - Dawn	If LIGHT CONDITION value(LGT_COND_CD) = 4
3 - Dusk	If LIGHT CONDITION value(LGT_COND_CD) = 5
4 - Dark-lighted	If LIGHT CONDITION value(LGT_COND_CD) = 2
5 - Dark-not lighted	If LIGHT CONDITION value(LGT_COND_CD) = 3
6 - Dark-unknown lighting	Data element not available
7 - Other	Other
99 - Unknown	If LIGHT CONDITION value(LGT_COND_CD) = 0
*All descriptions shown with capital letters are consistent with the Oregon database	

3.1.18 *locOffset* - Crash Offset

The offset distance for the individual crash is represented by the SafetyAnalyst "required" variable *locOffset*. For a route/milepost or a route/county/milepost location system, this value would be the milepost value. For a route/section/distance or section/distance location system the value of *locOffset* would be represented by a distance value. For the Oregon data, this variable can be reasonably approximated using the milepoint (MP_NO) variable.

3.1.19 *locSection* - Crash Location Section

The SafetyAnalyst "conditionally required" variable to define the crash section location is *locSection*. This variable is specifically required for Route/Section/Distance or Section/Distance location systems. The Oregon crash data provides location information using the City Section ID and City Section Name. These two values can collectively provide similar information as that required by SafetyAnalyst for locations in urban areas. There is no direct method to relate this variable to rural database indicators, so this variable can only be approximated using currently available data for urban regions. Additional data collection is needed to expand to the entire roadway network.

3.1.20 *locSystem* - Location System

The available location system is indicated using the SafetyAnalyst "required" variable *locSystem*. The candidate input values for this variable include:

A - Route/Milepost location system;
B - Route/County/Milepost location system;
C - Route/Section/Distance location system; and
D - Section/Distance location system.

The Oregon crash data is generally route/milepost or, in urban areas, distance based. As a result, the SafetyAnalyst options B, C, and D do not apply to the Oregon crash database. Table 3.9 demonstrates how the *locSystem* can be approximated based on Oregon crash information.

Table 3.9: Recoding for the *locSystem* Variable

SafetyAnalyst Variable	Generated Oregon Variable*
A - Route/Milepost - Route/milepost location system	Identify state highway routes: select Mileage Type value (MLGE_TYP_CD) not equal to blank
B - Route/County/Milepost - Route/county/milepost location system	Does not apply
C - Route/Section/Distance - Route/section/distance location system	Does not apply
D - Section/Distance - Section/distance location system	Does not apply
(see note below)	Identify city street crashes – Street1, street2, distance, and direction
*All descriptions shown with capital letters are consistent with the Oregon database	
Note: In OR, city crashes are located by specifying the closest intersection (Street 1 – XXX; and Street 2 – XXX), distance from the intersection and direction from the intersection. SafetyAnalyst, therefore, does not provide a manner to identify the city locations.	

3.1.21 *numberOfFatalities* - Number of Fatalities

The number of all fatalities that resulted from a specific motor crash (including drivers, occupants, and pedestrians) is represented by the SafetyAnalyst "required" variable *numberOfFatalities*. This variable is represented by a whole number (integer) in SafetyAnalyst. The Oregon crash data provides a similar variable known as the Total Fatality Count (TOT_FATAL_CNT) and is the addition of the fatal Injury Severity

values, so this variable can be generated directly from Oregon data for use with SafetyAnalyst.

3.1.22 *numberOfInjuries* - Number of Non-Fatal Injuries

The number of persons injured in a crash (drivers, occupants, and pedestrians) who were not fatally injured can be represented by the SafetyAnalyst "required" variable *numberOfInjuries*. This variable is represented by a whole number (integer) in SafetyAnalyst. The Oregon crash data provides a similar metric known as the Total Number of Non-Fatal Injuries in the Crash (TOT_INJ_CNT) and is the addition of the non-fatal Injury Severity values. This variable can be generated directly from Oregon data for use with SafetyAnalyst.

3.1.23 *numVehicles* - Number of Vehicles Involved

The number of vehicles (e.g., automobiles, single-unit trucks, truck combination, etc.) that were involved in a crash are identified by the SafetyAnalyst "required" variable *numVehicles*. Parked vehicles, bicycles, and pedestrians should not be included in this value. The format of the *numVehicles* variable is a whole number (integer). The Oregon crash data includes the Total Vehicle Count (TOT_VHCL_CNT) variable that can be used to generate this comparable SafetyAnalyst variable.

3.1.24 *pedestrianIndicator* - Pedestrian Indicator

The SafetyAnalyst "desired" variable *pedestrianIndicator* can be used to determine if a pedestrian was involved in a crash. The variable input options include:

Y - Yes, one or more pedestrians involved;
N - No pedestrians involved; and
X - Unknown.

The Oregon crash database value TOT_PED_CNT can be used to directly generate this SafetyAnalyst variable. Table 3.10 demonstrates how the Oregon data can be converted to the SafetyAnalyst format.

Table 3.10: Recoding for the *pedestrianIndicator* Variable

SafetyAnalyst Variable	Generated Oregon Variable*
Y - Yes, one or more pedestrians involved	If not TOTAL PEDESTRIANS INVOLVED IN THE CRASH (TOT_PED_CNT) = 0
N - No pedestrians involved	If TOTAL PEDESTRIANS INVOLVED IN THE CRASH (TOT_PED_CNT) = 0
X - Unknown - Unknown whether pedestrians involved	Unknown
*All descriptions shown with capital letters are consistent with the Oregon database	

3.1.25 *roadCondition* - Contributing Circumstances, Road

Circumstances that contribute to undesirable road conditions are represented by the SafetyAnalyst "desired" variable known as *roadCondition*. The variety of input options available for the SafetyAnalyst variable includes the following:

1 - None;
2 - Road surface condition (wet, icy, snow, slush, etc.);
3 - Debris;
4 - Rut, holes, bumps;
5 - Work zone (construction/maintenance/utility);
6 - Worn, travel-polished surface;
7 - Obstruction in roadway;
8 - Traffic control device inoperative, missing, or obscured;
9 - Shoulders (none, low, soft, high);
10 - Non-highway work;
11 - Other; and
99 - Unknown.

In addition to the Oregon road surface condition variable, much of this variable can be generated using crash and vehicle level events. Input values that are not directly available in the Oregon data include: 6 - Worn, travel-polished surface; 7 - Obstruction in roadway; and 10 - Non-highway work. These input items would require additional data if the comprehensive SafetyAnalyst variable input values are used. The conversion from Oregon crash data to the SafetyAnalyst is depicted in Table 3.11.

Table 3.11: Recoding for the *roadCondition* Variable

SafetyAnalyst Variable	Generated Oregon Variable*
1 - None	None
2 - Road surface condition (wet, icy, snow, slush, etc.)	If ROAD SURFACE CONDITION value (RD_SURF_COND_CD) = 1, 2, 3, or 4
3 - Debris	If CRASH LEVEL EVENTS (CRASH_EVNT_1_CD, CRASH_EVNT_2_CD, CRASH_EVNT_3_CD) = 068
4 - Rut, holes, bumps	If CRASH LEVEL EVENTS (CRASH_EVNT_1_CD, CRASH_EVNT_2_CD, CRASH_EVNT_3_CD) = 037 or 073
5 - Work zone (construction/maintenance/utility)	If WORK ZONE value (WRK_ZONE_IND) = 1
6 - Worn, travel-polished surface	If CRASH LEVEL EVENTS (CRASH_EVNT_1_CD, CRASH_EVNT_2_CD, CRASH_EVNT_3_CD) = 124 (Need new data collection)
7 - Obstruction in roadway	If CRASH LEVEL EVENTS (CRASH_EVNT_1_CD, CRASH_EVNT_2_CD, CRASH_EVNT_3_CD) = 023, 068, 080, 097, 100, or 101 (Need new data collection)
8 - Traffic control device inoperative, missing, or obscured	If TRAFFIC CONTROL DEVICE FUNCTIONAL (TRAF_CNTL_FUNC_FLG) = 0
9 - Shoulders (none, low, soft, high)	If CRASH LEVEL EVENTS (CRASH_EVNT_1_CD, CRASH_EVNT_2_CD, CRASH_EVNT_3_CD) = 078 or 125
10 - Non-highway work	Data element not available
11 - Other	Other
99 - Unknown	If CRASH LEVEL EVENTS (CRASH_EVNT_1_CD, CRASH_EVNT_2_CD, CRASH_EVNT_3_CD) = blank
*All descriptions shown with capital letters are consistent with the Oregon database	

3.1.26 *routeName* - Route Name

The route number or name of a route is indicated by the SafetyAnalyst "required" variable *routeName*. At locations where there are overlapping routes, the more important route type and corresponding lower route number will usually be used. The Oregon variable RTE_NM can provide route name information. At Oregon locations where the RTE_NM is empty, the street full name (ST_FULL_NM) variable may be used.

3.1.27 *routeType* - Route Type

The identification of a specific location is first described by the route type. The SafetyAnalyst variable for this "required" data item is *routeType* and this variable describes the specific road category as follows:

I - Interstate;
US - US route;
SR - State route;
BR - Business route;
BL - Business loop;
SP - Spur route;
CR - County road;

TR - Township road;
L - Local road;
O - Other; and
X - Unknown.

The SafetyAnalyst classification of route types is more detailed than that provided by the ODOT route type data variable. Though there is no ODOT variable exactly representing all of the alternative SafetyAnalyst values, a similar data element can be developed. The ODOT route type crash database variable includes the IS, OR, and US options that would directly correspond to the SafetyAnalyst IS, SR, and US values. Though they would require extraction from other variables, the Oregon road control and functional classification can provide supplement route type information. To comprehensively populate this variable would require additional data formatting and data collection, but portions of the variable are currently available. Table 3.12 depicts available Oregon variables and how they can be converted to the required SafetyAnalyst format.

Table 3.12: Recoding for the *routeType* Variable

SafetyAnalyst Variable	Generated Oregon Variable*
I - Interstate route category	Identify interstate route: ROUTE TYPE / ROUTE NUMBER value(RTE_NM)= IS XXX
US - US route category	Identify US route: ROUTE TYPE / ROUTE NUMBER value(RTE_NM)= US XXX
SR - State route category	Identify State route: ROUTE TYPE / ROUTE NUMBER value(RTE_NM)= OR XXX
BR - Business route category	New data collection
BL - Business loop category	New data collection
SP - Spur route category	New data collection
CR - County road category	New data collection
TR - Township road category	New data collection
L - Local road category	New data collection (could possibly be derived from functional classification)
O - Other	New data collection
X - Unknown	New data collection
*All descriptions shown with capital letters are consistent with the Oregon database	

3.1.28 *runoffIndicator* - Run-Off Road Indicator

The SafetyAnalyst variable that represents whether any of the motor vehicles involved in the crash ran off the road is the "desired" variable known as *runoffIndicator*. The input values used by SafetyAnalyst include:

Y - One or more vehicles ran off the road;
N - No vehicles ran off the road; and
X - Unknown whether vehicles ran off the road.

The Oregon crash database includes an Error variable that indicates errors that contributed to the crash, and the "Additional Miscellaneous" category for this variable includes a ran-off-road input value. Another Oregon variable that does not directly apply but could be misinterpreted is the Off Roadway (OFF_RDWY_FLG) which is actually

intended to indicate if the crash occurred on a road (as opposed to in a parking lot or on private property).

The Oregon ERROR variable provides information at the participant level as to whether they ran off the road, but if this variable does not have the value of 081 (for Ran Off Road), then the conversion assumes that no vehicles ran off the road. As a result there is no equivalent value for unknown available. The conversion recommendations are depicted in Table 3.13.

Table 3.13: Recoding for the *runoffIndicator* Variable

SafetyAnalyst Variable	Generated Oregon Variable*
Y - Yes, one or more vehicles ran off the road	If PARTIC_ERR = 081
N - No vehicles ran off the road	If PARTIC_ERR is not equal to 081
X - Unknown	Other
*All descriptions shown with capital letters are consistent with the Oregon database	

3.1.29 *schoolBus* - School Bus Related

If a school bus has been involved in a crash, SafetyAnalyst defines this using the "desired" variable *schoolBus*. In addition, SafetyAnalyst can incorporate information as to whether the school bus was directly or indirectly involved in the crash. The following input values reflect the options available for this variable:

1 – No;
2 - Yes, school bus directly involved;
3 - Yes, school bus indirectly involved; and
99 - Unknown.

The Oregon data includes this information in the Vehicle Type variable; however, this item does not reflect the level of detail available in the SafetyAnalyst variable. This variable could be generated using Oregon data but item 3 - Yes, school bus indirectly involved, would not be represented without additional information. Table 3.14 provides a recommended conversion from the Oregon crash database to the SafetyAnalyst format.

Table 3.14: Recoding for the *schoolBus* Variable

SafetyAnalyst Variable	Generated Oregon Variable*
1 - No	There is no VEHICLE TYPE value (VHCL_TYP_CD) = 07
2 - Yes, school bus directly involved	There is at least one VEHICLE TYPE value (VHCL_TYP_CD) = 07 or ERROR value (PARTIC_ERR_1_CD, PARTIC_ERR_2_CD, PARTIC_ERR_3_CD) = 041
3 - Yes, school bus indirectly involved	School bus is not directly involved and there is at least one VEHICLE TYPE value (VHCL_TYP_CD) = 07
99 - Unknown	Unknown
*All descriptions shown with capital letters are consistent with the Oregon database	

3.1.30 s*ideOfDividedHighway* - Divided Highway Crash-Side of Road

Crash locations that occur at divided highways require travel direction information directly associated with the side of the road where the crash occurred. The SafetyAnalyst "conditionally required" variable is *sideOfDividedHighway*. The available input options for this variable include:

NB - Travel direction is Northbound;
SB - Travel direction is Southbound;
EB - Travel direction is Eastbound;
WB - Travel direction is Westbound;
NA - Travel direction is not applicable; and
X - Travel direction is unknown.

The Oregon data includes information based on the intended travel direction of a vehicle and this may not directly correspond to the prevailing travel direction of the road. For example, if a vehicle is traveling against traffic and so in the wrong direction for the divided highway, this would be the value indicated by the Oregon direction of travel variable. SafetyAnalyst input considers the original travel direction of the roadway (not necessarily the vehicle at the time of collision). As a result, there is no direct match currently available in the Oregon database. It is possible, though, to approximate this value by using the road geometric databases or with additional data collection. If ODOT chooses to interpret this variable as the intended travel direction, then the ODOT crash database value for the Compass Direction Code (CMPSS_DIR_CD) may be used.

3.1.31 *surfaceCondition* - Roadway Surface Condition

The SafetyAnalyst "desired" variable that identifies the driving conditions of the road is a variable named *surfaceCondition*. The candidate values for this variable in SafetyAnalyst include the following:

1 - Dry;
2 - Wet;
3 - Snow;
4 - Slush;
5 - Ice/frost;
6 - Water (standing, moving);
7 - Sand;
8 - Mud, dirt, gravel;
9 - Oil;
10 - Other; and
99 - Unknown.

This variable corresponds to the Oregon road surface condition variable; however, the Oregon data elements do not directly address the following options: 4 - Slush, 6 - Water (standing, moving), 7 - Sand, 8 - Mud, dirt, gravel, 9 - Oil, or 10 - Other. As a result, this variable can be used in limited format. To comprehensively populate this

variable would require additional data formatting and data collection. Table 3.15 depicts how the Oregon crash data can be converted to the SafetyAnalyst format.

Table 3.15: Recoding for the *surfaceCondition* Variable

SafetyAnalyst Variable	Generated Oregon Variable*
1 - Dry	If ROAD SURFACE CONDITION value (RD_SURF_COND_CD) = 1
2 - Wet	If ROAD SURFACE CONDITION value (RD_SURF_COND_CD) = 2
3 - Snow	If ROAD SURFACE CONDITION value (RD_SURF_COND_CD) = 3
4 - Slush	Data element not available
5 - Ice/frost	If ROAD SURFACE CONDITION value (RD_SURF_COND_CD) = 4
6 - Water (standing, moving)	Data element not available
7 - Sand	Data element not available
8 - Mud, dirt, gravel	Data element not available
9 - Oil	Data element not available
10 - Other	Other
99 - Unknown	If ROAD SURFACE CONDITION value (RD_SURF_COND_CD) = 0
*All descriptions shown with capital letters are consistent with the Oregon database	

3.1.32 *towIndicator* - Tow-Away Indicator

Following a crash, if a vehicle must be towed from the scene of the crash, the SafetyAnalyst "desired" variable is *towIndicator*. The various input values for this SafetyAnalyst variable include:

Y - Yes, One or more vehicles towed;
N - No vehicles towed; and
X - Unknown whether vehicles towed.

The Oregon crash data does not include a similar variable. The Oregon data does have variables regarding the individual vehicles and whether they were towing vehicles during the crash, but this information does not match that required by SafetyAnalyst. As a result, this variable would need to be generated from new data.

3.1.33 *v1driverDOB* and *v2driverDOB* - Vehicle 1 and 2 Driver's Date of Birth

The year, month, and day of birth for the various drivers involved in a crash is represented by the SafetyAnalyst "desired" variables *v1driverDOB*, *v2driverDOB*, etc. The Oregon crash database only includes a variable that generally indicates the driver's age. The associated ODOT variable, AGE(AGE_VAL), includes the following values:

00 Age is unknown
01 Infants from birth to less than two years of age
02-98 Actual age of participant 2 years or over
99 Ninety-nine years of age or over.

As a result, this driver date of birth variable is not currently available and cannot be generated from current data. The initial crash reports should include this information, but additional data collection would be required to develop this variable if deemed necessary.

3.1.34 *v1firstEvent* and *v2firstEvent* - Vehicle 1 and 2 First Harmful Events

The first event executed by a vehicle that results in harm to the vehicle, occupants, or road users is known as the first harmful event. The corresponding SafetyAnalyst "desired" variable is *v1firstEvent* or *v2firstEvent*. The available input values for this SafetyAnalyst variable include:

Noncollision:
1 - Overturn/rollover ;
2 - Fire/explosion;
3 - Immersion;
4 - Jackknife;
5 - Cargo/equipment loss or shift;
6 - Fell/jumped from vehicle;
7 - Thrown or falling object;
8 - Other; and
9 - Unknown

Miscellaneous:
41 - Other; and
99 - Unknown.

Collision:
10 - Pedestrian;
11 - Bicyclist;
12 - Railway vehicle;
13 - Animal;
14 - Motor vehicle in transport;
15 - Parked motor vehicle;
16 - Work zone maintenance equipment;
17 - Other non-fixed object;
18 - Unknown non-fixed object;
19 - Impact attenuator/crash cushion;
20 - Bridge overhead structure;
21 - Bridge pier or support;
22 - Bridge rail;
23 - Culvert;
24 - Curb;
25 - Ditch;
26 - Embankment;
27 - Guardrail face;
28 - Guardrail end;
29 - Concrete traffic barrier (Jersey barrier);
30 - Other traffic barrier;
31 - Standing tree;
32 - Utility pole/Light support;
33 - Highway traffic sign or signpost;
34 - Overhead sign or sign support;
35 - Other post, pole, or support;
36 - Fence;
37 - Mailbox;
38 - Other fixed object (wall, building, tunnel, etc.);
39 - Unknown fixed object.

The Oregon crash level and vehicle level events include data similar to those required by SafetyAnalyst; however, the Oregon crash data variables provide more options than those available for SafetyAnalyst input (approximately 125 options for Oregon data). As a result, the Oregon data could be modified and a comparable variable

generated to match that required for SafetyAnalyst. Table 3.16 demonstrates the various data conversions recommended to generate the companion SafetyAnalyst variables.

Table 3.16: Recoding for the *v1firstEvent* and *v2firstEvent* Variables

SafetyAnalyst Variable	Generated Oregon Variable*
1 - Overturn/rollover - Noncollision	If CRASH TYPE value(CRASH_TYP_CD)=&
2 - Fire/explosion - Noncollision	If VEHICLE LEVEL EVENTS value(VHCL_EVNT_1_CD)=087
3 - Immersion - Noncollision	If VEHICLE LEVEL EVENTS value(VHCL_EVNT_1_CD)=086
4 - Jackknife - Noncollision	If VEHICLE LEVEL EVENTS value(VHCL_EVNT_1_CD)=020
5 - Cargo/equipment loss or shift - Noncollision	If VEHICLE LEVEL EVENTS value(VHCL_EVNT_1_CD)=028
6 - Fell/jumped from vehicle - Noncollision	If CRASH LEVEL EVENTS value(CRASH_EVNT_1_CD)=001
7 - Thrown or falling object - Noncollision	Need new data collection. If VEHICLE LEVEL EVENTS value(VHCL_EVNT_1_CD)=067, 068
8 - Other noncollision - Other noncollision	If COLLISION TYPE value(COLLIS_TYP_CD)=8 other
9 - Unknown noncollision - Unknown noncollision	If COLLISION TYPE value(COLLIS_TYP_CD)=8 unknown
10 - Pedestrian - Collision	If COLLISION TYPE value(COLLIS_TYP_CD)=0 or CRASH TYPE value(CRASH_TYP_CD)=3
11 - Bicyclist - Collision	If CRASH TYPE value(CRASH_TYP_CD)=6
12 - Railway vehicle - Collision	If CRASH TYPE value(CRASH_TYP_CD)=4
13 - Animal - Collision	If CRASH TYPE value(CRASH_TYP_CD)=7
14 - Motor vehicle in transport - Collision	If CRASH TYPE value(CRASH_TYP_CD)= A,B,C,D,E,F,G,H,I,J or 1
15 - Parked motor vehicle - Collision	If CRASH TYPE value(CRASH_TYP_CD)=2
16 - Work zone maintenance equipment - Collision	If VEHICLE LEVEL EVENTS value(VHCL_EVNT_1_CD)=069
17 - Other non-fixed object - Collision	If CRASH TYPE value(CRASH_TYP_CD)=9
18 - Unknown non-fixed object - Collision	If VEHICLE LEVEL EVENTS value(VHCL_EVNT_1_CD)=101
19 - Impact attenuator/crash cushion - Collision	If VEHICLE LEVEL EVENTS value(VHCL_EVNT_1_CD)=038
20 - Bridge overhead structure - Collision	If VEHICLE LEVEL EVENTS value(VHCL_EVNT_1_CD)=049
21 - Bridge pier or support - Collision	If VEHICLE LEVEL EVENTS value(VHCL_EVNT_1_CD)=047,048
22 - Bridge rail - Collision	If VEHICLE LEVEL EVENTS value(VHCL_EVNT_1_CD)=046
23 - Culvert - Collision	If VEHICLE LEVEL EVENTS value(VHCL_EVNT_1_CD)=037
24 - Curb - Collision	If VEHICLE LEVEL EVENTS value(VHCL_EVNT_1_CD)=040
25 - Ditch - Collision	If VEHICLE LEVEL EVENTS value(VHCL_EVNT_1_CD)=079
26 - Embankment - Collision	If VEHICLE LEVEL EVENTS value(VHCL_EVNT_1_CD)=079
27 - Guardrail face - Collision	If VEHICLE LEVEL EVENTS value(VHCL_EVNT_1_CD)=042

SafetyAnalyst Variable	Generated Oregon Variable*
28 - Guardrail end - Collision	If VEHICLE LEVEL EVENTS value(VHCL_EVNT_1_CD)=042,043
29 - Concrete traffic barrier (Jersey barrier) - Collision	No code , Derive from VEHICLE LEVEL EVENTS value(VHCL_EVNT_1_CD)=043
30 - Other traffic barrier - Collision	If VEHICLE LEVEL EVENTS value(VHCL_EVNT_1_CD)=044,120
31 - Standing tree - Collision	If VEHICLE LEVEL EVENTS value(VHCL_EVNT_1_CD)=062
32 - Utility pole/Light support - Collision	If VEHICLE LEVEL EVENTS value(VHCL_EVNT_1_CD)=053,054,055,059
33 - Highway traffic sign or signpost - Collision	If VEHICLE LEVEL EVENTS value(VHCL_EVNT_1_CD)=065,066,057
34 - Overhead sign or sign support - Collision	If VEHICLE LEVEL EVENTS value(VHCL_EVNT_1_CD)=056
35 - Other post, pole, or support - Collision	If VEHICLE LEVEL EVENTS value(VHCL_EVNT_1_CD)=052,058,060
36 - Fence - Collision	If VEHICLE LEVEL EVENTS value(VHCL_EVNT_1_CD)=088 Decide Fence or building for 088
37 - Mailbox - Collision	If VEHICLE LEVEL EVENTS value(VHCL_EVNT_1_CD)=061
38 - Other fixed object (wall, building, tunnel, etc.) - Collision	If VEHICLE LEVEL EVENTS value(VHCL_EVNT_1_CD)=045,072,048,049
39 - Unknown fixed object - Collision	If VEHICLE LEVEL EVENTS value(VHCL_EVNT_1_CD)=100
41 - Other - Other	If VEHICLE LEVEL EVENTS value(VHCL_EVNT_1_CD)=other value
99 - Unknown - Unknown	If VEHICLE LEVEL EVENTS value(VHCL_EVNT_1_CD)=Blank
*All descriptions shown with capital letters are consistent with the Oregon database	

3.1.35 *v1initialTravelDirection* and *v2initialTravelDirection* - Vehicle 1 and 2 Initial Directions of Travel

The direction of travel for the first and second vehicle involved in the crash corresponds to the SafetyAnalyst "required" variables *v1initialTravelDirection* and *v2initialTravelDirection*, respectively. The SafetyAnalyst value requires a typical travel direction for the roadway rather than a specific vehicle direction at the exact crash location. For example, the travel direction of a designated north-south roadway must be either southbound or northbound even if a vehicle may temporarily travel eastbound for a small segment of the roadway. The candidate SafetyAnalyst input values include:

NB - Northbound;
SB - Southbound;
EB - Eastbound;
WB - Westbound;
NO - Not on roadway; and
XX - Unknown.

The Oregon crash data direction of travel variable refers to the compass direction and specifically refers to the travel direction of the involved vehicles. As a result, there is not a direct match to this SafetyAnalyst value. To fully utilize this variable, additional Oregon data is recommended. The current direction of travel value could be used, but analysts should recognize that this variable does not completely adhere to the SafetyAnalyst variable definition. Alternatively, a comparable value could be estimated from the Oregon digital video log as well as from ODOT engineering databases (see Table 8.5).

3.1.36 *v1vehicleConfiguration* and *v2vehicleConfiguration* - Vehicle 1 and 2 Configurations

The type of vehicles involved in the crash is identified as the SafetyAnalyst "desired" variables *v1vehicleConfiguration* and *v2vehicleConfiguration*. The input values for this SafetyAnalyst variable include:

1 - Passenger car;
2 - Light truck, only four tires - Cargo van, mini-van, utility truck, panel truck, pickup under 10,001pounds gross vehicle weight rating (GVWR), only four tires;
3 - Sport utility vehicle;
4 - Motorcycle/Moped;
5 - Motor home/recreational vehicle;
6 - Single-unit truck - 2-axle and GVWR over 10,000 pounds;
7 - Single-unit truck - 3-or-more axles;
8 - Truck pulling trailer or trailers;
9 - Truck tractor (bobtail);
10 - Truck tractor/semi-trailer;
11 - Truck tractor/doubles;
12 - Truck tractor/triples;
13 - Truck over 10,000 pounds, cannot classify;
14 - Bus/large van - Seats for more than 15 people, including driver;
15 - Bus - Seats for 7-15 people, including driver;
16 - Emergency vehicle - Fire, police, ambulance, etc;.
17 - Other; and
99 - Unknown vehicle configuration.

The Oregon crash data vehicle type variable includes approximately 16 vehicle type options (two less that for SafetyAnalyst). In addition, several of the Oregon input values do not exactly match those used by SafetyAnalyst. For example:

- Oregon vehicle type input value 01- Passenger car, pickup, van, light delivery, and custom van would correspond to the SafetyAnalyst options 01, 02, and 03;
- Oregon value 05 - Truck with non-detachable bed, panel, self-propelled crane, tow truck, fire truck, refuse packer, leach packer, log grapple corresponds to the SafetyAnalyst options 06, 07, 13, and 16;
- Oregon input value 04 - Truck tractor with trailer/mobile home in tow this item could match the SafetyAnalyst options 10, 11, or 12;

- Oregon input 07- School bus (& van used to transport students) corresponds with SafetyAnalyst options 14 and 15; and
- Oregon value 08 - Other bus (flexi-bus, articulated – code "trailer") also corresponds with SafetyAnalyst options 14 and 15.

As a result, the Oregon variable can be modified to reasonably represent the SafetyAnalyst variable, but will not match it exactly using the current data format. Table 3.17 provides recommendations for conversion of the Oregon data to the required SafetyAnalyst format.

Table 3.17: Recoding for the *v1vehicleConfiguration* and *v2vehicleConfiguration* Variable

SafetyAnalyst Variable	Generated Oregon Variable*
1 - Passenger car - Passenger car	If VEHICLE TYPE value (VHCL_TYP_CD) = 01 (Need new data collection)
2 - Light truck, only four tires - Cargo van, mini-van, utility truck, panel truck, pickup under 10,001pounds GVWR, only four tires	If VEHICLE TYPE value (VHCL_TYP_CD) = 01 (Need new data collection)
3 - Sport utility vehicle - Sport utility vehicle	Need new data collection
4 - Motorcycle/Moped - Motorcycle/Moped	If VEHICLE TYPE value (VHCL_TYP_CD) = 09
5 - Motor home/recreational vehicle - Motor home/recreational vehicle	If VEHICLE TYPE value (VHCL_TYP_CD) = 11
6 - Single-unit truck - 2-axle and GVWR over 10,000 pounds	Derive from VEHICLE TYPE value (VHCL_TYP_CD) = 05, need to be divided (Need new data collection)
7 - Single-unit truck - 3-or-more axles	Derive from VEHICLE TYPE value (VHCL_TYP_CD) = 05, need to be divided (Need new data collection)
8 - Truck pulling trailer or trailers - Truck pulling trailer or trailers	Derive from NUMBER OF TRAILERS value (TRLR_QTY) = 1, 2, 3, or 8
9 - Truck tractor (bobtail) - Truck tractor (bobtail)	If VEHICLE TYPE value (VHCL_TYP_CD) = 02
10 - Truck tractor/semi-trailer - Truck tractor/semi-trailer	If VEHICLE TYPE value (VHCL_TYP_CD) = 04, need to be divided (Need new data collection)
11 - Truck tractor/doubles - Truck tractor/doubles	If VEHICLE TYPE value (VHCL_TYP_CD) = 04, need to divided (Need new data collection)
12 - Truck tractor/triples - Truck tractor/triples	If VEHICLE TYPE value (VHCL_TYP_CD) = 04, need to divided (Need new data collection)
13 - Truck over 10,000 pounds, cannot classify - Truck over 10,000 pounds, cannot classify	Need new data collection
14 - Bus/large van - Seats for more than 15 people, including driver	If VEHICLE TYPE value (VHCL_TYP_CD) = 07, 08, need to divided (Need new data collection)
15 - Bus - Seats for 7-15 people, including driver	If VEHICLE TYPE value (VHCL_TYP_CD) = 07, 08, need to divided (Need new data collection)
16 - Emergency vehicle - Fire, police, ambulance, etc.	EMRGCY_VHCL_USE_FLG = 1
17 - Other - Other	Other
99 - Unknown vehicle configuration - Unknown vehicle configuration	If VEHICLE TYPE value (VHCL_TYP_CD) = 99
*All descriptions shown with capital letters are consistent with the Oregon database	

3.1.37 *v1vehicleManeuver* and *v2vehicleManeuver* - Vehicle 1 and 2 Maneuvers

The maneuver or action executed by the vehicles prior to the crash can be represented by the SafetyAnalyst "required" variables *v1vehicleManeuver* and *v2vehicleManeuver*. The available SafetyAnalyst input values for this variable include:

1 - Movements essentially straight ahead;
2 - Backing;
3 - Changing lanes;
4 - Overtaking/passing;
5 - Turning right;
6 - Turning left;
7 - Making U-turn;
8 - Entering traffic lane;
9 - Leaving traffic lane;
10 - Parked;
11 - Slowing;
12 - Stopped in traffic;
13 - Negotiating a curve;
14 - Other; and
99 - Unknown.

The Oregon crash data vehicle movement variable generally corresponds to this SafetyAnalyst variable; however, it provides substantially less detail than that available for the *v1vehicleManeuver* and *v2vehicleManeuver* options. The Oregon variable does not include the options 3 - Changing lanes, 4 - Overtaking/passing, 8 - Entering traffic lane, 9 - Leaving traffic lane, and 13 - Negotiating a curve. A second Oregon variable called the Vehicle Level Action does provide some supplemental options (passing and entering traffic lane). The combined use of these two Oregon variables can be used to generate values similar to those used by SafetyAnalyst; however, the combined Oregon variables do not exactly agree with the more comprehensive SafetyAnalyst values and so a truncated variable can be used until additional Oregon data is available (see Table 3.18).

Table 3.18: Recoding for the *v1vehicleManeuver* and *v2vehicleManeuver* Variables

SafetyAnalyst Variable	Generated Oregon Variable*
1 - Movements essentially straight ahead	IF VEHICLE MOVEMENT value (MVMNT_CD) = 1
2 - Backing	IF VEHICLE MOVEMENT value (MVMNT_CD) = 5
3 - Changing lanes	No code, Need new data collection
4 - Overtaking/passing	VEHICLE LEVEL ACTION value (ACTN_CD) = 031
5 - Turning right	IF VEHICLE MOVEMENT value (MVMNT_CD) = 2
6 - Turning left	IF VEHICLE MOVEMENT value (MVMNT_CD) = 3
7 - Making U-turn	IF VEHICLE MOVEMENT value (MVMNT_CD) = 4
8 - Entering traffic lane	IF VEHICLE LEVEL ACTION value (ACTN_CD) = 018 or 051
9 - Leaving traffic lane	IF VEHICLE LEVEL ACTION value (ACTN_CD) = 019 (Need new data collection)
10 - Parked	IF VEHICLE MOVEMENT value (MVMNT_CD) = 7, 8, or 9
11 - Slowing	VEHICLE LEVEL ACTION value (ACTN_CD) = 006 for slowing
12 - Stopped in traffic	IF VEHICLE MOVEMENT value(MVMNT_CD) = 6 or VEHICLE LEVEL ACTION value(ACTN_CD) = 011-013
13 - Negotiating a curve	Derive from CHARACTER OF ROAD (RD_CHAR_CD) = 5 (Need new data collection)
14 - Other	IF VEHICLE MOVEMENT value(MVMNT_CD)=088
99 - Unknown	IF VEHICLE MOVEMENT value(MVMNT_CD)=0
*All descriptions shown with capital letters are consistent with the Oregon database	

3.1.38 *weatherCondition* - Weather Condition

The weather condition at the time a crash occurred can be represented by the SafetyAnalyst "desired" variable *weatherCondition*. The input values for this SafetyAnalyst variable include:

1 - Clear;
2 - Cloudy;
3 - Fog, smog, smoke;
4 - Rain;
5 - Sleet, hail (freezing rain or drizzle);
6 - Snow;
7 - Blowing snow;
8 - Severe crosswinds;
9 - Blowing sand, soil, dirt;
10 - Other; and
99 - Unknown.

The Oregon crash data weather condition variable provides similar information with the exception of items 7 - Blowing snow, and 8 - Severe crosswinds. The Oregon variable could be reasonably used with SafetyAnalyst in a truncated fashion (omission of these two input options). Table 3.19 demonstrates the conversion of the ODOT weather data to the SafetyAnalyst *weatherCondition* variable.

Table 3.19: Recoding for the *weatherCondition* Variable

SafetyAnalyst Variable	Generated Oregon Variable*
1 - Clear	If WEATHER CONDITION value(WTHR_COND_CD) = 1
2 - Cloudy	If WEATHER CONDITION value(WTHR_COND_CD) = 2
3 - Fog, smog, smoke	If WEATHER CONDITION value(WTHR_COND_CD) = 5 or 8
4 - Rain	If WEATHER CONDITION value(WTHR_COND_CD) = 3
5 - Sleet, hail (freezing rain or drizzle)	If WEATHER CONDITION value(WTHR_COND_CD) = 4
6 - Snow	If WEATHER CONDITION value(WTHR_COND_CD) = 6
7 - Blowing snow	Data element not available
8 - Severe crosswinds	Data element not available
9 - Blowing sand, soil, dirt	If WEATHER CONDITION value(WTHR_COND_CD) = 7 or 9
10 - Other	Other
99 - Unknown	If WEATHER CONDITION value(WTHR_COND_CD) = 0
*All descriptions shown with capital letters are consistent with the Oregon database	

3.1.39 *workZone* - Work Zone Related

If a crash occurred in or near a construction, maintenance, or utility work zone (even if workers were not present), the corresponding SafetyAnalyst "desired" variable for the work zone condition is *workZone*. The input values for this variable include:

Y - Yes, crash in or near a work zone;
N - No, crash not in or near a work zone; and
X - Unknown.

The Oregon work zone indicator variable (WRK_ZONE_IND) can be directly used to generate a comparable SafetyAnalyst variable as shown in Table 3.20.

Table 3.20: Recoding for the *workZone* Variable

SafetyAnalyst Variable	Generated Oregon Variable*
Y - Yes - Accident in or near a work zone	If WORK ZONE value (WRK_ZONE_IND) = 1
N - No - Accident not in or near a work zone	If WORK ZONE value (WRK_ZONE_IND) = 0
X - Unknown - Work zone relationship is unknown	If WORK ZONE value (WRK_ZONE_IND) = 9
*All descriptions shown with capital letters are consistent with the Oregon database	

3.2 DATA COMPATIBILITY FOR OREGON ROADWAY DATA

Roadway data in the Oregon crash database is limited to select variables associated with the individual crash reports; however, ODOT also maintains additional roadway data information in a variety of databases (see Table 8.5 in the appendix for candidate databases and their location). Many of the roadway characteristics are not directly available in a format suitable for immediate use with SafetyAnalyst. For data elements that are not directly available, some select data collection may be appropriate. Other variables would require additional data collection efforts or manual data acquisition from sources such as the Oregon digital video log, GIS maps, or similar resources. Since the number of roadway variables is much larger than the number of crash variables,

SafetyAnalyst includes the roadway data separated into the following nine individual tables:

- AltRoadwaySegment,
- AltSegmentTraffic,
- AltRamp,
- AltRampTraffic,
- AltIntersection,
- AltMajorRoadTraffic,
- AltMinorRoadTraffic,
- AltLeg, and
- AltLegTraffic.

In some instances, a variable may be included in more than one of the SafetyAnalyst roadway tables. For example, the County variable is included in the roadway segment table (AltRoadwaySegment) as well as in the ramp table (AltRamp). The following summary identifies the data variables required for each of these tables, the associated Oregon resource when applicable, and the SafetyAnalyst requirement level (listed as "required", "conditionally required", or "desired").

3.2.1 Roadway Variables in the SafetyAnalyst *AltRoadwaySegment* Table

A variety of Oregon databases and their on-line locations are summarized in the appendix of this report (see Table 8.5). The specific roadway segment data elements required by SafetyAnalyst are included in an input table named *AltRoadwaySegment*. While many of these variables are only included in the road segment table, others are included in multiple SafetyAnalyst tables. Each of these variable names and companion Oregon data sources, when available, are identified in Table 3.21.

The following sections are organized by Oregon data resource and the associated SafetyAnalyst variables. Since some variables are included in multiple tables, those variables and their associated tables are further defined. As shown in Table 3.21, the *AltRoadwaySegment* table variables are generally included in seven Oregon databases. Data that must be acquired from the digital video log or GIS resources are included in the "Requires additional data" summary since the acquisition of these variables may be more time consuming.

Table 3.21: SafetyAnalyst (*AltRoadwaySegment* Table) Data Variable Needs

Required Variables		Conditionally Required	Desired Variables	
Oregon: Bikeway, Sidewalk, & Crosswalk Report				
• d1auxLane1[6] • d1auxLane2[6] • d1auxLane3[6]	• d2auxLane1[6] • d2auxLane2[6] • d2auxLane3[6]	N/A	• d1bikeway • d2bikeway	
Oregon: Capacity Report				
N/A		N/A	• increasingMileposts	
Oregon: Functional Classification and NHS Status on Oregon State Highways				
• areaType[1] • roadwayClass1		N/A	• city[1]	
Oregon: Highway Inventory Detail Report				
• agencyID[2] • altRouteNames[1] • endOffset[3] • locSection[3]	• medianType1 • routeName[1] • segmentLength • startOffset[3]	• county[1] • medianWidth	• district[1] • d1shoulder TypeIn • d1shoulderTypeOut	• d2shoulder TypeIn • d2shoulder TypeOut
Oregon: Lane Report				
• d1auxLane1[6] • d1auxLane2[6] • d1auxLane3[6] • d2auxLane1[6] • d2auxLane2[6]	• d2auxLane3[6] • d1numThru Lane • d2numThru Lane	N/A	• d1avgLaneWidth • d1avgShoulder WidthIn • d1avgShoulder WidthOut	• d2avgLaneWidth • d2avgShoulder WidthIn • d2avgShoulder WidthOut
Oregon: Miscellaneous Highway Report				
N/A		N/A	• jurisdiction[1]	
Oregon: Routes to State Highway Cross Reference				
• majorRoadName[1] • routeType[1]		N/A	N/A	
Requires additional data (may acquire some data from the Digital Video Log and GIS Databases)				
• accessControl • interchange Influence • locSystem[3] • openedToTraffic[1]	• operationWay[5] • postedSpeed[5] • travelDirection	• discontinuity	• agencySiteSubtype[1] • comment[4] • corridor[1] • drivewayDensity	• gisID[1] • growthFactor[1] • terrain

[1]Variable included in SafetyAnalyst tables *AltRoadwaySegment*, *AltRamp*, and *AltIntersection*
[2]Variable included in all nine SafetyAnalyst site characteristic tables
[3]Variable included in SafetyAnalyst tables *AltRoadwaySegment* and *AltRamp*
[4]Variable included in SafetyAnalyst tables *AltRoadwaySegment*, *AltSegmentTraffic*, *AltRamp*, *AltRampTraffic*, *AltIntersection*, *AltMajorRoadTraffic*, and *AltMinorRoadTable*
[5]Variable included in SafetyAnalyst tables *AltRoadwaySegment* and *AltLeg*
[6]SafetyAnalyst variable must be acquired from more than one Oregon database

3.2.1.1 Segment Variables in the Oregon "Bikeway, Sidewalk, and Crosswalk Report" and "Lane Report"

The *d1bikeway* and the *d2bikeway* variables can be fully populated using the Oregon "Bikeway, Sidewalk, and Crosswalk Report." The auxiliary lane variables, however, require data from more than one Oregon database. These variables are summarized in the following section.

***d1auxLane1, d1auxLane2, d1auxLane3, d2auxLane1, d2auxLane2, and d2auxLane3* – Auxiliary Lane 1, 2, or 3, for Directions 1 and 2**

Road segment information that identifies the presence of auxiliary lanes for specific directions of travel are "required" variables with the following associated input options:

0 - No auxiliary lane;
1 - Passing/Climbing lane;
2 - Acceleration lane;
3 - Deceleration lane;
4 - Two-way left turn lane;
5 - Bus lane;
6 - HOV lane (including lanes with time restrictions for HOV use);
7 - Bicycle lane;
8 - Other auxiliary lane; and
99 - Unknown.

In the ODOT database, the "Bikeway, Sidewalk, & Crosswalk Report" includes information associated with bicycle lanes while additional auxiliary lane information can be acquired from the ODOT "Lane Report."

***d1bikeway* and *d2bikeway* – Bikeway Directions 1 and 2**

Road segment information that identifies a road, path, or way designated for shared or exclusive bicycle travel is the "desired" *d1bikeway* and *d2bikeway* SafetyAnalyst variable. The input options for these two variables are as follows:

1 - No bikeway present on roadway segment;
2 - Signed bicycle route present on roadway segment;
3 - Striped bicycle route present on roadway segment;
4 - Separate bicycle path or trail on roadway segment; and
99 - Unknown bikeway present on roadway segment.

In the ODOT database, the "Bikeway, Sidewalk, & Crosswalk Report" values for "Left Bikeways" and "Right Bikeways" can be used to populate this field.

3.2.1.2 Segment Variable in the Oregon "Capacity Report"

The Oregon "Capacity Report" can be used as a resource to populate the *increasingMileposts* variable. This variable conversion is described in the following section.

***increasingMileposts* – Direction of Increasing Mileposts or Distances**

Road segment information that specifies the direction of travel for which mileposts or distances increase on a segment is identified by the SafetyAnalyst "desired" variable *increasingMileposts*. The candidate input values for this variable include:

NB – Northbound travel direction;
SB – Southbound travel direction;
EB – Eastbound travel direction;
WB – Westbound travel direction;
NA – Not applicable; and
X – Unknown.

The Oregon "Capacity Report" category titled "Add Direction" can be used to populate this variable.

3.2.1.3 Segment Variables in the Oregon "Functional Classification and NHS Status on Oregon State Highways"

Three of the SafetyAnalyst roadway segment variables can be determined by acquiring data from the Oregon "Functional Classification and NHS Status on Oregon State Highways" database. These variable conversions are described in the following sections.

***areaType* – Area Type**

The characteristic of the area where a site is located is identified by the SafetyAnalyst "required" variable *areaType*. Available input options are:

U – Urban area type;
R – Rural area type; and
X – Area type unknown.

This variable can be populated by converting the "HPMS Area" value in the "functional Classification and NHS Status on Oregon State Highways." In addition to inclusion in the *AltRoadwaySegment* table, the *areaType* variable is also included in the *AltRamp* and *AltIntersection* tables.

***city* – City/Town**

The name of the city or town where the site is located is identified by the SafetyAnalyst "desired" variable *city*. This variable can be populated by using the values shown in the "Urban Area" column in the "Functional Classification and NHS Status on Oregon State Highways" database. In addition to inclusion in the *AltRoadwaySegment* table, the *city* variable is also included in the *AltRamp* and *AltIntersection* tables.

***roadwayClass1* – Roadway Class Level 1**

The variable that defines the functional classification of the street or highway is represented by the SafetyAnalyst "required" *roadwayClass1* variable. The input options for this SafetyAnalyst variable are as follows:

1 – Principal arterial-interstate;
2 – Principal arterial-other freeway or expressway;
3 – Principal arterial-other;
4 – Minor arterial;
5 – Major collector;
6 – Minor collector;
7 – Local;
0 – Other; and
99 – Unknown.

This variable can be populated by using the values shown in the "FC" column in the "Functional Classification and NHS Status on Oregon State Highways" database.

3.2.1.4 Segment Variables in the Oregon "Highway Inventory Detail Report"

There are 16 candidate variables in SafetyAnalyst that can be populated by using data from the Oregon "Highway Inventory Detail Report." There variables are summarized in the following sections.

***agencyID* – Segment ID**

The *agencyID* SafetyAnalyst "required" variable is a unique identifier used by an agency to designate a specific roadway segment and should be unique for the specific segment location. For road information, this variable is used as a link between the data from the nine roadway SafetyAnalyst variables. Oregon can define this variable in a variety of ways. One option for populating this value could be to develop a combined variable that depicts the "Unit ID" + "Highway #" + "Mile Point" by acquiring information from the Oregon "Highway Inventory Detail Report."

In addition to inclusion in the *altRoadwaySegment* table, the *agencyID* variable is also included in the *AltSegmentTraffic, AltRamp, AltRampTraffic, AltIntersection,*

AltMajorRoadTraffic, AltMinorRoadTraffic, AltLeg, and the *AltLegTraffic* SafetyAnalyst tables.

***altRouteNames* – Alternative Route Names**

If more than one route overlaps, the SafetyAnalyst "required" variable named *altRouteNames* identifies the alternative route number. If there are multiple alternative route numbers, these numbers should be listed and separated by a vertical bar (|) character. When applicable, this value can be acquired from the "Highway #" field in the Oregon "Highway Inventory Detail Report."

In addition to inclusion in the *AltRoadwaySegment* table, the *altRouteNames* variable is also included in the *AltRamp* and *AltIntersection* tables.

***county* - County**

The SafetyAnalyst *county* variable can be included as a component of the location system and would be a "required" variable for this application. In some cases, an agency may not use the county name for location system information. For these agencies, the inclusion of a county variable is still recommended, if available, as this variable helps to provide supplemental site searching capabilities. As a result, this variable is "conditionally required" as indicated in Table 3.21. In the Oregon "Highway Inventory Detail Report" the county is provided using Oregon county numbers, so these values would require conversion to county names.

In addition to inclusion in the *AltRoadwaySegment* table, the *county* variable is also included in the *AltRamp* and *AltIntersection* tables.

***district* – District**

The SafetyAnalyst *district* variable is a "desired" data item that allows an agency to define regional subdivisions based on geographic areas. These districts can then be used for network screening in specific regions. In the Oregon "Highway Inventory Detail Report" the district is indicated based on district numbers.

In addition to inclusion in the *AltRoadwaySegment* table, the *district* variable is also included in the *AltRamp* and *AltIntersection* tables.

***d1shoulderTypeIn* and *d2shoulderTypeIn* – Shoulder Type – Inside for Direction 1 and 2**

The SafetyAnalyst *d1shoulderTypeIn* and *d2shoulderTypeIn* "desired" variables define the predominant surface type for the inside shoulder type. Candidate input options include:

1 – Paved shoulder;
2 – Composite shoulder;

3 – Gravel shoulder;
4 – Turf shoulder;
5 – Curb;
6 – No shoulder;
98 – Not applicable; and
99 – Unknown.

In the Oregon "Highway Inventory Detail Report" the "Left Shldr" + "Type" information can be used to populate this inside shoulder type variable.

***d1shoulderTypeOut* and *d2shoulderTypeOut* – Shoulder Type – Inside for Direction 1 and 2**

The SafetyAnalyst *d1shoulderTypeOut* and *d2shoulderTypeOut* "desired" variables define the predominant surface type for the outside shoulder type. Candidate input options include:
1 – Paved shoulder;
2 – Composite shoulder;
3 – Gravel shoulder;
4 – Turf shoulder;
5 – Curb;
6 – No shoulder;
98 – Not applicable; and
99 – Unknown.

In the Oregon "Highway Inventory Detail Report" the "Right Shldr" + "Type" information can be used to populate this outside shoulder type variable.

***endOffset* – End of Segment Offset**

The *endOffset* variable in SafetyAnalyst is a "required" variable that indicates the offset distance value for the agency's location system. For Route/Milepost or Route/County/Milepost systems this value is the milepost. For Route/Selection/Distance or Section/Distance location systems the variable is the distance value. Currently for Oregon state highways, the Mile Point value in the "Highway Inventory Detail Report" can be used to populate this variable.

In addition to inclusion in the *AltRoadwaySegment* table, the *endOffset* variable is also included in the *AltRamp* table.

***locSection* – Section**

The *locSection* variable in SafetyAnalyst represents the section identified for the Route/Section/Distance or Section/Distance location systems. This variable is "required" for either of these two location system approaches. This field could be developed by using the "Highway #" + "Mile Point" in the ODOT "Highway Inventory Detail Report."

In addition to inclusion in the *AltRoadwaySegment* table, the *locSection* variable is also included in the *AltRamp* table.

***medianType1* – Median Type Level 1**

The *medianType1* variable in SafetyAnalyst defines the type and character of medians separating opposing traffic lanes. This "required" variable includes the following input options:

1 – Rigid barrier system (e.g., concrete);
2 – Semi-rigid barrier (e.g., box beam, W-beam strong post);
3 – Flexible barrier system (e.g., cable, W-beam weak post);
4 – Raised median with curve;
5 – Depressed median;
6 – Flush paved median (at least 4 feet in width);
7 – HOV lanes;
8 – Railroad or rapid transit;
9 – Other divided;
0 – Undivided; and
99 – Unknown.

The Oregon "Highway Inventory Detail Report" fields for "Median" and "Type" can be used to develop this SafetyAnalyst variable.

***medianWidth* – Median Width**

The *medianWidth* SafetyAnalyst variable is a "desired" variable that represents the average width of the median as measured from the inside edge of the through lane in each direction of travel. The Oregon "Highway Inventory Detail Report" fields for "Median" and "Width" can be used to develop this SafetyAnalyst variable.

***routeName* – Route Name**

The *routeName* variable in SafetyAnalyst is a "required" value that contains the number or name of the route where a site is located. If the site has overlapping route numbers, the most important route type and the associated lower route number should be used. If the road does not have a route name, the street name should be used. This value can be acquired from the "Highway #" field in the Oregon "Highway Inventory Detail Report."

In addition to inclusion in the *AltRoadwaySegment* table, the *routeName* variable is also included in the *AltRamp* and *AltIntersection* tables.

***segmentLength* – Segment Length**

The SafetyAnalyst variable named *segmentLength* is a "required" variable that represents the length of a study segment. This value may be calculated by subtracting the

beginning mile point from the ending mile point as provided in the Oregon "Highway Inventory Detail Report."

***startOffset* - Start of Segment Offset**

The *startOffset* variable in SafetyAnalyst is a "required" input value that identifies the offset distance for a given location. For the Route/Milepost or Route/County/Milepost location system, the *startOffset* value would be represented by the associated mile point value as shown in the Oregon "Highway Inventory Detail Report." For the Route/Section/Distance or Section/Distance this value is represented by a distance.

In addition to inclusion in the *AltRoadwaySegment* table, the *startOffset* variable is also included in the *AltRamp* table.

3.2.1.5 Segment Variables in the Oregon "Lane Report"

In addition to the auxiliary lane variables previously described in Section 3.2.1.1, the data required for eight variables can be acquired from the Oregon "Lane Report." These variables are described in the following sections.

***d1avgLaneWidth* and *d2avgLaneWidth* – Lane Width, Direction 1 and 2**

The *d1avgLaneWidth* and the *d2avgLaneWidth* variables in SafetyAnalyst are "desired" values that reflect the average through lane width for each direction of travel. The shoulder width values, however, are treated separately. The Oregon "Lane Report" columns LN1through LN6 can be used to populate this field, but they must first be associated with their respective direction.

***d1avgShoulderWidthIn* and *d2avgShoulderWidthIn* – Shoulder Width, Inside, Direction 1 and 2**

The *d1avgShoulderWidthIn* and *d2avgShoulderWidthIn* SafetyAnalyst variables are "desired" values that represent the average width of the inside shoulder for each direction of travel. A value of zero indicates that an inside shoulder is not present. The Oregon "Lane Report" column "LS" can be used to define the left (inside) shoulder width.

***d1avgShoulderWidthOut* and *d2avgShoulderWidthOut* – Shoulder Width, Outside, Direction 1 and 2**

The *d1avgShoulderWidthOut* and *d2avgShoulderWidthOut* variables in SafetyAnalyst are "desired" values that represent the average width of the outside shoulder for each direction of travel. A value of zero indicates that an outside shoulder is not present. The Oregon "Lane Report" column "RS" can be used to define the right (outside) shoulder width.

***d1numThruLane* and *d2numThruLane* – Number of Through Lanes, Direction 1 and 2**

The *d1numThruLane* and *d2numThruLane* roadway segment variables in SafetyAnalyst are "required" values that indicate the total number of through lanes for each direction of travel. Turn lanes and auxiliary lanes are not included in this value. The Oregon "Lane Report" can be used to calculate this value by counting the number of non-zero lanes designated by LN1, LN2, LN3, LN4, LN5, and LN6.

3.2.1.6 Segment Variables in the Oregon "Miscellaneous Highway Report"

Only the *jurisdiction* variable requires data that can be acquired from the Oregon "Miscellaneous Highway Report." The following section briefly reviews this variable.

***jurisdiction* – Jurisdiction**

The *jurisdiction* roadway segment SafetyAnalyst "desired" variable indicates the primary agency responsible for each site. Input options for this variable include:

1 – Federally maintained;
2 – State maintained;
3 – Maintained by a county;
4 – Locally maintained;
5 – Maintained by other agency not indicated;
6 – Township maintained;
99 – Primary agency unknown.

In addition to inclusion in the *AltRoadwaySegment* table, the *jurisdiction* variable is also included in the *AltRamp* and *AltIntersection* tables.

3.2.1.7 Segment Variables in the Oregon "Routes to State Highway Cross Reference"

Two variables (*majorRoadName* and *routeType*) can be populated by using information included in the Oregon "Routes to State Highway Cross Reference." These variables are reviewed in the following sections.

***majorRoadName* – Major Road Name**

The *majorRoadName* variable in SafetyAnalyst is a "required" value and represents the name of the road where the site is located. If the road has both a name and a route number, the route number should be displayed in the *routeName* variable and the road name should be the *majorRoadName* value. If the street name is not available, this field should be left blank. This variable can be populated using the "Route Name" field in the Oregon "Routes to State Highway Cross Reference" database.

In addition to inclusion in the *AltRoadwaySegment* table, the *majorRoadName* variable is also included in the *AltRamp* and *AltIntersection* tables.

***routeType* – Route Type**

The *routeType* roadway segment variable in SafetyAnalyst is a "required" value that indicates the category for the specific site. Input value options include:

I – Interstate;
US – US route;
SR – State route;
BR – Business route;
BL – Business loop;
SP – Spur route;
CR – County road;
TR – Township road;
L – Local road;
O – Other; and
X – Unknown.

The Oregon equivalent information for this variable can be acquired from the "Route Number" information located in the *Routes to State Highway Cross Reference*. The SafetyAnalyst input options are more extensive than those provided in the Oregon dataset (which simply includes interstate, US, and State route). To comprehensively populate this variable, however, would require additional data collection and formatting.

In addition to inclusion in the *AltRoadwaySegment* table, the *routeType* variable is also included in the *AltRamp* and *AltIntersection* tables.

3.2.1.8 Segment Variables that Require Additional Data Collection Efforts

Several of the SafetyAnalyst variables do not have a direct information resource in one of the current Oregon databases. This section identifies these variables and how, if feasible, to approximate the needed information.

***accessControl* – Access Control**

The *accessControl* variable in SafetyAnalyst is a "required" roadway segment variable that indicates the level of access available to the abutting lane. Available input variables include:

1 - Public authority has full access control;
2 - Public authority has partial access control;
3 - Public authority has no access control; and
99 - Public authority has unknown access control.

At this time, there does not appear to be an Oregon database that can be used to populate this variable. A reasonable assumption, however, could be used to assume that

interstates have full access, high functioning facilities have partial access, and other roads such as local or collector roads have no access control. If this approach is used, the functional classification information can be used to assist in estimating this variable.

***agencySiteSubtype* – Agency Site Subtype**

The *agencySiteSubtype* variable in SafetyAnalyst is a "desired" variable that indicates an agency-specified facility classification. This is an optional variable and will only be used by SafetyAnalyst for site subtypes that are not directly supported by SafetyAnalyst. Since this variable is not currently available in Oregon databases and is an optional variable, it should not be populated at this time.

In addition to inclusion in the *AltRoadwaySegment* table, the *agencySiteSubtype* variable is also included in the *AltRamp* and *AltIntersection* tables.

***comment* – Comment**

The *comment* SafetyAnalyst "desired" variable provides a variable that can be used for optional comments. In addition to inclusion in the *AltRoadwaySegment* table, the *comment* variable is also included in the *AltSegmentTraffic, AltRamp, AltRampTraffic, AltIntersection, AltMajorRoadTraffic, AltMinorRoadTraffic,* and the *AltLegTraffic* tables.

***corridor* - Corridor**

The *corridor* SafetyAnalyst "desired" variable is a unique identifier that can be used to link multiple roadway segments, intersections, and ramps together to perform a corridor analysis. There is not an equivalent variable for this in the current Oregon databases; however, such a unique identifier could be developed based on other road naming conventions previously identified. In addition to inclusion in the *AltRoadwaySegment* table, the *corridor* variable is also included in the *AltRamp* and *AltIntersection* tables.

***discontinuity* - Discontinuity**

The *discontinuity* variable in SafetyAnalyst is a "conditionally required" value that indicates if a roadway segment is contiguous to a previous roadway segment. Input options include:

Y - Yes, segment is contiguous to a previous segment;
N - No, segment is not contiguous to a previous segment; and
X - Unknown whether segment is contiguous to a previous segment.

Though there is not direct variable available in current ODOT databases, the Oregon "Highway Inventory Detail Report" as well as the Oregon "Lane Report" could be used, with minimal programming, to develop this *discontinuity* variable by building a query that checks upstream and downstream mile point values.

***drivewayDensity* – Driveway Density**

The *drivewayDensity* roadway segment variable in SafetyAnalyst is a "desired" value that indicates the number of driveways per mile (or per kilometer) on both sides of the road combined. If the road is a divided highway, the number of driveways should be based on only one side of the road. Currently Oregon does not maintain a comprehensive driveway inventory database, so information to populate this variable is not available. Since this variable is not "required" by SafetyAnalyst, development of this variable for the purposes of program compatibility can be deferred to a later time.

***gisID* – GIS Identifier**

The *gisID* SafetyAnalyst "desired" variable is used to link a roadway segment to an external GIs system. SafetyAnalyst does not directly process the *gisID* variable. Oregon is currently refining the use of GIS information with safety assessments, so this value can be developed using the current Oregon GIS files. In addition to inclusion in the *AltRoadwaySegment* table, the *gisID* variable is also included in the *AltRamp* and *AltIntersection* tables.

growthFactor – Growth Factor

The *growthFactor* SafetyAnalyst variable is a "desired" value that reflects the fixed annual rate of increase for which the traffic volume is expected to grow (represents exponential growth). A growth factor less than 1.0 represents negative traffic volume growth. A growth factor of 2.0 suggests that traffic volume will double each year. All growth factors must be greater than 0.0. Currently the Oregon databases do not have clearly defined growth factors for all traffic volumes, but this value could be approximated by using historic traffic volumes and calculating their associated growth factors for each site. In addition to inclusion in the *AltRoadwaySegment* table, the *growthFactor* variable is also included in the *AltRamp* and *AltIntersection* tables.

***interchangeInfluence* – Interchange Influence Area on Mainline Freeway**

The *interchangeInfluence* SafetyAnalyst "required" variable indicates if a site is located within an interchange influence area. Possible values for the *interchangeInfluence* variable include:

Y - Yes, roadway is within interchange influence area;
N - No, roadway is not within interchange influence area; and
X - Unknown whether roadway is within interchange influence area.

Oregon currently does not have a database with clearly defined interchange influence areas; however, this variable could be approximated by using some general approach distances for various interchange functions and posted speeds and applying this value to each interchange location.

***locSystem* – Location System**

The *locSystem* SafetyAnalyst "required" variable identifies the location system used for specific site data. Candidate input values include:

A - Route/Milepost;
B - Route/County/Milepost;
C - Route/Section/Distance; and
D - Section/Distance.

Though there is no Oregon database for this variable, the selection of Option "A" applies to state highways. Local roads may use other (currently unknown) location systems, but this information could ultimately be identified for the various facility types.

In addition to inclusion in the *AltRoadwaySegment* table, the *locSystem* variable is also included in the *AltRamp* table.

***openedToTraffic* – Date Opened to Traffic**

The *openedToTraffic* SafetyAnalyst "required" variable depicts the date when the site was opened to traffic. The SafetyAnalyst Data Management Tool requires the user to indicate the date format before importing this variable. Currently, Oregon databases do not readily provide this information; however, this information is included in the construction project tracking data and could possibly be acquired and ultimately included. It is not clear how SafetyAnalyst uses this "required" variable, but it is also possible that an estimated year may be adequate for this variable. In addition to inclusion in the *AltRoadwaySegment* table, the *openedToTraffic* variable is also included in the *AltRamp* and *AltIntersection* tables.

***operationWay* – Two-Way versus One-Way Operation**

The *operationWay* SafetyAnalyst "required" variable describes the operational status of roadway segments. Available input values include:

1 - One-way road or street;
2 - Two-way road or street;
3 - One direction of travel for a divided highway; and
99 - Unknown.

This variable does not appear to be easily acquired from a current Oregon database, but could be verified using the ODOT Digital Video Log. In addition to inclusion in the *AltRoadwaySegment* table, the *operationWay* variable is also included in the *AltLeg* table.

***postedSpeed* – Speed Limit**

The *postedSpeed* SafetyAnalyst variable contains the authorized posted speed limit. If passenger cars and trucks have different speed limits, this value should reflect the passenger car speed limit. This value is "required" for use with the *AltRoadwaySegment* table, but "desired" for use with the AltLeg table. The research team was not able to identify one consistent resource for providing the speed limit. This variable could be populated using the Oregon digital video log if a comprehensive database cannot be identified.

***terrain* – Terrain**

The *terrain* SafetyAnalyst variable is a "desired" value that indicates the predominant elevation change along the roadway. Candidate input values include:

L - Level;
R - Rolling;
M - Mountainous; and
X - Unknown.

At this time, there is not a comprehensive Oregon database that provides terrain information.

***travelDirection* – Direction of Travel**

The *travelDirection* SafetyAnalyst "required" variable describes the prevailing direction of travel for the associated segment if the road is a divided highway with one direction of travel (a value of three for the *operationWay* variable). Input options include:

NB - Northbound;
SB - Southbound;
EB - Eastbound;
WB - Westbound;
NA – Not applicable; and
X - Unknown.

Currently this variable is not available, but could be developed with limited effort using GIS and video resources.

3.2.2 Roadway Variables in the SafetyAnalyst *AltSegmentTraffic* Table

The specific roadway segment volume data required by SafetyAnalyst are included in an input table named *AltSegmentTraffic*. While some of these variables are only included in this segment traffic table, others are included in multiple SafetyAnalyst tables. Each of these variable names and companion Oregon data sources, when available, are identified in Table 3.22. The basic segment traffic data can be acquired from two

databases. The variables are further divided into "required" and "desired" values as defined by the SafetyAnalyst.

Table 3.22: SafetyAnalyst (*AltSegmentTraffic* Table) Data Variable Needs

Required Variables	Desired Variables
Oregon: Highway Inventory Detail Report	
• agencyID[1]	N/A
Oregon: Traffic Volumes and Vehicle Classification Report	
• aadtVPD[3] • calendarYear[3] • peakHourlyVolume • percentHeavyVehicles	N/A
Requires additional data (may acquire some data from the Digital Video Log and GIS Databases)	
N/A	• comment[2]

[1]Variable included in all nine SafetyAnalyst site characteristic tables
[2]Variable included in SafetyAnalyst tables *AltRoadwaySegment, AltSegmentTraffic, AltRamp, AltRampTraffic, AltIntersection, AltMajorRoadTraffic,* and *AltMinorRoadTable*
[3]Variable included in SafetyAnalyst tables *AltSegmentTraffic,AltRampTraffic, AltMajorRoadTraffic, AltMinorRoadTraffic,* and *AltLegTraffic*

The *agencyID* and *comment* variables were previously described in the *AltRoadwaySegment* table (see Section 3.2.1). As a result, these descriptions are not repeated in this section.

3.2.2.1 Segment Traffic Variables in the Oregon "Traffic Volumes and Vehicle Classification Report"

Four required variables identified in the *AltSegmentTraffic* table can be populated using data from the Oregon "Traffic Volumes and Vehicle Classification Report." The following sections provide detailed information about the compatibility of the Oregon data to the SafetyAnalyst variable format.

***aadtVPD* - AADT**

The *aadtVPD* SafetyAnalyst "required" variable provides the annual average daily traffic for the associated roadway segment. This value is the average of vehicles that traverse a roadway segment in both directions of travel. At intersection locations, the AADT is the average number of vehicles passing through the intersection from both directions for the major or minor roadways. For a one-way facility such as a ramp, this value would be the average number of vehicles traversing the facility in the one direction of travel. The AADT value is averaged for an entire year and presented in units of vehicles per day. The Oregon "Traffic Volumes and Vehicle Classification Report" includes this traffic volume information in the "AADT Volume" field.

In addition to inclusion in the *AltSegmentTraffic* table, the *aadtVPD* variable is also included in the *AltRampTraffic, AltMajorRoadTraffic, AltMinorRoadTraffic,* and *AltLegTraffic* tables.

***calendarYear* – Year**

The *calendarYear* SafetyAnalyst "required" variable shows the year for associated traffic data. The variable can be populated by using the Oregn "Traffic Volumes and Vehicle Classification Report" field titled "Effective Date."

In addition to inclusion in the *AltSegmentTraffic* table, the *calendarYear* variable is also included in the *AltRampTraffic, AltMajorRoadTraffic, AltMinorRoadTraffic,* and *AltLegTraffic* tables.

***peakHourlyVolume* – Peak or Design Volume**

The *peakHourlyVolume* SafetyAnalyst "required" value is the traffic volume for the peak or design hour volume in the peak direction of flow. Though the Oregon data does not directly provide this information, the design hour factor contained in the "Traffic Volumes and Vehicle Classification Report" can be used to estimate this value when combined with the AADT value and an estimate for the direction distribution.

***percentHeavyVehicles* – Heavy Vehicles**

The *percentHeavyVehicles* SafetyAnalyst "required" value is the number of commerical vehicles on the roadway divided by the number of all vehicles on the roadway. The commercial vehicle definition includes tractor-trailer combinations as well as large straight trucks with six or more tires. This definition corresponds with vehicle class 4 – 13 in the Oregon "Traffic Volumes and Vehicle Classification Report." This variable can be estimated by adding the values in these various "Vehicle Class Percentage" fields.

3.2.3 Roadway Variables in the SafetyAnalyst *AltRamp* Table

The specific ramp site characteristic data required by SafetyAnalyst are included in an input table named *AltRamp*. While some of these variables are only included in this table, others are included in multiple SafetyAnalyst tables. Each of these variable names and companion Oregon data sources, when available, are identified in Table 3.23. The ramp characteristic data can be acquired from five Oregon databases. The variables are further divided into "required", "conditionally required", and "desired" values as defined by the SafetyAnalyst.

Table 3.23: SafetyAnalyst (*AltRamp* Table) Data Variable Needs

Required Variables	Conditionally Required	Desired Variables
Oregon: Functional Classification and NHS Status on Oregon State Highways		
• areaType[1]	N/A	• city[1]
Oregon: Highway Inventory Detail Report		
• agencyID[2] • altRouteNames[1] • endOffset[3] • locSection[3] • routeName[1] • startOffset[3]	• county[1] • rampLength	• district[1]
Oregon: Lane Report		
• numOfLanes	N/A	N/A
Oregon: Miscellaneous Highway Report		
N/A	N/A	• jurisdiction[1]
Oregon: Routes to State Highway Cross Reference		
• majorRoadName[1] • routeType[1]	N/A	N/A
Requires additional data (may acquire some data from the Digital Video Log and GIS Databases)		
• locSystem[3] • openedToTraffic[1] • rampConfiguration	• rampCrossroadConnection • rampFreewayConnection • rampType	• agencySiteSubtype[1] • comment[4] • corridor[1] • gisID[1] • growthFactor[1]

[1]Variable included in SafetyAnalyst tables *AltRoadwaySegment, AltRamp,* and *AltIntersection*
[2]Variable included in all nine SafetyAnalyst site characteristic tables
[3]Variable included in SafetyAnalyst tables *AltRoadwaySegment* and *AltRamp*
[4]Variable included in SafetyAnalyst tables *AltRoadwaySegment, AltSegmentTraffic, AltRamp, AltRampTraffic, AltIntersection, AltMajorRoadTraffic,* and *AltMinorRoadTable*

Many of the variables contained in the *AltRamp* table were previously described in the *AltRoadwaySegment* table summary (see Section 3.2.1) and are not repeated in this section. These variables include the following:

- agencyID
- agencySiteSubtype
- altRouteNames
- areaType
- city
- comment
- corridor
- county
- district
- endOffset
- gisID
- growthFactor
- locSection
- locSystem
- majorRoadName
- openedToTraffic
- routeName
- routeType
- startOffset

The remaining six variables are described in the following sections.

3.2.3.1 Ramp Variable in the Oregon "Highway Inventory Detail Report"

One data element can be populated from data available in the Oregon "Highway Inventory Detail Report." The following section summarizes this variable.

***rampLength* – Ramp Length**

The *rampLength* SafetyAnalyst "conditionally required" variable represents the total length of the ramp, including horizontal curves and tangents. ODOT should first define a standard measurement point for all ramps (such as measurement at the gore nose) and then could populate this variable by subtracting the associated "Highway Inventory Detail Report" mile point values.

3.2.3.2 Ramp Variable in the Oregon "Lane Report"

The only data element that needs to be acquired from the Oregon "Lane Report" is the variable for the number of lanes on the ramp. This variable is described in the following section.

***numOfLanes* – Ramp Number of Lanes**

The *numOfLanes* SafetyAnalyst "required" variable identifies, as a whole number, the number of lanes on the ramp proper. This variable can be populated by adding the number of non-zero lanes (LN1, LN2, …) in the ODOT "Lane Report." To be sure this evaluation applies to ramps, the user must first select "Connections" as the road type.

3.2.3.3 Ramp Variables that Require Additional Data Collection

Four ramp-affiliated variables are required by SafetyAnalyst but not readily available in a current Oregon database. The following section identifies these variables.

***rampConfiguration* – Ramp Configuration**

The *rampConfiguration* SafetyAnalyst "required" variable characterizes the design of the ramp. Candidate input values may include:

1 - Ramp configuration is diamond;
2 - Partial clover leaf loop;
3 - Free-flow loop ramp;
4 - Ramp configuration is free-flow outer connection;
5 - Direct or semi-direct;
6 - C-D road or other connector;
0 - Other ramp configuration; and
99 - Unknown ramp configuration.

Currently the Oregon databases do not appear to have a comparable value and so additional data collection efforts are needed before this variable can be fully populated.

***rampCrossroadConnection* – Type of Connection (At Crossroad)**

The *rampCrossroadConnection* variable in SafetyAnalyst is a "conditionally required" variable that identifies the type of connection at the crossroad ramp terminal. Candidate input values include:

1 - At-grade ramp terminal intersection;
2 - Crossroad acceleration lane;
3 - Crossroad deceleration lane;
4 - Other; and
99 - Unknown.

Currently the Oregon databases do not appear to have a comparable value and so additional data collection efforts are needed before this variable can be fully populated.

***rampFreewayConnection* – Type of Connection (At Freeway)**

The *rampFreewayConnection* SafetyAnalyst is a "conditionally required" variable that characterizes the purpose and use of the ramp. Candidate input values include:

1 - Ramp is a mainline acceleration lane;
2 - Ramp is a mainline deceleration lane;
3 - Ramp is a mainline weaving area;
4 - Ramp is a C-D road;
5 - Ramp is characterized as other; and
99 - Ramp is characterized as unknown.

Currently the Oregon databases do not appear to have a comparable value and so additional data collection efforts are needed before this variable can be fully populated.

***rampType* – Ramp Type**

The *rampType* SafetyAnalyst "conditionally required" variable indicates if the ramp is an entrance or exit to a freeway or a connection between two freeways. The input values include:

1 - Off ramp, freeway exit;
2 - On ramp, freeway entrance;
3 - Freeway-to-freeway ramp to connect two freeways;
0 - Other type of ramp; and
99 - Unknown type of ramp.

Currently the Oregon databases do not appear to have a comparable value and so additional data collection efforts are needed before this variable can be fully populated.

3.2.4 Roadway Variables in the SafetyAnalyst *AltRampTraffic* Table

The specific ramp volume data required by SafetyAnalyst are included in an input table named *AltRampTraffic*. All of the variables included in this ramp traffic table also

occur in other, previously identified SafetyAnalyst tables. Each of these variable names and companion Oregon data sources, when available, are identified in Table 3.24. The basic ramp traffic data can be acquired from two databases. The variables are further divided into "required" and "desired" values as defined by the SafetyAnalyst.

Table 3.24: SafetyAnalyst (*AltRampTraffic* Table) Data Variable Needs

Required Variables	Desired Variables
Oregon: Highway Inventory Detail Report	
• agencyID[1]	N/A
Oregon: Traffic Volumes and Vehicle Classification Report	
• aadtVPD[2] • calendarYear[2]	N/A
Requires additional data (may acquire some data from the Digital Video Log and GIS Databases)	
N/A	• comment[3]

[1]Variable included in all nine SafetyAnalyst site characteristic tables
[2]Variable included in SafetyAnalyst tables *AltSegmentTraffic, AltRampTraffic, AltMajorRoadTraffic, AltMinorRoadTraffic,* and *AltLegTraffic*
[3]Variable included in SafetyAnalyst tables *AltRoadwaySegment, AltSegmentTraffic, AltRamp, AltRampTraffic, AltMajorRoadTraffic,* and *AltMinorRoadTraffic*

Two of the variables contained in the *AltRampTraffic* table were previously described in the *AltRoadwaySegment* table summary (see Section 3.2.1) and are not repeated in this section. These variables are the *agencyID* and the *comment.*

The remaining two variables contained in the *AltRampTraffic* table were previously described in the *AltSegmentTraffic* table summary (see Section 3.2.2) and are not repeated in this section. These variables are the *aadtVPD* and the *calendarYear*.

Collectively the four variables depicted in the *AltRampTraffic*, therefore, do not require any additional definitions in this section.

3.2.5 Roadway Variables in the SafetyAnalyst *AltIntersection* Table

The specific intersection site characteristic information required by SafetyAnalyst is included in an input table named *AltIntersection.* All of the variables included in this intersection site characteristic table also occur in other, previously identified SafetyAnalyst tables. Each of these variable names and companion Oregon data sources, when available, are identified in Table 3.25. The basic intersection site data can be acquired from five different Oregon databases. The variables are further divided into "required", "conditionally required", and "desired" values as defined by the SafetyAnalyst.

Table 3.25: SafetyAnalyst (*AltIntersection* Table) Data Variable Needs

Required Variables	Conditionally Required	Desired Variables
Oregon: Functional Classification and NHS Status on Oregon State Highways		
• areaType[1]	N/A	• city[1]
Oregon: Highway Inventory Detail Report		
• agencyID[2] • altRouteNames[1] • majorRoadOffset • minorRoadOffset • routeName[1]	• county[1] • majorRoadSection • minorRoadSection	• district[1]
Oregon: Lane Report		
• minorRoadName • minorRoadRouteName	N/A	N/A
Oregon: Miscellaneous Highway Report		
N/A	N/A	• jurisdiction[1]
Oregon: Routes to State Highway Cross Reference		
• majorRoadName[1] • minorRoadRouteType • routeType[1]	N/A	N/A
Requires additional data (may acquire some data from the Digital Video Log and GIS Databases)		
• intersectionType1 • majorRoadDirection • majorRoadLocSystem • offsetDistance • offsetIntersection • openedToTraffic[1] • trafficControl1	• majBeginInfluenceZone • majEndInfluenceZone	• agencySiteSubtype[1] • comment[3] • corridor[1] • gisID[1] • growthFactor[1] • minBeginInfluenceZone • minEndInfluenceZone • minorRoadLocSystem

[1]Variable included in SafetyAnalyst tables *AltRoadwaySegment*, *AltRamp*, and *AltIntersection*
[2]Variable included in all nine SafetyAnalyst site characteristic tables
[3]Variable included in SafetyAnalyst tables *AltRoadwaySegment*, *AltSegmentTraffic*, *AltRamp*, *AltRampTraffic*, *AltIntersection*, *AltMajorRoadTraffic*, and *AltMinorRoadTable*

Many of the variables contained in the *AltRamp* table were previously described in the *AltRoadwaySegment* table summary (see Section 3.2.1) and are not repeated in this section. These variables include the following:

- agencyID
- agencySiteSubtype
- altRouteNames
- areaType
- city
- comment
- corridor
- county
- district
- gisID
- growthFactor
- majorRoadName
- openedToTraffic
- routeName
- routeType

The remaining 18 variables are described in the following sections.

3.2.5.1 Intersection Variables in the Oregon "Highway Inventory Detail Report"

Four of the SafetyAnalyst intersection variables can be populated using information contained in the Oregon "Highway Inventory Detail Report." These variables are described in the following section.

***majorRoadOffset* and *minorRoadOffset* – Major and Minor Road Offset**

The *majorRoadOffset* and *minorRoadOffset* SafetyAnalyst "required" variables represents the offset distance associated with the location system used at the site. For a Route/Milepost or Route/County/Milepost location system, this value is represented by the associated milepost. For the Route/Section/Distance or Section/Distance location systems, these variables would then be represented by the associated distance measurement. Oregon data can be acquired from the "Highway Inventory Detail Report" in a manner similar to that previously indicated for the *startOffset* variable previously reviewed in the *AltRoadwaySegment* table.

***majorRoadSection* and *minorRoadSection* – Major and Minor Road Section**

The *majorRoadSection* and the *minorRoadSection* SafetyAnalyst "conditionally required" variables define the section identifier when the site specific location system is the Route/Section/Distance or the Section/Distance location systems. This information can be developed from the Oregon "Highway Inventory Detail Report" by using the "Road Type" connections and then extracting the "Highway #" and "Highway Name" information.

3.2.5.2 Intersection Variables in the Oregon "Lane Report"

Two SafetyAnalyst variables (*minorRoadName* and *minorRoadRouteName*) can be populated from data contained in the Oregon "Lane Report." These variables are further defined in the following section.

***minorRoadName* – Minor Road Name**

The *minorRoadName* SafetyAnalyst "required" variable includes the name of the minor road at an intersection. The Oregon "Lane Report" field titled "Description" can be used to determine this information.

***minorRoadRouteName* – Minor Road Route Name**

The *minorRoadRouteName* SafetyAnalyst "required" variable provides the number or name of the route assigned to the intersection minor road. If routes overlap, the more important route type and associated lower route number should be used. For routes that do not have numbers, the street name should be used. This information can also be

obtained from the "Description" field in the Oregon "Lane Report" for applicable locations.

3.2.5.3 Intersection Variables in the Oregon "Routes to State Highway Cross Reference"

Of the four required variables that can use the Oregon "Routes to State Highway Cross Reference" as a data course, only one variable (*minorRoadRouteType*) has not been previously defined. This variable is described in the following section.

***minorRoadRouteType* – Minor Road Route Type**

The *minorRoadRouteType* SafetyAnalyst "required" variable defines the designated road category for the minor road. Input options include:

I - Interstate;
US - US route;
SR - State route;
BR - Business route;
BL - Business loop;
SP - Spur route;
CR - County road;
TR - Township road;
L - Local road;
O - Other; and
X - Unknown.

The variable can be populated using the "Routes to State Highway Cross Reference" column titled "Route No." This input does not fully populate the variable, though, as previously discussed in the variable *routeType* description (table *AltRoadwaySegment*).

3.2.5.1 Intersection Variables that Require Additional Data Collection Efforts

Data required for 11 of the intersection variables is not readily available in Oregon databases. These variables are summarized in the following sections.

***intersectionType1*- Intersection Type Level 1**

The *intersectionType1* SafetyAnalyst "required" variable identifies the type of intersection where two or more roads meet at grade. Input options include:

1 - Tee intersection;
2 - Y intersection;
3 - Four-leg intersection;
4 - Traffic circle or roundabout;
5 - Multi-leg intersection of five or more legs;
0 - Other intersection type; and
99 - Unknown.

Currently there does not appear to be an Oregon database that can fully populate this variable. The digital video log or aerial photography could be used to manually acquire this information. Some intersection information, however, can be extracted from the "Roadway Codes" field in the Oregon "Lane Report."

***majBeginInfluenceZone* and *minBeginInfluenceZone* – Beginning Influence Zone for Major and Minor Road**

The "conditionally required" *majBeginInfluenceZone* and the "desired" *minBeginInfluenceZone* variables in SafetyAnalyst indicate the beginning search limits for auxiliary intersection crashes and are expressed as a distance, in miles (or kilometers), from the beginning of the intersection reference point towards the major or minor road, respectively. Currently Oregon databases do not include a value similar to this variable.

***majEndInfluenceZone* and *minEndInfluenceZone* – End Influence Zone for Major and Minor Road**

The "conditionally required" *majEndInfluenceZone* and the "desired" *minEndInfluenceZone* variables in SafetyAnalyst indicate the ending search limits for auxiliary intersection crashes and are expressed as a distance, in miles (or kilometers), from the intersection reference point towards end of the major and minor road, respectively. Currently Oregon databases do not include a value similar to this variable.

***majorRoadDirection* – Major Road Direction**

The *majorRoadDirection* SafetyAnalyst "required" variable indicates the prevailing direction of the major road. Input options include:

NS - North-south designated direction;
EW - East-west designated direction; and
X - Unknown.

Currently Oregon databases do not include a value that exactly matches the SafetyAnalyst definition; however, a reasonable method to approximate this variable is to use the "Add Direction" field in the Oregon "Capacity Report." This will give information about the direction of increasing mile point and could be used to identify this prevailing direction for the road.

***majorRoadLocSystem* and *minorRoadLocSystem* – Major and Minor Road Location System**

The "required" *majorRoadLocSystem* variable and the "desired" *minorRoadLocSystem* SafetyAnalyst variables identify the type of location system available on the major and minor roads, respectively. Input options include:

A - Route/Milepost;
B - Route/County/Milepost;
C - Route/Section/Distance; and

D - Section/Distance.

The description for the *locSystem* variable in the *AltRoadwaySegment* summary (see Section 3.2.1.8) also applies to these two variables.

***offsetDistance* – Offset Distance**

The *offsetDistance* SafetyAnalyst "required" variable indicates the distance between the minor road centerlines at intersections with offset approaches. For locations that do not have offsets, this value is zero. Currently there is no Oregon database variable that can directly populate this variable; however, a reasonable approximation can be used by subtracting the mile point values for the various intersection legs as depicted in the Oregon "Lane Report."

***offsetIntersection* – Offset Intersection**

The *offsetIntersection* SafetyAnalyst "required" variable identifies if cross streets (minor roads) centerlines intersect the road at the same location or if the centerlines are staggered. Input options for this variable include:

Y - Yes, intersecting legs are offset;
N - No, intersecting legs are not offset; and
X - Unknown.

Currently Oregon databases do not have a similar variable, but the Oregon "Lane Report" could be used to approximate this variable. A query that searches for the same cross street name and then subtracts their associated mile point could help populate this field. In cases where the two opposing minor approaches do not have the same street name, the query could include a proximity threshold (any intersection within a certain distance would be included in this assessment).

***trafficControl1* – Traffic Control Type at Intersection Level 1**

The *trafficControl1* SafetyAnalyst "required" variable identifies the traffic control devices at an intersection. Candidate input values include:

1 - No control;
2 - Stop signs on cross street only;
3 - Stop signs on mainline only;
4 - All-way stop signs;
5 - Two-way flasher (red on cross street);
6 - Two-way flasher (red on mainline);
7 - All-way flasher (red on all);
8 - Yield signs on cross street only;
9 - Yield signs on mainline only;
10 - Other non-signalized;
11 - Signals pre-timed (2 phase);
12 - Signals pre-timed (multi-phase);

13 - Signals semi-actuated (2 phase);
14 - Signals semi-actuated (multi-phase);
15 - Signals fully actuated (2 phase);
16 - Signals fully actuated (multi-phase);
17 - Other signalized;
18 - Roundabout; and
99 - Unknown.

In some instances, Oregon data includes traffic control device information. For example, the Oregon GIS system contains some traffic signal information. There is not currently a comprehensive Oregon database that can be used to fully populate this variable.

3.2.6 Roadway Variables in the SafetyAnalyst *AltMajorRoadTraffic* Table

The major road intersection traffic volume information required by SafetyAnalyst is included in an input table named *AltMajorRoadTraffic*. All of the variables included in this table also occur in other, previously identified SafetyAnalyst tables. Each of these variable names and companion Oregon data sources, when available, are identified in Table 3.26. The major road traffic data can be acquired from two Oregon databases. The variables are further divided into "required" and "desired" values as defined by the SafetyAnalyst.

Table 3.26: SafetyAnalyst (*AltMajorRoadTraffic* Table) Data Variable Needs

Required Variables	Desired Variables
Oregon: Highway Inventory Detail Report	
• agencyID[1]	N/A
Oregon: Traffic Volumes and Vehicle Classification Report	
• aadtVPD[2] • calendarYear[2]	N/A
Requires additional data (may acquire some data from the Digital Video Log and GIS Databases)	
N/A	• comment[3]

[1]Variable included in all nine SafetyAnalyst site characteristic tables
[2]Variable included in SafetyAnalyst tables *AltSegmentTraffic, AltRampTraffic, AltMajorRoadTraffic, AltMinorRoadTraffic,* and *AltLegTraffic*
[3]Variable included in SafetyAnalyst tables *AltRoadwaySegment, AltSegmentTraffic, AltRamp, AltRampTraffic, AltMajorRoadTraffic,* and *AltMinorRoadTraffic*

Two of the variables contained in the *AltMajorRoadTraffic* table were previously described in the *AltRoadwaySegment* table sumary (see Section 3.2.1) and are not repeated in this section. These variables are the *agencyID* and the *comment.*

The remaining two variables contained in the *AltMajorRoadTraffic* table were previously described in the *AltSegmentTraffic* table summary (see Section 3.2.2) and are not repeated in this section. These variables are the *aadtVPD* and the *calendarYear*.

Collectively the four variables depicted in the *AltMajorRoadTraffic*, therefore, do not require any additional definitions in this section.

3.2.7 Roadway Variables in the SafetyAnalyst *AltMinorRoadTraffic* Table

The minor road intersection traffic volume information required by SafetyAnalyst is included in an input table named *AltMinorRoadTraffic*. All of the variables included in this table also occur in other, previously identified SafetyAnalyst tables. Each of these variable names and companion Oregon data sources, when available, are identified in Table 3.27. The minor road traffic data can be acquired from two Oregon databases. The variables are further divided into "required" and "desired" values as defined by the SafetyAnalyst.

Table 3.27: SafetyAnalyst (*AltMinorRoadTraffic* Table) Data Variable Needs

Required Variables	Desired Variables
Oregon: Highway Inventory Detail Report	
• agencyID[1]	N/A
Oregon: Traffic Volumes and Vehicle Classification Report	
• aadtVPD[2, 3] • calendarYear[2]	N/A
Requires additional data (may acquire some data from the Digital Video Log and GIS Databases)	
• aadtVPD[2, 3]	• comment[4]

[1]Variable included in all nine SafetyAnalyst site characteristic tables
[2]Variable included in SafetyAnalyst tables *AltSegmentTraffic, AltRampTraffic, AltMajorRoadTraffic, AltMinorRoadTraffic,* and *AltLegTraffic*
[3] The AADT volume for the minor road is available for a subset of local streets. For those where traffic volume is not available, some additional data collection may be required.
[4]Variable included in SafetyAnalyst tables *AltRoadwaySegment, AltSegmentTraffic, AltRamp, AltRampTraffic, AltMajorRoadTraffic,* and *AltMinorRoadTraffic*

Two of the variables contained in the *AltMinorRoadTraffic* table were previously described in the *AltRoadwaySegment* table summary (see Section 3.2.1) and are not repeated in this section. These variables are the *agencyID* and the *comment.*

The remaining two variables contained in the *AltMinorRoadTraffic* table were previously described in the *AltSegmentTraffic* table summary (see Section 3.2.2) and are not repeated in this section. These variables are the *aadtVPD* and the *calendarYear*.

Collectively the four variables depicted in the *AltMinorRoadTraffic*, therefore, do not require any additional definitions in this section.

3.2.8 Roadway Variables in the SafetyAnalyst *AltLeg* Table

The intersection leg inventory data is required by SafetyAnalyst in an input table named *AltLeg*. In addition to two variables that were previously included in other SafetyAnalyst tables, Table 3.28 identifies several "required", "conditionally required", and "desired" variables needed to populate the intersection leg information.

Table 3.28: SafetyAnalyst (*AltLeg* Table) Data Variable Needs

Required Variables	Conditionally Required	Desired Variables
Oregon: Highway Inventory Detail Report		
• agencyID[1]	N/A	N/A
Oregon: Lane Report		
N/A	N/A	• legNumLeftTurnLane • legNumRightTurnLane • legNumThruLane
Requires additional data (may acquire some data from the Digital Video Log and GIS Databases)		
• legDirection • legID[2] • legMedianType • legType • operationWay[3]	• leftTurnPhasing	• postedSpeed[3] • turnProhibitions

[1]Variable included in all nine SafetyAnalyst site characteristic tables
[2]Variable included in SafetyAnalyst tables *AltLeg* and *AltLegTraffic*
[3]Variable included in SafetyAnalyst tables *AltRoadwaySegment* and *AltLeg*

Three of the variables contained in the *AltLeg* table were previously described in the *AltRoadwaySegment* table summary (see Section 3.2.1) and are not repeated in this section. These variables include the *agencyID, operationWay,* and *postedSpeed* variables. The remaining variables are reviewed in the following sections.

3.2.8.1 Intersection Leg Variables in the Oregon "Lane Report"

Three SafetyAnalyst variables (*legNumLeftTurnLane*, *legNumRightTurnLane,* and *legNumThruLane*) can be populated from data contained in the Oregon "Lane Report." These variables are further defined in the following section.

***legNumLeftTurnLane* – Number of Left Turn Lanes**

The *legNumLeftTurnLane* SafetyAnalyst "desired" variable identifies the number of exclusive left-turn lanes on the approach. This value must be a whole number and can be populated by the "LTL" column in the Oregon "Lane Report."

***legNumRightTurnLane* – Number of Right Turn Lanes**

The *legNumRightTurnLane* SafetyAnalyst "desired" variable identifies the number of exclusive right-turn lanes on the approach. This value must be a whole number and can be populated by the "RTW" column in the Oregon "Lane Report."

***legNumThruLane* – Thru Lanes**

The *legNumThruLane* SafetyAnalyst "desired" variable identifies the number of through lanes on the intersection approach. This number includes all lanes with a through movement, even if they are shared with turning movements. Exclusive turn lanes are not

included. This variable can be populated by adding the number of non-zero lanes (LN1, LN2, … LN6) in the Oregon "Lane Report."

3.2.8.2 Intersection Leg Variables that Require Additional Data Collection Efforts

Several variables cannot be fully populated or do not have comparable Oregon information available in currently available databases. These variables are reviewed in the following sections.

***leftTurnPhasing* – Left-Turn Phasing**

The *leftTurnPhasing* SafetyAnalyst "conditionally required" variable applies only to signalized intersections and identified the traffic signal phasing associated with the left turn movement. Input options for this variable include:

1 - Protected left-turn phasing on the approach;
2 - Protected/permitted left-turn phasing on the approach;
3 - Permitted left-turn phasing on the approach;
4 - No left-turn phasing on the approach;
98 - Phasing is not applicable; and
99 - Unknown left-turn phasing.

There is currently no comprehensive Oregon database that can be used to fully populate this variable.

***legDirection* – Direction**

The *legDirection* SafetyAnalyst "required" variable identifies the approach direction for the various intersection legs. Input options include:

NB – Northbound approach;
SB – Southbound approach;
WB – Westbound approach;
EB - Eastbound; and
X – Unknown.

This information could be developed from Oregon GIS and digital video resources; however, it would require considerable effort. This value could be approximated based on the prevailing direction of the road (assumed to apply to the major road).

***legID* – Leg ID**

The *legID* SafetyAnalyst "required" variable is a value that designates the leg number. Candidate input values include:

1- Leg 1;
2- Leg 2;

3- Leg 3;
4- Leg 4;
5- Leg 5; and
6- Leg 6.

This value can be assigned by the user during the input process and, though not currently available in an Oregon database, can be easily developed. In addition to inclusion in the *AltLeg* table, the *legID* variable is also included in the *AltLegTraffic* table.

***legMedianType* – Median Type**

The *legMedianType* SafetyAnalyst "required" variable identifies the character of the area that separates opposing traffic lanes at an intersection. Input options for this variable include:

1 - Raised median with curb;
2 - Depressed median;
3 - Flush paved median [at least 4 ft in width];
4 - Other divided;
5 - Undivided;
0 - Other; and
99 - Unknown.

The Oregon "Lane Report" includes information about the type of median for the major and minor road at an intersection, but does not specifically address the median type for individual approaches. This variable could be populated by extracting data from the Video Log or by using aerial photos; however, such an effort would require considerable effort. As an alternative, this value could be estimated by using the median types included in the "Lane Report" and assuming that they apply to both sides of an intersection.

***legType* - Type**

The *legType* SafetyAnalyst "required" variable indicates if the leg is on the major or the minor road and where it is located relative to the other legs. Input options include:

1 - Major road approach in the primary increasing milepost direction;
2 - Major road approach in the secondary or decreasing milepost direction;
3 - Minor road approach to right of the primary or increasing milepost direction;
4 - Minor road approach to left of the primary or increasing milepost direction;
98 - Not valid, e.g., 4th (unused) leg of a three-legged intersection; and
99 - Unknown.

This variable is not available in any of the Oregon databases, but could be populated by extracting data from the Video Log or by using aerial photos; however, such an effort would require considerable effort. It would also be possible to develop a query search and extract the information from the "Lane Report" by locating intersections and then

identifying the legs and direction of stationing. This method would require minimal computer programming and would be much less time consuming than a manual effort.

***turnProhibitions* – Turn Prohibitions**

The *turnProhibitions* SafetyAnalyst "desired" variable describes any turn restrictions associated with vehicles as they depart an approach. Input options include:

1 - No left turns any time;
2 - No left turns during specific times;
3 - No right turns any time;
4 - No right turns during specific times;
5 - No U turns;
6 - Other;
98 - No turn prohibitions; and
99 - Unknown.

At this time, there does not appear to be an Oregon database that could fully populate this variable. Since SafetyAnalyst does not require the variable, the development of this information would not be a high priority for the purposes of using SafetyAnalyst for Oregon data.

3.2.9 Roadway Variables in the SafetyAnalyst *AltLegTraffic* Table

The traffic volume information for the various intersection legs as required by SafetyAnalyst is included in an input table named *AltLegTraffic*. Each of these variable names and companion Oregon data sources, when available, are identified in Table 3.29. The required intersection leg traffic information not previously defined, unfortunately, is not readily available in an Oregon database. The variables are further divided into "required" and "desired" values as defined by the SafetyAnalyst.

Table 3.29: SafetyAnalyst (*AltLegTraffic* Table) Data Variable Needs

Required Variables	Desired Variables
Oregon: Highway Inventory Detail Report	
• agencyID[1]	N/A
Oregon: Traffic Volumes and Vehicle Classification Report	
• aadtVPD[2] • calendarYear[2]	N/A
Requires additional data (may acquire some data from the Digital Video Log and GIS Databases)	
• leftTurnVolume • legID[3] • rightTurnVolume • throughVolume	N/A

[1]Variable included in all nine SafetyAnalyst site characteristic tables
[2]Variable included in SafetyAnalyst tables *AltSegmentTraffic*, *AltRampTraffic*, *AltMajorRoadTraffic*, *AltMinorRoadTraffic*, and *AltLegTraffic*
[3]Variable included in SafetyAnalyst tables *AltLeg* and *AltLegTraffic*

One of the variables contained in the *AltLegRoadTraffic* table was previously described in the *AltRoadwaySegment* table summary (see Section 3.2.1) and is not repeated in this section. This variable is the *agencyID.*

Two additional variables contained in the *AltLegRoadTraffic* table were previously described in the *AltSegmentTraffic* table summary (see Section 3.2.2) and are not repeated in this section. These variables are the *aadtVPD* and the *calendarYear*.

In addition, the *legID* variable included in the *AltLegRoadTraffic* table was previously described in the *AltLeg* table summary (see Section 3.2.8) and so is not repeated in this section.

The remaining three variables included in the *AltLegRoadTraffic* table all require additional data collection and are reviewed in the following section.

3.2.9.1 Intersection Leg Variables that Require Additional Data Collection Efforts

The three remaining intersection leg variables are reviewed in the following sections.

***leftTurnVolume* – Left Turn Volume**

The *leftTurnVolume* SafetyAnalyst "required" variable identifies the average number of vehicles that exit an intersection approach leg and turn left onto a cross street. This value can be expressed as vehicles per day or as the design hourly volume. Available Oregon databases do not included detailed turn movement data, so new data is required to populate this field. Until this data is available, the AADT values could be proportionally distributed to populate this field but these values would be very rough estimates and would not reliably represent turn volumes at unique locations.

***rightTurnVolume* – Right Turn Volume**

The *rightTurnVolume* SafetyAnalyst "required" variable identifies the average number of vehicles that exit an intersection approach leg and turn right onto a cross street. This value can be expressed as vehicles per day or as the design hourly volume. Available Oregon databases do not included detailed turn movement data, so new data is required to populate this field. Until this data is available, the AADT values could be proportionally distributed to populate this field but these values would be very rough estimates and would not reliably represent turn volumes at unique locations.

***throughVolume* – Thru Volume**

The *throughVolume* SafetyAnalyst "required" variable identifies the average number of vehicles that travel straight through an intersection. This value can be expressed as vehicles per day or as the design hourly volume. Available Oregon databases do not included detailed turn movement data, so new data is required to populate this field since

it would include the total approach leg traffic volume minus the turning volume. Until this data is available, the AADT values could be proportionally distributed to populate this field but these values would be very rough estimates and would not reliably represent traffic volumes at unique locations.

3.3 DATA VARIABLE ASSESSMENT SUMMARY

Successful network screening using SafetyAnalyst can be accomplished using crash data (*AltAccident* input table variables) and roadway data (input tables *AltRoadwaySegment, AltSegmentTraffic, AltRamp, AltRampTraffic, AltIntersection, AltMajorRoadTraffic, AltMinorRoadTraffic, AltLeg,* and *AltLegTraffic*). Though only the "required" variables are essential to perform the analysis, the "conditionally required" and "desired" variables permit a more comprehensive SafetyAnalyst assessment.

In addition to the roadway and crash data, SafetyAnalyst also includes the *AltConstructionProject* and the *AltImplementedCountermeasure* input tables. Analysis of these optional input tables is beyond the scope of this research effort.

Table 3.1 identified that current Oregon crash data variables and their compatibility with SafetyAnalyst and noted the following characteristics:

- Eleven "required" crash data variables are comparable or can be approximated using Oregon crash data;
- Seven "required" or "conditionally required" crash data variables can be generated in a truncated form; and
- Two "required" crash data variables need additional data collection.

In addition, Table 3.1 summarizes "desired" variables that will enhance the analysis but are not mandatory. Eleven of these variables are directly comparable, ten can be developed in a truncated form, and only four of the "desired" variables are not available and would require some additional data collection.

The Oregon road data varies considerably from the format of the associated SafetyAnalyst variables; however, any supplemental data collection efforts should focus on the "required" and "conditionally required" variables needed to populate the nine road data input tables. Four of the traffic-based tables do not require any additional data collection, but five of the input tables include essential variables that Oregon agencies would need to develop by either estimating the variable from current data sources or developing the variable through supplemental data collection efforts or crude approximation procedures. Table 3.30 depicts these data gaps for the roadway data and further divides them into the "can be estimated" versus the "must develop" categories. As shown in this table, the focus for the generation of new variables should first include the "required" variables that must be developed. A total of seven variables meet this criterion. In addition, there are five variables that must be developed for the "conditionally required" category. In total, 12 variables have supplemental data needs,

though crude estimates for these variables could enable analysts to successfully use SafetyAnalyst until such time as the data collection effort can be expanded.

Table 3.30: Overview of "Required" and "Conditional Required" Data Gaps

Required Variables		Conditionally Required Variables	
Can Estimate with Minimal Effort	**Must Develop from New Data**	**Can Estimate with Minimal Effort**	**Must Develop from New Data**
***AltRoadwaySegment* Table (see Table 3.21)**			
• accessControl • locSystem[1] • openedToTraffic[2] • operationWay[3] • travelDirection	• interchange Influence • postedSpeed	• discontinuity	N/A
***AltRamp* Table (see Table 3.23)**			
• locSystem[1] • openedToTraffic[2]	• rampConfiguration	• rampType	• rampCrossroad Connection • rampFreeway Connection
***AltIntersection* Table (see Table 3.25)**			
• intersectionType1 • majorRoad Direction • majorRoadLoc System • offsetDistance • offsetIntersection • openedToTraffic[2]	• trafficControl1	N/A	• majBeginInfluence Zone • MajEndInfluence Zone
***AltLeg* Table (see Table 3.28)**			
• legDirection • legID[4] • legMedianType • legType • operationWay[3]	N/A	N/A	• leftTurnPhasing
***AltLegTraffic* Table (see Table 3.29)**			
• legID[4]	• leftTurnVolume • rightTurnVolume • throughVolume	N/A	N/A

[1] Located in the *AltRoadwaySegment* and *AltRamp* Tables
[2] Located in the *AltRoadwaySegment, AltRamp,* and *AltIntersection* Tables
[3] Located in the *AltRoadwaySegment* and *AltLeg* Tables
[4] Located in the *AltLeg* and *AltLegTraffic* Tables

As noted in this chapter, in some instances the roadway variables can be populated with minimal effort; however, several of the variables require considerable effort to fully develop. As a result, subsequent chapters of this report evaluate data input efforts for

case studies followed by a sensitivity analysis of key variables. The results of these two efforts can then be used to strategically determine if SafetyAnalyst is a practical tool for the state of Oregon to adopt and, if so, what variables are critical for data collection as compared to variables that could be approximately and have very little influence on the overall analysis results.

4 CASE STUDY EVALUATION

Though the SafetyAnalyst cannot be fully evaluated until the entire state of Oregon dataset has been reformatted for import purposes, it is practical to initially perform tests on a subset of corridors to determine if the basic conversions will succeed. As a result, the project research team developed input data for seven short Oregon highway segments. These facilities were characterized by a variety of road features so as to evaluate the data needs for all nine of the roadway input tables as well as the one input table for the crash data.

As indicated in Section 3.3, several "required" SafetyAnalyst variables did not have exact matches available in the Oregon data. For these locations, the project team approximated the conversion values so that the functionality of the SafetyAnalyst could be assessed. As a result, the output recommendations may not truly represent the expected safety, as predicted by SafetyAnalyst, for every facility. The project team's goal for this activity was to evaluate the import and execution of the software tool. This effort is briefly summarized in the following sections.

4.1 SITE SELECTION

The goal of this project was to evaluate how SafetyAnalyst, which is generally based on Part B, Volume 1 of the HSM, will adapt to highway facilities in the state of Oregon. Since this evaluation should be general, the project team selected sample test sites from a variety of locations in Oregon. These sites incorporated a variety of road functional classifications as well as facilities with ramps and intersections. Of the seven sample sites, the project team randomly selected six of the facilities. The team strategically elected to include Highway 026 since this highway experienced a large number of crashes in 2008 (the focus year for this assessment). Table 4.1 provides a summary of these sample site locations.

Table 4.1: Description of Sample Test Sites

Highway No	Length (miles)	Number of Segments	Number of Intersections	Number of Ramps
007	1.04	7	7	0
026	1.02	5	16	0
029	1.02	3	6	0
033	1.25	6	2	2
102	2.43	4	5	0
226	3.10	5	6	0
271	2.77	4	5	0

4.2 SAMPLE DESIGN

For the purposes of this assessment effort, the research team has adopted crash information obtained from the 2008 Oregon statewide crash data. The selection of the 2008 data coincided with the most complete crash database available at the time of project initialization. The companion roadway data can be acquired from a variety of data sources that extend over a period of years. These data sources for individual variables were previously identified in Section 3.2 and are further summarized in Table 8.5 located in the appendix of this report.

To demonstrate the required input data, this section includes a series of tables with sample input content used in the evaluation. Only Highway 007 and Highway 033 are shown in these tables since they collectively provide most of the roadway data input options; however, Section 8.2 of the appendix provides the SafetyAnalyst network screening analysis report for all sample test sites.

4.2.1 Crash Data Used

Table 4.2 demonstrates a portion of the crash data used in the *AltAccident* table (see Section 3.1 for a detailed review of the individual variables). Due to the large number of variables, Table 4.2 extends across two pages and a specific crash is linked by the discrete *agencyID* value. As previously demonstrated in Table 3.1, the crash data variables that are "required" and need additional data collection (or a modification of the definition) are the *v1InitialTravelDirection* and the *v2InitialTravelDirection* variables. The project team approximated the content for these two variables and the associated columns in Table 4.2 are shaded to identify estimated content. For the purposes of this estimate, the Oregon crash data vehicle maneuver direction information has been used to populate these variables.

Table 4.2: Sample Input Data for the *AltAccident* Table (Highway 007 and 033)

agencyID	locSystem	routeType	routeName	county	locOffset	accidentDate	accidentTime	accidentSeverity1	numberOfFatalities	numberOfInjuries	Junction Relationship	drivewayIndicator	lightCondition	weatherCondition	surfaceCondition	collisionType	Environment Condition	roadCondition	workZone
1289485	A	US	7	9	1.51	20080505	7	P	0	0	2	1	1	1	1	21	99	2	N
1275311	A	US	7	9	1.95	20080120	16	P	0	0	2	1	4	6	5	25	2	2	X
1298572	A	US	7	9	2.16	20081125	13	P	0	0	4	2	1	1	1	21	99	2	N
1292177	A	US	7	9	2.18	20080717	12	P	0	0	2	1	1	1	1	21	99	2	X
1297398	A	US	7	9	2.18	20080609	19	C	0	2	2	1	1	1	1	24	99	2	X
1297919	A	US	7	9	2.24	20081008	12	B	0	1	1	1	1	1	1	3	1	2	N
1297659	A	US	7	9	2.28	20080917	17	P	0	0	1	1	1	1	1	25	99	2	X
1298834	A	US	7	9	2.28	20081209	17	C	0	1	3	1	5	1	1	21	99	2	X
1284380	A	US	7	9	2.29	20080407	18	A	0	1	2	1	3	1	1	21	99	2	X
1297722	A	US	7	9	2.29	20081003	5	C	0	1	2	1	4	2	1	24	99	2	N
1297877	A	US	7	9	2.29	20081023	10	P	0	0	2	1	1	1	1	27	1	2	X
1309268	A	US	7	9	2.29	20080317	5	B	0	1	2	1	4	1	1	24	99	2	N
1297759	A	US	7	9	2.55	20080818	14	P	0	0	2	1	1	99	99	24	99	99	X
1297852	A	US	7	9	2.55	20080824	15	B	0	1	2	1	1	1	1	21	99	2	X
1302958	A	US	7	9	2.55	20081210	17	P	0	0	2	1	3	1	1	21	1	2	X
1300744	A	US	33	2	55.44	20081029	8	C	0	1	2	1	1	1	1	21	99	2	N
1306559	A	US	33	2	55.44	20081225	18	C	0	1	3	1	4	4	2	21	99	2	X
1286875	A	US	33	2	55.45	20080612	16	C	0	1	2	1	1	1	1	21	99	2	N
1286878	A	US	33	2	55.45	20080603	8	C	0	1	2	1	1	1	1	21	99	2	X
1304755	A	US	33	2	55.45	20081021	20	P	0	0	2	1	4	1	1	27	99	2	N
1274177	A	US	33	2	55.46	20080125	9	P	0	0	1	1	1	1	5	21	99	2	X
1287041	A	US	33	2	55.46	20080603	8	C	0	1	1	1	1	1	1	22	99	2	X
1286186	A	US	33	22	56.76	20080523	13	P	0	0	1	1	1	2	3	21	99	2	N

Table 4.2: Sample Input Data for the *AltAccident* Table (Highway 007 and 033) (continued)

agencyID	numVehicles	drugInvolved	towIndicator	runoffIndicator	pedestrianIndicator	bikeIndicator	v1vehicleManeuver	v2vehicleManeuver	v1firstEvent	v2firstEvent	v1vehicle Configuration	v2vehicle Configuration	v1driverDOB	v2driverDOB	schoolBus	v1initialTravel Direction	v2initialTravel Direction	sideOfDivided Highway
1289485	3	1	N	N	N	N	1	12	14	14	1	1	17	47	1	WB	WB	WB
1275311	2	1	N	N	N	N	1	1	14	14	1	1	25	56	1	WB	WB	WB
1298572	2	1	N	N	N	N	1	12	14	14	1	1	39	31	1	EB	EB	EB
1292177	2	1	N	N	N	N	1	12	14	14	1	1	0	52	1	EB	EB	EB
1297398	2	1	N	N	N	N	1	1	14	14	1	1	19	67	1	EB	NB	EB
1297919	1	1	N	Y	N	Y	8		11		1		52		1	EB		EB
1297659	2	1	N	N	N	N	1	1	14	14	1	1	20	16	1	EB	EB	EB
1298834	2	1	N	N	N	N	1	12	14	14	1	1	43	26	1	EB	EB	EB
1284380	2	1	N	N	N	N	1	12	14	14	1	1	0	58	1	NB	NB	NB
1297722	2	1	N	N	N	N	1	1	14	14	1	1	38	52	1	EB	NB	EB
1297877	3	1	N	N	N	N	1	5	14	14	1	1	84	30	1	WB	WB	WB
1309268	2	2	N	N	N	N	1	1	14	14	5	1	68	23	1	WB	SB	WB
1297759	2	1	N	N	N	N	6	1	14	14	1	1	0	21	1	WB	EB	WB
1297852	2	2	N	N	N	N	1	12	14	14	1	1	24	61	1	NB	NB	NB
1302958	3	1	N	N	N	N	1	12	14	14	1	1	0	0	1	NB	NB	NB
1300744	2	1	N	N	N	N	1	12	14	14	1	1	61	16	1	EB	EB	EB
1306559	2	1	N	N	N	N	1	12	14	14	1	1	17	32	1	EB	EB	EB
1286875	2	1	N	N	N	N	1	12	14	14	1	1	44	38	1	WB	WB	WB
1286878	2	1	N	N	N	N	1	12	14	14	1	1	41	17	1	EB	EB	EB
1304755	2	1	N	N	N	N	6	1	14	14	1	1	20	22	1	EB	NB	EB
1274177	2	1	N	N	N	N	1	12	14	14	1	1	21	0	1	WB	WB	WB
1287041	2	1	N	N	N	N	1	1	14	14	1	1	40	25	1	EB	WB	EB
1286186	2	1	N	N	N	N	1	12	14	14	1	1	22	44	1	NB	NB	NB

4.2.2 Roadway Data Used

For the roadway data, sample information for the nine SafetyAnalyst road data input tables are shown in the following report tables:

- Table 4.3 – *AltRoadwaySegment* sample input;
- Table 4.4 – *AltSegmentTraffic* sample input;
- Table 4.5 – *AltRamp* sample input;
- Table 4.6 – *AltRampTraffic* sample input;
- Table 4.7 – *AltIntersection* sample input;
- Table 4.8 – *AltMajorRoadTraffic* sample input;
- Table 4.9 – *AltMinorRoadTraffic* sample input;
- Table 4.10 – *AltLeg* sample input; and
- Table 4.11 – *AltLegTraffic* sample input.

Since the section of Highway 007 included in this case study does not include any ramps, Table 4.5 and Table 4.6 only depict Highway 033 data. All of the other road data tables include road characteristic data for both Highway 007 and Highway 033. Each "required" variable column that warrants additional data collection or clarification (see Table 3.30) has been estimated for this effort and is shaded in the appropriate table.

Ideally traffic volume data, when possible, should be used for the same year as the crash data. For the purposes of this effort, however, traffic data for the year 2010 has been incorporated. SafetyAnalyst does use the associated year in combination with a growth factor to estimate alternative year values of traffic. When possible, optimal AADT input data for SafetyAnalyst should include crash data, traffic volume, and roadway data for the same period of time.

Table 4.3: Sample Input Data for the *AltRoadwaySegment* Table (Highway 007 and 033)

agencyID	locSystem	routeType	routeName	county	startOffset	endOffset	altRoute Names	majorRoad Name	segment Length	district	city	jurisdiction	areaType	roadwayClass1	d1numThruLane	d2numThruLane	d1auxLane1	d1auxLane2	d1auxLane3	d2auxLane1	d2auxLane2	d2auxLane3	d1avgLane Width
007S1	A	US	7	Deschutes	1.61	1.70	Greenwood Ave	Central Oregon Hwy	0.09	10	Bend	2	U	3	2	2	7	0	0	7	0	0	12
007S2	A	US	7	Deschutes	1.70	1.80	Greenwood Ave	Central Oregon Hwy	0.10	10	Bend	2	U	3	2	2	7	4	0	7	4	0	12
007S3	A	US	7	Deschutes	1.86	1.92	Greenwood Ave	Central Oregon Hwy	0.06	10	Bend	2	U	3	2	2	7	0	0	7	0	0	12
007S4	A	US	7	Deschutes	2.00	2.17	Greenwood Ave	Central Oregon Hwy	0.17	10	Bend	2	U	3	2	2	7	4	0	7	4	0	12
007S5	A	US	7	Deschutes	2.19	2.27	Greenwood Ave	Central Oregon Hwy	0.08	10	Bend	2	U	3	2	2	7	4	0	7	4	0	12
007S6	A	US	7	Deschutes	2.30	2.38	Greenwood Ave	Central Oregon Hwy	0.08	10	Bend	2	U	3	2	2	7	4	0	7	4	0	12
007S7	A	US	7	Deschutes	2.41	2.54	Greenwood Ave	Central Oregon Hwy	0.13	10	Bend	2	U	3	2	2	7	4	0	7	4	0	12
033S1	A	US	33	Benton	55.45	55.55	OR 34	Corvallis-Newport Hwy	0.1	4	Corvallis	2	U	3	1	1	7	0	0	0	0	0	12
033S2	A	US	33	Benton	55.55	55.65	OR 34	Corvallis-Newport Hwy	0.1	4	Corvallis	2	U	3	1	1	7	4	0	4	0	0	12
033S3	A	SR	33	Benton	55.65	55.81	N/A	Corvallis-Newport Hwy	0.16	4	Corvallis	2	U	3	1	1	7	0	0	7	0	0	12
033S4	A	SR	33	Benton	55.81	56.14	N/A	Corvallis-Newport Hwy	0.33	4	Corvallis	2	U	3	1	1	7	0	0	7	0	0	12
033S5	A	SR	33	Linn	56.14	56.47	N/A	Corvallis-Newport Hwy	0.33	4	N/A	2	R	3	1	1	7	0	0	7	0	0	12
033S6	A	SR	33	Linn	56.47	56.8	N/A	Corvallis-Newport Hwy	0.33	4	N/A	2	R	3	2	1	7	0	0	7	0	0	12

Table 4.3: Sample Input Data for the *AltRoadSegment* Table (Highway 007 and 033) (continued)

agencyID	d2avgLane Width	medianType1	medianWidth	d1shoulder TypeOut	d1shoulder TypeIn	d2shoulder TypeOut	d2shoulder TypeIn	d1avgShoulder WidthOut	d1avgShoulder WidthIn	d2avgShoulder WidthOut	d2avgShoulder WidthIn	accessControl	driveway Density	postedSpeed	operationWay	travel Direction	increasing Mileposts	d1bikeway	d2bikeway	interchange Influence	openedTo Traffic	discontinuity
007S1	12	4	14	1	1	1	1	6	1	6	1	99	0	45	2	EB	EB	3	3	N	19481103	N
007S2	12	0	0	1	6	1	6	6	0	6	0	99	30	45	2	EB	EB	3	3	N	19481103	Y
007S3	12	4	14	1	1	1	1	6	1	6	1	99	0	45	2	EB	EB	3	3	N	19481103	Y
007S4	12	0	0	1	6	1	6	6	0	6	0	99	5	45	2	EB	EB	3	3	N	19481103	Y
007S5	12	0	0	1	6	1	6	6	0	6	0	99	13	45	2	EB	EB	3	3	N	19481103	Y
007S6	12	0	0	1	6	1	6	6	0	6	0	99	13	45	2	EB	EB	3	3	N	19481103	Y
007S7	12	0	0	1	6	1	6	6	0	6	0	99	23	45	2	EB	EB	3	3	N	19481103	Y
033S1	12	6	12	6	6	1	6	0	0	8	0	99	0	45	2	EB	EB	3	1	N	19590529	N
033S2	12	0	0	1	6	1	6	12	0	8	0	99	10	45	2	EB	EB	3	1	Y	19590529	Y
033S3	12	6	4	1	6	1	6	12	0	8	0	99	0	45	2	EB	EB	3	3	Y	19590529	Y
033S4	12	0	0	1	6	1	6	6	0	4	0	99	0	55	2	EB	EB	3	3	Y	19590529	Y
033S5	12	0	0	1	6	1	6	7.63	0	7.25	0	99	0	55	2	EB	EB	3	3	N	19590529	Y
033S6	12	0	0	1	6	1	6	8	0	8	0	99	0	55	2	EB	EB	3	3	N	19590529	Y

Table 4.4: Sample Input Data for the *AltSegmentTraffic* Table (Highway 007 and 033)

agencyID	calendarYear	aadtVPD	percentHeavyVehicles	peakHourlyVolume
007S1	2010	21400	4.83	1070
007S2	2010	21400	4.83	1070
007S3	2010	21400	4.83	1070
007S4	2010	21400	4.83	1070
007S5	2010	14400	4.49	720
007S6	2010	14400	4.49	720
007S7	2010	14400	4.49	720
033S1	2010	16100	7.78	805
033S2	2010	16100	7.78	805
033S3	2010	16100	7.78	805
033S4	2010	14300	7.78	715
033S5	2010	14300	7.78	715
033S6	2010	14300	7.78	715

Table 4.5: Sample Input Data for the *AltRamp* Table (Highway 033)

agencyID	locSystem	routeType	routeName	startOffset	endOffset	altRouteNames	majorRoadName	county	district	city	jurisdiction	areaType	rampType	ramp Configuration	rampFreeway Connection	rampCrossroad Connection	numOfLanes	rampLength	openedToTraffic
033R1	A	US	33	55.55	55.82	OR 34	Pacific Highway West Hwy	Benton	4	Corvallis	2	U	2	5	3	1	1	0.27	19880920
033R2	A	SR	33	55.65	55.98	N/A	Corvallis-Newport Hwy	Benton	4	Corvallis	2	U	1	5	2	1	1	0.31	19880920
033R3	A	US	33	56.81	57.12	OR 34	Pacific Highway West Hwy	Linn	4	N/A	2	R	2	5	1	1	1	0.31	19880920
033R4	A	SR	33	56.14	56.46	N/A	Corvallis-Newport Hwy	Linn	4	N/A	2	R	1	5	2	1	1	0.31	19880920

Table 4.6: Sample Input Data for the *AltRampTraffic* Table (Highway 033)

agencyID	calendarYear	aadtVPD
033R1	2010	3700
033R2	2010	3400
033R3	2010	2600
033R4	2010	990

Table 4.7: Sample Input Data for the *AltIntersection* Table (Highway 007 and 033)

agencyID	majorRoad LocSystem	routeType	routeName	county	majorRoad Offset	minorRoad LocSystem	minorRoad RouteType	minorRoad RouteName	altRoute Names	majorRoad Name	minorRoad Name
007I1	A	US	7	Deschutes	1.50	A	L	15th St	N/A	Central Oregon Hwy	15th St
007I2	A	US	7	Deschutes	1.80	A	L	Arnett Way	N/A	Central Oregon Hwy	Arnett Way
007I3	A	US	7	Deschutes	1.92	A	L	Azure Dr	N/A	Central Oregon Hwy	Azure Dr
007I4	A	US	7	Deschutes	2.17	A	L	Dean Swift Rd	N/A	Central Oregon Hwy	Dean Swift Rd
007I5	A	US	7	Deschutes	2.27	A	L	NE Purcell Blvd	N/A	Central Oregon Hwy	NE Purcell Blvd
007I6	A	US	7	Deschutes	2.38	A	L	Windy Knolls Dr	N/A	Central Oregon Hwy	Windy Knolls Dr
007I7	A	US	7	Deschutes	2.54	A	L	27th St	N/A	Central Oregon Hwy	27th St
033I1	A	US	33	Benton	55.50	A	L	SW 15th St	OR 34	Corvallis-Newport Hwy	SW 15th St
033I2	A	SR	33	Linn	56.75	A	SR	OR 34	N/A	Corvallis-Lebanon Hwy	Corvallis-Newport Hwy

Additional Variable Information:

agencyID	majorRoad Direction	majBegin Influence Zone	minBegin Influence Zone	majEnd Influence Zone	minEnd Influence Zone	district	city	jurisdiction	areaType	intersection Type1	traffic Control1	offset Intersection	offset Distance	openedTo Traffic
007I1	EW	1.50	0.047	1.61	0.047	10	Bend	2	U	1	11	N	0	19481103
007I2	EW	1.80	0.047	1.86	0.047	10	Bend	2	U	1	2	N	0	19481103
007I3	EW	1.92	0.047	2.00	0.047	10	Bend	2	U	3	2	N	0	19481103
007I4	EW	2.17	0.047	2.19	0.047	10	Bend	2	U	3	2	N	0	19481103
007I5	EW	2.27	0.047	2.30	0.047	10	Bend	2	U	3	12	N	0	19481103
007I6	EW	2.38	0.047	2.41	0.047	10	Bend	2	U	1	2	N	0	19481103
007I7	EW	2.54	0.047	2.60	0.047	10	Bend	2	U	3	12	N	0	19481103
033I1	EW	55.40	0.047	55.50	0.047	4	Corvallis	2	U	3	14	N	0	19590529
033I2	EW	56.75	0.047	56.85	0.047	4	N/A	2	R	3	14	N	0	19590529

Table 4.8: Sample Input Data for the *AltMajorRoadTraffic* Table (Highway 007 and 033)

agencyID	calendarYear	aadtVPD
007I1	2010	21400
007I2	2010	21400
007I3	2010	21400
007I4	2010	21400
007I5	2010	14400
007I6	2010	14400
007I7	2010	14400
033I1	2010	16100
033I2	2010	32500

Table 4.9: Sample Input Data for the *AltMinorRoadTraffic* Table (Highway 007 and 033)

agencyID	calendarYear	aadtVPD
007I1	2008	7816
007I2	2010	999
007I3	2010	999
007I4	2010	999
007I5	2009	6791
007I6	2010	999
007I7	2010	999
033I1	2010	1450
033I2	2010	16100

Table 4.10: Sample Input Data for the *AltLeg* Table (Highway 007 and 033)

agencyID	legID	legType	leg Direction	legNum ThruLane	legNumLeft TurnLane	leg NumRight Turn Lane	legMedian Type	leftTurn Phasing	posted Speed	turn Prohibitions	operation Way
007I1	1	1	EB	4	0	1	1	4	45	98	2
007I1	2	2	WB	4	1	0	1	3	45	98	2
007I1	3	3	NB	1	1	1	3	1	25	98	2
007I2	1	1	EB	4	0	0	1	98	45	98	2
007I2	2	2	WB	4	0	0	1	98	45	98	2
007I2	3	4	SB	1	0	1	5	98	25	98	2
007I3	1	1	EB	4	1	0	1	98	45	98	2
007I3	2	2	WB	4	1	0	5	98	45	98	2
007I3	3	3	NB	1	0	1	1	98	15	98	2
007I3	4	4	SB	2	0	0	5	98	25	98	2
007I4	1	1	EB	4	1	0	5	98	45	98	2
007I4	2	2	WB	4	1	0	5	98	45	98	2
007I4	3	3	NB	1	0	1	1	98	25	98	2
007I4	4	4	SB	2	0	0	5	98	25	98	2
007I5	1	1	EB	4	1	0	5	1	45	98	2
007I5	2	2	WB	4	1	0	5	1	45	98	2
007I5	3	3	NB	2	1	0	5	1	25	98	2
007I5	4	4	SB	2	1	0	5	1	25	98	2
007I6	1	1	EB	4	1	1	1	98	45	98	2
007I6	2	2	WB	4	1	0	5	98	45	98	2
007I6	3	3	NB	2	0	0	5	98	25	98	2
007I7	1	1	EB	4	1	0	5	1	45	98	2
007I7	2	2	WB	4	1	0	5	1	45	98	2
007I7	3	3	NB	4	1	0	1	1	25	98	2
007I7	4	4	SB	4	1	0	1	1	25	98	2
033I1	1	1	EB	2	1	1	5	1	45	98	2
033I1	2	2	WB	2	1	1	5	1	45	98	2
033I1	3	3	NB	2	0	0	5	3	25	98	2
033I1	4	4	SB	2	0	0	5	3	25	98	2
033I2	1	1	EB	4	1	0	3	1	45	98	2
033I2	2	2	WB	4	1	0	3	1	45	98	2
033I2	3	3	NB	3	0	1	5	3	55	98	2
033I2	4	4	SB	2	0	0	5	3	55	98	2

Table 4.11: Sample Input Data for the *AltLegTraffic* Table (Highway 007 and 033)

agencyID	legID	calendarYear	aadtVPD
007I1	1	2010	21400
007I1	2	2010	21400
007I1	3	2008	7816
007I2	1	2010	21400
007I2	2	2010	21400
007I2	3	2010	999
007I3	1	2010	21400
007I3	2	2010	21400
007I3	3	2010	999
007I3	4	2010	999
007I4	1	2010	21400
007I4	2	2010	14400
007I4	3	2010	999
007I4	4	2010	999
007I5	1	2010	14400
007I5	2	2010	14400
007I5	3	2009	6791
007I5	4	2009	6791
007I6	1	2010	14400
007I6	2	2010	14400
007I6	3	2010	999
007I7	1	2010	14400
007I7	2	2010	11500
007I7	3	2010	999
007I7	4	2010	999
033I1	1	2010	16100
033I1	2	2010	16100
033I1	3	2010	1450
033I1	4	2010	1450
033I2	1	2010	32500
033I2	2	2010	32500
033I2	3	2010	14300
033I2	4	2010	14300

Note: *leftTurnVolume, rightTurnVolume,* and *throughVolume* are listed as required variables, but the analysis runs successfully, in a reduced form, without the inclusion of these three items

4.3 SAMPLE OUTPUT

SafetyAnalyst automatically generates a network screening summary report following successful data conversion and analysis. The program initially creates the report in a *.rtf file format that can be converted to common word processing programs or saved as a *.pdf file. Included in a typical report are file statistics followed by a summary table that includes the candidate sites with potential for safety improvements in a ranked format and a note that defines the search method selected by the analyst. The average observed accidents (crash history), the average predicted accidents (based on using a safety performance function for prediction purposes), and the average expected

accidents (weighing the observed and expected using basic Empirical Bayes techniques) are included in the summary table. A full network screening sample report for the seven case studies is included in Section 8.2 on page 181. As notes in the output report, this example used the peak searching method for assessing sites for ranking purposes. The report also includes road segment limits, areas of emphasis, and the expected number of fatalities and injuries. Collectively this information can be used as one approach towards assessing the total crashes as well as the more serious injury and fatal crashes in a comprehensive network screening initiative.

5 SENSITIVITY ANALYSIS

Since funding data collection efforts must often occur as part of an established priority effort, one important issue regarding creating such a data collection ranking procedure would be to determine how essential a "required" SafetyAnalyst variable is towards the overall analysis. This section, therefore, reviews a sensitivity analysis conducted by the project research team for the "required" SafetyAnalyst variables.

The SafetyAnalyst sensitivity analysis only evaluated "required" or "conditionally required" variables for which data is not currently available. Many of the required variables do not actually have numeric values, but include items such as road names, crash identification numbers, or similar. In some instances, SafetyAnalyst simply reports the value and does not include it in the calculations. In other instances, however, SafetyAnalyst uses these textual variables to match crashes or sites. This report identifies those SafetyAnalyst variables that are used to link items between various tables or records as their content in not critical, but consistency is important for successful application of the SafetyAnalyst.

5.1 SENSITIVITY TEST OF SAFETYANALYST VARIABLES

As previously indicated, one crash input table and nine road characteristic input tables are critical for the application of SafetyAnalyst. Two supplemental tables can be used for construction and countermeasure assessments, but the functionality of these two tables has not been evaluated as they are beyond the scope of this effort. Each input table includes a collection of variables that are "required", "conditionally required", or "desired." For example, conditionally required variables may apply to ramp conditions and would only be needed at locations with on-ramps and off-ramps. The "desired" variables can add supplemental information to the analysis but are not critical for successful network screening efforts using SafetyAnalyst. Consequently, the research team did not evaluate "desired" variables in this sensitivity analysis as they are not essential analysis variables.

To assess a variable's sensitivity, the project team used the input tables developed for the case study evaluation and systematically modified individual variables to determine how these changes altered the overall results of the network screening when compared to the original data set (referred to as the control group for this assessment). If changing a variable altered the output results, the project team labeled the variable as "sensitive."

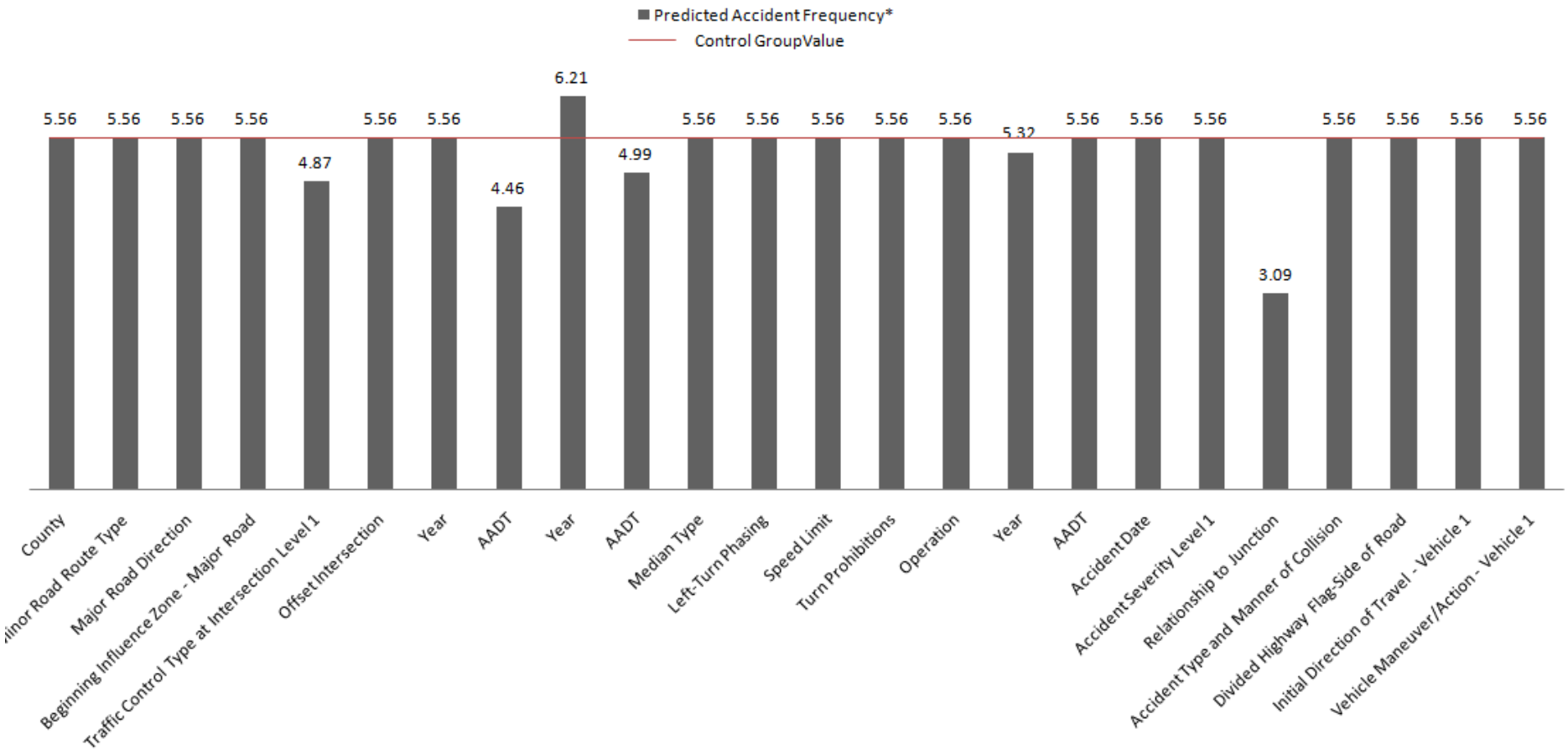

Figure 5.1: Comparison Sample

The overall sensitivity analysis required a series of evaluation runs and comparisons. For each of these, the project team modified the variables individually and then compared them to the original findings. As an example, a comparison sample is represented in Figure 5.1. The *siteID* for this sample (as created by the research team) was 026I2. This text-format variable can be interpreted as Highway 026, Intersection 2. The horizontal axis in the figure displays the names of test variables and the vertical axis represents the predicted crash frequency value calculated by SafetyAnalyst after the corresponding variable changes. The horizontal line represents the predicted crash frequency value of the control group. For example, the predicted crash frequency value for the "Relationship to Junction" variable is 5.56 crashes per year. If the *junctionRelationship* variable is unknown and a default volume is used, this unknown variable could modify the predicted crashes by up to 2.5 crashes per year as demonstrated in Figure 5.1. This example represents a small portion of how the project team performed this sensitivity comparison, but demonstrates the large number of variables and candidate permutations necessary for this analysis.

5.1.1 Crash Data Sensitivity

The SafetyAnalyst variable sensitivity analysis included crash data as well as road data variables. The SafetyAnalyst input table known as *AltAccident* includes the required crash data. The "required" and "conditionally required" variables, along with their associated descriptions, are shown in Table 5.1 and are based on the analysis previously summarized in Section 3.1.

Table 5.1: Crash-Related "Required" or "Conditionally Required" SafetyAnalyst Variables

SafetyAnalyst Variable	Description
Required Variables	
accidentDate	Accident Date
accidentSeverity1	Accident Severity Level
agencyID	Accident ID
collisionType	Crash Type and Manner of Collision
junctionRelationship	Relationship to Junction
locOffset	Crash Milepost/Distance
locSystem	Location System
numberOfFatalities	Number of Fatalities
numberOfInjuries	Number of Non-Fatal Injuries
numVehicles	Number of Vehicles Involved
routeName	Route Name
routeType	Route Type
v1InitialTravelDirection	Initial Direction of Travel for Vehicle 1
v2InitialTravelDirection	Initial Direction of Travel for Vehicle 2
v1vehicleManeuver	Vehicle Maneuver/Action 1
v2vehicleManeuver	Vehicle Maneuver/Action 2
Conditionally Required Variables	
sideOfDividedHighway	Divided Highway Flag-Side of Road

For crash data, several variables can be populated with Oregon data so there is no need to determine their sensitivity (since they are already available). Table 5.2 provides an overview of this crash data variable sensitivity analysis. For this table, the available Oregon data is summarized in the left column. The middle and right columns include variables that are not readily available and require additional data collection or some additional effort to extract from Oregon data sources. Of these, the research team found that only the *junctionRelationship* is a sensitive variable that would substantially alter the ranking results of the SafetyAnalyst network screening. Several variables are shown as not sensitive so collecting data to populate the variables shown in the right column would then be a lower priority. Note that the *routeType* and the *routeName* variables are used for matching purposes between tables and so need to be consistently populated.

Table 5.2: Sensitivity of Crash-Related Required Variables (*AltAccident* Table)

Can be Populated Using Current ODOT Data (Sensitivity Test Not Critical)	Required Variables in Need of Additional Data Collection or Development Efforts	
	Sensitive	Not Sensitive
• accidentDate • accidentSeverity1 • agencyID • locOffset • locSystem • numberOfFatalities • numberOfInjuries • numVehicles • routeName[1]	• junctionRelationship	• routeType[1] • collisionType • sideOfDividedHighway • v1InitialTravelDirection • v2InitialTravelDirection • v1vehicleManeuver • v2vehicleManuever

[1] Not a sensitive variable but must be consistently presented between the various input tables

5.1.2 Segment Data Sensitivity

The two segment-related SafetyAnalyst input tables, *AltRoadwaySegment* and *AltSegmentTraffic*, collectively include the roadway segment data necessary to assess general segment characteristics. Table 5.3 identifies the "required" and "conditionally required" variables and their associated descriptions for the roadway segment sensitivity analysis.

Table 5.4 depicts the sensitivity level of the segment-related variables. The two left columns represent data that is currently available from a collection of Oregon databases (see Section 3.2.1) and so it is not critical to perform a sensitivity analysis on these available data elements. For information purposes, the table still shows their sensitivity level, but since this information is already available this sensitivity is not included in the data collection priority assessment. As shown, the variables for *accessControl* and

operationWay are the two most sensitive unknown segment variables critical to the network screening analysis.

Table 5.3: Segment-Related "Required" and "Conditionally Required" SafetyAnalyst Variables

SafetyAnalyst Variable	Description
Required Variables	
aadtVPD	AADT
accessControl	Access Control
agencyID	Segment ID
altRouteNames	Alternate Route Names
areaType	Area Type
calendarYear	Year of AADT
d1auxLane1 thru d1auxLane3	Auxiliary Lanes for Direction 1
d2auxLane1 thru d2auxLane3	Auxiliary Lanes for Direction 2
d1numThruLane	Number of Through Lanes Direction 1
d2numThruLane	Number of Through Lanes Direction 2
endOffset	Ending Milepost/Distance
interchangeInfluence	Interchange Influence Area on Mainline Freeway
locSection	Segment Section
locSystem	Location System
majorRoadName	Major Road Name
medianType1	Median Type
openedToTraffic	Date Opened to Traffic
operationWay	Two-Way versus One-Way Operation
postedSpeed	Speed Limit
roadwayClass1	Roadway Class Level
routeName	Route Name
routeType	Route Type
segmentLength	Segment Length
startOffset	Starting Milepost/Distance
travelDirection	Direction of Travel
Conditionally Required Variables	
discontinuity	Discontinuity
medianWidth	Width of Median

Table 5.4: Sensitivity of Segment-Related Variables (*AtlRoadwaySegment* and *AltSegmentTraffic* Tables)

Can be Populated Using Current ODOT Data (Sensitivity Test Not Critical)		Required Variables in Need of Additional Data Collection or Development Efforts	
Sensitive	Not Sensitive	Sensitive	Not Sensitive
• aadtVPD • agencyID[1] • areaType • calendarYear • d1numThruLane • d2numThruLane • endOffset • locSection[1] • locSystem[2] • medianWidth • medianType1 • routeName • startOffset • segmentLength	• altRouteNames[1] • d1auxLane1 thru d1auxLane3 • d2auxLane1 thru d2auxLane3 • majorRoadName • roadwayClass1 • routeType[1]	• accessControl • locSystem[2] • operationWay	• discontinuity • interchangeInfluence • openedToTraffic • postedSpeed • travelDirection

[1] Not a sensitive variable but must be consistently presented between the various input tables
[2] Information available for state highways, but may be lacking for local roads

5.1.3 Ramp Data Sensitivity

The ramp-related variables that define SafetyAnalyst conditions associated with ramps are included in the SafetyAnalyst input tables *AltRamp* and *AltRampTraffic*. Detailed information about these variables is summarized in Section 3.2.3 (for ramp characteristics) and Section 3.2.4 (for ramp traffic volume information). Table 5.5 depicts these ramp-related "required" and "conditionally required" variables and their associated descriptions.

The sensitivity analysis procedure is similar to that described for other variables. As shown in Table 5.6, the *rampConfiguration* variable is the most sensitive unavailable variable. Note that previous analysis indicated that the variable *locSystem* may not always be available. For state-maintained highways, such as those with ramps, the mile point identification system applies and so this variable value is known and so is shown in the left column. If a local street with an unknown location system is evaluated, this would be a sensitive variable that should be populated.

Table 5.5: Ramp-Related "Required" or "Conditionally Required" SafetyAnalyst Variables

SafetyAnalyst Variables	Descriptions
Required Variables	
aadtVPD	AADT
agencyID	Ramp ID
altRouteNames	Alternate Route Names
areaType	Area Type
calendarYear	Year of AADT
endOffset	Ending Milepost/ Distance
locSection	Ramp Section Description
locSystem	Location System
majorRoadName	Major Road Name
numOfLanes	Number of Lanes on the Ramp
openedToTraffic	Date Opened to Traffic
rampConfiguration	Ramp Configuration
routeName	Route Name
routeType	Route Type
startOffset	Starting Milepost/Distance
Conditionally Required Variables	
rampCrossroadConnection	Type of Connection at Crossroad
rampFreewayConnection	Type of Connection at Freeway
rampLength	Ramp Length
rampType	Ramp Type

Table 5.6: Sensitivity of Ramp-Related Variables (*AltRamp* and *AltRampTraffic* Tables)

Can be Populated Using Current ODOT Data (Sensitivity Test Not Critical)		Required Variables in Need of Additional Data Collection or Development Efforts	
Sensitive	Not Sensitive	Sensitive	Not Sensitive
• aadtVPD • agencyID[1] • areaType • calendarYear • endOffset • locSection[1] • locSystem[2] • numOfLanes • rampLength • routeName • startOffset	• altRouteNames[1] • majorRoadName • routeType[1]	• locSystem[2] • rampConfiguration	• openedToTraffic • rampCrossroad Connection • rampFreewayConnection • rampType

[1] Not a sensitive variable but must be consistently presented between the various input tables
[2] Information available for state highways, but may be lacking for local roads

5.1.4 Intersection Data Sensitivity

The intersection-related variables are included in the SafetyAnalyst *AltIntersection*, *AltMajorRoadTraffic*, and *AltMinorRoadTraffic* tables. These three tables identify the intersection characteristics, traffic conditions on the major road, and traffic conditions on the minor road respectively. Table 5.7 depicts these intersection-related "required" and "conditionally required" variables and descriptions.

Table 5.7: Intersection-Related "Required" and "Conditionally Required" SafetyAnalyst Variables

SafetyAnalyst Variable	Description
Required Variables	
aadtVPD	Major Road AADT, Minor Road AADT
agencyID	Intersection ID
altRouteNames	Alternate Route Names
areaType	Area Type
calendarYear	Year of Major Road AADT, Year of Minor Road AADT
intersectionType1	Intersection Type
majorRoadDirection	Major Road Direction
majorRoadLocSystem	Major Road Location System
majorRoadName	Major Road Name
majorRoadOffset	Major Road Milepost/Distance
minorRoadLocSystem	Minor Road Location System
minorRoadName	Minor Road Name
minorRoadOffset	Minor Road Milepost/Distance
minorRoadRouteName	Minor Road Route Name
minorRoadRouteType	Minor Road Route Type
offsetDistance	Offset Distance
offsetIntersection	Offset Intersection
openedToTraffic	Date Opened to Traffic
routeName	Route Name
routeType	Route Type
trafficControl1	Traffic Control Type
Conditionally Required Variables	
county	County
majBeginInfluenceZone	Beginning Influence Zone for Major Road
majEndInfluenceZone	Ending Influence Zone for Major Road
majorRoadSection	Major Road Section Indicator
minorRoadSection	Minor Road Section Indicator

The sensitivity analysis for intersection-related crashes identified four sensitive variables that require additional data (see Table 5.8). Two of these sensitive variables are directly associated with the minor road traffic volume at the intersection (*aadtVPD* and *calendarYear* for the minor roads). The type of intersection and the traffic control at the intersection are also sensitive variables that can alter the results of the network screening analysis.

Table 5.8: Sensitivity of Intersection-Related Variables (*AltIntersection*, *AltMajorRoadTraffic*, and *AltMinorRoadTraffic* Tables)

Can be Populated Using Current ODOT Data (Sensitivity Test Not Critical)		Required Variables in Need of Additional Data Collection or Development Efforts	
Sensitive	Not Sensitive	Sensitive	Not Sensitive
• aadtVPD (*AltMajorRoad Traffic* table for Major Road) • agencyID[1] • areaType • calendarYear (*AltMajorRoad Traffic* table for Major Road) • majorRoadLoc System • majorRoadName • majorRoadOffset • minorRoadOffset • routeName	• altRouteNames[1] • county[1] • majorRoadSection[1] • minorRoadName[1] • minorRoadSection • minorRoadRoute Name • routeType[1]	• aadtVPD (*AltMinorRoad Traffic* table for Minor Road) • calendarYear (*AltMinorRoad Traffic* table for Minor Road) • intersectionType1 • trafficControl1	• majBeginInfluence Zone • majEndInfluence Zone • majorRoadDirection • offsetDistance • offsetIntersection • openedToTraffic
[1] Not a sensitive variable but must be consistently presented between the various input tables			

5.1.5 Approach Leg Data Sensitivity

The intersection approaches can be individually evaluated using SafetyAnalyst; however, this requires knowledge of geometric and traffic volume characteristics for each approach (as previously reviewed in Section 3.2.8). Table 5.9 depicts the variety of "required" and "conditionally required" variables SafetyAnalyst evaluates for each leg based on data included in the *AltLeg* and the *AltLegTraffic* input tables. Since this type of data is quite detailed and is not likely to be available for each intersection location, the sensitivity analysis for these variables is particularly critical.

Table 5.10 depicts the results of the sensitivity analysis for the intersection leg data. All data associated with turning volumes, phasing, or maneuvers is sensitive and so, as a result, precise use of SafetyAnalyst for intersection leg evaluations would require considerable data collection for the study locations. As noted previously, a less precise intersection screening can be conducted without this detailed information; however, results based on estimated traffic conditions cannot be assumed as accurate.

Table 5.9: Leg-Related "Required" and "Conditionally Required" SafetyAnalyst Variables

SafetyAnalyst Variable	Description
Required Variables	
aadtVPD	AADT
agencyID	Intersection ID, Leg ID
calendarYear	Year of AADT
leftTurnVolume	Left Turn Volume
legDirection	Leg Direction
legID	Identifier for Specific Leg
legMedianType	Median Type for Leg
legType	Leg Type
operationWay	One-way or two-way traffic operations
rightTurnVolume	Right Turn Volume
throughVolume	Through Volume excluding turning volume
Conditionally Requires Variables	
leftTurnPhasing	Left Turn Signal Phasing

Table 5.10: Sensitivity of Leg-Related Variables (*AltLeg* and *AltLegTraffic* Tables)

Can be Populated Using Current ODOT Data (Sensitivity Test Not Critical)		Required Variables in Need of Additional Data Collection or Development Efforts	
Sensitive	Not sensitive	Sensitive	Not sensitive
• agencyID[1]	---	• aadtVPD • calendarYear • legDirection • legMedianType • legType • leftTurnPhasing • leftTurnVolume • operationWay • rightTurnVolume • throughVolume	• legID[1]

[1] Not a sensitive variable but must be consistently presented between the various input tables

5.2 DATA COLLECTION PRIORITIES BASED ON SENSITIVITY ANALYSIS

The SafetyAnalyst sensitivity analysis resulted in some clear data collection directions if ODOT elects to initiate development of data suitable for use with this tool.

5.2.1 Data Collection or Modification to Enhance Oregon Crash Data

First, the Oregon crash data appears to reasonably convert to SafetyAnalyst without significant data issues. Though there are several variables that are not fully compatible, a reasonable transfer of ODOT crash data to the SafetyAnalyst data can be accomplished. Though eight variables appear to be lacking sufficient information to evaluate the crashes, only two of these appear to be critical as shown in Table 5.2. The only sensitive variable that needs additional data is the *junctionRelationship* variable (see Section 3.1.16). Portions of this variable are already available in Oregon databases. In addition, the *routeType* variable is not sensitive but is used to match data between tables and so should be consistently populated (see Section 3.1.27 for more information about this variable). Therefore, the following two priority crash variables are recommended as high priority for future crash data collection or modification:

Highest Crash Data Collection Priority:

- *junctionRelationhip*, and
- *routeType*.

5.2.2 Data Collection or Modification to Enhance Oregon Road Data

The road data sensitivity analysis included segment, ramp, intersection, and approach leg variable analysis. While many of the variables associated with segments, ramps, and intersections are readily available in the Oregon data, very few of the sensitive variables associated with the approach legs could be located. As a result, the recommendation for strategic data collection for Oregon road data would be to first focus on completing the essential variables for segment, ramp, and intersections. The data requirements for approach legs are extensive and so, until such time as this data could be acquired or developed, the project team recommends assigning a lower priority to developing these variables. This recommendation means, of course, that any network screening assessment that includes approach legs should assume only approximate values that need to be confirmed using alternative methods.

The following list, as a result, is divided into two data collection recommendations for highest and moderate data collection priorities:

Highest Road Data Collection Priority:

- *aadtVPD* (minor roads),
- *accessControl,*
- *calendarYear* (for traffic volume on minor roads),
- *intersectionType1,*
- *locSystem* (local roads primarily)
- *operationWay,*
- *rampConfiguration*, and
- *trafficControl1*.

Moderate Road Data Collection Priority:

- *aadtVPD* (each approach leg),
- *calendarYear* (for traffic volume at each leg approach),
- *legDirection,*
- *legMedianType,*
- *legType,*
- *leftTurnPhasing,*
- *leftTurnVolume,*
- *operationWay,*
- *rightTurnVolume,* and
- *throughVolume.*

An important issue to note is that ideally it would be advantageous for Oregon to populate all of the SafetyAnalyst variables including the "desired" variables, so if future data collection efforts are planned to acquire the high and moderate priority variables indicated, it would be advisable to review additional candidate variables that are associated and that could be developed at the same time.

Though there are many data issues that must be resolved before Oregon can seamlessly incorporate SafetyAnalyst procedures into their network screening procedures, the actual number of essential (sensitive) data variables that must be collected can be reduced to two for crash data and 18 for road data (with eight listed as the highest priority).

6 CONCLUSION

SafetyAnalyst provides a powerful high level screening capability that could be used in Oregon in a manner similar to the current SPIS tool. While SPIS ranks sites using a 0.1 mile segment sliding window and is based on rankings or historic crash data using crash frequency, crash rate index, and crash severity index, the SafetyAnalyst uses traffic volume based safety performance functions to predict crashes and adjusts these predictions using observed (historic) crash data. These predicted and observed crashes are combined using the Empirical Bayes procedure to generate site-specific crash estimates. As a result, the two analysis procedures will often generate site rankings that are similar but not exactly the same. Since the SPIS procedure is based solely on crash history and exposure, it is likely to result in very different rankings from year to year. The SafetyAnalyst technique, on the other hand, will also include variable annual site rankings but these rankings should provide more consistent site recommendations each year since this procedure balances typical crashes for a facility type with site-specific observed crashes. Section 2 of this report generally reviewed these procedures used by SPIS and SafetyAnalyst and then focused on issues associated with adapting Oregon data for use with this tool.

Section 3 of this report identified the crash and road data SafetyAnalyst requirements and compared each variable to associated Oregon data variables, where available. In many cases, the crash data is available but the data format is not suitable for direct inclusion in SafetyAnalyst (e.g. video information). In other cases, the Oregon data can only partially populate a SafetyAnalyst variable. A few data variables are not available and would require future data collection efforts.

SafetyAnalyst further defines variables as “required”, “conditionally required”, and “desired.” Future Oregon data collection efforts should initially focus on “required” variables that are essential to successful operation and analysis of the SafetyAnalyst network screening.

Section 4 of this report demonstrates a seven site case study using Oregon data imported into SafetyAnalyst. In some cases the research team estimated values for the unknown or unavailable variables (after completing data collection efforts of known variables). Section 8.2, located in the report appendix, depicts the SafetyAnalyst output report for the Section 4 case study.

Section 5 uses the case study files developed for Section 4 as a control case for a variable sensitivity analysis. The purpose of this effort was to determine how sensitive the SafetyAnalyst expected crash values would be for the input variables. The research team systematically modified values for one required variable while holding all others constant. Variables that altered the expected crash values substantially were deemed to be sensitive. Since many of the “required” variables were already available in the Oregon

data, this sensitivity analysis focused on required variables in need of additional data collection or data development efforts. Table 6.1 summarizes the required variables in need of additional data into Sensitive and Not Sensitive categories. Future data collection efforts should first focus on acquiring the sensitive values before developing values for variables that were determined to not be sensitive.

The sensitivity analysis included in Section 5 used the seven site case study data as a control group. It is, of course, possible that performing such an analysis for a larger or different sample of sites could slightly alter these recommendations, but in general crash data collection priorities should focus on refining the *junctionRelationship* and *routeType* variables.

Eighteen road variables are sensitive to the network screening analysis, but ten of these are associated with intersection legs while eight variables are segment, ramp, and intersection related. As a result, high priority should be given to the eight road data variables before focusing on the more complex and detailed approach leg variables.

For all models, an extremely influential variable is the AADT value. There are several instances where this is required for minor roads, so this particular variable should be a target for data collection efforts prior to wide scale application of SafetyAnalyst.

This study focused on a seven site case study, and the sensitivity analysis addressed required variables. The next steps to successful implementation of SafetyAnalyst for Oregon analysis purposes would be to expand data collection efforts to those identified as required, sensitive variables that need additional data collection or modification. In addition, a pilot test for one Oregon region may be appropriate. This pilot test could then be used to test the level of effort for variable conversion, contract ranking results to associated SPIS findings, and to further evaluate tool functionality for the construction and countermeasure analysis options prior to a full-scale Oregon deployment of SafetyAnalyst.

Table 6.1: Overview of Required Variable Sensitivity Test

SafetyAnalyst Table	Sensitive	Not Sensitive
AltAccident	junctionRelationship	route Type[1] collisionType sideOfDividedHighway v1InitialTravelDirection v2InitialTravelDirection v1vehicleManeuver v2vehicleManeuver
AltRoadwaySegment	accessControl operationWay locSystem[2]	discontinuity interchangeInfluence openedToTraffic postedSpeed travelDirection
AltSegmentTraffic	N/A	N/A
AltRamp	locSystem[2] rampConfiguration	openedToTraffic rampCrossroadConnection rampFreewayConnection rampType
AltRampTraffic	N/A	N/A
AltIntersection	intersectionType1 trafficControl1	majBeginInfluenceZone majEndInfluenceZone majorRoadDirection offsetDistance offsetIntersection openedToTraffic
AltMajorRoadTraffic	N/A	N/A
AltMinorRoadTraffic	aadtVPD[2] calendarYear	N/A
AltLeg	legDirection legMedianType legType operationWay	legID[1]
AltLegTraffic	aadtVPD[2] calendarYear leftTurnVolume rightTurnVolume throughVolume	legID[1]

[1] Variable itself is not sensitive, but value must be consistently presented in the various input tables

[2] Variable input generally complete for state highways but additional information likely required for local roads

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7 REFERENCES

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8 APPENDIX

This appendix includes supplemental tables and sample SafetyAnalyst output for the case study sites. These are included in the following sections.

8.1 SUPPLEMENTAL TABLES

Table 8.1: Abbreviations and Acronyms

Abbreviation or Acronym	Full Name
AADT	Average Annual Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
ADT	Average Daily Traffic
DMV	Department of Motor Vehicles
FHWA	Federal Highway Administration
GIS	Geographic Information System
GVWR	Gross Vehicle Weight Rating
HSIP	Highway Safety Improvement Program
HSM	Highway Safety Manual
ODOT	Oregon Department of Transportation
OR	Oregon
SPIS	Safety Priority Index System

Table 8.2: SafetyAnalyst Crash Table (AltAccident) Variable Descriptions

SafetyAnalyst (Source: ITT Corporation, 2009)				
Variable Name	**Variable Description**	**Data Type**	**Possible Values**	**Required or Desired**
accidentDate (Accident Date)	The date (year, month, and day) on which the accident occurred	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Unconstrained string, 128 characters maximum)	N/A	Required
accident IntersectionID (Agency Intersection Identifier)	Optional reference to a agency-specific intersection identifier, used when the accident has been explicitly located on the inventory before the data is imported. If this item is not available, the import process will attempt to associate the accident with an intersection based on the location data and the value of the junction relationship item.	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Unconstrained string, 128 characters maximum)	N/A	Desired
accidentRampID (Agency Ramp Identifier)	See *accidentIntersectionID*	See *accident IntersectionID*	N/A	Desired
accidentSegment ID (Agency Segment Identifier)	See *accidentIntersectionID*	See *accident IntersectionID*	N/A	Desired
accident Severity1 (Accident Severity Level 1)	Severity of the accident based on the most severe injury to any person involved	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Enumerated string, 128 characters maximum)	K - Fatal Injury A - Severe Injury B - Non-Incapacitating Injury C - Possible Injury P - Property-Damage-Only X - Unknown	Required

SafetyAnalyst (Source: ITT Corporation, 2009)				
Variable Name	**Variable Description**	**Data Type**	**Possible Values**	**Required or Desired**
accidentTime (Accident Time of Day)	Time (hour and minute) at which the accident occurred	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Unconstrained string, 128 characters maximum)	N/A	Desired
agencyID (Accident ID)	Length and format of this agency-specific identifier varies among states and is used to link sub files of vehicles and occupants to accidents. All states assign accidents a code number of this type (often known as the accident report number or case number). If case identifiers may be repeated in subsequent years, the two-digit year should be added as a prefix to make the identifier unique.	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Alphanumeric string, 128 characters maximum)	N/A	Required
bikeIndicator (Bicycle Indicator)	Indicates whether a bicycle was involved in the accident	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Enumerated string, 128 characters maximum)	Y - One or more bicycles involved N - No bicycles involved X - Unknown	Desired

SafetyAnalyst (Source: ITT Corporation, 2009)				
Variable Name	**Variable Description**	**Data Type**	**Possible Values**	**Required or Desired**
collisionType (Accident Type and Manner of Collision)	Type of first harmful event in a single-vehicle accident or, in a multiple-vehicle collision, manner in which two vehicles in transport initially came together without regard to the direction of force, or the type of object with which a single vehicle collided	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Enumerated string, 128 characters maximum)	1 - With parked motor vehicle 2 - With railroad train 3 - With bicyclist 4 - With pedestrian 5 - With animal 6 - With fixed object 7 - With other object 8 - Other single-vehicle collision 9 - Overturn 10 - Fire or explosion 11 - Other single-vehicle non-collision 21 - Rear-end 22 - Head-on 23 - Rear-to-rear 24 - Angle 25 - Sideswipe, same direction 26 - Sideswipe, opposite direction 27 - Other multiple-vehicle collision 99 - Unknown	Required
comment (Comment)	Optional comment for the accident.	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Unconstrained string, 128 characters maximum)	N/A	Desired

SafetyAnalyst (Source: ITT Corporation, 2009)				
Variable Name	**Variable Description**	**Data Type**	**Possible Values**	**Required or Desired**
county (County)	Value of this item identifies the county in which the site is located. When this variable is part of the location system, it is used in matching accidents to roadway segments, creating homogeneous roadway segments, determining contiguous sites for sliding window algorithm, and is displayed in all site lists and output reports. Also, queries to create site lists can use this item as a selection criterion. This variable should be included whether this is part of the location identifier or not, as searches may be conducted separately on this variable. MMUCC recommends the use of the Census FIPS codes, but few states currently use these codes. Instead, each state has its own one, two, or three digit county codes. The use of the codes with which current users are familiar is recommended. Additionally, each state has its own particular rules for identifying the proper county when a route is in more than one county.	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Alphanumeric string, 128 characters maximum)	N/A	Required when location system is Route/ County/ Milepost
driveway Indicator (Driveway Indicator)	Indicates if the accident occurred at or near a driveway junction	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Enumerated string, 128 characters maximum)	1 - No 2 - Yes, at driveway 3 - Yes, near driveway and related 99 - Unknown	Desired

SafetyAnalyst (Source: ITT Corporation, 2009)				
Variable Name	**Variable Description**	**Data Type**	**Possible Values**	**Required or Desired**
drugInvolved (Alcohol/Drug Involvement)	Investigating police officer's assessment of whether alcohol or drug use was suspected or demonstrated to be present by test for any vehicle driver or non-motorist in the accident	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Enumerated string, 128 characters maximum)	1 - Neither alcohol nor other drugs 2 - Yes (alcohol) 3 - Yes (drugs other than alcohol) 4 - Yes (alcohol and drugs) 99 - Unknown	Desired
environment Condition (Contributing Circumstances, Environment)	Apparent environmental conditions which contributed to the accident	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Enumerated string, 128 characters maximum)	1 - None 2 - Weather conditions 3 - Physical obstruction(s) 4 - Glare 5 - Animal(s) in roadway 6 - Other 99 - Unknown	Desired
gisID (GIS Identifier)	Value of this item is a GIS identifier associated with the location of the accident element (value is not processed or interpreted by SafetyAnalyst)	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Unconstrained string, 128 characters maximum)	N/A	Desired
junction Relationship (Relationship to Junction)	Identifies the type of related cross street to the accident site. Definitions vary across states. For compatibility with the structure of SafetyAnalyst, a recoding that differs from MMUCC is recommended. Some distinctions that MMUCC tries to make in this field will instead be made in site characteristics data in SafetyAnalyst	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Enumerated string, 128 characters maximum)	1 - Non-junction 2 - At intersection 3 - Intersection-related 4 - Driveway or driveway-related 5 - Entrance/exit ramp 6 - Other part of interchange 7 - Railroad/highway grade crossing 8 - Crossover related 9 - Other 99 - Unknown	Required

SafetyAnalyst (Source: ITT Corporation, 2009)				
Variable Name	**Variable Description**	**Data Type**	**Possible Values**	**Required or Desired**
lightCondition (Light Condition)	Type/level of lighting that existed at the time of the accident	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Enumerated string, 128 characters maximum)	1 - Daylight 2 - Dawn 3 - Dusk 4 - Dark-lighted 5 - Dark-not lighted 6 - Dark-unknown lighting 7 - Other 99 - Unknown	Desired
locOffset (Accident Milepost/ Distance)	Specifies a milepost or distance value for the appropriate location system. For a Route/ Milepost or Route/County/Milepost location system, this value represents a milepost value. For the Route/Section/Distance or Section/ Distance location systems, this value represents the distance value.	DOUBLE/ FLOAT/float/ float (Numeric)	N/A	Required
locSection (Accident Location Section)	Specifies the section identifier when using the Route/Section/Distance or Section/Distance location systems.	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Unconstrained string, 128 characters maximum)	N/A	Required for Route/ Section/ Distance or Section/ Distance location systems
locSystem (Location System)	Specifies the location system used for all location data for this element	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Enumerated string, 128 characters max.)	A - Route/ Milepost B - Route/ County/ Milepost C - Route/ section/distance D - Section/ distance	Required

SafetyAnalyst (Source: ITT Corporation, 2009)				
Variable Name	**Variable Description**	**Data Type**	**Possible Values**	**Required or Desired**
numberOf Fatalities (Number of Fatalities)	Number of all fatalities (drivers, occupants, pedestrians) resulting from this specific motor vehicle crash	BIGINT/NUMBER/ bigint/bigint (Int)	N/A	Required
numberOf Injuries (Number of Non-Fatal Injuries)	Number of all injured persons (drivers, occupants, pedestrians), excluding fatalities, resulting from this specific motor vehicle crash	BIGINT/NUMBER/ bigint/bigint (Int)	N/A	Required
numVehicles (Number of Vehicles Involved)	Count of motor vehicles (e.g., automobiles, single-unit trucks, truck combinations that are in motion or on a roadway) involved in the accident. (Note: Parked vehicles are not included in this vehicle count, nor are bicycles and pedestrians.).	BIGINT/NUMBER/ bigint/bigint (Int)	N/A	Required
pedestrian Indicator (Pedestrian Indicator)	Indicates whether a pedestrian was involved in the accident	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Enumerated string, 128 characters maximum)	Y - One or more pedestrians involved N - No pedestrians involved X - Unknown	Desired

SafetyAnalyst (Source: ITT Corporation, 2009)				
Variable Name	**Variable Description**	**Data Type**	**Possible Values**	**Required or Desired**
roadCondition (Contributing Circumstances, Road)	Apparent conditions of the road which contributed to the accident	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Enumerated string, 128 characters maximum)	1 - None 2 - Road surface condition (wet, icy, snow, slush, etc.) 3 - Debris 4 - Rut, holes, bumps 5 - Work zone (construction/ maintenance/utility) 6 - Worn, travel-polished surface 7 - Obstruction in roadway 8 - Traffic control device inoperative, missing, or obscured 9 - Shoulders (none, low, soft, high) 10 - Non-highway work 11 - Other 99 - Unknown	Desired
routeName (Route Name)	Number or name of the route where the site is located. Where routes overlap, the more important route type and the corresponding lower route number normally take precedence. For routes without numbers, the road or street name should be used. When this item is part of the location system, it is used in matching accidents to roadway segments, creating homogeneous roadway segments, determining contiguous sites for sliding window algorithm, and is displayed in all site lists and output reports. Queries to create site lists can use this item as a criterion	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Unconstrained string, 128 characters maximum)	N/A	Required

SafetyAnalyst (Source: ITT Corporation, 2009)				
Variable Name	**Variable Description**	**Data Type**	**Possible Values**	**Required or Desired**
routeType (Route Type)	Category of the route where the site is located. This item should be included whether it is part of the location identifier or not, as searches may be conducted separately on this item. Additional route type codes may be needed in some states.	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Enumerated string, 128 characters maximum)	I - Interstate US - US route SR - State route BR - Business route BL - Business loop SP - Spur route CR - County road TR - Township road L - Local road O - Other X - Unknown	Required
runoffIndicator (Run-Off Road Indicator)	Indicates whether any vehicle involved in the accident ran off the roadway	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Enumerated string, 128 characters maximum)	Y - One or more vehicles ran off the road N - No vehicles ran off the road X - Unknown	Desired
schoolBus (School Bus Related)	Indicates if a school bus or vehicle functioning as a school bus for a school-related purpose was involved in the accident. The school bus, with or without a passenger on board, must be directly involved as a contact vehicle or indirectly involved as a non-contact vehicle.	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Enumerated string, 128 characters maximum)	1 - No school bus involved 2 - School bus directly involved 3 - School bus indirectly involved 99 - Unknown	Desired
sideOfDivided Highway (Divided Highway Flag-Side of Road)	Indicates the direction of travel for the side of the divided highway where the accident occurred. Mandatory for agencies that keep independent records for the individual sides of a divided highway. Can be used for divided highway by any agency.	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Enumerated string, 128 characters maximum)	NB - Northbound travel direction SB - Southbound travel direction EB - Eastbound travel direction WB - Westbound travel direction NA - Not applicable X - Unknown	Required

SafetyAnalyst (Source: ITT Corporation, 2009)				
Variable Name	**Variable Description**	**Data Type**	**Possible Values**	**Required or Desired**
surface Condition (Roadway Surface Condition)	Roadway surface condition at the time and place of the accident	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Enumerated string, 128 characters maximum)	1 - Dry 2 - Wet 3 - Snow 4 - Slush 5 - Ice/frost 6 - Water (standing, moving) 7 - Sand 8 - Mud, dirt, gravel 9 - Oil 10 - Other 99 - Unknown	Desired
towIndicator (Tow-Away Indicator)	Indicates whether any vehicle involved in the accident was towed away from the scene.	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Enumerated string, 128 characters maximum)	Y - One or more vehicles towed N - No vehicles towed X - Unknown	Desired
v1driverDOB (Driver Date of Birth - Vehicle 1)	Year, month, and day of birth of driver(s) involved in the accident.	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Unconstrained string, 128 characters maximum)	N/A	Desired

SafetyAnalyst (Source: ITT Corporation, 2009)				
Variable Name	**Variable Description**	**Data Type**	**Possible Values**	**Required or Desired**
v1firstEvent (First Harmful Event - Vehicle 1)	First injury or damage-producing event that characterizes the accident type	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Enumerated string, 128 characters maximum)	<u>Non-collisions:</u> 1 - Overturn/rollover 2 - Fire/explosion 3 - Immersion 4 - Jackknife 5 - Cargo/equipment loss or shift 6 - Fell/jumped from vehicle 7 - Thrown or falling object 8 - Other noncollision 9 - Unknown noncollision <u>Collisions:</u> 10 - Pedestrian 11 - Bicyclist 12 - Railway vehicle 13 - Animal 14 - Motor vehicle in transport 15 - Parked motor vehicle 16 - Work zone maintenance equipment 17 - Other non-fixed object 18 - Unknown non-fixed object 19 - Impact attenuator/crash cushion 20 - Bridge overhead structure 21 - Bridge pier or support 22 - Bridge rail 23 - Culvert 24 - Curb	Desired

SafetyAnalyst (Source: ITT Corporation, 2009)				
Variable Name	**Variable Description**	**Data Type**	**Possible Values**	**Required or Desired**
v1firstEvent (First Harmful Event - Vehicle 1) [continued]			25 - Ditch 26 - Embankment 27 - Guardrail face 28 - Guardrail end 29 - Concrete traffic barrier 30 - Other traffic barrier 31 - Standing tree 32 - Utility pole/Light support 33 - Highway traffic sign or signpost 34 - Overhead sign or sign support 35 - Other post, pole, or support 36 - Fence 37 - Mailbox 38 - Other fixed object (wall, building, tunnel, etc.) 39 - Unknown fixed object 41 - Other - Other 99 - Unknown - Unknown	
v1initialTravel Direction (Initial Direction of Travel - Vehicle 1)	Direction of a vehicle's normal, general travel on the roadway before the accident. This is not a compass direction but a direction consistent with the designated direction of the road (e.g., the direction of a state designated north-south highway is northbound or southbound even though a vehicle may have been traveling due east as a result of a short segment of the highway having an east-west orientation.	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Enumerated string, 128 characters maximum)	NB - Northbound SB - Southbound EB - Eastbound WB - Westbound NO - Not on roadway XX - Unknown	Required

SafetyAnalyst (Source: ITT Corporation, 2009)				
Variable Name	**Variable Description**	**Data Type**	**Possible Values**	**Required or Desired**
v1vehicle Configuration (Vehicle Configuration - Vehicle 1)	Indicates the general configuration of the vehicle	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Enumerated string, 128 characters maximum)	1 - Passenger car 2 - Light truck, only four tires - Cargo van, mini-van, utility truck, panel truck, pickup under 10,001 pounds GVWR, only four tires 3 - Sport utility vehicle 4 - Motorcycle/Moped 5 - Motor home/recreational vehicle 6 - Single-unit truck - 2-axle and GVWR over 10,000 pounds 7 - Single-unit truck - 3-or-more axles 8 - Truck pulling trailer or trailers 9 - Truck tractor (bobtail) 10 - Truck tractor/semi-trailer 11 - Truck tractor/doubles 12 - Truck tractor/triples 13 - Truck over 10,000 pounds, cannot classify 14 - Bus/large van - Seats for more than 15 people, including driver 15 - Bus - Seats for 7-15 people, including driver 16 - Emergency vehicle - Fire, police, ambulance, etc. 17 - Other 99 - Unknown vehicle configuration	Desired

SafetyAnalyst (Source: ITT Corporation, 2009)				
Variable Name	**Variable Description**	**Data Type**	**Possible Values**	**Required or Desired**
v1vehicle Maneuver (Vehicle Maneuver/ Action - Vehicle 1)	Controlled maneuver that the vehicle was doing prior to the first event in the sequence of events for this vehicle	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Enumerated string, 128 characters maximum)	1 - Movements essentially straight ahead 2 - Backing 3 - Changing lanes 4 - Overtaking/passing 5 - Turning right 6 - Turning left 7 - Making U-turn 8 - Entering traffic lane 9 - Leaving traffic lane 10 - Parked 11 - Slowing 12 - Stopped in traffic 13 - Negotiating a curve 14 - Other 99 - Unknown	Required
v2driverDOB (Driver Date of Birth - Vehicle 2)	See *v1driverDOB*	See *v1driverDOB*	See *v1driverDOB*	Desired
v2firstEvent (First Harmful Event - Vehicle 2)	See *v1firstEvent*	See *v1firstEvent*	See *v1firstEvent*	Desired
v2initialTravel Direction (Initial Direction of Travel - Vehicle 2)	See *v1initialTravelDirection*	See *v1initialTravel Direction*	See *v1initialTravelDirection*	Required

SafetyAnalyst (Source: ITT Corporation, 2009)				
Variable Name	**Variable Description**	**Data Type**	**Possible Values**	**Required or Desired**
v2vehicle Configuration (Vehicle Configuration - Vehicle 2)	See *v1vehicleConfiguration*	See *v1vehicle Configuration*	See *v1vehicleConfiguration*	Desired
v2vehicle Maneuver (Vehicle Maneuver/Action - Vehicle 2)	See *v1vehicleManeuver*	See *v1vehicleManeuver*	See *v1vehicleManeuver*	Required
weather Condition (Weather Condition)	Prevailing atmospheric conditions that existed at the time of the accident	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Enumerated string, 128 characters maximum)	1 - Clear 2 - Cloudy 3 - Fog, smog, smoke 4 - Rain 5 - Sleet, hail (freezing rain or drizzle) 6 - Snow 7 - Blowing snow 8 - Severe crosswinds 9 - Blowing sand, soil, dirt 10 - Other 99 - Unknown	Desired
workZone (Work Zone Related)	Indicates whether the accident occurred in or near a construction, maintenance, or utility work zone (includes crashes involving vehicles slowed or stopped because of the work zone, even if the first harmful event was before the first warning sign). MMUCC has additional subfields related to this data item that are not included in this format.	VARCHAR/ VARCHAR2/ nvarchar/nvarchar (Enumerated string, 128 characters maximum)	Y - Yes - Accident in or near a work zone N - No - Accident not in or near a work zone X - Unknown - Work zone relationship is unknown	Desired

Table 8.3: SafetyAnalyst Variable Name Paired with ODOT Variable Information Description

ODOT Crash Database (Source: ODOT, 2007)					
SafetyAnalyst Variable Name	**ODOT Variable Name**	**Variable Description**	**Data Type**	**Possible Values**	**Note**
accidentDate (Accident Date)	CRASH_DT	Crash date	Num	Month (MM): 01 - January 02 - February 03 - March 04 - April 05 - May 06 - June 07 - July 08 - August 09 - September 10 - October 11 - November 12 - December Day (DD): 01 to 31 - Actual Day Year (YYYY): XXXX - Code Year	
accident Intersection ID (Agency Intersection Identifier)	ISECT_AGY_ST_NO	Intersecting street number	char	Blank - Crash occurred on milepointed Rural Highway or milepointed County Road outside an intersection 00000 - Street not found xxxxx - Obtained from System Set-up Book, City Set-up Book, or County Road Book	
accidentRampID (Agency Ramp Identifier)	Need to generate				Use connection number (RD_CON_NO)

ODOT Crash Database (Source: ODOT, 2007)					
SafetyAnalyst Variable Name	**ODOT Variable Name**	**Variable Description**	**Data Type**	**Possible Values**	**Note**
accidentSegment ID (Agency Segment Identifier)	Need to generate				Use Agency Street Number (AGY_ST_NO)
accidentSeverity1 (Accident Severity Level 1)	Need to generate				Use INJURY SEVERITY field (INJ_SVRTY_CD) to create a KABCO scale
accidentTime (Accident Time of Day)	CRASH_HR_NO	Crash hour	Char	00 - 12:00 to 12:59 a.m. 01 - 1:00 to 1:59 a.m. 02 - 2:00 to 2:59 a.m. 03 - 3:00 to 3:59 a.m. 04 - 4:00 to 4:59 a.m. 05 - 5:00 to 5:59 a.m. 06 - 6:00 to 6:59 a.m. 07 - 7:00 to 7:59 a.m. 08 - 8:00 to 8:59 a.m. 09 - 9:00 to 9:59 a.m. 10 - 10:00 to 10:59 a.m. 11 - 11:00 to 11:59 a.m. 12 - 12:00 to 12:59 p.m. 13 - 1:00 to 1:59 p.m. 14 - 2:00 to 2:59 p.m. 15 - 3:00 to 3:59 p.m. 16 - 4:00 to 4:59 p.m. 17 - 5:00 to 5:59 p.m. 18 - 6:00 to 6:59 p.m. 19 - 7:00 to 7:59 p.m. 20 - 8:00 to 8:59 p.m. 21 - 9:00 to 9:59 p.m. 22 - 10:00 to 10:59 p.m. 23 - 11:00 to 11:59 p.m. 24 - DO NOT USE 99 - Unknown Time	
agencyID (Accident ID)	CRASH_ID	DMV crash serial number	Char	00001 – 79999 - Actual number assigned by DMV 8xxxx - 8 leading: indicates original number assigned to incorrect county 9xxxx - 9 leading: indicates duplicate serial number for relevant county	

ODOT Crash Database (Source: ODOT, 2007)					
SafetyAnalyst Variable Name	**ODOT Variable Name**	**Variable Description**	**Data Type**	**Possible Values**	**Note**
bikeIndicator (Bicycle Indicator)	Need to generate				Use CRASH LEVEL EVENTS (CRASH_ EVNT_1_CD , CRASH_EVNT_2_ CD, CRASH_ EVNT_3_CD)
collisionType (Accident Type and Manner of Collision)	CRASH_TYP _CD COLLIS_TYP _CD	Crash type / collision type	Char	A - Enter at angle – one vehicle stopped B - Enter at angle – all others C - Same direction – both straight D - Same direction – one turn, one straight E - Same direction – one stopped F - Same direction – all others G - Oposite direction – both straight H - Opposite direction – one left turn, one straight I - Opposite direction – one stopped J - Opposite direction – all others <u>Other Crash Type:</u> 1 - Motor vehicle on other roadway 2 - Parked motor vehicle 3* - Pedestrian 4 - Railway train 6 - Pedalcyclist 7 - Animal 8* - Fixed object 9 - Other object & - Overturned 0 - Other non-collision	Crash Type is 8 (Fixed Object) and Collision Type is 9 (Fixed Object), the crash MUST be coded as Off Road, with the exception of when the following event codes are used: 049 - Bridge girder (horizontal structure overhead) 063 - Tree branch or other vegetation overhead, etc. 064 - Wire or cable across or over the road 067 - Slides, rocks off or on road, falling rocks All other event codes must be off roadway.

ODOT Crash Database (Source: ODOT, 2007)					
SafetyAnalyst Variable Name	**ODOT Variable Name**	**Variable Description**	**Data Type**	**Possible Values**	**Note**
comment (Comment)					
county (County)	CNTY_ID	County	Char	01 - Baker 02 - Benton 03 - Clackamas 04 - Clatsop 05 - Columbia 06 - Coos 07 - Crook 08 - Curry 09 - Deschutes 10 - Douglas 11 - Gilliam 12 - Grant 13 - Harney 14 - Hood River 15 - Jackson 16 - Jefferson 17 - Josephine 18 - Klamath 19 - Lake 20 - Lane 21 - Lincoln 22 - Linn 23 - Malheur 24 - Marion 25 - Morrow 26 - Multnomah 27 - Polk 28 - Sherman 29 - Tillamook 30 - Umatilla 31 - Union 32 - Wallowa 33 - Wasco 34 - Washington 35 - Wheeler 36 - Yamhill	County code is a two-digit code that identifies the county in which the crash occurred. The County code, together with the DMV Serial Number, makes up the unique DMV case identifier for each crash.
driveway Indicator (Driveway Indicator)	DRVWY_REL_ FLG	Driveway-related	Char	0 - No 1 - Yes	ODOT Crash cannot represent cases unknown or near driveway and related

ODOT Crash Database (Source: ODOT, 2007)					
SafetyAnalyst Variable Name	**ODOT Variable Name**	**Variable Description**	**Data Type**	**Possible Values**	**Note**
drugInvolved (Alcohol/Drug Involvement)	Need to generate				Use DRUG-INVOLVED (DRUG_ INVLV_FLG) and ALCOHOL-INVOLVED (ALCHL_ INVLV_FLG)
environment Condition (Contributing Circumstances, Environment)	Need to generate				Use CRASH LEVEL EVENTS (CRASH_ EVNT_1_ CD, CRASH_EVNT_2_CD, CRASH_EVNT_3_CD) and WEATHER CONDITION
gisID (GIS Identifier)	Need to generate			Latitude and Longitude	

ODOT Crash Database (Source: ODOT, 2007)					
SafetyAnalyst Variable Name	**ODOT Variable Name**	**Variable Description**	**Data Type**	**Possible Values**	**Note**
junction Relationship (Relationship to Junction)	Need to generate				Use INTERSECTION TYPE field (ISECT_ TYP_CD), INTER-SECTION-RELATED field(ISECT_REL_ FLG), DRIVEWAY-RELATED(DRVWY_ REL_FLG),CRASH LEVEL EVENTS (CRASH_EVNT_1_ CD , CRASH_EVNT_ 2_CD, CRASH_ EVNT_3_CD) and CHARACTER OF ROAD (RD_CHAR_ CD)
lightCondition (Light Condition)	LGT_COND_ CD	Light condition	Char	0 - Unknown 1 - Daylight 2 - Darkness – with street lights 3 - Darkness – no street lights 4 - Dawn (Twilight) 5 - Dusk (Twilight)	
locOffset (Crash Offset)	MP_NO	Milepoint	Num	Blank - Crash occurred on City Street or non-milepointed County/Recreational road 00000 - 99998 - Actual milepoint to the nearest 0.01 mile 99999 - Unknown	

ODOT Crash Database (Source: ODOT, 2007)					
SafetyAnalyst Variable Name	**ODOT Variable Name**	**Variable Description**	**Data Type**	**Possible Values**	**Note**
locSection (Accident Location Section)	Need to generate				Use city section name (CITY_SECT_NM) and city section ID (CITY_ SECT_ID)
locSystem (Location System)	Need to generate			MLGE_TYP_CD for state routes	Specifies the location system used for all location data for this element
numberOf Fatalities (Number of Fatalities)	Need to generate	TOT_FATAL _CNT	Integer	Can be calculated by adding the individual Injury Severity Fatal values for a given crash	
numberOfInjuries (Number of Non-Fatal Injuries)	Need to generate	TOT_INJ_ CNT	Integer	Can be calculated by adding the individual non-fatal injuries for a given crash	
numVehicles (Number of Vehicles Involved)	Need to generate	TOT_VHCL_ CNT	Integer		Use VEHICLE NUMBER (VHCL_CODED_ SEQ_NO)
pedestrian Indicator (Pedestrian Indicator)	Need to generate	TOT_PED_ CNT	Integer		Use CRASH LEVEL EVENTS (CRASH_ EVNT_1_CD , CRASH_EVNT_2_CD, CRASH_EVNT_3_CD)

ODOT Crash Database (Source: ODOT, 2007)					
SafetyAnalyst Variable Name	**ODOT Variable Name**	**Variable Description**	**Data Type**	**Possible Values**	**Note**
roadCondition (Contributing Circumstances, Road)	Need to generate				Use CRASH LEVEL EVENTS (CRASH_ EVNT_1_CD , CRASH_EVNT_2_CD, CRASH_EVNT_3_ CD), ROAD SURFACE CONDITION (RD_SURF_COND_ CD) , WORK ZONE (WRK_ZONE_IND) and TRAFFIC CONTROL DEVICE (TRAF_CNTL_ DEVICE_CD)
routeName (Route Name)	RTE_NM	Route type / route number	Char	IS xxx - Interstate route shield followed by number on shield OR xxx - Oregon route shield, followed by number on shield US xxx - US route shield, followed by number on shield	ST_FULL_NM may also be used for alternative locations
routeType (Route Type)	RTE_TYP_ CD	Route type / route number	Char	See *routeName*	Example, IS represents Interstate highway, xxx represents the posted shield number

ODOT Crash Database (Source: ODOT, 2007)					
SafetyAnalyst Variable Name	**ODOT Variable Name**	**Variable Description**	**Data Type**	**Possible Values**	**Note**
runoffIndicator (Run-Off Road Indicator)	Need to generate				Use ERROR (PARTIC_ERR_1_CD, PARTIC_ERR_2_CD, PARTIC_ERR_3_CD)
schoolBus (School Bus Related)	Need to generate				Use VEHICLE TYPE (VHCL_TYP_CD)
sideOfDivided Highway (Divided Highway Flag-Side of Road)	Need to generate				Use DIRECTION OF TRAVEL FROM / TO (CMPSS_DIR_CD) and DIRECTION OF TRAVEL FROM / TO (CMPSS_DIR_FROM_ CD, CMPSS_DIR_ TO_CD)
surfaceCondition (Roadway Surface Condition)	RD_SURF_ COND_CD	Road surface condition	Char	0 - Unknown 1 - Dry 2 - Wet 3 - Snow 4 - Ice	
towIndicator (Tow-Away Indicator)	Need to generate				Additional data collection required
v1driverDOB (Driver Date of Birth - Vehicle 1)	AGE_VAL	Age	Char	00 - Age is unknown 01 - Infants from birth to less than two years of age 02 to 98 - Actual age of participant 2 years or over 99 - Ninety-nine years of age or over.	Oregon data only provides age information instead of date of birth, additional data collection required

ODOT Crash Database (Source: ODOT, 2007)					
SafetyAnalyst Variable Name	**ODOT Variable Name**	**Variable Description**	**Data Type**	**Possible Values**	**Note**
v1firstEvent (First Harmful Event - Vehicle 1)	VHCL_EVNT_1_CD VHCL_EVNT_ 2_CD VHCL_EVNT_3_CD	Vehicle level events	Char	Blank - Not applicable at this level 004 - Pedestrian involved (non-pedestrian crash) 006 - Tricycle – bicycle involved 007 - Hitchhiker (soliciting a ride) 008 - Passenger being towed or pushed on conveyance 010 - Overturned after first harmful event 011 - Vehicle being pushed 012 - Vehicle towed or towing by another vehicle 013 - Vehicle forced by impact into other vehicle, cyclist or pedestrian 014 - Vehicle set in motion by non-driver (child released brakes, etc.) 017 - Train struck vehicle 018 - Vehicle struck train 019 - Vehicle struck railroad car on roadway 020 - Jackknife; trailer or towed vehicle struck towing vehicle 021 - Trailer or towed vehicle overturned 022 - Trailer connection broke 023 - Detached trailing object struck other vehicle, non-motorist, or object (2004) 024 - Vehicle door opened into adjacent lane (2004) 025 - Wheel came off 026 - Hood flew up 028 - Lost load, load moved or shifted 029 - Tire failure 030 - Pet: cat, dog and similar 031 - Stock: cow, calf, bull, steer, sheep, etc.	Use VEHICLE LEVEL and modify

ODOT Crash Database (Source: ODOT, 2007)					
SafetyAnalyst Variable Name	**ODOT Variable Name**	**Variable Description**	**Data Type**	**Possible Values**	**Note**
v1firstEvent (First Harmful Event - Vehicle 1) [continued]				032 - Horse, mule, or donkey 033 - Horse and rider 034 - Wild animal, game (includes birds; not deer or elk) 035 - Deer or elk, wapiti 036 - Animal-drawn vehicle 037 - Culvert, open low or high manhole 038 - Impact attenuator 039 - Parking meter 040 - Curb (also narrow sidewalks or bridges) 041 - Jiggle bars or traffic snake for channelization 042 - Leading edge of guardrail 043 - Guard rail (not metal median barrier) 044 - Median barrier (raised or metal) 045 - Retaining wall or tunnel wall 046 - Bridge railing (on bridge and approach) 047 - Bridge abutment (approach ends) 048 - Bridge pillar or column (even if struck protective guard rail first) 049 - Bridge girder (horizontal structure overhead) 050 - Traffic raised island 051 - Gore 052 - Pole – type unknown 053 - Pole – power or telephone 054 - Pole – Street light only 055 - Pole – Traffic signal and ped signal only 056 - Pole – Sign bridge 057 - Stop or yield sign 058 - Other sign, including street signs	

ODOT Crash Database (Source: ODOT, 2007)					
SafetyAnalyst Variable Name	**ODOT Variable Name**	**Variable Description**	**Data Type**	**Possible Values**	**Note**
v1firstEvent (First Harmful Event - Vehicle 1) [continued]				059 - Hydrant 060 - Delineator or marker (reflector posts) 061 - Mailbox 062 - Tree, stump or shrubs 063 - Tree branch or other vegetation overhead, etc. 064 - Wire or cable across or over the road 065 - Temporary sign or barricade in road, etc. 066 - Permanent sign or barricade in/off road 067 - Slides, rocks off or on road, falling rocks 068 - Foreign obstruction / debris in road (not gravel) 069 - Equipment working in/off road 070 - Other equipment in or off road (including parked trailer, boat) 071 - Wrecker, street sweeper, snow plow or sanding equipment 072 - Rock, brick or other solid wall (2004) 073 - Speed bump, other bump, pothole or pavement irregularity (Per PAR) (2004) 075 - Bridge or road cave in 076 - High water 077 - Snow bank 078 - Chuckhole in road, low or high shoulder at pavement edge 079 - Cut slope or ditch embankment 080 - Struck by rock or other object set in motion by other vehicle (including lost loads) 081 - Struck by other moving or flying object 085 - Wind gust 086 - Vehicle immersed in body of water	

ODOT Crash Database (Source: ODOT, 2007)					
SafetyAnalyst Variable Name	**ODOT Variable Name**	**Variable Description**	**Data Type**	**Possible Values**	**Note**
v1firstEvent (First Harmful Event - Vehicle 1) [continued]				087 - Fire or Explosion 088 - Fence or building, etc. 089 - Crash related to another separate crash 090 - Two-way traffic on divided roadway all routed to one side 092 - Other (phantom) non-contact vehicle (on report) 095 - Guy wire 096 - Berm (earthen or gravel mound) 097 - Gravel in roadway 098 - Abrupt edge 100 - Unknown type of fixed object 101 - Other or unknown object, not fixed (2004) 104 - Passenger riding on vehicle exterior (2004) 111 - Street car / trolley (on rails and / or overhead wire) struck vehicle (2004) 112 - Vehicle struck street car / trolley (on rails or overhead wires) (2004) 114 - Vehicle struck railroad equipment (not train) on tracks (2006) 120 - Wire or cable median barrier (2006) 124 - Sliding or swerving due to wet, icy, slippery or loose surface (2006) 125 - Shoulder gave way	
v1initialTravel Direction (Initial Direction of Travel - Vehicle 1)	Need to generate				

ODOT Crash Database (Source: ODOT, 2007)					
SafetyAnalyst Variable Name	**ODOT Variable Name**	**Variable Description**	**Data Type**	**Possible Values**	**Note**
v1vehicle Configuration (Vehicle Configuration - Vehicle 1)	VHCL_TYP_CD	Vehicle type	Char	01 - Passenger car, pickup, van, light delivery, and custom van 02 - Truck tractor with no trailers (bobtail) 03 - Farm tractor or self-propelled farm equipment (not truck) 04 - Truck tractor with trailer/mobile home in tow 05 - Truck with non-detachable bed, panel, self-propelled crane, tow truck, fire truck, refuse packer, leach packer, log grappler 06 - Moped, minibike, motor scooter (sitting), or motor bicycle 07 - School bus (& van used to transport students) 08 - Other bus (flexi-bus, articulated – code “trailer”) 09 - Motorcycle, dirt bike ATV w/o license (2007) (side car – code “trailer”) 10 - Other: forklift, backhoe, mailster, go cart, golf cart, lawnmower, snowplow, street cleaner, road grader, ice cream scooter, meter maid scooter 11 - Motorhome 12 - Motorized street car / trolley (no rails/wires) (2004) 13 - ATV (licensed) (2007) 14 - Motorized scooter (standing) 15 - Snowmobile 99 - Unknown vehicle type	Not an exact match to all of the SafetyAnalyst values

ODOT Crash Database (Source: ODOT, 2007)					
SafetyAnalyst Variable Name	**ODOT Variable Name**	**Variable Description**	**Data Type**	**Possible Values**	**Note**
v1vehicle Maneuver (Vehicle Maneuver/Action - Vehicle 1)	MVMNT_CD	Vehicle movement	Char	0 - Unknown 1 - Straight ahead 2 - Turning right 3 - Turning left 4 - Making a U-turn 5 - Backing 6 - Stopped in traffic 7 - Parked - properly 8 - Parked - improperly 9 - Parking maneuver	Use the Oregon VEHICLE MOVEMENT input and then the ODOT data (e.g., there is no code for negotiating a curve, changing lanes, or leaving traffic lane, etc.) Use VEHICLE LEVEL ACTION to populate additional fields. Negotiating a curve could be derived from character of road (RD_CHAR_CD).
v2driverDOB (Driver Date of Birth - Vehicle 2)	See *v1driverDOB*	See *v1driverDOB*	Char	See *v1driverDOB*	See *v1driverDOB*
v2firstEvent (First Harmful Event - Vehicle 2)	See *v1firstEvent*	See *v1firstEvent*	Char	See *v1firstEvent*	
v2initialTravel Direction (Initial Direction of Travel - Vehicle 2)	Need to generate				
v2vehicle Configuration	See *v1vehicle Configuration*	See *v1vehicle Configuration*	Char	See *v1vehicleConfiguration*	See *v1vehicle Configuration*

ODOT Crash Database (Source: ODOT, 2007)					
SafetyAnalyst Variable Name	**ODOT Variable Name**	**Variable Description**	**Data Type**	**Possible Values**	**Note**
(Vehicle Configuration - Vehicle 2)					
v2vehicle Maneuver (Vehicle Maneuver/Action - Vehicle 2)	See *v1vehicleManeuver*	See *v1vehicle Maneuver*	Char	See *v1vehicleManeuver*	See *v1vehicleManeuver*
weatherContition (Weather Condition)	WTHR_COND_ CD	Weather condition	Char	0 - Unknown 1 - Clear 2 - Cloudy 3 - Rain 4 - Sleet 5 - Fog 6 - Snow 7 - Dust 8 - Smoke 9 - Ash	
workZone (Work Zone Related)	WRK_ZONE _IND	Work zone	Char	Blank - Not Reported 0 - No 1 - Yes 9 - Unknown	

Table 8.4: SafetyAnalyst Roadway Variable Description and Associated ODOT Data

SafetyAnalyst					*ODOT Database*	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltRoadway Segment	access Control	Degree that access to abutting land in connection with a highway is fully, partially, or not controlled by public authority	1 - Full access control 2 - Partial access control 3 - No access control 99 - Unknown	Required		Requires additional data collection efforts
	agencyID	Unique, agency-specific, identifier for the roadway segment (value is expected to be temporally invariant)	N/A	Required	Unit ID, Highway number, and Mile Point	Can be generated by users or located in the ODOT *Highway Inventory Detail Report* (see Table 8.5)
	agencySite Subtype	Used to indicate the agency-specified classification of the facility (site subtype). This item is optional and should be used only for those site subtypes represented in an agency's data that are not supported by SafetyAnalyst.	N/A	Desired		Requires additional data collection efforts

SafetyAnalyst					*ODOT Database*	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltRoadway Segment	altRoute Names	Represents the other route number(s) for a section of roadway where overlapping routes share the same physical section of roadway. Each alternate route number includes the alternate route type as a concatenated prefix. Multiple alternate route designations are separated with a vertical bar (|) character.	Only available for roads with multiple route numbers. Should otherwise be blank.	Required	Highway #	Highway Inventory Detail Report (see Table 8.5)
	areaType	Characterizes the area in which the site is located.	U - Urban area type R - Rural area type X - Unknown area type	Required	HPMS Area	Functional Classification and NHS Status on Oregon State Highways (see Table 8.5)
	city	City/town in which the site is located. This item should be included to facilitate searching.	N/A	Desired	Urban Area	Functional Classification and NHS Status on Oregon State Highways (see Table 8.5)
	comment	Optional comment for the roadway segment element	N/A	Desired		

	SafetyAnalyst				***ODOT Database***	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltRoadway Segment	corridor	Unique identifier to link multiple roadway segments, intersections, and ramps together to perform corridor analyses	N/A	Desired		Needs to be generated
	county	Identifies the county in which the site is located, can be used to query site list	N/A	Context: Data Import Use: Needed when location system is Route/ County/ Milepost	County	ODOT *Highway Inventory Detail Report* (see Table 8.5)
	disconti-nuity	Indicates whether or not a roadway segment is contiguous to a previous roadway segment.	Y - Contiguous to a previous segment N - Not contiguous to a previous segment X – Unknown	N/A		Requires additional data collection efforts

SafetyAnalyst					*ODOT Database*	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltRoadway Segment	district	Designation of the subdivision of the highway agency responsible for maintenance of the site. For use in input and output, it may be desirable to have a look up table of district names associated with the district numbers	N/A	Desired	District	Located in the *Highway Inventory Detail Report* (see Table 8.5)
	driveway Density	Number of driveways per mile (or per kilometer), on both sides of the road combined. For divided highways in states that treat each side of a divided highway as a separate segment, this data item should be based on the number of driveways on one side of the road only.	N/A	Desired		Requires additional data collection efforts

	SafetyAnalyst				*ODOT Database*	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltRoadway Segment	d1auxLane1	Indicates the presence of additional lanes on the roadway segment. The auxiliary lane type is classified by function	0 - No auxiliary lane 1 - Passing/Climbing lane 2 - Acceleration lane 3 - Deceleration lane 4 - Two-way left turn lane 5 - Bus lane 6 - HOV lane (including lanes with time restrictions for HOV use) 7 - Bicycle lane 8 - Other auxiliary lane 99 – Unknown	Required		May require additional data. One source is the Oregon *Bikeway, Sidewalk, & Crosswalk Report* and the *Lane Report* (see Table 8.5)
	d1auxLane2	See *d1auxLane1*	See *d1auxLane1*	Required		See *d1auxLane1*
	d1auxLane3	See *d1auxLane1*	See *d1auxLane1*	Required		See *d1auxLane1*
	d1avgLane Width	Average width of the through lane(s), MMUCC variable RL7 includes subfields for shoulder width and lane width within one data item. In SafetyAnalyst, lane width and shoulder width are treated as two separate data items.	N/A	Desired	LN 1, LN2, LN3…….	ODOT *Lane Report* (see Table 8.5), users can calculate the average width, but lanes in the same direction should first be identified

SafetyAnalyst					*ODOT Database*	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltRoadway Segment	d1avg Shoulder WidthIn	Average width of the inside shoulder. A value of 0 indicates that no inside shoulder is present. The value of this item will always be zero for undivided roadway segments. MMUCC variable RL7 includes subfields for both shoulder width and lane width within one data item. In SafetyAnalyst, lane width and shoulder width are treated as two separate items	N/A	Desired	LS	ODOT *Lane Report* (see Table 8.5)
	d1avg Shoulder WidthOut	Average width of the outside shoulder. A value of 0 indicates that no outside shoulder is present. MMUCC variable RL7 includes subfields for both shoulder width and lane width within one data item. In SafetyAnalyst, lane width and shoulder width are treated as two separate data items	N/A	Desired	RS	ODOT *Lane Report* (see Table 8.5)

	SafetyAnalyst				***ODOT Database***	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltRoadway Segment	d1bikeway	Specifies any road, path, or way which is specifically designated as open to bicycle travel, regardless of whether such facilities are exclusive use or are to be shared with other transportation modes.	1 - No bikeway 2 - Bicycle route (signed) 3 - Bicycle lane (striped) 4 - Separate bicycle path/trail 99 - Unknown	Desired	Left Bikeways and Right Bikeways	ODOT *Bikeway, Sidewalk, & Crosswalk Report* (see Table 8.5)
	d1numThru Lane	Total number of through lanes in the target direction of travel. Turn lanes and auxiliary lanes are not to be included in this count	N/A	Required	LN 1, LN2, LN3……. Count the number of LNi which have non-zero widths	ODOT *Lane Report* (see Table 8.5)
	d1shoulder TypeIn	Identifies the predominant surface composition of the **inside** shoulder, or the lower shoulder type if more than one type	See *d1shoulderTypeOut*	Desired	Left Shldr plus Type	ODOT *Highway Inventory Detail Report* (see Table 8.5)
	d1shoulder TypeOut	Identifies the predominant surface composition of the **outside** shoulder, or the lower shoulder type if more than one type	1 - Shoulder is paved 2 - Shoulder is composite 3 - Shoulder is gravel 4 - Shoulder is turf 5 - Shoulder is a curb 6 - No shoulder exists 98 - Not applicable 99 - Unknown	Desired	Right Shldr plus Type	See *d1shoulderTypeIn*

	SafetyAnalyst				***ODOT Database***	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltRoadway Segment	d2auxLane1	See *d1auxLane1*	See *d1auxLane1*	Required	See *d1auxLane1*	See *d1auxLane1*
	d2auxLane2	See *d1auxLane1*	See *d1auxLane1*	Required	See *d1auxLane1*	See *d1auxLane1*
	d2auxLane3	See *d1auxLane1*	See *d1auxLane1*	Required	See *d1auxLane1*	See *d1auxLane1*
	d2avgLane Width	See *d1avgLaneWidth*	N/A	Desired	See *d1avgLaneWidth*	See *d1avgLaneWidth*
	d2avg Shoulder WidthIn	See *d1avgShoulderWidthIn*	N/A	Desired	See *d1avgShoulder WidthIn*	See *d1avgShoulder WidthIn*
	d2avg Shoulder WidthOut	See *d1avgShoulderWidthOut*	N/A	Desired	See *d1avgShoulder WidthOut*	See *d1avgShoulder WidthOut*
	d2bikeway	See *d1bikeway*	See *d1bikeway*	Desired	See *d1bikeway*	See *d1bikeway*
	d2numThru Lane	See *d1numThruLane*	N/A	Required	See *d1numThruLane*	See *d1numThruLane*
	d2shoulder TypeIn	See *d1shoulderTypeIn*	See *d1shoulderTypeIn*	Desired	See *d1shoulderTypeIn*	See *d1shoulderTypeIn*
	d2shoulder TypeOut	See *d1shoulderTypeOut*	See *d1shoulderTypeOut*	Desired	See *d1 shoulderType Out*	See *d1 shoulderType Out*

SafetyAnalyst					*ODOT Database*	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltRoadway Segment	endOffset	Specifies a milepost for a Route/Milepost or Route/ County/Milepost location system, indicates a distance for the Route/Section/ Distance or Section/Distance location systems	N/A	Required	Mile Point	ODOT *Highway Inventory Detail Report* (see Table 8.5)
	gisID	Identifier used to link segment to corresponding GIS representation. SafetyAnalyst does not directly use item	N/A	Desired		Requires additional data collection efforts
	growth Factor	Fixed annual rate of increase at which traffic volume is expected to grow (i.e., represents exponential growth)	< 1.0 -- negative growth > 1.0 -- positive growth = 1.0 -- no growth Growth factors must be greater than zero.	Desired		Requires additional data collection efforts
	increasing Mileposts	Direction of travel in which mileposts or distances increase on the segment. Used by the SafetyAnalyst default collision diagram viewer to orient the collision diagram	NB - Northbound SB - Southbound EB - Eastbound WB - Westbound NA - Not applicable X - Unknown	Desired	Add Direction	ODOT *Capacity Report* (see Table 8.5)

SafetyAnalyst					*ODOT Database*	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltRoadway Segment	interchange Influence	Indicates if the site is located with an interchange influence area	Y – Yes, located within interchange influence area N – No, not located within an interchange influence area X - Unknown	Required		Requires additional data collection efforts
	jurisdiction	Indicates the primary agency responsible for the site	1 - Federal maintained 2 - State maintained 3 - County maintained 6 - Township maintained 4 - Local maintained 5 - Other maintained 99 - Unknown	Desired		ODOT *Miscellaneous Highway Report* (see Table 8.5)
	locSection	Section identifier when using the Route/Section/Distance or Section/Distance location system	N/A	Required Context: Data Import	Highway # and Mile Point	ODOT *Highway Inventory Detail Report* (see Table 8.5)
	locSystem	Specifies the location system used for all location data for this element	A - Route/Milepost B - Route/County/Milepost C - Route/Section/Distance D - Section/Distance	Required		"A" for Oregon state highways, not available for local streets

SafetyAnalyst					*ODOT Database*	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltRoadway Segment	majorRoad Name	Displayed only on site information screens. If the site is located on a numbered route, but the road or street also has a name, the route number should appear in the route name and the name of the road should appear here	N/A	Required	Route Name	*Routes To State Highway Cross Reference* (see Table 8.5)
	median Type1	Indication of the type and characterization of the area separating opposing traffic lanes	1 - Rigid barrier system 2 - Semi-rigid barrier system 3 - Flexible barrier system 4 - Raised median with curb 5 - Depressed median 6 - Flush paved median, at least 4 ft in width 7 - HOV lane 8 - Railroad or rapid transit 9 - Other divided 0 - Undivided 99 – Unknown	Required	MEDIAN/ Type	ODOT *Highway Inventory Detail Report* (see Table 8.5)

	SafetyAnalyst				***ODOT Database***	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltRoadway Segment	median Width	Average width of that portion of a divided highway separating the traveled way for traffic in opposing directions, measured from the inside edge of the through lane to the inside edge of the through lane in the opposite direction of travel. (The median width of an undivided roadway should have a value that equals zero)	< 99 ft (but not measured) use 99, > 99ft (but not measured) use 999.	Desired	MEDIAN/ Width	ODOT *Highway Inventory Detail Report* (see Table 8.5)
	openedTo Traffic	Date when the site was opened to traffic. This date should be provided for all sites that were constructed (or reconstructed) during the period for which SafetyAnalyst data are available.	N/A	Required		Requires additional data collection efforts

	SafetyAnalyst				*ODOT Database*	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltRoadway Segment	operation Way	Indication of whether or not a roadway serves one-way or two-way traffic. The code for one direction of travel for a divided highway should be used only for those agencies that treat the two separate directions of travel on divided highways as separate segments for record keeping purposes.	1 - One-way road or street 2 - Two-way road or street 3 - One direction of travel for a divided highway 99 - Unknown	Required		Requires additional data collection efforts Can be evaluated using the ODOT Digital Video Log (see Table 8.5)
	postedSpeed	Authorized posted speed limit. If differing speed limits exist for passenger cars and trucks, this field should contain the passenger car speed limit. If no speed limit is posted, the speed limit that applies as a matter of law should be used. For intersection legs, this is the posted speed limit on the approach to the intersection.	N/A	Required	SPEED, N, 10, 0	The file posted_ speed_2008 can be downloaded from the GIS database or speed limit can be confirmed using the ODOT Digital Video Log (see Table 8.5)

SafetyAnalyst					*ODOT Database*	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltRoadway Segment	roadway Class1	Functional classification of the street or highway containing the roadway segment	1 - Principal arterial-interstate 2 - Principal arterial-other freeway or expressway 3 - Principal arterial-other 4 - Minor arterial 5 - Major Collector 6 - Minor Collector 7 - Local 0 - Other 99 - Unknown	Required	FC	ODOT *Functional Classification and National Highway System Status on Oregon State Highways* (see Table 8.5)
	routeName	Number or name of the route where the site is located. For routes without numbers, the road or street name should be used	N/A	Required	Highway #	ODOT *Highway Inventory Detail Report* (see Table 8.5)

	SafetyAnalyst				***ODOT Database***	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltRoadway Segment	routeType	Category of the route where the site is located and should be included whether it is part of the location identifier or not, as searches may be conducted separately on this item. Additional route type codes may be needed in some states.	I - Interstate US - US route SR - State route BR - Business route BL - Business loop SP - Spur route CR - County road TR - Township road L - Local road O - Other X - Unknown	Required	Route No	ODOT *Routes To State Highway Cross Reference* (see Table 8.5) Additional data collection may still be required
	segment Length	Length of the segment	Distance between the beginning mile point and the ending mile point	Required	Mile Point	ODOT *Highway Inventory Detail Report* (see Table 8.5)

	SafetyAnalyst				***ODOT Database***	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltRoadway Segment	startOffset	Specifies a milepost or distance value for the appropriate location system. For a Route/Milepost or Route/County/Milepost location system, this value represents a milepost value. For the Route/Section/ Distance or Section/Distance location systems, this value represents the distance value.	N/A	Required	Mile Point	ODOT *Highway Inventory Detail Report* (see Table 8.5)
	terrain	Characterizes the predominant change in elevation along the roadway	L - Level R - Rolling M - Mountainous X - Unknown	Desired		Requires additional data collection efforts
	travel Direction	If Two-Way vs. One-Way Operation is one direction of travel for a divided highway, this item indicates the direction of travel of the respective segment.	NB - Northbound SB - Southbound EB - Eastbound WB - Westbound NA - Not applicable X - Unknown	Required		Requires additional data collection efforts

	SafetyAnalyst				***ODOT Database***	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltSegment Traffic	aadtVPD	Annual average daily traffic: Segments -- average number of vehicles per day from both directions of the mainline route in a year Intersections -- average number of vehicles per day passing through an intersection from both directions of the major or minor roadways for a year Ramps -- average number of vehicles traversing the ramp in one direction for all days of a specified year	N/A	Required	AADT Volume	ODOT *Traffic Volumes and Vehicle Classification Report* (see Table 8.5)
	agencyID	See Table: *AltRoadway Segment*, Variable: *agencyID*	N/A	Required	See Table: *AltRoadway Segment*, Variable: *agencyID*	See Table: *AltRoadway Segment*, Variable: *agencyID*
	calendar Year	Calendar year for which the associated traffic data are applicable	N/A	Required	Effective Date	ODOT *Traffic Volumes and Vehicle Classification Report* (see Table 8.5)

	SafetyAnalyst				***ODOT Database***	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltSegment Traffic	comment	Optional comment for the traffic volume data at this site	N/A	Desired	comment	
	peakHourly Volume	Traffic volume for the peak or design hour in the peak direction of flow	N/A	N/A	Design Hour Factor	ODOT *Traffic Volumes and Vehicle Classification Report* (see Table 8.5)
	percent Heavy Vehicles	Count of commercial vehicles on roadway divided by count of all vehicles on roadway. This item includes both tractor-trailer combinations and large straight trucks with six or more tires.	N/A	N/A	Sum of Vehicle Class Percentage of Class 4, 5, 6, 7, 8, 9, 10, 11, 12, 13	ODOT *Traffic Volumes and Vehicle Classification Report* (see Table 8.5)

SafetyAnalyst					*ODOT Database*	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltRamp	agencyID	See Table: *AltRoadway Segment*, Variable: *agencyID*	N/A	Required	See Table: *AltRoadway Segment*, Variable: *agencyID*	See Table: *AltRoadway Segment*, Variable: *agencyID*
	agencySite Subtype	Used to indicate the agency-specified classification of the facility (site subtype). This item is optional and should be used only for those site subtypes represented in an agency's data that are not supported by SafetyAnalyst	N/A	Desired	See Table: *AltRoadway Segment*, Variable: *agencySiteSubtype*	See Table: *AltRoadway Segment*, Variable: *agencySite Subtype*
	altRoute Names	See Table: *AltRoadway Segment*, Variable: *altRouteNames*	N/A	Required	See Table: *AltRoadway Segment*, Variable: *altRouteNames*	See Table: *AltRoadway Segment*, Variable: *altRouteNames*
	areaType	See Table: *AltRoadway Segment*, Variable: *areaType*	See Table: *AltRoadway Segment*, Variable: *areaType*	Required	See Table: *AltRoadway Segment*, Variable: *areaType*	See Table: *AltRoadway Segment*, Variable: *areaType*
	city	See Table: *AltRoadway Segment*, Variable: *city*	N/A	Desired	See Table: *AltRoadway Segment*, Variable: *city*	See Table: *AltRoadway Segment*, Variable: *city*

	SafetyAnalyst				***ODOT Database***	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltRamp	comment	Optional comment for the ramp	N/A	Desired		
	county	See Table: *AltRoadway Segment*, Variable: *county*	N/A	See Table: *AltRoadway Segment*, Variable: *county*	See Table: *AltRoadway Segment*, Variable: *county*	See Table: *AltRoadway Segment*, Variable: *county*
	corridor	See Table: *AltRoadway Segment*, Variable: *corridor*	N/A	Desired		Requires additional data collection efforts
	district	See Table: *AltRoadway Segment* Variable: *district*	N/A	Desired	See Table: *AltRoadway Segment* Variable: *district*	See Table: *AltRoadway Segment* Variable: *district*
	endOffset	See Table: *AltRoadway Segment*, Variable: *endOffset* Used for post-processing if the ramp length is not specified	N/A	Required Context: Data Import	See Table: *AltRoadway Segment*, Variable: *endOffset*	See Table: *AltRoadway Segment*, Variable: *endOffset*
	gisID	See Table: *AltRoadway Segment*, Variable: *gisID*	N/A	Desired	See Table: *AltRoadway Segment*, Variable: gisID	See Table: *AltRoadway Segment*, Variable: gisID

	SafetyAnalyst				***ODOT Database***	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltRamp	growth Factor	See Table: *AltRoadway Segment*, Variable: *growthFactor*	See Table: *AltRoadway Segment*, Variable: *growthFactor*	Desired	See Table: *AltRoadway Segment*, Variable: growthFactor	See Table: *AltRoadway Segment*, Variable: growthFactor
	jurisdiction	Indicates the primary agency responsible for the site	See Table: *AltRoadway Segment*, Variable: *jurisdiction*	Desired	See Table: *AltRoadway Segment*, Variable: *jurisdiction*	See Table: *AltRoadway Segment*, Variable: *jurisdiction*
	locSection	See Table: *AltRoadway Segment*, Variable: *locSection*	See Table: *AltRoadway Segment*, Variable: *locSection*	See Table: *AltRoadway Segment*, Variable: *locSection*	See Table: *AltRoadway Segment*, Variable: *locSection*	See Table: *AltRoadway Segment*, Variable: *locSection*
	locSystem	See Table: *AltRoadway Segment*, Variable: *locSystem*	See Table: *AltRoadway Segment*, Variable: *locSystem*	Required	See Table: *AltRoadway Segment*, Variable: *locSystem*	See Table: *AltRoadway Segment*, Variable: *locSystem*
	majorRoad Name	See Table: *AltRoadway Segment*, Variable: *majorRoadName*	See Table: *AltRoadway Segment*, Variable: *majorRoadName*	Required	See Table: *AltRoadway Segment*, Variable: *majorRoadName*	See Table: *AltRoadway Segment*, Variable: *majorRoadName*

SafetyAnalyst					*ODOT Database*	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltRamp	numOf Lanes	Indicates the number of lanes on the ramp proper	N/A	Required	LN 1, LN2, LN3……. Count the number of LNi which have non-zero width.	ODOT *Lane Report* (see Table 8.5), select Connections as the Road Type
	openedTo Traffic	See Table: *AltRoadway Segment*, Variable: *openedToTraffic*	N/A	Required	See Table: *Alt RoadwaySegment*, Variable: *openedToTraffic*	See Table: *Alt RoadwaySegment*, Variable: *openedToTraffic*
	rampConfi-guration	Describes the characterization of the design of the ramp	1 - Ramp configuration is diamond 2 - Partial clover leaf loop 3 - Ramp configuration is a free-flow loop 4 - Ramp configuration is free-flow outer connection 5 - Direct or semi-direct 6 - C-D road or other 0 - Other 99 - Unknown	Required		Requires additional data collection efforts

SafetyAnalyst					*ODOT Database*	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltRamp	ramp Crossroad Connection	Characterizes the type of connection at the crossroad ramp terminal	1 - At-grade ramp terminal 2 - Acceleration lane 3 - Deceleration lane 4 - Other 99 - Unknown	Conditionally Required		Requires additional data collection efforts
	ramp Freeway Connection	Characterizes the purpose and use of the ramp	1 - Mainline acceleration lane 2 - Mainline deceleration lane 3 - Mainline weaving area 4 - C-D road 5 - Other 99 - Unknown	Conditionally Required		Requires additional data collection efforts
	rampLength	Total length of ramp, including horizontal curves and tangents. Agencies should use a fixed convention for measuring ramp length, such as starting the measurement at the gore area. Required for post-processing if ramp end location is not specified	N/A	Conditionally Required Context: Data Import	Select Connections as the Road Type then use the Mile Point value	ODOT *Highway Inventory Detail Report* (see Table 8.5)

SafetyAnalyst					*ODOT Database*	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltRamp	rampType	Indicates whether the ramp is used to enter or exit a freeway, or connect two freeways	1 - Off ramp (Exit) 2 - On ramp (Enter) 3 - Freeway-to-freeway 0 - Other type of ramp 99 - Unknown type of ramp	Condi-tionally Required		Requires additional data collection efforts
	routeName	See Table: *AltRoadway Segment,* Variable: *routeName*	N/A	Required	Select Connections as the Road Type	ODOT *Highway Inventory Detail Report* (see Table 8.5)
	routeType	See Table: *AltRoadway Segment,* Variable: *routeType*	See Table: *AltRoadway Segment,* Variable: *routeType*	Required	See Table: *AltRoadway Segment,* Variable: *routeType*	See Table: *AltRoadway Segment,* Variable: *routeType*
	startOffset	See Table: *AltRoadway Segment,* Variable: *startOffset*	N/A	Required	See Table: *AltRoadway Segment,* Variable: *startOffset*	See Table: *AltRoadway Segment,* Variable: *startOffset*

SafetyAnalyst					*ODOT Database*	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltRamp Traffic	aadtVPD	See Table: *AltSegment Traffic*, Variable: *aadtVPD*	N/A	Required	See Table: *AltSegment Traffic*, Variable: *aadtVPD*	See Table: *AltSegment Traffic*, Variable: *aadtVPD*
	agencyID	See Table: *AltRoadway Segment*, Variable: *agencyID*	N/A	Required	See Table: *AltRoadway Segment*, Variable: *agencyID*	See Table: *AltRoadway Segment*, Variable: *agencyID*
	calendar Year	See Table: *AltSegment Traffic*, Variable: *calendarYear*	N/A	Required	See Table: *AltSegment Traffic*, Variable: *calendarYear*	See Table: *AltSegment Traffic*, Variable: *calendarYear*
	comment	Optional comment for the traffic volume data at this site	N/A	Desired		
AltIntersection	agencyID	See Table: *AltRoadway Segment*, Variable: *agencyID*	N/A	Required	See Table: *AltRoadway Segment*, Variable: *agencyID*	See Table: *AltRoadway Segment*, Variable: *agencyID*

SafetyAnalyst					*ODOT Database*	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltIntersection	agencySite Subtype	Used to indicate the agency-specified classification of the facility (site subtype). This item is optional and should be used only for those site subtypes represented in an agency's data that are not supported by SafetyAnalyst	N/A	Desired	See Table: *AltRoadway Segment,* Variable: *agencySiteSubtype*	See Table: *AltRoadway Segment,* Variable: *agencySite Subtype*
	altRoute Names	See Table: *AltRoadway Segment,* Variable: *altRouteNames*	N/A	Required	See Table: *AltRoadway Segment,* Variable: *altRouteNames*	See Table: *AltRoadway Segment,* Variable: *altRouteNames*
	areaType	See Table: *AltRoadway Segment,* Variable: *areaTypes*	U - Urban R - Rural X - Unknown	Required	See Table: *AltRoadway Segment,* Variable: *areaTypes*	See Table: *AltRoadway Segment,* Variable: *areaTypes*
	city	See Table: *AltRoadway Segment,* Variable: *city*	N/A	Desired	See Table: *AltRoadway Segment,* Variable: *city*	See Table: *AltRoadway Segment,* Variable: *city*
	comment	Optional comment for the intersection	N/A	Desired		

SafetyAnalyst					*ODOT Database*	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltIntersection	corridor	See Table: *AltRoadway Segment,* Variable: *corridor*	N/A	Desired	See Table: *AltRoadway Segment,* Variable: *corridor*	See Table: *Alt RoadwaySegment,* Variable: *corridor*
	county	See Table: *AltRoadway Segment,* Variable: *county*	N/A	Condi-tionally Required	See Table: *AltRoadway Segment,* Variable: *county*	See Table: *Alt RoadwaySegment,* Variable: *county*
	district	See Table: *AltRoadway Segment,* Variable: *district*	N/A	Desired	See Table: *AltRoadway Segment,* Variable: *district*	See Table: *Alt RoadwaySegment,* Variable: *district*
	gisID	See Table: *AltRoadway Segment,* Variable: *gisID*	N/A	Desired	See Table: *AltRoadway Segment,* Variable: *gisID*	See Table: *Alt RoadwaySegment,* Variable: *gisID*
	growth Factor	See Table: *AltRoadway Segment,* Variable: *growthFactor*	See Table: *AltRoadway Segment,* Variable: *growthFactor*	Desired	See Table: *AltRoadway Segment,* Variable: *growthFactor*	See Table: *Alt RoadwaySegment,* Variable: *growthFactor*
	intersection Type1	Type of intersection at which two or more roadways intersect at grade. If an agency using SafetyAnalyst does not distinguish between Tee and Y intersections, all three-leg intersections should be classified as Tees (category 1)	1 - Tee intersection 2 - Y intersection 3 - Four-leg intersection 4 - Traffic circle or roundabout 5 – Multi-leg intersection of five or more legs 0 - Other 99 - Unknown	Required	Roadway Codes	Partial data available from ODOT "Lane Report", Requires additional data collection efforts

	SafetyAnalyst				***ODOT Database***	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltIntersection	jurisdiction	See Table: *AltRoadway Segment,* Variable: *jurisdiction*	See Table: *AltRoadway Segment* Variable: *jurisdiction*	Desired	See Table: *AltRoadway Segment,* Variable: *jurisdiction*	See Table: *AltRoadway Segment,* Variable: *jurisdiction*
	majBegin Influence Zone	Beginning search limit for auxiliary intersection accidents, expressed as distance in mi (km) from intersection reference point to beginning of major road	N/A	Condi-tionally Required		Requires additional data collection efforts
	majEnd Influence Zone	Ending search limit for auxiliary intersection accidents, expressed as distance in mi (or km) from intersection reference point to end of major road	N/A	Condi-tionally Required		Requires additional data collection efforts
	majorRoad Direction	Prevailing (designated) direction of the major roadway. For example, the direction of a state designated north-south highway must be either northbound or southbound even though a short segment of the highway may have an east-west orientation	NS - North-south EW - East-west X - Unknown	Required		Requires additional data collection efforts

	SafetyAnalyst				***ODOT Database***	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltIntersection	majorRoad LocSystem	See Table: *AltRoadway Segment*, Variable: *locSystem*	See Table: *AltRoadway Segment*, Variable: *locSystem*	Required	See Table: *AltRoadway Segment*, Variable: *locSystem*	See Table: *AltRoadway Segment*, Variable: *locSystem*
	majorRoad Name	See Table: *AltRoadway Segment*, Variable: *majorRoadName*	N/A	Required	See Table: *AltRoadway Segment*, Variable: *majorRoadName*	See Table: *AltRoadway Segment*, Variable: *majorRoadName*
	majorRoad Offset	See Table: *AltRoadway Segment*, Variable: *startOffset*	N/A	Required	See Table: *AltRoadway Segment*, Variable: *startOffset*	See Table: *AltRoadway Segment*, Variable: *startOffset*
	majorRoad Section	Specifies the section identifier when using the Route/Section/Distance or Section/Distance location systems	N/A	Condi-tionally Required Context: Data Import	Highway #, Highway Name	ODOT *Highway Inventory Detail Report* (see Table 8.5), select Connections as the Road Type then identify the highway in the *Routes To State Highway Cross Reference*

SafetyAnalyst					*ODOT Database*	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltIntersection	minBegin Influence Zone	See Table: *AltIntersection*, Variable: *majBegin*	N/A	Desired		Requires additional data collection efforts
	minEnd Influence Zone	See Table: *AltIntersection*, Variable: *majEnd*	N/A	Desired		Requires additional data collection efforts
	minorRoad LocSystem	See Table: *AltRoadway Segment*, Variable: *locSystem*	See Table: *AltRoadway Segment*, Variable: *locSystem*	Desired		See Table: *AltRoadway Segment*, Variable: *locSystem*
	minorRoad Name	The name of the minor road(s) at the intersection	N/A	Required	Description Column	ODOT *Lane Report* (see Table 8.5)
	minorRoad Offset	See Table: *AltRoadway Segment*, Variable: *startOffset*	N/A	Desired	Mile Point	See Table: *AltRoadway Segment*, Variable: *startOffset* for state highways, requires additional data for local streets if deemed necessary

SafetyAnalyst					*ODOT Database*	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltIntersection	minorRoad RouteName	Number or name of the route assigned to the minor road at the intersection. Where routes overlap, the more important route type and the corresponding lower route number normally take precedence. For routes without numbers, the road or street name should be used.	N/A	Required	Description Column (where applicable)	ODOT *Lane Report* (see Table 8.5)
	minorRoad RouteType	Identifies the category of the route for the minor road at the intersection. This item should be included whether it is part of the location identifier or not, as searches may be conducted separately on this item.	See Table: *AltRoadway Segment,* Variable: *routeType*	Required	See Table: *AltRoadway Segment,* Variable: *routeType*	See Table: *AltRoadway Segment,* Variable: *routeType*
	minorRoad Section	The section identifier when using the Route/Section/ Distance or Section/Distance location systems.	N/A	Condi-tionally Required	See Table: *AltIntersection,* Variable: *majorRoad Section*	See Table: *AltIntersection,* Variable: *majorRoad Section*

SafetyAnalyst					*ODOT Database*	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltIntersection	offset Distance	Indicates the offset distance between the centerlines of the intersecting legs (minor road) at the intersection. When the intersection legs are not offset, the value of this data item should be zero	N/A	Required		Requires additional data collection efforts
	offset Intersection	Indicates whether the cross streets intersect the major road at the same location or whether there is some separation or distance between the centerlines of the cross streets	Y - Legs are offset N - Legs are not offset X - Unknown	Required		Requires additional data collection efforts
	openedTo Traffic	See Table: *AltRoadway Segment*, Variable: *openedToTraffic*	N/A	Required	See Table: *AltRoadway Segment*, Variable: *openedToTraffic*	See Table: *AltRoadway Segment*, Variable: *openedToTraffic*

SafetyAnalyst					*ODOT Database*	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltIntersection	routeName	See Table: *AltRoadway Segment*, Variable: *routeName*	N/A	Required	See Table: *AltRoadway Segment*, Variable: *routeName*	See Table: *AltRoadway Segment*, Variable: *routeName*
	routeType	See Table: *AltRoadway Segment*, Variable: *routeType*	See Table: *AltRoadway Segment*, Variable: *routeType*	Required	See Table: *AltRoadway Segment*, Variable: *routeType*	See Table: *AltRoadway Segment*, Variable: *routeType*

SafetyAnalyst					*ODOT Database*	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltIntersection	traffic Control1	Type of traffic control device at the intersection. This category may be used for purposes of an advanced search, and categories listed in Traffic Control Type at Intersection Level 2 may be derived from this data item.	1 - No Traffic control 2 - Stop signs on cross street only 3 - Stop signs on mainline only 4 - All-way stop signs 5 - Two-way flasher (red on cross street) 6 - Two-way flasher (red on mainline) 7 - All-way flasher (red on all) 8 - Yield signs on cross street only 9 - Yield signs on mainline only 10 - Other non-signalized 11 – Pre-timed (2 Φ) 12 – Pre-timed (multi- Φ) 13 - Semi-actuated (2 Φ) 14 - Semi-actuated (multi- Φ) 15 - Fully actuated (2 Φ) 16 - Fully actuated (multi- Φ) 17 - Other signalized 18 - Roundabout 99 - Unknown	Required		Data file signals_ 2008 shows information of all of signals in Oregon. Additional data collection may be required for other traffic control.

SafetyAnalyst					*ODOT Database*	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltMajorRoadTraffic	aadtVPD	See Table: *AltSegment Traffic*, Variable: *aadtVPD*	N/A	Required	See Table: *AltSegment Traffic*, Variable: *aadtVPD*	See Table: *AltSegment Traffic*, Variable: *aadtVPD*
	agencyID	Unique agency-specific identifier for the intersection.	N/A	Required	See Table: *AltRoadway Segment*, Variable: *agencyID*	See Table: *AltRoadway Segment*, Variable: *agencyID*
	calendar Year	See Table: *AltSegment Traffic*, Variable: *calendarYear*	N/A	Required	See Table: *AltSegment Traffic*, Variable: *calendarYear*	See Table: *Alt SegmentTraffic*, Variable: *calendarYear*
	comment	Optional comment for the traffic data at this site.	N/A	Desired		comment
AltMinorRoadTraffic	aadtVPD	See Table: *AltSegment Traffic*, Variable: *aadtVPD*	N/A	Required	See Table: *AltSegment Traffic*, Variable: *aadtVPD*	See Table: *AltSegment Traffic*, Variable: *aadtVPD*
	agencyID	Unique agency-specific identifier for the intersection.	N/A	Required	See Table: *AltRoadway Segment*, Variable: *agencyID*	See Table: *Alt RoadwaySegment*, Variable: *agencyID*

	SafetyAnalyst				***ODOT Database***	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltMinorRoadTraffic	calendar Year	See Table: *AltSegment Traffic*, Variable: *calendarYear*	N/A	Required	See Table: *AltSegment Traffic*, Variable: *calendarYear*	See Table: *AltSegment Traffic*, Variable: *calendarYear*
	comment	Optional comment for the traffic data at this site	N/A	Desired		
AltLeg	agencyID	Unique agency-specific identifier for the intersection.	N/A	Required		See Table: *AltRoadway Segment*, Variable: *agencyID*
	leftTurn Phasing	Type of left-turn phasing provided on the approach (not applicable to unsignalized intersections)	1 - Protected left 2 - Protected/permitted left 3 - Permitted left 4 - No left-turn phase 98 - Not applicable 99 - Unknown	Condi-tionally Required		Requires additional data collection efforts
	legDirection	Indicates the directional approach of the intersecting leg	NB – Northbound approach SB – Southbound approach WB – Westbound approach EB – Eastbound approach X - Unknown	Required		Requires additional data collection efforts

	SafetyAnalyst				*ODOT Database*	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltLeg	legID	Internal enumeration used by SafetyAnalyst	1 - Leg 1 2 - Leg 2 3 - Leg 3 4 - Leg 4 5 - Leg 5 6 - Leg 6	Required		Generated by users
	legMedian Type	Character of the area separating opposing traffic lanes	1 - Raised median with curb 2 - Depressed median 3 - Flush paved median [at least 4 ft in width] 4 - Other divided 5 - Undivided 0 - Other 99 - Unknown	Required		Requires additional data collection efforts
	legNumLeft TurnLane	Number of exclusive left-turn lanes on the approach	N/A	Desired	LTL Column	ODOT *Lane Report* (see Table 8.5) for state highways, data collection needed for local streets
	legNum RightTurn Lane	Number of exclusive right-turn lanes on the approach.	N/A	Desired	RTW Column	ODOT *Lane Report* (see Table 8.5), data collection needed for local streets

SafetyAnalyst					*ODOT Database*	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltLeg	legNum ThruLane	Number of through lanes on the approach to the intersection. This includes all lanes with through movement (including shared lanes and left-turn and right-turn lanes at three leg intersections) except exclusive turn lanes.	N/A	Desired	LN 1, LN2, LN3……. Count the number of LNi which have non-zero width.	ODOT *Lane Report* (see Table 8.5) for state highways, data collection needed for local streets
	legType	Specifies the major/minor road classification of this leg relative to the other legs in the intersection. The Not Valid enumeration value is provided to support import data sets where the number of legs in the data is fixed. Non-existent legs may be denoted using the Not Valid value.	1 - Major road approach in primary increasing milepost direction 2 - Major road approach in secondary (decreasing) milepost direction 3 - Minor road approach to right of primary or increasing milepost direction 4 - Minor road approach to left of primary or increasing milepost direction 98 - Not valid, e.g., 4th (unused) leg of a three-legged intersection 99 - Unknown	Required		Requires additional data collection efforts

SafetyAnalyst					*ODOT Database*	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltLeg	operation Way	Indicates whether or not the intersection approach serves one-way or two-way traffic	1 - One-way street or road 2 - Two-way street or road 99 - Unknown	Required	See Table: *Alt RoadwaySegment,* Variable: *operationWay*	See Table: *Alt RoadwaySegment,* Variable: *operationWay*
	postedSpeed	Authorized posted speed limit. If differing speed limits exist for passenger cars and trucks, this field should contain the passenger car speed limit. If no speed limit is posted, the speed limit that applies as a matter of law should be used. For intersection legs, this is the posted speed limit on the approach to the intersection.	N/A	Desired	See Table: *Alt RoadwaySegment,* Variable: *postedSpeed*	See Table: *Alt RoadwaySegment,* Variable: *postedSpeed*
	turn Prohibitions	Characterizes the turn restrictions for vehicles leaving the approach.	1 - No left turns any time 2 - No left turns during specific times 3 - No right turns any time 4 - No right turns during specific times 5 - No U turns 6 - Other 98 - No turn 99 - Unknown	Desired		Requires additional data collection efforts

SafetyAnalyst					*ODOT Database*	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltLegTraffic	aadtVPD	See Table: *AltSegment Traffic*, Variable: *aadtVPD*	N/A	Required	See Table: *AltSegment Traffic*, Variable: *aadtVPD*	See Table: *Alt SegmentTraffic*, Variable: *aadtVPD*
	agencyID	Unique agency-specific identifier for the intersection	N/A	Required	See Table: *AltRoadway Segment*, Variable: *agencyID*	See Table: *Alt RoadwaySegment*, Variable: *agencyID*
	calendar Year	Calendar year for which the associated traffic data are applicable	N/A	Required	See Table: *AltSegmentTraffic*, Variable: *calendarYear*	See Table: *Alt SegmentTraffic*, Variable: *calendarYear*
	leftTurn Volume	Average number of vehicles exiting this leg that turn left onto a cross street, expressed as either vehicles per day or an hourly volume (reflecting peak or design hourly volume)	N/A	Required only when major and minor road traffic volumes are not available		Requires additional data collection efforts
	legID	Internal enumeration used by SafetyAnalyst	1 - Leg 1 2 - Leg 2 3 - Leg 3 4 - Leg 4 5 - Leg 5 6 - Leg 6	Required	See Table: *AltLeg* Variable: *legID*	See Table: *AltLeg* Variable: *legID*

SafetyAnalyst					*ODOT Database*	
Table	**Variable**	**Variable Description**	**Possible Values**	**Required or Desired**	**Variable Name**	**Database**
AltLegTraffic	rightTurn Volume	Average number of vehicles exiting this leg that turn right onto a cross street, expressed as either vehicles per day or an hourly volume (reflecting the peak or design hourly volume)	N/A	Required only when major and minor road traffic volume are not available		Requires additional data collection efforts
	through Volume	Average number of vehicles exiting this leg that travel straight through the intersection, expressed as either vehicles per day or an hourly volume (reflecting the peak or design hourly volume)	N/A	Required only when major and minor road traffic volume data are not available		Requires additional data collection efforts

Table 8.5: ODOT Database Resources

ODOT Database	Location of Database
Bikeway, Sidewalk, & Crosswalk Report	http://highway.odot.state.or.us/cf/highwayreports/bikeway_parms.cfm
Capacity Report	http://highway.odot.state.or.us/cf/highwayreports/cap_parms.cfm
Digital Video Log	https://keiko36.odot.state.or.us/whalecomfb751917efb5683a9c287df8a9ad831f7e55a2048a/whalecom0/cf/dvl/
Functional Classification and NHS Status on Oregon State Highways	http://www.oregon.gov/ODOT/TD/TDATA/rics/docs/ORStateHwysFCandNHS.pdf
GIS Database (ftp site)	ftp://ftp.odot.state.or.us/tdb/trandata/GIS_data/
Highway Inventory Detail Report	http://highway.odot.state.or.us/cf/highwayreports/mlpt_detail_parms.cfm
Lane Report	http://highway.odot.state.or.us/cf/highwayreports/aml_detail_parms.cfm
Miscellaneous Highway Report	http://highway.odot.state.or.us/cf/highwayreports/exclude_parms.cfm
Routes to State Highway Cross Reference	http://www.oregon.gov/ODOT/TD/asset_mgmt/docs/OTMS/Routes2HwyCrossRef.pdf
Signals_2008	Not available online
State Highway Names Report	http://highway.odot.state.or.us/cf/highwayreports/road_parms.cfm
Traffic Volumes and Vehicle Classification Report	http://highway.odot.state.or.us/cf/highwayreports/traffic_parms.cfm

8.2 SAFETYANALYST SAMPLE OUTPUT

SafetyAnalyst

Network Screening Report

Jun 17, 2011

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1. Network Screening Report

Basic Network Screening
SafetyAnalyst: v3.0.0, packaged: Jun 30, 2009 3:37 PM on sa_dev.ittsystems.com
Data set title: control group total level
Data set comment: null
Data set created: 4:52 PM
Roadway Segments: Peak Searching
Accident Severity Level: Fatal and all injury accidents
Site Types: Segments, Intersections, Ramps
Screening Attribute: Accident Month = January; February; March; April; May; June; July; August; September; October; November; December
Potential for Safety Improvement Using: Expected accident frequency
Analysis Period: From 2008 To 2008
Major Reconstruction: No major reconstruction occurred at any sites during the analysis period
CV limit (roadway segments): 0.5
CV limit (intersections): 0.5
CV limit (ramps): 0.5
Area Weights (Rural): 1.0
Area Weights (Urban): 1.0
Limiting Value (Roadway Segments): 0.0 crashes/mi/yr
Limiting Value (Intersections): 0.0 crashes/yr
Limiting Value (Ramps): 0.0 crashes/mi/yr
Number of sites in the site list: 85
Number of sites evaluated: 85
Number of segments evaluated: 34
Total length of segments evaluated: 10.730
Number of intersections evaluated: 47
Number of ramps evaluated: 4
Number of sites flagged: 47

Table 1. Basic Network Screening (with Peak Searching on roadway segments and CV test)

ID	Site Type	Site Subtype	County	Route	Site Start Loca-tion	Site End Loca-tion	Average Observed Accidents for Entire Site*	Location with Highest Potential for Safety Improvement								Rank	Additional Windows of Interest
								Average Observed Accidents*	Predicted Accident Frequency*	Expected Accident Frequency*	Variance**	Start Loca-tion	End Loca-tion	No. of Expected Fatalities	No. of Expected Injuries		
029S1	Segment	Seg/Urb; Multilane undivided	Washington	SR29	11.33	11.67	11.76	40.00	6.91	18.78	6.74	11.33	11.43	0.20	29.34	1	11.43 - 11.53 11.53 - 11.63 11.57 - 11.67
029S3	Segment	Seg/Urb; Multilane undivided	Washington	SR29	12.0	12.26	11.54	30.00	9.30	18.20	7.82	12.1	12.2	0.20	28.43	2	12.0 - 12.1 12.16 - 12.26
026S2	Segment	Seg/Urb; Multilane undivided	Multnomah	US26	2.14	2.46	15.62	30.00	8.65	17.44	7.19	2.24	2.34	0.19	27.25	3	2.14 - 2.24 2.34 - 2.44 2.36 - 2.46
026S3	Segment	Seg/Urb; Multilane undivided	Multnomah	US26	2.48	2.79	6.45	20.00	9.66	14.20	6.23	2.58	2.68	0.15	22.18	4	2.48 - 2.58 2.68 - 2.78 2.69 - 2.79
026S5	Segment	Seg/Urb; Multilane undivided	Multnomah	US26	2.92	2.99	14.29	14.29	9.66	11.29	4.00	2.92	2.99	0.12	17.65	5	
029S2	Segment	Seg/Urb; Multilane undivided	Washington	SR29	11.77	11.9	7.69	10.00	9.07	9.46	4.01	11.8	11.9	0.10	14.79	6	11.77 - 11.87
026S1	Segment	Seg/Urb; Multilane undivided	Multnomah	US26	2.02	2.07	0.00	0.00	10.13	7.18	2.09	2.02	2.07	0.08	11.22	7	
026I15	Inter-section	Int/Urb; 4-leg signalized	Multnomah	US26	2.9		8.00	8.00	4.61	6.58	3.82	-	-	0.05	9.88	8	
033S1	Segment	Seg/Urb; 2-lane arterial	Benton	US33	55.45	55.55	10.00	10.00	1.42	4.78	1.87	55.45	55.55	0.11	7.97	9	
007S5	Segment	Seg/Urb; Multilane undivided	Deschutes	US7	2.19	2.27	12.50	12.50	2.91	4.44	0.70	2.19	2.27	0.05	6.93	10	
007S2	Segment	Seg/Urb; Multilane undivided	Deschutes	US7	1.7	1.8	0.00	0.00	5.05	3.59	1.04	1.7	1.8	0.04	5.60	11	

Table 1. Basic Network Screening (with Peak Searching on roadway segments and CV test)

ID	Site Type	Site Subtype	County	Route	Site Start Loca-tion	Site End Loca-tion	Average Observed Accidents for Entire Site*	Location with Highest Potential for Safety Improvement								Rank	Additional Windows of Interest
								Average Observed Accidents*	Predicted Accident Frequency*	Expected Accident Frequency*	Variance**	Start Loca-tion	End Loca-tion	No. of Expected Fatalities	No. of Expected Injuries		
007S4	Segment	Seg/Urb; Multilane undivided	Deschutes	US7	2.0	2.17	0.00	0.00	5.05	3.59	1.04	2.0	2.1	0.04	5.60	11	2.07 - 2.17
007I5	Inter-section	Int/Urb; 4-leg signalized	Deschutes	US7	2.27		4.00	4.00	1.95	2.70	1.00	-	-	0.02	4.06	13	
029I6	Inter-section	Int/Urb; 3-leg minor-rd STOP	Washington	SR29	12.26		4.00	4.00	0.99	2.64	1.45	-	-	0.05	4.15	14	
026I2	Inter-section	Int/Urb; 4-leg signalized	Multnomah	US26	2.07		2.00	2.00	3.05	2.55	1.22	-	-	0.02	3.83	15	
026I8	Inter-section	Int/Urb; 4-leg signalized	Multnomah	US26	2.46		2.00	2.00	3.03	2.54	1.21	-	-	0.02	3.82	16	
007S6	Segment	Seg/Urb; Multilane undivided	Deschutes	US7	2.3	2.38	0.00	0.00	2.91	2.45	0.39	2.3	2.38	0.03	3.83	17	
007S7	Segment	Seg/Urb; Multilane undivided	Deschutes	US7	2.41	2.54	0.00	0.00	2.91	2.36	0.45	2.41	2.51	0.03	3.68	18	2.44 - 2.54
033I1	Inter-section	Int/Urb; 4-leg signalized	Benton	US33	55.5		4.00	4.00	1.57	2.34	0.75	-	-	0.02	3.52	19	
029I1	Inter-section	Int/Urb; 4-leg signalized	Washington	SR29	11.33		1.00	1.00	2.59	1.89	0.83	-	-	0.01	2.84	20	
029I3	Inter-section	Int/Urb; 4-leg signalized	Washington	SR29	11.67		1.00	1.00	2.54	1.88	0.81	-	-	0.01	2.82	21	

Table 1. Basic Network Screening (with Peak Searching on roadway segments and CV test)

ID	Site Type	Site Subtype	County	Route	Site Start Loca-tion	Site End Loca-tion	Average Observed Accidents for Entire Site*	Location with Highest Potential for Safety Improvement								Rank	Additional Windows of Interest
								Average Observed Accidents*	Predicted Accident Frequency*	Expected Accident Frequency*	Variance**	Start Loca-tion	End Loca-tion	No. of Expected Fatalities	No. of Expected Injuries		
029I5	Inter-section	Int/Urb; 4-leg signalized	Washington	SR29	12.13		1.00	1.00	2.09	1.67	0.64	-	-	0.01	2.50	22	
007I7	Inter-section	Int/Urb; 4-leg signalized	Deschutes	US7	2.54		1.00	1.00	1.40	1.28	0.38	-	-	0.01	1.92	23	
033S5	Segment	Seg/Rur; 2-lane	Linn	SR33	56.14	56.47	0.00	0.00	0.12	0.12	0.00	56.14	56.24	0.00	0.17	24	56.24 - 56.34 56.34 - 56.44 56.37 - 56.47
033S6	Segment	Seg/Rur; 2-lane	Linn	SR33	56.47	56.8	0.00	0.00	0.12	0.12	0.00	56.47	56.57	0.00	0.17	24	56.57 - 56.67 56.67 - 56.77 56.7 - 56.8
102I5	Inter-section	Int/Rur; 4-leg minor-rd STOP	Washington	SR102	88.0		0.00	0.00	0.09	0.09	0.00	-	-	0.01	0.18	26	
102S1	Segment	Seg/Rur; 2-lane	Washington	SR102	85.67	86.09	0.00	0.00	0.09	0.09	0.00	85.67	85.77	0.00	0.12	27	85.77 - 85.87 85.87 - 85.97 85.97 - 86.07 85.99 - 86.09
102S2	Segment	Seg/Rur; 2-lane	Washington	SR102	86.19	87.0	0.00	0.00	0.09	0.09	0.00	86.19	86.29	0.00	0.12	27	86.29 - 86.39 86.39 - 86.49 86.49 - 86.59 86.59 - 86.69 86.69 - 86.79 86.79 - 86.89 86.89 - 86.99 86.9 - 87.0

Table 1. Basic Network Screening (with Peak Searching on roadway segments and CV test)

ID	Site Type	Site Subtype	County	Route	Site Start Loca-tion	Site End Loca-tion	Average Observed Accidents for Entire Site*	Location with Highest Potential for Safety Improvement								Rank	Additional Windows of Interest
								Average Observed Accidents*	Predicted Accident Frequency*	Expected Accident Frequency*	Variance**	Start Loca-tion	End Loca-tion	No. of Expected Fatalities	No. of Expected Injuries		
102S3	Segment	Seg/Rur; 2-lane	Washington	SR102	87.1	87.81	0.00	0.00	0.09	0.09	0.00	87.1	87.2	0.00	0.12	27	87.2 - 87.3 87.3 - 87.4 87.4 - 87.5 87.5 - 87.6 87.6 - 87.7 87.7 - 87.8 87.71 - 87.81
102S4	Segment	Seg/Rur; 2-lane	Washington	SR102	87.81	88.0	0.00	0.00	0.09	0.09	0.00	87.81	87.91	0.00	0.12	27	87.9 - 88.0
226S1	Segment	Seg/Rur; 2-lane	Lane	SR226	8.03	8.66	0.00	0.00	0.05	0.05	0.00	8.03	8.13	0.00	0.07	31	8.13 - 8.23 8.23 - 8.33 8.33 - 8.43 8.43 - 8.53 8.53 - 8.63 8.56 - 8.66
271S2	Segment	Seg/Rur; 2-lane	Jackson	SR271	10.21	10.63	0.00	0.00	0.05	0.05	0.00	10.21	10.31	0.00	0.07	31	10.31 - 10.41 10.41 - 10.51 10.51 - 10.61 10.53 - 10.63
226S2	Segment	Seg/Rur; 2-lane	Lane	SR226	8.76	9.98	0.00	0.00	0.05	0.05	0.00	8.76	8.86	0.00	0.07	33	8.86 - 8.96 8.96 - 9.06 9.06 - 9.16 9.16 - 9.26 9.26 - 9.36 9.36 - 9.46 9.46 - 9.56 9.56 - 9.66 9.66 - 9.76 9.76 - 9.86 9.86 - 9.96 9.88 - 9.98
226S3	Segment	Seg/Rur; 2-lane	Lane	SR226	10.08	10.31	0.00	0.00	0.05	0.05	0.00	10.08	10.18	0.00	0.07	33	10.18 - 10.28 10.21 - 10.31

Table 1. Basic Network Screening (with Peak Searching on roadway segments and CV test)

ID	Site Type	Site Subtype	County	Route	Site Start Loca-tion	Site End Loca-tion	Average Observed Accidents for Entire Site*	Location with Highest Potential for Safety Improvement								Rank	Additional Windows of Interest
								Average Observed Accidents*	Predicted Accident Frequency*	Expected Accident Frequency*	Variance**	Start Loca-tion	End Loca-tion	No. of Expected Fatalities	No. of Expected Injuries		
226S4	Segment	Seg/Rur; 2-lane	Lane	SR226	10.41	10.63	0.00	0.00	0.05	0.05	0.00	10.41	10.51	0.00	0.07	33	10.51 - 10.61 10.53 - 10.63
226S5	Segment	Seg/Rur; 2-lane	Lane	SR226	10.73	11.03	0.00	0.00	0.05	0.05	0.00	10.73	10.83	0.00	0.07	33	10.83 - 10.93 10.93 - 11.03
102I2	Inter-section	Int/Rur; 4-leg minor-rd STOP	Washington	SR102	85.75		0.00	0.00	0.05	0.05	0.00	-	-	0.00	0.09	37	
271S3	Segment	Seg/Rur; 2-lane	Jackson	SR271	10.73	11.17	0.00	0.00	0.05	0.05	0.00	10.73	10.83	0.00	0.07	38	10.83 - 10.93 10.93 - 11.03 11.03 - 11.13 11.07 - 11.17
271S4	Segment	Seg/Rur; 2-lane	Jackson	SR271	11.27	12.56	0.00	0.00	0.05	0.05	0.00	11.27	11.37	0.00	0.07	38	11.37 - 11.47 11.47 - 11.57 11.57 - 11.67 11.67 - 11.77 11.77 - 11.87 11.87 - 11.97 11.97 - 12.07 12.07 - 12.17 12.17 - 12.27 12.27 - 12.37 12.37 - 12.47 12.46 - 12.56
102I4	Inter-section	Int/Rur; 4-leg minor-rd STOP	Washington	SR102	87.0		0.00	0.00	0.04	0.04	0.00	-	-	0.00	0.08	40	
271S1	Segment	Seg/Rur; 2-lane	Jackson	SR271	9.89	10.11	0.00	0.00	0.04	0.04	0.00	9.89	9.99	0.00	0.06	41	9.99 - 10.09 10.01 - 10.11
271I5	Inter-section	Int/Rur; 4-leg minor-rd STOP	Jackson	SR271	12.56		0.00	0.00	0.03	0.03	0.00	-	-	0.00	0.07	42	

Table 1. Basic Network Screening (with Peak Searching on roadway segments and CV test)

ID	Site Type	Site Subtype	County	Route	Site Start Loca-tion	Site End Loca-tion	Average Observed Accidents for Entire Site*	Location with Highest Potential for Safety Improvement								Rank	Additional Windows of Interest
								Average Observed Accidents*	Predicted Accident Frequency*	Expected Accident Frequency*	Variance**	Start Loca-tion	End Loca-tion	No. of Expected Fatalities	No. of Expected Injuries		
271I3	Inter-section	Int/Rur; 4-leg minor-rd STOP	Jackson	SR271	10.63		0.00	0.00	0.03	0.03	0.00	-	-	0.00	0.06	43	
226I5	Inter-section	Int/Rur; 4-leg minor-rd STOP	Lane	SR226	10.63		0.00	0.00	0.03	0.03	0.00	-	-	0.00	0.05	44	
226I1	Inter-section	Int/Rur; 4-leg minor-rd STOP	Lane	SR226	8.03		0.00	0.00	0.02	0.02	0.00	-	-	0.00	0.04	45	
271I1	Inter-section	Int/Rur; 4-leg minor-rd STOP	Jackson	SR271	9.89		0.00	0.00	0.02	0.02	0.00	-	-	0.00	0.04	46	
226I2	Inter-section	Int/Rur; 4-leg minor-rd STOP	Lane	SR226	8.66		0.00	0.00	0.02	0.02	0.00	-	-	0.00	0.03	47	

Total Roadway Segments Ranked = 28 out of 34 total segments in sitelist.
Total Roadway Segment Length Ranked = 9.900 out of 10.730 total segment length in sitelist.
Percentage of Roadway Segment Length Ranked = 92.3
Number of Intersections Ranked = 19 out of 47 total intersections in sitelist.
Percentage of Intersections Ranked = 40.4
Number of Ramps Ranked = 0 out of 4 total ramps in sitelist.
Percentage of Ramps Ranked = 0.0

* Units for Observed, Predicted and Expected Accident Frequency
- Roadway Segments (crashes/mi/yr)
- Intersections (crashes/yr)

- Ramps (crashes/mi/yr)

** Units for Variance
- Roadway Segments (crashes/mi**2/yr)
- Intersections (crashes/yr)
- Ramps (crashes/mi**2/yr)