Analysis Procedure Manual

2017 Change Sheets

February 2017

APM Version 1

Chapter 10

Removed:
Chapter 10

Replaced with:
Chapter 10 Analyzing Alternatives – See APM Version 2 Chapter 10

APM Version 2

Acknowledgements

Added:
Denise Whitney-Dahlke
Carrie Martin
Jean Palmateer
Savannah Crawford
Michael Holthoff
Sheila Lyons, P.E.
Gary Obery, P.E.
Kent Belleque, P.E.
Rodger Gutierrez, P.E.
Kevin Haas, P.E.

Chapter 10

Added:
Revised Chapter 10 Analyzing Alternatives

Technical Tools Webpage

https://www.oregon.gov/ODOT/Planning/Pages/Technical-Tools.aspx

Added:
Segment Analysis Tools

- Queue and Delay Cost Worksheet (XLS): This tool is a simplified spreadsheet calculator for sketch planning level evaluation of bottlenecks on freeways and multilane highways. The tool estimates vehicle queue length, delay, and user cost of delay for conditions where demand exceeds capacity for one or more hours of the day. For more information see Chapter 10 of the APM Version 2.

September 2017

APM Version 1

Overall Document

Changed:
Fixed various broken links.

APM Version 2

Overall Document

Changed:
Fixed various broken links.

Acknowledgements

Added:
PTV Group
Chetan Joshi, P.E.

Added to Oregon Department of Transportation group:
Rebecca Coffelt

Chapter 2, Section 2.4, Sub-section 2.4.2

Changed:
Safety Tools
Most studies will require some sort of safety analysis. At a minimum, a historic crash analysis is needed. The Crash Decoder Tool simplifies the processing and analysis of individual crash records. Historic crash data is also needed to support more-detailed predictive analysis. Travel demand model-based relative comparisons can use PlanSafe, which analyzes crashes on the TAZ level. Plans and projects can use Highway Safety Manual (HSM)-based screening methods for establishing critical crash rates within a community or predicting the number of crashes associated with changes to roadway segments or intersections. Additional HSM-based tools are available to conduct predictive analyses methods, such as the free NCHRP spreadsheets or HiSafe software. Interactive Highway Safety Design Manual (IHSDM) software allows for very detailed evaluation of safety effects of geometric design decisions and requires a project-level data collection effort to be used appropriately.

To:
Safety Tools
Most studies will require some sort of safety analysis. At a minimum, a historic crash analysis is needed. The Crash Graphing Tool and Crash Decoder Tool simplifies the processing and analysis of individual crash records. Historic crash data is also needed to support more-detailed predictive analysis. Plans and projects can use Highway Safety Manual (HSM)-based screening methods for establishing critical crash rates within a community or predicting the number of crashes associated with changes to roadway segments or intersections. Tools for screening include the ODOT critical rate calculator, excess proportion of crash types calculator, and the Visum Safety Add-In. Additional HSM-based tools are available to conduct predictive analyses methods, such as the free NCHRP spreadsheets or ISATe for

freeways and interchanges. Interactive Highway Safety Design Manual (IHSDM) software allows for very detailed evaluation of safety effects of geometric design decisions and requires a project-level data collection effort to be used appropriately. See Chapter 4 for more information on safety analysis tools and methods.

Changed:

Tools	**Deterministic**	**Stochastic**	**Systemic**	**Specific**	**Data Needs**	**Staffing**	**Time**
	Category				**Applications**		
IHSDM	X			X	H	M	H
PlanSafe	X		X		M	M	M
NCHRP HSM Spreadsheets	X			X	M	L	M
HiSafe	X			X	M	L	L
Crash Decoder Tool	X			X	L	L	L

To:

Tools	**Deterministic**	**Stochastic**	**Systemic**	**Specific**	**Data Needs**	**Staffing**	**Time**
	Category				**Applications**		
IHSDM	X			X	H	M	H
ISATe	X			X	M	M	M
Visum ODOT Safety Add-In	X			X	M	M	M
NCHRP HSM Spreadsheets	X			X	M	L	M
Excess Proportion of Crash Types Calculator	X			X	L	L	L
Critical Rate Calculator	X			X	M	L	L
Crash Decoder Tool	X			X	L	L	L
Crash Graphing Tool	X			X	L	L	L

Chapter 3, Overall

Added:
Updated version of Appendix 3C – Traffic Count Management (TCM) Program Count Report Guide.

Chapter 3, Section 3.2, Sub-section 3.2.1

Changed:
While several years of data may be available for any given roadway segment, it is common practice to analyze only the most recent, complete three to five (3-5) years of data as factors such as traffic volumes, environmental conditions and roadway characteristics may change with time. Three years of data gives a

minimal picture and is the minimum analysis period for a safety analysis, while the five year listing gives a more desirable view. Roadways with a small number of crashes should be looked at through a five year period to get a better representative sample. In some circumstances even a longer period may be reviewed. Also, remember that the crash databases are regularly updated to include more recent data, so care should be taken to select the correct timeframe(s).

To:
While several years of data may be available for any given roadway segment, it is common practice to analyze only the most recent, complete three to five (3-5) years of data as factors such as traffic volumes, environmental conditions and roadway characteristics may change with time. Three years of data gives a minimal picture and is the minimum analysis period for a safety analysis, while the five year listing gives a more desirable view. Roadways with a small number of crashes should be looked at through a five year period to get a better representative sample. In some circumstances even a longer period may be reviewed. Also, remember that the crash databases are regularly updated to include more recent data, so care should be taken to select the correct timeframe(s). For more information on pulling crash data, refer to Appendix 4A.

Chapter 3, Appendix 3C

Added:
Using the Statewide TCM Count Shapefile to Identify Pre-Existing Count Locations

The format of count data varies greatly depending on what type of count is taken and how the count is pulled from TCM. A statewide shapefile with pre-existing count location information is available upon request. This shapefile contains location information and basic information about each count taken since 2008. This count file can be used to locate counts within your project area.

The statewide count shapefile containing count locations has limits to its use. This shapefile does not contain count data; it simply contains basic count information. The shapefile is created in order to help the analyst visually narrow down count locations. It also gives the analyst information about the count location to help narrow down the counts to pull. It allows the analyst to have a list of needed counts to pull from TCM. If the analyst is a non-ODOT employee or does not have TCM, they would need to contact the Transportation System Monitoring (TSM) Unit with the list of count sites. The shapefile can be used as a first step for analysts working in ArcGIS or Visum.

The steps below are a brief overview of how to create a project shapefile with count information and count data. These instructions only go through how to place the raw counts onto the network; these counts will need to be adjusted according to the Analysis Procedures Manual (APM) in order to be used for analysis. If the user chooses you can add a column to the spreadsheet with the appropriately adjusted counts to be included on the network as well.

1. Clip down the statewide TCM count shapefile (contact TPAU to obtain) to only the counts that are within your project area and are appropriate for your project needs.
    a. This is done first by clipping the count shapefile to the boundary of your study area.
    b. Use the last count date, type of count and location to hand delete counts that are too old, not the right type of count or in the wrong locations.
        i. It is the analyst’s responsibility to make sure that the counts being pulled will be appropriate for the study type.

    ii. If the TSM is pulling the counts, the number of counts must be reasonable for the study area and study purpose.

2. Use the .dbf file from the shapefile and open it in Excel.
    a. Save it as an Excel file
        i. Use this Excel file to either send to TSM Unit for counts to be pulled, or use TCM to pull the counts yourself.
3. Once you have the counts from the TSM Unit or you have pulled them all from TCM, use the spreadsheets described in Appendix 17A to process the counts.
    a. If you get the counts from the TSM Unit go to Appendix 17A to the Excel Processor Guidelines
    b. If you plan on pulling the counts yourself see Pulling Counts from ODOT Traffic Count Management (TCM) Program.

Added:
Network Count Inventory

For use in Visum or ArcGIS networks, counts must be pulled from TCM and added to the network. Tube counts should be pulled as ATR edit sheets and Turning Movement Counts should be pulled as intersection reports. Below you will find basic instructions (ODOT users only).

Pulling Counts from ODOT Traffic Count Management (TCM) Program

<u>ATR Edit Sheet (Tube Counts, pulling multiple counts)</u>

1. Find the site(s) that you want to pull in the site management screen. After verifying that you have the correct site use the data validation screen if you do not know the date of the most recent count.

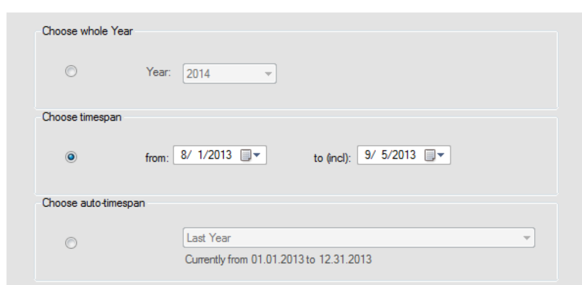
2. Open the reporting screen, and choose ATR Edit Sheet.

3. Click next (leaving unassigned assistant chosen).

4. Choose a date span that covers the dates for all of your counts for your project, and click next.

    a. For example, in Newport there were counts taken during August of 2013. Although they counts were not all taken during the same time frame, you can pull the entire month of August (and some of September) and the spreadsheets used for count inventory will “clean” the days that do not contain any empty count information.

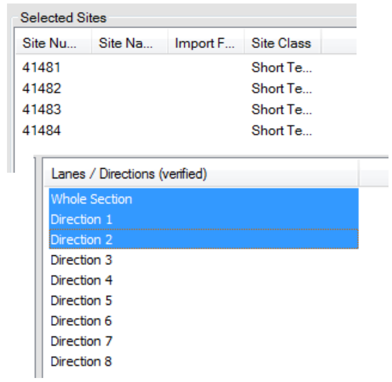
    b. By pulling the entire month you can pull all counts taken turning that month for the sites you choose.



5. To choose multiple count sites you can use the different filters to filter down to just those counts in your project (if there is some defining feature such as a remark) or you can hand search for each site. You can use control click to select multiple sites, and the select the green arrow . Or you can double click each site you want to get counts for.

6. After your desired sites are in the selected sites list, click the next button.

7. If your counts are bi-directional (they usually are), select Whole Selection, Direction 1 and Direction 2 from the verified list. Click Next



8. For this type of count, it is usually a volume only count. The spreadsheet that has been designed to clean these counts for this type of inventory has been coded to only utilize a vehicle count. It is not optimized to deal with classification counts. Therefore leave the vehicle choice set to Vehicles, and click Next.

9. Leave the setting for quality set to the default for this count process, click Next.

10. If you choose you can enter a prefix to your set of counts, click Next. For example, in Newport there were counts taken in August and October. Therefore two sets of counts were pulled and labeled with the appropriate month pre-fix.

11. Choose a location for your counts to be saved. It is best to save the ATR Edit Sheets in a separate folder from other counts and other information. This will allow you to easily use the Count Processor Spreadsheet.

12. Click next and then Finish. If you are doing a large number of counts at one time, this will take quite some time. If you are pulling more than 25 counts, it is suggested that you start the counts so they can run over night or during a long meeting.

The more counts pulled at one time, the more likely TCM is to throw an error in the middle of kicking out counts. Use caution when pulling large numbers of counts.

Intersection Turn Movement Counts (Video or TimeMark Counts)

1. Intersection counts in TCM can only be pulled one at a time. For this reason, I suggest check to make sure that these reports haven't been previously pulled.

a. Go to \\s6000e\atrshar\DATA_MNL (available for ODOT staff only – others contact TSM).

b. Intersection counts are placed here, and the file names are SiteID_YearofCount.

c. If they are available on the ATR drive it is suggested that they are pulled (copied) from here as this will save time.

2. For sites that are not available on the count drive they must be pulled individually from TCM. (This will take some time).

3. Find the site(s) that you want to pull in the site management screen (unless you already know the IDs of the counts you want to pull.

4. Open the reporting screen, and choose Intersection Reports. 

5. Click next (leaving unassigned assistant chosen).

6. In choosing which reports to include you can leave them all checked, but the spreadsheet processor only requires ‘Summary of Turning Movements (Type 1)’, and the ‘Summary of Traffic Count.’

7. Search for the count site, and choose which count you would like to pull. If there have been multiple intersection counts for that site they will all show, choose the most recent (or the appropriate count) for your project.

8. For the purpose of this process it is usually a volume only count. The spreadsheet that has been designed to clean these counts for this type of inventory has been coded to only utilize a vehicle count. It is not optimized to deal with classification counts. Therefore leave the vehicle choice set to Vehicles, and click Next.

9. For the pedestrian type(s), again the spreadsheet used to summarize the counts for VISUM is not used. Therefore leave the settings at the default and click Next.

10. Leave the Axle factor at the default, and click Next.

11. The count processor is currently set to handle 15 minute bins; in the future the user will be able to choose. For now leave it set to 15 minute bins and click next.

12. Do not save a template in the database (this is used by downstairs not us) and click finish.

13. You do not choose where to save these files because rather than save them to a folder it will open it in Excel. From there you will have to choose where to save the file and what file name to use.

Chapter 4, Overall

Added:
New Appendix 4A – Crash Attribution and Automation.

Chapter 4, Section 4.2, Sub-section 4.2.5

Changed:
Crash Decoder Tool

The Crash Decoder Tool is an Excel-based spreadsheet with macros that uses the Comprehensive (PRC) CDS380 crash report (in Excel format) and the Excel look-up tables to translate the information. Once the sheet has decoded the information, filters can be applied to the data set to investigate specific locations or issues. This tool also allows the analyst to create crash graphs that are helpful in both analysis and reporting. This tool can be used on all roadways. It is available on the ODOT Highway Safety Webpage.

To:
Crash Decoder Tool

The Crash Decoder Tool is an Excel-based spreadsheet with macros that uses the Comprehensive (PRC) CDS380 crash report (in Excel format) and the Excel look-up tables to translate the information. Once the sheet has decoded the information, filters can be applied to the data set to investigate specific locations or issues. This tool also allows the analyst to create crash graphs that are helpful in both analysis and reporting. This tool can be used on all roadways. It is available on the ODOT Highway Safety Webpage. For more information refer to Appendix 4A.

Changed:
Crash Graphing Tool (ODOT Employees Only)

The Crash Graphing Tool summarizes crash information of the “Direction” listing (in an Excel format) report from the State Highway Crash Reports and presents the information in standard graphs and charts. This report only analyzes state highways. Only ODOT employees can access this internal tool by contacting Information Services.

To:
Crash Graphing Tool (ODOT Employees Only)

The Crash Graphing Tool summarizes crash information of the “Direction” listing (in an Excel format) report from the State Highway Crash Reports and presents the information in standard graphs and charts. This report only analyzes state highways. Only ODOT employees can access this internal tool by contacting Information Services. For more information refer to Appendix 4A.

Changed:
Crash Summary Database (ODOT Employees Only)

The Crash Summary Database, produced annually since 1990, is useful to generate quick summary reports that are often sufficient to answer questions when there is not time to do a detailed analysis. This software must be installed by an Information Services field technician. The crash summary database is a product of the most current Safety Priority Index System (SPIS) run so it uses the same three years of data. The crash summary gives an estimated crash rate based on the number of crashes, the average of the AADTs at the beginning and ending mile points of the segment and the numeric difference in the same mile points. This summary does not account for interruptions in the mile point distance (equations) or variation in the volumes when crossing multiple segments. The output reports only an estimated value along with the highest and number of SPIS sites within the section. It should not be used to report a formal crash rate unless all of the above items have been accounted for.

To:
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Chapter 4, Section 4.3, Sub-section 4.3.4

Changed:
A spreadsheet is available from the safety analysis tools section of the ODOT Transportation Development Planning Technical Tools website that automates much of the Critical Crash Rate calculations.

To:
A spreadsheet is available from the safety analysis tools section of the ODOT Transportation Development Planning Technical Tools website that automates much of the Critical Crash Rate calculations. A planning level method for calculating critical crash rates using the ODOT Visum Safety Add-In tool is found in Appendix 4A.

Chapter 4, Section 4.3, Sub-section 4.3.5

Changed:
A spreadsheet is available under safety analysis tools on the ODOT Transportation Development Planning Technical Tools webpage that automates much of the Excess Proportion of Specific Crash Types analysis. The analyst can provide input data in a summary table manually or can use automated extraction macros to analyze a PRC comprehensive crash summary report directly from ODOT. If the automated method is used, the results should be reviewed to ensure that all intersection-related crashes have been included, even those not identified as such in the records. The analyst must clean and format the results as described in the instructions tab before use.

To:
A spreadsheet is available under safety analysis tools on the ODOT Transportation Development Planning Technical Tools webpage that automates much of the Excess Proportion of Specific Crash Types analysis. The analyst can provide input data in a summary table manually or can use automated extraction macros to analyze a PRC comprehensive crash summary report directly from ODOT. If the automated method is used, the results should be reviewed to ensure that all intersection-related crashes have been included, even those not identified as such in the records. The analyst must clean and format the results as described in the instructions tab before use. A planning level method for calculating critical crash rates using the ODOT Visum Safety Add-In tool is found in Appendix 4A.

Chapter 17, Overall

Added:
New Appendix 17A – Network Count Attribution.

Glossary

Changed:
NOTE: This is a work in progress and currently incorporates terms from APM Version 2 Chapters 1-8.

To:
NOTE: This is a work in progress and currently incorporates terms from APM Version 2 Chapters 1-8 and 18.

Added:
Active Traffic Management (ATM) – The ability to dynamically manage recurrent and non-recurrent congestion based on prevailing and predicted traffic conditions.
Active Transportation and Demand Management (ATDM) – The dynamic management, control, and influence of travel demand, traffic demand, and traffic flow on transportation facilities utilizing the following three components: Active Traffic Management, Active Demand Management, and Active Parking Management.
Adaptive Signal Control Systems – Traffic signal systems that self-adjust to traffic conditions, demand, and capacity.
General Transit Feed Specification (GTFS) – Defines a common format for public transportation schedules and associated geographic information.
Integrated Corridor Management (ICM) – An approach to managing the transportation network that encourages multi-agency coordination and combines arterial and freeway strategies to balance and manage travel demand across networks (freeway, arterial, transit, and parking).
Moving Ahead for Progress in the 21st Century Act (MAP-21) – A funding and authorization bill to govern US federal surface transportation spending passed by Congress in June 2012.
National Transportation Communications for Intelligent Transportation System Protocol (NTCIP) – A family of standards designed to achieve interoperability and interchangeability between computers and electronic traffic control equipment from different manufacturers.
Oregon Highway Plan (OHP) – A 1999 plan which establishes long-range policies and investment strategies for the State Highway System. .
Oregon Transportation Plan (OTP) – Oregon’s 2006 long-range multimodal transportation plan with the overarching goal of providing a safe efficient and sustainable transportation system that enhances Oregon’s quality of life and economic vitality.
Rectangular Rapid Flashing Beacons (RRFB) – User-actuated amber LEDs that supplement warning signs at unsignalized intersections or mid-block crosswalks.
Traffic Incident Management (TIM) – A multi-disciplinary effort to practice planned and coordinated detection, response, and clearance of traffic indidents.
Traffic Message Channel (TMC) – Refers to the ID number of predefined road segments that probe vehicle data is referenced to, used by HERE and other third party transportation data providers as a commercial industry standard.
Transportation Systems Management & Operations (TSMO) – An integrated program to optimize the performance of existing multimodal infrastructure through implementation of systems, services, and projects to preserve capacity and improve the security, safety, and reliability of our transportation system.
TripCheck Local Entry (TLE) – A TripCheck feature that allows transportation agencies within Oregon to share information about construction and maintenance projects between one another.
TripCheck Traveler Information Portal (TTIP) – A portal which provides incident and road and weather data, in Extensible Markup Language format at no cost to over 175 public and non-public subscribers.
Variable Advisory Speed (VAS) – Speed limits determined with a two-stage speed reduction scheme. It is intended to advise motorists to slow down because there is slowed or stopped traffic on the road ahead.
Vehicle to Everything (V2X) – is when connected vehicles “talk” to anything besides roadside infrastructure or other vehicles on the road, like mobile devices.

Vehicle to Infrastructure (V2I) – is when connected vehicles "talk" to roadside infrastructure, like traffic signals.
Vehicle to Vehicle (V2V) – is when connected vehicles "talk" to other vehicles on the road.

Abbreviations and Acronyms

Added:
AOC – Association of Oregon Counties
AVL – Automatic Vehicle Location
CAV – Connected and Automated Vehicles
CCTV – Closed Circuit Television
CDS – Crash Data System
DMS – Dynamic Message Signs
DXFS – Data Exchange Format Specification
FEMA – Federal Emergency Management Agency
FYA – Flashing Yellow Arrow
HAR – Highway Advisory Radio
HOT – High Occupancy Toll
NIMS – National Incident Management System (FEMA)
SCIP – Statewide Communication Interoperability Plan
TEV – Total Entering Volume
TMC – Traffic Management Center
TOC – Traffic Operations Center
TPR – Transportation Planning Rule
TR – Traffic Responsive
TRI – Transportation Research Institute
TRS – Traffic-Roadway Section

Website

Technical Tools web page

Added to Analysis Tools > Volume Development Tools:
Count Processors: These spreadsheet tools are used to process count data output from the ODOT Traffic Count Management program for input into Visum or ArcGIS. For instructions on use of these tools refer to Analysis Procedures Manual Appendix 17A.

December 2017

APM Version 1

Chapter 9

Replaced:
Replaced Chapter 9 content with reference to APM Version 2 Chapter 9.

APM Version 2

Acknowledgements

Added to Oregon Department of Transportation group:
Sam Ayash

Added to Review Group:
Katie Brown

Chapter 4 Section 4.8 Subsection 4.8.1

Changed:
Exhibit 4-1: Perception-Reaction Time, d_1

Distance Traveled During Perception-Reaction					
US Customary Units (Feet)(1)(2)					
Speed (mph)	Perception-Reaction Time (Seconds)(3)				
	1.0	2.0	3.0	4.0	5.0
30	45	90	130	175	220
40	60	115	175	235	295
45	65	130	200	265	330
50	75	145	220	295	370
60	90	175	265	355	440
70	105	310	310	410	515

(1) Rounded to 5 feet

(2) US Customary: distance (feet) = 1.47*(speed in mph)*t

(3) Distance traveled in t-seconds

To:

Exhibit 4-2: Perception-Reaction Time, d_1

Distance Traveled During Perception-Reaction					
US Customary Units (Feet)(1)(2)					
Speed (mph)	Perception-Reaction Time (Seconds)(3)				
	1.0	2.0	3.0	4.0	5.0
30	45	90	130	175	220
40	60	115	175	235	295
45	65	130	200	265	330
50	75	145	220	295	370
60	90	175	265	355	440
70	105	205	310	410	515

(1) Rounded to 5 feet

(2) US Customary: distance (feet) = 1.47*(speed in mph)*t

(3) Distance traveled in t-seconds

Chapter 6 Section 6.4

Changed:

Future Volume = (Linear Growth Rate x Number of Years) x Base Year Volume
VolumeFY = GLinear x N x VolumeBY

Where:

G = Linear growth rate (volume)
N = Years beyond the base year
FY = Future year
BY = Base Year

To:

Future Volume = GF x Base Year Volume, or
VolumeFY = GF x VolumeBY

Where:

GF = Growth Factor = 1 + (G x N)
G = Linear annual growth rate, expressed as a decimal, calculated per Section 6.5
N = Years beyond the base year
FY = Future year
BY = Base Year

Chapter 9

Added:
Full Chapter 9

Chapter 14 Section 14.6 Subsection 14.6.10

Added:
Full subsection 14.6.10 Signalized Intersections Pedestrian and Bicycle Level of Service

Website

Technical Tools web page

Added to Analysis Tools > Multimodal Analysis Tools:
Pedestrian and Bicycle Signalized Intersection MMLOS Calculator: This tool implements the signalized intersection bicycle and pedestrian multimodal analysis methodology. For more information see Chapter 14 of the Analysis Procedures Manual Version 2.