MoDOT Work Zone Impact Analysis Spreadsheet Instructions

(Updated Nov 29, 2021)

Contents

Introduction

This document guides on how to use the Work Zone Impact tool. This tool has been enhanced to incorporate guidance for advanced work zone and contract time acceleration time strategies. The sheet assists staff while planning and understanding the design process of work zones and finding efficient ways to mitigate the traffic impacts of work zones. The document is divided into four sections:

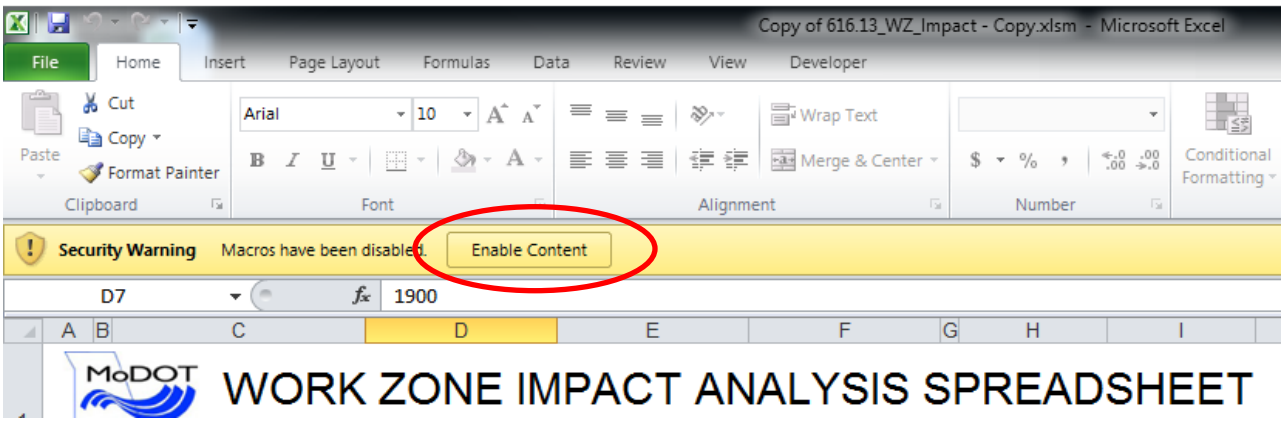
- Section 1: Getting Started
- Section 2: Navigating the Spreadsheet
- Section 3: Advanced Work Zone Strategy Selection
- Section 4: Contract Time Acceleration

Section 1 – Getting Started

The following steps will describe the process of running the capacity program and review the output for the *MoDOT Work Zone Impact Analysis Spreadsheet*.

Enable Content

Upon launching the program, there may be a popup box that looks similar to the image below.



You will need to enable to content in order to use the macros in this spreadsheet.

If this popup warning does not appear, the macros may have already been enabled previously.

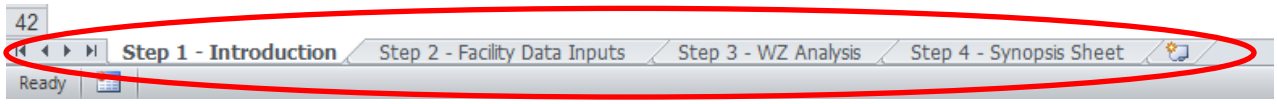
Section 2 Navigating the Spreadsheet

There are four steps that this spreadsheet uses to guide users through the Work Zone Impact Analysis.

- Step 1 – Introduction
- Step 2 – Facility Data Inputs
- Step 3 – WZ Analysis
    - Step 3a – ADV WZ Analysis
    - Step 3b – Acceleration Analysis
- Step 4 – Synopsis Sheet
    - Step 4a – ADV WZ Synopsis
    - Step 4b – Acceleration Synopsis

Note: Only the Step 1 - Introduction tab is visible when initially launching the spreadsheet. All tabs will be visible after a Volume Input Method has been selected.

Each Step is located on a different TAB, usually located near the bottom of the spreadsheet.



Entering Information

The cells that require the user to input data are highlighted. The highlight color attempts to indicate the type of data that is desired.

- **BLUE** cells indicate information needed regarding the Base Conditions.
- **ORANGE** cells indicate information needed regarding the Work Zone.
- **YELLOW** cells are optional inputs. Leave these BLANK if you want to use the spreadsheets defaults.
- **GREEN** cells are based on imported TSHV data.

Step 1 - Introduction

This tab of the spreadsheet contains some of the pertinent information for users to successfully utilize the spreadsheet.

The items discussed above are included in this section as well as links to the EPG Article that discusses Work Zone Capacity, Queue, and Travel Delay.

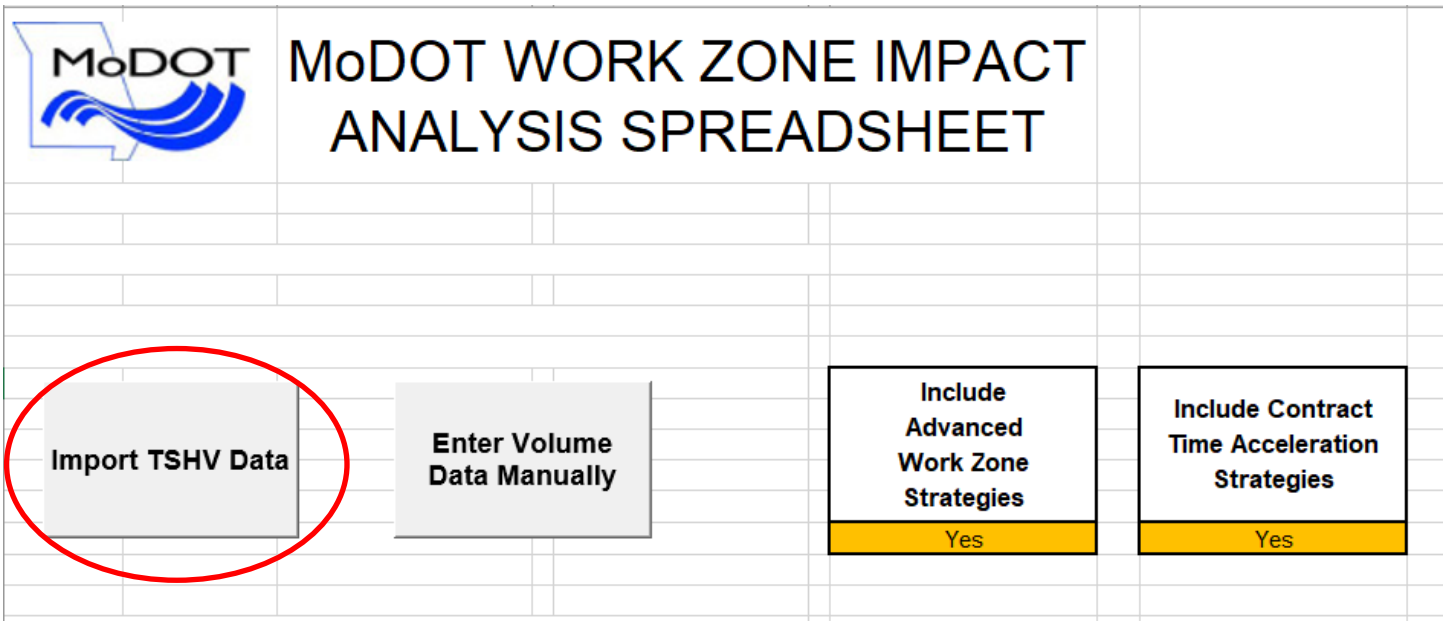
Any questions regarding the spreadsheet can be directed to the contact persons located on this page.

Importing Data

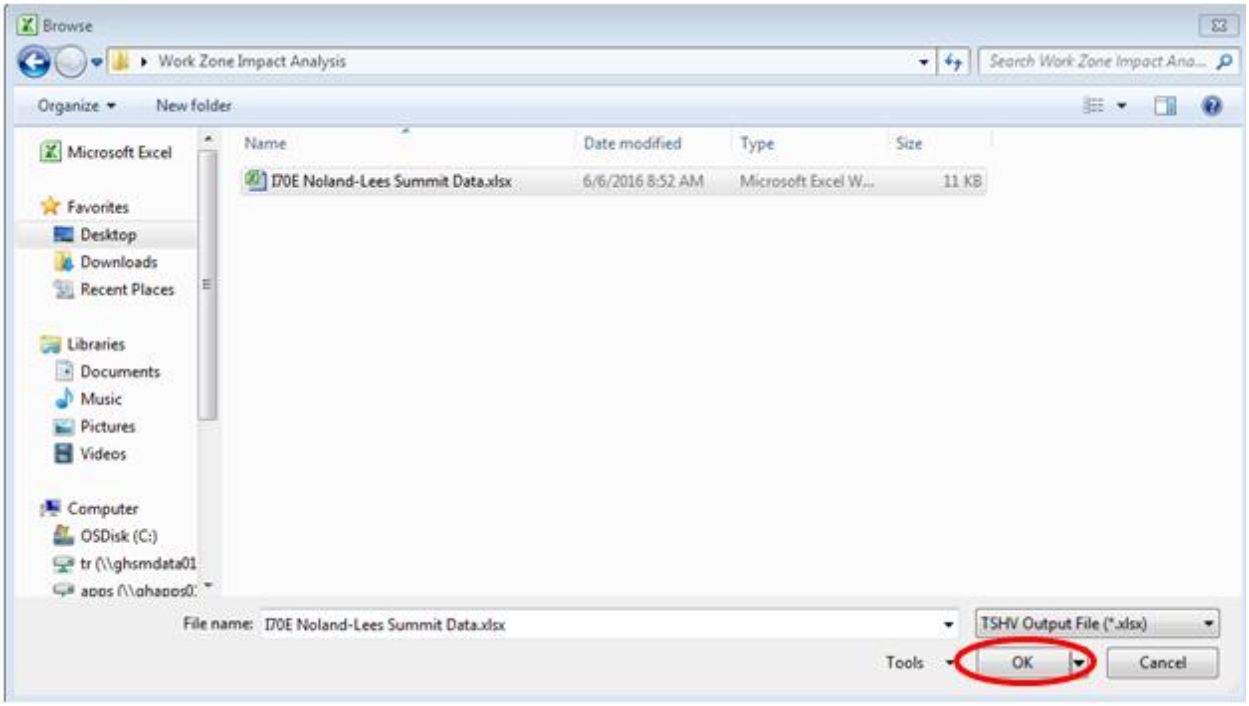
The link provided below contains instructions on how to collect volume data from the Traffic Segment Hourly Volume (TSHV) application in TMS.

Traffic Segment Hourly Volume Training Instructions

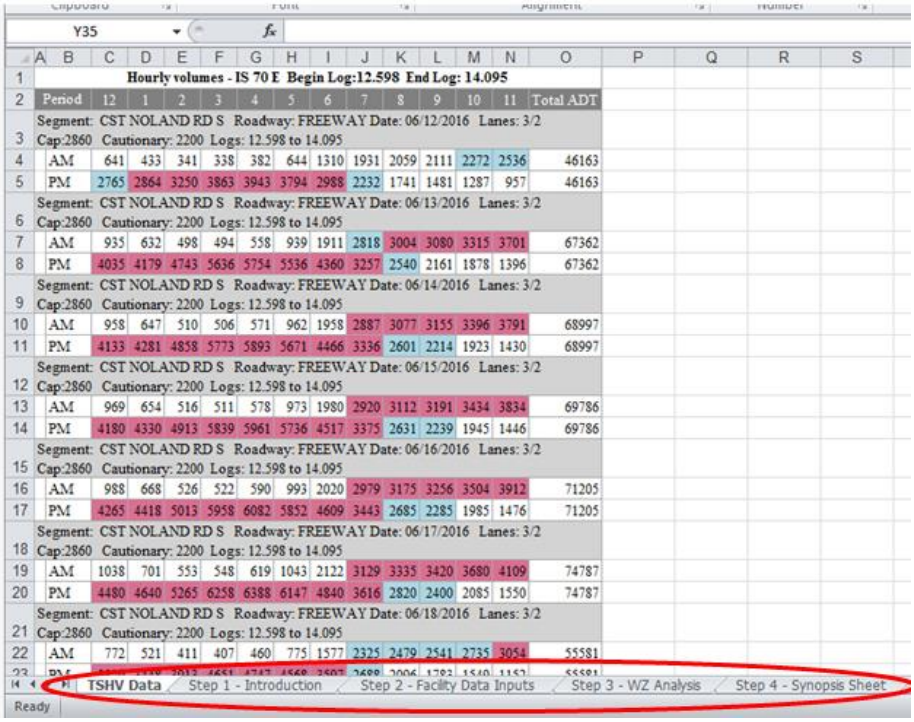
After the data is exported to Excel, save the file. Once saved, return to the Work Zone Impact spreadsheet and click “Import TSHV Data” circled in **RED** below.



Choose the file that contains the TSHV data and click “OK”.



The data is placed on a new tab called “TSHV Data” shown below. Additionally, the tabs titled “Step 2-Facility Data Inputs”, Step 3-WZ Analysis”, and “Step 4-Synopsis Sheet” should be visible.



Hourly volumes - IS 70 E Begin Log:12.598 End Log: 14.095

Period	12	1	2	3	4	5	6	7	8	9	10	11	Total ADT
Segment: CST NOLAND RD S Roadway: FREEWAY Date: 06/12/2016 Lanes: 3/2													
Cap:2860 Cautionary: 2200 Logs: 12.598 to 14.095													
AM	641	433	341	338	382	644	1310	1931	2059	2111	2272	2536	46163
PM	2765	2864	3250	3863	3943	3794	2988	2232	1741	1481	1287	957	46163
Segment: CST NOLAND RD S Roadway: FREEWAY Date: 06/13/2016 Lanes: 3/2													
Cap:2860 Cautionary: 2200 Logs: 12.598 to 14.095													
AM	935	632	498	494	558	939	1911	2818	3004	3080	3315	3701	67362
PM	4035	4179	4743	5636	5754	5536	4360	3257	2540	2161	1878	1396	67362
Segment: CST NOLAND RD S Roadway: FREEWAY Date: 06/14/2016 Lanes: 3/2													
Cap:2860 Cautionary: 2200 Logs: 12.598 to 14.095													
AM	958	647	510	506	571	962	1958	2887	3077	3155	3396	3791	68997
PM	4133	4281	4858	5773	5893	5671	4466	3336	2601	2214	1923	1430	68997
Segment: CST NOLAND RD S Roadway: FREEWAY Date: 06/15/2016 Lanes: 3/2													
Cap:2860 Cautionary: 2200 Logs: 12.598 to 14.095													
AM	969	654	516	511	578	973	1980	2920	3112	3191	3434	3834	69786
PM	4180	4330	4913	5839	5961	5736	4517	3375	2631	2239	1945	1446	69786
Segment: CST NOLAND RD S Roadway: FREEWAY Date: 06/16/2016 Lanes: 3/2													
Cap:2860 Cautionary: 2200 Logs: 12.598 to 14.095													
AM	988	668	526	522	590	993	2020	2979	3175	3256	3504	3912	71205
PM	4265	4418	5013	5958	6082	5852	4609	3443	2685	2285	1985	1476	71205
Segment: CST NOLAND RD S Roadway: FREEWAY Date: 06/17/2016 Lanes: 3/2													
Cap:2860 Cautionary: 2200 Logs: 12.598 to 14.095													
AM	1038	701	553	548	619	1043	2122	3129	3335	3420	3680	4109	74787
PM	4480	4640	5265	6258	6388	6147	4840	3616	2820	2400	2085	1550	74787
Segment: CST NOLAND RD S Roadway: FREEWAY Date: 06/18/2016 Lanes: 3/2													
Cap:2860 Cautionary: 2200 Logs: 12.598 to 14.095													
AM	772	521	411	407	460	775	1577	2325	2479	2541	2735	3054	55581

Step 2 – Facility Data Inputs

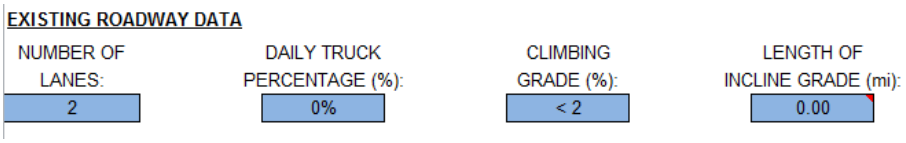
This tab of the spreadsheet is where the characteristics of the existing system are.

The Background Information located in the top row of the data is to identify the location of the work zone.

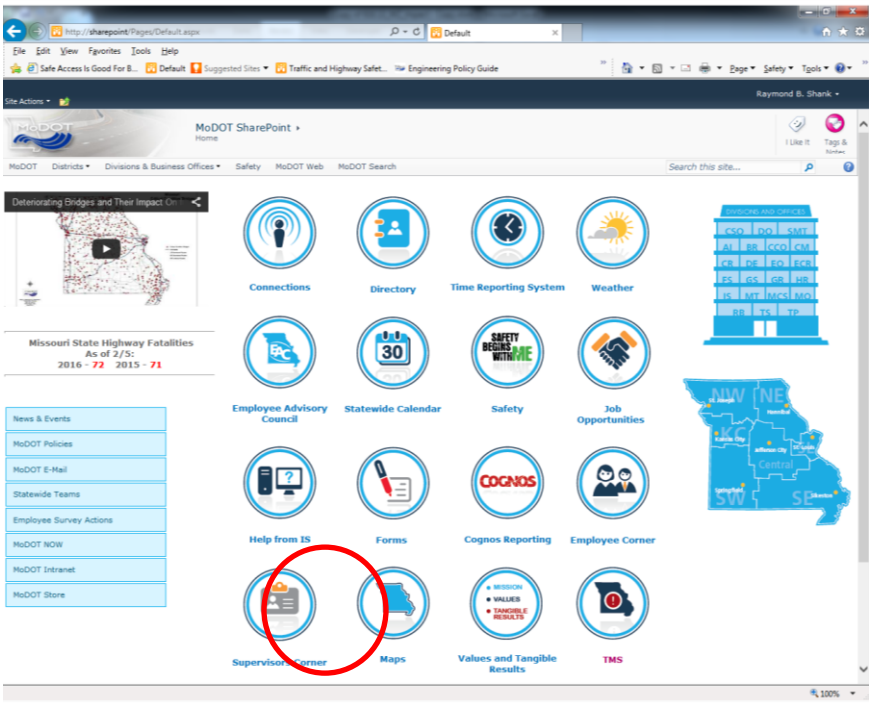
Please note that this spreadsheet only evaluates one direction at a time. Data inputs for volumes, truck percentage, climbing grades, etc, must be specific for that particular direction.

Existing Roadway Data

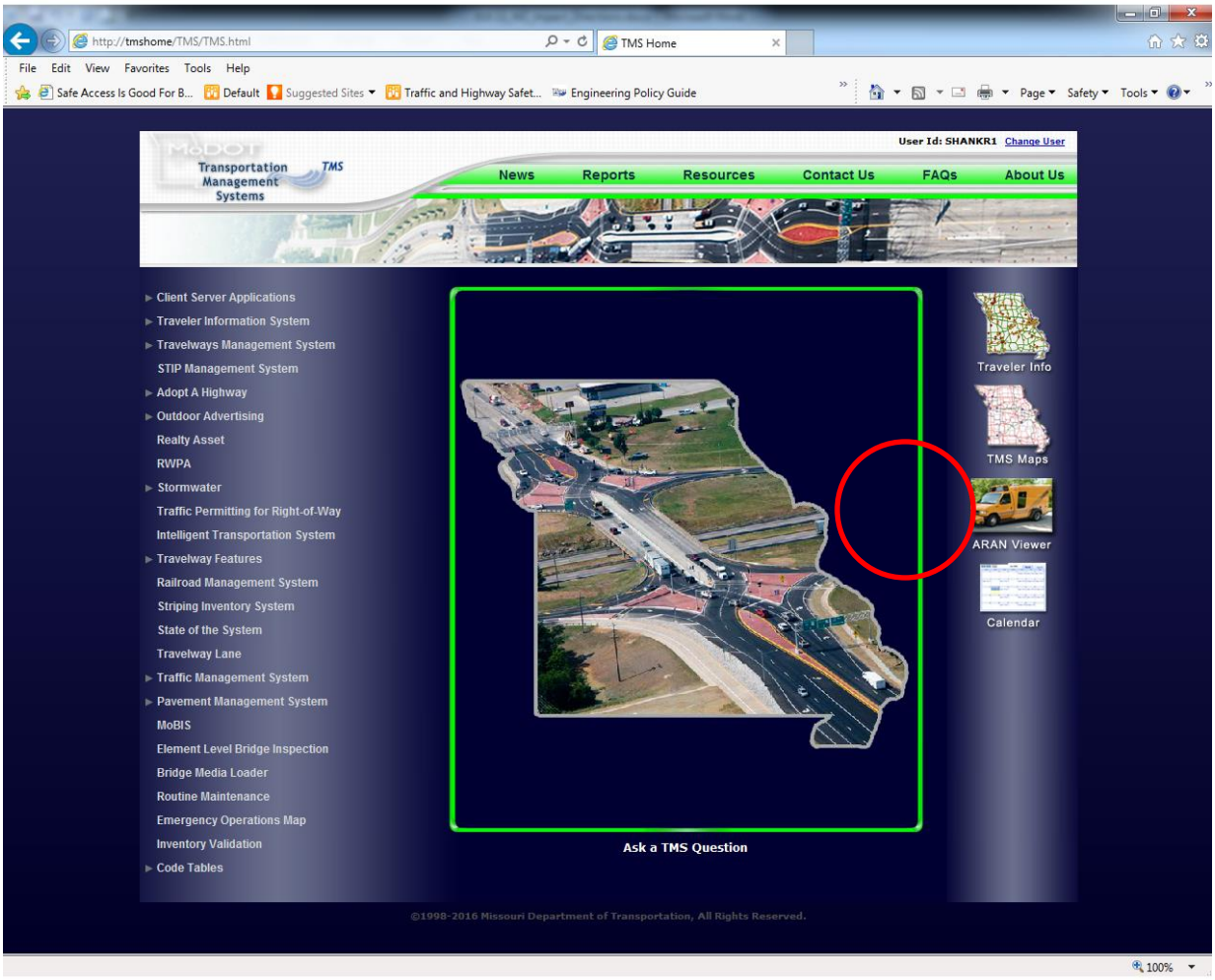
The information required to identify the existing facility can be found using the ARAN Viewer.



To access the ARAN Viewer, launch Internet Explorer and navigate to MoDOT's main SharePoint site. From this location, you can select the icon for TMS, circled in **RED** below. A link to the TMS website is also provided in the spreadsheet.

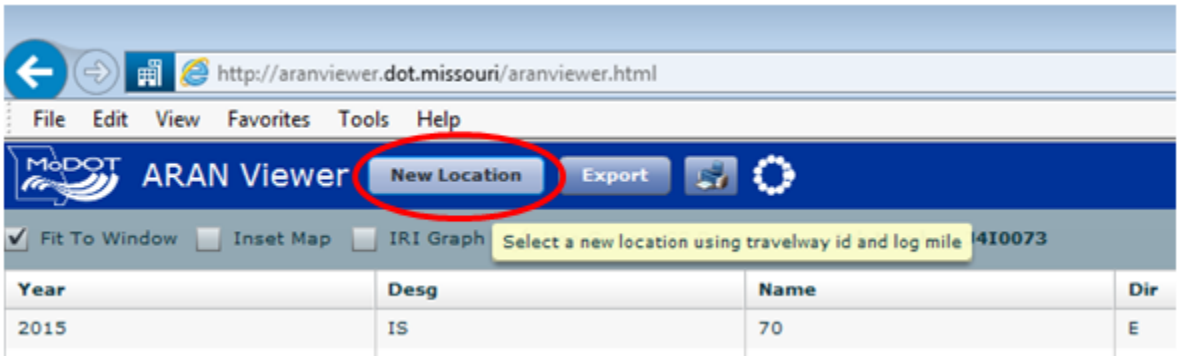


From the TMS website, an icon to access the ARAN viewer is located in a column on the right-hand side, circled in **RED** in the image below.

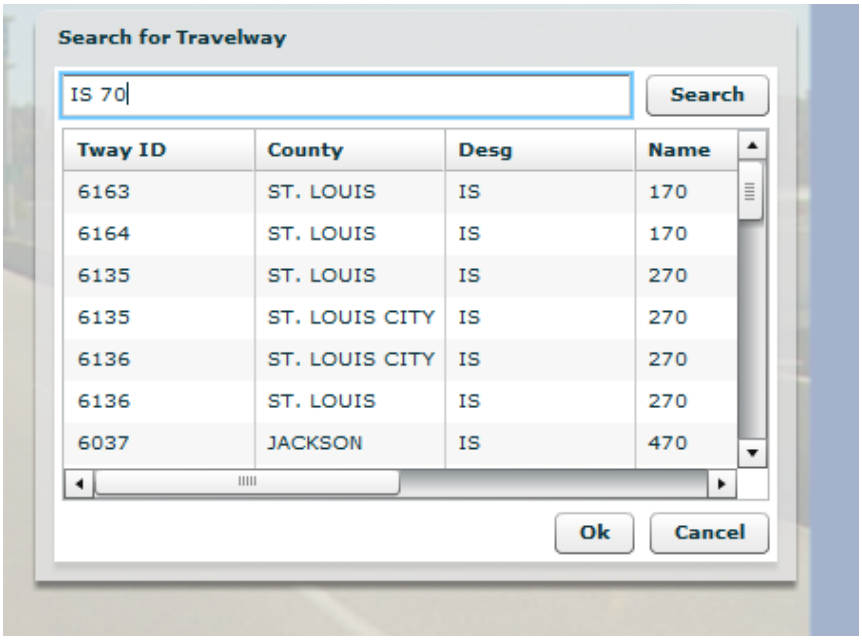


These instructions do not cover how to use the ARAN Viewer in detail. Only where to find the existing facility data required to use the Work Zone Analysis Spreadsheet.

To change the location or log points in the ARAN Viewer, click “New Location” circled in **RED**.



Hit the ellipsis (. . .) and type in the designation, roadway name, direction, and the county of interest. If you know the travel way ID enter that instead.

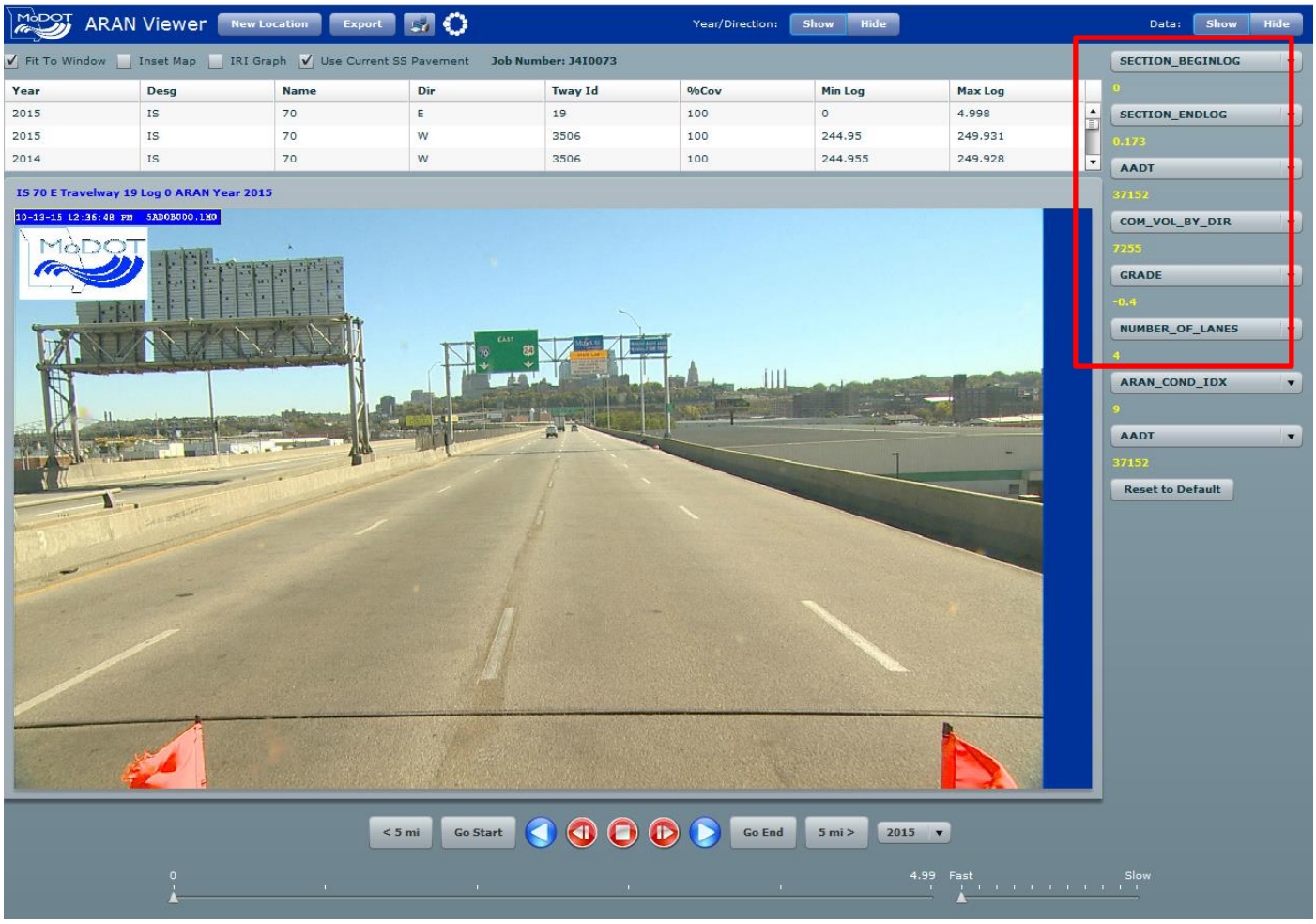


Once the segment is selected, the user can use the bottom of the screen circled in **RED** to travel through the segment.

On the right-hand side of the ARAN Viewer there are several drop-down boxes that can select various data for the roadway segment. To obtain information for the spreadsheet, we are interested in the following data types.

- NUMBER_OF_LANES
- COM_VOL_BY_DIR
- AADT
- GRADE
- SECTION_BEGINLOG / SECTION_ENDLOG

Below is a screenshot showing these data types selected.



Number of Lanes – This is the number of lanes available for travel (no work zone). This can be visually seen from the ARAN Viewer Image or obtained from the NUMBER_OF_LANES data box.

Large trucks, buses, and RVs in traffic cannot be compared with passenger vehicles (cars/small trucks) because of the length and weight of the trucks/buses/RVs. The next three inputs (Daily Truck Percentage, Climbing Grade, and Length of Incline Grade) are used to account for the impact of larger vehicles on the capacity of the work zone.

Daily Truck Percentage – This percentage can be obtained by dividing the number of commercial vehicles (COM_VOL_BY_DIR) by the total volume along the roadway (AADT). This method works for divided roadways. For undivided roadway, this method may need to be scrutinized for accuracy.

Climbing Grade – This is the average of the longest/steepest grade in the segment. To obtain this value, the user should observe the various GRADE data, stepping through each roadway segment through the work zone location. For a conservative analysis, applying the maximum grade over the overall segment is suggested. This grade can be revised for a more fine-tuned analysis should it be required. For segments that only contain downgrades, a climbing grade of <2% should be selected.

Length of Incline Grade – This is the total length of the incline where the climbing grade applies. This length can be obtained by recording the difference of the SECTION_BEGINLOG and SECTION_ENDLOG values that contain the total length of incline. This length should start from a level location, extend through the incline grade, and end when it levels out again. For segments that are level or only contain downgrades, a value of zero can be used for the length of incline grade.

User Cost – This is the value of a driver's time and operational costs for running a vehicle. The default values were provided by MoDOT's Planning Office, but location-specific data may be applied, if available. In most instances, this value will not be modified.

Traffic Volume Data – This hourly volume data can be obtained from a variety of sources. Typically, the TMS Traffic Segment Hourly Volume (TSHV) Application will be used to obtain this data. Links to TMS and Instructions on how to use the application can be found in the spreadsheet. Use this application to obtain the desired evaluation period for the work zone location.

TRAFFIC VOLUME DATA: Obtained from TMS Traffic Segment Hourly Volume (TSHV) Application

Link to Transportation Management System (TMS)

Link to Directions on how to use the TSHV table.

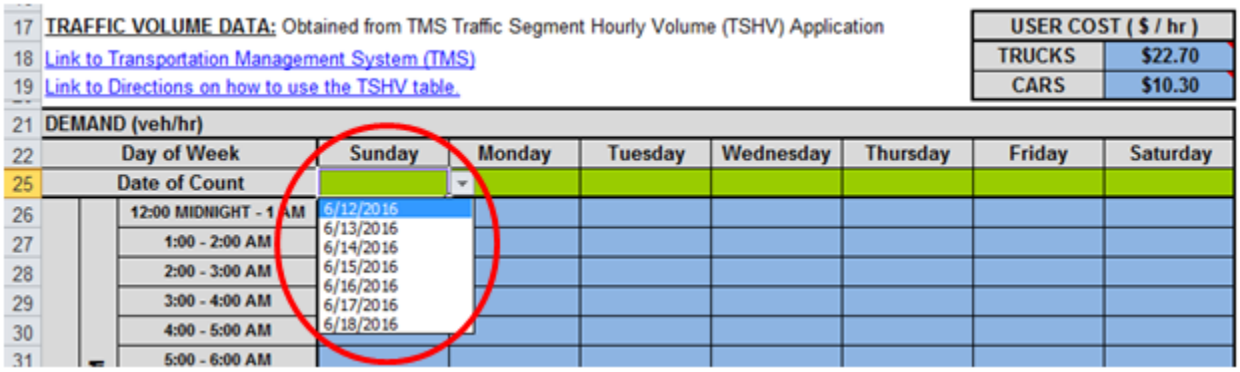
USER COST ($ / hr)	
TRUCKS	$22.70
CARS	$10.30

DEMAND (veh/hr)

		Day of Week	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		Date of Count	7/10/2016	7/11/2016	7/12/2016	7/13/2016	7/14/2016	7/15/2016	7/16/2016
Time of Day	AM	12:00 MIDNIGHT - 1 AM	411	205	206	207	234	253	358
		1:00 - 2:00 AM	236	113	128	128	140	156	230
		2:00 - 3:00 AM	153	85	95	96	107	114	151
		3:00 - 4:00 AM	98	110	126	121	127	127	121
		4:00 - 5:00 AM	81	171	179	169	167	168	113
		5:00 - 6:00 AM	120	418	424	419	380	360	184
		6:00 - 7:00 AM	243	999	1061	1037	954	903	409
		7:00 - 8:00 AM	455	1584	1678	1648	1600	1510	760
		8:00 - 9:00 AM	704	1560	1649	1604	1618	1564	1064
		9:00 - 10:00 AM	1077	1374	1392	1358	1399	1422	1330
		10:00 - 11:00 AM	1550	1436	1359	1359	1358	1493	1594
		11:00 - 12:00 NOON	1999	1553	1411	1437	1433	1635	1720
	PM	12 NOON - 1:00 PM	2272	1676	1528	1572	1551	1756	1777
		1:00 - 2:00 PM	2308	1683	1601	1617	1633	1842	1746
		2:00 - 3:00 PM	2228	1704	1636	1652	1703	1924	1733
		3:00 - 4:00 PM	2146	1912	1896	1922	1919	2177	1675
		4:00 - 5:00 PM	2063	2417	2483	2522	2454	2557	1648
		5:00 - 6:00 PM	1974	2741	2967	2912	2867	2757	1574
		6:00 - 7:00 PM	1812	2207	2362	2283	2382	2277	1435
		7:00 - 8:00 PM	1570	1354	1399	1377	1448	1579	1307
		8:00 - 9:00 PM	1200	994	1033	1046	1083	1171	1124
		9:00 - 10:00 PM	851	732	775	806	857	969	979
		10:00 - 11:00 PM	576	491	528	524	596	742	751
		11 PM - 12:00 MIDNIGHT	367	317	334	357	389	520	620
TOTAL ADT			26496	27837	28251	28175	28397	29973	24403

Please note that the projected volume data provided by this application is not specific to a particular day. The volume data reported are a typical week within a given month. That is to say, every Monday will have the same volume data within the same month. These 24-hour flow curves used to develop the hourly volumes are based on weekday flows. If a work zone is planned to occur over a weekend, the volumes may want to be further scrutinized.

The traffic volume data will be updated automatically once the “Date of Count” and “Location Segment” are selected. The “Date of Count” can be chosen by clicking on the box. A drop-down arrow will appear with dates corresponding to the data imported from TSHV, circled in **RED**.

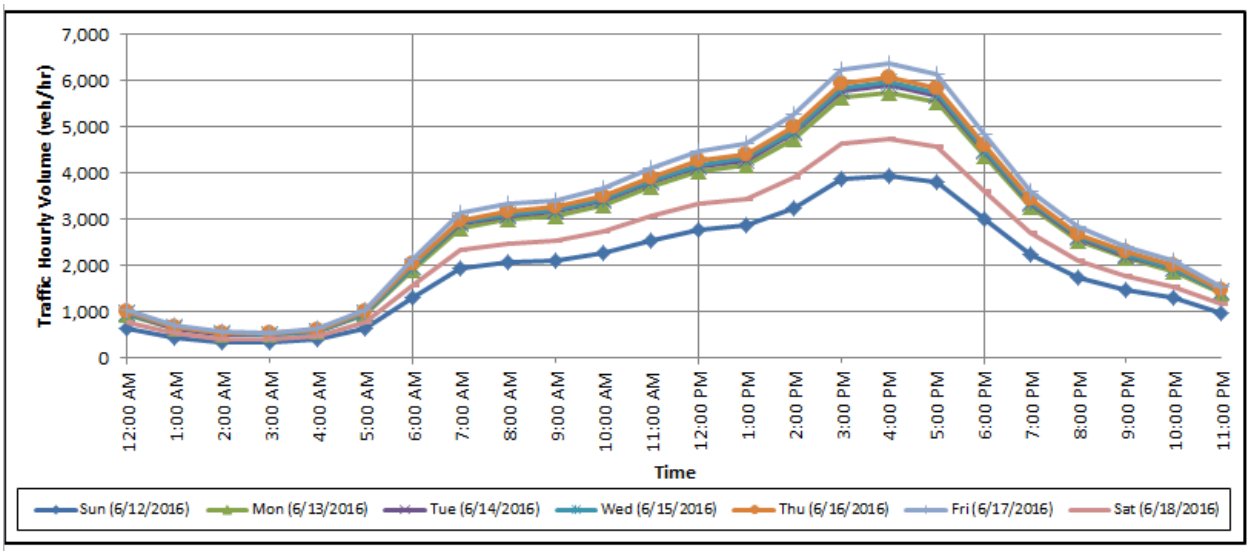


NOTE: In certain situations, unserved vehicles (leftover queue) at the end of a particular day will be carried over, added to the initial demand of the following day. This carry-over effect will occur under two circumstances.

1. If the following date of the unmet demand is selected in the Date of Count cells (ex. 6/12/2016 –> 6/13/2016).
2. If no dates are assigned, unserved vehicles will be added to the start of the following Day of Week (ex. Sunday –> Monday).

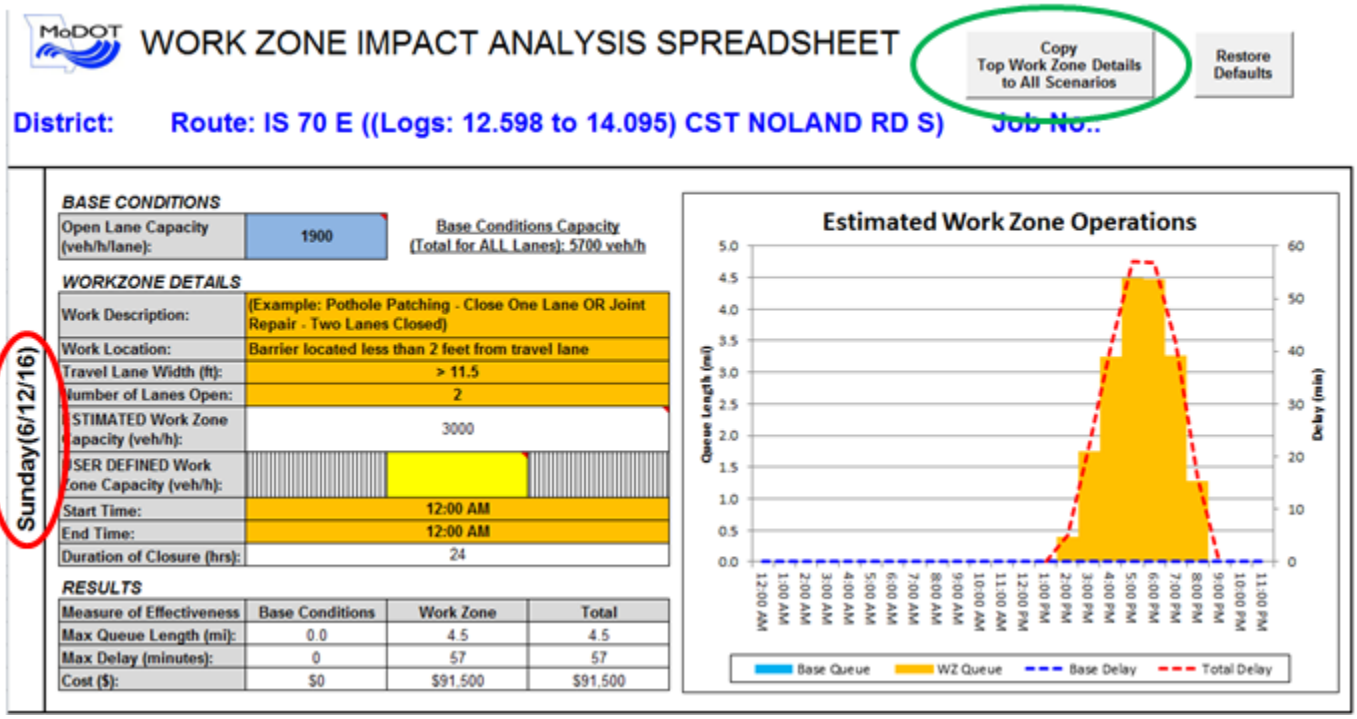
The "Location Segment (LOGS)", circled in **RED**, can be found just above the volume input table under Background Information. Once the box is selected, a drop-down arrow will appear. Select the appropriate segment and the demand will update automatically.

A graph of the input traffic flows can be found beneath the volume inputs. This can be used as a double-check to confirm the volume inputs.



Step 3 – WZ Analysis

The inputs for this tab involve details specific to the work zone. There are seven areas that require work zone inputs, one for each day of volume data have been plugged in during Step 2. The specific day of the week that the work zone data will apply can be found on the left side of the spreadsheet, circled in **RED** below. Should the same work zone characteristic apply to each day being evaluated, a macro has been developed to auto-populate the top work zones details to all scenarios. This macro can be activated by selecting the "Copy Top Work Zone Details to All Scenarios" Button in the upper right-hand corner, circled in **GREEN** below. Next to this button is another that will reset the work zone data to its defaults, i.e. no work zone.



BASE CONDITIONS

Open Lane Capacity – This section allows the user to input a location's specific capacity when no work zone is present. The base capacity mostly impacts the rate of queue dissipation should there be residual queues after the work zone has been removed. This value is critical for locations where the existing facility is at or over capacity during certain times of the day. For locations that currently operate overcapacity, this value can be adjusted by the user, to match the delay and queue outputs to existing field data. The default capacity is calculated using a Maximum Service Flow Rate of 2350 passenger cars/hour/lane and adjustments due to grade and truck percentage. Additional details regarding freeway capacities can be found in Highway Capacity Manual 2010 Chapter 11 on Basic Freeway Segments. Exhibit 11-17 shows a table of Maximum Service Flow Rates for Basic Freeway Segments under Base Conditions and Exhibit 11-11 shows a table of Passenger Car Equivalents for Trucks on Upgrades. District Traffic office staff should be able to assist with determining the Open Lane Capacity for the segment.

WORK ZONE DETAILS

Work Description – This section allows the user to input specific information about this work zone to help differentiate it from other scenarios.

Work Location - The relative location of workers and/or equipment to the traveling public has been shown to affect the capacity of the travel lane through the work area. The work location shows no work zone present to assist with calibrating the existing conditions. When a work zone type is selected, several cells will change their color to **ORANGE** indicating that this is an input required to estimate the capacity of the work zone.

The Highway Capacity Manual 2010 states the base work zone capacity is approximately 1600 passenger cars per hour per lane for "normal" work zone activity. If the work area is located close to the travel lane, the capacity is adjusted as much as 10% due to the closeness of vehicles and people, rubbernecking, etc. If the work area is located some distance from the travel lane, the capacity may increase as much as 10% due to less activity along the travel lane.

Travel Lane Width - At times the travel lane width may be reduced due to the type of operation, size of work equipment, etc. Restricting travel lane width has shown in studies that free-flow speed is reduced, which in turn will decrease the capacity.

Number of Lanes Open – Number of travel lanes that will be open to the traveling public.

ESTIMATED Work Zone Capacity – This is the estimated capacity of the work zone based on the Work Zone Location, Travel Lane Width, and Number of Lanes Open. This estimated work zone capacity will be used by the spreadsheet during the time specified that the work zone is active. The estimated work zone capacity can be superseded by a User Defined Work Zone Capacity.

USER DEFINED Work Zone Capacity – The user has the ability to override the Estimated Work Zone Capacity. The estimated capacity may want to be adjusted based on a variety of reasons, such as:

- Historical use of the spreadsheet. If the spreadsheet has previously underestimated the capacity of the work zone, the user can input an increased capacity to more accurately reflect previous work zone capacities in the area.

- Implementing strategies to improve capacity. If certain work zone layouts or ITS solutions are used with the project (such as zipper merge), capacities could be increased.

- Sensitivity Analysis. Depending on the project, a sensitivity analysis may be conducted. The user could see what kind of impact is anticipated when the capacity is reduced by a certain percentage. A reduced capacity could be the result of weather, incidents, and more conservative drivers. This helps assess the risks associated with the work zone.

Start Time – This is the time of day that the work zone is scheduled to begin.

End Time – This is the time of day that the work zone is scheduled to end.

For work zones active 24 hours a day, the Start Time and End Time should have the same value.

RESULTS

The results include three data types: Base Conditions, Work Zone, and Total. The measures of effectiveness were broken down to ensure delays and queues potentially caused by the Base Conditions were not attributed to the impact of the work zone.

Max Queue Length – This is the maximum length of stopped vehicles throughout the duration of the work zone. This length assumes vehicles will be equally distributed between the available upstream lanes. If lane imbalance occurs, the maximum queue length could be longer. Also, the Max Queue Length does not account for where vehicles are slowed; it only anticipates the stopped queue.

Max Delay – This is the maximum delay for a single vehicle to transverse the work zone. Similar to the Max Queue Length, the maximum delay does not account for when a vehicle is slowed; it only assesses delay when a vehicle is expected to stop.

Cost ($) – This is the User Cost attributed to the public as a result of the work zone. This cost accounts for the value of a person's time as well as the running and maintenance costs of running the vehicle for additional time.

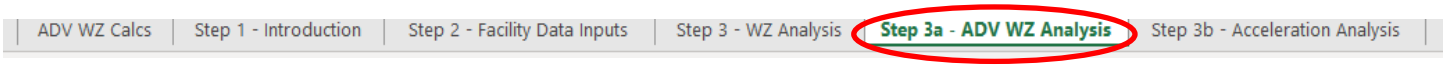
Estimated Work Zone Operations

This chart plots the estimated operations for the work zone. This chart will automatically update based on the values plugged into the cells adjacent to them. Two data types are plotted on this graph: Delay and Queue. Two different Y-Axis are provided to plot the data. Queue Length is located on the Left Y-Axis and Delay is located on the Right Y-Axis.

Please note that the scale of the Y-Axis will automatically update. This means that a visual comparison between various graphics on this page may not be applicable. A Synopsis Sheet, located in Step 4, is provided to make this direct comparison.

Step 3a Advance Work Zone Analysis

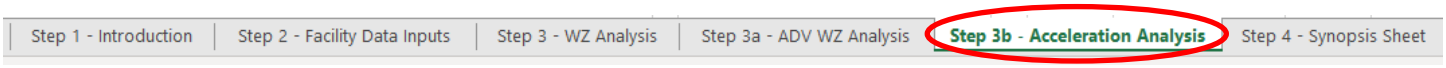
This is an additional tab that has been added under the recent improvements made to the sheet as shown encircled below. This tab asks for additional information for advanced work zone strategy recommendations related to the work zone.



Based on the input provided in this tab, the tool provides recommendations as tab "*Step 4a ADV WZ Synopsis*". The detail of which has been discussed later in this.

Step 3b Acceleration Analysis

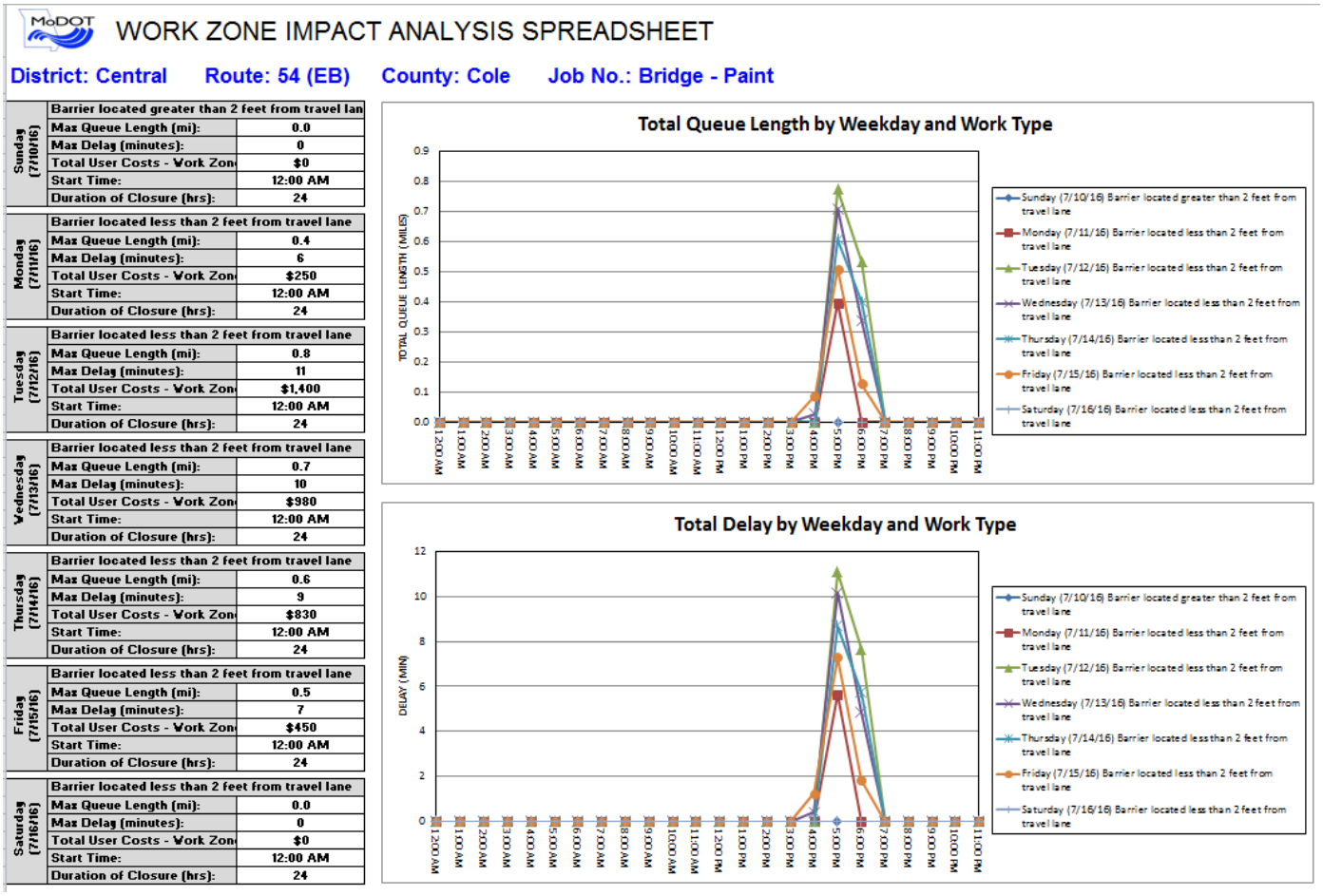
The sheet has also been modified to provide recommendations for contract time acceleration.



Based on the inputs provided under this tab, the tool would provide recommendations as "*Step 4b Acceleration Synopsis*" the details of which are discussed later in the document.

Step 4 – Synopsis Sheet

This tab contains a printable graphical representation of the queue and delay of the work zone. The entire week is graphed to see the trends of the work zone concerns of queue and delay.



Methodology

The following is a description of the methodology used to determine the Queues and Delays for the work zone. These calculations are performed on a hidden tab named WZ Analysis (Worksheet). To view this worksheet, right click on a tab located at the bottom of the spreadsheet. Select Unhide and then select the sheet desired to be shown.

The hourly traffic volumes which are a user input in Step 2 are utilized as the DEMAND for the facility. The Demand information is normally populated from the Transportation Management System (TMS) database. Data from the TMS is calculated from field data and updated every 1-3 yrs, dependent on roadway type. The Demand field can be populated by actual field data.

The Demand volume is used to determine the TOTAL ARRIVALS, which is a running count of the number of vehicles entering the work zone.

The TOTAL DEPARTURES is a running count of the number of vehicles that leave the work zone based on the maximum capacity.

QUEUED VEHICLES are the difference of vehicle arrivals versus departures. Below is an example of the work zone calculations for Queue Length and Delay.

The work zone data provided below has a capacity of 1,240 vehicles/hour. At 7:00 a.m., 1,371 vehicles arrive, but only 1,240 vehicles can travel through the work zone. There are 131 vehicles that cannot enter the work zone for that particular hour and must wait their turn. If the number of arriving vehicles is greater than the capacity of the work zone lane closures, then the work zone will see a queue and delay.

The QUEUE LENGTH output calculates the length (miles) of the queue based on the percentage of passenger vehicles and trucks. The length of vehicles for this example is 25 feet for passenger vehicles and 50 feet for trucks.

For example, at 7:00 a.m. there are 131 queued vehicles of which 25 percent (0.25) are trucks. (131 vehicles) * (0.75 percent cars) * (25 feet per passenger vehicles) + (131 vehicles) * (0.25 percent trucks) * (50 feet per trucks) = (2,456.25 feet + 1,637.5 feet) / (2 lanes of open lane) * (5,280 feet/mile) = 0.39 mile queue.

The DELAY output is the calculation of the queued vehicles, capacity, and conversion from hours to minutes. For 7:00 a.m. example, (131 vehicles) * (60 minutes/hour)/(1,240 vehicles/hour) = 6.34 minutes.

SATURDAY	TIME	DEMAND	CAPACITY	TOTAL ARRIVALS	TOTAL DEPARTURES	QUEUED VEHICLES	QUEUE LENGTH	DELAY
0 AM	0:00	364	1240	364	364	0	0.00	0.00
1	1:00	331	1240	695	695	0	0.00	0.00
2	2:00	296	1240	991	991	0	0.00	0.00
3	3:00	337	1240	1328	1328	0	0.00	0.00
4	4:00	395	1240	1723	1723	0	0.00	0.00
5	5:00	621	1240	2344	2344	0	0.00	0.00
6	6:00	1024	1240	3368	3368	0	0.00	0.00
7	7:00	1371	1240	4739	4608	131	0.39	6.34
8	8:00	1331	1240	6070	5848	222	0.66	10.74
9	9:00	1095	1240	7165	7088	77	0.23	3.73
10	10:00	1238	1240	8403	8328	75	0.22	3.63
11	11:00	1196	1240	9599	9568	31	0.09	1.50
12 PM	12:00	1276	1240	10875	10808	67	0.20	3.24
13	13:00	1216	1240	12091	12048	43	0.13	2.08
14	14:00	1317	1240	13408	13288	120	0.36	5.81
15	15:00	1326	1240	14734	14528	206	0.61	9.97
16	16:00	1310	1240	16044	15768	276	0.82	13.35
17	17:00	1222	1240	17266	17008	258	0.76	12.48
18	18:00	1091	1240	18357	18248	109	0.32	5.27
19	19:00	847	1240	19204	19204	0	0.00	0.00
20	20:00	859	1240	20063	20063	0	0.00	0.00
21	21:00	695	1240	20758	20758	0	0.00	0.00
22	22:00	601	1240	21359	21359	0	0.00	0.00
23	23:00	492	1240	21851	21851	0	0.00	0.00

Section 3 Advanced Work Zone Strategy Selection

The Work Zone Analysis spreadsheet includes a strategy selection element. This includes both advanced strategies and other work zone strategies such as full road closures, temporary rumble strips, and speed advisory systems.

The selection uses data from the work zone impact analysis portion of the spreadsheet as described previously in steps 1-4. A set of additional questions is also provided on the "Step 3a – ADV WZ Analysis" sheet and shown in the figure below. These questions provide additional information and are context-specific to the use of individual advanced work zone strategies.

Additional Questions for Advanced Work Zone Strategy Recommendation

Additional Existing Facility Information	
Facility Speed Limit (mph)	60
Are traffic patterns inconsistent from day to day? (e.g. unpredictible with substantial variability or impacts from random local traffic genertors)	No
Is the work zone on a route with an existing ITS Travel Time System?	No
Are one or more alternative routes with capacity available?	No
If yes, what is the approximate length of the existing alternative routes (mi)?	
If yes, do the alternatative routes have existing ITS Travel Time capability?	

Additional Work Zone and Project Inputs	
Work Zone Speed Limit (mph)	45
Total approximate work zone length (mi)	2
Total approximate taper length leading up to work zone (mi)	0.11
Number of days the work zone will be in place	180
Will proposed lane closures persist (e.g. not be set up and taken down frequently)?	Yes
Number of access points where low speed construction vehicles will enter the work zone without an adequate dedicated acceleration lane	2
Will sight distance be limited on the approach to the work zone?	No
Are queue lengths anticipated to extend past an upstream intersection or interchange?	Yes
Are there external merging conflicts or hazards on the approach to or within the work zone?	Yes
Will the work zone have navigating contrstraints that inhibit emergency responder access?	No
Total estimate project cost without smart workzone strategies ($)	$3,000,000

With the base work zone information and the additional strategy, selection questions answered, the tool provides a rank (1-100) along with a rank, a recommendation level, and a budgetary estimate on the “Step 4a – ADV WZ Synopsis” sheet shown in the following figure.

Advanced Work Zone Strategy	Score*	Rank	Recommendation	Budgetary Estimate
1. Construction Vehicle Warning System	80	3	Strongly Recommended	$40,000
2. Dynamic Late Merge (Zipper Merge) System	72	4	Strongly Recommended	$50,000
3. Queue Warning System	48	5	Should be Considered	$10,000
4. Road Closure	0	-	Not Applicable	$0
5. Speed Warning System	88	2	Strongly Recommended	$43,000
6. Temporary Rumble Strips	100	1	Strongly Recommended	$2,000
7. Temporary Traffic Incident Management and ITS System	0	-	Not Applicable	$0
8. Travel Time Advisory System	29	6	Not Recommended	$48,000
9. Travel Time Advisory System with Alternative Route	0	-	Not Applicable	$0

Section 4 Contract Time Acceleration

In a similar fashion, the tool includes recommendations for contract time acceleration strategies as defined in EPG 237.8 as follows:

- A+B Bidding
- Liquidated Damages Specified
- Liquidated Savings Specified
- Liquidated Savings / Liquidated Damages Specified

Various additional questions have been added to assess the various work zone elements that impact the selection of a time acceleration strategy, show below.

Contract Time Acceleration Considerations

The following questions can apply to the project as a whole, or to specific features or phases*	
Is the project considered "routine?"	No
What is the anticipated number of construction seasons?	much less than one
Is there is a critical completion date (e.g. to enable future work, or other reasons)?	Yes
Does the work zone for the project or one of its features cause unusually high impacts to travelers?	Yes
Does the project include numerous or long detours?	Yes
Are there unusually high safety concerns for the public or workers?	No
Will the project cause significant impacts to the local community or business economies?	No
Is the project is substantially free of third party conflicts (e.g. right of way, utilities)?	No
Are more than two bidders anticipated?	No

With the base work zone information and the additional contract time acceleration questions answered, the tool provides a rank (1-100) along with a rank, a recommendation level, and a budgetary estimate as illustrated below.

Contract Time Acceleration Strategy	Score**	Rank	Recommendation
A+B Bidding	29	4	Not Recommended
Liquidated Damages Specified	85	1	Strongly Recommended
Liquidated Savings Specified	67	3	Should be Considered
Liquidated Savings / Liquidated Damages Specified	75	2	Strongly Recommended